

River Corridor Plan for Mill Brook in Windsor, West Windsor, and Reading, Vermont

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Prepared by:

Fitzgerald Environmental Associates, LLC.

18 Severance Green, Suite 203
Colchester, VT 05446



**Fitzgerald Environmental
Associates, LLC.**

Applied Watershed Science & Ecology

Prepared under contract to:

**Southern Windsor County Regional Planning
Commission**

38 Ascutney Park Road
Ascutney VT, 05030



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Executive Summary

Mill Brook drains directly to the Connecticut River in southeastern Vermont. The watershed has a drainage area of 44.6 square miles, and is situated along the northern slopes of Mount Ascutney and the eastern slopes of the Green Mountains. The brook's outlet to the Connecticut River is in downtown Windsor, immediately downstream of the historic Cornish-Windsor covered bridge. The watershed is located within the Towns of Windsor, West Windsor, and Reading, with a small portion of the headwaters in the Town of Woodstock.

Tropical Storm Irene in August of 2011 tracked through the center of the watershed causing major flood damage in all three towns. It is estimated that 5 to 6 inches fell over much of the watershed and locally higher amounts were likely in the headwaters. Roads and bridges were especially hard hit by the flooding and the damage to the transportation network slowed recovery efforts and severed main access roads to dozens of homes within the watershed. In response to the impacts from this flood, and the increasing severity of rainfall and flood events in the past few decades, flooding and erosion hazards are a top concern for residents within the Mill Brook watershed.

As a result of dealing with severe, repeat flood and erosion damage throughout Vermont over the last two decades, Vermont's river scientists and engineers now understand that hazard mitigation and river restoration projects are most successful when carried out within a context of how reach and watershed-scale stressors influence flood and erosion hazards. In an effort to understand the root causes of stream channel instability and flood/fluvial erosion hazards in the Mill Brook watershed, the Southern Windsor County Regional Planning Commission (SWCRPC) has sought to develop a database of Stream Geomorphic Assessment (SGA) data for stream reaches of significant size in the Mill Brook watershed. This data allows for a comprehensive approach to flood and erosion hazard planning, in contrast to the conventional approach of multiple "spot fixes" with limited knowledge of the connectivity along the river corridor.

Fitzgerald Environmental Associates, LLC (FEA) was hired by SWCRPC in summer of 2013 to assist with a Phase 1 and Phase 2 SGA study and to develop a River Corridor Plan for the Mill Brook watershed. The Phase 1 study was completed in 2013 and the Phase 2 assessments were conducted in summer of 2014. This report describes the results of the Phase 1 and Phase 2 studies and the Mill Brook River Corridor Plan. The project objectives are described below:

- 1) Develop baseline watershed and reach-scale data for the study reaches.
- 2) Identify river reaches where more detailed field data collection (Phase 2) is needed.
- 3) Develop a basis for understanding the overall causes of channel instability and habitat degradation along the river corridors in the watershed.
- 4) Collect the information needed to map fluvial erosion hazard zones in the Mill Brook watershed.
- 5) Develop a list of preliminary river corridor restoration projects that can be further developed in the future to mitigate flood and erosion hazards and improve ecological integrity and water quality.
- 6) Prioritize river corridor restoration projects for each town in the watershed.

Below is a summary of key findings from the Phase 1 and Phase 2 SGA and River Corridor Plan:

Phase 1 Study

- A total of 39 reaches along 42.5 river miles were delineated during the Phase 1 SGA analysis. Full Phase 1 data and windshield survey data was collected by FEA and SWCRPC for Mill Brook, four (4) tributary watersheds, and two (2) sub-tributary watersheds.
- The Phase 1 SGA approach resulted in watershed-scale data about the landscape (e.g., soils and land cover) and the stream channel (e.g., slope and form), providing a basis for understanding the natural and human-impacted conditions within the watershed. The Phase 1 data also aided in the identification of specific stressors affecting the physical conditions of the stream channels and structures (e.g., bridges and culverts, bank armoring, etc.).
- Approximately half of the assessed reaches (19 reaches) are found in a confined valley setting that would normally support sediment and debris transport channels with A or B-type channel geometry. The remaining 20 reaches are found in an unconfined valley setting with meandering, depositional, C-type or E-type channel geometry.
- 80% of the watershed is forested, with agricultural land use representing 16%. Developed lands represent 2% of the land area and are mainly associated with developed corridors along major roads and the town centers of Windsor and Brownsville. Wetlands and other surface waters represent 1% of the land cover within the watershed.
- Impact ratings were developed for each reach using the Phase 1 parameters representing four classes of watershed and reach-scale impacts: 1) Land Cover and Reach Hydrology; 2) Channel Modifications; 3) Floodplain Modifications and Planform Changes; 4) Bed and Bank Conditions. Out of a total possible impact score of 32, the average rating for all reaches was 14, with a maximum score of 26 and a minimum score of 1.
- Based on the Phase 1 impact ratings, a total of 28 high-priority reaches in Windsor, West Windsor, and Reading were recommended for Phase 2 assessment. The selected reaches have a total channel length of approximately 30.1 miles.

Phase 2 Study

- Flooding from Tropical Storm Irene in August, 2011 triggered major channel adjustments in many of the Phase 2 study reaches. Although there is no USGS flow gage on Mill Brook, based on records in neighboring watersheds the discharge likely exceeded the 100-year flood. The flooding unleashed an enormous volume of coarse sediment and woody debris into the channel as a result of stream bed and bank erosion and mass failure valley erosion, much of this originating from the steep headwaters zones. In some instances, the flood triggered severe channel adjustments even in reaches with limited corridor impacts. These reaches, such as Mill Brook reach M05.B, Willow Brook reach T2.04, and all of Bailey Brook (T4.01.A - T4.02.B), tended to be on moderate gradient reaches with minimal floodplain access and valley side slopes composed of highly erodible soils.
- The presence of natural grade control (i.e., bedrock ledges which limit channel incision) was highly variable throughout the Phase 2 study reaches. The upper-middle portion of the watershed including Willow Brook, Reading Hill Brook, and Mill Brook from the confluence with

Willow Brook upstream to the confluence with Bailey Brook, contained a high density of natural grade control. Man-made grade controls were found upstream of M02 (large stacked stone dam) and in M06 (small concrete dam).

- Lack of grade control, encroachment, historic straightening, and sediment transport alterations led to major incision in many areas, resulting in 14 stream type departures. Several of these reaches/segments underwent major widening during T.S. Irene, but remain disconnected from adjacent floodplains. The subsequent massive sediment deposition and ongoing widening within segments that were less steep and/or confined resulted in an additional seven stream type departures due to the severe widening of the channel. Additional areas of deposition along the mainstem did not result in a stream type departure, however large channel migration features were observed throughout.
- Overall Phase 2 geomorphic ratings indicate poor river stability along Brook Road in Windsor, on one reach in the Beaver Brook watershed along Sheddsville Road and another in the Willow Brook watershed along Rush Meadow Road in West Windsor, and along most of Bailey Brook in Reading. Elsewhere, generally fair conditions were noted throughout the watershed. Habitat ratings indicated generally fair conditions across the watershed, with one poor rating on a tributary to Beaver Brook along Sheddsville Road, and another on a reach of Mill Brook found along Baileys Mills Road.

River Corridor Planning

- 50 bridges and 14 culverts were assessed for geomorphic compatibility and aquatic organism passage (AOP) as part of the Phase 2 SGA work. Approximately two-thirds of the bridges had spans less than the reference bankfull channel width, indicating an increased degree of structure vulnerability to flooding and erosion. All of the culverts represented significant bankfull constrictions, and six of the structures had widths less than 50% of bankfull. One culvert does not allow for any aquatic organism passage (AOP) and the remaining 14 culverts have reduced AOP. The summary of structures, including the reference bankfull channel width listed for each one, provides a means for towns to understand the relative flood vulnerability and prioritize structure replacements with these criteria in mind.
- Site level approaches to river corridor restoration were evaluated in detail at the reach scale, and are organized in the report by town. The projects were developed based on the Phase 2 results and watershed-scale mapping of stressors on channel stability. The lists of projects for each town are intended to provide a “roadmap” of restoration projects that will reduce future flood hazards and improve ecological conditions in the river corridor. This effort resulted in the identification of 64 restoration project areas, including 20 projects that do not require significant further study (i.e., passive approaches such as buffer plantings and corridor protection), and 44 projects requiring further feasibility study or engineering design (i.e., active restoration approaches such as bridge replacements).
- The projects were prioritized by FEA using our knowledge of the watershed and reach conditions, guidance from VTANR, and our best professional judgment. Following this prioritization, twelve high priority projects were selected and explored in further detail. These projects were identified as having the highest hazard mitigation priority or the greatest ecological benefits.

1.0 Project and Watershed Background

1.1 Project Introduction and Study Goals

1.1.1 Project Introduction

In 2013 the Southern Windsor County Regional Planning Commission (SWCRPC) and the Vermont Department of Environmental Conservation (VTDEC) identified reaches within the Mill Brook watershed in southeastern Vermont for assessment of fluvial geomorphic conditions. Mill Brook is the largest watershed located within Basin 13; an atypical planning basin consisting of several small to medium sized watersheds draining directly to the Connecticut River. Prior to this project, geomorphic assessment data had been collected for most of the other important watersheds within Basin 13 (Crosby Brook, Green River, Hubbard Brook, and Whetstone Brook).

Severe flooding and erosion damage sustained during Tropical Storm Irene (T.S. Irene) in the Towns of Windsor, West Windsor, and Reading led to the selection of this watershed for further study. Infrastructure along the river and tributaries was severely impacted by flooding and erosion, and therefore this information will serve to help these towns better understand existing flood vulnerabilities, and plan for future improvements with flood risks in mind. In addition, this study is part of a larger effort to characterize the physical and biological conditions of the Mill Brook watershed and to aid in the identification of stressors on channel stability and aquatic biota communities.

Fitzgerald Environmental Associates, LLC. (FEA) was retained by SWCRPC in 2013 to complete river assessments on Mill Brook, four (4) tributaries, and two (2) sub-tributaries following the Phase 1 Stream Geomorphic Assessment (SGA) Protocols (VTDEC, 2009) developed by the VTDEC. FEA used the Stream Geomorphic Assessment Tool (SGAT) to develop baseline GIS data for the watershed in 2013. A total of 39 reaches along 42.5 river miles were assessed during the Phase 1 analysis.

Following this study, a subset of the Phase 1 reaches was selected for field-based Phase 2 SGA data collection. FEA completed the Phase 2 field work in 2014 for 28 reaches (approximately 30.1 river miles), and developed a River Corridor Plan (RCP) for these reaches. This report summarizes watershed background information, SGA results, and the RCP into one planning document.

1.1.2 Study Goals

Watershed restoration projects are most successful when carried out within a context for understanding how reach and watershed-scale stressors cause channel instability. The VTDEC SGA Protocols and River Corridor Planning Guide provides sound, scientifically-defensible methods for identifying stressors on channel stability and restoration projects that will address them appropriately (VTANR, 2010). The overall goal of the VTDEC Rivers Program 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,” (VTANR, 2010) achieved through:

- Fluvial erosion hazard mitigation;
- Sediment and nutrient load reduction; and
- Aquatic and riparian protection and restoration

The Phase 1 SGA approach results in watershed-scale data about the landscape (e.g., soils and land cover) and the stream channel (e.g., slope and form), providing a basis for understanding the natural and human-impacted conditions within the watershed. The SGA data also aids in the identification of specific stressors affecting the physical conditions of the stream channels and structures (e.g., bridges and culverts). Ultimately, the Phase 1 results help guide planners in selected reaches for more detailed Phase 2 data collection where this information can be valuable for flood vulnerability mapping, identification of river restoration projects, and long-term river corridor planning. The goal of the Phase 2 and RCP effort is to provide:

- 1) A basis for understanding the overall causes of channel instability and habitat degradation along the river corridors in the watershed.
- 2) A list of preliminary corridor restoration projects that can be further developed in the future to mitigate flood and erosion hazards.
- 3) Information needed to map fluvial erosion hazard zones in Windsor, West Windsor, and Reading.

1.2 Background Watershed Information

1.2.1 Geographic Setting and Land Use History

The Mill Brook watershed is located in the Upper Connecticut River Basin in southeastern Vermont (Figure 1.1). At the confluence with the Connecticut River in Windsor, Mill Brook drains 44.6 square miles in Windsor County (Figure 1.2). Mill Brook (Reaches M1-M18) flows from the headwaters along the eastern slopes of Mount Moses and Long Hill to the confluence with the Connecticut River, draining portions of the Towns of Reading, West Windsor, and Windsor. Beaver Brook (Reaches T1.01-T1.04) drains the northeastern corner of the watershed and joins Mill Brook in reach M06. This tributary watershed covers 6.5 square miles in the town of West Windsor and also contains two unnamed sub-tributaries (Beaver Brook Tributary 3 and Beaver Brook Tributary 4, T1.01.S3.01 and T1.01.S4.01 respectively). Willow Brook (Reaches T2.01-T2.08) joins Mill Brook in reach M10 and drains 5.3 square miles to the north in West Windsor. Reading Hill Brook (Reaches T3.01-T3.06) joins Mill Brook in reach M13 and drains 4.1 square miles to the north in Reading and a small portion of Woodstock. Bailey Brook (Reaches T4.01-T4.02) flows in to Mill Brook in M14 and drains 5.4 square miles of the western edge of the watershed in the town of Reading.

Land cover data based on imagery from 2006 (NOAA, 2008a) are summarized in Table 1.1 and Figure 1.3. Mill Brook is drained by a rural watershed, with forest representing the dominant cover type. Agricultural lands cover 16% of the entire watershed ranging from 5% in the Bailey Brook basin to 29% in the Beaver Brook basin. Agricultural lands are predominantly found along the river valleys of Mill Brook, Beaver Brook, and Willow Brook. There is limited developed land within the watersheds ranging from 1 - 3%. Concentrated areas of residential and commercial development are found in the town of Windsor near the confluence of Mill Brook and the Connecticut River.

Table 1.1: Percent Land Cover for Mill Brook watershed and tributaries.

Watershed	Drainage Area (mi ²)	Agriculture	Development	Forest	Open Water	Scrub/Shrub	Wetland
Mill Brook Mainstem	23.4	13%	3%	80%	0%	3%	1%
Beaver Brook*	6.5	29%	1%	69%	0%	0%	0%
Willow Brook	5.3	27%	1%	72%	0%	0%	0%
Reading Hill Brook	4.1	12%	1%	86%	0%	0%	1%
Bailey Brook	5.4	5%	0%	94%	0%	0%	0%
Entire Watershed	44.6	16%	2%	80%	0%	2%	1%

*Land cover data for sub-tributaries are included.

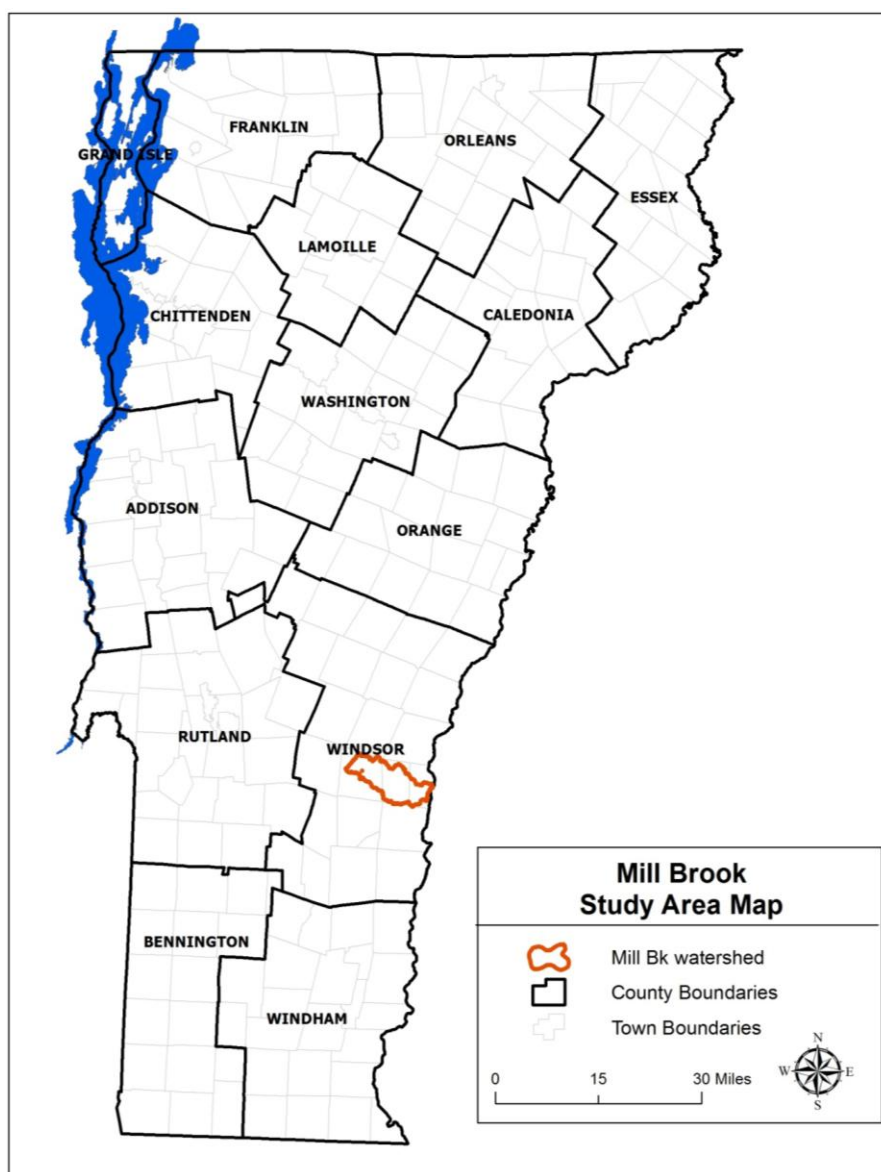


Figure 1.1: Location map for the Mill Brook watershed.

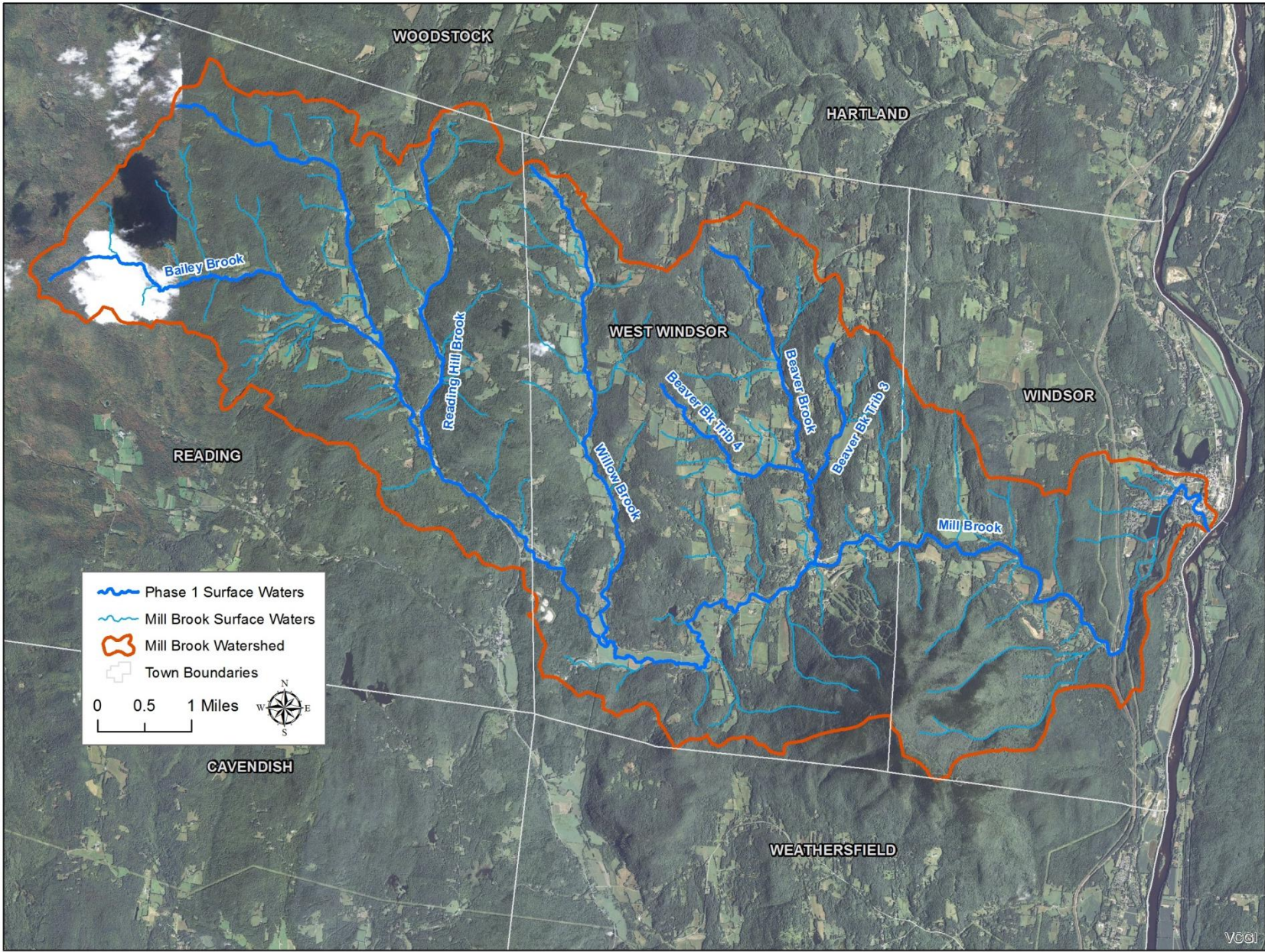


Figure 1.2: Mill Brook watershed, Phase 1 surface waters, and town boundaries.

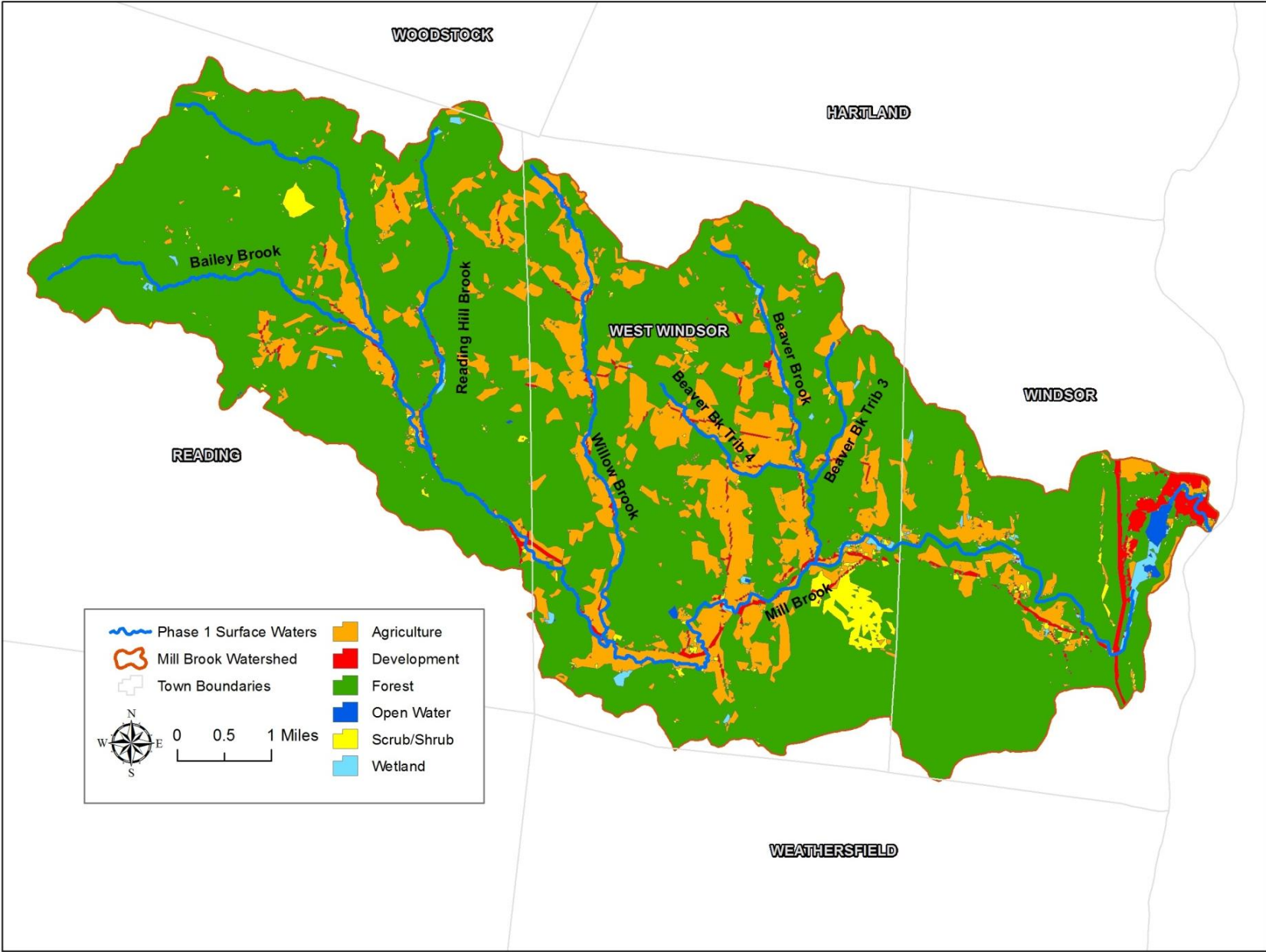


Figure 1.3: Land cover data for the Mill Brook watershed.

Historically, the impacts of agricultural practices on the Vermont landscape left a lasting legacy on waterways like the Mill Brook. Prior to the deforestation associated with human settlement, the watershed would have been a mixture of deciduous forest on the valley floors, coniferous forest along the mountain spines, and a mixture of both along the slopes. Deforestation and grazing, largely from sheep farms, likely left over 90 percent of the watershed devoid of trees at one time or another (Albers, 2000). This landscape change had a tremendous impact on waterways like Mill Brook. Exposed, highly-erodible soils (e.g. glacial tills) on steep slopes were carried to the valley floors and aggraded on river bottoms; a legacy that still influences the way Vermont's rivers are managed today.

As Vermont's farmers began to move to the Midwest in search of more productive farmland in the mid to late 1800's, the deciduous forests along the mountain slopes began to recover (Albers, 2000). Throughout the early and mid 1900's, as more family farms on marginal lands were given up, the forests continued to recover. Today, approximately 80 percent of the watershed is covered by forest. With the increasing tourism sector in the state, and the need for lumber for second-homes and construction, forestry has replaced agriculture in many of the rural hill slopes of Vermont.

Modern development within the watershed has seen the conversion of numerous working dairy and sheep farms to large residential estates with rolling pastures for horses and other exotic ungulates. The prevalence of private ponds within the watershed is approximately 2.5 times that in neighboring watersheds. These ponds are primarily used for recreational or aesthetic purposes, however they may play a significant role in watershed hydrology. Other modern watershed impacts include encroachment and manipulation of the river channel and corridor as developed areas expand within the watershed. An example of this was the construction of Interstate 91 through the Town of Windsor in 1965. This required a 673 foot long bridge over the Mill Brook Valley, and the embankments for the bridge pushed the channel to the north where it is located today (Figure 1.4).

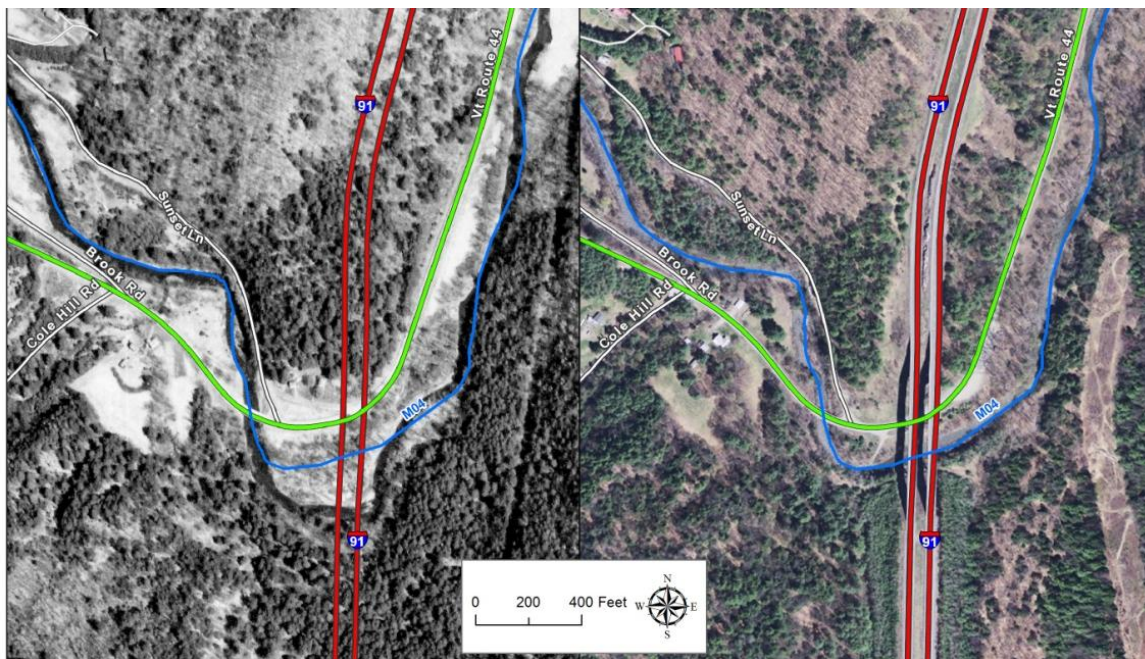


Figure 1.4: Channel relocation during the construction of Interstate 91. The left image is from 1962, showing the historic channel location prior to construction. The right image shows the current channel. The current channel centerline is shown in blue.

1.2.2 Geologic Setting

The underlying geology of the Mill Brook watershed is comprised of a range of bedrock types. Most of the watershed contains a mixture of carbonate-rich rocks and non-calcareous schists, phyllites, gneisses, and granofels from the Lower Devonian through the Upper Silurian period (Ratcliffe et al., 2011). Mt Ascutney on the southern border of the watershed contains igneous volcanic and mafic volcanic rock formations from the Early Cretaceous Period. The Waits River formation, which contains a mixture of schist and marble, is found the majority of the Mill Brook watershed. The weathering of calcium carbonate rich (sea bottom) sediments in these formations results in basic soils that typically support communities of rich woods species. Several gneiss formations from the Mount Holly Complex are found in the middle of the watershed west of Mount Ascutney.

Surficial geologic deposits in the Mill Brook watershed were governed largely by glacial activity. During the Wisconsin glaciation, glaciers one mile in thickness extended across New England, reaching their maximum extents approximately 20,000 years ago. This glacial event left the Green Mountains with a physical imprint that is clearly evident today. In the Mill Brook watershed dense till, glacial till, and outwash areas reflect the dynamic nature with which glaciers shaped the landscape (Figure 1.6). Most of the surficial geology of the watershed is dominated by till and the stream corridors are primarily outwash. The resultant soils in Mill Brook watershed are primarily loamy glacial tills and fine sands, many of which are very stony (Glover-Vershire, Vershire-Dummerston, Glebe-Stratton, and Tunbridge-Lyman).

The presence of Glacial Lake Hitchcock also had a significant effect on the surficial geology of the Mill Brook watershed (Figure 1.5). This lake occupied the Connecticut River Valley from central Connecticut to north of St. Johnsbury during the retreat of the Laurentide ice sheet beginning approximately 18,000 years ago (Ridge and Larson, 1990). The great size of the lake, combined with the erosive forces of the glacier moving over bedrock surfaces allowed for the development of annual layering of fine sediments (e.g., varves) throughout the area affected by the lake.



Figure 1.5: Extent of glacial Lake Hitchcock (NPS, 2010).

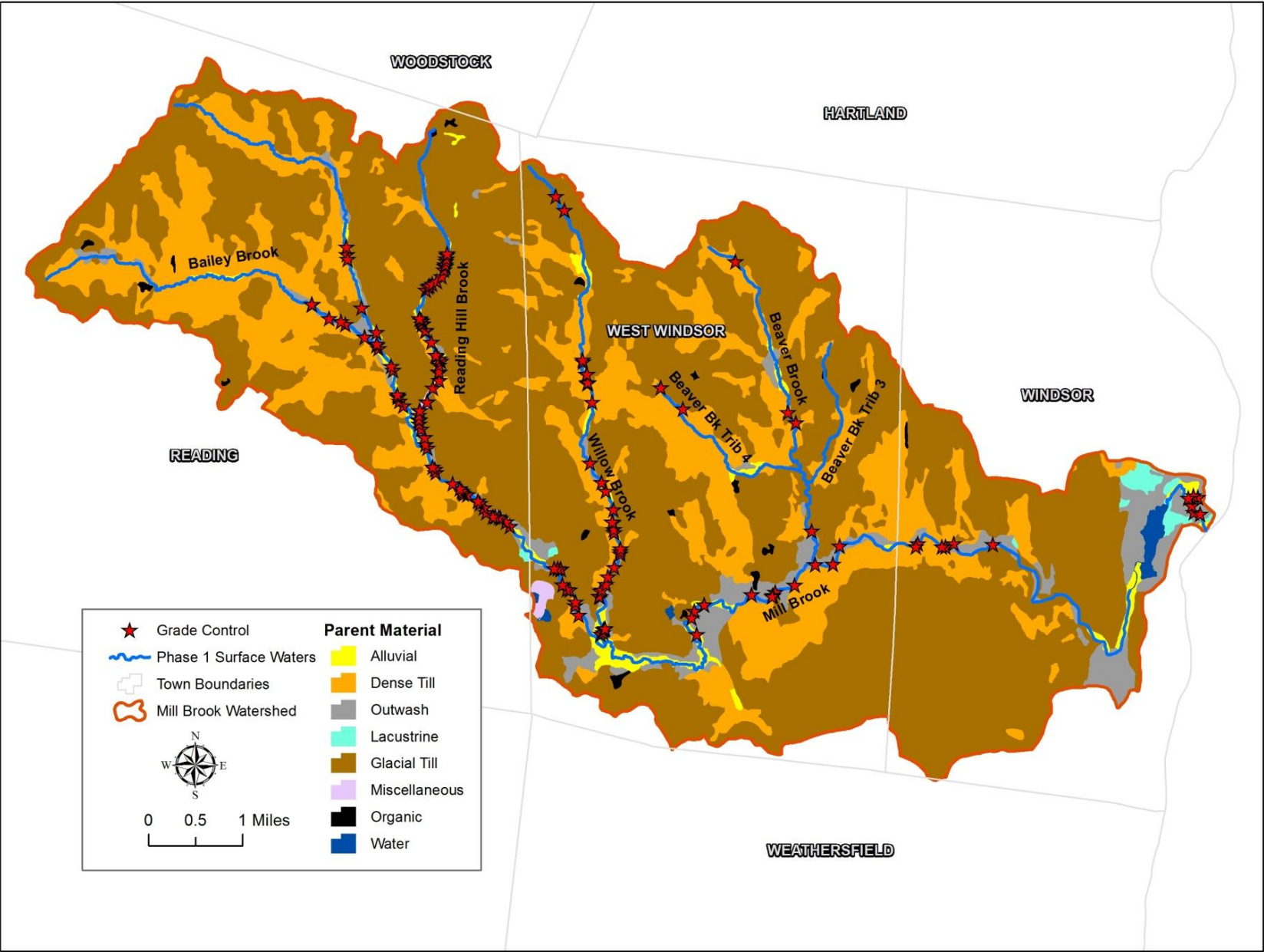


Figure 1.6: Parent surficial materials and grade controls in the Mill Brook Watershed.

1.2.3 Geomorphic Setting

The Mill Brook Phase 1 study area contains four major tributaries (Beaver Brook, Willow Brook, Reading Hill Brook, and Bailey Brook) and two additional sub-tributaries (Beaver Brook Tributaries 3 and 4). Average slopes for the study reaches are presented in Table 1.2. The first reach of Mill Brook begins in a wide channel backwatered from the Connecticut River. The stream then climbs through a series of bedrock cascades to the top of the first reach. The second reach (M02) flows through a very broad valley ending at the large stone dam for the upstream Mill Pond. Above Mill Pond, the stream flows through "the narrows", with tight valley walls on one or both sides. Channel slope and confinement both increase in M05 as the stream flows through a semi-confined valley shared with Brook Road throughout. Reaches M06 through M10 are located in unconfined valley settings with slopes less than 1%. M11 is semi-confined as the stream flows through a naturally tight valley shared with Route 44. M12 through M15 are located in unconfined broad to very broad valleys with slope increasing to 1.5% as the stream climbs to the headwaters. M16 through M18 are headwaters reaches with increased confinement and slopes from 3.8 to 8.2%. Average channel slope for Mill Brook is 1.9%, however average channel slope is under 1% if the three headwaters reaches are excluded.

Beaver Brook (T1) joins Mill Brook in M06 and flows through an unconfined very broad to broad valley with approximately 2% slope through T1.03. The last reach is very steep and confined as the tributary reaches the headwaters. Both of the unnamed sub-tributaries to Beaver Brook flow through steep and semi-confined valleys. Willow Brook (T2) joins Mill Brook in M10 and flows through a predominantly unconfined valley with slopes ranging from 1.3 to 3.1% slope. A short and steep semi-confined reach (T2.02) is found where the stream flows through a natural valley wall constriction. Reach T2.08 rises to the headwaters in a semi-confined valley with 5.9% slope. Reading Hill Brook joins Mill Brook in Reach M13 and flows through an unconfined valley with slopes ranging from 1.1 to 2.7% until reaching the steep and confined headwaters in T3.06. Bailey Brook joins Mill Brook in M14 and flows through a narrow and steeper valley (3.6% slope) for the first reach and then enters a semi-confined reach to the headwaters (4.6% slope).

Table 1.2: Average channel slopes for major and sub tributaries.

Channel (SGA Reaches)	Average Slope
Mill Brook (M1-M18)	1.9%
Beaver Brook (T1.01-T1.04)	2.8%
Beaver Brook Tributary 3 (T1.01.S3.01)	5.5%
Beaver Brook Tributary 4 (T1.01.S4.01)	4.5%
Willow Brook (T2.01-T2.08)	2.9%
Reading Hill Brook (T3.01-T3.06)	2.6%
Bailey Brook (T4.01-T4.02)	4.3%

1.2.4 Hydrology and Flood History

The United States Geological Survey (USGS) has never operated a real-time flow monitoring gage on Mill Brook. All of the nearby major river basins have USGS gage stations (Ottawquechee, Black, Williams, and Saxtons); however peak flows in many of these basins are regulated by large impoundments. Ayers Brook, tributary to the White River and a gaging station in West Bridgewater on the Ottawquechee are not affected by impoundments, but have smaller drainage areas than Mill Brook. Peak flow recurrence intervals for all nearby USGS stream gaging stations not affected by major impoundments are shown below in Table 1.3 (Olson, 2014).

Table 1.3: Frequency and magnitude of flow events in gaged basins near Mill Brook.

Return Frequency	Discharge (cfs)				
	¹ Ayers Brook	¹ Ottawquechee (W Bridgewater)	¹ Saxtons River	¹ Williams River	² Mill Brook
Drainage Area (mi²)	30.5	23.3	72.1	111	44.6
Data Period	1940-2012	1985-2011	1936-82, 2002-2011	1938-1984, 1987-2012	None
2 year	752	1,010	2,830	4,830	1,470
5 year	1,220	1,630	4,730	7,230	2,240
10 year	1,620	2,160	6,370	9,100	2,840
25 year	2,250	2,980	8,940	11,800	3,700
50 year	2,820	3,720	11,300	14,000	4,450
100 year	3,490	4,580	14,000	16,500	5,240
200 year	4,270	5,580	17,200	19,300	6,110
500 year	5,520	7,150	22,300	23,400	7,440

Recurrence interval data sources: ¹Olson, 2014; ²USGS StreamStats

Tropical Storm Irene was a major flood event on Mill Brook, estimated at over a 100-year flood based on nearby gage data. Ayers Brook and Williams River both recorded flows well over the 100-year flood, 3,920cfs and 21,300cfs respectively. The measured discharge of 21,600cfs on the Saxtons was well above the 200 year flood. The stream gage on the Ottawquechee did not record an estimated peak discharge, however the stage height recorded was over six feet higher than the previous peak discharge of 1,960cfs in 1995. Additional major floods (greater than the 25-year event) were recorded in 1976 for Williams and Saxtons Rivers, and 1952, 1973, and 1998 for Ayers Brook (Figure 1.8). Ayers Brook was the only gaging station with data for the great flood of 1927, and peak stage was approximately one foot higher than Tropical Storm Irene, indicating a 500-year flood. The flood of 1927 inundated much of downtown Windsor as shown in Figure 1.7.

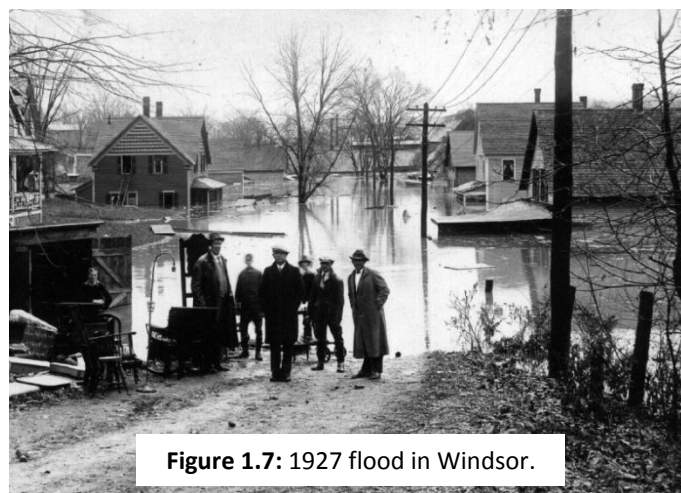


Figure 1.7: 1927 flood in Windsor.

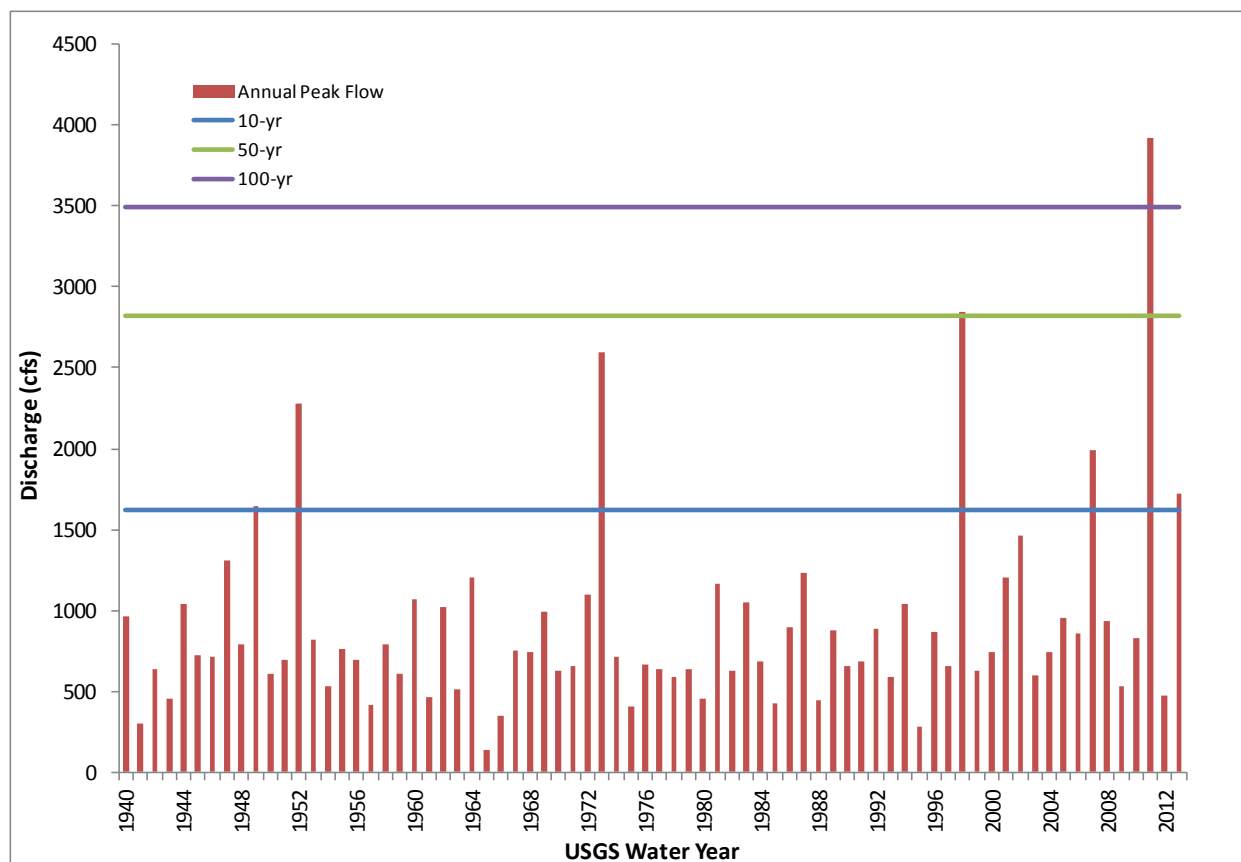


Figure 1.8: Annual peak streamflows from USGS gage on Ayers Brook in Randolph VT

Tropical Storm Irene caused significant damage to roads, bridges, and property throughout the Mill Brook watershed. Bridge failures and roadway washouts occurred in numerous locations, including severe damage to Route 44 as shown in Figure 1.9. Major erosion and channel migration were observed during field surveys and in recent aerial imagery. Major flood damage occurred both in natural areas and areas of significant historical channel manipulation (Figure 1.10).



Figure 1.9: Route 44 bridge approach destroyed in Reach M04.



Figure 1.10: Evidence of major flooding, erosion, and bank failure along Mill Brook Reach M10 (upper) and Reach T4.02 (lower).

1.2.5 Ecological Setting

The majority of the Mill Brook watershed is located in the Southern Vermont Piedmont (SP) biophysical region, except Bailey Brook and the headwaters of Mill Brook which are located in the Southern Green Mountains (SM) biophysical region (Thompson and Sorenson, 2000). The SP region is found along the eastern border of Vermont and extends from White River Junction down to Massachusetts. It is characterized by gentle rolling hills and bedrock geology that supports Northern

Hardwood Forest communities. Some areas of igneous intrusions (Ascutney Mountain) support rare communities such as the Pitch Pine-Oak-Heath community. Rich soils of loam and silt along the Connecticut River that once supported extensive areas of silver maple (*Acer saccharinum*) and Ostrich Fern (*Matteuccia struthiopteris*) were converted to agricultural use during European settlement in the late 18th century. Post-glacial deposits of sand and gravel are common in the river valleys of the SP region, including most of the Mill Brook watershed. The SM region is found along the spine of the Green Mountains and low foothills to the east in the southern half of Vermont. Temperatures are cooler and precipitation is higher in this region. Bedrock is typically metamorphic, acidic, and non-calcareous. The natural communities in this region tend to be those with northern affinities that are best suited for colder temperatures. Boreal communities are found on the highest peaks where winter conditions are harshest. The slopes grade into the Northern Hardwood forest type at elevations of around 2,500 feet. This forest type dominates most of the Mill Brook watershed. Deep glacial till deposits cover most of the SM region including the Mill Brook watershed. Glaciofluvial kame and outwash deposits common in the SM region are found throughout the Mill Brook valley.

Elevations within the study area range from 302 feet at the confluence of Mill Brook with the Connecticut River to over 3,100 feet at the top of Mount Ascutney on the southern border of the watershed. The headwaters of Mill Brook and Bailey Brook are surrounded by peaks over 2,000 feet, with Mount Moses being the tallest at 2,602 feet.

Macroinvertebrate and fish community assessments have been completed by the VTDEC Biomonitoring Division on the mainstem of Mill Brook on reaches M04, M05, and M11 for macroinvertebrates and M06 for fish. Only one pre-T.S. Irene sample on M04 was collected recently (2008) and it was characterized as "excellent". The site on M11 was sampled in 2014 and showed a sharp decline from a historically "excellent" community to a "fair" community. Biotic integrity scores were much higher and EPT richness was much lower, indicating a shift towards a community that is more tolerant of pollution, low dissolved oxygen, and fine sedimentation. Two species (*Baetis tricaudatus* and *Simulium tuberosom*) comprised over 75% of the samples; both are particulate feeders that are more tolerant of disturbance and high sediment systems.

Small areas of wetland are scattered throughout the watershed with a total land cover of approximately 1% of the watershed. The large wetland along reach M04 to Mill Pond is listed as a significant natural community (Silver Maple-Ostrich Fern Riverine Floodplain Forest). Additional small wetlands are found along streams and small tributaries throughout the watershed.

2.0 Data Collection

2.1 Data Collection Methods

The Vermont River Management Program (RMP) has invested many person-years of effort into developing a state-of-the-art system of Stream Geomorphic Assessment (SGA) protocols. The SGA protocols are intended to be used by resource managers, community watershed groups, municipalities and others 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 biological habitat of streams in Vermont. The SGA protocols have become a key tool in the prioritization of restoration projects that will 1) reduce sediment and nutrient loading to downstream receiving waters such as Lake Champlain and

the Connecticut River, 2) reduce the risk of property damage from flooding and erosion, and 3) enhance the quality of in-stream biological habitat. The protocols are based on defensible scientific principles and have been tested widely in many watersheds throughout the state. Data collected for the Mill Brook watershed using the protocols formed the basis for preliminary project identification carried out during the Phase 2 SGA and River Corridor Planning efforts.

The SGA protocols include three phases (VTDEC, 2009):

- Phase 1:** The Phase 1 SGA approach utilizes the Stream Geomorphic Assessment Tool (SGAT), a GIS extension developed by RMP for the collection of reach and watershed scale data. In addition to the GIS and remote sensing effort, a cursory field assessment (“windshield survey”) is included for the verification of stream and valley forms, significant channel features and the location of man-made infrastructure. The Phase 1 SGA approach results in watershed-scale data about the landscape (e.g., soils and land cover) and the stream channel (e.g., slope and form), which provides a basis for understanding the natural and human-impacted conditions within the watershed. The SGA data also aids in the identification of specific stressors affecting the physical conditions of the stream channels and structures (e.g., bridges and culverts). Table 2.1 summarizes the parameters collected in Phase 1 using the Feature Indexing Tool (FIT), which include those utilized to develop the final impact ratings.
- Phase 2:** The Phase 2 approach builds upon Phase 1 data through the collection of reach-specific data about the current physical conditions. Characterization of reach conditions utilizes a suite of quantitative (e.g., channel geometry, pebble counts) and qualitative (e.g., pool-riffle habitat) measurements to calculate two indices: Rapid Geomorphic Assessment (RGA) Score; Rapid Habitat Assessment (RHA) score. Using the RGA scores in conjunction with knowledge about the background or “reference” conditions, a sensitivity rating is developed to predict the degree to which the channel will adjust to human and natural impacts in the future.

Table 2.1: Parameters collected with FIT.

Phase 1 Step	Phase 2 Step	Data Type	Impact	Sub-Impact
3.1	1.2	Point	Alluvial Fan	NA
3.2	1.6	Point	Grade Control	Dam Ledge Waterfall Weir
NA	3.3	Point	Mass Failure	NA
5.5	5.5	Point	Dredging	Dredging Gravel Mining Commercial Mining
NA	4.4	Point	Debris Jam	NA
NA	4.6	Point	Stormwater Input	NA
NA	4.9	Point	Beaver Dam	NA
NA	5.2	Point	Migration	Neck Cut Off Flood chute Avulsion Braiding

Table 2.1: Parameters collected with FIT.

Phase 1 Step	Phase 2 Step	Data Type	Impact	Sub-Impact
NA	5.3	Point	Steep Riffle or Head Cut	Head Cut Steep Riffle
NA	5.4	Point	Stream Crossing	Stream Ford Animal Crossing
NA	3.3	Point	Gully	NA
6.2	1.3	Line	Development	NA
6.1	1.3	Line	Encroachment	Berm Improved Path Road Railroad
5.3	3.1	Line	Bank Armoring or Revetment	Rip-Rap Hard Bank Other
7.2	3.1	Line	Erosion	NA
5.4	5.5	Line	Straightening	Straightening With Windrowing

- Phase 3:** Phase 3 surveys involve the collection of detailed, reach-scale survey data to verify or build upon Phase 2 data. These surveys are typically carried out prior to project development for an “active” channel management approach (e.g., floodplain restoration), or for long-term monitoring purposes.

VTANR was responsible for developing the subwatershed, valley wall, and meander centerline themes for the study reaches, running the SGAT tool, and populating the VTANR Data Management System (DMS) with reference stream type data. The remaining Phase 1 data was collected remotely by FEA and through windshield surveys for reaches along 42.5 river miles. All major human impacts and natural features were indexed in a GIS using the FIT.

2.2 Quality Assurance

The VTDEC Quality Assurance (QA) protocols outlined in the SGA protocols (VTDEC, 2009) were followed in order to ensure a complete and accurate dataset. FEA and VTDEC shared responsibility for QA for the SGAT shapefiles and the finalized Phase 1 and Phase 2 datasets. The DMS database for all Phase 1 assessed reaches in the watershed was finalized in April, 2014. The DMS database for all Phase 2 assessed reaches was finalized in March 2015. The QA summaries for Phase 2 are included in Appendix E.

2.3 Bridge and Culvert Assessments

FEA conducted bridge and culvert surveys on all private and public structures 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 (VTDEC, 2009) were followed. Latitude and Longitude of each structure was recorded in the field with a GPS unit or digitized based on aerial imagery. The assessment included various photographs documenting the condition of each structure.

2.4 Stressor and Departure Analysis

FEA followed the VTDEC methods for developing river corridor plans as outlined in the Vermont River Corridor Planning Guide (VTANR, 2010). This technical guide is directed towards river scientists, planners, and engineers engaged in finding economically and ecologically sustainable solutions to the conflicts between human investments and river dynamics. The guide provides explanations for the following:

- River science and societal benefits of managing streams in a sustainable manner toward equilibrium conditions;
- Methods for assessing and mapping stream geomorphic conditions, and identifying and prioritizing river corridor protection and restoration projects;
- Methods for examining project feasibility and negotiating management alternatives with stakeholders; and
- Information on current programs available to Vermont landowners, towns, and other interested parties to implement river corridor protection and restoration projects.

Included in this approach is an extensive mapping exercise to lay the foundation for understanding stressors on stream channel stability at the watershed and reach scales. These maps are compiled as part of the stressor and departure analysis, and illustrate a gradient of human impacts and stream response across the watershed. The maps provide a basis for identifying projects through a step-wise procedure to screen potential projects for compatibility with long-term equilibrium conditions.

2.4.1 Stressor Analysis

The data collected through the Phase 1 and 2 SGA studies provides the basis for assessing the impacts to the hydrologic and sediment regimes, and the channel riparian and boundary conditions. This data, when combined with other watershed-scale data developed in this study, allows for the assessment of physical departure from reference conditions, and serves to validate watershed-scale patterns and stream conditions observed in the field.

Stressor, departure and sensitivity maps have been prepared to depict the effects of significant physical processes occurring within the Mill Brook study area. These maps provide an indication of where channel adjustment processes 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 channel adjustments. This is helpful in developing and prioritizing potential river corridor protection and restoration projects.

2.4.2 Departure Analysis

Much research has shown that alluvial river channels in wide valleys will adjust their geometry and planform to accommodate changes in the discharge and sediment loading from the upslope watershed (Dunne and Leopold, 1978). This concept was summarized by Lane (1955) to show that stream power and sediment (size and distribution) will seek a dynamic equilibrium condition in the absence of anthropogenic disturbance or catastrophic natural storm events. Slight changes from one year to another, such as variation in rainfall amounts (and a resulting variation in discharge), may cause subtle changes in channel form. However, the cross-sectional shape and profile of a river is typically stable under reference watershed conditions, and predictable given knowledge about: 1) the geologic conditions of the watershed and river corridor, 2) the topography of the watershed and river corridor, and 3) the regional climate.

Analysis of a watershed's sediment regime is a useful approach for summarizing the reach and watershed-scale stressors affecting the equilibrium conditions of river channels. Sediment regime mapping provides a context for understanding the sediment transport and channel evolution processes (Schumm, 1977) which govern changes in geometry and planform for river channels in a state of disequilibrium. The VTANR River Corridor Planning Guide (VTANR, 2010) outlines a methodology for understanding the reference and altered sediment regimes of reaches according to data collected during the Phase 2 field assessments. The sediment regime types used in this analysis are summarized below in Table 2.2.

Table 2.2: Sediment regime types for corridor planning (VTANR, 2010).

Sediment Regime	Narrative Description
Transport	Steeper bedrock and boulder/cobble cascade and step-pool stream types; typically in more confined valleys, do not supply appreciable quantities of sediments to downstream reaches on an annual basis; little or no mass wasting; storage of fine sediment is negligible due to high transport capacity derived from both the high gradient and/natural entrenchment of the channel.
Confined Source and Transport	Cobble step pool and steep plane bed streams; confining valley walls, comprised of erodible tills, glacial lacustrine, glacial fluvial, or alluvial materials; mass wasting and landslides common and may be triggered by valley rejuvenation processes; storage of coarse or fine sediment is limited due to high transport capacity derived from both the gradient and entrenchment of the channel. Look for streams in narrow valleys where dams, culverts, encroachment (roads, houses, etc.), and subsequent channel management may trigger incision, rejuvenation, and mass wasting processes.
Unconfined Source and Transport	Sand, gravel, or cobble plane bed streams; at least one side of the channel is unconfined by valley walls; may represent a stream type departure due to entrenchment or incision and associated bed form changes; these streams are not a significant sediment supply due to boundary resistance such as bank armoring, but may begin to experience erosion and supply both coarse and fine sediment when bank failure lead to channel widening; storage of coarse or fine sediment is negligible due to high transport capacity derived from the deep incision and little or no floodplain access. Look for straightened, incised or entrenched streams in unconfined valleys, which may have been bermed and extensively armored and are in Stage II or early Stage III of channel evolution.
Fine Source and Transport & Coarse Deposition	Sand, gravel, or cobble streams with variable bed forms; at least one side of the channel is unconfined by valley walls; may represent a stream type departure due to vertical profile and associated bed form changes; these streams supply both coarse and fine sediments due to little or no boundary resistance; storage of fine sediment is lost or severely limited as a result of channel incision and little or no floodplain access; an increase in coarse sediment storage occurs due to a high coarse sediment load coupled with the lower transport capacity that results from a lower gradient and/or channel depth. Look for historically straightened, incised, or entrenched streams in unconfined valleys, having little or no boundary resistance, increased bank erosion, and large unvegetated bars. These streams are typically in late Stage III and Stage IV of channel evolution.
Coarse Equilibrium (in = out) & Fine Deposition	Sand, gravel, or cobble streams with equilibrium bedforms; at least one side of the channel is unconfined by valley walls; these streams transport and deposit coarse sediment in equilibrium (stream power—produce as a result of channel gradient and hydraulic radius—is balanced by the sediment load, sediment size, and channel boundary resistance); and store a relatively large volume of fine sediment due to the access of high frequency (annual) floods to the floodplain. Look for unconfined streams, which are not incised or entrenched, have boundary resistance (woody buffers), minimal bank erosion, and vegetated bars. These streams are Stage I, late IV, and Stage V.

Table 2.2: Sediment regime types for corridor planning (VTANR, 2010).

Sediment Regime	Narrative Description
Deposition	Silt, sand, gravel, or cobble streams with variable and braided bed forms; at least one side of the channel is unconfined by valley walls; may represent a stream type departure due to changes in slope and/or depth resulting in the predominance of transient depositional features; storage of fine and coarse sediment frequently exceeds transport**. Floodplains are accessed during high frequency (annual) floods. Look for unconfined streams, which are not incised or entrenched, have become significantly over-widened, and if high rates of bank erosion are present, it is offset by the vertical growth of unvegetated bars. These regimes may be located at zones of naturally high deposition (e.g., active alluvial fans, deltas, or upstream of bedrock controls), or may exist due to impoundment and other backwater conditions above weirs dams and other constrictions.

** Use of the “Deposition” regime characterization may be rare, but valuable as a planning tool, where the reach is storing far more than it is transporting during some defined planning period. The extreme example would be that of an impounded reach where all of the coarse and a great percentage of the fine sediments are being deposited, rather than transported downstream. This man-made condition may change, thereby changing the sediment regime, but is not likely over the period at which the corridor plan will be used.

Channel evolution models (CEM) also provide a basis for understanding the temporal scale of channel adjustments and departure in the context of SGA Phase 2 results. Both the “D” stage and “F” stage CEMs (VTDEC, 2009) are helpful for explaining the channel adjustment processes underway in the Mill Brook watershed. The “F” stage CEM is used to understand the process that occurs when a stream degrades (incises) its bed. The more dominant adjustment process for the “D” stage channel evolution is aggradation, widening and planform change. D-stage CEM typically occurs where grade controls prevent severe channel incision and abandonment of the adjacent floodplain. The common stages of both CEMs are depicted in Figure 2.1 below.

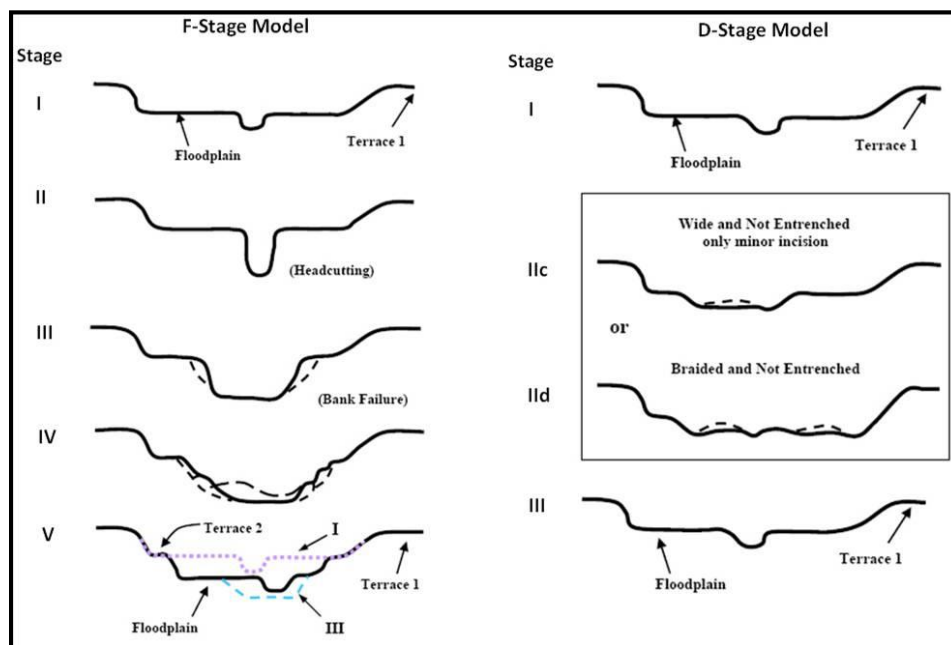


Figure 2.1: Typical channel evolution models for F-stage and D-stage (VTDEC, 2009).

2.4.3 Sensitivity Analysis

The following description of the sensitivity of various stream types to changes in sediment and flow regimes, boundary conditions and channel morphology, is included from the most recent version of the VTANR River Corridor Planning Guide (VTANR, 2010).

Certain geomorphic stream types are inherently more sensitive than others, responding readily through lateral and/or vertical adjustments to high flow events and/or influxes of sediment. Other geomorphic stream types may undergo far less adjustment in response to the same watershed inputs. In general, streams receiving a large supply of sediment, having a limited capacity to transport that sediment, and flowing through finer-grained, non-cohesive materials are inherently more sensitive to adjustment and likely to experience channel evolution processes more rapidly than streams with a lower sediment supply, higher transport capacity and flowing through cohesive or coarse-grained materials (Montgomery and Buffington, 1997). The geometry and roughness of the stream channel and floodplain (i.e., the width, depth, slope, sediment sizes, and floodplain relations) dictate the velocity of flow, how much erosive power is produced, and whether the stream has the power to transport the sediment delivered from upstream (Leopold, 1994). If the energy produced by the depth and slope of the water is either too little or too great in relation to the sediment available for transport, the stream may be out of equilibrium and channel adjustments are likely to occur, especially during flood conditions (Lane, 1955).

Stream sensitivity maps have been prepared for the Mill Brook study area. Sensitivity ratings were assigned using the VTDEC Protocols (VTDEC, 2009).

2.5 Project Identification

Site-specific projects were identified using methods outlined by VTANR in Chapter 6 Preliminary Project Identification and Prioritization (VTANR, 2010). This planning guide is intended to aid in the development of projects that protect and restore river equilibrium conditions. The projects identified for the study reaches 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 of human constructed constraints or the construction of meanders, floodplains or stable banks. Riparian buffer re-vegetation 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 ideal results. Riparian buffer re-vegetation and long-term protection of a river corridor (e.g., corridor easements) is essential to this alternative.

Conservation is an option to consider when stream conditions are generally "good" or "reference" and the channel is in a state of dynamic equilibrium. Typically, conservation is applied to minimally disturbed reaches where river structure and function and vegetation associations are relatively intact, and/or where high quality aquatic habitat is found.

3.0 Phase 1 Results

3.1 Reach Delineations

The 42.5 miles of surface waters within the Mill Brook watershed were divided into 39 reaches during the SGAT analysis carried out by VTANR and FEA. Reach divisions were based on changes in valley geometry, channel slope, and the size and influence of tributaries entering the mainstem channel. The Mill Brook mainstem, Beaver Brook, Willow Brook, Reading Hill Brook, Bailey Brook, and two (2) unnamed tributaries to Beaver Brook were included in the SGAT analysis. Table 3.1 summarizes data for the study watersheds. Detailed information about each reach location is found in the reach reports in Appendix A.

Table 3.1: Tributary and sub-tributary summary data.

DMS ID	Name	Watershed Area (square miles)	Assessed River Length (mi)	Number of Assessed Reaches
M	Mill Brook	44.6	19.5	17
T1	Beaver Brook	6.5	4.3	4
T1.01.S3	1st Unnamed Trib to Beaver Br	1.1	1.8	1
T1.01.S4	2nd Unnamed Trib to Beaver Br	1.4	2.2	1
T2	Willow Brook	5.3	6.1	8
T3	Reading Hill Brook	4.1	4.2	6
T4	Bailey Brook	5.4	4.4	2

3.2 Reference Stream Types

Windshield survey measurements and observations as well as remotely collected data of valley confinement, channel slope, and sinuosity were used to develop reference stream types for the assessed reaches according to the Rosgen (1994) and Montgomery and Buffington (1997) classification systems. Characterization of reference stream types is based on the channel forms and processes we would expect in a particular geologic and geomorphic setting without human influences. Detailed information about each reach reference stream type is found in the reach reports in Appendix A. Table 3.2 presents general valley and channel characteristics associated with reference stream types found in the Mill Brook and tributary watersheds. Table 3.3 describes the reference stream conditions for each study reach.

Table 3.2: Reference stream type characteristics.

Stream Type	Valley Confinement	Channel Slope	Sinuosity	Bedform	Number of Study Reaches*
A	Confined	> 4%	Low	Cascade or Step-pool	8 (20%)
B	Confined	2 – 4%	Low	Step-pool or Plane bed	11 (28%)
C	Unconfined	< 2%	Moderate	Riffle Pool	17 (44%)
E	Unconfined	<2%	Highly	Dune Ripple	3 (8%)

* Number of reaches and percentage of total reaches represented by type.

Table 3.3: Reach and watershed characteristics.

Surface Water	Reach ID	Watershed Area (Mi ²)	Channel Length (Mi)	Channel Width (ft)	Channel Slope (%)	Sinuosity	Valley Type*	Reference Stream Type†	Bedform‡
Mill Brook	M01	44.6	0.33	69.7	1.02	1.00	SC	A1 _c	Cascade
	M02	44.5	0.72	69.6	0.72	1.55	BD	C4	Riffle-Pool
	M04	43.1	1.53	68.6	0.52	1.02	NW	C4	Riffle-Pool
	M05	40.3	2.72	66.6	1.30	1.05	SC	B3 _c	Riffle-Pool
	M06	36.5	1.18	63.8	0.96	1.25	NW	C3	Riffle-Pool
	M07	27.9	1.43	56.7	0.62	1.16	BD	C4	Riffle-Pool
	M08	25.1	0.40	54.1	0.39	1.00	SC	B3 _c	Riffle-Pool
	M09	25.0	2.19	54.0	0.36	1.36	VB	C4	Riffle-Pool
	M10	16.8	0.36	45.3	0.38	1.14	VB	C4	Riffle-Pool
	M11	16.6	0.75	45.2	1.08	1.02	SC	B3 _c	Riffle-Pool
	M12	16.1	0.77	44.5	0.89	1.19	VB	C4	Riffle-Pool
	M13	15.3	1.37	43.5	1.18	1.02	NW	B3 _c	Riffle-Pool
	M14	9.7	1.42	35.7	1.37	1.24	VB	C4	Riffle-Pool
	M15	3.1	1.01	21.4	1.56	1.15	VB	C4	Riffle-Pool
	M16	2.6	0.95	19.8	3.79	1.09	NW	B3	Riffle-Pool
	M17	1.6	1.16	16.3	6.96	1.15	SC	A2	Step-Pool
	M18	0.6	1.23	10.6	8.17	1.09	SC	A2	Step-Pool
Beaver Brook	T1.01	6.5	1.24	29.9	1.66	1.21	NW	C3	Riffle-Pool
	T1.02	3.5	1.46	22.7	2.00	1.17	VB	C4	Riffle-Pool
	T1.03	1.0	1.06	13.1	2.07	1.08	VB	C4 _b	Riffle-Pool
	T1.04	0.3	0.49	7.2	9.41	1.03	SC	A3	Step-Pool
1st Trib to Beaver Bk	T1.01.S3.01	1.1	1.75	13.7	5.52	1.09	SC	A1	Step-Pool
2nd Trib to Beaver Bk	T1.01.S4.01	1.4	2.19	15.4	4.47	1.09	SC	A2	Step-Pool
Willow Brook	T2.01	5.3	0.76	27.2	1.28	1.29	VB	C4	Riffle-Pool
	T2.02	5.0	0.61	26.7	3.20	1.02	NW	B3	Step-Pool
	T2.03	4.7	1.29	25.9	2.04	1.13	BD	B3	Riffle-Pool
	T2.04	3.2	0.58	21.9	2.75	1.10	BD	C3 _b	Riffle-Pool
	T2.05	2.3	0.38	19.0	3.08	1.19	BD	C3	Riffle-Pool
	T2.06	1.7	0.88	16.5	2.39	1.10	BD	C4 _b	Riffle-Pool
	T2.07	1.1	0.68	13.6	2.19	1.07	BD	C4 _b	Riffle-Pool
	T2.08	0.3	0.97	7.8	5.91	1.20	SC	A2	Step-Pool
Reading Hill Brook	T3.01	4.1	0.57	24.3	1.22	1.17	BD	E4	Riffle-Pool
	T3.02	3.9	0.91	23.7	1.13	1.20	VB	E4	Riffle-Pool
	T3.03	2.7	0.59	20.2	1.38	1.18	VB	E4	Riffle-Pool
	T3.04	2.2	0.55	18.5	2.39	1.02	SC	B1	Step-Pool
	T3.05	1.8	0.97	16.8	2.65	1.09	NW	B3	Step-Pool
	T3.06	0.2	0.59	6.2	7.66	1.07	SC	A2	Step-Pool
Bailey Brook	T4.01	5.4	1.50	27.4	3.64	1.10	NW	B3	Riffle-Pool
	T4.02	3.3	2.94	22.2	4.62	1.12	SC	B3	Step-Pool

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

† per Rosgen (1994)

‡ per Montgomery and Buffington (1997)

Figure 3.1 presents the location of the reference stream types developed for the Mill Brook watershed. C-type reaches are most common in the watershed under reference conditions (44%). C-type streams are typically characterized by a moderately sinuous channel found in a broad, unconfined valley setting with a balance between the upslope sediment supply and the transport capacity. B-type streams (28%) are typically characterized by a low to moderately sinuous channel in a confined valley that is dominated by sediment transport processes. A-type streams (20%) are typically found in the steep headwater areas. Three reaches (T3.01, T3.02, and T3.03) were characterized as E-type. E-type reaches are typically found in broad valleys with low slope and depositional environments. Outside of the headwater areas; channel slope is relatively consistent through most of the study area, therefore reference stream type is primarily influenced by confinement. C-type reaches typically have broad and very broad confinement, and B-type reaches are typically found in semi-confined or narrow valleys. A-type reaches were found in upper headwater areas on several of the tributaries and the mainstem.

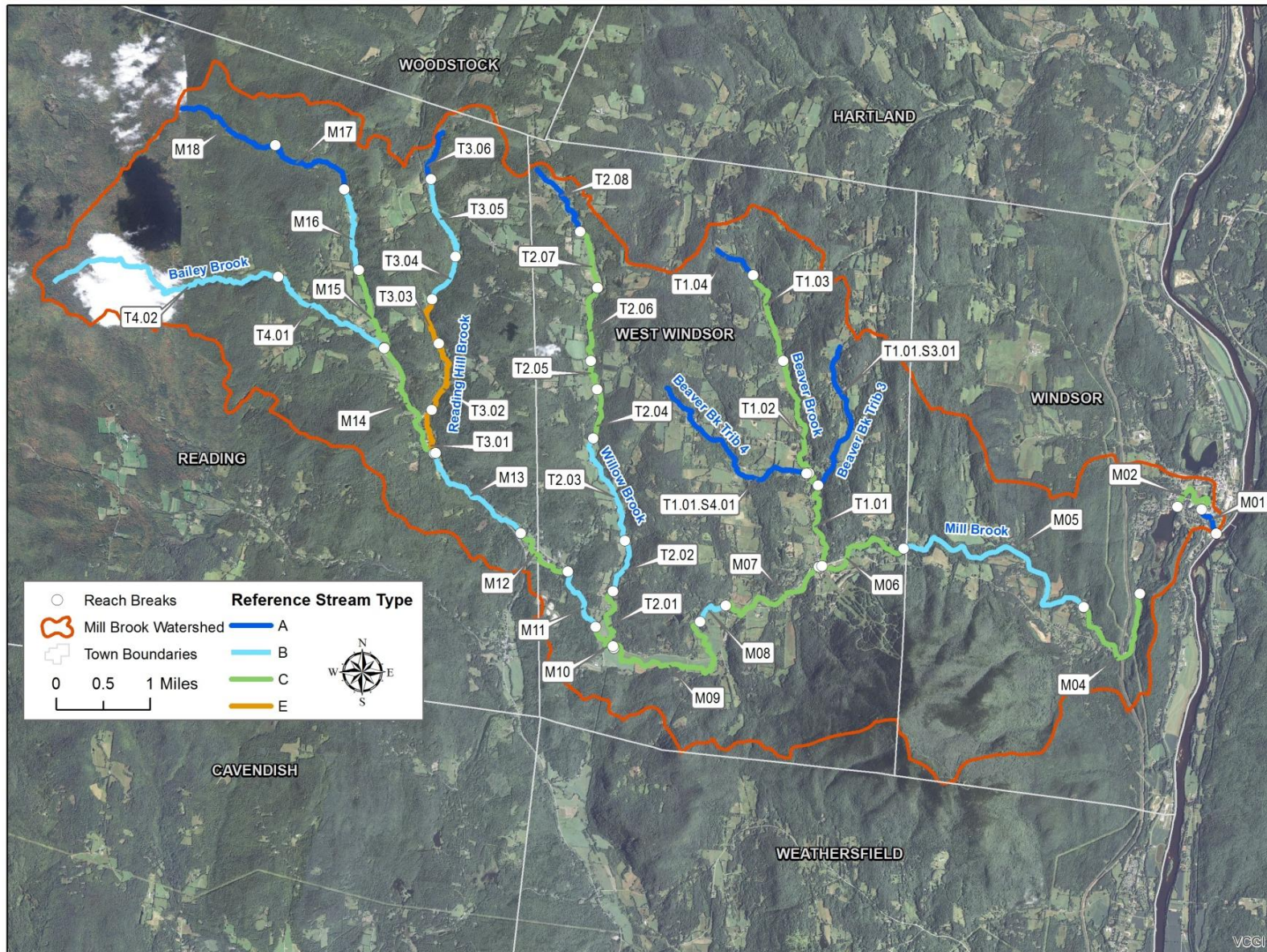


Figure 3.1: Reference stream types per Rosgen (1994) for the Mill Brook watershed.

3.3 Phase 1 Impacts Summary

Based on the Phase 1 impact scores, the DMS also develops predictions for channel adjustment processes (VTDEC, 2009). These predictions are based on the dominant impacts recorded for each reach, and are categorized based on the impacts typically associated with the following four channel adjustment processes: 1) Degradation (e.g., channel incision); 2) Aggradation (e.g., increased sediment deposition); 3) Channel widening (e.g., increased bank erosion); 4) Planform Changes (e.g., irregular meander patterns) (Table 3.4 and Figure 3.2). Impacts are scored from 0-2 (Insignificant to Major) and the total score (0-32) is indicative of the total degree of impact, however there are no qualitative ratings assigned to a particular Phase 1 impact score.

Table 3.4: Final Impact Score Parameters for Phase 1 Dataset.

Phase 1 Step	Phase 1 Parameter	Impact Category
4.1	Local Watershed Land Cover/Land Use	Land Use
4.2	Corridor Watershed Land Cover/Land Use	
4.3	Riparian Buffer Width	
5.1	Flow Regulations	Channel Modifications
5.2	Bridges and Culverts	
5.3	Bank Armoring	
5.4	Channel Straightening	
5.5	Dredging and Gravel Mining	
6.1	River Corridor Encroachments	Floodplain Modifications and Planform Changes
6.2	River Corridor Development	
6.3	Depositional Features	
6.4	Meander Migration	
6.5	Meander Belt Width Departure	
6.6	Meander Wavelength Departure	
7.2	Bank Erosion	Bed and Bank Conditions
7.3	Debris and Ice Jam Potential	

In the Mill Brook watershed, the most pervasive impacts mapped during Phase 1 assessment were river corridor and floodplain encroachments (Figure 3.3), and riparian buffer degradation (Figure 3.4). These are commonly the most widespread impacts in rural Vermont watersheds due to the presence of roadways along river networks and development and agricultural land uses found along the flat river valleys. Using the channel adjustment process ratings, a provisional geomorphic rating is developed for each reach based on the methods outlined in the SGA Phase 1 protocols (VTDEC, 2009). Table 3.5 outlines the four possible geomorphic ratings based on the SGA methods, and Figure 3.5 presents the provisional geomorphic condition for all study reaches.

Table 3.5: SGA Reach Condition Ratings.

SGA Rating	Predicted Conditions and Processes
Reference	In Equilibrium – no apparent or significant channel, floodplain, or land cover modifications; channel geometry is likely to be in balance with the flow and sediment produced in its watershed.
Good	In Equilibrium but may be in transition into or out of the range of natural variability – minor erosion or lateral adjustment but adequate floodplain function; any adjustment from historic modifications nearly complete.
Fair	In Adjustment – moderate loss of floodplain function; or moderate to major planform adjustments that could lead to channel avulsions.
Poor	In Adjustment and Stream Type Departure - may have changed to a new stream type or central tendency of fluvial processes – significant channel and floodplain modifications may have altered the channel geometry such that the stream is not in balance with the flow and sediment produced in its watershed.

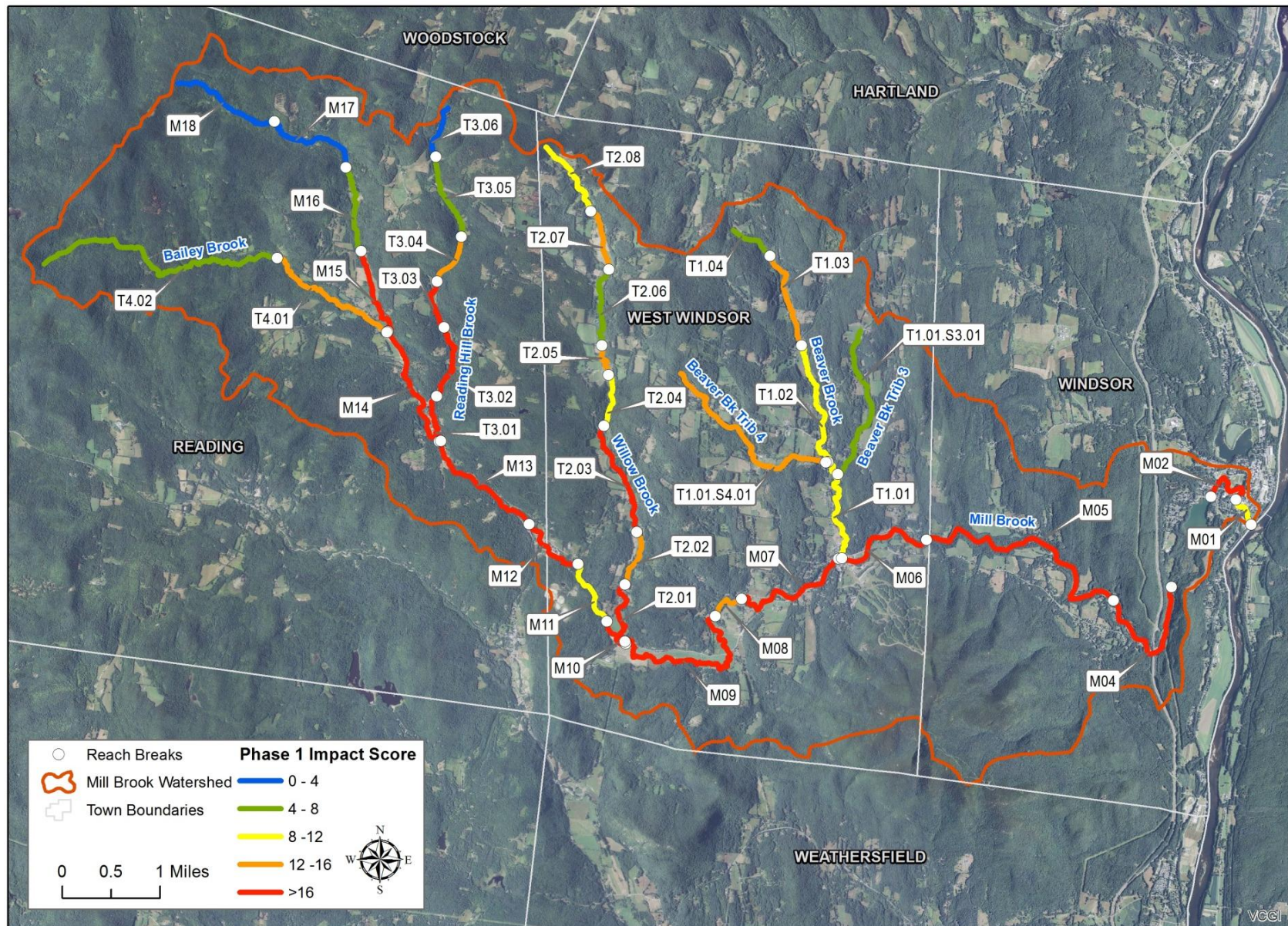


Figure 3.2: Phase 1 impact scores for the Mill Brook watershed.

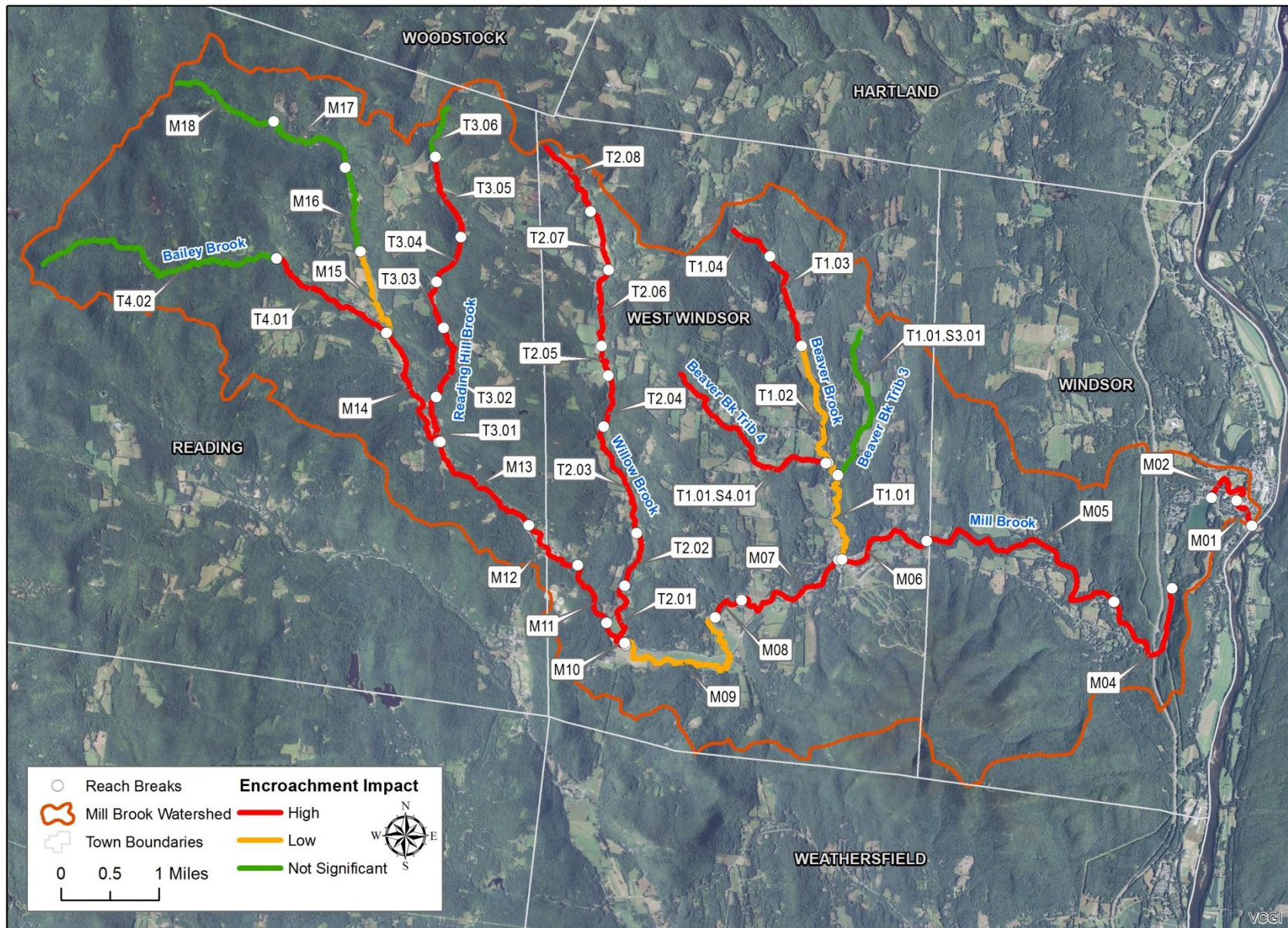


Figure 3.3: Phase 1 encroachment impacts for the Mill Brook Watershed.

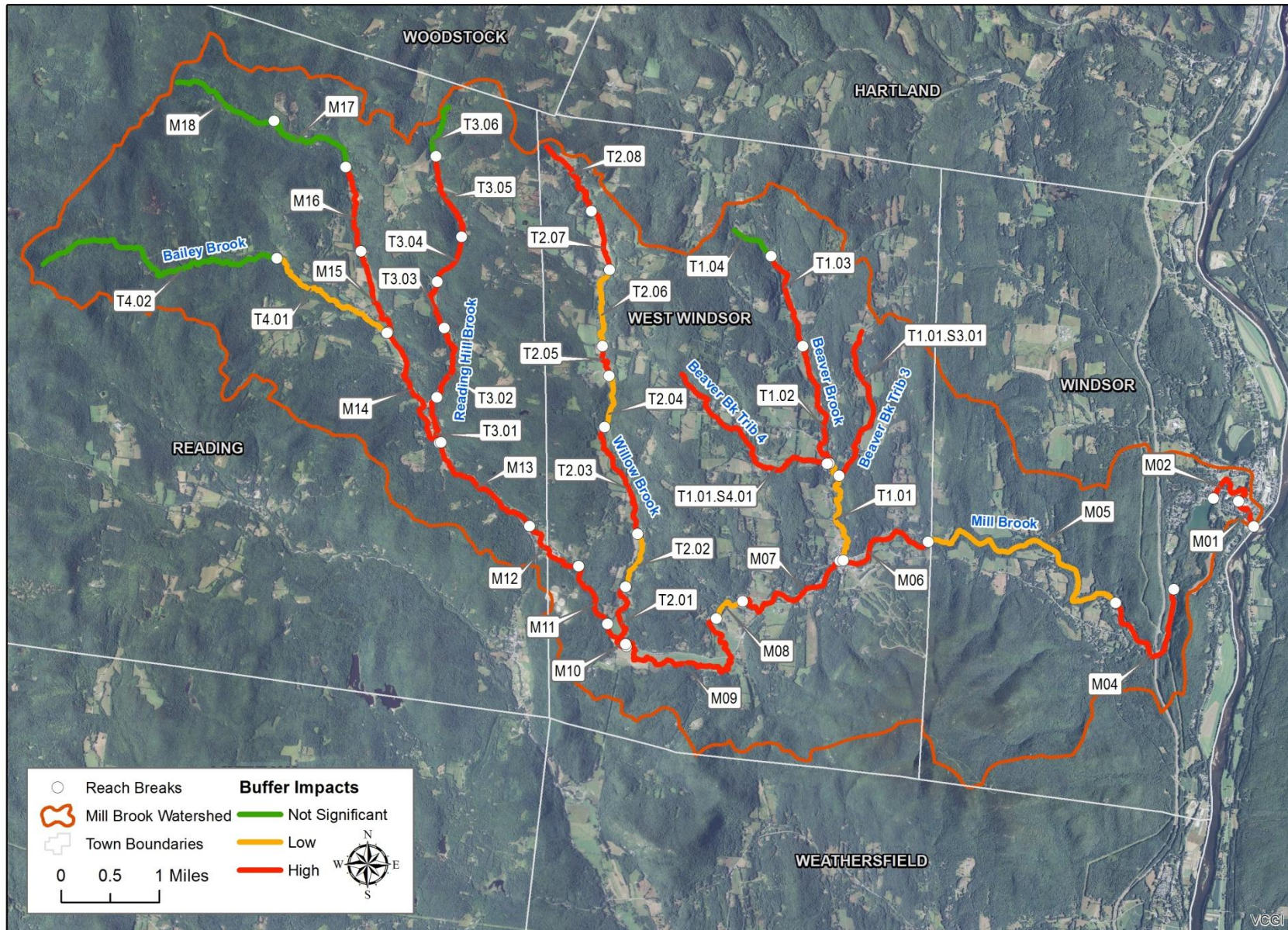


Figure 3.4: Phase 1 buffer impacts for the Mill Brook watershed.

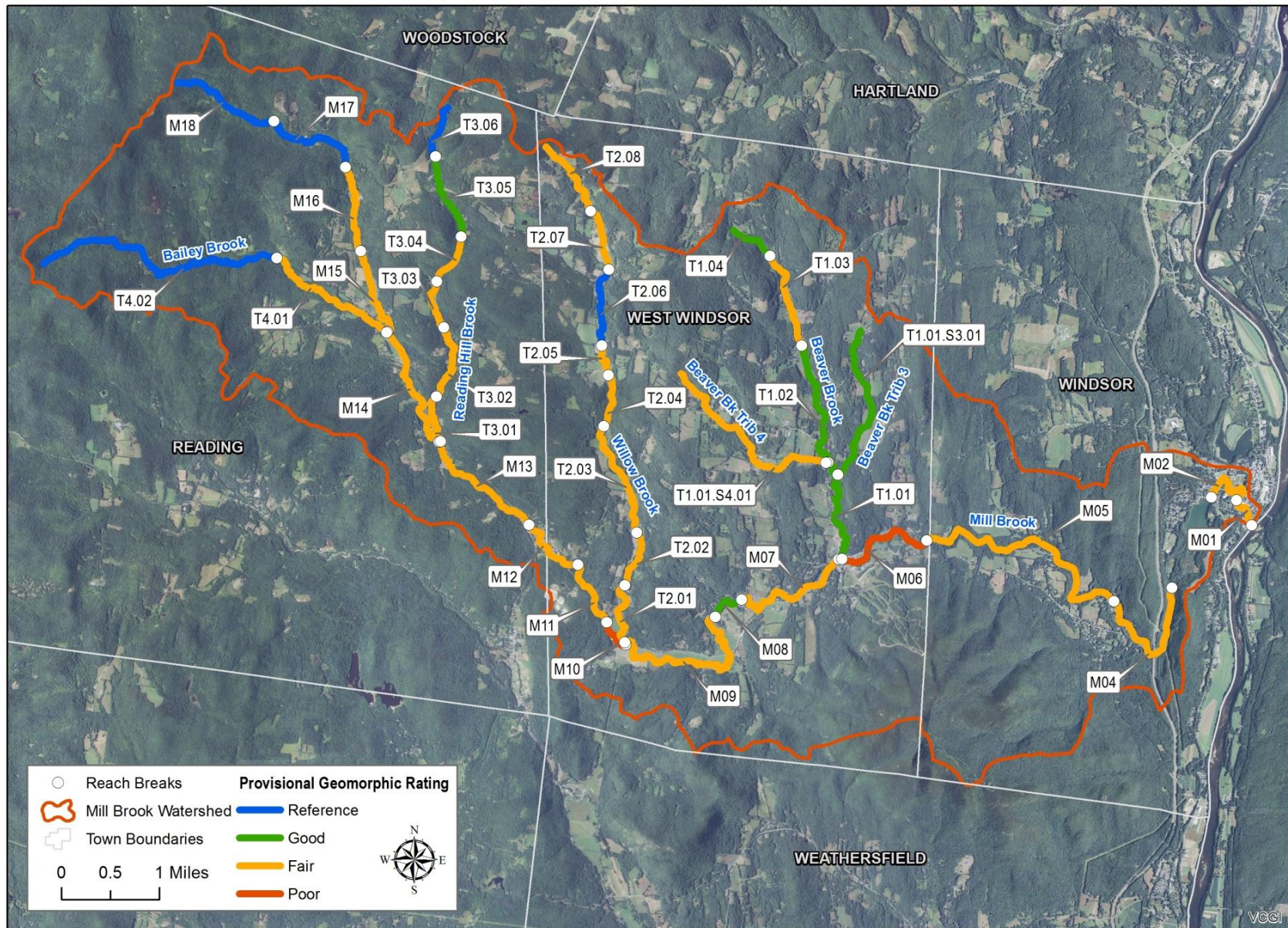


Figure 3.5: Provisional geomorphic ratings for the Mill Brook watershed.

3.4 Phase 2 Reach Recommendations

Using the Phase 1 Impact Ratings as the primary basis for reach selection, a list of reaches was developed for Phase 2 surveys within the Mill Brook watershed. Table 3.6 summarizes the twenty-eight (28) selected reaches covering 30.1 miles based on watershed location, channel length, channel slope, valley type, and preliminary reference stream type. The headwaters were trimmed off of two reaches T1.01.S4.01 and T4.02 during reach selection.

Table 3.6: Phase 2 reach recommendations and Phase 1 Impact Ratings.

