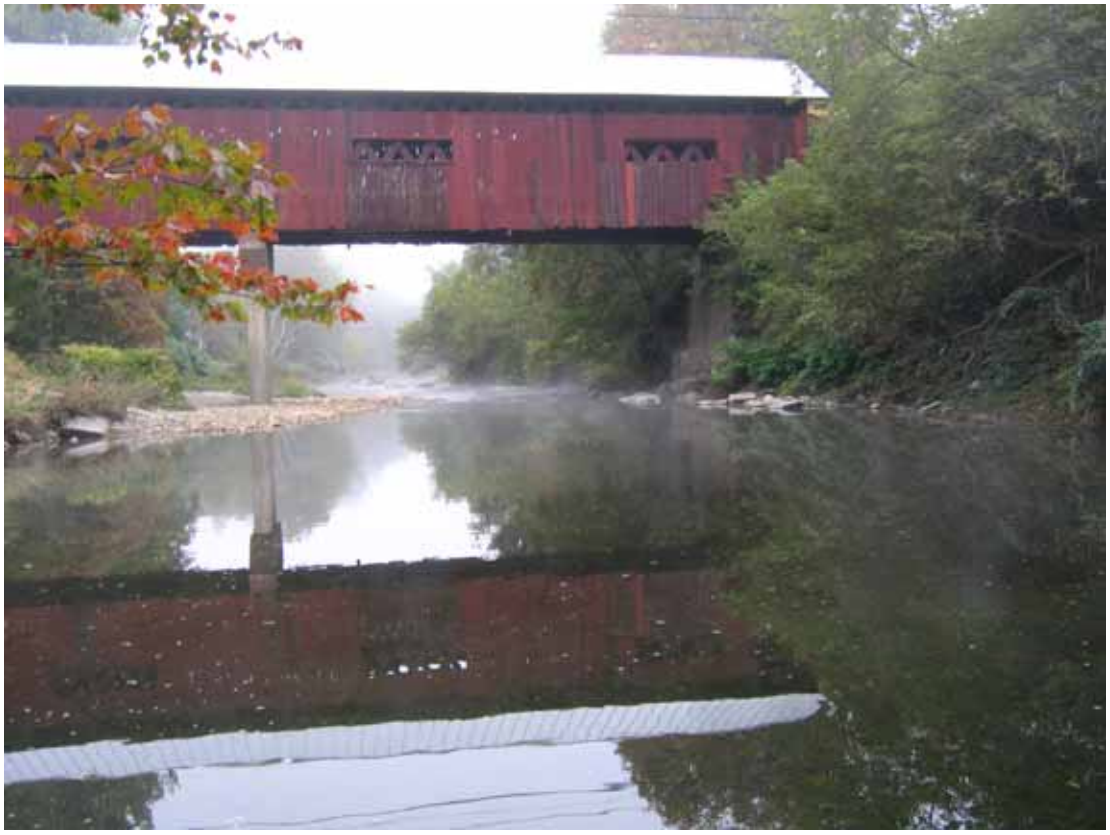
Dog River
River Corridor Plan
Roxbury, Northfield, Berlin & Montpelier, Vermont
April 8, 2009



Prepared by: Bear Creek Environmental, LLC

Bear Creek Environmental

Prepared for: Town of Northfield, Vermont

Bear Creek **Environmental**

297 East Bear Swamp Road, Middlesex, Vermont 05602
Phone: (802) 223-5140 / **Fax:** (802) 229-4410

Acknowledgements

Bear Creek Environmental, LLC would like to acknowledge the individuals and groups, who contributed their time and effort during the development of this river corridor plan for the Dog River watershed. Gretchen Alexander and Sacha Pealer from the Vermont River Management Program provided a quality assurance/control review of the data, contributed valuable feedback on the report and supplied many hours working with Bear Creek Environmental, LLC in the field. We would also like to thank Dan Currier from the Central Vermont Regional Planning Commission, who, along with Gretchen Alexander, generated the fluvial erosion hazard zones and assisted with recommendations for protection of the river corridor.

The Northfield and Berlin Conservation Commissions provided numerous hours of volunteer labor on the project. We would especially like to thank Larry Garland, of the Northfield Conservation Commission, who helped with landowner outreach and spent some time working with BCE in the field. We would also like to thank Jenn Ingersoll from the Berlin Conservation Commission for helping with landowner outreach in Berlin. Funding for the project was provided by a grant from the Vermont Clean and Clear Program.

Field workshop participants along the banks of the Dog River in September 2008

Bear Creek **Environmental**

297 East Bear Swamp Road, Middlesex, Vermont 05602
Phone: (802) 223-5140 / **Fax:** (802) 229-4410

Dog River
River Corridor Plan
Roxbury, Northfield, Berlin & Montpelier, Vermont

April 8, 2009

Prepared by:

Colleen Sullivan
and
Mary Nealon

Dog River
River Corridor Plan
Roxbury, Northfield, Berlin & Montpelier, Vermont

TABLE OF CONTENTS

Bear Creek **Environmental**

297 East Bear Swamp Road, Middlesex, Vermont 05602
Phone: (802) 223-5140 / **Fax:** (802) 229-4410

Dog River
River Corridor Plan
Roxbury, Northfield, Berlin & Montpelier, Vermont

1.0 EXECUTIVE SUMMARY

In 2008, the Town of Northfield and the Central Vermont Regional Planning Commission (CVRPC) completed a Phase I Stream Geomorphic Assessment of the Dog River Watershed, following the protocol developed by the Vermont Agency of Natural Resources (VANR). During Phase 1 the Dog River watershed was divided into 95 reaches, encompassing roughly 112 miles of river channel. Six of these reaches that were impounded by lakes, ponds or wetlands were excluded from the Phase 1 assessment.

The Town of Northfield hired Bear Creek Environmental, LLC to conduct Phase 2 assessment work on the Dog River from its confluence with the Winooski River nearly to its headwaters in Roxbury, and on the lowest reaches of six major tributaries. In total approximately 26 miles of river were assessed as part of the Phase 2 field work. The Vermont Department of Environmental Conservation, River Management program, provided technical expertise for both the Phase 1 and 2 assessments. The project was funded through the Vermont Clean and Clear Program.

The Phase 2 stream geomorphic assessment included field observations and measurements that were used to verify the Phase 1 study, to determine the channel adjustment process, and the stream geomorphic condition, aquatic habitat condition, and quality of the riparian corridor. The collection and synthesis of this information can be used in watershed planning, for the establishment of erosion hazard zones, and for the identification of watershed improvement projects. 47 restoration and protection projects were identified using information collected as part of the Phase 2 assessment. A glossary of stream geomorphic assessment terms is included in Appendix A of this report to assist the reader. These definitions, which were adapted from Fischenich (2000), are from Appendix Q of the Vermont Agency of Natural Resources' Stream Geomorphic Handbook (2004a).

A short summary of the Phase 2 results is as follows:

- The geomorphic condition of the Dog River is fair to good overall. The dominant adjustment processes in the Dog River watershed are aggradation and planform adjustment. Seventeen segments on the main stem have undergone historic incision and seven segments on the assessed tributaries have undergone historic incision.

- The habitat condition of the Dog River is generally fair. Numerous natural and manmade obstructions are impeding the passage of aquatic organisms and there are large areas lacking adequate riparian buffers. Pools are generally frequent and offer a range of depths but refuge habitat is lacking overall.

- Numerous undersized bridges, old abutments and breached dams are causing excessive sediment deposition and/or scouring of the channel bed upstream or downstream of the feature. These channel constrictions are likely responsible for a great deal of aggradation and planform adjustment occurring along the Dog River.

- Major roads run adjacent to the channel for much of the study area. These managed roads are limiting riparian buffer areas and causing increased runoff during storm events.

- Railroad tracks commonly run within the corridor of the Dog River. The railroad bed has generally been elevated to a level where it cuts off the channel's natural floodplain access.

2.0 LOCAL PLANNING PROGRAM OVERVIEW

2.1 RIVER CORRIDOR PLANNING TEAM

The River Corridor planning Team for the Dog River is comprised of the Town of Northfield, the Central Vermont Regional Planning Commission (CVRPC), the Berlin Conservation Commission, the Montpelier Conservation Commission, Norwich University, the Vermont Department of Environmental Conservation (DEC), Bear Creek Environmental (BCE), volunteers and landowners. The Town of Northfield and CVRPC completed the Phase 1 Assessment of the Dog River. Bear Creek Environmental was retained by the Town of Northfield and partners as part of a grant with the Vermont River Management Program, to conduct a Phase 2 Stream Geomorphic Assessment of the Dog River main stem and select tributaries. Gretchen Alexander from the Vermont River Management Section of the Vermont Agency of Natural Resources (VANR) provided technical guidance for this project.

Mary Nealon of BCE and Gretchen Alexander of VANR also hosted a field workshop for town officials and local Conservation Commissions to explain the Phase 2 Stream Geomorphic methods on September 13, 2008. The workshop took place along the banks of the Dog River near the confluence with Stony Brook.

The Northfield Conservation Commission, Bear Creek Environmental, LLC and the Vermont Agency of Natural Resources hosted a public meeting on March 25, 2009 to discuss the results of the Phase 2 Stream Geomorphic Assessment with members of the community and the steering committee.

2.2 GOALS AND OBJECTIVES OF THE PROJECT

2.2.1 State River Management Goals and Objectives

The State of Vermont's River Management Program has set out several goals and objectives that are supportive of the local initiative in the Dog River watershed. The state management goal is to, "manage toward, protect, and restore the fluvial geomorphic equilibrium condition of Vermont rivers by resolving conflicts between human investments and river dynamics in the most economically and ecologically sustainable manner" (Vermont Agency of Natural Resources, 2007c). The objectives of the Program are to avoid damage to investments due to fluvial erosion hazards, to reduce sediment and nutrient loads, and to restore and protect aquatic and riparian habitat. Additionally, the Vermont River Management Program has set out to provide funding and technical assistance to facilitate an understanding of river instability and the establishment of well developed and appropriately scaled strategies to protect and restore river equilibrium.

2.2.2 Local Goals and Objectives

The Dog River is an important resource for the Towns of Northfield, Roxbury, Berlin and Montpelier. Roads and infrastructure that have sustained damages during past flood events provide reasonable cause for concern about the potential impacts of further development in the watershed. A community-based river corridor management plan provides many opportunities for enhancing and restoring the Dog River watershed. The corridor plan addresses many of the concerns voiced by residents of the Dog River watershed including:

- Improve the water quality and biological integrity of the Dog River watershed
- Increase the recreational resource
- Restore river corridor functions
- Reduce erosion and flood hazards
- Protect existing flood and sediment attenuation areas

3.0 BACKGROUND WATERSHED INFORMATION

3.1 Geographic Setting

The Dog River watershed has an area of approximately 93 square miles and lies within the Winooski River Watershed, which is one of the major rivers in Vermont within the Lake Champlain Basin (Figure 3.1). Located in upper part of the Winooski River watershed, the Dog River begins near the town boundary between Roxbury and Warren in the vicinity of Warren Mountain Road, flows along Routes 12A and 12 in Northfield and Berlin, and enters the Winooski River near Junction Road in Montpelier. The Dog River watershed falls under the jurisdiction of the Central Vermont Regional Planning Commission.

The Dog River drains from approximately 2300 feet in elevation in Roxbury in a northerly direction and meets the Winooski River near Junction Road at approximately 510 feet above sea level. The Phase 2 study area focuses on the lower 21 reaches on the main stem of the Dog River and the lowest reaches of six major tributaries: Cox Brook, Union Brook, Sunny Brook, Bull Run, Stony Brook and Felchner Brook. The upper-most reach within the study area on the Dog River study area (M21) is approximately 505 feet higher in elevation than the lowest reach at the confluence with the Winooski River. The Dog River flows through a gentle gradient valley. With the exception of reaches M16 and T6.01 which have channel slopes of 2.2 percent and 3.5 percent, respectively, all reaches in the Phase 2 study area have a channel slope of less than one percent.

The Dog River watershed is dominated by forested land. However, within the watershed agriculture and urban (residential, commercial, and industrial) are subdominant land uses. As shown in Figure 3.2, 80 percent of the Dog River watershed is forest, eleven percent is agriculture and seven percent is urban. Most of the urban-classified land is located along the Route 12 and Route 12A corridors, particularly in the vicinity of downtown Northfield.

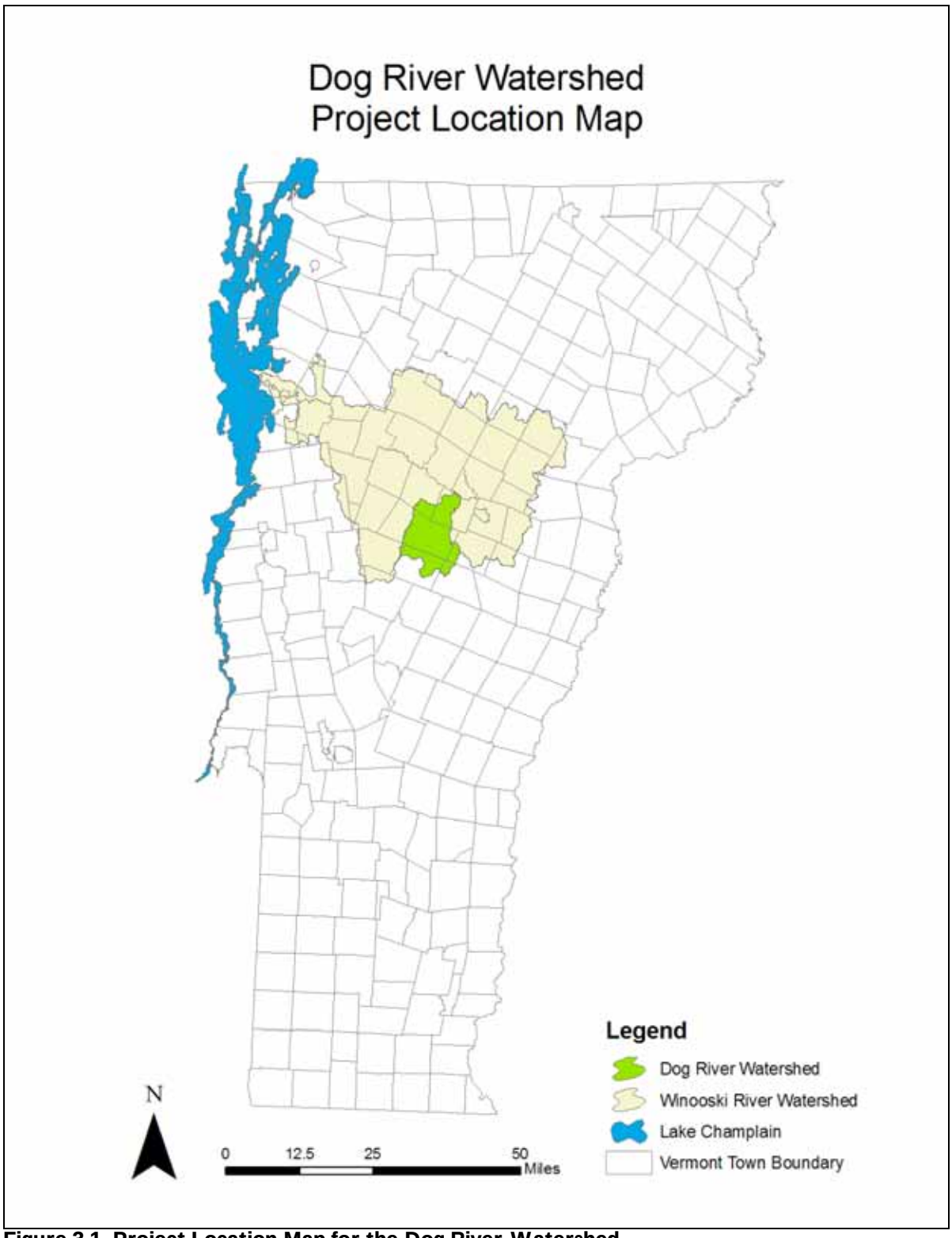


Figure 3.1. Project Location Map for the Dog River Watershed

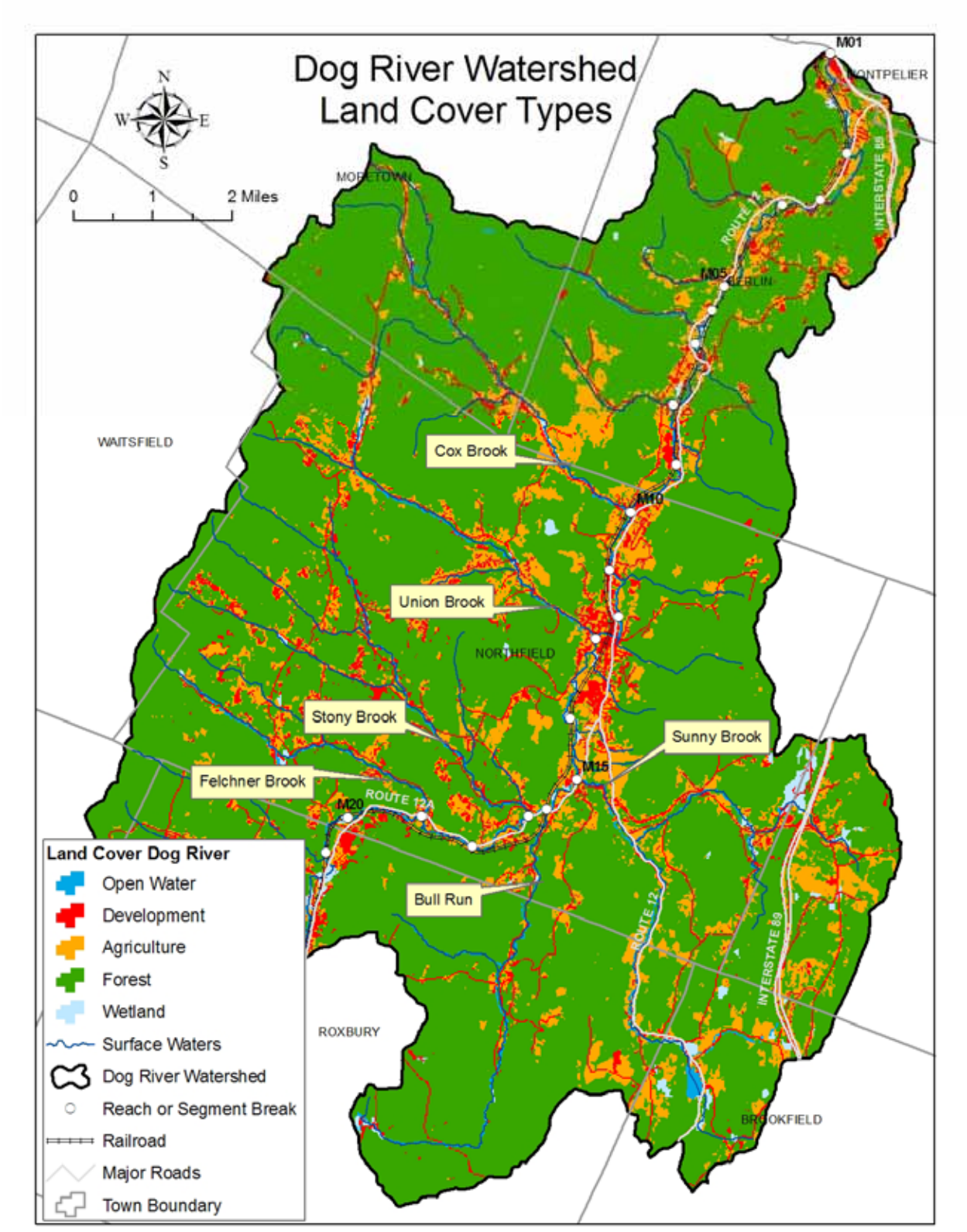


Figure 3.2. Land Cover & Land Use map for the Dog River Watershed

3.2 Geologic Setting

The Dog River Watershed is located within the Connecticut Valley Gaspe Province. This ancient sedimentary basin is characterized by Silurian and Devonian calcareous rocks of depositional origin (Doolan, 1996). The Dog River watershed was reshaped primarily by glacial activity. The last large ice sheet, the Laurentide Ice Sheet, covered all of New England and advanced up the Winooski River valley (Wright and Larsen, 2004). As the climate warmed, the glacier slowly retreated and formed glacial Lake Winooski, covering the Winooski valley and many tributaries upstream from Waterbury, with a lake surface elevation of approximately 915 feet (Van Diver, 1987). Following the retreat of the glacier, the Winooski River and its tributaries began eroding the glacial and lake sediments that were left behind (Wright and Larsen, 2004).

Bedrock maps of the Dog River watershed show that the watershed is primarily underlain by: the Northfield Formation: a slate or phyllite with interbeds of siltstone and crystalline limestone, the Moretown Member: a quartz rich granulite with pinstripes of phyllite and schist, and locally it is underlain by the Waits River Formation: a gray quartzose and micaceous crystalline limestone interbedded with quartz-muscovite, phyllite or schist (Doll, 1961). The dominant surficial sediments along the Dog River are comprised of glaciolacustrine and postglacial fluvial deposits with glacial till at higher points in the watershed (Doll, 1970).

3.3 Geomorphic Setting

The Dog River Watershed was divided into 95 reaches for the Phase 1 assessment. Phase 2 Geomorphic Assessments were conducted on 21 reaches on the Dog River main stem from Roxbury to the confluence of the Winooski River near the Berlin-Montpelier town line, and on the lowest reaches of 6 major tributaries in Northfield (Figure 3.3). These reaches were selected as high priority based on results from the Phase 1 assessment and input from the project steering committee at a planning meeting held on May 20, 2008. The steering committee was particularly interested in assessing the main stem of the Dog River through reach 21, and additional funding was secured to include the lowest reaches of six major tributaries as a result of concerns brought up at the planning meeting.

Reference stream types[1] are based on the valley type, geology and climate of a region and describe what the channel would look like in the absence of human-related changes. Reference stream typing was based on both the Rosgen (1996) and Montgomery and Buffington (1997) classification systems. Table 3.1 shows the typical characteristics used to determine reference stream types (VANR, 2007a).

[1] Additional information about reference stream typing can be found on the Vermont Agency of Natural Resources web page - http://www.anr.state.vt.us/dec/waterq/rivers/docs/assessmenthandbooks/rv_weblinkpgphase1.pdf

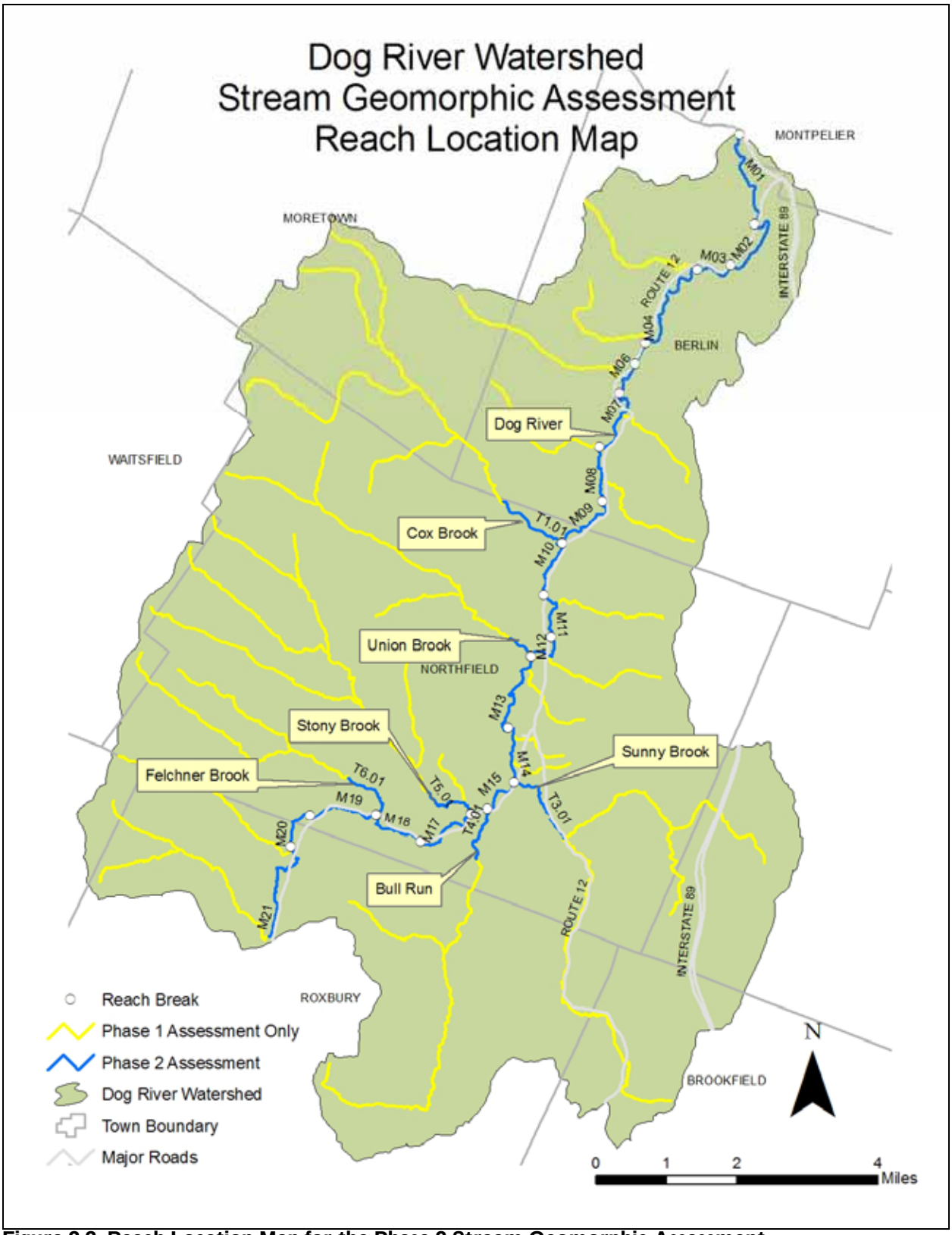


Figure 3.3. Reach Location Map for the Phase 2 Stream Geomorphic Assessment

Reference stream types for the assessed reaches are listed in Table 3.2. Reaches M05, M07, M08, T4.01 and T5.01 have a steeper gradient and a semi-confined valley with a reference stream type of "B". The reference stream type for all remaining reaches on the Dog River and its tributaries is "C". These reaches generally have a low slope, a moderate width to depth ratio, and flow through unconfined valleys.

Table 3.1: Reference Stream Type

Stream Type	Confinement	Valley Slope	Bed Form
A	Narrowly Confined	Very steep > 6.5 %	Cascade
A	Confined	Very steep 4.0 - 6.5 %	Step-Pool
B	Confined or Semi-confined	Steep 3.0 – 4.0 %	Step-Pool
B	Confined, Semi-confined or Narrow	Moderate to Steep 2.0 – 3.0 %	Plane Bed
C or E	Unconfined (Narrow, Broad or Very Broad)	Moderate to Gentle <2.0 %	Riffle-Pool or Dune-Ripple
D	Unconfined (Narrow, Broad or Very Broad)	Moderate to Gentle <4.0 %	Braided Channel

Table 3.2: Geomorphic Setting of Assessed Reaches

Reach ID	Reference Stream Type	Confinement	Valley Slope	Bed Form
M01	C	Very Broad	0.13	Riffle-Pool
M02	C	Very Broad	0.12	Riffle-Pool
M03	C	Narrow	0.18	Riffle-Pool
M04	C	Very Broad	0.07	Riffle-Pool
M05	B	Semi-Confined	0.28	Riffle-Pool
M06	C	Very Broad	0.70	Riffle-Pool
M07	B	Semi-Confined	0.89	Riffle-Pool
M08	B	Semi-Confined	0.50	Riffle-Pool
M09	C	Semi-Confined	0.41	Riffle-Pool
M10	C	Narrow	0.12	Riffle-Pool
M11	C	Very Broad	0.48	Riffle-Pool

Table 3.2: Geomorphic Setting of Assessed Reaches

Reach ID	Reference Stream Type	Confinement	Valley Slope	Bed Form
M12	C	Semi-Confined	1.38	Riffle-Pool
M13	C	Very Broad	0.33	Riffle-Pool
M14	C	Very Broad	0.11	Riffle-Pool
M15	C	Very Broad	0.49	Riffle-Pool
M16	C	Broad	2.25	Riffle-Pool
M17	C	Very Broad	0.64	Riffle-Pool
M18	C	Narrow	1.20	Riffle-Pool
M19	C	Broad	1.72	Riffle-Pool
M20	C	Narrow	0.59	Riffle-Pool
M21	C	Very Broad	0.54	Riffle-Pool
T1.01	C	Narrow	2.08	Riffle-Pool
T2.01	C	Very Broad	1.90	Riffle-Pool
T3.01	C	Narrow	1.61	Riffle-Pool
T4.01	B	Broad	1.96	Riffle-Pool
T5.01	B	Broad	2.00	Riffle-Pool
T6.01	C	Semi-Confined	3.68	Step-Pool

There are no alluvial fans within the Phase 2 assessed reaches. There are multiple waterfalls and ledge grade controls located in the reaches included in the Phase 2 assessment. Additionally, human constructed grade controls (dams and weirs) are located in the following segments: M09-B, M11-D, M12-A, T2.01 and T3.01.

3.4 Hydrology

In order to better understand the flood history of the Dog River, long term peak discharge data from the U.S. Department of the Interior, U.S. Geological Survey (USGS) gauge on the Dog River in Northfield Falls, VT was obtained. The Dog River gauge is located in segment M08-B and it provides a continuous record of flow from 1935 through the present. The drainage area at the Dog River gauge is 76 square miles.

The Dog River record shows that the 10 year discharge was exceeded in water years 1952, 1976, 1987 and 1989 and between a 25 and 50 year discharge occurred in 1938. During water year 1973, the peak discharge exceeded the projected 50 year discharge. A graph of the flood frequency analysis is provided in Figure 3.4.

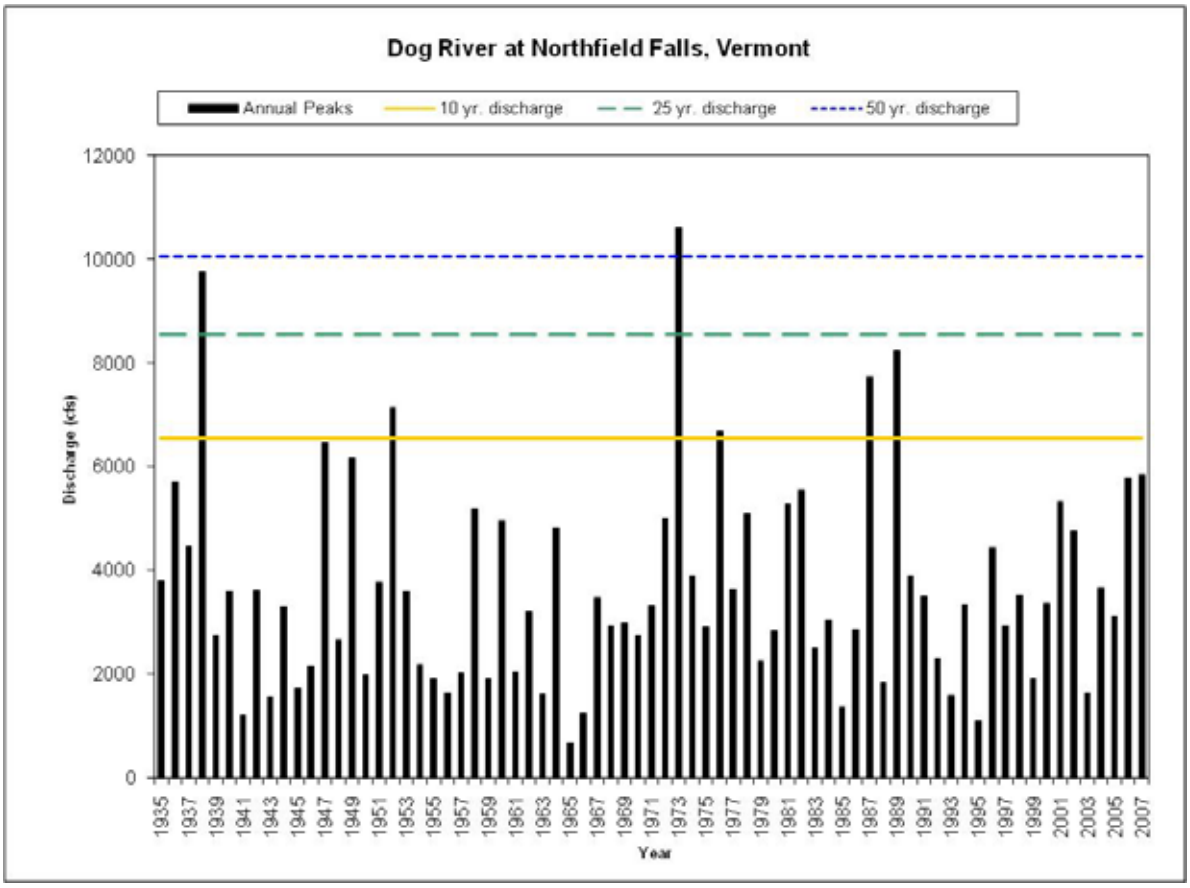


Figure 3.4: Flood frequency analysis for the Dog River.

Between 1995 and 1998 Vermonters suffered nearly $60,000,000 in flood damages; much of these losses may have been avoided with more stringent floodplain development regulations (Vermont Agency of Natural Resources, 2006). Through Vermont's history, flood waters on the Winooski River and its tributaries have destroyed property on numerous occasions.

Local flooding has commonly occurred on Water Street in Northfield. Also, in late July and early August of 2008, Central Vermont received an excessive amount of rain over a period of a few days. As a result, many of the smaller tributaries to the Dog River experienced flash flooding events. Several roads in Berlin were washed out as these small tributaries spilled over their banks.

3.5 Ecological Setting

The Dog River watershed lies within the Northern Green Mountain biophysical region. The Northern Green Mountains is characterized by Thompson and Sorenson (2005) as having high elevations and cool summers. The Green Mountains have a strong influence on the weather resulting in an abundance of precipitation in the form of both rain and snow. Northern hardwood forest is the dominant community in this biophysical region. The Northern Green Mountains provide important habitat for both aquatic and terrestrial animals. According to Thompson and Sorenson (2005), the Green Mountains provide

extensive habitat for black bear, white-tailed deer, bob cat, fisher, beaver and red squirrel. The Dog River mainstem and all of its tributaries are managed as "wild trout waters". The river is a popular with local anglers and it remains a very important resource for the towns of Northfield, Roxbury, Berlin and Montpelier (Vermont Agency of Natural Resources, 2008). The Dog River watershed has some localized areas of wetlands. There are also some beaver dams located within the Phase 2 study area contributing to increased biodiversity. Water flow backed up from the Northfield Mills dam in segment M11-D has also contributed to the creation of some deeper water habitat.

4.0 METHODS

The study of the Dog River watershed utilized the Stream Geomorphic Assessment (SGA) protocols developed by the Vermont Department of Environmental Conservation (DEC). The SGA protocols are intended to identify how changes to land use affect hydro-geomorphic processes at the landscape and reach scale, and how these changes alter the physical structure and habitat of rivers. The SGA protocol includes three phases:

- Phase 1 – Remote sensing and cursory field assessment;
- Phase 2 – Rapid habitat and rapid geomorphic assessments to provide field data to characterize the current physical condition of a river; and
- Phase 3 – Detailed survey information for designing "active" channel management projects.

The Town of Northfield and CVRPC began the Phase I assessment of the Dog River watershed in spring 2008. BCE completed the fieldwork for the Phase 2 assessment during summer and fall 2008. This data was used to develop the river restoration and protection projects presented in this report. Phase 3 surveys for active restoration projects, included in this report, may be considered at some point in the future for project design and permitting. A summary of the Phase 1 and 2 methodologies follows.

4.1 Phase 1 Methodology

A Stream Geomorphic Assessment process is divided into three phases, based on VANR protocols. Phase 1, the remote sensing phase, involves the collection of data from topographic maps and aerial photographs, from existing studies, and from very limited field studies, called "windshield surveys." The Phase 1 remote sensing techniques allow for large watersheds (100-150 square miles) to be assessed within a few months time. The Phase 1 assessment provides an overview of the general physical nature of the watershed and helps prioritize stream reaches in need of Phase 2 assessments. As noted in the Executive Summary, 95 river reaches or roughly 112 miles were assessed during Phase1.

4.2 Phase 2 Methodology

The Phase 2 assessment was conducted by BCE following procedures specified in the Vermont Stream Geomorphic Assessment Handbook Phase 2 (Vermont Agency of Natural Resources 2007b), and used versions 4.57 and 4.59 of the Stream Geomorphic Assessment

Tool (SGAT) GIS extension to index impacts within each reach. The geomorphic condition for each Phase 2 reach is determined from the rapid geomorphic assessment (RGA) protocol, and is based on the degree of departure of the channel from its reference stream type (Vermont Agency of Natural Resources, 2007b). The study also used new protocol developed by the Vermont Agency of Natural Resources (2008) for conducting a rapid habitat assessment (RHA).

4.3 Bridge and Culvert

The Field Team conducted bridge and culvert surveys on all private and public bridges and culverts within the selected Phase 2 reaches. The Bridge and Culvert Assessment and Survey Protocols specified in Appendix G of the Vermont Stream Geomorphic Assessment Handbook (Vermont Agency of Natural Resources, 2007d) were followed. All assessment data were recorded on the Agency of Natural Resources (ANR) Bridge and Culvert Assessment – Geomorphic and Habitat Parameters data sheet, and were entered into the ANR DMS.

The bankfull channel width from the Phase 2 fieldwork was used to determine the expected bankfull width in the vicinity of a particular structure. Latitude and Longitude at each of the structures was determined using a Garmin Etrex Vista GPS unit. The assessment included photo documentation of the inlet, outlet, upstream, and downstream of each of the structures.

There is only one culvert within the Dog River study area. The Vermont Culvert Geomorphic Screening tool (Milone and MacBroom, Inc., 2008a) and the Vermont Culvert Aquatic Organism Passage Screening tool (Milone and MacBroom, Inc., 2008b) were used to identify the culvert's priority for replacement/retrofit due to geomorphic incompatibility and/or for being a potential barrier to movement and migration of aquatic organisms.

4.4 River Corridor Plan

The Vermont Agency of Natural Resources River Corridor Planning Guide (2007c) and Draft 9 of Chapter 5 of the plan dated October 2, 2007 were followed to generate a series of stressor maps. These maps were created using indexed data from the Phase 1 and Phase 2 Stream Geomorphic Assessments along with existing data available from VCGI, including railroads, e911 roads, e911 buildings and e911 driveways. The stressor maps were then used to identify potential project locations that have few constraints to channel adjustment.

4.5 Quality Control/Quality Assurance Procedures

To assure a high level of confidence in the Phase 2 SGA data, strict quality assurance/quality control (QA/QC) procedures were followed by BCE. These procedures involved a thorough in-house review of all data as well as automated and manual QC checks with the DEC River Management Program.

In December 2008, BCE completed its own in-house QA review after all the Phase 2 data were entered into the DMS and the Phase 1 data were updated. The Phase 1 DMS and ArcView shapefiles were updated by Mary Nealon and Colleen Sullivan based on the Phase 2 field assessment work during the Phase 2 QA/QC process. The DMS and the ArcView shapefiles for the Dog River Phase 2 study were submitted to Gretchen Alexander of the ANR for a Quality Assurance review in mid December 2008. Some minor revisions were made by Bear Creek Environmental to the DMS following this review.

5.0 RESULTS

A description of each reach/segment from downstream to upstream is provided in this section. The Phase 2 geomorphic and habitat data are provided in Appendix B.

Berlin/Montpelier Reaches

Reach M01

Reach M01 begins at the confluence of the Dog River and the Winooski River and continues upstream to just below Lord Road off of Route 12 in Berlin. This reach was divided into 3 segments due to changes in valley width. Railroad tracks and major roads (Route 12 and Dog River Road) run close to the channel along much of this reach.

Segment M01-A begins at the confluence of the Dog River and the Winooski River near Junction Road on the Berlin-Montpelier town line and continues upstream to just below the Nelson Drive bridge. This segment was very depositional with large bars and steep riffles (Figure5.1). There was some evidence that localized dredging has occurred within this segment as a large side bar that was evident in a 2003 digital orthophoto was not observed in the field under base flow conditions. Erosion was extensive and riparian buffers were generally lacking on both banks. Near bank vegetation often included invasive species. Surrounding land use includes agriculture on the west bank of the channel and recreational fields on the east bank. This segment has been historically channelized and armored to accommodate the surrounding land use practices.

Figure 5.1: Large side bar and steep riffle on Dog River near recreation fields off Dog River Road

The Rapid Geomorphic Assessment (RGA) scored in the fair category due to major aggradation, widening of the channel and active planform adjustment. This segment is a “C” channel that has good floodplain access. The Rapid Habitat Assessment (RHA) rated in the fair category for M01-A due to limited refuge habitat, extensive historic channelization, and poor bank and riparian vegetation coverage. This segment has abundant deep pools, and adequate woody debris.

Segment M01-B is a short segment that begins at the Nelson Drive bridge and extends for just over 1,000 feet through a more confined valley between the natural valley wall to the east and the infringing railroad bed on the west side of the channel. This segment was much more entrenched than both the upstream and downstream segments primarily due to the close proximity of the railroad bed. M01-B was also very depositional with multiple large bars and steep riffles. This segment has been extensively channelized and armored and the riparian buffer was limited, particularly on the west bank where the railroad bed was located immediately adjacent to the channel (Figure 5.2).

Figure 5.2: Straightened segment of channel along railroad bed upstream of Nelson Drive Bridge

The RGA rated in the fair category as some minor historic degradation has occurred, likely associated with channelization activities to accommodate the encroaching railroad bed, and because aggradation and planform adjustment are major active processes. M01-B was on the border between a "C" and a "B" channel with an entrenchment ratio of 2.3. Additionally some plane bed features were noted as a result of extensive channel straightening. The RHA also scored in the fair category due to limited refuge habitat, extensive channelization, and poor bank and riparian vegetation on the west side of the channel. This segment had numerous deep pools and abundant woody debris cover.

Segment M01-C begins where the valley wall opens up and continues to just below Lord Road. This segment largely runs through agricultural fields with the railroad tracks running along the west side of the channel, thereby cutting off floodplain access. This segment was very depositional with numerous large bars and steep riffles. The channel has been substantially straightened and armored to accommodate the encroaching railroad bed, Route 12, and agricultural land use practices. The riparian vegetation on the east bank was generally less than 25 feet wide and this segment has many areas that would greatly benefit from an improved riparian buffer (Figure 5.3). Invasive species are common on the near bank.

The RGA ranked in the fair category due to major active aggradation and minor channel widening and planform adjustment. This segment is a "C" channel that has not undergone any historic degradation. The RHA was also fair for M01-C as a result of limited refuge habitat, limited woody debris cover, extensive historic channelization and limited bank and riparian vegetation. This segment has many deep pools, which provide habitat for trout and other fish.

Figure 5.3: Large point bar and steep riffle with no riparian buffer on east bank near Dog River Road intersection with Route 12

Berlin Reaches

Reach M02

Figure 5.4: Eroding banks and limited riparian vegetation near Browns Mill Road

Reach M02 begins near the intersection of Lord Road and Route 12 in Berlin and continues to about 700 feet upstream of the Browns Mill Road Bridge. This reach primarily runs through agricultural fields and it has been highly channelized and armored in places to accommodate farming activities. This reach is extremely depositional with numerous steep riffles and bars. The riparian vegetation, particularly on the west bank, could use improvement to provide additional stability to the extensively eroding banks (Figure 5.4). Route 12 runs along the channel in M02 but it is not elevated enough to cut off floodplain access. The railroad beyond Route 12, however, is limiting floodplain access.

The RGA scored in the fair category due to major channel aggradation and an actively adjusting planform, as evidenced by numerous flood chutes. M02 is a "C" channel that has not undergone any historic degradation. The RHA also ranked in the fair category due to limited refuge habitat, extensive historic channelization and limited bank and riparian vegetation. This reach has many deep pools and moderate woody debris cover.

Reach M03

Reach M03 begins just downstream of M's RV dealership and continues upstream along Route 12 for 3,255 feet. This reach has been highly channelized and armored, particularly in the area near the RV dealership. Upstream of the railroad bridge, this reach runs along an agricultural field on the north side of the channel and has been historically straightened. M03 was depositional with many bars and one steep riffle (Figure 5.5). Much of the north bank has little to no riparian buffer and near bank vegetation often includes invasive species. Two mass failures were mapped on the south bank in this reach (Figure 5.6). At the upper end of this reach multiple bedrock grade controls were noted. Multiple stormwater inputs were also observed in this reach.

Figure 5.5: Diagonal bar, bank armoring and railroad bridge near where railroad crosses Route 12

Figure 5.6: Mass failure on right bank near M's RV dealership on Route 12

The RGA rated in the good category as there were only minor geomorphic adjustments occurring in this reach. M03 is a "C" channel that has good floodplain access. The RHA scored in the fair category due to limited refuge habitat, limited woody debris cover, extensive historic channelization, and limited bank and riparian vegetation. While the pools in this reach were quite deep, their abundance was not optimal.

Reach M04

Reach M04 begins about 450 feet downstream of a tributary confluence on the west bank (tributary runs along Crozier Road/private driveway) and continues upstream through farm land along Route 12 until about 300 feet beyond the confluence with Muzzy Brook. The reach primarily runs through agricultural land and the railroad is often present along one side of the channel. Generally buffers were less than 25 feet wide and near bank vegetation was primarily invasive species (Figure 5.7). The channel has been straightened and armored in multiple locations within this reach. Bank erosion is extensive along both banks. This reach has significant aggradation with multiple steep riffles and large depositional features. The planform in this reach has adjusted via large flood chutes and a neck cut off in response to multiple undersized railroad bridges (Figure 5.8).

Figure 5.7: Bank erosion, lack of riparian buffer, invasive species and major deposition near Crozier Road intersection with Route 12

Figure 5.8: Major deposition and planform adjustment downstream of undersized railroad bridge

The RGA rated in the fair category as a result of major planform adjustment and aggradation occurring within M04. This reach is a "C" channel that has not undergone any historic degradation. The RHA ranked in the fair category as well due to limited refuge habitat, historic channelization, and limited bank and riparian vegetation. This reach has several deep pools and moderate woody debris cover.

Reach M05

Reach M05 is a short reach that begins just upstream from the confluence with Muzzy Brook and continues through a confined valley for about 1,800 feet. Route 12 runs between the natural valley wall and the channel on the west side, and the railroad runs between the natural valley wall and the channel on the east side. Generally buffers were less than 25 feet wide and near bank vegetation was primarily invasive species (Figure 5.9). About one third of this reach has been historically straightened at the lower end where the valley wall first begins to open up. Much of the reach has been armored to support the encroaching road and railroad. One steep riffle and multiple side bars indicate some minor aggradation is occurring in this reach.

Figure 5.9: Straight, confined channel with invasive near bank vegetation located upstream of confluence with Muzzy Brook

The RGA rated in the good category due to minor aggradation and planform adjustment in response to historic channelization. M05 is a "Bc" channel that has not undergone any historic degradation or widening but is naturally more entrenched in a confined valley with a low slope. The RHA scored in the fair category as a result of limited refuge habitat, limited woody debris cover, and poor bank and riparian vegetation. This reach has several deep pools.

Reach M06

Reach M06 begins where the valley wall opens up along Route 12 and ends near West Berlin Cemetery. This reach was split into two segments due to extensive straightening and an additional corridor encroachment (Route 12) at the lower end of the reach. The railroad runs close to the channel and cuts off floodplain access on the east side for the entire reach.

Segment M06-A is entirely straightened and extensively armored next to the railroad on the east bank. The segment ends where the channel regains some sinuosity. A majority of this segment has buffers of less than 25 feet, particularly on the west bank where residential land use (maintained yard) is dominant (Figure 5.10). Near bank vegetation was primarily invasive species on both banks. This segment is experiencing only minor aggradation, channel widening

and planform adjustments. There is one mass failure on the east bank at the upper end of this segment (Figure 5.11).

Figure 5.10: Straightened channel with invasive near bank vegetation and no riparian buffer where valley walls open up along Route 12

Figure 5.11: Mass failure on right bank where straightened segment begins downstream of Chase Brook confluence

The RGA ranked in the good category due to minor aggradation, widening and planform adjustment, primarily associated with historic channelization to accommodate the railroad. M06-A is a "C" channel that has not historically degraded. The RHA scored in the fair category due to limited refuge habitat, lack of woody debris cover, and poor bank and riparian vegetation. This segment has a few deep pools and little exposed substrate.

Segment M06-B begins where the channel regains sinuosity just downstream of the confluence with Chase Brook and continues upstream to the West Berlin Cemetery on the west bank. This segment was fairly aggradational with two steep riffles and numerous large depositional features. A massive delta bar exists where Chase Brook enters the Dog River (Figure 5.12) which may be in response to the flooding events of July 2008 that caused damage along Chase Brook Road. The buffers are greater than 100 feet on the east bank and generally greater than 50 feet wide on the west bank, with some localized areas that could use some buffer enhancement. Near bank vegetation was primarily invasive species on both banks. Erosion is moderate on both banks and armoring is minimal. This segment has one mass failure on the east bank.

Figure 5.12: Large delta bar at confluence with Chase Brook

The RGA scored in the good category with minor aggradation, widening and planform adjustment. M06-B is a "C" channel that has not historically degraded. The RHA scored in the fair category due to limited refuge habitat, lack of woody debris cover, and invasive bank vegetation. This segment has several deep pools and generally adequate riparian buffers.

Reach M07

Reach M07 begins near West Berlin Cemetery and continues upstream through a bedrock gorge ending where a tributary enters on the west bank near Haskins Terrace. This reach is split into three segments due to a bedrock gorge and large waterfall impacting flow status upstream. The railroad encroaches upon the channel for a significant length and crosses the channel twice in this reach.

Segment M07-A begins near the West Berlin Cemetery and continues upstream to the start of a major bedrock gorge. The riparian land use varies in this segment, with the railroad running along the west side of a major portion of the channel and residential development within the east corridor. Additionally, the Berlin Fire Department building, an industrial facility and areas of forested land exist within the riparian corridor of this segment. The channel has been straightened where it runs close to the railroad bed. In general the buffers are greater than 100 feet on the west bank and greater than 50 feet on the east bank, with some localized areas with buffers of less than 25 feet. Near bank vegetation is primarily invasive species on both banks. Multiple channel constrictions, including two bridges and an old mill structure, have caused some significant planform alteration and sediment aggradation. Large bars and major flood chutes are located above and below these constrictions (Figures 5.13 and 5.14).

Figure 5.13: Mid channel accumulation below undersized railroad bridge near West Berlin Cemetery

Figure 5.14: Old mill structure channel constriction downstream of Route 12 bridge near Berlin Volunteer Fire Department

The RGA ranked in the fair category due to major changes in planform and aggradation in this segment. M07-A is a "Bc" channel that has not incised historically but is naturally moderately entrenched and has a low slope. The RHA scored in the fair category due to limited refuge habitat, invasive bank vegetation and inadequate riparian buffers on the east bank. This segment has a few deep pools and nice woody debris cover. There is some conserved land within the river corridor in this segment (Dog River Natural Area, owned by the Berlin Conservation Commission) near the Berlin Volunteer Fire Department.

Segment M07-B was only partially assessed as it is a bedrock gorge. This segment is located adjacent to Route 12 in the vicinity of Gordon Drive. It is largely inaccessible and relatively unimpacted by human activities as Route 12 is located outside of the valley walls of the gorge.

There is healthy near bank and riparian vegetation on both sides of the channel. This segment has large deep pools and is dominated by bedrock on both the bed and the banks (Figure 5.15). A very large waterfall exists at the upper end of the segment (Figure 5.16). The RGA and RHA were not evaluated for this segment. M07-B is a "Gc" channel by reference that is entrenched in a narrowly confined valley with a low slope.

Figure 5.15: Bedrock gorge near Route 12 and Gordon Drive

Figure 5.16: Large waterfall at upper end of gorge near Route 12 and Gordon Drive

Segment M07-C is a short segment located immediately above the waterfall at the upper end of M07-B that was only partially assessed due to major influence from the waterfall. Most of the segment was a large, deep pool with no defined riffles or active channel characteristics (Figure 5.17). A railroad bridge crosses the channel in this segment that has caused a major mid channel sediment accumulation upstream of the structure. This segment is remotely located and has a healthy riparian buffer on both banks. M07-C is a "Bc" channel by reference in a confined valley with a low slope.

Figure 5.17: Large pool above waterfall and mid channel accumulation upstream of railroad bridge near Route 12 and Pine Hill Drive

Reach M08

Reach M08 begins where a tributary enters on the west bank near Haskins Terrace and continues along Route 12 to approximately 500 feet beyond a railroad bridge. This reach was split into two segments due to the presence of multiple grade controls in the upper segment.

Segment M08-A begins at the confluence of a tributary entering from the west side of the channel near Haskins Terrace and continues to the first waterfall grade control. Surrounding land uses include residential and a municipal gravel mine on the west side of the channel outside the valley wall, and the railroad runs continuously along the east side of the channel cutting off floodplain access. There was minor aggradation and planform adjustment occurring within this reach as evidenced by multiple depositional bars, two steep riffles and three flood chutes. A bedrock constriction upstream of the Lovers Lane Bridge has caused some significant upstream deposition (Figure 5.18). Riparian buffers are generally greater than 50 feet on both banks with localized areas on the east bank with buffers less than 25 feet. Invasive species are present but not dominant along the near bank.

Figure 5.18: Deposition above bedrock constriction near Lovers Lane Bridge

The RGA ranked in the fair category due to minor aggradation, channel widening and planform adjustment. M08-A is a "Bc" channel that has not historically incised but is in a semi-confined valley with a low slope. The RHA also scored in the fair category due to limited refuge habitat and inadequate riparian and bank vegetation.

Segment M08-B begins at a waterfall grade control near the USGS gauging station (Figure 5.19) and continues upstream to about 500 feet beyond a railroad bridge. This segment is dominated by large boulders and bedrock with multiple grade controls. A municipal gravel mine exists on the west side of the channel outside of the valley wall and the railroad runs within close proximity to the channel and crosses it once in this segment. Evidence of a water withdrawal system was noted in the field associated with the gravel mining operations. In general, riparian buffers are greater than 50 feet on the west and greater than 100 feet on the east side of the channel and erosion is minimal.

Figure 5.19: Bedrock grade control and good near bank vegetation near USGS gauging station

The RGA rated in the good category due to very minor aggradation and channel widening. M08-B is a "Bc" channel that has not historically incised and is in a naturally semi-confined valley with a low slope. The RHA ranked in the fair category due to lack of refuge habitat, limited woody debris cover, numerous obstructions (grade controls) and limited buffer width on the west bank due to the gravel mine. This segment has a few deep pools and good near bank vegetation.

Berlin/ Northfield Reaches

Reach M09

Reach M09 begins about 500 feet upstream from the last railroad bridge in Berlin and continues upstream along Route 12 and ends at the confluence with Cox Brook in Northfield. This reach was split into two segments due to changes in valley width and reference stream type.

Segment M09-A begins about 500 feet upstream from the last railroad bridge in Berlin and continues to a large dam near the MWT Products site on Mill Street. Route 12 runs within the east corridor commonly in this segment (Figure 5.20), while the railroad runs along the west side of the corridor; both restrict floodplain access. In areas where the channel is immediately adjacent to one of these encroachments, typically the channel has been straightened, the banks have been armored and riparian vegetation is lacking. Areas of extensive bank erosion are also common, particularly on the west bank (Figure 5.21). In general the riparian buffer is greater than 100 feet on the west bank and greater than 50 feet on the east bank with localized areas of buffers less than 25 feet that are in need of buffer enhancement. Near bank vegetation is primarily invasive species on both banks. Numerous flood chutes indicate active planform adjustment is occurring within this segment.

Figure 5.20: Route 12 running adjacent to channel with no riparian buffer near pull off by "Welcome to Berlin" sign on Route 12

Figure 5.21: Extensive bank erosion on west bank near Berlin-Northfield town line

The RGA ranked in the fair category as a result of an over-wide channel and minor aggradation and planform adjustment. M09-A is a "C" channel that has not historically incised. The channel does not appear to have been significantly impacted by the dam in M09-B. The RHA rated in the fair category also because of limited refuge habitat, limited woody debris cover, an over-wide channel with a lot of exposed substrate, and invasive near bank vegetation. This segment has a few deep pools and a generally healthy riparian buffer on the west side of the channel.

Segment M09-B begins at a large dam near the MWT Products site on Mill Street and continues upstream to the confluence with Cox Brook. This segment also has numerous grade controls and the dam is located on top of a large bedrock grade control making it a potential structure to consider removing in the future (Figure 5.22). The riparian land use characteristics of this

segment include the industrial brownfields site located within the east corridor and multiple residential properties with maintained lawns within both sides of the river corridor (Figure 5.23). The east bank in general is lacking a high quality riparian buffer with a significant portion of the segment having less than 25 feet of buffer, and most near bank vegetation consisting of invasive species. The west bank has a better riparian buffer than the east, but still has some areas that could be improved. Minor aggradation is occurring within this segment as evidenced by one large side bar that begins below the confluence with Cox Brook and continues for a distance below the Cox Brook Road covered bridge. This aggradation appears to be related to the undersized bridge.

Figure 5.22: Dam and bedrock near MWT Products on Mill Street

Figure 5.23: Residential yard lacking riparian buffer with invasive near bank vegetation on east bank near Mill Street

The RGA ranked in the good category with only minor aggradation hindering its score. M09-B is a "Bc" channel that has not historically incised and is in a semi-confined valley with a low slope. The RHA rated in the fair category due to limited refuge habitat, lack of woody debris cover, numerous obstructions (grade controls) and a poor riparian buffer on the east side of the channel. This segment has some deep pools.

Northfield Reaches

Reach M10

Reach M10 begins at the confluence with Cox Brook and continues upstream to just below the N. Main Street Bridge near the Grand Union. This reach was split into two segments due to changes in valley width and reference stream type.

Segment M10-A begins at the confluence with Cox Brook and continues through a narrowly confined valley until the valley walls open up about 175 feet below the Slaughterhouse Road covered bridge. This segment was confined in a very narrow valley where both banks are very steep and high and the channel has no floodplain access. Numerous grade controls and very deep pools (Figure 5.24) were noted. Many residential properties in downtown Northfield along Route 12 are located adjacent to the east side of the channel in this segment but outside the valley wall. This residential land use is responsible for the lack of a wide riparian buffer on

the east side of the channel. The west side of the channel has a healthy riparian buffer of greater than 100 feet.