Surface Water	Reach ID	Channel Length (Mi)	Channel Slope (%)	Valley Type*	Reference Stream Type†	Bedform‡	Impact Score (Geo Condition)
Mill Brook	M02	0.72	0.72	BD	C4	Riffle-Pool	18 (Fair)
	M04	1.53	0.52	NW	C4	Riffle-Pool	20 (Fair)
	M05	2.72	1.30	SC	B3 _c	Riffle-Pool	17 (Fair)
	M06	1.18	0.96	NW	C3	Riffle-Pool	22 (Poor)
	M07	1.43	0.62	BD	C4	Riffle-Pool	20 (Fair)
	M08	0.40	0.39	SC	B3 _c	Riffle-Pool	14 (Good)
	M09	2.19	0.36	VB	C4	Riffle-Pool	18 (Fair)
	M10	0.36	0.38	VB	C4	Riffle-Pool	26 (Poor)
	M11	0.75	1.08	SC	B3 _c	Riffle-Pool	11 (Fair)
	M12	0.77	0.89	VB	C4	Riffle-Pool	24 (Fair)
	M13	1.37	1.18	NW	B3	Riffle-Pool	22 (Fair)
	M14	1.42	1.37	VB	C4	Riffle-Pool	22 (Fair)
	M15	1.01	1.56	VB	C4	Riffle-Pool	20 (Fair)
	M16	0.95	3.79	NW	B3	Riffle-Pool	7 (Fair)
Beaver Brook	T1.01	1.24	1.66	NW	C3	Riffle-Pool	11 (Good)
	T1.02	1.46	2.00	VB	C4	Riffle-Pool	12 (Good)
4th Trib to Beaver	T1.01.S4.01	1.18 Δ	4.47	SC	A2	Step-Pool	16 (Fair)
Willow Brook Middle Branch	T2.01	0.76	1.28	VB	C4	Riffle-Pool	22 (Fair)
	T2.02	0.61	3.20	NW	B3	Step-Pool	13 (Fair)
	T2.03	1.29	2.04	BD	B3	Riffle-Pool	17 (Fair)
	T2.04	0.58	2.75	BD	C3 _B	Riffle-Pool	10 (Fair)
	T2.05	0.38	3.08	BD	C3	Riffle-Pool	15 (Fair)
Reading Hill Brook	T3.01	0.57	1.22	BD	E4	Riffle-Pool	20 (Fair)
	T3.02	0.91	1.13	VB	E4	Riffle-Pool	17 (Fair)
	T3.03	0.59	1.38	VB	E4	Riffle-Pool	17 (Fair)
	T3.04	0.55	2.39	SC	B1	Step-Pool	15 (Fair)
Bailey Brook	T4.01	1.50	3.64	NW	B3	Riffle-Pool	16 (Fair)
	T4.02	1.67Δ	4.62	SC	B3	Step-Pool	7 (Reference)

* SC= Semi-confined; NW= Narrow; BD=Broad; VB=Very Broad, NC=No Confinement; † per Rosgen, 1994

‡ per Montgomery and Buffington, 1997; Δ denotes that the uppermost segment of each reach was not planned for Phase 2 assessment

4.0 Phase 2 Results and River Corridor Planning

Phase 2 assessments were conducted on 28 reaches from June through August, 2015. Fifteen (15) reaches were segmented including five (5) with multiple segments, for a total of 48 reaches and segments covering 30.1 miles (Figures 4.1 - 4.3). Three (3) segments were not fully assessed due to impoundment from beaver dams (T1.02.C), property access (T3.02.A), and a bedrock gorge (M12.A).

4.1 Phase 2 Segment Summary Sheets

One page summaries for each Phase 2 segment/reach are presented in this section. The impact summary section includes color-coded designations of Not Significant, **Low**, or **High** levels of impact based on data collected during the Phase 2 assessments. Impact levels were assigned based on the longitudinal effect (<5% - Not Significant, 5-20% - Low, and >20% - High), and the overall impact of discrete features on the reach/segment (constrictions, stormwater inputs, steep riffles, etc.). Based on our professional judgment; potential impacts for bridges (B), culverts (C), and other (O) constrictions were summarized with the following abbreviations:

- **AOP:** Aquatic organism passage
- **D:** Deposition upstream and/or downstream
- **E:** Bank erosion upstream and/or downstream
- **I:** Ice/Debris jamming
- **R/R:** Failing bank armor upstream and/or downstream
- **S:** Scour upstream and/or downstream

Incision Ratio and Entrenchment Ratios are important indicators of the degree of stream departure from reference condition. Incision ratio describes the degree of floodplain accessibility: values close to 1.0 represent reference conditions with an accessible floodplain, values greater than 2.0 indicate an extreme disconnection of floodplain typically associated with a stream type departure. Entrenchment ratio describes the width of the floodprone area in relation to the bankfull channel width. Reference entrenchment ratios vary with stream type and valley setting. Stream impacts such as encroachment, incision, widening, and straightening may all lower the entrenchment ratio. C-type streams typically have entrenchment ratios greater than 2.0 and values below 2.0 or 1.4 represent stream type departures to B or F-type respectively. Definitions for technical terminology within the summary sheets are provided in the Glossary of Terms in Section 8.0.

Habitat assessment rankings for large woody debris and pool counts (measured in reference to predicted bankfull width - wbkf) are defined in Table 4.1.

Table 4.1: LWD and Pool Ranking for RHA.

Rank	LWD		Pool	
	Diameter (ft)	Length (relative to wbkf)	Depth (ft)	Length/Width (relative to wbkf)
1	$0.5 \leq D < 1.0$	< 0.5	$1.0 \leq D < 2.0$	< 0.5
2	$0.5 \leq D < 1.0$	≥ 0.5	$1.0 \leq D < 2.0$	≥ 0.5
3	$1.0 \leq D < 2.0$	< 0.5	$2.0 \leq D < 3.0$	< 0.5
4	$1.0 \leq D < 2.0$	≥ 0.5	$2.0 \leq D < 3.0$	≥ 0.5
5	$D \geq 2.0$	< 0.5	$D \geq 3.0$	< 0.5
6	$D \geq 2.0$	≥ 0.5	$D \geq 3.0$	≥ 0.5
7	--	--	$D \geq 3.0$	≥ 1.0

4.1.1 Town of Windsor Phase 2 Assessment Summary

The Phase 2 assessed reaches/segments on Mill Brook within the Town of Windsor are described below (Figure 4.1). Reach M01 was not assessed due to continuous bedrock grade control, a small dam, and backwater effects from the Connecticut River. Reach M03 was not assessed due to impoundment from the Ascutney Mill Dam.

- Reach M02
 - This reach flows from the Mill Pond dam down to the first Union Street bridge. Historic straightening and armoring have locked the channel in place leading to ongoing channel incision (i.e., downcutting). Large bedrock grade controls have limited incision in some areas and allow for channel widening and sediment deposition.
 - T.S. Irene damage was minimal within downtown Windsor, likely due to the floodwave dampening and debris storage in the large upstream wetlands and impoundment (Mill Pond).
- Reach M04
 - The lower portion of M04 flows through the "Narrows", a recently abandoned agricultural area that is now a valuable floodplain. The Route 44 bridge approach under Interstate 91 was destroyed in T.S. Irene when the opening plugged with woody debris and the channel carved through the embankment.
 - Upstream of this bridge the channel transitions to narrower valley with bedrock side slopes and elevated floodplains. We observed deep gravel deposits along the channel bottom that had filled in numerous swimming holes along Sunset Lane.
- Reach M05
 - Reach M05 was divided into three segments based on highly variable channel adjustments during and following T.S. Irene. The first segment (A) widened during the floods and is now aggrading and redeveloping planform and slowly gaining access to small floodplain areas. Segment B was incredibly active during the floods and scoured out the entire valley in several locations. Large mass failures continue to contribute sediment to the channel. Portions of Brook Road were destroyed along both reaches. Segment C is relatively stable due to a large bedrock gorge in the lower portion and heavy bank armoring along the upper portion.

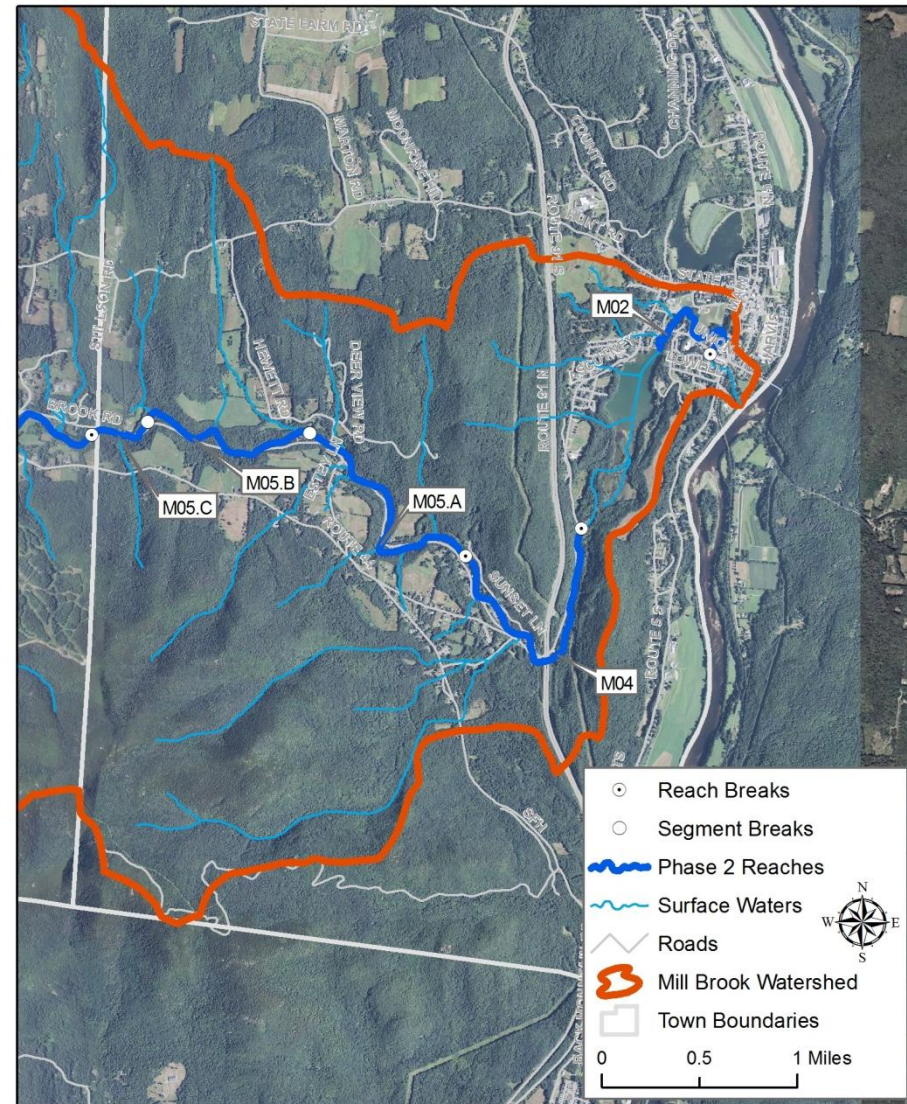


Figure 4.1: Town of Windsor reach and segment locations.

Stream: Mill Brook **Reach:** M02 **Town:** Windsor **Date Assessed:** 06/17/14
Channel Length (ft): 3,807 **Channel Slope (%):** 0.72 **Sinuosity:** 1.55 **Watershed Area (mi²):** 44.53

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	Very Broad	Narrow
Bedform	Riffle-Pool	Riffle-Pool
Median Substrate	Gravel	Gravel
Stream Type	C	F

Ph2 Cross-Section Data

Curve Width (ft)	69.6
Bankfull Width (ft)	66
Max Depth (ft)	2.8
Width/Depth Ratio	28.2
Entrenchment Ratio	1.3
Incision Ratio	2.4

Rapid Habitat Assessment

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
B	Union	107%	E
B	Footbridge	107%	S
B	Union	107	S
O	Sewer	57	S, I, D

of Other Constrictions: 0

of Grade Controls: 4

Rank	LWD	Pools
1	9	0
2	4	0
3	6	3
4	6	1
5	0	3
6	0	4
7	-	5
#/mile	34	22

Number of Debris Jams: 1

Step 6/7 Summary

RHA Score/Condition	41/Fair
Habitat Type Departure	None
RGA Score / Condition	43/Fair
Dominant Adjustment	Degradation
CEM Model Stage	F /II
Stream Type Departure	C to F
Stream Sensitivity	Extreme

Impact Summary

Bank Erosion Stormwater
Armoring **Constrictions**
Riparian Buffer **Deposition**
Encroachment Migration
Development Steep Riffle
Corridor Land Cover Head Cut
Mass Failure **Straightening**
Flow Regulation Dredging

Potential Projects in Reach

- **Project WI 1:** Utility Conduit - A steel conduit with concrete piers constricts the channel causing bed scour, and is a major debris/ice jam risk.

Reach Highlights: This reach was highly impacted from historic straightening and encroachment as it flows through the center of Windsor. Incision was variable but always F-type. Several grade controls reduced incision leading to widening and some deposition and gravel bar formation. The large dam and impoundment upstream is a major interruption to sediment supply, however the upper reach was bedrock controlled and did not indicate increased scour.



Bridge and armoring in the lower reach



Straightening and buffer impacts in the upper reach

Stream: Mill Brook **Reach:** M04 **Town:** Windsor **Date Assessed:** 06/17/14
Channel Length (ft): 8,067 **Channel Slope (%):** 0.52 **Sinuosity:** 1.02 **Watershed Area (mi²):** 43.05

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	Narrow	Narrow
Bedform	Riffle-Pool	Riffle-Pool
Median Substrate	Gravel	Gravel
Stream Type	C	B _c

Ph2 Cross-Section Data

Curve Width (ft)	68.6
Bankfull Width (ft)	70
Max Depth (ft)	2.9
Width/Depth Ratio	33.3
Entrenchment Ratio	1.6
Incision Ratio	1.8

Rapid Habitat Assessment

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
B	44	160%	D, I

of Other Constrictions: 1

of Grade Controls: 0

Rank	LWD	Pools
1	5	1
2	21	2
3	5	2
4	2	0
5	1	1
6	2	1
7	-	1
#/mile	36	8

Number of Debris Jams: 3

Step 6/7 Summary

RHA Score/Condition	50/Fair
Habitat Type Departure	None
RGA Score / Condition	38/Fair
Dominant Adjustment	Widening
CEM Model Stage	F /III
Stream Type Departure	C to Bc
Stream Sensitivity	Very High

Impact Summary

Bank Erosion	Stormwater
Armoring	Constrictions
Riparian Buffer	Deposition
Encroachment	Migration
Development	Steep Riffle
Corridor Land Cover	Head Cut
Mass Failure	Straightening
Flow Regulation	Dredging

Potential Projects in Reach

- **Project WI 2:** Conservation - "The Narrows" is a large forested floodplain area that provides valuable sediment and floodwater attenuation upstream of Mill Pond.
- **Project WI 3:** Corridor Protection - Small forested floodplain area

Reach Highlights: The channel is actively aggrading with sand and gravel from upstream mass failures and erosion. Extensive bank armoring and road encroachment are limiting planform adjustment, however the failure of historic armoring on the left bank throughout the lower reach is allowing for channel widening (note: armor failure was accounted for in RGA scoring for widening and planform). Some floodplain was accessible throughout the reach, likely a result of recent channel aggradation. This reach is transitioning from stage II to III.



Widening and aggradation in the lower reach with nice floodplain access



Widening and poor bedform in the upper reach

Stream: Mill Brook **Reach:** M05.A **Town:** Windsor **Date Assessed:** 06/17/14
Channel Length (ft): 7,170 **Channel Slope (%):** 1.3 **Sinuosity:** 1.05 **Watershed Area (mi²):** 40.31

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	Semi-Confined	Semi-Confined
Bedform	Riffle-Pool	Riffle-Pool
Median Substrate	Cobble	Gravel
Stream Type	B _c	F

Ph2 Cross-Section Data

Curve Width (ft)	66.6
Bankfull Width (ft)	75
Max Depth (ft)	2.9
Width/Depth Ratio	41.4
Entrenchment Ratio	1.1
Incision Ratio	2.9

Rapid Habitat Assessment

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
B	Brook Rd	105%	D, S, R
B	Brook Rd	73%	D, E, R, I
B	Hewett Rd	69%	D, A, E, I

of Other Constrictions: 0

of Grade Controls: 0

Rank	LWD	Pools
1	10	3
2	8	2
3	0	5
4	1	2
5	0	0
6	0	0
7	-	1
#/mile	13	9

Number of Debris Jams: 1

Step 6/7 Summary

RHA Score/Condition	49/Fair
Habitat Type Departure	None
RGA Score / Condition	32/Poor
Dominant Adjustment	Widening
CEM Model Stage	F /III
Stream Type Departure	Bc to F
Stream Sensitivity	Extreme

Impact Summary

Bank Erosion	Stormwater
Armoring	Constrictions
Riparian Buffer	Deposition
Encroachment	Migration
Development	Steep Riffle
Corridor Land Cover	Head Cut
Mass Failure	Straightening
Flow Regulation	Dredging

Potential Projects in Reach

- **Project WI 3b:** Corridor Protection - Several small floodplain areas
- **Project WI 4:** Floodplain Cleanup - Property on left floodplain has a large amount of debris/junk at risk of entering channel
- **Project WI 5:** Bank Stabilization - Eroding bank and no buffer vegetation along Merrell Property
- **Projects WI 6 + 8:** Bridge Replacement - Hewett Road bridge is high priority as an important transportation connector

Reach Highlights: This segment and M05-B were similarly scoured and widened during T.S. Irene. Segment B has remained plane-bed and is relatively featureless. Segment A has redeveloped some riffle-pool sequences and has some planform development. We assessed this reach as stage III due to the widened state and the large volume of flood sediments that will continue to work through the reach. Major bed aggradation in portions of the lower segment has created small areas of accessible floodplain. The reach will slowly transition to stage IV if this process continues. Evaluation of some characteristics of confined river valleys in the RGA form are not entirely applicable to this Bc stream type setting (i.e., step-pool systems).



Aggradation at the lower Brook Rd bridge



Widening and poor bedform in the upper segment

Stream: Mill Brook **Reach:** M05.B **Town:** Windsor **Date Assessed:** 06/18/14
Channel Length (ft): 5.345 **Channel Slope (%):** 1.3 **Sinuosity:** 1.05 **Watershed Area (mi²):** 40.31

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	Semi-Confined	Semi-Confined
Bedform	Riffle-Pool	Plane Bed
Median Substrate	Cobble	Gravel
Stream Type	B _c	F

Ph2 Cross-Section Data

Curve Width (ft)	66.6
Bankfull Width (ft)	77
Max Depth (ft)	2.5
Width/Depth Ratio	42.7
Entrenchment Ratio	1.0
Incision Ratio	2.8

Rapid Habitat Assessment

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
None in reach.			

of Other Constrictions: 1

of Grade Controls: 4

Rank	LWD	Pools
1	2	2
2	4	0
3	0	1
4	1	0
5	0	0
6	0	1
7	-	1
#/mile	6	4

Number of Debris Jams: 0

Step 6/7 Summary

RHA Score/Condition	41/Fair
Habitat Type Departure	Plane Bed
RGA Score / Condition	26/Poor
Dominant Adjustment	Widening
CEM Model Stage	F /III
Stream Type Departure	Bc to F
Stream Sensitivity	Extreme

Impact Summary

Bank Erosion	Stormwater
Armoring	Constrictions
Riparian Buffer	Deposition
Encroachment	Migration
Development	Steep Riffle
Corridor Land Cover	Head Cut
Mass Failure	Straightening
Flow Regulation	Dredging

Potential Projects in Reach

- **Project WI 8:** Channel and Floodplain Restoration - Post-T.S. Irene repairs upstream of the Hewett Road crossing on a private lot have created a narrow and incised channel, restore floodplain access and plant buffer while protecting house.
- **Project WI 9:** Conservation - Over one mile of river valley is now inaccessible and is highly active.

Reach Highlights: This reach scoured and widened considerably during T.S. Irene. The channel scoured out the entire valley in several stretches and huge mass failures, bank erosion, and heavy bank scour were observed throughout the reach. Brook Road closely followed the right valley through most of the reach and was completely washed out in numerous locations. This reach widened during TSI and is continuing to widen to accommodate the large volume of flood sediments working through. Historic floodplain terraces were observed through much of the reach; however these are elevated and were only partially accessed during T.S. Irene. Evaluation of some characteristics of confined river valleys in RGA form not entirely applicable to this Bc stream type setting (i.e., step-pool systems).



Channel and floodplain reconstructed in lower segment



Major widening, mass failure, and Brook Road washout

Stream: Mill Brook **Reach:** M05.C **Town:** Windsor **Date Assessed:** 06/18/14
Channel Length (ft): 1,841 **Channel Slope (%):** 1.3 **Sinuosity:** 1.05 **Watershed Area (mi²):** 40.31

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	Semi-Confined	Semi-Confined
Bedform	Riffle-Pool	Riffle-Pool
Median Substrate	Cobble	Cobble
Stream Type	B _c	B _c

Ph2 Cross-Section Data

Curve Width (ft)	66.6
Bankfull Width (ft)	56
Max Depth (ft)	2.5
Width/Depth Ratio	22.4
Entrenchment Ratio	2.1
Incision Ratio	1.6

Rapid Habitat Assessment

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
B	Brook Rd	78%	D, E, I, R/R, S

of Other Constrictions: 0

of Grade Controls: 2

Rank	LWD	Pools
1	3	1
2	1	1
3	1	2
4	2	1
5	0	0
6	0	2
7	-	2
#/mile	20	25

Number of Debris Jams: 0

Step 6/7 Summary

RHA Score/Condition	57/Fair
Habitat Type Departure	None
RGA Score / Condition	60/Fair
Dominant Adjustment	Degradation
CEM Model Stage	F /II
Stream Type Departure	None
Stream Sensitivity	Very Low

Impact Summary

Bank Erosion	Stormwater
Armoring	Constrictions
Riparian Buffer	Deposition
Encroachment	Migration
Development	Steep Riffle
Corridor Land Cover	Head Cut
Mass Failure	Straightening
Flow Regulation	Dredging

Potential Projects in Reach

- **Project WI 10:** Bridge Removal - Brook Road bridge is washed out and destroyed, remove abutments and deck which present a flood hazard risk.
- **Project WI 3c:** Corridor Protection - A small forested floodplain is low and accessible during all flood events

Reach Highlights: The bottom 600 feet of the segment are located in a bedrock gorge. Above the series of grade controls the channel is encroached by a heavily armored stretch of Brook Road along the left bank, but the right bank spills on to an accessible forested floodplain. The downstream bedrock and ledge along much of the banks has likely locked the bed in place through this segment. Minor incision led us to assess the segment as stage II CEM.



Minor scour and widening in lower segment, some floodplain access



Accessible forested right floodplain and armoring along Brook Rd on left bank

4.1.2 Town of West Windsor Phase 2 Assessment Summary

The Phase 2 assessed reaches/segments within the Town of West Windsor contain the middle reaches of Mill Brook as it winds through a wide valley to the community of Brownsville, and two tributaries: Beaver Brook (including a sub-tributary), and Willow Brook (Figure 4.2). Below are brief descriptions of each stream within the Town.

- Mill Brook mainstem
 - Mill Brook flows through typically unconfined valleys with an incised channel due to historical straightening and armoring along agricultural fields. Three segments are confined: M08 and M12.A naturally; M11 is encroached by Route 44 throughout. Segment M12.A runs through a highly modified channel along the former talc processing plant before crossing into Reading.
 - Major floodplain access during T.S. Irene occurred in transitional areas where the channel slope and confinement decrease. Several undersized bridge crossings increased flooding and many structures were damaged or destroyed.
- Beaver Brook
 - The assessed reaches on Beaver Brook followed Brownsville-Hartland Road; however encroachment impacts were relatively low. An accessible forested floodplain was observed along much of T1.01 and T1.02.A. Beaver dams were common in segment T1.02.B where the channel flows through a wet hayfield.
 - Sub-tributary T1.01.S4.01 is highly variable based on slope and confinement. The first segment (A) is tightly pinched against the valley wall by Sheddsville Road. The second segment (B) flows along a large horse pasture and is impacted by historical straightening. The third segment (C) is similar to (A) as the stream enters the steeper headwaters area but is impacted by road encroachment.
- Willow Brook
 - Encroachment, historic straightening, and armoring along the first three reaches of Willow Brook have resulted in some incision, however numerous grade controls have reduced this impact and allow for some widening and planform adjustment. Reach T2.04 winds through a forested floodplain and is very active and storing large volumes of sediment.

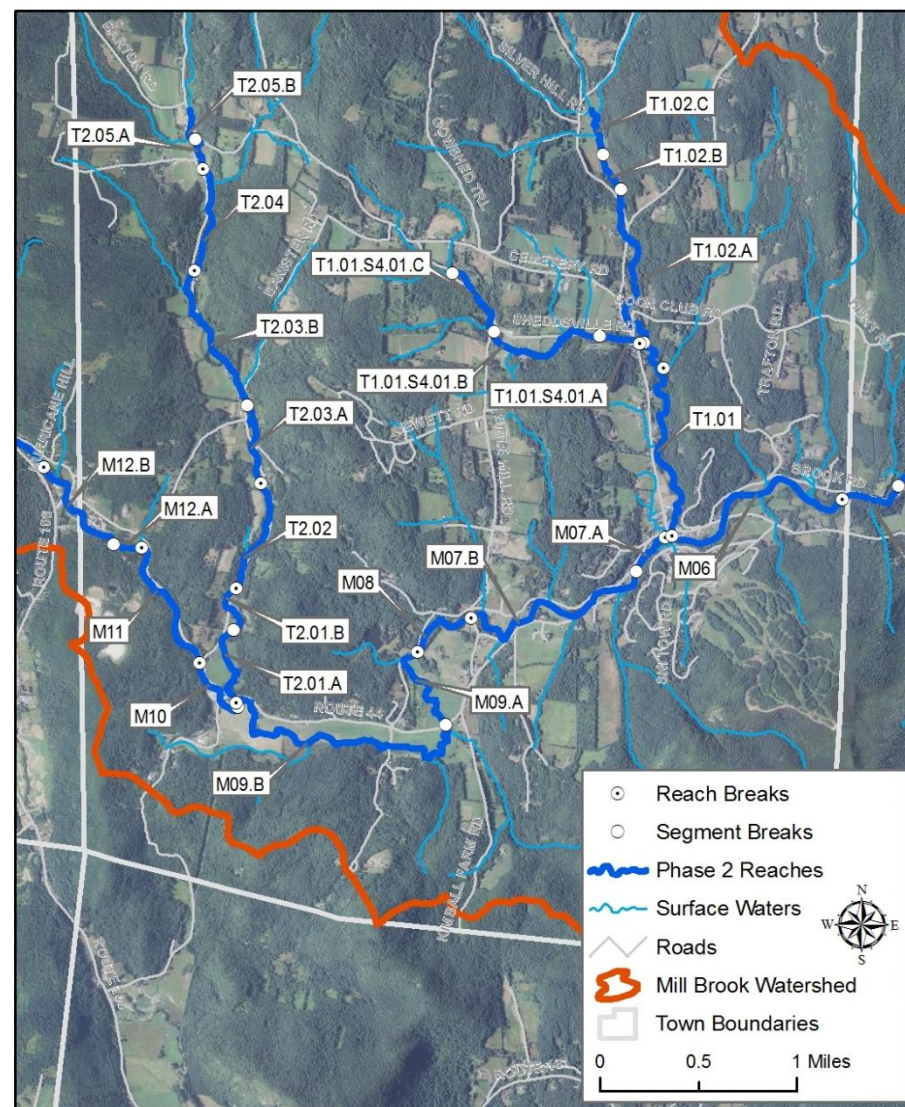


Figure 4.2: Town of West Windsor reach and segment locations.

Stream: Mill Brook **Reach:** M06 **Town:** West Windsor **Date Assessed:** 06/30/14

Channel Length (ft): 6,224 **Channel Slope (%):** 1.0 **Sinuosity:** 1.25 **Watershed Area (mi²):** 36.48

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	Narrow	Narrow
Bedform	Riffle-Pool	Riffle-Pool
Median Substrate	Cobble	Cobble
Stream Type	C	B _c

Ph2 Cross-Section Data

Curve Width (ft)	63.8
Bankfull Width (ft)	66
Max Depth (ft)	2.4
Width/Depth Ratio	27.9
Entrenchment Ratio	1.6
Incision Ratio	1.9

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
B	Trail	82%	D
B	Rt 44	111%	D. E

of Other Constrictions: 0

of Grade Controls: 3

Rapid Habitat Assessment

Rank	LWD	Pools
1	8	3
2	11	4
3	4	2
4	1	4
5	0	2
6	0	0
7	-	1
#/mile	20	13

Number of Debris Jams: 3

Step 6/7 Summary

RHA Score/Condition	49/Fair
Habitat Type Departure	None
RGA Score / Condition	44/Fair
Dominant Adjustment	Degradation
CEM Model Stage	F /II
Stream Type Departure	C to B
Stream Sensitivity	High

Impact Summary

Bank Erosion	Stormwater
Armoring	Constrictions
Riparian Buffer	Deposition
Encroachment	Migration
Development	Steep Riffle
Corridor Land Cover	Head Cut
Mass Failure	Straightening
Flow Regulation	Dredging

Potential Projects in Reach

- **Project WW 1:** Eroded Bank - Approximately 750' of major bank erosion along a hayfield with minimal buffer vegetation.
- **Project WW 2a:** Corridor Protection and Buffer Planting - Accessible floodplain area with minimal buffer vegetation.
- **Project WW 3:** Dam Removal/Retrofit - A former snow making withdrawal dam and current dry hydrant for WWVFD is in disrepair and at risk of being outflanked along the right bank. The impoundment behind the dam is completely filled in with gravel and causing fine deposition throughout the upstream segment.

Reach Highlights: Moderately accessible floodplain was present on at least one bank for most of this reach. The floodplain was elevated as indicated by the high incision ratio, but still accessible during larger events. Some planform adjustment was observed in the lower portion, however the banks appeared relatively stable for most of the reach and widening was minimal. This reach is likely still affected by historic straightening which has restricted widening and planform adjustment, leading to ongoing incision; we assessed this reach as stage II. Aggradation processes may be initiating after TS Irene flood and stage III adjustment processes will likely begin soon.



Planform adjustment and major bank erosion along hayfield



Corridor development and buffer impacts in upper reach

Stream: Mill Brook **Reach:** M07.A **Town:** West Windsor **Date Assessed:** 06/30/14

Channel Length (ft): 1,300 **Channel Slope (%):** 0.6 **Sinuosity:** 1.16 **Watershed Area (mi²):** 27.9

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	Broad	Broad
Bedform	Riffle-Pool	Plane Bed
Median Substrate	Cobble	Cobble
Stream Type	C	C

Ph2 Cross-Section Data

Curve Width (ft)	56.7
Bankfull Width (ft)	61
Max Depth (ft)	3.3
Width/Depth Ratio	25.9
Entrenchment Ratio	5.0
Incision Ratio	1.2

Rapid Habitat Assessment

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
None in reach.			

of Other Constrictions: 0

of Grade Controls: 0

Rank	LWD	Pools
1	4	1
2	2	4
3	1	0
4	0	0
5	0	1
6	0	1
7	-	0
#/mile	28	28

Number of Debris Jams: 0

Step 6/7 Summary

RHA Score/Condition	65/Good
Habitat Type Departure	Plane Bed
RGA Score / Condition	59/Fair
Dominant Adjustment	Degradation
CEM Model Stage	F /II
Stream Type Departure	None
Stream Sensitivity	High

Impact Summary

Bank Erosion	Stormwater
Armoring	Constrictions
Riparian Buffer	Deposition
Encroachment	Migration
Development	Steep Riffle
Corridor Land Cover	Head Cut
Mass Failure	Straightening
Flow Regulation	Dredging

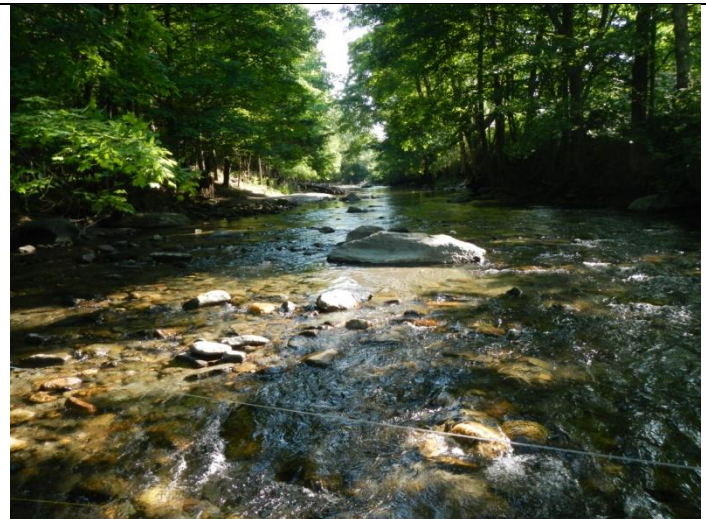
Potential Projects in Reach

- **Project WW2b:** Corridor Protection - Small forested floodplain on the right bank

Reach Highlights: The left bank is encroached by development or Route 44 and armored for most of the segment. The right bank has a low and accessible wide floodplain with relatively stable banks. Sand and gravel deposition throughout the segment indicates that the downstream dam causes enough gradient change to increase fine deposition throughout the segment. This is likely controlling incision and maintaining floodplain access. We assessed the reach as stage II due to limited opportunity for widening or planform adjustment with the high degree of encroachment and armoring. The channel could incise if the dam failed or was removed.



Development, armoring, and aggradation



Accessible left floodplain and some planform adjustment in the upper segment

Stream: Mill Brook **Reach:** M07.B **Town:** West Windsor **Date Assessed:** 06/30/14

Channel Length (ft): 6,234 **Channel Slope (%):** 0.6 **Sinuosity:** 1.16 **Watershed Area (mi²):** 27.9

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	Broad	Narrow
Bedform	Riffle-Pool	Plane Bed
Median Substrate	Cobble	Cobble
Stream Type	C	F

Ph2 Cross-Section Data

Curve Width (ft)	56.7
Bankfull Width (ft)	49
Max Depth (ft)	3.0
Width/Depth Ratio	16.4
Entrenchment Ratio	1.3
Incision Ratio	2.3

Rapid Habitat Assessment

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
B	Rt 44	106%	D, E
B	Trail	79%	I, D, E, R/R
B	Bible Hill	63%	I, E

of Other Constrictions: 1

of Grade Controls: 5

Rank	LWD	Pools
1	6	2
2	5	5
3	2	0
4	1	3
5	1	0
6	0	0
7	-	0
#/mile	12	8

Number of Debris Jams: 0

Step 6/7 Summary

RHA Score/Condition	45/Fair
Habitat Type Departure	Plane Bed
RGA Score / Condition	45/Fair
Dominant Adjustment	Degradation
CEM Model Stage	F /II
Stream Type Departure	C to F
Stream Sensitivity	Extreme

Impact Summary

Bank Erosion	Stormwater
Armoring	Constrictions
Riparian Buffer	Deposition
Encroachment	Migration
Development	Steep Riffle
Corridor Land Cover	Head Cut
Mass Failure	Straightening
Flow Regulation	Dredging

Potential Projects in Reach

- **Project WW 4: Dam Removal** - A partially breached historic dam is an ice/debris jam hazard and should be fully removed.
- **Projects WW2c - e: Corridor Protection and Buffer Planting** - Three small floodplain areas with reduced bank and buffer vegetation
- **Project WW 5: Bridge Replacement** - The Bible Hill covered bridge is a major channel constriction and caused flooding problems during T.S. Irene

Reach Highlights: This segment was deeply incised and narrow throughout. The only accessible floodplain was located in the lower portion of the segment immediately upstream of a large grade control with a breached concrete dam. Bank erosion and scour were minimal indicating no recent widening or planform adjustment. T.S. Irene caused major flood damage to adjacent properties, however no major channel adjustments are apparent. This segment was assessed as stage II.



Major constriction at the Bible Hill Rd bridge



Encroachment and deep incision

Stream: Mill Brook **Reach:** M08 **Town:** West Windsor **Date Assessed:** 06/30/14

Channel Length (ft): 2,087 **Channel Slope (%):** 0.4 **Sinuosity:** 1.0 **Watershed Area (mi²):** 25.1

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	Semi-confined	Semi-confined
Bedform	Riffle-Pool	Plane Bed
Median Substrate	Cobble	Cobble
Stream Type	B _c	F

Ph2 Cross-Section Data

Curve Width (ft)	54.1
Bankfull Width (ft)	52
Max Depth (ft)	3.0
Width/Depth Ratio	25.5
Entrenchment Ratio	1.3
Incision Ratio	1.3

Rapid Habitat Assessment

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
None in reach.			

of Other Constrictions: 2

of Grade Controls: 3

Rank	LWD	Pools
1	2	0
2	7	4
3	6	1
4	7	0
5	3	0
6	4	1
7	-	0
#/mile	73	15

Number of Debris Jams: 4

Step 6/7 Summary

RHA Score/Condition	61/Fair
Habitat Type Departure	Plane Bed
RGA Score / Condition	51/Fair
Dominant Adjustment	Degradation
CEM Model Stage	F /II
Stream Type Departure	None
Stream Sensitivity	High

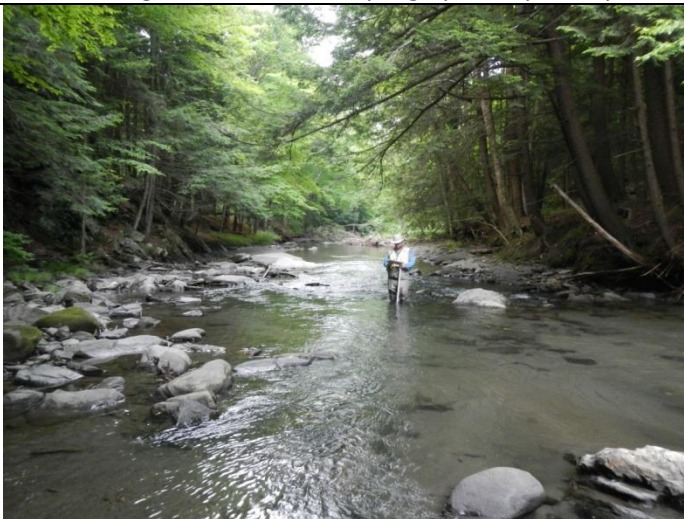
Impact Summary

Bank Erosion	Stormwater
Armoring	Constrictions
Riparian Buffer	Deposition
Encroachment	Migration
Development	Steep Riffle
Corridor Land Cover	Head Cut
Mass Failure	Straightening
Flow Regulation	Dredging

Potential Projects in Reach

- None

Reach Highlights: This reach scoured down during T.S. Irene in the upper reach and widened in the lower reach where multiple grade controls limited incision. Floodplain access is very limited throughout the reach and large mass failures were observed in the areas of widening. The upper half of the reach is naturally confined and is incised. A small ~5ft wide bench is the only accessible floodplain except during the largest events. Heavy bank scour was observed through most of the reach but widening is limited by stony soils, ledge, and dense roots. We assessed the reach as stage II due to the very high primary floodplain and the low potential for widening or planform adjustment.



Semi-confined valley with large channel substrate



Small floodplain bench and inaccessible main floodplain

Stream: Mill Brook **Reach:** M09.A **Town:** West Windsor **Date Assessed:** 07/21/14

Channel Length (ft): 3,021 **Channel Slope (%):** 0.4 **Sinuosity:** 1.36 **Watershed Area (mi²):** 25.0

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	Very broad	Very broad
Bedform	Riffle-Pool	Plane Bed
Median Substrate	Gravel	Gravel
Stream Type	E	F

Ph2 Cross-Section Data

Curve Width (ft)	54
Bankfull Width (ft)	29
Max Depth (ft)	3.8
Width/Depth Ratio	10.1
Entrenchment Ratio	1.2
Incision Ratio	2.1

Rapid Habitat Assessment

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
B	Farm access	59%	E, R/R

of Other Constrictions: 0

of Grade Controls: 1

Rank	LWD	Pools
1	40	10
2	3	0
3	5	5
4	5	5
5	0	0
6	4	0
7	-	0
#/mile	99	34

Number of Debris Jams: 1

Step 6/7 Summary

RHA Score/Condition	43/Fair
Habitat Type Departure	Plane Bed
RGA Score / Condition	41/Fair
Dominant Adjustment	Degradation
CEM Model Stage	F /II
Stream Type Departure	E to F
Stream Sensitivity	Extreme

Impact Summary

Bank Erosion	Stormwater
Armoring	Constrictions
Riparian Buffer	Deposition
Encroachment	Migration
Development	Steep Riffle
Corridor Land Cover	Head Cut
Mass Failure	Straightening
Flow Regulation	Dredging

Potential Projects in Reach

- **Project WW 2f:** Buffer Planting & Corridor Protection - Large hayfield floodplain area throughout reach needing buffer planting and protection from future development.

Reach Highlights: Extensive historic straightening and some armoring in upper segment near Route 44. Channel incised and stuck in Stage II of channel evolution. Signs of bed fining from recent floods, but no evidence of a transition to aggradation process. Minimal floodplain access during T.S. Irene.



Deeply entrenched and incised segment



LWD in lower segment

Stream: Mill Brook **Reach:** M09.B **Town:** West Windsor **Date Assessed:** 07/21/14

Channel Length (ft): 8,525 **Channel Slope (%):** 0.4 **Sinuosity:** 1.36 **Watershed Area (mi²):** 25.0

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	Very broad	Very broad
Bedform	Riffle-Pool	Riffle-Pool
Median Substrate	Gravel	Gravel
Stream Type	C	C

Ph2 Cross-Section Data

Curve Width (ft)	54
Bankfull Width (ft)	49
Max Depth (ft)	4.1
Width/Depth Ratio	20.5
Entrenchment Ratio	3.0
Incision Ratio	1.9

Rapid Habitat Assessment

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
B	Rt 44	119%	D, E, R/R
B	Yale Heights	63%	D, E, R/R

of Other Constrictions: 2

of Grade Controls: 0

Rank	LWD	Pools
1	86	4
2	38	8
3	24	20
4	27	22
5	1	3
6	12	9
7	-	0
#/mile	116	40

Number of Debris Jams: 7

Step 6/7 Summary

RHA Score/Condition	53/Fair
Habitat Type Departure	None
RGA Score / Condition	40/Fair
Dominant Adjustment	Widening
CEM Model Stage	F /III
Stream Type Departure	None
Stream Sensitivity	Very High

Impact Summary

Bank Erosion	Stormwater
Armoring	Constrictions
Riparian Buffer	Deposition
Encroachment	Migration
Development	Steep Riffle
Corridor Land Cover	Head Cut
Mass Failure	Straightening
Flow Regulation	Dredging

Potential Projects in Reach

- **Project WW 2g:** Buffer Planting & Corridor Protection - Large hayfield floodplain area throughout reach needing buffer planting and protection from future development.
- **Project WW 6:** Bridge Replacement - The Yale Heights bridge is relatively new and appropriately sized for the current channel dimensions. If the channel continues to widen the bridge may become undersized and present a flooding risk in future events.

Reach Highlights: Significant historical straightening throughout segment. Majority of reach was likely armored historically. Erosion is now occurring post-T.S. Irene where armor failed. Bed aggradation has likely been occurring in recent decades and lateral channel migration is beginning. Stage III channel evolution will transition into stage IV in near future in the absence of channel management.



Deposition and widening



Bank erosion from planform adjustment and widening

Stream: Mill Brook **Reach:** M10 **Town:** West Windsor **Date Assessed:** 07/01/14

Channel Length (ft): 1,908 **Channel Slope (%):** 0.38 **Sinuosity:** 1.14 **Watershed Area (mi²):** 16.8

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	Very broad	Broad
Bedform	Riffle-Pool	Riffle-Pool
Median Substrate	Gravel	Gravel
Stream Type	C	C

Ph2 Cross-Section Data

Curve Width (ft)	45.3
Bankfull Width (ft)	46
Max Depth (ft)	2.5
Width/Depth Ratio	29.1
Entrenchment Ratio	2.0
Incision Ratio	1.8

Rapid Habitat Assessment

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
B	Churchill	71%	D, S

of Other Constrictions: 0

of Grade Controls: 0

Rank	LWD	Pools
1	2	0
2	6	3
3	3	3
4	3	1
5	2	1
6	0	0
7	-	0
#/mile	44	22

Number of Debris Jams: 2

Step 6/7 Summary

RHA Score/Condition	53/Fair
Habitat Type Departure	None
RGA Score / Condition	44/Fair
Dominant Adjustment	Planform
CEM Model Stage	F /II
Stream Type Departure	None
Stream Sensitivity	Very High

Impact Summary

Bank Erosion	Stormwater
Armoring	Constrictions
Riparian Buffer	Deposition
Encroachment	Migration
Development	Steep Riffle
Corridor Land Cover	Head Cut
Mass Failure	Straightening
Flow Regulation	Dredging

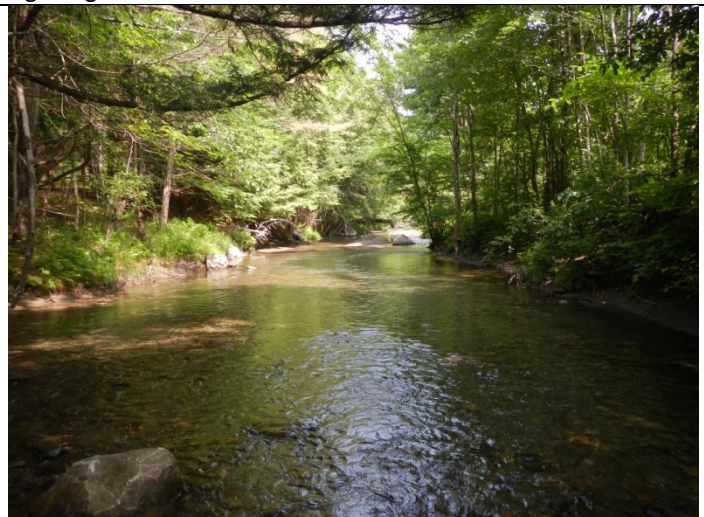
Potential Projects in Reach

- **Project WW 2h:** Corridor Protection - The right bank upstream of Churchill Rd has a nice floodplain hayfield that appears to have been abandoned following T.S. Irene. Protecting this floodplain from future development is important for reducing downstream flooding risk.
- **Project WW 7:** Bridge Replacement - The Churchill Road bridge is undersized and increased major overbank flooding during T.S. Irene. Replace with an appropriately sized structure to decrease flooding and reduce the risk of roadway and property damage.

Reach Highlights: The lower banks of this reach were scoured during TS Irene as indicated by the slumping banks and the scoured smooth bed profile through most of the riffle sections. We did not observe active widening; however the channel was adjusting planform and had access to a narrow floodplain throughout. The very large floodplain was typically 1ft above 2x bankfull and is only accessed during large events. The upper portion is pinched between Rt 44 and a tight right valley wall, cutting off access to a large left floodplain. The lower reach is also encroached but retains access to a large floodplain in a broad to very broad valley. We assessed the reach as stage II due to the high degree of encroachment.



Churchill Rd bridge and accessible floodplain bench



Stable channel in upper reach with some floodplain

Stream: Mill Brook **Reach:** M11 **Town:** West Windsor **Date Assessed:** 07/01/14

Channel Length (ft): 3,980 **Channel Slope (%):** 1.08 **Sinuosity:** 1.2 **Watershed Area (mi²):** 16.8

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	Semi-confined	Semi-confined
Bedform	Riffle-Pool	Plane Bed
Median Substrate	Cobble	Gravel
Stream Type	B _c	F

Ph2 Cross-Section Data

Curve Width (ft)	45.2
Bankfull Width (ft)	53
Max Depth (ft)	2.2
Width/Depth Ratio	29.0
Entrenchment Ratio	1.1
Incision Ratio	3.1

Rapid Habitat Assessment

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
None in reach.			

of Other Constrictions: 1

of Grade Controls: 8

Rank	LWD	Pools
1	6	3
2	10	7
3	2	3
4	2	2
5	0	1
6	2	0
7	-	0
#/mile	29	21

Number of Debris Jams: 2

Step 6/7 Summary

RHA Score/Condition	52/Fair
Habitat Type Departure	Plane Bed
RGA Score / Condition	39/Fair
Dominant Adjustment	Degradation
CEM Model Stage	F /III
Stream Type Departure	B to F
Stream Sensitivity	Extreme

Impact Summary

Bank Erosion	Stormwater
Armoring	Constrictions
Riparian Buffer	Deposition
Encroachment	Migration
Development	Steep Riffle
Corridor Land Cover	Head Cut
Mass Failure	Straightening
Flow Regulation	Dredging

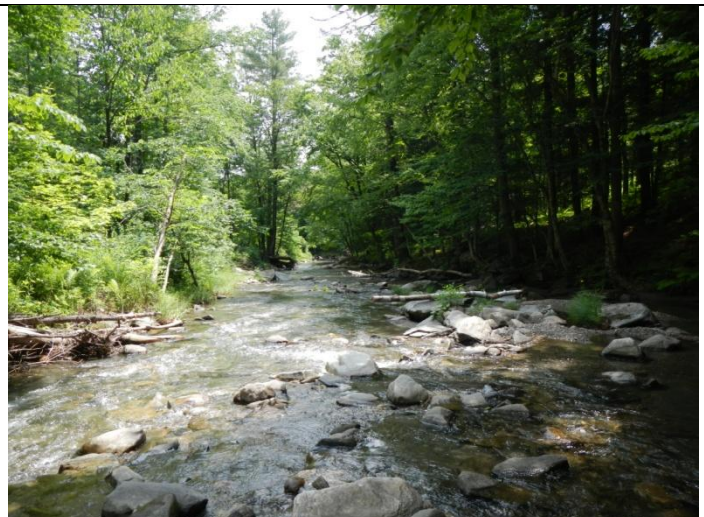
Potential Projects in Reach

- **Project WW 8:** House Buyout/Relocation - A house on the left floodplain is highly vulnerable to flood damage.
- **Project WW 9:** Gully Stabilization - A small gully is cutting into the Route 44 embankment.
- **Project WW 10:** Utility Repairs - A utility pole along Route 44 is in an active flood chute and at high risk of flood damage.

Reach Highlights: Floodplain access was extremely limited in this reach which is continuously encroached by Rt 44 and/or development between the road and the channel. An elevated historic terrace was observed along portions of the reach, but was typically 3x bankfull height and is only accessible during the largest events. Incision appears to be historic as the substrate is very large and resistant to further scour. The reach appears to have widened during TS Irene, scouring away lower benches. This caused a lower entrenchment ratio and departure from B to F.



Encroachment and armoring along Rt 44



Semi-confined valley with lower benches scoured away

Stream: Mill Brook **Reach:** M12.A **Town:** West Windsor **Date Assessed:** 07/21/14

Channel Length (ft): 778 **Channel Slope (%):** 4 **Sinuosity:** 1.0 **Watershed Area (mi²):** 16.1

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	N-confined	N-confined
Bedform	Step-pool	Step-pool
Median Substrate	Boulder	Boulder
Stream Type	A _b	A _b

Ph2 Cross-Section Data

Curve Width (ft)	44.5
Bankfull Width (ft)	
Max Depth (ft)	
Width/Depth Ratio	
Entrenchment Ratio	
Incision Ratio	

Rapid Habitat Assessment

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
B	Talc mine	40%	I, D, R/R

of Other Constrictions: 0

of Grade Controls: 2

Rank	LWD	Pools
1	2	1
2	1	0
3	1	0
4	0	0
5	0	1
6	0	0
7	0	0
#/mile	27	13

Number of Debris Jams: 0

Step 6/7 Summary

RHA Score/Condition	
Habitat Type Departure	
RGA Score / Condition	Good
Dominant Adjustment	Stable
CEM Model Stage	
Stream Type Departure	None
Stream Sensitivity	Very Low

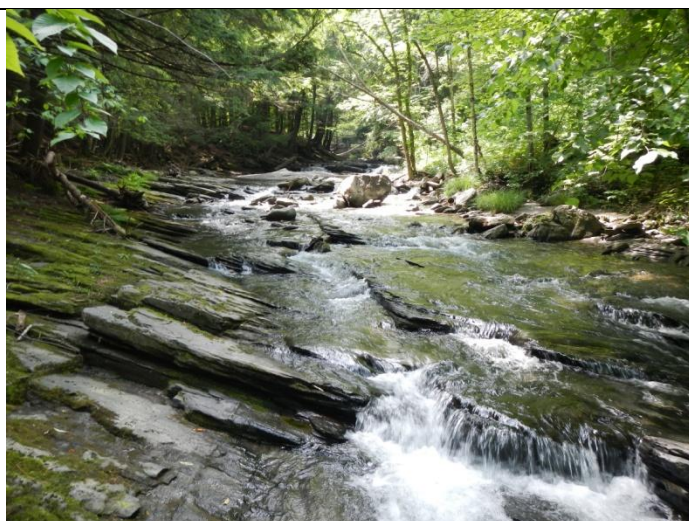
Impact Summary

Bank Erosion	Stormwater
Armoring	Constrictions
Riparian Buffer	Deposition
Encroachment	Migration
Development	Steep Riffle
Corridor Land Cover	Head Cut
Mass Failure	Straightening
Flow Regulation	Dredging

Potential Projects in Reach

- **Project WW 11:** Bridge Replacement/Removal - The abutments for a mine access bridge are a major channel constriction and likely plugged with debris during T.S. Irene causing major upstream flood elevation increases.

Reach Highlights: Segment was not assessed due to a gorge setting. An access road bridge at the top of the segment is a major bankfull constriction and likely caused the very high debris lines we observed in the field (10-12' above bankfull).



Bedrock gorge setting through most of segment



Major constriction at top of segment

Stream: Mill Brook **Reach:** M12.B **Town:** W. Windsor, Reading **Date Assessed:** 07/21/14

Channel Length (ft): 3,288 **Channel Slope (%):** 0.8 **Sinuosity:** 1.2 **Watershed Area (mi²):** 16.1

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	Very Broad	Broad
Bedform	Riffle-Pool	Plane Bed
Median Substrate	Gravel	Gravel
Stream Type	C	F

Ph2 Cross-Section Data

Curve Width (ft)	44.5
Bankfull Width (ft)	40
Max Depth (ft)	2.4
Width/Depth Ratio	22.4
Entrenchment Ratio	1.5
Incision Ratio	2.1

Rapid Habitat Assessment

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
B	Talc mine	134%	None
B	Rt 44	130%	D

of Other Constrictions: 0

of Grade Controls: 0

Rank	LWD	Pools
1	6	5
2	17	5
3	0	0
4	4	0
5	1	0
6	0	0
7	-	0
#/mile	44	16

Number of Debris Jams: 4

Step 6/7 Summary

RHA Score/Condition	46/Fair
Habitat Type Departure	Plane Bed
RGA Score / Condition	40/Fair
Dominant Adjustment	Degradation
CEM Model Stage	F/II
Stream Type Departure	C to F
Stream Sensitivity	Extreme

Impact Summary

Bank Erosion	Stormwater
Armoring	Constrictions
Riparian Buffer	Deposition
Encroachment	Migration
Development	Steep Riffle
Corridor Land Cover	Head Cut
Mass Failure	Straightening
Flow Regulation	Dredging

Potential Projects in Reach

- Project RE 1a:** Corridor Protection - An area of accessible floodplain in the upper segment should be protected from future development.

Reach Highlights: This segment is very incised and entrenched throughout. The segment likely incised further during TS Irene and is now aggrading with large volumes of sand and gravel, especially in the lower portion. Very tall banks along the talc mine property restrict access to the floodplain even during the largest events. This section is historically straightened and was likely dredged. Banks are lower in the upper portion of the segment; however floodplain access remains minimal causing a departure from C to F. Entrenchment ratios vary from approx. 1.2 in the lower reach to 1.6 in upper reach where cross section was taken. Reach likely transitioning from stage II to III channel evolution.



Straightening and incision along the talc mine property



Rt 44 bridge

Stream: Beaver Brook **Reach:** T1.01 **Town:** West Windsor **Date Assessed:** 07/01/14

Channel Length (ft): 6,569 **Channel Slope (%):** 1.66 **Sinuosity:** 1.21 **Watershed Area (mi²):** 6.53

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	Narrow	Narrow
Bedform	Riffle-Pool	Riffle-Pool
Median Substrate	Cobble	Cobble
Stream Type	C	C

Ph2 Cross-Section Data

Curve Width (ft)	29.9
Bankfull Width (ft)	29
Max Depth (ft)	2.8
Width/Depth Ratio	15.4
Entrenchment Ratio	4.7
Incision Ratio	1.5

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
B	Route 44	120	D, R/R
B	Private	187	S
B	Private	94	E, S

of Other Constrictions: 0

of Grade Controls: 1

Rapid Habitat Assessment

Rank	LWD	Pools
1	25	12
2	20	2
3	8	4
4	17	13
5	3	1
6	3	0
7	-	0
#/mile	61	25

Number of Debris Jams: 8

Step 6/7 Summary

RHA Score/Condition	71/Good
Habitat Type Departure	None
RGA Score / Condition	61/Fair
Dominant Adjustment	Degrading
CEM Model Stage	F/II
Stream Type Departure	None
Stream Sensitivity	High

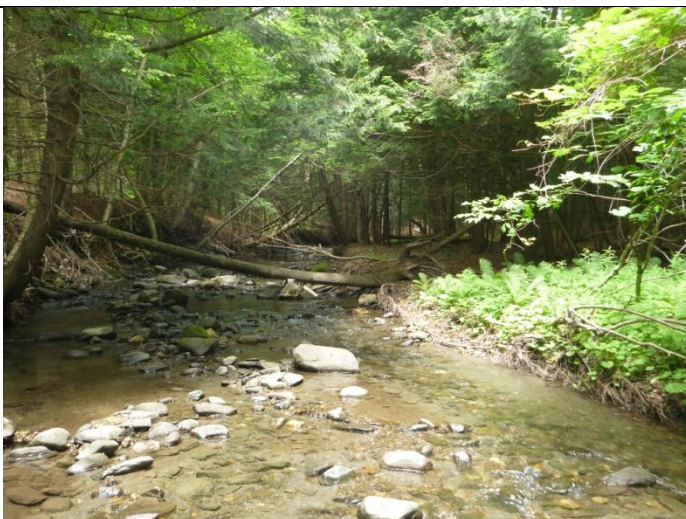
Impact Summary

Bank Erosion	Stormwater
Armoring	Constrictions
Riparian Buffer	Deposition
Encroachment	Migration
Development	Steep Riffle
Corridor Land Cover	Head Cut
Mass Failure	Straightening
Flow Regulation	Dredging

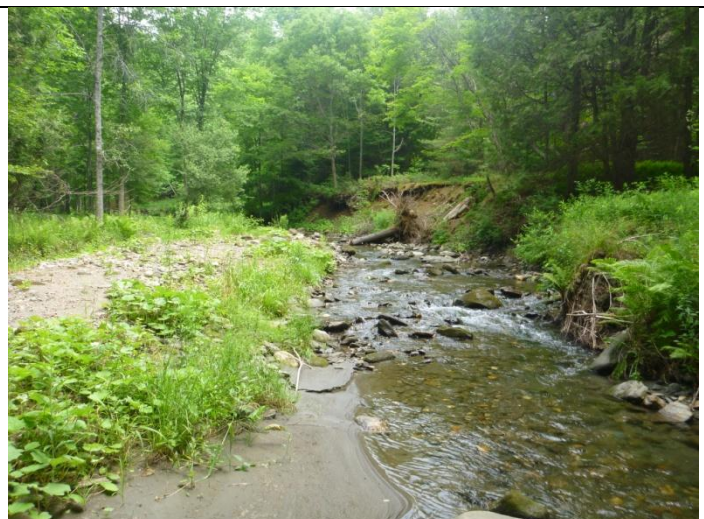
Potential Projects in Reach

- Project WW 12: Corridor Protection - Accessible and undeveloped floodplain for most of the reach

Reach Highlights: Channel appears to have incised moderately in the past but currently is in equilibrium. Bed does not appear to be vertically unstable at present and we observed minimal widening or planform adjustment. We assessed the reach as Stage II due to incision, however it is stable and could transition to Stage V over time. Areas of riparian impact and lateral instability are concentrated in the lower reach near the school, West Windsor Town Hall, and Route 44 crossing.



Accessible flood bench in upper reach



Moderate incision and bank erosion

Stream: Beaver Brook **Reach:** T1.02.A **Town:** West Windsor **Date Assessed:** 08/27/14

Channel Length (ft): 5,171 **Channel Slope (%):** 1.2 **Sinuosity:** 1.2 **Watershed Area (mi²):** 3.48

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	Narrow	Narrow
Bedform	Riffle-Pool	Riffle-Pool
Median Substrate	Gravel	Gravel
Stream Type	C	C

Ph2 Cross-Section Data

Curve Width (ft)	22.7
Bankfull Width (ft)	24
Max Depth (ft)	1.8
Width/Depth Ratio	19.1
Entrenchment Ratio	2.5
Incision Ratio	1.3

Rapid Habitat Assessment

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
C	Coon Club	57%	D, S, AOP
B	Brownsville	66%	D, R/R
C	Brownsville	56%	R/R

of Other Constrictions: 0

of Grade Controls: 2

Rank	LWD	Pools
1	31	24
2	31	18
3	18	6
4	13	6
5	2	0
6	0	1
7	-	0
#/mile	97	56

Number of Debris Jams: 7

Step 6/7 Summary

RHA Score/Condition	62/Fair
Habitat Type Departure	None
RGA Score / Condition	63/Fair
Dominant Adjustment	Degrading
CEM Model Stage	F/II
Stream Type Departure	None
Stream Sensitivity	Very High

Impact Summary

Bank Erosion	Stormwater
Armoring	Constrictions
Riparian Buffer	Deposition
Encroachment	Migration
Development	Steep Riffle
Corridor Land Cover	Head Cut
Mass Failure	Straightening
Flow Regulation	Dredging

Potential Projects in Reach

- **Project WW 13:** Culvert Replacement/Retrofit: Coon Club Road culvert is undersized and perched. Culvert could be replaced with a larger structure to reduce flood risk, and/or AOP could be improved with tailwater control or similar structure.
- **Project WW 14a + b:** Buffer Planting - Two small floodplain areas with reduced bank and buffer vegetation. Fence cattle away from buffer at site a.
- **Project WW 15:** Culvert Replacement - Brownsville-Hartland Road culvert is undersized and a moderate AOP barrier.

Reach Highlights: Minor incision and some bank/valley erosion noted throughout reach. Incision may be historic, but some current day encroachments in lower and upper segment may be contributing to ongoing instability. Given grade controls and natural vegetation in corridor and LWD in channel, segment does not appear susceptible to significant instability in the near future. Entrenchment varied throughout segment with some areas of Bc geometry.



Coon Club Road culvert



Moderate incision in the upper segment

Stream: Beaver Brook **Reach:** T1.02.B **Town:** West Windsor **Date Assessed:** 08/27/14

Channel Length (ft): 1,114 **Channel Slope (%):** 0.5 **Sinuosity:** 1.1 **Watershed Area (mi²):** 3.48

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	Very Broad	Very Broad
Bedform	Riffle-Pool	Riffle-Pool
Median Substrate	Sand	Sand
Stream Type	E	E

Ph2 Cross-Section Data

Curve Width (ft)	22.7
Bankfull Width (ft)	8
Max Depth (ft)	3.0
Width/Depth Ratio	3.2
Entrenchment Ratio	81.9
Incision Ratio	1.1

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
None in reach.			

of Other Constrictions: 0

of Grade Controls: 0

of Beaver Dams: 1

Rapid Habitat Assessment

Rank	LWD	Pools
1	24	28
2	12	16
3	0	0
4	0	0
5	0	0
6	0	0
7	-	0
#/mile	170	208

Number of Debris Jams: 0

Step 6/7 Summary

RHA Score/Condition	59/Fair
Habitat Type Departure	None
RGA Score / Condition	73/Good
Dominant Adjustment	Stable
CEM Model Stage	F/I
Stream Type Departure	None
Stream Sensitivity	High

Impact Summary

Bank Erosion	Stormwater
Armoring	Constrictions
Riparian Buffer	Deposition
Encroachment	Migration
Development	Steep Riffle
Corridor Land Cover	Head Cut
Mass Failure	Straightening
Flow Regulation	Dredging

Potential Projects in Reach

- **Project WW 14c:** Buffer Planting and Corridor Protection - A large hayfield and pasture area has reduced bank and buffer vegetation.

Reach Highlights: No evidence of channel instability; however beaver ponding made channel observations challenging in segment. Historic straightening likely given hay fields in corridor and obvious straightening in upstream segment.



Beaver ponding in upper segment



Dense alders along banks

Stream: Sheddsville Rd Trib **Reach:** T1.01S4.01.A **Town:** West Windsor **Date Assessed:** 07/01/14

Channel Length (ft): 1,127 **Channel Slope (%):** 3.9 **Sinuosity:** 1.0 **Watershed Area (mi²):** 1.43

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	Semi-Confined	Semi-Confined
Bedform	Step-Pool	Plane Bed
Median Substrate	Cobble	Gravel
Stream Type	B	F _b

Ph2 Cross-Section Data

Curve Width (ft)	15.4
Bankfull Width (ft)	16
Max Depth (ft)	1.6
Width/Depth Ratio	15.7
Entrenchment Ratio	1.2
Incision Ratio	4.5

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
B	Brownsville	117%	None
C	Sheddsville	78%	None

of Other Constrictions: 0

of Grade Controls: 0

of Beaver Dams: 0

Rapid Habitat Assessment

Rank	LWD	Pools
1	8	5
2	4	0
3	4	0
4	3	0
5	0	0
6	0	0
7	-	0
#/mile	89	23

Number of Debris Jams: 2

Step 6/7 Summary

RHA Score/Condition	34/Poor
Habitat Type Departure	Plane Bed
RGA Score / Condition	32/Poor
Dominant Adjustment	Degrading
CEM Model Stage	F/II
Stream Type Departure	B to F
Stream Sensitivity	Extreme

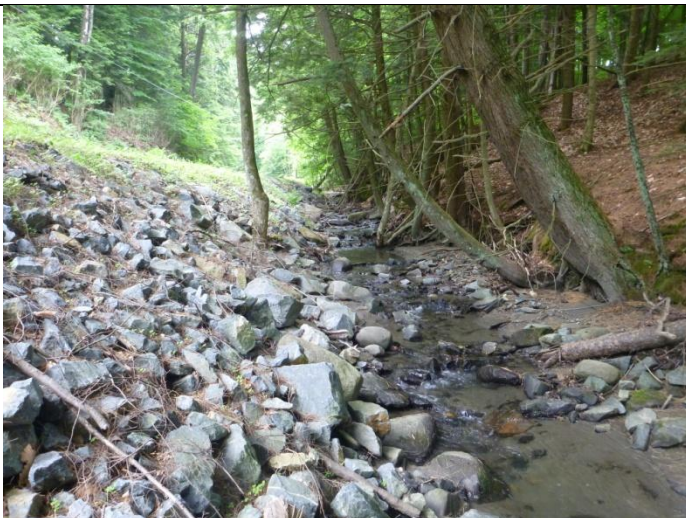
Impact Summary

Bank Erosion	Stormwater
Armoring	Constrictions
Riparian Buffer	Deposition
Encroachment	Migration
Development	Steep Riffle
Corridor Land Cover	Head Cut
Mass Failure	Straightening
Flow Regulation	Dredging

Potential Projects in Reach

- Project WW 16:** Bank Stabilization - Road embankment along Sheddsville Road has undersized armor and is vulnerable to erosion.

Reach Highlights: Channel is affected by encroachment and buffer impacts from Sheddsville Road for most of the segment. Significant channel erosion and roadway damage occurred during T.S. Irene in 2011. Mass failures along bank opposite road will likely worsen over time given the extensive hard bank armoring.



Highly encroached along Sheddsville Rd



New box culvert under Sheddsville Rd

Stream: Sheddsville Rd Trib **Reach:** T1.01S4.01.B **Town:** West Windsor **Date Assessed:** 07/01/14
Channel Length (ft): 3,640 **Channel Slope (%):** 0.5 **Sinuosity:** 1.18 **Watershed Area (mi²):** 1.43

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	Very Broad	Very Broad
Bedform	Riffle-Pool	Riffle-Pool
Median Substrate	Gravel	Gravel
Stream Type	E	E

Ph2 Cross-Section Data

Curve Width (ft)	15.4
Bankfull Width (ft)	11
Max Depth (ft)	1.3
Width/Depth Ratio	9.3
Entrenchment Ratio	2.7
Incision Ratio	1.4

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
C	Hemlock Hill	38%	None
C	Driveway	29%	S

of Other Constrictions: 0

of Grade Controls: 0

of Beaver Dams: 0

Rapid Habitat Assessment

Rank	LWD	Pools
1	20	11
2	6	10
3	7	0
4	5	2
5	0	0
6	0	0
7	-	0
#/mile	55	33

Number of Debris Jams: 3

Step 6/7 Summary

RHA Score/Condition	54/Fair
Habitat Type Departure	None
RGA Score / Condition	63/Fair
Dominant Adjustment	Degrading
CEM Model Stage	F/II
Stream Type Departure	None
Stream Sensitivity	Very High

Impact Summary

Bank Erosion	Stormwater
Armoring	Constrictions
Riparian Buffer	Deposition
Encroachment	Migration
Development	Steep Riffle
Corridor Land Cover	Head Cut
Mass Failure	Straightening
Flow Regulation	Dredging

Potential Projects in Reach

- **Project WW 17:** Buffer Planting - A large horse pasture follows most of the segment and has reduced buffer vegetation.
- **Project WW 18:** Culvert Replacement - A culvert under a private road is a major constriction and caused significant increased flooding during T.S. Irene.

Reach Highlights: Channel morphology has not departed significantly from reference, but sinuosity is low due to historical straightening. Channel likely aggraded coarse material during T.S. Irene in 2011. Aggradation and widening may occur in near future. Unless channel is armored or managed in future, natural planform may begin to redevelop upstream of the Sheddsville Road crossing. A severely undersized culvert is located on a private driveway mid-segment.



Moderately incised C-type geometry at the cross-section



Bank and buffer impacts through most of reach

Stream: Sheddsville Rd Trib **Reach:** T1.01S4.01.C **Town:** West Windsor **Date Assessed:** 07/01/14

Channel Length (ft): 1,493 **Channel Slope (%):** 4.0 **Sinuosity:** 1.05 **Watershed Area (mi²):** 1.43

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	N Confined	N Confined
Bedform	Step-Pool	Plane Bed
Median Substrate	Boulder	Gravel
Stream Type	A	A

Ph2 Cross-Section Data

Curve Width (ft)	15.4
Bankfull Width (ft)	12
Max Depth (ft)	1.7
Width/Depth Ratio	10.0
Entrenchment Ratio	1.0
Incision Ratio	1.0

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
B	Bible Hill	130%	None

of Other Constrictions: 1

of Grade Controls: 0

of Beaver Dams: 0

Rapid Habitat Assessment

Rank	LWD	Pools
1	12	4
2	19	17
3	2	0
4	10	0
5	0	0
6	0	0
7	-	0
#/mile	102	50

Number of Debris Jams: 5

Step 6/7 Summary

RHA Score/Condition	46/Fair
Habitat Type Departure	Plane Bed
RGA Score / Condition	51/Fair
Dominant Adjustment	Degrading
CEM Model Stage	F/II
Stream Type Departure	None
Stream Sensitivity	Very High

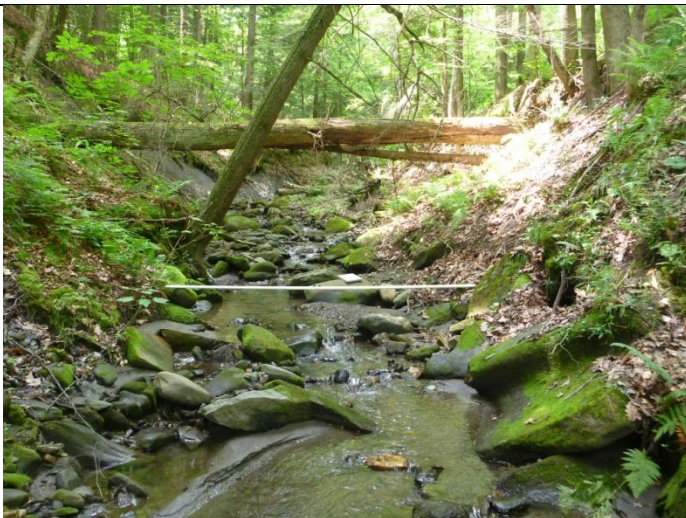
Impact Summary

Bank Erosion	Stormwater
Armoring	Constrictions
Riparian Buffer	Deposition
Encroachment	Migration
Development	Steep Riffle
Corridor Land Cover	Head Cut
Mass Failure	Straightening
Flow Regulation	Dredging

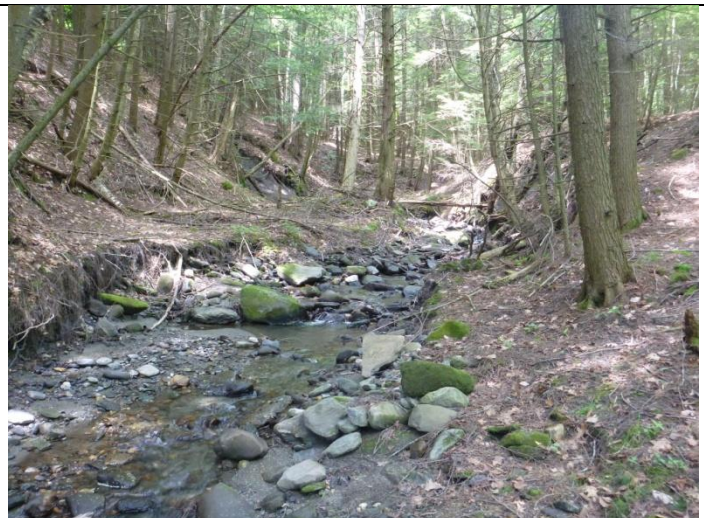
Potential Projects in Reach

- **Project WW 19:** Bank Stabilization: Road embankment armoring is undersized and road is at risk of erosion damage.

Reach Highlights: Channel is encroached by Sheddsville Road for over half the segment length. Some areas of road armor (i.e., rip rap) have constricted the channel by ~30%. Although no incision is reported (no natural floodplain for A-type channel), stage II CEM was selected to characterize the roadway impacts. Channel may incise in the future as there are no grade controls.



Typical cross-section with increased gravel



Typical geometry through segment

Stream: Willow Brook **Reach:** T2.01.A **Town:** West Windsor **Date Assessed:** 08/20/14

Channel Length (ft): 2,527 **Channel Slope (%):** 0.5 **Sinuosity:** 1.2 **Watershed Area (mi²):** 5.26

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	Very Broad	Very Broad
Bedform	Riffle-Pool	Riffle-Pool
Median Substrate	Gravel	Gravel
Stream Type	C	F

Ph2 Cross-Section Data

Curve Width (ft)	27.2
Bankfull Width (ft)	20
Max Depth (ft)	2.4
Width/Depth Ratio	11.1
Entrenchment Ratio	1.5
Incision Ratio	2.3

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
B	Route 44	55%	D, S

of Other Constrictions: 2

of Grade Controls: 5

of Beaver Dams: 0

Rapid Habitat Assessment

Rank	LWD	Pools
1	3	3
2	5	2
3	2	2
4	2	0
5	0	0
6	2	0
7	-	0
#/mile	29	14

Number of Debris Jams: 2

Step 6/7 Summary

RHA Score/Condition	48/Fair
Habitat Type Departure	None
RGA Score / Condition	45/Fair
Dominant Adjustment	Degrading
CEM Model Stage	F/II
Stream Type Departure	C to F
Stream Sensitivity	Extreme

Impact Summary

Bank Erosion	Stormwater
Armoring	Constrictions
Riparian Buffer	Deposition
Encroachment	Migration
Development	Steep Riffle
Corridor Land Cover	Head Cut
Mass Failure	Straightening
Flow Regulation	Dredging

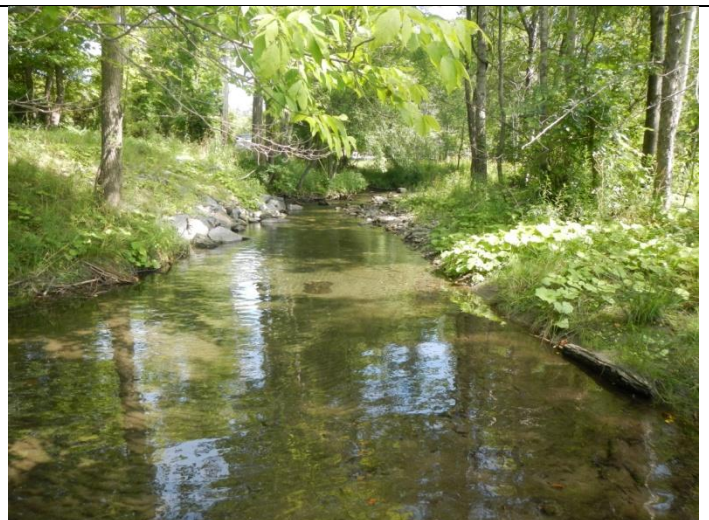
Potential Projects in Reach

- **Project WW 20:** Replace Bridge: The Route 44 bridge is a moderate channel constriction based on the observed channel width. The bridge is in poor condition and should be considered for a large structure when up for replacement.
- **Project WW 21:** Bank Stabilization - Small area of bank erosion with undersized rip-rap may threaten the Route 44 embankment.
- **Project WW 22a:** Buffer Planting & Corridor Protection - Large hayfield along most of the segment is lacking sufficient woody vegetation.

Reach Highlights: This segment is straightened through most of the horse pasture and as a result is narrow and deeply incised. The reach is either a very incised and narrow C-type or a highly straightened E-type by reference. Based on channel slope and the lack of obvious historic channel indicators in the meadow, we selected a C to F departure. The entrenchment ratio is slightly above the range for F-type; however this segment is approximately 30% under curve width. This segment is stuck in stage II with minimal access to the large floodplain except during larger events.



Straightening and incision through horse pasture



Encroachment from Rush Meadow Road

Stream: Willow Brook **Reach:** T2.01.B **Town:** West Windsor **Date Assessed:** 08/20/14

Channel Length (ft): 1,500 **Channel Slope (%):** 1.5 **Sinuosity:** 1.2 **Watershed Area (mi²):** 5.26

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	Broad	Narrow
Bedform	Riffle-Pool	Riffle-Pool
Median Substrate	Gravel	Gravel
Stream Type	C	C

Ph2 Cross-Section Data

Curve Width (ft)	27.2
Bankfull Width (ft)	28.2
Max Depth (ft)	1.9
Width/Depth Ratio	20.9
Entrenchment Ratio	2.8
Incision Ratio	1.4

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
B	Rush Meadow	74%	None

of Other Constrictions: 0

of Grade Controls: 4

of Beaver Dams: 0

Rapid Habitat Assessment

Rank	LWD	Pools
1	9	4
2	5	4
3	2	3
4	1	2
5	0	0
6	1	0
7	-	0
#/mile	63	45

Number of Debris Jams: 3

Step 6/7 Summary

RHA Score/Condition	62/Fair
Habitat Type Departure	None
RGA Score / Condition	57/Fair
Dominant Adjustment	Planform
CEM Model Stage	F/IV
Stream Type Departure	None
Stream Sensitivity	Very High

Impact Summary

Bank Erosion	Stormwater
Armoring	Constrictions
Riparian Buffer	Deposition
Encroachment	Migration
Development	Steep Riffle
Corridor Land Cover	Head Cut
Mass Failure	Straightening
Flow Regulation	Dredging

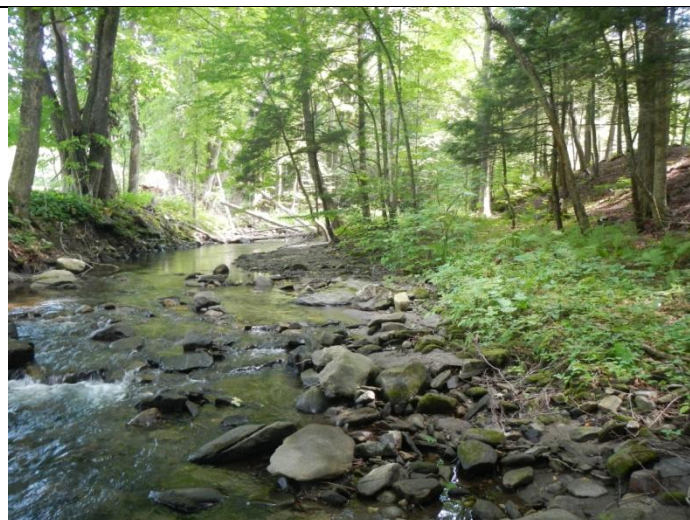
Potential Projects in Reach

- **Project WW 22b:** Buffer Planting & Corridor Protection - Several sections of the segment have reduced woody buffer vegetation and should be protected from future development.

Reach Highlights: This segment had moderate floodplain access throughout and appeared to be fairly stable. We assessed the reach as stage IV as there was no evidence of ongoing incision or widening, and aggrading materials were causing some planform adjustments in the middle and lower portion of the segment.



Straightening and low floodplain



Accessible floodplain benches in lower segment

Stream: Willow Brook **Reach:** T2.02 **Town:** West Windsor **Date Assessed:** 08/20/14

Channel Length (ft): 3,213 **Channel Slope (%):** 3.2 **Sinuosity:** 1.02 **Watershed Area (mi²):** 5.04

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	Narrow	Semi-Confined
Bedform	Step-Pool	Step-Pool
Median Substrate	Cobble	Gravel
Stream Type	B	B

Ph2 Cross-Section Data

Curve Width (ft)	26.7
Bankfull Width (ft)	29.6
Max Depth (ft)	1.6
Width/Depth Ratio	27.7
Entrenchment Ratio	1.6
Incision Ratio	1.8

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
C	Driveway	41%	AOP, I

of Other Constrictions: 0

of Grade Controls: 6

of Beaver Dams: 0

Rapid Habitat Assessment

Rank	LWD	Pools
1	5	3
2	15	9
3	3	6
4	3	1
5	1	0
6	1	1
7	-	1
#/mile	46	32

Number of Debris Jams: 5

Step 6/7 Summary

RHA Score/Condition	44/Fair
Habitat Type Departure	None
RGA Score / Condition	41/Fair
Dominant Adjustment	Widening
CEM Model Stage	F/III
Stream Type Departure	None
Stream Sensitivity	High

Impact Summary

Bank Erosion **Stormwater**
Armoring **Constrictions**
Riparian Buffer **Deposition**
Encroachment **Migration**
Development Steep Riffle
Corridor Land Cover Head Cut
Mass Failure Straightening
Flow Regulation Dredging

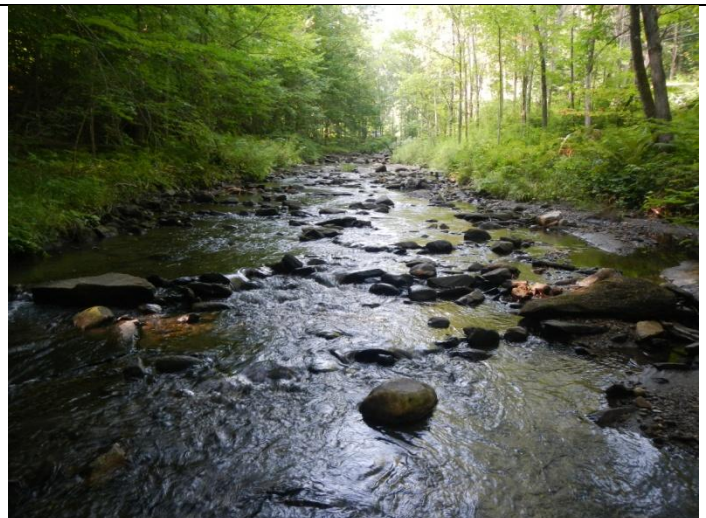
Potential Projects in Reach

- **Project WW 23:** Utility Repairs - A utility pole on the left floodplain is at risk during storm events.
- **Project WW 24:** Replace Culvert - An undersized driveway culvert is a major constriction and an AOP barrier.
- **Project WW 22c:** Corridor Protection: Small forested floodplain area on the left bank.

Reach Highlights: This reach widened during TS Irene scouring away low banks and then aggraded with larger cobbles and boulders. Currently the channel is continuing to aggrade with finer material and is beginning to adjust planform through the recent deposits. We observed evidence of continued widening and assessed the reach as stage III, likely to transition to stage IV in the future. Numerous grade controls limit incision and floodplain access was moderate throughout the reach.



Numerous grade controls limit incision through reach



Typical widened channel

Stream: Willow Brook **Reach:** T2.03.A **Town:** West Windsor **Date Assessed:** 08/20/14

Channel Length (ft): 2,412 **Channel Slope (%):** 0.9 **Sinuosity:** 1.2 **Watershed Area (mi²):** 5.04

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	Broad	Broad
Bedform	Riffle-Pool	Riffle-Pool
Median Substrate	Cobble	Cobble
Stream Type	E	E

Ph2 Cross-Section Data

Curve Width (ft)	25.9
Bankfull Width (ft)	17.5
Max Depth (ft)	2.25
Width/Depth Ratio	11.3
Entrenchment Ratio	9.1
Incision Ratio	1.7

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
B	Rush Meadow	52%	D
B	Private	54%	None

of Other Constrictions: 1

of Grade Controls: 5

of Beaver Dams: 1

Rapid Habitat Assessment

Rank	LWD	Pools
1	5	2
2	3	6
3	2	3
4	1	2
5	2	0
6	0	1
7	-	1
#/mile	28	32

Number of Debris Jams: 0

Step 6/7 Summary

RHA Score/Condition	52/Fair
Habitat Type Departure	None
RGA Score / Condition	57/Fair
Dominant Adjustment	Degrading
CEM Model Stage	F/II
Stream Type Departure	None
Stream Sensitivity	High

Impact Summary

Bank Erosion	Stormwater
Armoring	Constrictions
Riparian Buffer	Deposition
Encroachment	Migration
Development	Steep Riffle
Corridor Land Cover	Head Cut
Mass Failure	Straightening
Flow Regulation	Dredging

Potential Projects in Reach

- **Project WW 22d:** Buffer Planting - The hayfield along right floodplain has limited woody vegetation.

Reach Highlights: The first 1000ft of segment A were very similar to T2.02 (widening and aggrading B-type) and should be considered a part of that reach. The portion of segment A represented by our cross-section begins immediately downstream of the Rush Meadow bridge and continues upstream to the segment break. This E-type segment had an active beaver dam impounding the upper half. Moderate/high incision was observed below the beaver dam. Slumping banks and point bar development indicate that planform is slowly adjusting. We assessed the reach as stage II but transitioning towards aggradation and planform adjustment. The stream bottom was primarily cobble and was stable.



Typical incised E-type



Beaver dam in upper segment

Stream: Willow Brook **Reach:** T2.03.B **Town:** West Windsor **Date Assessed:** 08/20/14

Channel Length (ft): 4,406 **Channel Slope (%):** 1.9 **Sinuosity:** 1.2 **Watershed Area (mi²):** 5.04

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	Narrow	Semi-Confined
Bedform	Riffle-Pool	Riffle-Pool
Median Substrate	Cobble	Cobble
Stream Type	B	F

Ph2 Cross-Section Data

Curve Width (ft)	25.9
Bankfull Width (ft)	22
Max Depth (ft)	1.9
Width/Depth Ratio	15.7
Entrenchment Ratio	1.1
Incision Ratio	2.1

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
B	Bannister	69%	D
B	Private	44%	D, S, R/R
B	Rush Meadow	69%	D
C	Rush Meadow	33%	S,R/R,AOP
B	Private	139%	R/R

of Other Constrictions: 2

of Grade Controls: 3

of Beaver Dams: 0

Rapid Habitat Assessment

Rank	LWD	Pools
1	4	5
2	12	8
3	4	6
4	8	1
5	1	0
6	0	0
7	-	1
#/mile	34	25

Number of Debris Jams: 3

Step 6/7 Summary

RHA Score/Condition	46/Fair
Habitat Type Departure	None
RGA Score / Condition	38/Fair
Dominant Adjustment	Degrading
CEM Model Stage	F/II
Stream Type Departure	B to F
Stream Sensitivity	Extreme

Impact Summary

Bank Erosion	Stormwater
Armoring	Constrictions
Riparian Buffer	Deposition
Encroachment	Migration
Development	Steep Riffle
Corridor Land Cover	Head Cut
Mass Failure	Straightening
Flow Regulation	Dredging

Potential Projects in Reach

- **Project WW 25:** Replace Bridge: An undersized driveway bridge is a major constriction and in poor condition.
- **Projects WW 22e + f:** Buffer Planting & Corridor Protection: Several small floodplain areas have reduced woody vegetation and should be protected from future development.
- **Project WW 26:** Replace Culvert: The Rush Meadow Rd culvert at the top of the reach is a major constriction and a minor AOP barrier.

Reach Highlights: Width and slope were variable through this segment, incision and entrenchment were consistently high. The lower segment was impacted by armoring on one or both banks, the upper segment typically had ledge along the left bank and tall bank armoring to Rush Meadow Road on the right bank. A large flood chute mid-segment in an area with less entrenchment could lead to a channel avulsion. Overall this reach is stuck in stage II and due to natural or man-made hard banks it will likely remain there.



Typical incised F-type channel along Rush Meadow Ln



Several bridges and other constrictions increased incision

Stream: Willow Brook **Reach:** T2.04 **Town:** West Windsor **Date Assessed:** 08/21/14

Channel Length (ft): 3,051 **Channel Slope (%):** 2.75 **Sinuosity:** 1.1 **Watershed Area (mi²):** 3.23

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	Broad	Broad
Bedform	Riffle-Pool	Riffle-Pool
Median Substrate	Cobble	Cobble
Stream Type	C _b	C _b

Ph2 Cross-Section Data

Curve Width (ft)	21.9
Bankfull Width (ft)	23
Max Depth (ft)	2.3
Width/Depth Ratio	18.2
Entrenchment Ratio	2.8
Incision Ratio	1.5

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
None in reach.			

of Other Constrictions: 1

of Grade Controls: 1

of Beaver Dams: 0

Rapid Habitat Assessment

Rank	LWD	Pools
1	17	5
2	25	11
3	11	5
4	6	1
5	0	0
6	0	0
7	-	0
#/mile	102	28

Number of Debris Jams: 6

Step 6/7 Summary

RHA Score/Condition	70/Good
Habitat Type Departure	None
RGA Score / Condition	49/Fair
Dominant Adjustment	Planform
CEM Model Stage	F/IV
Stream Type Departure	None
Stream Sensitivity	High

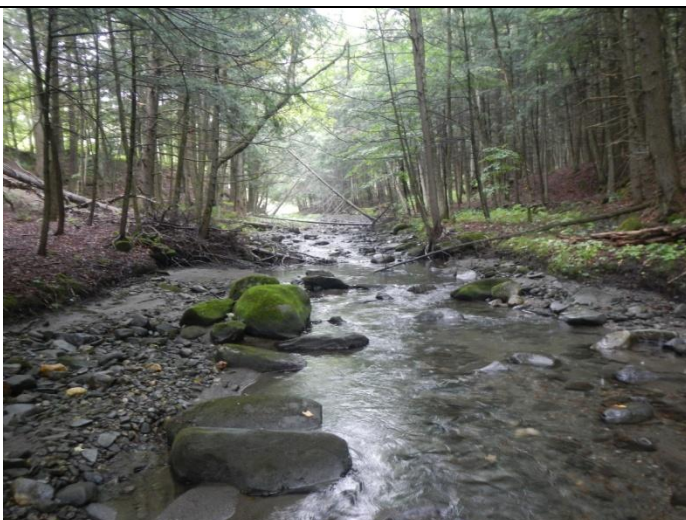
Impact Summary

Bank Erosion	Stormwater
Armoring	Constrictions
Riparian Buffer	Deposition
Encroachment	Migration
Development	Steep Riffle
Corridor Land Cover	Head Cut
Mass Failure	Straightening
Flow Regulation	Dredging

Potential Projects in Reach

- **Project WW 22g:** Reduced bank and buffer vegetation along both floodplains
- **Project WW 27:** Conservation - Most of the reach is a highly active depositional/planform area with accessible forested floodplain.
- **Project WW 28:** Bank Stabilization - A 20' tall mass failure is close to threatening Rush Meadow Rd and should be assessed for potential stabilization efforts
- **Project WW 29:** Bank Stabilization - A 25' tall mass failure is threatening a house

Reach Highlights: This reach was heavily scoured and widened during TS Irene. A low and accessible forested floodplain was present along one bank for most of the reach and was heavily accessed during TSI and other recent high flows. Numerous areas of floodplain access and deposition and a recent channel avulsion were also observed. The channel is currently aggrading and adjusting planform.



Typical geometry with accessible flood benches



Widening and planform adjustment

Stream: Willow Brook **Reach:** T2.05.A **Town:** West Windsor **Date Assessed:** 08/21/14
Channel Length (ft): 1,049 **Channel Slope (%):** 1.75 **Sinuosity:** 1.1 **Watershed Area (mi²):** 2.33

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	Broad	Broad
Bedform	Riffle-Pool	Riffle-Pool
Median Substrate	Cobble	Bedrock
Stream Type	C	C

Ph2 Cross-Section Data

Curve Width (ft)	19.0
Bankfull Width (ft)	16
Max Depth (ft)	1.7
Width/Depth Ratio	13.3
Entrenchment Ratio	2.6
Incision Ratio	1.3

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
B	Rush Meadow	53%	D

of Other Constrictions: 1

of Grade Controls: 5

of Beaver Dams: 0

Rapid Habitat Assessment

Rank	LWD	Pools
1	5	4
2	11	7
3	5	2
4	5	1
5	1	0
6	2	0
7	-	0
#/mile	145	70

Number of Debris Jams: 5

Step 6/7 Summary

RHA Score/Condition	66/Good
Habitat Type Departure	None
RGA Score / Condition	65/Good
Dominant Adjustment	Aggrading
CEM Model Stage	D/IIb
Stream Type Departure	None
Stream Sensitivity	Moderate

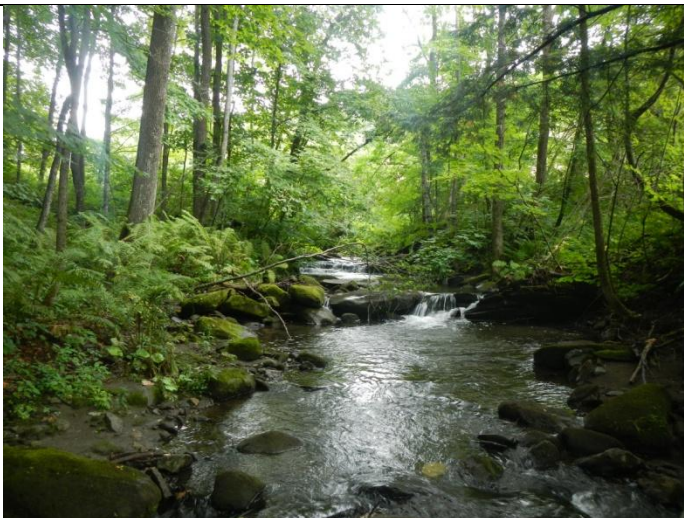
Impact Summary

Bank Erosion	Stormwater
Armoring	Constrictions
Riparian Buffer	Deposition
Encroachment	Migration
Development	Steep Riffle
Corridor Land Cover	Head Cut
Mass Failure	Straightening
Flow Regulation	Dredging

Potential Projects in Reach

- None

Reach Highlights: This short segment had numerous bedrock grade controls and the majority of the bed was underlain with ledge. The segment widened in several locations during TS Irene leading to some erosion and a large mass failure at the bottom of the segment. The channel has since filled back in with developing side bars and appears to be slowly adjusting planform in areas with less bedrock. We assessed this reach as stage IIb due to some widening and planform adjustments and limited incision due to numerous grade controls.



Near continuous grade control for most of segment



Aggradation and some widening

Stream: Willow Brook **Reach:** T2.05.B **Town:** West Windsor **Date Assessed:** 08/21/14

Channel Length (ft): 939 **Channel Slope (%):** 1.75 **Sinuosity:** 1.1 **Watershed Area (mi²):** 2.33

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	Very Broad	Very Broad
Bedform	Riffle-Pool	Riffle-Pool
Median Substrate	Gravel	Gravel
Stream Type	E	E

Ph2 Cross-Section Data

Curve Width (ft)	19.0
Bankfull Width (ft)	10.8
Max Depth (ft)	2.0
Width/Depth Ratio	5.5
Entrenchment Ratio	8.8
Incision Ratio	1.5

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
B	Rush Meadow	53%	None

of Other Constrictions: 0

of Grade Controls: 2

of Beaver Dams: 0

Rapid Habitat Assessment

Rank	LWD	Pools
1	4	1
2	6	4
3	3	2
4	1	0
5	0	0
6	0	0
7	-	0
#/mile	78	39

Number of Debris Jams: 3

Step 6/7 Summary

RHA Score/Condition	58/Fair
Habitat Type Departure	None
RGA Score / Condition	55/Fair
Dominant Adjustment	Degrading
CEM Model Stage	F/II
Stream Type Departure	None
Stream Sensitivity	Extreme

Impact Summary

Bank Erosion	Stormwater
Armoring	Constrictions
Riparian Buffer	Deposition
Encroachment	Migration
Development	Steep Riffle
Corridor Land Cover	Head Cut
Mass Failure	Straightening
Flow Regulation	Dredging

Potential Projects in Reach

- **Project WW 22h:** Buffer Planting & Corridor Protection - A hayfield along the right floodplain is lacking woody vegetation.

Reach Highlights: This short segment is E-type by reference and had moderate incision. We did not observe any evidence of widening or planform adjustment; therefore we assessed this segment as Stage II. The short stretch upstream of the Rush Meadow bridge is highly encroached by the road and is departed to F-type.



Moderately incised E-type at cross-section



Moderately incised E-type

4.1.3 Town of Reading Phase 2 Assessment Summary

The Phase 2 assessed reaches/segments within the Town of Reading highlight the differences between the three drainages that are all of similar size (Figure 4.3). Reading Hill Brook, Mill Brook mainstem, and Baileys Brook all converge within the Town of Reading. Below are brief descriptions of each stream within the Town.