Figure 5.24: Steep banks and deep pools downstream of Slaughterhouse Road Bridge

The RGA ranked in the good category with only minor aggradation and widening impacting the score. M10-A is an "F" channel that is entrenched in a narrowly-confined valley. The RHA scored in the fair category due to limited refuge habitat, lack of woody debris cover, bankfull obstructions (grade controls) and limited riparian area on the east bank.

Segment M10-B begins about 175 feet below the Slaughterhouse Road covered bridge and continues upstream past the waste water treatment facility, to just below the N. Main Street Bridge near the Grand Union. The railroad runs within the west corridor and cuts off floodplain access along the entire segment. This segment has been extensively straightened and armored along the railroad. The waste water treatment facility (WWTF) located on Dog River Drive is located within the corridor of this segment as well. There is a cement weir spanning the channel that appears to be associated with the WWTF. The Slaughterhouse Road covered bridge has a separate bedrock constriction just upstream and underneath the structure that seems to be causing significant scour and deposition both above and below the structure (Figure 5.25). In general the riparian buffers are greater than 100 feet on the east bank with a few notable areas lacking buffers, and the west bank generally has a buffer width of greater than 50 feet with the exception of the areas immediately adjacent to the WWTF and the railroad bed. Near bank vegetation includes invasive species on both banks (Figure 5.26). This segment has undergone major planform adjustment having multiple flood chutes, while aggradation and channel widening have been

Figure 5.25: Deep pool and scour above bedrock constriction and Slaughterhouse Road Bridge

Figure 5.26 Invasive Japanese Knotweed along west bank with railroad bed in background upstream of Slaughterhouse Road Bridge

minor processes.

The RGA ranked in the fair category due to major historic degradation and planform adjustment. Minor widening and aggradation also contributed to the RGA score. M10-B is a "C" channel that has historically incised (incision ratio=1.52) in response to channelization and floodplain encroachment, and has lost some access to its floodplain. The RHA also rated in the fair category due to limited refuge habitat, extensive historic channelization, and limited riparian area on the west bank. This segment has several very deep pools that are not wadeable and good woody debris cover.

Reach M11

Reach M11 begins just downstream of the N. Main Street bridge near the Grand Union and continues upstream to just above the Northfield Mills hydroelectric dam near Belknap Street. This reach was split into four segments due to changes in flow status resulting from a large beaver dam and a hydroelectric dam.

Segment M11-A begins just downstream of the N. Main Street Bridge and continues upstream to a large beaver dam. There is a large ledge grade control at the downstream end of the segment just above the bridge near the Grand Union (Figure 5.27). There is also a cement weir in the channel upstream of the bedrock grade control. A housing development is located within the floodprone width of this segment on the west side of the channel where the bank is reinforced with extensive bank armoring. The west bank also has many areas with little to no riparian buffer, while the east side of the channel generally has a buffer of greater than 100 feet. Near bank vegetation includes invasive Japanese knotweed (Figure 5.28).

Figure 5.27: Large ledge grade control located upstream of the N. Main Street bridge near the Grand Union

Figure 5.28: Invasive near bank vegetation and lack of riparian buffer near the Dogwood Glen housing development off N. Main Street

The RGA ranked in the good category with only minor aggradataion, widening and planform adjustment. M11-A is a "C" channel that has not historically incised. The RHA scored in the fair category due to limited refuge habitat, lack of woody debris cover, bankfull obstructions, and limited riparian buffer on the west bank. This reach has several nice deep pools.

Segment M11-B was only partially assessed as it was largely impounded by a beaver dam (Figure 5.29). The entire segment is void of riffles and bed features and is not wadeable. The riparian land use on the east side of the channel is primarily a hay field that appears to have not been hayed in a few years. On the west side of the channel, the land use type is primarily forest though there are some residential properties as well. The channel dimensions have been altered because back water from the beaver dam at the lower end of the segment has caused the channel width to depth ratio to be much lower than it would have been under reference conditions. M11-B is currently an "E" channel due to the beaver dam, whereas this segment is a "C" channel by reference.

Figure 5.29: Large beaver dam near Dogwood Glen housing development off N. Main Street

Segment M11-C begins where the beaver dam influence ends near the intersection of Sherman Avenue and Houston Street on the west side of the channel and continues to the Northfield Mills hydroelectric dam. The riparian land use on the west side of the channel is largely industrial while the east side of the channel is generally agricultural and forested. This segment has what appear to be granite tailings in large quantities in the channel downstream of the footbridge behind the Mobil Station on N. Main Street. These squarely cut fragments of granite look like they had been in the channel for some time as they were slightly embedded and covered with algae (Figure 5.30). The channel had been straightened and there is a considerable amount of bank armoring on the west bank where industrial buildings were located close to the channel. The riparian buffers on both banks could use improvement with large areas lacking adequate buffer vegetation. Near bank vegetation is dominated by invasive species on both banks.

Figure 5.30: Granite tailings in channel downstream of footbridge behind Mobil Station on N. Main Street

The RGA ranked in the fair category due to extreme historic degradation and minor widening and planform adjustment. M11-C is an "F" channel as a result of extreme historic incision due to being sediment starved below the large hydroelectric dam in M11-D (Figure 5.31). The channel no longer has access to its floodplain as a result of this incision and has undergone a stream type departure from its reference "C" stream

Figure 5.31: Northfield Mills hydroelectric dam near Belknap Street

type. The RHA also scored in the fair category due to limited refuge habitat, lack of woody debris cover, historic channel alteration, bankfull obstructions (grade controls), and inadequate riparian and near bank vegetation.

Segment M11-D was only partially assessed as the channel was impounded from the Northfield Mills hydroelectric dam. This is a very short segment of only about 140 feet in length beginning at the Northfield Mills dam. The west bank lacks a decent riparian buffer due to the industrial land use practices occurring within the riparian corridor. Both stream banks consist of bedrock and the channel is generally featureless with no riffles or depositional features (Figure 5.32).

Figure 5.32: Impounded channel above Northfield Mills dam near Belknap Street

Reach M12

Reach M12 begins about 140 feet upstream of the Northfield Mills hydroelectric dam and continues upstream to the confluence with Union Brook near Wall Street. This reach was split into two segments due to changes in grade control presence and flow status. The downstream segment has multiple human constructed grade controls and it is impounded from the Northfield Mills dam in M11-D.

Segment M12-A begins just above the Northfield Mills hydroelectric dam in M11-D and continues to just downstream of the Main Street Bridge near downtown Northfield. This segment is impounded by the Northfield Mills dam. Remnants of another dam (Cross Bros. dam) were noted in this segment though it was breached and is not causing an impoundment (Figure 5.33). A weir was also observed within this segment. Much of this segment has been straightened and armored, and some areas are lacking adequate riparian buffers. Near bank vegetation includes invasive species. This impounded segment is a "C" channel but does not have a distinct bedform.

Figure 5.33: Breached dam located downstream of Main Street bridge in downtown Northfield

Segment M12-B begins just below the Main Street Bridge in downtown Northfield and continues to the confluence with Union Brook near Wall Street. This segment flows through a heavily developed area of downtown Northfield where riparian land uses are primarily residential and commercial. Nearly the entire north and many areas on the south side of the channel have a riparian buffer of less than 25 feet. Invasive species are dominant among the near bank and riparian corridor vegetation (Figure 5.34). There are numerous stormwater inputs in this segment due to the urban setting in which it is located. Nearly the entire channel

has been straightened and extensive bank armoring is preventing the channel from further widening.

The RGA ranked in the fair category due to extreme historic degradation and major aggradation and planform adjustment. M12-B is a "B" channel as a result of extensive channelization and development within the riparian corridor. The channel no longer has access to its floodplain as a result of this incision and has undergone a stream type departure from its reference "C" stream type. The RHA also scored in the fair category due to limited refuge habitat, historic channelization, alteration of runoff characteristics and poor riparian and near bank vegetation.

Figure 5.34: Residential development within corridor, invasive bank vegetation and large side bar near the intersection of Water Street and Carpenter Street

Reach M13

Reach M13 begins at the confluence with Union Brook near Wall Street and runs through Norwich University's athletic fields to just below a railroad crossing. This reach has been extensively channelized and armored (Figure 5.35). Much of this reach could use riparian buffer enhancement. Bank erosion was also common on both stream banks. Residential land uses, including Norwich University, dominate the riparian corridor. Near bank and riparian vegetation include invasive species. Many houses have been built right along the banks of the river on Water Street within the floodprone width (Figure 5.36). These properties have a reported history of flooding, and several stormwater inputs were mapped within this reach. Aggradation and planform adjustment are major processes in this reach with numerous large depositional bars, steep riffles, and channel migration features.

The RGA scored in the fair category in this reach due to major aggradation, major planform adjustment and minor channel widening. M13 is a "C" channel that has not incised historically. The RHA also rated in the fair category as a result of limited woody debris cover, limited refuge habitat, extensive historic channelization and low quality riparian and bank vegetation. This reach has several deep pools.

Figure 5.35: Channelized section of Dog River with extensive rip rap and no riparian buffer along Water Street near Norwich University

Figure 5.36: Houses built along Dog River on Water Street near intersection with Western Avenue

Reach M14

Reach M14 begins just below a railroad bridge below the Northfield Town Wellfield and ends at the confluence with Sunny Brook near Fairground Road. Multiple steep riffles, diagonal bars and flood chutes indicate increased aggradation and planform adjustment in this reach (Figure 5.37). Riparian land uses on the west side of the channel is primarily forest, while residential land use dominates the east side of the channel (Figure 5.38). The riparian buffer is less than 25 feet wide in many places along the east bank and both the near bank and riparian vegetation include invasive species on both sides of the channel. The railroad crosses the channel at the lower end of the reach via a bridge located well above the channel, with one pier in the middle of the channel causing major deposition to the west of the pier. This reach has been considerably straightened and minimally armored.

Figure 5.37: Large diagonal bar and invasive bank vegetation near downstream end of Northfield Town Wellfield

Figure 5.38: Residential property lacking bank vegetation downstream of confluence with Sunny Brook

The RGA rated in the fair category as a result of major aggradation and planform adjustment, and minor channel widening. M14 is a “C” channel that has not historically incised. The RHA

scored in the fair category as well due to limited woody debris cover, limited refuge habitat, and inadequate riparian and bank vegetation on the east bank.

Reach M15

Reach M15 begins at the confluence with Sunny Brook near Fairground Road and continues to about 100 feet above the confluence with Bull Run. Much of this reach has been straightened as it runs through a field and adjacent to Route 12A at the lower end (Figure 5.39). Bank armoring is also preventing widening at the lower end of the reach. There is extensive erosion along both banks and limited riparian buffer along portions of the east side of the channel where residential land use dominates. Near bank and riparian vegetation largely consists of invasive species. Multiple steep riffles, diagonal bars and flood chutes indicate increased aggradation and planform adjustment within the reach. There is some evidence of juvenile floodplain beginning to form on the east bank near the measured cross section.

Figure 5.39: Straightened channel with limited near bank vegetation and riparian buffer near end of Expansion Drive.

The RGA scored in the fair category due to major aggradation and planform adjustment, and minor widening and historic degradation. M15 is a "C" channel that has historically incised (incision ratio=1.3) and has lost some access to its floodplain. The RHA ranked in the fair category due to limited woody debris cover, limited refuge habitat, and inadequate vegetation on the near bank and within the buffer on the east side of the channel. This reach has several deep pools.

Reach M16

Reach M16 begins about 100 feet upstream of the confluence with Bull Run, just below a railroad bridge, and continues upstream along Route 12A to the confluence with Stony Brook. This reach runs adjacent to Route 12A for its entire length and is lacking a riparian buffer on the east bank along the road embankment (Figure 5.40). The land use on the west side of the channel is primarily residential and it generally has a buffer of 50-100 feet. This reach has been significantly straightened and armored along the east bank. Both the near bank and riparian vegetation included invasive species. This reach had long riffles due to channelization.

Figure 5.40: Straightened channel with no riparian buffer along Route 12A near Stony Brook Road

The RGA rated in the fair category due to major historic degradation and minor widening and planform adjustment. M16 is a "Cb" channel that has historically incised due to the Route 12A encroachment and extensive straightening. Though this reach has historically degraded, it has not lost access to its floodplain. The RHA also ranked in the fair category due to lack of woody debris cover, lack of refuge habitat, extensive historic channelization, and lack of riparian buffer on the east side of the channel. This reach has a few deep pools.

Reach M17

Reach M17 begins at the confluence with Stony Brook and continues upstream through the golf course at Northfield Country Club and ends upstream of Freeman Road. This reach was split into three segments due to changes in channel dimensions and changes in the quality of the near bank and buffer vegetation.

Segment M17-A begins at the confluence with Stony Brook and ends at the first golf cart bridge at the golf course at Northfield Country Club. Bedrock is present in several places in this segment but there are no channel spanning grade controls. There are multiple steep riffles and diagonal bars in this reach though there were no large depositional bars. The aggradation noted may be the result of channel straightening through the golf course upstream allowing the stream to carry more sediment into this segment. There was some straightening and minor bank armoring in this segment. The buffers are generally healthy and greater than 100 feet in width on both sides of the channel in this segment. Near bank vegetation was dominated by invasive species (Figure 5.41).

Figure 5.41: Invasive vegetation on near bank and deep pool just below start of golf course at Northfield Country Club along Route 12A

The RGA scored in the fair category as a result of major historic channel degradation, minor widening and minor planform adjustment. M17-A is a "C" channel that has historically incised (incision ratio=1.41) and has lost some access to its floodplain. The RHA ranked in the fair category as well due to limited woody debris cover and limited refuge habitat. This segment had numerous deep pools and healthy riparian buffers.

Segment M17-B begins at the lowest golf cart bridge at the golf course at Northfield Country Club and continues upstream through the golf course to about 100 feet above the Route 12A Bridge where the riparian buffer improves. The channel has been highly altered through the golf course with extensive channelization, bank armoring and lack of riparian buffer. The extensive bank armoring is preventing the channel from widening. The channel also has five undersized bridges acting as channel constrictions (Figure 5.42). Near bank vegetation is dominated by invasive species.

The RGA scored in the good category though the stream channel has been highly altered and is only stable due to extensive bank armoring. M17-B has undergone a stream type departure from a reference "C" stream type to an "E" stream type due to extensive channelization that has caused a low width to depth ratio. The RHA ranked in the fair category due to lack of woody debris cover, lack of refuge habitat, extensive historic channelization, poor bank vegetation and lack of riparian buffers. This segment has several deep pools.

Figure 5.42: Straightened channel through golf course at Northfield Country Club with no riparian vegetation and bridge

Segment M17-C begins where the riparian buffer improves at the upper end of the golf course at Northfield Country club and continues to above Freeman Road. The golf course is within the riparian corridor on the northwest side of the channel but a riparian buffer of 26-50 feet exists between the channel and the golf course. There is a healthy riparian buffer of greater than 100 feet on the southeast side of the channel. The vegetation is generally comprised of large deciduous trees and native herbaceous species with some minimal invasive species noted on the near bank. One rejuvenating tributary was mapped within this segment where the mainstem has incised historically, and a well developed juvenile floodplain has developed in some places. Two bedrock grade controls were mapped in this segment (Figure 5.43).

Figure 5.43: Ledge grade control with deep pool and healthy near bank vegetation near the intersection of Freeman Road and Route 12A

The RGA scored in the fair category due to major historic degradation, minor aggradation, minor widening and minor planform adjustment. M17-C is a "C" stream type that has incised historically but has not lost access to its floodplain. The RHA ranked in the good category with abundant woody debris cover, numerous deep pools, well vegetated river banks and generally healthy riparian buffers. This segment has limited refuge habitat and two bankfull obstructions (bedrock grade controls).

Reach M18

Reach M18 begins upstream of the intersection of Route 12A and Freeman Road and continues to the confluence with Felchner Brook. This reach was split into two segments to accommodate for different reference stream types and grade control presence.

Segment M18-A begins upstream of the intersection of Route 12A and Freeman Road and continues for about 985 feet along Route 12A to the first major bend the river takes away from the road. This segment has numerous ledge grade controls and the channel slope is steeper than the rest of the reach (Figure 5.44). Route 12A runs very close to the north bank of the channel along the entire segment and a riparian buffer is absent on that side. The south side of the channel has a healthy riparian buffer of greater than 100 feet. Near bank vegetation includes some invasive species on both banks. This segment has been extensively straightened to run adjacent to the road and the north bank has been heavily armored.

Figure 5.44: Ledge grade control, invasive vegetation and lack of riparian buffer along Route 12A near sharp bend upstream of Freeman Road

The RGA scored in the good category with only minor aggradation, widening and planform adjustment. M18-A is a "B" stream type in a naturally narrow valley. The RHA ranked in the fair category due to lack of woody debris cover, extensive historic channelization, limited refuge habitat, flow alteration due to runoff and lack of riparian buffer on the north side of the channel.

Segment M18-B begins at a major bend the river takes away from Route 12A and continues to the confluence with Felchner Brook. The upper part of this segment runs along an agricultural field and is in a broader valley than the lower part of the segment. A good portion of this segment has been straightened. The banks have been minimally armored and are generally in good shape with minor erosion. In general this segment has good riparian buffers but runs through some agricultural and residential land where the buffers could use improvement (Figure 5.45). Invasive vegetation is present on the stream banks. Aggradation is a major process occurring within this segment as evidenced by multiple steep riffles and large depositional features.

Figure 5.45: Agricultural field lacking riparian buffer and eroding banks near Little Northfield Road and Route 12A

The RGA rated in the fair category due to major historic degradation, major aggradation, minor channel widening and minor planform adjustment. M18-B is a "C" stream type that has historically incised but has not lost access to its floodplain. The RHA scored in the good category with abundant woody debris cover, abundant refuge habitat, many deep pools

(including one very large and deep pool at a sharp bend) and adequate near bank and riparian vegetation (Figure 5.46).

Figure 5.46: Large, deep pool at sharp bend downstream of Little Northfield Road

Reach M19

Reach M19 begins at the confluence with Felchner Brook near Little Northfield Road, continues along Route 12A through a bedrock gorge and ends just upstream of the Beaudette Road Bridge. This reach was split into three segments due to changes in valley width and grade control presence.

Segment M19-A begins at the confluence with Felchner Brook and continues to just above the Route 12A bridge near Potato Hill Road. This segment runs adjacent to Route 12A and generally has a riparian buffer of less than 50 feet on the north bank where the road is located. The railroad runs outside of the valley wall on the south side of the channel and the riparian buffer is generally greater than 100 feet on that side. Near bank vegetation is healthy with alders dominating the banks (Figure 5.47). One mass failure was observed in this reach. About one quarter of the length of this segment has been straightened and localized areas of bank armoring and erosion are present.

Figure 5.47: Healthy near bank vegetation downstream of Route 12A bridge near Potato Hill Road.

The RGA ranked in the fair category due to major historic degradation, minor aggradation, widening and planform adjustment. M19-A is a "C" channel that has historically incised (incision ratio=1.60) and has lost some access to its floodplain. The RHA ranked in the good category with excellent woody debris cover, abundant refuge habitat, numerous deep pools, and generally healthy riparian buffers.

Segment M19-B was only partially assessed as it is a bedrock gorge. This segment begins just above the Route 12A Bridge near Potato Hill Road and continues upstream through a narrowly confined valley for about 570 feet to the end of the gorge. Route 12 A runs along the southeast side of the channel along with some residential development, where buffers are generally greater than 25 feet wide. The northwest side of the channel has buffers of

Figure 5.48: Bedrock stream banks in gorge segment near railroad bridge and Potato Hill Road.

greater than 100 feet. The banks are bedrock dominated and are in good shape (Figure 5.48). The railroad crosses the channel in this segment at a very high elevation that does not impact the channel as a constriction. This gorge-segment is an "F" stream type that does not have floodplain access by reference.

Segment M19-C begins above the bedrock gorge and continues to just upstream of the Beaudette Road Bridge. This segment has adequate riparian buffers on both sides of the channel with minimal residential land use within the corridor. The banks are healthy with no invasive species present, no bank armoring and minimal bank erosion. This segment had three bedrock grade controls (Figure 5.49).

Figure 5.49: Grade control near Beaudette Road Bridge

The RGA scored in the fair category due to major historic degradation, minor aggradation, minor channel widening and minor planform adjustment. M19-C is a "C" channel that has historically incised but has not lost access to its floodplain. The RHA rated in the good category with excellent woody debris cover, abundant refuge habitat, numerous deep pools, and healthy riparian buffers. This segment has multiple bankfull obstructions impeding fish passage.

Northfield/Roxbury Reaches

Reach M20

Reach M20 begins upstream of the Beaudette Road bridge and continues upstream to a sharp bend in the channel just below a railroad bridge where a tributary enters on the west bank. This reach was split into three reaches due to changes in valley width and sinuosity.

Segment M20-A begins upstream of the Beaudette Road bridge and below a railroad bridge and continues along a fairly straight path adjacent to the railroad bed to just upstream of the Rabbit Hollow Road Bridge. This segment has been straightened in places and heavily armored along the east bank where it runs close to the railroad (Figure 5.50). The railroad bed has been built up near the stream channel and it has cut off floodplain access and significantly altered the valley width for this segment. The riparian buffer is inadequate along the east bank near the railroad as well. In general near bank and riparian vegetation is healthy. The Rabbit Hollow Road Bridge is located high above the

Figure 5.50: Straightened channel along railroad bed lacking riparian vegetation downstream of Rabbit Hollow Road

river and is not constricting the channel.

The RGA ranked in the fair category due to extreme historic degradation, minor aggradation, minor widening and minor planform adjustment. M20-A has undergone a stream type departure from a "C" stream type in a very broad valley to a "B" stream type in a semi-confined valley with limited floodplain access due to the railroad encroachment. The RHA ranked in the fair category due to limited woody debris cover, lack of refuge habitat and lack of riparian buffer on the east bank. This segment has abundant deep pools.

Segment M20-B begins just above the Rabbit Hollow Road Bridge and continues through a sinuous path to where the valley width begins to narrow. This segment has extensive wetlands on both sides of the channel and an offstream pond exists within the west riparian corridor in a residential yard. In general the segment has adequate buffers with the exception of the residential property on the west bank where some additional vegetation planting could help to stabilize the bank. Erosion is common on the west bank where the riparian buffer is lacking (Figure 5.51). This segment is fairly aggradational with multiple steep riffles and depositional bars (Figure 5.52), and the planform is undergoing adjustment as evidenced by multiple floodchutes.

Figure 5.51: Lack of riparian buffer and bank erosion along residential property on Rabbit Hollow Road

Figure 5.52: Large diagonal bar and steep riffle just over Roxbury town line above Rabbit Hollow Road

The RGA ranked in the fair category due to minor historic degradation, minor aggradation, minor channel widening and major planform adjustment. M20-B is a "C" stream type that has historically incised but has not lost access to its floodplain. The RHA also scored in the fair category due to lack of woody debris cover, limited refuge habitat, and lack of riparian buffer and increased erosion in residential areas. This segment has several deep pools.

Segment M20-C begins where the valley width begins to narrow upstream of Rabbit Hollow Road and continues along a very straight path adjacent to the railroad bed to a sharp bed in the channel just below a railroad bridge where a tributary enters on the west bank. This segment is extremely straight and has been channelized along its entire length (Figure 5.53). The railroad bed encroachment cuts off floodplain access on the east bank and has caused a change in the valley type from broad to narrow. The riparian buffer width on the east bank is generally less

than 50 feet with many areas lacking a riparian buffer altogether. The west side of the channel has an adequate and healthy riparian buffer. In general the stream banks are fairly stable with some localized areas of bank erosion.

Figure 5.53: Straightened channel with stable banks and good vegetation above Roxbury town line

The RGA scored in the fair category due to major historic degradation as a result of extensive channelization, minor aggradation, minor channel widening and minor planform adjustment. M20-C is a "C" stream type that has historically incised (incision ratio=1.41) and has lost some access to its floodplain. The RHA also ranked in the fair category due to limited woody debris cover, limited refuge habitat, few deep pools, extensive historic channelization, and lack of riparian buffer on the east bank near the railroad. This segment has fairly stable banks.

Roxbury Reaches

Reach M21

Reach M21 begins just below a railroad bridge at a sharp bend in the channel near the Roxbury Cemetery and continues to just beyond the Town Garage. This reach was split into four segments due to changes in channel dimensions and flow status.

Segment M21-A begins just below a railroad bridge and continues upstream to just below the first Roxbury Road bridge. This segment generally has adequate riparian buffers with some localized areas on both banks near Roxbury Road that could use some buffer enhancement. Established alders are common along the banks and seem to be holding the banks together and preventing widening. There were some localized areas of bank erosion where adequate near bank vegetation is lacking. The channel is fairly straight but there is no direct evidence that the stream has been straightened where it runs away from Roxbury Road (Figure 5.54).

Figure 5.54: Naturally straight channel with stable bank vegetation near Roxbury Cemetery

The RGA ranked in the fair category due to major historic degradation, minor aggradation, minor channel widening and minor planform adjustment. M21-A is a "C" channel that has historically incised (incision ratio=1.46) and has lost some access to its floodplain. The RHA also rated in the fair category due to lack of woody debris cover and lack of refuge habitat.

This segment has several deep pools and riparian buffers that are generally greater than 100 feet with diverse, native vegetation.

Segment M21-B was only partially assessed as it is a wetland. This segment begins just below the first Roxbury Road Bridge and continues to the end of the wetland where a recently excavated channel begins. Some clay is present in isolated areas of the lower bank. In general the riparian buffers on both banks are greater than 100 feet with some isolated exceptions near stream crossings. This segment had four undersized bridges crossing the wetland, and two beaver dams were observed. M21-B is am "E" wetland channel by reference that is in good condition (Figure 5.55).

Figure 5.55: Wetland channel downstream of second Roxbury Road Bridge

Segment M21-C was only partially assessed because the channel was dry. This segment begins at the end of the wetland and continues upstream to just below Warren Mountain Road. The stream is ephemeral in this segment with some isolated pools but over 90 percent of the bed was dry upon observation (Figure 5.56). The railroad runs along the east side of the channel and cuts off floodplain access. A portion of this channel has been recently relocated and channelized. This segment is lacking healthy riparian buffers on both sides of the channel and the east bank has been significantly armored. M21-C is a "C" channel that seems to be in fair condition.

Figure 5.56: Dry stream channel with pockets of groundwater seepage in channelized area near tennis camp on Roxbury Road

Segment M21-D begins at the Warren Mountain Road Bridge and continues upstream to just beyond the Town Garage. This segment has been largely channelized and bermed with extensive floodplain encroachment and poor riparian buffers. In general the near bank and riparian vegetation in this segment could use improvement (Figure 5.57).

Figure 5.57: Straightened channel lacking riparian buffer with low width to depth ratio upstream of Warren Mountain Road Bridge

The RGA scored in the fair category due to major historic degradation, minor aggradation, minor channel widening and minor planform adjustment. M21-D has undergone a stream

type departure from a reference "C" channel to an "E" stream type as a result of channelization. The RHA ranked in the poor category due to extensive historic channelization, altered hydrologic characteristics, lack of refuge habitat, lack of bank vegetation and lack of riparian buffer. This segment has a few deep pools and some woody debris cover.

Tributaries (Northfield)

Reach T1.01 (Cox Brook)

Reach T1.01 begins at the confluence with the Dog River near Cox Brook Road and continues upstream to a sharp bend in the channel below Aseltine Road. This reach was split into three segments due to changes in valley width and grade control presence.

Segment T1.01-A begins at the confluence with the Dog River and continues upstream to just beyond the Cox Brook Road Bridge near the intersection with Staples Road. There are numerous ledge and waterfall grade controls in this segment. A dam was removed from this segment in September 2008. This dam was located in a bedrock dominated area downstream of the second Cox Brook Road Bridge and the removal of the dam does not appear to have caused any major incision downstream of its former location. New grass and small saplings had been planted in the vicinity of the old dam (Figure 5.58). Cox Brook Road runs along the entire length of this segment, thereby slightly altering the valley width and limiting floodplain access. There are four channel constrictions in this segment causing various problems within the channel. Many areas have bank armoring and are lacking riparian buffers where the channel runs immediately adjacent to Cox Brook Road (Figure 5.59). Multiple flood chutes indicate major planform adjustment is occurring within this segment.

Figure 5.58: Location of removed dam along Cox Brook Road near Pierson Hill with bedrock grade controls and newly planted vegetation

Figure 5.59: Bank erosion along maintained yard with Cox Brook Road in background upstream of second covered bridge on Cox Brook Road

The RGA rated in the fair category due to extreme historic degradation as a result of floodplain encroachments, major planform adjustment, minor aggradation and minor widening. T1.01-A has undergone a stream type departure from a reference "C" stream type to an "F" stream type as a result of Cox Brook Road cutting off floodplain access. The RHA rated in the fair

category due to lack of woody debris cover, limited refuge habitat, numerous bankfull obstructions, and inadequate riparian buffers. This segment has abundant deep pools.

Segment T1.01-B begins just beyond the Cox Brook Road Bridge near the intersection with Staples Road and continues to about 300 feet below the Jerry Road Bridge. Cox Brook Road runs along the south side of the channel and is built up as the new valley wall. There is an undersized driveway bridge that is causing planform adjustment with large flood chutes both above and below the structure (Figure 5.60). The riparian buffer on the north side of the channel is greater than 100 feet while the buffer on the south side of the channel is generally greater than 50 feet with some areas of less than 25 feet of buffer.

Figure 5.60: Incised channel and flood chute looking at south bank downstream of driveway bridge off Cox Brook Road below Jerry Road

The RGA ranked in the fair category due to extreme historic degradation as a result of a floodplain encroachment, major planform adjustment, minor aggradation and minor channel widening. T1.01-B has undergone a stream type departure from a reference "C" channel to a "Bc" channel as a result of Cox Brook Road cutting off floodplain access. The RHA scored in the fair category due to lack of refuge habitat and limited riparian buffers on the south side of the channel. This segment has several deep pools, abundant woody debris cover and a healthy riparian habitat on the north side of the channel.

Segment T1.01-C begins about 300 feet below the Jerry Road Bridge and continues to a sharp bed in the channel below Aseltine Road. This segment had many grade controls and the bed substrate was dominated by bedrock and large boulders (Figure 5.61). The channel is further away from Cox Brook Road than the lower segments and it has not been significantly channelized. Some minor bank armoring exists in areas where the channel is closer to the road and in the vicinity of the Jerry Road Bridge. Cox Brook Road is creating a new valley wall and limiting floodplain access in this segment. There is some residential development within both sides of the riparian corridor. In general the north bank has a healthy riparian buffer of greater than 100 feet in width, while there is a significant portion on the south side of the channel with little to no riparian buffer along a residential property.

Figure 5.61: Bedrock and bounder dominated substrate with residential development within right corridor upstream of Jerry Road

The RGA ranked in the good category due to extreme historic degradation, minor aggradation, minor channel widening and minor planform adjustment. T1.01-C has undergone a stream type departure from a reference "C" channel to an "F" channel as a result of historic channel incision. The RHA also scored in the fair category due to lack of woody debris cover, limited refuge habitat, numerous bankfull obstructions and poor riparian buffers on the south side of the channel.

Reach T2.01 (Union Brook)

Reach T2.01 begins at the confluence with the Dog River near Wall Street in downtown Northfield and continues for about 2,100 feet along Union Street. This reach runs through a heavily developed area with roads on either side of the channel in places. All adjacent roads are not elevated significantly above the floodprone elevation of Union Brook and are therefore not altering the natural valley walls of the stream. The channel has been highly channelized and armored in this extremely developed area (Figure 5.62). Bank erosion is common on both banks, and the riparian buffers are nearly non-existent along the entire north bank and along the lower half of the south bank. The south side of the channel gains a healthier riparian buffer at the upper end of this reach. As per a local landowner, the area downstream of Pleasant Street on the south bank was filled in and armored in 2006. Seven stormwater inputs were mapped in this reach, locally altering the runoff characteristics of the stream. Some recent tributary and/or stormwater ditching was noted to be entering the stream, originating from a residential yard.

Figure 5.62: Straightened channel with bank armoring and lacking riparian buffers near the intersection of Traverse Street and Union Street

The RGA rated in the fair category due to major historic degradation as a result of floodplain encroachment, minor aggradation, minor widening and minor planform adjustment. T2.01 is a "C" channel that has historically incised but has not lost access to its floodplain. The RHA also ranked in the fair category due to lack of woody debris cover, extensive historic channelization, lack of refuge habitat, lack of deep pools and lack of adequate riparian buffers.

Reach T3.01 (Sunny Brook)

Reach T3.01 begins at the confluence with the Dog River near the intersection of Lovers Lane and Route 12A in Northfield and continues to the confluence with a major tributary near the intersection of Old Mill Hill and Route 12. Lovers Lane and Route 12 run alongside the channel for the entire length of the reach. Residential land use dominates this reach where riparian buffers of less than 25 feet in width are common. Twelve stormwater inputs were mapped in this reach, indicating that stormwater runoff patterns have been altered. This reach has been significantly straightened and armored on both banks to accommodate roads and infrastructure

(Figure 5.63). Localized areas of moderate bank erosion were common and one mass failure was noted on the northeast bank. Five undersized bridges span the channel in this reach and one breached dam exists as a channel constriction (Figure 5.64). Eight bedrock grade controls were mapped in this reach along with two human constructed, non-regulated dams, all of which impede fish passage. Numerous flood chutes indicate major planform adjustment.

Figure 5.63: Straightened channel with armoring on both banks and small dam along Lovers Lane near the intersection with Route 12A

Figure 5.64: Mid channel accumulation upstream of breached dam near the intersection of Route 12 and Lovers Lane

The RGA scored in the fair category due to extreme historic degradation as a result of extensive road encroachments, major planform adjustment, minor aggradation and minor channel widening. T3.01 has undergone a stream type departure from a reference "C" stream type to a "B" stream type as a result of extensive road encroachments cutting off floodplain access to the channel. The RHA also ranked in the fair category due to limited refuge habitat, major historic channelization, increased stormwater influence, abundant bankfull obstructions and lack of a continuous and healthy riparian buffer. This reach has several large deep pools and abundant woody debris cover.

Reach T4.01 (Bull Run)

Reach T4.01 begins at the confluence with the Dog River near Bull Run Road and continues along Bull Run Road to just below Camp Wihakowi. Bull Run Road remains outside the valley wall on the east side of the channel for the most part with forested land dominating the corridor land use type. There are some isolated areas where the riparian buffer is less than 25 feet on the east side of the channel, but in general the riparian buffers are greater than 100 feet on both banks. The upper portion of this reach had a section with a slightly narrower valley width, but the valley width was consistent both above and below this narrower section. Three undersized bridges in this reach are causing deposition and scour problems within the channel. There is a fair amount of erosion and one mass failure on the east bank. Several flood chutes and one island indicate some major planform adjustment is occurring within this reach, much of this planform adjustment is confined to the area near the island (Figure 5.65).

The RGA scored in the fair category due to minor aggradation, minor channel widening and major planform adjustment. T4.01 is a "Bc" stream type that has not incised but naturally has limited floodplain access. In some areas the stream had some additional floodplain access and the stream type is borderline between a "C" and a "Bc" channel. The RHA ranked in the good category due to adequate woody debris cover, numerous deep large pools and healthy near bank and riparian vegetation. This reach is limited in terms of refuge habitat.

Figure 5.65: Island in channel with healthy near bank and riparian vegetation downstream of Bull Run Road Bridge

Reach T5.01 (Stony Brook)

Reach T5.01 begins at the confluence with the Dog River near Stony Brook Road and continues to about 400 feet upstream of the Stony Brook Road covered bridge. This reach was split into two segments due to changes in channel dimensions.

Segment T5.01-A begins at the confluence with the Dog River near Stony Brook Road and continues to just above a major channel avulsion above the intersection of Stony Brook Road and Smith Hill Road. This segment had variable issues and was difficult to characterize. The lower end of the segment was completely channelized and armored with the road and some residential properties within the north riparian corridor (Figure 5.66). There is a large waterfall above this channelized section and several ledge grade controls above the waterfall. At the upper end of the segment the channel has avulsed from its original location and Stony Brook Road now runs close to the north bank (Figure 5.67). The riparian buffer is less than 25 feet on the north side of the channel in this area near the channel avulsion. Aside from this localized area, the riparian buffers were generally healthy on both banks. The bankfull channel width is over-wide in this segment due to the channel avulsion.

Figure 5.66: Straightened portion of segment with bank armoring and near Stony Brook's confluence with the Dog River

Figure 5.67: Lower end of large channel avulsion with active flood chute near intersection of Smith Hill Road and Stony Brook Road

The RGA scored in the fair category due to minor historic degradation from the channel avulsion, major channel widening, major planform adjustment and minor aggradation. T5.01-A is a "Bc" channel that has historically incised and also naturally has reduced floodplain access. The RHA ranked in the fair category due to limited refuge habitat, major historic channelization, many bankfull obstructions and reduced riparian vegetation near the channel avulsion. This segment has several large pools and abundant woody debris cover.

Segment T5.01-B begins above the large channel avulsion above the intersection of Stony Brook Road and Smith Hill Road and continues to about 400 feet upstream of the Stony Brook Road covered bridge. Stony Brook Road runs alongside the channel throughout this segment. Road material was noted to be washing into the channel in the vicinity of the covered bridge. Six mapped stormwater inputs indicate some alteration of the runoff characteristics within this reach due to the road (Figure 5.68). The riparian buffer was generally greater than 100 feet on both sides of the channel, but there were some isolated areas lacking a riparian buffer on both sides where the channel runs close to the road. This segment had numerous bedrock grade controls obstructing fish passage (Figure 5.69).

Figure 5.68: Stormwater outfall in loose road material that can easily wash into channel downstream of Stony Brook Road Bridge.

Figure 5.69: One of many large bedrock grade controls obstructing fish passage below Stony Brook Road covered bridge.

The RGA scored in the good category due to minor aggradation, minor widening and minor planform adjustment. T5.01-B is a "Bc" channel that has not incised historically but is in a naturally narrow valley with reduced floodplain access. The RHA ranked in the fair category due to limited woody debris cover and numerous bankfull obstructions. This segment has several large deep pools, abundant refuge habitat, and generally adequate riparian buffers.

Reach T6.01 (Felchner Brook)

Reach T6.01 begins at the confluence with the Dog River near Little Northfield Road and continues along Little Northfield Road to about 1000 feet below Murphy Road. This reach was split into three segments due to changes in valley width, grade control presence and reference stream type.

Segment T6.01-A is a short segment that begins at the confluence with the Dog River near Little Northfield Road and continues through agricultural land to the start of a bedrock gorge. This segment is completely channelized with some areas of bank armoring and bank erosion. Both banks have dominant riparian buffers of less than 25 feet. There is one undersized culvert in this reach running under Route 12A causing some deposition and scour below the structure (Figure 5.70).

Figure 5.70: Undersized culvert and straightened channel at Route 12A near Little Northfield Road

The RGA scored in the fair category due to extreme historic degradation from channelization, minor aggradation, minor channel widening and minor planform adjustment. T6.01-A has undergone a stream type departure from a reference "C" stream type to a "B" channel due to extreme historic incision associated with channelization. The RHA also scored in the fair category due to lack of woody debris cover, extensive historic channelization, lack of refuge habitat and lack of healthy riparian buffers.

Segment T6.01-B was only partially assessed as it is a bedrock gorge. This segment begins above the agricultural land near the intersection of Little Northfield Road and Route 12A and continues to the end of the gorge. The gorge runs through a semi-confined valley that is entirely dominated by bedrock (Figure 5.71). Little Northfield Road runs along the east side of the channel but the road is outside of the valley wall. This segment is minimally impacted with dominant riparian buffers of greater than 100 feet on both sides of the channel. T6.01-B is an "A" stream type by reference and it appears to be stable and in good condition.

Figure 5.71: Downstream end of bedrock gorge near Little Northfield Road and Route 12A

Segment T6.01-C begins above the bedrock gorge along Little Northfield Road and continues to about 1,000 feet below Murphy Road. This segment is remotely located, with Little Northfield Road running outside the valley wall on the north side of the channel. In general the riparian buffers are greater than 100 feet on both sides of the channel with forested land dominating the corridor land uses (Figure 5.72). Several channel spanning bedrock grade controls were mapped within this segment (Figure 5.73).

Figure 5.72: Channel with floodplain access and nice riparian vegetation above bedrock gorge

Figure 5.73: Bedrock waterfall with woody debris downstream of Murphy Road crossing

The RGA rated in the good category due to minor aggradation and minor planform adjustment as evidenced by five flood chutes and numerous small side bars. T6.01-C is a "Cb" stream type that has not historically incised. Some areas of this segment were slightly more entrenched, but overall the channel had good floodplain access. The RHA also scored in the good category with abundant woody debris cover, several deep pools and healthy riparian buffers. This segment has limited refuge habitat and many bankfull obstructions (bedrock grade controls).

5.1 Rapid Geomorphic Assessment

The geomorphic condition for each Phase 2 reach is determined using the rapid geomorphic assessment (RGA) protocol, and is based on the degree of departure of the channel from its reference stream type (Vermont Agency of Natural Resources, 2007b). The reference condition for each of the Phase 2 reaches was previously identified in Table 3.1. The 26 reaches of the Dog River watershed that were assessed were further broken down into 54 segments based on changing stream conditions. Of these 54 segments, Phase 2 RGAs were conducted on 45 segments, the remaining 9 segments were only partially assessed as they were either bedrock gorges or they were impounded due to dams or beaver activity. Of the 45 segments where RGAs were evaluated, 12 segments rated in the good category and 33 segments rated in the fair category. Figure 5.74 illustrates the geomorphic condition of the streams in relation to the watershed.

The dominant adjustment processes in the Dog River watershed are aggradation and planform adjustment. Several of the reaches studied in the Dog River watershed are undergoing a channel evolution process in response to large scale changes in sediment, slope, and/or discharge associated with human influences on the watershed. Table 5.1 below summarizes the existing stream type, channel evolution stage, and the primary active adjustment processes that are occurring for each study reach or segment. Active adjustment processes are generally minor to major; no extreme active adjustment processes are taking place within the study area.

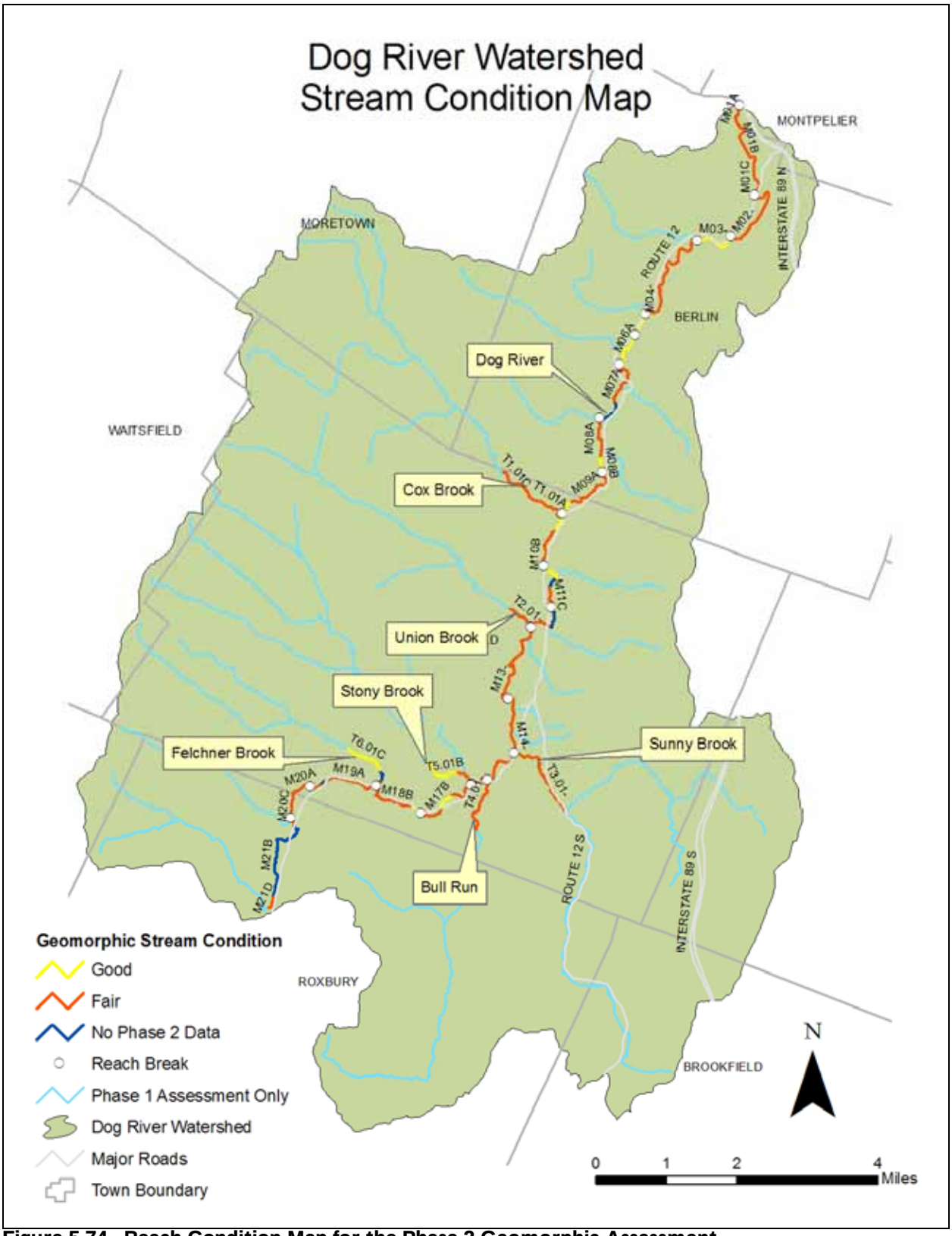


Figure 5.74. Reach Condition Map for the Phase 2 Geomorphic Assessment

Table 5.1. Stream Type and Channel Evolution Stage

Segment Number	Entrench-ment Ratio	Width to Depth Ratio	Reference Stream Type	Existing Stream Type	Channel Evolution Stage	Active Adjustment Process
M01-A	2.6	26.0	C4	C4	D IIc	**Planform Widening Aggradation**
M01-B	2.3	13.4	C4	C4	F III	**Aggradation** Widening **Planform**
M01-C	11.2	27.1	C4	C4	D IIc	**Aggradation** Planform Widening
M02	10.1	16.1	C4	C4	D IIc	**Aggradation Planform** Widening
M03	3.0	25.8	C4	C4	D IIc	Aggradation Widening Planform
M04	7.2	14.8	C4	C4	D IIc	**Aggradation Planform** Widening
M05	2.1	13.4	B4c	B4c	F I	Aggradation Planform
M06-A	8.7	14.5	C4	C4	D IIc	Aggradation Planform Widening
M06-B	3.4	18.8	C4	C4	D IIc	Aggradation Planform Widening
M07-A	2.0	29.6	B4c	B4c	D IIc	**Planform** Widening **Aggradation**
M07-B	Not Assessed – Bedrock Gorge					
M07-C	Not Assessed – Impounded					
M08-A	1.9	14.8	B4c	B4c	D IIc	Aggradation Widening Planform
M08-B	1.4	26.3	B4c	B2c	F I	Aggradation Widening
M09-A	2.7	31.0	C4	C4	D IIc	Aggradation Planform **Widening**
M09-B	1.4	19.3	B2c	B2c	F I	Aggradation
M10-A	1.2	18.8	F3	F3	F I	Aggradation Widening
M10-B	2.1	23.7	C4	C4	F III	**Planform** Aggradation Widening

Table 5.1. Stream Type and Channel Evolution Stage

Segment Number	Entrench-ment Ratio	Width to Depth Ratio	Reference Stream Type	Existing Stream Type	Channel Evolution Stage	Active Adjustment Process
M11-A	7.5	21.1	C4	C4	D IIc	Aggradation Widening Planform
M11-B	Not Assessed - Beaver Dam					
M11-C	1.1	24.1	C4	F3	F II	Widening Planform
M11-D	Not Assessed - Impounded					
M12-A	Not Assessed - Impounded					
M12-B	1.7	20.7	C4	B4c	F III	**Aggradation Planform** Widening
M13	20.4	11.2	C4	C4	D IIc	**Aggradation Planform** Widening
M14	6.4	40.1	C4	C4	D IId	**Aggradation Planform** Widening
M15	5.2	17.0	C4	C4	F III	**Aggradation Planform** Widening
M16	3.9	16.3	C4b	C4b	F II	Widening Planform
M17-A	3.6	16.3	C4	C4	F III	**Aggradation** Widening Planform
M17-B	9.7	9.8	C4	E4	F II	Aggradation Widening Planform
M17-C	2.5	21.3	C4	C4	F IV	Aggradation Widening Planform
M18-A	1.5	10.0	B3	B3	F I	Aggradation Widening Planform
M18-B	10.2	18.0	C4	C4	F III	**Aggradation** Widening Planform
M19-A	4.5	15.8	C4	C4	F III	Aggradation Widening Planform
M19-B	Not Assessed-Bedrock Gorge					
M19-C	4.3	16.1	C4	C4	F III	Aggradation Widening Planform
M20-A	1.7	15.5	C4	B3c	F II	Aggradation Widening Planform

Table 5.1. Stream Type and Channel Evolution Stage

Segment Number	Entrench-ment Ratio	Width to Depth Ratio	Reference Stream Type	Existing Stream Type	Channel Evolution Stage	Active Adjustment Process
M20-B	8.4	22.4	C4	C4	F III	Aggradation Widening **Planform**
M20-C	2.8	25.5	C4	C4	F III	Aggradation Widening Planform
M21-A	8.6	10.7	C4	C3	F III	Widening Aggradation Planform
M21-B	Not Assessed-Wetland					
M21-C	Not Assessed-Dry Channel					
M21-D	5.9	9.3	C4	E4	F III	Aggradation Widening Planform
T1.01-A	1.3	17.4	C3	F3	F II	Aggradation Widening **Planform**
T1.01-B	1.5	21.9	C3	B4c	F III	**Planform** Aggradation Widening
T1.01-C	1.2	21.9	C3	F2	F II	Aggradation Widening Planform
T2.01	5.5	17.5	C4	C4	F II	Aggradation Widening Planform
T3.01	1.6	16.5	C4	B4c	F II	**Planform** Aggradation Widening
T4.01	1.5	29.4	B4c	B4c	D IIc	Aggradation Widening **Planform**
T5.01-A	1.7	45.0	B4c	B4c	F III	Aggradation **Widening Planform**
T5.01-B	2.1	24.5	B4c	B3c	F I	Aggradation Widening Planform
T6.01-A	1.4	11.1	C3b	B3	F II	Aggradation Widening Planform
T6.01-B	Not Assessed-Bedrock gorge					
T6.01-C	2.8	14.5	C3b	C3b	F I	Aggradation Planform

Bold Black lettering – denotes major adjustment process
Black lettering (no bold) – denotes minor adjustment process

Both the "D" stage and "F" stage channel evolution model (Appendix C, ANR 2004b) are helpful for explaining the channel adjustment processes underway in the Dog River watershed. The "F" stage channel evolution model is used to understand the process that occurs when a stream degrades (incises). The common stages of the "F" channel evolution stage, as depicted in Figure 5.75 include:

- A pre-disturbance period
- Incision – channel degradation
- Aggradation and channel widening
- The gradual formation of a stable channel with access to its floodplain at a lower elevation

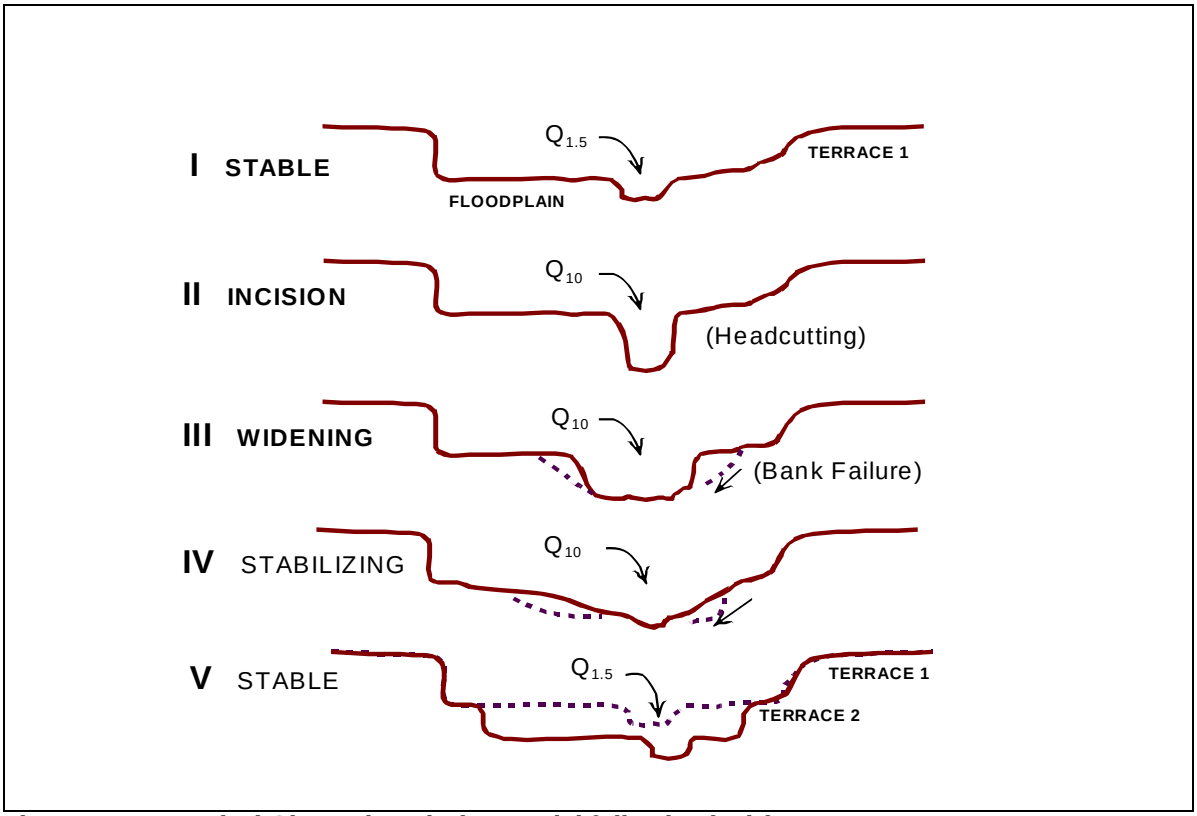


Figure 5.75. Typical Channel Evolution Model following incision.

About half (24) of the assessed segments have undergone historic incision. Channel straightening and the impact of road encroachments likely contributed to this historic incision. Segments in stage II of the "F" channel evolution model include M11-C, M16, M17-B, M20-A, T1.01-A, T1.01-C, T2.01, T3.01 and T6.01-A. These segments have historically incised and have generally been historically straightened, extensively armored, and have contiguous corridor encroachments preventing widening and the building of new floodplain. Segments in stage III of the "F" channel evolution model include M01-B, M10-B, M12-B, M15, M17-A, M18-B, M19-A, M19-C, M20-B, M20-C,

M21-A, M21-D, T1.01-B and T5.01-A. These segments have historically incised and are starting to or actively going through a widening process to create a floodplain at a lower elevation. Segment M17-C is in stage IV of the "F" channel evolution model. This segment has historically incised, the channel has widened, and it is actively establishing a new floodplain at a lower elevation. Segments in stage I of the "F" channel evolution model include: M08-B, M09-B, M10-A, M18-A, T5.01-B and T6.01-C. These segments are stable and are not significantly aggrading or degrading. The numerous grade controls along the entire length of the Dog River and its tributaries have likely helped to control continuous incision along the length of the river.

The segments assessed during the Phase 2 assessment within the Dog River watershed that have not undergone historic incision but are not stable enough to be classified by stage I of the "F" model have adjustment processes that are best explained by the "D" stage evolution model. The more dominant active adjustment processes for the "D" stage channel evolution are aggradation, widening and planform change. Extreme deposition (stage D II d) was noted in segment M14, making it an important attenuation reach. Segments with moderate to major aggradation and widening (stage D II c) include M01-A, M01-C, M02, M03, M04, M06-A, M06-B, M07-A, M08-A, M09-A, M11-A, M13 and T4.01.

The bed erosion that occurs when a meandering river is straightened in its valley is a problem that translates to other sections of the stream. Localized incision will travel upstream and into tributaries eroding sediments from otherwise stable streambeds. These bed sediments will move into and clog reaches downstream leading to lateral scour and erosion of the streambanks. Channel evolution processes may take decades to play out. Even landowners that have maintained wooded areas along their stream and riverbanks may have experienced eroding banks as stream channel slopes adjust to match the valley slopes.

It is difficult for streams to attain a new equilibrium where the placement of roads and other infrastructure has resulted in little or no valley space for the stream to access or to create a floodplain. Landowners and government agencies have repeatedly armored and bermed reaches of Vermont's rivers to contain floodwaters in channels. These efforts have proven to be temporary fixes at best, and in some cases have lead to disastrous property losses and natural resource degradation. A more effective solution is to limit encroachments within the riparian corridor and maintain a buffer of woody vegetation between the stream and adjacent land uses. Maintaining vegetated riparian corridors and offsetting development limits the conflict between property investments and the natural processes of flooding and channel migration that occurs gradually over time. Given room, a channel can adjust its shape and slope to changes in flow and sediment load. In general, the space provided by an established riparian corridor allows the river or stream system to be more resilient to watershed changes, thereby protecting the fish, wildlife, and humans that depend on Vermont's rivers and streams (Vermont Agency of Natural Resources 2005).

5.2 Rapid Habitat Assessment

The Rapid Habitat Assessment (RHA) is used to evaluate the physical components of a stream (channel bed, banks, and riparian vegetation) and how the physical condition of the stream affects aquatic life. The results can be used to compare physical habitat condition between sites, streams, or watersheds, and also serve as a management tool in watershed planning.

Table 5.2 shows a comparison of the habitat condition based on the Rapid Habitat Assessment (RHA) and the geomorphic condition based on the Rapid Geomorphic Assesment (RGA). One segment (T6.01-C) had an RHA and RGA score of good condition. For 26 of the segments both the RHA and RGA resulted in fair condition. The RGA was fair while the RHA was good for five segments (M17-C, M18-B, M19-A, M19-C and T4.01). These segments are undergoing significant planform adjustment and aggradational processes, but have good to excellent instream cover and riparian buffers resulting in a higher habitat score.

Eleven of the segments have a RGA score of good, while the habitat score is only fair (M03, M05, M06-A, M06-B, M08-B, M09-B, M10-A, M11-A, M17-B, M18-A and T5.01-B). The lower habitat score for these segments is due to lack refuge areas, lack of high quality riparian buffers, and abundant natural stream channel obstructions.

One segment (M21-D) had an RGA score of fair and a habitat score of poor. The poor habitat score resulted from extensive historic channelization, altered hydrologic characteristics, lack of refuge habitat, lack of bank vegetation and lack of riparian buffer.

Bed Substrate Cover and Scour and Depositional Features are the two habitat categories that scored the highest within the Dog River watershed. Many of the reaches along the Dog River have pools greater than 3 feet in depth (Figure 5.76), providing deep water shelter for fish including adult trout. Figure 5.77 is an example of a segment that has “good” habitat including deep pools. Riparian area and woody debris are the two categories that resulted in the lowest habitat scores. Figure 5.78 is a segment with “poor” habitat due to channelization, lack of riparian vegetation and encroachments within the river corridor.

Table 5.2. Comparison of RHA and RGA Scores for Phase 2 Reaches

Segment Number	Score RGA	Score RHA	Rating RGA	Rating RHA
M01-A	0.49	0.43	Fair	Fair
M01-B	0.49	0.47	Fair	Fair
M01-C	0.60	0.47	Fair	Fair
M02	0.58	0.42	Fair	Fair
M03	0.66	0.36	Good	Fair
M04	0.56	0.51	Fair	Fair
M05	0.71	0.55	Good	Fair
M06-A	0.66	0.49	Good	Fair

Table 5.2. Comparison of RHA and RGA Scores for Phase 2 Reaches				
Segment Number	**Score RGA**	**Score RHA**	**Rating RGA**	**Rating RHA**
M06-B	0.65	0.55	Good	Fair
M07-A	0.59	0.63	Fair	Fair
M08-A	0.64	0.58	Fair	Fair
M08-B	0.78	0.54	Good	Fair
M09-A	0.59	0.52	Fair	Fair
M09-B	0.75	0.49	Good	Fair
M10-A	0.79	0.54	Good	Fair
M10-B	0.54	0.56	Fair	Fair
M11-A	0.70	0.54	Good	Fair
M11-C	0.60	0.43	Fair	Fair
M12-B	0.43	0.39	Fair	Fair
M13	0.56	0.49	Fair	Fair
M14	0.53	0.50	Fair	Fair
M15	0.56	0.49	Fair	Fair
M16	0.63	0.46	Fair	Fair
M17-A	0.58	0.59	Fair	Fair
M17-B	0.69	0.41	Good	Fair
M17-C	0.59	0.68	Fair	Good
M18-A	0.71	0.47	Good	Fair
M18-B	0.55	0.66	Fair	Good
M19-A	0.61	0.66	Fair	Good
M19-C	0.61	0.68	Fair	Good
M20-A	0.59	0.55	Fair	Fair
M20-B	0.59	0.60	Fair	Fair
M20-C	0.59	0.51	Fair	Fair
M21-A	0.63	0.53	Fair	Fair
M21-D	0.61	0.33	Fair	Poor
T1.01-A	0.49	0.51	Fair	Fair
T1.01-B	0.49	0.55	Fair	Fair
T1.01-C	0.53	0.51	Fair	Fair
T2.01	0.58	0.43	Fair	Fair
T3.01	0.51	0.48	Fair	Fair
T4.01	0.64	0.70	Fair	Good
T5.01-A	0.48	0.52	Fair	Fair
T5.01-B	0.70	0.64	Good	Fair
T6.01-A	0.58	0.48	Fair	Fair
T6.01-C	0.76	0.66	Good	Good

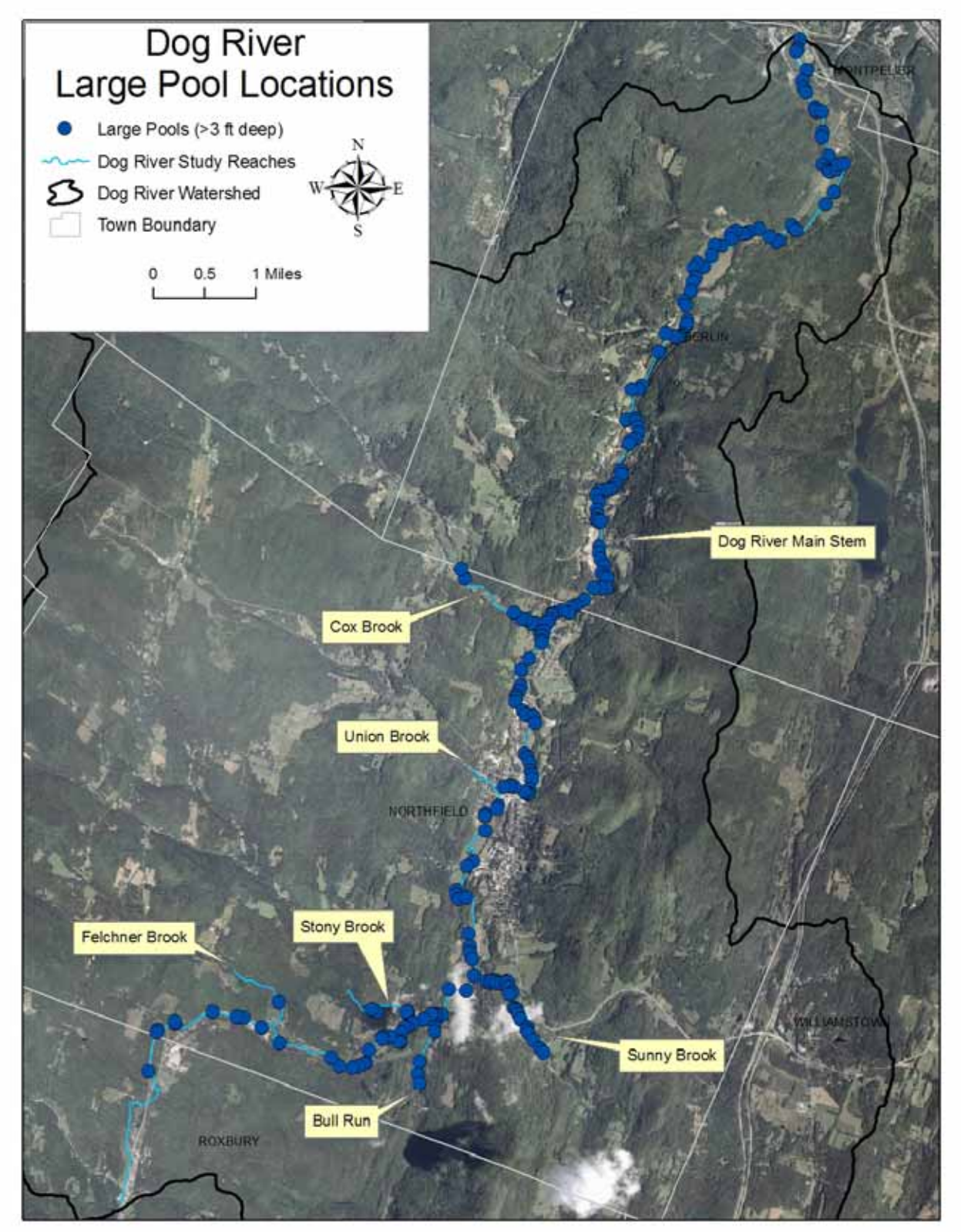


Figure 5.76: Large pool locations within the Dog River Watershed

Figure 5.77: Segment M18-B received a habitat rating of good due to deep pools, stable banks, abundance woody debris cover and a high quality riparian zone.

Figure 5.78: Segment M21-D received a habitat rating of poor due to channelization, channel encroachments, lack of riparian vegetation and little refuge habitat.

Natural and manmade obstructions are impeding passage of aquatic organisms. Figure 5.78 shows where there are culverts or natural barriers that are obstructions. Large waterfalls (higher than 10 feet) were found in segments M07-B, M19-C, T1.01-A, T5.01-A, T5.01-B, T6.01-B and T6.01-C. Large dams (higher than 10 feet) were found in segments: M09-B, M11-D, M12-A and T3.01. There is only one culvert within the study area on Felchner Brook at Route 12A.

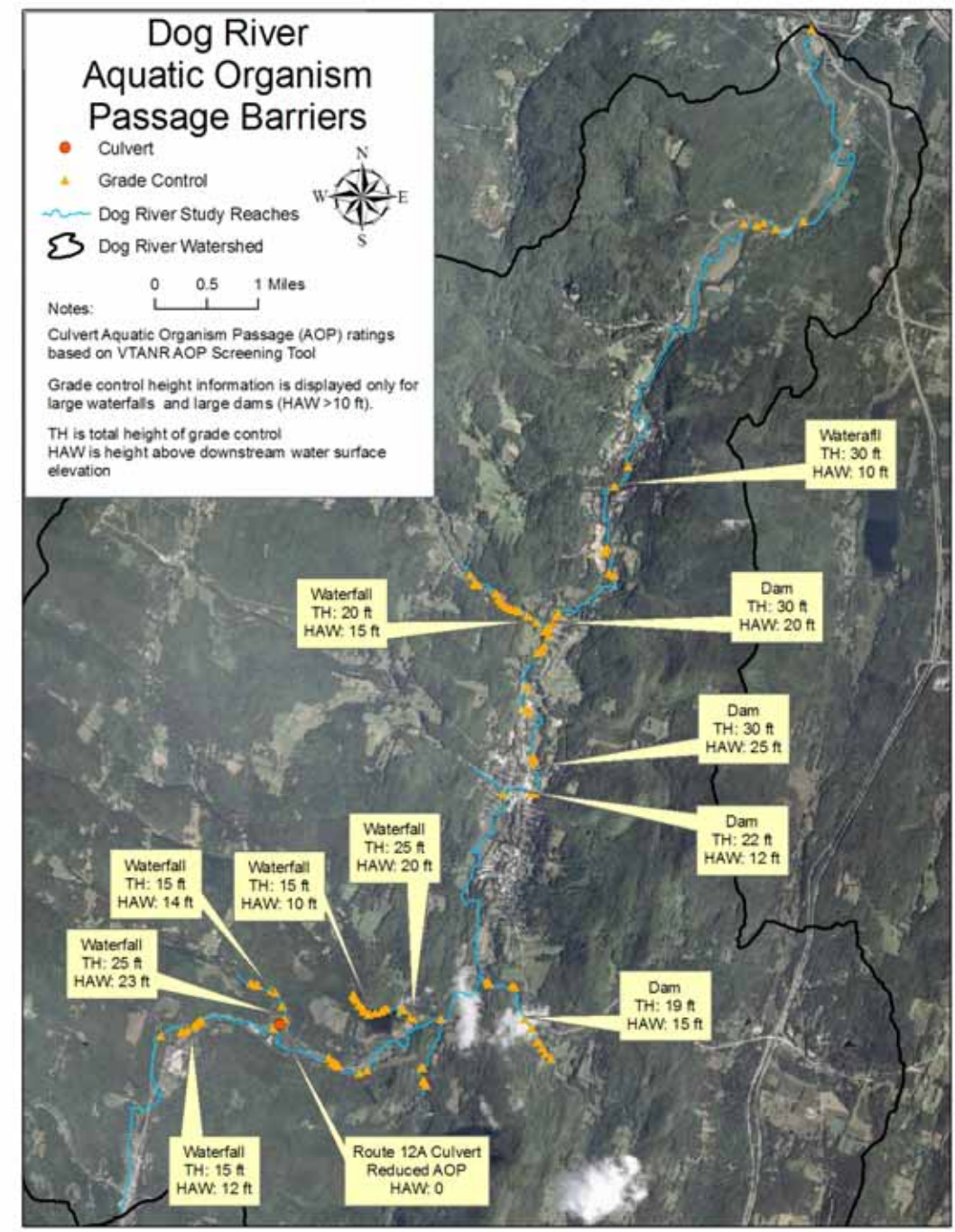


Figure 5.79. Aquatic organism passage barriers map.

5.3 Bridge and Culvert Assessment

Tables 5.3 through 5.6 summarize the data collected for 64 bridges and one culvert that cross the mainstem of Dog River and six major tributaries within the study area. The results are presented by town with the main stem of the Dog River in the first three tables and the tributary results in the fourth table. The final column of each table includes a prioritization of structures for replacement or retrofit based on a review of the following three criteria: geomorphic compatibility, structure width in relation to bankfull channel width; and aquatic organism passage. In order to assist local municipalities with priorities for replacement of the structures, priority lists were generated using geomorphic compatibility and aquatic organism passage screening tool developed by Milone and McBroom (2008a and 2008b). Geomorphic compatibility was scored in five categories: fully compatible, mostly compatible, partially compatible, mostly compatible and fully incompatible. Aquatic organism passage (AOP) was rated as full AOP, reduced AOP or No AOP.

Structures with No AOP or those rating as fully incompatible are considered high priority for replacement or retrofit. There are no structures assessed within the Dog River study area that fall within the fully incompatible or no AOP category. Structures that are mostly incompatible or have reduced AOP were given a rating of at least moderate priority for replacement or retrofit. Some of these structures were moved to the high priority category if problems were noted in the field to warrant this higher priority. Structures that are high priority for replacement/retrofit are included in the project identification table in Section 7.

As summarized in Table 5.3, fourteen bridges on the main stem of the Dog River in Berlin were assessed, and the results of these assessments are presented in Table 5.3. Of these 14 bridges, six of the bridges were rated as mostly incompatible. Two of the railroad bridges in Berlin were identified as causing localized geomorphic stability (deposition and/or planform adjustment in the channel) and were given a high priority for replacement or retrofit. These railroad bridges are located in reaches M04 and M07. The four structures given a moderate priority for replacement or retrofit are located in M01 at the lower end of the Dog River (railroad bridge and Junction Road), M02 (Brown's Mill Road), and M04 (railroad bridge).

Twenty seven bridges were assessed on the main stem of the Dog River in Northfield (Table 5.4). Generally, these bridges have a wide span relative to the bankfull width, and only two structures were flagged for geomorphic incompatibility. Both of these structures were given a rating of mostly incompatible and are moderate priority for replacement. The moderate priority structures are located in M17 (golf cart crossing within Northfield Country Club) and M20 (railroad bridge).

Only one structure of the six evaluated was flagged for geomorphic instability on the Dog River main stem in Roxbury (Table 5.5). This bridge located in Reach M21 was rated as mostly incompatible and was given a moderate priority for replacement.

The results of the bridge and culvert assessment for the Dog River Tributary reaches are provided in Table 5.6. Stream crossings on the tributary reaches had the highest incidence of being flagged for geomorphic incompatibility. All eighteen of the structures had a span less than the bankfull channel width with five of the structures having a span less than 50 percent of the bankfull channel width. Five of the structures were flagged for geomorphic incompatibility and were given a rating of mostly incompatible. The only culvert in the study area (located on Felchner Brook) is at grade, but has reduced aquatic organism passage because bed material is not throughout the structure. Six bridges (Cox Brook Road – Cox Brook; railroad bridge- Cox Brook; Pleasant Street – Union Brook; private driveway- Sunny Brook; Route 12A - Bull Run; and Stony Brook Road-Stony Brook) were given a priority of moderate for replacement or retrofit. One bridge, a private driveway on Cox Brook was given a priority of high for replacement or retrofit. This structure is undersized, and is causing major planform adjustment downstream, evidenced by a large flood chute. The culvert on Felchner Brook that is undersized and has reduced AOP has been given a moderate priority for replacement.

Table 5.3
Dog River Main Stem Crossings
Town of Berlin

Reach No.	Road Name/ Location	Road Type	Structure Type	Condition/Observation	Percent Bankfull Channel Width[1]	Aquatic Organism Passage[2]	Geomorphic Compatibility[3]	Priority for Replacement or Retrofit
M01		Railroad	Bridge		79	NA	Mostly Incompatible	Moderate
M01	Junction Road	Paved	Bridge	Bedrock grade control below bridge	76	NA	Mostly Incompatible	Moderate
M01	Nelson Drive	Gravel	Bridge		86	NA	Partially Compatible	
M02	Brown's Mill Road	Gravel	Bridge		56	NA	Mostly Incompatible	Moderate
M02	Route 12	Paved	Bridge	Abundant fine sediment (sand) deposited inside structure on right bank forming very high side bar	91	NA	Partially Compatible	
M03		Railroad	Bridge	Structure is very high and does not constrict channel	93	NA	Partially Compatible	
M04		Railroad	Bridge	Very deep pool upstream of structure and sharp bend at inlet. Extreme aggradation extreme erosion and a neck cut off below structure	93	NA	Mostly Incompatible	High
M04		Railroad	Bridge	Major side bar upstream of bridge is causing sharp bend approaching structure	98	NA	Mostly Incompatible	Moderate
M04	Rowell Hill Road	Gravel	Bridge		112	NA	Partially Compatible	
M07		Railroad	Bridge	Failing rip rap downstream; large pool	77	NA	Mostly Incompatible	High

Table 5.3
Dog River Main Stem Crossings
Town of Berlin

Reach No.	Road Name/ Location	Road Type	Structure Type	Condition/Observation	Percent Bankfull Channel Width[1]	Aquatic Organism Passage[2]	Geomorphic Compatibility[3]	Priority for Replacement or Retrofit
				(very deep) extends from upstream to below structure. Deposition upstream was greater than half bankfull elevation				
M07		Railroad	Bridge		102**	NA	Partially Compatible	
M07	Route 12	Paved	Bridge	No major problems with structure	94	NA	Mostly Compatible	
M08		Railroad	Bridge	Some concrete on wing wall has been scoured; very deep pool upstream and within structure	94	NA	Partially Compatible	
M08	Lovers Lane	Paved	Bridge	Bedrock and deposition above bridge. Deposition may be due to bedrock constriction more than bridge.	93	NA	Partially Compatible	

[1]Shaded for bankfull width percentage less than 50%; [2]Aquatic Organism Passage ratings developed with the VTANR methodology (not applicable to bridges);
[3]Scores and ratings developed with the VTANR Geomorphic Compatibility Screening Tool
** Reference channel width was used for this percent bankfull width because segment M07-C was not fully assessed and bankfull width was not measured

Table 5.4
Dog River Main Stem Crossings
Town of Northfield

Reach No.	Road Name/ Location	Road Type	Structure Type	Condition/Observation	Percent Bankfull Channel Width[1]	Aquatic Organism Passage[2]	Geomorphic Compatibility[3]	Priority for Replacement or Retrofit
M09	Cox Brook Road	Paved	Bridge	Large side bar on west bank – likely due to bridge pier	151	N A	Partially Compatible	
M10	Slaughterhouse Road	Gravel	Bridge	Bedrock constriction just upstream and within structure. Bedrock under covered bridge is smaller width than bridge abutments	53	NA	Partially Compatible	
M11		Trail	Bridge	Foot bridge with bedrock abutment on west bank. Very deep pool within structure and sharp bend approaching structure.	70	NA	Partially Compatible	
M11	North Main Street	Paved	Bridge	Not a channel constriction, but a floodprone constriction. Pier in middle causing major deposition within structure.	260	NA	Fully Compatible	
M12		Railroad	Bridge	Railroad ties and riprap in channel. Bridge built in 1928. Slight change in channel slope at upstream end of bridge.	110	NA	Partially Compatible	

Table 5.4
Dog River Main Stem Crossings
Town of Northfield

Reach No.	Road Name/ Location	Road Type	Structure Type	Condition/Observation	Percent Bankfull Channel Width[1]	Aquatic Organism Passage[2]	Geomorphic Compatibility[3]	Priority for Replacement or Retrofit
M12	North Main Street	Paved	Bridge	Scour at south pier creating pool above structure. Footer within structure broken off in several locations and abutment is cracked.	145	NA	Partially Compatible	
M13		Trail	Bridge	Scour above likely associated with rip rap and bridge. Popular swimming location for Norwich University Students.	92	NA	Partially Compatible	
M13	Wall Street	Paved	Bridge		128	NA	Partially Compatible	
M14		Trail	Bridge	No major problems noted.	65	NA	Partially Compatible	
M15		Trail	Bridge	Snowmobile bridge, minimal impact on river.	88	NA	Partially Compatible	
M15	Fairground Road	Paved	Bridge	Lots of invasive plants (knotweed)	72	NA	Partially Compatible	
M16		Railroad	Bridge	Railroad bridge has high clearance. Pier undermined due to scour, has steel reinforcement on upstream end of pier. Not a priority for replacement.	432	NA	Mostly Compatible	
M16	Stony Brook Road	Paved	Bridge	Lots of knotweed.	90	NA	Partially Compatible	

Table 5.4
Dog River Main Stem Crossings
Town of Northfield

Reach No.	Road Name/ Location	Road Type	Structure Type	Condition/Observation	Percent Bankfull Channel Width[1]	Aquatic Organism Passage[2]	Geomorphic Compatibility[3]	Priority for Replacement or Retrofit
M17	Route 12A	Paved	Bridge	Concrete blocks in river are creating a drop immediately downstream of bridge. Some deposition in and above structure from concrete blocks.	156*	NA	Partially Compatible	
M17	Northfield Country Club	Trail	Bridge		202*	NA	Partially Compatible	
M17	Northfield Country Club	Trail	Bridge		215*	NA	Partially Compatible	
M17		Trail	Bridge	Rip rap between Rt 12A bridge and this bridge is failing and is in the channel.	184*	NA	Partially Compatible	
M17		Trail	Bridge	Bridge is having minimal impact on river. In this location, bridge span is approximately reference channel width, actual bankfull width is less than reference width due to channelization.	215*	NA	Partially Compatible	
M17	Northfield Country Club	Trail	Bridge	Some riprap associated with south abutment is causing flood prone constriction.	104	NA	Mostly Incompatible	Moderate
M17	Private bridge to gravel pit	Gravel	Bridge	Steep riffle above; abundant knotweed adjacent to structure on south bank.	115	NA	Partially Compatible	
M18	Pedestrian bridge	Trail	Bridge	Minimal impact; rip rap at base of abutments	103	NA	Partially Compatible	

Table 5.4
Dog River Main Stem Crossings
Town of Northfield

Reach No.	Road Name/ Location	Road Type	Structure Type	Condition/Observation	Percent Bankfull Channel Width[1]	Aquatic Organism Passage[2]	Geomorphic Compatibility[3]	Priority for Replacement or Retrofit
M18	Driveway	Gravel	Bridge		77	NA	Partially Compatible	
M18	Private Access Road	Gravel	Bridge	Wooden planks on bridge; bedrock supports bridge on south bank	114	NA	Partially Compatible	
M19	Driveway	Gravel	Bridge		100	NA	Mostly Compatible	
M19	Beaudette Road	Gravel	Bridge	Minimal impact from structure due to bedrock upstream, within and downstream	107	NA	Fully Compatible	
M19	Route 12A	Paved	Bridge		166	NA	Partially Compatible	
M20		Railroad	Bridge	Abutments, footers and bridge bottom have lots of scour and are deteriorating. Recommend wider span if replaced.	53	NA	Mostly Incompatible	Moderate

[1]Shaded for bankfull width percentage less than 50%; [2]Aquatic Organism Passage ratings developed with the VTANR methodology (not applicable to bridges);
[3]Scores and ratings developed with the VTANR Geomorphic Compatibility Screening Tool
*Structures have large percent bankfull channel width because actual bankfull width is significantly less than reference width due to channelization

Table 5.5
Dog River Main Stream Crossings
Town of Roxbury

Reach No.	Road Name/ Location	Road Type	Structure Type	Condition/Observation	Percent Bankfull Channel Width[1]	Aquatic Organism Passage[2]	Geomorphic Compatibility[3]	Priority for Replacement or Retrofit
M21		Railroad	Bridge	Mild bend approaching structure	74	NA	Mostly Incompatible	Moderate
M21		Railroad	Bridge	No problems noted	82	NA	Partially Compatible	
M21	Premo Road	Gravel	Bridge	Some scour and deterioration of footers. No other problems noted.	49	NA	Mostly Compatible	
M21	Roxbury Road	Paved	Bridge	Structure located downstream of railroad bridge; no problems noted	72	NA	Mostly Compatible	
M21	Roxbury Road	Paved	Bridge	Mild bend approaching structure	68	NA	Partially Compatible	
M21	Warren Mountain Road	Paved	Bridge	Streambed dry starting in center of bridge; scour on downstream abutment;	59	NA	Partially Compatible	

[1]Shaded for bankfull width percentage less than 50%; [2]Aquatic Organism Passage ratings developed with the VTANR methodology (not applicable to bridges);
[3]Scores and ratings developed with the VTANR Geomorphic Compatibility Screening Tool

Table 5.6
Dog River Tributary Crossings
Town of Northfield

Reach No.	Road Name/ Location	Road Type	Structure Type	Condition/Observation	Percent Bankfull Channel Width[1]	Aquatic Organism Passage[2]	Geomorphic Compatibility[3]	Priority for Replacement or Retrofit
T1.01 Cox Brook	Driveway	Gravel	Bridge	Major planform adjustment downstream of bridge	68	NA	Mostly Incompatible	High
T1.01		Railroad	Bridge	Abutments look old and are failing; grade control upstream of bridge	51	NA	Mostly Incompatible	Moderate
T1.01	Cox Brook Road	Paved	Bridge		83	NA	Partially Compatible	
T1.01	Cox Brook Road	Paved	Bridge	Mild bend approaching structure, large side bar within structure. Upstream riprap looks new.	45	NA	Mostly Incompatible	Moderate
T1.01	Cox Brook Road	Paved	Bridge	Covered bridge	85	NA	Partially Compatible	
T1.01	Jerry Road	Gravel	Bridge	Bridge looks fairly new.	40	NA	Partially Compatible	
T2.01 Union Brook	Pleasant Street	Paved	Bridge	Channelized; landowner mentioned parts of bridge has washed downstream.	59	NA	Mostly Incompatible	Moderate
T2.01	Water Street	Paved	Bridge	Cement pillars in bed downstream of bridge along right bank. Dam under structure is grade control. Clearance is much lower on upstream end than downstream end.	91	NA	Partially Compatible	
T3.01 Sunny Brook	Driveway	Gravel	Bridge	Bank armoring failing, no other major problems noted.	55	NA	Mostly Incompatible	Moderate

Table 5.6
Dog River Tributary Crossings
Town of Northfield

Reach No.	Road Name/ Location	Road Type	Structure Type	Condition/Observation	Percent Bankfull Channel Width[1]	Aquatic Organism Passage[2]	Geomorphic Compatibility[3]	Priority for Replacement or Retrofit
T3.01		Gravel	Bridge	Pond off stream on north bank. Grade control (bedrock) under structure.	64	NA	Mostly Compatible	
T3.01	Lovers Lane	Paved	Bridge	Scour undermining structure and upper wing wall; low clearance	90	NA	Mostly Compatible	
T3.01	Route 12A	Paved	Bridge	No problems noted.	78	NA	Partially Compatible	
T3.01	TH 54	Gravel	Bridge	Channelelized; no major problems noted.	78	NA	Partially Compatible	
T4.01 Bull Run		Trail	Bridge	Snowmobile trail; no major problems noted.	42	NA	Partially Compatible	
T4.01	Bull Run Road	Paved	Bridge	Bedrock grade control in structure	38	NA	Partially Compatible	
T4.01	Route 12A	Paved	Bridge	Upstream of confluence with Dog River; large side bar within bridge.	55	NA	Mostly Incompatible	Moderate
T5.01 Stony Brook	Stony Brook Road	Gravel	Bridge	Alignment is poor, sharp bend upstream and downstream of structure. Loose road material adjacent to channel.	49	NA	Mostly Incompatible	Moderate
T6.01	Route 12A	Paved	Culvert	Culvert looks okay; pool downstream; undersized width.	57	Reduced AOP	Partially Compatible	Moderate

[1]Shaded for bankfull width percentage less than 50%; [2]Aquatic Organism Passage ratings developed with the VTANR methodology (not applicable to bridges);
[3]Scores and ratings developed with the VTANR Geomorphic Compatibility Screening Tool

6.0 STRESSOR, DEPARTURE AND SENSITIVITY ANALYSIS

Stressor, departure and sensitivity maps are presented here as a means of displaying the effects of all significant physical processes occurring within the Dog River watershed that were observed during the Phase 1 and Phase 2 Stream Geomorphic Assessments. These maps also provide an indication of the degree to which the channel adjustment processes within the watershed have been altered, at both the watershed scale and the reach scale. The analysis of existing and historic departures from equilibrium conditions along a stream network allows for the prediction of future alterations within the watershed. This is helpful in developing and prioritizing potential protection and restoration projects.

6.1 Departure Analysis and Stressor Identification

6.1.1 Hydrologic Regime Stressors

The hydrologic regime is the timing, volume, and duration of flow events throughout the year and over time and is characterized by the input and manipulation of water at the watershed scale. When the hydrologic regime has been significantly changed, stream channels will respond by undergoing a series of channel adjustments. The land use within the watershed plays a role in the hydrology of the receiving waters. The percentage of urban and cropland development within the watershed are factors which change a watershed's response to precipitation. The most common effects of urban and cropland development is increasing peak discharges and runoff by reducing infiltration and travel time (United States Department of Agriculture 1986).

Wetlands are characterized by their specific vegetation, hydrology and the presence of hydric soils. Hydric soils are classified by the Natural Resource Conservation Service (2009) as soils that formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper parts. Wetlands and areas of hydric soils from the Natural Resource Conservation Service Washington County Soil Survey Data (2008) are displayed in Figure 6.1 as "intact wetlands" to provide the most recent locations of existing wetlands and areas of hydric soils. Analysis of hydric soils located where current land uses are agricultural or urban indicates some minor loss of wetlands within the Dog River watershed. The loss of wetlands decreases the attenuation of peak flows within the watershed. Based on hydric soils in areas that are urban or agricultural, the upper subwatersheds of the Dog River, particularly within the Sunny Brook subwatershed, have experienced some wetland loss.

The Dog River watershed has a moderate network of roads as shown in Figure 6.1. Many stormwater inputs from encroaching roads were mapped in the field. These stormwater inputs are responsible for increasing peak flows and for contributing sediment to the Dog River watershed. Figure 6.1 shows segments in red where stormwater inputs per mile exceeded 5. Only three subwatersheds within the study area have road densities greater than 7 miles per square mile (M12, M16 and T2.01). This may contribute to localized increased flows resulting both from increased runoff

and stormwater ditching in the lowest subwatershed. The close proximity of maintained roads, including Route 12 and Route 12A, in many reaches are increasing runoff throughout the Dog River watershed. According to Foreman and Alexander (1998), increased peak flows in streams may be evident at road densities of 3.2 miles/ square mile. Subwatersheds with road densities of greater than 3.2 mile/ square mile account for approximately 17 percent of the entire Dog River watershed. Urban land use exceeds 20 percent of cumulative subwatershed area only in phase 2 reaches M12 and T2.01 in downtown Northfield.

6.1.2 Sediment Regime Stressors

The sediment regime is the quantity, size, transport, sorting and distribution of sediments. The sediment regime may be influenced by the proximity of sediment sources, the hydrologic regime, and the specific morphology of the valley, floodplain, and stream. The Sediment Load Indicators Map (Figure 6.2) shows the distribution of sediment load indicators in the Dog River watershed at the watershed scale. The dominant watershed land cover/land use within the Dog River watershed is forest. There is also a significant amount of agricultural land use within the watershed. Study area reaches that exceed 20 percent of cumulative subwatershed agricultural land use include: M14, M15, M16 and T2.01. Bank erosion and mass failures contribute to sediment inputs along the Dog River and its tributaries. Bank erosion is defined as "an area of raw and barren soil where the vegetation does not have the ability to hold the soil and/or the soil has slumped or fallen into the channel". Mass failures can occur when "a perennial stream erodes into or undercuts a high erodible landform, such as glacial lacustrine terrace" (Vermont Agency of Natural Resources, 2007b).

Mass wasting sites were observed on the Dog River mainstem (4 mass failures), Sunny Brook (one mass failure), Bull Run (one mass failure) and Stony Brook (one mass failure) during the Stream Geomorphic Assessment. The total length of mass failures on the Dog River is approximately 285 feet, 62 feet on Sunny Brook, 35 feet on Bull Run and 100 feet on Stony Brook. These mass failures represent a significant source of sediment within the Dog River watershed. Localized areas of bank erosion and depositional features (steep riffles, mid channel bars, delta bars, flood chutes, and/or avulsions) are prevalent. As shown below in Figure 6.2, the majority of the segments in the study area have moderate to high bank erosion (5 to greater than 20% of the length) and/or high depositional features (> 5 per mile).

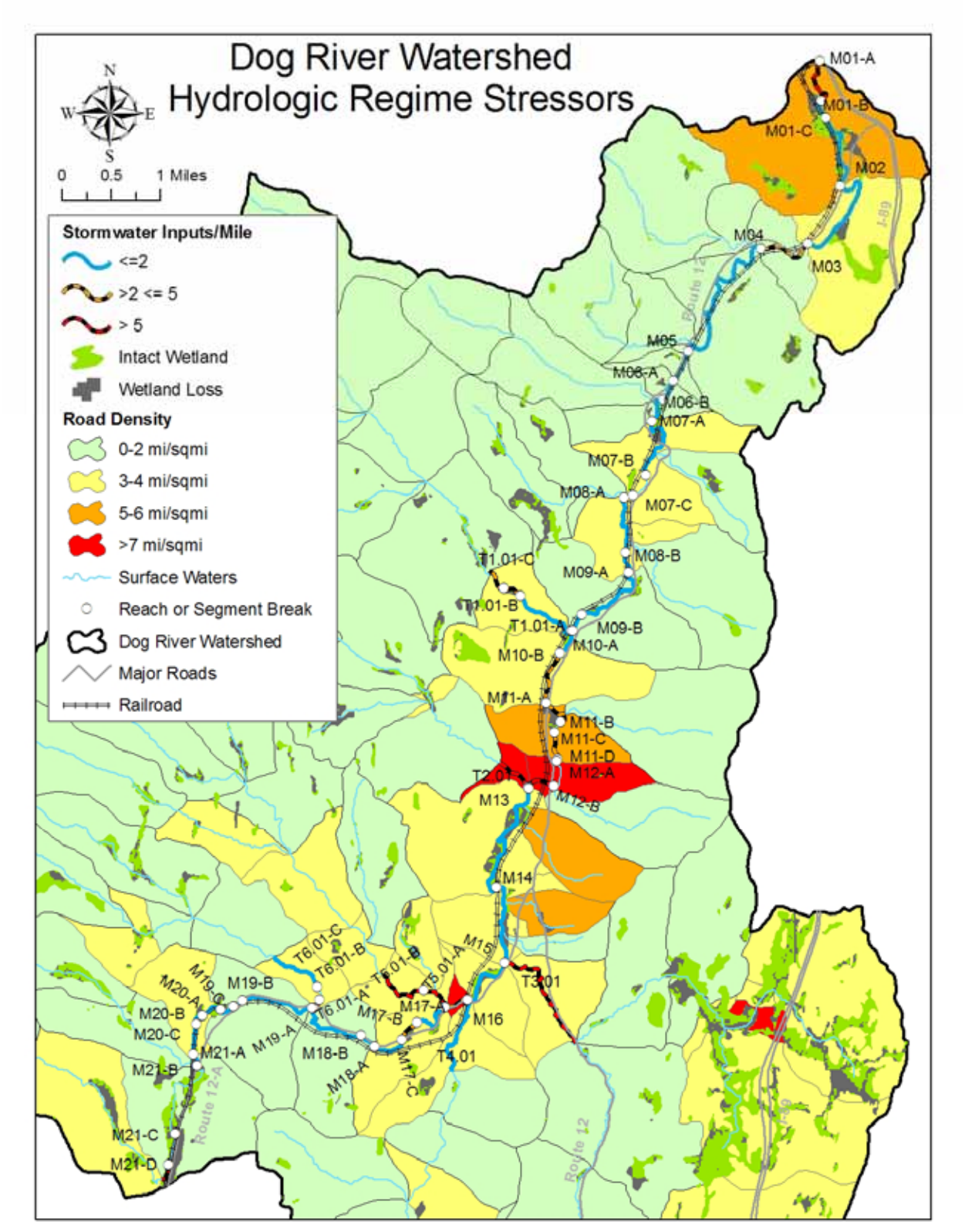


Figure 6.1. Land use map showing road density, stormwater influence, existing wetlands and lost wetlands

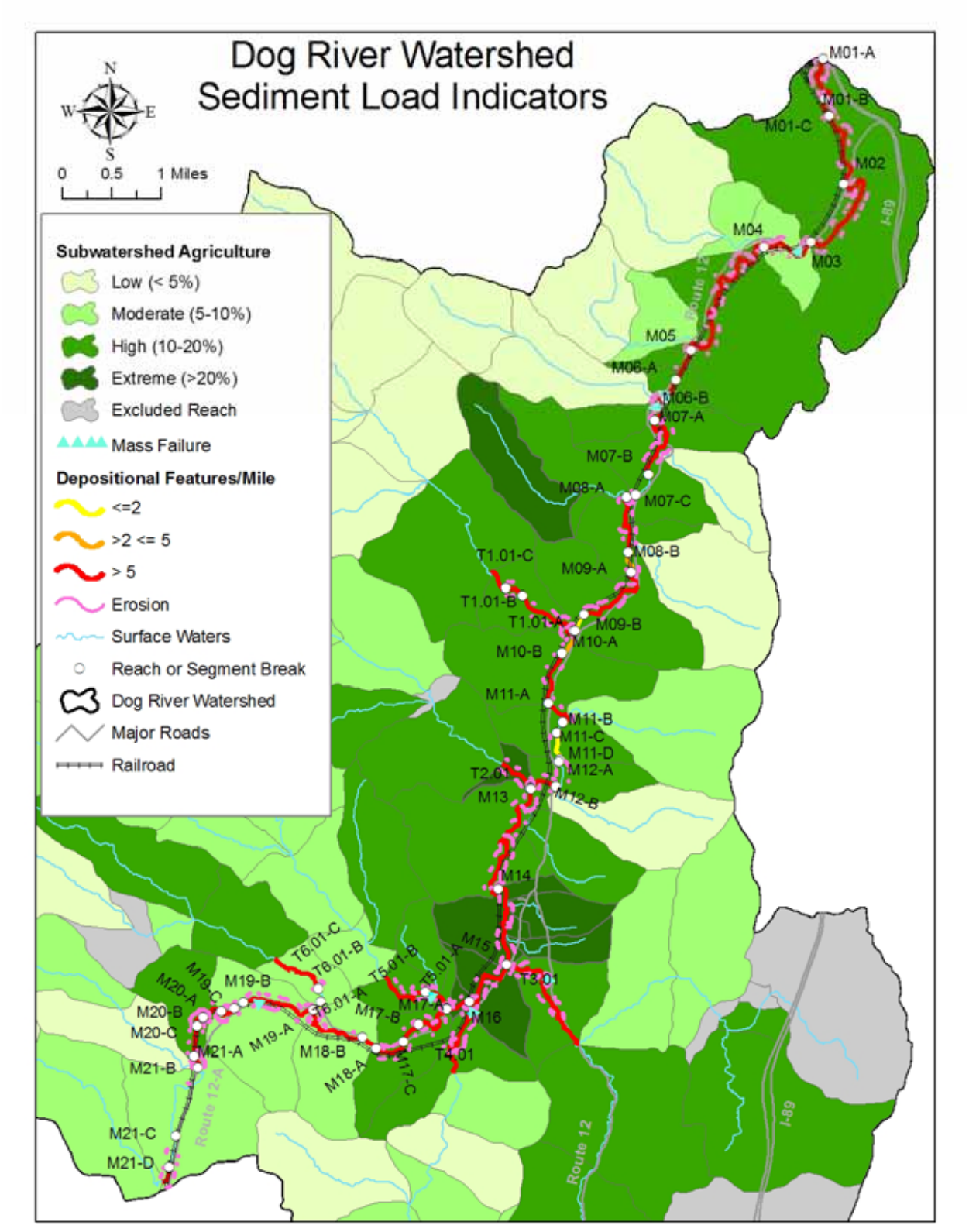


Figure 6.2. Sediment load indicators map showing cumulative subwatershed % agriculture, depositional features per mile, bank erosion and mass failures

6.1.3 Reach Scale Sediment Regime Stressors

The previously discussed alterations to flow and sediment load at the watershed scale serve as a pretext for understanding the timing and degree to which reach scale modifications are contributing to field observed channel adjustment. When the valley, floodplain, channel and channel boundary conditions are modified, a stream may change the way sediment is transported, sorted, stored and distributed. The stressors that alter these conditions either increase or decrease stream power and or increase or decrease the resistance of its boundary conditions. This is helpful for determining why a reach is under adjustment and what types of management activities will be beneficial in returning the stream to equilibrium conditions.

6.1.4 Channel Slope Modifiers

Results from the Dog River watershed indicate that primary stressors include straightening of the channel along with road and development encroachments (see Figure 6.3). Development along the length of the watershed has contributed to the loss of wetlands and increased runoff. Records at the Vermont Agency of Natural Resources and field observations indicate that gravel mining or dredging of the channel has occurred along the study reaches in segments M01-A, M02, M04, M08-A, M10-B, M12B, M14 and M21-B. These dredging activities generally appeared to be minor. Additionally, where the channel showed that it had been straightened, it is likely that some dredging may have occurred during the straightening process. Many bedrock and human constructed grade controls exist along the Dog River and its tributaries. These grade controls often control incision within the watershed. Numerous constrictions exist within the study area causing the width of the bankfull channel or floodprone area to be significantly less than it would be in the absence of such structures. These constrictions, including bridges, culverts, old abutments, breached dams and bedrock outcrops, can cause excessive sediment deposition and/or scouring of the channel bed upstream or downstream of the feature.

6.1.5 Boundary Conditions and Riparian Modifiers

Riparian buffers provide many benefits. Some of these benefits are protecting and enhancing water quality, providing fish and wildlife habitat, providing streamside shading, and providing root structure to prevent bank erosion (see Figure 6.4). Much of the Dog River and its tributaries are lacking sufficient riparian buffers. Several segments in the watershed (M01-A, M01-B, M01-C, M02, M03, M04, M05, M06-A, M09-B, M11-A, M11-C, M11-D, M12-B, M13, M14, M16, M17-B, M18-A, M20-A, M21-A, M21-C, M21-D, T1.01-A, T1.01-C, T2.01, T3.01 and T6.01-A) have 40 percent or more of the reach with little or no buffer on at least one bank. These stream reaches which lack a high quality riparian buffer are at a significantly higher risk of experiencing high rates of lateral erosion. Consequently, many segments have stream banks that are stabilized with rip rap or hard bank armoring where they are adjacent to human constructed infrastructure.

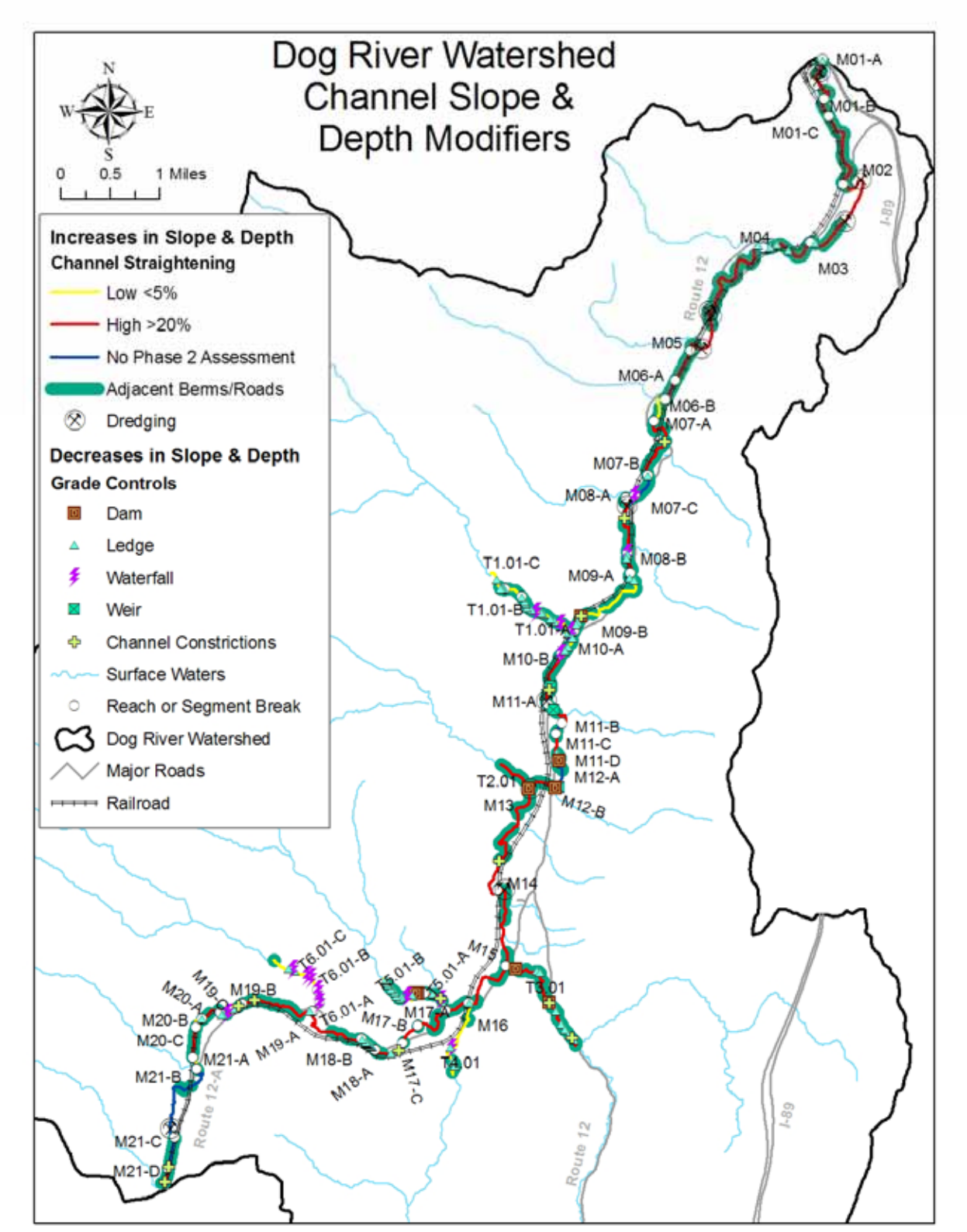


Figure 6.3. Channel slope and depth modifiers map showing stressors contributing to increases in slope and depth and stressors contributing to decreases in slope and depth

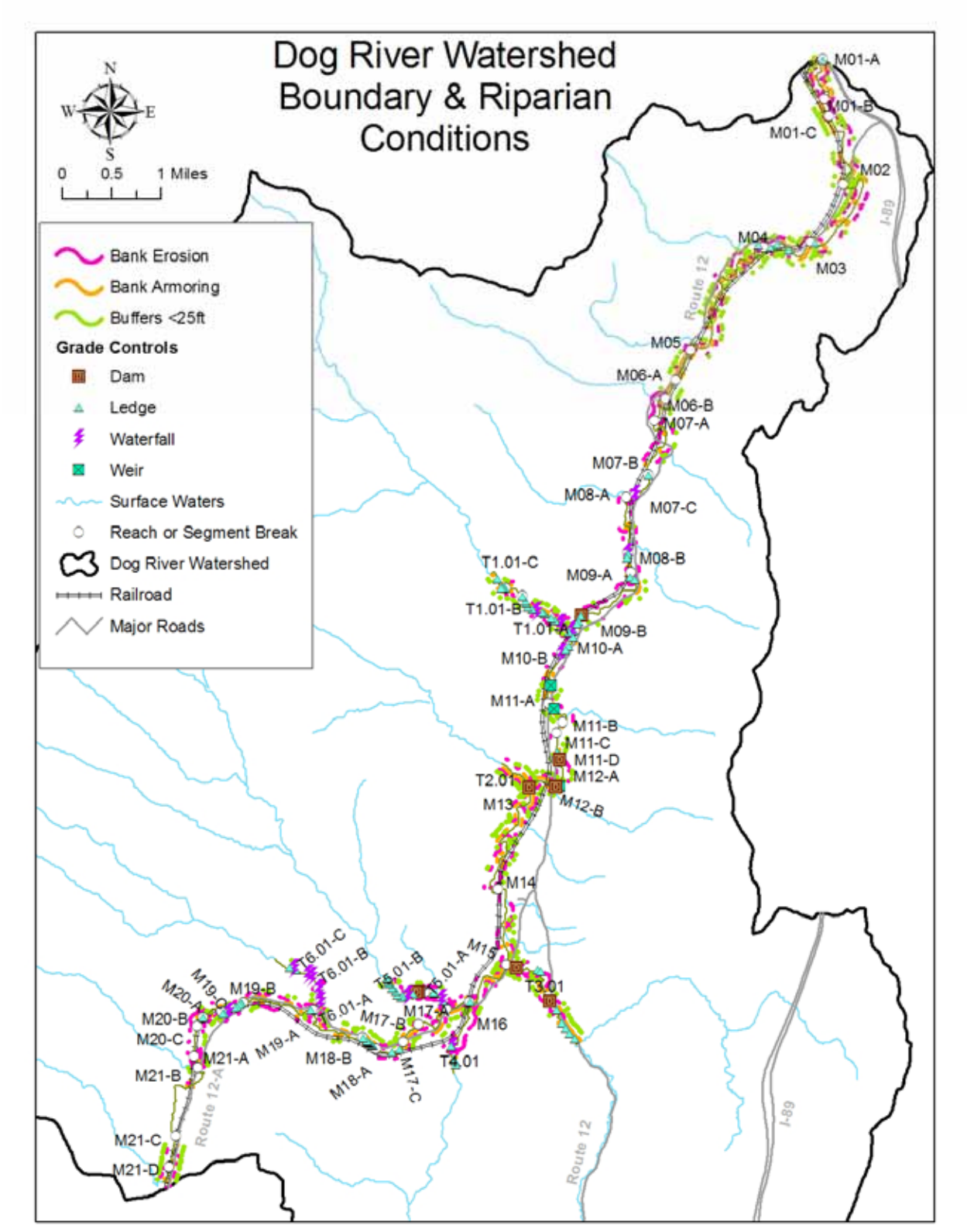


Figure 6.4. Boundary and riparian conditions map showing areas of buffers less than 25 feet, bank erosion, bank armoring, dredging and grade controls

6.1.6 Constraints to Sediment Transport and Attenuation

Successful river corridor restoration and protection projects depend on a thorough understanding of the sources, volumes, and attenuation of flood flows and sediment loads within the stream network. If increased loads are transported through the network to a sensitive reach, where conflicts with human investments are creating a management expectation, little success can be expected unless the restoration design accommodates the increased load or finds a way to attenuate the loads upstream (Vermont Agency of Natural Resources, 2007c).

Within a reach, the principles of stream equilibrium dictate that stream power and sediment will tend to distribute evenly over time (Leopold, 1994). Changes or modifications to watershed inputs and hydraulic geometry create disequilibrium and lead to an uneven distribution of power and sediment. Large channel adjustments observed as dramatic erosion and deposition may be the result of this uneven distribution and may continue.

The reference sediment regime map (Figure 6.5) shows the Phase 1 reference stream sediment conditions for each segment of the Dog River and its tributaries that were evaluated during Phase 2. These reference type streams use available floodplain access as a means to store sediment within the watershed. All segments of the study area have a reference sediment regime of *Equilibrium Channels* or *Transport* reaches. *Equilibrium Channels* are unconfined on at least one side, and they transport and deposit sediment in equilibrium, wherein the stream power is balanced by the sediment load, sediment size and channel boundary resistance. *Transport* channels on the other hand are steep, dominated by bedrock and boulder/cobble substrates, typically are in confined valleys and they do not supply appreciable quantities of sediments to downstream reaches (VTANR, 2007c).

Changes in hydrology (primarily development within the riparian corridor) and sediment storage within the watershed have altered the reference sediment regime types for some reach segments (Figure 6.6). Sediment regime departures were derived from the sediment regime criteria established by the Vermont Agency of Natural Resources (2007c). Sixteen segments (M11-C, M15, M16, M17-A, M17-C, M18-B, M19-A, M19-C, M20-B, M20-C, M21-A, T1.01-A, T1.01-B, T1.01-C, T3.01 and T6.01-A) that were *Equilibrium Channel* type segments by reference have been converted to *Fine Source and Transport & Coarse Deposition* sediment regimes based on the Phase 2 Stream Geomorphic Assessment data. This means that most fine sediment entering the stream is either being transported through without being deposited as a result of channel incision and reduced floodplain access.

Three segments (M10-B, M20-A and M21-D) that were *Equilibrium Channels* by reference have been converted to *Confined Source and Transport* sediment regimes due to a change in confinement from channel encroachments and increased sediment sourcing derived from an incised channel and mass wasting sites. Three segments (M13, M18-A and

T5.01-A) that were *Equilibrium Channels* by reference have been converted to *Transport* reaches due to considerable changes in valley confinement from channel encroachments. Two segments (M12-B and T2.01) that were *Equilibrium Channels* by reference have been converted to *Unconfined Source and Transport* sediment regimes due to increased transport capacity derived from bank armoring and channel straightening. These channel management practices have resulted in reduced attenuation of flood waters and sediment.

The existing sediment regime for the Dog River watershed includes reduced floodplain access, increased stream power, reduced boundary resistance, and lateral constraints at various locations throughout the stream network. Watersheds which have lost attenuation or sediment storage areas, due to human related constraints, are generally more sensitive to erosion hazards, transport greater quantities of sediment and nutrients to receiving waters, and lack the sediment storage and distribution processes that create and maintain habitat (Vermont Agency of Natural Resources, 2007c). Segments and reaches of the Dog River Phase 2 study area that can act as attenuation assets are identified below to help in designing stream corridor protection and restoration projects within the stream network.

These segments include:

M01-A
M01-B
M01-C
M02
M04
M07-A
M12-B
M13
M14
M15
M17-A
M18-B

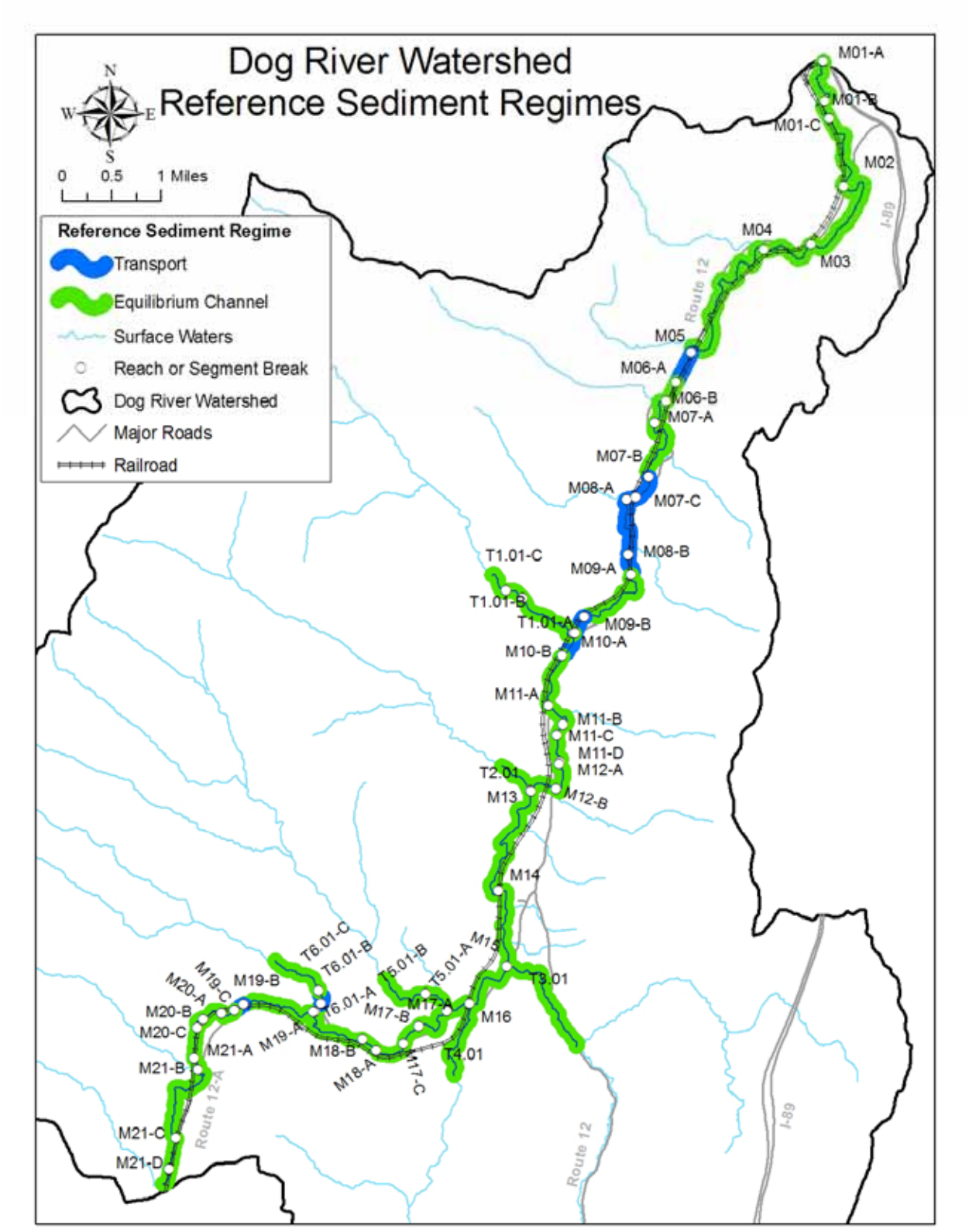


Figure 6.5. Reference Sediment Regime Map

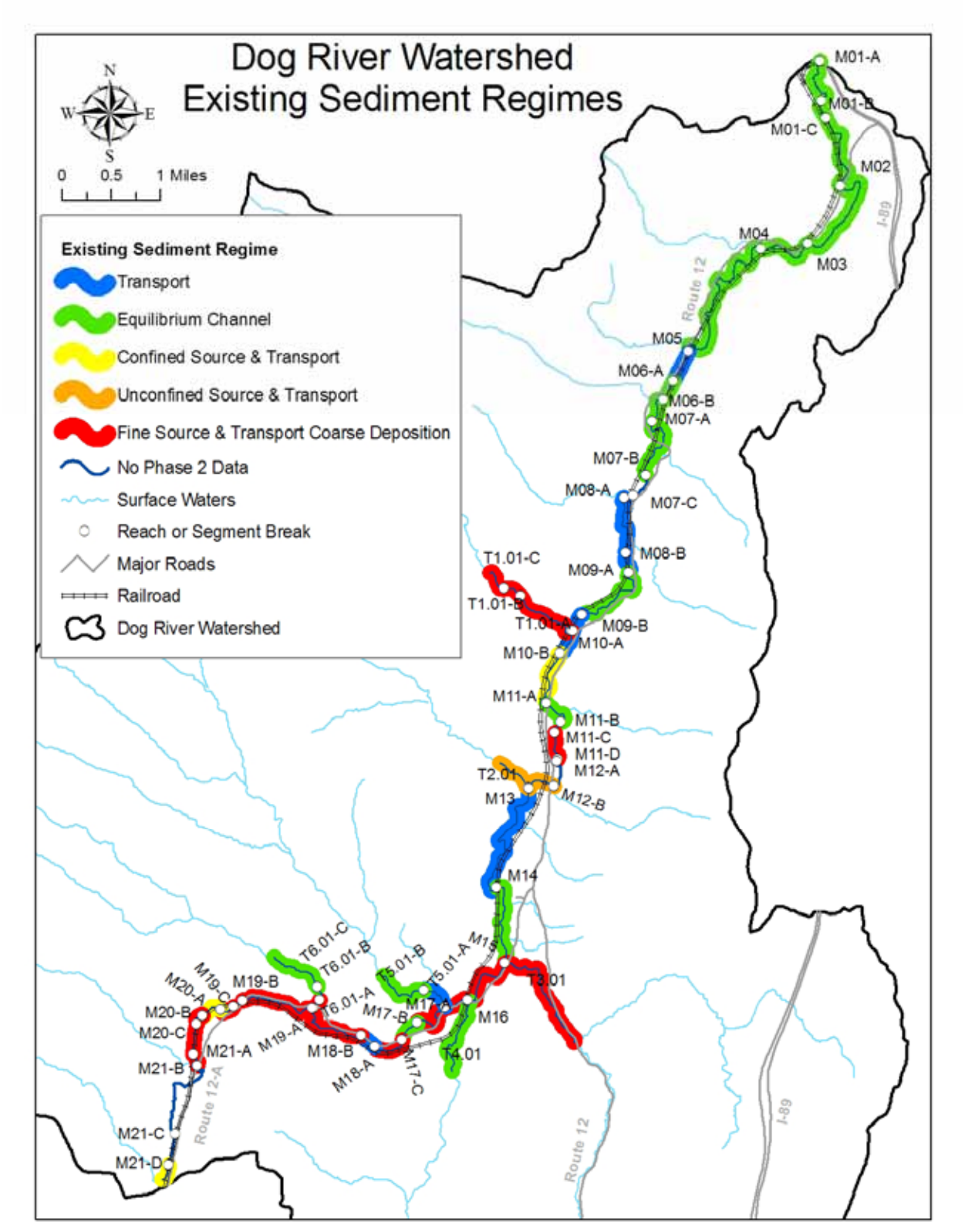


Figure 6.6. Existing Sediment Regime Map

6.2 Sensitivity Analysis

Stream sensitivity refers to the likelihood that a stream will respond to a watershed or local disturbance or stressor, such as; floodplain encroachment, channel straightening or armoring, changes in sediment or flow inputs, and/or disturbance of riparian vegetation (Vermont Agency of Natural Resources, 2007b).