- Mill Brook mainstem
 - Highly variable confinement and encroachment leads to alternating areas of incision and widening/aggradation. Several areas indicate channel instability as huge volumes of sediment from Bailey Brook are working through the reach.
 - Upstream of the Bailey Brook confluence the channel flows through a forested floodplain and then along a large hayfield before entering the steeper and primarily forested headwaters reaches.
- Reading Hill Brook
 - The assessed reaches on Reading Hill Brook were typically more stable with numerous grade controls and large areas of beaver meadow.
 - Segment T3.02.A flows through a blasted bedrock channel around two large holding ponds associated with the talc mine.
- Bailey Brook
 - The first segment of Bailey Brook is deeply incised and has an alluvial fan setting upstream of the undersized road crossing. Upstream of the Bailey Brook B&B the stream flows through an undeveloped valley that was incredibly active during T.S. Irene. Huge mass failures were observed along every channel bend and giant debris fields filled the valley in several locations. The sediment and debris deposits generated by T.S. Irene along Bailey Brook represents a significant threat to downstream during future floods.

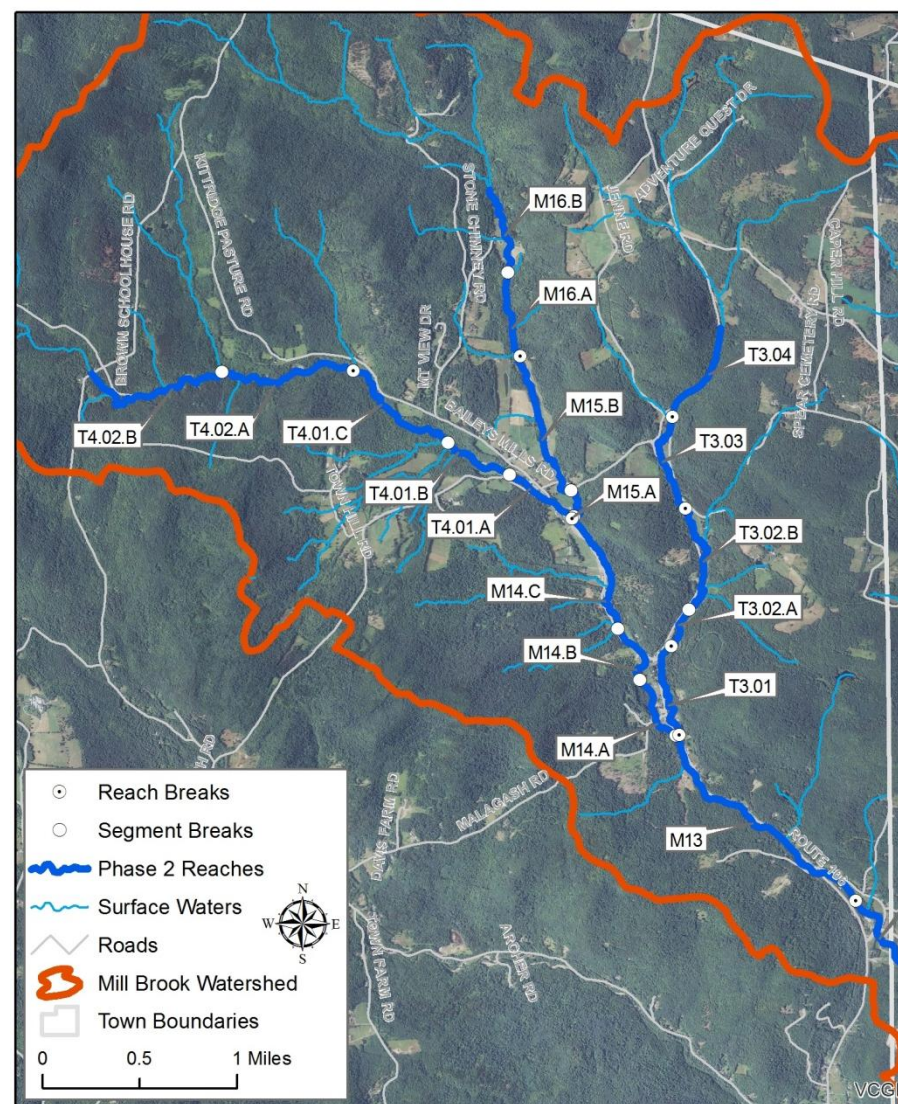


Figure 4.3: Town of Reading reach and segment locations.

Stream: Mill Brook **Reach:** M13 **Town:** Reading **Date Assessed:** 07/21/14

Channel Length (ft): 7,217 **Channel Slope (%):** 1.2 **Sinuosity:** 1.02 **Watershed Area (mi²):** 15.3

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	Narrow	Semi-confined
Bedform	Riffle-Pool	Plane Bed
Median Substrate	Cobble	Cobble
Stream Type	Bc	F

Ph2 Cross-Section Data

Curve Width (ft)	43.5
Bankfull Width (ft)	36
Max Depth (ft)	2.5
Width/Depth Ratio	20.3
Entrenchment Ratio	1.2
Incision Ratio	2.3

Rapid Habitat Assessment

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
B	Rt 106	161%	D
B	Private	133%	D

of Other Constrictions: 3

of Grade Controls: 19

Rank	LWD	Pools
1	6	3
2	15	13
3	0	6
4	4	0
5	0	0
6	0	0
7	-	0
#/mile	18	16

Number of Debris Jams: 3

Step 6/7 Summary

RHA Score/Condition	48/Fair
Habitat Type Departure	Plane Bed
RGA Score / Condition	45/Fair
Dominant Adjustment	Degradation
CEM Model Stage	F/II
Stream Type Departure	B to F
Stream Sensitivity	Extreme

Impact Summary

Bank Erosion	Stormwater
Armoring	Constrictions
Riparian Buffer	Deposition
Encroachment	Migration
Development	Steep Riffle
Corridor Land Cover	Head Cut
Mass Failure	Straightening
Flow Regulation	Dredging

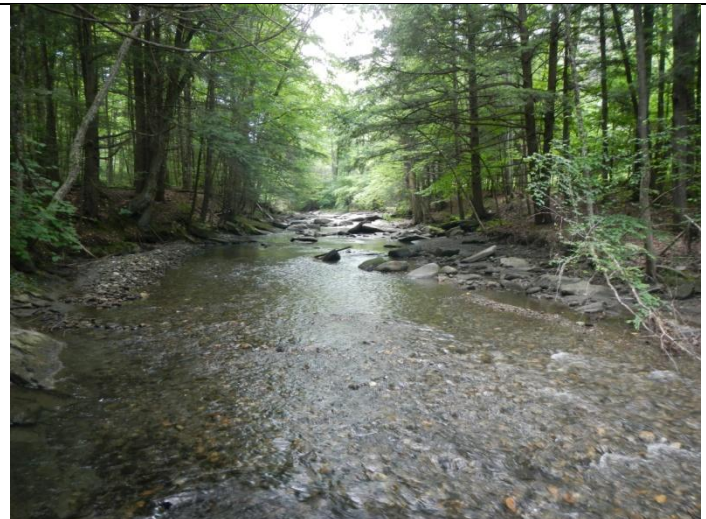
Potential Projects in Reach

- **Project RE 1b:** Buffer Planting - A recently armored and straightened section below the private covered bridge has no woody vegetation shading the channel.
- **Project RE 2:** Gully Stabilization - A small but active gully is eroding a footpath to a former swimming area.

Reach Highlights: Most of this reach is highly encroached by Rt 106. This encroachment and heavy bank armoring has locked the channel in place leading to historic incision. We observed moderate scour along the right banks from TS Irene through most of the reach, but widening was limited by stony soils and dense roots along the bank. Side bars have formed along most of these scoured banks, indicating that aggradation is an ongoing process. Minimal floodplain access led to a stream type departure from Bc to F. We assessed the reach as stage II transitioning slowly to stage III.



Incision and encroachment along Rt 106



Evidence of bank scour and recent incision

Stream: Mill Brook **Reach:** M14.A **Town:** Reading **Date Assessed:** 07/22/14
Channel Length (ft): 1,999 **Channel Slope (%):** 1.0 **Sinuosity:** 1.1 **Watershed Area (mi²):** 9.74

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	Very Broad	Broad
Bedform	Riffle-Pool	Plane Bed
Median Substrate	Gravel	Gravel
Stream Type	C	C

Ph2 Cross-Section Data

Curve Width (ft)	35.7
Bankfull Width (ft)	65
Max Depth (ft)	2.3
Width/Depth Ratio	60.3
Entrenchment Ratio	5.6
Incision Ratio	1.2

Rapid Habitat Assessment

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
A	Agony Hill	70%	I, D, E, S

of Other Constrictions: 0

of Grade Controls: 0

Rank	LWD	Pools
1	2	2
2	8	5
3	0	1
4	5	0
5	0	0
6	2	0
7	-	0
#/mile	44	21

Number of Debris Jams: 3

Step 6/7 Summary

RHA Score/Condition	53/Fair
Habitat Type Departure	Plane Bed
RGA Score / Condition	39/Fair
Dominant Adjustment	Planform
CEM Model Stage	F/III
Stream Type Departure	None
Stream Sensitivity	Very High

Impact Summary

Bank Erosion	Stormwater
Armoring	Constrictions
Riparian Buffer	Deposition
Encroachment	Migration
Development	Steep Riffle
Corridor Land Cover	Head Cut
Mass Failure	Straightening
Flow Regulation	Dredging

Potential Projects in Reach

- **Project RE 3:** Arch Replacement - Agony Hill Road arch is undersized and causing major sediment accumulation upstream and exacerbated flooding and road damage during T.S. Irene.
- **Project RE 4:** Conservation - Valuable forested floodplain on the right bank
- **Project RE 1 c+d:** Corridor Protection and Buffer Planting - Two large areas along the left bank have minimal woody vegetation and should be protected from future development.

Reach Highlights: This segment was highly active during TS Irene with major access to both floodplains, planform adjustments, and huge volumes of gravel/sand deposition. A large volume of floodwater spilled on the left floodplain upstream of the undersized Agony Hill Rd arch damaging adjacent properties and structures. The channel widened considerably and is currently aggrading and adjusting planform to accommodate the large volume of gravel and sand working through the reach. We assessed this segment as somewhere between stage III and IV due to ongoing aggradation and planform adjustments.



Widening and major deposition at the cross-section



Undersized arch and downstream mass failure

Stream: Mill Brook **Reach:** M14.B **Town:** Reading **Date Assessed:** 07/22/14

Channel Length (ft): 1,868 **Channel Slope (%):** 1.5 **Sinuosity:** 1.15 **Watershed Area (mi²):** 9.74

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	Very Broad	Very Broad
Bedform	Riffle-Pool	Plane Bed
Median Substrate	Gravel	Cobble
Stream Type	C	F

Ph2 Cross-Section Data

Curve Width (ft)	35.7
Bankfull Width (ft)	28
Max Depth (ft)	2.1
Width/Depth Ratio	17.1
Entrenchment Ratio	1.5
Incision Ratio	2.2

Rapid Habitat Assessment

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
B	Bailey's Mills	137%	D, E

of Other Constrictions: 0

of Grade Controls: 2

Rank	LWD	Pools
1	0	0
2	2	1
3	0	0
4	1	0
5	0	0
6	0	0
7	-	0
#/mile	8	2

Number of Debris Jams: 0

Step 6/7 Summary

RHA Score/Condition	34/Poor
Habitat Type Departure	Plane Bed
RGA Score / Condition	41/Fair
Dominant Adjustment	Degradation
CEM Model Stage	F/II
Stream Type Departure	C to F
Stream Sensitivity	Extreme

Impact Summary

Bank Erosion	Stormwater
Armoring	Constrictions
Riparian Buffer	Deposition
Encroachment	Migration
Development	Steep Riffle
Corridor Land Cover	Head Cut
Mass Failure	Straightening
Flow Regulation	Dredging

Potential Projects in Reach

- **Project RE 5:** Farmer Outreach - A dairy barn on the floodplain is potentially contributing nutrients to the channel.
- **Project RE 1e:** Buffer Planting - Channel was straightened and armored following T.S. Irene and is lacking woody bank vegetation.
- **Project RE 6:** Remove House - An abandoned house on the right valley wall is falling in to the stream and should be removed.

Reach Highlights: This segment has departed from C to F due to incision. The entrenchment ratio is close to B, however the bankfull width is well under curve width and the W/D is very low, further indicating a high degree of incision. Historic armoring and straightening have locked the channel in place and reduced floodplain access compared with segment A.



Straightening and encroachment along Bailey's Mills Rd



Incision mid segment

Stream: Mill Brook **Reach:** M14.C **Town:** Reading **Date Assessed:** 07/22/14

Channel Length (ft): 3,631 **Channel Slope (%):** 1.5 **Sinuosity:** 1.15 **Watershed Area (mi²):** 9.74

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	Narrow	Narrow
Bedform	Riffle-Pool	Riffle-Pool
Median Substrate	Cobble	Gravel
Stream Type	C	B _c

Ph2 Cross-Section Data

Curve Width (ft)	35.7
Bankfull Width (ft)	38
Max Depth (ft)	2.3
Width/Depth Ratio	22.9
Entrenchment Ratio	1.8
Incision Ratio	1.9

Rapid Habitat Assessment

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
None in reach.			

of Other Constrictions: 1

of Grade Controls: 7

Rank	LWD	Pools
1	7	4
2	21	2
3	7	3
4	7	1
5	1	0
6	3	0
7	-	0
#/mile	66	14

Number of Debris Jams: 4

Step 6/7 Summary

RHA Score/Condition	61/Fair
Habitat Type Departure	None
RGA Score / Condition	36/Fair
Dominant Adjustment	Widening
CEM Model Stage	F/III
Stream Type Departure	C to B
Stream Sensitivity	Very High

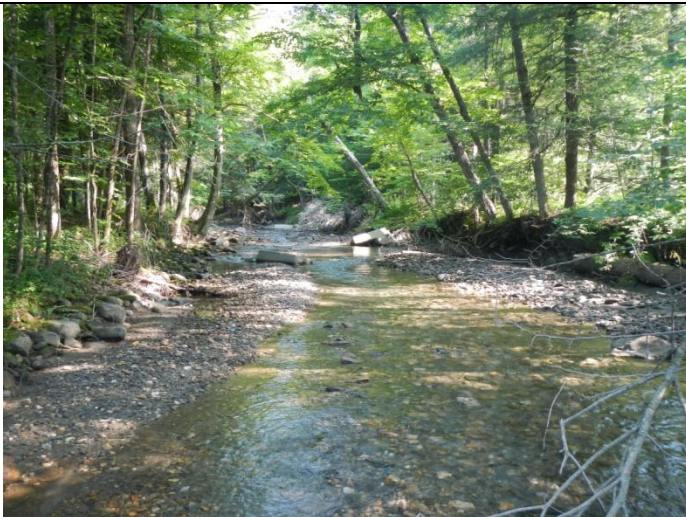
Impact Summary

Bank Erosion	Stormwater
Armoring	Constrictions
Riparian Buffer	Deposition
Encroachment	Migration
Development	Steep Riffle
Corridor Land Cover	Head Cut
Mass Failure	Straightening
Flow Regulation	Dredging

Potential Projects in Reach

- **Project RE 1f:** Corridor Protection - Several areas of highly active channel and floodplain should be protected from future development.
- **Project RE 7:** Abutment Removal - Concrete blocks from a snowmobile bridge were damaged during T.S. Irene and are a moderate constriction leading to sediment deposition and bed scour.

Reach Highlights: This segment had moderate to high incision throughout and had access to floodplain of variable width for most of the reach for the largest events (i.e., T.S. Irene). Some areas had access to a 60-80ft wide forested floodplain, other areas were a 5-10 ft herbaceous bench. Our cross-selection represents an average floodplain width and height and results in a departure from C to B. The reach scoured and widened during TS Irene and currently appears to be aggrading and widening. Huge volumes of sediment are stored in the channel through T4, and will likely continue to work through this segment for a long time. We assessed the reach as stage III possibly transitioning to stage IV in the near future.



Widening and moderate incision



Aggradation and accessible narrow floodplain

Stream: Mill Brook **Reach:** M15.A **Town:** Reading **Date Assessed:** 07/22/14

Channel Length (ft): 986 **Channel Slope (%):** 1.5 **Sinuosity:** 1.4 **Watershed Area (mi²):** 3.06

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	Broad	Broad
Bedform	Riffle-Pool	Riffle-Pool
Median Substrate	Gravel	Cobble
Stream Type	C	C

Ph2 Cross-Section Data

Curve Width (ft)	21.4
Bankfull Width (ft)	19
Max Depth (ft)	2.3
Width/Depth Ratio	11.6
Entrenchment Ratio	7.3
Incision Ratio	1.4

Rapid Habitat Assessment

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
None in reach.			

of Other Constrictions: 0

of Grade Controls: 2

Rank	LWD	Pools
1	2	1
2	7	5
3	1	0
4	2	0
5	0	0
6	2	0
7	-	0
#/mile	74	32

Number of Debris Jams: 3

Step 6/7 Summary

RHA Score/Condition	74/Good
Habitat Type Departure	None
RGA Score / Condition	73/Good
Dominant Adjustment	Stable
CEM Model Stage	F/V
Stream Type Departure	None
Stream Sensitivity	Moderate

Impact Summary

Bank Erosion	Stormwater
Armoring	Constrictions
Riparian Buffer	Deposition
Encroachment	Migration
Development	Steep Riffle
Corridor Land Cover	Head Cut
Mass Failure	Straightening
Flow Regulation	Dredging

Potential Projects in Reach

- **Project RE 1g:** Corridor Protection - An accessible forested floodplain is located along the left bank throughout the segment.

Reach Highlights: This short segment flows through a nice forested floodplain with low/moderate incision. The large right floodplain is elevated and only accessible during the largest events - difficult to tell whether this is an old abandoned floodplain or a glacial-era feature. The channel has carved out several meanders with nice riffle pool sequences. We assessed this as stage V based on the assumption that the channel was likely manipulated historically given the agricultural setting in the valley.



Accessible forested floodplain



Stable banks and sinuous channel

Stream: Mill Brook **Reach:** M15.B **Town:** Reading **Date Assessed:** 08/07/14
Channel Length (ft): 4,325 **Channel Slope (%):** 1.5 **Sinuosity:** 1.1 **Watershed Area (mi²):** 3.06

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	Very Broad	Very Broad
Bedform	Riffle-Pool	Plane Bed
Median Substrate	Gravel	Gravel
Stream Type	C	B _c

Ph2 Cross-Section Data

Curve Width (ft)	21.4
Bankfull Width (ft)	27
Max Depth (ft)	1.8
Width/Depth Ratio	22.5
Entrenchment Ratio	1.6
Incision Ratio	1.4

Rapid Habitat Assessment

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
C	Whitmore	63%	I, D, E
C	Farm access	42%	I, D, E, AOP
B	Trail	58%	I, D, E
B	Trail	140%	

of Other Constrictions: 0

of Grade Controls: 2

Rank	LWD	Pools
1	14	5
2	22	1
3	3	1
4	9	0
5	0	0
6	0	0
7	-	0
#/mile	58	10

Number of Debris Jams: 10

Step 6/7 Summary

RHA Score/Condition	56/Fair
Habitat Type Departure	Plane Bed
RGA Score / Condition	36/Fair
Dominant Adjustment	Degradation
CEM Model Stage	F/II
Stream Type Departure	C to B
Stream Sensitivity	Very High

Impact Summary

Bank Erosion	Stormwater
Armoring	Constrictions
Riparian Buffer	Deposition
Encroachment	Migration
Development	Steep Riffle
Corridor Land Cover	Head Cut
Mass Failure	Straightening
Flow Regulation	Dredging

Potential Projects in Reach

- **Projects RE 1h+i:** Buffer Planting & Corridor Protection - Several areas along the left floodplain area lacking woody vegetation, increasing bank erosion.
- **Project RE 8:** Culvert Replacement - A pair of very undersized culverts under a farm access road are highly susceptible to flood damage and are interrupting sediment transport through the segment.
- **Project RE 9:** Bank Stabilization and Swale - A swale receiving hayfield runoff is causing bank erosion, stabilize and plant.

Reach Highlights: This segment is historically incised due to channel straightening and armoring. The channel is currently aggrading material as seen through numerous bars, and has regained access to the previously disconnected floodplain in several locations, however access to the large floodplain remains limited. Because of the moderate incision and reduced access to the large floodplain we assessed this reach as having recently transitioned to stage III.



Straightening and elevated floodplain hayfield



Small accessible floodplain bench

Stream: Mill Brook **Reach:** M16.A **Town:** Reading **Date Assessed:** 08/07/14

Channel Length (ft): 2,413 **Channel Slope (%):** 3.25 **Sinuosity:** 1.1 **Watershed Area (mi²):** 2.57

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	Broad	Broad
Bedform	Riffle-Pool	Riffle-Pool
Median Substrate	Cobble	Cobble
Stream Type	B	B

Ph2 Cross-Section Data

Curve Width (ft)	19.8
Bankfull Width (ft)	26
Max Depth (ft)	2.0
Width/Depth Ratio	21
Entrenchment Ratio	1.7
Incision Ratio	1.8

Rapid Habitat Assessment

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
None in reach.			

of Other Constrictions: 0

of Grade Controls: 2

Rank	LWD	Pools
1	14	6
2	21	5
3	5	1
4	11	0
5	0	0
6	0	0
7	-	0
#/mile	111	26

Number of Debris Jams: 6

Step 6/7 Summary

RHA Score/Condition	65/Good
Habitat Type Departure	None
RGA Score / Condition	59/Fair
Dominant Adjustment	Widening
CEM Model Stage	F/III
Stream Type Departure	None
Stream Sensitivity	High

Impact Summary

Bank Erosion	Stormwater
Armoring	Constrictions
Riparian Buffer	Deposition
Encroachment	Migration
Development	Steep Riffle
Corridor Land Cover	Head Cut
Mass Failure	Straightening
Flow Regulation	Dredging

Potential Projects in Reach

- Project RE 10:** Floodplain Management - A logging road is contributing large volumes of sediment to the channel.
- Project RE 11:** Conservation - Approximately 2000' of forested valley floodplain is providing valuable floodwater and sediment attenuation.

Reach Highlights: This segment widened during TS Irene and is currently aggrading as flood sediments work through the channel. Moderate to high bank scour was observed along all banks that were not ledge. Numerous grade controls restrict incision and several created large areas of widening with mass failure and debris jams upstream. A small to moderate floodplain bench was accessible during moderate to large events for most of the reach. A larger glacial terrace was present for most of the reach, however it is well above even the largest flood elevations.



Accessible floodplain benches and grade control



Evidence of recent widening

Stream: Mill Brook **Reach:** M16.B **Town:** Reading **Date Assessed:** 08/07/14

Channel Length (ft): 2,616 **Channel Slope (%):** 2.0 **Sinuosity:** 1.1 **Watershed Area (mi²):** 2.57

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	Narrow	Narrow
Bedform	Riffle-Pool	Plane Bed
Median Substrate	Cobble	Cobble
Stream Type	C	F

Ph2 Cross-Section Data

Curve Width (ft)	19.8
Bankfull Width (ft)	19
Max Depth (ft)	1.6
Width/Depth Ratio	14.1
Entrenchment Ratio	1.2
Incision Ratio	2.8

Rapid Habitat Assessment

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
None in reach.			

of Other Constrictions: 1

of Grade Controls: 0

Rank	LWD	Pools
1	15	7
2	3	1
3	0	0
4	2	0
5	0	0
6	1	1
7	-	0
#/mile	42	18

Number of Debris Jams: 4

Step 6/7 Summary

RHA Score/Condition	51/Fair
Habitat Type Departure	Plane Bed
RGA Score / Condition	43/Fair
Dominant Adjustment	Degradation
CEM Model Stage	F/II
Stream Type Departure	C to F
Stream Sensitivity	Extreme

Impact Summary

Bank Erosion	Stormwater
Armoring	Constrictions
Riparian Buffer	Deposition
Encroachment	Migration
Development	Steep Riffle
Corridor Land Cover	Head Cut
Mass Failure	Straightening
Flow Regulation	Dredging

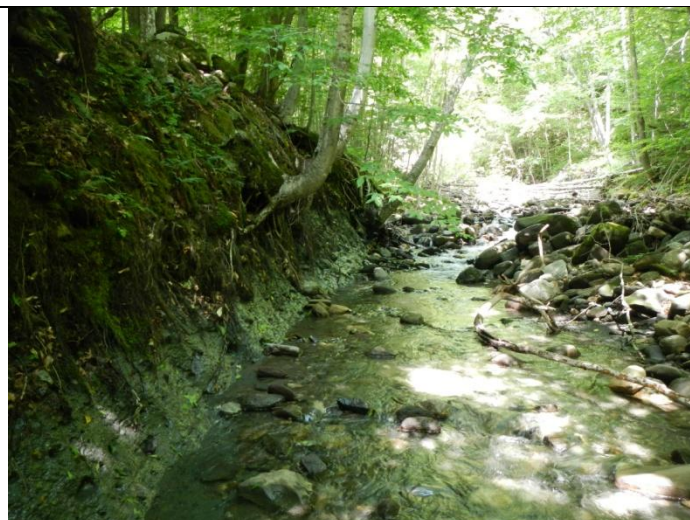
Potential Projects in Reach

- **Project RE 1j:** Buffer Planting & Corridor Protection - Woody buffer vegetation is reduced for most of the reach and is increasing bank erosion.

Reach Highlights: The channel bed of this segment was scoured during TS Irene, removing lower benches. Subsequent coarse deposition has lined much of the lower banks and has filled in the widened channel. The stream is currently cutting down and further incising. The upper portion of the segment is generating large volumes of sediment where coarse deposition is pushing the channel into the opposite bank causing erosion and mass failure.



Incision through historic straightening



Active incision in the upper segment

Stream: Reading Hill Brook **Reach:** T3.01 **Town:** Reading **Date Assessed:** 08/07/14

Channel Length (ft): 3,017 **Channel Slope (%):** 1.22 **Sinuosity:** 1.17 **Watershed Area (mi²):** 4.07

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	Broad	Broad
Bedform	Riffle-Pool	Plane Bed
Median Substrate	Gravel	Gravel
Stream Type	E	E

Ph2 Cross-Section Data

Curve Width (ft)	24.3
Bankfull Width (ft)	14
Max Depth (ft)	2.0
Width/Depth Ratio	7.1
Entrenchment Ratio	40
Incision Ratio	1.4

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
B	Route 106	60%	D
B	Driveway	49%	D, E
B	Trail	131%	E, R/R, S
B	Private	70%	D

of Other Constrictions: 1

of Grade Controls: 10

of Beaver Dams: 0

Rapid Habitat Assessment

Rank	LWD	Pools
1	15	0
2	7	3
3	3	5
4	0	3
5	0	0
6	0	0
7	-	0
#/mile	43	19

Number of Debris Jams: 1

Step 6/7 Summary

RHA Score/Condition	54/Fair
Habitat Type Departure	Plane Bed
RGA Score / Condition	57/Fair
Dominant Adjustment	Planform
CEM Model Stage	D/IIc
Stream Type Departure	None
Stream Sensitivity	Extreme

Impact Summary

Bank Erosion	Stormwater
Armoring	Constrictions
Riparian Buffer	Deposition
Encroachment	Migration
Development	Steep Riffle
Corridor Land Cover	Head Cut
Mass Failure	Straightening
Flow Regulation	Dredging

Potential Projects in Reach

- **Project RE 12:** Bank Stabilization - Undersized armor along Route 106 is an erosion risk.

Reach Highlights: This segment had a unique bedform and channel characteristics. It is E-type currently and likely also by reference. We observed numerous grade controls that represented most of the vertical drop within the reach. Riffles below the grade controls were very clean cobble substrate, the remainder of the reach consisted of deep runs and pools. Encroachment from Rt 106 decreased the floodplain throughout, especially in the upper reach where the road was immediately adjacent to the channel. Most of the reach was likely historically straightened, however the grade controls limited incision decreasing the impact. We assessed the reach as stage IIc with some observed aggradation and planform changes.



E-type with numerous bedrock grade controls



Moderately incised E-type encroached by Rt 106

Stream: Reading Hill Brook **Reach:** T3.02.A **Town:** Reading **Date Assessed:** 08/07/14

Channel Length (ft): 1,161 **Channel Slope (%):** 2 **Sinuosity:** 1.0 **Watershed Area (mi²):** 3.86

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	Semi-Confined	N Confined
Bedform	Riffle-Pool	Plane Bed
Median Substrate	Cobble	Bedrock
Stream Type	B	F

Ph2 Cross-Section Data

Curve Width (ft)	23.7
Bankfull Width (ft)	14
Max Depth (ft)	
Width/Depth Ratio	
Entrenchment Ratio	
Incision Ratio	

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
C	Access Road	100%	none

of Other Constrictions: 2

of Grade Controls: 2

of Beaver Dams: 2

Rapid Habitat Assessment

Rank	LWD	Pools
1	3	1
2	4	2
3	1	2
4	0	0
5	0	0
6	0	0
7	-	0
#/mile	36	22

Number of Debris Jams: 0

Step 6/7 Summary

RHA Score/Condition	Poor
Habitat Type Departure	Plane Bed
RGA Score / Condition	Poor
Dominant Adjustment	
CEM Model Stage	
Stream Type Departure	B to F
Stream Sensitivity	High

Impact Summary

Bank Erosion	Stormwater
Armoring	Constrictions
Riparian Buffer	Deposition
Encroachment	Migration
Development	Steep Riffle
Corridor Land Cover	Head Cut
Mass Failure	Straightening
Flow Regulation	Dredging

Potential Projects in Reach

- Project RE 13:** Bank Stabilization – Moderate bank erosion is found along the embankment for the talc mine pond. The landowner is aware of the erosion. A geotechnical engineer is developing recommendations to address the erosion.

Reach Highlights: The entire reach was moved to a new location in a blasted bedrock channel. Bedrock is present along both banks and under the channel throughout. A poured concrete slope occupies most of the left bank in the lower segment. An area of mass failure at the bottom of the reach is threatening to breach the storage pond embankment, potentially causing major flooding. Recent survey markers indicate that this is known and being addressed. We did not fully assess the reach due to the gorge-like conditions and property access concerns.



Straightened channel with ledge along right bank and poured concrete along left bank



Ledge and mine access culvert

Stream: Reading Hill Brook **Reach:** T3.02.B **Town:** Reading **Date Assessed:** 08/07/14

Channel Length (ft): 3,649 Channel Slope (%): 0.5 **Sinuosity:** 1.25 **Watershed Area (mi²):** 3.86

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	Very Broad	Very Broad
Bedform	Riffle-Pool	Riffle-Pool
Median Substrate	Gravel	Gravel
Stream Type	E	E

Ph2 Cross-Section Data

Curve Width (ft)	23.7
Bankfull Width (ft)	12
Max Depth (ft)	2.3
Width/Depth Ratio	5.3
Entrenchment Ratio	12.3
Incision Ratio	1.4

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
None in reach.			

of Other Constrictions: 1

of Grade Controls: 10

of Beaver Dams: 2

Rapid Habitat Assessment

Rank	LWD	Pools
1	16	7
2	5	2
3	4	9
4	1	0
5	0	0
6	0	1
7	-	0
#/mile	37	27

Number of Debris Jams: 2

Step 6/7 Summary

RHA Score/Condition	56/Fair
Habitat Type Departure	None
RGA Score / Condition	65/Good
Dominant Adjustment	Planform
CEM Model Stage	F/IV
Stream Type Departure	None
Stream Sensitivity	High

Impact Summary

Bank Erosion	Stormwater
Armoring	Constrictions
Riparian Buffer	Deposition
Encroachment	Migration
Development	Steep Riffle
Corridor Land Cover	Head Cut
Mass Failure	Straightening
Flow Regulation	Dredging

Potential Projects in Reach

- **Project RE 14a:** Corridor Protection - Large areas of wet meadow provide valuable floodplain functions and should be protected from future development.
- **Project RE 14b:** Buffer Planting - The left floodplain in the upper segment is mowed lawn to the top of the bank.

Reach Highlights: This E-type reach has some areas of historic straightening that remain straightened. The remainder of the reach is adjusting planform and we observed several potential neck cutoffs and a few active cutoffs and flood chutes. Many beaver dams were recently mechanically removed from the segment, leading to some areas of temporary erosion as the bed adjusts slope.



Straightened along Rt 106



Evidence of numerous recently removed beaver dams

Stream: Reading Hill Brook **Reach:** T3.03 **Town:** Reading **Date Assessed:** 08/07/14

Channel Length (ft): 3,090 **Channel Slope (%):** 0.5 **Sinuosity:** 1.3 **Watershed Area (mi²):** 2.68

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	Very Broad	Very Broad
Bedform	Riffle-Pool	Riffle-Pool
Median Substrate	Gravel	Gravel
Stream Type	E	E

Ph2 Cross-Section Data

Curve Width (ft)	20.2
Bankfull Width (ft)	11
Max Depth (ft)	1.8
Width/Depth Ratio	8.0
Entrenchment Ratio	17.9
Incision Ratio	1.4

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
C	Rt 106	59%	D
C	Whitmore	24%	D, E, AOP

of Other Constrictions:

of Grade Controls: 10

of Beaver Dams: 3

Rapid Habitat Assessment

Rank	LWD	Pools
1	30	7
2	24	16
3	11	2
4	4	1
5	0	3
6	0	0
7	-	0
#/mile	117	49

Number of Debris Jams: 8

Step 6/7 Summary

RHA Score/Condition	61/Fair
Habitat Type Departure	None
RGA Score / Condition	51/Fair
Dominant Adjustment	Planform
CEM Model Stage	F/IV
Stream Type Departure	None
Stream Sensitivity	Extreme

Impact Summary

Bank Erosion	Stormwater
Armoring	Constrictions
Riparian Buffer	Deposition
Encroachment	Migration
Development	Steep Riffle
Corridor Land Cover	Head Cut
Mass Failure	Straightening
Flow Regulation	Dredging

Potential Projects in Reach

- **Project RE 14c:** Corridor Protection - Large areas of wet meadow provide valuable floodplain functions and should be protected from future development.
- **Project RE 15:** Replace Culvert - The Whitmore Circle culvert is a major constriction causing scour, deposition, and is a flood damage risk.

Reach Highlights: The lower portion of the reach has one recently removed beaver dam and alternates between reference C and reference E. Above the Whitmore Circle culvert the reach flows through an active beaver meadow. Much of this portion is highly impacted by beaver dams with multiple channels and deep deposition. The cross-section was collected near the top of the reach where the channel returns to a single thread and is E-type.



Large beaver dam in upper reach



Multi-thread channel through a beaver meadow

Stream: Reading Hill Brook **Reach:** T3.04 **Town:** Reading **Date Assessed:** 08/27/14

Channel Length (ft): 2,902 **Channel Slope (%):** 2.4 **Sinuosity:** 1.02 **Watershed Area (mi²):** 2.20

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	S Confined	N Confined
Bedform	Step-Pool	Step-Pool
Median Substrate	Bedrock	Bedrock
Stream Type	B	F

Ph2 Cross-Section Data

Curve Width (ft)	18.5
Bankfull Width (ft)	14
Max Depth (ft)	2.0
Width/Depth Ratio	10.8
Entrenchment Ratio	1.2
Incision Ratio	2.3

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
C	Whitmore	57%	None
C	Rt 106	65%	I

of Other Constrictions: 2

of Grade Controls: 14

of Beaver Dams: 0

Rapid Habitat Assessment

Rank	LWD	Pools
1	32	11
2	32	9
3	5	4
4	2	1
5	0	1
6	0	0
7	-	0
#/mile	129	49

Number of Debris Jams: 8

Step 6/7 Summary

RHA Score/Condition	49/Fair
Habitat Type Departure	None
RGA Score / Condition	41/Fair
Dominant Adjustment	Degradation
CEM Model Stage	F/II
Stream Type Departure	B to F
Stream Sensitivity	High

Impact Summary

Bank Erosion	Stormwater
Armoring	Constrictions
Riparian Buffer	Deposition
Encroachment	Migration
Development	Steep Riffle
Corridor Land Cover	Head Cut
Mass Failure	Straightening
Flow Regulation	Dredging

Potential Projects in Reach

- **Project RE 16:** Embankment Stabilization - A small erosional rill is cutting in to the Route 106 embankment.
- **Project RE 17:** Culvert Replacement - The culvert under Route 106 is at a sharp angle and undersized, major damage to the road is possible in a large event of if the culvert plugs with debris.
- **Project RE 18:** Bank Stabilization - A mass failure may eventually threaten Route 106.

Reach Highlights: The lowest portion of the reach transitions from a B-type with a small low floodplain and some planform adjustments to a narrowly confined reference B or A_b reach that is highly encroached by Rt 106. This encroachment likely pushed the stream against the valley walls and has removed all floodplain resulting in a departure to F. The stream bed and banks are primarily bedrock or heavy rip-rap along the embankment, leaving little to no opportunity for channel adjustment vertically or laterally.



Encroachment from Route 106 throughout reach



Near continuous grade control

Stream: Bailey Brook **Reach:** T4.01.A **Town:** Reading **Date Assessed:** 08/28/14

Channel Length (ft): 2,130 **Channel Slope (%):** 2.1 **Sinuosity:** 1.1 **Watershed Area (mi²):** 5.36

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	Broad	Broad
Bedform	Riffle-Pool	Braided
Median Substrate	Gravel	Gravel
Stream Type	C _b	D

Ph2 Cross-Section Data

Curve Width (ft)	27.4
Bankfull Width (ft)	45.9
Max Depth (ft)	3
Width/Depth Ratio	41.7
Entrenchment Ratio	1.2
Incision Ratio	1.2

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
A	Baileys Rd	70%	D, R/R, S
B	Private	74%	D, E, S

of Other Constrictions: 0

of Grade Controls: 1

of Beaver Dams: 0

Rapid Habitat Assessment

Rank	LWD	Pools
1	10	5
2	7	3
3	2	0
4	5	2
5	0	0
6	0	0
7	-	0
#/mile	59	24

Number of Debris Jams: 2

Step 6/7 Summary

RHA Score/Condition	40/Fair
Habitat Type Departure	Braided
RGA Score / Condition	21/Poor
Dominant Adjustment	Aggradation
CEM Model Stage	D/Ild
Stream Type Departure	B to D
Stream Sensitivity	Extreme

Impact Summary

Bank Erosion	Stormwater
Armoring	Constrictions
Riparian Buffer	Deposition
Encroachment	Migration
Development	Steep Riffle
Corridor Land Cover	Head Cut
Mass Failure	Straightening
Flow Regulation	Dredging

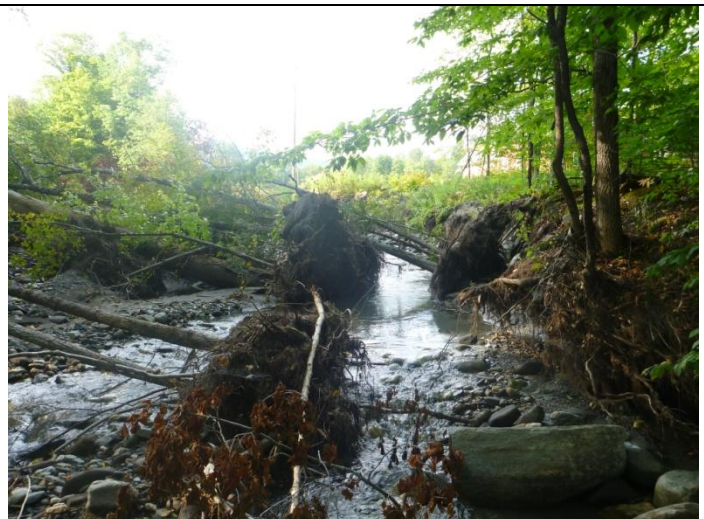
Potential Projects in Reach

- **Project RE 19:** Bank Stabilization - Two areas of major bank erosion are threatening the Smith property driveway and potentially utilities.
- **Project RE 20:** Arch Replacement - The Baileys Mills Road arch is undersized and increased deposition and scour during T.S. Irene.
- **Project RE 21:** Channel and Floodplain Restoration - The floodplain and channel upstream of the arch were buried in sediment and debris during T.S. Irene, floodplain is now largely inaccessible.

Reach Highlights: Severe vertical and lateral adjustments throughout reach due to alluvial fan setting, undersized crossing, and post-flood recovery work that left channel prone to ongoing erosion. In lower segment below Bailey's Mills Road, entrenchment ratios are <2.0 due to severe channel widening. Upstream of Bailey's Mills Road, some berms left from flood recovery work are confining flood flows. Stream type departure varies between C->D and C->F depending on limits of berming. D-type departure chosen due to severe aggradation and braiding throughout, and presence of grade controls.



Widening, deposition, and severe erosion



Widening, deposition, and severe erosion

Stream: Bailey Brook **Reach:** T4.01.B **Town:** Reading **Date Assessed:** 08/28/14

Channel Length (ft): 2,040 **Channel Slope (%):** 3.5 **Sinuosity:** 1.1 **Watershed Area (mi²):** 5.36

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	Narrow	Narrow
Bedform	Step-Pool	Plane Bed
Median Substrate	Cobble	Gravel
Stream Type	B	F

Ph2 Cross-Section Data

Curve Width (ft)	27.4
Bankfull Width (ft)	30.0
Max Depth (ft)	2.3
Width/Depth Ratio	26.8
Entrenchment Ratio	1.1
Incision Ratio	3.8

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
None in reach.			

of Other Constrictions: 0

of Grade Controls: 3

of Beaver Dams: 0

Rapid Habitat Assessment

Rank	LWD	Pools
1	6	5
2	28	4
3	5	1
4	10	0
5	0	0
6	1	0
7	-	0
#/mile	129	25

Number of Debris Jams: 2

Step 6/7 Summary

RHA Score/Condition	48/Fair
Habitat Type Departure	Plane Bed
RGA Score / Condition	32/Poor
Dominant Adjustment	Degradation
CEM Model Stage	F/II
Stream Type Departure	B to F
Stream Sensitivity	Extreme

Impact Summary

Bank Erosion	Stormwater
Armoring	Constrictions
Riparian Buffer	Deposition
Encroachment	Migration
Development	Steep Riffle
Corridor Land Cover	Head Cut
Mass Failure	Straightening
Flow Regulation	Dredging

Potential Projects in Reach

- **Project RE 22:** Buffer Planting - No woody vegetation along a vulnerable berm near the B&B pond.
- **Project RE 23:** Conservation - The entire valley from Baileys Mills Bed and Breakfast to Brown Schoolhouse Road is incredibly active and is storing and generating huge volumes of sediment and debris. This entire area should be conserved and protected from logging, future development, and channel management.

Reach Highlights: This segment was massively scoured during TSI and typically widened to 50-80 feet. The scoured channel was then buried in 4-8ft of gravel/cobble. The stream is currently cutting down through these deposits and was observed to be well below the pre-Irene bed elevation in several areas. Floodplain access was non-existent and only minimal storage was possible on top of flood sediments in areas where the channel was wider. This reach is actively cutting down and is deeply incised, assessed as a B to F departure and stage II.



Channel is cutting down through huge flood deposits



8' tall gravel deposits along channel margins

Stream: Bailey Brook **Reach:** T4.01.C **Town:** Reading **Date Assessed:** 08/28/14

Channel Length (ft): 3,743 **Channel Slope (%):** 2.1 **Sinuosity:** 1.1 **Watershed Area (mi²):** 5.36

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	Narrow	Narrow
Bedform	Riffle-Pool	Plane Bed
Median Substrate	Cobble	Cobble
Stream Type	B	D

Ph2 Cross-Section Data

Curve Width (ft)	27.4
Bankfull Width (ft)	46
Max Depth (ft)	2.2
Width/Depth Ratio	42.7
Entrenchment Ratio	2.5
Incision Ratio	1.7

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
None in reach.			

of Other Constrictions: 1

of Grade Controls: 2

of Beaver Dams: 0

Rapid Habitat Assessment

Rank	LWD	Pools
1	26	16
2	86	11
3	13	2
4	45	0
5	8	0
6	6	0
7	-	0
#/mile	259	40

Number of Debris Jams: 9

Step 6/7 Summary

RHA Score/Condition	50/Fair
Habitat Type Departure	Plane Bed
RGA Score / Condition	31/Poor
Dominant Adjustment	Aggradation
CEM Model Stage	D/IIc
Stream Type Departure	B to D
Stream Sensitivity	Extreme

Impact Summary

Bank Erosion	Stormwater
Armoring	Constrictions
Riparian Buffer	Deposition
Encroachment	Migration
Development	Steep Riffle
Corridor Land Cover	Head Cut
Mass Failure	Straightening
Flow Regulation	Dredging

Potential Projects in Reach

- **Project RE 24:** Buffer Planting - A large mass failure is carving into a hayfield along Kittridge Pasture Rd. Buffer plantings may help slow this process and reduce sediment inputs to the channel.
- **Project RE 25:** Road Stabilization - A large mass failure is potentially threatening Kittridge Pasture Rd. and should be assessed and monitored.

Reach Highlights: This reach also massively widened during TSI, scouring from valley wall to valley wall throughout. Huge volumes of cobbles and gravels were deposited and continue to work through the reach. This segment is very different from T4.01B. However, the ongoing deposition is filling the channel leading to floodplain access and planform adjustment. Some grade control was observed and huge debris jams were also helping to hold the bed in place and allow for aggradation. This widening, aggradation, and planform adjustment led to a B to D departure and an assessment at type IIc.



LWD and huge gravel deposits



Ongoing widening and erosion/mass failure

Stream: Bailey Brook **Reach:** T4.02.A **Town:** Reading **Date Assessed:** 08/28/14

Channel Length (ft): 4,101 **Channel Slope (%):** 2.0 **Sinuosity:** 1.1 **Watershed Area (mi²):** 3.31

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	Narrow	Narrow
Bedform	Riffle-Pool	Braided
Median Substrate	Cobble	Gravel
Stream Type	B	C _b

Ph2 Cross-Section Data

Curve Width (ft)	22.2
Bankfull Width (ft)	24
Max Depth (ft)	2.3
Width/Depth Ratio	16.7
Entrenchment Ratio	2.4
Incision Ratio	1.3

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
None in reach.			

of Other Constrictions: 0

of Grade Controls: 0

of Beaver Dams: 0

Rapid Habitat Assessment

Rank	LWD	Pools
1	12	9
2	125	5
3	15	1
4	80	0
5	1	0
6	9	0
7	-	0
#/mile	311	19

Number of Debris Jams: 5

Step 6/7 Summary

RHA Score/Condition	58/Fair
Habitat Type Departure	Braided
RGA Score / Condition	31/Poor
Dominant Adjustment	Planform
CEM Model Stage	D/Ild
Stream Type Departure	B to C _b
Stream Sensitivity	Very High

Impact Summary

Bank Erosion	Stormwater
Armoring	Constrictions
Riparian Buffer	Deposition
Encroachment	Migration
Development	Steep Riffle
Corridor Land Cover	Head Cut
Mass Failure	Straightening
Flow Regulation	Dredging

Potential Projects in Reach

- None

Reach Highlights: Similar to T4.01.C, this segment scoured the entire valley during TSI and filled in with 6-8ft of cobble and gravel deposition. The channel is now carving through these deposits and adjusting planform. We assessed the CEM stage for this segment as Ild due to the areas of braiding and increased planform adjustment. Bankfull width and W/D were also lower and we assessed the segment as a departure from B to C.



LWD and huge gravel deposits



Braiding as the channel carves through flood deposits

Stream: Bailey Brook **Reach:** T4.02.B **Town:** Reading **Date Assessed:** 08/28/14

Channel Length (ft): 4,680 **Channel Slope (%):** 3.0 **Sinuosity:** 1.1 **Watershed Area (mi²):** 3.31

Stream Type Summary

	P1 Reference	P2 Assessed
Confinement	S Confined	S Confined
Bedform	Step-Pool	Step-Pool
Median Substrate	Cobble	Gravel
Stream Type	B	B

Ph2 Cross-Section Data

Curve Width (ft)	22.2
Bankfull Width (ft)	20
Max Depth (ft)	1.8
Width/Depth Ratio	1534
Entrenchment Ratio	1.8
Incision Ratio	1.4

Crossing/Constriction Summary

Type	Location	% wbkf	Impacts
C	B Schoolhouse	36%	D, E, S

of Other Constrictions: 0

of Grade Controls: 0

of Beaver Dams: 0

Rapid Habitat Assessment

Rank	LWD	Pools
1	41	31
2	117	12
3	20	3
4	87	1
5	5	0
6	19	0
7	-	0
#/mile	326	43

Number of Debris Jams: 19

Step 6/7 Summary

RHA Score/Condition	58/Fair
Habitat Type Departure	None
RGA Score / Condition	34/Poor
Dominant Adjustment	Planform
CEM Model Stage	D/IId
Stream Type Departure	None
Stream Sensitivity	High

Impact Summary

Bank Erosion Stormwater
Armoring **Constrictions**
Riparian Buffer **Deposition**
Encroachment **Migration**
Development **Steep Riffle**
Corridor Land Cover **Head Cut**
Mass Failure Straightening
Flow Regulation Dredging

Potential Projects in Reach

- None

Reach Highlights: Similar to T4.01C and T4.02A, this segment scoured the entire valley during TSI and filled in with approximately 2ft of cobble and gravel deposition. The channel is now carving through these deposits and adjusting planform. We assessed the segment as IID due to the areas of braiding and increased planform adjustment. Bankfull dimensions were relatively close to reference width and with only moderate incision. Most of the reach is lined with eroding banks and mass failures and it will remain highly active for a long time.



LWD and large mass failures



Widened channel adjusting planform

4.2 Phase 2 Results Summary

Rapid Habitat Assessment (RHA) and Rapid Geomorphic Assessment (RGA) scores for all Phase 2 reaches/segments are summarized in Table 4.2 and Figures 4.4 and 4.5. FEA divided the "Fair" category into "Low Fair" and "High Fair" to better indicate which reaches were closer to "Poor" or "Good" respectively. The "Fair" scores were split at the numerical mean for the categories (49%). Detailed summaries of geomorphic data for each segment are provided in Appendix B. Habitat assessment summary data is provided in Appendix C.

Table 4.2: Summary RHA and RGA data for all Phase 2 Reaches and Segments.

Stream	Reach/Segment	RHA Score	RHA Condition	RGA Score	RGA Condition
Mill Brook	M02	41%	Fair	43%	Fair
	M04	50%	Fair	38%	Fair
	M05.A	49%	Fair	33%	Poor
	M05.B	41%	Fair	26%	Poor
	M05.C	57%	Fair	60%	Fair
	M06	49%	Fair	44%	Fair
	M07.A	65%	Good	59%	Fair
	M07.B	45%	Fair	45%	Fair
	M08	61%	Fair	51%	Fair
	M09.A	43%	Fair	41%	Fair
	M09.B	53%	Fair	40%	Fair
	M10	52%	Fair	44%	Fair
	M11	52%	Fair	39%	Fair
	M12.A	*	Good	*	Good
	M12.B	46%	Fair	40%	Fair
	M13	48%	Fair	45%	Fair
	M14.A	53%	Fair	39%	Fair
	M14.B	34%	Poor	41%	Fair
	M14.C	61%	Fair	36%	Fair
	M15.A	74%	Good	73%	Good
	M15.B	56%	Fair	36%	Fair
	M16.A	65%	Good	59%	Fair
	M16.B	51%	Fair	43%	Fair
Beaver Brook	T1.01	71%	Good	61%	Fair
	T1.02.A	62%	Fair	63%	Fair
	T1.02.B	59%	Fair	73%	Good
Beaver Brook Tributary 4	T1.01.S4.01.A	34%	Poor	33%	Poor
	T1.01.S4.01.B	54%	Fair	63%	Fair
	T1.01.S4.01.C	46%	Fair	51%	Fair
Willow Brook	T2.01.A	48%	Fair	45%	Fair
	T2.01.B	62%	Fair	58%	Fair

Table 4.2: Summary RHA and RGA data for all Phase 2 Reaches and Segments.

Stream	Reach/Segment	RHA Score	RHA Condition	RGA Score	RGA Condition
	T2.02	44%	Fair	41%	Fair
	T2.03.A	52%	Fair	58%	Fair
	T2.03.B	46%	Fair	38%	Fair
	T2.04	70%	Good	49%	Fair
	T2.05.A	66%	Good	65%	Good
	T2.05.B	58%	Fair	55%	Fair
Reading Hill Brook	T3.01	54%	Fair	58%	Fair
	T3.02.A	*	Poor	*	Poor
	T3.02.B	56%	Fair	65%	Good
	T3.03	61%	Fair	51%	Fair
	T3.04	49%	Fair	41%	Fair
Bailey Brook	T4.01.A	40%	Fair	21%	Poor
	T4.01.B	48%	Fair	33%	Poor
	T4.01.C	50%	Fair	31%	Poor
	T4.02.A	58%	Fair	31%	Poor
	T4.02.B	58%	Fair	34%	Poor

*RHA and RGA assigned based on administrative judgment, full assessments not conducted on M05.A or T3.02A

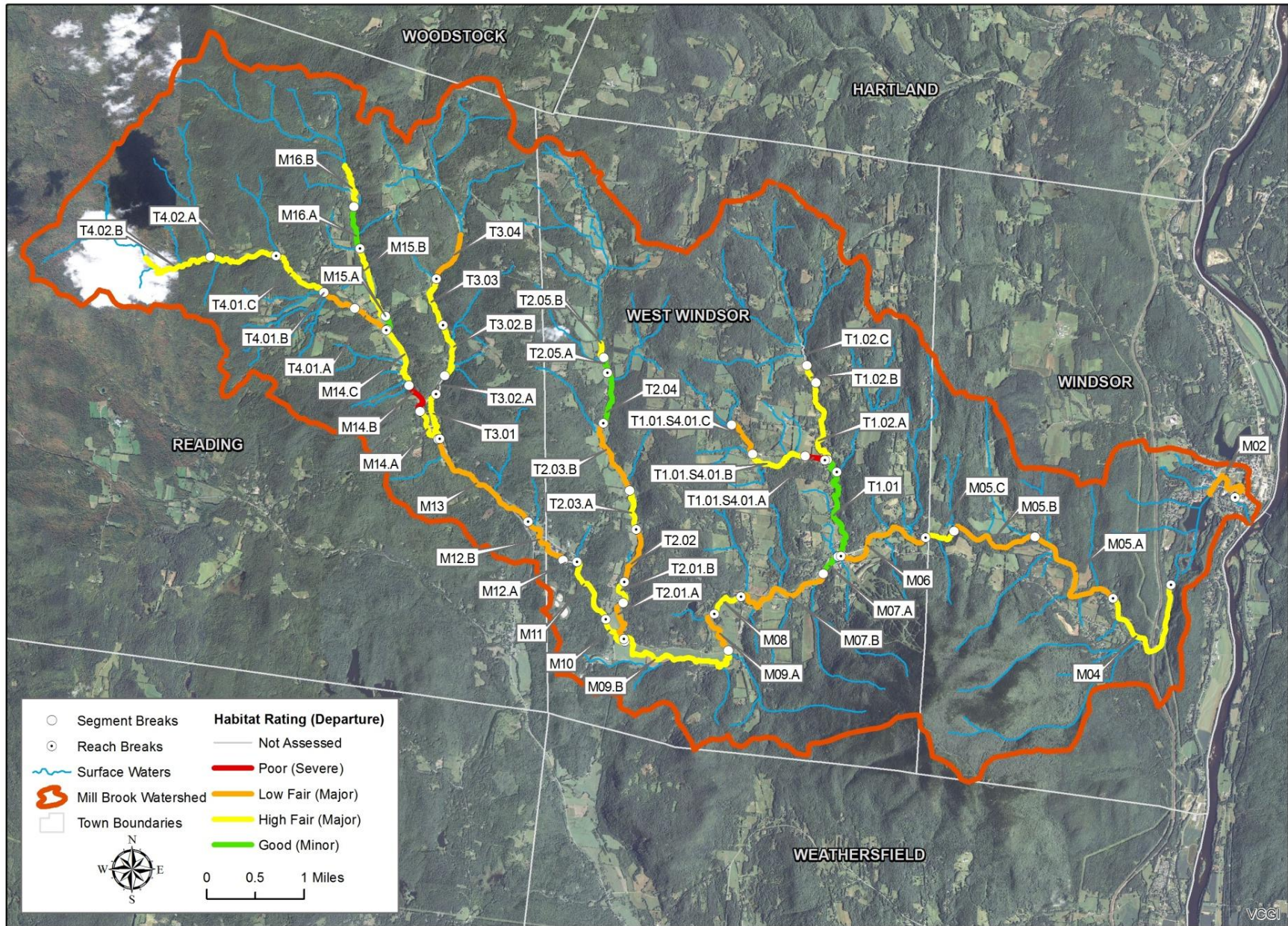


Figure 4.4: Rapid Habitat Assessment Ratings for the Mill Brook Watershed.

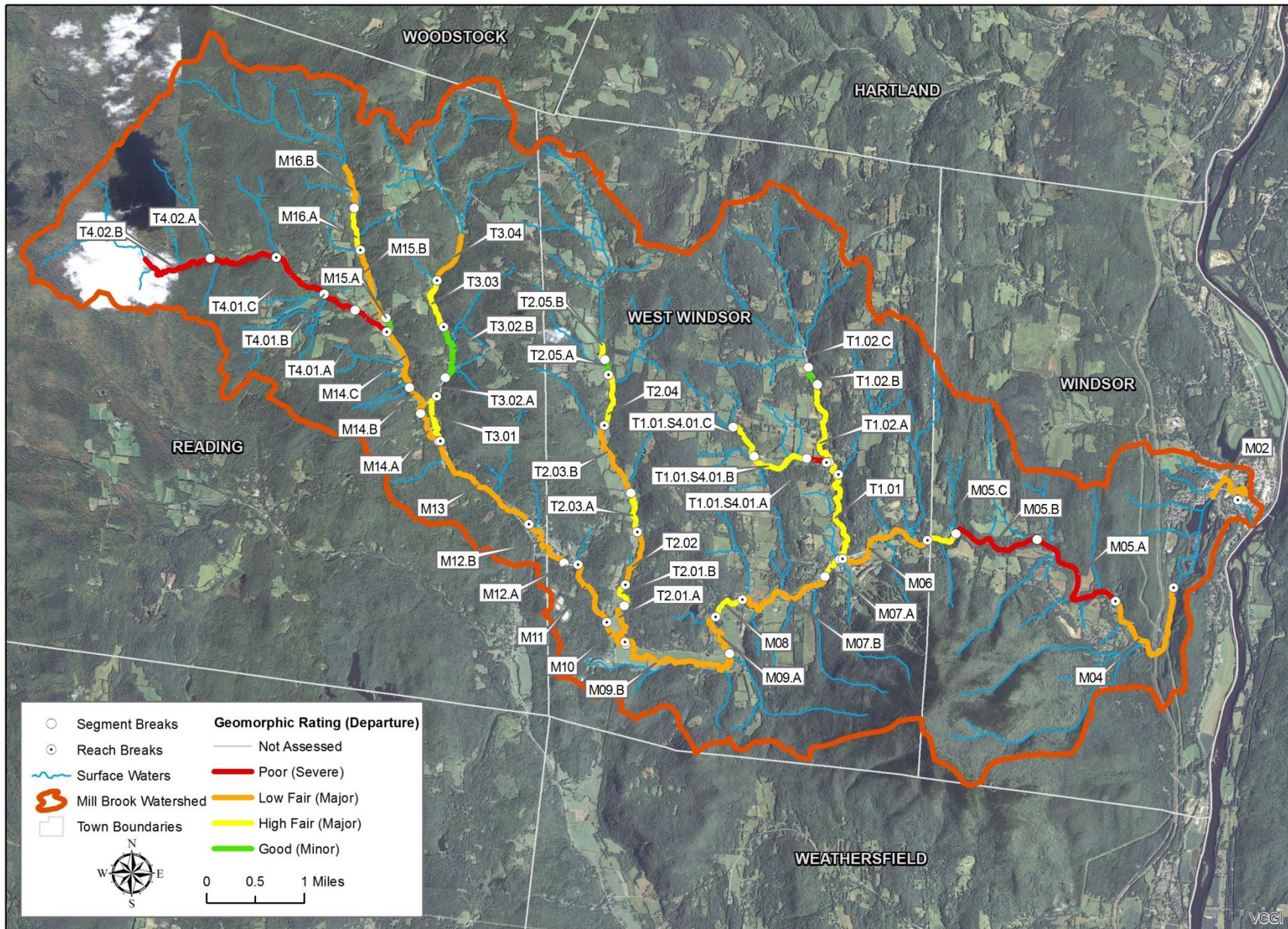


Figure 4.5: Rapid Geomorphic Assessment Ratings for the Mill Brook Watershed.

4.3 River Corridor Planning

The following sections summarize the stressor identification and departure maps. The data collected through the Phase 1 and 2 SGA studies provides the basis for assessing the impacts to the hydrologic and sediment regimes, and the channel riparian and boundary conditions. These data, when combined with other watershed-scale data developed in this study, allows for the assessment of physical departure from reference conditions, and serves to validate watershed-scale patterns and stream conditions observed in the field. The mapping of physical stressors and natural or human constraints allowed for 1) a process-based approach to understanding stream conditions at different scales, and 2) an evaluation of the connectivity of stressors along the channel network. The maps were referenced during the project identification process summarized in Section 5.0.

4.3.1 Stressor Maps

Modifications to Riparian and Boundary Condition

The boundary conditions of a river encompass the bed and bank substrate, and the vegetation and root material found along the riverbank. Human alterations to the river boundary conditions are often made to increase the resistance of the banks and bed to reduce lateral and vertical adjustments. However, extensive removal of riparian vegetation in the absence of bank hardening can cause a decrease in boundary resistance, and lead to increased lateral migration. Other natural and human-installed features within the channel, such as bedrock ledges and dams, affect boundary resistance in an upstream and downstream direction by controlling vertical adjustment processes.

Alterations to the channel boundary conditions and riparian areas in the Mill Brook study area have been mapped using the variables extracted from the Phase 2 field dataset (Figure 4.16). Bank armoring (e.g., rip-rap) highlights areas of increased resistance to lateral migration, whereas bank erosion highlights reaches where significant lateral adjustments are found. Additional data showing the location of natural and man-made channel features (e.g., ledges and dam) depict areas that have a resistance to channel change.

Areas influencing riparian zone and boundary conditions include:

Increased Boundary Resistance

- Areas with numerous natural grade control on segments: M02, M07.B, M11, M13, M14.C, T2.01.A, T2.01.B, T2.02, T2.03.A, T2.05.A, T3.01, T3.02.B, T3.03, T3.04 (Figures 4.6 and 4.7).
- An on-stream dam is located on reach M06 (Figure 4.8) and a major impoundment (Mill Pond) is located immediately upstream of reach M02 (Figure 4.9).
- Extensive bank armoring on segments: M02, M04, M05.C, M07.A, M07.B, M09.A, M09.B, M10, M11, M12.B, M13, M14.B, T1.01.S4.01.A, T2.01.A, T2.01.B, T2.02, T2.03.B, T2.05.B, T3.01, T3.03, T3.04 (Figures 4.10 and 4.11).

Decreased Boundary Resistance

- High bank erosion in segments: M05.A, M05.B, M06, M07.A, M09.B, M14.A, M14.C, M15.A, M15.B, M16.A, M16.B, T2.03.A, T2.04, T4.01.A, T4.01.B, T4.01.C, T4.02.A, T4.02.B (Figures 4.12 and 4.13).
- Huge mass failures in segments: M05.A, M05.B, T4.01.B, T4.01.C, T4.02.A, T4.02.B (Figures 4.14 and 4.15).
- Dredging in segments: M04, M05.A, M05.B, M06, M07.B, M10, M12.B, M13, M14.A, M14.C, T1.01, T1.01.S4.01.B, T2.01.A, T3.04, T4.01.A, T4.01.B.
- High density of riparian buffer width impacts in segments M09.A, M09.B, M11, T1.01.S4.01.B, T2.01.A, T2.03.B, T3.02.B, T3.04.



Figure 4.6: Numerous grade controls in reach M11.



Figure 4.7: Grade controls on reach T2.02.



Figure 4.8: Small concrete block dam in reach M06.

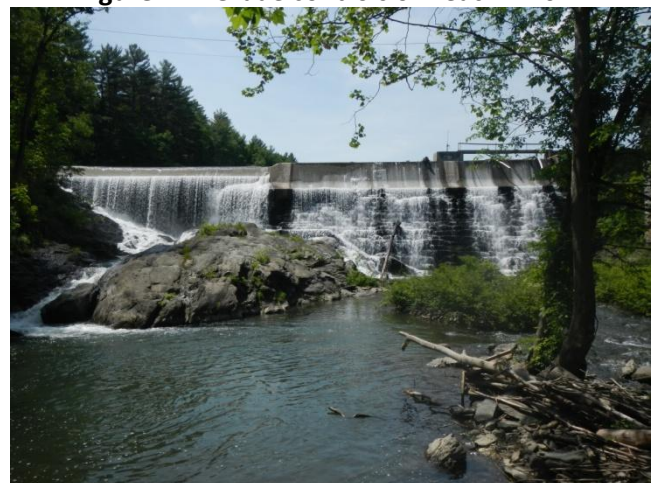


Figure 4.9: Large dam at the top of Reach M02.



Figure 4.10: Extensive bank armoring along Brook Road on segment M05.C.



Figure 4.11: Harrington Road bank armoring in segment M07.B.



Figure 4.12: Major bank erosion and buffer impacts in reach M06.



Figure 4.13: Extensive bank erosion in a natural corridor on reach T2.04.



Figure 4.14: Huge mass failure on segment M05.B.



Figure 4.15: Near continuous mass failure along segment T4.02.B.

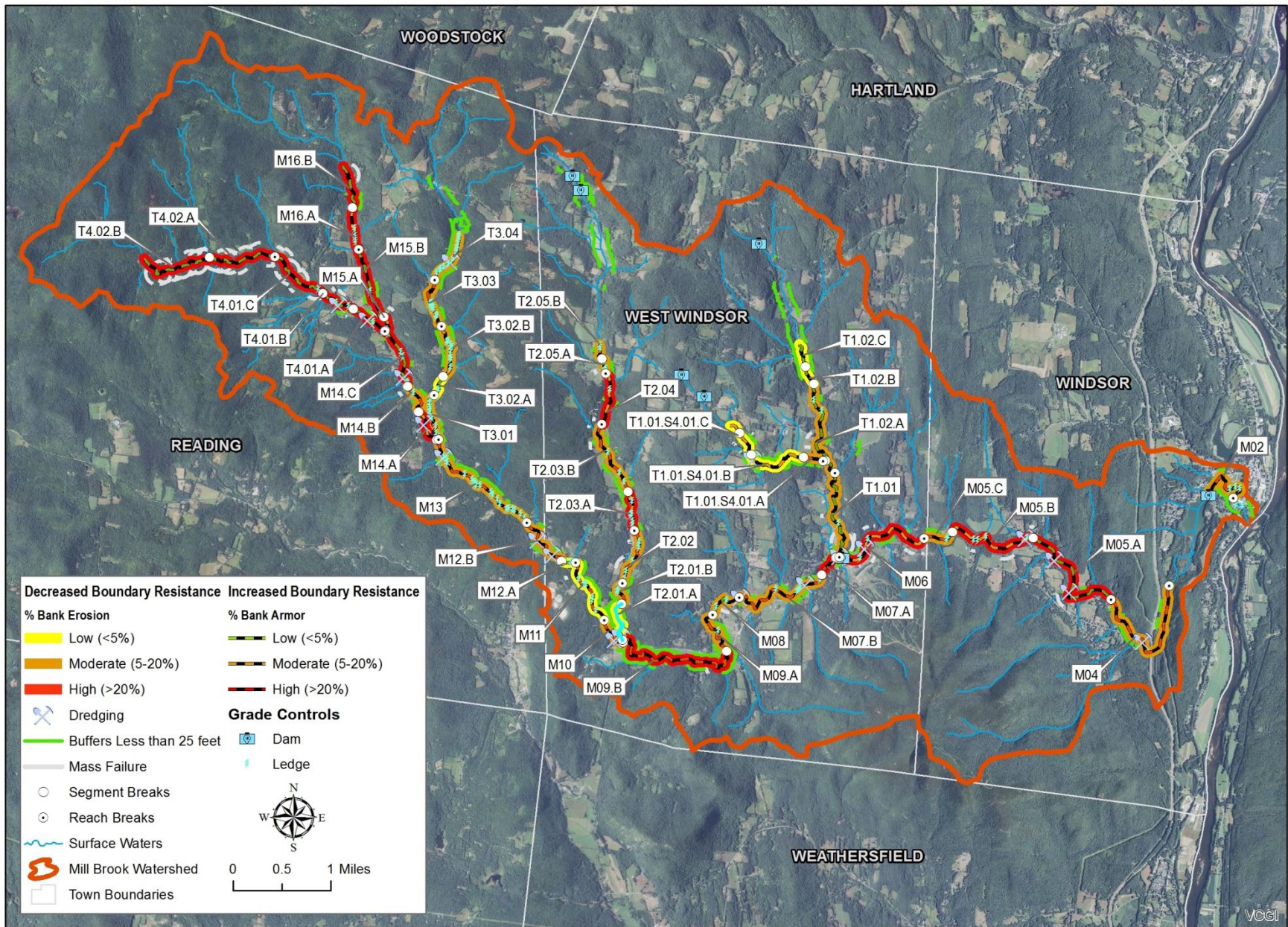


Figure 4.16: Riparian and boundary condition modifiers for the Mill Brook watershed.

Channel Slope and Depth Modifiers

Many of Vermont's rivers and streams have been historically manipulated and straightened to maintain an unnaturally steep slope, allowing for a short term sense of security from flooding and subsequent encroachment of infrastructure in the floodplain. Over time, many alluvial rivers will seek to redevelop a sinuous planform through the deposition of sediments in unconfined valleys. Following flood events when alluvial rivers become energized enough to transport large amounts of coarse sediment into depositional zones of the watershed, lateral channel migration intensifies and further channel straightening is required to protect infrastructure found in the floodplain. In larger alluvial rivers of Vermont, straightening and channelization typically ranges between 25 and 75 percent of the total river channel length in Vermont (VTANR, 2010).

In addition to historic alterations to channel slope in Vermont's alluvial rivers, the lowering of stream beds (e.g., dredging) and the raising of floodplains (e.g., encroachments) have resulted in an increase in channel depth (VTANR, 2010). Channel depths have typically been increased through the encroachment on the floodplain by roads and railroads and subsequent filling and armoring required to construct and maintain this infrastructure. Increases in impervious cover have also led to the deepening and eventual widening of channels throughout urbanized areas of Vermont (Fitzgerald, 2007).

Alterations to channel slope and depth in the Mill Brook study area have been mapped using the variables extracted from the Phase 2 field dataset (Figure 4.23). Areas of channel straightening mapped during the Phase 1 and 2 assessments are included to depict areas of increased channel slope. Corridor encroachment data highlights where roads and development have reduced the floodplain area, typically resulting in increased stream power and channel deepening. Additional data showing the location of natural channel features (ledges) and man-made features such as dams which depict areas that have a resistance to vertical channel change.

Areas impacted by increases in slope and depth or influenced by controls on slope and depth include:

Increases in Slope and Depth

- Extreme channel straightening in segments: M09.A, M09.B, M15.B, T1.01.S4.01.B, T2.01.A (Figures 4.17 and 4.18).
- High straightening in segments: M02, M06, M08, M12.B, M14.C, M16.B, T1.02.B, T2.03.A, T2.05.B, T3.02.B.
- Extreme corridor encroachments from berms and adjacent roadways and embankments in segments: M04, M05.C, M07.A, M08, M11, M13, T1.01.S4.01.A, T2.02, T2.03.A, T2.03.B, T2.05.B, T3.04, T4.01.A (Figures 4.19 and 4.20).
- Dredging in segments: M04, M05.A, M05.B, M06, M07.B, M10, M12.B, M13, M14.A, M14.C, T1.01, T1.01.S4.01.B, T2.01.A, T3.04, T4.01.A, T4.01.B (Figures 4.21 and 4.22).

Controls on Slope and Depth

- Areas with numerous natural grade control on segments: M02, M07.B, M11, M13, M14.C, T2.01.A, T2.01.B, T2.02, T2.03.A, T2.05.A, T3.01, T3.02.B, T3.03, T3.04.
- An on-stream dam is located on reach M06 and a major impoundment (Mill Pond) is located immediately upstream of reach M02.



Figure 4.17: Recently straightened channel along reach M13.



Figure 4.18: Extreme straightening through hayfields on segment T2.01.A.



Figure 4.19: Encroachment from development in Brownsville on segment M07.A.



Figure 4.20: Extreme encroachment along Route 106 on reach T3.04.



Figure 4.21: Dredged material blocking off a flood chute entrance on segment M05.B.



Figure 4.22: Dredged material along the banks of segment T1.01.S4.01.B.

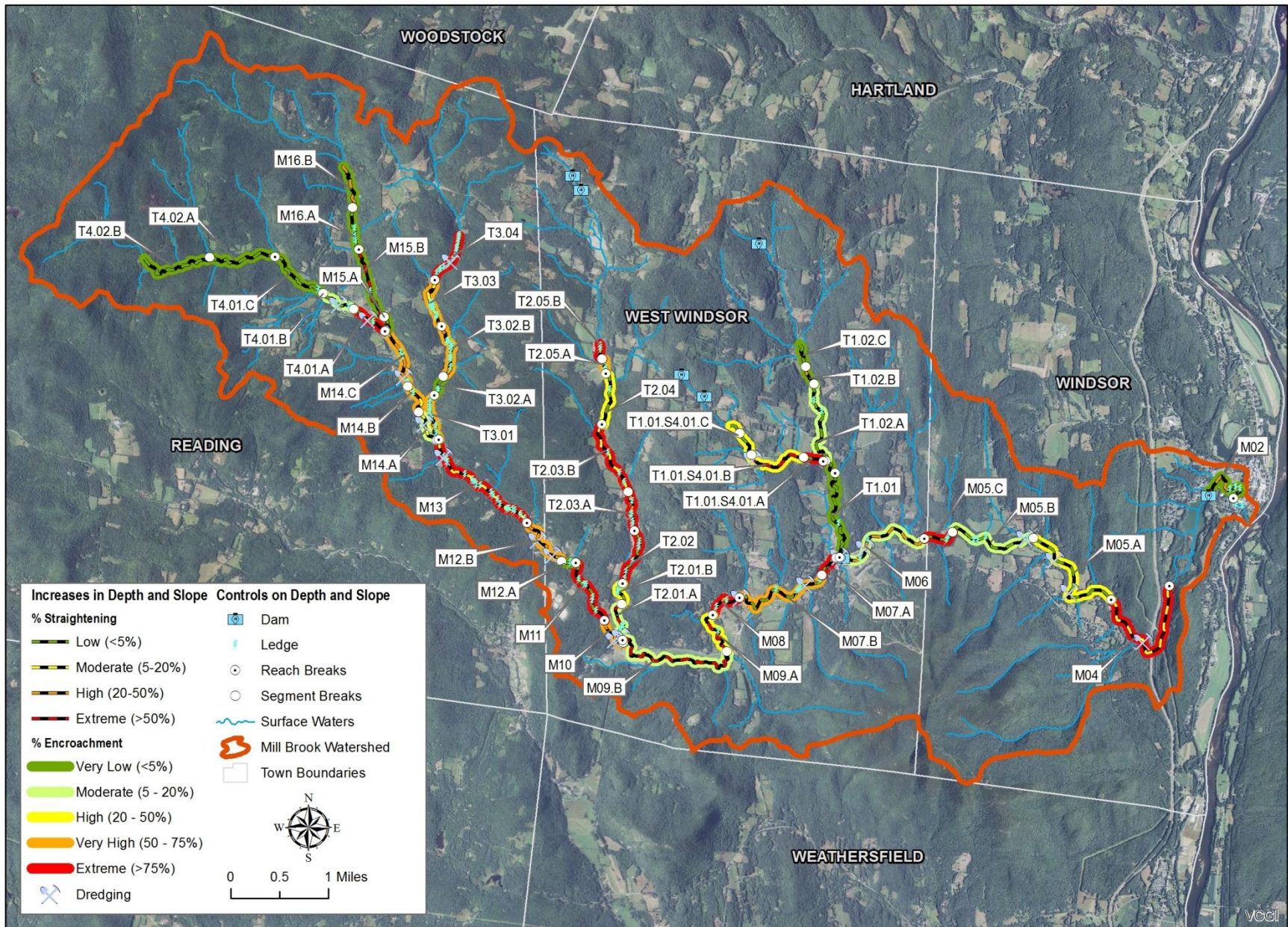


Figure 4.23: Controls on slope and depth for the Mill Brook Watershed.

4.3.2 Departure Analysis

The reference and existing sediment regime types have been mapped using data from the Phase 1 and 2 assessments (Figures 4.24 and 4.25). Several segments in the Mill Brook study area have undergone a departure in both sediment regime and stream type due to channel incision and/or widening as a result of: 1) historical land uses, 2) encroachments or development in the river corridor, or 3) extensive straightening and bank armoring. Many of the channel adjustments caused by these historic stressors were exacerbated by the extreme flood of 2011, leading to further stream type departures. M15.A, T1.01, T1.02.B, T2.05.A, T3.02.B, and T3.03 were the only Phase 2 study segments that were assessed as stable and did not contain a stream type departure and/or a sediment regime departure.

Stream type departures (per Rosgen, 1994) are summarized below (Table 4.3) to better describe the reaches where physical changes in channel morphology have accompanied sediment regime changes.

Table 4.3: Summary of stream type departures from reference conditions.

Phase 2 Segment ID	Stream Type Departure	Dominant Adjustment Type
M02	C to F	Historic Straightening/Encroachment and Upstream Impoundment
M05.A	B to F	Recent Widening/Incision
M05.B	B to F	Recent Widening/Incision
M06	C to B	Historic Straightening
M07.B	C to F	Recent Incision and Historic Impoundment/Encroachment
M09.A	E to F	Major Historic Straightening
M11	B to F	Historic Incision and Extensive Encroachment
M12.B	C to F	Historic Incision and Encroachment/Straightening, Active Aggradation
M13	B to F	Historic Incision and Extensive Encroachment
M14.B	C to F	Historic Armoring/Straightening and Active Incision
M14.C	C to B	Recent Incision and Active Widening/Aggradation
M15.B	C to B	Extensive Historic Straightening and Active Aggradation
M16.B	C to F	Recent Scour and Active Incision
T1.01.S4.01.A	B to F	Extensive Historic Encroachment and Active Incision
T2.01.A	C to F	Historic Straightening
T2.03.B	B to F	Historic Straightening and Encroachment
T3.04	B to F	Historic Encroachment
T4.01.A	C to D	Recent Deposition and Widening
T4.01.B	B to F	Recent Widening and Active Incision
T4.01.C	B to D	Recent Widening and Active Aggradation
T4.02.A	B to C	Recent Widening and Active Aggradation

In addition to these morphological stream type departures, several reaches/segments of the Mill Brook watershed have undergone departures in sediment regimes in the absence of stream type departures. All sediment regime departures are summarized below in Table 4.4. An additional map summarizing channel adjustment processes within each town is included in Figures 4.26 to 4.28.

Table 4.4: Summary of Sediment Regime Departures.

Phase 2 Segment ID	Reference Sediment Regime	Existing Sediment Regime	Cause of Departure
M02	Coarse Equilibrium and Fine Deposition	Unconfined Source and Transport	Historic straightening/encroachment
M04	Coarse Equilibrium and Fine Deposition	Fine Source Transport and Coarse Deposition	Historic straightening/armoring and ongoing aggradation/widening
M05.A	Transport	Confined Source and Transport	Recent widening and aggradation
M05.B	Transport	Confined Source and Transport	Recent widening with major bank erosion and mass failure
M05.C	Transport	Confined Source and Transport	Historic armoring and minor incision
M06	Coarse Equilibrium and Fine Deposition	Fine Source Transport and Coarse Deposition	Historic straightening and ongoing incision
M07.A	Coarse Equilibrium and Fine Deposition	Deposition	Deposition due to impoundment
M07.B	Coarse Equilibrium and Fine Deposition	Unconfined Source and Transport	Historic and active incision
M08	Transport	Confined Source and Transport	Historic and active incision
M09.A	Coarse Equilibrium and Fine Deposition	Unconfined Source and Transport	Major historic straightening, active incision
M09.B	Coarse Equilibrium and Fine Deposition	Fine Source Transport and Coarse Deposition	Historic straightening, active widening/planform
M10	Coarse Equilibrium and Fine Deposition	Unconfined Source and Transport	Encroachment and incision
M11	Transport	Confined Source and Transport	Incision and recent widening
M12.B	Coarse Equilibrium and Fine Deposition	Unconfined Source and Transport	Straightening and major historic incision

Table 4.4: Summary of Sediment Regime Departures.

Phase 2 Segment ID	Reference Sediment Regime	Existing Sediment Regime	Cause of Departure
M13	Transport	Confined Source and Transport	Historic armoring/encroachment and incision
M14.A	Coarse Equilibrium and Fine Deposition	Fine Source Transport and Coarse Deposition	Aggradation and Widening
M14.B	Coarse Equilibrium and Fine Deposition	Unconfined Source and Transport	Historic straightening/armoring and active incision
M14.C	Coarse Equilibrium and Fine Deposition	Fine Source Transport and Coarse Deposition	Active widening/aggradation
M15.B	Coarse Equilibrium and Fine Deposition	Fine Source Transport and Coarse Deposition	Historic straightening and active aggradation
M16.A	Transport	Confined Source and Transport	Active widening/aggradation
M16.B	Coarse Equilibrium and Fine Deposition	Unconfined Source and Transport	Recent widening and active incision
T1.02.A	Coarse Equilibrium and Fine Deposition	Fine Source Transport and Coarse Deposition	Historic incision
T1.01.S4.01.A	Transport	Confined Source and Transport	Extensive encroachment/armoring and active incision
T1.01.S4.01.B	Coarse Equilibrium and Fine Deposition	Unconfined Source and Transport	Incision
T1.01.S4.01.C	Transport	Confined Source and Transport	Encroachment/armoring
T2.01.A	Coarse Equilibrium and Fine Deposition	Unconfined Source and Transport	Historic straightening and active incision
T2.01.B	Coarse Equilibrium and Fine Deposition	Fine Source Transport and Coarse Deposition	Active aggradation and planform

Table 4.4: Summary of Sediment Regime Departures.

Phase 2 Segment ID	Reference Sediment Regime	Existing Sediment Regime	Cause of Departure
T2.02	Transport	Confined Source and Transport	Active widening/aggradation
T2.03.A	Coarse Equilibrium and Fine Deposition	Fine Source Transport and Coarse Deposition	Incision and active aggradation/planform
T2.03.B	Transport	Confined Source and Transport	Historic encroachment/armoring ongoing incision
T2.04	Coarse Equilibrium and Fine Deposition	Fine Source Transport and Coarse Deposition	Recent widening and ongoing aggradation/planform
T2.05.B	Coarse Equilibrium and Fine Deposition	Fine Source Transport and Coarse Deposition	Incision
T3.01	Coarse Equilibrium and Fine Deposition	Fine Source Transport and Coarse Deposition	Encroachment and historic incision
T3.04	Transport	Confined Source and Transport	Historic encroachment and incision
T4.01.A	Coarse Equilibrium and Fine Deposition	Deposition	Recent widening and ongoing aggradation/braiding
T4.01.B	Coarse Equilibrium and Fine Deposition	Unconfined Source and Transport	Recent widening/aggradation and ongoing incision
T4.01.C	Coarse Equilibrium and Fine Deposition	Deposition	Recent widening and ongoing aggradation/braiding
T4.02.A	Coarse Equilibrium and Fine Deposition	Deposition	Recent widening and ongoing aggradation/braiding
T4.02.B	Transport	Confined Source and Transport	Recent widening and ongoing aggradation/braiding

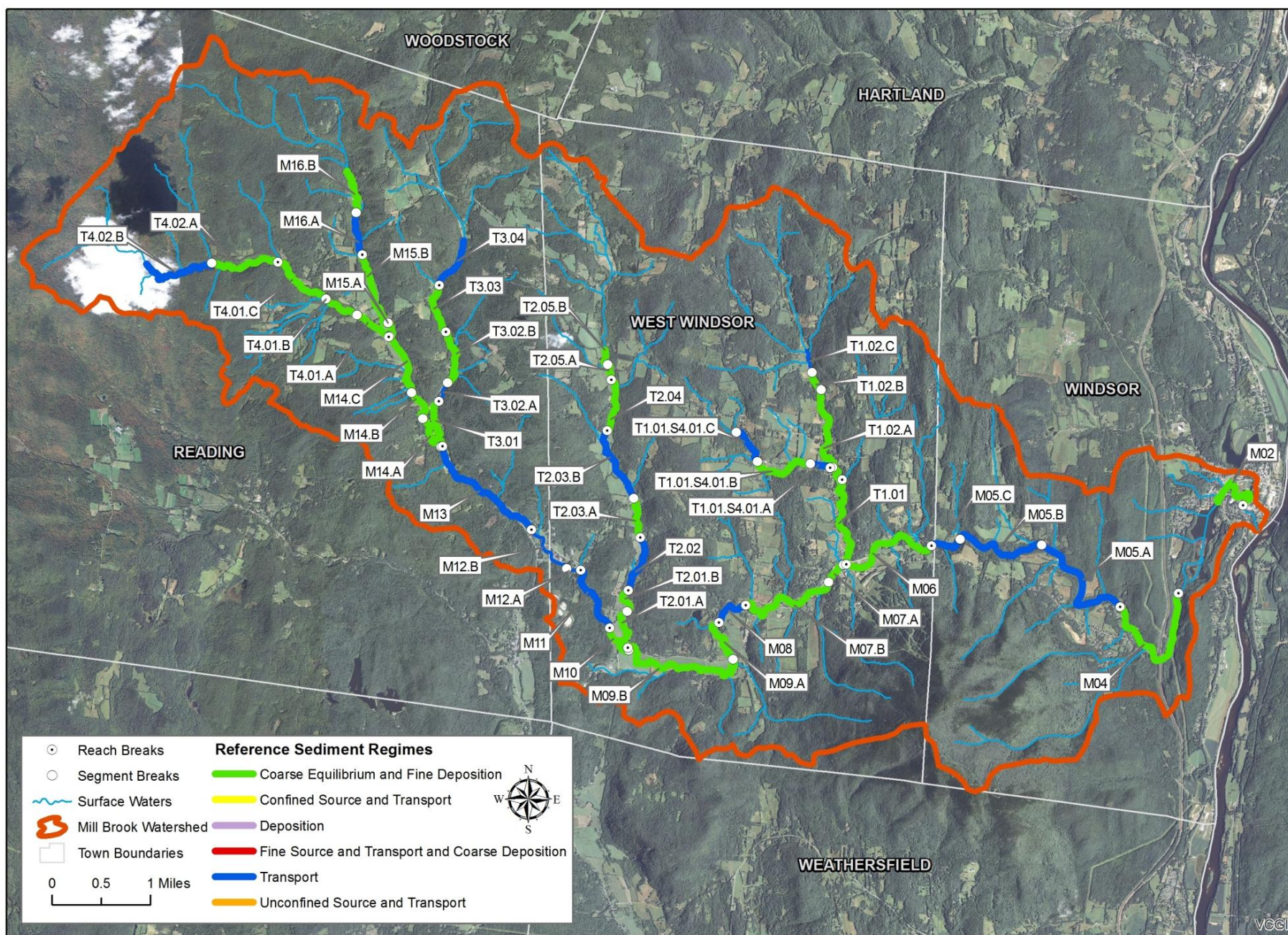


Figure 4.24: Reference Sediment Regime for the Mill Brook watershed.

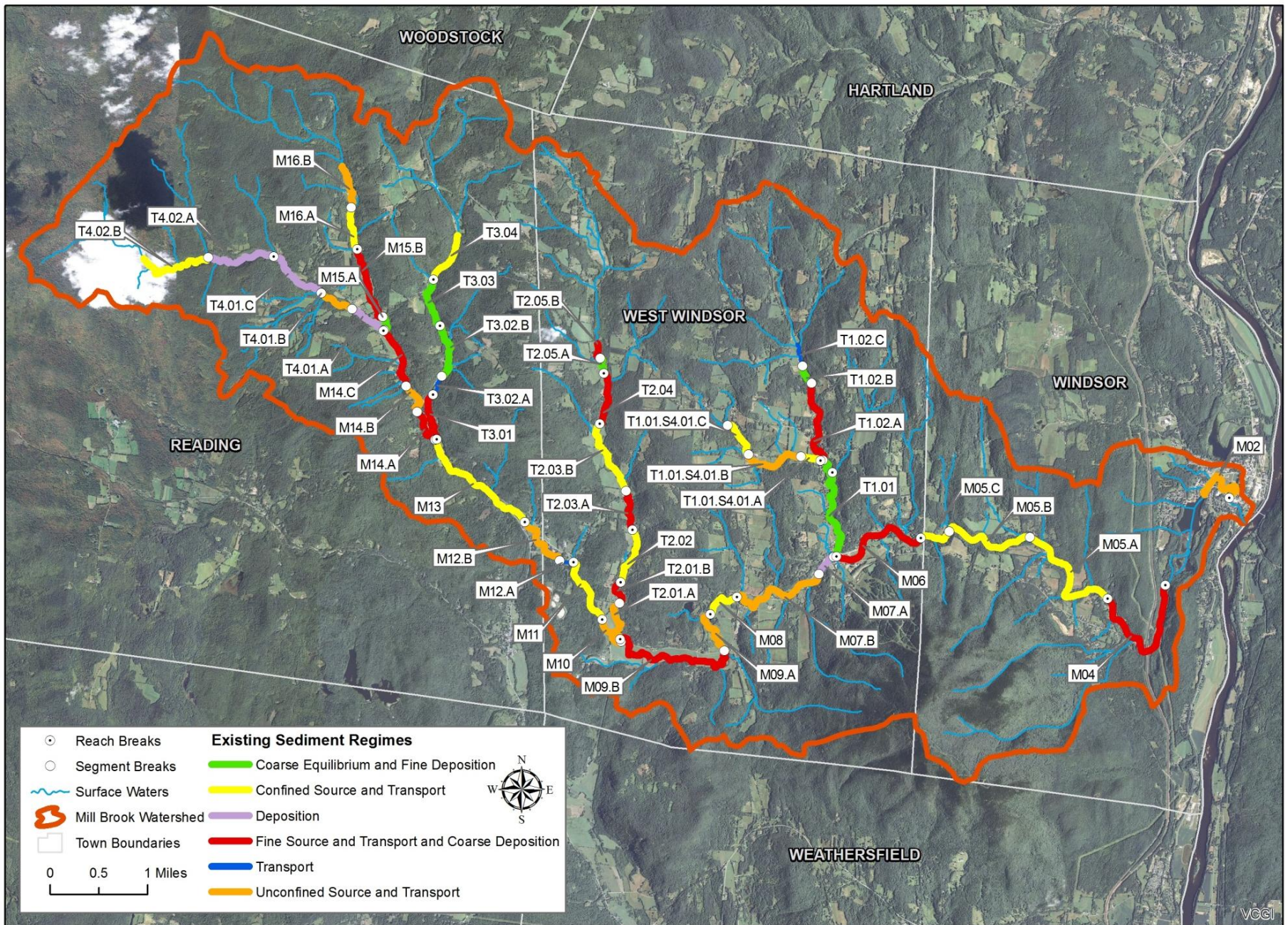


Figure 4.25: Existing Sediment Regime for the Mill Brook watershed.

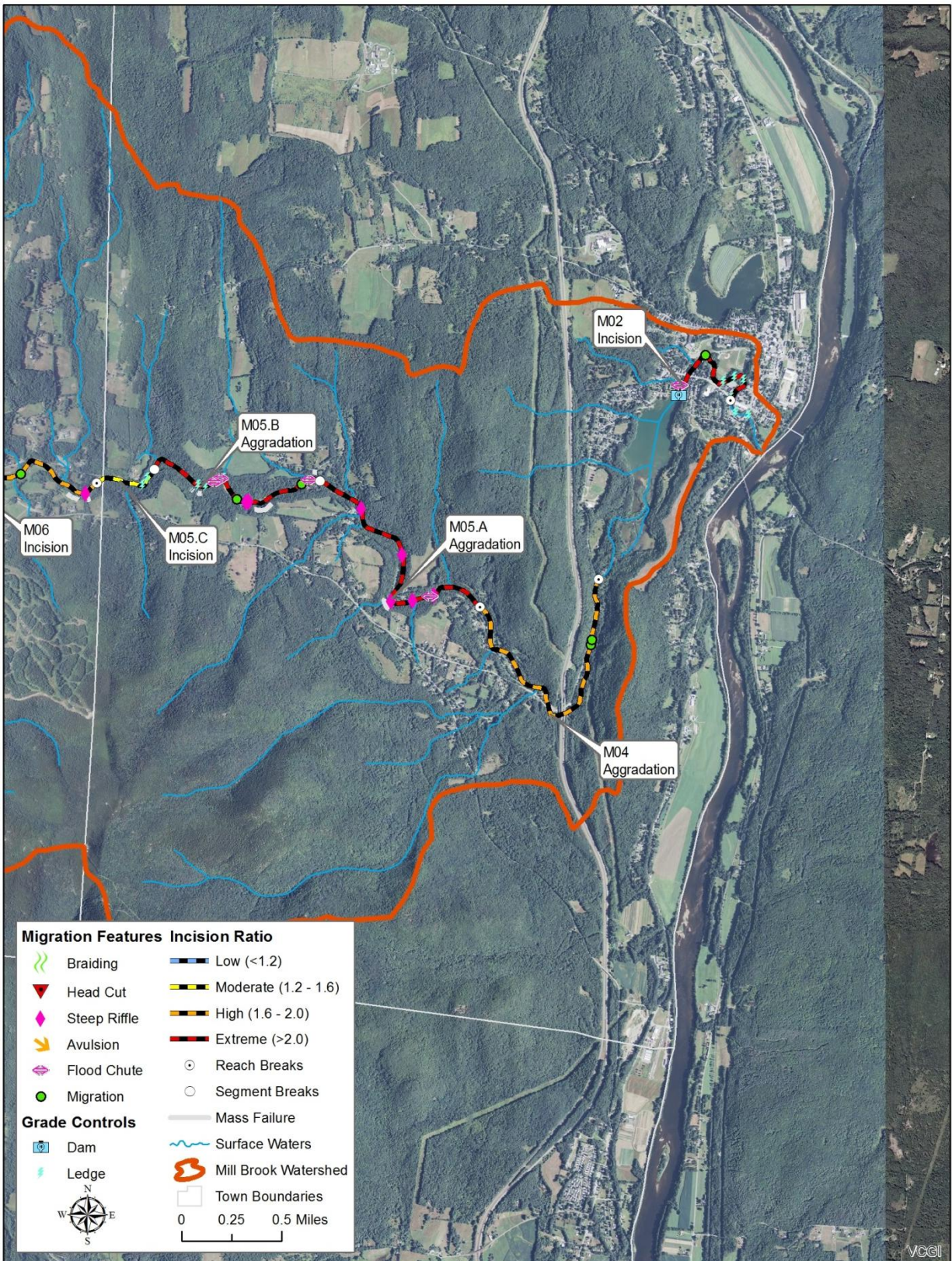
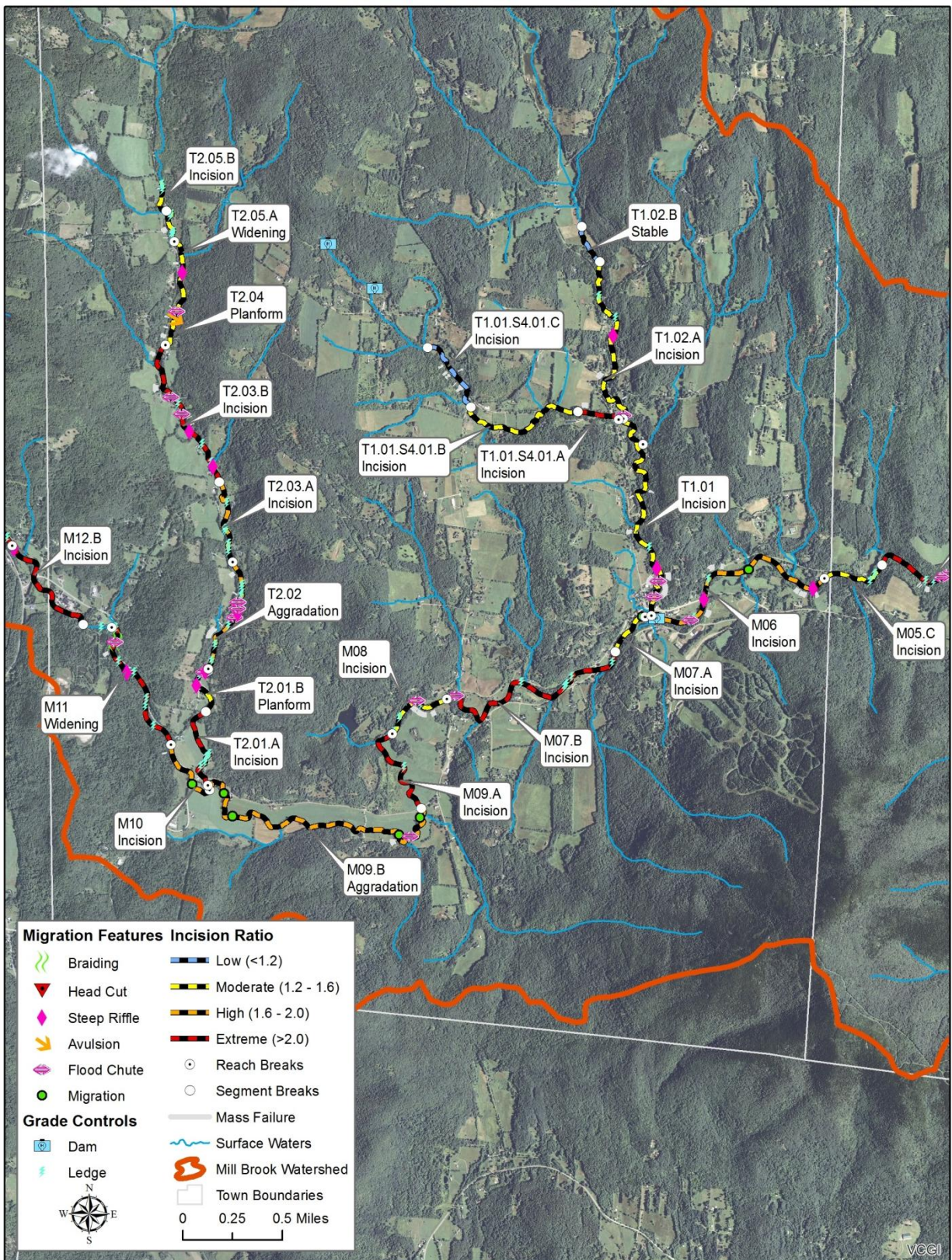


Figure 4.26: Channel Adjustment Process Map for the Mill Brook watershed in Windsor VT.