Assigning a sensitivity rating to a stream is done with the assumption that some streams, due to their setting and location within the watershed, are more likely to be in an episodic, rapid, and/or measurable state of change or adjustment. A stream's inherent sensitivity may be heightened when human activities alter the setting characteristics that influence a stream's natural adjustment rate including: boundary conditions; sediment and flow regimes; and the degree of confinement within the valley. Streams that are currently in adjustment, especially those undergoing degradation or aggradation, may become acutely sensitive (Vermont Agency of Natural Resources, 2007b).

There are many variables that are contributing to the sensitivity of the segments in the Dog River watershed. Abundant bedrock and large bed substrates in many of the segments of the Dog River are more resistant to lateral and vertical adjustment and therefore seem to be in reality less sensitive streams. Additionally, bank vegetation and its soil holding roots, help to improve the boundary condition between water and land and have reduced the sensitivity of some sections of the study area that are well buffered. Segments that are lacking this vegetation tend to be more sensitive to channel adjustment.

The location and slope of a stream also affects is morphology and sensitivity. Streams that are transporting sediment through the channel are less sensitive than streams that are storing and responding to sediment. Low gradient streams, like many reaches in the Dog River watershed, with high sediment supplies are very sensitive and may undergo adjustment following minor changes in channel geometry or boundary conditions.

Additionally, flow regime and floodplain constrictions may be affecting the sensitivity of some Dog River stream reaches. Changes in land use and land cover that increase impervious cover, peak discharges, and/or the frequency of high flows will heighten a stream's sensitivity to change and adjustment. Confinement becomes a significant sensitivity concern when structures such as roads, railroads, and berms significantly change the confinement ratio, reduce or restrict a stream's access to floodplain, and result in higher stream power during flood stage. Figure 6.7 is a map presenting the stream sensitivity, generalized according to stream type and condition as per the ANR protocol, and active adjustments for each reach segment in the Dog River watershed. The stream sensitivity map also documents vertical channel adjustments currently going on within a reach segment. Major aggradation adjustment processes are displayed on the corridor where they were found to be actively occurring and not evaluated as historic. This information is helpful in prioritizing the implementation of the projects identified in section 7 of this report, as certain management actions may be influenced by these active adjustment processes. Current vertical channel adjustments exist in the following reaches:

Segment ID	Current Major Adjustment Process
M01-A	Aggradation
M01-B	Aggradation
M01-C	Aggradation
M02	Aggradation
M04	Aggradation
M07-A	Aggradation
M13	Aggradation
M14	Aggradation
M15	Aggradation
M17-A	Aggradation
M18-B	Aggradation

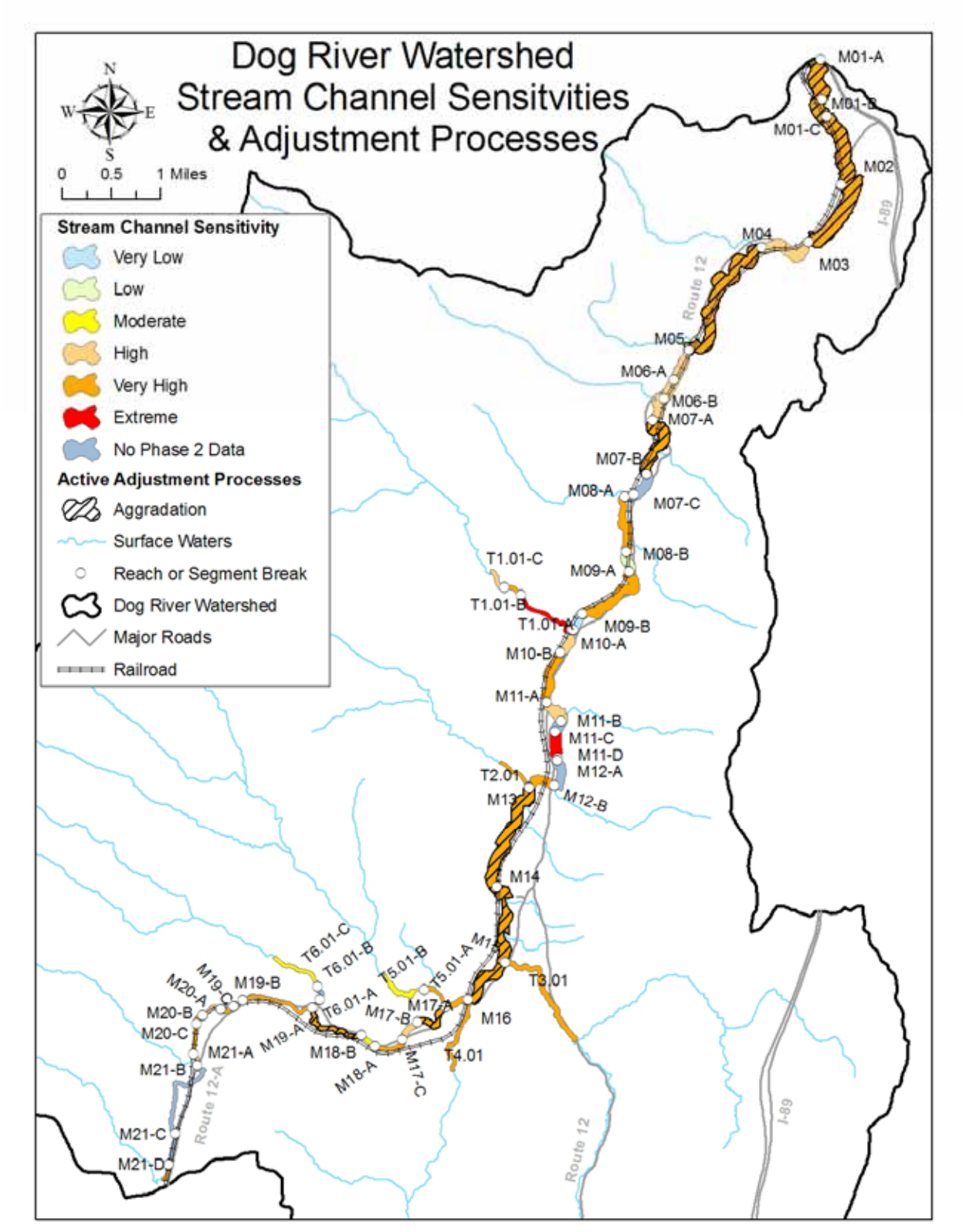


Figure 6.7. Dog River Watershed Stream Sensitivity and Current Adjustment Map

7.0 PRELIMINARY PROJECT IDENTIFICATION AND PRIORITIZATION

The departure and sensitivity analyses presented in Section 6.0 of this report provide beneficial background for selecting potential projects that will effectively help the channel return to equilibrium conditions by assessing limiting factors and by identifying underlying causes of channel instability. The stream reaches evaluated in this study present a variety of planning and management strategies which can be classified under one of the following categories: Active Geomorphic Restoration, Passive Geomorphic Restoration, and Conservation.

Active Geomorphic Restoration implies the management of rivers to a state of geomorphic equilibrium through active, physical alteration of the channel and/or floodplain. Often this approach involves the removal or reduction of human constructed constraints or the construction of meanders, floodplains or stable banks. Active riparian buffer revegetation and long-term protection of a river corridor is essential to this alternative.

Passive Geomorphic Restoration allows rivers to return to a state of geomorphic equilibrium by removing factors adversely impacting the river and subsequently using the river's own energy and watershed inputs to re-establish its meanders, floodplains and equilibrium conditions. In many cases, passive restoration projects may require varying degrees of active measures to achieve the ideal results. Active riparian buffer revegetation and long-term protection of a river corridor is also essential to this alternative.

Conservation is an option to consider when stream conditions are generally good and nearing a state of dynamic equilibrium. Typically, conservation is applied to minimally disturbed stream reaches where river structure and function and vegetation associations are relatively intact.

There are a number of voluntary programs available for river protection. Two of the primary programs are the Conservation Reserve Enhancement Program (CREP) and the River Corridor Easement (RCE). CREP is a program that helps protect environmentally sensitive land, decrease erosion, and restore wildlife habitat by taking land out of agricultural production. An overview of the Conservation Reserve Enhancement Program is found at http://www.fsa.usda.gov/FSA/webapp?area=home&subject=lown&topic=cep. The River Corridor Easement is designed to promote the long term physical stability of the river by allowing the river to achieve a state of equilibrium (where sediment and water loads are in balance). River corridor easements are vital for a passive geomorphic restoration approach and can also be used for conserving rivers that are in good condition (equilibrium). Rivers that are in equilibrium have access to their floodplains and therefore experience less erosion and negative impacts from flooding events. A description of each of the programs prepared by the Vermont River Management Program is provided below.

Conservation Reserve Enhancement Program

- CREP can be either a 15 or 30 year contract to plant trees.
- 90% of the practice costs are covered with the remaining 10% either resting with the participants or could be paid by the US Partners for Fish and Wildlife. Examples of the practice costs include fencing, watering facilities, and trees. There are some costs that are capped, but generally all the practice costs can be paid through the program.

- To provide additional incentives to enroll in CREP, the program offers upfront and annual rental payments for the land where agricultural production is lost during the contract period.

River Corridor Easement (RCE)

- Easements are in perpetuity, meaning the agreement stays with the land forever.
- A one time payment is received by the landowner for transferal of channel management rights to a second party (a land trust).
- Transferal of channel management rights means that the landowner would not longer be able to rock line river banks or remove gravel for personal use.
- A management plan accompanies the easement outlining the management and land use practices expected to occur within the corridor and describe any accommodations that must be made for existing structures (e.g. outbuildings, stream crossing, etc.).
- A RCE requires a minimum 50 foot buffer that floats with the river. No active land use is allowed within the buffer. The buffer can be actively planted or allowed to revegetate passively.
- The easement does not take away the agricultural land use rights, so the landowner could continue to crop or pasture the farm land mapped within the corridor for as long as the river allows.

7.1 Watershed-Level Opportunities

7.1.1 Fluvial Erosion Hazard Zones

Of all types of natural hazards experienced in Vermont, flash flooding represents the most frequent disaster mode and has resulted in by far the greatest magnitude of damage suffered by private property and public infrastructure. While inundation-related flood loss is a significant component of flood disasters, the predominant mode of damage is associated with the dynamic, and oftentimes catastrophic, physical adjustment of stream channel dimensions and location during storm events due to bed and bank erosion, debris and ice jams, structural failures, flow diversion, or flow modification by man-made structures. These channel adjustments and their devastating consequences have frequently been documented wherein such adjustments are related to historic channel management activities, floodplain encroachments, adjacent land use practices and/or changes to watershed hydrology associated with land use and drainage.

The purpose of defining Fluvial Erosion Hazard Zones is to prevent increases in fluvial erosion resulting from uncontrolled development in identified fluvial erosion hazard areas; minimize property loss and damage due to fluvial erosion; prohibit land uses and development in fluvial erosion hazard areas that pose a danger to health and safety; and discourage the development of property that is unsuited for the intended purposes due to fluvial erosion hazards.

The basis of a Fluvial Erosion Hazard Zone is a defined river corridor which includes the course of a river and its adjacent lands. The width of the corridor is defined by the

lateral extent of the river meanders, called the meander belt width, which is governed by valley landforms, surficial geology, and the length and slope requirements of the river channel. The width of the corridor is also governed by the reference channel width, stream type and sensitivity of the stream. River corridors, defined through VTANR Stream Geomorphic Assessment (2007b), are intended to provide landowners, land use planners, and river managers with a meander belt width which would accommodate the meanders and slope of a balanced or equilibrium channel, which when achieved, would serve to maximize channel stability and minimize fluvial erosion hazards. Figures 7.1-7.3 display the Draft Fluvial Erosion Hazards Zones for the Dog River watershed by town (Berlin, Northfield and Roxbury) developed by Gretchen Alexander (VANR) and Dan Currier (CVRPC).

7.1.2 Stormwater Management

Improving stormwater management and construction practices in the Dog River watershed is recommended to reduce siltation of critical aquatic habitat and improve geomorphic stability. Another added benefit to stormwater management is the reduction of peak flows in the channel.

7.2 Reach-Level Opportunities

47 potential projects have been identified as high, moderate or low priority based on their effectiveness and feasibility (see Tables 7.1-7.3 and Figures 7.4-7.6). These projects were identified using the criteria outlined by the ANR in Chapter 6 Preliminary Project Identification and Prioritization (Vermont Agency of Natural Resources, 2007c). This planning guide is intended to aid in the development of projects that protect and restore river equilibrium. Potential projects include: the implementation of FEH zones and corridor easements to limit further development and protect river corridors, replacing or retrofitting stream crossing structures and removing old abutments and dams to allow for better sediment transport and aquatic organism passage, developing a stormwater improvement plan for selected areas and buffer and near bank vegetation improvements.

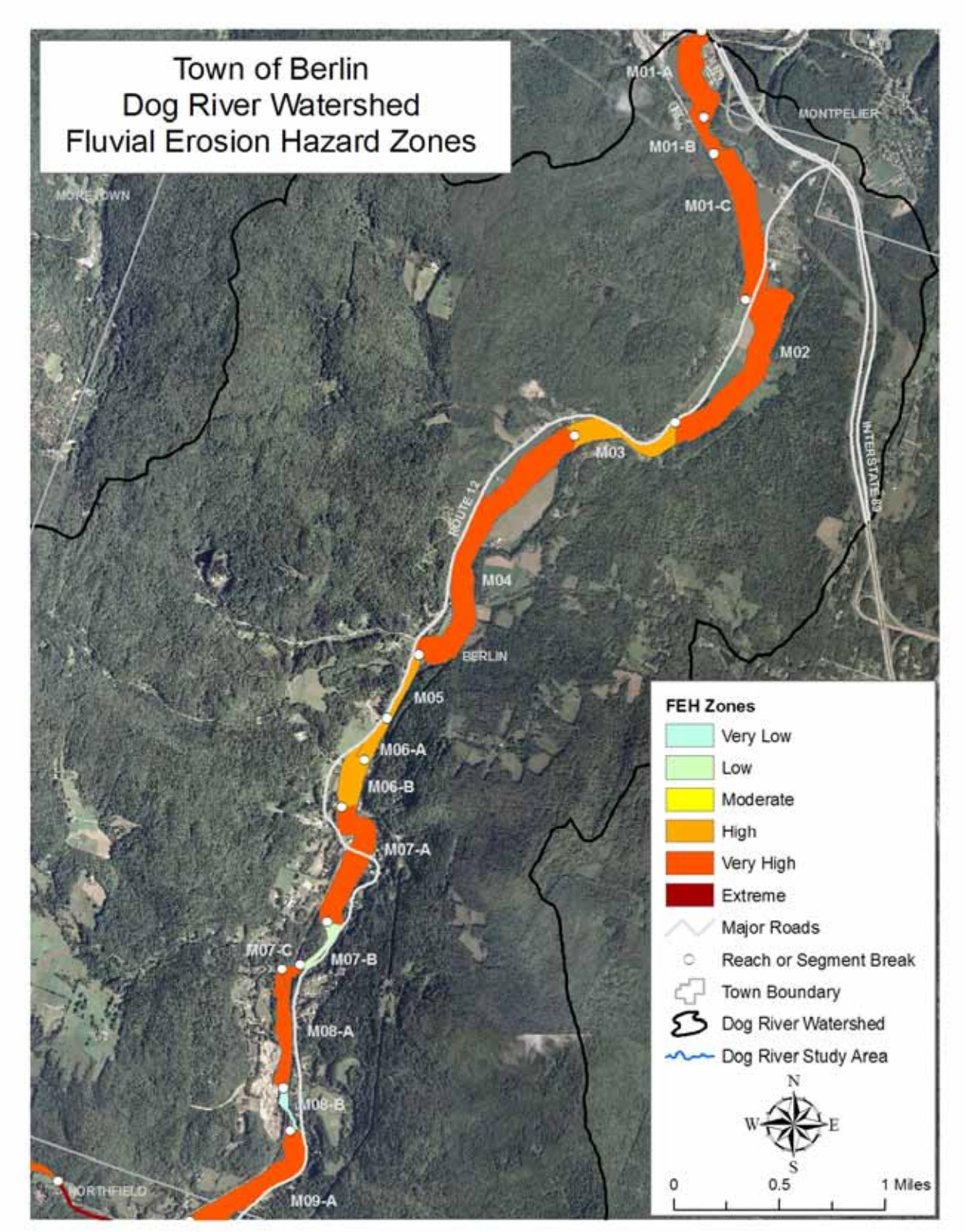


Figure 7.1. Draft Fluvial Erosion Hazard Zone Map for the Town of Berlin - Dog River watershed

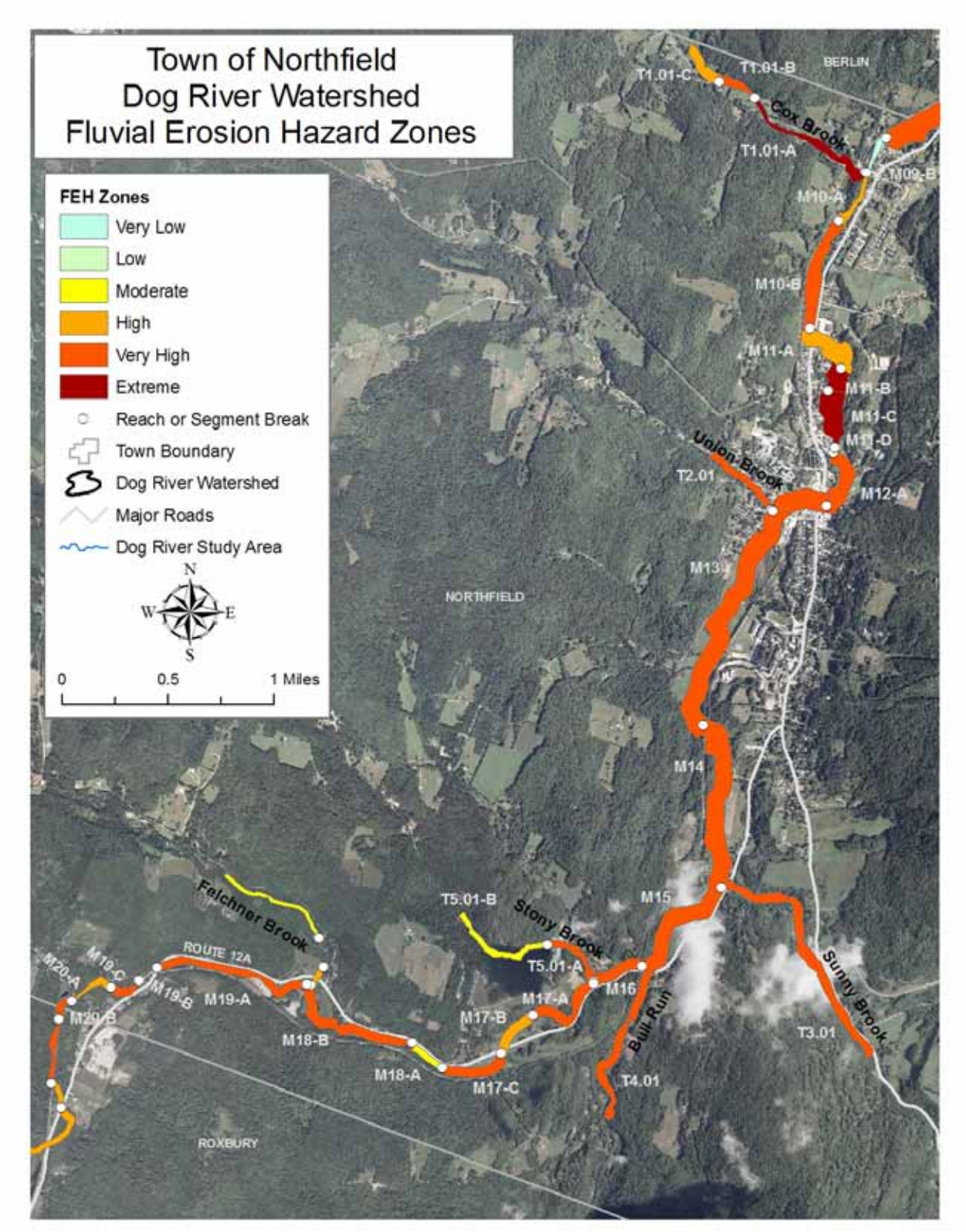


Figure 7.2. Draft Fluvial Erosion Hazard Zone Map for the Town of Northfield - Dog River watershed

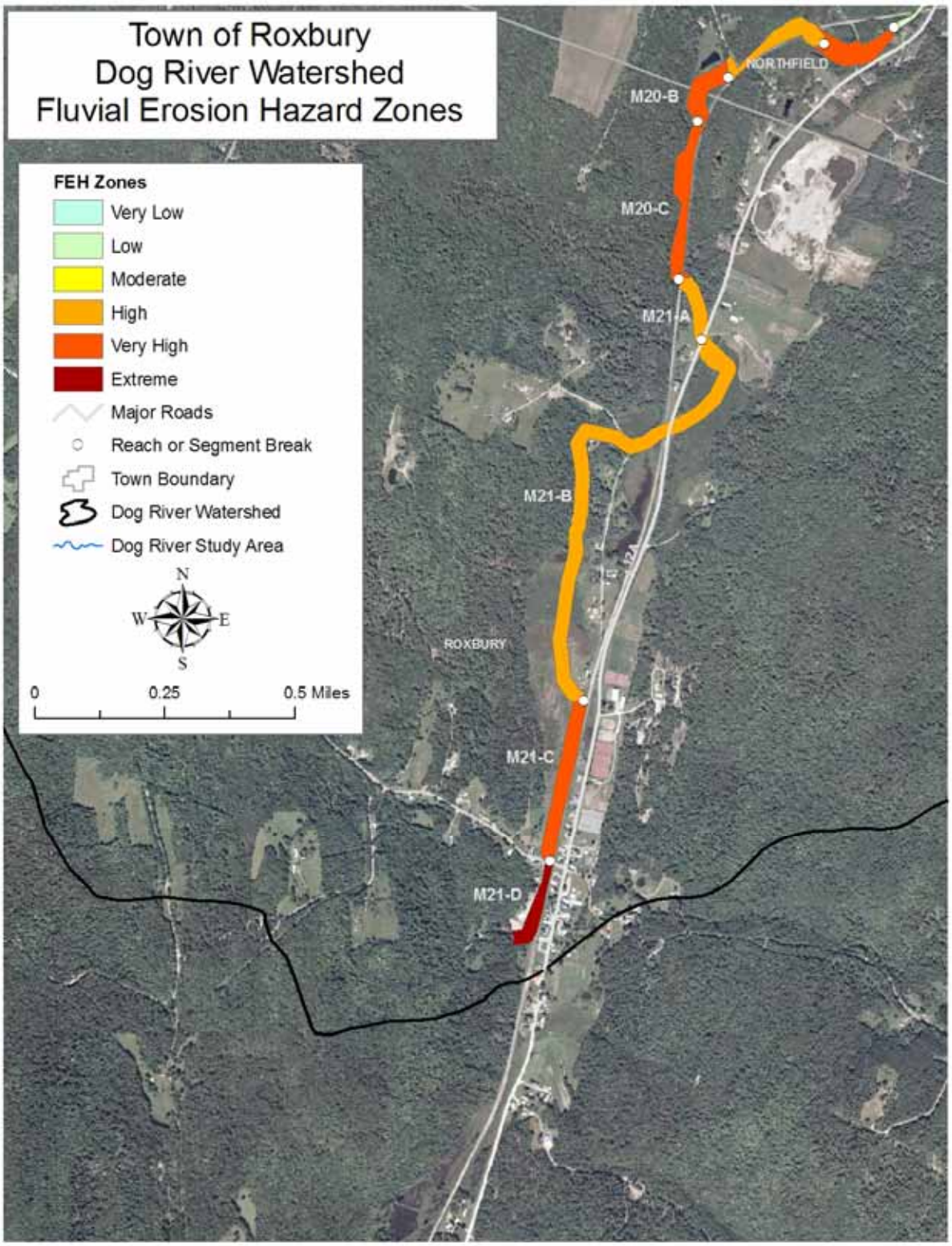


Figure 7.3. Draft Fluvial Erosion Hazard Zone Map for the Town of Roxbury - Dog River watershed

Table 7.1. Dog River Site Level Opportunities for Restoration and Protection – Town of Berlin

Project #, Reach	Condition and Channel Evolution Stage	Site Description Including Stressors and Constraints	Project or Strategy Description	Technical Feasibility and Priority	Other Social Benefits	Costs	Land Use Conversion	Potential Partners
#1 M01-A	Fair D II c	Recreational fields along east bank and agricultural fields along west bank	Improve buffer along both banks	High priority due to town land and one private landowner	Improved habitat and geomorphic stability	Relatively low cost for native plant materials and labor	Recreation/ agriculture to forested buffer	Landowners, City of Montpelier
#2 M01-C	Fair D II c	Field on east bank	Improve riparian buffer	Moderate priority due to three landowners	Improved habitat and geomorphic stability	Relatively low cost for native plant materials and labor	Field to forested buffer	landowners
#3 M01	A) Fair, D II c B) Fair, F III C) Fair, D IIc	Natural attenuation reach	Corridor Easement	High priority for corridor easement	Increased sediment and flood attenuation	Potentially high costs due landowners	No additional structures within corridor	Landowners, CREP
#4 M02	Fair D II c	Runs through agricultural land	Improve riparian buffer	High priority due to one landowner	Improved habitat and geomorphic stability	Relatively low cost for native plant materials and labor	Agricultural land to forested buffer	Landowners, CREP
#5 M02	Fair D II c	Natural attenuation reach	Corridor Easement	High priority for corridor easement	Increased sediment and flood attenuation	Potentially high cost for corridor easement	No additional structures within corridor	Landowners, CREP
#6 M03	Good D II c	Runs along farm land at upper end or reach and along Route 12 at lower end.	Improve riparian buffer	Low priority due to multiple landowners	Improved habitat and geomorphic stability	Relatively low cost for native plant materials and labor	Agricultural land to forested buffer	Landowners
#7 M03	Good D II c	Adjacent to Route 12	Manage stormwater	High priority to reduce sedimentation	Improved water quality and habitat	Moderate costs to design and maintain stormwater improvements	Not known	Town of Berlin
#8 M04	Fair D II c	Runs through agricultural land	Improve riparian buffers	Moderate priority due to two landowners	Improved habitat and geomorphic stability	Relatively low cost for native plant materials and labor	Agricultural land to forested buffer	Landowners, CREP
#9 M04	Fair D II c	Natural attenuation reach	Corridor Easement	High priority for corridor easement	Increased sediment and flood attenuation	Potentially high cost for corridor easement	No additional structures within corridor	Landowners, CREP
#10 M04	Fair D II c	Undersized railroad bridge causing significant planform adjustment and aggradation	Replace undersized railroad bridge	Low priority due to railroad	Improved geomorphic compatibility	High cost for design, permitting and replacement	Wider span may take more space away from agricultural land	Railroad

Table 7.1. Dog River Site Level Opportunities for Restoration and Protection – Town of Berlin

Project #, Reach	Condition and Channel Evolution Stage	Site Description Including Stressors and Constraints	Project or Strategy Description	Technical Feasibility and Priority	Other Social Benefits	Costs	Land Use Conversion	Potential Partners
#11 M05	Good F I	Good geomorphic condition in narrow valley with Route 12 and railroad in corridors	Conservation	Moderate priority due to multiple landowners	Flood attenuation	Low to moderate cost for conservation	None	landowners
#12 M06-B	Good D II c	Runs along residential property	Improve riparian buffers on small area of west bank	High priority due to one landowner	Improved habitat and geomorphic stability	Relatively low cost for native plant materials and labor	Residential land to forested buffer	landowners
#13 M07-A	Fair D II c	Runs along some conserved land in Berlin and through residential property	Improve riparian buffers	Moderate priority due to multiple landowners	Improved habitat and geomorphic stability	Relatively low cost for native plant materials and labor	Residential land to forested buffer	Landowners
#14 M07-A	Fair D II c	Natural attenuation segment with some conserved land	Corridor Easement	High priority for corridor easement	Increased sediment and flood attenuation	Potentially high cost for corridor easement	No additional structures within corridor	Landowners, Berlin Conservation Commission
#15 M07-A	Fair D II c	Undersized railroad bridge causing adjustment problems in channel	Replace undersized railroad bridge	Low priority due to railroad and private landowner	Improved geomorphic compatibility	High cost for design, permitting and replacement	Wider span may take up more space	Railroad, landowners.
#16 M07-A	Fair D II c	Old abutment causing channel constriction	Remove old abutment	Low priority due to private land	Improved geomorphic compatibility	High cost for design, permitting and construction	None	Landowners, ANR
#17 M08-A	Fair D II c	Runs through some residential land	Improve riparian buffers	High priority due to one landowner	Improved habitat and geomorphic stability	Relatively low cost for native plant materials and labor	Residential land to forested buffer	Landowners
#18 M08-B	Good F I	Bedrock dominated segment in good condition	Protect River Corridor	High priority due to one landowner and railroad	Flood attenuation asset	Moderate cost for easement	No additional structures in corridor	landowners
#19 M09-A	Fair D II c	Along Route 12 and agricultural land	Improve riparian buffers on east bank	High priority due to one landowner	Improved habitat and geomorphic stability	Relatively low cost for native plant materials and labor	Agricultural land to forested buffer	Landowners, CREP

Table 7.2. Dog River Site Level Opportunities for Restoration and Protection – Town of Northfield

Project #, Reach	Condition and Channel Evolution Stage	Site Description Including Stressors and Constraints	Project or Strategy Description	Technical Feasibility and Priority	Other Social Benefits	Costs	Land Use Conversion	Potential Partners
#1 M09-B	Good F I	Large breached dam structure on top of bedrock grade control	Remove dam structure	Moderate priority for improve aquatic organism passage at high cost	Improve aquatic organism passage	High cost for design, permitting and construction	None	VDEC, Vermont Fish & Wildlife Department
#2 M09-B	Good F I	Runs along residential properties on both sides	Improve riparian buffers and near bank vegetation next to managed lawns	Moderate priority due to multiple landowners	Improved habitat and geomorphic stability	Relatively low cost for native plant materials and labor	Residential land to forested buffer	Landowners
#3 M10-A	Good F I	Narrow valley channel	Protect river corridor	Moderate priority due to multiple landowners		Potentially high costs due to multiple landowners	No additional structures in corridor	Landowners
#4 M11-A	Good D II c	Segment runs along VSHA housing development with mowed lawns	Improve riparian buffer	High priority due to one landowner (Vermont Housing Authority)	Improved habitat and geomorphic stability	Relatively low cost for native plant materials and labor	Residential land to forested buffer	VSHA
#5 M11-C	Fair F II	Old agricultural field along east bank that looks like it has not been used in a few years	Natural revegetation	High priority due to one landowner	Improved habitat and geomorphic stability	Low cost for natural revegetation	Agricultural land to forested buffer	Landowners
#6 M12-B	Fair F III	Runs through downtown Northfield with urban development along banks	Manage stormwater	High priority to reduce sedimentation	Improved water quality and habitat	Moderate costs to design and maintain stormwater improvements	Not known	Town of Northfield
#7 M13	Fair D II c	River close to houses and development along Water Street on west bank	Implement FEH zones	Low priority due to multiple landowners and existing building restrictions	Flood and sediment attenuation asset	Unknown cost for FEH implementation	No additional structures in corridor	ANR
#8 M13	Fair D II c	Runs through Norwich University athletic fields	Improve riparian buffers	High priority due to one landowner (Norwich University)	Improved habitat and geomorphic stability	Relatively low cost for native plant materials and labor	Recreational land to forested buffer	Norwich University
#9 M14	Fair D II d	Runs along Northfield town wellfield	Improve riparian buffers along wellfield	High priority due to one landowner (Town of Northfield)	Improved habitat and geomorphic stability	Relatively low cost for native plant materials and labor	Managed town land to forested buffer	Town of Northfield
#10 M14	Fair D II d	Natural Attenuation reach	Corridor Easement	High priority for corridor easement	Increased sediment and flood attenuation	Potentially high cost for corridor easement	No additional structures within corridor	Town of Northfield, ANR

Table 7.2. Dog River Site Level Opportunities for Restoration and Protection – Town of Northfield

Project #, Reach	Condition and Channel Evolution Stage	Site Description Including Stressors and Constraints	Project or Strategy Description	Technical Feasibility and Priority	Other Social Benefits	Costs	Land Use Conversion	Potential Partners
#11 M16	Fair F II	Runs very close to Route 12A	Improve near bank vegetation along road	Low priority due to limited room for planting	Improved habitat and geomorphic stability	Relatively low cost for native plant materials and labor	Bare stream bank to vegetated stream bank	Town of Northfield
#12 M17-A	Fair F III	Natural attenuation reach downstream of channelized golf course	Corridor Easement	High priority due to channelized segments upstream contributing sediment	Increased sediment and flood attenuation	Potentially high cost for corridor easement	No additional structures within corridor	Landowners, ANR
#13 M17-B	Good F II	Runs through golf course at Northfield Country Club	Improve riparian buffers	High priority due to one landowner (Northfield CC)	Improved habitat and geomorphic stability	Relatively low cost for native plant materials and labor	Commercial to forested buffer	Northfield Country Club
#14 M18-B	Fair F III	Upper end of segment runs near agricultural land	Improve riparian buffers on small areas of north bank near farm	Low priority due to small area and channel widening	Improved habitat and geomorphic stability	Relatively low cost for native plant materials and labor	Agricultural land to forested buffer	Landowners, CREP
#15 M18-B	Fair F III	Natural attenuation reach	Corridor Easement	High priority for corridor easement	Increased sediment and flood attenuation	Potentially high cost for corridor easement	No additional structures within corridor	Landowners, CREP, ANR
#16 M20-B	Fair F III	Runs along residential property	Improve riparian and near bank vegetation on west bank	Low priority due to channel widening	Improved habitat and geomorphic stability	Relatively low cost for native plant materials and labor	Residential land to forested buffer	Landowners
#17 T1.01-B	Fair F III	Runs along Cox Brook Road with a driveway bridge crossing channel	Replace undersized driveway bridge	Moderate priority due to private ownership	Improved geomorphic compatibility	High cost for design, permitting and replacement	Wider span may take up more space	Landowners
#18 T1.01-C	Fair F II	Runs along Cox Brook Road and residential properties	Improve riparian buffers	Low priority due to 2 landowners and channel adjustment	Improved habitat and geomorphic stability	Relatively low cost for native plant materials and labor	Residential land to forested buffer	Landowners
#19 T2.01	Fair F II	Runs through downtown Northfield with urban development	Manage stormwater	High priority to reduce sedimentation	Improved water quality and habitat	Moderate costs to design and maintain stormwater improvements	Not known	Town of Northfield
#20 T3.01	Fair F II	Runs along Lovers Lane and Route 12	Manage stormwater	High priority to reduce sedimentation	Improved water quality and habitat	Moderate costs to design and maintain stormwater improvements	Not known	Town of Northfield

Table 7.2. Dog River Site Level Opportunities for Restoration and Protection – Town of Northfield

Project #, Reach	Condition and Channel Evolution Stage	Site Description Including Stressors and Constraints	Project or Strategy Description	Technical Feasibility and Priority	Other Social Benefits	Costs	Land Use Conversion	Potential Partners
#21 T3.01	Fair F II	Breached dam structure causing upstream deposition	Remove breached dam	High priority to improve aquatic organism passage; unknown historic preservation status	Improve aquatic organism passage	High cost for design, permitting and construction	None	Landowners
#22 T5.01-B	Good F I	Runs along Stony Brook Road near covered bridge	Manage stormwater to control road washout	High priority to reduce sedimentation	Improved water quality and habitat	Moderate costs to design and maintain stormwater improvements	Not known	Town of Northfield
#23 T6.01-A	Good F I	Channelized segment that runs through agricultural land	Improve riparian buffer	Moderate priority due to 2 landowners	Improved habitat and geomorphic stability	Relatively low cost for native plant materials and labor	Agricultural land to forested buffer	Landowners, CREP
#24 T6.01-B	Good Not Evaluated	Bedrock gorge segment	Conservation	Low priority due to only 2 landowners; not a concern for geomorphic stability	Conserve bedrock gorge	Moderate cost for conservation	No additional structures in corridor	Landowners
#25 T6.01-C	Good F I	Runs along Little Northfield Road	Conservation	Moderate priority due to only 2 landowners		Moderate cost for conservation easement	No additional structures in corridor	Landowners

Table 7.3. Dog River Site Level Opportunities for Restoration and Protection – Town of Roxbury

Project #, Reach	Condition and Channel Evolution Stage	Site Description Including Stressors and Constraints	Project or Strategy Description	Technical Feasibility and Priority	Other Social Benefits	Costs	Land Use Conversion	Potential Partners
#1 M21-C	Fair Not Evaluated	Recently relocated section of channel along Roxbury Road	Improve riparian vegetation	Moderate priority. Number of landowners unknown	Improved habitat and geomorphic stability	Relatively low cost for native plant materials and labor	Field to forested buffer	Town of Roxbury
#2 M21-D	Fair F III	Runs close to railroad and Town Garage	Improve near bank vegetation and riparian buffer	Low priority due to limited room for planting	Improved habitat and geomorphic stability	Relatively low cost for native plant materials and labor	Commercial to forested buffer	Town of Roxbury, Landowners
#3 M21-D	Fair F III	Runs close to railroad and Town Garage; railroad is heavily bermed	Remove berms	Low priority as berms are protecting the railroad	Restore floodplain access, but still would be limited by railroad	Moderate to high costs	None	Town of Roxbury, railroad

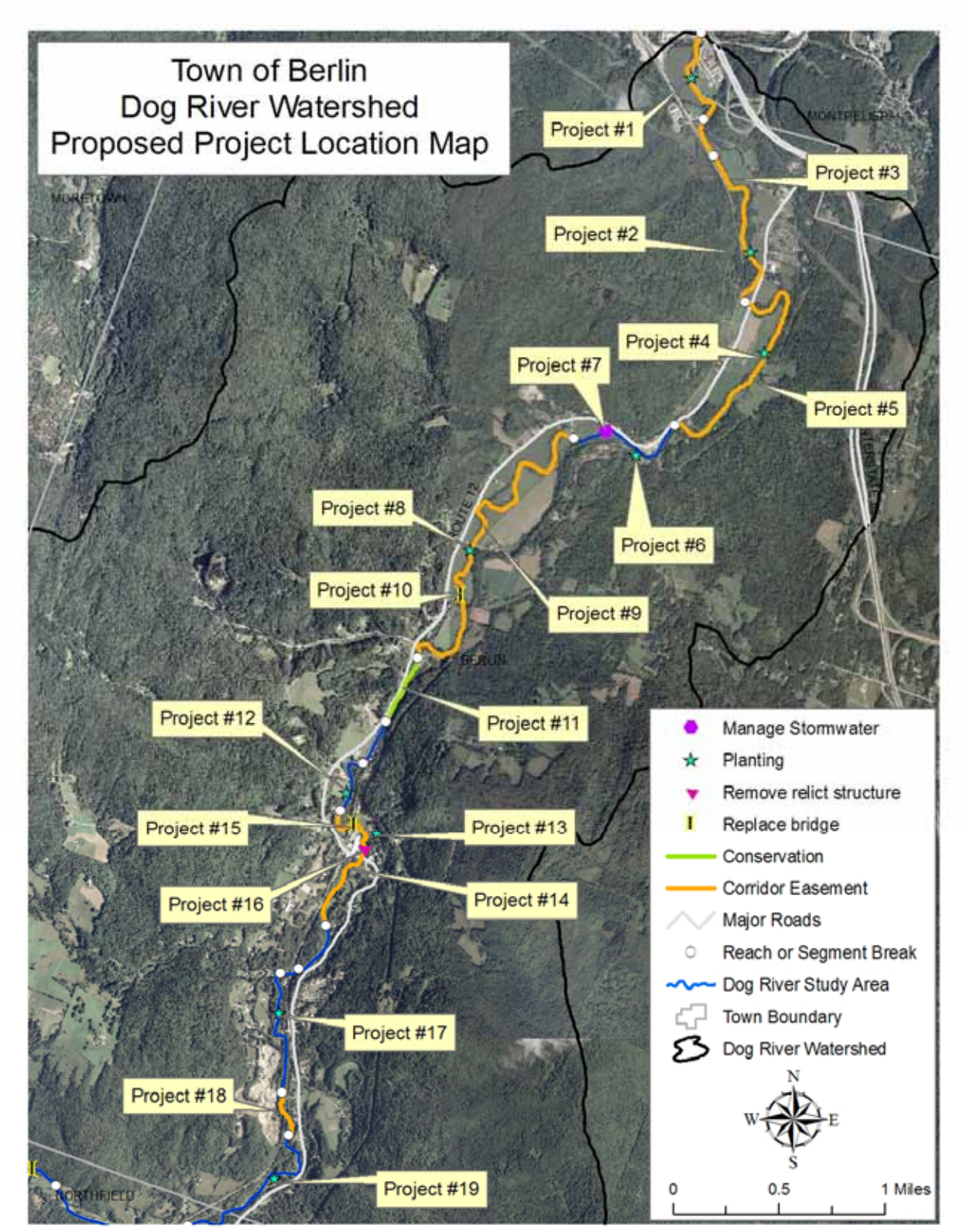


Figure 7.4 Proposed project location map for the Town of Berlin, Dog River Watershed

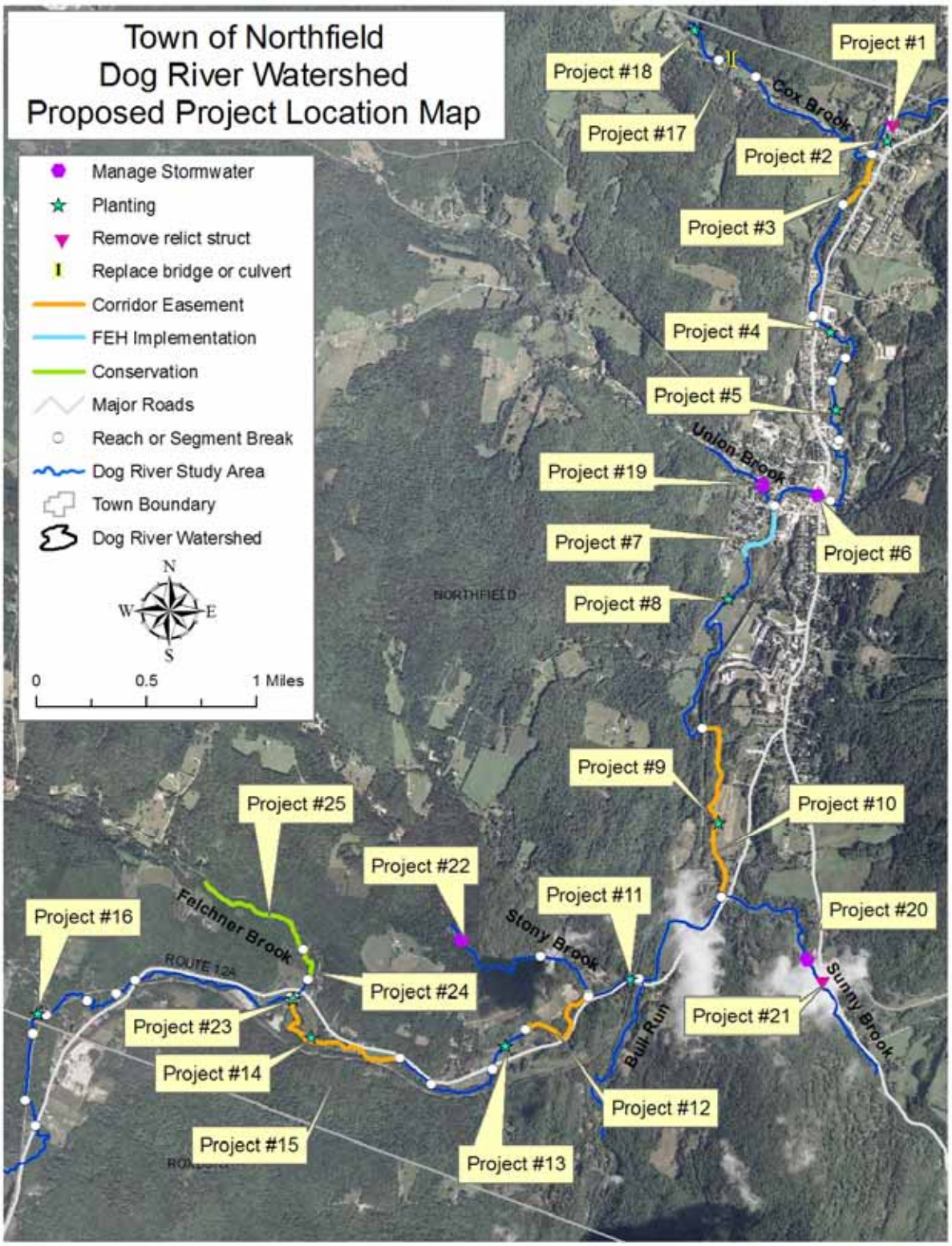


Figure 7.5 Proposed project location map for the Town of Northfield, Dog River watershed

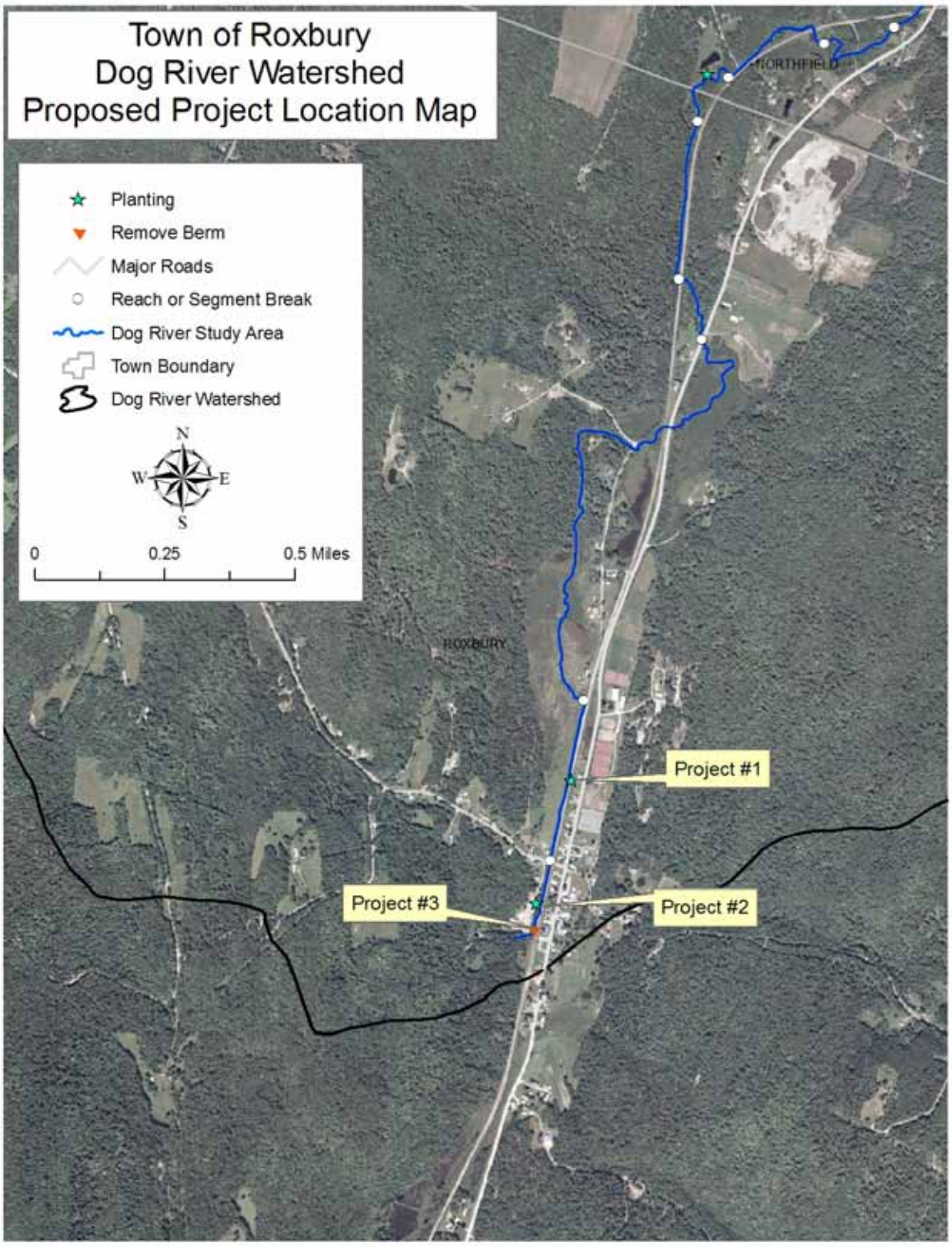


Figure 7.6 Proposed project location map for the Town of Roxbury, Dog River watershed

8.0 REFERENCES

Doll, C. G. 1961. Centennial Geologic Map of Vermont. http://www.anr.state.vt.us/DEC/GEO/centmap.htm. Accessed January, 2009.

Doll, C. G. 1970. Surficial Geologic Map of Vermont. http://www.anr.state.vt.us/DEC/GEO/SurfMap.htm. Accessed January 2009.

Doolan, Barry. 1996 . Geology of Vermont. In Rocks and Minerals *Vermont Issue.* Helderf Publications. 1319 Eighteenth Street, NW, Washington DC 20036-1802.

FindLakes. http://findlakes.com/north_montpelier_pond_vermont~vt00081.htm. accessed 4/14/08.

Foreman, R.T.T. and L.E. Alexander. 1998. Roads and Their Ecological Effects: Annual. Review of Ecological Systematics. Vol. 29: 207-231.

Leopold, L.B. 1994. A View of the River. Harvard University Press. Cambridge, MA.

Montgomery, D., and J. Buffington. 1997. Channel-reach Morphology in Mountain Drainage Basins. Geological Society of America Bulletin; v. 109; no. 5; pp 596-611.

Rosgen, D. 1996. Applied River Morphology. Wildland Hydrology, Pagosa Springs, CO.

Thompson and Sorenson. 2005. Wetland, Woodland, Wildland: A guide to the natural communities of Vermont. Capital City Press, Montpelier, Vermont.

United States Department of Agriculture. 1986. Urban Hydrology for Small Watersheds. Soil Conservation Service, Engineering Division, Technical Release 55. Washington, D.C.

Van Diver, B. 1987. Roadside Geology of Vermont and New Hampshire. Mountain Press Publishing Company. Missoula, MT.

Vermont Agency of Natural Resources, 2004a. Appendix Q, Glossary of Terms. Waterbury, VT.

Vermont Agency of Natural Resources, 2004b. Appendix C, Channel Evolution Models. Waterbury, VT.

Vermont Agency of Natural Resources. 2005. Riparian Buffers and Corridors: Technical Papers. Waterbury, Vermont

Vermont Agency of Natural Resources. 2006. Vermont River Management Section website, Flood Hazard Management. http://www.anr.state.vt.us/dec/waterq/rivers/htm/rv_floodhazard.htm

Vermont Agency of Natural Resources. 2007a. Vermont Stream Geomorphic Assessment Phase 1 Handbook. Watershed Assessment Using Maps, Existing Data, and Windshield Surveys. Waterbury, Vermont.

Vermont Agency of Natural Resources. 2007b. Vermont Stream Geomorphic Assessment Phase 2 Handbook. Rapid Stream Assessment. Waterbury, Vermont.

Vermont Agency of Natural Resources. 2007c. Vermont Agency of Natural Resources River Corridor Planning Guide to Identify and Develop River Corridor Protection and Restoration Projects (Partially Drafted). Waterbury, Vermont.

Vermont Agency of Natural Resources. 2007d. Vermont Stream Geomorphic Assessment, Appendix G, Bridge and Culvert Assessment. Waterbury, Vermont

Vermont Agency of Natural Resources 2008. Basin 8 Winooski River Watershed Water Quality and Aquatic Habitat Assessment Reort. Waterbury, VT

Wright, S. and F. Larsen. 2004. Surficial Geology of the Barre-Montpelier Region. http://www.anr.state.vt.us/dec/geo/pdfdocs/BarreWestwright.pdf. Accessed January 2007.

APPENDIX A

Glossary of Terms

(From Vermont Agency of Natural Resources – Appendix Q, April 2004)

Glossary of Terms

Adapted from:
ERDC TN-EMRRP-SR-01 1
Glossary of Stream
Restoration Terms
by Craig Fischenich.. February 2000
USAE Research and Development Center, Environmental Laboratory, 3909 Halls Ferry Rd., Vicksburg, MS 39180

OVERVIEW
Following is a glossary of terms commonly used in stream geomorphic assessment.

TERMS
Acre -- A measure of area equal to 43,560 ft 2(4,046.87 m2). One square mile equals 640 acres.
Adjustment process --or type of change, that is underway due to natural causes or human activity that has or will result in a change to the valley, floodplain, and/or channel condition (e.g., vertical, lateral, or channel plan form adjustment processes)
Aggradation -- A progressive buildup or raising of the channel bed and floodplain due to sediment deposition. The geologic process by which streambeds are raised in elevation and floodplains are formed. Aggradation indicates that stream discharge and/or bed-load characteristics are changing. Opposite of degradation.
Algae -- Microscopic plants that grow in sunlit water containing phosphates, nitrates, and other nutrients. Algae, like all aquatic plants, add oxygen to the water and are important in the fish food chain.
Alluvial -- Deposited by running water.
Alluvium -- A general term for detrital deposits make by streams on riverbeds, floodplains, and alluvial fans; esp. a deposit of silt or silty clay laid down during time of flood. The term applies to stream deposits of recent time. It does not include subaqueous sediments of seas or lakes.
Anadromous -- Pertaining to fish that spend a part of their life cycle in the sea and return to freshwater streams to spawn.
Aquatic ecosystem -- Any body of water, such as a stream, lake, or estuary, and all organisms and nonliving components within it, functioning as a natural system.
Armoring -- A natural process where an erosion-resistant layer of relatively large particles is established on the surface of the streambed through removal of finer particles by stream flow. A properly armored streambed generally resists movement of bed material at discharges up to approximately 3/4 bank-full depth.
Augmentation (of stream flow) – Increasing flow under normal conditions, by releasing storage water from reservoirs.
Avulsion -- A change in channel course that occurs when a stream suddenly breaks through its banks, typically bisecting an overextended meander arc.
Backwater -- (1) A small, generally shallow body of water attached to the main channel, with little or no current of its own, or (2) A condition in subcritical flow where the water surface elevation is raised by downstream flow impediments.
Backwater pool -- A pool that formed as a result of an obstruction like a large tree, weir, dam, or boulder.
Bank stability -- The ability of a streambank to counteract erosion or gravity forces.
Bankfull channel depth -- The maximum depth of a channel within a riffle segment when flowing at a bank-full discharge.
Bankfull channel width -- The top surface width of a stream channel when flowing at a bank-full discharge.
Bankfull discharge -- The stream discharge corresponding to the water stage that first overtops the natural banks. This flow occurs, on average, about once every 1 to 2 years.
Bankfull width -- The width of a river or stream channel between the highest banks on either side of a stream.
Bar -- An accumulation of alluvium (usually gravel or sand) caused by a decrease in sediment transport capacity on the inside of meander bends or in the center of an overwide channel.

Barrier -- A physical block or impediment to the movement or migration of fish, such as a waterfall (natural barrier) or a dam (man-made barrier).

Base flow -- The sustained portion of stream discharge that is drawn from natural storage sources, and not affected by human activity or regulation.

Bed load -- Sediment moving on or near the streambed and transported by jumping, rolling, or sliding on the bed layer of a stream. See also suspended load.

Bed material -- The sediment mixture that a streambed is composed of.

Bed material load -- That portion of the total sediment load with sediments of a size found in the streambed.

Bed roughness -- A measure of the irregularity of the streambed as it contributes to flow resistance. Commonly expressed as a Manning "n" value.

Bed slope -- The inclination of the channel bottom, measured as the elevation drop per unit length of channel.

Benthic invertebrates -- Aquatic animals without backbones that dwell on or in the bottom sediments of fresh or salt water. Examples: clams, crayfish, and a wide variety of worms.

Berms -- mounds of dirt, earth, gravel, or other fill built parallel to the stream banks designed to keep flood flows from entering the adjacent floodplain.

Biota -- All living organisms of a region, as in a stream or other body of water.

Boulder -- A large substrate particle that is larger than cobble, 256 mm in diameter.

Braided channel -- A stream characterized by flow within several channels, which successively meet and divide. Braiding often occurs when sediment loading is too large to be carried by a single channel.

Braiding (of river channels) -- Successive division and rejoining of riverflow with accompanying islands.

Buffer strip -- A barrier of permanent vegetation, either forest or other vegetation, between waterways and land uses such as agriculture or urban development, designed to intercept and filter out pollution before it reaches the surface water resource.

Canopy -- A layer of foliage in a forest stand. This most often refers to the uppermost layer of foliage, but it can be used to describe lower layers in a multistoried stand. Leaves, branches and vegetation that are above ground and/or water that provide shade and cover for fish and wildlife.

Cascade -- A short, steep drop in streambed elevation often marked by boulders and agitated white water.

Catchment -- (1) The catching or collecting of water, especially rainfall. (2) A reservoir or other basin for catching water. (3) The water thus caught. (4) A watershed.

Channel -- An area that contains continuously or periodically flowing water that is confined by banks and a streambed.

Channelization -- The process of changing (usually straightening) the natural path of a waterway.

Clay -- Substrate particles that are smaller than silt and generally less than 0.003 mm in diameter.

Coarse woody debris (CWD) -- Portion of a tree that has fallen or been cut and left in the woods. Usually refers to pieces at least 20 in. in diameter.

Cobble -- Substrate particles that are smaller than boulders and larger than gravels, and are generally 64-256 mm in diameter. Can be further classified as small and large cobble.

Confluence -- (1) The act of flowing together; the meeting or junction of two or more streams; also, the place where these streams meet. (2) The stream or body of water formed by the junction of two or more streams; a combined flood.

Conifer -- A tree belonging to the order Gymnospermae, comprising a wide range of trees that are mostly evergreens. Conifers bear cones (hence, coniferous) and have needle-shaped or scalelike leaves.

Conservation -- The process or means of achieving recovery of viable populations.

Contiguous habitat -- Habitat suitable to support the life needs of a species that is distributed continuously or nearly continuously across the landscape.

Cover – "cover" is the general term used to describe any structure that provides refugia for fish, reptiles or amphibians. These animals seek cover to hide from predators, to avoid warm water temperatures, and to rest, by avoiding higher velocity water. These animals come in all sizes, so even cobbles on the stream bottom that are not sedimented in with fine sands and silt can serve as cover for small fish and salamanders. Larger fish and reptiles often use large boulders, undercut banks, submerged logs, and snags for cover.

Critical shear stress -- The minimum amount of shear stress exerted by stream currents required to initiate soil particle motion. Because gravity also contributes to streambank particle movement but not on streambeds, critical shear stress along streambanks is less than for streambeds.

Crown -- The upper part of a tree or other woody plant that carries the main system of branches and the foliage.

Crown cover -- The degree to which the crowns of trees are nearing general contact with one another.

Cubic feet per second (cfs) -- A unit used to measure water flow. One cubic foot per second is equal to 449 gallons per minute.

Culvert -- A buried pipe that allows flows to pass under a road.

Debris flow -- A rapidly moving mass of rock fragments, soil, and mud, with more than half of the particles being larger than sand size.

Deciduous -- Trees and plants that shed their leaves at the end of the growing season.

Degradation -- (1) A progressive lowering of the channel bed due to scour. Degradation is an indicator that the stream's discharge and/or sediment load is changing. The opposite of aggradation. (2) A decrease in value for a designated use.

Detritus -- is organic material, such as leaves, twigs, and other dead plant matter, that collects on the stream bottom. It may occur in clumps, such as leaf packs at the bottom of a pool, or as single pieces, such as a fallen tree branch.

Dike -- (1) (Engineering) An embankment to confine or control water, especially one built along the banks of a river to prevent overflow of lowlands; a levee. (2) A low wall that can act as a barrier to prevent a spill from spreading. (3) (Geology) A tabular body of igneous (formed by volcanic action) rock that cuts across the structure of adjacent rocks or cuts massive rocks.

Dissolved oxygen (DO) -- The amount of free (not chemically combined) oxygen dissolved in water, wastewater, or other liquid, usually expressed in milligrams per liter, parts per million, or percent of saturation.

Ditch -- A long narrow trench or furrow dug in the ground, as for irrigation, drainage, or a boundary line.

Drainage area -- The total surface area upstream of a point on a stream that drains toward that point. Not to be confused with watershed. The drainage area may include one or more watersheds.

Drainage basin -- The total area of land from which water drains into a specific river.

Dredging -- Removing material (usually sediments) from wetlands or waterways, usually to make them deeper or wider.

Ecology -- The study of the interrelationships of living organisms to one another and to their surroundings.

Ecosystem -- Recognizable, relatively homogeneous units, including the organisms they contain, their environment, and all the interactions among them.

Embankment -- An artificial deposit of material that is raised above the natural surface of the land and used to contain, divert, or store water, support roads or railways, or for other similar purposes.

Embeddedness -- is a measure of the amount of surface area of cobbles, boulders, snags and other stream bottom structures that is covered with sand and silt. An embedded streambed may be packed hard with sand and silt such that rocks in the stream bottom are difficult or impossible to pick up. The spaces between the rocks are filled with fine sediments, leaving little room for fish, amphibians, and bugs to use the structures for cover, resting, spawning, and feeding. A streambed that is **not** embedded has loose rocks that are easily removed from the stream bottom, and may even "roll" on one another when you walk on them.

Entrenchment ratio --The width of the flood-prone area divided by the bankfull width.

Epifaunal – "epi" means surface, and "fauna" means animals. Thus, "epifaunal substrate" is structures in the stream (on the stream bed) that provide surfaces on which animals can live. In this case, the animals are aquatic invertebrates (such as aquatic insects and other "bugs"). These bugs live on or under cobbles, boulders, logs, and snags, and the many cracks and crevices found in these structures. In general, older decaying logs are better suited for bugs to live on/in than newly fallen "green" logs and trees.

Ephemeral streams -- Streams that flow only in direct response to precipitation and whose channel is at all times above the water table.

Erosion -- Wearing away of rock or soil by the gradual detachment of soil or rock fragments by water, wind, ice, and other mechanical, chemical, or biological forces.

Eutrophic -- Usually refers to a nutrient-enriched, highly productive body of water.

Eutrophication -- The process of enrichment of water bodies by nutrients.

Flash Flood -- A sudden flood of great volume, usually caused by a heavy rain. Also, a flood that crests in a short length of time and is often characterized by high velocity flows.

Floodplain -- Land built of sediment that is regularly covered with water as a result of the flooding of a nearby stream.

Floodplain (100-year) -- The area adjacent to a stream that is on average inundated once a century.

Floodplain Function – Flood water access of floodplain which effects the velocity, depth, and slope (stream power) of the flood flow thereby influencing the sediment transport characteristics of the flood (i.e., loss of floodplain access and function may lead to higher stream power and erosion during flood).

Flow -- The amount of water passing a particular point in a stream or river, usually expressed in cubic feet per second (cfs).

Fluvial -- Migrating between main rivers and tributaries. Of or pertaining to streams or rivers.

Ford -- A shallow place in a body of water, such as a river, where one can cross by walking or riding on an animal or in a vehicle.

Fry -- A recently hatched fish.

Gabion -- A wire basket or cage that is filled with gravel or cobble and generally used to stabilize streambanks.

Gaging station -- A particular site in a stream, lake, reservoir, etc., where hydrologic data are obtained.

Gallons per minute (gpm) -- A unit used to measure water flow.

Geographic information system (GIS) -- A computer system capable of storing and manipulating spatial data.

Geomorphology -- A branch of both physiography and geology that deals with the form of the earth, the general configuration of its surface, and the changes that take place due to erosion of the primary elements and the buildup of erosional debris.

Glide -- A section of stream that has little or no turbulence.

Gradient -- Vertical drop per unit of horizontal distance.

Grass/forb -- Herbaceous vegetation.

Gravel -- An unconsolidated natural accumulation of rounded rock fragments, mostly of particles larger than sand (diameter greater than 2 mm), such as boulders, cobbles, pebbles, granules, or any combination of these.

Groundwater -- Subsurface water and underground streams that can be collected with wells, or that flow naturally to the earth's surface through springs.

Groundwater basin -- A groundwater reservoir, defined by an overlying land surface and the underlying aquifers that contain water stored in the reservoir. In some cases, the boundaries of successively deeper aquifers may differ and make it difficult to define the limits of the basin.

Groundwater recharge -- Increases in groundwater storage by natural conditions or by human activity. See also artificial recharge.

Groundwater table -- The upper surface of the zone of saturation, except where the surface is formed by an impermeable body.

Habitat -- The local environment in which organisms normally live and grow.

Habitat diversity -- The number of different types of habitat within a given area.
Habitat fragmentation -- The breaking up of habitat into discrete islands through modification or conversion of habitat by management activities.
Headwater -- Referring to the source of a stream or river.
High gradient streams -- typically appear as steep cascading streams, step/pool streams, or streams that exhibit riffle/pool sequences. Most of the streams in Vermont are high gradient streams.
Hydraulic gradient -- The slope of the water surface. See also streambed gradient.
Hydraulic radius -- The cross-sectional area of a stream divided by the wetted perimeter.
Hydric -- Wet.
Hydrograph -- A curve showing stream discharge over time.
Hydrologic balance -- An accounting of all water inflow to, water outflow from, and changes in water storage within a hydrologic unit over a specified period of time.
Hydrologic region -- A study area, consisting of one or more planning subareas, that has a common hydrologic character.
Hydrologic unit -- A distinct watershed or river basin defined by an 8-digit code.
Hydrology -- The scientific study of the water of the earth, its occurrence, circulation and distribution, its chemical and physical properties, and its interaction with its environment, including its relationship to living things.
Hyporheic zone -- The area under the stream channel and floodplain where groundwater and the surface waters of the stream are exchanged freely.
Improved paths – Paths that are maintained and typically involve paved, gravel or macadam surfaces.
Incised river -- A river that erodes its channel by the process of degradation to a lower base level than existed previously or is consistent with the current hydrology.
Incision ratio -- The low bank height divided by the bankfull maximum depth.
Infiltration (soil) -- The movement of water through the soil surface into the soil.
Inflow -- Water that flows into a stream, lake,
Instream cover -- The layers of vegetation, like trees, shrubs, and overhanging vegetation, that are in the stream or immediately adjacent to the wetted channel.
Instream flows -- (1) Portion of a flood flow that is contained by the channel. (2) A minimum flow requirement to maintain ecological health in a stream.
Instream use -- Use of water that does not require diversion from its natural watercourse. For example, the use of water for navigation, recreation, fish and wildlife, aesthetics, and scenic enjoyment.
Intermittent stream -- Any nonpermanent flowing drainage feature having a definable channel and evidence of scour or deposition. This includes what are sometimes referred to as ephemeral streams if they meet these two criteria.
Irrigation diversion -- Generally, a ditch or channel that deflects water from a stream channel for irrigation purposes.
Islands – mid-channel bars that are above the average water level and have established woody vegetation.
Lake – An inland body of standing water deeper than a pond, an expanded part of a river, a reservoir behind a dam
Landslide -- A movement of earth mass down a steep slope.
Large woody debris (LWD) -- Pieces of wood at least 6 ft. long and 1 ft. in diameter (at the large end) contained, at least partially, within the bankfull channel.
Levee -- An embankment constructed to prevent a river from overflowing (flooding).
Limiting factor -- A requirement such as food, cover, or another physical, chemical, or biological factor that is in shortest supply with respect to all resources necessary to sustain life and thus "limits" the size or retards production of a population.
Low gradient -- streams typically appear slow moving and winding, and have poorly defined riffles and pools. These streams are usually found in the large valley bottoms of the Champlain Valley and occasionally in high wet meadows. The lower reaches of the Otter Creek,

Lewis Creek, and Poultney River are all areas you are likely to find low gradient streams.

Macroinvertebrate -- Invertebrates visible to the naked eye, such as insect larvae and crayfish.

Macrophytes -- Aquatic plants that are large enough to be seen with the naked eye.

Mainstem -- The principal channel of a drainage system into which other smaller streams or rivers flow.

Mass movement -- The downslope movement of earth caused by gravity. Includes but is not limited to landslides, rock falls, debris avalanches, and creep. It does not however, include surface erosion by running water. It may be caused by natural erosional processes, or by natural disturbances (e.g., earthquakes or fire events) or human disturbances (e.g., mining or road construction).

Mean annual discharge -- Daily mean discharge averaged over a period of years. Mean annual discharge generally fills a channel to about one-third of its bank-full depth.

Mean velocity -- The average cross-sectional velocity of water in a stream channel. Surface values typically are much higher than bottom velocities. May be approximated in the field by multiplying the surface velocity, as determined with a float, times 0.8.

Meander -- The winding of a stream channel, usually in an erodible alluvial valley. A series of sine-generated curves characterized by curved flow and alternating banks and shoals.

Meander amplitude -- The distance between points of maximum curvature of successive meanders of opposite phase in a direction normal to the general course of the meander belt, measured between center lines of channels.

Meander belt width -- the distance between lines drawn tangential to the extreme limits of fully developed meanders. Not to be confused with meander amplitude.

Meander length -- The lineal distance downvalley between two corresponding points of successive meanders of the same phase.

Mid-channel Bars – bars located in the channel away from the banks, generally found in areas where the channel runs straight. Mid-channel bars caused by recent channel instability are unvegetated.

Milligrams per liter (mg/l) -- The weight in milligrams of any substance dissolved in 1 liter of liquid; nearly the same as parts per million by weight.

Natural flow -- The flow past a specified point on a natural stream that is unaffected by stream diversion, storage, import, export, return flow, or change in use caused by modifications in land use.

Outfall -- The mouth or outlet of a river, stream, lake, drain or sewer.

Oxbow -- An abandoned meander in a river or stream, caused by cutoff. Used to describe the U-shaped bend in the river or the land within such a bend of a river.

Peat -- Partially decomposed plants and other organic material that build up in poorly drained wetland habitats.

Perched groundwater -- Groundwater supported by a zone of material of low permeability located above an underlying main body of groundwater with which it is not hydrostatically connected.

Perennial streams -- Streams that flow continuously.

Permeability -- The capability of soil or other geologic formations to transmit water.

pH -- The negative logarithm of the molar concentration of the hydrogen ion, or, more simply acidity.

Point bar -- The convex side of a meander bend that is built up due to sediment deposition.

Pond -- A body of water smaller than a lake, often artificially formed.

Pool -- A reach of stream that is characterized by deep, low-velocity water and a smooth surface.

Pool/riffle ratio -- The ratio of surface area or length of pools to the surface area or length of riffles in a given stream reach; frequently expressed as the relative percentage of each category. Used to describe fish habitat rearing quality.

Potential plant height -- the height to which a plant, shrub or tree would grow if undisturbed.

Probability of exceedence -- The probability that a random flood will exceed a specified magnitude in a given period of time.
Railroads – Used or unused railroad infrastructure.
Rapids -- A reach of stream that is characterized by small falls and turbulent, high-velocity water.
Reach -- A section of stream having relatively uniform physical attributes, such as valley confinement, valley slope, sinuosity, dominant bed material, and bed form, as determined in the Phase 1 assessment.
Rearing habitat -- Areas in rivers or streams where juvenile fish find food and shelter to live and grow.
Regime theory -- A theory of channel formation that applies to streams that make a part of their boundaries from their transported sediment load and a portion of their transported sediment load from their boundaries. Channels are considered in regime or equilibrium when bank erosion and bank formation are equal.
Restoration -- The return of an ecosystem to a close approximation of its condition prior to disturbance.
Riffle -- A reach of stream that is characterized by shallow, fast-moving water broken by the presence of rocks and boulders.
Riffle/step frequency -- ratio of the distance between riffles to the stream width.
Riparian area -- An area of land and vegetation adjacent to a stream that has a direct effect on the stream. This includes woodlands, vegetation, and floodplains.
Riparian buffer is the width of naturally vegetated land adjacent to the stream between the top of the bank (or top of slope, depending on site characteristics) and the edge of other land uses. A buffer is largely undisturbed and consists of the trees, shrubs, groundcover plants, duff layer, and naturally uneven ground surface. The buffer serves to protect the water body from the impacts of adjacent land uses.
Riparian corridor includes lands defined by the lateral extent of a stream's meanders necessary to maintain a stable stream dimension, pattern, profile, and sediment regime. For instance, in stable pool-riffle streams, riparian corridors may be as wide as 10-12 times the channel's bankfull width. In addition the riparian corridor typically corresponds to the land area surrounding and including the stream that supports (or could support if unimpacted) a distinct ecosystem, generally with abundant and diverse plant and animal communities (as compared with upland communities).
Riparian habitat -- The aquatic and terrestrial habitat adjacent to streams, lakes, estuaries, or other waterways.
Riparian -- Located on the banks of a stream or other body of water.
Riparian vegetation -- The plants that grow adjacent to a wetland area such as a river, stream, reservoir, pond, spring, marsh, bog, meadow, etc., and that rely upon the hydrology of the associated water body.
Ripple -- (1) A specific undulated bed form found in sand bed streams. (2) Undulations or waves on the surface of flowing water.
Riprap -- Rock or other material with a specific mixture of sizes referred to as a "gradation," used to stabilize streambanks or riverbanks from erosion or to create habitat features in a stream.
River channels -- Large natural or artificial open streams that continuously or periodically contain moving water, or which form a connection between two bodies of water.
River miles -- Generally, miles from the mouth of a river to a specific destination or, for upstream tributaries, from the confluence with the main river to a specific destination.
River reach -- Any defined length of a river.
River stage -- The elevation of the water surface at a specified station above some arbitrary zero datum (level).
Riverine -- Relating to, formed by, or resembling a river including tributaries, streams, brooks, etc.
Riverine habitat -- The aquatic habitat within streams and rivers.
Roads - Transportation infrastructure. Includes private, town, state roads, and roads that are dirt, gravel, or paved.
Rock -- A naturally formed mass of minerals.
Rootwad -- The mass of roots associated with a tree adjacent to or in a stream that provides refuge for fish and other aquatic life.

Run (in stream or river) -- A reach of stream characterized by fast-flowing, low-turbulence water.
Runoff -- Water that flows over the ground and reaches a stream as a result of rainfall or snowmelt.
Sand -- Small substrate particles, generally from 0.06 to 2 mm in diameter. Sand is larger than silt and smaller than gravel.
Scour -- The erosive action of running water in streams, which excavates and carries away material from the bed and banks. Scour may occur in both earth and solid rock material and can be classed as general, contraction, or local scour.
Sediment -- Soil or mineral material transported by water or wind and deposited in streams or other bodies of water.
Sedimentation -- (1) The combined processes of soil erosion, entrainment, transport, deposition, and consolidation. (2) Deposition of sediment.
Seepage -- The gradual movement of a fluid into, through, or from a porous medium.
Segment: A relatively homogenous section of stream contained within a reach that has the same reference stream characteristics but is distinct from other segments in the reach in one or more of the following parameters: degree of floodplain encroachment, presence/absence of grade controls, bankfull channel dimensions (W/D ratio, entrenchment), channel sinuosity and slope, riparian buffer and corridor conditions, abundance of springs/seeps/adjacent wetlands/stormwater inputs, and degree of channel alterations.
Sensitivity --of the valley, floodplain, and/or channel condition to change due to natural causes and/or anticipated human activity.
Shoals – unvegetated deposits of gravels and cobbles adjacent to the banks that have a height less than the average water level. In channels that are over-widened, the stream does not have the power to transport these larger sediments, and thus they are deposited throughout the channel as shoals.
Silt -- Substrate particles smaller than sand and larger than clay (3 to 60 mm).
Siltation -- The deposition or accumulation of fine soil particles.
Sinuosity -- The ratio of channel length to direct down-valley distance. Also may be expressed as the ratio of down-valley slope to channel slope.
Slope -- The ratio of the change in elevation over distance.
Slope stability -- The resistance of a natural or artificial slope or other inclined surface to failure by mass movement.
Snag -- Any standing dead, partially dead, or defective (cull) tree at least 10 in. in diameter at breast height and at least 6 ft tall. Snags are important riparian habitat features.
Spawning -- The depositing and fertilizing of eggs (or roe) by fish and other aquatic life.
Spillway -- A channel for reservoir overflow.
Stable channel -- A stream channel with the right balance of slope, planform, and cross section to transport both the water and sediment load without net long-term bed or bank sediment deposition or erosion throughout the stream segment.
Stone -- Rock or rock fragments used for construction.
Straightening -- the removal of meander bends, often done in towns and along roadways, railroads, and agricultural fields.
Stream -- A general term for a body of water flowing by gravity; natural watercourse containing water at least part of the year. In hydrology, the term is generally applied to the water flowing in a natural narrow channel as distinct from a canal.
Stream banks are features that define the channel sides and contain stream flow within the channel; this is the portion of the channel bank that is between the toe of the bank slope and the bankfull elevation. The banks are distinct from the streambed, which is normally wetted and provides a substrate that supports aquatic organisms. The top of bank is the point where an abrupt change in slope is evident, and where the stream is generally able to overflow the banks and enter the adjacent floodplain during flows at or exceeding the average annual high water.
Stream channel -- A long narrow depression shaped by the concentrated flow of a stream and covered continuously or periodically by water.

Stream condition -- Given the land use, channel and floodplain modifications documented at the assessment sites, the current degree of change in the channel and floodplain from the reference condition for parameters such as dimension, pattern, profile, sediment regime, and vegetation.

Stream gradient -- A general slope or rate of change in vertical elevation per unit of horizontal distance of the bed, water surface, or energy grade of a stream.

Stream morphology -- The form and structure of streams.

Stream order -- A hydrologic system of stream classification. Each small unbranched tributary is a first-order stream. Two first-order streams join to make a second-order stream. A third-order stream has only first-and second-order tributaries, and so forth.

Stream reach -- An individual segment of stream that has beginning and ending points defined by identifiable features such as where a tributary confluence changes the channel character or order.

Stream type -- Gives the overall physical characteristics of the channel and helps predict the reference or stable condition of the reach.

Streambank armoring – The installation of concrete walls, gabions, stone riprap, and other large erosion resistant material along stream banks.

Streambank erosion -- The removal of soil from streambanks by flowing water.

Streambank stabilization -- The lining of streambanks with riprap, matting, etc., or other measures intended to control erosion.

Streambed -- (1) The unvegetated portion of a channel boundary below the baseflow level. (2) The channel through which a natural stream of water runs or used to run, as a dry streambed.

Streamflow -- The rate at which water passes a given point in a stream or river, usually expressed in cubic feet per second (cfs).

Step (in a river system) -- A step is a steep, step-like feature in a high gradient stream (> 2%). Steps are composed of large boulders lines across the stream. Steps are important for providing grade-control, and for dissipating energy. As fast-shallow water flows over the steps it takes various flow paths thus dissipating energy during high flow events.

Substrate -- (1) The composition of a streambed, including either mineral or organic materials. (2) Material that forms an attachment medium for organisms.

Surface erosion -- The detachment and transport of soil particles by wind, water, or gravity. Or a group of processes whereby soil materials are removed by running water, waves and currents, moving ice, or wind.

Surface water -- All waters whose surface is naturally exposed to the atmosphere, for example, rivers, lakes, reservoirs, ponds, streams, impoundments, seas, estuaries, etc., and all springs, wells, or other collectors directly influenced by surface water.

Suspended sediment -- Sediment suspended in a fluid by the upward components of turbulent currents, moving ice, or wind.

Suspended sediment load -- That portion of a stream's total sediment load that is transported within the body of water and has very little contact with the streambed.

Tailwater -- (1) The area immediately downstream of a spillway. (2) Applied irrigation water that runs off the end of a field.

Thalweg -- (1) The lowest thread along the axial part of a valley or stream channel. (2) A subsurface, groundwater stream percolating beneath and in the general direction of a surface stream course or valley. (3) The middle, chief, or deepest part of a navigable channel or waterway.

Tractive Force --The drag on a streambed or bank caused by passing water, which tends to pull soil particles along with the streamflow.

Transpiration -- An essential physiological process in which plant tissues give off water vapor to the atmosphere.

Tributary -- A stream that flows into another stream, river, or lake.

Turbidity -- A measure of the content of suspended matter that interferes with the passage of light through the water or in which visual depth is restricted. Suspended sediments are only one

component of turbidity.
Urban runoff -- Storm water from city streets and gutters that usually carries a great deal of litter and organic and bacterial wastes into the sewer systems and receiving waters.
Variable stage stream -- Stream flows perennially but water level rises and falls significantly with storm and runoff events.
Velocity -- In this concept, the speed of water flowing in a watercourse, such as a river.
Washout -- (1) Erosion of a relatively soft surface, such as a roadbed, by a sudden gush of water, as from a downpour or floods. (2) A channel produced by such erosion.
Water quality -- A term used to describe the chemical, physical, and biological characteristics of water, usually in respect to its suitability for a particular purpose.
Waterfall -- A sudden, nearly vertical drop in a stream, as it flows over rock.
Watershed -- An area of land whose total surface drainage flows to a single point in a stream.
Watershed management -- The analysis, protection, development, operation, or maintenance of the land, vegetation, and water resources of a drainage basin for the conservation of all its resources for the benefit of its residents.
Watershed project -- A comprehensive program of structural and nonstructural measures to preserve or restore a watershed to good hydrologic condition. These measures may include detention reservoirs, dikes, channels, contour trenches, terraces, furrows, gully plugs, revegetation, and possibly other practices to reduce flood peaks and sediment production.
Watershed restoration -- Improving current conditions of watersheds to restore degraded habitat and provide long-term protection to aquatic and riparian resources.
Weir -- A structure to control water levels in a stream. Depending upon the configuration, weirs can provide a specific "rating" for discharge as a function of the upstream water level.

APPENDIX B
STANDARD PHASE 2 DMS REPORTS

Project: **Dog River**

Phase 2 Segment Summary

March 2, 2009 SGAT Version: 4.56

Stream: **Dog River** Reach # **M01** Segment: **A** Completion Date: **October 17, 2008**

Organization: **Bear Creek Environmental** Observers: **PD, TL** Why Not assessed: Rain: **Yes**

Segment Length (ft): **2,755** Segment Location: **Segment runs from confluence with Winooski River up to Nelson Drive bridge crossing in**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Valley Width**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	1,561	63
height	0	0
Railroads	758	35
height	0	0
Improved Paths	0	0
height	0	0
Development	524	126

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

1.5 Valley Features

Valley Width (ft) **838**

Width Determination **Measured**

Confinement Type **Broad**

Rock Gorge? **No**

Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **113**

2.2 Max Depth (ft) **6.40**

2.3 Mean Depth (ft) **4.33**

2.4 Floodprone Width (ft) **289**

Notes:

Reach was very depositional. Some bars on orthophotos seem to have been altered through erosion on banks. Very high elevation banks near downstream end of reach. Not sure if RAF was top of right bank at cross section. Most likely not incised.

Step 2. (Contued)

2.5 Aband. Floodpln **6.40** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **25.98**

2.7 Entrenchment Ratio **2.56**

2.8 Incision Ratio **1.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Sedimented**

2.11 Riffle/Step Spacing (ft) **352**

2.12 Substrate Composition

Bedrock	0%
Boulder	0%
Cobble	18%
Coarse Gravel	59%
Fine Gravel	10%
Sand	13%
Silt and smaller	0%

Silt/Clay Present? **Yes**

Detritus **2** %

Large Woody **29**

2.13 Average Largest Particle on

Bed **4.0** **inches**

Bar **3.5** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

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 **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Gravel	Gravel
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	1,120	731
Erosion Height (ft)	6.47	6.77
Revetmt. Type	Multiple	Multiple
Revetmt. Length (ft)	215	734
Near Bank Veg. Type	Left	Right
Dominant	Herbaceous	Herbaceous
Sub-dominant	Deciduous Shrubs/Saplin	
Bank Canopy	Left	Right
Canopy %	1-25	26-50
Mid-Channel Canopy	Open	

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	0-25	26-50
Sub-dominant	None	0-25
W less than 25	1,591	1,102
Buffer Veg. Type	Left	Right
Dominant	Herbaceous	Herbaceous
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Crop	Industrial
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 **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

Impoundmt. Location

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

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	2
Other	1	Tile Drain	0
Overland Flow	1	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
2	3	7
Diagonal	**Delta**	**Island**
1	1	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
5	0	1	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
2	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **1,607**

5.5 Dredging **Gravel Mining**

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

Stream: **Dog River** Reach # **M01** Segment: **A** Completion Date: **October 17, 2008**

Organization: **Bear Creek Environmental** Observers: **PD, TL** Rain: **Yes**

Segment Length (ft): **2,755** Segment Location: **Segment runs from confluence with Winooski River up to Nelson Drive bridge crossing**

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken
Ledge	**Mid-segment**	**8.00**	**3.00**	**Yes**	

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	**88.5**	**Yes**	**Yes**	**Yes**	**Yes**
Problem	**Deposition Above,Deposition Below,Scour**				
Bridge	**85.5**	**Yes**	**Yes**	**Yes**	**Yes**
Problem	**Deposition Above,Deposition Below,Scour**				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**16**	**None**	**No**
7.2 Channel Aggradation	**7**	**None**	**No**
7.3 Widening Channel	**10**		**No**
7.4 Change in Planform	**6**		**No**
Total Score	**39**		
Geomorphic Rating	**0.4875**		

Channel Evolution Model **D**

Channel Evolution Stage **IIc**

Geomorphic Condition **Fair**

Stream Sensitivity **Very High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Narrative:

Major aggradation, widening and planform adjustment.

Project: **Dog River**

Phase 2 Segment Summary

March 2, 2009 SGAT Version: 4.56

Stream: **Dog River** Reach # **M01** Segment: **B** Completion Date: **October 17, 2008**

Organization: **Bear Creek Environmental** Observers: **PD, TL** Why Not assessed: Rain: **No**

Segment Length (ft): **1,049** Segment Location: **Segment runs from Nelson Drive bridge along rail road for 1049 feet to just beyond a**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Valley Width**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	0	39
height	0	0
Railroads	1,049	0
height	0	0
Improved Paths	0	0
height	0	0
Development	309	0

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

1.5 Valley Features

Valley Width (ft) **310**

Width Determination **Measured**

Confinement Type **Semi-confined**

Rock Gorge? **No**

Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **86**

2.2 Max Depth (ft) **8.70**

2.3 Mean Depth (ft) **6.40**

2.4 Floodprone Width (ft) **197**

Notes:

Reach was much more entrenched in this segment than upstream or downstream due to proximity of railroad bed. Another cross section was done since the valley walls were so different. The entrenchment came out be 2.3, borderline between "B" and "C" stream

Step 2. (Contued)

2.5 Aband. Floodpln **11.20** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **13.36**

2.7 Entrenchment Ratio **2.30**

2.8 Incision Ratio **1.29**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Sedimented**

2.11 Riffle/Step Spacing (ft) **350**

2.12 Substrate Composition

Bedrock	0%
Boulder	0%
Cobble	9%
Coarse Gravel	41%
Fine Gravel	40%
Sand	10%
Silt and smaller	0%

Silt/Clay Present? **No**

Detritus **2** %

Large Woody **41**

2.13 Average Largest Particle on

Bed **3.0** **inches**

Bar **3.7** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

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 **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Gravel	Gravel
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	77	246
Erosion Height (ft)	12.00	7.35
Revetmt. Type	Multiple	Rip-Rap
Revetmt. Length (ft)	605	45
Near Bank Veg. Type	Left	Right
Dominant	Herbaceous	Herbaceous
Sub-dominant	None	Shrubs/Saplin
Bank Canopy	Left	Right
Canopy %	0	1-25
Mid-Channel Canopy		Open

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	0-25	>100
Sub-dominant	26-50	0-25
W less than 25	739	0
Buffer Veg. Type	Left	Right
Dominant	Herbaceous	Shrubs/Saplin
Sub-dominant	None	Herbaceous

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Industrial	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 **None**

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 **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

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

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
1	0	1	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
2	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **740**

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: **Dog River** Reach # **M01** Segment: **B** Completion Date: **October 17, 2008**

Organization: **Bear Creek Environmental** Observers: **PD, TL** Rain: **No**

Segment Length (ft): **1,049** Segment Location: **Segment runs from Nelson Drive bridge along rail road for 1049 feet to just beyond a**

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	**73.5**	**Yes**	**Yes**	**Yes**	**Yes**
Problem	**Deposition Above,Deposition Below,Scour**				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**13**	**None**	**Yes**
7.2 Channel Aggradation	**7**	**None**	**No**
7.3 Widening Channel	**13**		**No**
7.4 Change in Planform	**6**		**No**
Total Score	**39**		
Geomorphic Rating	**0.4875**		

Channel Evolution Model **F**

Channel Evolution Stage **III**

Geomorphic Condition **Fair**

Stream Sensitivity **Very High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Narrative:

Minor historic degradation, minor widening, major aggradation and planform adjustment due to encroachment and alteration.

Stream: **Dog River** Reach # **M01** Segment: **C** Completion Date: **October 23, 2008**

Organization: **Bear Creek Environmental** Observers: **CS, TL, PD** Why Not assessed: Rain: **Yes**

Segment Length (ft): **4,533** Segment Location: **Segment runs from channel avulsion upstram to just downstream from the first bridge**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Valley Width**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	1,114	0
height	0	0
Railroads	4,530	0
height	0	0
Improved Paths	0	0
height	0	0
Development	745	0

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

1.5 Valley Features

Valley Width (ft) **772**

Width Determination **Measured**

Confinement Type **Broad**

Rock Gorge? **No**

Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **119**

2.2 Max Depth (ft) **7.00**

2.3 Mean Depth (ft) **4.39**

2.4 Floodprone Width (ft) **1,337**

Notes:

Segment largely runs through agricultural fields with railroad running along left side of river (creating new valley wall). Road on right side of river (Route 12) is not high enough in elevation to exceed floodprone area and is therefore not the new valley wall. Distinct

Step 2. (Contued)

2.5 Aband. Floodpln **7.00** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **27.11**

2.7 Entrenchment Ratio **11.24**

2.8 Incision Ratio **1.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Sedimented**

2.11 Riffle/Step Spacing (ft) **595**

2.12 Substrate Composition

Bedrock	0%
Boulder	0%
Cobble	13%
Coarse Gravel	54%
Fine Gravel	7%
Sand	26%
Silt and smaller	0%

Silt/Clay Present? **No**

Detritus **2** %

Large Woody **34**

2.13 Average Largest Particle on

Bed **4.8** **inches**

Bar **3.2** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

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 **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Gravel	Gravel
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	258	776
Erosion Height (ft)	5.00	7.55
Revetmt. Type	Rip-Rap	Rip-Rap
Revetmt. Length (ft)	1,407	442
Near Bank Veg. Type	Left	Right
Dominant	Herbaceous	Herbaceous
Sub-dominant	Deciduous	Deciduous
Bank Canopy	Left	Right
Canopy %	51-75	1-25
Mid-Channel Canopy		Open

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	0-25
Sub-dominant	0-25	51-100
W less than 25	1,513	2,568
Buffer Veg. Type	Left	Right
Dominant	Mixed Trees	Herbaceous
Sub-dominant	Herbaceous	Deciduous

3.3 Riparian Corridor

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

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	1	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
2	3	10
Diagonal	**Delta**	**Island**
3	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
6	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
4	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **3,878**

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: **Dog River** Reach # **M01** Segment: **C** Completion Date: **October 23, 2008**

Organization: **Bear Creek Environmental** Observers: **CS, TL, PD** Rain: **Yes**

Segment Length (ft): **4,533** Segment Location: **Segment runs from channel avulsion upstram to just downstream from the first 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 **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**16**	**None**	**No**
7.2 Channel Aggradation	**9**	**None**	**No**
7.3 Widening Channel	**11**		**No**
7.4 Change in Planform	**12**		**No**
Total Score	**48**		
Geomorphic Rating	**0.6**		

Channel Evolution Model **D**

Channel Evolution Stage **IIc**

Geomorphic Condition **Fair**

Stream Sensitivity **Very High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Narrative:

Major aggradation, minor widening and planform adjustment.

Project: **Dog River**

Phase 2 Segment Summary

March 2, 2009 SGAT Version: 4.56

Stream: **Dog River** Reach # **M02** Segment: **0** Completion Date: **October 13, 2008**

Organization: **Bear Creek Environmental** Observers: **PD, TL** Why Not assessed: Rain: **No**

Segment Length (ft): **6,393** Segment Location: **Reach runs from just below most downstream Rt 12 bridge, through farm land near Dog**

QC Status - Staff: Provisional Cons Passed

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	1,405	223
height	0	0
Railroads	348	0
height	0	0
Improved Paths	0	0
height	0	0
Development	788	0

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

1.5 Valley Features

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

Width Determination **Measured**

Confinement Type **Very Broad**

Rock Gorge? **No**

Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **97**

2.2 Max Depth (ft) **8.35**

2.3 Mean Depth (ft) **6.02**

2.4 Floodprone Width (ft) **977**

Notes:

Reach runs through agriculture fields. CS raisedcross section bankfull height by 0.6 feet based on note from PD on cross section form. Road on LB is not higher than floodprone elevation and therefore does not create new valley wall, railroad beyond road

Step 2. (Contued)

2.5 Aband. Floodpln **8.35** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **16.10**

2.7 Entrenchment Ratio **10.08**

2.8 Incision Ratio **1.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Sedimented**

2.11 Riffle/Step Spacing (ft) **429**

2.12 Substrate Composition

Bedrock	0%
Boulder	0%
Cobble	23%
Coarse Gravel	44%
Fine Gravel	13%
Sand	20%
Silt and smaller	0%

Silt/Clay Present? **Yes**

Detritus **2** %

Large Woody **86**

2.13 Average Largest Particle on

Bed **6.8** **inches**

Bar **3.6** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

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 **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Gravel	Gravel
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	997	975
Erosion Height (ft)	6.34	7.28
Revetmt. Type	Multiple	Multiple
Revetmt. Length (ft)	897	861
Near Bank Veg. Type	Left	Right
Dominant	Herbaceous	Herbaceous
Sub-dominant	None	None
Bank Canopy	Left	Right
Canopy %	1-25	1-25
Mid-Channel Canopy		Open

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	0-25	>100
Sub-dominant	>100	26-50
W less than 25	2,664	1,598
Buffer Veg. Type	Left	Right
Dominant	Herbaceous	Mixed Trees
Sub-dominant	Deciduous	Herbaceous

3.3 Riparian Corridor

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

Impoundmt. Location

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

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	1	Road Ditch	1
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
7	2	18

Diagonal	Delta	Island
4	5	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
10	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
7	0	No

5.4 Stream Ford or Animal **Yes**

5.5 Straightening **Straightening**

Straightening Length: **4,910**

5.5 Dredging **Gravel Mining**

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

Stream: **Dog River** Reach # **M02** Segment: **0** Completion Date: **October 13, 2008**

Organization: **Bear Creek Environmental** Observers: **PD, TL** Rain: **No**

Segment Length (ft): **6,393** Segment Location: **Reach runs from just below most downstream Rt 12 bridge, through farm land near**

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken
Ledge	**Mid-segment**	**22.00**	**2.00**	**Yes**	

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	**54.0**	**Yes**	**Yes**	**Yes**	**Yes**
Problem	**Deposition Above,Deposition Below,Scour**				
Bridge	**88.5**	**Yes**	**Yes**	**Yes**	**Yes**
Problem	**Deposition Above,Deposition Below,Scour**				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**16**	**None**	**No**
7.2 Channel Aggradation	**8**	**None**	**No**
7.3 Widening Channel	**13**		**No**
7.4 Change in Planform	**9**		**No**
Total Score	**46**		
Geomorphic Rating	**0.575**		

Channel Evolution Model **D**

Channel Evolution Stage **IIc**

Geomorphic Condition **Fair**

Stream Sensitivity **Very High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Narrative:

Major aggradation, minor widening, major plaform alteration due to channel alteration.

Stream: **Dog River** Reach # **M03** Segment: **0** Completion Date: **October 10, 2008**

Organization: **Bear Creek Environmental** Observers: **TL, PD, CS** Why Not assessed: Rain: **No**

Segment Length (ft): **3,255** Segment Location: **Reach runs from about 650 feet upstream of Browns Mill Road bridge and continues for**

QC Status - Staff: Provisional Cons Passed

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	390	2,583
height	0	0
Railroads	2,476	0
height	0	0
Improved Paths	0	0
height	0	0
Development	356	1,102

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

1.5 Valley Features

Valley Width (ft) **410**

Width Determination **Measured**

Confinement Type **Narrow**

Rock Gorge? **No**

Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **122**

2.2 Max Depth (ft) **6.80**

2.3 Mean Depth (ft) **4.73**

2.4 Floodprone Width (ft) **370**

Notes:

Channelized reach, RV dealership along left bank. Lots of rip rap. Tributary entering from a culvert that is not at grade with the stream.

Step 2. (Contued)

2.5 Aband. Floodpln **6.80** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **25.79**

2.7 Entrenchment Ratio **3.03**

2.8 Incision Ratio **1.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Sedimented**

2.11 Riffle/Step Spacing (ft) **483**

2.12 Substrate Composition

Bedrock	1%
Boulder	0%
Cobble	18%
Coarse Gravel	59%
Fine Gravel	12%
Sand	10%
Silt and smaller	0%

Silt/Clay Present? **Yes**

Detritus **2** %

Large Woody **16**

2.13 Average Largest Particle on

Bed **9.5** **inches**

Bar **5.4** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

Field Measured Slope:

2.15 Reference Stream Type (if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	One	40.00
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Silt	Silt
Consistency	Cohesive	Cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	136	660
Erosion Height (ft)	6.94	5.33
Revetmt. Type	Multiple	Multiple
Revetmt. Length (ft)	1,181	155
Near Bank Veg. Type	Left	Right
Dominant	Invasives	Invasives
Sub-dominant	Herbaceous	Herbaceous
Bank Canopy	Left	Right
Canopy %	0	1-25
Mid-Channel Canopy		Open

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	0-25	51-100
Sub-dominant	51-100	0-25
W less than 25	3,254	1,417
Buffer Veg. Type	Left	Right
Dominant	Invasives	Invasives
Sub-dominant	Deciduous	Deciduous

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Commercial	Residential
Sub-dominant	Hay	Forest
Mass Failures	0	67
Height	0	40
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

Impoundmt. Location

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

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	1	Road Ditch	1
Other	0	Tile Drain	0
Overland Flow	1	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
7	0	7

Diagonal	Delta	Island
0	1	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: **2,500**

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: **Dog River** Reach # **M03** Segment: **0** Completion Date: **October 10, 2008**

Organization: **Bear Creek Environmental** Observers: **TL, PD, CS** Rain: **No**

Segment Length (ft): **3,255** Segment Location: **Reach runs from about 650 feet upstream of Browns Mill Road bridge and continues for**

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken
Ledge	**Mid-segment**	**5.00**	**1.00**	**Yes**	
Ledge	**Mid-segment**	**3.00**	**1.00**	**Yes**	
Ledge	**Mid-segment**	**4.00**	**1.00**	**Yes**	

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	**114.**	**Yes**	**Yes**	**No**	**Yes**
Problem	**Deposition Above,Deposition Below,Scour**				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**16**	**None**	**No**
7.2 Channel Aggradation	**11**	**None**	**No**
7.3 Widening Channel	**12**		**No**
7.4 Change in Planform	**14**		**No**
Total Score	**53**		
Geomorphic Rating	**0.6625**		

Channel Evolution Model **D**

Channel Evolution Stage **IIc**

Geomorphic Condition **Good**

Stream Sensitivity **High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Narrative:

minor aggradation, minor widening, minor planform adjustment.

Stream: **Dog River** Reach # **M04** Segment: **0** Completion Date: **October 9, 2008**

Organization: **Bear Creek Environmental** Observers: **CS, TL** Why Not assessed: Rain: **No**

Segment Length (ft): **9,786** Segment Location: **Reach begins about 450 feet downstream of a trib entering on the left bank (trib runs along**

QC Status - Staff: Provisional Cons Passed

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	1,516	45
height	0	0
Railroads	5,453	107
height	0	0
Improved Paths	0	0
height	0	0
Development	403	0

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

1.5 Valley Features

Valley Width (ft) **605**

Width Determination **Measured**

Confinement Type **Broad**

Rock Gorge? **No**

Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **86**

2.2 Max Depth (ft) **7.80**

2.3 Mean Depth (ft) **5.83**

2.4 Floodprone Width (ft) **618**

Notes:

Long reach running through agricultural fields with railroad often present along one side of the river. CS spoke with farmer who owns most of the land on both sides of the reach, indicated that they have lost land due to bank erosion, also there is a huge point bar DS of

Step 2. (Contued)

2.5 Aband. Floodpln **7.80** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **14.75**

2.7 Entrenchment Ratio **7.19**

2.8 Incision Ratio **1.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Moderate**

2.10 Riffles Type **Sedimented**

2.11 Riffle/Step Spacing (ft) **439**

2.12 Substrate Composition

Bedrock	0%
Boulder	0%
Cobble	9%
Coarse Gravel	73%
Fine Gravel	12%
Sand	6%
Silt and smaller	0%

Silt/Clay Present? **Yes**

Detritus **2** %

Large Woody **100**

2.13 Average Largest Particle on

Bed **4.3** **inches**

Bar **2.7** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

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 **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Gravel	Gravel
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	1,129	2,382
Erosion Height (ft)	4.35	5.21
Revetmt. Type	Multiple	Multiple
Revetmt. Length (ft)	1,674	1,133
Near Bank Veg. Type	Left	Right
Dominant	Invasives	Invasives
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	0-25	0-25
Sub-dominant	51-100	26-50
W less than 25	4,243	5,881
Buffer Veg. Type	Left	Right
Dominant	Herbaceous	Herbaceous
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Hay	Hay
Sub-dominant	Residential	Industrial
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

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
13	5	23

Diagonal	Delta	Island
3	6	1

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
10	1	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
7	0	No

5.4 Stream Ford or Animal **Yes**

5.5 Straightening **Straightening**

Straightening Length: **3,620**

5.5 Dredging **Gravel Mining**

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

Stream: **Dog River** Reach # **M04** Segment: **0** Completion Date: **October 9, 2008**

Organization: **Bear Creek Environmental** Observers: **CS, TL** Rain: **No**

Segment Length (ft): **9,786** Segment Location: **Reach begins about 450 feet downstream of a trib entering on the left bank (trib runs**

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken
Ledge	**Mid-segment**	**3.00**	**1.00**	**Yes**	

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	**84.0**	**Yes**	**Yes**	**Yes**	**Yes**
Problem		**Deposition Above,Deposition Below,Scour**			
Bridge	**80.0**	**Yes**	**Yes**	**Yes**	**Yes**
Problem		**Deposition Above,Deposition Below,Scour**			
Bridge	**96.0**	**Yes**	**Yes**	**No**	**Yes**
Problem		**Deposition Above,Deposition Below,Scour**			

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**16**	**None**	**No**
7.2 Channel Aggradation	**10**	**None**	**No**
7.3 Widening Channel	**12**		**No**
7.4 Change in Planform	**7**		**No**

Total Score **45**

Geomorphic Rating **0.5625**

Channel Evolution Model **D**

Channel Evolution Stage **IIc**

Geomorphic Condition **Fair**

Stream Sensitivity **Very High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Narrative:

Major aggradation and planform adjustment, minor widening.

Stream: **Dog River** Reach # **M05** Segment: **0** Completion Date: **October 1, 2008**

Organization: **Bear Creek Environmental** Observers: **CS, TL** Why Not assessed: Rain: **Yes**

Segment Length (ft): **1,801** Segment Location: **Short reach begins about 300 feet upstream of confluence with Muzzy Brook and continues**

QC Status - Staff: Provisional Cons Passed

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	1,801	0
height	0	0
Railroads	1,801	0
height	0	0
Improved Paths	0	0
height	0	0
Development	286	0

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

1.5 Valley Features

Valley Width (ft) **175**

Width Determination **Measured**

Confinement Type **Narrowly**

Rock Gorge? **No**

Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **79**

2.2 Max Depth (ft) **7.00**

2.3 Mean Depth (ft) **5.91**

2.4 Floodprone Width (ft) **165**

Notes:

Short and confined reach, very minor human caused change in valley width as railroad runs just inside the phase 1 valley wall on the right bank. Road (Route 12 runs just inside the valley wall on the left bank, however elevation of the road is not as high as the

Step 2. (Contued)

2.5 Aband. Floodpln **7.00** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **13.37**

2.7 Entrenchment Ratio **2.09**

2.8 Incision Ratio **1.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Sedimented**

2.11 Riffle/Step Spacing (ft) **348**

2.12 Substrate Composition

Bedrock	0 %
Boulder	0 %
Cobble	18 %
Coarse Gravel	59 %
Fine Gravel	11 %
Sand	12 %
Silt and smaller	0 %

Silt/Clay Present? **Yes**

Detritus **2** %

Large Woody **11**

2.13 Average Largest Particle on

Bed **8.4** inches

Bar **4.1** inches

2.14 Stream Type

Stream Type: **B**

Bed Material: **Gravel**

Subclass Slope: **c**

Bed Form: **Riffle-Pool**

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 **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Gravel	Gravel
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	127	0
Erosion Height (ft)	6.00	0.00
Revetmt. Type	Rip-Rap	Rip-Rap
Revetmt. Length (ft)	884	730
Near Bank Veg. Type	Left	Right
Dominant	Herbaceous	Herbaceous
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin
Bank Canopy	Left	Right
Canopy %	1-25	26-50
Mid-Channel Canopy	Open	

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	0-25	26-50
Sub-dominant	26-50	51-100
W less than 25	1,340	0
Buffer Veg. Type	Left	Right
Dominant	Herbaceous	Deciduous
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Residential	Industrial
Sub-dominant	None	Forest
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

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	0	8
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.
2	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **563**

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: **Dog River** Reach # **M05** Segment: **0** Completion Date: **October 1, 2008**

Organization: **Bear Creek Environmental** Observers: **CS, TL** Rain: **Yes**

Segment Length (ft): **1,801** Segment Location: **Short reach begins about 300 feet upstream of confluence with Muzzy Brook and**

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken

4.8 Channel Constrictions **None**

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

Narrative:
Minor aggradation and planform adjustment.

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Confined**

	Score	STD	Historic
7.1 Channel Degradation	**16**	**None**	**No**
7.2 Channel Aggradation	**12**	**None**	**No**
7.3 Widening Channel	**16**		**No**
7.4 Change in Planform	**13**		**No**
Total Score	**57**		
Geomorphic Rating	**0.7125**		

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

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Project: **Dog River**

Phase 2 Segment Summary

March 2, 2009 SGAT Version: 4.56

Stream: **Dog River** Reach # **M06** Segment: **A** Completion Date: **September 29, 2008**

Organization: **Bear Creek Environmental** Observers: **CS, TL** Why Not assessed: Rain: **No**

Segment Length (ft): **1,186** Segment Location: **Segment begins where valley wall opens up and continues for 1186 feet to just before sharp**

QC Status - Staff: Provisional Cons Passed

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	931	0
height	0	0
Railroads	1,186	0
height	0	0
Improved Paths	0	0
height	0	0
Development	180	0

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

1.5 Valley Features

Valley Width (ft) **928**

Width Determination **Measured**

Confinement Type **Semi-confined**

Rock Gorge? **No**

Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **88**

2.2 Max Depth (ft) **7.70**

2.3 Mean Depth (ft) **6.08**

2.4 Floodprone Width (ft) **762**

Notes:

Completely straightened segment with railroad along right bank. Field along left corridor, Route 12 beyond field is lower in elevation than floodprone elevation and is therefore not new valley wall. Segment was completely straightened with continuous rip

Step 2. (Contued)

2.5 Aband. Floodpln **7.70** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **14.47**

2.7 Entrenchment Ratio **8.66**

2.8 Incision Ratio **1.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **272**

2.12 Substrate Composition

Bedrock	0%
Boulder	1%
Cobble	32%
Coarse Gravel	46%
Fine Gravel	12%
Sand	9%
Silt and smaller	0%

Silt/Clay Present? **Yes**

Detritus **2** %

Large Woody **1**

2.13 Average Largest Particle on

Bed **6.9** **inches**

Bar **3.6** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

Field Measured Slope:

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	One	25.00
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Gravel	Gravel
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	0	87
Erosion Height (ft)	0.00	12.00
Revetmt. Type	None	Rip-Rap
Revetmt. Length (ft)	0	795
Near Bank Veg. Type	Left	Right
Dominant	Invasives	Invasives
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	0-25	26-50
Sub-dominant	26-50	0-25
W less than 25	614	101
Buffer Veg. Type	Left	Right
Dominant	Invasives	Shrubs/Saplin
Sub-dominant	Shrubs/Saplin	Herbaceous

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Residential	Industrial
Sub-dominant	None	None
Mass Failures	0	152
Height	0	25
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

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	0	3
Diagonal	**Delta**	**Island**
0	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.
0	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **993**

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: **Dog River** Reach # **M06** Segment: **A** Completion Date: **September 29,**

Organization: **Bear Creek Environmental** Observers: **CS, TL** Rain: **No**

Segment Length (ft): **1,186** Segment Location: **Segment begins where valley wall opens up and continues for 1186 feet to just before**

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken

4.8 Channel Constrictions **None**

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

Narrative:

Minor aggradation, widening and planform adjustment.

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**16**	**None**	**No**
7.2 Channel Aggradation	**12**	**None**	**No**
7.3 Widening Channel	**14**		**No**
7.4 Change in Planform	**11**		**No**
Total Score	**53**		
Geomorphic Rating	**0.6625**		

Channel Evolution Model **D**

Channel Evolution Stage **IIc**

Geomorphic Condition **Good**

Stream Sensitivity **High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Project: **Dog River**

Phase 2 Segment Summary

March 2, 2009 SGAT Version: 4.56

Stream: **Dog River** Reach # **M06** Segment: **B** Completion Date: **October 1, 2008**

Organization: **Bear Creek Environmental** Observers: **CS, TL** Why Not assessed: Rain: **Yes**

Segment Length (ft): **1,662** Segment Location: **Segment begins just before sharp bend near the confluence with Chase Brook and**

QC Status - Staff: Provisional Cons Passed

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	459	0
height	0	0
Railroads	978	0
height	0	0
Improved Paths	0	0
height	0	0
Development	386	0

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

1.5 Valley Features

Valley Width (ft) **650**

Width Determination **Measured**

Confinement Type **Broad**

Rock Gorge? **No**

Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **79**

2.2 Max Depth (ft) **5.60**

2.3 Mean Depth (ft) **4.20**

2.4 Floodprone Width (ft) **270**

Notes:

Chase Brook enters the Dog River in this segment. Very large delta bar at confluence and trib looks like it has recently widened (July 2008 flood event). Lare amounts of sediment entering Dog River from this trib. Cross section had good bench, there was

Step 2. (Contued)

2.5 Aband. Floodpln **5.60** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **18.81**

2.7 Entrenchment Ratio **3.42**

2.8 Incision Ratio **1.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Sedimented**

2.11 Riffle/Step Spacing (ft) **335**

2.12 Substrate Composition

Bedrock	0%
Boulder	1%
Cobble	30%
Coarse Gravel	46%
Fine Gravel	12%
Sand	11%
Silt and smaller	0%

Silt/Clay Present? **No**

Detritus **2** %

Large Woody **12**

2.13 Average Largest Particle on

Bed **8.0** **inches**

Bar **3.6** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

Field Measured Slope:

2.15 Reference Stream Type

(if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	One	20.00
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Gravel	Gravel
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	208	651
Erosion Height (ft)	4.15	5.96
Revetmt. Type	Rip-Rap	None
Revetmt. Length (ft)	70	0
Near Bank Veg. Type	Left	Right
Dominant	Invasives	Invasives
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	51-100	>100
Sub-dominant	0-25	None
W less than 25	361	0
Buffer Veg. Type	Left	Right
Dominant	Herbaceous	Deciduous
Sub-dominant	Shrubs/Saplin	Herbaceous

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Hay	Forest
Sub-dominant	Residential	Industrial
Mass Failures	0	57
Height	0	20
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Minimal**

4.2 Adjacent Wetlands **Minimal**

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 **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
1	0	6
Diagonal	**Delta**	**Island**
2	1	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
4	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
2	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: **Dog River** Reach # **M06** Segment: **B** Completion Date: **October 1, 2008**

Organization: **Bear Creek Environmental** Observers: **CS, TL** Rain: **Yes**

Segment Length (ft): **1,662** Segment Location: **Segment begins just before sharp bend near the confluence with Chase Brook and**

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	**17**	**None**	**No**
7.2 Channel Aggradation	**11**	**None**	**No**
7.3 Widening Channel	**13**		**No**
7.4 Change in Planform	**11**		**No**
Total Score	**52**		
Geomorphic Rating	**0.65**		

Channel Evolution Model **D**

Channel Evolution Stage **IIc**

Geomorphic Condition **Good**

Stream Sensitivity **High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Narrative:

Minor aggradation, widening and planform adjustment.