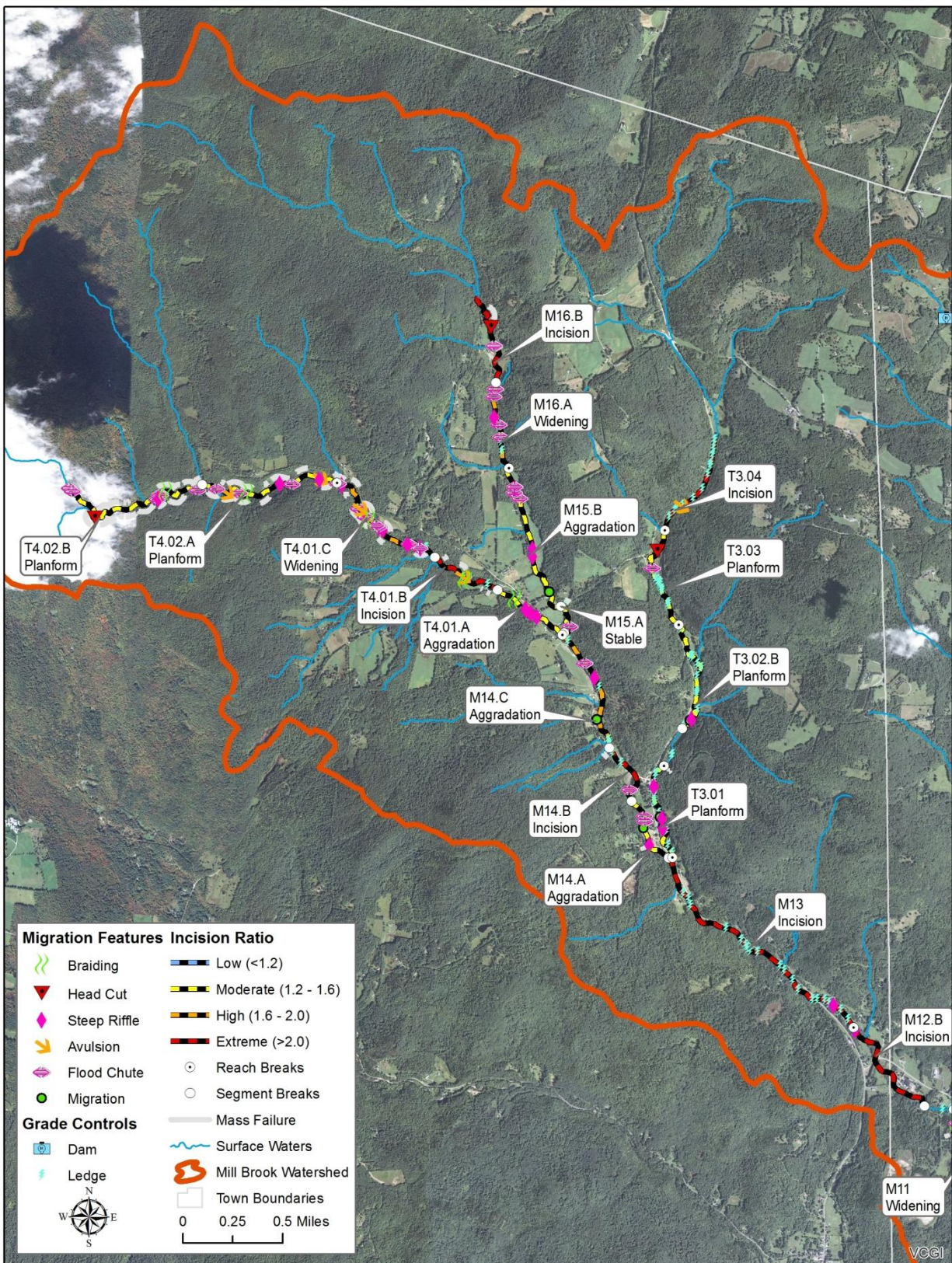


Figure 4.28: Channel Adjustment Process Map for the Mill Brook watershed in Reading VT.

4.3.3 Sensitivity Analysis

The methods outlined in the VTANR Corridor Planning Guide have been used to describe the stream sensitivities of the segments in the Mill Brook study area. Using the stream geometry and substrate data in conjunction with overall geomorphic stability (RGA score) as determined during the Phase 2 surveys, stream sensitivity ratings have been assigned to each segment (Figure 4.29). 19 segments have heightened sensitivities of “Extreme” and 10 segments have heightened sensitivities of “Very High” due to human impacts. The increased stream sensitivity ratings are most often because of stream type departures (STD) (Table 4.5).

Incision due to encroachment, armoring, and/or straightening was the most common driver for heightened sensitivity ratings. Deposition and widening/planform in reaches that are impacted by flood sediments was another important driver for extreme and very high sensitivity ratings.

Incision due to encroachment, armoring, or straightening was the most common scenario for “Extreme” sensitivity in the study area. Areas of major deposition coupled with encroachment also led to “Extreme” sensitivity on some segments. “Very High” sensitivity segments were typically due to incision; however some of the reaches were impacted by major deposition from recent floods leading to widening and aggradation.

Table 4.5: Very High and Extreme sensitivity segments and descriptions of the specific impacts and adjustments.

Phase 2 Segment ID	Stream Sensitivity	Description of Impacts
M02	Extreme	STD, Straightening, Encroachment
M04	Very High	Encroachment, Aggradation
M05.A	Extreme	STD, Widening, Aggradation
M05.B	Extreme	STD, Widening, Aggradation, Incision
M07.B	Extreme	STD, Incision
M09.A	Extreme	STD, Incision, Straightening
M09.B	Very High	Incision, Straightening, Planform
M10	Very High	Encroachment, Incision
M11	Extreme	STD, Incision
M12.B	Extreme	STD, Incision, Widening
M13	Extreme	STD, Incision, Encroachment
M14.A	Very High	Aggradation, Planform
M14.B	Extreme	STD, Incision
M15.B	Very High	STD, Straightening, Incision
M16.B	Extreme	STD, Incision
T1.02.A	Very High	Encroachment, Constriction
T1.01.S4.01.A	Extreme	STD, Encroachment, Incision
T1.01.S4.01.B	Very High	Straightening, Widening, Aggradation
T1.01.S4.01.C	Very High	Encroachment
T2.01.A	Extreme	STD, Straightening, Incision

Table 4.5: Very High and Extreme sensitivity segments and descriptions of the specific impacts and adjustments.

Phase 2 Segment ID	Stream Sensitivity	Description of Impacts
T2.01.B	Very High	Incision
T2.03.B	Extreme	STD, Incision, Armoring, Encroachment
T2.05.B	Extreme	Incision, Encroachment
T3.01	Extreme	Encroachment, Straightening
T3.03	Extreme	Beaver Impoundment
T4.01.A	Extreme	STD, Aggradation, Widening, Braiding
T4.01.B	Extreme	STD, Incision, Widening
T4.01.C	Extreme	STD, Aggradation, Widening, Braiding
T4.02.A	Very High	STD, Aggradation, Widening, Braiding

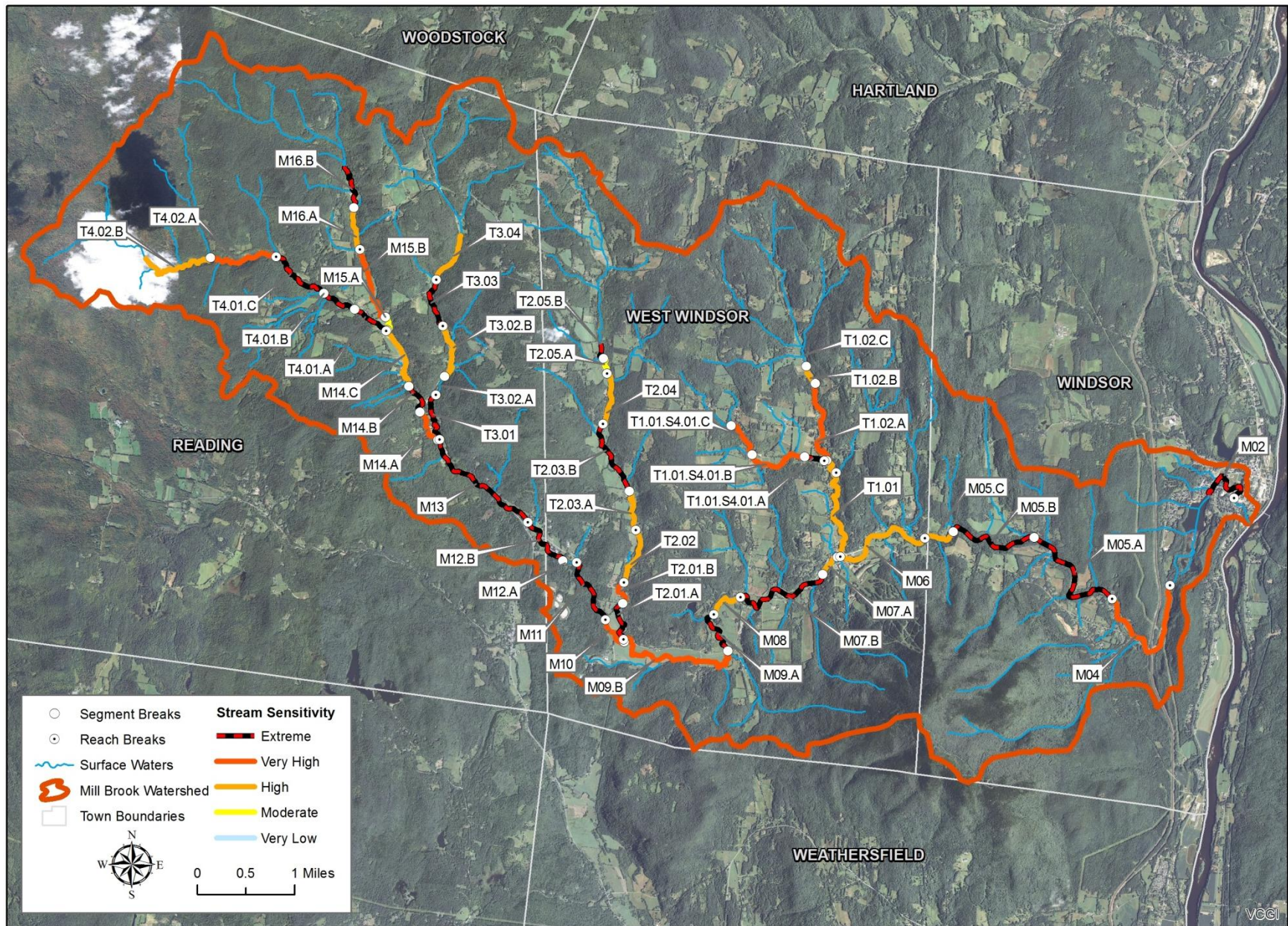


Figure 4.29: Stream Sensitivity Ratings for the Mill Brook study area.

5.0 Preliminary Project Identification

5.1 Watershed Level Opportunities

5.1.1 Stormwater Runoff

Increased stormwater runoff, even in less developed and rural areas of Vermont such as the Towns of Windsor, West Windsor, and Reading, can increase peak flood flows and the erosive power of the streams. Stormwater runoff originating from gravel roads and exposed soil during development, or over farm fields can add significant sediment inputs to streams. Increasing development results in more driveways and roads, which funnel sediment and runoff directly into streams. Sediment from roads and driveways can be addressed with improved drainage ditch networks, limiting future driveway lengths in sensitive areas, and other approaches. The Vermont Better Back Roads program provides assistance for towns seeking ways to reduce rural stormwater problems.

The Mill Brook watershed has limited stormwater impacts because of the largely forested watersheds and low road densities. In the future, if development pressures heighten concerns about impacts from stormwater runoff, the towns in the watershed could consider enacting local standards and guidelines for stormwater treatment or mitigation. Alternatively, concerns about stormwater management can be raised during local development review as necessary. Local planning efforts are important to control and monitor stormwater and development impacts on natural resources. By planning proactively, towns can reduce long-term costs and risks associated with stormwater runoff. Options that the towns could consider at the local level include:

- Requiring stormwater controls for development projects which are not large enough in size to fall under state regulatory permits (less than 1 acre impervious cover), but likely have a measurable impact on the conditions of adjacent waterbodies (e.g., habitat, water quality).
- Incorporating more rigorous requirements for stormwater control of new development in headwaters areas. Research in Vermont has shown that physical and biotic conditions in small watersheds (< 5 square miles in area) are impacted by very low levels of impervious cover (as low as 5 percent; Fitzgerald, 2007).
- Encouraging Low Impact Development (LID) and the use of green stormwater infrastructure (GSI) by offering development density incentives for those projects which result in reduced footprints of impervious cover.

5.1.2 Flood Hazard Zones

Many Vermont communities found along rivers large and small have faced significant property losses and risks to public safety during past flood events. The Mill Brook watershed is an extremely flashy watershed due to its steep headwaters and soils with poor infiltration. The National Flood Insurance Program (NFIP) study for Mill Brook does not cover the entire river corridor with a detailed study; therefore inundation hazards may be underestimated in the smaller drainages such as Beaver Brook, Willow Brook, Reading Hill Brook, the upper reaches of Mill Brook, and Bailey Brook. Given the hydrologic characteristics of the watershed, and the severe flood damage witnessed during Tropical Storm Irene, we recommend that all towns in the watershed consider flood hazard ordinances that prevent encroachment in the entire 100-year floodplain (i.e., floodway and floodplain fringe).

While inundation-related flood loss is a significant component of flood disasters, the predominant mode of damage during floods in Vermont is fluvial erosion. Towns can reduce flood recovery and infrastructure maintenance costs and increase public safety by limiting development in areas adjacent to rivers with a high potential for vertical and lateral adjustment. The Fluvial Erosion Hazard (FEH) zone can be thought of as the corridor a river or stream requires to redevelop or maintain equilibrium (i.e., least erosive) conditions over the long term. Fluvial Erosion Hazard (FEH) zone ordinances should be considered by each town to better map flood and erosion risks for both the safety and protection of their citizens, and the infrastructure controlled by the municipality.

By implementing at least one of the above-mentioned zoning recommendations, towns can qualify for increased state aid (from 12.5% to 17.5%) from the Emergency Relief and Assistance Fund (ERAF) to cover future flood damages.

5.1.3 Stream Crossings

Throughout Vermont, undersized and poorly aligned river crossings interrupt flood flows, sediment and woody debris movement downstream, and fish and wildlife migration. These conditions result in: 1) channel instability and/or damage to infrastructure and personal property; 2) increased flooding; and 3) decreased fish and wildlife population health. Many arches, bridges, and culverts in the Mill Brook study area are currently undersized and causing various problems such as upstream sediment/debris deposition, excessive erosion, and limited aquatic organism passage (Tables 5.1 and 5.2). Debris jams formed during T.S. Irene on some of the larger bridges - particularly those with piers - exacerbating area flooding and infrastructure damage (Figure 5.1). As such structures come up for replacement, resizing them to accommodate expected discharge and sediment loads and placing them in proper alignment with stream channels is highly recommended.



Figure 5.1: Tropical Storm Irene damage to the Route 44 bridge over Mill Brook in reach M04 (photo from www.windsorvt.org).

Table 5.1: Summary of culvert data in the Mill Brook watershed.

Map ID	SGA Reach/Segment	Town	SGAID	Location	% Bankfull Width	Geomorphic Compatibility	Aquatic Organism Passage* (AOP)	AOP Retrofit Potential**
1	M15.B	Reading	100000000214141	Whitmore Rd	63	Partially Compatible	Gray	MML
2	M15.B	Reading	700000000214143	Farm Access	21	Partially Compatible	Red	LLL
3	T1.02.A	W. Windsor	100000000314221	Coon Club Rd	57	Partially Compatible	Gray	MML
4	T1.02.A	W. Windsor	100000000514221	Brownsville-Hartland Rd	55	Partially Compatible	Gray	MML
5	T1.01.S4.01.A	W. Windsor	100000000014221	Sheddsville Rd	77	Mostly Incompatible	Gray	HHM
6	T1.01.S4.01.B	W. Windsor	100000000114221	Sheddsville Rd	39	Mostly Compatible	Gray	MLL
7	T1.01.S4.01.B	W. Windsor	700000000814223	Private Driveway	29	Partially Compatible	Gray	LLL
8	T2.02	W. Windsor	700000000914223	Private Driveway	41	Partially Compatible	Gray	MLL
9	T2.03.B	W. Windsor	100000001014221	Rush Meadow Ln	33	Mostly Incompatible	Gray	MLL
10	T3.02.A	Reading	700000000914143	Talc Mine Access	61	Mostly Compatible	Gray	MML
11	T3.03	Reading	100000000314141	Whitmore Rd	25	Partially Compatible	Gray	LLL
12	T3.03	Reading	200000000014142	Route 106	59	Mostly Compatible	Gray	MML
13	T3.04	Reading	100000000414141	Whitmore Rd	57	Mostly Compatible	Gray	MML
14	T4.02.B	Reading	100000000614141	Brown Schoolhouse Rd	53	Mostly Incompatible	Gray	MML

***Notes on AOP**

Green: Full AOP for all aquatic organisms
Gray: Reduced AOP for all aquatic organisms
Orange: No AOP for all aquatic organisms except adult salmonids
Red: No AOP for all aquatic organisms including adult salmonids

**** Notes on AOP Retrofit Potential:**

H: High probability the existing culvert can be retrofitted
M: Medium probability the existing culvert can be retrofitted
L: Low probability the existing culvert can be retrofitted
Position 1 (left): For strong swimmers
Position 2 (Center): For moderate swimmers
Position 3 (right): For weak swimmers

Table 5.2: Summary of Bridge Data in the Mill Brook Watershed.

Map ID #	SGA Reach/ Segment	Town	SGAID	Road	Material	Curve Channel Width (ft)	Structure Length (ft)	Structure Height (ft)	Structure Width (ft)	% Bankfull Width
1	M02	Windsor	100000000014231	Union St	Steel	69.6	48	14	75	108
2	M02	Windsor	100000000114231	Trail	Steel	69.6	7	12	75	108
3	M02	Windsor	100000000214231	Union St	Steel	69.6	60	15	75	108
4	M04	Windsor	200044000014232	Route 44	Concrete	68.6	32	15	110	160
5	M05.A	Windsor	100000000314231	Brook Rd	Steel	66.6	20	14	70	105
6	M05.A	Windsor	100000000414231	Brook Rd	Steel	66.6	25	13	48	72
7	M05.A	Windsor	100000000514231	Hewett Rd	Steel	66.6	28	13	46	69
8	M05.C	Windsor	100000000614231	Brook Rd	Steel	66.6	30	15	52	78
9	M06	W. Windsor	200044000014222	Route 44	Steel	63.8	23	15	76	119
10	M06	W. Windsor	700000000014223	Private foot path	Steel	63.8	6	7.5	52	82
11	M07.B	W. Windsor	200044000114222	Route 44	Concrete	56.7	46	14	60	103
12	M07.B	W. Windsor	700000000114223	Private field access	Steel	56.7	10	9.5	45	79
13	M07.B	W. Windsor	400000000014221	Bible Hill Rd	Timber	56.7	15	12	36	63
14	M09.A	W. Windsor	700000000214223	Private	Steel	54	15	9.2	35	65
15	M09.B	W. Windsor	200044000314222	Route 44	Steel	54	28	7.5	64	119
16	M09.B	W. Windsor	700000000314223	Private field access	Steel	54	12	7	56	104
17	M09.B	W. Windsor	400000000114221	Yale Heights Rd	Concrete	54	18	9.8	34	63
18	M10	W. Windsor	400000000214221	Churchill Rd	Timber	45.3	18	9	32	71
19	M12.A	W. Windsor	700000000414223	Private mine rd	Steel	44.5	15	18	25	56
20	M12.B	W. Windsor	700000000514223	private	Steel	44.5	8	9	60	135
21	M12.B	Reading	200044000014142	Route 44	Steel	44.5	38	12	58	130

Table 5.2: Summary of Bridge Data in the Mill Brook Watershed.

Map ID #	SGA Reach/ Segment	Town	SGAID	Road	Material	Curve Channel Width (ft)	Structure Length (ft)	Structure Height (ft)	Structure Width (ft)	% Bankfull Width
22	M13	Reading	200106000114142	Route 106	Steel	43.5	44	10.5	70	161
23	M13	Reading	700000000114143	Private driveway	Concrete	43.5	18	7.5	58	133
24	M14.A	Reading	100000000014141	Agony Hill Rd	Steel	35.7	52	7.5	25	70
25	M14.B	Reading	100000000114141	Baileys Mills Rd	Steel	35.7	38	8	49	137
26	M15.B	Reading	700000000314143	Private field access	Steel	21.4	9	8	24	112
27	M15.B	Reading	700000000414143	Private field access	Steel	21.4	15	5	30	140
28	T1.01	W. Windsor	200044000214222	Route 44	Concrete	29.9	36	9	22	74
29	T1.01	W. Windsor	700000000614223	Private	Steel	29.9	8	8	56	187
30	T1.01	W. Windsor	700000000714223	Private driveway	Steel	29.9	12	8.5	28	94
31	T1.02.A	W. Windsor	100000000414221	Brownsville-Hartland Rd	Concrete	23	30	11	15	65
32	T1.01.S4.01.A	W. Windsor	400000000314221	Brownsville-Hartland Rd	Concrete	15.4	26	11	18	117
33	T1.01.S4.01.C	W. Windsor	100000000214221	Bible Hill Rd	Concrete	15.5	24	7.5	20	129
34	T2.01.A	W. Windsor	200000000014222	Route 44	Concrete	27.2	42	7	15	55
35	T2.01.B	W. Windsor	100000000614221	Rush Meadow Rd	Concrete	27.2	30	9	20	74
36	T2.03.A	W. Windsor	700000001014223	Private driveway	Steel	25.9	18	7	14	54
37	T2.03.A	W. Windsor	100000000714221	Rush Meadow Rd	Concrete	25.9	33	6	13.5	52
38	T2.03.B	W. Windsor	100000000814221	Banister Rd	Concrete	25.9	24	7.7	18	69
39	T2.03.B	W. Windsor	700000001114223	Private driveway	Steel	25.9	18	8	11.5	44
40	T2.03.B	W. Windsor	100000000914221	Rush Meadow Rd	Concrete	25.9	24	7	18	69
41	T2.03.B	W. Windsor	700000001214223	Private field access	Steel	25.9	12	8.5	36	139

Table 5.2: Summary of Bridge Data in the Mill Brook Watershed.

Map ID #	SGA Reach/ Segment	Town	SGAID	Road	Material	Curve Channel Width (ft)	Structure Length (ft)	Structure Height (ft)	Structure Width (ft)	% Bankfull Width
42	T2.05.A	W. Windsor	100000001114221	Rush Meadow Rd	Concrete	19	40	4.7	10	53
43	T2.05.B	W. Windsor	100000001214221	Rush Meadow Rd	Concrete	19	45	6	10	53
44	T3.01	Reading	200106000214142	Route 106	Concrete	24.3	45	8	14.5	60
45	T3.01	Reading	700000000514143	Private driveway	Steel	24.3	25	7	12	49
46	T3.01	Reading	700000000614143	Private foot bridge	Timber	24.3	4	2.5	32	132
47	T3.01	Reading	700000000714143	Private driveway	Steel	24.3	18	6	17	70
48	T3.04	Reading	200106000001012	Route 106	Steel	18.5	60	6	12	65
49	T4.01.A	Reading	100000000514141	Baileys Mills Rd	Steel	27.4	24	13	19	69
50	T4.01.A	Reading	700000000814143	Private access road	Steel	27.4	25	12	20	73

5.2 Site-Level Project Opportunities

The site-level projects developed for the Mill Brook watershed are provided for each Town in Tables 5.3 through 5.5. The project strategy, technical feasibility, and priority for each project are listed by project number and reach/segment. A total of 64 projects were identified to promote the restoration or protection of channel stability and aquatic habitat. These tables summarize key information for each project, including the site stressors and constraints, project strategy, priorities for hazard mitigation and ecological benefit, relative costs (i.e., low, moderate, and high), and potential partners and funding sources.

Tables 5.3 to 5.5 include a ranking of project priority, using our best professional judgment (and input from VTDEC, SWCRPC, and other local stakeholders), of hazard mitigation and ecological benefits. Many river corridor restoration projects help mitigate flood and erosion hazards **and** improve the ecological conditions of the reach and watershed as a whole (e.g., improved habitat, protection of water quality, etc.). However, some project types provide a greater benefit to one over the other. While it is difficult to place a specific value on each project, rankings of “low,” “medium,” and “high” are intended to provide a means to compare the types of benefits each project provides relative to the others. A summary of what is meant by these two priority types is provided below.

Hazard Mitigation Priority: refers to the potential for the project to mitigate flood and erosion hazards for the river corridor in the reach and in downstream areas. For example, replacing an undersized culvert with an appropriately sized structure could reduce flood/erosion hazards around the structure and downstream.

Ecological Benefits Priority: refers to the potential for the project to improve aquatic habitat conditions and water quality in the reach and watershed. For example, a riparian buffer planting will improve habitat by increasing shading along the river and reducing long-term bank erosion.

The project locations for the study area are included on the maps provided in Appendix D. The 64 projects are further broken down by category as follows: forty-five (44) active geomorphic restoration projects and nineteen (20) passive geomorphic restoration projects, including six (6) conservation projects. A total of forty-two (42) buffer planting and corridor protection areas are grouped into ten (10) projects by stream and by Town. Select “high” priority projects within each Town are described in greater detail in section 5.3.

5.2.1 Town of Windsor Site-level Project Opportunities

Table 5.3: Site-Level Project Identification for the Mill Brook Watershed in the Town of Windsor, Vermont.

Project ID, Location, Reach, Lat/Long	Type of Project	Site Description Including Stressors and Constraints	Project or Strategy Description	Hazard Mitigation Priority	Ecological Benefits Priority	Project Benefits	Costs	Potential Partners & Funding
WI 1 Windsor High School Reach M02 43.47913 N 72.393 W	Active Restoration Sewer Line Retrofit/ Replacement	A large steel casing protecting an active sewer line for the High School crosses the river and creates a major constriction and high-flow obstruction. The channel is also scouring around the footers.	We discussed the sewer line with Mike Reynolds (Sewer Plant Operator) and they are aware of flooding risks but there were no issues during T.S. Irene. Assess options to reroute sewer or reconstruct a new crossing to improve protection of the infrastructure and reduce flooding risks.	High	Moderate	Remove or reduce a flooding hazard and threat to an important sewer line.	Moderate to High	Town of Windsor; FEMA
WI 2 The Narrows Reach M04 43.46122 N 72.40322 W	Passive Restoration Conservation	The large floodplain area from the I-91 bridge downstream to Mill Pond is accessible during most flood events and provides valuable sediment and floodwater attenuation. The area was historically used as a hayfield but is now forested.	Work with private land owners to prevent stream corridor from future development or agricultural conversion.	High	Medium	Large area for sediment and floodwater attenuation, reduce sediment inputs to Mill Pond, alleviate erosion impacts along Route 44, and store and slow flood waters before reaching Downtown Windsor.	Low to Moderate	VTANR; VLT; VRC, Private Landowners; Town of Windsor
WI 3 a-c Multiple Areas Reach/Segment M04, M05.A, and M05.C	Passive Restoration Corridor Protection	Small areas of accessible floodplain that provide valuable sediment, debris, and floodwater attenuation during larger events.	Protect corridor from future development.	Low	Low	Protect active corridor from future development, and protect floodplain area. Provide minor flood water and sediment/debris storage.	Low	VTANR ERP; VRC, Private landowners; Town of Windsor

Table 5.3: Site-Level Project Identification for the Mill Brook Watershed in the Town of Windsor, Vermont.

Project ID, Location, Reach, Lat/Long	Type of Project	Site Description Including Stressors and Constraints	Project or Strategy Description	Hazard Mitigation Priority	Ecological Benefits Priority	Project Benefits	Costs	Potential Partners & Funding
WI 4 Brook Road Segment M05.A 43.46153 N 72.42292 W	Passive Restoration Floodplain Cleanup, Buffer Planting, and possible Corridor Protection	A property on the left floodplain in between the two Brook Road bridges has a large area of accessible floodplain that has insufficient buffer vegetation and a large volume of "junk". Many old vehicles were flooded and partially buried in sediment during Irene and represent a debris hazard in future events.	Work with the private landowner to remove cars and other debris from the floodplain, establish a buffer of native vegetation, and protect the corridor from future development.	Medium	Low	Improved floodplain functionality and reduce risk of debris entering stream during future flood events.	Low to Moderate	VTANR ERP; Private Landowner; ONRCD Trees for Streams
WI 5 Brook Road - Merrell Property Segment M05.A 43.46197 N 72.42401 W	Active Restoration Bank Stabilization	The right bank along Gary Merrell Sr's property is actively eroding for a distance of 200 feet. Minimal buffer vegetation is present to stabilize the bank.	Bank could likely be stabilized with a combination of rock/wood toe structures and re-grading of upper bank with native plantings.	Low	Low	Reduce sediment inputs to channel and protect property from further erosion.	Low	Private Landowner; ONRCD Trees for Streams; NRCS Emergency Watershed Protection (EWP)
WI 6 Brook Road Segment M05.A 43.6208 N 72.42363 W	Active Restoration Bridge Replacement	The second bridge within the segment is undersized (72% of bankfull channel width) but otherwise in good condition. Due to the upstream washout of Brook Rd, the bridge only services one household. The reach has a very high sediment load.	Replace bridge with a larger structure that will improve sediment and debris transport, and conveyance of flood waters through the reach.	Medium	Low	Reduced risk of debris or sediment accumulation at bridge during a storm event, improve sediment transport through reach.	High	Town of Windsor; VTrans
WI 7 Hewett Road Segment M05.A 43.46931 N 72.42913 W	Active Restoration Bridge Replacement	Bridge is in fair condition and is a moderate channel constriction (69% of bankfull channel width). Hewett Road is a critical connector due to washouts on Brook Road.	Replace bridge with a larger structure that will improve sediment and debris transport, and conveyance of flood waters through the reach.	Medium	Low	Reduced risk of debris or sediment accumulation at bridge during a storm event, improve sediment transport through reach, protect critical transportation and emergency access corridor.	High	Town of Windsor; VTrans

Table 5.3: Site-Level Project Identification for the Mill Brook Watershed in the Town of Windsor, Vermont.

Project ID, Location, Reach, Lat/Long	Type of Project	Site Description Including Stressors and Constraints	Project or Strategy Description	Hazard Mitigation Priority	Ecological Benefits Priority	Project Benefits	Costs	Potential Partners & Funding
WI 8 Brook Road Segment M05.B 43.46995 N 72.43205 W	Active and Passive Restoration Channel and Floodplain Restoration, Buffer Planting, Corridor Protection	The channel scoured out a huge area of floodplain during T.S. Irene and caused major damage to the downstream property and house. A large flood chute formed near the house and was filled in during cleanup activities. Major filling along the right bank occurred after the storm and the current channel is too narrow and deeply incised. A lateral berm was also constructed near the horse barn.	Alternatives analysis to determine strategies for increasing floodplain storage and channel width while protecting the property during future floods. Potentially restore access to the large flood chute and reconfigure the lateral berm. Buffer plantings throughout the right floodplain to stabilize the filled area and increase channel shading. Protect corridor from future development.	Medium	Medium	Increase floodplain access to store sediment and floodwaters. Reduce channel constriction to decrease scour and bank erosion at the site and downstream. Establishing woody buffer vegetation will stabilize banks and increase channel shading.	Moderate to High	Private landowner; ONRCD Trees for Streams
WI 9 Brook Road Segment M05.B 43.46919 N 72.43967 W	Passive Restoration Conservation	Over one mile of river corridor is highly active and has no usable infrastructure following major damage to Brook Road during T.S. Irene. The channel is incredibly active and has some access to floodplain areas throughout. Brook Road was destroyed in several locations and is not feasible for reconstruction.	Work with private land owners to prevent stream corridor from future development.	High	Medium	Conserve a large area with valuable floodplain and channel storage for the huge volumes of sediment and debris that will continue to work through the reach. Reconstructing Brook Road is not feasible and no other infrastructure is located within the corridor.	Moderate	VTANR ERP; Private landowners

Table 5.3: Site-Level Project Identification for the Mill Brook Watershed in the Town of Windsor, Vermont.

Project ID, Location, Reach, Lat/Long	Type of Project	Site Description Including Stressors and Constraints	Project or Strategy Description	Hazard Mitigation Priority	Ecological Benefits Priority	Project Benefits	Costs	Potential Partners & Funding
WI 10 Brook Road Segment M05.C 43.47005 N 72.44846 W	Active Restoration Bridge/Debris Removal	The third Brook Road bridge was destroyed during T.S. Irene, however it remains in the channel and the deck and abutments are attached and upright. Both abutments were outflanked and some bank erosion appears to be ongoing. No other infrastructure is at risk.	Remove bridge abutments and deck.	Medium	Low	Remove debris and reduce erosion along banks. Bridge could collapse and cause increased flooding or bank erosion risks.	High	Town of Windsor

5.2.2 Town of West Windsor Site-level Project Opportunities

Table 5.4: Site-Level Project Identification for the Mill Brook Watershed in the Town of West Windsor, Vermont.

Project #, Location, Reach, Lat/Long	Type of Project	Site Description Including Stressors and Constraints	Project or Strategy Description	Hazard Mitigation Priority	Ecological Benefits Priority	Project Benefits	Costs	Potential Partners & Funding
WW 1 Hayfield along Brook Road Reach M06 43.47075 N 72.46031 W	Passive and Active Restoration Corridor Protection and Bank Stabilization	Major erosion along the right bank for approximately 750 ft. The vertical bank is approximately 7ft tall and has cut back up to 70ft in the last 5 years. No woody vegetation exists along the hayfield edge and the erosion will likely continue as the channel attempts to reestablish a meandering form. A utility pole is currently located 25' from the failing bank.	Conduct an alternatives analysis and consider the following options: 1) Do nothing - allow the channel to continue migrating; 2) Plant top of bank and buffer with native woody vegetation; 3) Stabilize bank with rock and/or wood and plant buffer. The corridor should be protected from future development under all scenarios, and the utility pole should be moved or monitored for stability.	High	Medium	Bank stabilization would reduce a very large sediment source and native plantings will increase shading and woody debris inputs to the channel. Provide moderate flood water and sediment/debris storage.	Moderate to High	VTANR ERP; Private landowners; VLT; ONRCD Trees for Streams
WW 2 a-h Mill Brook Multiple Areas Reach/Segment M06, M07.A, M07.B, M09.A, M09.B, M10, M12.B	Passive Restoration Corridor Protection	Small to large areas of accessible floodplain that provide valuable sediment, debris, and floodwater attenuation during larger events. Most sites have reduced woody buffer vegetation. High priority area along Route 44 on Segments M09.A and M09.B.	Protect corridor from future development and plant buffer with native woody vegetation.	Low to High	Low to High	Protect floodplain area from future development and increase shading and woody debris inputs to channel. Provide minor to moderate flood water and sediment/debris storage.	Low to Moderate	VTANR ERP; Private landowners; VLT; ONRCD Trees for Streams

Table 5.4: Site-Level Project Identification for the Mill Brook Watershed in the Town of West Windsor, Vermont.

Project #, Location, Reach, Lat/Long	Type of Project	Site Description Including Stressors and Constraints	Project or Strategy Description	Hazard Mitigation Priority	Ecological Benefits Priority	Project Benefits	Costs	Potential Partners & Funding
WW 3 West Windsor Volunteer Fire Department (WWVFD) Reach M06 43.4671 N 72.4700 W	Active Restoration Dam Removal or Retrofit	A 6 foot tall concrete block dam is constructed across the channel, formerly used for snowmaking withdrawals, and currently the location of a dry hydrant for the WWVFD. The impounded channel behind the dam is completely filled in with sediment. The brook is eroding around the right (south) side of the dam, potentially destabilizing the structure. Segment M07.B upstream is storing a large volume of gravel and sand as a result of this impoundment, which is exacerbating flooding upstream and erosion downstream.	Explore potential for removal of dam and stabilization of banks. A man-made grade control such as a boulder weir may be required to prevent downcutting through the deep channel deposits and to retain dry hydrant access for WWVFD. A series of boulder weirs may be needed to maintain aquatic organism passage. The dry hydrant location, depth, and configuration could be enhanced to ensure its function for the WWVFD even after the dam is removed.	Medium	High	Restore a more natural sediment transport regime, remove potentially unnecessary dam, reduce bank erosion, improve fish passage.	Moderate to High	Private landowner; Town of West Windsor; USFWS; VTANR ERP
WW 4 Harrington Road Segment M07.B 43.46286 N 72.47846 W	Active Restoration Dam Removal	A historic mill dam is located on top of a large ledge grade control. The dam is partially breached but it represents a moderate debris catchment risk during high flows.	Remove the remaining concrete dam structure. There is no risk of channel incision or headcutting due to underlying bedrock.	Medium	Low	Reduce risk of debris catchment and flooding of adjacent properties during large floods.	Low	Private landowner; USFWS; VTANR ERP

Table 5.4: Site-Level Project Identification for the Mill Brook Watershed in the Town of West Windsor, Vermont.

Project #, Location, Reach, Lat/Long	Type of Project	Site Description Including Stressors and Constraints	Project or Strategy Description	Hazard Mitigation Priority	Ecological Benefits Priority	Project Benefits	Costs	Potential Partners & Funding
WW 5 Bible Hill Road Reach/Segment M07.B 43.46132 N 72.49069 W	Active Restoration Bridge Replacement	The covered bridge was washed off of the abutments during TS Irene and deposited on the floodplain approximately 350ft downstream. A new bridge was constructed and the abutments create a significant constriction (63% of bankfull channel width).	Reconfigure abutments to increase bankfull width, bridge will likely need to be replaced. New structure/configuration would improve sediment transport and floodwater conveyance through the reach. Structure could possibly be moved to another crossing.	High	Low	Remove a significant constriction that increased localized flooding during TS Irene.	High	Town of West Windsor; VTrans
WW 6 Yale Heights Road Segment M09.B 43.45179 N 72.49925 W	Active Restoration Bridge Replacement	The bridge is relatively new. Compared to the channelized and narrow bankfull widths observed near the structure it is not severely undersized. However, the bridge is a significant constriction based on reference width (62% of bankfull channel width).	In the long-term the bridge should be replaced with a larger structure when it comes up for replacement. The crossing could become a more important constriction if the surrounding segment is protected or conserved and begins to widen and re-develop planform.	Low	Low	Remove a significant constriction that increased localized flooding during TS Irene. Replacing this structure could be an important piece to restoring this large floodplain following the implementation of other projects.	High	Town of West Windsor; VTrans
WW 7 Churchill Road Reach M10 43.45515 N 72.51635 W	Active Restoration Bridge Replacement	This bridge is located at a transition to a narrow and channelized stretch of the brook downstream. The bridge is a significant constriction based on reference width (71% of bankfull channel width). Major overbank flooding occurred through this area during TS Irene and the undersized crossing increased the degree of localized flooding. A house adjacent to the bridge appears to have been flooded.	Replace with a larger structure that will improve sediment transport through the reach. The crossing could become a more important constriction if the surrounding segment is protected or conserved and begins to widen and re-develop planform.	Medium	Low	Remove a significant constriction that increased area flooding during TS Irene.	High	Town of West Windsor; VTrans

Table 5.4: Site-Level Project Identification for the Mill Brook Watershed in the Town of West Windsor, Vermont.

Project #, Location, Reach, Lat/Long	Type of Project	Site Description Including Stressors and Constraints	Project or Strategy Description	Hazard Mitigation Priority	Ecological Benefits Priority	Project Benefits	Costs	Potential Partners & Funding
WW 8 House off of Route 44 Reach M11 43.46041 N 72.52081 W	Passive Restoration House Buyout	A house on the left floodplain is highly vulnerable to flooding.	Explore buyout of property through Town; remove house; plant native woody vegetation along floodplain.	Medium	Low	Improved public safety; lower risk of damage to house and debris entering the river.	High	Town of West Windsor; FEMA
WW 9 Route 44 Reach M11 43.46188 N 72.52068 W	Active Restoration Gully Stabilization	A small gully has formed along the west side of Route 44 where concentrated runoff is cutting through the road embankment. Moderate risk of undermining the road and a significant sediment source. The site was marked and may be scheduled for repair by VTrans.	Stabilize gully and armor road embankment to decrease risk of road undermining.	Medium	Low	Reduce risk of road undermining, reduce sediment inputs to channel.	Low to Moderate	VTrans
WW 10 Route 44 Reach M11 43.46547 N 72.52387 W	Active Restoration Utility Repairs	The channel avulsed through the left floodplain and now flows along the Route 44 embankment. A utility pole is in the channel and is likely only functional due to a very large tree that is caught on the pole deflecting flow back towards the center of the channel.	Move utility pole and assess road embankment stability.	Medium	Low	Reduce risk of utility line damage and loss of residential service.	Moderate	Green Mountain Power; VTrans

Table 5.4: Site-Level Project Identification for the Mill Brook Watershed in the Town of West Windsor, Vermont.

Project #, Location, Reach, Lat/Long	Type of Project	Site Description Including Stressors and Constraints	Project or Strategy Description	Hazard Mitigation Priority	Ecological Benefits Priority	Project Benefits	Costs	Potential Partners & Funding
WW 11 Talc Mine Access Road Segment M12.A 43.46662 N 72.52683 W	Active Restoration Bridge Replacement/ Removal	An access road bridge for the talc mine is a major channel constriction (56% of bankfull width) and caused significant upstream flooding during TS Irene. The bridge is located at the top of a bedrock gorge and the concrete abutment along the right bank reduces bankfull capacity. It is likely that the bridge plugged with debris during TS Irene leading to flood depths of at least 10ft upstream.	Remove bridge if it is no longer in use or replace with a wider structure.	Medium	Low	Remove a significant constriction that increased localized flooding during TS Irene.	Moderate to High	Private landowner
WW 12 Brownsville Cemetery Reach T1.01 43.47135 N 72.47042 W	Passive Restoration Corridor Protection	Area of accessible and undeveloped floodplain for most of the reach upstream of the Town Hall and school. Buffers are well vegetated.	Protect corridor from future development.	Medium	Medium	Protect accessible floodplain areas that provide valuable sediment, debris, and floodwater attenuation.	Low to Moderate	VTANR ERP; Private landowners
WW 13 Coon Club Road Segment T1.02.A 43.483 N 72.47449 W	Active Restoration Culvert Replacement/ Retrofit	The corrugated squashed culvert under Coon Club Road is a significant channel constriction (57% of bankfull channel width) and is perched, creating a moderate fish passage barrier.	Replace culvert with a larger structure to improve sediment and floodwater capacity, and/or improve AOP through the installation of a tailwater control downstream of the structure.	Medium	Medium	Remove a significant constriction to improve sediment and floodwater conveyance, and/or increase downstream water surface elevation to remove a barrier to aquatic organism passage	Moderate to High	VTrans; Town of West Windsor; VTANR ERP
WW 14a-d Willow Brook Multiple Areas Segments T1.02.A, T1.02. B, and T1.01S4.01.B	Passive Restoration Buffer Planting and Cattle Exclusion	Several small areas of accessible floodplain with reduced woody buffer vegetation. Project 14-b is a small pasture area that runs along the left bank with no woody vegetation and moderate to severe erosion for approximately 300ft.	Plant buffer with native woody vegetation and move electric fence line back from top of bank.	Low	Medium	Reduce sediment and nutrient inputs to channel, increase shading and woody debris inputs.	Low	Private landowner; ONRCD Trees for Streams

Table 5.4: Site-Level Project Identification for the Mill Brook Watershed in the Town of West Windsor, Vermont.

Project #, Location, Reach, Lat/Long	Type of Project	Site Description Including Stressors and Constraints	Project or Strategy Description	Hazard Mitigation Priority	Ecological Benefits Priority	Project Benefits	Costs	Potential Partners & Funding
WW 15 Brownsville- Hartland Road Segment T1.02.A 43.4918 N 72.47568 W	Active Restoration Culvert Replacement/ Retrofit	The corrugated squashed culvert under Brownsville-Hartland Road is a significant channel constriction (55% of bankfull channel width) and is a moderate fish passage barrier.	Replace culvert with a larger structure to improve sediment and floodwater capacity, and/or improve AOP through the installation of a tailwater control downstream of the structure.	Medium	Medium	Remove a significant constriction to improve sediment and floodwater conveyance, and/or increase downstream water surface elevation to remove a barrier to aquatic organism passage	Moderate to High	VTrans; Town of West Windsor; VTANR ERP
WW 16 Sheddsville Road Segment T1.01.S4.01.A 43.48213 N 72.47706 W	Active Restoration Bank Stabilization	Road embankment armoring is undersized and constricts the channel. Channel and roadway are vulnerable to erosion.	Replace with larger rip-rap and possibly increase channel width using a placed rip-rap wall installation. Consider willow joint plantings to strengthen bank and provide shading.	High	Low	Reduce risk of channel and roadway erosion. Mitigate long term erosion on opposite bank (private land).	Medium to High	Town of West Windsor; FEMA
WW 17 Horse Pasture Segment T1.01.S4.01.B 43.48155 N 72.48219 W	Passive Restoration Buffer Planting	A large horse pasture along the left bank has reduced buffer vegetation for much of the segment.	Plant buffer with native woody vegetation.	Low	Moderate	Increase shading and woody debris inputs to channel.	Low	VTANR ERP; ONRCD Trees for Streams; Private landowner
WW 18 Private Driveway Segment T1.01.S4.01.B 43.48105 N 72.48512 W	Active Restoration Culvert Replacement	A culvert under a private driveway is a major constriction (29% of bankfull channel width) and aggravated localized flooding during TS Irene.	Replace culvert with larger structure or add an additional culvert to increase capacity.	Medium	Low	Remove a significant constriction to improve sediment, debris, and floodwater conveyance.	Moderate	Private landowner
WW 19 Sheddsville Road Segment T1.01.S4.01.C 43.48459 N 72.4897 W	Active Restoration Bank Stabilization	Road embankment armoring is undersized and constricts the channel. Channel and roadway are vulnerable to erosion.	Replace with larger rip-rap and possibly increase channel width using a placed rip-rap wall installation. Consider willow joint plantings to strengthen bank and provide shading.	High	Low	Reduce risk of channel and roadway erosion.	Moderate	Town of West Windsor; FEMA

Table 5.4: Site-Level Project Identification for the Mill Brook Watershed in the Town of West Windsor, Vermont.

Project #, Location, Reach, Lat/Long	Type of Project	Site Description Including Stressors and Constraints	Project or Strategy Description	Hazard Mitigation Priority	Ecological Benefits Priority	Project Benefits	Costs	Potential Partners & Funding
WW 20 Route 44 at Churchill Road Segment T2.01.A 43.45549 N 72.51501 W	Active Restoration Bridge Replacement	The bridge is a significant constriction based on reference width (55% of bankfull width), however the straightened channel is consistently narrower than reference width. The bridge is in poor condition and may be up for replacement soon.	Replace with a larger structure that will improve sediment and debris transport through the reach. The crossing could become a more important constriction if the surrounding segment is protected or conserved and begins to widen and re-develop planform.	Medium	Low	Remove a significant constriction and improve sediment, debris, and floodwater conveyance.	High	Town of West Windsor; VTrans
WW 21 Route 44 at Churchill Road Segment T2.01.A 43.4557 N 72.51549 W	Active Restoration Bank Stabilization	Channel is pushing in to the right bank and eroding the Route 44 embankment. Some historic armoring is present, however this is not sufficiently protecting the road.	Replace existing armor with a slope of larger placed angular rip-rap.	Medium	Low	Protect Route 44 from erosion damage.	Moderate	VTrans
WW 22a-h Willow Brook Multiple Areas Reach/Segment T2.01.A, T2.01.B, T2.02, T2.03.A, T2.03.B, T2.04, T2.05.B	Passive Restoration Corridor Protection and Buffer Planting	Several areas of accessible floodplain that provide valuable sediment and floodwater attenuation. Most sites have reduced woody buffer vegetation.	Protect corridor from future development and plant buffer with native woody vegetation.	Medium	Medium	Protect floodplain area from future development and increase shading and woody debris inputs to channel. Provide minor to moderate flood water and sediment/debris storage.	Low to Moderate	VTANR ERP; Private landowners; ONRCD Trees for Streams
WW 23 Rush Meadow Road Reach T2.02 43.46572 N 72.51375 W	Active Restoration Utility Repairs	A utility pole on the left floodplain is vulnerable to floodwaters and debris.	Move utility pole.	Medium	Low	Reduce risk of utility line damage and loss of residential service.	Moderate	Green Mountain Power
WW 24 Private Driveway Reach T2.02 43.46607 N 72.51335 W	Active Restoration Culvert Replacement	A culvert under a private driveway is a major constriction (41% of bankfull width) and a barrier to AOP.	Replace culvert with larger structure or add an additional culvert to increase capacity. Remove AOP barrier by lowering culvert invert or by adding a tailwater control structure.	Medium	Medium	Remove a significant constriction to improve sediment, debris, and floodwater conveyance and increase AOP.	Moderate	Private landowner

Table 5.4: Site-Level Project Identification for the Mill Brook Watershed in the Town of West Windsor, Vermont.

Project #, Location, Reach, Lat/Long	Type of Project	Site Description Including Stressors and Constraints	Project or Strategy Description	Hazard Mitigation Priority	Ecological Benefits Priority	Project Benefits	Costs	Potential Partners & Funding
WW 25 Private Driveway Segment T2.03.B 43.48062 N 72.51636 W	Active Restoration Bridge Replacement	The bridge is a major constriction based on curve width (44% of bankfull width), leading to bank erosion. The bridge is in poor condition and the abutments are failing.	Replace with a larger structure that is geomorphically compatible with the channel.	High	Low	Remove a significant constriction and improve sediment, debris, and floodwater conveyance.	High	Private landowner
WW 26 Rush Meadow Rd Segment T2.03.B 43.48689 N 72.51912 W	Active Restoration Culvert Replacement	A culvert under Rush Meadow Road is a major bankfull constriction (33% of bankfull width) and increased upstream flooding during TS Irene due to insufficient capacity. Minor AOP impacts due to outlet drop.	Replace culvert with larger structure. If culvert will not be replaced in near future, address AOP barrier by lowering culvert invert or by adding a tailwater control structure.	Medium	Medium	Remove a significant constriction to improve sediment, debris, and floodwater conveyance and increase AOP.	Moderate	Town of West Windsor; VTrans; VTANR ERP
WW 27 Rush Meadow Rd Reach T2.04 43.48889 N 72.51808 W	Passive Restoration Conservation	This section of reach is very active and has access to a nice forested floodplain on one or both banks. The reach is storing a large volume of sediment and developing planform.	Protect stream corridor from future development and protect with River Corridor Easement.	Low	Low	Downstream benefits through the maintenance of water and sediment attenuation in this riparian floodplain area.	Low to Moderate	VLT; Private landowner
WW 28 Rush Meadow Rd Reach T2.04 43.48958 N 72.51821 W	Active Restoration Bank Stabilization	A 20ft tall mass failure along the right bank is close to Rush Meadow Rd and may soon threaten the road. The VHD centerline is not accurate through this section.	Analyze the stability of the bank and the vegetation along the road edge. Protect the slope toe from further erosion and install log structures to deflect thalweg away from the bank.	High	Medium	Protect the road from erosion and reduce sediment inputs to the channel.	Moderate to High	Town of West Windsor; VTrans
WW 29 Rush Meadow Rd Reach T2.04 43.49301 N 72.51735 W	Active Restoration Bank Stabilization	A 25ft tall mass failure along the right bank is threatening a house. Recently fallen trees indicate the slope failure is active and progressing towards the house. Some armoring was observed.	Stabilize the slope toe and install a deflection structure to push thalweg away from the slope.	Medium	Medium	Protect house from erosion along the valley wall.	Moderate to High	Private landowner; FEMA

5.2.3 Town of Reading Site-level Project Opportunities

Table 5.5: Site-Level Project Identification for the Mill Brook Watershed in the Town of Reading, Vermont.

Project #, Location, Reach, Lat/Long	Type of Project	Site Description Including Stressors and Constraints	Project or Strategy Description	Hazard Mitigation Priority	Ecological Benefits Priority	Project Benefits	Costs	Potential Partners & Funding
RE 1a-j Mill Brook Many Areas Reach/Segment M12.B, M13, M14.A, M14.B, M14.C, M15.A, M15.B, M16.B	Passive Restoration Corridor Protection and Buffer Planting	Several areas of accessible floodplain that provide valuable sediment and floodwater attenuation. Most sites have reduced woody buffer vegetation.	Protect corridor from future development and plant buffer with native woody vegetation.	Medium	Medium	Protect floodplain area from future development and increase shading and woody debris inputs to channel. Provide minor to moderate flood water and sediment/debris storage.	Low to Moderate	VTANR ERP; Private landowners; VLT; ONRCD Trees for Streams
RE 2 Route 106 Reach M13 43.48012 N 72.54946 W	Active Restoration Gully Stabilization	A medium sized gully has formed along a footpath from a parking area to a former swimming area. The gully is contributing a significant volume of sediment to the brook. The swimming area was completely filled in during TS Irene.	Stabilize the gully and plant the eroding slope and a portion of the parking area.	Low	Medium	Reduce sediment inputs from the gully and parking area, stabilize eroding bank.	Low to Moderate	VTANR ERP; Private Landowner
RE 3 Agony Hill Rd Segment M14.A 43.4859 N 72.55463 W	Active Restoration Arch Replacement	The Agony Hill Road arch is undersized based on reference width (70% of bankfull width) and is well undersized for the highly active and aggradational segment (current channel width is 65ft. The arch partially plugged during TS Irene, exacerbating major overbank flooding, impacting multiple properties.	Replace with a larger structure to better accommodate the large volume of sediments working through the reach. A secondary flow path over the road to the east should be stabilized to reduce erosion in future storms.	High	Low	Reduce flooding with a properly sized structure; improved sediment and debris transport through the segment.	High	Town of Reading; VTrans

Table 5.5: Site-Level Project Identification for the Mill Brook Watershed in the Town of Reading, Vermont.

Project #, Location, Reach, Lat/Long	Type of Project	Site Description Including Stressors and Constraints	Project or Strategy Description	Hazard Mitigation Priority	Ecological Benefits Priority	Project Benefits	Costs	Potential Partners & Funding
RE 4 Floodplain near Route 106 Segment M14.A 43.48779 N 72.55522 W	Passive Restoration Conservation	A small forested floodplain along the right bank is very accessible to the brook and is storing large volumes of fine sediment. This is most accessible floodplain observed along Mill Brook.	Prevent stream corridor from future development and/or logging. Protect with River Corridor Easement.	Medium	Low	Downstream benefits through the maintenance of water and sediment attenuation in this riparian area.	Low	Private landowner; VLT; VRC; VTANR ERP; Town of Reading
RE 5 Baileys Mills Road at Route 106 Segment M14.B 43.4903 N 72.55552 W	Passive Restoration Farmer Outreach; Nutrient Management	A small dairy farm is located on the left bank including a cattle barn on the floodplain.	Meet with farmer and possibly NRCS to discuss agricultural BMP options.	Low	Medium	Potentially reduce a major nutrient source to the channel	Low	NRCS; Private landowner
RE 6 Baileys Mills Road Segment M14.B 43.49252 N 72.55863 W	Active Restoration House Buyout and Removal	House is abandoned and falling into the channel.	Explore property buyout and remove house and all debris from the valley wall.	Medium	Low	Remove debris which could enter stream in future floods.	Moderate	Town of Reading; Private landowner; FEMA
RE 7 Snowmobile Trail Segment M14.C 43.49737 N 72.55962 W	Active Restoration Remove Bridge Abutments	A snowmobile trail bridge was washed out during T.S. Irene. Some of the abutments and the trail bed remain and represent a moderate constriction. Some additional deposition was observed upstream and scour downstream, indicating that this constriction is affecting sediment transport through the segment.	Remove concrete abutment blocks to increase bankfull width to 35 to 40ft.	Low	Low	Remove channel constriction and improve sediment transport through segment.	Low to Moderate	Private Landowner, VAST

Table 5.5: Site-Level Project Identification for the Mill Brook Watershed in the Town of Reading, Vermont.

Project #, Location, Reach, Lat/Long	Type of Project	Site Description Including Stressors and Constraints	Project or Strategy Description	Hazard Mitigation Priority	Ecological Benefits Priority	Project Benefits	Costs	Potential Partners & Funding
RE 8 Farm Access Road Segment M15.B 43.50529 N 72.5654 W	Active Restoration Culvert Replacement	A pair of culverts under a farm access road are a major constriction (21% of bankfull width). This constriction is leading to upstream deposition and downstream scour, and the road was partially washed out during a moderate storm event in 2014.	Replace culverts with a larger structure.	Medium	Medium	Improve sediment and floodwater conveyance and reduce sediment inputs to channel.	Moderate	Private landowner; NRCS
RE 9 Field Edge Segment M15.B 43.50546 N 72.56568 W	Active Restoration Bank Stabilization and Swale Planting	Concentrated runoff from the field is causing moderate erosion of the stream bank.	Stabilize the eroding bank and plant the swale with native woody vegetation.	Low	Medium	Reduce sediment and nutrient inputs to the channel, increase shading.	Low to Moderate	NRCS; ONRCD Trees for Streams; Private landowner
RE 10 Logging Road Segment M16.A 43.51404 N 72.56923 W	Active Restoration Floodplain Management	A recently constructed logging road runs up the steep right valley wall and is a major sediment source to the channel.	Stabilize, seed, and mulch the logging road; install water bars and stabilize any erosion rills.	Low	Medium	Reduce sediment inputs to the channel.	Low to Moderate	Private landowner; NRCS
RE 11 Segment M16.A 43.51703 N 72.56987 W	Passive Restoration Conservation	Approximately 2,000ft of channel flows through a healthy forested valley with floodplain access throughout. A large volume of sediment is retained within this section. Excellent fish habitat was observed.	Prevent stream corridor from future development and/or logging. Protect with River Corridor Easement or other landowner agreement.	Medium	Medium	Downstream benefits through the maintenance of water and sediment attenuation in this riparian area.	Low	Private landowner; VLT; VRC; VTANR ERP
RE 12 Route 106 Reach T3.01 43.48581 N 72.55326 W	Active Restoration Bank Stabilization	Approximately 120ft of armoring along the right bank is comprised of small rip-rap with insufficient protection of Route 106.	Remove small rip-rap and replace with larger material. Utilize a placed rip-rap wall approach as necessary to reduce channel encroachment.	Medium	Low	Protect Route 106 from erosion.	Moderate	VTrans

Table 5.5: Site-Level Project Identification for the Mill Brook Watershed in the Town of Reading, Vermont.

Project #, Location, Reach, Lat/Long	Type of Project	Site Description Including Stressors and Constraints	Project or Strategy Description	Hazard Mitigation Priority	Ecological Benefits Priority	Project Benefits	Costs	Potential Partners & Funding
RE 13 Talc Mine Ponds Segment T3.02.A 43.49156 N 72.55322 W	Active Restoration Bank Stabilization	A 40ft long 15ft high mass failure on the left bank is eroding into the embankment for a large storage pond. Recent communication with Imerys Talc VT Inc. indicate that they are aware of the problem and have a geotechnical design plan in progress.	Maintain contact with Imerys to track project progress.	Medium	Low	Stabilize bank before the pond embankment is breached and downstream properties are damaged.	Moderate to High	Imerys Talc VT Inc.
RE 14a-c Willow Brook Multiple Areas Reach/Segment T3.02.B, T3.03	Passive Restoration Corridor Protection and Buffer Planting	A long stretch of channel from upstream of the talc mine ponds to the second Whitmore Circle crossing contains large areas of wet meadow floodplain. Several active beaver dams were observed, however many other dams were recently removed. The left floodplain along the Reading Farm property lacks a sufficient woody buffer.	Protect corridor from future development and plant buffer with native woody vegetation where needed.	Medium	Medium	Protect floodplain area from future development and increase shading and woody debris inputs to channel. Provide minor to moderate flood water and sediment/debris storage.	Low to Moderate	Private landowners; VLT; VTANR ERP; ONRCD Trees for Streams
RE 15 Whitmore Circle Reach T3.03 43.50536 N 72.55407 W	Active Restoration Culvert Replacement	The culvert under Whitmore Circle is a major constriction (25% of bankfull width). This constriction is leading to upstream deposition and downstream scour, and likely exacerbates flooding impacts	Replace culvert with a larger structure designed to be geomorphically compatible with the stream dimensions.	Medium	Medium	Improve sediment and floodwater conveyance and reduce sediment inputs to channel.	Moderate	Town of Reading; VTrans

Table 5.5: Site-Level Project Identification for the Mill Brook Watershed in the Town of Reading, Vermont.

Project #, Location, Reach, Lat/Long	Type of Project	Site Description Including Stressors and Constraints	Project or Strategy Description	Hazard Mitigation Priority	Ecological Benefits Priority	Project Benefits	Costs	Potential Partners & Funding
RE 16 Route 106 Reach T3.04 43.51063 N 72.55047 W	Active Restoration Embankment Stabilization	A small rill has formed along the south side of Route 106 where concentrated runoff is cutting through the road embankment and the edge of the pavement. Moderate risk of undermining the road and a significant sediment source. The site was marked in the field and may be scheduled for repair.	Stabilize and armor embankment to decrease risk of road undermining.	Medium	Low	Reduce risk of road undermining, reduce sediment inputs to channel.	Low to Moderate	VTrans
RE 17 Route 106 Reach T3.04 43.51075 N 72.55028 W	Active Restoration Arch Replacement	The steel arch under Route 106 is at a sharp angle to the channel and is undersized. If the structure plugged or flow capacity was exceeded, flood waters would severely damage Route 106.	Replace with a better aligned and larger capacity structure, construct wingwalls to reduce the risk of avulsion.	High	Low	Protect Route 106 from major flood damage.	High	VTrans
RE 18 Route 106 Reach T3.04 43.51304 N 72.54853 W	Active Restoration Bank Stabilization	A mass failure along the right bank may eventually threaten Route 106. The failing bank appears to be due to a combination of road runoff and toe erosion.	Stabilize the failing slope and address runoff issues to protect Route 106.	Low	Low	Protect Route 106 from bank failure.	High	VTrans
RE 19 Smith Property Segment T4.01.A 43.50156 N 72.56422 W	Active Restoration Bank Stabilization	Two areas of tall bank erosion totaling 250ft of length are cutting into the Smith property and threatening the driveway and a utility pole. The channel is overwidened and depositing large volumes of sediment.	Install a rock armor slope keyed in to the channel bed, grade the upper slope and plant with willows. Project is under way with survey and preliminary design completed by FEA.	Medium	Low	Protect property from further erosion, reduce sediment inputs to channel.	Moderate	Private landowner

Table 5.5: Site-Level Project Identification for the Mill Brook Watershed in the Town of Reading, Vermont.

Project #, Location, Reach, Lat/Long	Type of Project	Site Description Including Stressors and Constraints	Project or Strategy Description	Hazard Mitigation Priority	Ecological Benefits Priority	Project Benefits	Costs	Potential Partners & Funding
RE 20 Baileys Mills Road Segment T4.01.A 43.50219 N 72.56551 W	Active Restoration Arch Replacement or Retrofit and/or Road Realignment to Accommodate Alluvial Fan Flooding	The existing arch is installed on a bedrock grade control and represents a moderate constriction (69%) based on reference width. However the current channel width in the segment varies from 40 to 50ft. The channel is situated on an alluvial fan and has a massive upstream sediment load. The arch led to increased flooding and sediment deposition during TS Irene.	Complete an alternatives analysis to evaluate options for alluvial fan management. Options may include: 1. Replace arch with a larger structure to maximize capacity over the bedrock grade control; 2. Road or intersection realignment to southwest to allow flood flows to funnel back into the channel rather than along Baileys Mills Road. Local flood hydraulics and sediment transport will need to be analyzed carefully to ensure that risks to downstream property are not increased.	High	Low	Increase sediment and floodwater conveyance; Reduce a constriction that caused increased flooding during TS Irene; Reduce risk of major road damage in next large flood.	Very High	Town of Reading; VTrans; FEMA
RE 21 Rolling Meadows Farm Segment T4.01.A 43.50279 N 72.56691 W	Active Restoration Channel and Floodplain Restoration	Approximately 900ft of channel and floodplain upstream of the Baileys Mills Arch was completely buried in flood sediments during TS Irene. The channel is actively carving and braiding through these deposits. Many of the trees within the pine/hemlock floodplain forest along Town Hill Road are dead due to girdling from flood sediments.	Alternatives analysis to reconstruct a channel with sufficient width to accommodate the ongoing sediment load, remove berms to reconnect floodplains, install floodplain benches for additional storage, and plant area with rigorous native vegetation. Dead trees could be cut and used for log structures within the reach to improve sediment/debris capture and improve habitat.	High	Medium	Increase sediment storage capacity, restore floodplain access, and reduce risk of catastrophic damage during the next large flood.	High	VTANR ERP; Town of Reading; Private landowners; FEMA

Table 5.5: Site-Level Project Identification for the Mill Brook Watershed in the Town of Reading, Vermont.

Project #, Location, Reach, Lat/Long	Type of Project	Site Description Including Stressors and Constraints	Project or Strategy Description	Hazard Mitigation Priority	Ecological Benefits Priority	Project Benefits	Costs	Potential Partners & Funding
RE 22 Baileys Mills Bed and Breakfast Property Segment T4.01.B 43.50483 N 72.5722 W	Passive Restoration Buffer Planting	A small pond along the left bank was destroyed during TS Irene when floodwaters eroded the embankment and the berm. This embankment was reconstructed, however it is loose fill material and has no woody vegetation. This area will likely erode into the channel in future floods.	Reshape pond embankment and plant vigorous native woody shrubs (willows) to stabilize the bank.	Medium	Low	Reduce sediment inputs to the stream; reduced risks of pond failure and damage to downstream properties and infrastructure.	Low to Moderate	Private landowner; ONRCD Trees for Streams
RE 23 Bailey Brook Segments T4.01.B - T4.02.B	Passive Restoration Conservation	The entire valley from the Baileys Mills B&B upstream to Brown Schoolhouse Road is incredibly active and unstable. Huge mass failures are generating massive volumes of sediment, much of which is being stored by numerous debris jams that fill the entire valley. Any debris clearing or logging/development activities could trigger additional mass failures. Several Green Mountain Horse Association (GMHA) trails are found within the valley.	Prevent stream corridor from future development, logging, debris clearing, and dredging. Protect with River Corridor Easement or other landowner agreement.	High	Medium	Downstream benefits through the maintenance of water and sediment attenuation in this highly active area.	Low to Moderate costs depending on conservation or easement approach and size of parcels.	VLT; Town of Reading; Private landowners; GMHA
RE 24 Kittridge Pasture Segment T4.01.C 43.50861 N 72.58101 W	Passive Restoration Buffer Planting	A 25ft tall mass failure on the left valley wall has cut back to the edge of a hayfield. The loss of all stabilizing woody vegetation indicates that this failure may rapid progress into the hayfield.	Plant a buffer of woody vegetation to stabilize the upper slope. Equipment access and overall reach condition make toe stabilization unfeasible.	Medium	Medium	Reduce sediment inputs to channel; reduce risk of further erosion and damage to hay field and downstream properties.	Low	Private landowner; ONRCD Trees for Streams

Table 5.5: Site-Level Project Identification for the Mill Brook Watershed in the Town of Reading, Vermont.

Project #, Location, Reach, Lat/Long	Type of Project	Site Description Including Stressors and Constraints	Project or Strategy Description	Hazard Mitigation Priority	Ecological Benefits Priority	Project Benefits	Costs	Potential Partners & Funding
RE 25 Kittridge Pasture Road Segment T4.01.C 43.51178 N 72.58391 W	Active Restoration Road Risk Assessment	An 80ft tall mass failure is close to threatening Kittridge Pasture Rd. It is not possible to stabilize the valley wall, therefore the road should be monitored and potentially moved to the east if necessary.	Monitor mass failure and move road if necessary.	Medium	Low	Reduce risk of losing road from mass failure progression.	Moderate to High	Town of Reading; FEMA; Private landowner

5.3 High Priority Project Summaries

We selected twelve of the "High" priority projects to explore in further detail. These projects were identified as having the highest hazard mitigation priority or the greatest ecological benefits. Summaries of each project by town are provided on the following pages. Each summary includes:

- A location map
- Site photograph(s)
- A description of the site location and river reach
- A brief technical summary of the stressors on channel stability and aquatic habitat
- A description of channel and floodplain restoration alternatives
- A list of potential technical partners and funding

The twelve projects selected for further description are:

1. Town of Windsor Projects

- *Project WI 1 - Relocate or retrofit sewer line from Windsor High School*
- *Project WI 2 - Conservation of forested floodplain known as the " Narrows"*
- *Project WI 9 - Conservation of highly active valley along upper portion of Brook Road*

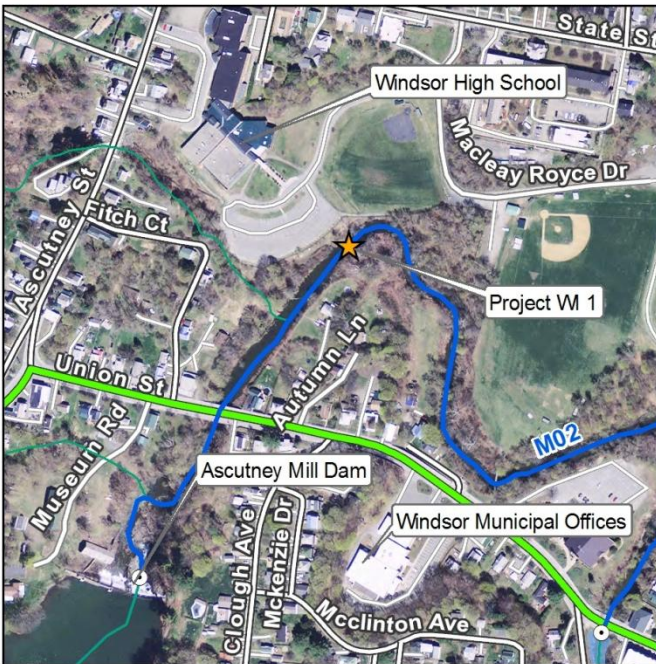
2. Town of West Windsor Projects

- *Project WW 1 - Alternatives analysis for large eroding bank along hayfield*
- *Project WW 2f and WW 2g - Buffer plantings and corridor protection through large hayfield*
- *Project WW 3 - Remove concrete block dam and stabilize banks and channel*
- *Project WW 5 - Replace Bible Hill Road bridge and abutments with a larger structure*
- *Project WW 16 - Replace/retrofit embankment armoring to protect Sheddsville Road*

3. Town of Reading Projects

- *Project RE 3 - Replace Agony Hill Road arch with a larger structure*
- *Project RE 17 - Replace Route 106 arch with a larger structure and improve alignment*
- *Project RE 20 - Replace Baileys Mills Road arch with a larger structure and design for over bank flooding*
- *Project RE 21 - Channel and floodplain restoration in alluvial fan area*
- *Project RE 23 - Conserve incredibly active valley from Baileys Mills B&B to Brown Schoolhouse Road*

Project WI 1 - Windsor High School Sewer Line



Reach M02 is bounded by the small dam near the American Precision Museum and by the large Ascutney Mill Dam creating Mill Pond. The reach flows through a densely developed residential and commercial area in downtown Windsor. As a result of historical straightening and bank armoring, the channel is incised and floodplain access is limited to the left bank along the Windsor High School athletic fields during large storm events. An active sewer line from the High School crosses Mill Brook approximately 650 feet downstream of the Union Street bridge. The sewer line is protected by a steel casing and is supported by three concrete piers, one of which is located in the center of the channel. The sewer line spans the channel at approximate bankfull elevation, and becomes fully submerged during large

events. This obstruction has caused the channel bed to scour, potentially undermining the center pier. The sewer line was not damaged during T.S. Irene, however this is likely only due to peak flow and woody debris attenuation in Mill Pond. Debris catchment on the sewer line could increase flood elevations and impact upstream houses. Damage to the sewer line in a future storm event would interrupt sewer service to the High School and cause major water quality impacts to Mill Brook and the Connecticut River.

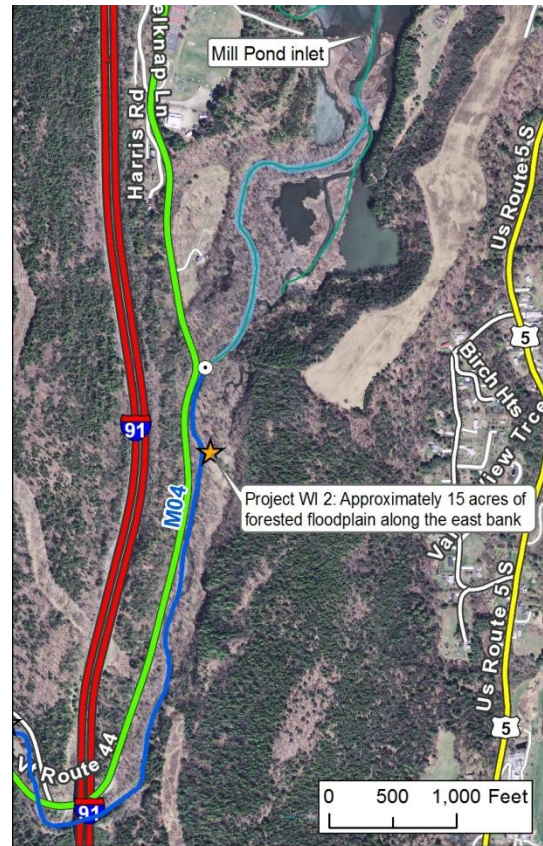
We recommend an alternatives analysis to assess options to re-route the sewer line or replace the existing structure to improve flood capacity and reduce the risk of debris jamming. We discussed this site with Mike Reynolds, an operator at the Windsor Sewer Plant, and they are aware of the issues and concerned about flooding risks. Potential project partners and funding sources for this project include the Town of Windsor and FEMA.



Project WI 2 - Floodplain Conservation along the "Narrows"

The confined valley running along Route 44 from the Mill Pond inlet to the Interstate 91 bridges is referred to as the "Narrows". This valley was described in a previous Phase 2 SGA study that assessed sediment sources to Mill Pond (SWCRPC, 2003). SWCRPC assessed the reach as highly impacted by road encroachment and armoring with some floodplain access along a partially abandoned hayfield. Based on our observations in 2014, the reach appears to be aggrading and developing a meandering planform. The hayfield along the right floodplain is fully abandoned and is filling in with shrubs and small trees. A narrow band of large trees lines most of the right bank and historic armoring along this bank is failing as the channel widens and builds a meander sequence. Large sand and gravel bars within the channel and thick sand/silt deposits on the floodplain indicate that this area is storing large volumes of T.S. Irene related sediments and reducing sedimentation of Mill Pond.

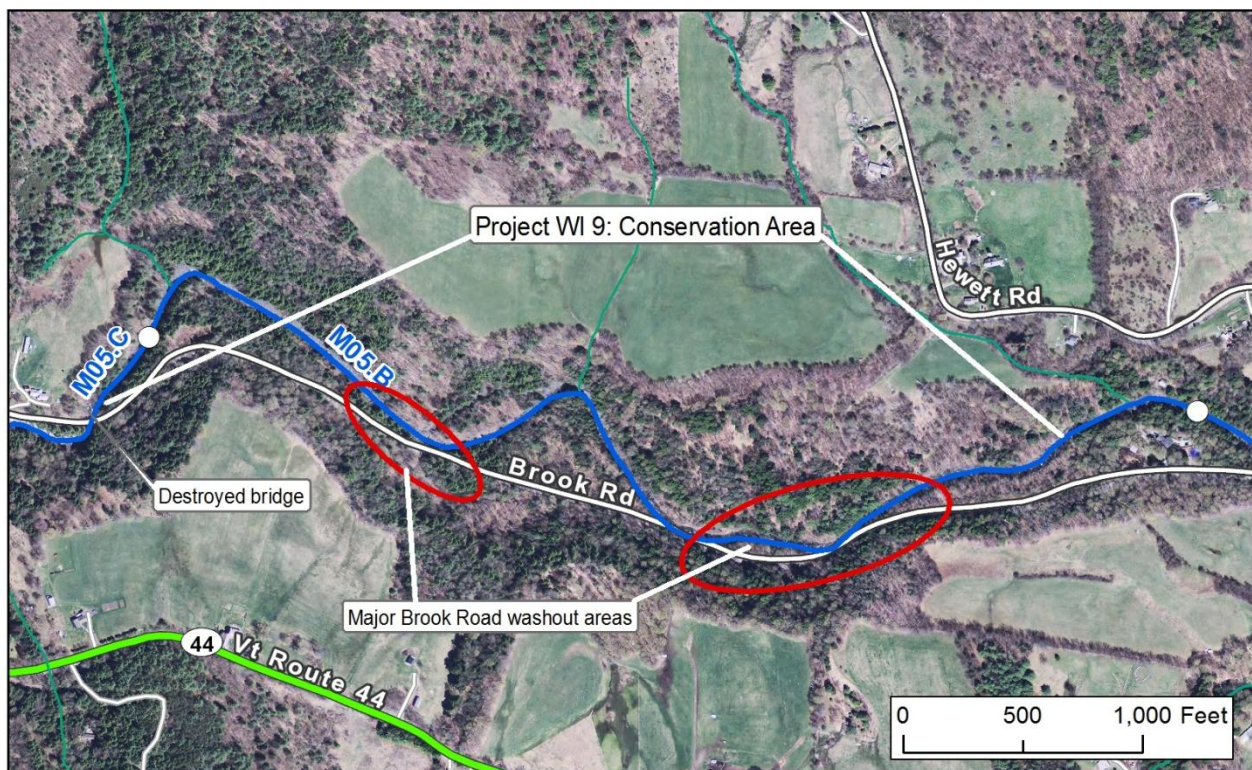
There are currently no improved structures or active agricultural practices within this floodplain area. We recommend long-term protection of this valuable floodplain through a conservation easement with VLT and/or through VTANR ERP. The landowner has not yet been identified or contacted.



Project WI 9 - Brook Road Conservation Area

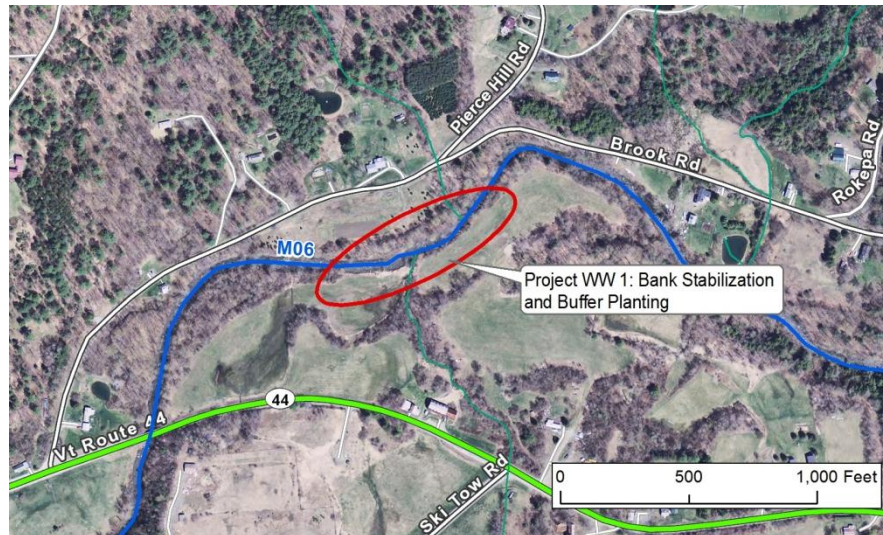
The river valley along most of Segment M05.B to the destroyed Brook Road bridge in M05.C is incredibly active and is generating and storing huge volumes of sediment and debris. Brook Road is completely washed out in several locations and is not feasible to repair. The channel severely widening during T.S. Irene, triggering large mass failures, most of which remain active. Following the flood, the channel is continuing to widen and aggrading gravel and sand as flood sediments work through the reach. Larger forested floodplain areas were only partially accessed during T.S. Irene, therefore most of the floodwater and sediment storage will continue to occur within the widened channel.

The washed out Brook Road bridge is the only improved structure within this area and the remaining portions of Brook Road along the right valley are slowly revegetating. We recommend long-term protection of this highly active valley through a conservation easement with VLT and/or through VTANR ERP. The landowners have not yet been identified or contacted.



Project WW 1 - Bank Erosion along Hayfield

A large bank erosion site is located in Reach M06 where the right bank is carving into a hayfield with minimal woody bank/buffer vegetation. This reach was likely straightened historically causing the channel to incise and limit floodplain access. Tropical Storm Irene triggered some widening and planform adjustment leading to bank erosion in areas with reduced stabilization from bank and buffer vegetation. Project WW 1 is a 750 foot long eroding bank that is typically 7 feet high.



Based on pre-Irene aerial imagery, the channel has migrated approximately 70 feet to the southeast over the last five years. This erosion will continue to contribute large volumes of sediment to the Brook, and may accelerate with ongoing planform adjustments. A utility pole is located near the middle of the project area and is currently 25 feet from the top of the eroding bank.

We recommend an alternatives analysis to determine the feasibility of re-grading and stabilizing the bank. A "do nothing" approach may be appropriate to allow the channel to develop a meander sequence and build an accessible floodplain area. Bank and buffer plantings should also be considered and could be paired with stabilization using rock or wood along the toe of the bank. The utility pole should be moved or monitored for stability. VTANR ERP, private landowner, VLT, and ONRCD Trees for Streams are all potential project partners.



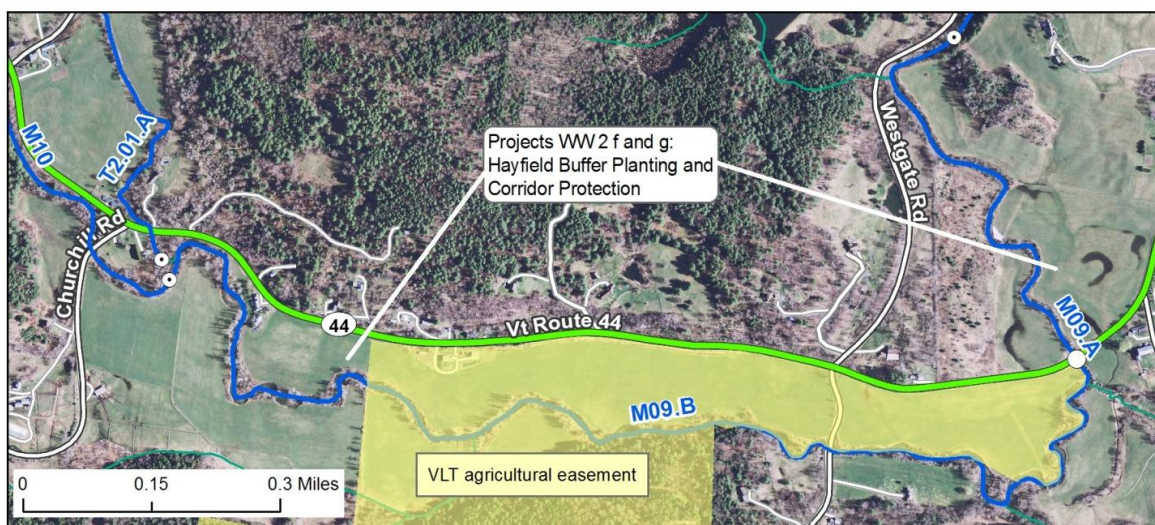
Projects WW 2f and WW 2g – Buffer Plantings and Corridor Protection in Reach M09

Mill Brook Reach M09 is found in a very broad valley along Route 44 in West Windsor. This long reach was segmented to highlight the differences between the river corridor characteristics upstream and downstream of the Route 44 crossing.



In the upper reach (Segment M09.B) there was a significant amount of coarse and fine sediment deposited during T.S. Irene, which led to channel widening and severe bank erosion. The segment was historically straightened but is now redeveloping meanders through the valley. Corridor protection in the upper segment is a high priority given the floodplain's capacity to absorb flood flow and sediment from unstable reaches of Mill Brook and Willow Brook upstream, thereby taking pressure off the villages and infrastructure downstream. There is a narrow strip of woody vegetation along most of M09.B, but given the tendency for the reach to continue widening and migrating, we recommend that targeted buffer plantings along the segment take into account the future meander belt width. The lower segment (M09.A) is deeply incised; only minimal areas of the adjacent floodplain were accessed during T.S. Irene. The meander scars in the valley suggest that the river used to occupy a much wider corridor. There is a narrow strip of woody vegetation (many invasives) along M09.A. The buffer could be substantially improved in targeted areas, taking into account

channel stability (existing erosion and armoring) along the river, with appropriate setbacks of larger planting stock in areas expected to migrate. Corridor protection in M09.A is a medium to high priority given the incised state of the channel, with potential for the floodplain to function better in the long term. A VLT agricultural easement covers the middle portion of the reach. VLT, VTANR, and the Vermont River Conservancy (VRC) are potential partners for river corridor easements.



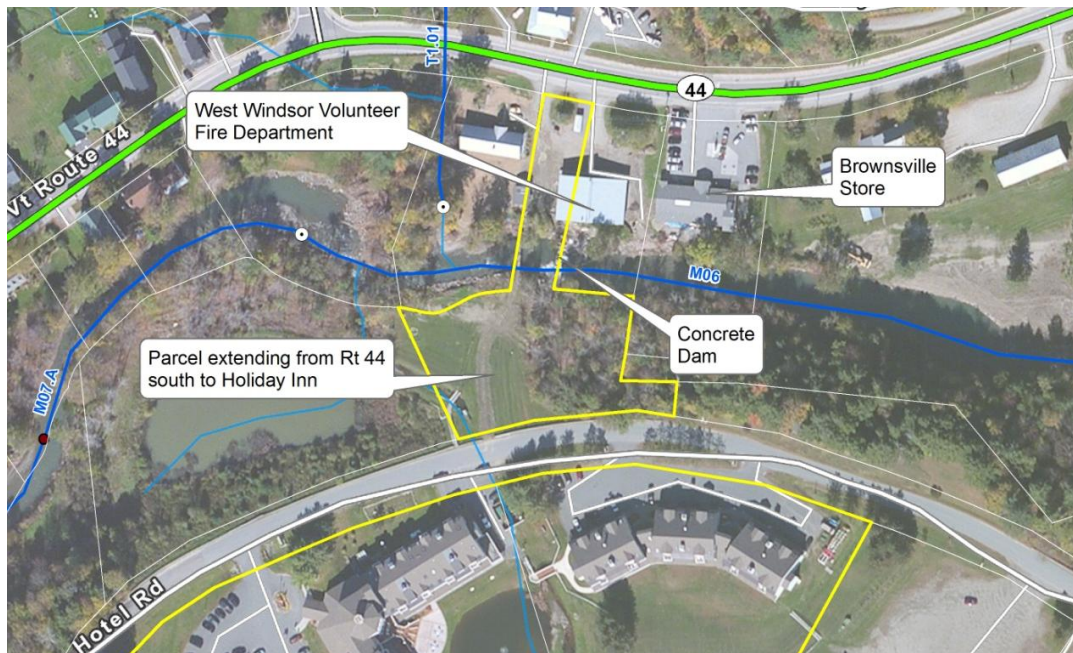
Project WW 3 – Brownsville Dam Removal or Retrofit

A former snowmaking withdrawal site for Ascutney Mountain Resort has a 6-foot tall concrete block dam. The West Windsor Fire Department currently maintains the structure as a water source for fighting fires in the village. The small impoundment behind the dam is completely filled in with sediment. The channel is eroding around the right (south) side of the dam, potentially destabilizing the structure. The dam is likely a barrier to upstream migration of fish and other aquatic organisms. The upstream river segment (M07.B) is storing a large volume of gravel and sand, which exacerbates flooding upstream and increases erosion downstream.



As a long-term solution to address the negative effects of the dam on the river and flooding/erosion, we recommend that the Town pursue dam removal or retrofit, while developing an alternative water withdrawal configuration to address critical public safety concerns in the village with respect to fire fighting. Potential partners and funding include VTANR, USFWS, and other stakeholder groups in the Connecticut River watershed. Apart from the social and legal aspects of current dam ownership and liability, a pre-design feasibility assessment of structure removal/retrofit should include the following components:

- Detailed survey of channel upstream and downstream of dam to determine depth of sediment deposits and potential vertical adjustments in the bed following dam removal;
- Evaluation of bank stability and risk to adjacent properties upstream as there are homes and other infrastructure (i.e., septic systems) in close proximity to the channel;
- Evaluation of sediment management options and restoration plan to reform channel bedform features and potentially provide grade control to prevent channel downcutting.



Project WW 5 - Bible Hill Road Covered Bridge

The Bowers covered bridge on Bible Hill Road crosses Mill Brook at the upstream end of Segment M07.B. The original bridge was constructed in 1919 and was heavily damaged in T.S. Irene when the bridge was lifted off of the abutments and carried downstream to the Biebel property. The original abutments were a major channel constriction and caused increased flooding and debris jamming during T.S. Irene. The covered bridge was rebuilt and installed in 2012, however the new concrete abutments are also a major channel constriction at 36 feet. The predicted bankfull channel width and the measured bankfull width are 54 feet and 51 feet, respectively.

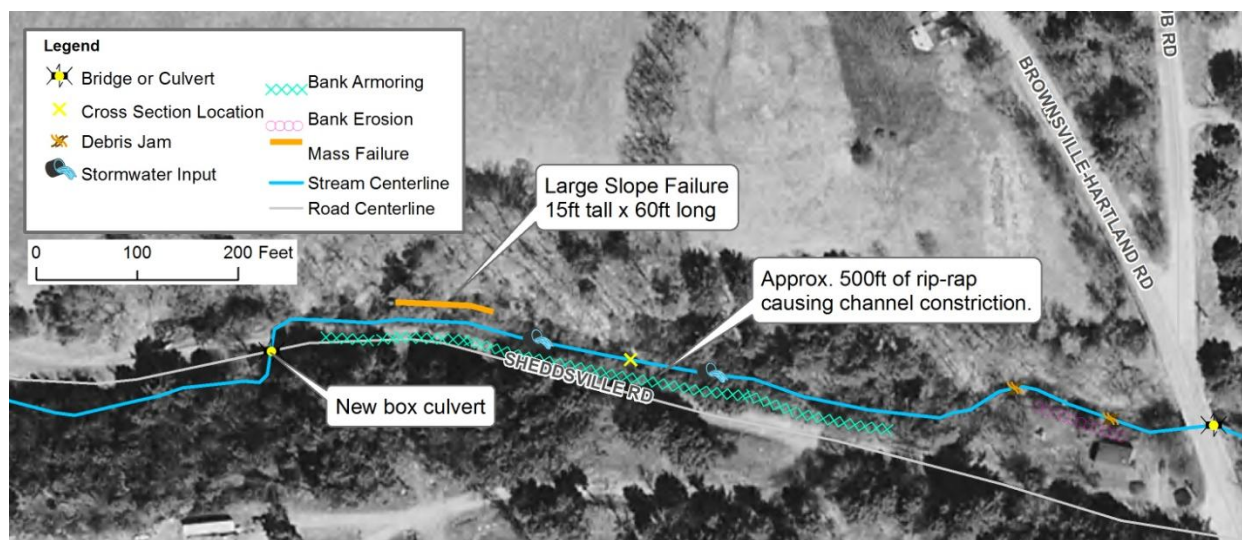


We recommend replacing the bridge with an appropriately sized structure to increase geomorphic compatibility and reduce flooding risk. The bounding reaches are incised and fairly stable so a structure designed to the bankfull channel width will be sufficient. The covered bridge could be relocated to a crossing where the span is appropriate. VTrans and the Town of West Windsor are potential partners for this project.



Project WW 16 – Sheddsville Road Bank Stabilization

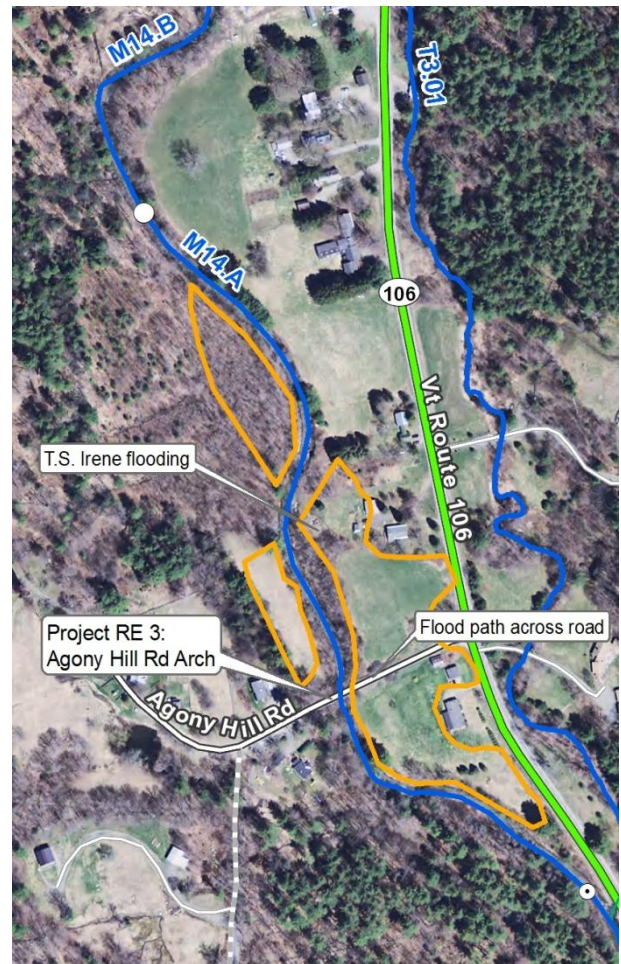
A small tributary to Beaver Brook flows parallel to Sheddsville Road in West Windsor (Segment T4.01S4.01-A). This tributary is known locally as Potash Brook. Sheddsville Road was severely damaged by erosion along the lower portion of this segment during T.S. Irene flooding in 2011. Approximately 500 feet of rip-rap armor was placed along the road embankment during flood recovery. Much of this armor is Type II stone, which would not resist the velocity of the stream (11 feet per second) we estimated for the 100-year flood using USGS Streamstats and the Manning's equation. In addition, the armor extends out into the bankfull channel beyond the pre-Irene bank; note the fill beyond the base of the trees in photo to the right. The channel constriction increases flood flow velocity, putting both the road embankment and the adjacent slope at risk of erosion. The adjacent slope is beginning to erode in several locations, with one large mass failure slope in the upper segment just downstream of the new box culvert (see photo to right). To ensure greater flood resiliency of the road embankment, and limit the risk of further bank erosion on the opposite bank, we recommend that the armor slope be rebuilt with a placed rip-rap wall per specifications in the Vermont Standard River Management Principles and Practices (Schiff *et al.*, 2014). The target bankfull width of 15 feet should be achieved to the greatest extent possible when the slopes are rebuilt. If this area has experienced repeat flood damage, it may be eligible for FEMA funding. The Town of West Windsor should coordinate with SWCRPC to determine other potential funding sources.