Stream: **Dog River** Reach # **M07** Segment: **A** Completion Date: **September 29, 2008**

Organization: **Bear Creek Environmental** Observers: **CS, TL** Why Not assessed: Rain: **No**

Segment Length (ft): **4,130** Segment Location: **Segment begins near West Berlin Cemetary and continues upstream to the beginning of a**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Grade Controls**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	1,003	54
height	0	0
Railroads	1,864	54
height	0	0
Improved Paths	0	0
height	0	0
Development	1,073	0

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

1.5 Valley Features

Valley Width (ft) **622**

Width Determination **Measured**

Confinement Type **Broad**

Rock Gorge? **No**

Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **93**

2.2 Max Depth (ft) **4.00**

2.3 Mean Depth (ft) **3.14**

2.4 Floodprone Width (ft) **183**

Notes:

Segment has some conserved land within corridor (Berlin Conservation Commission) near Berlin Vol. Fire Dept. Also has a granite finishing type business in corridor that seems to have granite tailings/rip rap along bank in area of granite tailing storage. Old mill

Step 2. (Contued)

2.5 Aband. Floodpln **4.00** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **29.55**

2.7 Entrenchment Ratio **1.97**

2.8 Incision Ratio **1.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Moderate**

2.10 Riffles Type **Sedimented**

2.11 Riffle/Step Spacing (ft) **351**

2.12 Substrate Composition

Bedrock	0 %
Boulder	4 %
Cobble	32 %
Coarse Gravel	50 %
Fine Gravel	4 %
Sand	10 %
Silt and smaller	0 %

Silt/Clay Present? **No**

Detritus **2** %

Large Woody **44**

2.13 Average Largest Particle on

Bed **7.9** **inches**

Bar **1.7** **inches**

2.14 Stream Type

Stream Type: **B**

Bed Material: **Gravel**

Subclass Slope: **c**

Bed Form: **Riffle-Pool**

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 **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Gravel	Gravel
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	360	376
Erosion Height (ft)	6.09	9.23
Revetmt. Type	Multiple	Multiple
Revetmt. Length (ft)	346	108
Near Bank Veg. Type	Left	Right
Dominant	Invasives	Invasives
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin
Bank Canopy	Left	Right
Canopy %	26-50	26-50
Mid-Channel Canopy	Open	

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	51-100
Sub-dominant	51-100	0-25
W less than 25	0	973
Buffer Veg. Type	Left	Right
Dominant	Mixed Trees	Mixed Trees
Sub-dominant	Herbaceous	Herbaceous

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Forest	Residential
Sub-dominant	Industrial	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 **None**

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	1
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
2	4	8
Diagonal	**Delta**	**Island**
1	2	1

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
6	0	0	0

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: **1,273**

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: **Dog River** Reach # **M07** Segment: **A** Completion Date: **September 29,**

Organization: **Bear Creek Environmental** Observers: **CS, TL** Rain: **No**

Segment Length (ft): **4,130** Segment Location: **Segment begins near West Berlin Cemetary and continues upstream to the beginning**

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	**87.0**	**Yes**	**Yes**	**Yes**	**Yes**
Problem	**Deposition Above,Scour Above**				
Other	**60.0**	**Yes**	**No**	**Yes**	**Yes**
Problem	**Deposition Below,Scour Below**				
Bridge	**71.0**	**Yes**	**Yes**	**Yes**	**Yes**
Problem	**Deposition Above,Deposition Below,Scour**				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**16**	**None**	**No**
7.2 Channel Aggradation	**10**	**None**	**No**
7.3 Widening Channel	**13**		**No**
7.4 Change in Planform	**8**		**No**

Total Score **47**

Geomorphic Rating **0.5875**

Channel Evolution Model **D**

Channel Evolution Stage **IIc**

Geomorphic Condition **Fair**

Stream Sensitivity **Very High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Narrative:

Major aggradation and planform adjustment, minor widening. Many bars.

Stream: **Dog River** Reach # **M07** Segment: **B** Completion Date: **September 29, 2008**
Organization: **Bear Creek Environmental** Observers: **CS, TL** Why Not assessed: **bedrock gorge** Rain: **Yes**
Segment Length (ft): **1,460** Segment Location: **Segment begins at bedrock gorge along Rt 12 in Berlin downstream of Rt 12 intersection**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Substrate Size**
1.2 Alluvial Fan **None**
1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	1,333	0
height	0	0
Railroads	131	0
height	0	0
Improved Paths	0	0
height	0	0
Development	330	0

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

1.5 Valley Features
Valley Width (ft) **95**
Width Determination **Measured**
Confinement Type **Narrowly**
Rock Gorge? **Yes**
Human-caused Change? **No**

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:

Bedrock gorge segment with very large waterfall at upstream end. Very deep pools. Largely unimpacted and inaccessible. Road runs along right side of stream but outside valley wall. High good or low reference condition. Minor residential land use in

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: **G**
Bed Material: **Bedrock**
Subclass Slope: **c**
Bed Form: **Cascade**
Field Measured Slope:
2.15 Reference Stream Type
(if different from Phase 1)
G 1 c Cascade

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	Bedrock	Bedrock
Consistency	Cohesive	Cohesive
Lower		
Material Type	Bedrock	Bedrock
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	Coniferous	Coniferous
Sub-dominant	Herbaceous	Herbaceous

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

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

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

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

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 **Abundant**
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
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: **643**
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: **Dog River** Reach # **M07** Segment: **B** Completion Date: **September 29,**

Organization: **Bear Creek Environmental** Observers: **CS, TL** Rain: **Yes**

Segment Length (ft): **1,460** Segment Location: **Segment begins at bedrock gorge along Rt 12 in Berlin downstream of Rt 12**

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken
Ledge	**Mid-segment**	**4.00**	**4.00**	**Yes**	
Waterfall	**Mid-segment**	**30.00**	**10.00**	**Yes**	

4.8 Channel Constrictions **None**

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

Narrative:

Step 7. Rapid Geomorphic Assessment Data

Confinement Type

Channel Evolution Model

Channel Evolution Stage

Geomorphic Condition **Referenc**

Stream Sensitivity

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Stream: **Dog River** Reach # **M07** Segment: **C** Completion Date: **September 26, 2008**

Organization: **Bear Creek Environmental** Observers: **CS, TL** Why Not assessed: **Other (to be explained in** Rain: **Yes**

Segment Length (ft): **515** Segment Location: **Short segment located just upstream from large waterfall and continuing upstream for 515**

QC Status - Staff: Provisional Cons

Step 1. Valley and Floodplain

1.1 Segmentation **Valley Width**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	221	0
height	0	0
Railroads	0	51
height	0	0
Improved Paths	0	0
height	0	0
Development	0	0

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

1.5 Valley Features

Valley Width (ft) **200**

Width Determination **Measured**

Confinement Type **Semi-confined**

Rock Gorge? **No**

Human-caused Change? **No**

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:

Short segment located just upstream of bedrock gorge and large waterfall. Segment was not assessed due to major influence from waterfall (large pool occupied most of segment, no riffles for most of segment). Upstream of the railroad bridge was a large

Passed *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? **No**

Detritus **2** %

Large Woody **3**

2.13 Average Largest Particle on

Bed **0.0**

Bar **0.0**

2.14 Stream Type

Stream Type: **B**

Bed Material: **Gravel**

Subclass Slope: **c**

Bed Form: **Riffle-Pool**

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 **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Gravel	Gravel
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	53	106
Erosion Height (ft)	9.00	7.00
Revetmt. Type	Rip-Rap	Rip-Rap
Revetmt. Length (ft)	32	42
Near Bank Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Deciduous
Sub-dominant	Herbaceous	Herbaceous
Bank Canopy	Left	Right
Canopy %	26-50	51-75
Mid-Channel Canopy		Open

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	>100
Sub-dominant	None	None
W less than 25	0	0
Buffer Veg. Type	Left	Right
Dominant	Mixed Trees	Mixed Trees
Sub-dominant	Herbaceous	Herbaceous

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 **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 **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
2	1	1
Diagonal	**Delta**	**Island**
0	1	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: **320**

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: **Dog River** Reach # **M07** Segment: **C** Completion Date: **September 26,**

Organization: **Bear Creek Environmental** Observers: **CS, TL** Rain: **Yes**

Segment Length (ft): **515** Segment Location: **Short segment located just upstream from large waterfall and continuing upstream for**

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	**93.0**	**Yes**	**Yes**	**No**	**Yes**
Problem	**Deposition Above,Deposition Below,Scour**				

Narrative:

Step 7. Rapid Geomorphic Assessment Data

Confinement Type

Channel Evolution Model

Channel Evolution Stage

Geomorphic Condition **Fair**

Stream Sensitivity

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Stream: **Dog River** Reach # **M08** Segment: **A** Completion Date: **September 26, 2008**

Organization: **Bear Creek Environmental** Observers: **CS, TL** Why Not assessed: Rain: **No**

Segment Length (ft): **3,352** Segment Location: **Segment begins about 250 feet upstream of railroad bridge where trib enters on left bank**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Grade Controls**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	1,064	32
height	0	0
Railroads	1,840	0
height	0	0
Improved Paths	0	0
height	0	0
Development	575	1,218

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

1.5 Valley Features

Valley Width (ft) **331**

Width Determination **Measured**

Confinement Type **Semi-confined**

Rock Gorge? **No**

Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **86**

2.2 Max Depth (ft) **6.70**

2.3 Mean Depth (ft) **5.80**

2.4 Floodprone Width (ft) **167**

Notes:

Lover's Lane bridge is just downstream of a bedrock constriction (not a grade control, just bedrock on both banks), most of the upstream problems associated with the bridge are likely due to the bedrock constriction more than the bridge. There was

Step 2. (Contued)

2.5 Aband. Floodpln **6.70** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **14.83**

2.7 Entrenchment Ratio **1.94**

2.8 Incision Ratio **1.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **321**

2.12 Substrate Composition

Bedrock	0%
Boulder	9%
Cobble	29%
Coarse Gravel	44%
Fine Gravel	13%
Sand	5%
Silt and smaller	0%

Silt/Clay Present? **No**

Detritus **2** %

Large Woody **33**

2.13 Average Largest Particle on

Bed **10.2** **inches**

Bar **10.4** **inches**

2.14 Stream Type

Stream Type: **B**

Bed Material: **Gravel**

Subclass Slope: **c**

Bed Form: **Riffle-Pool**

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 **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Gravel	Gravel
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	178	603
Erosion Height (ft)	6.61	7.24
Revetmt. Type	Multiple	Rip-Rap
Revetmt. Length (ft)	166	242
Near Bank Veg. Type	Left	Right
Dominant	Deciduous	Deciduous
Sub-dominant	Invasives	Invasives
Bank Canopy	Left	Right
Canopy %	26-50	26-50
Mid-Channel Canopy		Open

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	51-100	51-100
Sub-dominant	>100	0-25
W less than 25	0	219
Buffer Veg. Type	Left	Right
Dominant	Deciduous	Deciduous
Sub-dominant	Herbaceous	Herbaceous

3.3 Riparian Corridor

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

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **Small**

Flow Regulation Use **Other**

Impoundments

Impoundmt. Location

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

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	1
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	6
Diagonal	**Delta**	**Island**
3	1	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
3	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
2	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **2,494**

5.5 Dredging **Gravel Mining**

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

Stream: **Dog River** Reach # **M08** Segment: **A** Completion Date: **September 26,**

Organization: **Bear Creek Environmental** Observers: **CS, TL** Rain: **No**

Segment Length (ft): **3,352** Segment Location: **Segment begins about 250 feet upstream of railroad bridge where trib enters on left**

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	**40.0**	**Yes**	**No**	**Yes**	**No**
Problem		**Deposition Above,Deposition Below,Scour**			
Bridge	**80.0**	**Yes**	**Yes**	**Yes**	**Yes**
Problem		**Deposition Above,Deposition Below,Scour**			
Bedrock	**35.0**	**Yes**	**No**	**Yes**	**No**
Problem		**Deposition Above,Deposition Below,Scour**			

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Confined**

	Score	STD	Historic
7.1 Channel Degradation	**16**	**None**	**No**
7.2 Channel Aggradation	**11**	**None**	**No**
7.3 Widening Channel	**13**		**No**
7.4 Change in Planform	**11**		**No**
Total Score	**51**		
Geomorphic Rating	**0.6375**		

Channel Evolution Model **D**

Channel Evolution Stage **IIc**

Geomorphic Condition **Fair**

Stream Sensitivity **Very High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Narrative:

Minor aggradation, widening and planform adjustment

Stream: **Dog River** Reach # **M08** Segment: **B** Completion Date: **September 26, 2008**
Organization: **Bear Creek Environmental** Observers: **CS, TL** Why Not assessed: Rain: **No**
Segment Length (ft): **1,187** Segment Location: **Segment begins at waterfall grade control near USGS gaging station and continues**

QC Status - Staff: Provisional Cons **Passed**

Step 1. Valley and Floodplain

1.1 Segmentation **Grade Controls**
1.2 Alluvial Fan **None**
1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	508	0
height	0	0
Railroads	1,086	38
height	0	0
Improved Paths	0	0
height	0	0
Development	318	865

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

1.5 Valley Features
Valley Width (ft) **241**
Width Determination **Measured**
Confinement Type **Semi-confined**
Rock Gorge? **No**
Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **98**
2.2 Max Depth (ft) **5.80**
2.3 Mean Depth (ft) **3.72**
2.4 Floodprone Width (ft) **136**

Notes:
Bedrock dominated segment with gravel mining operation going on on left bank (outside the valley wall). Railroad also runs within corridor for most of segment. Minimal bars available for measuring largest particle (were generally sand on top of outcropping

Step 2. (Contued)

2.5 Aband. Floodpln **5.80** ft.
Human Elev Floodpln **0.00** ft.
2.6 Width/Depth Ratio **26.29**
2.7 Entrenchment Ratio **1.39**
2.8 Incision Ratio **1.00**
Human Elevated Inc Rat **0.00**
2.9 Sinuosity **Low**
2.10 Riffles Type **Complete**
2.11 Riffle/Step Spacing (ft) **337**
2.12 Substrate Composition

Bedrock	44 %
Boulder	11 %
Cobble	22 %
Coarse Gravel	16 %
Fine Gravel	3 %
Sand	4 %
Silt and smaller	0 %

Silt/Clay Present? **No**
Detritus **2** %
Large Woody **17**
2.13 Average Largest Particle on

Bed	14.2	inches
Bar	N/A	inches

2.14 Stream Type
Stream Type: **B**
Bed Material: **Boulder**
Subclass Slope: **c**
Bed Form: **Step-Pool**
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 **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Bedrock	Bedrock
Consistency	Cohesive	Cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	124	65
Erosion Height (ft)	5.33	6.00
Revetmt. Type	Hard Bank	None
Revetmt. Length (ft)	70	0
Near Bank Veg. Type	Left	Right
Dominant	Coniferous	Coniferous
Sub-dominant	Herbaceous	Herbaceous
Bank Canopy	Left	Right
Canopy %	76-100	76-100
Mid-Channel Canopy		Open

3.2 Riparian Buffer

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

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Industrial	Industrial
Sub-dominant	Forest	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 **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
1	1	2
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: **741**
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: **Dog River** Reach # **M08** Segment: **B** Completion Date: **September 26,**

Organization: **Bear Creek Environmental** Observers: **CS, TL** Rain: **No**

Segment Length (ft): **1,187** Segment Location: **Segment begins at waterfall grade control near USGS gaging station and continues**

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken
Waterfall	**Mid-segment**	**4.00**	**4.00**	**Yes**	
Ledge	**Mid-segment**	**3.00**	**2.00**	**Yes**	
Ledge	**Mid-segment**	**3.00**	**1.00**	**Yes**	

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	**92.0**	**Yes**	**Yes**	**Yes**	**Yes**

Problem **Scour Above,Scour Below,Alignment**

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Confined**

	Score	STD	Historic
7.1 Channel Degradation	**18**	**None**	**No**
7.2 Channel Aggradation	**14**	**None**	**No**
7.3 Widening Channel	**14**		**No**
7.4 Change in Planform	**16**		**No**
Total Score	**62**		
Geomorphic Rating	**0.775**		

Channel Evolution Model **F**

Channel Evolution Stage **I**

Geomorphic Condition **Good**

Stream Sensitivity **Low**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Narrative:

Minor aggradation and widening.

(Note stream sensitivity of Low as the stream type B2c is not included in protocol. In good condition B2 would be Very Low, B3c would be Moderate, went with the

Project: **Dog River**

Phase 2 Segment Summary

March 2, 2009 SGAT Version: 4.56

Stream: **Dog River** Reach # **M09** Segment: **A** Completion Date: **September 25, 2008**

Organization: **Bear Creek Environmental** Observers: **CS, TL** Why Not assessed: Rain: **No**

Segment Length (ft): **4,655** Segment Location: **Reach begins about 550 feet upstream from railroad bridge and continues upstream to just**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Valley Width**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	2,255	0
height	0	0
Railroads	2,016	0
height	0	0
Improved Paths	0	0
height	0	0
Development	962	315

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

1.5 Valley Features

Valley Width (ft) **550**

Width Determination **Measured**

Confinement Type **Broad**

Rock Gorge? **No**

Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **121**

2.2 Max Depth (ft) **5.60**

2.3 Mean Depth (ft) **3.90**

2.4 Floodprone Width (ft) **329**

Notes:

Segment is just downstream of grade control/bedrock dominated segment with large dam just upstream of segment break. Segment does not appear incised and has little impact from the dam. Segment is much lower gradient and is a C by reference due to

Step 2. (Contued)

2.5 Aband. Floodpln **5.60** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **31.03**

2.7 Entrenchment Ratio **2.72**

2.8 Incision Ratio **1.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Moderate**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **378**

2.12 Substrate Composition

Bedrock	0%
Boulder	0%
Cobble	29%
Coarse Gravel	50%
Fine Gravel	9%
Sand	12%
Silt and smaller	0%

Silt/Clay Present? **Yes**

Detritus **2** %

Large Woody **34**

2.13 Average Largest Particle on

Bed **5.7** **inches**

Bar **4.1** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

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 **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Gravel	Gravel
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	799	335
Erosion Height (ft)	5.35	6.52
Revetmt. Type	Rip-Rap	Rip-Rap
Revetmt. Length (ft)	84	464
Near Bank Veg. Type	Left	Right
Dominant	Invasives	Invasives
Sub-dominant	Deciduous	Deciduous
Bank Canopy	Left	Right
Canopy %	1-25	1-25
Mid-Channel Canopy		Open

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	51-100
Sub-dominant	26-50	0-25
W less than 25	73	1,458
Buffer Veg. Type	Left	Right
Dominant	Deciduous	Deciduous
Sub-dominant	Shrubs/Saplin	Invasives

3.3 Riparian Corridor

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

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 **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
5	8	8

Diagonal	Delta	Island
1	1	1

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
10	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.

Stream: **Dog River** Reach # **M09** Segment: **A** Completion Date: **September 25,**

Organization: **Bear Creek Environmental** Observers: **CS, TL** Rain: **No**

Segment Length (ft): **4,655** Segment Location: **Reach begins about 550 feet upstream from railroad bridge and continues upstream to**

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**	**2.00**	**0.00**	**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	**16**	**None**	**No**
7.2 Channel Aggradation	**11**	**None**	**No**
7.3 Widening Channel	**8**		**No**
7.4 Change in Planform	**12**		**No**

Total Score **47**

Geomorphic Rating **0.5875**

Channel Evolution Model **D**

Channel Evolution Stage **IIc**

Geomorphic Condition **Fair**

Stream Sensitivity **Very High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Narrative:

Minor aggradation and planform adjustment, major widening.

Project: **Dog River**

Phase 2 Segment Summary

March 2, 2009 SGAT Version: 4.56

Stream: **Dog River** Reach # **M09** Segment: **B** Completion Date: **September 25, 2008**

Organization: **Bear Creek Environmental** Observers: **CS, TL, PD** Why Not assessed: Rain: **No**

Segment Length (ft): **1,041** Segment Location: **Segment begins at large dam near MWT products and continues upstream to confluence**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Subreach**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	415	208
height	0	0
Railroads	1,026	0
height	0	0
Improved Paths	0	0
height	0	0
Development	47	964

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

1.5 Valley Features

Valley Width (ft) **260**

Width Determination **Measured**

Confinement Type **Semi-confined**

Rock Gorge? **No**

Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **78**

2.2 Max Depth (ft) **6.10**

2.3 Mean Depth (ft) **4.02**

2.4 Floodprone Width (ft) **112**

Notes:

Large side bar under covered bridge and continues downstream. Many bedrock grade controls and large dam at DS end of segment. Brown fields site (MWT products) located near dam in right corridor. Industrial building encroachments and residential

Step 2. (Contued)

2.5 Aband. Floodpln **6.10** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **19.28**

2.7 Entrenchment Ratio **1.44**

2.8 Incision Ratio **1.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **185**

2.12 Substrate Composition

Bedrock	45%
Boulder	8%
Cobble	6%
Coarse Gravel	32%
Fine Gravel	4%
Sand	5%
Silt and smaller	0%

Silt/Clay Present? **No**

Detritus **2** %

Large Woody **1**

2.13 Average Largest Particle on

Bed **7.5** **inches**

Bar **5.4** **inches**

2.14 Stream Type

Stream Type: **B**

Bed Material: **Boulder**

Subclass Slope: **c**

Bed Form: **Riffle-Pool**

Field Measured Slope:

2.15 Reference Stream Type

(if different from Phase 1)

B 2 c Riffle-Pool

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	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Bedrock	Bedrock
Consistency	Cohesive	Cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	0	0
Erosion Height (ft)	0.00	0.00
Revetmt. Type	Hard Bank	Multiple
Revetmt. Length (ft)	34	176
Near Bank Veg. Type	Left	Right
Dominant	Herbaceous	Invasives
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	51-100	0-25
Sub-dominant	0-25	26-50
W less than 25	117	663
Buffer Veg. Type	Left	Right
Dominant	Deciduous	Herbaceous
Sub-dominant	Herbaceous	Shrubs/Saplin

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Residential	Industrial
Sub-dominant	Forest	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 **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	2
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 **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: **Dog River** Reach # **M09** Segment: **B** Completion Date: **September 25,**

Organization: **Bear Creek Environmental** Observers: **CS, TL, PD** Rain: **No**

Segment Length (ft): **1,041** Segment Location: **Segment begins at large dam near MWT products and continues upstream to**

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken
Dam	**Mid-segment**	**30.00**	**20.00**	**Yes**	
Ledge	**Mid-segment**	**20.00**	**5.00**	**Yes**	
Ledge	**Mid-segment**	**5.00**	**1.00**	**Yes**	
Ledge	**Mid-segment**	**3.00**	**1.00**	**Yes**	

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	**117.**	**Yes**	**Yes**	**No**	**Yes**
Problem	**Deposition Above,Deposition Below,Scour**				
Bedrock	**12.0**	**Yes**	**No**	**Yes**	**Yes**
Problem	**Deposition Below,Scour Above,Scour**				

Narrative:
minor aggradation

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Confined**

	Score	STD	Historic
7.1 Channel Degradation	**16**	**None**	**No**
7.2 Channel Aggradation	**12**	**None**	**No**
7.3 Widening Channel	**16**		**No**
7.4 Change in Planform	**16**		**No**
Total Score	**60**		
Geomorphic Rating	**0.75**		

Channel Evolution Model **F**
Channel Evolution Stage **I**
Geomorphic Condition **Good**
Stream Sensitivity **Very Low**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Project: **Dog River**

Phase 2 Segment Summary

March 2, 2009 SGAT Version: 4.56

Stream: **Dog River** Reach # **M10** Segment: **A** Completion Date: **September 22, 2008**

Organization: **Bear Creek Environmental** Observers: **PD, CS** Why Not assessed: Rain: **No**

Segment Length (ft): **1,487** Segment Location: **Segment begins at confluence with Cox Brook and continues upstream in narrowly**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Subreach**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	970	0
height	0	0
Railroads	236	0
height	0	0
Improved Paths	0	0
height	0	0
Development	1,487	0

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

1.5 Valley Features

Valley Width (ft) **154**

Width Determination **Measured**

Confinement Type **Narrowly**

Rock Gorge? **No**

Human-caused Change? **No**

Step 2. Stream Channel

2.1 Bankfull Width **61**

2.2 Max Depth (ft) **4.00**

2.3 Mean Depth (ft) **3.26**

2.4 Floodprone Width (ft) **72**

Notes:

Segment was in very narrow valley, almost bedrock gorge-like. No RAF within 3 max bankfull depths (both banks were very steep and very high). Does not appear recently incised but has no floodplain access. Called a subreach with F stream type by reference

Step 2. (Contued)

2.5 Aband. Floodpln **4.00** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **18.80**

2.7 Entrenchment Ratio **1.17**

2.8 Incision Ratio **1.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **298**

2.12 Substrate Composition

Bedrock	8%
Boulder	3%
Cobble	52%
Coarse Gravel	28%
Fine Gravel	4%
Sand	5%
Silt and smaller	0%

Silt/Clay Present? **No**

Detritus **2** %

Large Woody **3**

2.13 Average Largest Particle on

Bed **10.5** **inches**

Bar **4.8** **inches**

2.14 Stream Type

Stream Type: **F**

Bed Material: **Cobble**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

Field Measured Slope:

2.15 Reference Stream Type

(if different from Phase 1)

F 3 Non Riffle-Pool

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	Sand	Bedrock
Consistency	Non-cohesive	Cohesive
Lower		
Material Type	Bedrock	Bedrock
Consistency	Cohesive	Cohesive

Bank Erosion	Left	Right
Erosion Length (ft)	85	0
Erosion Height (ft)	10.97	0.00
Revetmt. Type	None	Rip-Rap
Revetmt. Length (ft)	0	121

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

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

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

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

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

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Forest	Residential
Sub-dominant	Hay	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 **None**

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 **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
0	1	4

Diagonal	Delta	Island
1	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.

Stream: **Dog River** Reach # **M10** Segment: **A** Completion Date: **September 22,**

Organization: **Bear Creek Environmental** Observers: **PD, CS** Rain: **No**

Segment Length (ft): **1,487** Segment Location: **Segment begins at confluence with Cox Brook and continues upstream in narrowly**

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken
Ledge	**Mid-segment**	**6.00**	**5.00**	**Yes**	
Ledge	**Mid-segment**	**6.00**	**5.00**	**Yes**	
Waterfall	**Mid-segment**	**17.00**	**7.00**	**Yes**	
Ledge	**Mid-segment**	**5.00**	**1.00**	**Yes**	

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bedrock	**10.0**	**Yes**	**No**	**Yes**	**Yes**
Problem	**Deposition Above,Deposition Below,Scour**				
Bedrock	**20.0**	**Yes**	**No**	**Yes**	**Yes**
Problem	**Deposition Above,Deposition Below,Scour**				

Narrative:
Minor aggradation and widening.

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Confined**

	Score	STD	Historic
7.1 Channel Degradation	**16**	**None**	**No**
7.2 Channel Aggradation	**15**	**None**	**No**
7.3 Widening Channel	**14**		
7.4 Change in Planform	**18**		**No**
Total Score	**63**		
Geomorphic Rating	**0.7875**		

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

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Project: **Dog River**

Phase 2 Segment Summary

March 2, 2009 SGAT Version: 4.56

Stream: **Dog River** Reach # **M10** Segment: **B** Completion Date: **September 18, 2008**

Organization: **Bear Creek Environmental** Observers: **CS, SP** Why Not assessed: Rain: **No**

Segment Length (ft): **3,001** Segment Location: **Segment begins about 175 feet below the Slaugherhouse Road covered bridge and**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Valley Width**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	472	1,086
height	0	0
Railroads	2,645	0
height	0	0
Improved Paths	0	0
height	0	0
Development	832	1,062

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

1.5 Valley Features

Valley Width (ft) **300**

Width Determination **Measured**

Confinement Type **Semi-confined**

Rock Gorge? **No**

Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **94**

2.2 Max Depth (ft) **5.15**

2.3 Mean Depth (ft) **3.97**

2.4 Floodprone Width (ft) **200**

Notes:

Segment has wastewater treatment facility (WWTF) at upper end. Weir located in segment appears to be assoicated with WWTF (possible discharge location?). No visible stormwater input near facility. Also some large pools (too deep to walk in).

Step 2. (Contued)

2.5 Aband. Floodpln **7.85** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **23.68**

2.7 Entrenchment Ratio **2.13**

2.8 Incision Ratio **1.52**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **460**

2.12 Substrate Composition

Bedrock	1%
Boulder	3%
Cobble	41%
Coarse Gravel	43%
Fine Gravel	4%
Sand	8%
Silt and smaller	0%

Silt/Clay Present? **No**

Detritus **2** %

Large Woody **34**

2.13 Average Largest Particle on

Bed **7.3** **inches**

Bar **6.2** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

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 **Steep**

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

Bank Erosion	Left	Right
Erosion Length (ft)	142	186
Erosion Height (ft)	6.72	6.59
Revetmt. Type	Rip-Rap	Rip-Rap
Revetmt. Length (ft)	1,050	310

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

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

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	51-100	>100
Sub-dominant	0-25	0-25
W less than 25	966	339

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

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Industrial	Residential
Sub-dominant	Residential	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 **None**

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	1	Urb Strm Wtr Pipe	1

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
2	1	9

Diagonal	Delta	Island
1	1	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
4	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: **2,239**

5.5 Dredging **Gravel Mining**

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

Stream: **Dog River** Reach # **M10** Segment: **B** Completion Date: **September 18,**

Organization: **Bear Creek Environmental** Observers: **CS, SP** Rain: **No**

Segment Length (ft): **3,001** Segment Location: **Segment begins about 175 feet below the Slaughterhouse Road covered bridge and**

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken
Weir	**Mid-segment**	**3.00**	**0.00**	**Yes**	

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bedrock	**45.0**	**Yes**	**No**	**Yes**	**No**
Problem		**Deposition Above,Scour Above**			
Bridge	**54.0**	**Yes**	**Yes**	**Yes**	**Yes**
Problem		**Deposition Above,Deposition Below,Scour**			
Bedrock	**40.0**	**Yes**	**No**	**Yes**	**No**
Problem		**Deposition Above,Deposition Below,Scour**			

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**8**	**None**	**Yes**
7.2 Channel Aggradation	**13**	**None**	**No**
7.3 Widening Channel	**12**		**No**
7.4 Change in Planform	**10**		**No**
Total Score	**43**		
Geomorphic Rating	**0.5375**		

Channel Evolution Model **F**

Channel Evolution Stage **III**

Geomorphic Condition **Fair**

Stream Sensitivity **Very High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Narrative:

major historic degradation, major planforma adjustment, minor aggradation and widening.

Stream: **Dog River** Reach # **M11** Segment: **A** Completion Date: **September 17, 2008**

Organization: **Bear Creek Environmental** Observers: **CS, TL, GA** Why Not assessed: Rain: **No**

Segment Length (ft): **1,731** Segment Location: **Segment begins about 90 feet downstream of the Route 12 bridge near the Grand Union and**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Flow Status**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	0	627
height	0	0
Railroads	126	0
height	0	0
Improved Paths	0	0
height	0	0
Development	681	1,042

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

1.5 Valley Features

Valley Width (ft) **591**

Width Determination **Measured**

Confinement Type **Broad**

Rock Gorge? **No**

Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **66**

2.2 Max Depth (ft) **3.65**

2.3 Mean Depth (ft) **3.10**

2.4 Floodprone Width (ft) **488**

Notes:

Segment is just below a beaver dam and impounded segment. Has large ledge grade control at downstream end of segment just above the Rt 12 bridge. Also a cement weir in channel upstream of the bedrock grade control. Housing development in corridor

Step 2. (Contued)

2.5 Aband. Floodpln **3.65** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **21.13**

2.7 Entrenchment Ratio **7.45**

2.8 Incision Ratio **1.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Moderate**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **310**

2.12 Substrate Composition

Bedrock	0 %
Boulder	0 %
Cobble	26 %
Coarse Gravel	55 %
Fine Gravel	10 %
Sand	9 %
Silt and smaller	0 %

Silt/Clay Present? **Yes**

Detritus **2** %

Large Woody **7**

2.13 Average Largest Particle on

Bed **9.2** **inches**

Bar **5.3** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

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 **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Gravel	Gravel
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	0	167
Erosion Height (ft)	0.00	4.67
Revetmt. Type	Multiple	Multiple
Revetmt. Length (ft)	627	195
Near Bank Veg. Type	Left	Right
Dominant	Invasives	Invasives
Sub-dominant	Herbaceous	Herbaceous
Bank Canopy	Left	Right
Canopy %	1-25	1-25

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	0-25	>100
Sub-dominant	>100	51-100
W less than 25	807	261
Buffer Veg. Type	Left	Right
Dominant	Herbaceous	Deciduous
Sub-dominant	Deciduous	Herbaceous

3.3 Riparian Corridor

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

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	1

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
4	2	5
Diagonal	**Delta**	**Island**
0	1	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
2	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: **920**

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: **Dog River** Reach # **M11** Segment: **A** Completion Date: **September 17,**

Organization: **Bear Creek Environmental** Observers: **CS, TL, GA** Rain: **No**

Segment Length (ft): **1,731** Segment Location: **Segment begins about 90 feet downstream of the Route 12 bridge near the Grand**

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken
Ledge	**Mid-segment**	**7.00**	**5.00**	**Yes**	
Weir	**Mid-segment**	**0.00**	**0.00**	**No**	

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	**170.**	**Yes**	**Yes**	**No**	**Yes**
Problem	**Deposition Above,Deposition Below,Scour**				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**18**	**None**	**No**
7.2 Channel Aggradation	**13**	**None**	**No**
7.3 Widening Channel	**14**		**No**
7.4 Change in Planform	**11**		**No**
Total Score	**56**		
Geomorphic Rating	**0.7**		

Channel Evolution Model **D**

Channel Evolution Stage **IIc**

Geomorphic Condition **Good**

Stream Sensitivity **High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Narrative:

Minor aggradation, widening and planform adjusment.

Stream: **Dog River** Reach # **M11** Segment: **B** Completion Date: **September 17, 2008**

Organization: **Bear Creek Environmental** Observers: **CS, GA** Why Not assessed: **beaver dam** Rain: **No**

Segment Length (ft): **694** Segment Location: **Segment begins at large beaver dam near Dogwood Glen housing development and**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Flow Status**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	237	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	694	0

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

1.5 Valley Features

Valley Width (ft) **772**

Width Determination **Measured**

Confinement Type **Broad**

Rock Gorge? **No**

Human-caused Change? **Yes**

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:

Entire segment is impounded by a beaver dam. No riffles or features in segment, too deep to wade.

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: **E**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

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 **Steep**

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

Bank Erosion	Left	Right
Erosion Length (ft)	0	0
Erosion Height (ft)	0.00	0.00
Revetmt. Type	None	Rip-Rap
Revetmt. Length (ft)	0	49

Near Bank Veg. Type	Left	Right
Dominant	Invasives	Invasives
Sub-dominant	Deciduous 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	26-50
Sub-dominant	0-25	>100
W less than 25	0	0

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

3.3 Riparian Corridor

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

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) **650**

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: **584**

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: **Dog River** Reach # **M11** Segment: **B** Completion Date: **September 17,**

Organization: **Bear Creek Environmental** Observers: **CS, GA** Rain: **No**

Segment Length (ft): **694** Segment Location: **Segment begins at large beaver dam near Dogwood Glen housing development and**

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken

4.8 Channel Constrictions **None**

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

Narrative:

Step 7. Rapid Geomorphic Assessment Data

Confinement Type

Channel Evolution Model

Channel Evolution Stage

Geomorphic Condition **Fair**

Stream Sensitivity

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Project: **Dog River**

Phase 2 Segment Summary

March 2, 2009 SGAT Version: 4.56

Stream: **Dog River** Reach # **M11** Segment: **C** Completion Date: **September 17, 2008**

Organization: **Bear Creek Environmental** Observers: **CS, TL, GA** Why Not assessed: Rain: **No**

Segment Length (ft): **1,542** Segment Location: **Segment begins where beaver dam influence ends near Sherman Ave and Houston street**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Channel Dimensions**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	627	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	1,542	0

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

1.5 Valley Features

Valley Width (ft) **513**

Width Determination **Measured**

Confinement Type **Broad**

Rock Gorge? **No**

Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **64**

2.2 Max Depth (ft) **3.80**

2.3 Mean Depth (ft) **2.66**

2.4 Floodprone Width (ft) **73**

Notes:

Segment is located above beaver dam influenced segment and downstream of a large dam with industrial activity on the left bank. Lots of granite tailings located in the stream channel (look like they have been there for a long time).

Step 2. (Contued)

2.5 Aband. Floodpln **7.90** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **24.06**

2.7 Entrenchment Ratio **1.13**

2.8 Incision Ratio **2.08**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **195**

2.12 Substrate Composition

Bedrock	23%
Boulder	12%
Cobble	40%
Coarse Gravel	16%
Fine Gravel	4%
Sand	5%
Silt and smaller	0%

Silt/Clay Present? **No**

Detritus **2** %

Large Woody **4**

2.13 Average Largest Particle on

Bed **11.6** **inches**

Bar **7.0** **inches**

2.14 Stream Type

Stream Type: **F**

Bed Material: **Cobble**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

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 **Steep**

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

Bank Erosion	Left	Right
Erosion Length (ft)	87	0
Erosion Height (ft)	6.00	0.00
Revetmt. Type	Rip-Rap	Rip-Rap
Revetmt. Length (ft)	460	113

Near Bank Veg. Type	Left	Right
Dominant	Invasives	Invasives
Sub-dominant	Deciduous 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	0-25
Sub-dominant	0-25	26-50
W less than 25	494	692

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

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Industrial	Hay
Sub-dominant	Residential	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 **None**

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	1

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	2
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: **962**

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: **Dog River** Reach # **M11** Segment: **C** Completion Date: **September 17,**

Organization: **Bear Creek Environmental** Observers: **CS, TL, GA** Rain: **No**

Segment Length (ft): **1,542** Segment Location: **Segment begins where beaver dam influence ends near Sherman Ave and Houston**

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken
Ledge	**Mid-segment**	**1.00**	**0.00**	**Yes**	
Ledge	**Mid-segment**	**2.00**	**1.00**	**Yes**	

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	**45.0**	**Yes**	**Yes**	**Yes**	**Yes**
Problem	**Scour Above,Scour Below**				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**3**	**C to F**	**Yes**
7.2 Channel Aggradation	**16**	**None**	**No**
7.3 Widening Channel	**14**		**No**
7.4 Change in Planform	**15**		**No**
Total Score	**48**		
Geomorphic Rating	**0.6**		

Channel Evolution Model **F**

Channel Evolution Stage **II**

Geomorphic Condition **Fair**

Stream Sensitivity **Extreme**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Narrative:

extreme historic degradation due to dam, minor widening and planform adjustment.

Project: **Dog River**

Phase 2 Segment Summary

March 2, 2009 SGAT Version: 4.56

Stream: **Dog River** Reach # **M11** Segment: **D** Completion Date: **September 17, 2008**

Organization: **Bear Creek Environmental** Observers: **CS, TL** Why Not assessed: **impounded** Rain: **No**

Segment Length (ft): **137** Segment Location: **Segment begins at large dam and continues upstream for 137 feet.**

QC Status - Staff: Provisional Cons **Passed**

Step 1. Valley and Floodplain

1.1 Segmentation **Flow Status**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	32	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	137	0

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

1.5 Valley Features

Valley Width (ft) **130**

Width Determination **Measured**

Confinement Type **Narrowly**

Rock Gorge? **No**

Human-caused Change? **No**

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:

Impounded segment upstream of dam. Very short segment, bedrock on both banks, generally featureless (no riffles or deposition).

Dam in segment is owned by Nantana Mill Partnership and it is a hydroelectric, run of

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: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Plane Bed**

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 **Steep**

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

Bank Erosion	Left	Right
Erosion Length (ft)	0	0
Erosion Height (ft)	0.00	0.00
Revetmt. Type	Hard Bank	None
Revetmt. Length (ft)	24	0

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

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

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	0-25	26-50
Sub-dominant	26-50	51-100
W less than 25	129	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	Industrial	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 **None**

4.2 Adjacent Wetlands **None**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **0**

4.5 Flow Regulation Type **Large Run of**

Flow Regulation Use **Hydro-electric**

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.

Stream: **Dog River** Reach # **M11** Segment: **D** Completion Date: **September 17,**

Organization: **Bear Creek Environmental** Observers: **CS, TL** Rain: **No**

Segment Length (ft): **137** Segment Location: **Segment begins at large dam and continues upstream for 137 feet.**

1.6 Grade Controls **None**

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken
Dam	**Mid-segment**	**30.00**	**25.00**	**Yes**	

4.8 Channel Constrictions **None**

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

Narrative:

Step 7. Rapid Geomorphic Assessment Data

Confinement Type

Channel Evolution Model

Channel Evolution Stage

Geomorphic Condition **Fair**

Stream Sensitivity

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Project: **Dog River**

Phase 2 Segment Summary

March 2, 2009 SGAT Version: 4.56

Stream: **Dog River** Reach # **M12** Segment: **A** Completion Date: **September 8, 2008**

Organization: **Bear Creek Environmental** Observers: **MN, SP** Why Not assessed: **impounded** Rain: **No**

Segment Length (ft): **1,886** Segment Location: **Segment begins about 137 feet upstream of large dam and continues for 1886 feet to an old**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Valley Width**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	484	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	607	1,268

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

1.5 Valley Features

Valley Width (ft) **613**

Width Determination **Measured**

Confinement Type **Broad**

Rock Gorge? **No**

Human-caused Change? **No**

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:

Segment is impounded from downstream dam. One dam and one wier also exist in this segment. The bedform has not been entered into the DMS. The reach is impounded and does not really fit any of the bedforms listed.

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 **21**

2.13 Average Largest Particle on

Bed **0.0**

Bar **0.0**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

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 **Steep**

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

Bank Erosion	Left	Right
Erosion Length (ft)	183	162
Erosion Height (ft)	5.87	3.85
Revetmt. Type	Multiple	Multiple
Revetmt. Length (ft)	303	179

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

Bank Canopy	Left	Right
Canopy %	26-50	1-25
Mid-Channel Canopy	Open	

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	51-100	51-100
Sub-dominant	0-25	0-25
W less than 25	35	363

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

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Forest	Residential
Sub-dominant	Commercial	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

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
2	0	3

Diagonal	Delta	Island
0	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
2	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: **1,386**

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
Weir	**Mid-segment**	**1.00**	**0.00**	**Yes**	
Dam	**Mid-segment**	**22.00**	**12.00**	**Yes**	

4.8 Channel Constrictions **None**

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

Narrative:

Step 7. Rapid Geomorphic Assessment Data

Confinement Type

Channel Evolution Model
Channel Evolution Stage
Geomorphic Condition **Fair**
Stream Sensitivity

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Stream: Dog River Reach # M12 Segment: B Completion Date: September 18, 2008
Organization: Bear Creek Environmental Observers: MN, SP, CS Why Not assessed: Rain: No
Segment Length (ft): 1,653 Segment Location: Segment begins at old dam about 150 feet downstream of N. Main Street bridge in

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation Flow Status
1.2 Alluvial Fan None
1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	887	52
height	0	0
Railroads	0	45
height	0	0
Improved Paths	0	0
height	0	0
Development	0	1,653

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

1.5 Valley Features
Valley Width (ft) 588
Width Determination Measured
Confinement Type Broad
Rock Gorge? No
Human-caused Change? Yes

Step 2. Stream Channel

2.1 Bankfull Width 77
2.2 Max Depth (ft) 5.70
2.3 Mean Depth (ft) 3.70
2.4 Floodprone Width (ft) 129

Notes:
Rip rap and channelization for most of reach is preventing further widening of the channel. Bankfull indicators were difficult to find. Dam downstream is causing some excess fining.

Step 2. (Contued)

2.5 Aband. Floodpln 11.00 ft.
Human Elev Floodpln 0.00 ft.
2.6 Width/Depth Ratio 20.68
2.7 Entrenchment Ratio 1.69
2.8 Incision Ratio 1.93
Human Elevated Inc Rat 0.00
2.9 Sinuosity Low
2.10 Riffles Type Sedimented
2.11 Riffle/Step Spacing (ft) 263
2.12 Substrate Composition

Bedrock	0%
Boulder	2%
Cobble	23%
Coarse Gravel	40%
Fine Gravel	21%
Sand	14%
Silt and smaller	0%

Silt/Clay Present? No
Detritus 2 %
Large Woody 29
2.13 Average Largest Particle on

Bed	8.0	inches
Bar	6.1	inches

2.14 Stream Type
Stream Type: B
Bed Material: Gravel
Subclass Slope: c
Bed Form: Riffle-Pool
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 Steep

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Gravel	Gravel
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	205	161
Erosion Height (ft)	4.99	4.89
Revetmt. Type	Multiple	Multiple
Revetmt. Length (ft)	1,217	513
Near Bank Veg. Type	Left	Right
Dominant	Invasives	Invasives
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	0-25	0-25
Sub-dominant	None	51-100
W less than 25	1,625	565
Buffer Veg. Type	Left	Right
Dominant	Invasives	Invasives
Sub-dominant	None	Shrubs/Saplin

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Residential	Residential
Sub-dominant	Commercial	Commercial
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
Impoundmt. Location
4.6 Up/Down strm flow reg None
(old) Upstrm Flow Reg
4.7 StormwaterInputs

Field Ditch	0	Road Ditch	6
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	0	4
Diagonal	Delta	Island
0	1	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: 1,599
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: **Dog River** Reach # **M12** Segment: **B** Completion Date: **September 18,**

Organization: **Bear Creek Environmental** Observers: **MN, SP, CS** Rain: **No**

Segment Length (ft): **1,653** Segment Location: **Segment begins at old dam about 150 feet downstream of N. Main Street bridge in**

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	**84.0**	**Yes**	**Yes**	**No**	**Yes**
Problem	**Deposition Above**				
Bridge	**79.0**	**Yes**	**Yes**	**No**	**Yes**
Problem	**None**				
Bridge	**55.0**	**Yes**	**Yes**	**Yes**	**Yes**
Problem	**Deposition Below,Scour Above**				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**3**	**C to B**	**Yes**
7.2 Channel Aggradation	**10**	**None**	**Yes**
7.3 Widening Channel	**11**		**No**
7.4 Change in Planform	**10**		**No**
Total Score	**34**		
Geomorphic Rating	**0.425**		

Channel Evolution Model **F**

Channel Evolution Stage **III**

Geomorphic Condition **Fair**

Stream Sensitivity **Very High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Narrative:

Extreme historic degradation, major aggradation and planform adjustment, minor widening.

Stream: **Dog River** Reach # **M13** Segment: **0** Completion Date: **September 8, 2008**

Organization: **Bear Creek Environmental** Observers: **MN, CS, SP** Why Not assessed: Rain: **No**

Segment Length (ft): **7,728** Segment Location: **Reach begins at confluence with Union Brook and runs through Norwich University athletic**

QC Status - Staff: Provisional Cons Passed

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	2,924	85
height	0	0
Railroads	546	0
height	0	0
Improved Paths	0	0
height	0	0
Development	756	1,035

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

1.5 Valley Features

Valley Width (ft) **890**

Width Determination **Measured**

Confinement Type **Very Broad**

Rock Gorge? **Yes**

Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **59**

2.2 Max Depth (ft) **6.40**

2.3 Mean Depth (ft) **5.25**

2.4 Floodprone Width (ft) **1,202**

Notes:

Lots of channelization in reach, parts run through Norwich University fields, could use some buffer enhancement. Many houses built right along river banks, history of flooding on Water Street.

Step 2. (Contued)

2.5 Aband. Floodpln **6.40** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **11.20**

2.7 Entrenchment Ratio **20.44**

2.8 Incision Ratio **1.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Sedimented**

2.11 Riffle/Step Spacing (ft) **367**

2.12 Substrate Composition

Bedrock	0%
Boulder	0%
Cobble	26%
Coarse Gravel	54%
Fine Gravel	15%
Sand	5%
Silt and smaller	0%

Silt/Clay Present? **Yes**

Detritus **2** %

Large Woody **39**

2.13 Average Largest Particle on

Bed **6.7** **inches**

Bar **2.1** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

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 **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Gravel	Gravel
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	807	1,674
Erosion Height (ft)	4.31	4.87
Revetmt. Type	Multiple	Multiple
Revetmt. Length (ft)	1,728	933
Near Bank Veg. Type	Left	Right
Dominant	Invasives	Invasives
Sub-dominant	Deciduous	None
Bank Canopy	Left	Right
Canopy %	26-50	1-25
Mid-Channel Canopy	Open	

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	0-25	0-25
Sub-dominant	>100	26-50
W less than 25	3,111	2,853
Buffer Veg. Type	Left	Right
Dominant	Herbaceous	Herbaceous
Sub-dominant	Invasives	Invasives

3.3 Riparian Corridor

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

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	1	Urb Strm Wtr Pipe	3

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
4	3	19

Diagonal	Delta	Island
6	1	3

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
9	0	1	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
7	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **4,962**

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: **Dog River** Reach # **M13** Segment: **0** Completion Date: **September 8,**

Organization: **Bear Creek Environmental** Observers: **MN, CS, SP** Rain: **No**

Segment Length (ft): **7,728** Segment Location: **Reach begins at confluence with Union Brook and runs through Norwich University**

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?
Old	**51.0**	**Yes**	**No**	**Yes**	**Yes**
Problem	**Scour Above,Scour Below**				
Bridge	**54.0**	**Yes**	**Yes**	**Yes**	**Yes**
Problem	**Deposition Below,Scour Above,Scour**				
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	**16**	**None**	**No**
7.2 Channel Aggradation	**8**	**None**	**No**
7.3 Widening Channel	**12**		**No**
7.4 Change in Planform	**9**		**No**
Total Score	**45**		
Geomorphic Rating	**0.5625**		

Channel Evolution Model **D**

Channel Evolution Stage **IIc**

Geomorphic Condition **Fair**

Stream Sensitivity **Very High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Narrative:

Major aggradation and planform adjustment, minor widening.

Stream: **Dog River** Reach # **M14** Segment: **0** Completion Date: **September 5, 2008**
Organization: **Bear Creek Environmental** Observers: **CS, MN** Why Not assessed: Rain: **No**
Segment Length (ft): **4,676** Segment Location: **Reach begins just below railroad bridge and continues upstream past Northfield Town**

QC Status - Staff: Provisional Cons Passed

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	1,132	0
height	0	0
Railroads	941	44
height	0	0
Improved Paths	0	0
height	0	0
Development	0	961

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

1.5 Valley Features
Valley Width (ft) **835**
Width Determination **Measured**
Confinement Type **Very Broad**
Rock Gorge? **No**
Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **94**
2.2 Max Depth (ft) **3.20**
2.3 Mean Depth (ft) **2.33**
2.4 Floodprone Width (ft) **602**

Notes:
Multiple steep riffles and diagonal bars in reach. Did not appear to be incised with very wide floodplain at bankfull elevation. Railroad bridge in reach did not get full bridge and culver assessment because it was too high to take any accurate measurments. There was

Step 2. (Contued)

2.5 Aband. Floodpln **3.20** ft.
Human Elev Floodpln **0.00** ft.
2.6 Width/Depth Ratio **40.13**
2.7 Entrenchment Ratio **6.44**
2.8 Incision Ratio **1.00**
Human Elevated Inc Rat **0.00**
2.9 Sinuosity **Low**
2.10 Riffles Type **Sedimented**
2.11 Riffle/Step Spacing (ft) **250**
2.12 Substrate Composition

Bedrock	0%
Boulder	0%
Cobble	23%
Coarse Gravel	54%
Fine Gravel	10%
Sand	13%
Silt and smaller	0%

Silt/Clay Present? **No**
Detritus **2** %
Large Woody **44**
2.13 Average Largest Particle on
Bed **6.9** **inches**
Bar **3.1** **inches**

2.14 Stream Type
Stream Type: **C**
Bed Material: **Gravel**
Subclass Slope: **None**
Bed Form: **Riffle-Pool**
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 **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Gravel	Gravel
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	831	991
Erosion Height (ft)	3.78	4.07
Revetmt. Type	Hard Bank	Multiple
Revetmt. Length (ft)	23	693
Near Bank Veg. Type	Left	Right
Dominant	Invasives	Invasives
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin
Bank Canopy	Left	Right
Canopy %	26-50	1-25
Mid-Channel Canopy	Open	

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	0-25
Sub-dominant	None	>100
W less than 25	0	2,449
Buffer Veg. Type	Left	Right
Dominant	Deciduous	Invasives
Sub-dominant	Invasives	Shrubs/Saplin

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Forest	Residential
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 **Minimal**
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 **0**
Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
3	1	14
Diagonal	Delta	Island
6	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
5	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
7	0	No

5.4 Stream Ford or Animal **No**
5.5 Straightening **Straightening**
Straightening Length: **3,452**
5.5 Dredging **Gravel Mining**

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

Stream: **Dog River** Reach # **M14** Segment: **0** Completion Date: **September 5,**

Organization: **Bear Creek Environmental** Observers: **CS, MN** Rain: **No**

Segment Length (ft): **4,676** Segment Location: **Reach begins just below railroad bridge and continues upstream past Northfield Town**

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	**60.5**	**Yes**	**Yes**	**Yes**	**Yes**
Problem	**Scour Above,Scour Below**				
Bridge	**83.0**	**Yes**	**No**	**No**	**Yes**
Problem	**Deposition Above,Deposition Below**				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**16**	**None**	**No**
7.2 Channel Aggradation	**6**	**None**	**No**
7.3 Widening Channel	**12**		**No**
7.4 Change in Planform	**8**		**No**
Total Score	**42**		
Geomorphic Rating	**0.525**		

Channel Evolution Model **D**

Channel Evolution Stage **IId**

Geomorphic Condition **Fair**

Stream Sensitivity **Very High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Narrative:

major aggradation (dominant process), major planform adjustment, minor widening.

Stream: Dog River Reach # M15 Segment: 0 Completion Date: September 2, 2008
Organization: Bear Creek Environmental Observers: CS, MN, LG Why Not assessed: Rain: No
Segment Length (ft): 3,544 Segment Location: Reach begins at confluence with Sunny Brook and continues upstream to about 100 feet

QC Status - Staff: Provisional Cons **Passed**

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	987	61
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	1,574	122

1.4 Adjacent Side	Left	Right
Hillside Slope	Flat	Hilly
Continuous w/	Never	Never
W/in 1 Bankfill	Never	Sometimes
Texture	Not Evalua	Not Evalua

1.5 Valley Features
Valley Width (ft) **680**
Width Determination **Measured**
Confinement Type **Very Broad**
Rock Gorge? **No**
Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **58**
2.2 Max Depth (ft) **4.40**
2.3 Mean Depth (ft) **3.41**
2.4 Floodprone Width (ft) **302**

Notes:
Much of reach has been straightened. Owner of trailer park at downstream end of reach in left corridor has been battling with FEMA about whether or not property is within floodplain, consulting company was out surveying while we were assessing this

Step 2. (Contued)

2.5 Aband. Floodpln **5.80** ft.
Human Elev Floodpln **0.00** ft.
2.6 Width/Depth Ratio **17.01**
2.7 Entrenchment Ratio **5.21**
2.8 Incision Ratio **1.32**
Human Elevated Inc Rat **0.00**
2.9 Sinuosity **Low**
2.10 Riffles Type **Sedimented**
2.11 Riffle/Step Spacing (ft) **328**
2.12 Substrate Composition

Bedrock	0%
Boulder	1%
Cobble	40%
Coarse Gravel	41%
Fine Gravel	13%
Sand	5%
Silt and smaller	0%

Silt/Clay Present? **No**
Detritus **2** %
Large Woody **28**
2.13 Average Largest Particle on
Bed **9.2** **inches**
Bar **5.6** **inches**

2.14 Stream Type
Stream Type: **C**
Bed Material: **Gravel**
Subclass Slope: **None**
Bed Form: **Riffle-Pool**
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 **Steep**

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

Bank Erosion	Left	Right
Erosion Length (ft)	1,125	579
Erosion Height (ft)	4.33	4.86
Revetmt. Type	Multiple	Multiple
Revetmt. Length (ft)	365	768

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

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

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	26-50
Sub-dominant	26-50	0-25
W less than 25	147	1,207

Buffer Veg. Type	Left	Right
Dominant	Invasives	Invasives
Sub-dominant	Deciduous	Deciduous

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Forest	Residential
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
Impoundmt. Location
4.6 Up/Down strm flow reg **None**
(old) Upstrm Flow Reg
4.7 StormwaterInputs

Field Ditch	0	Road Ditch	1
Other	0	Tile Drain	0
Overland Flow	0	Urb Strm Wtr Pipe	1

4.9 # of Beaver Dams **0**
Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
5	2	18

Diagonal	Delta	Island
4	0	2

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
5	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
5	0	No

5.4 Stream Ford or Animal **No**
5.5 Straightening **Straightening**
Straightening Length: **3,475**
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: **Dog River** Reach # **M15** Segment: **0** Completion Date: **September 2,**

Organization: **Bear Creek Environmental** Observers: **CS, MN, LG** Rain: **No**

Segment Length (ft): **3,544** Segment Location: **Reach begins at confluence with Sunny Brook and continues upstream to about 100**

1.6 Grade Controls

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

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	**51.0**	**Yes**	**Yes**	**Yes**	**Yes**
Problem	**Deposition Above**				
Bridge	**41.5**	**Yes**	**Yes**	**Yes**	**Yes**
Problem	**Deposition Above**				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**13**	**None**	**Yes**
7.2 Channel Aggradation	**9**	**None**	**No**
7.3 Widening Channel	**14**		**No**
7.4 Change in Planform	**9**		**No**
Total Score	**45**		
Geomorphic Rating	**0.5625**		

Channel Evolution Model **F**

Channel Evolution Stage **III**

Geomorphic Condition **Fair**

Stream Sensitivity **Very High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Narrative:

Minor historic degradation, major aggradation and planform adjustment, minor widening.

Project: **Dog River**

Phase 2 Segment Summary

March 2, 2009 SGAT Version: 4.56

Stream: **Dog River** Reach # **M16** Segment: **0** Completion Date: **August 28, 2008**

Organization: **Bear Creek Environmental** Observers: **CS, MN** Why Not assessed: Rain: **No**

Segment Length (ft): **1,376** Segment Location: **Reach begins about 100 above the confluence with Bull Run, just below a railroad bridge,**

QC Status - Staff: Provisional Cons Passed

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	1,330	0
height	0	0
Railroads	0	43
height	0	0
Improved Paths	0	0
height	0	0
Development	0	735

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

1.5 Valley Features

Valley Width (ft) **275**

Width Determination **Measured**

Confinement Type **Narrow**

Rock Gorge? **No**

Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **50**

2.2 Max Depth (ft) **4.05**

2.3 Mean Depth (ft) **3.06**

2.4 Floodprone Width (ft) **195**

Notes:

Lots of invasives (honeysuckle, japanese knotweed). Long riffles and no buffer on right bank due to Route 12A encroachment.

Short reach with long riffles, but 4 rank 7 pools. Long riffle spacing is likely due to

Step 2. (Contued)

2.5 Aband. Floodpln **6.05** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **16.34**

2.7 Entrenchment Ratio **3.89**

2.8 Incision Ratio **1.49**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **325**

2.12 Substrate Composition

Bedrock	0 %
Boulder	7 %
Cobble	39 %
Coarse Gravel	29 %
Fine Gravel	18 %
Sand	7 %
Silt and smaller	0 %

Silt/Clay Present? **No**

Detritus **2** %

Large Woody **3**

2.13 Average Largest Particle on

Bed **10.8** **inches**

Bar **5.6** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **b**

Bed Form: **Riffle-Pool**

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 **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Gravel	Gravel
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	289	92
Erosion Height (ft)	4.25	5.48
Revetmt. Type	Rip-Rap	Multiple
Revetmt. Length (ft)	82	1,161
Near Bank Veg. Type	Left	Right
Dominant	Invasives	Invasives
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	0-25
Sub-dominant	26-50	None
W less than 25	0	1,191
Buffer Veg. Type	Left	Right
Dominant	Deciduous	None
Sub-dominant	Herbaceous	None

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Residential	Residential
Sub-dominant	Forest	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

Impoundmt. Location

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

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	1
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	7

Diagonal	Delta	Island
1	0	1

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: **651**

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: **Dog River** Reach # **M16** Segment: **0** Completion Date: **August 28, 2008**

Organization: **Bear Creek Environmental** Observers: **CS, MN** Rain: **No**

Segment Length (ft): **1,376** Segment Location: **Reach begins about 100 above the confluence with Bull Run, just below a railroad**

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	**35.0**	**Yes**	**Yes**	**Yes**	**Yes**
Problem		**Deposition Below,Scour Below**			

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**8**	**None**	**Yes**
7.2 Channel Aggradation	**16**	**None**	**No**
7.3 Widening Channel	**12**		**No**
7.4 Change in Planform	**14**		**No**
Total Score	**50**		
Geomorphic Rating	**0.625**		

Channel Evolution Model **F**

Channel Evolution Stage **II**

Geomorphic Condition **Fair**

Stream Sensitivity **Very High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Narrative:

Major historic degradation due to Rt12A encroachment and straightening, minor widening and planform adjustment. Limited widening due to extensive rip rap.

Project: **Dog River**

Phase 2 Segment Summary

March 2, 2009 SGAT Version: 4.56

Stream: **Dog River** Reach # **M17** Segment: **A** Completion Date: **August 28, 2008**

Organization: **Bear Creek Environmental** Observers: **MN, CS** Why Not assessed: Rain: **No**

Segment Length (ft): **2,554** Segment Location: **Segment begins at confluence with Stony Brook and continues upstream to first golf cart**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Channel Dimensions**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	1,589	6
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	342	0

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

1.5 Valley Features

Valley Width (ft) **403**

Width Determination **Measured**

Confinement Type **Broad**

Rock Gorge? **No**

Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **41**

2.2 Max Depth (ft) **3.40**

2.3 Mean Depth (ft) **2.51**

2.4 Floodprone Width (ft) **149**

Notes:

Bedrock present in several places but no channel spanning grade controls. Numerous steep riffles and diagonal bars. No large depositional bars, aggradation may be a result of channel straightening through Northfield Country Club golf course.

Step 2. (Contued)

2.5 Aband. Floodpln **4.80** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **16.25**

2.7 Entrenchment Ratio **3.65**

2.8 Incision Ratio **1.41**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Moderate**

2.10 Riffles Type **Sedimented**

2.11 Riffle/Step Spacing (ft) **146**

2.12 Substrate Composition

Bedrock	0%
Boulder	0%
Cobble	40%
Coarse Gravel	44%
Fine Gravel	12%
Sand	4%
Silt and smaller	0%

Silt/Clay Present? **No**

Detritus **2** %

Large Woody **18**

2.13 Average Largest Particle on

Bed **6.8** **inches**

Bar **4.8** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

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 **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Gravel	Gravel
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	395	201
Erosion Height (ft)	4.72	5.18
Revetmt. Type	Multiple	Rip-Rap
Revetmt. Length (ft)	54	430
Near Bank Veg. Type	Left	Right
Dominant	Invasives	Invasives
Sub-dominant	Deciduous	Deciduous
Bank Canopy	Left	Right
Canopy %	76-100	51-75
Mid-Channel Canopy	Closed	

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	>100
Sub-dominant	51-100	0-25
W less than 25	14	381
Buffer Veg. Type	Left	Right
Dominant	Deciduous	Deciduous
Sub-dominant	Herbaceous	Herbaceous

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Forest	Forest
Sub-dominant	Commercial	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 **1**

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	4	7
Diagonal	Delta	Island
5	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
2	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
8	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **1,433**

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: **Dog River** Reach # **M17** Segment: **A** Completion Date: **August 28, 2008**

Organization: **Bear Creek Environmental** Observers: **MN, CS** Rain: **No**

Segment Length (ft): **2,554** Segment Location: **Segment begins at confluence with Stony Brook and continues upstream to first golf**

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	**47.0**	**Yes**	**Yes**	**Yes**	**Yes**
Problem	**Deposition Above,Scour Above,Scour**				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**8**	**None**	**Yes**
7.2 Channel Aggradation	**10**	**None**	**No**
7.3 Widening Channel	**15**		**No**
7.4 Change in Planform	**13**		**No**
Total Score	**46**		
Geomorphic Rating	**0.575**		

Channel Evolution Model **F**

Channel Evolution Stage **III**

Geomorphic Condition **Fair**

Stream Sensitivity **Very High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Narrative:

major historic degradation, major aggradation, minor widening and planform adjustment.

Project: **Dog River**

Phase 2 Segment Summary

March 2, 2009 SGAT Version: 4.56

Stream: **Dog River** Reach # **M17** Segment: **B** Completion Date: **July 1, 2008**

Organization: **Bear Creek Environmental** Observers: **MN, PD, SN** Why Not assessed: Rain: **Yes**

Segment Length (ft): **1,305** Segment Location: **Segment begins at first golf cart bridge at Northfield Country Club and continues upstream**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Banks and Buffers**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	0	108
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	Never
W/in 1 Bankfill	Sometimes	Never
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **295**

Width Determination **Measured**

Confinement Type **Broad**

Rock Gorge? **No**

Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **30**

2.2 Max Depth (ft) **5.20**

2.3 Mean Depth (ft) **3.09**

2.4 Floodprone Width (ft) **295**

Notes:

Segment runs through Northfield Country Club golf course, poor buffers and multiple golf cart bridges (constrictions). Lots of rip rap preventing channel from widening. Phase 2 stream type is an "E", but is a "C" by reference. Channelization is resulting in low

Step 2. (Contued)

2.5 Aband. Floodpln **6.50** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **9.81**

2.7 Entrenchment Ratio **9.74**

2.8 Incision Ratio **1.25**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **168**

2.12 Substrate Composition

Bedrock	0 %
Boulder	1 %
Cobble	34 %
Coarse Gravel	38 %
Fine Gravel	21 %
Sand	6 %
Silt and smaller	0 %

Silt/Clay Present? **No**

Detritus **2** %

Large Woody **1**

2.13 Average Largest Particle on

Bed **5.0** **inches**

Bar **6.0** **inches**

2.14 Stream Type

Stream Type: **E**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

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 **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	97	25
Erosion Height (ft)	4.69	2.00
Revetmt. Type	Multiple	Multiple
Revetmt. Length (ft)	355	903
Near Bank Veg. Type	Left	Right
Dominant	Invasives	Invasives
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	0-25	0-25
Sub-dominant	>100	51-100
W less than 25	958	1,023
Buffer Veg. Type	Left	Right
Dominant	Herbaceous	Herbaceous
Sub-dominant	None	None

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Commercial	Commercial
Sub-dominant	None	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

Impoundmt. Location

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

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	0
Other	1	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
2	0	1
Diagonal	**Delta**	**Island**
0	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.
2	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **1,204**

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: **Dog River** Reach # **M17** Segment: **B** Completion Date: **July 1, 2008**

Organization: **Bear Creek Environmental** Observers: **MN, PD, SN** Rain: **Yes**

Segment Length (ft): **1,305** Segment Location: **Segment begins at first golf cart bridge at Northfield Country Club and continues**

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	**35.0**	**Yes**	**Yes**	**Yes**	**Yes**
Problem	**None**				
Bridge	**25.5**	**Yes**	**Yes**	**Yes**	**Yes**
Problem	**Deposition Above,Deposition Below,Scour**				
Bridge	**30.0**	**Yes**	**Yes**	**Yes**	**Yes**
Problem	**Scour Below**				
Bridge	**33.0**	**Yes**	**Yes**	**Yes**	**Yes**
Problem	**Deposition Below,Scour Below**				
Bridge	**35.0**	**Yes**	**Yes**	**Yes**	**Yes**
Problem	**Deposition Above,Deposition Below**				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**13**	**None**	**Yes**
7.2 Channel Aggradation	**13**	**None**	**No**
7.3 Widening Channel	**15**		**No**
7.4 Change in Planform	**14**		**No**

Total Score **55**

Geomorphic Rating **0.6875**

Channel Evolution Model **F**

Channel Evolution Stage **II**

Geomorphic Condition **Good**

Stream Sensitivity **High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Narrative:

Minor historic degradation, minor aggradation, widening and planform adjustment. Stuck in stage II because of rip rap. RGA resulted in good, but stream channel is highly altered and only stable due to riprap.

Project: **Dog River**

Phase 2 Segment Summary

March 2, 2009 SGAT Version: 4.56

Stream: **Dog River** Reach # **M17** Segment: **C** Completion Date: **July 1, 2008**

Organization: **Bear Creek Environmental** Observers: **MN, PD, SN** Why Not assessed: Rain: **Yes**

Segment Length (ft): **1,878** Segment Location: **Segment begins about 100 feet upstream of Rt 12A bridge at Northfield Country Club and**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Channel Dimensions**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	430	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	Sometimes
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **257**

Width Determination **Measured**

Confinement Type **Broad**

Rock Gorge? **No**

Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **47**

2.2 Max Depth (ft) **3.50**

2.3 Mean Depth (ft) **2.18**

2.4 Floodprone Width (ft) **115**

Notes:

RAF consistent with upstream. Well developed juvenile floodplain bench in some places. Vegetation good overall, some Japanese knotweed.

Step 2. (Contued)

2.5 Aband. Floodpln **5.30** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **21.33**

2.7 Entrenchment Ratio **2.47**

2.8 Incision Ratio **1.51**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **238**

2.12 Substrate Composition

Bedrock	0 %
Boulder	0 %
Cobble	23 %
Coarse Gravel	46 %
Fine Gravel	21 %
Sand	10 %
Silt and smaller	0 %

Silt/Clay Present? **No**

Detritus **2** %

Large Woody **43**

2.13 Average Largest Particle on

Bed **12.5** **inches**

Bar **8.0** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

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 **Steep**

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

Bank Erosion	Left	Right
Erosion Length (ft)	422	231
Erosion Height (ft)	6.57	5.45
Revetmt. Type	Rip-Rap	Rip-Rap
Revetmt. Length (ft)	60	89

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

Bank Canopy	Left	Right
Canopy %	51-75	76-100

Mid-Channel Canopy **Closed**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	26-50	>100
Sub-dominant	51-100	None
W less than 25	741	66

Buffer Veg. Type	Left	Right
Dominant	Deciduous	Deciduous
Sub-dominant	Herbaceous	Herbaceous

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Commercial	Forest
Sub-dominant	Forest	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

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	6
Diagonal	**Delta**	**Island**
1	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
3	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
1	0	Yes

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **951**

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: **Dog River** Reach # **M17** Segment: **C** Completion Date: **July 1, 2008**

Organization: **Bear Creek Environmental** Observers: **MN, PD, SN** Rain: **Yes**

Segment Length (ft): **1,878** Segment Location: **Segment begins about 100 feet upstream of Rt 12A bridge at Northfield Country Club**

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken
Ledge	**Mid-segment**	**4.00**	**1.00**	**Yes**	
Ledge	**Mid-segment**	**4.00**	**3.00**	**Yes**	

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bedrock	**25.0**	**Yes**	**No**	**Yes**	**No**
Problem	**Deposition Above,Scour Below**				
Bridge	**42.0**	**Yes**	**Yes**	**No**	**Yes**
Problem	**None**				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**8**	**None**	**Yes**
7.2 Channel Aggradation	**12**	**None**	**No**
7.3 Widening Channel	**14**		**No**
7.4 Change in Planform	**13**		**No**
Total Score	**47**		
Geomorphic Rating	**0.5875**		

Channel Evolution Model **F**

Channel Evolution Stage **IV**

Geomorphic Condition **Fair**

Stream Sensitivity **Very High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Narrative:

major historic degradation, minor aggradation, widening and planform adjustment.

Stream: **Dog River** Reach # **M18** Segment: **A** Completion Date: **September 8, 2008**

Organization: **Bear Creek Environmental** Observers: **CS, GA** Why Not assessed: Rain: **Yes**

Segment Length (ft): **985** Segment Location: **Segment begins about 2000 feet upstream of Rt 12A bridge at Northfield Country Club and**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Subreach**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	985	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	Extremely	Extremely
Continuous w/	Never	Never
W/in 1 Bankfill	Sometimes	Never
Texture	Bedrock	Not Evalua

1.5 Valley Features

Valley Width (ft) **196**

Width Determination **Measured**

Confinement Type **Narrow**

Rock Gorge? **No**

Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **36**

2.2 Max Depth (ft) **4.70**

2.3 Mean Depth (ft) **3.60**

2.4 Floodprone Width (ft) **55**

Notes:

Short segment runs very close to Rt 12A on LB. Many grade controls and step pool bedform. Very minor change in valley width due to road, but phase 1 valley wall is just on the other side of the road, segment is B step pool by reference (sub reach). No subclass

Step 2. (Contued)

2.5 Aband. Floodpln **4.70** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **10.00**

2.7 Entrenchment Ratio **1.54**

2.8 Incision Ratio **1.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Sedimented**

2.11 Riffle/Step Spacing (ft) **85**

2.12 Substrate Composition

Bedrock	0 %
Boulder	11 %
Cobble	41 %
Coarse Gravel	29 %
Fine Gravel	11 %
Sand	8 %
Silt and smaller	0 %

Silt/Clay Present? **No**

Detritus **2** %

Large Woody **4**

2.13 Average Largest Particle on

Bed **11.2** **inches**

Bar **7.5** **inches**

2.14 Stream Type

Stream Type: **B**

Bed Material: **Cobble**

Subclass Slope: **None**

Bed Form: **Step-Pool**

Field Measured Slope:

2.15 Reference Stream Type

(if different from Phase 1)

B 3 Non Step-Pool

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	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Boulder/Cobbl	Gravel
Consistency	Non-cohesive	Non-cohesive
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)	654	31
Near Bank Veg. Type	Left	Right
Dominant	Invasives	Deciduous
Sub-dominant	None	Invasives
Bank Canopy	Left	Right
Canopy %	1-25	26-50
Mid-Channel Canopy		Open

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	0-25	>100
Sub-dominant	None	None
W less than 25	949	0
Buffer Veg. Type	Left	Right
Dominant	None	Coniferous
Sub-dominant	None	Herbaceous

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Residential	Forest
Sub-dominant	None	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

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
2	0	5
Diagonal	**Delta**	**Island**
0	1	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: **964**

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: **Dog River** Reach # **M18** Segment: **A** Completion Date: **September 8,**

Organization: **Bear Creek Environmental** Observers: **CS, GA** Rain: **Yes**

Segment Length (ft): **985** Segment Location: **Segment begins about 2000 feet upstream of Rt 12A bridge at Northfield Country Club**

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**	**5.00**	**3.00**	**Yes**	
Ledge	**Mid-segment**	**2.00**	**1.00**	**Yes**	
Ledge	**Mid-segment**	**13.00**	**3.00**	**Yes**	
Ledge	**Mid-segment**	**4.00**	**3.00**	**Yes**	
Ledge	**Mid-segment**	**4.00**	**3.00**	**Yes**	
Ledge	**Mid-segment**	**4.00**	**2.00**	**Yes**	

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	**41.0**	**Yes**	**Yes**	**Yes**	**Yes**

Problem **Scour Above,Scour Below**

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**16**	**None**	**No**
7.2 Channel Aggradation	**12**	**None**	**No**
7.3 Widening Channel	**14**		**No**
7.4 Change in Planform	**15**		**No**
Total Score	**57**		
Geomorphic Rating	**0.7125**		

Channel Evolution Model **F**

Channel Evolution Stage **I**

Geomorphic Condition **Good**

Stream Sensitivity **Moderate**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Narrative:

Minor aggradation, widening and planform adjustment. Multiple grade controls in segment.

Stream: **Dog River** Reach # **M18** Segment: **B** Completion Date: **June 26, 2008**

Organization: **Bear Creek Environmental** Observers: **CS, GA** Why Not assessed: Rain: **Yes**

Segment Length (ft): **3,933** Segment Location: **Segment begins where river first turns away from road and continues upstream to**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Grade Controls**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	1,159	51
height	0	0
Railroads	455	0
height	0	0
Improved Paths	0	0
height	0	0
Development	0	417

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

1.5 Valley Features

Valley Width (ft) **400**

Width Determination **Measured**

Confinement Type **Broad**

Rock Gorge? **No**

Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **36**

2.2 Max Depth (ft) **3.10**

2.3 Mean Depth (ft) **2.02**

2.4 Floodprone Width (ft) **369**

Notes:

Upper part of segment runs along agricultural field and is more broad than lower part of segment. Segmented due to presence of grade controls in M18A. This segment has some good pools including one huge mega-pool at the sharp bend. Banks generally

Step 2. (Contued)

2.5 Aband. Floodpln **5.10** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **17.97**

2.7 Entrenchment Ratio **10.18**

2.8 Incision Ratio **1.65**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Sedimented**

2.11 Riffle/Step Spacing (ft) **161**

2.12 Substrate Composition

Bedrock	0%
Boulder	2%
Cobble	28%
Coarse Gravel	55%
Fine Gravel	10%
Sand	5%
Silt and smaller	0%

Silt/Clay Present? **No**

Detritus **2** %

Large Woody **69**

2.13 Average Largest Particle on

Bed **11.0** **inches**

Bar **7.0** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

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 **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Gravel	Gravel
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	294	243
Erosion Height (ft)	4.38	5.00
Revetmt. Type	Rip-Rap	Rip-Rap
Revetmt. Length (ft)	398	179
Near Bank Veg. Type	Left	Right
Dominant	Invasives	Invasives
Sub-dominant	Deciduous	Deciduous
Bank Canopy	Left	Right
Canopy %	51-75	76-100

Mid-Channel Canopy **Closed**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	51-100	>100
Sub-dominant	0-25	0-25
W less than 25	1,280	456
Buffer Veg. Type	Left	Right
Dominant	Herbaceous	Mixed Trees
Sub-dominant	Mixed Trees	Shrubs/Saplin

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Residential	Forest
Sub-dominant	Crop	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 **1**

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
2	6	14
Diagonal	Delta	Island
4	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
3	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
8	0	Yes

5.4 Stream Ford or Animal **Yes**

5.5 Straightening **Straightening**

Straightening Length: **1,634**

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: **Dog River** Reach # **M18** Segment: **B** Completion Date: **June 26, 2008**

Organization: **Bear Creek Environmental** Observers: **CS, GA** Rain: **Yes**

Segment Length (ft): **3,933** Segment Location: **Segment begins where river first turns away from road and continues upstream to**

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	**28.0**	**Yes**	**Yes**	**Yes**	**Yes**

Problem **Deposition Below**

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**8**	**None**	**Yes**
7.2 Channel Aggradation	**10**	**None**	**No**
7.3 Widening Channel	**13**		**No**
7.4 Change in Planform	**13**		**No**
Total Score	**44**		
Geomorphic Rating	**0.55**		

Channel Evolution Model **F**

Channel Evolution Stage **III**

Geomorphic Condition **Fair**

Stream Sensitivity **Very High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Narrative:

Major historic degradation, major aggradation, minor widening and minor planform adjustment.

Stream: **Dog River** Reach # **M19** Segment: **A** Completion Date: **June 26, 2008**

Organization: **Bear Creek Environmental** Observers: **MN, SP** Why Not assessed: Rain: **Yes**

Segment Length (ft): **4,281** Segment Location: **Segment begins at confluence with Felchner Brook and continues upstream to Rt 12A**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Valley Width**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	2,948	200
height	0	0
Railroads	178	0
height	0	0
Improved Paths	0	0
height	0	0
Development	1,305	0

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

1.5 Valley Features

Valley Width (ft) **201**

Width Determination **Measured**

Confinement Type **Broad**

Rock Gorge? **No**

Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **28**

2.2 Max Depth (ft) **2.35**

2.3 Mean Depth (ft) **1.77**

2.4 Floodprone Width (ft) **125**

Notes:

Alders dominant at downstream end of reach. In stage III but very little bank erosion.

Step 2. (Contued)

2.5 Aband. Floodpln **3.75** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **15.82**

2.7 Entrenchment Ratio **4.46**

2.8 Incision Ratio **1.60**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Moderate**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **142**

2.12 Substrate Composition

Bedrock	0%
Boulder	3%
Cobble	35%
Coarse Gravel	43%
Fine Gravel	18%
Sand	1%
Silt and smaller	0%

Silt/Clay Present? **Yes**

Detritus **2** %

Large Woody **123**

2.13 Average Largest Particle on

Bed **11.0** **inches**

Bar **9.0** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

Field Measured Slope:

2.15 Reference Stream Type (if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	One	50.00
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Gravel	Gravel
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	570	433
Erosion Height (ft)	4.21	4.79
Revetmt. Type	Multiple	Multiple
Revetmt. Length (ft)	686	310
Near Bank Veg. Type	Left	Right
Dominant	Deciduous	Deciduous
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin
Bank Canopy	Left	Right
Canopy %	76-100	26-50
Mid-Channel Canopy		Open

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	26-50	>100
Sub-dominant	0-25	51-100
W less than 25	559	563
Buffer Veg. Type	Left	Right
Dominant	Deciduous	Deciduous
Sub-dominant	Herbaceous	Shrubs/Saplin

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Residential	Forest
Sub-dominant	Forest	Residential
Mass Failures	0	47
Height	0	50
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

Impoundmt. Location

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

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	2
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	8	21

Diagonal	Delta	Island
2	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
3	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
6	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **1,415**

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: **Dog River** Reach # **M19** Segment: **A** Completion Date: **June 26, 2008**

Organization: **Bear Creek Environmental** Observers: **MN, SP** Rain: **Yes**

Segment Length (ft): **4,281** Segment Location: **Segment begins at confluence with Felchner Brook and continues upstream to Rt 12A**

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken
Ledge	**Mid-segment**	**3.00**	**1.00**	**Yes**	

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	**28.0**	**Yes**	**Yes**	**Yes**	**Yes**
Problem	**None**				
Old	**19.5**	**Yes**	**Yes**	**Yes**	**Yes**
Problem	**Deposition Below,Scour Above,Scour**				
Bridge	**46.5**	**Yes**	**Yes**	**No**	**Yes**
Problem	**None**				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**9**	**None**	**Yes**
7.2 Channel Aggradation	**13**	**None**	**No**
7.3 Widening Channel	**14**		**No**
7.4 Change in Planform	**13**		**Yes**
Total Score	**49**		
Geomorphic Rating	**0.6125**		

Channel Evolution Model **F**

Channel Evolution Stage **III**

Geomorphic Condition **Fair**

Stream Sensitivity **Very High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Narrative:

Major historic degradation, minor aggradation, widening and planform adjustment.

Project: **Dog River** — **Phase 2 Segment Summary** — March 2, 2009 SGAT Version: 4.56

Stream: **Dog River** Reach # **M19** Segment: **B** Completion Date: **June 30, 2008**

Organization: **Bear Creek Environmental** Observers: **MN, CS, SN, TC** Why Not assessed: **bedrock gorge** Rain: **Yes**

Segment Length (ft): **571** Segment Location: **Segment begins just above Rt 12A bridge and continues upstream for 571 feet to end of**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Valley Width**

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	64
height	0	0
Improved Paths	0	0
height	0	0
Development	160	0

1.4 Adjacent Side	Left	Right
Hillside Slope	Extremely	Extremely
Continuous w/	Always	Always
W/in 1 Bankfill	Always	Always
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **40**

Width Determination **Measured**

Confinement Type **Narrowly**

Rock Gorge? **Yes**

Human-caused Change? **No**

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:

Narrowly confined, bedrock dominated segment. Railroad bridge crosses river in this segment but is very high and is not a constriction (channel or floodprone) since it's so much higher than the river, and the river is so confined in this area. Subreach is F1 by

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 **2** %

Large Woody **6**

2.13 Average Largest Particle on

Bed **0.0**

Bar **0.0**

2.14 Stream Type

Stream Type: **F**

Bed Material: **Bedrock**

Subclass Slope: **None**

Bed Form: **Step-Pool**

Field Measured Slope:

2.15 Reference Stream Type

(if different from Phase 1)

F 1 Non Step-Pool

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	Bedrock	Bedrock
Consistency	Cohesive	Cohesive
Lower		
Material Type	Bedrock	Bedrock
Consistency	Cohesive	Cohesive

Bank Erosion	Left	Right
Erosion Length (ft)	40	0
Erosion Height (ft)	4.00	0.00
Revetmt. Type	None	None
Revetmt. Length (ft)	0	0

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

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

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

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

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

3.3 Riparian Corridor

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

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
1	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 **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: **Dog River** Reach # **M19** Segment: **B** Completion Date: **June 30, 2008**

Organization: **Bear Creek Environmental** Observers: **MN, CS, SN, TC** Rain: **Yes**

Segment Length (ft): **571** Segment Location: **Segment begins just above Rt 12A bridge and continues upstream for 571 feet to end**

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken
Ledge	**Mid-segment**	**5.00**	**3.00**	**Yes**	
Ledge	**Mid-segment**	**8.00**	**3.00**	**Yes**	
Ledge	**Mid-segment**	**3.00**	**2.00**	**Yes**	
Ledge	**Mid-segment**	**4.00**	**2.00**	**Yes**	
Ledge	**Mid-segment**	**4.00**	**2.00**	**Yes**	

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bedrock	**5.00**	**Yes**	**No**	**Yes**	**No**

Problem **Scour Below**

Narrative:

Step 7. Rapid Geomorphic Assessment Data

Confinement Type

Channel Evolution Model

Channel Evolution Stage

Geomorphic Condition **Good**

Stream Sensitivity

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Project: **Dog River**

Phase 2 Segment Summary

March 2, 2009 SGAT Version: 4.56

Stream: **Dog River** Reach # **M19** Segment: **C** Completion Date: **June 30, 2008**

Organization: **Bear Creek Environmental** Observers: **MN, CS, SN, TC** Why Not assessed: Rain: **Yes**

Segment Length (ft): **1,118** Segment Location: **Segment begins at end of bedrock gorge, about 250 feet upstream of high railroad bridge,**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Valley Width**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	0	52
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	8	0

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

1.5 Valley Features

Valley Width (ft)	326
Width Determination	Measured
Confinement Type	Broad
Rock Gorge?	No
Human-caused Change?	Yes

Step 2. Stream Channel

2.1 Bankfull Width	31
2.2 Max Depth (ft)	2.70
2.3 Mean Depth (ft)	1.92
2.4 Floodprone Width (ft)	134

Notes:

Foot bridge constriction did not get full structure assessment since it is not a permanent structure. Segment in good condition generally, minimally impacted and many grade controls. RGA resulting in fair condition due to historic incision.

Step 2. (Contued)

2.5 Aband. Floodpln	4.50 ft.
Human Elev Floodpln	0.00 ft.
2.6 Width/Depth Ratio	16.15
2.7 Entrenchment Ratio	4.31
2.8 Incision Ratio	1.67
Human Elevated Inc Rat	0.00
2.9 Sinuosity	Moderate
2.10 Riffles Type	Complete
2.11 Riffle/Step Spacing (ft)	100

2.12 Substrate Composition

Bedrock	3%
Boulder	5%
Cobble	28%
Coarse Gravel	49%
Fine Gravel	13%
Sand	2%
Silt and smaller	0%

Silt/Clay Present?	No
Detritus	2 %
# Large Woody	31

2.13 Average Largest Particle on

Bed	10.0	inches
Bar	9.0	inches

2.14 Stream Type

Stream Type:	C
Bed Material:	Gravel
Subclass Slope:	None
Bed Form:	Riffle-Pool
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 **Steep**

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

Bank Erosion	Left	Right
Erosion Length (ft)	158	112
Erosion Height (ft)	4.04	6.30
Revetmt. Type	None	None
Revetmt. Length (ft)	0	0

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

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

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	>100
Sub-dominant	26-50	None
W less than 25	131	0

Buffer Veg. Type	Left	Right
Dominant	Deciduous	Deciduous
Sub-dominant	Herbaceous	Herbaceous

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	Minimal
4.3 Flow Status	Moderate
4.4 # of Debris Jams	1
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
1	3	3

Diagonal	Delta	Island
0	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
2	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.

Stream: **Dog River** Reach # **M19** Segment: **C** Completion Date: **June 30, 2008**

Organization: **Bear Creek Environmental** Observers: **MN, CS, SN, TC** Rain: **Yes**

Segment Length (ft): **1,118** Segment Location: **Segment begins at end of bedrock gorge, about 250 feet upstream of high railroad**

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken
Waterfall	**Mid-segment**	**15.00**	**12.00**	**Yes**	
Ledge	**Mid-segment**	**4.00**	**2.00**	**Yes**	
Ledge	**Mid-segment**	**4.00**	**2.00**	**Yes**	

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	**33.2**	**Yes**	**Yes**	**No**	**Yes**
Problem	**None**				
Bridge	**28.0**	**Yes**	**No**	**Yes**	**Yes**
Problem	**None**				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**8**	**None**	**Yes**
7.2 Channel Aggradation	**14**	**None**	**No**
7.3 Widening Channel	**14**		**No**
7.4 Change in Planform	**13**		**No**
Total Score	**49**		
Geomorphic Rating	**0.6125**		

Channel Evolution Model **F**

Channel Evolution Stage **III**

Geomorphic Condition **Fair**

Stream Sensitivity **Very High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Narrative:

Major historic degradation, minor aggradation, widening and planform adjustment

Stream: **Dog River** Reach # **M20** Segment: **A** Completion Date: **October 16, 2008**

Organization: **Bear Creek Environmental** Observers: **MN, CS** Why Not assessed: Rain: **No**

Segment Length (ft): **1,318** Segment Location: **Segment begins about 225 below railroad bridge and continues upstream to about 150 feet**

QC Status - Staff: Provisional Cons

Step 1. Valley and Floodplain

1.1 Segmentation **Valley Width**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	0	56
height	0	0
Railroads	510	42
height	0	0
Improved Paths	0	0
height	0	0
Development	0	0

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

1.5 Valley Features

Valley Width (ft) **105**

Width Determination **Measured**

Confinement Type **Semi-confined**

Rock Gorge? **No**

Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **34**

2.2 Max Depth (ft) **3.55**

2.3 Mean Depth (ft) **2.19**

2.4 Floodprone Width (ft) **58**

Notes:

Railroad runs along right bank very close to stream for a good portion of this segment. Rabbit Hollow Road bridge is very high and not impacting the river at all, did not do full structure assessment on this structure.

Passed *Step 2. (Contued)*

2.5 Aband. Floodpln **6.05** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **15.53**

2.7 Entrenchment Ratio **1.69**

2.8 Incision Ratio **1.70**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **202**

2.12 Substrate Composition

Bedrock	1 %
Boulder	21 %
Cobble	44 %
Coarse Gravel	17 %
Fine Gravel	7 %
Sand	10 %
Silt and smaller	0 %

Silt/Clay Present? **No**

Detritus **2** %

Large Woody **7**

2.13 Average Largest Particle on

Bed **12.6** **inches**

Bar **8.9** **inches**

2.14 Stream Type

Stream Type: **B**

Bed Material: **Cobble**

Subclass Slope: **c**

Bed Form: **Riffle-Pool**

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 **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Boulder/Cobbl	Boulder/Cobbl
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	39	129
Erosion Height (ft)	5.00	6.12
Revetmt. Type	Multiple	Multiple
Revetmt. Length (ft)	153	505
Near Bank Veg. Type	Left	Right
Dominant	Coniferous	Herbaceous
Sub-dominant	Herbaceous	Shrubs/Saplin
Bank Canopy	Left	Right
Canopy %	76-100	1-25

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	51-100
Sub-dominant	None	0-25
W less than 25	0	810
Buffer Veg. Type	Left	Right
Dominant	Mixed Trees	Herbaceous
Sub-dominant	Herbaceous	Mixed Trees

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Forest	Industrial
Sub-dominant	None	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 **Minimal**

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) **80**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
2	2	8
Diagonal	**Delta**	**Island**
0	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.
0	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **409**

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: **Dog River** Reach # **M20** Segment: **A** Completion Date: **October 16, 2008**

Organization: **Bear Creek Environmental** Observers: **MN, CS** Rain: **No**

Segment Length (ft): **1,318** Segment Location: **Segment begins about 225 below railroad bridge and continues upstream to about 150**

1.6 Grade Controls

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

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bedrock	**20.0**	**Yes**	**No**	**Yes**	**Yes**
Problem	**Deposition Above**				
Bridge	**75.0**	**Yes**	**No**	**No**	**Yes**
Problem	**None**				
Bridge	**18.0**	**Yes**	**Yes**	**Yes**	**Yes**
Problem	**Scour Above,Scour Below,Alignment**				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**5**	**C to B**	**Yes**
7.2 Channel Aggradation	**14**	**None**	**Yes**
7.3 Widening Channel	**15**		**No**
7.4 Change in Planform	**13**		**No**
Total Score	**47**		
Geomorphic Rating	**0.5875**		

Channel Evolution Model **F**

Channel Evolution Stage **II**

Geomorphic Condition **Fair**

Stream Sensitivity **High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Narrative:

extreme historic degradation, minor aggradation, widening and planform adjustment.

Phase 2 Segment Summary

Reach # M20 | Observers: CS, TL, MN | Segment Location: Segment begins about 150 feet upstream of Rabbit Hollow Road bridge and continues

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation: **Banks and Buffers**

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	98	0
height	0	0
Improved Paths	0	0
height	0	0
Development	0	0

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

1.5 Valley Features

Valley Width (ft)	323
Width Determination	Measured
Confinement Type	Very Broad
Rock Gorge?	No
Human-caused Change?	Yes

Step 2. Stream Channel

2.1 Bankfull Width	35
2.2 Max Depth (ft)	3.00
2.3 Mean Depth (ft)	1.56
2.4 Floodprone Width (ft)	295

Notes:

Segment has extensive wetlands on both sides of the stream. Off stream pond on left bank in yard. Buffer could be improved on left bank at downstream end of segment (possible planting project).

Step 2. (Contued)

2.5 Aband. Floodpln	4.00 ft.
Human Elev Floodpln	0.00 ft.
2.6 Width/Depth Ratio	22.44
2.7 Entrenchment Ratio	8.41
2.8 Incision Ratio	1.33
Human Elevated Inc Rat	0.00
2.9 Sinuosity	Moderate
2.10 Riffles Type	Sedimented
2.11 Riffle/Step Spacing (ft)	89

2.12 Substrate Composition

Bedrock	0 %
Boulder	0 %
Cobble	20 %
Coarse Gravel	57 %
Fine Gravel	11 %
Sand	12 %
Silt and smaller	0 %

Silt/Clay Present?	No
Detritus	2 %
# Large Woody	3

2.13 Average Largest Particle on

Bed	5.0	inches
Bar	4.4	inches

2.14 Stream Type

Stream Type:	C
Bed Material:	Gravel
Subclass Slope:	None
Bed Form:	Riffle-Pool
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: **Steep**

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

Bank Erosion	Left	Right
Erosion Length (ft)	278	183
Erosion Height (ft)	3.47	1.28
Revetmt. Type	Rip-Rap	None
Revetmt. Length (ft)	53	0

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

Bank Canopy	Left	Right
Canopy %	26-50	51-75
Mid-Channel Canopy	Open	

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	>100
Sub-dominant	0-25	51-100
W less than 25	301	0

Buffer Veg. Type	Left	Right
Dominant	Herbaceous	Herbaceous
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	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	0
Affected Length (ft)	0

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
1	3	6
Diagonal	**Delta**	**Island**
2	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
2	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
4	0	No

5.4 Stream Ford or Animal	No
5.5 Straightening	Straightening
Straightening Length:	9
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: **Dog River** Reach # **M20** Segment: **B** Completion Date: **October 16, 2008**

Organization: **Bear Creek Environmental** Observers: **CS, TL, MN** Rain: **No**

Segment Length (ft): **904** Segment Location: **Segment begins about 150 feet upstream of Rabbit Hollow Road bridge and continues**

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**	**Yes**
7.2 Channel Aggradation	**11**	**None**	**No**
7.3 Widening Channel	**13**		**No**
7.4 Change in Planform	**10**		**No**
Total Score	**47**		
Geomorphic Rating	**0.5875**		

Channel Evolution Model **F**

Channel Evolution Stage **III**

Geomorphic Condition **Fair**

Stream Sensitivity **Very High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Narrative:

minor historic degradation, minor aggradation and widening, major planform adjustment.

Project: **Dog River**

Phase 2 Segment Summary

March 2, 2009 SGAT Version: 4.56

Stream: **Dog River** Reach # **M20** Segment: **C** Completion Date: **October 16, 2008**

Organization: **Bear Creek Environmental** Observers: **CS, MN, TL** Why Not assessed: Rain: **Yes**

Segment Length (ft): **1,651** Segment Location: **Segment begins where valley wall begins to narrow and railroad begins to run very close to**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Banks and Buffers**

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	1,608	0
height	0	0
Improved Paths	0	0
height	0	0
Development	0	0

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

1.5 Valley Features

Valley Width (ft) **134**

Width Determination **Measured**

Confinement Type **Narrow**

Rock Gorge? **No**

Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **42**

2.2 Max Depth (ft) **2.45**

2.3 Mean Depth (ft) **1.65**

2.4 Floodprone Width (ft) **117**

Notes:

Segment is extremely straight and railroad runs along right bank for entire segment. Good buffers on left bank.

Step 2. (Contued)

2.5 Aband. Floodpln **3.45** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **25.45**

2.7 Entrenchment Ratio **2.77**

2.8 Incision Ratio **1.41**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **159**

2.12 Substrate Composition

Bedrock	0%
Boulder	0%
Cobble	14%
Coarse Gravel	54%
Fine Gravel	17%
Sand	15%
Silt and smaller	0%

Silt/Clay Present? **No**

Detritus **2** %

Large Woody **9**

2.13 Average Largest Particle on

Bed **4.9** **inches**

Bar **4.2** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

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 **Steep**

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

Bank Erosion	Left	Right
Erosion Length (ft)	172	235
Erosion Height (ft)	3.20	3.41
Revetmt. Type	None	None
Revetmt. Length (ft)	0	0

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

Bank Canopy	Left	Right
Canopy %	51-75	76-100

Mid-Channel Canopy **Closed**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	26-50
Sub-dominant	None	0-25
W less than 25	0	575

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

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Forest	Industrial
Sub-dominant	None	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

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	13

Diagonal	Delta	Island
1	1	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
4	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: **1,584**

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: **Dog River** Reach # **M20** Segment: **C** Completion Date: **October 16, 2008**

Organization: **Bear Creek Environmental** Observers: **CS, MN, TL** Rain: **Yes**

Segment Length (ft): **1,651** Segment Location: **Segment begins where valley wall begins to narrow and railroad begins to run very**

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	**9**	**None**	**Yes**
7.2 Channel Aggradation	**13**	**None**	**No**
7.3 Widening Channel	**12**		**No**
7.4 Change in Planform	**13**		**No**
Total Score	**47**		
Geomorphic Rating	**0.5875**		

Channel Evolution Model **F**

Channel Evolution Stage **III**

Geomorphic Condition **Fair**

Stream Sensitivity **Very High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Narrative:

major historic degradation, minor aggradation, widening and planform adjustment.

Stream: **Dog River** Reach # **M21** Segment: **A** Completion Date: **October 15, 2008**

Organization: **Bear Creek Environmental** Observers: **CS, MN** Why Not assessed: Rain: **No**

Segment Length (ft): **764** Segment Location: **Segment begins just below railroad bridge and continues upstream for 764 feet to just**

QC Status - Staff: Provisional Cons Passed

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	29
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	Steep	Hilly
Continuous w/	Never	Never
W/in 1 Bankfill	Never	Never
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **322**

Width Determination **Measured**

Confinement Type **Very Broad**

Rock Gorge? **No**

Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **25**

2.2 Max Depth (ft) **3.70**

2.3 Mean Depth (ft) **2.31**

2.4 Floodprone Width (ft) **214**

Notes:

Channel is very straight but no direct evidence that portion located away from road has been straightened. Alders along bank are holding banks together and are preventing widening especially at upstream end of segment.

Step 2. (Contued)

2.5 Aband. Floodpln **5.40** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **10.69**

2.7 Entrenchment Ratio **8.64**

2.8 Incision Ratio **1.46**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Sedimented**

2.11 Riffle/Step Spacing (ft) **88**

2.12 Substrate Composition

Bedrock	0%
Boulder	1%
Cobble	50%
Coarse Gravel	42%
Fine Gravel	2%
Sand	5%
Silt and smaller	0%

Silt/Clay Present? **No**

Detritus **2** %

Large Woody **3**

2.13 Average Largest Particle on

Bed **7.1** **inches**

Bar **5.1** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Cobble**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

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 **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Gravel	Gravel
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	256	206
Erosion Height (ft)	3.77	3.38
Revetmt. Type	Multiple	Multiple
Revetmt. Length (ft)	40	112
Near Bank Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Shrubs/Saplin
Sub-dominant	Herbaceous	Herbaceous
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	83	475
Buffer Veg. Type	Left	Right
Dominant	Deciduous	Deciduous
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin

3.3 Riparian Corridor

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

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	6

Diagonal	Delta	Island
2	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.
2	0	No

5.4 Stream Ford or Animal **Yes**

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: **Dog River** Reach # **M21** Segment: **A** Completion Date: **October 15, 2008**

Organization: **Bear Creek Environmental** Observers: **CS, MN** Rain: **No**

Segment Length (ft): **764** Segment Location: **Segment begins just below railroad bridge and continues upstream for 764 feet to just**

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	**25.0**	**Yes**	**No**	**Yes**	**Yes**
Problem	**Deposition Below**				
Bridge	**18.2**	**Yes**	**Yes**	**Yes**	**Yes**
Problem	**Deposition Above,Scour Above,Alignment**				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**10**	**None**	**Yes**
7.2 Channel Aggradation	**14**	**None**	**No**
7.3 Widening Channel	**12**		**No**
7.4 Change in Planform	**14**		**No**
Total Score	**50**		
Geomorphic Rating	**0.625**		

Channel Evolution Model **F**

Channel Evolution Stage **III**

Geomorphic Condition **Fair**

Stream Sensitivity **High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Narrative:

major historic degradation, minor widening, aggradation and planform adjustment. Minor widening as evident by 33% bank erosion (L) and 30% (R).

Project: **Dog River**

Phase 2 Segment Summary

March 2, 2009 SGAT Version: 4.56

Stream: **Dog River** Reach # **M21** Segment: **B** Completion Date: **September 24, 2008**

Organization: **Bear Creek Environmental** Observers: **MN, TL** Why Not assessed: **wetland** Rain: **No**

Segment Length (ft): **5,781** Segment Location: **Segment begins just above Rt 12 A (Roxbury Road) bridge and continues through wetland**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Banks and Buffers**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	239	145
height	0	0
Railroads	44	34
height	0	0
Improved Paths	0	0
height	0	0
Development	0	0

1.4 Adjacent Side	Left	Right
Hillside Slope	Hilly	Hilly
Continuous w/	Never	Never
W/in 1 Bankfill	Never	Never
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft) **596**

Width Determination **Measured**

Confinement Type **Very Broad**

Rock Gorge? **No**

Human-caused Change? **Yes**

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:

Wetland segment, channels split, some clay present in isolated areas of lower bank. Segment break between B and C at wetland where channel braids. Relocated channel included in segment C.

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? **Yes**

Detritus **0** %

Large Woody **0**

2.13 Average Largest Particle on

Bed **0.0**

Bar **0.0**

2.14 Stream Type

Stream Type: **E**

Bed Material: **Sand**

Subclass Slope: **None**

Bed Form: **Dune-Ripple**

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 **Shallow**

Bank Texture	Left	Right
Upper		
Material Type	Silt	Silt
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	20	0
Erosion Height (ft)	4.00	0.00
Revetmt. Type	Multiple	Multiple
Revetmt. Length (ft)	179	131
Near Bank Veg. Type	Left	Right
Dominant	Herbaceous	Herbaceous
Sub-dominant	None	None
Bank Canopy	Left	Right
Canopy %	0	0
Mid-Channel Canopy		Open

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	>100
Sub-dominant	None	0-25
W less than 25	29	34
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	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 **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 **2**

Affected Length (ft) **250**

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 **Gravel Mining**

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	**12.3**	**Yes**	**Yes**	**Yes**	**Yes**
Problem	**Scour Below**				
Bridge	**20.5**	**Yes**	**Yes**	**Yes**	**Yes**
Problem	**None**				
Bridge	**36.0**	**Yes**	**Yes**	**Yes**	**Yes**
Problem	**None**				
Bridge	**43.0**	**Yes**	**Yes**	**Yes**	**Yes**
Problem	**Alignment**				

Narrative:

Step 7. Rapid Geomorphic Assessment Data

Confinement Type

Channel Evolution Model
Channel Evolution Stage
Geomorphic Condition **Good**
Stream Sensitivity

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Project: **Dog River**

Phase 2 Segment Summary

March 2, 2009 SGAT Version: 4.56

Stream: **Dog River** Reach # **M21** Segment: **C** Completion Date: **September 24, 2008**

Organization: **Bear Creek Environmental** Observers: **MN, TL** Why Not assessed: **Other (to be explained in** Rain: **No**

Segment Length (ft): **1,677** Segment Location: **Segment begins at end of wetland and has been rerouted/excavated and continues**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Flow Status**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	0	12
height	0	0
Railroads	1,677	0
height	0	0
Improved Paths	0	0
height	0	0
Development	0	0

1.4 Adjacent Side	Left	Right
Hillside Slope	Hilly	Steep
Continuous w/	Never	Never
W/in 1 Bankfull	Never	Sometimes
Texture	Other	Not Evalua

1.5 Valley Features

Valley Width (ft) **346**

Width Determination **Measured**

Confinement Type **Very Broad**

Rock Gorge? **No**

Human-caused Change? **Yes**

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:

Railroad runs along right bank cuts off floodplain. Relocated channel included in segment C to allow FEH zones to be drawn. Still defined channel at lower end of segment with good floodplain access starting at relocated section at top of rip rap. Fair

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 **3**

2.13 Average Largest Particle on

Bed **0.0**

Bar **0.0**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

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 **Steep**

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

Bank Erosion	Left	Right
Erosion Length (ft)	107	73
Erosion Height (ft)	4.00	4.02
Revetmt. Type	Multiple	Multiple
Revetmt. Length (ft)	134	557

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

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

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	0-25	0-25
Sub-dominant	None	None
W less than 25	1,178	1,325

Buffer Veg. Type	Left	Right
Dominant	Herbaceous	Herbaceous
Sub-dominant	None	None

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Hay	Industrial
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 **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 **Straightening**

Straightening Length: **1,653**

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 **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?
Other	**14.0**	**Yes**	**Yes**	**Yes**	**Yes**
Problem	**Deposition Above**				

Narrative:

Step 7. Rapid Geomorphic Assessment Data

Confinement Type

Channel Evolution Model
Channel Evolution Stage
Geomorphic Condition **Fair**
Stream Sensitivity

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Stream: **Dog River** Reach # **M21** Segment: **D** Completion Date: **September 24, 2008**

Organization: **Bear Creek Environmental** Observers: **MN, TL** Why Not assessed: Rain: **Yes**

Segment Length (ft): **963** Segment Location: **Segment begins at Warren Mountain Road bridge and continues usptream for 963 feet.**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Flow Status**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	78	0
height	3	0
Roads	0	41
height	0	0
Railroads	963	0
height	0	0
Improved Paths	0	0
height	0	0
Development	0	0

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

1.5 Valley Features

Valley Width (ft) **97**

Width Determination **Measured**

Confinement Type **Semi-confined**

Rock Gorge? **No**

Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **24**

2.2 Max Depth (ft) **3.30**

2.3 Mean Depth (ft) **2.54**

2.4 Floodprone Width (ft) **139**

Notes:

This segment is not an E channel by reference, definitely a C. The reach is channelized and bermed resulting in a cross section with a very low width to depth ratio. Extensive floodplain encroachment and poor buffers.

Step 2. (Contued)

2.5 Aband. Floodpln **5.00** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **9.25**

2.7 Entrenchment Ratio **5.91**

2.8 Incision Ratio **1.52**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **76**

2.12 Substrate Composition

Bedrock	0%
Boulder	0%
Cobble	25%
Coarse Gravel	52%
Fine Gravel	15%
Sand	8%
Silt and smaller	0%

Silt/Clay Present? **No**

Detritus **2** %

Large Woody **12**

2.13 Average Largest Particle on

Bed **3.8** **inches**

Bar **3.8** **inches**

2.14 Stream Type

Stream Type: **E**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

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 **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Gravel	Gravel
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	189	210
Erosion Height (ft)	5.00	5.76
Revetmt. Type	Hard Bank	Multiple
Revetmt. Length (ft)	59	138
Near Bank Veg. Type	Left	Right
Dominant	Herbaceous	Herbaceous
Sub-dominant	Invasives	Invasives
Bank Canopy	Left	Right
Canopy %	1-25	1-25
Mid-Channel Canopy		Open

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	0-25	0-25
Sub-dominant	26-50	51-100
W less than 25	850	527
Buffer Veg. Type	Left	Right
Dominant	Herbaceous	Herbaceous
Sub-dominant	None	None

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Residential	Residential
Sub-dominant	None	Industrial
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

Impoundmt. Location

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

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	2
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
2	1	10
Diagonal	**Delta**	**Island**
0	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.
0	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **534**

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: **Dog River** Reach # **M21** Segment: **D** Completion Date: **September 24,**

Organization: **Bear Creek Environmental** Observers: **MN, TL** Rain: **Yes**

Segment Length (ft): **963** Segment Location: **Segment begins at Warren Mountain Road bridge and continues usptream for 963 feet.**

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?
Old	**14.5**	**Yes**	**No**	**Yes**	**Yes**
Problem	**Deposition Above,Deposition Below,Scour**				
Bridge	**13.8**	**Yes**	**Yes**	**Yes**	**Yes**
Problem	**Deposition Above**				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**8**	**None**	**Yes**
7.2 Channel Aggradation	**13**	**None**	**No**
7.3 Widening Channel	**14**		**No**
7.4 Change in Planform	**14**		**No**
Total Score	**49**		
Geomorphic Rating	**0.6125**		

Channel Evolution Model **F**

Channel Evolution Stage **III**

Geomorphic Condition **Fair**

Stream Sensitivity **Very High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Narrative:

major historic degradation, minor aggradation, widening and planform adjustment.

Project: **Dog River**

Phase 2 Segment Summary

March 2, 2009 SGAT Version: 4.56

Stream: **Cox Brook** Reach # **T1.01** Segment: **A** Completion Date: **October 24, 2008**

Organization: **Bear Creek Environmental** Observers: **CS, MN** Why Not assessed: Rain: **Yes**

Segment Length (ft): **3,896** Segment Location: **Segment begins at confluence with Dog River and continues upstream to about 600 feet**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Valley Width**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	2,513	470
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	478	622

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

1.5 Valley Features

Valley Width (ft) **185**

Width Determination **Measured**

Confinement Type **Narrow**

Rock Gorge? **No**

Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **47**

2.2 Max Depth (ft) **3.40**

2.3 Mean Depth (ft) **2.70**

2.4 Floodprone Width (ft) **61**

Notes:

Dam was removed from this segment in September 2008. Dam was located in grade control/bedrock dominated area and did not appear to have caused any incision downstream of its former location. New grass and small saplings have been planted in

Step 2. (Contued)

2.5 Aband. Floodpln **8.00** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **17.41**

2.7 Entrenchment Ratio **1.29**

2.8 Incision Ratio **2.35**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **134**

2.12 Substrate Composition

Bedrock	29 %
Boulder	18 %
Cobble	29 %
Coarse Gravel	16 %
Fine Gravel	8 %
Sand	0 %
Silt and smaller	0 %

Silt/Clay Present? **No**

Detritus **2** %

Large Woody **36**

2.13 Average Largest Particle on

Bed **9.8** **inches**

Bar **6.1** **inches**

2.14 Stream Type

Stream Type: **F**

Bed Material: **Cobble**

Subclass Slope: **None**

Bed Form: **Step-Pool**

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 **Steep**

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

Bank Erosion	Left	Right
Erosion Length (ft)	643	412
Erosion Height (ft)	3.96	3.33
Revetmt. Type	Multiple	Multiple
Revetmt. Length (ft)	776	373

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

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

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	0-25	>100
Sub-dominant	51-100	0-25
W less than 25	1,862	1,668

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

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Residential	Forest
Sub-dominant	Forest	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 **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	1
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
11	1	33

Diagonal	Delta	Island
0	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
5	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.

Stream: **Cox Brook** Reach # **T1.01** Segment: **A** Completion Date: **October 24, 2008**

Organization: **Bear Creek Environmental** Observers: **CS, MN** Rain: **Yes**

Segment Length (ft): **3,896** Segment Location: **Segment begins at confluence with Dog River and continues upstream to about 600**

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken
Ledge	**Mid-segment**	**2.00**	**1.00**	**Yes**	
Waterfall	**Mid-segment**	**5.00**	**2.00**	**Yes**	
Ledge	**Mid-segment**	**5.00**	**3.00**	**Yes**	
Waterfall	**Mid-segment**	**20.00**	**15.00**	**Yes**	
Ledge	**Mid-segment**	**7.00**	**4.00**	**Yes**	
Ledge	**Mid-segment**	**1.00**	**1.00**	**Yes**	
Ledge	**Mid-segment**	**4.00**	**2.00**	**Yes**	
Ledge	**Mid-segment**	**6.00**	**3.00**	**Yes**	
Waterfall	**Mid-segment**	**6.00**	**4.00**	**Yes**	
Ledge	**Mid-segment**	**2.00**	**1.00**	**Yes**	
Ledge	**Mid-segment**	**3.00**	**1.00**	**Yes**	
Ledge	**Mid-segment**	**3.00**	**2.00**	**Yes**	
Ledge	**Mid-segment**	**1.00**	**1.00**	**No**	
Ledge	**Mid-segment**	**2.00**	**1.00**	**No**	

	Problem	**Deposition Above,Deposition**				
Bridge	**39.0**	**Yes**	**Yes**	**Yes**	**Yes**	
	Problem	**Deposition Above,Deposition Below,Scour**				
Bridge	**21.0**	**Yes**	**Yes**	**Yes**	**Yes**	
	Problem	**Deposition Above,Deposition Below,Scour**				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**4**	**C to F**	**Yes**
7.2 Channel Aggradation	**11**	**None**	**Yes**
7.3 Widening Channel	**14**		**No**
7.4 Change in Planform	**10**		**No**
Total Score	**39**		
Geomorphic Rating	**0.4875**		

Channel Evolution Model **F**

Channel Evolution Stage **II**

Geomorphic Condition **Fair**

Stream Sensitivity **Extreme**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Narrative:

Extreme historic incision due to encroachment. Minor aggradation and widening. Major planform adjustment.

Stream: **Cox Brook** Reach # **T1.01** Segment: **B** Completion Date: **October 24, 2008**

Organization: **Bear Creek Environmental** Observers: **CS, TL** Why Not assessed: Rain: **Yes**

Segment Length (ft): **1,061** Segment Location: **Segment begins about 600 feet upstream of Cox Brook Road bridge near intersection with**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Valley Width**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	720	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	Extremely	Steep
Continuous w/	Sometimes	Never
W/in 1 Bankfill	Sometimes	Never
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft)	183
Width Determination	Measured
Confinement Type	Narrow
Rock Gorge?	No
Human-caused Change?	Yes

Step 2. Stream Channel

2.1 Bankfull Width	53
2.2 Max Depth (ft)	3.45
2.3 Mean Depth (ft)	2.42
2.4 Floodprone Width (ft)	77

Notes:

Cox Brook Road is built up as new valley wall on RB.

Driveway bridge is very undersized and is causing some planform adjustment upstream and downstream (major flood chute).

Step 2. (Contued)

2.5 Aband. Floodpln	9.95 ft.
Human Elev Floodpln	0.00 ft.
2.6 Width/Depth Ratio	21.90
2.7 Entrenchment Ratio	1.46
2.8 Incision Ratio	2.88
Human Elevated Inc Rat	0.00
2.9 Sinuosity	Low
2.10 Riffles Type	Complete
2.11 Riffle/Step Spacing (ft)	119

2.12 Substrate Composition

Bedrock	0%
Boulder	6%
Cobble	36%
Coarse Gravel	38%
Fine Gravel	13%
Sand	7%
Silt and smaller	0%

Silt/Clay Present?	No
Detritus	2 %
# Large Woody	20

2.13 Average Largest Particle on

Bed	9.6	inches
Bar	5.0	inches

2.14 Stream Type

Stream Type:	B
Bed Material:	Gravel
Subclass Slope:	c
Bed Form:	Riffle-Pool
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 **Steep**

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

Bank Erosion	Left	Right
Erosion Length (ft)	104	96
Erosion Height (ft)	3.30	4.71
Revetmt. Type	Rip-Rap	Rip-Rap
Revetmt. Length (ft)	55	39

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

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

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	51-100
Sub-dominant	None	0-25
W less than 25	0	387

Buffer Veg. Type	Left	Right
Dominant	Coniferous	Herbaceous
Sub-dominant	None	Mixed Trees

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Forest	Residential
Sub-dominant	None	Forest
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	
Impoundmt. Location	
4.6 Up/Down strm flow reg	None
(old) Upstrm Flow Reg	

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	1
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	5

Diagonal	Delta	Island
0	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
2	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	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: **Cox Brook** Reach # **T1.01** Segment: **B** Completion Date: **October 24, 2008**

Organization: **Bear Creek Environmental** Observers: **CS, TL** Rain: **Yes**

Segment Length (ft): **1,061** Segment Location: **Segment begins about 600 feet upstream of Cox Brook Road bridge near intersection**

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	**36.0**	**Yes**	**Yes**	**Yes**	**Yes**
Problem	**Deposition Above,Deposition Below,Scour**				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**3**	**C to B**	**Yes**
7.2 Channel Aggradation	**13**	**None**	**No**
7.3 Widening Channel	**14**		**No**
7.4 Change in Planform	**9**		**No**
Total Score	**39**		
Geomorphic Rating	**0.4875**		

Channel Evolution Model **F**

Channel Evolution Stage **III**

Geomorphic Condition **Fair**

Stream Sensitivity **Very High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Narrative:

Extreme historic degradation due to road encroachment, major planform adjustment, minor aggradation and widening.