Project RE 3 - Agony Hill Road Arch

The steel arch under Agony Hill Road is a channel constriction (70% of bankfull width), poorly aligned, deformed, and filling in with sediment. The arch is located near the middle of segment M14.A which was likely historically straightened and incised. During T.S. Irene the channel widened dramatically and began to redevelop some meander bends. Overbank flooding deposited large volumes of sand and gravel over the forested right floodplain areas (orange areas in map to right) and buried three properties along the left bank. A low section of road bed along Agony Hill Rd served as a valuable flood relief area and likely reduced damage to the upstream properties. The channel remains highly active and continues to widen and adjust planform. Huge volumes of flood sediments are working through the segment, creating large bar features.

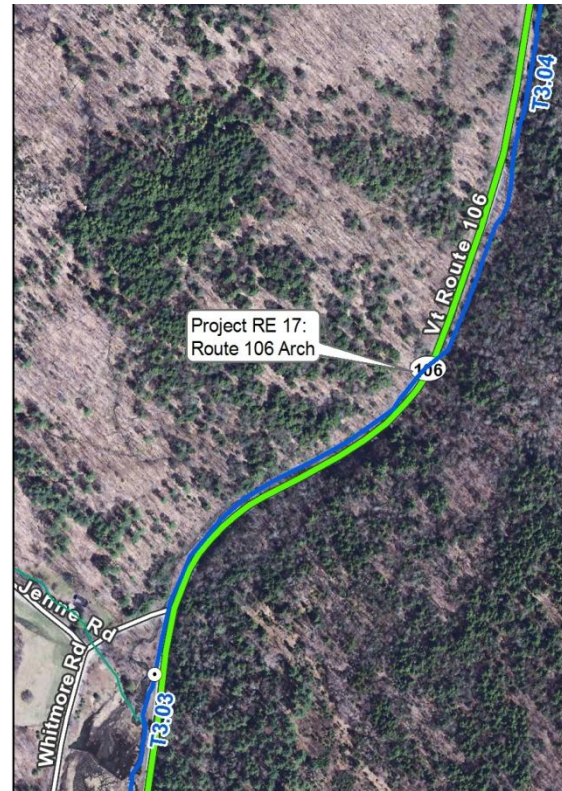
We recommend replacing the arch with a larger structure to better accommodate the large volumes of sediment working through the reach. A structure larger than the predicted bankfull channel width (36 feet) should be considered based on channel adjustment processes (Schiff *et al.*, 2014). The floodplain spillway over the road should be stabilized but not elevated. Additional projects to protect floodplain (RE 4) and stabilize and plant an eroding bank (RE 1d) should be considered for implementation before or during any structure replacement. VTrans and the Town of Reading are potential partners for this project.



Project RE 17 - Route 106 Arch

The steel arch where Route 106 crosses over Reading Hill Brook on Reach T3.04 is undersized (65% of bankfull width) and poorly aligned. The arch is located approximately 1,000 feet upstream of the northern Whitmore Circle intersection. The stream valley along Route 106 is confined and bedrock is present along much of the valley wall and channel bed. The road shares this confined valley resulting in extreme encroachment and a complete loss of floodplain storage.

The arch crosses under Route 106 at a sharp angle, increasing the risk of ice or debris jamming. If the culvert capacity was exceeded either due to a large flood and/or jamming, flow would continue along Route 106 and quickly cause major damage. We recommend replacing the structure to increase capacity and improve alignment. The construction of a wingwall along the left bank would also protect the road embankment from erosion and flooding during large events. VTrans would likely oversee design and implementation of this project.



Projects RE 20 and RE 21 – Bailey Brook Alluvial Fan Restoration and Flood Mitigation

Bailey Brook flows out of steep, mountainous terrain and reaches a significant transition point near the intersection of Baileys Mills Road and Town Farm Road. At this point (Segment T4.01.A), the slope of the river decreases and the river valley widens. In geologic terms, this area is referred to as an “alluvial fan,” where the sediment and debris carried by the brook settles out across the valley. Exacerbating this natural deposition process is a bridge-arch structure underneath Baileys Mills Road that is undersized for the channel. The post-Irene channel width varies between 40 and 50 feet in segment T4.01.A, while the arch width is only 19 feet. During Tropical Storm Irene flooding, tremendous amounts of sediment and debris generated from upstream mass failures along Bailey Brook were deposited over this alluvial fan. The debris field extended over 1,000 feet upstream along Bailey Brook and Town Farm Road. The channel is actively carving and braiding through these deposits. Many of the trees within the pine/hemlock floodplain forest along Town Hill Road are dead due to girdling from flood sediments. Berms are disconnecting the floodplain in one location, and bank erosion is severe throughout.

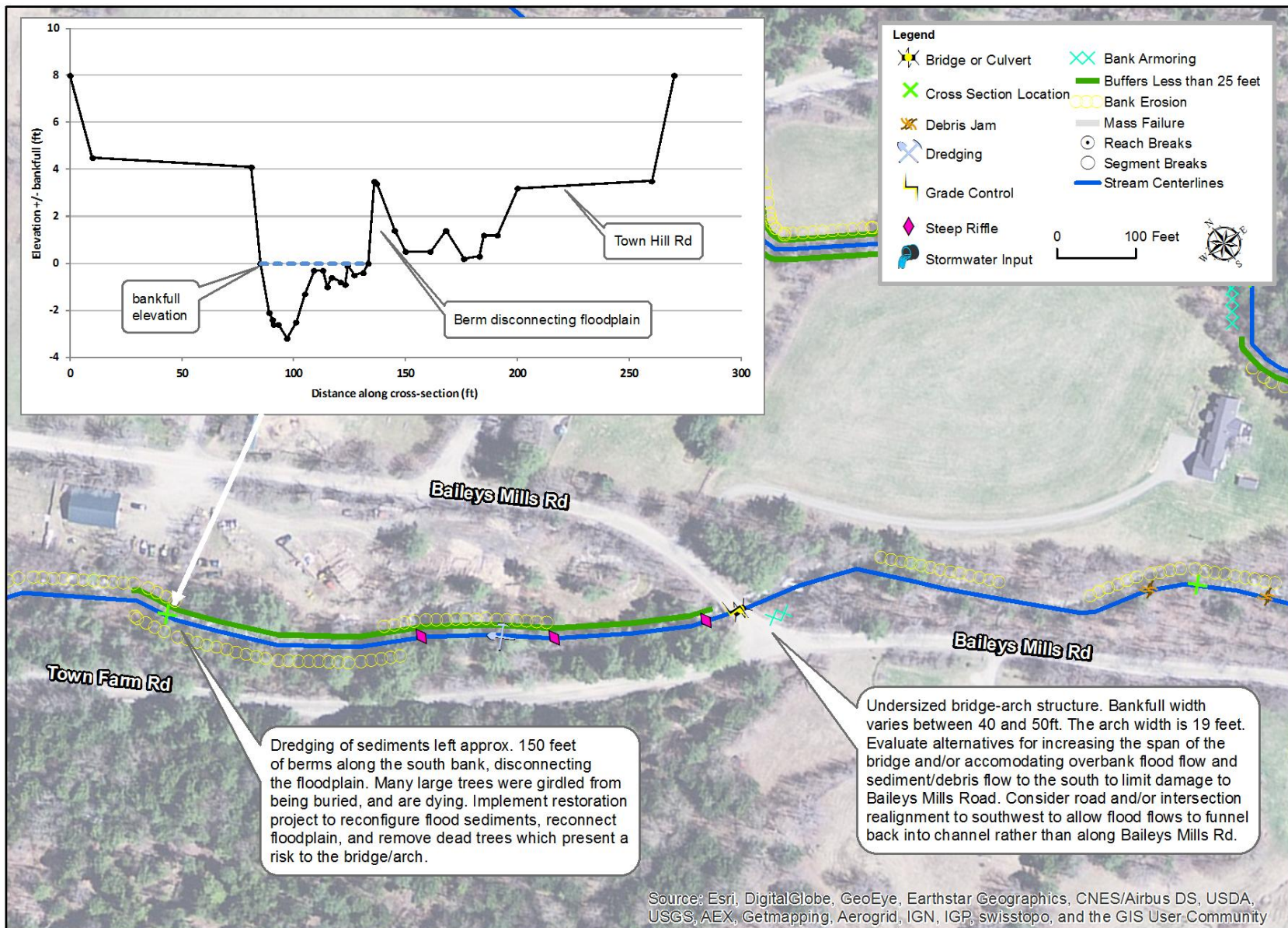


Given the severe instability of the upstream banks and valley walls, and the amount of sediment and debris in the river corridor waiting to be carried down to the alluvial fan in the next flood, we expect the degree of risk and conflict at this site to worsen during future floods. We recommend that the Town



complete an alternatives analysis to evaluate options for alluvial fan management. Options may include: 1) Replace arch with a larger structure to maximize capacity over the bedrock grade control; 2) Road or intersection realignment to southwest to accommodate alluvial fan flooding; 3) Berm removal, dead tree removal, and re-vegetation of the floodplain along Town Farm Road. With any of these alternatives, local flood hydraulics and sediment transport will need to be analyzed carefully to ensure that risks to downstream property are not increased. If this area has experienced repeat flood damage, it may be eligible

for FEMA funding. The Town of Reading should coordinate with SWCRPC to determine other potential funding sources.



Project RE 23 - Bailey Brook Conservation Area

The portion of Baileys Brook from the Baileys Mills Bed & Breakfast upstream to Browns Schoolhouse Road flows through a forested valley with minimal impacts from Kittridge Pasture Road and a small adjoining hayfield. This watershed was incredibly active during T.S. Irene as the floodwaters carved into the valley walls triggering huge landslides. The debris from these bank failures filled the valley in several locations which subsequently trapped huge volumes of woody debris, gravel, and sand. The channel is now braiding through these deep flood deposits in the upper segments (T4.01.C - T4.02.B), and carving down into the stream bed causing deep incision in the lower segment (T4.01.B). The sediment flushed out of this stream continues to have major impacts on Mill Brook that were visible for miles downstream. Many of the mass failures remain active and will likely continue to generate sediment and woody debris for a long time. The debris jams throughout the valley are critical for retaining sediment and re-establishing floodplain areas. Any clearing of these debris jams could release huge volumes of sediment and increase downstream flood risks.

We are recommending long-term protection for the entire valley from Baileys Mills B&B upstream to Browns Schoolhouse Road. A conservation easement through VLT and/or VTANR ERP would protect this area from management or clearing and allow for natural channel adjustment and sediment storage processes. The Green Mountain Horse Association maintains numerous trails through the area and may be an additional project partner. The landowners have not yet been identified or contacted.



6.0 Conclusions and Recommendations

The steep terrain draining the Mill Brook watershed, coupled with road networks, infrastructure, and agricultural land uses sharing the river valleys, creates fluvial erosion hazards throughout the Towns of Windsor, West Windsor, and Reading. Tropical Storm Irene in August of 2011 tracked through the center of the Mill Brook watershed causing major flood damage in all three towns. It is estimated that 5 to 6 inches of rain fell over much of the watershed and locally higher amounts were likely in the headwaters. Roads and bridges were especially hard hit by the flooding and the damage to the transportation network slowed recovery efforts and severed main access roads to dozens of homes within the watershed. In response to the impacts from this flood, and the increasing severity of rainfall and flood events over the last few decades, the towns in the Mill Brook watershed are wise to take a long-term corridor planning approach to better understand, plan for, and mitigate flood hazards within the watershed.

The Mill Brook channel is still adjusting its width, depth, and planform to the following historical and ongoing impacts: 1) aggradation of sediment in the valleys due to European settlement and deforestation that occurred during the 1700's and 1800's; 2) channel straightening, dredging, and corridor encroachment associated with adjacent roads, agriculture, and other land uses; 3) significant floods in recent years such as Tropical Storm Irene in 2011.

Flooding from Tropical Storm Irene in August 2011 triggered major channel adjustments in many of the Phase 2 study reaches. Although there is no USGS flow gage on Mill Brook, based on records in neighboring watersheds the discharge likely exceeded the 100-year flood. The flooding unleashed an enormous volume of coarse sediment and woody debris into the channel as a result of stream bed and bank erosion and mass failure valley erosion, much of this originating from the steep headwaters zones. In some instances, the flood triggered severe channel adjustments even in reaches with limited human impacts in the river corridor.

Overall Phase 2 geomorphic ratings indicate poor river stability along Brook Road in Windsor, on one reach in the Beaver Brook watershed along Sheddsville Road and another in the Willow Brook watershed along Rush Meadow Road in West Windsor, and along most of Bailey Brook in Reading. Elsewhere, generally fair conditions were noted throughout the watershed. Habitat ratings indicated generally fair conditions across the watershed, with one poor rating on a tributary to Beaver Brook along Sheddsville Road, and another on a reach of Mill Brook found along Baileys Mills Road.

Key flood resiliency recommendations are summarized below for the watershed and each town:

Mill Brook Watershed

- The Mill Brook watershed is an extremely flashy watershed due to its steep headwaters and soils with poor infiltration. The National Flood Insurance Program (NFIP) study for Mill Brook does not cover the entire river corridor with a detailed study; therefore inundation hazards may be underestimated in the smaller drainages such as Beaver Brook, Willow Brook, Reading Hill Brook, the upper reaches of Mill Brook, and Bailey Brook. Given the hydrologic characteristics of the watershed, and the severe flood damage witnessed during Tropical Storm Irene, we

recommend that all towns in the watershed consider flood hazard ordinances that prevent encroachment in the entire 100-year floodplain (i.e., floodway and floodplain fringe).

- Fluvial Erosion Hazard (FEH) zone ordinances should be considered by each town to better map flood and erosion risks for both the safety and protection of their citizens, and the infrastructure controlled by the municipality.
- By implementing at least one of the above-mentioned zoning recommendations, towns can qualify for increased state aid (from 12.5% to 17.5%) from the Emergency Relief and Assistance Fund (ERAF) to cover future flood damages.
- All across the reaches of the watershed, floodwaters from Tropical Storm Irene initiated severe bank and valley erosion. In some locations, the smaller scale of instability and good site access make it potentially feasible to mitigate these hazards. For example, the embankment instability along Sheddsville Road in West Windsor has good machinery access along the entire road. In other locations, the severity of the erosion and limitations of access make stabilization unfeasible. These areas, which include the upper reaches of Bailey Brook in Reading and the lower reaches of Mill Brook along Brook Road in Windsor, will continue to generate large volumes of sediment and debris over the coming years. The towns and residents along these areas of Bailey Brook and Mill Brook will need to plan for ongoing sedimentation and debris hazards during flood events.

Town of Windsor

- The long-term conservation or protection of the “Narrows” floodplains will pay dividends for years to come, including reduced sedimentation in Mill Pond, and the dampening of flood waves during future floods. There are currently no improved structures or active agricultural practices within this floodplain area. This area of the river is storing enormous volumes of sediment and woody debris, and will continue to do so for the foreseeable future.
- Many sections of Brook Road damaged during Tropical Storm Irene are unfeasible to repair. The remaining transportation network is somewhat vulnerable to future flood events at three undersized bridges. The two remaining Brook Road bridges are both fairly stable and while undersized, they do not represent a major constriction or ice/debris jamming risk. The Hewett Road bridge is less compatible with the channel dimensions and indicated active bank erosion with failing armoring near the abutments. This bridge is a very important transportation connector for residents and emergency vehicle access, and therefore should be considered for replacement or retrofit with a more suitable structure.

Town of West Windsor

- Several key floodplain and river corridor protection sites were identified in West Windsor. Many of these sites lack healthy riparian buffers, which has contributed to bank instability over the years. Conservation of these key flood and sediment attenuation assets will pay dividends in the future by protecting the floodplain’s capacity to absorb flood flow and sediment from unstable reaches of Mill Brook and Willow Brook upstream, thereby taking pressure off the villages downstream.

- Numerous in-stream structures (bridges, culverts, dams) are problematic in West Windsor. These include the Brownsville dam, Bible Hill Covered Bridge, and several undersized culverts along Beaver Brook and Willow Brook. The summary of stream crossing structures included in Section 5.1.3 of this report provides a way for the Town of West Windsor to understand the relative flood vulnerability and prioritize structure replacements with these criteria in mind.

Town of Reading

- Given the severe bank and valley erosion initiated by Tropical Storm Irene in the upper reaches of Bailey Brook in Reading, the Town and residents along Bailey Brook and Mill Brook in Reading will need to plan for ongoing sedimentation in the lower, wider valleys (i.e., downstream of the confluence of Mill Brook and Bailey Brook).
- The “alluvial fan” area on Bailey Brook at the intersection of Baileys Mills Road and Town Farm Road was severely damaged during Tropical Storm Irene flooding, and has increased flood vulnerabilities given the unstable conditions in Bailey Brook upstream. We strongly recommend the Town of Reading commits further resources to study flood mitigation alternatives at this site, as summarized in Section 5.3 of the report.

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8.0 Glossary of Terms

Adapted from:

Restoration Terms, by Craig Fischenich, February, 2000, USAE Research and Development Center, Environmental Laboratory, 3909 Halls Ferry Rd., Vicksburg, MS 39180

And

Vermont Stream Geomorphic Assessment Handbook, 2007, Vermont Agency of Natural Resources, Waterbury, VT
http://www.anr.state.vt.us/dec/waterq/rivers/htm/rv_geoassesspro.htm

Acre -- A measure of area equal to 43,560 ft² (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 made 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 overtops the natural banks. This flow occurs, on average, about once every 1 to 2 years and given its frequency and magnitude is responsible for the shaping of most stream or river channels.

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.

Bedform -- Individual patterns which streams follow that characterize the condition of the stream bed into several categories. (See: braided, dune-ripple, plane bed, riffle-pool, step-pool, and cascade)

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, between 10 and 160 inches in diameter.

Boundary resistance -- The ability a stream bank has to withstand the erosional forces of the flowing water at varying intensities. Under natural conditions boundary resistance is increased due to stream bank vegetation (roots), cohesive clays, large boulder substrate, etc.

Braided -- A stream channel 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.

Channel evolution model (CEM) -- A series of stages used to describe the erosional or depositional processes that occur within a stream or river in order to regain a dynamic equilibrium following a disturbance.

Clay -- Substrate particles that are smaller than silt and generally less than 0.0001 inches in diameter.

Coarse gravel -- Substrate that is smaller than cobble, but larger than fine gravel. The diameter of this stream-bottom particulate is between 0.63 and 2.5 inches.

Cobble -- Substrate particles that are smaller than boulders and larger than gravels, and are generally between 2.5 and 10 inches in diameter.

Confinement -- see Valley confinement

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 refuge 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.]

Cross-section -- A series of measurements, relative to bankfull, that are taken across a stream channel that are representative of the geomorphic condition and stream type of the reach.

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.

Dune-ripple -- A bedform associated with low-gradient, sand-bed channels; the low gradient nature of the channel causes the sand to form a sequence of dunes and small ripples; significant sediment transport typically occurs at most stream stages.

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.

Equilibrium Condition -- The state of a river reach in which the upstream input of energy (flow of water) and materials (sediment and debris) is equal to its output to downstream reaches. Natural river reaches without human impacts tend towards a "stable" state where predictable channel forms are maintained over the long term under varying flow conditions.

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.

Fine gravel -- Is substrate which is larger than sand, but smaller than coarse gravel. It is between 0.08 and 0.63 inches in diameter.

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 fine particulate organic matter and small substrate 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.

Fluvial Geomorphology -- The study of how rivers and their landforms interact over time through different climatic conditions.

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.

Grade control -- A fixed feature on the streambed that controls the bed elevation at that point, effectively fixing the bed elevation from potential incision; typically bedrock, dams, or culverts.

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.

Headcut -- A sharp change in slope, almost vertical, where the streambed is being eroded from downstream to upstream.

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 -- soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper horizon.

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 Code (HUC) -- 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.

Impoundment -- An area where the natural flow of the river has been disrupted by the presence of human-made or natural structure (e.g. weir or beaver dam). The impoundment backwater extends upstream causing sediment to be deposited on the stream bottom.

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.

Kame -- a deposit of stratified glacial drift in isolated mounds or steep-sided hills.

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 area of a 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.

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.

Main Stem -- 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 down valley 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.

Moraine -- a mass of till either carried by an active glacier or deposited on the land after a glacier recedes.

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.

Neck cutoff -- A channel migration feature where the land that separates a meander bend is cut off by the lateral migration of the channel. This process may be part of the equilibrium regime or associated with channel instability.

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

Outwash -- water-transported material carried away from the ablation zone of a melting glacier.

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.

Planform -- The channel shape as if observed from the air. Changes in planform often involve shifts in large amount of sediment, bank erosion, or the migration of the channel. A channel straightened for agricultural purposes has a highly impacted planform.

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.

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

Probability of exceedance -- 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.

Reference stream type -- Uses preliminary observations to determine the natural channel form and process that would be present in the absence of anthropogenic impacts to the channel and the surrounding watershed.

Refuge area -- An area within a stream that provides protection to aquatic species during very low and/or high flows.

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-pool 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.

Riffle-step ratio -- 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 0.002 to 0.08 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; between 0.0001 and 0.002 inches in diameter.

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.

Stream type departure -- When the current stream type differs from the reference stream type as a response to anthropogenic or severe natural disturbances. These departures are often characterized by large-scale incision, deposition, or changes in planform.

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.

Valley confinement -- Referring to the ratio of valley width to channel width. Unconfined channels (confinement of 4 or greater) flow through broader valleys and typically have higher sinuosity and area for floodplain. Confined channels (confinement of less than 4) typically flow through narrower valleys.

Valley wall -- The side slope of a valley, which begins where the topography transitions from the gentle-sloped valley floor. The distance between valley walls is used to calculate the valley confinement.

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.

Wetland -- Areas adjacent to, or within the stream, with sufficient surface/groundwater influence to have present hydric soils and aquatic vegetation (e.g. cattails, sedges, rushes, willows or alders).

Width/depth ratio -- The ratio of channel bankfull width to the average bankfull depth. An indicator of channel widening or aggradation, and used for stream type classification.

APPENDIX A:

PHASE 1 REACH REPORTS

Mill Brook - Basin 13

Basin: **Lower Connecticut**
 Stream Name: **Mill Brook**
 Topo Maps: **WINDSOR**
 Watershed:

Sub-watershed:

Step 1. Reach Location

1.1 Reach Description:

1.2 Towns: **Windsor**

1.3 Downstream Latitude: **43.472294**

1.3 Downstream Longitude: **-72.387101**

Step 2. Stream Type

2.1 Elevation Upstream: **320**

2.1 Elevation Downstream: **302**

2.1 Is Gradient Gentle?: **No**

2.2 Valley Length: **1,759.6 ft.** **0.33** Miles

2.3 Valley Slope: **1.0**

2.4 Channel Length: **1,764.3 ft.** **0.33** Miles

2.5 Channel Slope: **1.02 %**

2.6 Sinuosity: **1.00**

2.7 Watershed Area: **44.6** Square Miles

2.8 Channel Width: **69.7** feet

2.9 Valley Width: **275.0** feet

2.10 Confinement Ratio: **3.9**

2.10 Confinement Type: **Semi-confined**

2.11 Reference Stream Type: **A**

Bedform: **Cascade**

Sub-Class Slope: **c**

Bed Material: **Bedrock**

Step 3. Basin Characteristics

3.1 Alluvial Fan: **None**

3.2 Grade Control: **Ledge**

3.3 Dominant Geological Mat.: **Ice-Contact** **65.7 %**

3.3 Sub-dom. Geological Mat.: **Alluvial**

3.4 Valley Slope Left: **Ext. Steep**

3.4 Valley Slope Right: **Ext. Steep**

3.5 Soils

Hydrologic Group: **Not Rated** **64.2 %**

Flooding: **None/Rare** **66.3 %**

Water Table Deep: **3.0** **33.1 %**

Water Table Shallow: **1.5** **33.1 %**

Erodibility: **slight** **1.5 %**

7.4 Comments:

Main Street and railroad bridge are high and wide, no ice jam risk.

Phase 1 - Reach Summary Report

Reach ID: **M01**

SGAT Version: **4.56**

Date Last Edited: **April, 03 2015**

QA Status: **No checks are complete**

Is Reach An Impoundment?: **No**

This reach extends from the confluence with the Connecticut River and extends upstream to the Union St. Bridge.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed

Historic Land Cover: **Forest**

Current Dominant Land Cover: **Forest** **75.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.2 Corridor

Historic Land Cover:: **Commercial**

Current Dominant Land Cover: **Urban** **51.0 %**

Current Sub-Dominant Land Cover: **Crop**

4.3 Riparian Buffer Left Bank Right Bank

Dominant: **0-25** **0-25**

Sub-dominant: **26-50** **51-100**

Length w / less than 25 ft.: **1,481.0 ft.** **735.0 ft.**

4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):

Type: **None**

Use:

5.2 Bridges and Culverts: **2** **3.7 %**

5.3 Bank Armoring: **0.0** **0.0 %**

Left: **0.0 ft.** Right: **0.0 ft.**

5.4 Channel Straightening: **0.0** **0.0 %**

5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **460.7 ft.** **26.1**

One Side Both Sides

Road: **460.7 ft.** **0.0 ft.**

Railroad: **0.0 ft.** **0.0 ft.**

Berm: **0.0 ft.** **0.0 ft.**

Improved Path: **0.0 ft.** **0.0 ft.**

6.2 Development: **759.4 ft.** **594.3 ft.**

6.3 Channel Bars: **Side**

6.4 Meander Migration: **None**

6.5 Meander Width: **N/A** Ratio: **0.0**

6.6 Wavelength: **N/A** Ratio: **0.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **0** **ft**

7.2 Bank Height: **No Data** **ft**

7.3 Ice/Debris Jam Potential: **None**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1	2	2	0	0	0	0	0	2	2	0	0	0	0	0	0	9
Low	High	High	N.S.	N.S.	N.S.	N.S.	N.S.	High	High	N.S.	N.S.	N/A	N/A	N.S.	N.S.	

Mill Brook - Basin 13

Basin: **Lower Connecticut**
 Stream Name: **Mill Brook**
 Topo Maps: **WINDSOR**
 Watershed:

Sub-watershed:

Step 1. Reach Location

This reach extends from the reachpoint south of Union street upstream to the dam West of Clough Ave

1.1 Reach Description:

1.2 Towns: **Windsor**

1.3 Downstream Latitude: **43.475993**

1.3 Downstream Longitude: **-72.390204**

Step 2. Stream Type

2.1 Elevation Upstream: **347**

2.1 Elevation Downstream: **320**

2.1 Is Gradient Gentle?: **No**

2.2 Valley Length: **2,460.3 ft.** **0.47** Miles

2.3 Valley Slope: **1.1**

2.4 Channel Length: **3,806.8 ft.** **0.72** Miles

2.5 Channel Slope: **0.72 %**

2.6 Sinuosity: **1.55**

2.7 Watershed Area: **44.5 Square Miles**

2.8 Channel Width: **69.6 feet**

2.9 Valley Width: **550.0 feet**

2.10 Confinement Ratio: **7.9**

2.10 Confinement Type: **Broad**

2.11 Reference Stream Type: **C**

Bedform: **Riffle-Pool**

Sub-Class Slope: **None**

Bed Material: **Gravel**

Step 3. Basin Characteristics

3.1 Alluvial Fan: **None**

3.2 Grade Control: **Ledge**

3.3 Dominant Geological Mat.: **Alluvial** **54.4 %**

3.3 Sub-dom. Geological Mat.: **Ice-Contact**

3.4 Valley Slope Left: **Steep**

3.4 Valley Slope Right: **Very Steep**

3.5 Soils

Hydrologic Group: **C** **39.2 %**

Flooding: **None/Rare** **45.6 %**

Water Table Deep: **1.5** **39.2 %**

Water Table Shallow: **0.0** **39.2 %**

Erodibility: **slight** **14.1 %**

7.4 Comments:

Upstream dam likely limits ice movement, bridges are fairly high and wide.

Phase 1 - Reach Summary Report

Reach ID: **M02**

SGAT Version: **4.56**

Date Last Edited: **April, 03 2015**

QA Status: **No checks are complete**

Is Reach An Impoundment?: **No**

Step 4. Land Cover - Reach Hydrology

4.1 Watershed

Historic Land Cover: **Forest**

Current Dominant Land Cover: **Forest** **75.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.2 Corridor

Historic Land Cover:: **Commercial**

Current Dominant Land Cover: **Urban** **64.0 %**

Current Sub-Dominant Land Cover: **Crop**

4.3 Riparian Buffer **Left Bank** **Right Bank**

Dominant: **26-50** **26-50**

Sub-dominant: **51-100** **0-25**

Length w / less than 25 ft.: **101.0 ft.** **1,601.0 ft.**

4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):

Type: **None**

Use:

5.2 Bridges and Culverts: **4** **3.1 %**

5.3 Bank Armoring: **1,794.2** **47.1 %**

Left: **1,057.1 ft.** Right: **737.1 ft.**

5.4 Channel Straightening: **1,390.2** **36.5 %**

5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **85.1 ft.** **2.2**

One Side **Both Sides**

Road: **85.1 ft.** **0.0 ft.**

Railroad: **0.0 ft.** **0.0 ft.**

Berm: **0.0 ft.** **0.0 ft.**

Improved Path: **0.0 ft.** **0.0 ft.**

6.2 Development: **1,815.4 ft.** **1,500.8 ft.**

6.3 Channel Bars: **Multiple**

6.4 Meander Migration: **Multiple**

6.5 Meander Width: **110 ft.** Ratio: **1.6**

6.6 Wavelength: **290 ft.** Ratio: **4.2**

Step 7. Windshield Survey

7.1 Bank Erosion: **571.373** **ft**

7.2 Bank Height: **5** **ft**

7.3 Ice/Debris Jam Potential: **None**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1	2	2	0	0	2	2	0	0	2	1	1	2	2	1	0	18
Low	High	High	N.S.	N.S.	High	High	N.S.	N.S.	High	Low	Low	High	High	Low	N.S.	

Mill Brook - Basin 13

Basin: **Lower Connecticut**
 Stream Name: **Mill Brook**
 Topo Maps: **WINDSOR**
 Watershed:

Sub-watershed:

Step 1. Reach Location

1.1 Reach Description:

1.2 Towns: **Windsor**

1.3 Downstream Latitude: **43.463029**

1.3 Downstream Longitude: **-72.40334**

Step 2. Stream Type

2.1 Elevation Upstream: **420**

2.1 Elevation Downstream: **378**

2.1 Is Gradient Gentle?: **No**

2.2 Valley Length: **7,919.1 ft.** **1.50** Miles

2.3 Valley Slope: **0.5**

2.4 Channel Length: **8,067.2 ft.** **1.53** Miles

2.5 Channel Slope: **0.52 %**

2.6 Sinuosity: **1.02**

2.7 Watershed Area: **43.1** Square Miles

2.8 Channel Width: **68.6** feet

2.9 Valley Width: **390.0** feet

2.10 Confinement Ratio: **5.7**

2.10 Confinement Type: **Narrow**

2.11 Reference Stream Type: **C**

Bedform: **Riffle-Pool**

Sub-Class Slope: **None**

Bed Material: **Gravel**

Step 3. Basin Characteristics

3.1 Alluvial Fan: **None**

3.2 Grade Control: **None**

3.3 Dominant Geological Mat.: **Alluvial** **59.3 %**

3.3 Sub-dom. Geological Mat.: **Ice-Contact**

3.4 Valley Slope Left: **Ext. Steep**

3.4 Valley Slope Right: **Very Steep**

3.5 Soils

Hydrologic Group: **C** **56.8 %**

Flooding: **Frequent** **42.8 %**

Water Table Deep: **1.5** **42.8 %**

Water Table Shallow: **0.0** **42.8 %**

Erodibility: **slight** **24.2 %**

7.4 Comments:

Route 44 bridge and sharp bend has some potential for ice jamming. Bridge was destroyed during T. S. Irene, significant channel migration towards Route 44 in lower reach.

Phase 1 - Reach Summary Report

Reach ID: **M04**

SGAT Version: **4.56**

Date Last Edited: **April, 03 2015**

QA Status: **No checks are complete**

Is Reach An Impoundment?: **No**

This reach extends from the reach point along Acutney Street West of I-91 and extends upstream to the reach break at Brooks Rd and Sunset Ln.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed

Historic Land Cover: **Forest**

Current Dominant Land Cover: **Forest** **76.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.2 Corridor

Historic Land Cover:: **Commercial**

Current Dominant Land Cover: **Urban** **34.0 %**

Current Sub-Dominant Land Cover: **Forest**

4.3 Riparian Buffer Left Bank Right Bank

Dominant: **51-100** **>100**

Sub-dominant: **0-25** **0-25**

Length w / less than 25 ft.: **1,560.0 ft.** **1,986.0 ft.**

4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):

Type: **None**

Use:

5.2 Bridges and Culverts: **2** **1.6 %**

5.3 Bank Armoring: **2,105.5** **26.1 %**

Left: **831.4 ft.** Right: **1,274.1 ft.**

5.4 Channel Straightening: **660.9** **8.2 %**

5.5 Dredging History: **Dredging**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **6,459.2 ft.** **80.1**

One Side Both Sides

Road: **6,459.2 ft.** **0.0 ft.**

Railroad: **0.0 ft.** **0.0 ft.**

Berm: **0.0 ft.** **0.0 ft.**

Improved Path: **0.0 ft.** **0.0 ft.**

6.2 Development: **710.2 ft.** **0.0 ft.**

6.3 Channel Bars: **Multiple**

6.4 Meander Migration: **Migration**

6.5 Meander Width: **150 ft.** Ratio: **2.2**

6.6 Wavelength: **800 ft.** Ratio: **11.7**

Step 7. Windshield Survey

7.1 Bank Erosion: **576.287** ft

7.2 Bank Height: **5** ft

7.3 Ice/Debris Jam Potential: **Bend**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1	2	2	0	0	2	1	2	2	1	1	2	2	0	1	1	20
Low	High	High	N.S.	N.S.	High	Low	High	High	Low	Low	High	High	N.S.	Low	Low	

Mill Brook - Basin 13

Basin: **Lower Connecticut**
 Stream Name: **Mill Brook**
 Topo Maps: **WINDSOR**
 Watershed:

Sub-watershed:

Step 1. Reach Location

This reach follows Brook Rd from the reach break between Brook Rd and Sunset Ln and continues upstream to the reach break southeast of Rokepa Rd.

1.1 Reach Description:

1.2 Towns: **West Windsor, Windsor**

1.3 Downstream Latitude: **43.460994**

1.3 Downstream Longitude: **-72.415161**

Step 2. Stream Type

2.1 Elevation Upstream: **607**

2.1 Elevation Downstream: **420**

2.1 Is Gradient Gentle?: **No**

2.2 Valley Length: **13,724.6 ft. 2.60 Miles**

2.3 Valley Slope: **1.4**

2.4 Channel Length: **14,356.8 ft. 2.72 Miles**

2.5 Channel Slope: **1.30 %**

2.6 Sinuosity: **1.05**

2.7 Watershed Area: **40.3 Square Miles**

2.8 Channel Width: **66.6 feet**

2.9 Valley Width: **218.0 feet**

2.10 Confinement Ratio: **3.3**

2.10 Confinement Type: **Semi-confined**

2.11 Reference Stream Type: **B**

Bedform: **Riffle-Pool**

Sub-Class Slope: **c**

Bed Material: **Cobble**

Step 3. Basin Characteristics

3.1 Alluvial Fan: **None**

3.2 Grade Control: **Ledge**

3.3 Dominant Geological Mat.: **Till 51.6 %**

3.3 Sub-dom. Geological Mat.: **Ice-Contact**

3.4 Valley Slope Left: **Ext. Steep**

3.4 Valley Slope Right: **Ext. Steep**

3.5 Soils

Hydrologic Group: **C 51.3 %**

Flooding: **None/Rare 99.0 %**

Water Table Deep: **6.0 80.2 %**

Water Table Shallow: **6.0 80.2 %**

Erodibility: **Very Severe 86.9 %**

7.4 Comments:

Brook road bridge angled and with narrower channel due to bedrock - some ice jam potential. Brook Rd closely follows stream for most of reach and sustained major damage during T. S. Irene.

Phase 1 - Reach Summary Report

Reach ID: **M05**

SGAT Version: **4.56**

Date Last Edited: **April, 03 2015**

QA Status: **No checks are complete**

Is Reach An Impoundment?: **No**

Step 4. Land Cover - Reach Hydrology

4.1 Watershed

Historic Land Cover: **Forest**

Current Dominant Land Cover: **Forest 76.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.2 Corridor

Historic Land Cover:: **Forest**

Current Dominant Land Cover: **Forest 39.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer **Left Bank Right Bank**

Dominant: **>100 >100**

Sub-dominant: **26-50 26-50**

Length w / less than 25 ft.: **1,083.0 ft. 433.0 ft.**

4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):

Type: **None**

Use:

5.2 Bridges and Culverts: **4 0.8 %**

5.3 Bank Armoring: **1,353.1 9.4 %**

Left: **458.9 ft.** Right: **894.2 ft.**

5.4 Channel Straightening: **0.0 0.0 %**

5.5 Dredging History: **Dredging**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **4,339.9 ft. 30.2**

One Side Both Sides

Road: **4,339.9 ft. 0.0 ft.**

Railroad: **0.0 ft. 0.0 ft.**

Berm: **283.9 ft. 0.0 ft.**

Improved Path: **0.0 ft. 0.0 ft.**

6.2 Development: **1,741.3 ft. 121.5 ft.**

6.3 Channel Bars: **Multiple**

6.4 Meander Migration: **Multiple**

6.5 Meander Width: **N/A Ratio: 0.0**

6.6 Wavelength: **N/A Ratio: 0.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **4934.88 ft**

7.2 Bank Height: **8 ft**

7.3 Ice/Debris Jam Potential: **Bridge**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1	2	1	0	0	1	0	2	2	1	2	2	0	0	2	1	17
Low	High	Low	N.S.	N.S.	Low	N.S.	High	High	Low	High	High	N/A	N/A	High	Low	

Mill Brook - Basin 13

Basin: **Lower Connecticut**
 Stream Name: **Mill Brook**
 Topo Maps: **WINDSOR**
 Watershed:

Sub-watershed:

Step 1. Reach Location

1.1 Reach Description:

1.2 Towns: **West Windsor**

1.3 Downstream Latitude: **43.470043**

1.3 Downstream Longitude: **-72.453251**

Step 2. Stream Type

2.1 Elevation Upstream: **667**

2.1 Elevation Downstream: **607**

2.1 Is Gradient Gentle?: **No**

2.2 Valley Length: **4,961.1 ft.** **0.94** Miles

2.3 Valley Slope: **1.2**

2.4 Channel Length: **6,223.7 ft.** **1.18** Miles

2.5 Channel Slope: **0.96 %**

2.6 Sinuosity: **1.25**

2.7 Watershed Area: **36.5** Square Miles

2.8 Channel Width: **63.8** feet

2.9 Valley Width: **380.0** feet

2.10 Confinement Ratio: **6.0**

2.10 Confinement Type: **Narrow**

2.11 Reference Stream Type: **C**

Bedform: **Riffle-Pool**

Sub-Class Slope: **None**

Bed Material: **Cobble**

Step 3. Basin Characteristics

3.1 Alluvial Fan: **None**

3.2 Grade Control: **Multiple**

3.3 Dominant Geological Mat.: **Ice-Contact** **78.3 %**

3.3 Sub-dom. Geological Mat.: **Till**

3.4 Valley Slope Left: **Steep**

3.4 Valley Slope Right: **Steep**

3.5 Soils

Hydrologic Group: **B** **64.6 %**

Flooding: **None/Rare** **91.4 %**

Water Table Deep: **2.5** **56.6 %**

Water Table Shallow: **1.5** **65.2 %**

Erodibility: **Severe** **69.1 %**

7.4 Comments:

Route 44 bridge is high and channel is fairly large, no ice jam potential.

Phase 1 - Reach Summary Report

Reach ID: **M06**

SGAT Version: **4.56**

Date Last Edited: **April, 03 2015**

QA Status: **No checks are complete**

Is Reach An Impoundment?: **No**

This reach begins at the reach break Southeast of Rokepa Rd. and extends upstream to the intersection of Brownsville Rd. and Brownsville Hartland Rd.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed

Historic Land Cover: **Forest**

Current Dominant Land Cover: **Forest** **76.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.2 Corridor

Historic Land Cover:: **Field**

Current Dominant Land Cover: **Forest** **27.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer Left Bank Right Bank

Dominant: **51-100** **>100**

Sub-dominant: **0-25** **0-25**

Length w / less than 25 ft.: **1,302.0 ft.** **735.0 ft.**

4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):

Type: **Small Withdrawal**

Use: **Other**

5.2 Bridges and Culverts: **2** **0.5 %**

5.3 Bank Armoring: **1,124.8** **18.1 %**

Left: **955.7 ft.** Right: **169.1 ft.**

5.4 Channel Straightening: **1,554.0** **25.0 %**

5.5 Dredging History: **Dredging**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **669.5 ft.** **10.8**

One Side Both Sides

Road: **669.5 ft.** **0.0 ft.**

Railroad: **0.0 ft.** **0.0 ft.**

Berm: **0.0 ft.** **0.0 ft.**

Improved Path: **0.0 ft.** **0.0 ft.**

6.2 Development: **1,316.7 ft.** **0.0 ft.**

6.3 Channel Bars: **Multiple**

6.4 Meander Migration: **Multiple**

6.5 Meander Width: **250 ft.** Ratio: **3.9**

6.6 Wavelength: **1200 ft.** Ratio: **18.8**

Step 7. Windshield Survey

7.1 Bank Erosion: **1472.42** ft

7.2 Bank Height: **5** ft

7.3 Ice/Debris Jam Potential: **None**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1	2	2	1	0	1	2	2	1	2	2	1	1	2	2	0	22
Low	High	High	Low	N.S.	Low	High	High	Low	High	High	Low	Low	High	High	N.S.	

Mill Brook - Basin 13

Basin: **Lower Connecticut**
 Stream Name: **Mill Brook**
 Topo Maps: **WINDSOR**
 Watershed:

Sub-watershed:

Step 1. Reach Location

1.1 Reach Description:

1.2 Towns: **West Windsor**

1.3 Downstream Latitude: **43.467238**

1.3 Downstream Longitude: **-72.471148**

Step 2. Stream Type

2.1 Elevation Upstream: **714**

2.1 Elevation Downstream: **667**

2.1 Is Gradient Gentle?: **No**

2.2 Valley Length: **6,504.5 ft.** **1.23** Miles

2.3 Valley Slope: **0.7**

2.4 Channel Length: **7,534.5 ft.** **1.43** Miles

2.5 Channel Slope: **0.62 %**

2.6 Sinuosity: **1.16**

2.7 Watershed Area: **27.9** Square Miles

2.8 Channel Width: **56.7** feet

2.9 Valley Width: **350.0** feet

2.10 Confinement Ratio: **6.2**

2.10 Confinement Type: **Broad**

2.11 Reference Stream Type: **C**

Bedform: **Riffle-Pool**

Sub-Class Slope: **None**

Bed Material: **Gravel**

Step 3. Basin Characteristics

3.1 Alluvial Fan: **None**

3.2 Grade Control: **Ledge**

3.3 Dominant Geological Mat.: **Ice-Contact** **79.1 %**

3.3 Sub-dom. Geological Mat.: **Alluvial**

3.4 Valley Slope Left: **Steep**

3.4 Valley Slope Right: **Steep**

3.5 Soils

Hydrologic Group: **A** **77.7 %**

Flooding: **None/Rare** **81.7 %**

Water Table Deep: **6.0** **77.7 %**

Water Table Shallow: **6.0** **77.7 %**

Erodibility: **slight** **12.9 %**

7.4 Comments:

Bible Hill Rd bridge is very narrow and is a major ice/debris jam risk. Partially breached dam mid reach is also of concern.

Phase 1 - Reach Summary Report

Reach ID: **M07**

SGAT Version: **4.56**

Date Last Edited: **April, 03 2015**

QA Status: **No checks are complete**

Is Reach An Impoundment?: **No**

Begins at the reach break East of the intersection of Seems Rd and Rt-44 and continues upstream to the Bible Hill Rd bridge.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed

Historic Land Cover: **Forest**

Current Dominant Land Cover: **Forest** **78.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.2 Corridor

Historic Land Cover:: **Field**

Current Dominant Land Cover: **Urban** **29.0 %**

Current Sub-Dominant Land Cover: **Forest**

4.3 Riparian Buffer Left Bank Right Bank

Dominant: **51-100** **51-100**

Sub-dominant: **0-25** **26-50**

Length w / less than 25 ft.: **2,106.0 ft.** **873.0 ft.**

4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):

Type: **None**

Use:

5.2 Bridges and Culverts: **3** **0.9 %**

5.3 Bank Armoring: **2,043.1** **27.1 %**

Left: **1,631.0 ft.** Right: **412.1 ft.**

5.4 Channel Straightening: **157.6** **2.1 %**

5.5 Dredging History: **Dredging**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **4,445.7 ft.** **59.0**

One Side Both Sides

Road: **3,571.6 ft.** **874.1 ft.**

Railroad: **0.0 ft.** **0.0 ft.**

Berm: **284.5 ft.** **0.0 ft.**

Improved Path: **0.0 ft.** **0.0 ft.**

6.2 Development: **2,315.0 ft.** **0.0 ft.**

6.3 Channel Bars: **Multiple**

6.4 Meander Migration: **Multiple**

6.5 Meander Width: **260 ft.** Ratio: **4.6**

6.6 Wavelength: **620 ft.** Ratio: **10.9**

Step 7. Windshield Survey

7.1 Bank Erosion: **845.637** ft

7.2 Bank Height: **4** ft

7.3 Ice/Debris Jam Potential: **Bridge**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1	2	2	0	0	2	0	2	2	2	2	1	1	0	1	2	20
Low	High	High	N.S.	N.S.	High	N.S.	High	High	High	High	Low	Low	N.S.	Low	High	

Mill Brook - Basin 13

Basin: **Lower Connecticut**
 Stream Name: **Mill Brook**
 Topo Maps: **WINDSOR**
 Watershed:

Sub-watershed:

Step 1. Reach Location **Begins at the Bible Hill Rd bridge and continues upstream to the reach break Southwest of Westgate Rd.**

1.1 Reach Description:

1.2 Towns: **West Windsor**

1.3 Downstream Latitude: **43.461268**

1.3 Downstream Longitude: **-72.490878**

Step 2. Stream Type

2.1 Elevation Upstream: **722**

2.1 Elevation Downstream: **714**

2.1 Is Gradient Gentle?: **No**

2.2 Valley Length: **2,080.2 ft.** **0.39** Miles

2.3 Valley Slope: **0.4**

2.4 Channel Length: **2,087.0 ft.** **0.40** Miles

2.5 Channel Slope: **0.39 %**

2.6 Sinuosity: **1.00**

2.7 Watershed Area: **25.1** Square Miles

2.8 Channel Width: **54.1** feet

2.9 Valley Width: **210.0** feet

2.10 Confinement Ratio: **3.9**

2.10 Confinement Type: **Semi-confined**

2.11 Reference Stream Type: **B**

Bedform: **Riffle-Pool**

Sub-Class Slope: **c**

Bed Material: **Cobble**

Step 3. Basin Characteristics

3.1 Alluvial Fan: **None**

3.2 Grade Control: **Ledge**

3.3 Dominant Geological Mat.: **Alluvial** **57.1 %**

3.3 Sub-dom. Geological Mat.: **Till**

3.4 Valley Slope Left: **Very Steep**

3.4 Valley Slope Right: **Steep**

3.5 Soils

Hydrologic Group: **B** **57.1 %**

Flooding: **Occasional** **57.1 %**

Water Table Deep: **3.0** **57.1 %**

Water Table Shallow: **1.5** **57.1 %**

Erodibility: **Moderate** **42.9 %**

7.4 Comments:

Only observed lower reach at Bible Hill Road crossing. Covered bridge washed away during TS Irene and replaced with new abutments ~36ft wide. Debris jam risk likely remains due to change in valley width and narrow span.

Phase 1 - Reach Summary Report

Reach ID: **M08**

SGAT Version: **4.56**

Date Last Edited: **April, 03 2015**

QA Status: **No checks are complete**

Is Reach An Impoundment?: **No**

Step 4. Land Cover - Reach Hydrology

4.1 Watershed

Historic Land Cover: **Forest**

Current Dominant Land Cover: **Forest** **79.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.2 Corridor

Historic Land Cover:: **Forest**

Current Dominant Land Cover: **Forest** **34.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer Left Bank Right Bank

Dominant: **>100** **51-100**

Sub-dominant: **51-100** **>100**

Length w / less than 25 ft.: **0.0 ft.** **194.0 ft.**

4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):

Type: **None**

Use:

5.2 Bridges and Culverts: **0** **0.0 %**

5.3 Bank Armoring: **0.0** **0.0 %**

Left: **0.0 ft.** Right: **0.0 ft.**

5.4 Channel Straightening: **498.1** **23.9 %**

5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **1,951.1 ft.** **93.5**

One Side Both Sides

Road: **1,951.1 ft.** **0.0 ft.**

Railroad: **0.0 ft.** **0.0 ft.**

Berm: **0.0 ft.** **0.0 ft.**

Improved Path: **0.0 ft.** **0.0 ft.**

6.2 Development: **0.0 ft.** **0.0 ft.**

6.3 Channel Bars: **Multiple**

6.4 Meander Migration: **Flood Chute**

6.5 Meander Width: **200 ft.** Ratio: **3.7**

6.6 Wavelength: **580 ft.** Ratio: **10.7**

Step 7. Windshield Survey

7.1 Bank Erosion: **415.495** **ft**

7.2 Bank Height: **4** **ft**

7.3 Ice/Debris Jam Potential: **Bridge**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1	2	1	0	0	0	2	0	2	0	2	0	1	0	1	2	14
Low	High	Low	N.S.	N.S.	N.S.	High	N.S.	High	N.S.	High	N.S.	Low	N.S.	Low	High	

Mill Brook - Basin 13

Phase 1 - Reach Summary Report

Basin: **Lower Connecticut**
 Stream Name: **Mill Brook**
 Topo Maps: **CAVENDISH, WINDSOR**
 Watershed:

Reach ID: **M09**
 SGAT Version: **4.56**
 Date Last Edited: **April, 03 2015**
 QA Status: **No checks are complete**

Sub-watershed:

Is Reach An Impoundment?: **No**

Step 1. Reach Location

This reach begins at the reach break southeast of Westgate Rd and continues upstream to the reach break east of Churchill Rd.

1.1 Reach Description:

1.2 Towns: **West Windsor**

1.3 Downstream Latitude: **43.458742**

1.3 Downstream Longitude: **-72.496311**

Step 2. Stream Type

2.1 Elevation Upstream: **764**

2.1 Elevation Downstream: **722**

2.1 Is Gradient Gentle?: **No**

2.2 Valley Length: **8,480.2 ft.** **1.61** Miles

2.3 Valley Slope: **0.5**

2.4 Channel Length: **11,546.8 ft.** **2.19** Miles

2.5 Channel Slope: **0.36 %**

2.6 Sinuosity: **1.36**

2.7 Watershed Area: **25.0** Square Miles

2.8 Channel Width: **54.0** feet

2.9 Valley Width: **900.0** feet

2.10 Confinement Ratio: **16.7**

2.10 Confinement Type: **Very Broad**

2.11 Reference Stream Type: **C**

Bedform: **Riffle-Pool**

Sub-Class Slope: **None**

Bed Material: **Gravel**

Step 3. Basin Characteristics

3.1 Alluvial Fan: **None**

3.2 Grade Control: **Ledge**

3.3 Dominant Geological Mat.: **Alluvial** **82.4 %**

3.3 Sub-dom. Geological Mat.: **Ice-Contact**

3.4 Valley Slope Left: **Hilly**

3.4 Valley Slope Right: **Hilly**

3.5 Soils

Hydrologic Group: **B** **91.4 %**

Flooding: **Occasional** **82.4 %**

Water Table Deep: **3.0** **82.4 %**

Water Table Shallow: **1.5** **91.1 %**

Erodibility: **slight** **17.6 %**

7.4 Comments:

Due to low slope and flooding potential, risk of ice/debris jamming is likely high at Rt 44 bridge and Yale Heights Rd bridge.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed

Historic Land Cover: **Forest**

Current Dominant Land Cover: **Forest** **79.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.2 Corridor

Historic Land Cover:: **Field**

Current Dominant Land Cover: **Field** **32.0 %**

Current Sub-Dominant Land Cover: **Forest**

4.3 Riparian Buffer

Left Bank

Right Bank

Dominant: **0-25** **0-25**

Sub-dominant: **26-50** **26-50**

Length w / less than 25 ft.: **6,480.0 ft.** **7,019.0 ft.**

4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):

Type: **None**

Use:

5.2 Bridges and Culverts: **4** **0.6 %**

5.3 Bank Armoring: **3,418.6** **29.6 %**

Left: **1,929.1 ft.** Right: **1,489.6 ft.**

5.4 Channel Straightening: **7,377.3** **63.9 %**

5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **1,476.2 ft.** **12.8**

One Side

Both Sides

Road: **1,476.2 ft.** **0.0 ft.**

Railroad: **0.0 ft.** **0.0 ft.**

Berm: **0.0 ft.** **0.0 ft.**

Improved Path: **0.0 ft.** **0.0 ft.**

6.2 Development: **207.5 ft.** **0.0 ft.**

6.3 Channel Bars: **Multiple**

6.4 Meander Migration: **Multiple**

6.5 Meander Width: **220 ft.** Ratio: **4.1**

6.6 Wavelength: **610 ft.** Ratio: **11.3**

Step 7. Windshield Survey

7.1 Bank Erosion: **3060.96** ft

7.2 Bank Height: **6** ft

7.3 Ice/Debris Jam Potential: **Bridge**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1	2	2	0	0	2	2	0	1	0	1	2	1	0	2	2	18
Low	High	High	N.S.	N.S.	High	High	N.S.	Low	N.S.	Low	High	Low	N.S.	High	High	

Mill Brook - Basin 13

Basin: **Lower Connecticut**
 Stream Name: **Mill Brook**
 Topo Maps: **CAVENDISH**
 Watershed:

Sub-watershed:

Step 1. Reach Location

This reach begins at the reach break East of Churchill Rd and continues upstream to the reach point Southwest of Rush Meadow Rd.

1.1 Reach Description:

1.2 Towns: **West Windsor**

1.3 Downstream Latitude: **43.454643**

1.3 Downstream Longitude: **-72.514537**

Step 2. Stream Type

2.1 Elevation Upstream: **771**

2.1 Elevation Downstream: **764**

2.1 Is Gradient Gentle?: **No**

2.2 Valley Length: **1,680.0 ft.** **0.32** Miles

2.3 Valley Slope: **0.4**

2.4 Channel Length: **1,908.0 ft.** **0.36** Miles

2.5 Channel Slope: **0.38 %**

2.6 Sinuosity: **1.14**

2.7 Watershed Area: **16.8** Square Miles

2.8 Channel Width: **45.3** feet

2.9 Valley Width: **525.0** feet

2.10 Confinement Ratio: **11.6**

2.10 Confinement Type: **Very Broad**

2.11 Reference Stream Type: **C**

Bedform: **Riffle-Pool**

Sub-Class Slope: **None**

Bed Material: **Gravel**

Step 3. Basin Characteristics

3.1 Alluvial Fan: **None**

3.2 Grade Control: **None**

3.3 Dominant Geological Mat.: **Alluvial** **63.4 %**

3.3 Sub-dom. Geological Mat.: **Ice-Contact**

3.4 Valley Slope Left: **Hilly**

3.4 Valley Slope Right: **Steep**

3.5 Soils

Hydrologic Group: **B** **90.8 %**

Flooding: **Occasional** **63.4 %**

Water Table Deep: **3.0** **63.4 %**

Water Table Shallow: **1.5** **90.8 %**

Erodibility: **Moderate** **36.6 %**

7.4 Comments:

Churchill Road bridge was jammed with debris during TS Irene. Meander geometry impacts selected as "high" even though straightening is <50% due to high road encroachment.

Phase 1 - Reach Summary Report

Reach ID: **M10**

SGAT Version: **4.56**

Date Last Edited: **April, 03 2015**

QA Status: **No checks are complete**

Is Reach An Impoundment?: **No**

Step 4. Land Cover - Reach Hydrology

4.1 Watershed

Historic Land Cover: **Forest**

Current Dominant Land Cover: **Forest** **82.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.2 Corridor

Historic Land Cover:: **Field**

Current Dominant Land Cover: **Urban** **33.0 %**

Current Sub-Dominant Land Cover: **Field**

4.3 Riparian Buffer Left Bank Right Bank

Dominant: **26-50** **26-50**

Sub-dominant: **0-25** **>100**

Length w / less than 25 ft.: **697.0 ft.** **221.0 ft.**

4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):

Type: **None**

Use:

5.2 Bridges and Culverts: **1** **0.9 %**

5.3 Bank Armoring: **444.6** **23.3 %**

Left: **228.7 ft.** Right: **216.0 ft.**

5.4 Channel Straightening: **671.4** **35.2 %**

5.5 Dredging History: **Dredging**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **1,249.8 ft.** **65.5**

One Side Both Sides

Road: **1,249.8 ft.** **0.0 ft.**

Railroad: **0.0 ft.** **0.0 ft.**

Berm: **0.0 ft.** **0.0 ft.**

Improved Path: **0.0 ft.** **0.0 ft.**

6.2 Development: **613.5 ft.** **0.0 ft.**

6.3 Channel Bars: **Multiple**

6.4 Meander Migration: **Migration**

6.5 Meander Width: **45 ft.** Ratio: **1.0**

6.6 Wavelength: **45 ft.** Ratio: **1.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **140.903** ft

7.2 Bank Height: **2** ft

7.3 Ice/Debris Jam Potential: **Bridge**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1	2	2	0	0	2	2	2	2	2	2	2	2	2	1	2	26
Low	High	High	N.S.	N.S.	High	High	High	High	High	High	High	High	High	Low	High	

Mill Brook - Basin 13

Basin: **Lower Connecticut**
 Stream Name: **Mill Brook**
 Topo Maps: **CAVENDISH**
 Watershed:

Sub-watershed:

Step 1. Reach Location

This reach begins at the reach break Southwest of Rush meadow Rd and continues upstream to the reach break south of Shattuck Hill Rd.

1.1 Reach Description:

1.2 Towns: **West Windsor**

1.3 Downstream Latitude: **43.457935**

1.3 Downstream Longitude: **-72.518403**

Step 2. Stream Type

2.1 Elevation Upstream: **814**

2.1 Elevation Downstream: **771**

2.1 Is Gradient Gentle?: **No**

2.2 Valley Length: **3,889.7 ft.** **0.74** Miles

2.3 Valley Slope: **1.1**

2.4 Channel Length: **3,980.3 ft.** **0.75** Miles

2.5 Channel Slope: **1.08 %**

2.6 Sinuosity: **1.02**

2.7 Watershed Area: **16.6** Square Miles

2.8 Channel Width: **45.2** feet

2.9 Valley Width: **150.0** feet

2.10 Confinement Ratio: **3.3**

2.10 Confinement Type: **Semi-confined**

2.11 Reference Stream Type: **B**

Bedform: **Riffle-Pool**

Sub-Class Slope: **c**

Bed Material: **Cobble**

Step 3. Basin Characteristics

3.1 Alluvial Fan: **None**

3.2 Grade Control: **Ledge**

3.3 Dominant Geological Mat.: **Till** **91.0 %**

3.3 Sub-dom. Geological Mat.: **Ice-Contact**

3.4 Valley Slope Left: **Very Steep**

3.4 Valley Slope Right: **Very Steep**

3.5 Soils

Hydrologic Group: **C** **55.8 %**

Flooding: **None/Rare** **100.0 %**

Water Table Deep: **6.0** **66.0 %**

Water Table Shallow: **6.0** **66.0 %**

Erodibility: **Very Severe** **100.0 %**

7.4 Comments:

NULL

Phase 1 - Reach Summary Report

Reach ID: **M11**

SGAT Version: **4.56**

Date Last Edited: **April, 03 2015**

QA Status: **No checks are complete**

Is Reach An Impoundment?: **No**

Step 4. Land Cover - Reach Hydrology

4.1 Watershed

Historic Land Cover: **Forest**

Current Dominant Land Cover: **Forest** **83.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.2 Corridor

Historic Land Cover:: **Forest**

Current Dominant Land Cover: **Urban** **59.0 %**

Current Sub-Dominant Land Cover: **Forest**

4.3 Riparian Buffer Left Bank Right Bank

Dominant: **26-50** **>100**

Sub-dominant: **0-25** **None**

Length w / less than 25 ft.: **2,152.0 ft.** **0.0 ft.**

4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):

Type: **None**

Use:

5.2 Bridges and Culverts: **0** **0.0 %**

5.3 Bank Armoring: **1,458.8** **36.7 %**

Left: **1,458.8** ft. Right: **0.0** ft.

5.4 Channel Straightening: **0.0** **0.0 %**

5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **3,967.6 ft.** **99.7**

One Side Both Sides

Road: **3,967.6 ft.** **0.0 ft.**

Railroad: **0.0 ft.** **0.0 ft.**

Berm: **0.0 ft.** **0.0 ft.**

Improved Path: **0.0 ft.** **0.0 ft.**

6.2 Development: **634.3 ft.** **0.0 ft.**

6.3 Channel Bars: **Multiple**

6.4 Meander Migration: **Multiple**

6.5 Meander Width: **N/A** Ratio: **0.0**

6.6 Wavelength: **N/A** Ratio: **0.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **49.7935** ft

7.2 Bank Height: **2** ft

7.3 Ice/Debris Jam Potential: **None**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1	2	2	0	0	2	0	0	2	1	1	0	0	0	0	0	11
Low	High	High	N.S.	N.S.	High	N.S.	N.S.	High	Low	Low	N.S.	N/A	N/A	N.S.	N.S.	

Mill Brook - Basin 13

Basin: **Lower Connecticut**
 Stream Name: **Mill Brook**
 Topo Maps: **CAVENDISH**
 Watershed:

Sub-watershed:

Step 1. Reach Location

This reach begins at the reach break South of Shattuck Hill Rd and continues upstream to the reach break Southwest of Hurricane Hill Rd.

1.1 Reach Description:

1.2 Towns: **Reading, West Windsor**

1.3 Downstream Latitude: **43.466469**

1.3 Downstream Longitude: **-72.52427**

Step 2. Stream Type

2.1 Elevation Upstream: **850**

2.1 Elevation Downstream: **814**

2.1 Is Gradient Gentle?: **No**

2.2 Valley Length: **3,413.8 ft.** **0.65** Miles

2.3 Valley Slope: **1.1**

2.4 Channel Length: **4,066.6 ft.** **0.77** Miles

2.5 Channel Slope: **0.89 %**

2.6 Sinuosity: **1.19**

2.7 Watershed Area: **16.1** Square Miles

2.8 Channel Width: **44.5** feet

2.9 Valley Width: **500.0** feet

2.10 Confinement Ratio: **11.2**

2.10 Confinement Type: **Very Broad**

2.11 Reference Stream Type: **C**

Bedform: **Riffle-Pool**

Sub-Class Slope: **None**

Bed Material: **Gravel**

Step 3. Basin Characteristics

3.1 Alluvial Fan: **None**

3.2 Grade Control: **Ledge**

3.3 Dominant Geological Mat.: **Alluvial** **52.7 %**

3.3 Sub-dom. Geological Mat.: **Ice-Contact**

3.4 Valley Slope Left: **Steep**

3.4 Valley Slope Right: **Steep**

3.5 Soils

Hydrologic Group: **B** **75.3 %**

Flooding: **Occasional** **52.7 %**

Water Table Deep: **3.0** **52.7 %**

Water Table Shallow: **1.5** **67.5 %**

Erodibility: **Moderate** **47.3 %**

7.4 Comments:

Meander geometry impacts selected as "high" even though straightening is <50% due to high road and development corridor encroachment.

Phase 1 - Reach Summary Report

Reach ID: **M12**

SGAT Version: **4.56**

Date Last Edited: **April, 03 2015**

QA Status: **No checks are complete**

Is Reach An Impoundment?: **No**

Step 4. Land Cover - Reach Hydrology

4.1 Watershed

Historic Land Cover: **Forest**

Current Dominant Land Cover: **Forest** **84.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.2 Corridor

Historic Land Cover:: **Field**

Current Dominant Land Cover: **Urban** **54.0 %**

Current Sub-Dominant Land Cover: **Forest**

4.3 Riparian Buffer

Left Bank

Right Bank

Dominant: **>100** **>100**

Sub-dominant: **26-50** **51-100**

Length w / less than 25 ft.: **960.0 ft.** **427.0 ft.**

4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):

Type: **Small Withdrawal**

Use: **Other**

5.2 Bridges and Culverts: **3** **1.5 %**

5.3 Bank Armoring: **2,183.4** **53.7 %**

Left: **1,336.4 ft.** Right: **847.0 ft.**

5.4 Channel Straightening: **1,083.1** **26.6 %**

5.5 Dredging History: **Dredging**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **1,000.7 ft.** **24.6**

One Side

Both Sides

Road: **878.0 ft.** **0.0 ft.**

Railroad: **0.0 ft.** **0.0 ft.**

Berm: **504.4 ft.** **0.0 ft.**

Improved Path: **1,000.7 ft.** **0.0 ft.**

6.2 Development: **1,237.7 ft.** **0.0 ft.**

6.3 Channel Bars: **Multiple**

6.4 Meander Migration: **None**

6.5 Meander Width: **44 ft.** Ratio: **1.0**

6.6 Wavelength: **44 ft.** Ratio: **1.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **412.75** **ft**

7.2 Bank Height: **4** **ft**

7.3 Ice/Debris Jam Potential: **Bridge**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1	2	2	1	0	2	2	2	2	2	2	0	2	2	1	1	24
Low	High	High	Low	N.S.	High	High	High	High	High	High	N.S.	High	High	Low	Low	

Mill Brook - Basin 13

Basin: **Lower Connecticut**
 Stream Name: **Mill Brook**
 Topo Maps: **CAVENDISH**
 Watershed:

Sub-watershed:

Step 1. Reach Location

1.1 Reach Description:

This reach begins at the reach break Southwest of Hurricane Hill Rd and continues upstream to the reach point South of Agony Hill Rd.

1.2 Towns: **Reading**

1.3 Downstream Latitude: **43.472408**

1.3 Downstream Longitude: **-72.534192**

Step 2. Stream Type

2.1 Elevation Upstream: **936**

2.1 Elevation Downstream: **850**

2.1 Is Gradient Gentle?: **No**

2.2 Valley Length: **7,108.8 ft.** **1.35** Miles

2.3 Valley Slope: **1.2**

2.4 Channel Length: **7,217.4 ft.** **1.37** Miles

2.5 Channel Slope: **1.18 %**

2.6 Sinuosity: **1.02**

2.7 Watershed Area: **15.3** Square Miles

2.8 Channel Width: **43.5** feet

2.9 Valley Width: **220.0** feet

2.10 Confinement Ratio: **5.1**

2.10 Confinement Type: **Narrow**

2.11 Reference Stream Type: **B**

Bedform: **Riffle-Pool**

Sub-Class Slope: **c**

Bed Material: **Cobble**

Step 3. Basin Characteristics

3.1 Alluvial Fan: **None**

3.2 Grade Control: **Ledge**

3.3 Dominant Geological Mat.: **Ice-Contact** **50.6 %**

3.3 Sub-dom. Geological Mat.: **Till**

3.4 Valley Slope Left: **Very Steep**

3.4 Valley Slope Right: **Very Steep**

3.5 Soils

Hydrologic Group: **B** **74.9 %**

Flooding: **None/Rare** **81.0 %**

Water Table Deep: **2.5** **59.2 %**

Water Table Shallow: **1.5** **78.2 %**

Erodibility: **Very Severe** **81.0 %**

7.4 Comments:

Meander geometry impacts selected as "high" even though straightening is <50% due to high road and development corridor encroachment. Low ice jam potential from two bridges and narrow encroached channel. Private bridge in upper reach may have jammed during T.S. Irene.

Phase 1 - Reach Summary Report

Reach ID: **M13**

SGAT Version: **4.56**

Date Last Edited: **April, 03 2015**

QA Status: **No checks are complete**

Is Reach An Impoundment?: **No**

Step 4. Land Cover - Reach Hydrology

4.1 Watershed

Historic Land Cover: **Forest**

Current Dominant Land Cover: **Forest** **85.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.2 Corridor

Historic Land Cover:: **Commercial**

Current Dominant Land Cover: **Urban** **41.0 %**

Current Sub-Dominant Land Cover: **Forest**

4.3 Riparian Buffer Left Bank Right Bank

Dominant: **0-25** **>100**

Sub-dominant: **51-100** **0-25**

Length w / less than 25 ft.: **2,996.0 ft.** **346.0 ft.**

4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):

Type: **None**

Use:

5.2 Bridges and Culverts: **2** **0.9 %**

5.3 Bank Armoring: **3,461.2** **48.0 %**

Left: **3,024.6 ft.** Right: **436.6 ft.**

5.4 Channel Straightening: **600.4** **8.3 %**

5.5 Dredging History: **Dredging**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **6,692.6 ft.** **92.7**

One Side Both Sides

Road: **6,006.7 ft.** **685.9 ft.**

Railroad: **0.0 ft.** **0.0 ft.**

Berm: **0.0 ft.** **0.0 ft.**

Improved Path: **0.0 ft.** **0.0 ft.**

6.2 Development: **1,210.5 ft.** **400.8 ft.**

6.3 Channel Bars: **Multiple**

6.4 Meander Migration: **None**

6.5 Meander Width: **44 ft.** Ratio: **1.0**

6.6 Wavelength: **44 ft.** Ratio: **1.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **451.514** ft

7.2 Bank Height: **4** ft

7.3 Ice/Debris Jam Potential: **Bridge**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1	2	2	0	0	2	1	2	2	2	2	0	2	2	1	1	22
Low	High	High	N.S.	N.S.	High	Low	High	High	High	High	N.S.	High	High	Low	Low	

Mill Brook - Basin 13

Basin: **Lower Connecticut**
 Stream Name: **Mill Brook**
 Topo Maps: **WOODSTOCK SOUTH, CAVENDISH**
 Watershed:

Sub-watershed:

Step 1. Reach Location

1.1 Reach Description:

1.2 Towns: **Reading**

1.3 Downstream Latitude: **43.484702**

1.3 Downstream Longitude: **-72.552562**

Step 2. Stream Type

2.1 Elevation Upstream: **1,038**

2.1 Elevation Downstream: **936**

2.1 Is Gradient Gentle?: **No**

2.2 Valley Length: **6,053.5 ft.** **1.15** Miles

2.3 Valley Slope: **1.7**

2.4 Channel Length: **7,498.5 ft.** **1.42** Miles

2.5 Channel Slope: **1.37 %**

2.6 Sinuosity: **1.24**

2.7 Watershed Area: **9.7** Square Miles

2.8 Channel Width: **35.7** feet

2.9 Valley Width: **475.0** feet

2.10 Confinement Ratio: **13.3**

2.10 Confinement Type: **Very Broad**

2.11 Reference Stream Type: **C**

Bedform: **Riffle-Pool**

Sub-Class Slope: **None**

Bed Material: **Gravel**

Step 3. Basin Characteristics

3.1 Alluvial Fan: **None**

3.2 Grade Control: **Ledge**

3.3 Dominant Geological Mat.: **Alluvial** **81.2 %**

3.3 Sub-dom. Geological Mat.: **Till**

3.4 Valley Slope Left: **Steep**

3.4 Valley Slope Right: **Steep**

3.5 Soils

Hydrologic Group: **B** **86.0 %**

Flooding: **Occasional** **81.2 %**

Water Table Deep: **3.0** **81.2 %**

Water Table Shallow: **1.5** **82.9 %**

Erodibility: **slight** **18.8 %**

7.4 Comments:

Baily's Mills Road bridge failed during TS Irene. Clearance likely much higher than previous bridge, but ice/debris jamming still possible given change in valley confinement and slope as mainstem approaches trib confluence.

Phase 1 - Reach Summary Report

Reach ID: **M14**

SGAT Version: **4.56**

Date Last Edited: **April, 03 2015**

QA Status: **No checks are complete**

Is Reach An Impoundment?: **No**

This reach begins at the reach break South of Agony Hill Rd and continues upstream to the reach break south of the Whitmore Rd crossing.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed

Historic Land Cover: **Forest**

Current Dominant Land Cover: **Forest** **85.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.2 Corridor

Historic Land Cover:: **Field**

Current Dominant Land Cover: **Forest** **38.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer Left Bank Right Bank

Dominant: **>100** **26-50**

Sub-dominant: **0-25** **>100**

Length w / less than 25 ft.: **1,867.0 ft.** **593.0 ft.**

4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):

Type: **None**

Use:

5.2 Bridges and Culverts: **2** **1.2 %**

5.3 Bank Armoring: **1,430.2** **19.1 %**

Left: **684.5 ft.** Right: **745.6 ft.**

5.4 Channel Straightening: **2,144.9** **28.6 %**

5.5 Dredging History: **Dredging**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **3,788.6 ft.** **50.5**

One Side Both Sides

Road: **3,788.6 ft.** **0.0 ft.**

Railroad: **0.0 ft.** **0.0 ft.**

Berm: **181.5 ft.** **0.0 ft.**

Improved Path: **0.0 ft.** **0.0 ft.**

6.2 Development: **487.9 ft.** **0.0 ft.**

6.3 Channel Bars: **Multiple**

6.4 Meander Migration: **Multiple**

6.5 Meander Width: **230 ft.** Ratio: **6.4**

6.6 Wavelength: **1050 ft.** Ratio: **29.4**

Step 7. Windshield Survey

7.1 Bank Erosion: **2404.31** ft

7.2 Bank Height: **5** ft

7.3 Ice/Debris Jam Potential: **Bridge**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1	2	2	0	0	1	2	2	2	1	2	2	0	2	2	1	22
Low	High	High	N.S.	N.S.	Low	High	High	High	Low	High	High	N.S.	High	High	Low	

Mill Brook - Basin 13

Basin: **Lower Connecticut**
 Stream Name: **Mill Brook**
 Topo Maps: **WOODSTOCK SOUTH**
 Watershed:

Sub-watershed:

Step 1. Reach Location

1.1 Reach Description:

1.2 Towns: **Reading**

1.3 Downstream Latitude: **43.501038**

1.3 Downstream Longitude: **-72.562996**

Step 2. Stream Type

2.1 Elevation Upstream: **1,121**

2.1 Elevation Downstream: **1,038**

2.1 Is Gradient Gentle?: **No**

2.2 Valley Length: **4,625.0 ft.** **0.88** Miles

2.3 Valley Slope: **1.8**

2.4 Channel Length: **5,311.5 ft.** **1.01** Miles

2.5 Channel Slope: **1.56 %**

2.6 Sinuosity: **1.15**

2.7 Watershed Area: **3.1** Square Miles

2.8 Channel Width: **21.4** feet

2.9 Valley Width: **325.0** feet

2.10 Confinement Ratio: **15.2**

2.10 Confinement Type: **Very Broad**

2.11 Reference Stream Type: **C**

Bedform: **Riffle-Pool**

Sub-Class Slope: **None**

Bed Material: **Gravel**

Step 3. Basin Characteristics

3.1 Alluvial Fan: **None**

3.2 Grade Control: **Ledge**

3.3 Dominant Geological Mat.: **Alluvial** **77.9 %**

3.3 Sub-dom. Geological Mat.: **Till**

3.4 Valley Slope Left: **Steep**

3.4 Valley Slope Right: **Steep**

3.5 Soils

Hydrologic Group: **B** **75.1 %**

Flooding: **Occasional** **63.8 %**

Water Table Deep: **3.0** **63.8 %**

Water Table Shallow: **1.5** **64.9 %**

Erodibility: **slight** **22.1 %**

7.4 Comments:

Undersized culvert at slope transition has some ice jam potential.

Phase 1 - Reach Summary Report

Reach ID: **M15**

SGAT Version: **4.56**

Date Last Edited: **April, 03 2015**

QA Status: **No checks are complete**

Is Reach An Impoundment?: **No**

This reach begins at the reach break South of Whitmore Rd. and extends upstream to the reach break East of Mountain View Drive.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed

Historic Land Cover: **Forest**

Current Dominant Land Cover: **Forest** **85.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.2 Corridor

Historic Land Cover:: **Field**

Current Dominant Land Cover: **Forest** **26.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer **Left Bank** **Right Bank**

Dominant: **26-50** **26-50**

Sub-dominant: **0-25** **51-100**

Length w / less than 25 ft.: **1,408.0 ft.** **852.0 ft.**

4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):

Type: **Small Withdrawal**

Use: **Other**

5.2 Bridges and Culverts: **4** **1.8 %**

5.3 Bank Armoring: **279.7** **5.3 %**

Left: **127.4 ft.** Right: **152.4 ft.**

5.4 Channel Straightening: **2,495.1** **47.0 %**

5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **0.0 ft.** **0.0**

One Side **Both Sides**

Road: **0.0 ft.** **0.0 ft.**

Railroad: **0.0 ft.** **0.0 ft.**

Berm: **0.0 ft.** **0.0 ft.**

Improved Path: **0.0 ft.** **0.0 ft.**

6.2 Development: **275.3 ft.** **0.0 ft.**

6.3 Channel Bars: **Side**

6.4 Meander Migration: **Multiple**

6.5 Meander Width: **21 ft.** Ratio: **1.0**

6.6 Wavelength: **21 ft.** Ratio: **1.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **1132.01** **ft**

7.2 Bank Height: **2** **ft**

7.3 Ice/Debris Jam Potential: **Culvert**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1	2	2	1	0	1	2	0	0	1	1	2	2	2	2	1	20
Low	High	High	Low	N.S.	Low	High	N.S.	Unk.	Low	Low	High	High	High	High	Low	

Mill Brook - Basin 13

Basin: **Lower Connecticut**
 Stream Name: **Mill Brook**
 Topo Maps: **WOODSTOCK SOUTH**
 Watershed:

Sub-watershed:

Step 1. Reach Location

1.1 Reach Description:

1.2 Towns: **Reading**

1.3 Downstream Latitude: **43.512996**

1.3 Downstream Longitude: **-72.568484**

Step 2. Stream Type

2.1 Elevation Upstream: **1,311**

2.1 Elevation Downstream: **1,121**

2.1 Is Gradient Gentle?: **No**

2.2 Valley Length: **4,615.0 ft.** **0.87** Miles

2.3 Valley Slope: **4.1**

2.4 Channel Length: **5,029.0 ft.** **0.95** Miles

2.5 Channel Slope: **3.79 %**

2.6 Sinuosity: **1.09**

2.7 Watershed Area: **2.6** Square Miles

2.8 Channel Width: **19.8** feet

2.9 Valley Width: **100.0** feet

2.10 Confinement Ratio: **5.0**

2.10 Confinement Type: **Narrow**

2.11 Reference Stream Type: **B**

Bedform: **Riffle-Pool**

Sub-Class Slope: **None**

Bed Material: **Cobble**

Step 3. Basin Characteristics

3.1 Alluvial Fan: **None**

3.2 Grade Control: **Ledge**

3.3 Dominant Geological Mat.: **Alluvial** **40.2 %**

3.3 Sub-dom. Geological Mat.: **Ice-Contact**

3.4 Valley Slope Left: **Very Steep**

3.4 Valley Slope Right: **Very Steep**

3.5 Soils

Hydrologic Group: **B** **76.1 %**

Flooding: **None/Rare** **59.8 %**

Water Table Deep: **3.0** **40.2 %**

Water Table Shallow: **1.5** **73.9 %**

Erodibility: **Severe** **59.8 %**

7.4 Comments:

Meander geometry not evaluated due to B-type and steep channel slope.

Valley may be confined but was not accessible during windshield surveys.

Phase 1 - Reach Summary Report

Reach ID: **M16**

SGAT Version: **4.56**

Date Last Edited: **April, 03 2015**

QA Status: **No checks are complete**

Is Reach An Impoundment?: **No**

This reach is between Stone Chimney and Jenne Rd and bound by the reach breaks North and South of Newton Rd.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed

Historic Land Cover: **Forest**

Current Dominant Land Cover: **Forest** **88.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.2 Corridor

Historic Land Cover:: **Forest**

Current Dominant Land Cover: **Forest** **42.0 %**

Current Sub-Dominant Land Cover: **Field**

4.3 Riparian Buffer **Left Bank** **Right Bank**

Dominant: **>100** **>100**

Sub-dominant: **0-25** **26-50**

Length w / less than 25 ft.: **900.0 ft.** **410.0 ft.**

4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):

Type: **None**

Use:

5.2 Bridges and Culverts: **0** **0.0 %**

5.3 Bank Armoring: **148.4** **3.0 %**

Left: **148.4 ft.** Right: **0.0 ft.**

5.4 Channel Straightening: **786.6** **15.6 %**

5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **0.0 ft.** **0.0**

One Side **Both Sides**

Road: **0.0 ft.** **0.0 ft.**

Railroad: **0.0 ft.** **0.0 ft.**

Berm: **0.0 ft.** **0.0 ft.**

Improved Path: **0.0 ft.** **0.0 ft.**

6.2 Development: **0.0 ft.** **0.0 ft.**

6.3 Channel Bars: **Multiple**

6.4 Meander Migration: **Flood Chute**

6.5 Meander Width: **N/A** Ratio: **0.0**

6.6 Wavelength: **N/A** Ratio: **0.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **1689.92** **ft**

7.2 Bank Height: **4** **ft**

7.3 Ice/Debris Jam Potential: **Not Evaluated**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1	0	2	0	0	0	1	0	0	0	1	0	0	0	2	0	7
Low	N.S.	High	N.S.	N.S.	N.S.	Low	N.S.	Unk.	N.S.	Low	N.S.	N/A	N/A	High	N.S.	

Mill Brook - Basin 13

Basin: **Lower Connecticut**
 Stream Name: **Mill Brook**
 Topo Maps: **WOODSTOCK SOUTH**
 Watershed:

Sub-watershed:

Step 1. Reach Location

This reach is bound by the reach breaks up and down stream of the Stone Chimney Rd crossing.

1.1 Reach Description:

1.2 Towns: **Reading**

1.3 Downstream Latitude: **43.525393**

1.3 Downstream Longitude: **-72.571604**

Step 2. Stream Type

2.1 Elevation Upstream: **1,739**

2.1 Elevation Downstream: **1,311**

2.1 Is Gradient Gentle?: **No**

2.2 Valley Length: **5,350.0 ft.** **1.01** Miles

2.3 Valley Slope: **8.0**

2.4 Channel Length: **6,148.6 ft.** **1.16** Miles

2.5 Channel Slope: **6.96 %**

2.6 Sinuosity: **1.15**

2.7 Watershed Area: **1.6** Square Miles

2.8 Channel Width: **16.3** feet

2.9 Valley Width: **65.0** feet

2.10 Confinement Ratio: **4.0**

2.10 Confinement Type: **Semi-confined**

2.11 Reference Stream Type: **A**

Bedform: **Step-Pool**

Sub-Class Slope: **None**

Bed Material: **Boulder**

Step 3. Basin Characteristics

3.1 Alluvial Fan: **None**

3.2 Grade Control: **None**

3.3 Dominant Geological Mat.: **Till** **69.6 %**

3.3 Sub-dom. Geological Mat.: **Ice-Contact**

3.4 Valley Slope Left: **Very Steep**

3.4 Valley Slope Right: **Ext. Steep**

3.5 Soils

Hydrologic Group: **C** **69.6 %**

Flooding: **None/Rare** **100.0 %**

Water Table Deep: **2.0** **69.2 %**

Water Table Shallow: **1.0** **69.2 %**

Erodibility: **Very Severe** **100.0 %**

7.4 Comments:

NULL

Phase 1 - Reach Summary Report

Reach ID: **M17**

SGAT Version: **4.56**

Date Last Edited: **April, 03 2015**

QA Status: **No checks are complete**

Is Reach An Impoundment?: **No**

Step 4. Land Cover - Reach Hydrology

4.1 Watershed

Historic Land Cover: **Forest**

Current Dominant Land Cover: **Forest** **91.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.2 Corridor

Historic Land Cover:: **Forest**

Current Dominant Land Cover: **Forest** **49.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer

Left Bank

Right Bank

Dominant: **>100**

>100

Sub-dominant:

Length w / less than 25 ft.: **0.0 ft.**

0.0 ft.

4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):

Type: **None**

Use:

5.2 Bridges and Culverts: **1** **0.2 %**

5.3 Bank Armoring: **0.0** **0.0 %**

Left: **0.0 ft.** Right: **0.0 ft.**

5.4 Channel Straightening: **0.0** **0.0 %**

5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **0.0 ft.** **0.0**

One Side

Both Sides

Road: **0.0 ft.** **0.0 ft.**

Railroad: **0.0 ft.** **0.0 ft.**

Berm: **0.0 ft.** **0.0 ft.**

Improved Path: **0.0 ft.** **0.0 ft.**

6.2 Development: **0.0 ft.** **0.0 ft.**

6.3 Channel Bars: **Not Evaluated**

6.4 Meander Migration: **None**

6.5 Meander Width: **N/A** Ratio: **0.0**

6.6 Wavelength: **N/A** Ratio: **0.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **0** **ft**

7.2 Bank Height: **No Data** **ft**

7.3 Ice/Debris Jam Potential: **Not Evaluated**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
N.S.	Low	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	Unk.	N.S.	N.S.	N.S.	N/A	N/A	N.S.	N.S.	

Mill Brook - Basin 13

Basin: **Lower Connecticut**
 Stream Name: **Mill Brook**
 Topo Maps: **WOODSTOCK SOUTH**
 Watershed:

Sub-watershed:

Step 1. Reach Location

This reach is bound by the reach breaks North and South of the Chase 4 Corners Trail.

1.1 Reach Description:

1.2 Towns: **Reading**

1.3 Downstream Latitude: **43.532228**

1.3 Downstream Longitude: **-72.586202**

Step 2. Stream Type

2.1 Elevation Upstream: **2,271**

2.1 Elevation Downstream: **1,739**

2.1 Is Gradient Gentle?: **No**

2.2 Valley Length: **5,950.0 ft.** **1.13** Miles

2.3 Valley Slope: **8.9**

2.4 Channel Length: **6,500.0 ft.** **1.23** Miles

2.5 Channel Slope: **8.17 %**

2.6 Sinuosity: **1.09**

2.7 Watershed Area: **0.6** Square Miles

2.8 Channel Width: **10.6** feet

2.9 Valley Width: **40.0** feet

2.10 Confinement Ratio: **3.8**

2.10 Confinement Type: **Semi-confined**

2.11 Reference Stream Type: **A**

Bedform: **Step-Pool**

Sub-Class Slope: **None**

Bed Material: **Boulder**

Step 3. Basin Characteristics

3.1 Alluvial Fan: **None**

3.2 Grade Control: **None**

3.3 Dominant Geological Mat.: **Till** **100.0 %**

3.3 Sub-dom. Geological Mat.: **Alluvial**

3.4 Valley Slope Left: **Ext. Steep**

3.4 Valley Slope Right: **Ext. Steep**

3.5 Soils

Hydrologic Group: **C** **52.6 %**

Flooding: **None/Rare** **100.0 %**

Water Table Deep: **2.0** **46.0 %**

Water Table Shallow: **1.0** **52.5 %**

Erodibility: **Very Severe** **100.0 %**

7.4 Comments:

NULL

Phase 1 - Reach Summary Report

Reach ID: **M18**

SGAT Version: **4.56**

Date Last Edited: **April, 03 2015**

QA Status: **No checks are complete**

Is Reach An Impoundment?: **No**

Step 4. Land Cover - Reach Hydrology

4.1 Watershed

Historic Land Cover: **Forest**

Current Dominant Land Cover: **Forest** **94.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.2 Corridor

Historic Land Cover:: **Forest**

Current Dominant Land Cover: **Forest** **77.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer

Left Bank

Right Bank

Dominant: **>100** **>100**

Sub-dominant:

Length w / less than 25 ft.: **0.0 ft.** **0.0 ft.**

4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):

Type: **None**

Use:

5.2 Bridges and Culverts: **1** **0.2 %**

5.3 Bank Armoring: **0.0** **0.0 %**

Left: **0.0 ft.** Right: **0.0 ft.**

5.4 Channel Straightening: **0.0** **0.0 %**

5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **0.0 ft.** **0.0**

One Side

Both Sides

Road: **0.0 ft.** **0.0 ft.**

Railroad: **0.0 ft.** **0.0 ft.**

Berm: **0.0 ft.** **0.0 ft.**

Improved Path: **0.0 ft.** **0.0 ft.**

6.2 Development: **0.0 ft.** **0.0 ft.**

6.3 Channel Bars: **Not Evaluated**

6.4 Meander Migration: **None**

6.5 Meander Width: **N/A** Ratio: **0.0**

6.6 Wavelength: **N/A** Ratio: **0.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **0** **ft**

7.2 Bank Height: **No Data** **ft**

7.3 Ice/Debris Jam Potential: **Not Evaluated**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Low	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	Unk.	N.S.	N.S.	N.S.	N/A	N/A	N.S.	N.S.	

Mill Brook - Basin 13

Basin: **Lower Connecticut**
 Stream Name: **Beaver Brook**
 Topo Maps: **WINDSOR**
 Watershed:

Sub-watershed:

Step 1. Reach Location

1.1 Reach Description:

1.2 Towns: **West Windsor**

1.3 Downstream Latitude: **43.467327**

1.3 Downstream Longitude: **-72.470515**

Step 2. Stream Type

2.1 Elevation Upstream: **776**

2.1 Elevation Downstream: **667**

2.1 Is Gradient Gentle?: **No**

2.2 Valley Length: **5,425.0 ft.** **1.03** Miles

2.3 Valley Slope: **2.0**

2.4 Channel Length: **6,569.0 ft.** **1.24** Miles

2.5 Channel Slope: **1.66 %**

2.6 Sinuosity: **1.21**

2.7 Watershed Area: **6.5** Square Miles

2.8 Channel Width: **29.9** feet

2.9 Valley Width: **170.0** feet

2.10 Confinement Ratio: **5.7**

2.10 Confinement Type: **Narrow**

2.11 Reference Stream Type: **C**

Bedform: **Riffle-Pool**

Sub-Class Slope: **None**

Bed Material: **Cobble**

Step 3. Basin Characteristics

3.1 Alluvial Fan: **None**

3.2 Grade Control: **Ledge**

3.3 Dominant Geological Mat.: **Till** **70.6 %**

3.3 Sub-dom. Geological Mat.: **Ice-Contact**

3.4 Valley Slope Left: **Steep**

3.4 Valley Slope Right: **Very Steep**

3.5 Soils

Hydrologic Group: **B** **70.2 %**

Flooding: **None/Rare** **100.0 %**

Water Table Deep: **6.0** **99.6 %**

Water Table Shallow: **6.0** **99.6 %**

Erodibility: **Very Severe** **89.5 %**

7.4 Comments:

Private bridge at slope transition may have low ice jam potential.

Phase 1 - Reach Summary Report

Reach ID: **T1.01**

SGAT Version: **4.56**

Date Last Edited: **April, 03 2015**

QA Status: **No checks are complete**

Is Reach An Impoundment?: **No**

This reach begins South of the Rt-44 crossing just West of Strawberry Hill Rd and continues upstream to the reach break South of the Coon Club Rd crossing.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed

Historic Land Cover: **Forest**

Current Dominant Land Cover: **Forest** **69.0 %**

Current Sub-Dominant Land Cover: **Field**

4.2 Corridor

Historic Land Cover:: **Forest**

Current Dominant Land Cover: **Forest** **38.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer Left Bank Right Bank

Dominant: **>100** **>100**

Sub-dominant: **51-100** **51-100**

Length w / less than 25 ft.: **407.0 ft.** **356.0 ft.**

4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):

Type: **None**

Use:

5.2 Bridges and Culverts: **3** **0.9 %**

5.3 Bank Armoring: **265.6** **4.0 %**

Left: **151.2 ft.** Right: **114.4 ft.**

5.4 Channel Straightening: **0.0** **0.0 %**

5.5 Dredging History: **Dredging**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **150.0 ft.** **2.3**

One Side Both Sides

Road: **0.0 ft.** **0.0 ft.**

Railroad: **0.0 ft.** **0.0 ft.**

Berm: **150.0 ft.** **0.0 ft.**

Improved Path: **0.0 ft.** **0.0 ft.**

6.2 Development: **597.5 ft.** **190.6 ft.**

6.3 Channel Bars: **Multiple**

6.4 Meander Migration: **Flood Chute**

6.5 Meander Width: **140 ft.** Ratio: **4.7**

6.6 Wavelength: **370 ft.** Ratio: **12.4**

Step 7. Windshield Survey

7.1 Bank Erosion: **1022.91** ft

7.2 Bank Height: **5** ft

7.3 Ice/Debris Jam Potential: **Bridge**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
2	2	1	0	0	0	0	2	0	1	0	0	1	0	1	1	11
High	High	Low	N.S.	N.S.	N.S.	N.S.	High	N.S.	Low	N.S.	N.S.	Low	N.S.	Low	Low	

Mill Brook - Basin 13

Basin: **Lower Connecticut**
 Stream Name: **Unnamed Trib 01 to Beaver Brook**
 Topo Maps: **HARTLAND, WINDSOR**
 Watershed:

Sub-watershed:

Step 1. Reach Location

Begins at the reach break South of Coon Club Rd and continues upstream to the reach break North of the Hammond Hill Rd Crossing.

1.1 Reach Description:

1.2 Towns: **West Windsor**

1.3 Downstream Latitude: **43.479805**

1.3 Downstream Longitude: **-72.471359**

Step 2. Stream Type

2.1 Elevation Upstream: **1,272**

2.1 Elevation Downstream: **763**

2.1 Is Gradient Gentle?: **No**

2.2 Valley Length: **8,500.0 ft.** **1.61** Miles

2.3 Valley Slope: **6.0**

2.4 Channel Length: **9,236.3 ft.** **1.75** Miles

2.5 Channel Slope: **5.52 %**

2.6 Sinuosity: **1.09**

2.7 Watershed Area: **1.1** Square Miles

2.8 Channel Width: **13.7** feet

2.9 Valley Width: **50.0** feet

2.10 Confinement Ratio: **3.7**

2.10 Confinement Type: **Semi-confined**

2.11 Reference Stream Type: **A**

Bedform: **Step-Pool**

Sub-Class Slope: **None**

Bed Material: **Bedrock**

Step 3. Basin Characteristics

3.1 Alluvial Fan: **None**

3.2 Grade Control: **None**

3.3 Dominant Geological Mat.: **Till** **92.7 %**

3.3 Sub-dom. Geological Mat.: **Other**

3.4 Valley Slope Left: **Very Steep**

3.4 Valley Slope Right: **Very Steep**

3.5 Soils

Hydrologic Group: **C** **46.8 %**

Flooding: **None/Rare** **100.0 %**

Water Table Deep: **6.0** **59.0 %**

Water Table Shallow: **6.0** **59.0 %**

Erodibility: **Very Severe** **92.7 %**

7.4 Comments:

NULL

Phase 1 - Reach Summary Report

Reach ID: **T1.01.S3.01**

SGAT Version: **4.56**

Date Last Edited: **April, 03 2015**

QA Status: **No checks are complete**

Is Reach An Impoundment?: **No**

Step 4. Land Cover - Reach Hydrology

4.1 Watershed

Historic Land Cover: **Forest**

Current Dominant Land Cover: **Forest** **68.0 %**

Current Sub-Dominant Land Cover: **Field**

4.2 Corridor

Historic Land Cover:: **Forest**

Current Dominant Land Cover: **Forest** **37.0 %**

Current Sub-Dominant Land Cover: **Field**

4.3 Riparian Buffer **Left Bank** **Right Bank**

Dominant: **51-100** **>100**

Sub-dominant: **26-50** **51-100**

Length w / less than 25 ft.: **1,486.0 ft.** **562.0 ft.**

4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):

Type: **None**

Use:

5.2 Bridges and Culverts: **2** **0.5 %**

5.3 Bank Armoring: **0.0** **0.0 %**

Left: **0.0 ft.** Right: **0.0 ft.**

5.4 Channel Straightening: **432.1** **4.7 %**

5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **0.0 ft.** **0.0**

One Side **Both Sides**

Road: **0.0 ft.** **0.0 ft.**

Railroad: **0.0 ft.** **0.0 ft.**

Berm: **0.0 ft.** **0.0 ft.**

Improved Path: **0.0 ft.** **0.0 ft.**

6.2 Development: **172.3 ft.** **0.0 ft.**

6.3 Channel Bars: **None**

6.4 Meander Migration: **None**

6.5 Meander Width: **N/A** Ratio: **0.0**

6.6 Wavelength: **N/A** Ratio: **0.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **0** **ft**

7.2 Bank Height: **No Data** **ft**

7.3 Ice/Debris Jam Potential: **Culvert**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
2	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	5
High	Low	High	N.S.	N.S.	N.S.	N.S.	N.S.	Unk.	N.S.	N.S.	N.S.	N/A	N/A	N.S.	N.S.	