Phase 2 Segment Summary

Reach # T1.01 | Observers: CS, TL | Segment Location: Segment begins about 300 feet downstream of Jerry Road bridge and continues upstream

March 2, 2009 SGAT Version: 4.56
Segment: C | Why Not assessed:
Completion Date: October 24, 2008
Rain: Yes

QC Status - Staff: Provisional Cons

Step 1. Valley and Floodplain

1.1 Segmentation: **Grade Controls**
1.2 Alluvial Fan: **None**
1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	304	69
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	115	0

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

1.5 Valley Features

Valley Width (ft)	368
Width Determination	Measured
Confinement Type	Broad
Rock Gorge?	No
Human-caused Change?	Yes

Step 2. Stream Channel

2.1 Bankfull Width	50
2.2 Max Depth (ft)	3.75
2.3 Mean Depth (ft)	2.28
2.4 Floodprone Width (ft)	62

Notes:

Many grade controls in reach. Lots of bedrock, appears to have incised historically. Right bank could use a better buffer at upstream end of reach where there is a house. Phase 1 valley width is wider in this segment than downstream.

Passed *Step 2. (Contued)*

2.5 Aband. Floodpln	9.75 ft.
Human Elev Floodpln	0.00 ft.
2.6 Width/Depth Ratio	21.93
2.7 Entrenchment Ratio	1.24
2.8 Incision Ratio	2.60
Human Elevated Inc Rat	0.00
2.9 Sinuosity	Low
2.10 Riffles Type	Complete
2.11 Riffle/Step Spacing (ft)	148

2.12 Substrate Composition

Bedrock	43 %
Boulder	13 %
Cobble	24 %
Coarse Gravel	14 %
Fine Gravel	4 %
Sand	2 %
Silt and smaller	0 %

Silt/Clay Present?	No
Detritus	2 %
# Large Woody	6

2.13 Average Largest Particle on

Bed	10.3	inches
Bar	6.0	inches

2.14 Stream Type

Stream Type:	F
Bed Material:	Boulder
Subclass Slope:	None
Bed Form:	Step-Pool
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: **Steep**

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

Bank Erosion	Left	Right
Erosion Length (ft)	0	19
Erosion Height (ft)	0.00	10.00
Revetmt. Type	Rip-Rap	Rip-Rap
Revetmt. Length (ft)	108	278

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

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

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	0-25
Sub-dominant	0-25	26-50
W less than 25	311	776

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

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Forest	Residential
Sub-dominant	Residential	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	None
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	1
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	1	8
Diagonal	**Delta**	**Island**
0	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
2	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	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: **Cox Brook** Reach # **T1.01** Segment: **C** Completion Date: **October 24, 2008**

Organization: **Bear Creek Environmental** Observers: **CS, TL** Rain: **Yes**

Segment Length (ft): **1,333** Segment Location: **Segment begins about 300 feet downstream of Jerry Road bridge and continues**

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**	**2.00**	**2.00**	**Yes**	
Ledge	**Mid-segment**	**2.00**	**1.00**	**No**	
Ledge	**Mid-segment**	**3.00**	**2.00**	**No**	
Ledge	**Mid-segment**	**3.00**	**2.00**	**Yes**	

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	**15.0**	**Yes**	**Yes**	**Yes**	**Yes**
Problem		**Deposition Above,**		**Deposition**	

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**4**	**C to F**	**Yes**
7.2 Channel Aggradation	**13**	**None**	**No**
7.3 Widening Channel	**13**		**No**
7.4 Change in Planform	**12**		**No**
Total Score	**42**		
Geomorphic Rating	**0.525**		

Channel Evolution Model **F**

Channel Evolution Stage **II**

Geomorphic Condition **Fair**

Stream Sensitivity **High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Narrative:

Extreme historic degradation due to incision, minor aggradation, widening and planform adjustment.

Project: **Dog River**

Phase 2 Segment Summary

March 2, 2009 SGAT Version: 4.56

Stream: **Union Brook** Reach # **T2.01** Segment: **0** Completion Date: **November 3, 2008**

Organization: **Bear Creek Environmental** Observers: **PD, TL** Why Not assessed: Rain: **No**

Segment Length (ft): **2,134** Segment Location: **Reach begins at confluence with Dog River and continues upstream for 2134 feet.**

QC Status - Staff: Provisional Cons Passed

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	647	618
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	923	781

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

1.5 Valley Features

Valley Width (ft) **324**

Width Determination **Measured**

Confinement Type **Very Broad**

Rock Gorge? **No**

Human-caused Change? **No**

Step 2. Stream Channel

2.1 Bankfull Width **40**

2.2 Max Depth (ft) **3.80**

2.3 Mean Depth (ft) **2.26**

2.4 Floodprone Width (ft) **219**

Notes:

Rejuvenating trib noted as ditch from backyard across road to stream. Some plane bed features and lack of pools toward downstream end of reach. No human caused change in valley width as road running along LB is not elevated higher than floodprone

Step 2. (Contued)

2.5 Aband. Floodpln **6.20** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **17.48**

2.7 Entrenchment Ratio **5.54**

2.8 Incision Ratio **1.63**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Sedimented**

2.11 Riffle/Step Spacing (ft) **241**

2.12 Substrate Composition

Bedrock	0%
Boulder	9%
Cobble	30%
Coarse Gravel	29%
Fine Gravel	16%
Sand	16%
Silt and smaller	0%

Silt/Clay Present? **No**

Detritus **2** %

Large Woody **4**

2.13 Average Largest Particle on

Bed **15.6** **inches**

Bar **7.7** **inches**

2.14 Stream Type

Stream Type: **C**

Bed Material: **Gravel**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

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 **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Gravel	Gravel
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	686	538
Erosion Height (ft)	4.53	4.40
Revetmt. Type	Multiple	Multiple
Revetmt. Length (ft)	1,128	540
Near Bank Veg. Type	Left	Right
Dominant	Herbaceous	Deciduous
Sub-dominant	None	Herbaceous
Bank Canopy	Left	Right
Canopy %	1-25	26-50
Mid-Channel Canopy		Open

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	0-25	0-25
Sub-dominant	None	>100
W less than 25	2,117	1,201
Buffer Veg. Type	Left	Right
Dominant	Herbaceous	Deciduous
Sub-dominant	None	None

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Residential	Residential
Sub-dominant	None	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 **None**

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	7
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
6	1	19

Diagonal	Delta	Island
1	2	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.
4	0	Yes

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **1,771**

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: **Union Brook** Reach # **T2.01** Segment: **0** Completion Date: **November 3,**

Organization: **Bear Creek Environmental** Observers: **PD, TL** Rain: **No**

Segment Length (ft): **2,134** Segment Location: **Reach begins at confluence with Dog River and continues upstream for 2134 feet.**

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken
Dam	**Mid-segment**	**3.00**	**2.00**	**Yes**	

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	**36.0**	**Yes**	**Yes**	**Yes**	**Yes**
Problem	**Deposition Above,Deposition Below,Scour**				
Bridge	**23.5**	**Yes**	**Yes**	**Yes**	**Yes**
Problem	**Deposition Above,Scour Above,Alignment**				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**7**	**None**	**Yes**
7.2 Channel Aggradation	**13**	**None**	**No**
7.3 Widening Channel	**12**		**No**
7.4 Change in Planform	**14**		**No**
Total Score	**46**		
Geomorphic Rating	**0.575**		

Channel Evolution Model **F**

Channel Evolution Stage **II**

Geomorphic Condition **Fair**

Stream Sensitivity **Very High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Narrative:

Major historic degradation due to encroachment, minor aggradation, minor widening, minor planform adjustment. Channel is completely straightened and heavily armored.

Stream: **Sunny Brook** Reach # **T3.01** Segment: **0** Completion Date: **October 31, 2008**

Organization: **Bear Creek Environmental** Observers: **CS, TL** Why Not assessed: Rain: **Yes**

Segment Length (ft): **6,805** Segment Location: **Reach begins at confluence with Dog River and continues upstream for 6805 feet to a**

QC Status - Staff: Provisional Cons Passed

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	5,612	268
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	907	1,324

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

1.5 Valley Features

Valley Width (ft) **192**

Width Determination **Measured**

Confinement Type **Narrow**

Rock Gorge? **No**

Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **40**

2.2 Max Depth (ft) **3.50**

2.3 Mean Depth (ft) **2.43**

2.4 Floodprone Width (ft) **65**

Notes:

Lovers Lane and VT12 run within corridor along most of the reach, extensive straightening. Many stream crossings and constrictions. Some areas with hard bank channelization on both banks.

Step 2. (Contued)

2.5 Aband. Floodpln **9.00** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **16.46**

2.7 Entrenchment Ratio **1.63**

2.8 Incision Ratio **2.57**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **181**

2.12 Substrate Composition

Bedrock	8%
Boulder	1%
Cobble	22%
Coarse Gravel	39%
Fine Gravel	6%
Sand	24%
Silt and smaller	0%

Silt/Clay Present? **No**

Detritus **2** %

Large Woody **75**

2.13 Average Largest Particle on

Bed **8.0** **inches**

Bar **4.3** **inches**

2.14 Stream Type

Stream Type: **B**

Bed Material: **Gravel**

Subclass Slope: **c**

Bed Form: **Riffle-Pool**

Field Measured Slope:

2.15 Reference Stream Type (if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	One	10.00
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Gravel	Gravel
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	637	474
Erosion Height (ft)	3.40	3.96
Revetmt. Type	Multiple	Multiple
Revetmt. Length (ft)	1,547	1,613
Near Bank Veg. Type	Left	Right
Dominant	Shrubs/Saplin	Deciduous
Sub-dominant	Deciduous	Shrubs/Saplin
Bank Canopy	Left	Right
Canopy %	51-75	51-75
Mid-Channel Canopy	Open	

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	0-25	0-25
Sub-dominant	>100	>100
W less than 25	2,187	2,801
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	Residential	Residential
Sub-dominant	Forest	Forest
Mass Failures	0	62
Height	0	10
Gullies	0	0
Height	0	0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps **Abundant**

4.2 Adjacent Wetlands **Minimal**

4.3 Flow Status **Moderate**

4.4 # of Debris Jams **2**

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	9
Other	0	Tile Drain	0
Overland Flow	2	Urb Strm Wtr Pipe	1

4.9 # of Beaver Dams **0**

Affected Length (ft) **0**

Step 5. Channel Bed and Planform Changes

5.1 Bar Types

Mid	Point	Side
5	4	33

Diagonal	Delta	Island
3	1	1

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
12	0	0	0

5.3 Steep Riffles and Head Cuts

Steep Riffles	Head Cuts	Trib Rejuv.
5	0	No

5.4 Stream Ford or Animal **No**

5.5 Straightening **Straightening**

Straightening Length: **2,192**

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: **Sunny Brook** Reach # **T3.01** Segment: **0** Completion Date: **October 31, 2008**

Organization: **Bear Creek Environmental** Observers: **CS, TL** Rain: **Yes**

Segment Length (ft): **6,805** Segment Location: **Reach begins at confluence with Dog River and continues upstream for 6805 feet to a**

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken
Ledge	**Mid-segment**	**4.00**	**2.00**	**Yes**	
Dam	**Mid-segment**	**5.00**	**3.00**	**Yes**	
Ledge	**Mid-segment**	**5.00**	**3.00**	**Yes**	
Ledge	**Mid-segment**	**4.00**	**2.00**	**Yes**	
Dam	**Mid-segment**	**19.00**	**15.00**	**Yes**	
Ledge	**Mid-segment**	**2.00**	**1.00**	**Yes**	
Ledge	**Mid-segment**	**4.00**	**3.00**	**No**	
Ledge	**Mid-segment**	**5.00**	**3.00**	**No**	
Ledge	**Mid-segment**	**4.00**	**2.00**	**Yes**	
Ledge	**Mid-segment**	**5.00**	**3.00**	**Yes**	

4.6 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bedrock	**13.0**	**Yes**	**No**	**Yes**	**Yes**
Problem	**Deposition Above,Scour Below**				
Bridge	**22.0**	**Yes**	**Yes**	**Yes**	**Yes**
Problem	**None**				
Bridge	**31.0**	**Yes**	**Yes**	**Yes**	**Yes**
Problem	**None**				
Other	**12.0**	**Yes**	**No**	**Yes**	**No**
Problem	**Deposition Above,Deposition Below,Scour**				
Bridge	**36.0**	**Yes**	**Yes**	**Yes**	**Yes**
Problem	**Deposition Below,Scour Above,Alignment**				
Bridge	**25.5**	**Yes**	**Yes**	**Yes**	**Yes**
Problem	**Deposition Below,Scour Below**				
Bridge	**31.0**	**Yes**	**Yes**	**Yes**	**Yes**
Problem	**Deposition Above,Deposition Below,Scour**				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**4**	**C to B**	**Yes**
7.2 Channel Aggradation	**13**	**None**	**No**
7.3 Widening Channel	**14**		**No**
7.4 Change in Planform	**10**		**No**
Total Score	**41**		
Geomorphic Rating	**0.5125**		

Channel Evolution Model **F**

Channel Evolution Stage **II**

Geomorphic Condition **Fair**

Stream Sensitivity **Very High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Narrative:

Extreme historic degradation due to road encroachment. Major planform adjustment, minor aggradation and widening.

Project: **Dog River**

Phase 2 Segment Summary

March 2, 2009 SGAT Version: 4.56

Stream: **Bull Run Brook** Reach # **T4.01** Segment: **0** Completion Date: **November 4, 2008**

Organization: **Bear Creek Environmental** Observers: **CS, TL** Why Not assessed: Rain: **Yes**

Segment Length (ft): **4,579** Segment Location: **Segment begins at confluence with Dog River and continues upstream to about 850 feet**

QC Status - Staff: Provisional Cons Passed

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	831	123
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	109	0

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

1.5 Valley Features

Valley Width (ft) **234**

Width Determination **Measured**

Confinement Type **Broad**

Rock Gorge? **No**

Human-caused Change? **No**

Step 2. Stream Channel

2.1 Bankfull Width **53**

2.2 Max Depth (ft) **2.75**

2.3 Mean Depth (ft) **1.80**

2.4 Floodprone Width (ft) **78**

Notes:

Upper end of reach had a section with a slightly narrower valley width but VW opened up at the very top of the reach. Overall reach was consistent. Some funky planform adjustment going on in places. Overall reach looked minimally impacted. For the most part

Step 2. (Contued)

2.5 Aband. Floodpln **2.75** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **29.44**

2.7 Entrenchment Ratio **1.47**

2.8 Incision Ratio **1.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **151**

2.12 Substrate Composition

Bedrock	0%
Boulder	7%
Cobble	35%
Coarse Gravel	30%
Fine Gravel	12%
Sand	16%
Silt and smaller	0%

Silt/Clay Present? **No**

Detritus **2** %

Large Woody **60**

2.13 Average Largest Particle on

Bed **11.7** **inches**

Bar **5.3** **inches**

2.14 Stream Type

Stream Type: **B**

Bed Material: **Gravel**

Subclass Slope: **c**

Bed Form: **Riffle-Pool**

Field Measured Slope:

2.15 Reference Stream Type (if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	One	10.00
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Steep**

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

Bank Erosion	Left	Right
Erosion Length (ft)	315	1,009
Erosion Height (ft)	4.48	4.24
Revetmt. Type	Multiple	Multiple
Revetmt. Length (ft)	103	115

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

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

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	>100
Sub-dominant	51-100	0-25
W less than 25	0	417

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

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Forest	Forest
Sub-dominant	Residential	Residential
Mass Failures	0	35
Height	0	10
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 **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	1
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
6	4	33

Diagonal	Delta	Island
0	3	1

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
9	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 **Yes**

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: **Bull Run Brook** Reach # **T4.01** Segment: **0** Completion Date: **November 4,**

Organization: **Bear Creek Environmental** Observers: **CS, TL** Rain: **Yes**

Segment Length (ft): **4,579** Segment Location: **Segment begins at confluence with Dog River and continues upstream to about 850**

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken
Waterfall	**Mid-segment**	**8.00**	**6.00**	**Yes**	
Ledge	**Mid-segment**	**1.00**	**1.00**	**Yes**	
Ledge	**Mid-segment**	**5.00**	**2.00**	**Yes**	
Ledge	**Mid-segment**	**2.00**	**1.00**	**Yes**	
Ledge	**Mid-segment**	**1.00**	**0.00**	**Yes**	

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	**20.0**	**Yes**	**Yes**	**Yes**	**Yes**
Problem	**Deposition Above,Deposition Below,Scour**				
Bridge	**22.0**	**Yes**	**Yes**	**Yes**	**Yes**
Problem	**Deposition Below,Scour Below**				
Bridge	**29.0**	**Yes**	**Yes**	**Yes**	**Yes**
Problem	**Deposition Above,Deposition Below,Scour**				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**17**	**None**	**No**
7.2 Channel Aggradation	**13**	**None**	**No**
7.3 Widening Channel	**11**		**No**
7.4 Change in Planform	**10**		**No**
Total Score	**51**		
Geomorphic Rating	**0.6375**		

Channel Evolution Model **D**

Channel Evolution Stage **IIc**

Geomorphic Condition **Fair**

Stream Sensitivity **Very High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Narrative:

Minor aggradation and widening, major planform adjustment.

Project: **Dog River**

Phase 2 Segment Summary

March 2, 2009 SGAT Version: 4.56

Stream: **Stony Brook** Reach # **T5.01** Segment: **A** Completion Date: **November 5, 2008**

Organization: **Bear Creek Environmental** Observers: **CS, MN** Why Not assessed: Rain: **No**

Segment Length (ft): **1,668** Segment Location: **Segment begins at confluence with Dog River and continues upstream for 1668 feet, just**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Channel Dimensions**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	593	88
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	Steep	Hilly
Continuous w/	Sometimes	Sometimes
W/in 1 Bankfill	Sometimes	Sometimes
Texture	Not Evalua	Not Evalua

1.5 Valley Features

Valley Width (ft)	158
Width Determination	Measured
Confinement Type	Narrow
Rock Gorge?	No
Human-caused Change?	Yes

Step 2. Stream Channel

2.1 Bankfull Width	77
2.2 Max Depth (ft)	3.40
2.3 Mean Depth (ft)	1.70
2.4 Floodprone Width (ft)	131

Notes:

Short segment with variable issues was difficult to characterize. Large channel avulsion and waterfall in reach. Channelized at lower end of reach. Cross section was measured at lower end of channel avulsion and channel is extremely over-widened.

Step 2. (Contued)

2.5 Aband. Floodpln	4.40 ft.
Human Elev Floodpln	0.00 ft.
2.6 Width/Depth Ratio	45.00
2.7 Entrenchment Ratio	1.71
2.8 Incision Ratio	1.29
Human Elevated Inc Rat	0.00
2.9 Sinuosity	Low
2.10 Riffles Type	Complete
2.11 Riffle/Step Spacing (ft)	143

2.12 Substrate Composition

Bedrock	0%
Boulder	1%
Cobble	37%
Coarse Gravel	37%
Fine Gravel	18%
Sand	7%
Silt and smaller	0%

Silt/Clay Present?	Yes
Detritus	2 %
# Large Woody	17

2.13 Average Largest Particle on

Bed	8.1	inches
Bar	6.4	inches

2.14 Stream Type

Stream Type:	B
Bed Material:	Gravel
Subclass Slope:	c
Bed Form:	Riffle-Pool
Field Measured Slope:	

2.15 Reference Stream Type (if different from Phase 1)

3.3 old	Amount	Mean Height
Failures	One	50.00
Gullies	None	0.00

Step 3. Riparian Features

3.1 Stream Banks

Typical Bank Slope **Steep**

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

Bank Erosion	Left	Right
Erosion Length (ft)	464	630
Erosion Height (ft)	3.49	2.61
Revetmt. Type	None	None
Revetmt. Length (ft)	0	0

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

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	80	0

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

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Residential	Forest
Sub-dominant	Forest	None
Mass Failures	0	103
Height	0	50
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	
Impoundmt. Location	
4.6 Up/Down strm flow reg	None
(old) Upstrm Flow Reg	

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	2
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
5	0	5

Diagonal	Delta	Island
0	0	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
4	0	1	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:	630
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: **Stony Brook** Reach # **T5.01** Segment: **A** Completion Date: **November 5,**

Organization: **Bear Creek Environmental** Observers: **CS, MN** Rain: **No**

Segment Length (ft): **1,668** Segment Location: **Segment begins at confluence with Dog River and continues upstream for 1668 feet,**

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken
Ledge	**Mid-segment**	**7.00**	**3.00**	**No**	
Waterfall	**Mid-segment**	**25.00**	**20.00**	**Yes**	
Ledge	**Mid-segment**	**1.00**	**0.00**	**Yes**	
Ledge	**Mid-segment**	**1.00**	**0.00**	**Yes**	

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Old	**26.5**	**Yes**	**No**	**Yes**	**Yes**

Problem **Deposition Above**

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**13**	**None**	**Yes**
7.2 Channel Aggradation	**12**	**None**	**No**
7.3 Widening Channel	**6**		**No**
7.4 Change in Planform	**7**		**No**

Total Score **38**

Geomorphic Rating **0.475**

Channel Evolution Model **F**

Channel Evolution Stage **III**

Geomorphic Condition **Fair**

Stream Sensitivity **Very High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Narrative:

Minor historic degradation due to channel avulsion, minor aggradation, major widening and major planform adjustment.

Project: **Dog River**

Phase 2 Segment Summary

March 2, 2009 SGAT Version: 4.56

Stream: **Stony Brook** Reach # **T5.01** Segment: **B** Completion Date: **November 5, 2008**

Organization: **Bear Creek Environmental** Observers: **CS, MN** Why Not assessed: Rain: **No**

Segment Length (ft): **3,064** Segment Location: **Segment begins at major channel avulsion and continues upstream to about 400 feet above**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Channel Dimensions**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	1,581	68
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	257	0

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

1.5 Valley Features

Valley Width (ft) **230**

Width Determination **Measured**

Confinement Type **Broad**

Rock Gorge? **No**

Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **53**

2.2 Max Depth (ft) **2.80**

2.3 Mean Depth (ft) **2.15**

2.4 Floodprone Width (ft) **109**

Notes:

Segment has many bedrock grade controls. Runs along Stony Brook Road. Evidence of road material entering stream near Stony Brook Road covered bridge.

Step 2. (Contued)

2.5 Aband. Floodpln **2.80** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **24.51**

2.7 Entrenchment Ratio **2.07**

2.8 Incision Ratio **1.00**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **171**

2.12 Substrate Composition

Bedrock	6%
Boulder	3%
Cobble	45%
Coarse Gravel	38%
Fine Gravel	5%
Sand	3%
Silt and smaller	0%

Silt/Clay Present? **No**

Detritus **2** %

Large Woody **15**

2.13 Average Largest Particle on

Bed **10.0** **inches**

Bar **6.0** **inches**

2.14 Stream Type

Stream Type: **B**

Bed Material: **Cobble**

Subclass Slope: **c**

Bed Form: **Riffle-Pool**

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 **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Gravel	Gravel
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	388	183
Erosion Height (ft)	4.23	3.64
Revetmt. Type	Hard Bank	Multiple
Revetmt. Length (ft)	35	46
Near Bank Veg. Type	Left	Right
Dominant	Herbaceous	Coniferous
Sub-dominant	Coniferous	Herbaceous
Bank Canopy	Left	Right
Canopy %	51-75	76-100
Mid-Channel Canopy		Open

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	>100
Sub-dominant	0-25	0-25
W less than 25	886	203
Buffer Veg. Type	Left	Right
Dominant	Mixed Trees	Mixed Trees
Sub-dominant	Herbaceous	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 **Abundant**

4.2 Adjacent Wetlands **Minimal**

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	6
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
8	1	27

Diagonal	Delta	Island
2	1	0

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
4	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 **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: **Stony Brook** Reach # **T5.01** Segment: **B** Completion Date: **November 5,**

Organization: **Bear Creek Environmental** Observers: **CS, MN** Rain: **No**

Segment Length (ft): **3,064** Segment Location: **Segment begins at major channel avulsion and continues upstream to about 400 feet**

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken
Ledge	**Mid-segment**	**2.00**	**1.00**	**No**	
Ledge	**Mid-segment**	**2.00**	**1.00**	**No**	
Ledge	**Mid-segment**	**2.00**	**1.00**	**Yes**	
Waterfall	**Mid-segment**	**15.00**	**10.00**	**Yes**	
Ledge	**Mid-segment**	**4.00**	**2.00**	**Yes**	
Ledge	**Mid-segment**	**1.00**	**0.00**	**Yes**	
Ledge	**Mid-segment**	**3.00**	**1.00**	**Yes**	
Ledge	**Mid-segment**	**0.00**	**0.00**	**No**	
Ledge	**Mid-segment**	**1.00**	**0.00**	**Yes**	
Ledge	**Mid-segment**	**0.00**	**0.00**	**Yes**	
Ledge	**Mid-segment**	**0.00**	**0.00**	**Yes**	
Ledge	**Mid-segment**	**1.00**	**0.00**	**No**	
Ledge	**Mid-segment**	**1.00**	**0.00**	**Yes**	
Ledge	**Mid-segment**	**1.00**	**1.00**	**Yes**	

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**17**	**None**	**No**
7.2 Channel Aggradation	**14**	**None**	**No**
7.3 Widening Channel	**13**		**No**
7.4 Change in Planform	**12**		**No**
Total Score	**56**		
Geomorphic Rating	**0.7**		

Channel Evolution Model **F**

Channel Evolution Stage **I**

Geomorphic Condition **Good**

Stream Sensitivity **Moderate**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Narrative:

Minor aggradation, widening, and planform adjustment.

Stream: **Felchner Brook** Reach # **T6.01** Segment: **A** Completion Date: **November 6, 2008**

Organization: **Bear Creek Environmental** Observers: **CS, TL** Why Not assessed: Rain: **No**

Segment Length (ft): **549** Segment Location: **Segment begins at confluence with Dog River and continues upstream for 549 feet to**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Valley Width**

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	0	0
height	0	0
Development	0	0

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

1.5 Valley Features

Valley Width (ft) **517**

Width Determination **Measured**

Confinement Type **Very Broad**

Rock Gorge? **No**

Human-caused Change? **Yes**

Step 2. Stream Channel

2.1 Bankfull Width **25**

2.2 Max Depth (ft) **2.85**

2.3 Mean Depth (ft) **2.20**

2.4 Floodprone Width (ft) **35**

Notes:

Short segment all channelized running through agricultural fields.

Step 2. (Contued)

2.5 Aband. Floodpln **6.30** ft.

Human Elev Floodpln **0.00** ft.

2.6 Width/Depth Ratio **11.14**

2.7 Entrenchment Ratio **1.43**

2.8 Incision Ratio **2.21**

Human Elevated Inc Rat **0.00**

2.9 Sinuosity **Low**

2.10 Riffles Type **Complete**

2.11 Riffle/Step Spacing (ft) **101**

2.12 Substrate Composition

Bedrock	0 %
Boulder	17 %
Cobble	35 %
Coarse Gravel	21 %
Fine Gravel	14 %
Sand	13 %
Silt and smaller	0 %

Silt/Clay Present? **No**

Detritus **2** %

Large Woody **2**

2.13 Average Largest Particle on

Bed **11.7** **inches**

Bar **6.3** **inches**

2.14 Stream Type

Stream Type: **B**

Bed Material: **Cobble**

Subclass Slope: **None**

Bed Form: **Riffle-Pool**

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 **Steep**

Bank Texture	Left	Right
Upper		
Material Type	Sand	Sand
Consistency	Non-cohesive	Non-cohesive
Lower		
Material Type	Boulder/Cobbl	Boulder/Cobbl
Consistency	Non-cohesive	Non-cohesive
Bank Erosion	Left	Right
Erosion Length (ft)	120	28
Erosion Height (ft)	5.00	4.00
Revetmt. Type	Rip-Rap	Rip-Rap
Revetmt. Length (ft)	115	73
Near Bank Veg. Type	Left	Right
Dominant	Herbaceous	Herbaceous
Sub-dominant	Shrubs/Saplin	Shrubs/Saplin
Bank Canopy	Left	Right
Canopy %	26-50	26-50
Mid-Channel Canopy	Open	

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	0-25	0-25
Sub-dominant	>100	26-50
W less than 25	426	257
Buffer Veg. Type	Left	Right
Dominant	Herbaceous	Herbaceous
Sub-dominant	Coniferous	Shrubs/Saplin

3.3 Riparian Corridor

Corridor Land	Left	Right
Dominant	Hay	Pasture
Sub-dominant	Forest	Hay
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

Impoundmt. Location

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

(old) Upstrm Flow Reg

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	1
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	2
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 **Yes**

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: **Felchner Brook** Reach # **T6.01** Segment: **A** Completion Date: **November 6,**

Organization: **Bear Creek Environmental** Observers: **CS, TL** Rain: **No**

Segment Length (ft): **549** Segment Location: **Segment begins at confluence with Dog River and continues upstream for 549 feet to**

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	**14.0**	**Yes**	**Yes**	**Yes**	**Yes**
Problem	**Deposition Above,Deposition Below,Scour**				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**4**	**C to B**	**Yes**
7.2 Channel Aggradation	**14**	**None**	**No**
7.3 Widening Channel	**15**		**No**
7.4 Change in Planform	**13**		**No**
Total Score	**46**		
Geomorphic Rating	**0.575**		

Channel Evolution Model **F**

Channel Evolution Stage **II**

Geomorphic Condition **Fair**

Stream Sensitivity **High**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Narrative:

Extreme historic degradation due to channelization, minor aggradation, widening and planform adjustment.

Stream: **Felchner Brook** Reach # **T6.01** Segment: **B** Completion Date: **November 6, 2008**

Organization: **Bear Creek Environmental** Observers: **CS, TL** Why Not assessed: **bedrock gorge** Rain: **No**

Segment Length (ft): **837** Segment Location: **Segment begins at start of bedrock gorge about 549 feet upstream of the confluence with**

QC Status - Staff: Provisional Cons

Step 1. Valley and Floodplain

1.1 Segmentation **Valley Width**

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	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	Bedrock	Bedrock

1.5 Valley Features

Valley Width (ft) **56**

Width Determination **Measured**

Confinement Type **Semi-confined**

Rock Gorge? **Yes**

Human-caused Change? **No**

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:

Bedrock gorge segment, minimally impacted. Road runs on LB outside of the valley wall.

Passed *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: **A**

Bed Material: **Bedrock**

Subclass Slope: **None**

Bed Form: **Cascade**

Field Measured Slope:

2.15 Reference Stream Type

(if different from Phase 1)

A 1 Non Cascade

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	Bedrock	Bedrock
Consistency	Cohesive	Cohesive
Lower		
Material Type	Bedrock	Bedrock
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	Coniferous	Coniferous
Sub-dominant	Herbaceous	Herbaceous

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

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

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

Buffer Veg. Type	Left	Right
Dominant	Coniferous	Coniferous
Sub-dominant	None	None

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

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 **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: **Felchner Brook** Reach # **T6.01** Segment: **B** Completion Date: **November 6,**

Organization: **Bear Creek Environmental** Observers: **CS, TL** Rain: **No**

Segment Length (ft): **837** Segment Location: **Segment begins at start of bedrock gorge about 549 feet upstream of the confluence**

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken
Waterfall	**Mid-segment**	**15.00**	**14.00**	**Yes**	
Waterfall	**Mid-segment**	**0.00**	**0.00**	**Yes**	

4.8 Channel Constrictions

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

Narrative:

Step 7. Rapid Geomorphic Assessment Data

Confinement Type

Channel Evolution Model

Channel Evolution Stage

Geomorphic Condition **Good**

Stream Sensitivity

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Project: **Dog River**

Phase 2 Segment Summary

March 2, 2009 SGAT Version: 4.56

Stream: **Felchner Brook** Reach # **T6.01** Segment: **C** Completion Date: **November 6, 2008**

Organization: **Bear Creek Environmental** Observers: **CS, TL** Why Not assessed: Rain: **No**

Segment Length (ft): **3,143** Segment Location: **Segment begins at end of bedrock gorge and continues upstream for 3143 feet.**

QC Status - Staff: Provisional Cons Passed

Step 1. Valley and Floodplain

1.1 Segmentation **Valley Width**

1.2 Alluvial Fan **None**

1.3 Corridor Encroachments

Length (ft)	One	Both
Berms	0	0
height	0	0
Roads	43	0
height	0	0
Railroads	0	0
height	0	0
Improved Paths	0	0
height	0	0
Development	367	0

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

1.5 Valley Features

Valley Width (ft)	142
Width Determination	Measured
Confinement Type	Narrow
Rock Gorge?	No
Human-caused Change?	No

Step 2. Stream Channel

2.1 Bankfull Width	28
2.2 Max Depth (ft)	2.65
2.3 Mean Depth (ft)	1.90
2.4 Floodprone Width (ft)	76

Notes:

Some areas were more entrenched (went back and forth between B and C-like channel) but generally segment had good floodplain access. Segment is minimally impacted.

Step 2. (Contued)

2.5 Aband. Floodpln	2.65 ft.
Human Elev Floodpln	0.00 ft.
2.6 Width/Depth Ratio	14.47
2.7 Entrenchment Ratio	2.76
2.8 Incision Ratio	1.00
Human Elevated Inc Rat	0.00
2.9 Sinuosity	Low
2.10 Riffles Type	Complete
2.11 Riffle/Step Spacing (ft)	91

2.12 Substrate Composition

Bedrock	0%
Boulder	23%
Cobble	43%
Coarse Gravel	21%
Fine Gravel	10%
Sand	3%
Silt and smaller	0%

Silt/Clay Present?	No
Detritus	2 %
# Large Woody	69

2.13 Average Largest Particle on

Bed	12.1	inches
Bar	6.5	inches

2.14 Stream Type

Stream Type:	C
Bed Material:	Cobble
Subclass Slope:	b
Bed Form:	Step-Pool
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 **Steep**

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

Bank Erosion	Left	Right
Erosion Length (ft)	88	33
Erosion Height (ft)	5.21	8.00
Revetmt. Type	None	None
Revetmt. Length (ft)	0	0

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

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

Mid-Channel Canopy **Open**

3.2 Riparian Buffer

Buffer Width	Left	Right
Dominant	>100	>100
Sub-dominant	51-100	None
W less than 25	62	54

Buffer Veg. Type	Left	Right
Dominant	Mixed Trees	Mixed Trees
Sub-dominant	None	None

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	
Impoundmt. Location	
4.6 Up/Down strm flow reg	None
(old) Upstrm Flow Reg	

4.7 StormwaterInputs

Field Ditch	0	Road Ditch	1
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
7	1	40

Diagonal	Delta	Island
0	0	3

5.2 Other Features

Flood	Neck Cutoff	Avulsion	Braiding
5	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	Yes
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: **Felchner Brook** Reach # **T6.01** Segment: **C** Completion Date: **November 6,**

Organization: **Bear Creek Environmental** Observers: **CS, TL** Rain: **No**

Segment Length (ft): **3,143** Segment Location: **Segment begins at end of bedrock gorge and continues upstream for 3143 feet.**

1.6 Grade Controls

Type	Location	Total	Total Height Above Water	Photo Taken	GPSTaken
Waterfall	**Mid-segment**	**25.00**	**23.00**	**Yes**	
Waterfall	**Mid-segment**	**8.00**	**7.00**	**Yes**	
Ledge	**Mid-segment**	**3.00**	**3.00**	**Yes**	
Waterfall	**Mid-segment**	**9.00**	**6.00**	**Yes**	
Ledge	**Mid-segment**	**2.00**	**1.00**	**No**	

4.8 Channel Constrictions

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?
Bridge	**21.0**	**Yes**	**No**	**Yes**	**Yes**
Problem	**Deposition Above,Deposition**				
Bedrock	**7.00**	**Yes**	**No**	**Yes**	**No**
Problem	**Deposition Below,Scour Below**				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type **Unconfined**

	Score	STD	Historic
7.1 Channel Degradation	**18**	**None**	**No**
7.2 Channel Aggradation	**14**	**None**	**No**
7.3 Widening Channel	**16**		**No**
7.4 Change in Planform	**13**		**No**
Total Score	**61**		
Geomorphic Rating	**0.7625**		

Channel Evolution Model **F**

Channel Evolution Stage **I**

Geomorphic Condition **Good**

Stream Sensitivity **Moderate**

Step 6. Rapid Habitat Assessment Data

Stream Gradient Type

Habitat Stream Condition

Narrative:

Minor aggradation and planform adjustment.

Stream Geometry Data

Dog River

		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
M01	A	C	Gravel	Riffle-Pool	None	No	0.12	96.24	112.5	6.4	4.33	288.5	6.4	25.98	2.56	1.00	IIc	D	Fair		P	P
M01	B	C	Gravel	Riffle-Pool	None	No	0.12	96.24	85.5	8.7	6.4	197.0	11.2	13.36	2.30	1.29	III	F	Fair		P	P
M01	C	C	Gravel	Riffle-Pool	None	No	0.12	96.24	119.0	7.0	4.39	1337.0	7.0	27.11	11.24	1.00	IIc	D	Fair		P	P
M02	0	C	Gravel	Riffle-Pool	None	No	0.08	95.38	96.9	8.35	6.02	977.0	8.35	16.10	10.08	1.00	IIc	D	Fair		P	P
M03	0	C	Gravel	Riffle-Pool	None	No	0.15	94.67	122.0	6.8	4.73	370.0	6.8	25.79	3.03	1.00	IIc	D	Good		P	P
M04	0	C	Gravel	Riffle-Pool	None	No	0.05	94.48	86.0	7.8	5.83	618.0	7.8	14.75	7.19	1.00	IIc	D	Fair		P	P
M05	0	B	Gravel	Riffle-Pool	c	No	0.28	92.02	79.0	7.0	5.91	165.0	7.0	13.37	2.09	1.00	I	F	Good		P	P
M06	A	C	Gravel	Riffle-Pool	None	No	0.35	91.94	88.0	7.7	6.08	762.0	7.7	14.47	8.66	1.00	IIc	D	Good		P	P
M06	B	C	Gravel	Riffle-Pool	None	No	0.35	91.94	79.0	5.6	4.2	270.0	5.6	18.81	3.42	1.00	IIc	D	Good		P	P
M07	A	B	Gravel	Riffle-Pool	c	No	0.66	90.84	92.8	4.0	3.14	183.0	4.0	29.55	1.97	1.00	IIc	D	Fair		P	P
M07	B	G	Bedrock	Cascade	c	Yes	0.66	90.84											Refere		P	F
M07	C	B	Gravel	Riffle-Pool	c	No	0.66	90.84											Fair		P	F
M08	A	B	Gravel	Riffle-Pool	c	No	0.44	89.31	86.0	6.7	5.8	166.5	6.7	14.83	1.94	1.00	IIc	D	Fair		P	P
M08	B	B	Boulder	Step-Pool	c	No	0.44	89.31	97.8	5.8	3.72	135.6	5.8	26.29	1.39	1.00	I	F	Good		P	P
M09	A	C	Gravel	Riffle-Pool	None	No	0.35	88.38	121.0	5.6	3.9	329.3	5.6	31.03	2.72	1.00	IIc	D	Fair		P	P
M09	B	B	Boulder	Riffle-Pool	c	Yes	0.35	88.38	77.5	6.1	4.02	111.5	6.1	19.28	1.44	1.00	I	F	Good		P	P
M10	A	F	Cobble	Riffle-Pool	None	Yes	0.11	81.85	61.3	4.0	3.26	71.6	4.0	18.80	1.17	1.00	I	F	Good		P	P
M10	B	C	Gravel	Riffle-Pool	None	No	0.11	81.85	94.0	5.15	3.97	200.0	7.85	23.68	2.13	1.52	III	F	Fair		P	P
M11	A	C	Gravel	Riffle-Pool	None	No	0.37	81.13	65.5	3.65	3.1	488.0	3.65	21.13	7.45	1.00	IIc	D	Good		P	P
M11	B	E	Gravel	Riffle-Pool	None	No	0.37	81.13											Fair		P	F
M11	C	F	Cobble	Riffle-Pool	None	No	0.37	81.13	64.0	3.8	2.66	72.5	7.9	24.06	1.13	2.08	II	F	Fair		P	P
M11	D	C	Gravel	Plane Bed	None	No	0.37	81.13											Fair		P	F
M12	A	C	Gravel		None	No	1.13	79.94											Fair		P	F
M12	B	B	Gravel	Riffle-Pool	c	No	1.13	79.94	76.5	5.7	3.7	129.0	11.0	20.68	1.69	1.93	III	F	Fair		P	P
M13	0	C	Gravel	Riffle-Pool	None	No	0.26	75.46	58.8	6.4	5.25	1202.0	6.4	11.20	20.44	1.00	IIc	D	Fair		P	P
M14	0	C	Gravel	Riffle-Pool	None	No	0.11	74.20	93.5	3.2	2.33	602.0	3.2	40.13	6.44	1.00	IId	D	Fair		P	P
M15	0	C	Gravel	Riffle-Pool	None	No	0.42	61.18	58.0	4.4	3.41	302.0	5.8	17.01	5.21	1.32	III	F	Fair		P	P
M16	0	C	Gravel	Riffle-Pool	b	No	2.18	52.46	50.0	4.05	3.06	194.7	6.05	16.34	3.89	1.49	II	F	Fair		P	P
M17	A	C	Gravel	Riffle-Pool	None	No	0.52	41.88	40.8	3.4	2.51	148.8	4.8	16.25	3.65	1.41	III	F	Fair		P	P
M17	B	E	Gravel	Riffle-Pool	None	No	0.52	41.88	30.3	5.2	3.09	295.0	6.5	9.81	9.74	1.25	II	F	Good		P	P
M17	C	C	Gravel	Riffle-Pool	None	No	0.52	41.88	46.5	3.5	2.18	115.0	5.3	21.33	2.47	1.51	IV	F	Fair		P	P
M18	A	B	Cobble	Step-Pool	None	Yes	1.02	41.03	36.0	4.7	3.6	55.4	4.7	10.00	1.54	1.00	I	F	Good		P	P

		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.	Model	RGA Cond.	RHA Cond.	QC Stf	QC Aut
M18	B	C	Gravel	Riffle-Pool	None	No	1.02	41.03	36.3	3.1	2.02	369.4	5.1	17.97	10.18	1.65	III	F	Fair		P	P
M19	A	C	Gravel	Riffle-Pool	None	No	1.51	32.77	28.0	2.35	1.77	125.0	3.75	15.82	4.46	1.60	III	F	Fair		P	P
M19	B	F	Bedrock	Step-Pool	None	Yes	1.51	32.77											Good		P	F
M19	C	C	Gravel	Riffle-Pool	None	No	1.51	32.77	31.0	2.7	1.92	133.6	4.5	16.15	4.31	1.67	III	F	Fair		P	P
M20	A	B	Cobble	Riffle-Pool	c	No	0.52	30.77	34.0	3.55	2.19	57.5	6.05	15.53	1.69	1.70	II	F	Fair		P	P
M20	B	C	Gravel	Riffle-Pool	None	No	0.52	30.77	35.0	3.0	1.56	294.5	4.0	22.44	8.41	1.33	III	F	Fair		P	P
M20	C	C	Gravel	Riffle-Pool	None	No	0.52	30.77	42.0	2.45	1.65	116.5	3.45	25.45	2.77	1.41	III	F	Fair		P	P
M21	A	C	Cobble	Riffle-Pool	None	No	0.44	25.04	24.7	3.7	2.31	213.5	5.4	10.69	8.64	1.46	III	F	Fair		P	P
M21	B	E	Sand	Dune-Ripple	None	No	0.44	25.04											Good		P	F
M21	C	C	Gravel	Riffle-Pool	None	No	0.44	25.04											Fair		P	F
M21	D	E	Gravel	Riffle-Pool	None	No	0.44	25.04	23.5	3.3	2.54	139.0	5.0	9.25	5.91	1.52	III	F	Fair		P	P
T1.01	A	F	Cobble	Step-Pool	None	No	1.83	37.63	47.0	3.4	2.7	60.5	8.0	17.41	1.29	2.35	II	F	Fair		P	P
T1.01	B	B	Gravel	Riffle-Pool	c	No	1.83	37.63	53.0	3.45	2.42	77.2	9.95	21.90	1.46	2.88	III	F	Fair		P	P
T1.01	C	F	Boulder	Step-Pool	None	No	1.83	37.63	50.0	3.75	2.28	62.0	9.75	21.93	1.24	2.60	II	F	Fair		P	P
T2.01	0	C	Gravel	Riffle-Pool	None	No	1.87	29.01	39.5	3.8	2.26	219.0	6.2	17.48	5.54	1.63	II	F	Fair		P	P
T3.01	0	B	Gravel	Riffle-Pool	c	No	1.47	45.67	40.0	3.5	2.43	65.0	9.0	16.46	1.63	2.57	II	F	Fair		P	P
T4.01	0	B	Gravel	Riffle-Pool	c	No	1.75	34.97	53.0	2.75	1.8	78.0	2.75	29.44	1.47	1.00	IIc	D	Fair		P	P
T5.01	A	B	Gravel	Riffle-Pool	c	No	1.90	34.99	76.5	3.4	1.7	130.5	4.4	45.00	1.71	1.29	III	F	Fair		P	P
T5.01	B	B	Cobble	Riffle-Pool	c	No	1.90	34.99	52.7	2.8	2.15	109.0	2.8	24.51	2.07	1.00	I	F	Good		P	P
T6.01	A	B	Cobble	Riffle-Pool	None	No	3.53	25.33	24.5	2.85	2.2	35.0	6.3	11.14	1.43	2.21	II	F	Fair		P	P
T6.01	B	A	Bedrock	Cascade	None	Yes	3.53	25.33											Good		P	F
T6.01	C	C	Cobble	Step-Pool	b	No	3.53	25.33	27.5	2.65	1.9	75.8	2.65	14.47	2.76	1.00	I	F	Good		P	P

Rapid Geomorphic Assessment

Dog River

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							
M01	A	No	16	None	No	7	None	No	10	No	6	No	0.49	Fair	IIc	BD	Very	P	P
M01	B	No	13	None	Yes	7	None	No	13	No	6	No	0.49	Fair	III	SC	Very	P	P
M01	C	No	16	None	No	9	None	No	11	No	12	No	0.60	Fair	IIc	BD	Very	P	P
M02	0	No	16	None	No	8	None	No	13	No	9	No	0.58	Fair	IIc	VB	Very	P	P
M03	0	No	16	None	No	11	None	No	12	No	14	No	0.66	Good	IIc	NW	High	P	P
M04	0	No	16	None	No	10	None	No	12	No	7	No	0.56	Fair	IIc	BD	Very	P	P
M05	0	No	16	None	No	12	None	No	16	No	13	No	0.71	Good	I	NC	High	P	P
M06	A	No	16	None	No	12	None	No	14	No	11	No	0.66	Good	IIc	SC	High	P	P
M06	B	No	17	None	No	11	None	No	13	No	11	No	0.65	Good	IIc	BD	High	P	P
M07	A	No	16	None	No	10	None	No	13	No	8	No	0.59	Fair	IIc	BD	Very	P	P
M07	B	Yes											0.00	Reference		NC		P	F
M07	C	No											0.00	Fair		SC		P	F
M08	A	No	16	None	No	11	None	No	13	No	11	No	0.64	Fair	IIc	SC	Very	P	P
M08	B	No	18	None	No	14	None	No	14	No	16	No	0.78	Good	I	SC	Low	P	P
M09	A	No	16	None	No	11	None	No	8	No	12	No	0.59	Fair	IIc	BD	Very	P	P
M09	B	Yes	16	None	No	12	None	No	16	No	16	No	0.75	Good	I	SC	Very	P	P
M10	A	Yes	16	None	No	15	None	No	14		18	No	0.79	Good	I	NC	High	P	P
M10	B	No	8	None	Yes	13	None	No	12	No	10	No	0.54	Fair	III	SC	Very	P	P
M11	A	No	18	None	No	13	None	No	14	No	11	No	0.70	Good	IIc	BD	High	P	P
M11	B	No											0.00	Fair		BD		P	F
M11	C	No	3	C to F	Yes	16	None	No	14	No	15	No	0.60	Fair	II	BD	Extreme	P	P
M11	D	No											0.00	Fair		NC		P	F
M12	A	No											0.00	Fair		BD		P	F
M12	B	No	3	C to B	Yes	10	None	Yes	11	No	10	No	0.43	Fair	III	BD	Very	P	P
M13	0	No	16	None	No	8	None	No	12	No	9	No	0.56	Fair	IIc	VB	Very	P	P
M14	0	No	16	None	No	6	None	No	12	No	8	No	0.53	Fair	IId	VB	Very	P	P
M15	0	No	13	None	Yes	9	None	No	14	No	9	No	0.56	Fair	III	VB	Very	P	P
M16	0	No	8	None	Yes	16	None	No	12	No	14	No	0.63	Fair	II	NW	Very	P	P
M17	A	No	8	None	Yes	10	None	No	15	No	13	No	0.58	Fair	III	BD	Very	P	P
M17	B	No	13	None	Yes	13	None	No	15	No	14	No	0.69	Good	II	BD	High	P	P
M17	C	No	8	None	Yes	12	None	No	14	No	13	No	0.59	Fair	IV	BD	Very	P	P
M18	A	Yes	16	None	No	12	None	No	14	No	15	No	0.71	Good	I	NW	Moderat	P	P
M18	B	No	8	None	Yes	10	None	No	13	No	13	No	0.55	Fair	III	BD	Very	P	P

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							
M19	A	No	9	None	Yes	13	None	No	14	No	13	Yes	0.61	Fair	III	BD	Very	P	P
M19	B	Yes											0.00	Good		NC		P	F
M19	C	No	8	None	Yes	14	None	No	14	No	13	No	0.61	Fair	III	BD	Very	P	P
M20	A	No	5	C to B	Yes	14	None	Yes	15	No	13	No	0.59	Fair	II	SC	High	P	P
M20	B	No	13	None	Yes	11	None	No	13	No	10	No	0.59	Fair	III	VB	Very	P	P
M20	C	No	9	None	Yes	13	None	No	12	No	13	No	0.59	Fair	III	NW	Very	P	P
M21	A	No	10	None	Yes	14	None	No	12	No	14	No	0.63	Fair	III	VB	High	P	P
M21	B	No											0.00	Good		VB		P	F
M21	C	No											0.00	Fair		VB		P	F
M21	D	No	8	None	Yes	13	None	No	14	No	14	No	0.61	Fair	III	SC	Very	P	P
T1.01	A	No	4	C to F	Yes	11	None	Yes	14	No	10	No	0.49	Fair	II	NW	Extreme	P	P
T1.01	B	No	3	C to B	Yes	13	None	No	14	No	9	No	0.49	Fair	III	NW	Very	P	P
T1.01	C	No	4	C to F	Yes	13	None	No	13	No	12	No	0.53	Fair	II	BD	High	P	P
T2.01	0	No	7	None	Yes	13	None	No	12	No	14	No	0.58	Fair	II	VB	Very	P	P
T3.01	0	No	4	C to B	Yes	13	None	No	14	No	10	No	0.51	Fair	II	NW	Very	P	P
T4.01	0	No	17	None	No	13	None	No	11	No	10	No	0.64	Fair	IIc	BD	Very	P	P
T5.01	A	No	13	None	Yes	12	None	No	6	No	7	No	0.48	Fair	III	NW	Very	P	P
T5.01	B	No	17	None	No	14	None	No	13	No	12	No	0.70	Good	I	BD	Moderat	P	P
T6.01	A	No	4	C to B	Yes	14	None	No	15	No	13	No	0.58	Fair	II	VB	High	P	P
T6.01	B	Yes											0.00	Good		SC		P	F
T6.01	C	No	18	None	No	14	None	No	16	No	13	No	0.76	Good	I	NW	Moderat	P	P

Project: Dog River
Stream: Dog River
Organization: BCE, VTANR
Observers: CS, MN, TL, PD, SP, GA
Date(s) Assessed: 6/26/2008-11/6/2008

Summary of the Rapid Habitat Assessment (RHA) Values for the Dog River Watershed

Reach Point ID	Bedform	Woody Debris Cover	Bed Substrate Cover	Scour and Depositional Features	Channel Morphology	Hydrologic Characteristics	Connectivity	River Banks		Riparian Area		Total Score	Percentage**	Habitat Condition
								Left Bank	Right Bank	Left Corridor	Right Corridor			
M01-A	Riffle-Pool	12	7	13	8	9	10	3	4	1	2	69	43%	Fair
M01-B	Riffle-Pool	12	7	10	8	11	13	2	4	1	7	75	47%	Fair
M01-C	Riffle-Pool	8	8	10	9	10	13	5	4	5	3	75	47%	Fair
M02	Riffle-Pool	11	9	7	9	9	10	2	3	2	5	67	42%	Fair
M03	Riffle-Pool	7	6	9	8	8	8	3	5	1	2	57	36%	Fair
M04	Riffle-Pool	11	13	9	13	12	11	2	2	4	4	81	51%	Fair
M05	Riffle-Pool	10	12	14	17	16	10	3	3	1	2	88	55%	Fair
M06-A	Riffle-Pool	6	10	12	14	15	11	4	3	2	2	79	49%	Fair
M06-B	Riffle-Pool	7	12	12	14	12	11	6	5	6	4	89	56%	Fair
M07-A	Riffle-Pool	12	15	15	12	13	13	3	5	7	5	100	63%	Fair
M08-A	Riffle-Pool	12	11	11	14	14	12	6	5	4	4	93	58%	Fair
M08-B	Step-Pool	8	12	15	10	13	5	7	8	4	5	87	54%	Fair
M09-A	Riffle-Pool	8	13	13	8	9	11	5	6	7	4	84	53%	Fair
M09-B	Riffle-Pool	5	13	14	13	12	3	6	6	4	2	78	49%	Fair
M10-A	Riffle-Pool	3	8	14	15	14	8	7	6	9	2	86	54%	Fair
M10-B	Riffle-Pool	14	11	14	7	13	14	3	5	3	5	89	56%	Fair
M11-A	Riffle-Pool	6	13	12	13	13	8	7	6	3	6	87	54%	Fair
M11-C	Riffle-Pool	4	16	14	7	10	5	5	4	3	2	70	44%	Fair
M12-B	Riffle-Pool	12	9	11	8	7	8	2	3	1	2	63	39%	Fair
M13	Riffle-Pool	8	13	10	10	14	13	3	2	3	2	78	49%	Fair
M14	Riffle-Pool	11	14	11	8	9	12	5	2	6	2	80	50%	Fair
M15	Riffle-Pool	9	13	11	12	12	10	4	2	4	1	78	49%	Fair
M16	Riffle-Pool	3	17	13	8	14	8	4	1	4	1	73	46%	Fair
M17-A	Riffle-Pool	8	14	14	12	15	12	7	4	5	3	94	59%	Fair
M17-B	Riffle-Pool	2	9	12	8	13	13	3	1	3	2	66	41%	Fair
M17-C	Riffle-Pool	16	13	16	13	10	13	8	7	4	8	108	68%	Good
M18-A	Step-Pool	5	13	12	13	9	7	2	5	1	8	75	47%	Fair
M18-B	Riffle-Pool	14	13	14	9	14	16	7	8	4	7	106	66%	Good
M19-A	Riffle-Pool	14	17	13	11	13	13	7	7	4	7	106	66%	Good
M19-C	Riffle-Pool	13	14	16	13	14	8	7	7	8	8	108	68%	Good
M20-A	Riffle-Pool	9	12	15	9	13	7	8	3	9	3	88	55%	Fair
M20-B	Riffle-Pool	6	14	11	15	13	13	4	7	5	8	96	60%	Fair
M20-C	Riffle-Pool	10	12	8	5	12	12	7	6	7	2	81	51%	Fair
M21-A	Riffle-Pool	3	14	13	13	9	11	5	7	5	5	85	53%	Fair
M21-D	Riffle-Pool	5	11	11	6	6	8	2	2	1	1	53	33%	Poor
T1.01-A	Step-Pool	5	14	12	10	12	8	5	8	2	5	81	51%	Fair
T1.01-B	Riffle-Pool	11	14	10	8	11	8	8	8	8	5	91	57%	Fair

Project: Dog River
Stream: Dog River
Organization: BCE, VTANR
Observers: CS, MN, TL, PD, SP, GA
Date(s) Assessed: 6/26/2008-11/6/2008

Summary of the Rapid Habitat Assessment (RHA) Values for the Dog River Watershed

Reach Point ID	Bedform	Woody Debris Cover	Bed Substrate Cover	Scour and Depositional Features	Channel Morphology	Hydrologic Characteristics	Connectivity	River Banks		Riparian Area		Total Score	Percentage**	Habitat Condition
								Left Bank	Right Bank	Left Corridor	Right Corridor			
T1.01-C	Step-Pool	6	15	13	9	10	6	8	5	7	2	81	51%	Fair
T2.01	Riffle-Pool	8	13	11	9	10	8	2	4	2	2	69	43%	Fair
T3.01	Riffle-Pool	13	10	13	8	11	4	4	7	2	6	78	49%	Fair
T4.01	Riffle-Pool	15	19	13	10	15	8	9	7	8	8	112	70%	Good
T5.01-A	Riffle-Pool	12	15	11	7	10	5	4	6	5	8	83	52%	Fair
T5.01-B	Riffle-Pool	9	16	14	14	15	7	6	7	6	8	102	64%	Fair
T6.01-A	Riffle-Pool	5	15	14	6	13	11	3	4	3	3	77	48%	Fair
T6.01-C	Step-Pool	12	16	12	14	13	5	8	8	8	9	105	66%	Good
Total Possible Score		**20**	**20**	**20**	**20**	**20**	**20**	**10**	**10**	**10**	**10**	**160**	**100%**	**Reference**

** Percentages are calculated from a reference RHA score of 160