Mill Brook - Basin 13

Basin: **Lower Connecticut**
 Stream Name: **Unnamed Trib 02 to Beaver Brook**
 Topo Maps: **CAVENDISH, WINDSOR**
 Watershed:

Sub-watershed:

Step 1. Reach Location

1.1 Reach Description:

1.2 Towns: **West Windsor**

1.3 Downstream Latitude: **43.481587**

1.3 Downstream Longitude: **-72.473776**

Step 2. Stream Type

2.1 Elevation Upstream: **1,299**

2.1 Elevation Downstream: **782**

2.1 Is Gradient Gentle?: **No**

2.2 Valley Length: **10,600.0 ft.** **2.01** Miles

2.3 Valley Slope: **4.9**

2.4 Channel Length: **11,559.2 ft.** **2.19** Miles

2.5 Channel Slope: **4.47 %**

2.6 Sinuosity: **1.09**

2.7 Watershed Area: **1.4** Square Miles

2.8 Channel Width: **15.4** feet

2.9 Valley Width: **60.0** feet

2.10 Confinement Ratio: **3.9**

2.10 Confinement Type: **Semi-confined**

2.11 Reference Stream Type: **A**

Bedform: **Step-Pool**

Sub-Class Slope: **None**

Bed Material: **Boulder**

Step 3. Basin Characteristics

3.1 Alluvial Fan: **None**

3.2 Grade Control: **Dam**

3.3 Dominant Geological Mat.: **Till** **82.2 %**

3.3 Sub-dom. Geological Mat.: **Alluvial**

3.4 Valley Slope Left: **Very Steep**

3.4 Valley Slope Right: **Very Steep**

3.5 Soils

Hydrologic Group: **C** **89.6 %**

Flooding: **None/Rare** **82.3 %**

Water Table Deep: **2.5** **43.4 %**

Water Table Shallow: **1.5** **43.4 %**

Erodibility: **Very Severe** **82.3 %**

7.4 Comments:

Culvert under private drive south of Sheddsville Road plugged during TS Irene and caused flooding over field. Bible Hill Rd culvert may have jammed during TS Irene.

Phase 1 - Reach Summary Report

Reach ID: **T1.01.S4.01**

SGAT Version: **4.56**

Date Last Edited: **April, 03 2015**

QA Status: **No checks are complete**

Is Reach An Impoundment?: **No**

This reach follows Sheddsville Rd beginning just East of the Brownsville-Hartland Rd crossing and continuing upstream to the terminal reach break North of Sheddsville Rd.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed

Historic Land Cover: **Field**

Current Dominant Land Cover: **Forest** **54.0 %**

Current Sub-Dominant Land Cover: **Field**

4.2 Corridor

Historic Land Cover:: **Field**

Current Dominant Land Cover: **Urban** **26.0 %**

Current Sub-Dominant Land Cover: **Field**

4.3 Riparian Buffer Left Bank Right Bank

Dominant: **>100** **51-100**

Sub-dominant: **0-25** **0-25**

Length w / less than 25 ft.: **2,945.0 ft.** **2,447.0 ft.**

4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):

Type: **Small Run of River**

Use: **Recreation**

5.2 Bridges and Culverts: **10** **1.6 %**

5.3 Bank Armoring: **1,221.4** **10.6 %**

Left: **406.2 ft.** Right: **815.2 ft.**

5.4 Channel Straightening: **3,092.2** **26.8 %**

5.5 Dredging History: **Dredging**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **4,326.4 ft.** **37.4**

One Side Both Sides

Road: **4,326.4 ft.** **0.0 ft.**

Railroad: **0.0 ft.** **0.0 ft.**

Berm: **0.0 ft.** **0.0 ft.**

Improved Path: **0.0 ft.** **0.0 ft.**

6.2 Development: **424.2 ft.** **0.0 ft.**

6.3 Channel Bars: **Multiple**

6.4 Meander Migration: **None**

6.5 Meander Width: **N/A Ratio: 0.0**

6.6 Wavelength: **N/A Ratio: 0.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **294.007** **ft**

7.2 Bank Height: **5** **ft**

7.3 Ice/Debris Jam Potential: **Culvert**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
2	2	2	1	0	1	2	2	2	0	0	0	0	0	0	2	16
High	High	High	Low	N.S.	Low	High	High	High	N.S.	N.S.	N.S.	N/A	N/A	N.S.	High	

Mill Brook - Basin 13

Basin: **Lower Connecticut**
 Stream Name: **Beaver Brook**
 Topo Maps: **WINDSOR**
 Watershed:

Sub-watershed:

Step 1. Reach Location

1.1 Reach Description:

1.2 Towns: **West Windsor**

1.3 Downstream Latitude: **43.481655**

1.3 Downstream Longitude: **-72.473307**

Step 2. Stream Type

2.1 Elevation Upstream: **930**

2.1 Elevation Downstream: **776**

2.1 Is Gradient Gentle?: **No**

2.2 Valley Length: **6,600.0 ft.** **1.25** Miles

2.3 Valley Slope: **2.3**

2.4 Channel Length: **7,723.2 ft.** **1.46** Miles

2.5 Channel Slope: **2.00 %**

2.6 Sinuosity: **1.17**

2.7 Watershed Area: **3.5 Square Miles**

2.8 Channel Width: **22.7 feet**

2.9 Valley Width: **250.0 feet**

2.10 Confinement Ratio: **11.0**

2.10 Confinement Type: **Very Broad**

2.11 Reference Stream Type: **C**

Bedform: **Riffle-Pool**

Sub-Class Slope: **None**

Bed Material: **Gravel**

Step 3. Basin Characteristics

3.1 Alluvial Fan: **None**

3.2 Grade Control: **Ledge**

3.3 Dominant Geological Mat.: **Till** **70.2 %**

3.3 Sub-dom. Geological Mat.: **Alluvial**

3.4 Valley Slope Left: **Very Steep**

3.4 Valley Slope Right: **Steep**

3.5 Soils

Hydrologic Group: **B** **54.1 %**

Flooding: **None/Rare** **72.5 %**

Water Table Deep: **2.0** **36.3 %**

Water Table Shallow: **1.0** **36.3 %**

Erodibility: **Severe** **72.5 %**

7.4 Comments:

Culvert and sharp bed in lower reach may have potential for ice jams

Phase 1 - Reach Summary Report

Reach ID: **T1.02**

SGAT Version: **4.56**

Date Last Edited: **April, 03 2015**

QA Status: **No checks are complete**

Is Reach An Impoundment?: **No**

This reach begins at the reach break East of the intersection of Sheddsville and Brownsville-Hartland Rd and continues upstream to the reach break Southast of the intersection of Brownsville-Hartland and Blood Hill Rd.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed

Historic Land Cover: **Forest**

Current Dominant Land Cover: **Forest** **75.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.2 Corridor

Historic Land Cover:: **Forest**

Current Dominant Land Cover: **Forest** **27.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer Left Bank Right Bank

Dominant: **0-25** **51-100**

Sub-dominant: **51-100** **0-25**

Length w / less than 25 ft.: **3,045.0 ft.** **2,237.0 ft.**

4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):

Type: **Small Withdrawal**

Use: **Recreation**

5.2 Bridges and Culverts: **4** **2.5 %**

5.3 Bank Armoring: **209.5** **2.7 %**

Left: **0.0 ft.** Right: **209.5 ft.**

5.4 Channel Straightening: **969.7** **12.6 %**

5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **915.5 ft.** **11.9**

One Side Both Sides

Road: **915.5 ft.** **0.0 ft.**

Railroad: **0.0 ft.** **0.0 ft.**

Berm: **0.0 ft.** **0.0 ft.**

Improved Path: **0.0 ft.** **0.0 ft.**

6.2 Development: **1,197.2 ft.** **168.1 ft.**

6.3 Channel Bars: **Point**

6.4 Meander Migration: **Flood Chute**

6.5 Meander Width: **70 ft.** Ratio: **3.1**

6.6 Wavelength: **200 ft.** Ratio: **8.8**

Step 7. Windshield Survey

7.1 Bank Erosion: **800.72** **ft**

7.2 Bank Height: **7** **ft**

7.3 Ice/Debris Jam Potential: **Bridge**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1	2	2	1	0	0	1	0	1	1	0	0	1	0	1	1	12
Low	High	High	Low	N.S.	N.S.	Low	N.S.	Low	Low	N.S.	N.S.	Low	N.S.	Low	Low	

Mill Brook - Basin 13

Basin: **Lower Connecticut**
 Stream Name: **Beaver Brook**
 Topo Maps: **HARTLAND, WINDSOR**
 Watershed:

Sub-watershed:

Step 1. Reach Location

1.1 Reach Description:

This reach follows Blood Hill Rd and is bound by the reach breaks North and South of the intersection of Blood Hill and Cross Rd.

1.2 Towns: **West Windsor**

1.3 Downstream Latitude: **43.498973**

1.3 Downstream Longitude: **-72.478674**

Step 2. Stream Type

2.1 Elevation Upstream: **1,046**

2.1 Elevation Downstream: **930**

2.1 Is Gradient Gentle?: **No**

2.2 Valley Length: **5,175.0 ft.** **0.98** Miles

2.3 Valley Slope: **2.2**

2.4 Channel Length: **5,580.8 ft.** **1.06** Miles

2.5 Channel Slope: **2.07 %**

2.6 Sinuosity: **1.08**

2.7 Watershed Area: **1.0** Square Miles

2.8 Channel Width: **13.1** feet

2.9 Valley Width: **350.0** feet

2.10 Confinement Ratio: **26.8**

2.10 Confinement Type: **Very Broad**

2.11 Reference Stream Type: **C**

Bedform: **Riffle-Pool**

Sub-Class Slope: **b**

Bed Material: **Gravel**

Step 3. Basin Characteristics

3.1 Alluvial Fan: **None**

3.2 Grade Control: **None**

3.3 Dominant Geological Mat.: **Till** **80.5 %**

3.3 Sub-dom. Geological Mat.: **Alluvial**

3.4 Valley Slope Left: **Steep**

3.4 Valley Slope Right: **Very Steep**

3.5 Soils

Hydrologic Group: **D** **46.7 %**

Flooding: **None/Rare** **85.0 %**

Water Table Deep: **1.5** **46.7 %**

Water Table Shallow: **0.0** **46.7 %**

Erodibility: **Very Severe** **85.0 %**

7.4 Comments:

Meander geometry measured from short area of channel visible in ESRI World Imager at scale 1:1500 or smaller. Channel definition disappears upstream of this point due to cattle grazing impacts.

Phase 1 - Reach Summary Report

Reach ID: **T1.03**

SGAT Version: **4.56**

Date Last Edited: **April, 03 2015**

QA Status: **No checks are complete**

Is Reach An Impoundment?: **No**

Step 4. Land Cover - Reach Hydrology

4.1 Watershed

Historic Land Cover: **Forest**

Current Dominant Land Cover: **Forest** **79.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.2 Corridor

Historic Land Cover:: **Field**

Current Dominant Land Cover: **Forest** **48.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer Left Bank Right Bank

Dominant: **0-25** **0-25**

Sub-dominant: **26-50** **51-100**

Length w / less than 25 ft.: **3,394.0 ft.** **3,469.0 ft.**

4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):

Type: **None**

Use:

5.2 Bridges and Culverts: **2** **1.1 %**

5.3 Bank Armoring: **0.0** **0.0 %**

Left: **0.0 ft.** Right: **0.0 ft.**

5.4 Channel Straightening: **1,012.4** **18.1 %**

5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **1,155.4 ft.** **20.7**

One Side Both Sides

Road: **1,155.4 ft.** **0.0 ft.**

Railroad: **0.0 ft.** **0.0 ft.**

Berm: **0.0 ft.** **0.0 ft.**

Improved Path: **0.0 ft.** **0.0 ft.**

6.2 Development: **181.2 ft.** **0.0 ft.**

6.3 Channel Bars: **Mid-channel**

6.4 Meander Migration: **None**

6.5 Meander Width: **26 ft.** Ratio: **2.0**

6.6 Wavelength: **78 ft.** Ratio: **6.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **1618.76** ft

7.2 Bank Height: **1** ft

7.3 Ice/Debris Jam Potential: **None**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1	2	2	0	0	0	1	0	2	0	2	0	2	2	2	0	16
Low	High	High	N.S.	N.S.	N.S.	Low	N.S.	High	N.S.	High	N.S.	High	High	High	N.S.	

Mill Brook - Basin 13

Basin: **Lower Connecticut**
 Stream Name: **Beaver Brook**
 Topo Maps: **HARTLAND**
 Watershed:

Sub-watershed:

Step 1. Reach Location

1.1 Reach Description:

This reach follows Blood Hill Rd and is bound by the reach breaks North and South of the intersection of Blood Hill Rd and Parrish View Rd.

1.2 Towns: **West Windsor**

1.3 Downstream Latitude: **43.512241**

1.3 Downstream Longitude: **-72.485093**

Step 2. Stream Type

2.1 Elevation Upstream: **1,291**

2.1 Elevation Downstream: **1,046**

2.1 Is Gradient Gentle?: **No**

2.2 Valley Length: **2,520.0 ft.** **0.48** Miles

2.3 Valley Slope: **9.7**

2.4 Channel Length: **2,607.3 ft.** **0.49** Miles

2.5 Channel Slope: **9.41 %**

2.6 Sinuosity: **1.03**

2.7 Watershed Area: **0.3** Square Miles

2.8 Channel Width: **7.2** feet

2.9 Valley Width: **25.0** feet

2.10 Confinement Ratio: **3.4**

2.10 Confinement Type: **Semi-confined**

2.11 Reference Stream Type: **A**

Bedform: **Step-Pool**

Sub-Class Slope: **None**

Bed Material: **Cobble**

Step 3. Basin Characteristics

3.1 Alluvial Fan: **None**

3.2 Grade Control: **Dam**

3.3 Dominant Geological Mat.: **Till** **100.0 %**

3.3 Sub-dom. Geological Mat.: **Alluvial**

3.4 Valley Slope Left: **Very Steep**

3.4 Valley Slope Right: **Ext. Steep**

3.5 Soils

Hydrologic Group: **C** **100.0 %**

Flooding: **None/Rare** **100.0 %**

Water Table Deep: **2.0** **69.5 %**

Water Table Shallow: **1.0** **69.5 %**

Erodibility: **Very Severe** **100.0 %**

7.4 Comments:

NULL

Phase 1 - Reach Summary Report

Reach ID: **T1.04**

SGAT Version: **4.56**

Date Last Edited: **April, 03 2015**

QA Status: **No checks are complete**

Is Reach An Impoundment?: **No**

Step 4. Land Cover - Reach Hydrology

4.1 Watershed

Historic Land Cover: **Forest**

Current Dominant Land Cover: **Forest** **75.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.2 Corridor

Historic Land Cover:: **Forest**

Current Dominant Land Cover: **Forest** **36.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer Left Bank Right Bank

Dominant: **26-50** **>100**

Sub-dominant: **51-100** **51-100**

Length w / less than 25 ft.: **0.0 ft.** **0.0 ft.**

4.4 Ground Water Inputs: **None**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):

Type: **Small Run of River**

Use: **Recreation**

5.2 Bridges and Culverts: **1** **0.6 %**

5.3 Bank Armoring: **0.0** **0.0 %**

Left: **0.0 ft.** Right: **0.0 ft.**

5.4 Channel Straightening: **0.0** **0.0 %**

5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **1,071.2 ft.** **41.1**

One Side Both Sides

Road: **1,071.2 ft.** **0.0 ft.**

Railroad: **0.0 ft.** **0.0 ft.**

Berm: **0.0 ft.** **0.0 ft.**

Improved Path: **0.0 ft.** **0.0 ft.**

6.2 Development: **321.7 ft.** **0.0 ft.**

6.3 Channel Bars: **None**

6.4 Meander Migration: **None**

6.5 Meander Width: **N/A** Ratio: **0.0**

6.6 Wavelength: **N/A** Ratio: **0.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **0** **ft**

7.2 Bank Height: **No Data** **ft**

7.3 Ice/Debris Jam Potential: **None**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
2	2	0	1	0	0	0	0	2	1	0	0	0	0	0	0	8
High	High	N.S.	Low	N.S.	N.S.	N.S.	N.S.	High	Low	N.S.	N.S.	N/A	N/A	N.S.	N.S.	

Mill Brook - Basin 13

Basin: **Lower Connecticut**
 Stream Name: **Willow Brook**
 Topo Maps: **CAVENDISH**
 Watershed:

Sub-watershed:

Step 1. Reach Location

1.1 Reach Description:

This reach begins at the reach break south of Rt-44 and extends upstream to the reach break North of the first Rush Meadow Crossing.

1.2 Towns: **West Windsor**

1.3 Downstream Latitude: **43.454982**

1.3 Downstream Longitude: **-72.51471**

Step 2. Stream Type

2.1 Elevation Upstream: **816**

2.1 Elevation Downstream: **764**

2.1 Is Gradient Gentle?: **No**

2.2 Valley Length: **3,120.0 ft.** **0.59** Miles

2.3 Valley Slope: **1.7**

2.4 Channel Length: **4,027.9 ft.** **0.76** Miles

2.5 Channel Slope: **1.28 %**

2.6 Sinuosity: **1.29**

2.7 Watershed Area: **5.3** Square Miles

2.8 Channel Width: **27.2** feet

2.9 Valley Width: **510.0** feet

2.10 Confinement Ratio: **18.8**

2.10 Confinement Type: **Very Broad**

2.11 Reference Stream Type: **C**

Bedform: **Riffle-Pool**

Sub-Class Slope: **None**

Bed Material: **Gravel**

Step 3. Basin Characteristics

3.1 Alluvial Fan: **None**

3.2 Grade Control: **Ledge**

3.3 Dominant Geological Mat.: **Alluvial** **66.4 %**

3.3 Sub-dom. Geological Mat.: **Ice-Contact**

3.4 Valley Slope Left: **Steep**

3.4 Valley Slope Right: **Hilly**

3.5 Soils

Hydrologic Group: **B** **66.4 %**

Flooding: **Occasional** **66.4 %**

Water Table Deep: **3.0** **66.4 %**

Water Table Shallow: **1.5** **66.4 %**

Erodibility: **Moderate** **33.6 %**

7.4 Comments:

Minor debris jam potential at Rt 44 bridge. Dredging at Rt 44 post-Irene and downstream along Reach M09.

Phase 1 - Reach Summary Report

Reach ID: **T2.01**

SGAT Version: **4.56**

Date Last Edited: **April, 03 2015**

QA Status: **No checks are complete**

Is Reach An Impoundment?: **No**

Step 4. Land Cover - Reach Hydrology

4.1 Watershed

Historic Land Cover: **Forest**

Current Dominant Land Cover: **Forest** **75.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.2 Corridor

Historic Land Cover:: **Field**

Current Dominant Land Cover: **Forest** **20.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer Left Bank Right Bank

Dominant: **0-25** **0-25**

Sub-dominant: **26-50** **26-50**

Length w / less than 25 ft.: **2,031.0 ft.** **2,744.0 ft.**

4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):

Type: **None**

Use:

5.2 Bridges and Culverts: **3** **1.9 %**

5.3 Bank Armoring: **1,513.4** **37.6 %**

Left: **326.8 ft.** Right: **1,186.5 ft.**

5.4 Channel Straightening: **1,307.9** **32.5 %**

5.5 Dredging History: **Dredging**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **1,041.6 ft.** **25.9**

One Side Both Sides

Road: **1,041.6 ft.** **0.0 ft.**

Railroad: **0.0 ft.** **0.0 ft.**

Berm: **0.0 ft.** **0.0 ft.**

Improved Path: **0.0 ft.** **0.0 ft.**

6.2 Development: **479.3 ft.** **0.0 ft.**

6.3 Channel Bars: **Multiple**

6.4 Meander Migration: **Flood Chute**

6.5 Meander Width: **60 ft.** Ratio: **2.2**

6.6 Wavelength: **230 ft.** Ratio: **8.5**

Step 7. Windshield Survey

7.1 Bank Erosion: **362.224** **ft**

7.2 Bank Height: **5** **ft**

7.3 Ice/Debris Jam Potential: **Bridge**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
2	2	2	0	0	2	2	2	2	1	2	1	2	0	1	1	22
High	High	High	N.S.	N.S.	High	High	High	High	Low	High	Low	High	N.S.	Low	Low	

Mill Brook - Basin 13

Basin: **Lower Connecticut**
 Stream Name: **Willow Brook**
 Topo Maps: **CAVENDISH**
 Watershed:

Sub-watershed:

Step 1. Reach Location This reach follows Rush Meadow Rd. and is bound by the two reach breaks south of West Rowe Hill Rd.

1.1 Reach Description:

1.2 Towns: **West Windsor**

1.3 Downstream Latitude: **43.463456**

1.3 Downstream Longitude: **-72.514676**

Step 2. Stream Type

2.1 Elevation Upstream: **919**

2.1 Elevation Downstream: **816**

2.1 Is Gradient Gentle?: **No**

2.2 Valley Length: **3,150.0 ft.** **0.60** Miles

2.3 Valley Slope: **3.3**

2.4 Channel Length: **3,213.8 ft.** **0.61** Miles

2.5 Channel Slope: **3.20 %**

2.6 Sinuosity: **1.02**

2.7 Watershed Area: **5.0** Square Miles

2.8 Channel Width: **26.7** feet

2.9 Valley Width: **130.0** feet

2.10 Confinement Ratio: **4.9**

2.10 Confinement Type: **Narrow**

2.11 Reference Stream Type: **B**

Bedform: **Step-Pool**

Sub-Class Slope: **None**

Bed Material: **Cobble**

Step 3. Basin Characteristics

3.1 Alluvial Fan: **None**

3.2 Grade Control: **Ledge**

3.3 Dominant Geological Mat.: **Till** **93.6 %**

3.3 Sub-dom. Geological Mat.: **Ice-Contact**

3.4 Valley Slope Left: **Steep**

3.4 Valley Slope Right: **Very Steep**

3.5 Soils

Hydrologic Group: **C** **93.6 %**

Flooding: **None/Rare** **100.0 %**

Water Table Deep: **2.0** **91.4 %**

Water Table Shallow: **1.0** **91.4 %**

Erodibility: **Very Severe** **100.0 %**

7.4 Comments:

NULL

Phase 1 - Reach Summary Report

Reach ID: **T2.02**

SGAT Version: **4.56**

Date Last Edited: **April, 03 2015**

QA Status: **No checks are complete**

Is Reach An Impoundment?: **No**

Step 4. Land Cover - Reach Hydrology

4.1 Watershed

Historic Land Cover: **Forest**

Current Dominant Land Cover: **Forest** **76.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.2 Corridor

Historic Land Cover:: **Forest**

Current Dominant Land Cover: **Urban** **36.0 %**

Current Sub-Dominant Land Cover: **Forest**

4.3 Riparian Buffer Left Bank Right Bank

Dominant: **26-50** **>100**

Sub-dominant: **51-100** **51-100**

Length w / less than 25 ft.: **588.0 ft.** **0.0 ft.**

4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):

Type: **None**

Use:

5.2 Bridges and Culverts: **1** **1.0 %**

5.3 Bank Armoring: **1,106.2** **34.4 %**

Left: **843.6 ft.** Right: **262.6 ft.**

5.4 Channel Straightening: **0.0** **0.0 %**

5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **3,159.3 ft.** **98.3**

One Side Both Sides

Road: **3,159.3 ft.** **0.0 ft.**

Railroad: **0.0 ft.** **0.0 ft.**

Berm: **0.0 ft.** **0.0 ft.**

Improved Path: **0.0 ft.** **0.0 ft.**

6.2 Development: **0.0 ft.** **0.0 ft.**

6.3 Channel Bars: **Multiple**

6.4 Meander Migration: **Flood Chute**

6.5 Meander Width: **N/A** Ratio: **0.0**

6.6 Wavelength: **N/A** Ratio: **0.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **483.218** ft

7.2 Bank Height: **2** ft

7.3 Ice/Debris Jam Potential: **Culvert**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
2	2	1	0	0	2	0	0	2	0	2	0	0	0	1	1	13
High	High	Low	N.S.	N.S.	High	N.S.	N.S.	High	N.S.	High	N.S.	N/A	N/A	Low	Low	

Mill Brook - Basin 13

Basin: **Lower Connecticut**
 Stream Name: **Willow Brook**
 Topo Maps: **CAVENDISH**
 Watershed:

Sub-watershed:

Step 1. Reach Location

This reach follows Rush Meadow Rd. and is bound by the reach breaks North and South of Banister Rd.

1.1 Reach Description:

1.2 Towns: **West Windsor**

1.3 Downstream Latitude: **43.471249**

1.3 Downstream Longitude: **-72.512231**

Step 2. Stream Type

2.1 Elevation Upstream: **1,058**

2.1 Elevation Downstream: **919**

2.1 Is Gradient Gentle?: **No**

2.2 Valley Length: **6,045.0 ft.** **1.14** Miles

2.3 Valley Slope: **2.3**

2.4 Channel Length: **6,818.9 ft.** **1.29** Miles

2.5 Channel Slope: **2.04 %**

2.6 Sinuosity: **1.13**

2.7 Watershed Area: **4.7** Square Miles

2.8 Channel Width: **25.9** feet

2.9 Valley Width: **200.0** feet

2.10 Confinement Ratio: **7.7**

2.10 Confinement Type: **Broad**

2.11 Reference Stream Type: **B**

Bedform: **Riffle-Pool**

Sub-Class Slope: **None**

Bed Material: **Cobble**

Step 3. Basin Characteristics

3.1 Alluvial Fan: **None**

3.2 Grade Control: **Ledge**

3.3 Dominant Geological Mat.: **Till** **53.4 %**

3.3 Sub-dom. Geological Mat.: **Ice-Contact**

3.4 Valley Slope Left: **Steep**

3.4 Valley Slope Right: **Hilly**

3.5 Soils

Hydrologic Group: **C** **65.3 %**

Flooding: **None/Rare** **79.0 %**

Water Table Deep: **2.5** **40.6 %**

Water Table Shallow: **1.5** **40.6 %**

Erodibility: **Very Severe** **79.0 %**

7.4 Comments:

Minor debris jam potential at first crossing of Rush Meadow Road near West Hill Rd.

Phase 1 - Reach Summary Report

Reach ID: **T2.03**

SGAT Version: **4.56**

Date Last Edited: **April, 03 2015**

QA Status: **No checks are complete**

Is Reach An Impoundment?: **No**

Step 4. Land Cover - Reach Hydrology

4.1 Watershed

Historic Land Cover: **Forest**

Current Dominant Land Cover: **Forest** **75.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.2 Corridor

Historic Land Cover:: **Commercial**

Current Dominant Land Cover: **Urban** **42.0 %**

Current Sub-Dominant Land Cover: **Forest**

4.3 Riparian Buffer

Left Bank Right Bank

Dominant: **>100** **0-25**

Sub-dominant: **0-25** **26-50**

Length w / less than 25 ft.: **1,803.0 ft.** **3,257.0 ft.**

4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):

Type: **Small Withdrawal**

Use: **Other**

5.2 Bridges and Culverts: **7** **2.8 %**

5.3 Bank Armoring: **1,954.5** **28.7 %**

Left: **871.4 ft.** Right: **1,083.1 ft.**

5.4 Channel Straightening: **924.5** **13.6 %**

5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **6,385.6 ft.** **93.6**

One Side Both Sides

Road: **6,103.7 ft.** **281.9 ft.**

Railroad: **0.0 ft.** **0.0 ft.**

Berm: **0.0 ft.** **0.0 ft.**

Improved Path: **0.0 ft.** **0.0 ft.**

6.2 Development: **646.6 ft.** **0.0 ft.**

6.3 Channel Bars: **Multiple**

6.4 Meander Migration: **Flood Chute**

6.5 Meander Width: **110 ft.** Ratio: **4.3**

6.6 Wavelength: **330 ft.** Ratio: **12.8**

Step 7. Windshield Survey

7.1 Bank Erosion: **1001.09** ft

7.2 Bank Height: **4** ft

7.3 Ice/Debris Jam Potential: **Multiple**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
2	2	2	1	0	2	1	0	2	1	1	0	1	0	1	1	17
High	High	High	Low	N.S.	High	Low	N.S.	High	Low	Low	N.S.	Low	N.S.	Low	Low	

Mill Brook - Basin 13

Basin: **Lower Connecticut**
 Stream Name: **Willow Brook**
 Topo Maps: **CAVENDISH**
 Watershed:

Sub-watershed:

Step 1. Reach Location

This reach parallels Rush Meadow Rd to the east, and is bound by the two reach breaks south of Delano Rd.

1.1 Reach Description:

1.2 Towns: **West Windsor**

1.3 Downstream Latitude: **43.487033**

1.3 Downstream Longitude: **-72.518926**

Step 2. Stream Type

2.1 Elevation Upstream: **1,141**

2.1 Elevation Downstream: **1,058**

2.1 Is Gradient Gentle?: **No**

2.2 Valley Length: **2,775.0 ft.** **0.53** Miles

2.3 Valley Slope: **3.0**

2.4 Channel Length: **3,051.4 ft.** **0.58** Miles

2.5 Channel Slope: **2.75 %**

2.6 Sinuosity: **1.10**

2.7 Watershed Area: **3.2** Square Miles

2.8 Channel Width: **21.9** feet

2.9 Valley Width: **150.0** feet

2.10 Confinement Ratio: **6.8**

2.10 Confinement Type: **Broad**

2.11 Reference Stream Type: **C**

Bedform: **Riffle-Pool**

Sub-Class Slope: **b**

Bed Material: **Cobble**

Step 3. Basin Characteristics

3.1 Alluvial Fan: **None**

3.2 Grade Control: **Ledge**

3.3 Dominant Geological Mat.: **Alluvial** **65.0 %**

3.3 Sub-dom. Geological Mat.: **Till**

3.4 Valley Slope Left: **Very Steep**

3.4 Valley Slope Right: **Ext. Steep**

3.5 Soils

Hydrologic Group: **B** **66.9 %**

Flooding: **Occasional** **65.0 %**

Water Table Deep: **3.0** **65.0 %**

Water Table Shallow: **1.5** **70.6 %**

Erodibility: **Moderate** **35.0 %**

7.4 Comments:

Meander geometry not assessed because channel centerline not visible with aerial photos under dense canopy.

Phase 1 - Reach Summary Report

Reach ID: **T2.04**

SGAT Version: **4.56**

Date Last Edited: **April, 03 2015**

QA Status: **No checks are complete**

Is Reach An Impoundment?: **No**

Step 4. Land Cover - Reach Hydrology

4.1 Watershed

Historic Land Cover: **Forest**

Current Dominant Land Cover: **Forest** **74.0 %**

Current Sub-Dominant Land Cover: **Field**

4.2 Corridor

Historic Land Cover:: **Forest**

Current Dominant Land Cover: **Forest** **36.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer Left Bank Right Bank

Dominant: **>100** **>100**

Sub-dominant: **0-25** **51-100**

Length w / less than 25 ft.: **220.0 ft.** **230.0 ft.**

4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):

Type: **None**

Use:

5.2 Bridges and Culverts: **0** **0.0 %**

5.3 Bank Armoring: **240.5** **7.9 %**

Left: **24.1 ft.** Right: **216.4 ft.**

5.4 Channel Straightening: **0.0** **0.0 %**

5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **871.8 ft.** **28.6**

One Side Both Sides

Road: **871.8 ft.** **0.0 ft.**

Railroad: **0.0 ft.** **0.0 ft.**

Berm: **0.0 ft.** **0.0 ft.**

Improved Path: **0.0 ft.** **0.0 ft.**

6.2 Development: **415.6 ft.** **0.0 ft.**

6.3 Channel Bars: **Multiple**

6.4 Meander Migration: **Multiple**

6.5 Meander Width: **N/A** Ratio: **0.0**

6.6 Wavelength: **N/A** Ratio: **0.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **903.739** **ft**

7.2 Bank Height: **3** **ft**

7.3 Ice/Debris Jam Potential: **Not Evaluated**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1	2	1	0	0	1	0	0	2	1	0	0	0	0	2	0	10
Low	High	Low	N.S.	N.S.	Low	N.S.	N.S.	High	Low	N.S.	N.S.	N/A	N/A	High	N.S.	

Mill Brook - Basin 13

Basin: **Lower Connecticut**
 Stream Name: **Willow Brook**
 Topo Maps: **CAVENDISH**
 Watershed:

Sub-watershed:

Step 1. Reach Location This reach follows Rush Meadow Rd. and is bound by the reach breaks North and South of Sheddsville Rd.

1.1 Reach Description:

1.2 Towns: **West Windsor**

1.3 Downstream Latitude: **43.494564**

1.3 Downstream Longitude: **-72.518078**

Step 2. Stream Type

2.1 Elevation Upstream: **1,203**

2.1 Elevation Downstream: **1,141**

2.1 Is Gradient Gentle?: **No**

2.2 Valley Length: **1,670.0 ft.** **0.32** Miles

2.3 Valley Slope: **3.7**

2.4 Channel Length: **1,989.0 ft.** **0.38** Miles

2.5 Channel Slope: **3.08 %**

2.6 Sinuosity: **1.19**

2.7 Watershed Area: **2.3** Square Miles

2.8 Channel Width: **19.0** feet

2.9 Valley Width: **160.0** feet

2.10 Confinement Ratio: **8.4**

2.10 Confinement Type: **Broad**

2.11 Reference Stream Type: **C**

Bedform: **Riffle-Pool**

Sub-Class Slope: **None**

Bed Material: **Cobble**

Step 3. Basin Characteristics

3.1 Alluvial Fan: **None**

3.2 Grade Control: **Ledge**

3.3 Dominant Geological Mat.: **Till** **100.0 %**

3.3 Sub-dom. Geological Mat.: **Alluvial**

3.4 Valley Slope Left: **Steep**

3.4 Valley Slope Right: **Very Steep**

3.5 Soils

Hydrologic Group: **C** **81.7 %**

Flooding: **None/Rare** **100.0 %**

Water Table Deep: **2.5** **51.7 %**

Water Table Shallow: **1.5** **51.7 %**

Erodibility: **Very Severe** **100.0 %**

7.4 Comments:

Meander geometry measurements difficult because channel centerline not visible with aerial photos under dense canopy.

Phase 1 - Reach Summary Report

Reach ID: **T2.05**

SGAT Version: **4.56**

Date Last Edited: **April, 03 2015**

QA Status: **No checks are complete**

Is Reach An Impoundment?: **No**

Step 4. Land Cover - Reach Hydrology

4.1 Watershed

Historic Land Cover: **Field**

Current Dominant Land Cover: **Forest** **73.0 %**

Current Sub-Dominant Land Cover: **Field**

4.2 Corridor

Historic Land Cover:: **Field**

Current Dominant Land Cover: **Urban** **31.0 %**

Current Sub-Dominant Land Cover: **Forest**

4.3 Riparian Buffer Left Bank Right Bank

Dominant: **26-50** **26-50**

Sub-dominant: **0-25** **>100**

Length w / less than 25 ft.: **849.0 ft.** **536.0 ft.**

4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):

Type: **None**

Use:

5.2 Bridges and Culverts: **2** **4.3 %**

5.3 Bank Armoring: **333.1** **16.7 %**

Left: **31.0 ft.** Right: **302.1 ft.**

5.4 Channel Straightening: **378.4** **19.0 %**

5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **1,496.1 ft.** **75.2**

One Side Both Sides

Road: **1,496.1 ft.** **0.0 ft.**

Railroad: **0.0 ft.** **0.0 ft.**

Berm: **0.0 ft.** **0.0 ft.**

Improved Path: **0.0 ft.** **0.0 ft.**

6.2 Development: **270.7 ft.** **0.0 ft.**

6.3 Channel Bars: **Multiple**

6.4 Meander Migration: **None**

6.5 Meander Width: **55 ft.** Ratio: **2.9**

6.6 Wavelength: **325 ft.** Ratio: **17.1**

Step 7. Windshield Survey

7.1 Bank Erosion: **240.577** ft

7.2 Bank Height: **3** ft

7.3 Ice/Debris Jam Potential: **Bridge**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1	2	2	0	0	1	1	0	2	1	0	0	2	2	1	0	15
Low	High	High	N.S.	N.S.	Low	Low	N.S.	High	Low	N.S.	N.S.	High	High	Low	N.S.	

Mill Brook - Basin 13

Basin: **Lower Connecticut**
 Stream Name: **Willow Brook**
 Topo Maps: **WOODSTOCK SOUTH, CAVENDISH**
 Watershed:

Sub-watershed:

Step 1. Reach Location

This reach parallels Rush Meadow Rd and is bound by the reach breaks North and South of Wardner Rd.

1.1 Reach Description:

1.2 Towns: **West Windsor**

1.3 Downstream Latitude: **43.498998**

1.3 Downstream Longitude: **-72.519417**

Step 2. Stream Type

2.1 Elevation Upstream: **1,314**

2.1 Elevation Downstream: **1,203**

2.1 Is Gradient Gentle?: **No**

2.2 Valley Length: **4,200.0 ft.** **0.80** Miles

2.3 Valley Slope: **2.6**

2.4 Channel Length: **4,634.9 ft.** **0.88** Miles

2.5 Channel Slope: **2.39 %**

2.6 Sinuosity: **1.10**

2.7 Watershed Area: **1.7** Square Miles

2.8 Channel Width: **16.5** feet

2.9 Valley Width: **150.0** feet

2.10 Confinement Ratio: **9.1**

2.10 Confinement Type: **Broad**

2.11 Reference Stream Type: **C**

Bedform: **Riffle-Pool**

Sub-Class Slope: **b**

Bed Material: **Gravel**

Step 3. Basin Characteristics

3.1 Alluvial Fan: **None**

3.2 Grade Control: **None**

3.3 Dominant Geological Mat.: **Till** **78.4 %**

3.3 Sub-dom. Geological Mat.: **Alluvial**

3.4 Valley Slope Left: **Hilly**

3.4 Valley Slope Right: **Hilly**

3.5 Soils

Hydrologic Group: **C** **68.4 %**

Flooding: **None/Rare** **78.4 %**

Water Table Deep: **1.5** **51.2 %**

Water Table Shallow: **0.0** **51.2 %**

Erodibility: **Very Severe** **78.4 %**

7.4 Comments:

New structure at Wardner Rd post-Irene. Some debris jam risk at Rush Meadow Rd culvert (6'x4' squash). Meander geometry not assessed because channel centerline not visible with aerial photos under dense canopy.

Phase 1 - Reach Summary Report

Reach ID: **T2.06**

SGAT Version: **4.56**

Date Last Edited: **April, 03 2015**

QA Status: **No checks are complete**

Is Reach An Impoundment?: **No**

Step 4. Land Cover - Reach Hydrology

4.1 Watershed

Historic Land Cover: **Forest**

Current Dominant Land Cover: **Forest** **73.0 %**

Current Sub-Dominant Land Cover: **Field**

4.2 Corridor

Historic Land Cover:: **Forest**

Current Dominant Land Cover: **Forest** **37.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer **Left Bank** **Right Bank**

Dominant: **>100** **26-50**

Sub-dominant: **51-100** **51-100**

Length w / less than 25 ft.: **226.0 ft.** **118.0 ft.**

4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):

Type: **None**

Use:

5.2 Bridges and Culverts: **3** **1.2 %**

5.3 Bank Armoring: **199.0** **4.3 %**

Left: **0.0 ft.** Right: **199.0 ft.**

5.4 Channel Straightening: **0.0** **0.0 %**

5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **1,675.0 ft.** **36.1**

One Side **Both Sides**

Road: **1,675.0 ft.** **0.0 ft.**

Railroad: **0.0 ft.** **0.0 ft.**

Berm: **0.0 ft.** **0.0 ft.**

Improved Path: **0.0 ft.** **0.0 ft.**

6.2 Development: **0.0 ft.** **0.0 ft.**

6.3 Channel Bars: **Not Evaluated**

6.4 Meander Migration: **None**

6.5 Meander Width: **N/A** Ratio: **0.0**

6.6 Wavelength: **N/A** Ratio: **0.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **0** **ft**

7.2 Bank Height: **No Data** **ft**

7.3 Ice/Debris Jam Potential: **Multiple**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1	2	1	0	0	0	0	0	2	0	0	0	0	0	0	1	7
Low	High	Low	N.S.	N.S.	N.S.	N.S.	N.S.	High	N.S.	N.S.	N.S.	N/A	N/A	N.S.	Low	

Mill Brook - Basin 13

Basin: **Lower Connecticut**
 Stream Name: **Willow Brook**
 Topo Maps: **WOODSTOCK SOUTH**
 Watershed:

Sub-watershed:

Step 1. Reach Location This reach follows Rush Meadow Rd and is bound by the two reach breaks North of Bryant Rd.

1.1 Reach Description:

1.2 Towns: **West Windsor**

1.3 Downstream Latitude: **43.510276**

1.3 Downstream Longitude: **-72.518001**

Step 2. Stream Type

2.1 Elevation Upstream: **1,392**

2.1 Elevation Downstream: **1,314**

2.1 Is Gradient Gentle?: **No**

2.2 Valley Length: **3,350.0 ft.** **0.63** Miles

2.3 Valley Slope: **2.3**

2.4 Channel Length: **3,583.7 ft.** **0.68** Miles

2.5 Channel Slope: **2.19 %**

2.6 Sinuosity: **1.07**

2.7 Watershed Area: **1.1** Square Miles

2.8 Channel Width: **13.6** feet

2.9 Valley Width: **100.0** feet

2.10 Confinement Ratio: **7.4**

2.10 Confinement Type: **Broad**

2.11 Reference Stream Type: **C**

Bedform: **Riffle-Pool**

Sub-Class Slope: **b**

Bed Material: **Gravel**

Step 3. Basin Characteristics

3.1 Alluvial Fan: **None**

3.2 Grade Control: **None**

3.3 Dominant Geological Mat.: **Till** **50.5 %**

3.3 Sub-dom. Geological Mat.: **Alluvial**

3.4 Valley Slope Left: **Steep**

3.4 Valley Slope Right: **Hilly**

3.5 Soils

Hydrologic Group: **C** **59.0 %**

Flooding: **None/Rare** **50.5 %**

Water Table Deep: **1.5** **49.5 %**

Water Table Shallow: **0.0** **49.5 %**

Erodibility: **Severe** **50.5 %**

7.4 Comments:

Crossings not observed during windshield surveys due to private roads.

Phase 1 - Reach Summary Report

Reach ID: **T2.07**

SGAT Version: **4.56**

Date Last Edited: **April, 03 2015**

QA Status: **No checks are complete**

Is Reach An Impoundment?: **No**

Step 4. Land Cover - Reach Hydrology

4.1 Watershed

Historic Land Cover: **Field**

Current Dominant Land Cover: **Forest** **75.0 %**

Current Sub-Dominant Land Cover: **Field**

4.2 Corridor

Historic Land Cover:: **Field**

Current Dominant Land Cover: **Forest** **29.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer Left Bank Right Bank

Dominant: **0-25** **0-25**

Sub-dominant: **26-50** **26-50**

Length w / less than 25 ft.: **2,211.0 ft.** **2,684.0 ft.**

4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):

Type: **None**

Use:

5.2 Bridges and Culverts: **3** **1.3 %**

5.3 Bank Armoring: **0.0** **0.0 %**

Left: **0.0 ft.** Right: **0.0 ft.**

5.4 Channel Straightening: **2,367.9** **66.1 %**

5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **883.7 ft.** **24.7**

One Side Both Sides

Road: **883.7 ft.** **0.0 ft.**

Railroad: **0.0 ft.** **0.0 ft.**

Berm: **0.0 ft.** **0.0 ft.**

Improved Path: **0.0 ft.** **0.0 ft.**

6.2 Development: **294.9 ft.** **0.0 ft.**

6.3 Channel Bars: **Not Evaluated**

6.4 Meander Migration: **None**

6.5 Meander Width: **13 ft.** Ratio: **1.0**

6.6 Wavelength: **13 ft.** Ratio: **1.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **0** **ft**

7.2 Bank Height: **No Data** **ft**

7.3 Ice/Debris Jam Potential: **Not Evaluated**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1	2	2	0	0	0	2	0	2	1	0	0	2	2	0	0	14
Low	High	High	N.S.	N.S.	N.S.	High	N.S.	High	Low	N.S.	N.S.	High	High	N.S.	N.S.	

Mill Brook - Basin 13

Basin: **Lower Connecticut**
 Stream Name: **Willow Brook**
 Topo Maps: **WOODSTOCK SOUTH**
 Watershed:

Sub-watershed:

Step 1. Reach Location

1.1 Reach Description:

1.2 Towns: **West Windsor**

1.3 Downstream Latitude: **43.518915**

1.3 Downstream Longitude: **-72.521696**

Step 2. Stream Type

2.1 Elevation Upstream: **1,695**

2.1 Elevation Downstream: **1,392**

2.1 Is Gradient Gentle?: **No**

2.2 Valley Length: **4,280.0 ft.** **0.81** Miles

2.3 Valley Slope: **7.1**

2.4 Channel Length: **5,121.8 ft.** **0.97** Miles

2.5 Channel Slope: **5.91 %**

2.6 Sinuosity: **1.20**

2.7 Watershed Area: **0.3** Square Miles

2.8 Channel Width: **7.8** feet

2.9 Valley Width: **30.0** feet

2.10 Confinement Ratio: **3.8**

2.10 Confinement Type: **Semi-confined**

2.11 Reference Stream Type: **A**

Bedform: **Step-Pool**

Sub-Class Slope: **None**

Bed Material: **Boulder**

Step 3. Basin Characteristics

3.1 Alluvial Fan: **None**

3.2 Grade Control: **Dam**

3.3 Dominant Geological Mat.: **Till** **100.0 %**

3.3 Sub-dom. Geological Mat.: **Alluvial**

3.4 Valley Slope Left: **Very Steep**

3.4 Valley Slope Right: **Very Steep**

3.5 Soils

Hydrologic Group: **A** **86.1 %**

Flooding: **None/Rare** **100.0 %**

Water Table Deep: **6.0** **100.0 %**

Water Table Shallow: **6.0** **100.0 %**

Erodibility: **Very Severe** **100.0 %**

7.4 Comments:

NULL

Phase 1 - Reach Summary Report

Reach ID: **T2.08**

SGAT Version: **4.56**

Date Last Edited: **April, 03 2015**

QA Status: **No checks are complete**

Is Reach An Impoundment?: **No**

This reach begins at the reach break South of the intersection of Duling and Rush Meadow Rd and continues upstream to the reach break in the forested headwaters.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed

Historic Land Cover: **Forest**

Current Dominant Land Cover: **Forest** **75.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.2 Corridor

Historic Land Cover:: **Field**

Current Dominant Land Cover: **Forest** **36.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer Left Bank Right Bank

Dominant: **51-100** **51-100**

Sub-dominant: **0-25** **0-25**

Length w / less than 25 ft.: **1,045.0 ft.** **1,255.0 ft.**

4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):

Type: **Small Run of River**

Use: **Recreation**

5.2 Bridges and Culverts: **2** **0.7 %**

5.3 Bank Armoring: **0.0** **0.0 %**

Left: **0.0 ft.** Right: **0.0 ft.**

5.4 Channel Straightening: **0.0** **0.0 %**

5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **1,876.2 ft.** **36.6**

One Side Both Sides

Road: **1,876.2 ft.** **0.0 ft.**

Railroad: **0.0 ft.** **0.0 ft.**

Berm: **0.0 ft.** **0.0 ft.**

Improved Path: **0.0 ft.** **0.0 ft.**

6.2 Development: **0.0 ft.** **0.0 ft.**

6.3 Channel Bars: **Not Evaluated**

6.4 Meander Migration: **Migration**

6.5 Meander Width: **N/A** Ratio: **0.0**

6.6 Wavelength: **N/A** Ratio: **0.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **0** **ft**

7.2 Bank Height: **No Data** **ft**

7.3 Ice/Debris Jam Potential: **Not Evaluated**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
2	2	2	1	0	0	0	0	2	0	0	0	0	0	0	0	9
High	High	High	Low	N.S.	N.S.	N.S.	N.S.	High	N.S.	N.S.	N.S.	N/A	N/A	N.S.	N.S.	

Mill Brook - Basin 13

Basin: **Lower Connecticut**
 Stream Name: **Reading Hill Brook**
 Topo Maps: **CAVENDISH**
 Watershed:

Sub-watershed:

Step 1. Reach Location

1.1 Reach Description:

1.2 Towns: **Reading**

1.3 Downstream Latitude: **43.484744**

1.3 Downstream Longitude: **-72.552217**

Step 2. Stream Type

2.1 Elevation Upstream: **970**

2.1 Elevation Downstream: **934**

2.1 Is Gradient Gentle?: **No**

2.2 Valley Length: **2,575.0 ft.** **0.49** Miles

2.3 Valley Slope: **1.4**

2.4 Channel Length: **3,017.5 ft.** **0.57** Miles

2.5 Channel Slope: **1.22 %**

2.6 Sinuosity: **1.17**

2.7 Watershed Area: **4.1** Square Miles

2.8 Channel Width: **24.3** feet

2.9 Valley Width: **225.0** feet

2.10 Confinement Ratio: **9.3**

2.10 Confinement Type: **Broad**

2.11 Reference Stream Type: **E**

Bedform: **Riffle-Pool**

Sub-Class Slope: **None**

Bed Material: **Gravel**

Step 3. Basin Characteristics

3.1 Alluvial Fan: **None**

3.2 Grade Control: **Ledge**

3.3 Dominant Geological Mat.: **Alluvial** **42.7 %**

3.3 Sub-dom. Geological Mat.: **Other**

3.4 Valley Slope Left: **Very Steep**

3.4 Valley Slope Right: **Hilly**

3.5 Soils

Hydrologic Group: **B** **54.5 %**

Flooding: **None/Rare** **57.3 %**

Water Table Deep: **6.0** **55.0 %**

Water Table Shallow: **1.5** **43.2 %**

Erodibility: **slight** **20.8 %**

7.4 Comments:

Two private culverts may present ice/debris jam risks.

Phase 1 - Reach Summary Report

Reach ID: **T3.01**

SGAT Version: **4.56**

Date Last Edited: **April, 03 2015**

QA Status: **No checks are complete**

Is Reach An Impoundment?: **No**

This reach begins at the confluence with the mainstem south of Agony Hill Road and parallels Rt-106 to the east. The reach ends at the upstream reach break at an old talc mine.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed

Historic Land Cover: **Forest**

Current Dominant Land Cover: **Forest** **82.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.2 Corridor

Historic Land Cover:: **Field**

Current Dominant Land Cover: **Urban** **38.0 %**

Current Sub-Dominant Land Cover: **Forest**

4.3 Riparian Buffer Left Bank Right Bank

Dominant: **>100** **0-25**

Sub-dominant: **None** **51-100**

Length w / less than 25 ft.: **390.0 ft.** **1,533.0 ft.**

4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):

Type: **Small Withdrawal**

Use: **Other**

5.2 Bridges and Culverts: **4** **3.0 %**

5.3 Bank Armoring: **698.3** **23.1 %**

Left: **234.6 ft.** Right: **463.7 ft.**

5.4 Channel Straightening: **994.2** **32.9 %**

5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **1,770.8 ft.** **58.7**

One Side Both Sides

Road: **1,770.8 ft.** **0.0 ft.**

Railroad: **0.0 ft.** **0.0 ft.**

Berm: **123.1 ft.** **0.0 ft.**

Improved Path: **0.0 ft.** **0.0 ft.**

6.2 Development: **180.3 ft.** **0.0 ft.**

6.3 Channel Bars: **Multiple**

6.4 Meander Migration: **Migration**

6.5 Meander Width: **80 ft.** Ratio: **3.3**

6.6 Wavelength: **120 ft.** Ratio: **4.9**

Step 7. Windshield Survey

7.1 Bank Erosion: **280.236** ft

7.2 Bank Height: **3** ft

7.3 Ice/Debris Jam Potential: **Culvert**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1	2	2	1	0	2	2	0	2	1	1	1	1	2	1	1	20
Low	High	High	Low	N.S.	High	High	N.S.	High	Low	Low	Low	Low	High	Low	Low	

Mill Brook - Basin 13

Basin: **Lower Connecticut**
 Stream Name: **Reading Hill Brook**
 Topo Maps: **WOODSTOCK SOUTH, CAVENDISH**
 Watershed:
 Sub-watershed:

Step 1. Reach Location

1.1 Reach Description:

1.2 Towns: **Reading**

1.3 Downstream Latitude: **43.491384**

1.3 Downstream Longitude: **-72.553036**

Step 2. Stream Type

2.1 Elevation Upstream: **1,025**

2.1 Elevation Downstream: **970**

2.1 Is Gradient Gentle?: **No**

2.2 Valley Length: **4,010.0 ft.** **0.76** Miles

2.3 Valley Slope: **1.4**

2.4 Channel Length: **4,809.8 ft.** **0.91** Miles

2.5 Channel Slope: **1.13 %**

2.6 Sinuosity: **1.20**

2.7 Watershed Area: **3.9** Square Miles

2.8 Channel Width: **23.7** feet

2.9 Valley Width: **420.0** feet

2.10 Confinement Ratio: **17.7**

2.10 Confinement Type: **Very Broad**

2.11 Reference Stream Type: **E**

Bedform: **Riffle-Pool**

Sub-Class Slope: **None**

Bed Material: **Gravel**

Step 3. Basin Characteristics

3.1 Alluvial Fan: **None**

3.2 Grade Control: **Ledge**

3.3 Dominant Geological Mat.: **Alluvial** **73.3 %**

3.3 Sub-dom. Geological Mat.: **Other**

3.4 Valley Slope Left: **Hilly**

3.4 Valley Slope Right: **Steep**

3.5 Soils

Hydrologic Group: **C** **75.4 %**

Flooding: **Frequent** **73.3 %**

Water Table Deep: **1.5** **73.3 %**

Water Table Shallow: **0.0** **73.3 %**

Erodibility: **slight** **6.1 %**

7.4 Comments:

The lower reach just upstream of the reach break is not in the location shown in the VHD stream centerline. It is channelized to the west around a pond at an old talc mine. There is a culvert crossing that has low debris jam risk.

Phase 1 - Reach Summary Report

Reach ID: **T3.02**

SGAT Version: **4.56**

Date Last Edited: **April, 03 2015**

QA Status: **No checks are complete**

Is Reach An Impoundment?: **No**

This reach follows Rt-106. The lower reach break is located at the site of an old talc mine, and the upper reach break is found near Reading Farms Rd.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed

Historic Land Cover: **Forest**

Current Dominant Land Cover: **Forest** **82.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.2 Corridor

Historic Land Cover:: **Commercial**

Current Dominant Land Cover: **Urban** **40.0 %**

Current Sub-Dominant Land Cover: **Forest**

4.3 Riparian Buffer **Left Bank** **Right Bank**

Dominant: **>100** **51-100**

Sub-dominant: **0-25** **0-25**

Length w / less than 25 ft.: **833.0 ft.** **1,783.0 ft.**

4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):

Type: **None**

Use:

5.2 Bridges and Culverts: **1** **0.3 %**

5.3 Bank Armoring: **2,068.3** **43.0 %**

Left: **1,256.4 ft.** Right: **811.9 ft.**

5.4 Channel Straightening: **1,936.8** **40.3 %**

5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **3,299.8 ft.** **68.6**

One Side **Both Sides**

Road: **3,299.8 ft.** **0.0 ft.**

Railroad: **0.0 ft.** **0.0 ft.**

Berm: **1,103.4 ft.** **0.0 ft.**

Improved Path: **0.0 ft.** **0.0 ft.**

6.2 Development: **0.0 ft.** **0.0 ft.**

6.3 Channel Bars: **Multiple**

6.4 Meander Migration: **Multiple**

6.5 Meander Width: **70 ft.** Ratio: **2.9**

6.6 Wavelength: **145 ft.** Ratio: **6.1**

Step 7. Windshield Survey

7.1 Bank Erosion: **444.976** **ft**

7.2 Bank Height: **2** **ft**

7.3 Ice/Debris Jam Potential: **Culvert**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1	2	2	0	0	2	2	0	2	0	0	1	2	1	1	1	17
Low	High	High	N.S.	N.S.	High	High	N.S.	High	N.S.	N.S.	Low	High	Low	Low	Low	

Mill Brook - Basin 13

Basin: **Lower Connecticut**
 Stream Name: **Reading Hill Brook**
 Topo Maps: **WOODSTOCK SOUTH**
 Watershed:

Sub-watershed:

Step 1. Reach Location

1.1 Reach Description:

1.2 Towns: **Reading**

1.3 Downstream Latitude: **43.501634**

1.3 Downstream Longitude: **-72.55159**

Step 2. Stream Type

2.1 Elevation Upstream: **1,067**

2.1 Elevation Downstream: **1,025**

2.1 Is Gradient Gentle?: **No**

2.2 Valley Length: **2,610.0 ft.** **0.49** Miles

2.3 Valley Slope: **1.6**

2.4 Channel Length: **3,090.5 ft.** **0.59** Miles

2.5 Channel Slope: **1.38 %**

2.6 Sinuosity: **1.18**

2.7 Watershed Area: **2.7** Square Miles

2.8 Channel Width: **20.2** feet

2.9 Valley Width: **360.0** feet

2.10 Confinement Ratio: **17.8**

2.10 Confinement Type: **Very Broad**

2.11 Reference Stream Type: **E**

Bedform: **Riffle-Pool**

Sub-Class Slope: **None**

Bed Material: **Gravel**

Step 3. Basin Characteristics

3.1 Alluvial Fan: **None**

3.2 Grade Control: **Ledge**

3.3 Dominant Geological Mat.: **Alluvial** **66.2 %**

3.3 Sub-dom. Geological Mat.: **Till**

3.4 Valley Slope Left: **Very Steep**

3.4 Valley Slope Right: **Very Steep**

3.5 Soils

Hydrologic Group: **D** **39.1 %**

Flooding: **Frequent** **66.2 %**

Water Table Deep: **0.5** **39.1 %**

Water Table Shallow: **0.0** **66.2 %**

Erodibility: **Moderate** **33.8 %**

7.4 Comments:

Culvert under Rt 106 is 6ft wide and has some risk of debris jamming. Risk considered low due to lack of LWD in channel upstream and beaver dams/floodplain in reach.

Phase 1 - Reach Summary Report

Reach ID: **T3.03**

SGAT Version: **4.56**

Date Last Edited: **April, 03 2015**

QA Status: **No checks are complete**

Is Reach An Impoundment?: **No**

This reach follows Rt-106. The lower reach break is found near Reading Farms Rd., and the upper reach break is found east of the intersection of Whitmore Circle and Jenne Road.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed

Historic Land Cover: **Forest**

Current Dominant Land Cover: **Forest** **82.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.2 Corridor

Historic Land Cover:: **Commercial**

Current Dominant Land Cover: **Urban** **33.0 %**

Current Sub-Dominant Land Cover: **Forest**

4.3 Riparian Buffer Left Bank Right Bank

Dominant: **>100** **>100**

Sub-dominant: **0-25** **26-50**

Length w / less than 25 ft.: **1,067.0 ft.** **104.0 ft.**

4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):

Type: **None**

Use:

5.2 Bridges and Culverts: **2** **3.4 %**

5.3 Bank Armoring: **1,073.5** **34.7 %**

Left: **1,025.0 ft.** Right: **48.5 ft.**

5.4 Channel Straightening: **478.9** **15.5 %**

5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **1,924.0 ft.** **62.3**

One Side Both Sides

Road: **1,924.0 ft.** **0.0 ft.**

Railroad: **0.0 ft.** **0.0 ft.**

Berm: **0.0 ft.** **0.0 ft.**

Improved Path: **0.0 ft.** **0.0 ft.**

6.2 Development: **0.0 ft.** **0.0 ft.**

6.3 Channel Bars: **Multiple**

6.4 Meander Migration: **Multiple**

6.5 Meander Width: **50 ft.** Ratio: **2.5**

6.6 Wavelength: **100 ft.** Ratio: **4.9**

Step 7. Windshield Survey

7.1 Bank Erosion: **178.864** ft

7.2 Bank Height: **2** ft

7.3 Ice/Debris Jam Potential: **Culvert**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1	2	2	0	0	2	1	0	2	0	1	0	2	2	1	1	17
Low	High	High	N.S.	N.S.	High	Low	N.S.	High	N.S.	Low	N.S.	High	High	Low	Low	

Mill Brook - Basin 13

Basin: **Lower Connecticut**
 Stream Name: **Reading Hill Brook**
 Topo Maps: **WOODSTOCK SOUTH**
 Watershed:

Sub-watershed:

Step 1. Reach Location

1.1 Reach Description:

This reach follows Rt-106. The lower reach break is found east of the intersection of Whitmore Circle and Jenne Road. The upper reach break is found at a change in valley confinement approx. 1/2 mile to the north along Rt 106.

1.2 Towns: **Reading**

1.3 Downstream Latitude: **43.508495**

1.3 Downstream Longitude: **-72.552958**

Step 2. Stream Type

2.1 Elevation Upstream: **1,137**

2.1 Elevation Downstream: **1,067**

2.1 Is Gradient Gentle?: **No**

2.2 Valley Length: **2,850.0 ft.** **0.54** Miles

2.3 Valley Slope: **2.4**

2.4 Channel Length: **2,902.4 ft.** **0.55** Miles

2.5 Channel Slope: **2.39 %**

2.6 Sinuosity: **1.02**

2.7 Watershed Area: **2.2** Square Miles

2.8 Channel Width: **18.5** feet

2.9 Valley Width: **60.0** feet

2.10 Confinement Ratio: **3.2**

2.10 Confinement Type: **Semi-confined**

2.11 Reference Stream Type: **B**

Bedform: **Step-Pool**

Sub-Class Slope: **None**

Bed Material: **Bedrock**

Step 3. Basin Characteristics

3.1 Alluvial Fan: **None**

3.2 Grade Control: **Multiple**

3.3 Dominant Geological Mat.: **Till** **92.5 %**

3.3 Sub-dom. Geological Mat.: **Alluvial**

3.4 Valley Slope Left: **Ext. Steep**

3.4 Valley Slope Right: **Very Steep**

3.5 Soils

Hydrologic Group: **D** **75.9 %**

Flooding: **None/Rare** **92.5 %**

Water Table Deep: **6.0** **92.5 %**

Water Table Shallow: **6.0** **92.5 %**

Erodibility: **Very Severe** **92.5 %**

7.4 Comments:

Some evidence of dredging at the culvert crossing mid-reach. A small tributary entering from the west mid reach damaged Rt 106 during TS Irene. The upper bank of Reading Hill Brook was armored along east side of roadway.

Phase 1 - Reach Summary Report

Reach ID: **T3.04**

SGAT Version: **4.56**

Date Last Edited: **April, 03 2015**

QA Status: **No checks are complete**

Is Reach An Impoundment?: **No**

Step 4. Land Cover - Reach Hydrology

4.1 Watershed

Historic Land Cover: **Forest**

Current Dominant Land Cover: **Forest** **83.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.2 Corridor

Historic Land Cover:: **Commercial**

Current Dominant Land Cover: **Urban** **47.0 %**

Current Sub-Dominant Land Cover: **Forest**

4.3 Riparian Buffer Left Bank Right Bank

Dominant: **>100** **>100**

Sub-dominant: **0-25** **0-25**

Length w / less than 25 ft.: **1,431.0 ft.** **1,386.0 ft.**

4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):

Type: **None**

Use:

5.2 Bridges and Culverts: **2** **3.6 %**

5.3 Bank Armoring: **2,022.3** **69.7 %**

Left: **521.9 ft.** Right: **1,500.4 ft.**

5.4 Channel Straightening: **0.0** **0.0 %**

5.5 Dredging History: **Dredging**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **2,901.9 ft.** **100.0**

One Side Both Sides

Road: **2,901.9 ft.** **0.0 ft.**

Railroad: **0.0 ft.** **0.0 ft.**

Berm: **0.0 ft.** **0.0 ft.**

Improved Path: **0.0 ft.** **0.0 ft.**

6.2 Development: **0.0 ft.** **0.0 ft.**

6.3 Channel Bars: **Multiple**

6.4 Meander Migration: **Avulsion**

6.5 Meander Width: **N/A** Ratio: **0.0**

6.6 Wavelength: **N/A** Ratio: **0.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **173.784** ft

7.2 Bank Height: **5** ft

7.3 Ice/Debris Jam Potential: **Culvert**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1	2	2	0	0	2	0	2	2	0	1	0	0	0	1	2	15
Low	High	High	N.S.	N.S.	High	N.S.	High	High	N.S.	Low	N.S.	N/A	N/A	Low	High	

Mill Brook - Basin 13

Basin: **Lower Connecticut**
 Stream Name: **Reading Hill Brook**
 Topo Maps: **WOODSTOCK SOUTH**
 Watershed:

Sub-watershed:

Step 1. Reach Location

This reach follows Rt-106 and is bound by the reach breaks north and south of Caper Hill Rd.

1.1 Reach Description:

1.2 Towns: **Reading**

1.3 Downstream Latitude: **43.515091**

1.3 Downstream Longitude: **-72.548029**

Step 2. Stream Type

2.1 Elevation Upstream: **1,272**

2.1 Elevation Downstream: **1,137**

2.1 Is Gradient Gentle?: **No**

2.2 Valley Length: **4,675.0 ft.** **0.89** Miles

2.3 Valley Slope: **2.9**

2.4 Channel Length: **5,100.6 ft.** **0.97** Miles

2.5 Channel Slope: **2.65 %**

2.6 Sinuosity: **1.09**

2.7 Watershed Area: **1.8** Square Miles

2.8 Channel Width: **16.8** feet

2.9 Valley Width: **80.0** feet

2.10 Confinement Ratio: **4.8**

2.10 Confinement Type: **Narrow**

2.11 Reference Stream Type: **B**

Bedform: **Step-Pool**

Sub-Class Slope: **None**

Bed Material: **Cobble**

Step 3. Basin Characteristics

3.1 Alluvial Fan: **None**

3.2 Grade Control: **None**

3.3 Dominant Geological Mat.: **Till** **48.5 %**

3.3 Sub-dom. Geological Mat.: **Ice-Contact**

3.4 Valley Slope Left: **Very Steep**

3.4 Valley Slope Right: **Ext. Steep**

3.5 Soils

Hydrologic Group: **C** **86.8 %**

Flooding: **None/Rare** **78.9 %**

Water Table Deep: **1.5** **51.5 %**

Water Table Shallow: **0.0** **51.5 %**

Erodibility: **Very Severe** **78.9 %**

7.4 Comments:

Reach slope and planform highly variable. Lower reach has a lower slope with some meanders. Middle and upper reach are steeper and confined by naturally tight valley and encroachment from Rt 106.

Phase 1 - Reach Summary Report

Reach ID: **T3.05**

SGAT Version: **4.56**

Date Last Edited: **April, 03 2015**

QA Status: **No checks are complete**

Is Reach An Impoundment?: **No**

Step 4. Land Cover - Reach Hydrology

4.1 Watershed

Historic Land Cover: **Forest**

Current Dominant Land Cover: **Forest** **80.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.2 Corridor

Historic Land Cover:: **Commercial**

Current Dominant Land Cover: **Urban** **33.0 %**

Current Sub-Dominant Land Cover: **Forest**

4.3 Riparian Buffer Left Bank Right Bank

Dominant: **0-25** **>100**

Sub-dominant: **>100** **0-25**

Length w / less than 25 ft.: **2,579.0 ft.** **1,790.0 ft.**

4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):

Type: **None**

Use:

5.2 Bridges and Culverts: **3** **1.8 %**

5.3 Bank Armoring: **0.0** **0.0 %**

Left: **0.0 ft.** Right: **0.0 ft.**

5.4 Channel Straightening: **0.0** **0.0 %**

5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **2,803.0 ft.** **55.0**

One Side Both Sides

Road: **2,803.0 ft.** **0.0 ft.**

Railroad: **0.0 ft.** **0.0 ft.**

Berm: **0.0 ft.** **0.0 ft.**

Improved Path: **0.0 ft.** **0.0 ft.**

6.2 Development: **314.2 ft.** **0.0 ft.**

6.3 Channel Bars: **Point**

6.4 Meander Migration: **None**

6.5 Meander Width: **N/A** Ratio: **0.0**

6.6 Wavelength: **N/A** Ratio: **0.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **0** **ft**

7.2 Bank Height: **No Data** **ft**

7.3 Ice/Debris Jam Potential: **Culvert**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1	2	2	0	0	0	0	0	2	1	0	0	0	0	0	0	8
Low	High	High	N.S.	N.S.	N.S.	N.S.	N.S.	High	Low	N.S.	N.S.	N/A	N/A	N.S.	N.S.	

Mill Brook - Basin 13

Basin: **Lower Connecticut**
 Stream Name: **Reading Hill Brook**
 Topo Maps: **WOODSTOCK SOUTH**
 Watershed:

Sub-watershed:

Step 1. Reach Location

This headwaters reach is found to the east of Rt-106 and north of Adventure Quest Road.

1.1 Reach Description:

1.2 Towns: **Reading**

1.3 Downstream Latitude: **43.526998**

1.3 Downstream Longitude: **-72.553252**

Step 2. Stream Type

2.1 Elevation Upstream: **1,509**

2.1 Elevation Downstream: **1,272**

2.1 Is Gradient Gentle?: **No**

2.2 Valley Length: **2,900.0 ft.** **0.55** Miles

2.3 Valley Slope: **8.2**

2.4 Channel Length: **3,094.0 ft.** **0.59** Miles

2.5 Channel Slope: **7.66 %**

2.6 Sinuosity: **1.07**

2.7 Watershed Area: **0.2** Square Miles

2.8 Channel Width: **6.2** feet

2.9 Valley Width: **20.0** feet

2.10 Confinement Ratio: **3.2**

2.10 Confinement Type: **Semi-confined**

2.11 Reference Stream Type: **A**

Bedform: **Step-Pool**

Sub-Class Slope: **None**

Bed Material: **Boulder**

Step 3. Basin Characteristics

3.1 Alluvial Fan: **None**

3.2 Grade Control: **None**

3.3 Dominant Geological Mat.: **Till** **76.6 %**

3.3 Sub-dom. Geological Mat.: **Other**

3.4 Valley Slope Left: **Very Steep**

3.4 Valley Slope Right: **Ext. Steep**

3.5 Soils

Hydrologic Group: **D** **58.4 %**

Flooding: **None/Rare** **100.0 %**

Water Table Deep: **6.0** **76.6 %**

Water Table Shallow: **6.0** **76.6 %**

Erodibility: **Very Severe** **80.7 %**

7.4 Comments:

NULL

Phase 1 - Reach Summary Report

Reach ID: **T3.06**

SGAT Version: **4.56**

Date Last Edited: **April, 03 2015**

QA Status: **No checks are complete**

Is Reach An Impoundment?: **No**

Step 4. Land Cover - Reach Hydrology

4.1 Watershed

Historic Land Cover: **Forest**

Current Dominant Land Cover: **Forest** **85.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.2 Corridor

Historic Land Cover:: **Forest**

Current Dominant Land Cover: **Forest** **57.0 %**

Current Sub-Dominant Land Cover: **Crop**

4.3 Riparian Buffer **Left Bank** **Right Bank**

Dominant: **>100** **>100**

Sub-dominant: **None** **None**

Length w / less than 25 ft.: **0.0 ft.** **0.0 ft.**

4.4 Ground Water Inputs: **Minimal**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):

Type: **None**

Use:

5.2 Bridges and Culverts: **0** **0.0 %**

5.3 Bank Armoring: **0.0** **0.0 %**

Left: **0.0 ft.** Right: **0.0 ft.**

5.4 Channel Straightening: **0.0** **0.0 %**

5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **0.0 ft.** **0.0**

One Side **Both Sides**

Road: **0.0 ft.** **0.0 ft.**

Railroad: **0.0 ft.** **0.0 ft.**

Berm: **0.0 ft.** **0.0 ft.**

Improved Path: **0.0 ft.** **0.0 ft.**

6.2 Development: **0.0 ft.** **0.0 ft.**

6.3 Channel Bars: **Not Evaluated**

6.4 Meander Migration: **None**

6.5 Meander Width: **N/A** Ratio: **0.0**

6.6 Wavelength: **N/A** Ratio: **0.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **0** **ft**

7.2 Bank Height: **No Data** **ft**

7.3 Ice/Debris Jam Potential: **None**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Low	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	Unk.	N.S.	N.S.	N.S.	N/A	N/A	N.S.	N.S.	

Mill Brook - Basin 13

Basin: **Lower Connecticut**
 Stream Name: **Bailey Brook**
 Topo Maps: **WOODSTOCK SOUTH**
 Watershed:

Sub-watershed:

Step 1. Reach Location

1.1 Reach Description:

1.2 Towns: **Reading**

1.3 Downstream Latitude: **43.500895**

1.3 Downstream Longitude: **-72.563159**

Step 2. Stream Type

2.1 Elevation Upstream: **1,325**

2.1 Elevation Downstream: **1,037**

2.1 Is Gradient Gentle?: **No**

2.2 Valley Length: **7,169.7 ft.** **1.36** Miles

2.3 Valley Slope: **4.0**

2.4 Channel Length: **7,913.5 ft.** **1.50** Miles

2.5 Channel Slope: **3.64 %**

2.6 Sinuosity: **1.10**

2.7 Watershed Area: **5.4** Square Miles

2.8 Channel Width: **27.4** feet

2.9 Valley Width: **160.0** feet

2.10 Confinement Ratio: **5.8**

2.10 Confinement Type: **Narrow**

2.11 Reference Stream Type: **B**

Bedform: **Riffle-Pool**

Sub-Class Slope: **None**

Bed Material: **Cobble**

Step 3. Basin Characteristics

3.1 Alluvial Fan: **Yes**

3.2 Grade Control: **Ledge**

3.3 Dominant Geological Mat.: **Ice-Contact** **72.0 %**

3.3 Sub-dom. Geological Mat.: **Till**

3.4 Valley Slope Left: **Very Steep**

3.4 Valley Slope Right: **Very Steep**

3.5 Soils

Hydrologic Group: **B** **74.3 %**

Flooding: **None/Rare** **97.8 %**

Water Table Deep: **2.5** **49.9 %**

Water Table Shallow: **1.5** **52.2 %**

Erodibility: **Very Severe** **97.8 %**

7.4 Comments:

Squashed and skewed culvert on Baileys Mills Rd already has sediment/debris jamming issues, increased risk of ice and debris jam. Alluvial fan with severe sediment deposition upstream (west) of Baileys Mill Road culvert during TS Irene and dredging. Severe mass wasting of valley side slopes in upper reaches delivered enormous sediment load to this area and into downstream Mill Brook reach M14.

Phase 1 - Reach Summary Report

Reach ID: **T4.01**

SGAT Version: **4.56**

Date Last Edited: **April, 03 2015**

QA Status: **No checks are complete**

Is Reach An Impoundment?: **No**

This reach begins at the reach break south of the Baileys Mills and Town Hill Rd and continues upstream to the reach break South of Kittridge Pasture Rd.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed

Historic Land Cover: **Forest**

Current Dominant Land Cover: **Forest** **87.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.2 Corridor

Historic Land Cover:: **Forest**

Current Dominant Land Cover: **Urban** **29.0 %**

Current Sub-Dominant Land Cover: **Forest**

4.3 Riparian Buffer Left Bank Right Bank

Dominant: **>100** **>100**

Sub-dominant: **0-25** **51-100**

Length w / less than 25 ft.: **980.0 ft.** **228.0 ft.**

4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):

Type: **None**

Use:

5.2 Bridges and Culverts: **2** **0.7 %**

5.3 Bank Armoring: **20.6** **0.3 %**

Left: **0.0 ft.** Right: **20.6 ft.**

5.4 Channel Straightening: **0.0** **0.0 %**

5.5 Dredging History: **Dredging**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **2,151.2 ft.** **27.2**

One Side Both Sides

Road: **2,151.2 ft.** **0.0 ft.**

Railroad: **0.0 ft.** **0.0 ft.**

Berm: **365.7 ft.** **0.0 ft.**

Improved Path: **0.0 ft.** **0.0 ft.**

6.2 Development: **584.7 ft.** **0.0 ft.**

6.3 Channel Bars: **Multiple**

6.4 Meander Migration: **Multiple**

6.5 Meander Width: **N/A** Ratio: **0.0**

6.6 Wavelength: **N/A** Ratio: **0.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **3398.5** **ft**

7.2 Bank Height: **7** **ft**

7.3 Ice/Debris Jam Potential: **Culvert**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1	2	1	0	0	0	0	2	2	1	2	2	0	0	2	2	17
Low	High	Low	N.S.	N.S.	N.S.	N.S.	High	High	Low	High	High	N/A	N/A	High	High	

Mill Brook - Basin 13

Basin: **Lower Connecticut**
 Stream Name: **Bailey Brook**
 Topo Maps: **PLYMOUTH, WOODSTOCK SOUTH**
 Watershed:

Sub-watershed:

Step 1. Reach Location

1.1 Reach Description:

1.2 Towns: **Reading**

1.3 Downstream Latitude: **43.511916**

1.3 Downstream Longitude: **-72.585564**

Step 2. Stream Type

2.1 Elevation Upstream: **2,044**

2.1 Elevation Downstream: **1,325**

2.1 Is Gradient Gentle?: **No**

2.2 Valley Length: **13,850.0 ft.** **2.62** Miles

2.3 Valley Slope: **5.2**

2.4 Channel Length: **15,539.2 ft.** **2.94** Miles

2.5 Channel Slope: **4.62 %**

2.6 Sinuosity: **1.12**

2.7 Watershed Area: **3.3** Square Miles

2.8 Channel Width: **22.2** feet

2.9 Valley Width: **85.0** feet

2.10 Confinement Ratio: **3.8**

2.10 Confinement Type: **Semi-confined**

2.11 Reference Stream Type: **B**

Bedform: **Step-Pool**

Sub-Class Slope: **None**

Bed Material: **Cobble**

Step 3. Basin Characteristics

3.1 Alluvial Fan: **None**

3.2 Grade Control: **None**

3.3 Dominant Geological Mat.: **Till** **57.2 %**

3.3 Sub-dom. Geological Mat.: **Alluvial**

3.4 Valley Slope Left: **Ext. Steep**

3.4 Valley Slope Right: **Ext. Steep**

3.5 Soils

Hydrologic Group: **C** **54.5 %**

Flooding: **None/Rare** **78.1 %**

Water Table Deep: **2.5** **47.7 %**

Water Table Shallow: **1.0** **54.3 %**

Erodibility: **Severe** **57.2 %**

7.4 Comments:

Did not visit Browns Schoolhouse Road crossing. Severe mass valley wasting throughout middle and lower reach contributing huge sediment load to downstream reaches.

Phase 1 - Reach Summary Report

Reach ID: **T4.02**

SGAT Version: **4.56**

Date Last Edited: **April, 03 2015**

QA Status: **No checks are complete**

Is Reach An Impoundment?: **No**

This reach begins at the downstream reach break South of Kittridge Pasture Rd. and extends west up into the headwaters north of Mount Tom.

Step 4. Land Cover - Reach Hydrology

4.1 Watershed

Historic Land Cover: **Forest**

Current Dominant Land Cover: **Forest** **90.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.2 Corridor

Historic Land Cover:: **Forest**

Current Dominant Land Cover: **Forest** **57.0 %**

Current Sub-Dominant Land Cover: **Urban**

4.3 Riparian Buffer

Left Bank

Right Bank

Dominant: **>100**

>100

Sub-dominant: **None**

None

Length w / less than 25 ft.: **0.0 ft.**

0.0 ft.

4.4 Ground Water Inputs: **Abundant**

Step 5. Instream Channel Modifications

5.1 Flow Regulation - (old):

Type: **None**

Use:

5.2 Bridges and Culverts: **1** **0.2 %**

5.3 Bank Armoring: **0.0** **0.0 %**

Left: **0.0 ft.** Right: **0.0 ft.**

5.4 Channel Straightening: **0.0** **0.0 %**

5.5 Dredging History: **None**

Step 6. Floodplain Modifications

6.1 Berms & Roads - old: **0.0 ft.** **0.0**

One Side

Both Sides

Road: **0.0 ft.** **0.0 ft.**

Railroad: **0.0 ft.** **0.0 ft.**

Berm: **0.0 ft.** **0.0 ft.**

Improved Path: **0.0 ft.** **0.0 ft.**

6.2 Development: **0.0 ft.** **0.0 ft.**

6.3 Channel Bars: **Multiple**

6.4 Meander Migration: **Multiple**

6.5 Meander Width: **N/A** Ratio: **0.0**

6.6 Wavelength: **N/A** Ratio: **0.0**

Step 7. Windshield Survey

7.1 Bank Erosion: **2561.3** ft

7.2 Bank Height: **6** ft

7.3 Ice/Debris Jam Potential: **Not Evaluated**

4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.3	Total
1	1	0	0	0	0	0	0	0	0	2	2	0	0	1	0	7
Low	Low	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	Unk.	N.S.	High	High	N/A	N/A	Low	N.S.	

APPENDIX B:

PHASE 2 STREAM GEOMORPHIC ASSESSMENT DATA



Stream Geomorphic Assessment

Agency of Natural Resources



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Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream: **Mill Brook**
Reach: **M02-0**
Segment Length(ft): **3,807**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Fitzgerald Environmental**
Observers: **JHB, MPL**
Completion Date: **6/17/2014**
Quality Control Status - Consultant: **Provisional**
Quality Control Status - Staff: **Provisional**

Step 0 - Location: **This reach extends from the reachpoint south of Union street upstream to the dam West of Clough Ave**

Step 5 - Notes: **Large gravel deposits were found near grade controls in the areas where the channel was less armored and has more room to widen.**

Step 7 - Narrative: **This reach was highly impacted from historic straightening and encroachment as it flows through the center of Windsor. Incision was variable but always F-type. Several grade controls reduced incision leading to widening and some deposition and gravel bar formation. The large dam and impoundment upstream is a major interruption to sediment supply, however the upper reach was bedrock controlled and did not indicate increased scour.**

Step 1. Valley and Floodplain

1.1 Segmentation: None	1.4 Adjacent Side	<u>Left</u>	<u>Right</u>	1.5 Valley Features
1.2 Alluvial Fan: None	Hillside Slope:	Hilly	Hilly	Valley Width (ft): 380
1.3 Corridor Encroachments:	Continuous w/ Bank:	Sometimes	Sometimes	Width Determination: Measured
<u>Length (ft)</u> <u>One</u> <u>Height</u> <u>Both</u> <u>Height</u>	Within 1 Bankfull W:	Sometimes	Sometimes	Confinement Type: NW
Berm: 0	Texture:	Mixed	Mixed	In Rock Gorge: No
Road: 85 15 0				Human Caused Change in Valley Width?: Yes
Railroad: 0 0				
Imp. Path: 0 0				
Dev.: 1,815 1,501				

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	0.0	0.0	Yes	
Ledge	Mid-segment	0.0	0.0	No	
Ledge	Mid-segment	0.0	0.0	No	
Ledge	Mid-segment	0.0	0.0	No	



Stream Geomorphic Assessment

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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M02-0**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	65.61	2.11 Riffle/Step Spacing:	300 ft.	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	2.80	2.12 Substrate Composition		Bed:	250 mm
2.3 Mean Depth (ft.):	2.33	Bedrock:	0.0 %	Bar:	140 mm
2.4 Floodprone Width (ft.):	87.00	Boulder:	0.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	6.80	Cobble:	24.0 %	Stream Type:	F
Human Elev FloodPln (ft.):	0.00	Coarse Gravel:	51.0 %	Bed Material:	Gravel
2.6 Width/Depth Ratio:	28.16	Fine Gravel:	17.0 %	Subclass Slope:	None
2.7 Entrenchment Ratio:	1.33	Sand:	8.0 %	Bed Form:	Riffle-Pool
2.8 Incision Ratio:	2.43	Silt and Smaller:	0.0 %	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	No	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	High	Detritus:	5.0 %	Reference Stream Type:	
2.10 Riffles Type:	Sedimented	# Large Woody Debris:	25	Reference Bed Material:	
				Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks					Typical Bank Slope: Steep				
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>	Near Bank Vegetation Type <u>Left</u>			<u>Right</u>
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	272.4	299.0	Dominant:	Herbaceous	Herbaceous	
Material Type:	Mix	Mix	Erosion Height (ft.):	6.2	5.3	Sub-dominant:	Deciduous	Deciduous	
Consistency:	Non-cohesive	Non-cohesive	Revetment Type:	Rip-Rap	Multiple	Bank Canopy			
Lower			Revetment Length:	1,057.1	737.1	Canopy %:	51-75	51-75	
Material Type:	Boulder/Cobble	Mix				Mid-Channel Canopy: Open			
Consistency:	Non-cohesive	Non-cohesive							

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>
Dominant	26-50	26-50
Sub-Dominant	51-100	0-25
W less than 25	101	1,601
Buffer Vegetation Type		
Dominant	Herbaceous	Herbaceous
Sub-Dominant	Deciduous	Deciduous

3.3 Riparian Corridor

Corridor Land	<u>Left</u>	<u>Right</u>	<u>Left</u>	<u>Right</u>
Dominant	Residential	Residential	Mass Failures	
Sub-dominant	Commercial	Commercial	Height	
(Legacy)	<u>Amount</u>	<u>Mean Height</u>	Gullies Number	0
Failures	None		Gullies Length	0
Gullies	None			



Stream Geomorphic Assessment

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Page3

Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M02-0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	Minimal	4.5 Flow Regulation Type	None	4.7 Stormwater Inputs	
4.2 Adjacent Wetlands:	None	Flow Reg. Use:		Field Ditch:	0 Road Ditch: 0
4.3 Flow Status:	Low	Impoundments:		Other:	0 Tile Drain: 0
4.4 # of Debris Jams:	1	Impoundment Loc.:		Overland Flow:	0 Urb Strm Wtr Pipe: 3
		4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	0
		(old) Upstrm Flow Reg.:		Affected Length (ft):	0

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	75	Yes	No	Yes	Yes	None
Other	40	Yes	No	Yes	No	Scour Above, Scour Below
Bridge	75	No	No	No	Yes	None

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal: 2	5.2 Other Features	Neck Cutoff: 0	5.4 Stream Ford or Animal Crossing:	No
Mid: 2	Delta: 0	Flood chutes: 1	Avulsion: 0	5.5 Straightening:	Straightening
Point: 3	Island: 0	5.3 Steep Riffles and Head Cuts	Head Cuts: 0	Straightening Length (ft.):	1,390
Side: 5	Braiding: 0	Steep Riffles: 0	Trib Rejuv.: No	5.5 Dredging:	None

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:	6.4 Sediment Deposition:	Stream Gradient Type	<u>Left</u>	<u>Right</u>
6.2 Pool Substrate:	6.5 Channel Flow Status:	6.8 Bank Stability:		
6.3 Pool Variability:	6.6 Channel Alteration:	6.9 Bank Vegetation Protection		
Total Score: 0	6.7 Channel Sinuosity:	6.10 Riparian Veg. Zone Width:		
Habitat Rating: 0.00				
Habitat Stream Condition:				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Unconfined	Score	STD	Historic		
7.1 Channel Degradation		4	C to F	No	Geomorphic Rating	0.43
7.2 Channel Aggradation		10	None	No	Channel Evolution Model	F
7.3 Widening Channel		11	None	No	Channel Evolution Stage	II
7.4 Change in Planform		9	None	Yes	Geomorphic Condition	Fair
Total Score		34			Stream Sensitivity	Extreme



Stream Geomorphic Assessment

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Phase 2 Segment Summary Report Mill Brook - Basin 13

Page 1

Stream: **Mill Brook**
Reach: **M04-0**
Segment Length(ft): **8,067**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Fitzgerald Environmental**
Observers: **JHB, MPL**
Completion Date: **6/17/2014**
Quality Control Status - Consultant: **Provisional**
Quality Control Status - Staff: **Provisional**

- Step 0 - Location: This reach extends from the reach point along Ascutney Street West of I-91 and extends upstream to the reach break at Brooks Rd and Sunset Ln.
- Step 5 - Notes: Most of reach along Rt 44 was historically straightened, however much of the right bank armoring was washed out during TS Irene. Only one stretch is still straightened.
- Step 7 - Narrative: The channel is actively aggrading with sand and gravel from upstream mass failures and erosion. Extensive bank armoring and road encroachment are limiting planform adjustment, however the failure of historic armoring on the left bank throughout the lower reach is allowing for channel widening (note: armor failure was accounted for in scoring for widening and planform). Some floodplain was accessible throughout the reach, likely a result of recent channel aggradation. This reach is transitioning from stage II to III.

Step 1. Valley and Floodplain

1.1 Segmentation: None	1.4 Adjacent Side	<u>Left</u>	<u>Right</u>	1.5 Valley Features
1.2 Alluvial Fan: None	Hillside Slope:	Extr.Steep	Steep	Valley Width (ft): 290
1.3 Corridor Encroachments:	Continuous w/ Bank:	Never	Never	Width Determination: Measured
<u>Length (ft)</u> <u>One</u> <u>Height</u> <u>Both</u> <u>Height</u>	Within 1 Bankfull W:	Never	Sometimes	Confinement Type: NW
Berm: 0 0	Texture:	Mixed	Mixed	In Rock Gorge: No
Road: 6,459 10 0				Human Caused Change in Valley Width?: Yes
Railroad: 0 0				
Imp. Path: 0 0				
Dev.: 710 0				
1.6 Grade Controls: None				



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M04-0**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	70.20	2.11 Riffle/Step Spacing:	250 ft.	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	2.90	2.12 Substrate Composition		Bed:	200 mm
2.3 Mean Depth (ft.):	2.11	Bedrock:	0.0 %	Bar:	120 mm
2.4 Floodprone Width (ft.):	145.00	Boulder:	0.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	5.30	Cobble:	27.0 %	Stream Type:	C
Human Elev FloodPln (ft.):		Coarse Gravel:	47.0 %	Bed Material:	Gravel
2.6 Width/Depth Ratio:	33.27	Fine Gravel:	12.0 %	Subclass Slope:	None
2.7 Entrenchment Ratio:	2.07	Sand:	14.0 %	Bed Form:	Plane Bed
2.8 Incision Ratio:	1.83	Silt and Smaller:	0.0 %	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	No	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	Low	Detritus:	3.0 %	Reference Stream Type:	
2.10 Riffles Type:	Sedimented	# Large Woody Debris:	36	Reference Bed Material:	
				Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks					Typical Bank Slope: Steep				
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>	Near Bank Vegetation Type <u>Left</u>			<u>Right</u>
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	252.0	324.3	Dominant:	Herbaceous	Deciduous	
Material Type:	Mix	Mix	Erosion Height (ft.):	3.1	7.4	Sub-dominant:	Shrubs/Sapling	Herbaceous	
Consistency:	Non-cohesive	Non-cohesive	Revetment Type:	Rip-Rap	Rip-Rap	Bank Canopy			
Lower			Revetment Length:	831.4	1,274.1	Canopy %:	76-100	76-100	
Material Type:	Mix	Boulder/Cobble				Mid-Channel Canopy:		Open	
Consistency:	Non-cohesive	Non-cohesive							

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>	Corridor Land	<u>Left</u>	<u>Right</u>	<u>Left</u>	<u>Right</u>
Dominant	51-100	>100	Dominant	Commercial	Forest	Mass Failures	
Sub-Dominant	0-25	0-25	Sub-dominant	Forest	Residential	Height	
W less than 25	1,560	1,986	(Legacy)	<u>Amount</u>	<u>Mean Height</u>	Gullies Number	0
Buffer Vegetation Type			Failures	None		Gullies Length	0
Dominant	Deciduous	Mixed Trees	Gullies	None			
Sub-Dominant	Herbaceous	Herbaceous					

3.3 Riparian Corridor



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M04-0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps: **Abundant**

4.5 Flow Regulation Type **None**

4.7 Stormwater Inputs **None**

4.2 Adjacent Wetlands: **Abundant**

Flow Reg. Use:

Field Ditch:

Road Ditch:

4.3 Flow Status: **Low**

Impoundments:

Other:

Tile Drain:

4.4 # of Debris Jams: **3**

Impoundment Loc.:

Overland Flow:

Urb Strm Wtr Pipe:

4.6 Up/Down Strm flow reg.: **None**

4.9 # of Beaver Dams: **0**

(old) Upstrm Flow Reg.:

Affected Length (ft):

0

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Old Abutment	68	No	No	Yes	Yes	Deposition Above, Deposition Below
Bridge	110	No	No	No	Yes	Deposition Above

Step 5. Channel Bed and Planform Changes

5.1 Bar Types Diagonal: **5**

5.2 Other Features

Neck Cutoff: **0**

5.4 Stream Ford or Animal Crossing: **Yes**

Mid: **7** Delta: **0**

Flood chutes: **0**

Avulsion: **0**

5.5 Straightening: **Straightening**

Point: **4** Island: **0**

5.3 Steep Riffles and Head Cuts

Head Cuts: **0**

Straightening Length (ft.):

661

Side: **10** Braiding: **0**

Steep Riffles: **0**

Trib Rejuv.: **No**

5.5 Dredging:

Dredging

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:

6.4 Sediment Deposition:

Stream Gradient Type

Left

Right

6.2 Pool Substrate:

6.5 Channel Flow Status:

6.8 Bank Stability:

6.3 Pool Variability:

6.6 Channel Alteration:

6.9 Bank Vegetation Protection

Total Score:

0

6.7 Channel Sinuosity:

6.10 Riparian Veg. Zone Width:

Habitat Rating:

0.00

Habitat Stream Condition:

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Unconfined	Score	STD	Historic		
7.1 Channel Degradation		9	None	Yes	Geomorphic Rating	0.38
7.2 Channel Aggradation		4	None	No	Channel Evolution Model	F
7.3 Widening Channel		8	None	No	Channel Evolution Stage	III
7.4 Change in Planform		9	None	No	Geomorphic Condition	Fair
Total Score		30			Stream Sensitivity	Very High



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Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream: **Mill Brook**
Reach: **M05-A**
Segment Length(ft): **7,170**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Fitzgerald Environmental**
Observers: **JHB, MPL**
Completion Date: **6/17/2014**
Quality Control Status - Consultant: **Provisional**
Quality Control Status - Staff: **Provisional**

- Step 0 - Location: **This reach begins at the reach break South of Sunset lane and extends upstream to the segment point upstream of Hewett Rd**
- Step 5 - Notes: **Several huge depositional features were observed along this segment. The river is currently working through the T.S. Irene deposits.**
- Step 7 - Narrative: **This segment and M05-B were both similarly scoured and widened during T.S. Irene. Segment B has remained plane-bed and is relatively featureless. Segment A has redeveloped some riffle-pool sequences and has some planform development. We assessed this reach as stage III due to the widened state and the large volume of flood sediments that will continue to work through the reach. Major bed aggradation in portions of the lower segment has created small areas of accessible floodplain. The reach will slowly transition to stage IV if this process continues. Evaluation of some characteristics of confined river valleys in RGA form not entirely applicable to this Bc stream type setting (i.e., step-pool systems).**

Step 1. Valley and Floodplain

1.1 Segmentation: **Channel Dimensions**

1.2 Alluvial Fan: **None**

1.3 Corridor Encroachments:

	<u>Length (ft)</u>	<u>One</u>	<u>Height</u>	<u>Both</u>	<u>Height</u>
Berm:	0			0	
Road:	2,884	10		0	
Railroad:	0			0	
Imp. Path:	0			0	
Dev.:	1,098			0	

1.4 Adjacent Side

	<u>Left</u>	<u>Right</u>
Hillside Slope:	Extr.Steep	Steep
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Always	Always
Texture:	Bedrock	Bedrock

1.5 Valley Features

Valley Width (ft): **200**
Width Determination: **Measured**
Confinement Type: **SC**
In Rock Gorge: **No**
Human Caused Change in Valley Width?: **Yes**

1.6 Grade Controls: **None**



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M05-A**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	74.93	2.11 Riffle/Step Spacing:	200 ft.	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	2.90	2.12 Substrate Composition		Bed:	350 mm
2.3 Mean Depth (ft.):	1.81	Bedrock:	0.0 %	Bar:	140 mm
2.4 Floodprone Width (ft.):	84.00	Boulder:	3.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	8.40	Cobble:	43.0 %	Stream Type:	F
Human Elev FloodPln (ft.):		Coarse Gravel:	37.0 %	Bed Material:	Gravel
2.6 Width/Depth Ratio:	41.40	Fine Gravel:	8.0 %	Subclass Slope:	None
2.7 Entrenchment Ratio:	1.12	Sand:	9.0 %	Bed Form:	Riffle-Pool
2.8 Incision Ratio:	2.90	Silt and Smaller:	0.0 %	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	Yes	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	Low	Detritus:	2.0 %	Reference Stream Type:	
2.10 Riffles Type:	Sedimented	# Large Woody Debris:	19	Reference Bed Material:	
				Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks					Typical Bank Slope: Steep				
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>	Near Bank Vegetation Type <u>Left</u>			<u>Right</u>
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	188.2	1,744.4	Dominant:	Coniferous	Coniferous	
Material Type:	Mix	Mix	Erosion Height (ft.):	6.5	7.4	Sub-dominant:	Herbaceous	Herbaceous	
Consistency:	Non-cohesive	Non-cohesive	Revetment Type:	None	Rip-Rap	Bank Canopy			
Lower			Revetment Length:	0.0	191.2	Canopy %:	76-100	76-100	
Material Type:	Boulder/Cobbles	Boulder/Cobbles				Mid-Channel Canopy:		Open	
Consistency:	Non-cohesive	Non-cohesive							

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>
Dominant	>100	>100
Sub-Dominant	26-50	26-50
W less than 25	658	171
Buffer Vegetation Type		
Dominant	Coniferous	Coniferous
Sub-Dominant	Shrubs/Sapling	Shrubs/Sapling

3.3 Riparian Corridor

Corridor Land	<u>Left</u>	<u>Right</u>	<u>Left</u>	<u>Right</u>
Dominant	Forest	Forest	Mass Failures	113.40
Sub-dominant	Residential	Residential	Height	20.0
(Legacy)	<u>Amount</u>	<u>Mean Height</u>	Gullies Number	0
Failures	One	20.0	Gullies Length	0
Gullies	None			



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M05-A**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	Abundant	4.5 Flow Regulation Type	None	4.7 Stormwater Inputs	
4.2 Adjacent Wetlands:	Minimal	Flow Reg. Use:		Field Ditch:	0 Road Ditch: 1
4.3 Flow Status:	Low	Impoundments:		Other:	0 Tile Drain: 0
4.4 # of Debris Jams:	1	Impoundment Loc.:		Overland Flow:	0 Urb Strm Wtr Pipe: 0
		4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	0
		(old) Upstrm Flow Reg.:		Affected Length (ft):	0

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	48	Yes	No	Yes	Yes	Deposition Above,Deposition Below
Bridge	70	Yes	No	Yes	Yes	Deposition Above,Deposition Below
Bridge	46	Yes	No	Yes	Yes	Deposition Above,Deposition Below

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	3	5.2 Other Features	Neck Cutoff:	0	5.4 Stream Ford or Animal Crossing:	No
Mid:	3	Delta:	0	Flood chutes:	1	5.5 Straightening:	None
Point:	6	Island:	0	5.3 Steep Riffles and Head Cuts	Head Cuts:	0	Straightening Length (ft.): 0
Side:	10	Braiding:	0	Steep Riffles:	5	Trib Rejuv.:	No
						5.5 Dredging:	Dredging

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradient Type	<u>Left</u>	<u>Right</u>
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:		
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection		
Total Score:	0	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:		
Habitat Rating:	0.00					
Habitat Stream Condition:						

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Confined	Score	STD	Historic		
7.1 Channel Degradation		5	B to F	No	Geomorphic Rating	0.32
7.2 Channel Aggradation		6	None	No	Channel Evolution Model	F
7.3 Widening Channel		5	None	No	Channel Evolution Stage	III
7.4 Change in Planform		10	None	No	Geomorphic Condition	Poor
Total Score		26			Stream Sensitivity	Extreme



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Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream: **Mill Brook**
Reach: **M05-B**
Segment Length(ft): **5,345**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Fitzgerald Environmental**
Observers: **JHB, MPL**
Completion Date: **6/18/2014**
Quality Control Status - Consultant: **Provisional**
Quality Control Status - Staff: **Provisional**

- Step 0 - Location: This reach begins at the segment point upstream from the Hewett road crossing and end at the segment point downstream of the Brook Rd bridge East of the intersection with Rokepa Rd.
- Step 5 - Notes: Huge side bars were observed through much of this segment. T.S. Irene deposits filled the channel from valley wall to valley wall in several areas leading to large mass failures and further sediment inputs to the channel.
- Step 7 - Narrative: This reach scoured and widened considerably during T.S. Irene. The channel scoured out the entire valley in several stretches and huge mass failures, bank erosion, and heavy bank scour were observed throughout the reach. Brook road closely followed the right valley through most of the reach and was completely washed out in numerous locations. This reach widened during TSI and is continuing to widen to accommodate the large volume of flood sediments working through. Historic floodplain terraces were observed through much of the reach; however these are elevated and were only partially accessed during T.S. Irene. Evaluation of some characteristics of confined river valleys in RGA form not entirely applicable to this Bc stream type setting (i.e., step-pool systems).

Step 1. Valley and Floodplain

1.1 Segmentation: **Valley Width**

1.2 Alluvial Fan: **None**

1.3 Corridor Encroachments:

	<u>Length (ft)</u>	<u>One</u>	<u>Height</u>	<u>Both</u>	<u>Height</u>
Berm:	284	3	0		
Road:	0	15	0		
Railroad:	0		0		
Imp. Path:	0		0		
Dev.:	643		0		

1.4 Adjacent Side

Hillside Slope:

Continuous w/ Bank:

Within 1 Bankfull W:

Texture:

Left

Right

Extr.Steep

Extr.Steep

Sometimes

Sometimes

Always

Sometimes

Mixed

Mixed

1.5 Valley Features

Valley Width (ft): **210**

Width Determination: **Measured**

Confinement Type: **SC**

In Rock Gorge: **No**

Human Caused Change in Valley Width?: **No**

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	3.0	2.0	No	
Ledge	Mid-segment	0.0	0.0	No	
Ledge	Mid-segment	5.0	2.0	No	
Ledge	Mid-segment	1.0	0.0	No	



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M05-B**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	76.79	2.11 Riffle/Step Spacing:	200 ft.	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	2.50	2.12 Substrate Composition		Bed:	600 mm
2.3 Mean Depth (ft.):	1.80	Bedrock:	0.0 %	Bar:	100 mm
2.4 Floodprone Width (ft.):	79.00	Boulder:	11.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	7.05	Cobble:	22.0 %	Stream Type:	F
Human Elev FloodPln (ft.):		Coarse Gravel:	33.0 %	Bed Material:	Gravel
2.6 Width/Depth Ratio:	42.66	Fine Gravel:	21.0 %	Subclass Slope:	None
2.7 Entrenchment Ratio:	1.03	Sand:	13.0 %	Bed Form:	Plane Bed
2.8 Incision Ratio:	2.82	Silt and Smaller:	0.0 %	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	Yes	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	Low	Detritus:	2.0 %	Reference Stream Type:	
2.10 Riffles Type:	Sedimented	# Large Woody Debris:	7	Reference Bed Material:	
				Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks					Typical Bank Slope: Steep					
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>	Near Bank Vegetation Type <u>Left</u>			<u>Right</u>	
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	1,502.9	1,291.7	Dominant:	Coniferous	Coniferous		
Material Type:	Bedrock	Mix	Erosion Height (ft.):	7.7	9.6	Sub-dominant:	Herbaceous	Herbaceous		
Consistency:	Cohesive	Non-cohesive	Revetment Type:	None	Rip-Rap	Bank Canopy				
Lower			Revetment Length:	0.0	703.0	Canopy %:	76-100	76-100		
Material Type:	Mix	Mix				Mid-Channel Canopy:		Open		
Consistency:	Non-cohesive	Non-cohesive								

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>	Corridor Land
Dominant	>100	>100	Dominant
Sub-Dominant	None	26-50	Sub-dominant
W less than 25	0	261	(Legacy)
Buffer Vegetation Type			Failures
Dominant	Mixed Trees	Mixed Trees	Gullies
Sub-Dominant	Shrubs/Sapling	Herbaceous	

3.3 Riparian Corridor

	<u>Left</u>	<u>Right</u>		<u>Left</u>	<u>Right</u>
Dominant	Forest	Forest	Mass Failures	81.077	482.00
Sub-Dominant	None	Residential	Height	9	08
W less than 25	0	261	Gullies Number	2	
Buffer Vegetation Type			Gullies Length	240	
Dominant	Mixed Trees	Mixed Trees			
Sub-Dominant	Shrubs/Sapling	Herbaceous			



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M05-B**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	Abundant	4.5 Flow Regulation Type	None	4.7 Stormwater Inputs	None
4.2 Adjacent Wetlands:	Minimal	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	Low	Impoundments:		Other:	Tile Drain:
4.4 # of Debris Jams:	0	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	0
		(old) Upstrm Flow Reg.:		Affected Length (ft):	0

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bedrock Outcrops	50	No	No	Yes	Yes	Deposition Below

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal: 0	5.2 Other Features	Neck Cutoff: 0	5.4 Stream Ford or Animal Crossing:	No
Mid: 1	Delta: 0	Flood chutes: 3	Avulsion: 0	5.5 Straightening:	None
Point: 4	Island: 0	5.3 Steep Riffles and Head Cuts	Head Cuts: 0	Straightening Length (ft.):	0
Side: 11	Braiding: 0	Steep Riffles: 2	Trib Rejuv.: No	5.5 Dredging:	Dredging

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:	6.4 Sediment Deposition:	Stream Gradient Type	<u>Left</u>	<u>Right</u>
6.2 Pool Substrate:	6.5 Channel Flow Status:	6.8 Bank Stability:		
6.3 Pool Variability:	6.6 Channel Alteration:	6.9 Bank Vegetation Protection		
Total Score: 0	6.7 Channel Sinuosity:	6.10 Riparian Veg. Zone Width:		
Habitat Rating: 0.00				
Habitat Stream Condition:				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Confined	Score	STD	Historic		
7.1 Channel Degradation		5	B to F	No	Geomorphic Rating	0.26
7.2 Channel Aggradation		5	None	No	Channel Evolution Model	F
7.3 Widening Channel		4	None	No	Channel Evolution Stage	III
7.4 Change in Planform		7	None	No	Geomorphic Condition	Poor
Total Score		21			Stream Sensitivity	Extreme



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Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream: **Mill Brook**
Reach: **M05-C**
Segment Length(ft): **1,841**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Fitzgerald Environmental**
Observers: **JHB, MPL**
Completion Date: **6/18/2014**
Quality Control Status - Consultant: **Provisional**
Quality Control Status - Staff: **Provisional**

Step 0 - Location: This reach begins at the segment break downstream of the Brook Rd bridge East of the intersection with Rokepa Rd.

Step 5 - Notes: Deposition was noticeable lower through this segment, likely due to increased channel slope and the presence of ledge along the valley walls. The Brook Road bridge listed as a constriction was destroyed during TS Irene, however it remains in the channel. The left abutment was flanked and erosion has scoured to the ledge VW.

Step 7 - Narrative: The bottom 600ft of the segment are located in a bedrock gorge. Above the series of grade controls the channel is encroached by a heavily armored stretch of Brook Road along the left bank, but the right bank spills on to an accessible forested floodplain. The downstream bedrock and ledge along much of the banks has likely locked the bed in place through this segment. Minor incision led us to assess the segment as stage II CEM.

Step 1. Valley and Floodplain

1.1 Segmentation: Channel Dimensions

1.2 Alluvial Fan: **None**

1.3 Corridor Encroachments:

	<u>Length (ft)</u>	<u>One</u>	<u>Height</u>	<u>Both</u>	<u>Height</u>
Berm:	0			0	
Road:	1,456	15		0	
Railroad:	0			0	
Imp. Path:	0			0	
Dev.:	0			122	

1.4 Adjacent Side

	<u>Left</u>	<u>Right</u>
Hillside Slope:	Very Steep	Extr.Steep
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Always	Always
Texture:	Bedrock	Bedrock

1.5 Valley Features

Valley Width (ft):	150
Width Determination:	Estimated
Confinement Type:	SC
In Rock Gorge:	Yes
Human Caused Change in Valley Width?:	Yes

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	12.0	10.0	Yes	
Ledge	Mid-segment	10.0	8.0	Yes	



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M05-C**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	55.55	2.11 Riffle/Step Spacing:	200 ft.	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	4.20	2.12 Substrate Composition		Bed:	550 mm
2.3 Mean Depth (ft.):	2.48	Bedrock:	0.0 %	Bar:	220 mm
2.4 Floodprone Width (ft.):	118.00	Boulder:	44.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	6.55	Cobble:	42.0 %	Stream Type:	B
Human Elev FloodPln (ft.):		Coarse Gravel:	6.0 %	Bed Material:	Cobble
2.6 Width/Depth Ratio:	22.40	Fine Gravel:	6.0 %	Subclass Slope:	c
2.7 Entrenchment Ratio:	2.12	Sand:	2.0 %	Bed Form:	Riffle-Pool
2.8 Incision Ratio:	1.56	Silt and Smaller:	0.0 %	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	Yes	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	Low	Detritus:	3.0 %	Reference Stream Type:	
2.10 Riffles Type:	Sedimented	# Large Woody Debris:	7	Reference Bed Material:	
				Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks					Typical Bank Slope: Steep				
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>	Near Bank Vegetation Type <u>Left</u>			<u>Right</u>
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	0.0	207.7	Dominant:	Shrubs/Sapling	Coniferous	
Material Type:	Mix	Mix	Erosion Height (ft.):	0.0	10.0	Sub-dominant:	Herbaceous	Herbaceous	
Consistency:	Non-cohesive	Non-cohesive	Revetment Type:	Rip-Rap	None	Bank Canopy			
Lower			Revetment Length:	458.9	0.0	Canopy %:	26-50	76-100	
Material Type:	Boulder/Cobble	Boulder/Cobble				Mid-Channel Canopy: Open			
Consistency:	Non-cohesive	Non-cohesive							

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>
Dominant	26-50	>100
Sub-Dominant	0-25	26-50
W less than 25	424	0
Buffer Vegetation Type		
Dominant	Shrubs/Sapling	Coniferous
Sub-Dominant	Herbaceous	Shrubs/Sapling

3.3 Riparian Corridor

Corridor Land	<u>Left</u>	<u>Right</u>	<u>Left</u>	<u>Right</u>
Dominant	Commercial	Forest	Mass Failures	
Sub-dominant	Residential	None	Height	
(Legacy)	<u>Amount</u>	<u>Mean Hieght</u>	Gullies Number	0
Failures	None		Gullies Length	0
Gullies	None			



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M05-C**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	Abundant	4.5 Flow Regulation Type	None	4.7 Stormwater Inputs	
4.2 Adjacent Wetlands:	Minimal	Flow Reg. Use:		Field Ditch:	1 Road Ditch: 1
4.3 Flow Status:	Low	Impoundments:		Other:	0 Tile Drain: 0
4.4 # of Debris Jams:	0	Impoundment Loc.:		Overland Flow:	0 Urb Strm Wtr Pipe: 0
		4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	0
		(old) Upstrm Flow Reg.:		Affected Length (ft):	0

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	52	Yes	Yes	Yes	Yes	Deposition Above, Deposition Below, Scour Below

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal: 0	5.2 Other Features	Neck Cutoff: 0	5.4 Stream Ford or Animal Crossing:	No
Mid: 2	Delta: 0	Flood chutes: 0	Avulsion: 0	5.5 Straightening:	None
Point: 1	Island: 0	5.3 Steep Riffles and Head Cuts	Head Cuts: 0	Straightening Length (ft.):	0
Side: 2	Braiding: 0	Steep Riffles: 0	Trib Rejuv.: No	5.5 Dredging:	None

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:	6.4 Sediment Deposition:	Stream Gradient Type	<u>Left</u>	<u>Right</u>
6.2 Pool Substrate:	6.5 Channel Flow Status:	6.8 Bank Stability:		
6.3 Pool Variability:	6.6 Channel Alteration:	6.9 Bank Vegetation Protection		
Total Score: 0	6.7 Channel Sinuosity:	6.10 Riparian Veg. Zone Width:		
Habitat Rating: 0.00				
Habitat Stream Condition:				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Confined	Score	STD	Historic		
7.1 Channel Degradation		11	None	No	Geomorphic Rating	0.60
7.2 Channel Aggradation		14	None	Yes	Channel Evolution Model	F
7.3 Widening Channel		12	None	No	Channel Evolution Stage	II
7.4 Change in Planform		11	None	Yes	Geomorphic Condition	Fair
Total Score		48			Stream Sensitivity	High



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Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream: **Mill Brook**
Reach: **M06-0**
Segment Length(ft): **6,224**
Rain: **No**

SGAT Version: **4.56**
Organization: **Fitzgerald Environmental**
Observers: **JHB, MPL, EPF**
Completion Date: **6/30/2014**
Quality Control Status - Consultant: **Provisional**
Quality Control Status - Staff: **Provisional**

Step 0 - Location: **This reach begins at the reach break Southeast of Rokepa Rd. and extends upstream to the intersection of Brownsville Rd. and Brownsville Hartland Rd.**

Step 5 - Notes:

Step 7 - Narrative: **Moderately accessible floodplain was present on at least one bank for most of this reach. The floodplain was elevated as indicated by the high incision ratio, but still accessible during larger events. Some planform adjustment was observed in the lower portion, however the banks appeared relatively stable for most of the reach and widening was minimal. This reach is likely still affected by historic straightening which has restricted widening and planform adjustment, leading to ongoing incision; we assessed this reach as stage II. Aggradation processes may be initiating after TS Irene flood and stage III adjustment processes will likely begin soon.**

Step 1. Valley and Floodplain

1.1 Segmentation: **None**

1.2 Alluvial Fan: **None**

1.3 Corridor Encroachments:

	Length (ft)	One	Height	Both	Height
Berm:	0			0	
Road:	669	15		0	
Railroad:	0			0	
Imp. Path:	0			0	
Dev.:	1,317			0	

1.4 Adjacent Side

Left

Right

Hillside Slope:

Hilly

Steep

Continuous w/ Bank:

Never

Sometimes

Within 1 Bankfull W:

Sometimes

Sometimes

Texture:

Mixed

Mixed

1.5 Valley Features

Valley Width (ft): **349**

Width Determination: **Measured**

Confinement Type: **NW**

In Rock Gorge: **No**

Human Caused Change in Valley Width?: **Yes**

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	6.0	2.0	No	
Ledge	Mid-segment	3.0	1.0		
Dam	Mid-segment	6.0	3.0	Yes	



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M06-0**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	65.67	2.11 Riffle/Step Spacing:	235 ft.	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	3.80	2.12 Substrate Composition		Bed:	500 mm
2.3 Mean Depth (ft.):	2.35	Bedrock:	0.0 %	Bar:	180 mm
2.4 Floodprone Width (ft.):	105.00	Boulder:	29.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	7.30	Cobble:	23.0 %	Stream Type:	B
Human Elev FloodPln (ft.):		Coarse Gravel:	17.0 %	Bed Material:	Cobble
2.6 Width/Depth Ratio:	27.94	Fine Gravel:	11.0 %	Subclass Slope:	c
2.7 Entrenchment Ratio:	1.60	Sand:	20.0 %	Bed Form:	Riffle-Pool
2.8 Incision Ratio:	1.92	Silt and Smaller:	0.0 %	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	Yes	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	Moderate	Detritus:	4.0 %	Reference Stream Type:	
2.10 Riffles Type:	Sedimented	# Large Woody Debris:	24	Reference Bed Material:	
				Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks					Typical Bank Slope: Steep				
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>	Near Bank Vegetation Type <u>Left</u>			<u>Right</u>
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	214.6	1,257.8	Dominant:	Shrubs/Sapling	Deciduous	
Material Type:	Mix	Mix	Erosion Height (ft.):	5.1	5.6	Sub-dominant:	Herbaceous	Herbaceous	
Consistency:	Non-cohesive	Non-cohesive	Revetment Type:	Rip-Rap	Rip-Rap	Bank Canopy			
Lower			Revetment Length:	955.7	169.1	Canopy %:	51-75	26-50	
Material Type:	Mix	Mix				Mid-Channel Canopy: Open			
Consistency:	Non-cohesive	Non-cohesive							

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>
Dominant	51-100	>100
Sub-Dominant	0-25	0-25
W less than 25	1,302	735
Buffer Vegetation Type		
Dominant	Herbaceous	Herbaceous
Sub-Dominant	Shrubs/Sapling	Deciduous

3.3 Riparian Corridor

Corridor Land	<u>Left</u>	<u>Right</u>		<u>Left</u>	<u>Right</u>
Dominant	Forest	Pasture	Mass Failures	159.88	371.08
Sub-dominant	Residential	Forest	Height	15.0	36.5
(Legacy)	<u>Amount</u>	<u>Mean Hieght</u>	Gullies Number	2	
Failures	Multiple	30.8	Gullies Length	140	
Gullies	Multiple	2.0			



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M06-0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	Abundant	4.5 Flow Regulation Type	Small Withdrawal	4.7 Stormwater Inputs	None
4.2 Adjacent Wetlands:	Abundant	Flow Reg. Use:	Other	Field Ditch:	Road Ditch:
4.3 Flow Status:	Low	Impoundments:		Other:	Tile Drain:
4.4 # of Debris Jams:	3	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	0
		(old) Upstrm Flow Reg.:		Affected Length (ft):	0

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	52	Yes	Yes	Yes	Yes	Deposition Above, Deposition Below
Bridge	76	Yes	Yes	Yes	Yes	Deposition Above, Deposition Below

Step 5. Channel Bed and Planform Changes

5.1 Bar Types		Diagonal:	0	5.2 Other Features		Neck Cutoff:	0	5.4 Stream Ford or Animal Crossing:		No
Mid:	2	Delta:	0	Flood chutes:	1	Avulsion:	0	5.5 Straightening:		Straightening
Point:	7	Island:	0	5.3 Steep Riffles and Head Cuts		Head Cuts:	0	Straightening Length (ft.):		1,554
Side:	11	Braiding:	0	Steep Riffles:	2	Trib Rejuv.:	No	5.5 Dredging:		Dredging

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradient Type	<u>Left</u>	<u>Right</u>
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:		
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection		
Total Score:	0	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:		
Habitat Rating:	0.00					
Habitat Stream Condition:						

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Unconfined	Score	STD	Historic		
7.1 Channel Degradation		7	C to B	No	Geomorphic Rating	0.44
7.2 Channel Aggradation		8	None	No	Channel Evolution Model	F
7.3 Widening Channel		10	None	No	Channel Evolution Stage	II
7.4 Change in Planform		10	None	No	Geomorphic Condition	Fair
Total Score		35			Stream Sensitivity	High



Stream Geomorphic Assessment

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Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream: **Mill Brook**
Reach: **M07-A**
Segment Length(ft): **1,300**
Rain: **No**

SGAT Version: **4.56**
Organization: **Fitzgerald Environmental**
Observers: **JHB, MPL, EPF**
Completion Date: **6/30/2014**
Quality Control Status - Consultant: **Provisional**
Quality Control Status - Staff: **Provisional**

Step 0 - Location: This reach begins at the reachbreak upstream of the intersection of Rt-44 and Brownsville-Hartland road and extends upstream to the reachbreak downstream of intersection of Harrington Rd and Rt-44

Step 5 - Notes: Finer sediment deposits were observed in this short segment above the concrete dam at the M06/M07 reach break.

Step 7 - Narrative: The left bank is encroached by development on Route 44 and armored for most of the segment. The right bank has a low and accessible wide floodplain with relatively stable banks. Sand and gravel deposition throughout the segment indicates that the downstream dam causes enough gradient change to increase fine deposition throughout the segment. This is likely controlling incision and maintaining floodplain access. We assessed the reach as stage II due to limited opportunity for widening or planform adjustment with the high degree of encroachment and armoring. The channel would likely rapidly incise if the dam failed or was removed.

Step 1. Valley and Floodplain

1.1 Segmentation: **Channel Dimensions**

1.2 Alluvial Fan: **None**

1.3 Corridor Encroachments:

	<u>Length (ft)</u>	<u>One</u>	<u>Height</u>	<u>Both</u>	<u>Height</u>
Berm:	0			0	
Road:	1,238	10		0	
Railroad:	0			0	
Imp. Path:	0			0	
Dev.:	703			0	

1.4 Adjacent Side

Left

Right

Hillside Slope:

Hilly

Steep

Continuous w/ Bank:

Never

Never

Within 1 Bankfull W:

Sometimes

Sometimes

Texture:

Mixed

Mixed

1.5 Valley Features

Valley Width (ft): **250**

Width Determination: **Measured**

Confinement Type: **NW**

In Rock Gorge: **No**

Human Caused Change in Valley Width?: **Yes**

1.6 Grade Controls: **None**



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M07-A**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	60.53	2.11 Riffle/Step Spacing:	200 ft.	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	3.25	2.12 Substrate Composition		Bed:	450 mm
2.3 Mean Depth (ft.):	2.34	Bedrock:	0.0 %	Bar:	150 mm
2.4 Floodprone Width (ft.):	305.00	Boulder:	9.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	3.95	Cobble:	54.0 %	Stream Type:	C
Human Elev FloodPln (ft.):		Coarse Gravel:	23.0 %	Bed Material:	Cobble
2.6 Width/Depth Ratio:	25.87	Fine Gravel:	9.0 %	Subclass Slope:	None
2.7 Entrenchment Ratio:	5.04	Sand:	5.0 %	Bed Form:	Plane Bed
2.8 Incision Ratio:	1.22	Silt and Smaller:	0.0 %	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	Yes	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	Low	Detritus:	4.0 %	Reference Stream Type:	
2.10 Riffles Type:	Complete	# Large Woody Debris:	7	Reference Bed Material:	
				Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks			Typical Bank Slope:	Moderate	
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	201.2	136.2
Material Type:	Mix	Mix	Erosion Height (ft.):	5.0	3.6
Consistency:	Non-cohesive	Non-cohesive	Revetment Type:	Rip-Rap	None
Lower			Revetment Length:	705.4	0.0
Material Type:	Boulder/Cobbles	Boulder/Cobbles			
Consistency:	Non-cohesive	Non-cohesive			
			Near Bank Vegetation Type	<u>Left</u>	<u>Right</u>
			Dominant:	Shrubs/Sapling	Deciduous
			Sub-dominant:	Herbaceous	Herbaceous
			Bank Canopy		
			Canopy %:	76-100	51-75
			Mid-Channel Canopy:	Open	

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>
Dominant	26-50	>100
Sub-Dominant	0-25	26-50
W less than 25	404	100
Buffer Vegetation Type		
Dominant	Shrubs/Sapling	Deciduous
Sub-Dominant	Herbaceous	Herbaceous

3.3 Riparian Corridor

Corridor Land	<u>Left</u>	<u>Right</u>		<u>Left</u>	<u>Right</u>
Dominant	Residential	Forest	Mass Failures		
Sub-dominant	Forest	Commercial	Height		
(Legacy)	<u>Amount</u>	<u>Mean Height</u>	Gullies Number	0	
Failures	None		Gullies Length	0	
Gullies	None				



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M07-A**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	Minimal	4.5 Flow Regulation Type	None	4.7 Stormwater Inputs	None
4.2 Adjacent Wetlands:	Minimal	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	Low	Impoundments:		Other:	Tile Drain:
4.4 # of Debris Jams:	0	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	0
		(old) Upstrm Flow Reg.:		Affected Length (ft):	0
4.8 Channel Constrictions:	None				

Step 5. Channel Bed and Planform Changes

5.1 Bar Types		Diagonal:	1	5.2 Other Features		Neck Cutoff:	0	5.4 Stream Ford or Animal Crossing:		No
Mid:	1	Delta:	0	Flood chutes:	0	Avulsion:	0	5.5 Straightening:		None
Point:	2	Island:	0	5.3 Steep Riffles and Head Cuts		Head Cuts:	0	Straightening Length (ft.):		0
Side:	1	Braiding:	0	Steep Riffles:	0	Trib Rejuv.:	No	5.5 Dredging:		None

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradient Type	<u>Left</u>	<u>Right</u>
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:		
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection		
Total Score:	0	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:		
Habitat Rating:	0.00					
Habitat Stream Condition:						

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Unconfined	Score	STD	Historic		
7.1 Channel Degradation		12	None	No	Geomorphic Rating	0.59
7.2 Channel Aggradation		12	None	No	Channel Evolution Model	F
7.3 Widening Channel		13	None	No	Channel Evolution Stage	II
7.4 Change in Planform		10	None	No	Geomorphic Condition	Fair
Total Score		47			Stream Sensitivity	High



Stream Geomorphic Assessment

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Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream: **Mill Brook**
Reach: **M07-B**
Segment Length(ft): **6,234**
Rain: **No**

SGAT Version: **4.56**
Organization: **Fitzgerald Environmental**
Observers: **JHB, MPL**
Completion Date: **6/30/2014**
Quality Control Status - Consultant: **Provisional**
Quality Control Status - Staff: **Provisional**

- Step 0 - Location: This reach begins at the reachbreak downstream of intersection of Harrington Rd and Rt-44 and extends upstream to the reachbreak upstream of the Bible Hill Rd crossing.
- Step 5 - Notes: Large deposits of gravel and sand were observed upstream of the failing dam and grade control mid-segment. Two culverts crossing under Rt 44 had large delta bars where they entered the stream.
- Step 7 - Narrative: This segment was deeply incised and narrow throughout. The only accessible floodplain was located in the lower portion of the segment immediately upstream of a large grade control with a breached concrete dam. Bank erosion and scour were minimal indicating no recent widening or planform adjustment. T.S. Irene caused major flood damage to adjacent properties, however no major channel adjustments are apparent. This segment was assessed as stage II.

Step 1. Valley and Floodplain

1.1 Segmentation: Channel Dimensions	1.4 Adjacent Side	<u>Left</u>	<u>Right</u>	1.5 Valley Features
1.2 Alluvial Fan: None	Hillside Slope:	Steep	Steep	Valley Width (ft): 340
1.3 Corridor Encroachments:	Continuous w/ Bank:	Never	Sometimes	Width Determination: Measured
<u>Length (ft)</u> <u>One</u> <u>Height</u> <u>Both</u> <u>Height</u>	Within 1 Bankfull W:	Sometimes	Sometimes	Confinement Type: BD
Berm: 285 15 0	Texture:	Mixed	Mixed	In Rock Gorge: No
Road: 2,333 8 874 10				Human Caused Change in Valley Width?: Yes
Railroad: 0 0				
Imp. Path: 0 0				
Dev.: 1,612 0				

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	15.0	10.0	Yes	
Ledge	Mid-segment	6.0	2.0	Yes	
Ledge	Mid-segment	0.0	0.0	No	
Ledge	Mid-segment	0.0	0.0	No	
Ledge	Mid-segment	0.0	0.0	No	



Stream Geomorphic Assessment

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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M07-B**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	48.64	2.11 Riffle/Step Spacing:	200 ft.	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	3.60	2.12 Substrate Composition		Bed:	400 mm
2.3 Mean Depth (ft.):	2.96	Bedrock:	0.0 %	Bar:	N/A mm
2.4 Floodprone Width (ft.):	62.00	Boulder:	7.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	8.30	Cobble:	48.0 %	Stream Type:	F
Human Elev FloodPln (ft.):		Coarse Gravel:	25.0 %	Bed Material:	Cobble
2.6 Width/Depth Ratio:	16.43	Fine Gravel:	11.0 %	Subclass Slope:	None
2.7 Entrenchment Ratio:	1.27	Sand:	9.0 %	Bed Form:	Plane Bed
2.8 Incision Ratio:	2.31	Silt and Smaller:	0.0 %	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	Yes	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	Low	Detritus:	3.0 %	Reference Stream Type:	
2.10 Riffles Type:	Eroded	# Large Woody Debris:	15	Reference Bed Material:	
				Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks			Typical Bank Slope:	Steep		
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>	Near Bank Vegetation Type <u>Left</u> <u>Right</u>
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	303.8	204.5	Dominant: Herbaceous Deciduous
Material Type:	Mix	Mix	Erosion Height (ft.):	5.6	3.0	Sub-dominant: Deciduous Shrubs/Sapling
Consistency:	Non-cohesive	Non-cohesive	Revetment Type:	Rip-Rap	Multiple	Bank Canopy
Lower			Revetment Length:	925.6	412.1	Canopy %: 51-75 51-75
Material Type:	Boulder/Cobble	Mix				Mid-Channel Canopy: Open
Consistency:	Non-cohesive	Non-cohesive				

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>	Corridor Land	<u>Left</u>	<u>Right</u>
Dominant	51-100	51-100	Dominant	Residential	Residential
Sub-Dominant	0-25	0-25	Sub-dominant	Hay	Forest
W less than 25	1,702	773	(Legacy)	<u>Amount</u>	<u>Mean Height</u>
Buffer Vegetation Type			Failures	One	10.0
Dominant	Herbaceous	Deciduous	Gullies	One	4.0
Sub-Dominant	Shrubs/Sapling	Herbaceous			

3.3 Riparian Corridor

Mass Failures	19.139				
Height	65				
Gullies Number	1				
Gullies Length	60				



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M07-B**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	Minimal	4.5 Flow Regulation Type	None	4.7 Stormwater Inputs	
4.2 Adjacent Wetlands:	Minimal	Flow Reg. Use:		Field Ditch:	0 Road Ditch: 1
4.3 Flow Status:	Low	Impoundments:		Other:	0 Tile Drain: 0
4.4 # of Debris Jams:	0	Impoundment Loc.:		Overland Flow:	0 Urb Strm Wtr Pipe: 0
		4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	0
		(old) Upstrm Flow Reg.:		Affected Length (ft):	0

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	36	Yes	Yes	Yes	Yes	Deposition Below
Bridge	60	Yes	Yes	No	Yes	Deposition Above, Deposition Below
Old Abutment	42	No	No	Yes	Yes	None
Bridge	45	Yes	No	Yes	Yes	Deposition Above, Deposition Below

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal: 2	5.2 Other Features	Neck Cutoff: 0	5.4 Stream Ford or Animal Crossing:	No
Mid: 5	Delta: 2	Flood chutes: 1	Avulsion: 0	5.5 Straightening:	Straightening
Point: 2	Island: 0	5.3 Steep Riffles and Head Cuts	Head Cuts: 0	Straightening Length (ft.):	158
Side: 5	Braiding: 0	Steep Riffles: 0	Trib Rejuv.: No	5.5 Dredging:	Dredging

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:	6.4 Sediment Deposition:	Stream Gradient Type	<u>Left</u>	<u>Right</u>
6.2 Pool Substrate:	6.5 Channel Flow Status:	6.8 Bank Stability:		
6.3 Pool Variability:	6.6 Channel Alteration:	6.9 Bank Vegetation Protection		
Total Score: 0	6.7 Channel Sinuosity:	6.10 Riparian Veg. Zone Width:		
Habitat Rating: 0.00				
Habitat Stream Condition:				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Unconfined	Score	STD	Historic		
7.1 Channel Degradation		5	C to F	No	Geomorphic Rating	0.45
7.2 Channel Aggradation		7	None	No	Channel Evolution Model	F
7.3 Widening Channel		13	None	Yes	Channel Evolution Stage	II
7.4 Change in Planform		11	None	Yes	Geomorphic Condition	Fair
Total Score		36			Stream Sensitivity	Extreme



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Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream: **Mill Brook**
Reach: **M08-0**
Segment Length(ft): **2,087**
Rain: **No**

SGAT Version: **4.56**
Organization: **Fitzgerald Environmental**
Observers: **JHB, MPL, EPF**
Completion Date: **6/30/2014**
Quality Control Status - Consultant: **Provisional**
Quality Control Status - Staff: **Provisional**

Step 0 - Location: **Begins at the Bible Hill Rd bridge and continues upstream to the reach break Southwest of Westgate Rd.**

Step 5 - Notes: **Two large diagonal bars were soft underfoot and were likely being supplied with sand and gravel from fresh bank erosion and mass failure within the reach.**

Step 7 - Narrative: **This reach scoured down during T.S. Irene in the upper reach and widened in the lower reach where multiple grade controls limited incision. Floodplain access is very limited throughout the reach and large mass failures were observed in the areas of widening. The upper half of the reach is naturally confined and is incised. A small ~5ft wide bench is the only accessible floodplain except during the largest events. Heavy bank scour was observed through most of the reach but widening is limited by stony soils, ledge, and dense roots. We assessed the reach as stage II due to the very high primary floodplain and the low potential for widening or planform adjustment.**

Step 1. Valley and Floodplain

1.1 Segmentation: **None**

1.2 Alluvial Fan: **None**

1.3 Corridor Encroachments:

	<u>Length (ft)</u>	<u>One</u>	<u>Height</u>	<u>Both</u>	<u>Height</u>
Berm:	0			0	
Road:	1,951	13		0	
Railroad:	0			0	
Imp. Path:	0			0	
Dev.:	0			0	

1.4 Adjacent Side

Left

Right

Hillside Slope:

Very Steep

Steep

Continuous w/ Bank:

Sometimes

Sometimes

Within 1 Bankfull W:

Always

Sometimes

Texture:

Mixed

Mixed

1.5 Valley Features

Valley Width (ft): **140**

Width Determination: **Measured**

Confinement Type: **SC**

In Rock Gorge: **No**

Human Caused Change in Valley Width?: **Yes**

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	6.0	4.0	No	
Ledge	Mid-segment	4.0	2.0	No	
Ledge	Mid-segment	4.0	2.0	No	



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M08-0**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	52.00	2.11 Riffle/Step Spacing:	240 ft.	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	3.00	2.12 Substrate Composition		Bed:	400 mm
2.3 Mean Depth (ft.):	2.04	Bedrock:	0.0 %	Bar:	110 mm
2.4 Floodprone Width (ft.):	69.00	Boulder:	16.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	4.00	Cobble:	37.0 %	Stream Type:	B
Human Elev FloodPln (ft.):		Coarse Gravel:	14.0 %	Bed Material:	Cobble
2.6 Width/Depth Ratio:	25.49	Fine Gravel:	10.0 %	Subclass Slope:	c
2.7 Entrenchment Ratio:	1.33	Sand:	21.0 %	Bed Form:	Plane Bed
2.8 Incision Ratio:	1.33	Silt and Smaller:	2.0 %	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	Yes	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	Low	Detritus:	3.0 %	Reference Stream Type:	
2.10 Riffles Type:	Eroded	# Large Woody Debris:	29	Reference Bed Material:	
				Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks					Typical Bank Slope: Steep				
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>	Near Bank Vegetation Type <u>Left</u>			<u>Right</u>
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	261.5	154.0	Dominant:	Coniferous	Coniferous	
Material Type:	Mix	Mix	Erosion Height (ft.):	4.7	4.3	Sub-dominant:	Herbaceous	Shrubs/Sapling	
Consistency:	Non-cohesive	Non-cohesive	Revetment Type:	None	None	Bank Canopy			
Lower			Revetment Length:	0.0	0.0	Canopy %:	76-100	76-100	
Material Type:	Boulder/Cobbles	Boulder/Cobbles				Mid-Channel Canopy:		Open	
Consistency:	Non-cohesive	Non-cohesive							

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>
Dominant	>100	51-100
Sub-Dominant	51-100	>100
W less than 25	0	194
Buffer Vegetation Type		
Dominant	Coniferous	Coniferous
Sub-Dominant	Herbaceous	Herbaceous

3.3 Riparian Corridor

Corridor Land	<u>Left</u>	<u>Right</u>		<u>Left</u>	<u>Right</u>
Dominant	Forest	Forest	Mass Failures		286.73
Sub-dominant	Hay	Hay	Height		35.4
(Legacy)	<u>Amount</u>	<u>Mean Height</u>	Gullies Number	0	
Failures	Multiple	36.7	Gullies Length	0	
Gullies	None				



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M08-0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	Minimal	4.5 Flow Regulation Type	None	4.7 Stormwater Inputs	None
4.2 Adjacent Wetlands:	Minimal	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	Low	Impoundments:		Other:	Tile Drain:
4.4 # of Debris Jams:	4	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	0
		(old) Upstrm Flow Reg.:		Affected Length (ft):	0

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bedrock Outcrops	50	No	No	Yes	Yes	None
Bedrock Outcrops	30	No	No	Yes	Yes	None

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal: 2	5.2 Other Features	Neck Cutoff: 0	5.4 Stream Ford or Animal Crossing:	No
Mid: 0	Delta: 0	Flood chutes: 1	Avulsion: 0	5.5 Straightening:	Straightening
Point: 1	Island: 0	5.3 Steep Riffles and Head Cuts	Head Cuts: 0	Straightening Length (ft.):	498
Side: 4	Braiding: 0	Steep Riffles: 0	Trib Rejuv.: No	5.5 Dredging:	None

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:	6.4 Sediment Deposition:	Stream Gradient Type	<u>Left</u>	<u>Right</u>
6.2 Pool Substrate:	6.5 Channel Flow Status:	6.8 Bank Stability:		
6.3 Pool Variability:	6.6 Channel Alteration:	6.9 Bank Vegetation Protection		
Total Score: 0	6.7 Channel Sinuosity:	6.10 Riparian Veg. Zone Width:		
Habitat Rating: 0.00				
Habitat Stream Condition:				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Confined	Score	STD	Historic		
7.1 Channel Degradation		13	None	No	Geomorphic Rating	0.51
7.2 Channel Aggradation		6	None	No	Channel Evolution Model	F
7.3 Widening Channel		10	None	No	Channel Evolution Stage	II
7.4 Change in Planform		12	None	No	Geomorphic Condition	Fair
Total Score		41			Stream Sensitivity	High



Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream: **Mill Brook**
Reach: **M09-A**
Segment Length(ft): **3,021**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Fitzgerald Environmental**
Observers: **EPF**
Completion Date: **7/21/2014**
Quality Control Status - Consultant: **Provisional**
Quality Control Status - Staff: **Provisional**

- Step 0 - Location: This reach begins at the reach break southeast of Westgate Rd and continues upstream to the segmentation point at the Rt-44 bridge.
- Step 5 - Notes: Historical straightening appears to be limited to the upper segment from Route 44 down to a pinch in the valley. The valley pinches naturally in the lower segment and the channel planform there was likely straight historically. Many small pieces of LWD, but overall recruitment potential very low. Channel banks are extensively armored, otherwise there would be significantly more erosion and widening (ie, channel locked into stage II). No evidence of significant overbank flow during T.S. Irene except for one bend in segment ~1,000ft downstream of Route 44.
- Step 7 - Narrative: Extensive historic straightening and some armoring in upper segment near Route 44. Channel incised and stuck in Stage II channel evolution. Signs of bed fining from recent floods, but no evidence of a transition to aggradation process.

Step 1. Valley and Floodplain

1.1 Segmentation: Channel Dimensions	1.4 Adjacent Side	<u>Left</u>	<u>Right</u>	1.5 Valley Features
1.2 Alluvial Fan: None	Hillside Slope:	Hilly	Hilly	Valley Width (ft): 900
1.3 Corridor Encroachments:	Continuous w/ Bank:	Sometimes	Never	Width Determination: Estimated
<u>Length (ft)</u> <u>One</u> <u>Height</u> <u>Both</u> <u>Height</u>	Within 1 Bankfull W:	Sometimes	Sometimes	Confinement Type: VB
Berm: 0	Texture:	N.E.	N.E.	In Rock Gorge: No
Road: 690 10 0	Human Caused Change in Valley Width?: No			
Railroad: 0 0				
Imp. Path: 0 0				
Dev.: 0 0				

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	0.0	0.0	Yes	



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M09-A**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	29.17	2.11 Riffle/Step Spacing:		2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	3.80	2.12 Substrate Composition		Bed:	N/A
2.3 Mean Depth (ft.):	2.90	Bedrock:	0.0 %	Bar:	N/A
2.4 Floodprone Width (ft.):	35.00	Boulder:	2.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	8.10	Cobble:	10.0 %	Stream Type:	F
Human Elev FloodPln (ft.):		Coarse Gravel:	25.0 %	Bed Material:	Gravel
2.6 Width/Depth Ratio:	10.06	Fine Gravel:	24.0 %	Subclass Slope:	None
2.7 Entrenchment Ratio:	1.20	Sand:	35.0 %	Bed Form:	Plane Bed
2.8 Incision Ratio:	2.13	Silt and Smaller:	4.0 %	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	No	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	Moderate	Detritus:	3.0 %	Reference Stream Type:	E
2.10 Riffles Type:	Sedimented	# Large Woody Debris:	57	Reference Bed Material:	Gravel
				Reference Subclass Slope:	None
				Reference Bedform:	Riffle-Pool

Step 3. Riparian Features

3.1 Stream Banks			Typical Bank Slope:	Steep		
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>	Near Bank Vegetation Type <u>Left</u> <u>Right</u>
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	219.0	51.4	Dominant: Shrubs/Sapling Shrubs/Sapling
Material Type:	Sand	Sand	Erosion Height (ft.):	4.0	4.0	Sub-dominant: Deciduous Deciduous
Consistency:	Non-cohesive	Non-cohesive	Revetment Type:	Rip-Rap	Rip-Rap	Bank Canopy
Lower			Revetment Length:	284.8	532.5	Canopy %: 26-50 26-50
Material Type:	Boulder/Cobb	Boulder/Cobb				Mid-Channel Canopy: Open
	e	e				
Consistency:	Non-cohesive	Non-cohesive				

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>
Dominant	51-100	0-25
Sub-Dominant	0-25	None
W less than 25	1,030	2,895
Buffer Vegetation Type		
Dominant	Herbaceous	Herbaceous
Sub-Dominant	Deciduous	Shrubs/Sapling

3.3 Riparian Corridor

Corridor Land	<u>Left</u>	<u>Right</u>	<u>Left</u>	<u>Right</u>
Dominant	Hay	Hay	Mass Failures	
Sub-dominant	Forest	None	Height	
(Legacy)	<u>Amount</u>	<u>Mean Hieght</u>	Gullies Number	0
Failures	None		Gullies Length	0
Gullies	None			



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M09-A**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	Abundant	4.5 Flow Regulation Type	None	4.7 Stormwater Inputs	None
4.2 Adjacent Wetlands:	Minimal	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	Low	Impoundments:		Other:	Tile Drain:
4.4 # of Debris Jams:	1	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	0
		(old) Upstrm Flow Reg.:		Affected Length (ft):	0

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	32	Yes	No	No	Yes	Deposition Above

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal: 0	5.2 Other Features	Neck Cutoff: 0	5.4 Stream Ford or Animal Crossing:	No
Mid: 1	Delta: 0	Flood chutes: 0	Avulsion: 0	5.5 Straightening:	Straightening
Point: 3	Island: 0	5.3 Steep Riffles and Head Cuts	Head Cuts: 0	Straightening Length (ft.):	1,877
Side: 3	Braiding: 0	Steep Riffles: 0	Trib Rejuv.: No	5.5 Dredging:	None

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:	6.4 Sediment Deposition:	Stream Gradient Type	<u>Left</u>	<u>Right</u>
6.2 Pool Substrate:	6.5 Channel Flow Status:	6.8 Bank Stability:		
6.3 Pool Variability:	6.6 Channel Alteration:	6.9 Bank Vegetation Protection		
Total Score: 0	6.7 Channel Sinuosity:	6.10 Riparian Veg. Zone Width:		
Habitat Rating: 0.00				
Habitat Stream Condition:				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Unconfined	Score	STD	Historic		
7.1 Channel Degradation		3	E to F	Yes	Geomorphic Rating	0.41
7.2 Channel Aggradation		10	None	No	Channel Evolution Model	F
7.3 Widening Channel		10	None	No	Channel Evolution Stage	II
7.4 Change in Planform		10	None	No	Geomorphic Condition	Fair
Total Score		33			Stream Sensitivity	Extreme



Stream Geomorphic Assessment

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Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream: **Mill Brook**
Reach: **M09-B**
Segment Length(ft): **8,525**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Fitzgerald Environmental**
Observers: **EPF**
Completion Date: **7/21/2014**
Quality Control Status - Consultant: **Provisional**
Quality Control Status - Staff: **Provisional**

- Step 0 - Location: **This reach begins at the segmentation point at the Rt-44 bridge and continues upstream to the reach break east of Churchill Rd.**
- Step 5 - Notes: **Numerous small sand and gravel bars were observed throughout this low gradient reach. Areas without historical straightening are difficult to discern as most of reach appears to have been straightened in past. Very important flood attenuation reach for downstream areas.**
- Step 7 - Narrative: **Significant historical straightening throughout segment. Majority of reach was likely armored historically. Erosion is now occurring post-T.S. Irene where armor failed. Bed aggradation has likely been occurring in recent decades and lateral channel migration is beginning. Stage III channel evolution will transition into stage IV in near future in the absence of channel management.**

Step 1. Valley and Floodplain

1.1 Segmentation: **Channel Dimensions**

1.2 Alluvial Fan: **None**

1.3 Corridor Encroachments:

	<u>Length (ft)</u>	<u>One</u>	<u>Height</u>	<u>Both</u>	<u>Height</u>
Berm:	0			0	
Road:	786		10	0	
Railroad:	0			0	
Imp. Path:	0			0	
Dev.:	207			0	

1.4 Adjacent Side

Hillside Slope:

Continuous w/ Bank:

Within 1 Bankfull W:

Texture:

Left

Hilly

Sometimes

Sometimes

Sand

Right

Steep

Sometimes

Sometimes

Sand

1.5 Valley Features

Valley Width (ft): **870**

Width Determination: **Estimated**

Confinement Type: **VB**

In Rock Gorge: **No**

Human Caused Change in Valley Width?: **Yes**

1.6 Grade Controls: **None**



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M09-B**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	49.00	2.11 Riffle/Step Spacing:	180 ft.	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	4.10	2.12 Substrate Composition		Bed:	4 inches
2.3 Mean Depth (ft.):	2.39	Bedrock:	0.0 %	Bar:	2.5 inches
2.4 Floodprone Width (ft.):	148.00	Boulder:	1.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	7.80	Cobble:	6.0 %	Stream Type:	C
Human Elev FloodPln (ft.):		Coarse Gravel:	49.0 %	Bed Material:	Gravel
2.6 Width/Depth Ratio:	20.50	Fine Gravel:	10.0 %	Subclass Slope:	None
2.7 Entrenchment Ratio:	3.02	Sand:	30.0 %	Bed Form:	Riffle-Pool
2.8 Incision Ratio:	1.90	Silt and Smaller:	4.0 %	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	No	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	Moderate	Detritus:	2.0 %	Reference Stream Type:	
2.10 Riffles Type:	Sedimented	# Large Woody Debris:	188	Reference Bed Material:	
				Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks					Typical Bank Slope: Steep				
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>	Near Bank Vegetation Type <u>Left</u>			<u>Right</u>
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	1,313.5	1,477.0	Dominant:	Shrubs/Sapling	Shrubs/Sapling	
Material Type:	Sand	Sand	Erosion Height (ft.):	6.7	6.9	Sub-dominant:	Deciduous	Deciduous	
Consistency:	Non-cohesive	Non-cohesive	Revetment Type:	Multiple	Rip-Rap	Bank Canopy			
Lower			Revetment Length:	1,644.2	957.0	Canopy %:	51-75	51-75	
Material Type:	Gravel	Gravel				Mid-Channel Canopy:		Open	
Consistency:	Non-cohesive	Non-cohesive							

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>	Corridor Land	<u>Left</u>	<u>Right</u>
Dominant	0-25	0-25	Dominant	Hay	Hay
Sub-Dominant	26-50	51-100	Sub-dominant	Forest	Forest
W less than 25	5,450	4,123	(Legacy)	<u>Amount</u>	<u>Mean Hieght</u>
Buffer Vegetation Type			Failures	One	18.0
Dominant	Herbaceous	Herbaceous	Gullies	None	
Sub-Dominant	Shrubs/Sapling	Shrubs/Sapling			

3.3 Riparian Corridor

	<u>Left</u>	<u>Right</u>		<u>Left</u>	<u>Right</u>
Mass Failures					61.648
Height					19
Gullies Number	0				
Gullies Length	0				



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M09-B**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps: Abundant	4.5 Flow Regulation Type None	4.7 Stormwater Inputs
4.2 Adjacent Wetlands: Abundant	Flow Reg. Use:	Field Ditch: 0 Road Ditch: 1
4.3 Flow Status: Low	Impoundments:	Other: 0 Tile Drain: 0
4.4 # of Debris Jams: 7	Impoundment Loc.:	Overland Flow: 0 Urb Strm Wtr Pipe: 0
	4.6 Up/Down Strm flow reg.: None	4.9 # of Beaver Dams: 0
	(old) Upstrm Flow Reg.:	Affected Length (ft): 0

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	56	Yes	No	No	Yes	Deposition Above
Bridge	34	Yes	No	Yes	Yes	Deposition Above, Deposition Below
Old Abutment	36	Yes	No	Yes	Yes	None
Old Abutment	36	Yes	No	Yes	Yes	None

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal: 4	5.2 Other Features	Neck Cutoff: 0	5.4 Stream Ford or Animal Crossing: No
Mid: 4	Delta: 0	Flood chutes: 1	Avulsion: 0	5.5 Straightening: Straightening
Point: 22	Island: 0	5.3 Steep Riffles and Head Cuts	Head Cuts: 0	Straightening Length (ft.): 5,500
Side: 14	Braiding: 0	Steep Riffles: 0	Trib Rejuv.: No	5.5 Dredging: None

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:	6.4 Sediment Deposition:	Stream Gradient Type	Left	Right
6.2 Pool Substrate:	6.5 Channel Flow Status:	6.8 Bank Stability:		
6.3 Pool Variability:	6.6 Channel Alteration:	6.9 Bank Vegetation Protection		
Total Score: 0	6.7 Channel Sinuosity:	6.10 Riparian Veg. Zone Width:		
Habitat Rating: 0.00				
Habitat Stream Condition:				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Unconfined	Score	STD	Historic		
7.1 Channel Degradation		9	None	Yes	Geomorphic Rating	0.40
7.2 Channel Aggradation		9	None	No	Channel Evolution Model	F
7.3 Widening Channel		7	None	No	Channel Evolution Stage	III
7.4 Change in Planform		7	None	No	Geomorphic Condition	Fair
Total Score		32			Stream Sensitivity	Very High



Stream Geomorphic Assessment

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Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream: **Mill Brook**
Reach: **M10-0**
Segment Length(ft): **1,908**
Rain: **No**

SGAT Version: **4.56**
Organization: **Fitzgerald Environmental**
Observers: **JHB, MPL**
Completion Date: **7/1/2014**
Quality Control Status - Consultant: **Provisional**
Quality Control Status - Staff: **Provisional**

Step 0 - Location: **This reach begins at the reach break East of Churchill Rd and continues upstream to the reach point Southwest of Rush Meadow Rd.**

Step 5 - Notes: **No true flood chutes were observed but significant over bank spillage occurred during large storm events throughout the reach.**

Step 7 - Narrative: **The lower banks of this reach were scoured during TS Irene as indicated by the slumping banks and the scoured smooth bed profile through most of the riffle sections. We did not observe active widening; however the channel was adjusting planform and had access to a narrow floodplain throughout. The very large floodplain was typically 1ft above 2x bankfull and is only accessed during large events. The upper portion is pinched between Rt 44 and a tight right valley wall, cutting off access to a large left floodplain. The lower reach is also encroached but retains access to a large floodplain in a broad to very broad valley. We assessed the reach as stage II due to the high degree of encroachment.**

Step 1. Valley and Floodplain

1.1 Segmentation: **None**

1.2 Alluvial Fan: **None**

1.3 Corridor Encroachments:

	<u>Length (ft)</u>	<u>One</u>	<u>Height</u>	<u>Both</u>	<u>Height</u>
Berm:	0			0	
Road:	1,250	10		0	
Railroad:	0			0	
Imp. Path:	0			0	
Dev.:	613			0	

1.4 Adjacent Side

Hillside Slope:

Continuous w/ Bank:

Within 1 Bankfull W:

Texture:

Left

Right

Hilly

Steep

Sometimes

Sometimes

Never

Sometimes

Mixed

Mixed

1.5 Valley Features

Valley Width (ft): **310**

Width Determination: **Measured**

Confinement Type: **BD**

In Rock Gorge: **No**

Human Caused Change in Valley Width?: **Yes**

1.6 Grade Controls: **None**



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M10-0**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	46.00	2.11 Riffle/Step Spacing:	150 ft.	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	2.50	2.12 Substrate Composition		Bed:	250 mm
2.3 Mean Depth (ft.):	1.58	Bedrock:	0.0 %	Bar:	120 mm
2.4 Floodprone Width (ft.):	92.00	Boulder:	7.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	4.50	Cobble:	34.0 %	Stream Type:	C
Human Elev FloodPln (ft.):		Coarse Gravel:	30.0 %	Bed Material:	Gravel
2.6 Width/Depth Ratio:	29.11	Fine Gravel:	18.0 %	Subclass Slope:	None
2.7 Entrenchment Ratio:	2.00	Sand:	11.0 %	Bed Form:	Riffle-Pool
2.8 Incision Ratio:	1.80	Silt and Smaller:	0.0 %	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	No	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	Low	Detritus:	4.0 %	Reference Stream Type:	
2.10 Riffles Type:	Sedimented	# Large Woody Debris:	16	Reference Bed Material:	
				Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks			Typical Bank Slope:	Steep	
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	140.9	0.0
Material Type:	Mix	Mix	Erosion Height (ft.):	2.5	0.0
Consistency:	Non-cohesive	Non-cohesive	Revetment Type:	Rip-Rap	Rip-Rap
Lower			Revetment Length:	228.7	216.0
Material Type:	Boulder/Cobbles	Boulder/Cobbles	Bank Canopy		
Consistency:	Non-cohesive	Non-cohesive	Canopy %:	26-50	51-75
			Mid-Channel Canopy:	Open	

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>
Dominant	26-50	26-50
Sub-Dominant	0-25	>100
W less than 25	697	221
Buffer Vegetation Type		
Dominant	Herbaceous	Herbaceous
Sub-Dominant	Shrubs/Sapling	Mixed Trees

3.3 Riparian Corridor

Corridor Land	<u>Left</u>	<u>Right</u>		<u>Left</u>	<u>Right</u>
Dominant	Residential	Forest	Mass Failures		47.918
Sub-dominant	Shrubs/Sapling	Hay	Height		32
(Legacy)	<u>Amount</u>	<u>Mean Hieght</u>	Gullies Number	0	20.0
Failures	One	20.0	Gullies Length	0	
Gullies	None				



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M10-0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps: **Minimal**

4.2 Adjacent Wetlands: **Minimal**

4.3 Flow Status: **Low**

4.4 # of Debris Jams: **2**

4.5 Flow Regulation Type **None**

Flow Reg. Use:

Impoundments:

Impoundment Loc.:

4.6 Up/Down Strm flow reg.: **None**

(old) Upstrm Flow Reg.:

4.7 Stormwater Inputs **None**

Field Ditch: Road Ditch:

Other: Tile Drain:

Overland Flow: Urb Strm Wtr Pipe:

4.9 # of Beaver Dams: **0**

Affected Length (ft): **0**

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	32	Yes	No	Yes	Yes	Deposition Above, Deposition Below

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal: 1	5.2 Other Features	Neck Cutoff: 0	5.4 Stream Ford or Animal Crossing: Yes
Mid: 2	Delta: 0	Flood chutes: 0	Avulsion: 0	5.5 Straightening: Straightening
Point: 2	Island: 0	5.3 Steep Riffles and Head Cuts	Head Cuts: 0	Straightening Length (ft.): 671
Side: 5	Braiding: 0	Steep Riffles: 0	Trib Rejuv.: No	5.5 Dredging: Dredging

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:	6.4 Sediment Deposition:	Stream Gradient Type	<u>Left</u>	<u>Right</u>
6.2 Pool Substrate:	6.5 Channel Flow Status:	6.8 Bank Stability:		
6.3 Pool Variability:	6.6 Channel Alteration:	6.9 Bank Vegetation Protection		
Total Score: 0	6.7 Channel Sinuosity:	6.10 Riparian Veg. Zone Width:		
Habitat Rating: 0.00				
Habitat Stream Condition:				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Unconfined	Score	STD	Historic		
7.1 Channel Degradation		8	None	Yes	Geomorphic Rating	0.44
7.2 Channel Aggradation		10	None	No	Channel Evolution Model	F
7.3 Widening Channel		9	None	No	Channel Evolution Stage	II
7.4 Change in Planform		8	None	No	Geomorphic Condition	Fair
Total Score		35			Stream Sensitivity	Very High



Stream Geomorphic Assessment

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Phase 2 Segment Summary Report Mill Brook - Basin 13

Page 1

Stream: **Mill Brook**
Reach: **M11-0**
Segment Length(ft): **3,980**
Rain: **No**

SGAT Version: **4.56**
Organization: **Fitzgerald Environmental**
Observers: **JHB, MPL**
Completion Date: **7/1/2014**
Quality Control Status - Consultant: **Provisional**
Quality Control Status - Staff: **Provisional**

Step 0 - Location: **This reach begins at the reach break Southwest of Rush meadow Rd and continues upstream to the reach break south of Shattuck Hill Rd.**

Step 5 - Notes:

Step 7 - Narrative: **Floodplain access was extremely limited in this reach which is continuously encroached by Rt 44 and/or development between the road and the channel. An elevated historic terrace was observed along portions of the reach, but was typically 3x bankfull height and is only accessible during the largest events. Incision appears to be historic as the substrate is very large and resistant to further scour. The reach appears to have to widened during TS Irene, scouring away lower benches. This caused a lower entrenchment ratio and departure from B to F.**

Step 1. Valley and Floodplain

1.1 Segmentation: **None**

1.2 Alluvial Fan: **None**

1.3 Corridor Encroachments:

	<u>Length (ft)</u>	<u>One</u>	<u>Height</u>	<u>Both</u>	<u>Height</u>
Berm:	0			0	
Road:	3,968	10		0	
Railroad:	0			0	
Imp. Path:	0			0	
Dev.:	634			0	

1.4 Adjacent Side

Hillside Slope:

Continuous w/ Bank:

Within 1 Bankfull W:

Texture:

Left

Right

Very Steep

Extr.Steep

Sometimes

Sometimes

Always

Always

Mixed

Bedrock

1.5 Valley Features

Valley Width (ft): **135**

Width Determination: **Measured**

Confinement Type: **SC**

In Rock Gorge: **No**

Human Caused Change in Valley Width?: **Yes**

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	5.0	2.0	No	
Ledge	Mid-segment	3.0	1.0	No	
Ledge	Mid-segment	0.0	0.0	No	
Ledge	Mid-segment	6.0	4.0	Yes	
Ledge	Mid-segment	3.0	1.0	No	
Ledge	Mid-segment	5.0	3.0	No	
Ledge	Mid-segment	5.0	3.0	No	
Ledge	Mid-segment	9.0	4.0	Yes	



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M11-0**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	52.72	2.11 Riffle/Step Spacing:	190 ft.	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	2.20	2.12 Substrate Composition		Bed:	400 mm
2.3 Mean Depth (ft.):	1.82	Bedrock:	0.0 %	Bar:	160 mm
2.4 Floodprone Width (ft.):	59.00	Boulder:	19.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	6.90	Cobble:	30.0 %	Stream Type:	F
Human Elev FloodPln (ft.):		Coarse Gravel:	22.0 %	Bed Material:	Gravel
2.6 Width/Depth Ratio:	28.97	Fine Gravel:	21.0 %	Subclass Slope:	None
2.7 Entrenchment Ratio:	1.12	Sand:	8.0 %	Bed Form:	Plane Bed
2.8 Incision Ratio:	3.14	Silt and Smaller:	0.0 %	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	Yes	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	Low	Detritus:	4.0 %	Reference Stream Type:	
2.10 Riffles Type:	Sedimented	# Large Woody Debris:	22	Reference Bed Material:	
				Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks			Typical Bank Slope:	Steep	
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	49.8	0.0
Material Type:	Mix	Bedrock	Erosion Height (ft.):	2.0	0.0
Consistency:	Non-cohesive	Cohesive	Revetment Type:	Rip-Rap	None
Lower			Revetment Length:	1,458.8	0.0
Material Type:	Mix	Mix			
Consistency:	Non-cohesive	Non-cohesive			
			Near Bank Vegetation Type	<u>Left</u>	<u>Right</u>
			Dominant:	Shrubs/Sapling	Coniferous
			Sub-dominant:	Herbaceous	Shrubs/Sapling
			Bank Canopy		
			Canopy %:	51-75	76-100
			Mid-Channel Canopy:	Open	

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>	Corridor Land	<u>Left</u>	<u>Right</u>
Dominant	26-50	>100	Dominant	Commercial	Forest
Sub-Dominant	0-25	None	Sub-dominant	Residential	Shrubs/Sapling
W less than 25	2,152	0	(Legacy)	<u>Amount</u>	<u>Mean Height</u>
Buffer Vegetation Type			Failures	One	10.0
Dominant	Shrubs/Sapling	Coniferous	Gullies	One	3.0
Sub-Dominant	Herbaceous	Shrubs/Sapling			

3.3 Riparian Corridor

Mass Failures	43.576	
Height	17	
Gullies Number	1	
Gullies Length	30	



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M11-0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	Abundant	4.5 Flow Regulation Type	None	4.7 Stormwater Inputs	
4.2 Adjacent Wetlands:	Minimal	Flow Reg. Use:		Field Ditch:	0 Road Ditch: 2
4.3 Flow Status:	Low	Impoundments:		Other:	0 Tile Drain: 0
4.4 # of Debris Jams:	2	Impoundment Loc.:		Overland Flow:	0 Urb Strm Wtr Pipe: 0
		4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	0
		(old) Upstrm Flow Reg.:		Affected Length (ft):	0

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Other	36	Yes	No	Yes	Yes	None

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal: 0	5.2 Other Features	Neck Cutoff: 0	5.4 Stream Ford or Animal Crossing:	No
Mid: 6	Delta: 0	Flood chutes: 1	Avulsion: 0	5.5 Straightening:	None
Point: 3	Island: 0	5.3 Steep Riffles and Head Cuts	Head Cuts: 0	Straightening Length (ft.):	0
Side: 5	Braiding: 1	Steep Riffles: 1	Trib Rejuv.: No	5.5 Dredging:	None

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:	6.4 Sediment Deposition:	Stream Gradient Type	<u>Left</u>	<u>Right</u>
6.2 Pool Substrate:	6.5 Channel Flow Status:	6.8 Bank Stability:		
6.3 Pool Variability:	6.6 Channel Alteration:	6.9 Bank Vegetation Protection		
Total Score: 0	6.7 Channel Sinuosity:	6.10 Riparian Veg. Zone Width:		
Habitat Rating: 0.00				
Habitat Stream Condition:				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Confined	Score	STD	Historic		
7.1 Channel Degradation		4	B to F	Yes	Geomorphic Rating	0.39
7.2 Channel Aggradation		9	None	No	Channel Evolution Model	F
7.3 Widening Channel		8	None	No	Channel Evolution Stage	III
7.4 Change in Planform		10	None	No	Geomorphic Condition	Fair
Total Score		31			Stream Sensitivity	Extreme



Stream Geomorphic Assessment

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Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream:	Mill Brook	SGAT Version:	4.56
Reach:	M12-A	Organization:	Fitzgerald Environmental
Segment Length(ft):	778	Observers:	JHB, MPL
Rain:	Yes	Completion Date:	7/21/2014
		Quality Control Status - Consultant:	Provisional
		Quality Control Status - Staff:	Provisional
		Why Not Assessed:	bedrock gorge

Step 0 - Location: This reach begins at the reach break south of Shattuck Hill Rd and continues to the segmentation point just upstream of the private bridge used by the talc mine.

Step 5 - Notes:

Step 7 - Narrative:

Step 1. Valley and Floodplain

1.1 Segmentation:	Grade Controls	1.4 Adjacent Side	<u>Left</u>	<u>Right</u>	1.5 Valley Features
1.2 Alluvial Fan:	None	Hillside Slope:	Extr.Steep	Extr.Steep	Valley Width (ft): 80
1.3 Corridor Encroachments:		Continuous w/ Bank:	Always	Always	Width Determination: Estimated
<u>Length (ft)</u>	<u>One</u>	<u>Height</u>	<u>Both</u>	<u>Height</u>	Confinement Type: NC
Berm:	0		0		In Rock Gorge: Yes
Road:	0		0		Human Caused Change in Valley Width?: No
Railroad:	0		0		
Imp. Path:	287	10	0		
Dev.:	193		0		

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	2.0	0.0	No	
Ledge	Mid-segment	10.0	8.0	Yes	



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M12-A**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):		2.11 Riffle/Step Spacing:		2.13 Average Largest Particle on	
2.2 Max Depth (ft.):		2.12 Substrate Composition		Bed:	
2.3 Mean Depth (ft.):		Bedrock:	%	Bar:	
2.4 Floodprone Width (ft.):		Boulder:	%	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):		Cobble:	%	Stream Type:	A
Human Elev FloodPln (ft.):		Coarse Gravel:	%	Bed Material:	Boulder
2.6 Width/Depth Ratio:	0.00	Fine Gravel:	%	Subclass Slope:	b
2.7 Entrenchment Ratio:	0.00	Sand:	%	Bed Form:	Step-Pool
2.8 Incision Ratio:	0.00	Silt and Smaller:	%	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:		2.15 Sub-reach Stream Type	
2.9 Sinuosity:		Detritus:	0.0 %	Reference Stream Type:	A
2.10 Riffles Type:		# Large Woody Debris:		Reference Bed Material:	Boulder
				Reference Subclass Slope:	b
				Reference Bedform:	Step-Pool

Step 3. Riparian Features

3.1 Stream Banks					Typical Bank Slope: Steep				
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>	Near Bank Vegetation Type <u>Left</u>			<u>Right</u>
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	0.0	0.0	Dominant:	Coniferous	Coniferous	
Material Type:	Bedrock	Bedrock	Erosion Height (ft.):	0.0	0.0	Sub-dominant:	Shrubs/Sapling	Deciduous	
Consistency:	Cohesive	Cohesive	Revetment Type:	Rip-Rap	None	Bank Canopy			
Lower			Revetment Length:	210.9	0.0	Canopy %:	76-100	76-100	
Material Type:	Boulder/Cobble	Bedrock				Mid-Channel Canopy: Closed			
Consistency:	Cohesive	Cohesive							

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>
Dominant	>100	>100
Sub-Dominant		
W less than 25	0	0
Buffer Vegetation Type		
Dominant	Coniferous	Coniferous
Sub-Dominant	Shrubs/Sapling	Mixed Trees

3.3 Riparian Corridor

Corridor Land	<u>Left</u>	<u>Right</u>	<u>Left</u>	<u>Right</u>
Dominant	Forest	Forest	Mass Failures	
Sub-dominant	None	None	Height	
(Legacy)	<u>Amount</u>	<u>Mean Height</u>	Gullies Number	0
Failures	None		Gullies Length	0
Gullies	None			



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M12-A**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	Abundant	4.5 Flow Regulation Type	None	4.7 Stormwater Inputs	
4.2 Adjacent Wetlands:	None	Flow Reg. Use:		Field Ditch:	0 Road Ditch: 1
4.3 Flow Status:	Low	Impoundments:		Other:	0 Tile Drain: 0
4.4 # of Debris Jams:	0	Impoundment Loc.:		Overland Flow:	0 Urb Strm Wtr Pipe: 0
		4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	0
		(old) Upstrm Flow Reg.:		Affected Length (ft):	0

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bedrock Outcrops	18	Yes	Yes	Yes	Yes	None

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal: 0	5.2 Other Features	Neck Cutoff: 0	5.4 Stream Ford or Animal Crossing:	No
Mid: 1	Delta: 0	Flood chutes: 0	Avulsion: 0	5.5 Straightening:	None
Point: 0	Island: 0	5.3 Steep Riffles and Head Cuts	Head Cuts: 0	Straightening Length (ft.):	0
Side: 0	Braiding: 0	Steep Riffles: 0	Trib Rejuv.: No	5.5 Dredging:	None

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:	6.4 Sediment Deposition:	Stream Gradient Type	<u>Left</u>	<u>Right</u>
6.2 Pool Substrate:	6.5 Channel Flow Status:	6.8 Bank Stability:		
6.3 Pool Variability:	6.6 Channel Alteration:	6.9 Bank Vegetation Protection		
Total Score:	6.7 Channel Sinuosity:	6.10 Riparian Veg. Zone Width:		

Habitat Rating:

Habitat Stream Condition:

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Score	STD	Historic	Geomorphic Rating
7.1 Channel Degradation				Channel Evolution Model
7.2 Channel Aggradation				Channel Evolution Stage
7.3 Widening Channel				Geomorphic Condition
7.4 Change in Planform				Good
Total Score				Stream Sensitivity



Stream Geomorphic Assessment

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Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream: **Mill Brook**
Reach: **M12-B**
Segment Length(ft): **3,288**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Fitzgerald Environmental**
Observers: **JHB, MPL**
Completion Date: **7/21/2014**
Quality Control Status - Consultant: **Provisional**
Quality Control Status - Staff: **Provisional**

Step 0 - Location: This reach begins at the segmentation point upstream of the talc mine's private bridge southeast of their plant and continues upstream to the reach break southwest of Hurricane Hill Rd.

Step 5 - Notes: Numerous mid channel and diagonal bars were observed in this segment with substrate size fining downstream near the large grade control/gorge. It is likely that the downstream bridge was blocked with debris during TS Irene backing up water through much of the lower portion of the segment.

Step 7 - Narrative: This segment is very incised and entrenched throughout. The segment likely incised further during TS Irene and is now aggrading with large volumes of sand and gravel, especially in the lower portion. Very tall banks along the talc mine property restrict access to the floodplain even during the largest events. This section is historically straightened and was likely dredged. Banks are lower in the upper portion of the segment; however floodplain access remains minimal causing a departure from C to F. Entrenchment ratios vary from approx. 1.2 in the lower reach to 1.5 in upper reach where cross section was taken. Reach likely transitioning from stage II to III channel evolution.

Step 1. Valley and Floodplain

1.1 Segmentation: **Grade Controls**

1.2 Alluvial Fan: **None**

1.3 Corridor Encroachments:

	<u>Length (ft)</u>	<u>One</u>	<u>Height</u>	<u>Both</u>	<u>Height</u>
Berm:	504	7	0		
Road:	878	10	0		
Railroad:	0		0		
Imp. Path:	713	10	0		
Dev.:	1,045		0		

1.4 Adjacent Side

Hillside Slope:

Continuous w/ Bank:

Within 1 Bankfull W:

Texture:

Left

Steep

Never

Sometimes

Mixed

Right

Steep

Never

Sometimes

Mixed

1.5 Valley Features

Valley Width (ft): **300**

Width Determination: **Estimated**

Confinement Type: **BD**

In Rock Gorge: **No**

Human Caused Change in Valley Width?: **Yes**

1.6 Grade Controls: **None**



Stream Geomorphic Assessment

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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M12-B**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	39.60	2.11 Riffle/Step Spacing:	170 ft.	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	2.40	2.12 Substrate Composition		Bed:	280 mm
2.3 Mean Depth (ft.):	1.77	Bedrock:	0.0 %	Bar:	110 mm
2.4 Floodprone Width (ft.):	61.00	Boulder:	2.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	5.00	Cobble:	44.0 %	Stream Type:	F
Human Elev FloodPln (ft.):		Coarse Gravel:	26.0 %	Bed Material:	Gravel
2.6 Width/Depth Ratio:	22.37	Fine Gravel:	17.0 %	Subclass Slope:	None
2.7 Entrenchment Ratio:	1.54	Sand:	11.0 %	Bed Form:	Plane Bed
2.8 Incision Ratio:	2.08	Silt and Smaller:	0.0 %	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	No	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	Low	Detritus:	4.0 %	Reference Stream Type:	
2.10 Riffles Type:	Sedimented	# Large Woody Debris:	28	Reference Bed Material:	
				Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks					Typical Bank Slope: Steep					
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>	Near Bank Vegetation Type <u>Left</u>			<u>Right</u>	
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	144.0	268.7	Dominant:	Deciduous	Deciduous		
Material Type:	Mix	Mix	Erosion Height (ft.):	3.5	4.9	Sub-dominant:	Herbaceous	Herbaceous		
Consistency:	Non-cohesive	Non-cohesive	Revetment Type:	Rip-Rap	Rip-Rap	Bank Canopy				
Lower			Revetment Length:	1,125.6	847.0	Canopy %:	76-100	76-100		
Material Type:	Boulder/Cobbles	Boulder/Cobbles				Mid-Channel Canopy:				Closed
Consistency:	Non-cohesive	Non-cohesive								

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>
Dominant	26-50	>100
Sub-Dominant	0-25	51-100
W less than 25	960	427
Buffer Vegetation Type		
Dominant	Herbaceous	Mixed Trees
Sub-Dominant	Mixed Trees	Herbaceous

3.3 Riparian Corridor

Corridor Land	<u>Left</u>	<u>Right</u>	<u>Left</u>	<u>Right</u>
Dominant	Commercial	Forest	Mass Failures	
Sub-dominant	Forest	Residential	Height	
(Legacy)	<u>Amount</u>	<u>Mean Height</u>	Gullies Number	0
Failures	None		Gullies Length	0
Gullies	None			



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Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M12-B**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	Minimal	4.5 Flow Regulation Type	Small Withdrawal	4.7 Stormwater Inputs	
4.2 Adjacent Wetlands:	Minimal	Flow Reg. Use:	Other	Field Ditch:	0 Road Ditch: 1
4.3 Flow Status:	Low	Impoundments:		Other:	0 Tile Drain: 0
4.4 # of Debris Jams:	4	Impoundment Loc.:		Overland Flow:	0 Urb Strm Wtr Pipe: 1
		4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	0
		(old) Upstrm Flow Reg.:		Affected Length (ft):	0

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	60	Yes	No	No	Yes	Deposition Above,Deposition Below
Bridge	58	Yes	No	No	Yes	Deposition Above,Deposition Below

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	4	5.2 Other Features	Neck Cutoff:	0	5.4 Stream Ford or Animal Crossing:	Yes
Mid:	4	Delta:	0	Flood chutes:	0	5.5 Straightening:	Straightening
Point:	7	Island:	0	5.3 Steep Riffles and Head Cuts	Head Cuts:	0	Straightening Length (ft.): 1,083
Side:	8	Braiding:	0	Steep Riffles:	1	Trib Rejuv.:	No
						5.5 Dredging:	Dredging

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradient Type	<u>Left</u>	<u>Right</u>
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:		
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection		
Total Score:	0	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:		
Habitat Rating:	0.00					
Habitat Stream Condition:						

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Unconfined	Score	STD	Historic		
7.1 Channel Degradation		5	C to F	Yes	Geomorphic Rating	0.40
7.2 Channel Aggradation		7	None	No	Channel Evolution Model	F
7.3 Widening Channel		10	None	No	Channel Evolution Stage	II
7.4 Change in Planform		10	None	No	Geomorphic Condition	Fair
Total Score		32			Stream Sensitivity	Extreme



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Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream: **Mill Brook**
Reach: **M13-0**
Segment Length(ft): **7,217**
Rain: **No**

SGAT Version: **4.56**
Organization: **Fitzgerald Environmental**
Observers: **JHB, MPL**
Completion Date: **7/21/2014**
Quality Control Status - Consultant: **Provisional**
Quality Control Status - Staff: **Provisional**

Step 0 - Location: **This reach begins at the reach break Southwest of Hurricane Hill Rd and continues upstream to the reach point South of Agony Hill Rd.**

Step 5 - Notes: **Bars were typically small except for a few large side bars upstream of grade controls.**

Step 7 - Narrative: **Most of this reach is highly encroached by Rt 106. This encroachment and heavy bank armoring has locked the channel in place leading to historic incision. We observed moderate scour along the right banks from TS Irene through most of the reach, but widening was limited by stony soils and dense roots along the bank. Side bars have formed along most of these scoured banks, indicating that aggradation is an ongoing process. Minimal floodplain access led to a stream type departure from Bc to F. We assessed the reach as stage II transitioning slowly to stage III.**

Step 1. Valley and Floodplain

1.1 Segmentation: **None**

1.2 Alluvial Fan: **None**

1.3 Corridor Encroachments:

	<u>Length (ft)</u>	<u>One</u>	<u>Height</u>	<u>Both</u>	<u>Height</u>
Berm:	0			0	
Road:	6,007	10		686	10
Railroad:	0			0	
Imp. Path:	0			0	
Dev.:	1,210			401	

1.4 Adjacent Side

Left

Right

Hillside Slope:

Very Steep

Very Steep

Continuous w/ Bank:

Never

Sometimes

Within 1 Bankfull W:

Sometimes

Sometimes

Texture:

Mixed

Mixed

1.5 Valley Features

Valley Width (ft): **145**

Width Determination: **Estimated**

Confinement Type: **SC**

In Rock Gorge: **No**

Human Caused Change in Valley Width?: **Yes**

1.6 Grade Controls:



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Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	6.0	4.0	Yes	
Ledge	Mid-segment	8.0	6.0	Yes	
Ledge	Mid-segment	5.0	3.0	No	
Ledge	Mid-segment	0.0	0.0	No	
Ledge	Mid-segment	0.0	0.0	Yes	
Ledge	Mid-segment	4.0	3.0	No	
Ledge	Mid-segment	3.0	1.0	No	
Ledge	Mid-segment	7.0	4.0	Yes	
Ledge	Mid-segment	6.0	3.0	Yes	
Ledge	Mid-segment	4.0	3.0	Yes	
Ledge	Mid-segment	4.0	2.0	No	
Ledge	Mid-segment	4.0	2.0	No	
Ledge	Mid-segment	2.0	1.0	No	
Ledge	Mid-segment	6.0	4.0	No	
Ledge	Mid-segment	3.0	2.0	No	
Ledge	Mid-segment	4.0	3.0	Yes	
Ledge	Mid-segment	4.0	3.0	No	
Ledge	Mid-segment	1.0	1.0	No	
Ledge	Mid-segment	0.0	0.0	No	



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M13-0**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	35.60	2.11 Riffle/Step Spacing:	180 ft.	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	2.50	2.12 Substrate Composition		Bed:	550 mm
2.3 Mean Depth (ft.):	1.75	Bedrock:	17.0 %	Bar:	220 mm
2.4 Floodprone Width (ft.):	44.00	Boulder:	5.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	5.70	Cobble:	28.0 %	Stream Type:	F
Human Elev FloodPln (ft.):		Coarse Gravel:	24.0 %	Bed Material:	Cobble
2.6 Width/Depth Ratio:	20.34	Fine Gravel:	13.0 %	Subclass Slope:	None
2.7 Entrenchment Ratio:	1.24	Sand:	13.0 %	Bed Form:	Plane Bed
2.8 Incision Ratio:	2.28	Silt and Smaller:	0.0 %	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	No	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	Low	Detritus:	2.0 %	Reference Stream Type:	
2.10 Riffles Type:	Sedimented	# Large Woody Debris:	25	Reference Bed Material:	
				Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks					Typical Bank Slope: Steep				
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>	Near Bank Vegetation Type <u>Left</u>			<u>Right</u>
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	108.0	343.5	Dominant:	Herbaceous	Deciduous	
Material Type:	Mix	Mix	Erosion Height (ft.):	3.4	4.4	Sub-dominant:	Deciduous	Shrubs/Sapling	
Consistency:	Non-cohesive	Non-cohesive	Revetment Type:	Rip-Rap	Rip-Rap	Bank Canopy			
Lower			Revetment Length:	3,024.6	436.6	Canopy %:	26-50	76-100	
Material Type:	Boulder/Cobbles	Boulder/Cobbles				Mid-Channel Canopy: Open			
Consistency:	Non-cohesive	Non-cohesive							

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>	Corridor Land	<u>Left</u>	<u>Right</u>	<u>Left</u>	<u>Right</u>
Dominant	0-25	>100	Dominant	Commercial	Forest	Mass Failures	
Sub-Dominant	51-100	0-25	Sub-dominant	Residential	Residential	Height	
W less than 25	2,996	346	(Legacy)	<u>Amount</u>	<u>Mean Height</u>	Gullies Number	1
Buffer Vegetation Type			Failures	None		Gullies Length	3
Dominant	Herbaceous	Coniferous	Gullies	One	30.0		
Sub-Dominant	Deciduous	Shrubs/Sapling					

3.3 Riparian Corridor



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Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M13-0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	Abundant	4.5 Flow Regulation Type	None	4.7 Stormwater Inputs	
4.2 Adjacent Wetlands:	Minimal	Flow Reg. Use:		Field Ditch:	0 Road Ditch: 8
4.3 Flow Status:	Low	Impoundments:		Other:	0 Tile Drain: 0
4.4 # of Debris Jams:	3	Impoundment Loc.:		Overland Flow:	0 Urb Strm Wtr Pipe: 0
		4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	0
		(old) Upstrm Flow Reg.:		Affected Length (ft):	0

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bedrock Outcrops	35	Yes	No	Yes	Yes	None
Bedrock Outcrops	30	Yes	No	No	Yes	None
Bedrock Outcrops	25	Yes	No	No	Yes	None
Bridge	58	No	No	No	Yes	Deposition Above, Deposition Below
Bedrock Outcrops	25	Yes	No	Yes	Yes	None

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal: 2	5.2 Other Features	Neck Cutoff: 0	5.4 Stream Ford or Animal Crossing:	No
Mid: 5	Delta: 0	Flood chutes: 0	Avulsion: 0	5.5 Straightening:	Straightening
Point: 9	Island: 0	5.3 Steep Riffles and Head Cuts	Head Cuts: 0	Straightening Length (ft.):	600
Side: 18	Braiding: 0	Steep Riffles: 1	Trib Rejuv.: No	5.5 Dredging:	Dredging

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradient Type	<u>Left</u>	<u>Right</u>
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:		
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection		
Total Score:	0	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:		
Habitat Rating:	0.00					
Habitat Stream Condition:						

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Unconfined	Score	STD	Historic		
7.1 Channel Degradation		4	B to F	Yes	Geomorphic Rating	0.45
7.2 Channel Aggradation		11	None	No	Channel Evolution Model	F
7.3 Widening Channel		10	None	No	Channel Evolution Stage	II
7.4 Change in Planform		11	None	No	Geomorphic Condition	Fair
Total Score		36			Stream Sensitivity	Extreme



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Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream: **Mill Brook**
Reach: **M14-A**
Segment Length(ft): **1,999**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Fitzgerald Environmental**
Observers: **JHB, MPL**
Completion Date: **7/22/2014**
Quality Control Status - Consultant: **Provisional**
Quality Control Status - Staff: **Provisional**

- Step 0 - Location: This reach begins at the reach break south of Agony Hill Rd and continues upstream to the segmentation point downstream of the Bailey's Mills Rd crossing.
- Step 5 - Notes: Major deposition features were observed throughout this segment. Several huge and very tall side and point bars were located in the upper half of the segment. Numerous diagonal and mid channel bars indicate that a large volume of T.S. Irene gravel and sand are still working through the reach. A short stretch of the reach was straightened and armored following TS Irene along a stretch of major floodplain access over the left bank.
- Step 7 - Narrative: This segment was highly active during TS Irene with major access to both floodplains, planform adjustments, and huge volumes of gravel/sand deposition. A large volume of floodwater spilled on the left the floodplain upstream of the undersized Agony Hill Rd arch damaging adjacent properties and structures. The channel widened considerably and is currently aggrading and adjusting planform to accommodate the large volume of gravel and sand working through the reach. We assessed this segment as somewhere between stage III and IV due to ongoing aggradation and planform adjustments.

Step 1. Valley and Floodplain

1.1 Segmentation: Channel Dimensions	1.4 Adjacent Side	<u>Left</u>	<u>Right</u>	1.5 Valley Features
1.2 Alluvial Fan: None	Hillside Slope:	Flat	Hilly	Valley Width (ft): 495
1.3 Corridor Encroachments:	Continuous w/ Bank:	Never	Never	Width Determination: Measured
<u>Length (ft)</u> <u>One</u> <u>Height</u> <u>Both</u> <u>Height</u>	Within 1 Bankfull W:	Never	Sometimes	Confinement Type: BD
Berm: 0	Texture:	Mixed	Mixed	In Rock Gorge: No
Road: 238 10 0	Human Caused Change in Valley Width?: Yes			
Railroad: 0 0				
Imp. Path: 0 0				
Dev.: 282 0				
1.6 Grade Controls: None				



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M14-A**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	64.50	2.11 Riffle/Step Spacing:	230 ft.	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	2.30	2.12 Substrate Composition		Bed:	180 mm
2.3 Mean Depth (ft.):	1.07	Bedrock:	0.0 %	Bar:	150 mm
2.4 Floodprone Width (ft.):	363.00	Boulder:	0.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	2.80	Cobble:	21.0 %	Stream Type:	C
Human Elev FloodPln (ft.):		Coarse Gravel:	56.0 %	Bed Material:	Gravel
2.6 Width/Depth Ratio:	60.28	Fine Gravel:	12.0 %	Subclass Slope:	None
2.7 Entrenchment Ratio:	5.63	Sand:	11.0 %	Bed Form:	Plane Bed
2.8 Incision Ratio:	1.22	Silt and Smaller:	0.0 %	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	No	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	Moderate	Detritus:	3.0 %	Reference Stream Type:	
2.10 Riffles Type:	Sedimented	# Large Woody Debris:	17	Reference Bed Material:	
				Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks			Typical Bank Slope:	Moderate	
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	717.3	362.7
Material Type:	Mix	Sand	Erosion Height (ft.):	4.1	5.1
Consistency:	Non-cohesive	Non-cohesive	Revetment Type:	Rip-Rap	None
Lower			Revetment Length:	246.0	0.0
Material Type:	Mix	Gravel			
Consistency:	Non-cohesive	Non-cohesive			
			Near Bank Vegetation Type	<u>Left</u>	<u>Right</u>
			Dominant:	Herbaceous	Deciduous
			Sub-dominant:	Shrubs/Sapling	Shrubs/Sapling
			Bank Canopy		
			Canopy %:	26-50	76-100
			Mid-Channel Canopy:	Open	

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>
Dominant	0-25	>100
Sub-Dominant	51-100	51-100
W less than 25	1,105	0
Buffer Vegetation Type		
Dominant	Herbaceous	Mixed Trees
Sub-Dominant	Shrubs/Sapling	Shrubs/Sapling

3.3 Riparian Corridor

Corridor Land	<u>Left</u>	<u>Right</u>		<u>Left</u>	<u>Right</u>
Dominant	Residential	Forest	Mass Failures		129.93
Sub-dominant	Shrubs/Sapling	Shrubs/Sapling	Height		14
(Legacy)	<u>Amount</u>	<u>Mean Hieght</u>	Gullies Number	0	30.0
Failures	One	30.0	Gullies Length	0	
Gullies	None				



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M14-A**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	Abundant	4.5 Flow Regulation Type	None	4.7 Stormwater Inputs	None
4.2 Adjacent Wetlands:	Abundant	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	Low	Impoundments:		Other:	Tile Drain:
4.4 # of Debris Jams:	3	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	0
		(old) Upstrm Flow Reg.:		Affected Length (ft):	0

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	25	Yes	No	Yes	Yes	Deposition Above, Deposition Below, Scour Above

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal: 1	5.2 Other Features	Neck Cutoff: 0	5.4 Stream Ford or Animal Crossing:	No
Mid: 6	Delta: 0	Flood chutes: 2	Avulsion: 0	5.5 Straightening:	With Windrowing
Point: 4	Island: 0	5.3 Steep Riffles and Head Cuts	Head Cuts: 0	Straightening Length (ft.):	348
Side: 6	Braiding: 0	Steep Riffles: 1	Trib Rejuv.: No	5.5 Dredging:	Dredging

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:	6.4 Sediment Deposition:	Stream Gradient Type	<u>Left</u>	<u>Right</u>
6.2 Pool Substrate:	6.5 Channel Flow Status:	6.8 Bank Stability:		
6.3 Pool Variability:	6.6 Channel Alteration:	6.9 Bank Vegetation Protection		
Total Score: 0	6.7 Channel Sinuosity:	6.10 Riparian Veg. Zone Width:		
Habitat Rating: 0.00				
Habitat Stream Condition:				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Unconfined	Score	STD	Historic		
7.1 Channel Degradation		13	None	No	Geomorphic Rating	0.39
7.2 Channel Aggradation		5	None	No	Channel Evolution Model	F
7.3 Widening Channel		5	None	No	Channel Evolution Stage	III
7.4 Change in Planform		8	None	No	Geomorphic Condition	Fair
Total Score		31			Stream Sensitivity	Very High



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Stream: **Mill Brook**
Reach: **M14-B**
Segment Length(ft): **1,868**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Fitzgerald Environmental**
Observers: **JHB, MPL**
Completion Date: **7/22/2014**
Quality Control Status - Consultant: **Provisional**
Quality Control Status - Staff: **Provisional**

Step 0 - Location: **This reach is bound by the segmentation points up and downstream of the Bailey's Mills Rd crossing.**

Step 5 - Notes: **Several large side bars were also present in this segment, however they appear to be more stable than downstream and are slowly vegetating.**

Step 7 - Narrative: **This segment has departed from C to F due to incision. The entrenchment ratio is close to B, however the bankfull width is well under curve width and the W/D is very low, further indicating a high degree of incision. Historic armoring and straightening have locked the channel in place and reduced floodplain access compared with segment A.**

Step 1. Valley and Floodplain

1.1 Segmentation: Channel Dimensions	1.4 Adjacent Side	<u>Left</u>	<u>Right</u>	1.5 Valley Features
1.2 Alluvial Fan: None	Hillside Slope:	Hilly	Hilly	Valley Width (ft): 400
1.3 Corridor Encroachments:	Continuous w/ Bank:	Sometimes	Never	Width Determination: Estimated
<u>Length (ft)</u> <u>One</u> <u>Height</u> <u>Both</u> <u>Height</u>	Within 1 Bankfull W:	Sometimes	Sometimes	Confinement Type: VB
Berm: 182 4 0	Texture:	Mixed	Mixed	In Rock Gorge: No
Road: 1,040 10 0				Human Caused Change in Valley Width?: Yes
Railroad: 0 0				
Imp. Path: 0 0				
Dev.: 206 0				

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	2.0	1.0	No	
Ledge	Mid-segment	3.0	2.0	No	



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Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M14-B**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	27.50	2.11 Riffle/Step Spacing:	190 ft.	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	2.10	2.12 Substrate Composition		Bed:	400 mm
2.3 Mean Depth (ft.):	1.61	Bedrock:	0.0 %	Bar:	250 mm
2.4 Floodprone Width (ft.):	40.00	Boulder:	4.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	4.60	Cobble:	47.0 %	Stream Type:	F
Human Elev FloodPln (ft.):		Coarse Gravel:	23.0 %	Bed Material:	Cobble
2.6 Width/Depth Ratio:	17.08	Fine Gravel:	21.0 %	Subclass Slope:	None
2.7 Entrenchment Ratio:	1.45	Sand:	5.0 %	Bed Form:	Plane Bed
2.8 Incision Ratio:	2.19	Silt and Smaller:	0.0 %	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	No	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	Low	Detritus:	4.0 %	Reference Stream Type:	
2.10 Riffles Type:	Sedimented	# Large Woody Debris:	3	Reference Bed Material:	
				Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks					Typical Bank Slope: Steep					
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>	Near Bank Vegetation Type <u>Left</u>			<u>Right</u>	
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	125.5	50.4	Dominant:	Herbaceous	Herbaceous		
Material Type:	Sand	Sand	Erosion Height (ft.):	7.3	3.0	Sub-dominant:	Shrubs/Sapling	Shrubs/Sapling		
Consistency:	Non-cohesive	Non-cohesive	Revetment Type:	Rip-Rap	Rip-Rap	Bank Canopy				
Lower			Revetment Length:	438.6	573.0	Canopy %:	26-50	26-50		
Material Type:	Mix	Mix				Mid-Channel Canopy:		Open		
Consistency:	Non-cohesive	Non-cohesive								

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>	Corridor Land	<u>Left</u>	<u>Right</u>
Dominant	26-50	26-50	Dominant	Hay	Forest
Sub-Dominant	0-25	0-25	Sub-dominant	Shrubs/Sapling	Pasture
W less than 25	620	373	(Legacy)	<u>Amount</u>	<u>Mean Hieght</u>
Buffer Vegetation Type			Failures	One	15.0
Dominant	Herbaceous	Shrubs/Sapling	Gullies	None	
Sub-Dominant	Mixed Trees	Mixed Trees			

3.3 Riparian Corridor

	<u>Left</u>	<u>Right</u>		<u>Left</u>	<u>Right</u>
Mass Failures					104.02
Height					4
Gullies Number	0				
Gullies Length	0				



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Mill Brook - Basin 13

Stream: Mill Brook

Reach: M14-B

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	Abundant	4.5 Flow Regulation Type	None	4.7 Stormwater Inputs	None
4.2 Adjacent Wetlands:	Minimal	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	Low	Impoundments:		Other:	Tile Drain:
4.4 # of Debris Jams:	0	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	0
		(old) Upstrm Flow Reg.:		Affected Length (ft):	0

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	49	Yes	No	No	Yes	Deposition Above, Deposition Below

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal: 1	5.2 Other Features	Neck Cutoff: 0	5.4 Stream Ford or Animal Crossing:	Yes
Mid: 2	Delta: 0	Flood chutes: 1	Avulsion: 0	5.5 Straightening:	Straightening
Point: 2	Island: 0	5.3 Steep Riffles and Head Cuts	Head Cuts: 0	Straightening Length (ft.):	361
Side: 7	Braiding: 0	Steep Riffles: 0	Trib Rejuv.: No	5.5 Dredging:	None

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:	6.4 Sediment Deposition:	Stream Gradient Type	Left	Right
6.2 Pool Substrate:	6.5 Channel Flow Status:	6.8 Bank Stability:		
6.3 Pool Variability:	6.6 Channel Alteration:	6.9 Bank Vegetation Protection		
Total Score: 0	6.7 Channel Sinuosity:	6.10 Riparian Veg. Zone Width:		
Habitat Rating: 0.00				
Habitat Stream Condition:				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Unconfined	Score	STD	Historic		
7.1 Channel Degradation		4	C to F	No	Geomorphic Rating	0.41
7.2 Channel Aggradation		7	None	No	Channel Evolution Model	F
7.3 Widening Channel		11	None	No	Channel Evolution Stage	II
7.4 Change in Planform		11	None	No	Geomorphic Condition	Fair
Total Score		33			Stream Sensitivity	Extreme



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Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream: **Mill Brook**
Reach: **M14-C**
Segment Length(ft): **3,631**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Fitzgerald Environmental**
Observers: **JHB, MPL, EPF**
Completion Date: **7/22/2014**
Quality Control Status - Consultant: **Provisional**
Quality Control Status - Staff: **Provisional**

- Step 0 - Location: This reach begins at the segmentation point upstream of the Bailey's Mills Rd crossing and continues to the reach break just upstream of the confluence of Bailey's Brook with the main stem.
- Step 5 - Notes: Major gravel and cobble deposits were observed throughout the segment. The reach appears to have widened during T.S. Irene followed by major gravel deposition. The stream is still aggrading and is beginning to develop new meanders through the recent flood deposits.
- Step 7 - Narrative: This segment had moderate to high incision throughout and had access to floodplain of variable width for most of the reach for the largest events (ie., TS Irene). Some areas had access to a 60-80ft wide forested floodplain, other areas were a 5-10 ft herbaceous bench. Our cross-selection represents an average floodplain width and height and results in a departure from C to B. The reach scoured and widened during TS Irene and currently appears to be aggrading and widening. Huge volumes of sediment are stored in the channel through T4, and will likely continue to work through this segment for a long time. We assessed the reach as stage III possibly transitioning to stage IV in the near future.

Step 1. Valley and Floodplain

1.1 Segmentation: **Grade Controls**

1.2 Alluvial Fan: **None**

1.3 Corridor Encroachments:

	<u>Length (ft)</u>	<u>One</u>	<u>Height</u>	<u>Both</u>	<u>Height</u>
Berm:	0			0	
Road:	2,510	10		0	
Railroad:	0			0	
Imp. Path:	0			0	
Dev.:	0			0	

1.4 Adjacent Side

Hillside Slope:

Continuous w/ Bank:

Within 1 Bankfull W:

Texture:

Left

Right

Very Steep

Hilly

Sometimes

Never

Sometimes

Never

Mixed

Mixed

1.5 Valley Features

Valley Width (ft): **400**

Width Determination: **Estimated**

Confinement Type: **VB**

In Rock Gorge: **No**

Human Caused Change in Valley Width?: **No**

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	0.0	0.0	No	
Ledge	Mid-segment	2.0	1.0	Yes	
Ledge	Mid-segment	2.0	1.0	No	
Ledge	Mid-segment	0.0	0.0	Yes	
Ledge	Mid-segment	0.0	0.0	No	
Ledge	Mid-segment	5.0	3.0	Yes	
Ledge	Mid-segment	3.0	1.0	Yes	



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Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M14-C**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	38.25	2.11 Riffle/Step Spacing:	200 ft.	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	2.30	2.12 Substrate Composition		Bed:	400 mm
2.3 Mean Depth (ft.):	1.67	Bedrock:	0.0 %	Bar:	180 mm
2.4 Floodprone Width (ft.):	70.00	Boulder:	16.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	4.45	Cobble:	36.0 %	Stream Type:	B
Human Elev FloodPln (ft.):		Coarse Gravel:	20.0 %	Bed Material:	Cobble
2.6 Width/Depth Ratio:	22.90	Fine Gravel:	16.0 %	Subclass Slope:	c
2.7 Entrenchment Ratio:	1.83	Sand:	12.0 %	Bed Form:	Riffle-Pool
2.8 Incision Ratio:	1.93	Silt and Smaller:	0.0 %	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	No	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	Low	Detritus:	2.0 %	Reference Stream Type:	
2.10 Riffles Type:	Sedimented	# Large Woody Debris:	46	Reference Bed Material:	
				Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks			Typical Bank Slope:	Steep		
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>	Near Bank Vegetation Type <u>Left</u> <u>Right</u>
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	492.2	656.1	Dominant: Deciduous Deciduous
Material Type:	Mix	Mix	Erosion Height (ft.):	3.6	7.0	Sub-dominant: Shrubs/Sapling Herbaceous
Consistency:	Non-cohesive	Non-cohesive	Revetment Type:	None	Rip-Rap	Bank Canopy
Lower			Revetment Length:	0.0	172.6	Canopy %: 76-100 51-75
Material Type:	Boulder/Cobble	Boulder/Cobble				Mid-Channel Canopy: Open
Consistency:	Non-cohesive	Non-cohesive				

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>	Corridor Land	<u>Left</u>	<u>Right</u>
Dominant	>100	51-100	Dominant	Forest	Forest
Sub-Dominant	0-25	26-50	Sub-dominant	None	Residential
W less than 25	141	219	(Legacy)	<u>Amount</u>	<u>Mean Height</u>
Buffer Vegetation Type			Failures	None	
Dominant	Mixed Trees	Deciduous	Gullies	None	
Sub-Dominant	Shrubs/Sapling	Herbaceous			

3.3 Riparian Corridor

	<u>Left</u>	<u>Right</u>		<u>Left</u>	<u>Right</u>
Mass Failures					
Height					
Gullies Number	0				
Gullies Length	0				



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M14-C**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	Abundant	4.5 Flow Regulation Type	None	4.7 Stormwater Inputs	None
4.2 Adjacent Wetlands:	Abundant	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	Low	Impoundments:		Other:	Tile Drain:
4.4 # of Debris Jams:	4	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	0
		(old) Upstrm Flow Reg.:		Affected Length (ft):	0

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Old Abutment	36	Yes	No	No	Yes	None

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal: 3	5.2 Other Features	Neck Cutoff: 0	5.4 Stream Ford or Animal Crossing:	Yes
Mid: 3	Delta: 0	Flood chutes: 1	Avulsion: 0	5.5 Straightening:	Straightening
Point: 2	Island: 0	5.3 Steep Riffles and Head Cuts	Head Cuts: 0	Straightening Length (ft.):	1,436
Side: 11	Braiding: 0	Steep Riffles: 1	Trib Rejuv.: No	5.5 Dredging:	Dredging

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:	6.4 Sediment Deposition:	Stream Gradient Type	<u>Left</u>	<u>Right</u>
6.2 Pool Substrate:	6.5 Channel Flow Status:	6.8 Bank Stability:		
6.3 Pool Variability:	6.6 Channel Alteration:	6.9 Bank Vegetation Protection		
Total Score: 0	6.7 Channel Sinuosity:	6.10 Riparian Veg. Zone Width:		
Habitat Rating: 0.00				
Habitat Stream Condition:				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Unconfined	Score	STD	Historic		
7.1 Channel Degradation		8	C to B	Yes	Geomorphic Rating	0.36
7.2 Channel Aggradation		6	None	No	Channel Evolution Model	F
7.3 Widening Channel		6	None	No	Channel Evolution Stage	III
7.4 Change in Planform		9	None	No	Geomorphic Condition	Fair
Total Score		29			Stream Sensitivity	High



Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream: **Mill Brook**
Reach: **M15-A**
Segment Length(ft): **986**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Fitzgerald Environmental**
Observers: **JHB, MPL, EPF**
Completion Date: **7/22/2014**
Quality Control Status - Consultant: **Provisional**
Quality Control Status - Staff: **Provisional**

Step 0 - Location: **This reach begins at the reach break just upstream of the confluence of Bailey's Brook with the main stem and continues upstream to the segmentation point downstream of the Whitmore Rd. crossing.**

Step 5 - Notes:

Step 7 - Narrative: **This short segment flows through a nice forested floodplain with low/moderate incision. The large right floodplain is elevated and only accessible during the largest events - difficult to tell whether this is an old abandoned floodplain or a glacial-era feature. The channel has carved out several meanders with nice riffle pool sequences. We assessed this as stage V based on the assumption that the channel was likely manipulated historically given the agricultural setting in the valley.**

Step 1. Valley and Floodplain

1.1 Segmentation: **Channel Dimensions**

1.2 Alluvial Fan: **None**

1.3 Corridor Encroachments:

	<u>Length (ft)</u>	<u>One</u>	<u>Height</u>	<u>Both</u>	<u>Height</u>
Berm:	0			0	
Road:	0			0	
Railroad:	0			0	
Imp. Path:	0			0	
Dev.:	275			0	

1.4 Adjacent Side

	<u>Left</u>	<u>Right</u>
Hillside Slope:	Very Steep	Hilly
Continuous w/ Bank:	Never	Never
Within 1 Bankfull W:	Sometimes	Never
Texture:	Mixed	Mixed

1.5 Valley Features

Valley Width (ft):	230
Width Determination:	Measured
Confinement Type:	BD
In Rock Gorge:	No
Human Caused Change in Valley Width?:	No

1.6 Grade Controls:

Type	Location	Total Height	Total Height	Photo	GPS
		Height	Above Water	Taken?	Taken?
Ledge	Mid-segment	2.0	0.0	Yes	
Ledge	Mid-segment	0.0	0.0	Yes	



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M15-A**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	18.50	2.11 Riffle/Step Spacing:	180 ft.	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	2.25	2.12 Substrate Composition		Bed:	400 mm
2.3 Mean Depth (ft.):	1.60	Bedrock:	0.0 %	Bar:	170 mm
2.4 Floodprone Width (ft.):	135.00	Boulder:	7.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	3.25	Cobble:	52.0 %	Stream Type:	C
Human Elev FloodPln (ft.):		Coarse Gravel:	21.0 %	Bed Material:	Cobble
2.6 Width/Depth Ratio:	11.56	Fine Gravel:	14.0 %	Subclass Slope:	None
2.7 Entrenchment Ratio:	7.30	Sand:	6.0 %	Bed Form:	Riffle-Pool
2.8 Incision Ratio:	1.44	Silt and Smaller:	0.0 %	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	No	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	Low	Detritus:	4.0 %	Reference Stream Type:	
2.10 Riffles Type:	Complete	# Large Woody Debris:	14	Reference Bed Material:	
				Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks				Typical Bank Slope: Moderate					
Bank Texture		Bank Erosion		<u>Left</u>	<u>Right</u>	Near Bank Vegetation Type		<u>Left</u>	<u>Right</u>
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	132.1	133.6	Dominant:	Coniferous	Herbaceous	
Material Type:	Mix	Mix	Erosion Height (ft.):	4.1	2.6	Sub-dominant:	Herbaceous	Shrubs/Sapling	
Consistency:	Non-cohesive	Non-cohesive	Revetment Type:	None	Rip-Rap	Bank Canopy			
Lower			Revetment Length:	0.0	118.6	Canopy %:	76-100	76-100	
Material Type:	Mix	Mix				Mid-Channel Canopy:		Closed	
Consistency:	Non-cohesive	Non-cohesive							

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>	Corridor Land	
Dominant	>100	26-50	Dominant	
Sub-Dominant	0-25	51-100	Sub-dominant	
W less than 25	32	127	(Legacy)	
Buffer Vegetation Type			Failures	
Dominant	Mixed Trees	Herbaceous	Gullies	
Sub-Dominant	Shrubs/Sapling	Shrubs/Sapling		

3.3 Riparian Corridor

	<u>Left</u>	<u>Right</u>		<u>Left</u>	<u>Right</u>
Dominant	Forest	Hay	Mass Failures	59.046	16
Sub-Dominant	None	Residential	Height	20.0	
W less than 25	<u>Amount</u>	<u>Mean Hieght</u>	Gullies Number	0	
Failures	One	20.0	Gullies Length	0	
Gullies	None				



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M15-A**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	Minimal	4.5 Flow Regulation Type	None	4.7 Stormwater Inputs	None
4.2 Adjacent Wetlands:	Minimal	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	Low	Impoundments:		Other:	Tile Drain:
4.4 # of Debris Jams:	3	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	0
		(old) Upstrm Flow Reg.:		Affected Length (ft):	0
4.8 Channel Constrictions:	None				

Step 5. Channel Bed and Planform Changes

5.1 Bar Types		Diagonal:	0	5.2 Other Features		Neck Cutoff:	0	5.4 Stream Ford or Animal Crossing:		No
Mid:	1	Delta:	0	Flood chutes:	1	Avulsion:	0	5.5 Straightening:		None
Point:	4	Island:	0	5.3 Steep Riffles and Head Cuts		Head Cuts:	0	Straightening Length (ft.):		0
Side:	2	Braiding:	0	Steep Riffles:	0	Trib Rejuv.:	No	5.5 Dredging:		None

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradient Type	<u>Left</u>	<u>Right</u>
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:		
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection		
Total Score:	0	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:		
Habitat Rating:	0.00					
Habitat Stream Condition:						

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Unconfined	Score	STD	Historic		
7.1 Channel Degradation		14	None	Yes	Geomorphic Rating	0.73
7.2 Channel Aggradation		14	None	Yes	Channel Evolution Model	F
7.3 Widening Channel		15	None	Yes	Channel Evolution Stage	V
7.4 Change in Planform		15	None	No	Geomorphic Condition	Good
Total Score		58			Stream Sensitivity	Moderate



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Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream: **Mill Brook**
Reach: **M15-B**
Segment Length(ft): **4,325**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Fitzgerald Environmental**
Observers: **JHB, MPL**
Completion Date: **8/7/2014**
Quality Control Status - Consultant: **Provisional**
Quality Control Status - Staff: **Provisional**

Step 0 - Location: **Begins at the segmentation point south of the Whitmore Rd crossing and continues upstream to the reach break east of the intersection of Stone Chimney Road and Mount View Drive**

Step 5 - Notes: **This segment had numerous recent small deposition features throughout. The deposits were typically very soft under foot and were likely moved and deposited during a large storm shortly before the assessment was conducted.**

Step 7 - Narrative: **This segment is historically incised due to channel straightening and armoring. The channel is currently aggrading material as seen through numerous bars, and has regained access to the previously disconnected floodplain in several locations, however access to the large floodplain remains limited. Because of the moderate incision and reduced access to the large floodplain we assessed this reach as having recently transitioned to stage III.**

Step 1. Valley and Floodplain

1.1 Segmentation: Channel Dimensions	1.4 Adjacent Side	<u>Left</u>	<u>Right</u>	1.5 Valley Features
1.2 Alluvial Fan: None	Hillside Slope:	Hilly	Steep	Valley Width (ft): 350
1.3 Corridor Encroachments:	Continuous w/ Bank:	Never	Sometimes	Width Determination: Measured
<u>Length (ft)</u> <u>One</u> <u>Height</u> <u>Both</u> <u>Height</u>	Within 1 Bankfull W:	Never	Sometimes	Confinement Type: VB
Berm: 0 0	Texture:	Mixed	Mixed	In Rock Gorge: No
Road: 0 0				Human Caused Change in Valley Width?: No
Railroad: 0 0				
Imp. Path: 0 0				
Dev.: 0 0				

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	0.0	0.0	No	



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M15-B**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	27.00	2.11 Riffle/Step Spacing:	120 ft.	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	1.80	2.12 Substrate Composition		Bed:	300 mm
2.3 Mean Depth (ft.):	1.20	Bedrock:	0.0 %	Bar:	180 mm
2.4 Floodprone Width (ft.):	42.00	Boulder:	7.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	2.50	Cobble:	43.0 %	Stream Type:	B
Human Elev FloodPln (ft.):		Coarse Gravel:	29.0 %	Bed Material:	Gravel
2.6 Width/Depth Ratio:	22.50	Fine Gravel:	10.0 %	Subclass Slope:	c
2.7 Entrenchment Ratio:	1.56	Sand:	11.0 %	Bed Form:	Plane Bed
2.8 Incision Ratio:	1.39	Silt and Smaller:	0.0 %	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	Yes	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	Low	Detritus:	4.0 %	Reference Stream Type:	
2.10 Riffles Type:	Sedimented	# Large Woody Debris:	26	Reference Bed Material:	
				Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks					Typical Bank Slope: Moderate				
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>	Near Bank Vegetation Type <u>Left</u>			<u>Right</u>
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	831.3	35.0	Dominant:	Herbaceous	Deciduous	
Material Type:	Mix	Mix	Erosion Height (ft.):	2.6	2.3	Sub-dominant:	Deciduous	Herbaceous	
Consistency:	Non-cohesive	Non-cohesive	Revetment Type:	Multiple	Rip-Rap	Bank Canopy			
Lower			Revetment Length:	127.4	33.8	Canopy %:	26-50	76-100	
Material Type:	Mix	Boulder/Cobble				Mid-Channel Canopy:		Open	
Consistency:	Non-cohesive	Non-cohesive							

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>
Dominant	26-50	>100
Sub-Dominant	0-25	51-100
W less than 25	1,376	725
Buffer Vegetation Type		
Dominant	Herbaceous	Mixed Trees
Sub-Dominant	Shrubs/Sapling	Herbaceous

3.3 Riparian Corridor

Corridor Land	<u>Left</u>	<u>Right</u>		<u>Left</u>	<u>Right</u>
Dominant	Hay	Forest	Mass Failures		103.90
Sub-dominant	Shrubs/Sapling	Hay	Height		11.2
(Legacy)	<u>Amount</u>	<u>Mean Hieight</u>	Gullies Number	2	
Failures	Multiple	10.7	Gullies Length	82	
Gullies	Multiple	202.0			



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M15-B**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	Abundant	4.5 Flow Regulation Type	Small Withdrawal	4.7 Stormwater Inputs	None
4.2 Adjacent Wetlands:	Abundant	Flow Reg. Use:	Other	Field Ditch:	Road Ditch:
4.3 Flow Status:	Low	Impoundments:		Other:	Tile Drain:
4.4 # of Debris Jams:	9	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	0
		(old) Upstrm Flow Reg.:		Affected Length (ft):	0

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Other	13	Yes	No	Yes	Yes	None
Instream Culvert	13.5	Yes	No	Yes	Yes	Deposition Above,Deposition Below
Instream Culvert	9	Yes	No	Yes	Yes	Deposition Above,Deposition Below
Bridge	30	Yes	No	No	Yes	Deposition Above,Deposition Below
Bridge	12.5	Yes	No	Yes	Yes	Deposition Above,Deposition Below

Step 5. Channel Bed and Planform Changes

5.1 Bar Types		Diagonal:	3	5.2 Other Features		Neck Cutoff:	0	5.4 Stream Ford or Animal Crossing:		Yes		
Mid:		10	Delta:	0	Flood chutes:		3	5.5 Straightening:		Straightening		
Point:		4	Island:	0	5.3 Steep Riffles and Head Cuts		Head Cuts:	0	Straightening Length (ft.):		2,495	
Side:		12	Braiding:	0	Steep Riffles:		3	Trib Rejuv.:		No	5.5 Dredging:	None

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradient Type	<u>Left</u>	<u>Right</u>
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:		
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection		
Total Score:	0	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:		
Habitat Rating:	0.00					
Habitat Stream Condition:						

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Unconfined	Score	STD	Historic		
7.1 Channel Degradation		5	C to B	Yes	Geomorphic Rating	0.36
7.2 Channel Aggradation		4	None	No	Channel Evolution Model	F
7.3 Widening Channel		10	None	No	Channel Evolution Stage	III
7.4 Change in Planform		10	None	No	Geomorphic Condition	Fair
Total Score		29			Stream Sensitivity	Very High



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Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream: **Mill Brook**
Reach: **M16-A**
Segment Length(ft): **2,413**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Fitzgerald Environmental**
Observers: **JHB, MPL**
Completion Date: **8/7/2014**
Quality Control Status - Consultant: **Provisional**
Quality Control Status - Staff: **Provisional**

Step 0 - Location: **Begins at the reach break east of the intersection of Stone Chimney Rd and Mount View Dr and continues upstream to the segmentation point northeast of the intersection of Stone Chimney Rd and Newton Rd**

Step 5 - Notes: **Post T.S. Irene cobble deposits lined most of both banks throughout the segment. A few larger side and point bars were observed above grade controls.**

Step 7 - Narrative: **This segment widened during TS Irene and is currently aggrading as flood sediments work through the channel. Moderate to high bank scour was observed along all banks that were not ledge. Numerous grade controls restrict incision and several created large areas of widening with mass failure and debris jams upstream. A small to moderate floodplain bench was accessible during moderate to large events for most of the reach. A larger glacial terrace was present for most of the reach, however it is well above even the largest flood elevations.**

Step 1. Valley and Floodplain

1.1 Segmentation: Channel Dimensions	1.4 Adjacent Side	<u>Left</u>	<u>Right</u>	1.5 Valley Features
1.2 Alluvial Fan: None	Hillside Slope:	Very Steep	Very Steep	Valley Width (ft): 85
1.3 Corridor Encroachments:	Continuous w/ Bank:	Never	Sometimes	Width Determination: Estimated
<u>Length (ft)</u> <u>One</u> <u>Height</u> <u>Both</u> <u>Height</u>	Within 1 Bankfull W:	Sometimes	Sometimes	Confinement Type: SC
Berm: 0	Texture:	Mixed	Mixed	In Rock Gorge: No
Road: 0				Human Caused Change in Valley Width?: No
Railroad: 0				
Imp. Path: 0				
Dev.: 0				

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	8.0	5.0	No	
Ledge	Mid-segment	3.0	1.0	No	
Ledge	Mid-segment	4.0	3.0	No	



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M16-A**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	26.00	2.11 Riffle/Step Spacing:	120 ft.	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	2.00	2.12 Substrate Composition		Bed:	370 mm
2.3 Mean Depth (ft.):	1.24	Bedrock:	0.0 %	Bar:	200 mm
2.4 Floodprone Width (ft.):	44.00	Boulder:	7.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	3.50	Cobble:	65.0 %	Stream Type:	B
Human Elev FloodPln (ft.):		Coarse Gravel:	14.0 %	Bed Material:	Cobble
2.6 Width/Depth Ratio:	20.97	Fine Gravel:	9.0 %	Subclass Slope:	None
2.7 Entrenchment Ratio:	1.69	Sand:	5.0 %	Bed Form:	Riffle-Pool
2.8 Incision Ratio:	1.75	Silt and Smaller:	0.0 %	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	Yes	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	Low	Detritus:	3.0 %	Reference Stream Type:	
2.10 Riffles Type:	Sedimented	# Large Woody Debris:	51	Reference Bed Material:	
				Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks					Typical Bank Slope: Moderate				
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>	Near Bank Vegetation Type <u>Left</u>			<u>Right</u>
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	245.6	317.3	Dominant:	Coniferous	Coniferous	
Material Type:	Mix	Mix	Erosion Height (ft.):	4.4	5.7	Sub-dominant:	Herbaceous	Herbaceous	
Consistency:	Non-cohesive	Non-cohesive	Revetment Type:	Rip-Rap	None	Bank Canopy			
Lower			Revetment Length:	148.4	0.0	Canopy %:	76-100	76-100	
Material Type:	Boulder/Cobble	Mix				Mid-Channel Canopy: Closed			
Consistency:	Non-cohesive	Non-cohesive							

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>
Dominant	>100	>100
Sub-Dominant	None	None
W less than 25	26	0
Buffer Vegetation Type		
Dominant	Mixed Trees	Mixed Trees
Sub-Dominant	Deciduous	Coniferous

3.3 Riparian Corridor

Corridor Land	<u>Left</u>	<u>Right</u>	<u>Left</u>	<u>Right</u>
Dominant	Forest	Forest	Mass Failures	
Sub-dominant	None	None	Height	
(Legacy)	<u>Amount</u>	<u>Mean Hieght</u>	Gullies Number	0
Failures	None		Gullies Length	0
Gullies	None			



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M16-A**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	Abundant	4.5 Flow Regulation Type	None	4.7 Stormwater Inputs	None
4.2 Adjacent Wetlands:	Minimal	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	Low	Impoundments:		Other:	Tile Drain:
4.4 # of Debris Jams:	6	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	0
		(old) Upstrm Flow Reg.:		Affected Length (ft):	0
4.8 Channel Constrictions:	None				

Step 5. Channel Bed and Planform Changes

5.1 Bar Types		Diagonal:	0	5.2 Other Features		Neck Cutoff:	0	5.4 Stream Ford or Animal Crossing:		Yes	
Mid:		4	Delta:	0	Flood chutes:		4	5.5 Straightening:		None	
Point:		2	Island:	0	5.3 Steep Riffles and Head Cuts		Head Cuts:	0	Straightening Length (ft.):		0
Side:		6	Braiding:	0	Steep Riffles:		1	Trib Rejuv.:		No	
								5.5 Dredging:		None	

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradient Type	<u>Left</u>	<u>Right</u>
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:		
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection		
Total Score:	0	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:		
Habitat Rating:	0.00					
Habitat Stream Condition:						

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Confined	Score	STD	Historic		
7.1 Channel Degradation		13	None	Yes	Geomorphic Rating	0.59
7.2 Channel Aggradation		10	None	No	Channel Evolution Model	F
7.3 Widening Channel		11	None	No	Channel Evolution Stage	III
7.4 Change in Planform		13	None	No	Geomorphic Condition	Fair
Total Score		47			Stream Sensitivity	High



Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream: **Mill Brook**
Reach: **M16-B**
Segment Length(ft): **2,616**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Fitzgerald Environmental**
Observers: **JHB, MPL**
Completion Date: **8/7/2014**
Quality Control Status - Consultant: **Provisional**
Quality Control Status - Staff: **Provisional**

- Step 0 - Location: **Begins at the segmentation point northeast of the intersection of Stone Chimney Rd and Newton Rd and continues upstream to the next reach break.**
- Step 5 - Notes: **Similar to segment A, we observed recent cobble deposits along the base of both banks for much of the reach. A few larger cobble bars were observed in locations where the channel widened, but most depositional features were smaller and stable. A small but active headcut was observed in the upper portion where incision was very high.**
- Step 7 - Narrative: **The channel bed of this segment was scoured during TS Irene, removing lower benches. Subsequent coarse deposition has lined much of the lower banks and has filled in the widened channel. The stream is currently cutting down and further incising. The upper portion of the segment is generating large volumes of sediment where coarse deposition is pushing the channel into the opposite bank causing erosion and mass failure.**

Step 1. Valley and Floodplain

1.1 Segmentation: Channel Dimensions	1.4 Adjacent Side	<u>Left</u>	<u>Right</u>	1.5 Valley Features
1.2 Alluvial Fan: None	Hillside Slope:	Steep	Steep	Valley Width (ft): 370
1.3 Corridor Encroachments:	Continuous w/ Bank:	Sometimes	Sometimes	Width Determination: Estimated
<u>Length (ft)</u> <u>One</u> <u>Height</u> <u>Both</u> <u>Height</u>	Within 1 Bankfull W:	Sometimes	Sometimes	Confinement Type: VB
Berm: 0	Texture:	Mixed	Mixed	In Rock Gorge: No
Road: 0				Human Caused Change in Valley Width?: No
Railroad: 0				
Imp. Path: 0				
Dev.: 0				
1.6 Grade Controls: None				



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M16-B**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	18.67	2.11 Riffle/Step Spacing:	120 ft.	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	1.60	2.12 Substrate Composition		Bed:	300 mm
2.3 Mean Depth (ft.):	1.32	Bedrock:	0.0 %	Bar:	150 mm
2.4 Floodprone Width (ft.):	22.00	Boulder:	7.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	4.55	Cobble:	55.0 %	Stream Type:	F
Human Elev FloodPln (ft.):		Coarse Gravel:	18.0 %	Bed Material:	Cobble
2.6 Width/Depth Ratio:	14.14	Fine Gravel:	10.0 %	Subclass Slope:	None
2.7 Entrenchment Ratio:	1.18	Sand:	1.0 %	Bed Form:	Plane Bed
2.8 Incision Ratio:	2.84	Silt and Smaller:	0.0 %	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	Yes	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	Low	Detritus:	4.0 %	Reference Stream Type:	C
2.10 Riffles Type:	Sedimented	# Large Woody Debris:	21	Reference Bed Material:	Cobble
				Reference Subclass Slope:	None
				Reference Bedform:	Riffle-Pool

Step 3. Riparian Features

3.1 Stream Banks					Typical Bank Slope: Steep				
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>	Near Bank Vegetation Type <u>Left</u>			<u>Right</u>
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	476.1	650.9	Dominant:	Herbaceous	Deciduous	
Material Type:	Mix	Mix	Erosion Height (ft.):	4.5	4.9	Sub-dominant:	Deciduous	Herbaceous	
Consistency:	Non-cohesive	Non-cohesive	Revetment Type:	None	None	Bank Canopy			
Lower			Revetment Length:	0.0	0.0	Canopy %:	51-75	76-100	
Material Type:	Boulder/Cobble	Boulder/Cobble				Mid-Channel Canopy:		Open	
Consistency:	Non-cohesive	Non-cohesive							

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>	Corridor Land	<u>Left</u>	<u>Right</u>
Dominant	>100	>100	Dominant	Forest	Forest
Sub-Dominant	0-25	0-25	Sub-dominant	Hay	Residential
W less than 25	874	410	(Legacy)	<u>Amount</u>	<u>Mean Height</u>
Buffer Vegetation Type			Failures	Multiple	31.5
Dominant	Herbaceous	Deciduous	Gullies	None	
Sub-Dominant	Deciduous	Herbaceous			

3.3 Riparian Corridor

Buffer Width	<u>Left</u>	<u>Right</u>	Corridor Land	<u>Left</u>	<u>Right</u>	Mass Failures	170.52
Dominant	>100	>100	Dominant	Forest	Forest	Height	55
Sub-Dominant	0-25	0-25	Sub-dominant	Hay	Residential	Gullies Number	0
W less than 25	874	410	(Legacy)	<u>Amount</u>	<u>Mean Height</u>	Gullies Length	0
Buffer Vegetation Type			Failures	Multiple	31.5		
Dominant	Herbaceous	Deciduous	Gullies	None			
Sub-Dominant	Deciduous	Herbaceous					



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Mill Brook**

Reach: **M16-B**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	Abundant	4.5 Flow Regulation Type	None	4.7 Stormwater Inputs	None
4.2 Adjacent Wetlands:	Minimal	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	Low	Impoundments:		Other:	Tile Drain:
4.4 # of Debris Jams:	3	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	0
		(old) Upstrm Flow Reg.:		Affected Length (ft):	0

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Old Abutment	14	Yes	No	Yes	Yes	None

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	0	5.2 Other Features	Neck Cutoff:	0	5.4 Stream Ford or Animal Crossing:	Yes		
Mid:	4	Delta:	0	Flood chutes:	2	5.5 Straightening:	Straightening		
Point:	6	Island:	0	5.3 Steep Riffles and Head Cuts	Head Cuts:	1	Straightening Length (ft.):	787	
Side:	5	Braiding:	0	Steep Riffles:	0	Trib Rejuv.:	No	5.5 Dredging:	None

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradient Type	<u>Left</u>	<u>Right</u>
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:		
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection		
Total Score:	0	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:		
Habitat Rating:	0.00					
Habitat Stream Condition:						

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Unconfined	Score	STD	Historic		
7.1 Channel Degradation		4	C to F	No	Geomorphic Rating	0.43
7.2 Channel Aggradation		10	None	No	Channel Evolution Model	F
7.3 Widening Channel		10	None	No	Channel Evolution Stage	II
7.4 Change in Planform		10	None	No	Geomorphic Condition	Fair
Total Score		34			Stream Sensitivity	Extreme



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Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream: **Beaver Brook**
Reach: **T1.01-0**
Segment Length(ft): **6,569**
Rain: **No**

SGAT Version: **4.56**
Organization: **Fitzgerald Environmental**
Observers: **EPF, JHB, MPL**
Completion Date: **7/1/2014**
Quality Control Status - Consultant: **Provisional**
Quality Control Status - Staff: **Provisional**

Step 0 - Location: **This reach begins South of the Rt-44 crossing just West of Strawberry Hill Rd and continues upstream to the reach break South of the Coon Club Rd crossing.**

Step 5 - Notes: **Reach is very long therefore numerous mid and side bars observed; however density of depositional features is very low.**

Step 7 - Narrative: **Channel appears to have incised moderately in the past but currently is in equilibrium. Bed does not appear to be vertically unstable at present and we observed minimal widening or planform adjustment. We assessed the reach as Stage II due to incision, however it is stable and could transition to Stage V over time. Areas of riparian impact and lateral instability are concentrated in the lower reach near the school, West Windsor Town Hall, and Route 44 crossing.**

Step 1. Valley and Floodplain

1.1 Segmentation: None	1.4 Adjacent Side	<u>Left</u>	<u>Right</u>	1.5 Valley Features
1.2 Alluvial Fan: None	Hillside Slope:	Steep	Very Steep	Valley Width (ft): 170
1.3 Corridor Encroachments:	Continuous w/ Bank:	Sometimes	Sometimes	Width Determination: Measured
<u>Length (ft)</u> <u>One</u> <u>Height</u> <u>Both</u> <u>Height</u>	Within 1 Bankfull W:	Sometimes	Sometimes	Confinement Type: NW
Berm: 150 3 0	Texture:	Mixed	Mixed	In Rock Gorge: No
Road: 0 0	Human Caused Change in Valley Width?: No			
Railroad: 0 0				
Imp. Path: 0 0				
Dev.: 597 191				

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	1.8	0.5	No	



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Mill Brook - Basin 13

Stream: **Beaver Brook**

Reach: **T1.01-0**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	28.50	2.11 Riffle/Step Spacing:	250 ft.	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	2.80	2.12 Substrate Composition		Bed:	400 mm
2.3 Mean Depth (ft.):	1.85	Bedrock:	0.0 %	Bar:	120 mm
2.4 Floodprone Width (ft.):	133.00	Boulder:	7.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	4.15	Cobble:	51.0 %	Stream Type:	C
Human Elev FloodPln (ft.):		Coarse Gravel:	28.0 %	Bed Material:	Cobble
2.6 Width/Depth Ratio:	15.41	Fine Gravel:	10.0 %	Subclass Slope:	None
2.7 Entrenchment Ratio:	4.67	Sand:	4.0 %	Bed Form:	Riffle-Pool
2.8 Incision Ratio:	1.48	Silt and Smaller:	0.0 %	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	No	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	Moderate	Detritus:	5.0 %	Reference Stream Type:	
2.10 Riffles Type:	Complete	# Large Woody Debris:	76	Reference Bed Material:	
				Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks					Typical Bank Slope: Steep				
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>	Near Bank Vegetation Type <u>Left</u>			<u>Right</u>
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	675.2	347.7	Dominant:	Deciduous	Deciduous	
Material Type:	Mix	Mix	Erosion Height (ft.):	6.2	5.0	Sub-dominant:	Herbaceous	Shrubs/Sapling	
Consistency:	Non-cohesive	Non-cohesive	Revetment Type:	Multiple	Rip-Rap	Bank Canopy			
Lower			Revetment Length:	151.2	114.4	Canopy %:	76-100	76-100	
Material Type:	Boulder/Cobble	Boulder/Cobble				Mid-Channel Canopy:		Closed	
Consistency:	Non-cohesive	Non-cohesive							

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>	Corridor Land
Dominant	>100	>100	Dominant
Sub-Dominant	51-100	51-100	Sub-dominant
W less than 25	407	356	(Legacy)
Buffer Vegetation Type			Failures
Dominant	Deciduous	Mixed Trees	Gullies
Sub-Dominant	Shrubs/Sapling	Shrubs/Sapling	

3.3 Riparian Corridor

	<u>Left</u>	<u>Right</u>		<u>Left</u>	<u>Right</u>
Dominant	Forest	Forest	Mass Failures	261.47	178.47
Sub-Dominant	None	Residential	Height	81	32
W less than 25	<u>Amount</u>	<u>Mean Height</u>	Gullies Number	18.4	15.1
Failures	Multiple	17.8	Gullies Length	1	
Gullies	One	3.0		70	



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Beaver Brook**

Reach: **T1.01-0**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	Minimal	4.5 Flow Regulation Type	None	4.7 Stormwater Inputs	
4.2 Adjacent Wetlands:	Minimal	Flow Reg. Use:		Field Ditch:	0 Road Ditch: 0
4.3 Flow Status:	Low	Impoundments:		Other:	0 Tile Drain: 0
4.4 # of Debris Jams:	8	Impoundment Loc.:		Overland Flow:	0 Urb Strm Wtr Pipe: 1
		4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	0
		(old) Upstrm Flow Reg.:		Affected Length (ft):	0

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	56	Yes	No	No	Yes	Deposition Above, Scour Above, Scour Below
Bridge	22	Yes	No	Yes	Yes	Deposition Below
Bridge	28	Yes	No	No	Yes	Scour Above, Scour Below

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal: 0	5.2 Other Features	Neck Cutoff: 0	5.4 Stream Ford or Animal Crossing:	No
Mid: 4	Delta: 0	Flood chutes: 2	Avulsion: 0	5.5 Straightening:	None
Point: 8	Island: 1	5.3 Steep Riffles and Head Cuts	Head Cuts: 0	Straightening Length (ft.):	0
Side: 4	Braiding: 0	Steep Riffles: 1	Trib Rejuv.: No	5.5 Dredging:	Dredging

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradient Type	<u>Left</u>	<u>Right</u>
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:		
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection		
Total Score:	0	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:		
Habitat Rating:	0.00					
Habitat Stream Condition:						

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Unconfined	Score	STD	Historic		
7.1 Channel Degradation		11	None	Yes	Geomorphic Rating	0.61
7.2 Channel Aggradation		13	None	No	Channel Evolution Model	F
7.3 Widening Channel		12	None	No	Channel Evolution Stage	II
7.4 Change in Planform		13	None	No	Geomorphic Condition	Fair
Total Score		49			Stream Sensitivity	High



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Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream: **Beaver Brook**
Reach: **T1.02-A**
Segment Length(ft): **5,171**
Rain: **No**

SGAT Version: **4.56**
Organization: **Fitzgerald Environmental**
Observers: **EPF**
Completion Date: **8/27/2014**
Quality Control Status - Consultant: **Provisional**
Quality Control Status - Staff: **Provisional**

- Step 0 - Location: This reach begins at the reach break just north of the intersection of Brownsville-Hartland and Sheddsville Rd and continues upstream to the segment break north of the intersection of Brownsville-Hartland and Hammond Hill Rd.
- Step 5 - Notes: Some buffer impacts from adjacent development and horse farm in lower segment are impacting segment, but majority of the reach is fairly stable.
- Step 7 - Narrative: Minor incision and some bank/valley erosion noted throughout reach. Incision may be historic, but some current day encroachments in lower and upper segment may be contributing to ongoing instability. Given grade controls and natural vegetation in corridor and LWD in channel, segment does not appear susceptible to significant instability in the near future. Entrenchment varied throughout segment with some areas of Bc geometry.

Step 1. Valley and Floodplain

1.1 Segmentation: Channel Dimensions	1.4 Adjacent Side	<u>Left</u>	<u>Right</u>	1.5 Valley Features
1.2 Alluvial Fan: None	Hillside Slope:	Steep	Steep	Valley Width (ft): 130
1.3 Corridor Encroachments:	Continuous w/ Bank:	Sometimes	Sometimes	Width Determination: Estimated
<u>Length (ft)</u> <u>One</u> <u>Height</u> <u>Both</u> <u>Height</u>	Within 1 Bankfull W:	Sometimes	Sometimes	Confinement Type: NW
Berm: 0	Texture:	Mixed	Mixed	In Rock Gorge: No
Road: 916 8 0	Human Caused Change in Valley Width?: No			
Railroad: 0 0				
Imp. Path: 0 0				
Dev.: 1,059 168				

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	1.0	0.4	No	
Ledge	Mid-segment	2.0	2.1	No	



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Beaver Brook**

Reach: **T1.02-A**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	24.11	2.11 Riffle/Step Spacing:	215 ft.	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	1.80	2.12 Substrate Composition		Bed:	250 mm
2.3 Mean Depth (ft.):	1.26	Bedrock:	0.0 %	Bar:	90 mm
2.4 Floodprone Width (ft.):	61.00	Boulder:	6.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	2.40	Cobble:	27.0 %	Stream Type:	C
Human Elev FloodPln (ft.):		Coarse Gravel:	37.0 %	Bed Material:	Gravel
2.6 Width/Depth Ratio:	19.13	Fine Gravel:	8.0 %	Subclass Slope:	None
2.7 Entrenchment Ratio:	2.53	Sand:	21.0 %	Bed Form:	Riffle-Pool
2.8 Incision Ratio:	1.33	Silt and Smaller:	1.0 %	Field Measured Slope:	1.2
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	No	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	Low	Detritus:	3.0 %	Reference Stream Type:	
2.10 Riffles Type:	Complete	# Large Woody Debris:	95	Reference Bed Material:	
				Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks			Typical Bank Slope:	Moderate	
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	528.1	272.6
Material Type:	Sand	Sand	Erosion Height (ft.):	6.0	10.4
Consistency:	Non-cohesive	Non-cohesive	Revetment Type:	None	Rip-Rap
Lower			Revetment Length:	0.0	209.5
Material Type:	Gravel	Gravel	Canopy %:	76-100	76-100
Consistency:	Non-cohesive	Non-cohesive	Mid-Channel Canopy:	Closed	

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>	Corridor Land	<u>Left</u>	<u>Right</u>
Dominant	>100	51-100	Dominant	Forest	Forest
Sub-Dominant	0-25	26-50	Sub-dominant	Residential	Residential
W less than 25	1,534	210	(Legacy)	<u>Amount</u>	<u>Mean Hieght</u>
Buffer Vegetation Type			Failures	Multiple	18.5
Dominant	Mixed Trees	Mixed Trees	Gullies	None	
Sub-Dominant	Shrubs/Sapling	Shrubs/Sapling			

3.3 Riparian Corridor

Mass Failures	30.719	41.572
Height	64	85
Gullies Number	0	
Gullies Length	0	



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Beaver Brook**

Reach: **T1.02-A**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	Abundant	4.5 Flow Regulation Type	Small Withdrawal	4.7 Stormwater Inputs	None
4.2 Adjacent Wetlands:	Minimal	Flow Reg. Use:	Recreation	Field Ditch:	Road Ditch:
4.3 Flow Status:	Moderate	Impoundments:		Other:	Tile Drain:
4.4 # of Debris Jams:	7	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	0
		(old) Upstrm Flow Reg.:		Affected Length (ft):	0

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Instream Culvert	13	Yes	No	Yes	Yes	Deposition Above, Scour Below
Bridge	15	Yes	No	Yes	Yes	Deposition Above, Scour Above
Instream Culvert	12.6	Yes	No	Yes	Yes	None

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal: 0	5.2 Other Features	Neck Cutoff: 0	5.4 Stream Ford or Animal Crossing:	Yes
Mid: 0	Delta: 0	Flood chutes: 1	Avulsion: 0	5.5 Straightening:	None
Point: 18	Island: 0	5.3 Steep Riffles and Head Cuts	Head Cuts: 0	Straightening Length (ft.):	0
Side: 8	Braiding: 0	Steep Riffles: 1	Trib Rejuv.: No	5.5 Dredging:	None

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:	6.4 Sediment Deposition:	Stream Gradient Type	<u>Left</u>	<u>Right</u>
6.2 Pool Substrate:	6.5 Channel Flow Status:	6.8 Bank Stability:		
6.3 Pool Variability:	6.6 Channel Alteration:	6.9 Bank Vegetation Protection		
Total Score: 0	6.7 Channel Sinuosity:	6.10 Riparian Veg. Zone Width:		
Habitat Rating: 0.00				
Habitat Stream Condition:				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Unconfined	Score	STD	Historic		
7.1 Channel Degradation		13	None	No	Geomorphic Rating	0.63
7.2 Channel Aggradation		12	None	No	Channel Evolution Model	F
7.3 Widening Channel		13	None	No	Channel Evolution Stage	II
7.4 Change in Planform		12	None	No	Geomorphic Condition	Fair
Total Score		50			Stream Sensitivity	Very High



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Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream: **Beaver Brook**
Reach: **T1.02-B**
Segment Length(ft): **1,114**
Rain: **No**

SGAT Version: **4.56**
Organization: **Fitzgerald Environmental**
Observers: **EPF**
Completion Date: **8/27/2014**
Quality Control Status - Consultant: **Provisional**
Quality Control Status - Staff: **Provisional**

- Step 0 - Location: **This segment begins at the segment break north of the intersection of Brownsville-Hartland and Hammond Hill Rd and continues another 1100ft upstream to the next segment point.**
- Step 5 - Notes: **Dense alder thickets throughout reach. Channel had much higher sinuosity than shown on the VHD. Ponding from beaver dams affected segment, but it was still accessible. Upstream segment severely ponded by large beaver dam.**
- Step 7 - Narrative: **No evidence of channel instability; however beaver ponding made channel observations challenging in segment. Historic straightening likely given hay fields in corridor and obvious straightening in upstream segment.**

Step 1. Valley and Floodplain

1.1 Segmentation: Channel Dimensions	1.4 Adjacent Side	<u>Left</u>	<u>Right</u>	1.5 Valley Features
1.2 Alluvial Fan: None	Hillside Slope:	Hilly	Flat	Valley Width (ft): 500
1.3 Corridor Encroachments:	Continuous w/ Bank:	Never	Never	Width Determination: Estimated
<u>Length (ft)</u> <u>One</u> <u>Height</u> <u>Both</u> <u>Height</u>	Within 1 Bankfull W:	Never	Never	Confinement Type: VB
Berm: 0 0	Texture:	N.E.	N.E.	In Rock Gorge: No
Road: 0 0	Human Caused Change in Valley Width?: No			
Railroad: 0 0				
Imp. Path: 0 0				
Dev.: 138 0				
1.6 Grade Controls: None				



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Beaver Brook**

Reach: **T1.02-B**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	8.00	2.11 Riffle/Step Spacing:		2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	3.00	2.12 Substrate Composition		Bed:	35 mm
2.3 Mean Depth (ft.):	2.50	Bedrock:	0.0 %	Bar:	55 mm
2.4 Floodprone Width (ft.):	655.00	Boulder:	0.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	3.20	Cobble:	0.0 %	Stream Type:	E
Human Elev FloodPln (ft.):		Coarse Gravel:	5.0 %	Bed Material:	Sand
2.6 Width/Depth Ratio:	3.20	Fine Gravel:	38.0 %	Subclass Slope:	None
2.7 Entrenchment Ratio:	81.88	Sand:	51.0 %	Bed Form:	Riffle-Pool
2.8 Incision Ratio:	1.07	Silt and Smaller:	6.0 %	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	Yes	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	High	Detritus:	6.0 %	Reference Stream Type:	E
2.10 Riffles Type:	Complete	# Large Woody Debris:	36	Reference Bed Material:	Sand
				Reference Subclass Slope:	None
				Reference Bedform:	Riffle-Pool

Step 3. Riparian Features

3.1 Stream Banks			Typical Bank Slope:	Steep	
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	0.0	0.0
Material Type:	Sand	Sand	Erosion Height (ft.):	0.0	0.0
Consistency:	Non-cohesive	Non-cohesive	Revetment Type:	None	None
Lower			Revetment Length:	0.0	0.0
Material Type:	Gravel	Gravel			
Consistency:	Non-cohesive	Non-cohesive			
			Near Bank Vegetation Type	<u>Left</u>	<u>Right</u>
			Dominant:	Shrubs/Sapling	Shrubs/Sapling
			Sub-dominant:	Herbaceous	Herbaceous
			Bank Canopy		
			Canopy %:	26-50	26-50
			Mid-Channel Canopy:	Open	

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>
Dominant	51-100	0-25
Sub-Dominant	0-25	26-50
W less than 25	380	589
Buffer Vegetation Type		
Dominant	Herbaceous	Herbaceous
Sub-Dominant	Shrubs/Sapling	Shrubs/Sapling

3.3 Riparian Corridor

Corridor Land	<u>Left</u>	<u>Right</u>		<u>Left</u>	<u>Right</u>
Dominant	Hay	Hay	Mass Failures		
Sub-dominant	Shrubs/Sapling	Shrubs/Sapling	Height		
(Legacy)	<u>Amount</u>	<u>Mean Height</u>	Gullies Number	0	
Failures	None		Gullies Length	0	
Gullies	None				



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Beaver Brook**

Reach: **T1.02-B**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	Abundant	4.5 Flow Regulation Type	None	4.7 Stormwater Inputs	None
4.2 Adjacent Wetlands:	Abundant	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	Moderate	Impoundments:		Other:	Tile Drain:
4.4 # of Debris Jams:	0	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	1
		(old) Upstrm Flow Reg.:		Affected Length (ft):	250
4.8 Channel Constrictions:	None				

Step 5. Channel Bed and Planform Changes

5.1 Bar Types		Diagonal:	0	5.2 Other Features		Neck Cutoff:	0	5.4 Stream Ford or Animal Crossing:		No
Mid:	0	Delta:	0	Flood chutes:	0	Avulsion:	0	5.5 Straightening:		Straightening
Point:	7	Island:	0	5.3 Steep Riffles and Head Cuts		Head Cuts:	0	Straightening Length (ft.):		251
Side:	1	Braiding:	0	Steep Riffles:	0	Trib Rejuv.:	No	5.5 Dredging:		None

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradient Type	<u>Left</u>	<u>Right</u>
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:		
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection		
Total Score:	0	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:		
Habitat Rating:	0.00					
Habitat Stream Condition:						

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Unconfined	Score	STD	Historic		
7.1 Channel Degradation		14	None	No	Geomorphic Rating	0.73
7.2 Channel Aggradation		15	None	No	Channel Evolution Model	F
7.3 Widening Channel		16	None	No	Channel Evolution Stage	I
7.4 Change in Planform		13	None	No	Geomorphic Condition	Good
Total Score		58			Stream Sensitivity	High



Stream Geomorphic Assessment

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Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream: **Beaver Brook**
Reach: **T1.02-C**
Segment Length(ft): **1,437**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Fitzgerald Environmental**
Observers: **EPF**
Completion Date: **8/27/2014**
Quality Control Status - Consultant: **Provisional**
Quality Control Status - Staff: **Provisional**
Why Not Assessed: **beaver dam**

Step 0 - Location: **This reach is bound by the segment point to the south of the intersection of Brownsville-Hartland and Knob Hill Rd and continues upstream to the reach break before Beaver Brook crosses back under the Brownsville-Hartland Rd**

Step 5 - Notes:

Step 7 - Narrative:

Step 1. Valley and Floodplain

1.1 Segmentation: **Other Reason**

1.2 Alluvial Fan: **None**

1.3 Corridor Encroachments:

	<u>Length (ft)</u>	<u>One</u>	<u>Height</u>	<u>Both</u>	<u>Height</u>
Berm:	0			0	
Road:	0			0	
Railroad:	0			0	
Imp. Path:	0			0	
Dev.:	0			0	

1.4 Adjacent Side

Left

Right

Hillside Slope:

Hilly

Flat

Continuous w/ Bank:

Never

Never

Within 1 Bankfull W:

Never

Never

Texture:

N.E.

N.E.

1.5 Valley Features

Valley Width (ft): **450**

Width Determination: **Estimated**

Confinement Type: **VB**

In Rock Gorge: **No**

Human Caused Change in Valley Width?: **No**

1.6 Grade Controls:



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Beaver Brook**

Reach: **T1.02-C**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):		2.11 Riffle/Step Spacing:		2.13 Average Largest Particle on	
2.2 Max Depth (ft.):		2.12 Substrate Composition		Bed:	
2.3 Mean Depth (ft.):		Bedrock:	%	Bar:	
2.4 Floodprone Width (ft.):		Boulder:	%	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):		Cobble:	%	Stream Type:	E
Human Elev FloodPln (ft.):		Coarse Gravel:	%	Bed Material:	Sand
2.6 Width/Depth Ratio:	0.00	Fine Gravel:	%	Subclass Slope:	None
2.7 Entrenchment Ratio:	0.00	Sand:	%	Bed Form:	Riffle-Pool
2.8 Incision Ratio:	0.00	Silt and Smaller:	%	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	No	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	Moderate	Detritus:	0.0 %	Reference Stream Type:	
2.10 Riffles Type:	Not Evaluated	# Large Woody Debris:		Reference Bed Material:	
				Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks					Typical Bank Slope: Steep				
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>	Near Bank Vegetation Type <u>Left</u>			<u>Right</u>
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	0.0	0.0	Dominant:	Shrubs/Sapling	Shrubs/Sapling	
Material Type:	Sand	Sand	Erosion Height (ft.):	0.0	0.0	Sub-dominant:	Herbaceous	Herbaceous	
Consistency:	Non-cohesive	Non-cohesive	Revetment Type:	None	None	Bank Canopy			
Lower			Revetment Length:	0.0	0.0	Canopy %:	26-50	26-50	
Material Type:	Gravel	Gravel				Mid-Channel Canopy:	Open		
Consistency:	Non-cohesive	Non-cohesive							

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>
Dominant	0-25	0-25
Sub-Dominant	26-50	26-50
W less than 25	1,130	1,437
Buffer Vegetation Type		
Dominant	Herbaceous	Herbaceous
Sub-Dominant	Shrubs/Sapling	Shrubs/Sapling

3.3 Riparian Corridor

Corridor Land	<u>Left</u>	<u>Right</u>		<u>Left</u>	<u>Right</u>
Dominant	Hay	Hay	Mass Failures		
Sub-dominant	Shrubs/Sapling	Shrubs/Sapling	Height		
(Legacy)	<u>Amount</u>	<u>Mean Hieght</u>	Gullies Number	0	
Failures	None		Gullies Length	0	
Gullies	None				



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Beaver Brook**

Reach: **T1.02-C**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	4.5 Flow Regulation Type	None	4.7 Stormwater Inputs	None
4.2 Adjacent Wetlands:	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	Impoundments:		Other:	Tile Drain:
4.4 # of Debris Jams: 0	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
	4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	2
	(old) Upstrm Flow Reg.:		Affected Length (ft):	1150

4.8 Channel Constrictions:

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	5.2 Other Features	Neck Cutoff:	0	5.4 Stream Ford or Animal Crossing:	No	
Mid:	Delta:	Flood chutes:	0	Avulsion:	0	5.5 Straightening:	Straightening
Point:	Island:	5.3 Steep Riffles and Head Cuts	Head Cuts:	0	Straightening Length (ft.):	719	
Side:	Braiding:	0	Steep Riffles:	0	Trib Rejuv.:	5.5 Dredging:	None

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:	6.4 Sediment Deposition:	Stream Gradient Type	<u>Left</u>	<u>Right</u>
6.2 Pool Substrate:	6.5 Channel Flow Status:	6.8 Bank Stability:		
6.3 Pool Variability:	6.6 Channel Alteration:	6.9 Bank Vegetation Protection		
Total Score:	6.7 Channel Sinuosity:	6.10 Riparian Veg. Zone Width:		
Habitat Rating:				
Habitat Stream Condition:				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Score	STD	Historic	Geomorphic Rating
7.1 Channel Degradation				Channel Evolution Model
7.2 Channel Aggradation				Channel Evolution Stage
7.3 Widening Channel				Geomorphic Condition
7.4 Change in Planform				Stream Sensitivity
Total Score				Fair



Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream: Willow Brook
Reach: T2.01-A
Segment Length(ft): 2,527
Rain: No

SGAT Version: 4.56
Organization: Fitzgerald Environmental
Observers: JHB, MPL, EPF
Completion Date: 8/20/2014
Quality Control Status - Consultant: Provisional
Quality Control Status - Staff: Provisional

Step 0 - Location: Begins at the reach break southeast of the intersection of Churchill Rd and Rt-44 and continues upstream to the segmentation point to the east of Rush Meadow Rd before the stream crosses under the road.

Step 5 - Notes:

Step 7 - Narrative: This segment is straightened through most of the horse pasture and as a result is narrow and deeply incised. The reach is either a very incised and narrow C-type or a highly straightened E-type by reference. Based on channel slope and the lack of obvious historic channel indicators in the meadow, we selected a C to F departure. The entrenchment ratio is slightly above the range for F-type, however this segment is approximately 30% under curve width. This segment is stuck in stage II with minimal access to the large floodplain except during larger events.

Step 1. Valley and Floodplain

1.1 Segmentation: Channel Dimensions

1.2 Alluvial Fan: None

1.3 Corridor Encroachments:

	Length (ft)	One	Height	Both	Height
Berm:	0			0	
Road:	364	10		0	
Railroad:	0			0	
Imp. Path:	0			0	
Dev.:	280			0	

1.4 Adjacent Side

Hillside Slope:

Continuous w/ Bank:

Within 1 Bankfull W:

Texture:

Left

Right

Flat

Hilly

Sometimes

Never

Sometimes

Never

Mixed

Mixed

1.5 Valley Features

Valley Width (ft): 600

Width Determination: Measured

Confinement Type: VB

In Rock Gorge: No

Human Caused Change in Valley Width?: No

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	0.0	0.0	No	
Ledge	Mid-segment	0.0	0.0	No	
Ledge	Mid-segment	0.0	0.0	No	
Ledge	Mid-segment	2.0	1.0	No	
Ledge	Mid-segment	0.0	0.0	No	



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: Willow Brook

Reach: T2.01-A

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	19.50	2.11 Riffle/Step Spacing:	110 ft.	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	2.35	2.12 Substrate Composition		Bed:	280 mm
2.3 Mean Depth (ft.):	1.75	Bedrock:	0.0 %	Bar:	40 mm
2.4 Floodprone Width (ft.):	29.00	Boulder:	4.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	5.35	Cobble:	43.0 %	Stream Type:	F
Human Elev FloodPln (ft.):		Coarse Gravel:	37.0 %	Bed Material:	Gravel
2.6 Width/Depth Ratio:	11.14	Fine Gravel:	9.0 %	Subclass Slope:	None
2.7 Entrenchment Ratio:	1.49	Sand:	7.0 %	Bed Form:	Riffle-Pool
2.8 Incision Ratio:	2.28	Silt and Smaller:	0.0 %	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	No	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	Moderate	Detritus:	7.0 %	Reference Stream Type:	
2.10 Riffles Type:	Sedimented	# Large Woody Debris:	14	Reference Bed Material:	
				Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks			Typical Bank Slope:	Steep	
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	68.3	53.4
Material Type:	Mix	Mix	Erosion Height (ft.):	4.6	3.0
Consistency:	Non-cohesive	Non-cohesive	Revetment Type:	Rip-Rap	Multiple
Lower			Revetment Length:	174.1	946.4
Material Type:	Gravel	Gravel	Canopy %:	26-50	26-50
Consistency:	Non-cohesive	Non-cohesive	Mid-Channel Canopy:	Open	

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>
Dominant	0-25	0-25
Sub-Dominant	>100	26-50
W less than 25	1,322	2,061
Buffer Vegetation Type		
Dominant	Herbaceous	Herbaceous
Sub-Dominant	Shrubs/Sapling	Shrubs/Sapling

3.3 Riparian Corridor

Corridor Land	<u>Left</u>	<u>Right</u>	<u>Left</u>	<u>Right</u>
Dominant	Hay	Pasture	Mass Failures	
Sub-dominant	Shrubs/Sapling	Shrubs/Sapling	Height	
(Legacy)	<u>Amount</u>	<u>Mean Hieght</u>	Gullies Number	0
Failures	None		Gullies Length	0
Gullies	None			



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: Willow Brook

Reach: T2.01-A

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	Minimal	4.5 Flow Regulation Type	None	4.7 Stormwater Inputs	
4.2 Adjacent Wetlands:	Minimal	Flow Reg. Use:		Field Ditch:	0 Road Ditch: 1
4.3 Flow Status:	Low	Impoundments:		Other:	0 Tile Drain: 0
4.4 # of Debris Jams:	2	Impoundment Loc.:		Overland Flow:	0 Urb Strm Wtr Pipe: 0
		4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	0
		(old) Upstrm Flow Reg.:		Affected Length (ft):	0

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Old Abutment	12	Yes	No	Yes	Yes	None
Other	18	No	No	Yes	Yes	None
Bridge	15	Yes	No	Yes	Yes	Deposition Above, Scour Above

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal: 0	5.2 Other Features	Neck Cutoff: 0	5.4 Stream Ford or Animal Crossing:	Yes
Mid: 0	Delta: 0	Flood chutes: 0	Avulsion: 0	5.5 Straightening:	Straightening
Point: 2	Island: 0	5.3 Steep Riffles and Head Cuts	Head Cuts: 0	Straightening Length (ft.):	1,308
Side: 8	Braiding: 0	Steep Riffles: 0	Trib Rejuv.: No	5.5 Dredging:	Dredging

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:	6.4 Sediment Deposition:	Stream Gradient Type	Left	Right
6.2 Pool Substrate:	6.5 Channel Flow Status:	6.8 Bank Stability:		
6.3 Pool Variability:	6.6 Channel Alteration:	6.9 Bank Vegetation Protection		
Total Score: 0	6.7 Channel Sinuosity:	6.10 Riparian Veg. Zone Width:		
Habitat Rating: 0.00				
Habitat Stream Condition:				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Unconfined	Score	STD	Historic		
7.1 Channel Degradation		5	C to F	No	Geomorphic Rating	0.45
7.2 Channel Aggradation		10	None	No	Channel Evolution Model	F
7.3 Widening Channel		11	None	No	Channel Evolution Stage	II
7.4 Change in Planform		10	None	No	Geomorphic Condition	Fair
Total Score		36			Stream Sensitivity	Extreme



Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream: Willow Brook
Reach: T2.01-B
Segment Length(ft): 1,500
Rain: No

SGAT Version: 4.56
Organization: Fitzgerald Environmental
Observers: JHB, MPL
Completion Date: 8/20/2014
Quality Control Status - Consultant: Provisional
Quality Control Status - Staff: Provisional

Step 0 - Location: This segment begins at the segmentation point downstream of the Rush Meadow Rd crossing and continues upstream to the reach break south of the intersection of West Rowe Hill Rd and Rush Meadow Rd

Step 5 - Notes:

Step 7 - Narrative: This segment had moderate floodplain access throughout and appeared to be fairly stable. We assessed the reach as stage IV as there was no evidence of ongoing incision or widening, and aggrading materials were causing some planform adjustments in the middle and lower portion of the segment.

Step 1. Valley and Floodplain

1.1 Segmentation: Channel Dimensions	1.4 Adjacent Side	Left	Right	1.5 Valley Features
1.2 Alluvial Fan: None	Hillside Slope:	Very Steep	Hilly	Valley Width (ft): 160
1.3 Corridor Encroachments:	Continuous w/ Bank:	Sometimes	Never	Width Determination: Estimated
Length (ft) One Height Both Height	Within 1 Bankfull W:	Always	Never	Confinement Type: NW
Berm: 0 0	Texture:	Bedrock	Mixed	In Rock Gorge: No
Road: 677 10 0				Human Caused Change in Valley Width?: Yes
Railroad: 0 0				
Imp. Path: 0 0				
Dev.: 200 0				

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	4.0	2.0	Yes	
Ledge	Mid-segment	0.0	0.0	No	
Ledge	Mid-segment	0.0	0.0	No	
Ledge	Mid-segment	4.0	2.0	No	



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Willow Brook**

Reach: **T2.01-B**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	28.23	2.11 Riffle/Step Spacing:	110 ft.	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	1.90	2.12 Substrate Composition		Bed:	280 mm
2.3 Mean Depth (ft.):	1.35	Bedrock:	0.0 %	Bar:	150 mm
2.4 Floodprone Width (ft.):	80.00	Boulder:	9.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	2.75	Cobble:	38.0 %	Stream Type:	C
Human Elev FloodPln (ft.):		Coarse Gravel:	23.0 %	Bed Material:	Gravel
2.6 Width/Depth Ratio:	20.91	Fine Gravel:	20.0 %	Subclass Slope:	None
2.7 Entrenchment Ratio:	2.83	Sand:	10.0 %	Bed Form:	Riffle-Pool
2.8 Incision Ratio:	1.45	Silt and Smaller:	0.0 %	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	No	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	Moderate	Detritus:	4.0 %	Reference Stream Type:	
2.10 Riffles Type:	Sedimented	# Large Woody Debris:	18	Reference Bed Material:	
				Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks					Typical Bank Slope: Steep				
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>	Near Bank Vegetation Type <u>Left</u>			<u>Right</u>
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	163.0	77.5	Dominant:	Deciduous	Herbaceous	
Material Type:	Mix	Mix	Erosion Height (ft.):	8.6	1.6	Sub-dominant:	Herbaceous	Deciduous	
Consistency:	Non-cohesive	Non-cohesive	Revetment Type:	Rip-Rap	Rip-Rap	Bank Canopy			
Lower			Revetment Length:	152.8	240.1	Canopy %:	76-100	51-75	
Material Type:	Gravel	Gravel				Mid-Channel Canopy:		Open	
Consistency:	Non-cohesive	Non-cohesive							

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>	Corridor Land	
Dominant	>100	26-50	Dominant	
Sub-Dominant	0-25	0-25	Sub-dominant	
W less than 25	709	682	(Legacy)	
Buffer Vegetation Type			Failures	
Dominant	Mixed Trees	Herbaceous	Gullies	
Sub-Dominant	Shrubs/Sapling	Deciduous		

3.3 Riparian Corridor

	<u>Left</u>	<u>Right</u>		<u>Left</u>	<u>Right</u>
Dominant	Forest	Pasture	Mass Failures		
Sub-Dominant	Hay	Residential	Height		
Amount	<u>Amount</u>	<u>Mean Hieght</u>	Gullies Number	0	
None	None		Gullies Length	0	



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: Willow Brook

Reach: T2.01-B

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	Minimal	4.5 Flow Regulation Type	None	4.7 Stormwater Inputs	
4.2 Adjacent Wetlands:	Minimal	Flow Reg. Use:		Field Ditch:	1 Road Ditch: 0
4.3 Flow Status:	Low	Impoundments:		Other:	0 Tile Drain: 0
4.4 # of Debris Jams:	3	Impoundment Loc.:		Overland Flow:	0 Urb Strm Wtr Pipe: 0
		4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	0
		(old) Upstrm Flow Reg.:		Affected Length (ft):	0

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	20	Yes	No	Yes	Yes	None

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal: 0	5.2 Other Features	Neck Cutoff: 0	5.4 Stream Ford or Animal Crossing:	Yes
Mid: 2	Delta: 0	Flood chutes: 1	Avulsion: 0	5.5 Straightening:	None
Point: 1	Island: 0	5.3 Steep Riffles and Head Cuts	Head Cuts: 0	Straightening Length (ft.):	0
Side: 4	Braiding: 0	Steep Riffles: 2	Trib Rejuv.: No	5.5 Dredging:	None

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:	6.4 Sediment Deposition:	Stream Gradient Type	Left	Right
6.2 Pool Substrate:	6.5 Channel Flow Status:	6.8 Bank Stability:		
6.3 Pool Variability:	6.6 Channel Alteration:	6.9 Bank Vegetation Protection		
Total Score: 0	6.7 Channel Sinuosity:	6.10 Riparian Veg. Zone Width:		
Habitat Rating: 0.00				
Habitat Stream Condition:				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Unconfined	Score	STD	Historic		
7.1 Channel Degradation		11	None	No	Geomorphic Rating	0.57
7.2 Channel Aggradation		11	None	No	Channel Evolution Model	F
7.3 Widening Channel		12	None	No	Channel Evolution Stage	IV
7.4 Change in Planform		12	None	No	Geomorphic Condition	Fair
Total Score		46			Stream Sensitivity	Very High



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Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream: **Willow Brook**
Reach: **T2.02-0**
Segment Length(ft): **3,213**
Rain: **No**

SGAT Version: **4.56**
Organization: **Fitzgerald Environmental**
Observers: **JHB, MPL**
Completion Date: **8/20/2014**
Quality Control Status - Consultant: **Provisional**
Quality Control Status - Staff: **Provisional**

Step 0 - Location: **This reach follows Rush Meadow Rd. and is bound by the two reach breaks south of West Rowe Hill Rd.**

Step 5 - Notes: **Most bars were small and comprised of gravel. A few large cobble MCBs were observed in short areas of widening channel.**

Step 7 - Narrative: **This reach widened during TS Irene scouring away low banks and then aggraded with larger cobbles and boulders. Currently the channel is continuing to aggrade with finer material and is beginning to adjust planform through the recent deposits. We observed evidence of continued widening and assessed the reach as stage III, likely to transition to stage IV in the future. Numerous grade controls limit incision and floodplain access was moderate throughout the reach.**

Step 1. Valley and Floodplain

1.1 Segmentation: **None**

1.2 Alluvial Fan: **None**

1.3 Corridor Encroachments:

	Length (ft)	One	Height	Both	Height
Berm:	0			0	
Road:	3,159	10		0	
Railroad:	0			0	
Imp. Path:	0			0	
Dev.:	0			0	

1.4 Adjacent Side

Left

Right

Hillside Slope:

Steep

Very Steep

Continuous w/ Bank:

Sometimes

Sometimes

Within 1 Bankfull W:

Sometimes

Always

Texture:

Cobble

Gravel

1.5 Valley Features

Valley Width (ft): **100**

Width Determination: **Estimated**

Confinement Type: **SC**

In Rock Gorge: **No**

Human Caused Change in Valley Width?: **Yes**

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	5.0	2.0	Yes	
Ledge	Mid-segment	3.0	1.0	No	
Ledge	Mid-segment	6.0	4.0	Yes	
Ledge	Mid-segment	4.0	2.0	Yes	
Ledge	Mid-segment	11.0	8.0	Yes	
Ledge	Mid-segment	4.0	3.0	Yes	



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Willow Brook**

Reach: **T2.02-0**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	29.61	2.11 Riffle/Step Spacing:	170 ft.	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	1.60	2.12 Substrate Composition		Bed:	450 mm
2.3 Mean Depth (ft.):	1.07	Bedrock:	2.0 %	Bar:	N/A mm
2.4 Floodprone Width (ft.):	47.00	Boulder:	11.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	2.90	Cobble:	31.0 %	Stream Type:	B
Human Elev FloodPln (ft.):		Coarse Gravel:	35.0 %	Bed Material:	Gravel
2.6 Width/Depth Ratio:	27.67	Fine Gravel:	10.0 %	Subclass Slope:	None
2.7 Entrenchment Ratio:	1.59	Sand:	11.0 %	Bed Form:	Step-Pool
2.8 Incision Ratio:	1.81	Silt and Smaller:	0.0 %	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	Yes	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	Low	Detritus:	3.0 %	Reference Stream Type:	
2.10 Riffles Type:	Sedimented	# Large Woody Debris:	28	Reference Bed Material:	
				Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks					Typical Bank Slope: Moderate				
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>	Near Bank Vegetation Type <u>Left</u>			<u>Right</u>
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	97.0	386.2	Dominant:	Deciduous	Coniferous	
Material Type:	Mix	Mix	Erosion Height (ft.):	5.4	2.2	Sub-dominant:	Shrubs/Sapling	Herbaceous	
Consistency:	Non-cohesive	Non-cohesive	Revetment Type:	Rip-Rap	Rip-Rap	Bank Canopy			
Lower			Revetment Length:	843.6	262.6	Canopy %:	76-100	76-100	
Material Type:	Boulder/Cobble	Bedrock				Mid-Channel Canopy:		Closed	
Consistency:	Non-cohesive	Cohesive							

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>
Dominant	26-50	>100
Sub-Dominant	51-100	26-50
W less than 25	588	0
Buffer Vegetation Type		
Dominant	Mixed Trees	Mixed Trees
Sub-Dominant	Shrubs/Sapling	Herbaceous

3.3 Riparian Corridor

Corridor Land	<u>Left</u>	<u>Right</u>	<u>Left</u>	<u>Right</u>
Dominant	Forest	Forest	Mass Failures	404.15
Sub-dominant	Commercial	Residential	Height	34
(Legacy)	<u>Amount</u>	<u>Mean Hieght</u>	Gullies Number	1
Failures	Multiple	23.3	Gullies Length	80
Gullies	One	5.0		



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: Willow Brook

Reach: T2.02-0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	Minimal	4.5 Flow Regulation Type	None	4.7 Stormwater Inputs	
4.2 Adjacent Wetlands:	Minimal	Flow Reg. Use:		Field Ditch:	0 Road Ditch: 2
4.3 Flow Status:	Low	Impoundments:		Other:	0 Tile Drain: 0
4.4 # of Debris Jams:	5	Impoundment Loc.:		Overland Flow:	0 Urb Strm Wtr Pipe: 0
		4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	0
		(old) Upstrm Flow Reg.:		Affected Length (ft):	0

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Instream Culvert	11	Yes	No	Yes	Yes	None

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal: 3	5.2 Other Features	Neck Cutoff: 0	5.4 Stream Ford or Animal Crossing:	No
Mid: 13	Delta: 0	Flood chutes: 3	Avulsion: 0	5.5 Straightening:	None
Point: 4	Island: 0	5.3 Steep Riffles and Head Cuts	Head Cuts: 0	Straightening Length (ft.):	0
Side: 8	Braiding: 0	Steep Riffles: 1	Trib Rejuv.: No	5.5 Dredging:	None

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:	6.4 Sediment Deposition:	Stream Gradient Type	Left	Right
6.2 Pool Substrate:	6.5 Channel Flow Status:	6.8 Bank Stability:		
6.3 Pool Variability:	6.6 Channel Alteration:	6.9 Bank Vegetation Protection		
Total Score: 0	6.7 Channel Sinuosity:	6.10 Riparian Veg. Zone Width:		
Habitat Rating: 0.00				
Habitat Stream Condition:				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Confined	Score	STD	Historic		
7.1 Channel Degradation		9	None	No	Geomorphic Rating	0.41
7.2 Channel Aggradation		7	None	No	Channel Evolution Model	F
7.3 Widening Channel		7	None	No	Channel Evolution Stage	III
7.4 Change in Planform		10	None	No	Geomorphic Condition	Fair
Total Score		33			Stream Sensitivity	High



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Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream: **Willow Brook**
Reach: **T2.03-A**
Segment Length(ft): **2,412**
Rain: **No**

SGAT Version: **4.56**
Organization: **Fitzgerald Environmental**
Observers: **JHB, MPL**
Completion Date: **8/20/2014**
Quality Control Status - Consultant: **Provisional**
Quality Control Status - Staff: **Provisional**

Step 0 - Location: **This segment begins at the reach break south of the intersection of West Rowe Hill and Rush Meadow Rd and continues upstream to the segmentation point south of the intersection of Banister and Rush Meadow Road**

Step 5 - Notes:

Step 7 - Narrative: **The first 1000ft of segment A were very similar to T2.02 (widening and aggrading B-type) and should be considered a part of that reach. The portion of segment A represented by our cross-section begins immediately downstream of the Rush Meadow Ln bridge and continues upstream to the segment break. This E-type segment had an active beaver dam impounding the upper half. Moderate/high incision was observed below the beaver dam. Slumping banks and point bar development indicate that planform is slowly adjusting. We assessed the reach as stage II but transitioning towards aggradation and planform adjustment. The stream bottom was primarily cobble and was stable.**

Step 1. Valley and Floodplain

1.1 Segmentation: Channel Dimensions	1.4 Adjacent Side	<u>Left</u>	<u>Right</u>	1.5 Valley Features
1.2 Alluvial Fan: None	Hillside Slope:	Hilly	Flat	Valley Width (ft): 200
1.3 Corridor Encroachments:	Continuous w/ Bank:	Never	Never	Width Determination: Estimated
<u>Length (ft)</u> <u>One</u> <u>Height</u> <u>Both</u> <u>Height</u>	Within 1 Bankfull W:	Sometimes	Never	Confinement Type: BD
Berm: 0	Texture:	Mixed	Mixed	In Rock Gorge: No
Road: 1,698 8 282 8	Human Caused Change in Valley Width?: Yes			
Railroad: 0				
Imp. Path: 0				
Dev.: 123				

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	2.0	1.0	No	
Ledge	Mid-segment	0.0	0.0	Yes	
Ledge	Mid-segment	5.0	3.0	Yes	
Ledge	Mid-segment	7.0	5.0	Yes	
Ledge	Mid-segment	3.0	2.0	Yes	



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Willow Brook**

Reach: **T2.03-A**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	17.50	2.11 Riffle/Step Spacing:	120 ft.	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	2.25	2.12 Substrate Composition		Bed:	220 mm
2.3 Mean Depth (ft.):	1.55	Bedrock:	0.0 %	Bar:	80 mm
2.4 Floodprone Width (ft.):	160.00	Boulder:	7.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	3.75	Cobble:	46.0 %	Stream Type:	E
Human Elev FloodPln (ft.):		Coarse Gravel:	22.0 %	Bed Material:	Cobble
2.6 Width/Depth Ratio:	11.29	Fine Gravel:	17.0 %	Subclass Slope:	None
2.7 Entrenchment Ratio:	9.14	Sand:	8.0 %	Bed Form:	Riffle-Pool
2.8 Incision Ratio:	1.67	Silt and Smaller:	0.0 %	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	No	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	Moderate	Detritus:	5.0 %	Reference Stream Type:	E
2.10 Riffles Type:	Sedimented	# Large Woody Debris:	13	Reference Bed Material:	Cobble
				Reference Subclass Slope:	None
				Reference Bedform:	Riffle-Pool

Step 3. Riparian Features

3.1 Stream Banks			Typical Bank Slope:	Steep	
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	233.3	286.6
Material Type:	Mix	Mix	Erosion Height (ft.):	2.6	3.4
Consistency:	Non-cohesive	Non-cohesive	Revetment Type:	Rip-Rap	Rip-Rap
Lower			Revetment Length:	167.9	23.3
Material Type:	Gravel	Gravel	Bank Canopy		
Consistency:	Non-cohesive	Non-cohesive	Canopy %:	51-75	26-50
			Mid-Channel Canopy:	Open	

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>
Dominant	>100	0-25
Sub-Dominant	0-25	>100
W less than 25	517	1,126
Buffer Vegetation Type		
Dominant	Herbaceous	Herbaceous
Sub-Dominant	Shrubs/Sapling	Shrubs/Sapling

3.3 Riparian Corridor

Corridor Land	<u>Left</u>	<u>Right</u>	<u>Left</u>	<u>Right</u>
Dominant	Shrubs/Sapling	Pasture	Mass Failures	
Sub-dominant	Forest	Shrubs/Sapling	Height	
(Legacy)	<u>Amount</u>	<u>Mean Hieght</u>	Gullies Number	0
Failures	None		Gullies Length	0
Gullies	None			



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: Willow Brook

Reach: T2.03-A

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	Abundant	4.5 Flow Regulation Type	None	4.7 Stormwater Inputs	None
4.2 Adjacent Wetlands:	Abundant	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	Low	Impoundments:		Other:	Tile Drain:
4.4 # of Debris Jams:	0	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	1
		(old) Upstrm Flow Reg.:		Affected Length (ft):	370

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	14	Yes	No	Yes	Yes	None
Bridge	13.5	Yes	No	No	No	Deposition Below
Bedrock Outcrops	18	Yes	No	Yes	Yes	None

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal: 0	5.2 Other Features	Neck Cutoff: 0	5.4 Stream Ford or Animal Crossing:	No
Mid: 5	Delta: 0	Flood chutes: 0	Avulsion: 0	5.5 Straightening:	Straightening
Point: 2	Island: 0	5.3 Steep Riffles and Head Cuts	Head Cuts: 0	Straightening Length (ft.):	531
Side: 6	Braiding: 0	Steep Riffles: 0	Trib Rejuv.: No	5.5 Dredging:	None

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:	6.4 Sediment Deposition:	Stream Gradient Type	<u>Left</u>	<u>Right</u>
6.2 Pool Substrate:	6.5 Channel Flow Status:	6.8 Bank Stability:		
6.3 Pool Variability:	6.6 Channel Alteration:	6.9 Bank Vegetation Protection		
Total Score: 0	6.7 Channel Sinuosity:	6.10 Riparian Veg. Zone Width:		
Habitat Rating: 0.00				
Habitat Stream Condition:				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Unconfined	Score	STD	Historic		
7.1 Channel Degradation		10	None	Yes	Geomorphic Rating	0.57
7.2 Channel Aggradation		12	None	No	Channel Evolution Model	F
7.3 Widening Channel		13	None	No	Channel Evolution Stage	II
7.4 Change in Planform		11	None	No	Geomorphic Condition	Fair
Total Score		46			Stream Sensitivity	High



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Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream: Willow Brook
Reach: T2.03-B
Segment Length(ft): 4,406
Rain: No

SGAT Version: 4.56
Organization: Fitzgerald Environmental
Observers: JHB, MPL
Completion Date: 8/20/2014
Quality Control Status - Consultant: Provisional
Quality Control Status - Staff: Provisional

Step 0 - Location: This reach begins at the segmentation point south of the intersection of Rush Meadow and Banister Road and continues to the reach break just upstream of where the stream crosses from the east to west side of Rush Meadow Road

Step 5 - Notes:

Step 7 - Narrative: Width and slope were variable through this segment, incision and entrenchment were consistently high. The lower segment was impacted by armoring on one or both banks, the upper segment typically had ledge along the left bank and tall bank armoring to Rush Meadow Road on the right bank. A large avulsion was observed mid segment in an area with less entrenchment. Overall this reach is stuck in stage II and due to natural or man-made hard banks it will likely remain there.

Step 1. Valley and Floodplain

1.1 Segmentation: Channel Dimensions	1.4 Adjacent Side	Left	Right	1.5 Valley Features
1.2 Alluvial Fan: None	Hillside Slope:	Extr.Steep	Steep	Valley Width (ft): 100
1.3 Corridor Encroachments:	Continuous w/ Bank:	Sometimes	Sometimes	Width Determination: Estimated
<u>Length (ft)</u> <u>One</u> <u>Height</u> <u>Both</u> <u>Height</u>	Within 1 Bankfull W:	Always	Sometimes	Confinement Type: SC
Berm: 0 0	Texture:	Gravel	Gravel	In Rock Gorge: No
Road: 4,406 8 0				Human Caused Change in Valley Width?: Yes
Railroad: 0 0				
Imp. Path: 0 0				
Dev.: 523 0				

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	4.0	0.0	No	
Ledge	Mid-segment	15.5	13.5	Yes	
Ledge	Mid-segment	0.0	0.0	No	



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Willow Brook**

Reach: **T2.03-B**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	22.18	2.11 Riffle/Step Spacing:	140 ft.	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	1.90	2.12 Substrate Composition		Bed:	500 mm
2.3 Mean Depth (ft.):	1.41	Bedrock:	0.0 %	Bar:	190 mm
2.4 Floodprone Width (ft.):	25.00	Boulder:	6.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	4.05	Cobble:	44.0 %	Stream Type:	F
Human Elev FloodPln (ft.):		Coarse Gravel:	18.0 %	Bed Material:	Cobble
2.6 Width/Depth Ratio:	15.73	Fine Gravel:	21.0 %	Subclass Slope:	None
2.7 Entrenchment Ratio:	1.13	Sand:	8.0 %	Bed Form:	Riffle-Pool
2.8 Incision Ratio:	2.13	Silt and Smaller:	3.0 %	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	Yes	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	Low	Detritus:	4.0 %	Reference Stream Type:	
2.10 Riffles Type:	Sedimented	# Large Woody Debris:	29	Reference Bed Material:	
				Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks					Typical Bank Slope: Steep				
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>	Near Bank Vegetation Type <u>Left</u>			<u>Right</u>
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	263.3	217.9	Dominant:	Coniferous	Herbaceous	
Material Type:	Mix	Mix	Erosion Height (ft.):	8.1	2.7	Sub-dominant:	Herbaceous	Shrubs/Sapling	
Consistency:	Non-cohesive	Non-cohesive	Revetment Type:	Rip-Rap	Rip-Rap	Bank Canopy			
Lower			Revetment Length:	703.5	1,059.7	Canopy %:	51-75	51-75	
Material Type:	Gravel	Gravel				Mid-Channel Canopy:		Closed	
Consistency:	Non-cohesive	Non-cohesive							

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>	Corridor Land	
Dominant	>100	51-100	Dominant	
Sub-Dominant	0-25	0-25	Sub-dominant	
W less than 25	1,285	2,130	(Legacy)	
Buffer Vegetation Type			Failures	
Dominant	Deciduous	Herbaceous	Gullies	
Sub-Dominant	Shrubs/Sapling	Mixed Trees		

3.3 Riparian Corridor

	<u>Left</u>	<u>Right</u>		<u>Left</u>	<u>Right</u>
Dominant	Forest	Residential	Mass Failures	101.89	114.74
Sub-Dominant	None	Pasture	Height	59	68
W less than 25	<u>Amount</u>	<u>Mean Hieght</u>	Gullies Number	0	
Failures	Multiple	17.0	Gullies Length	0	
Gullies	None				



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: Willow Brook

Reach: T2.03-B

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	Abundant	4.5 Flow Regulation Type	Small Withdrawal	4.7 Stormwater Inputs	None
4.2 Adjacent Wetlands:	Minimal	Flow Reg. Use:	Other	Field Ditch:	Road Ditch:
4.3 Flow Status:	Low	Impoundments:		Other:	Tile Drain:
4.4 # of Debris Jams:	3	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	0
		(old) Upstrm Flow Reg.:		Affected Length (ft):	0

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Old Abutment	16	Yes	No	No	Yes	None
Bridge	11.5	Yes	No	Yes	Yes	Scour Below, Alignment
Bridge	18	Yes	Yes	No	Yes	Deposition Above
Instream Culvert	8.5	Yes	No	Yes	Yes	Scour Below
Bedrock Outcrops	18	No	No	Yes	Yes	None

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	1	5.2 Other Features	Neck Cutoff:	0	5.4 Stream Ford or Animal Crossing:	Yes		
Mid:	4	Delta:	0	Flood chutes:	2	5.5 Straightening:	Straightening		
Point:	0	Island:	0	5.3 Steep Riffles and Head Cuts	Head Cuts:	0	Straightening Length (ft.):	394	
Side:	6	Braiding:	0	Steep Riffles:	2	Trib Rejuv.:	No	5.5 Dredging:	None

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradient Type	<u>Left</u>	<u>Right</u>
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:		
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection		
Total Score:	0	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:		
Habitat Rating:	0.00					
Habitat Stream Condition:						

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Confined	Score	STD	Historic		
7.1 Channel Degradation		4	B to F	Yes	Geomorphic Rating	0.38
7.2 Channel Aggradation		8	None	No	Channel Evolution Model	F
7.3 Widening Channel		10	None	No	Channel Evolution Stage	II
7.4 Change in Planform		8	None	No	Geomorphic Condition	Fair
Total Score		30			Stream Sensitivity	Extreme



Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream: **Willow Brook**
Reach: **T2.04-0**
Segment Length(ft): **3,051**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Fitzgerald Environmental**
Observers: **JHB, MPL**
Completion Date: **8/21/2014**
Quality Control Status - Consultant: **Provisional**
Quality Control Status - Staff: **Provisional**

Step 0 - Location: **This reach parallels Rush Meadow Rd to the east, and is bound by the two reach breaks south of Delano Rd.**

Step 5 - Notes:

Step 7 - Narrative: **This reach was heavily scoured and widened during TS Irene. A low and accessible forested floodplain was present along one bank for most of the reach and was heavily accessed during TSI and other recent high flows. Numerous areas of floodplain access and deposition and a recent channel avulsion were also observed. The channel is currently aggrading and adjusting planform.**

Step 1. Valley and Floodplain

1.1 Segmentation: None	1.4 Adjacent Side	<u>Left</u>	<u>Right</u>	1.5 Valley Features
1.2 Alluvial Fan: None	Hillside Slope:	Very Steep	Extr.Steep	Valley Width (ft): 150
1.3 Corridor Encroachments:	Continuous w/ Bank:	Sometimes	Sometimes	Width Determination: Estimated
<u>Length (ft)</u> <u>One</u> <u>Height</u> <u>Both</u> <u>Height</u>	Within 1 Bankfull W:	Always	Always	Confinement Type: BD
Berm: 0	Texture:	Gravel	Gravel	In Rock Gorge: No
Road: 872 8 0				Human Caused Change in Valley Width?: No
Railroad: 0 0				
Imp. Path: 0 0				
Dev.: 416 0				

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	1.0	0.0	No	



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Willow Brook**

Reach: **T2.04-0**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	23.16	2.11 Riffle/Step Spacing:	180 ft.	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	2.30	2.12 Substrate Composition		Bed:	500 mm
2.3 Mean Depth (ft.):	1.27	Bedrock:	0.0 %	Bar:	230 mm
2.4 Floodprone Width (ft.):	65.00	Boulder:	17.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	3.55	Cobble:	36.0 %	Stream Type:	C
Human Elev FloodPln (ft.):		Coarse Gravel:	27.0 %	Bed Material:	Cobble
2.6 Width/Depth Ratio:	18.24	Fine Gravel:	5.0 %	Subclass Slope:	b
2.7 Entrenchment Ratio:	2.81	Sand:	10.0 %	Bed Form:	Riffle-Pool
2.8 Incision Ratio:	1.54	Silt and Smaller:	5.0 %	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	Yes	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	Low	Detritus:	3.0 %	Reference Stream Type:	
2.10 Riffles Type:	Sedimented	# Large Woody Debris:	59	Reference Bed Material:	
				Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks					Typical Bank Slope: Steep				
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>	Near Bank Vegetation Type <u>Left</u>			<u>Right</u>
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	447.5	456.3	Dominant:	Coniferous	Coniferous	
Material Type:	Mix	Mix	Erosion Height (ft.):	4.3	3.7	Sub-dominant:	Shrubs/Sapling	Herbaceous	
Consistency:	Non-cohesive	Non-cohesive	Revetment Type:	Rip-Rap	Rip-Rap	Bank Canopy			
Lower			Revetment Length:	24.1	216.4	Canopy %:	76-100	76-100	
Material Type:	Gravel	Gravel				Mid-Channel Canopy: Closed			
Consistency:	Non-cohesive	Non-cohesive							

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>	Corridor Land	<u>Left</u>	<u>Right</u>
Dominant	>100	>100	Dominant	Forest	Forest
Sub-Dominant	0-25	51-100	Sub-dominant	Residential	Residential
W less than 25	220	230	(Legacy)	<u>Amount</u>	<u>Mean Hieght</u>
Buffer Vegetation Type			Failures	Multiple	15.0
Dominant	Coniferous	Coniferous	Gullies	None	
Sub-Dominant	Shrubs/Sapling	Shrubs/Sapling			

3.3 Riparian Corridor

	<u>Left</u>	<u>Right</u>
Mass Failures	18.086	258.82
	07	08
Height	10.0	17.6
Gullies Number	0	
Gullies Length	0	



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: Willow Brook

Reach: T2.04-0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	Abundant	4.5 Flow Regulation Type	None	4.7 Stormwater Inputs	None
4.2 Adjacent Wetlands:	Minimal	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	Low	Impoundments:		Other:	Tile Drain:
4.4 # of Debris Jams:	6	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	0	Affected Length (ft):	0
(old) Upstrm Flow Reg.:					
4.8 Channel Constrictions:	None				

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal: 1	5.2 Other Features	Neck Cutoff: 0	5.4 Stream Ford or Animal Crossing:	Yes
Mid: 5	Delta: 0	Flood chutes: 1	Avulsion: 1	5.5 Straightening:	None
Point: 0	Island: 0	5.3 Steep Riffles and Head Cuts	Head Cuts: 0	Straightening Length (ft.):	0
Side: 8	Braiding: 0	Steep Riffles: 1	Trib Rejuv.: No	5.5 Dredging:	None

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:	6.4 Sediment Deposition:	Stream Gradient Type	Left	Right
6.2 Pool Substrate:	6.5 Channel Flow Status:	6.8 Bank Stability:		
6.3 Pool Variability:	6.6 Channel Alteration:	6.9 Bank Vegetation Protection		
Total Score: 0	6.7 Channel Sinuosity:	6.10 Riparian Veg. Zone Width:		
Habitat Rating: 0.00				
Habitat Stream Condition:				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Unconfined	Score	STD	Historic		
7.1 Channel Degradation		12	None	Yes	Geomorphic Rating	0.49
7.2 Channel Aggradation		9	None	No	Channel Evolution Model	F
7.3 Widening Channel		10	None	No	Channel Evolution Stage	IV
7.4 Change in Planform		8	None	No	Geomorphic Condition	Fair
Total Score		39			Stream Sensitivity	High



Stream Geomorphic Assessment

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Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream:	Willow Brook	SGAT Version:	4.56
Reach:	T2.05-A	Organization:	Fitzgerald Environmental
Segment Length(ft):	1,049	Observers:	JHB, MPL
Rain:	Yes	Completion Date:	8/21/2014
		Quality Control Status - Consultant:	Provisional
		Quality Control Status - Staff:	Provisional

- Step 0 - Location: Begins at the reach break southeast of the intersection of Rush Meadow and Delano Rd and continues upstream to the segmentation point at the Rush Meadow Rd crossing
- Step 5 - Notes: Pebble count indicates bedrock as the dominant substrate type, but cobble is likely the dominant substrate size throughout the reach. The best riffle for a cross-section happened to be in an area with more bedrock along the banks. Sensitivity will be assessed as a C3.
- Step 7 - Narrative: This short segment had numerous bedrock grade controls and the majority of the bed was underlain with ledge. The segment widened in several locations during TS Irene leading to some erosion and a large mass failure at the bottom of the segment. The channel has since filled back in with developing side bars and appears to be slowly adjusting planform in areas with less bedrock. We assessed this reach as stage IIb due to some widening and planform adjustments and limited incision due to numerous grade controls.

Step 1. Valley and Floodplain

1.1 Segmentation: Channel Dimensions	1.4 Adjacent Side	<u>Left</u>	<u>Right</u>	1.5 Valley Features
1.2 Alluvial Fan: None	Hillside Slope:	Steep	Extr.Steep	Valley Width (ft): 120
1.3 Corridor Encroachments:	Continuous w/ Bank:	Never	Sometimes	Width Determination: Estimated
<u>Length (ft)</u> <u>One</u> <u>Height</u> <u>Both</u> <u>Height</u>	Within 1 Bankfull W:	Sometimes	Always	Confinement Type: BD
Berm: 0	Texture:	Mixed	Gravel	In Rock Gorge: No
Road: 557				Human Caused Change in Valley Width?: No
Railroad: 0				
Imp. Path: 0				
Dev.: 88				

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	9.0	6.0	Yes	
Ledge	Mid-segment	5.0	3.0	No	
Ledge	Mid-segment	4.0	2.0	Yes	
Ledge	Mid-segment	3.0	2.0	Yes	
Ledge	Mid-segment	5.0	3.0	Yes	



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Willow Brook**

Reach: **T2.05-A**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	15.60	2.11 Riffle/Step Spacing:	100 ft.	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	1.65	2.12 Substrate Composition		Bed:	430 mm
2.3 Mean Depth (ft.):	1.17	Bedrock:	50.0 %	Bar:	180 mm
2.4 Floodprone Width (ft.):	40.00	Boulder:	5.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	2.15	Cobble:	11.0 %	Stream Type:	C
Human Elev FloodPln (ft.):		Coarse Gravel:	18.0 %	Bed Material:	Bedrock
2.6 Width/Depth Ratio:	13.33	Fine Gravel:	5.0 %	Subclass Slope:	None
2.7 Entrenchment Ratio:	2.56	Sand:	11.0 %	Bed Form:	Riffle-Pool
2.8 Incision Ratio:	1.30	Silt and Smaller:	0.0 %	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	No	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	Low	Detritus:	4.0 %	Reference Stream Type:	
2.10 Riffles Type:	Complete	# Large Woody Debris:	29	Reference Bed Material:	
				Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks			Typical Bank Slope:	Steep		
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>	Near Bank Vegetation Type <u>Left</u> <u>Right</u>
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	34.6	76.7	Dominant: Herbaceous Deciduous
Material Type:	Mix	Mix	Erosion Height (ft.):	4.4	3.4	Sub-dominant: Shrubs/Sapling Shrubs/Sapling
Consistency:	Non-cohesive	Non-cohesive	Revetment Type:	Rip-Rap	Rip-Rap	Bank Canopy
Lower			Revetment Length:	31.0	103.1	Canopy %: 51-75 76-100
Material Type:	Gravel	Bedrock				Mid-Channel Canopy: Closed
Consistency:	Non-cohesive	Cohesive				

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>	Corridor Land	<u>Left</u>	<u>Right</u>
Dominant	26-50	51-100	Dominant	Shrubs/Sapling	Forest
Sub-Dominant	0-25	>100	Sub-dominant	Hay	Commercial
W less than 25	849	0	(Legacy)	<u>Amount</u>	<u>Mean Hieght</u>
Buffer Vegetation Type			Failures	Multiple	25.0
Dominant	Herbaceous	Mixed Trees	Gullies	None	
Sub-Dominant	Shrubs/Sapling	Shrubs/Sapling			

3.3 Riparian Corridor

	<u>Left</u>	<u>Right</u>		<u>Left</u>	<u>Right</u>
Mass Failures					73.306
Height					65
Gullies Number	0				27.1
Gullies Length	0				



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: Willow Brook

Reach: T2.05-A

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	Minimal	4.5 Flow Regulation Type	None	4.7 Stormwater Inputs	None
4.2 Adjacent Wetlands:	Minimal	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	Low	Impoundments:		Other:	Tile Drain:
4.4 # of Debris Jams:	5	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	0
		(old) Upstrm Flow Reg.:		Affected Length (ft):	0

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Old Abutment	13	Yes	No	Yes	Yes	None
Bridge	10	Yes	No	Yes	Yes	Deposition Above, Deposition Below

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal: 0	5.2 Other Features	Neck Cutoff: 0	5.4 Stream Ford or Animal Crossing:	No
Mid: 3	Delta: 0	Flood chutes: 0	Avulsion: 0	5.5 Straightening:	None
Point: 0	Island: 0	5.3 Steep Riffles and Head Cuts	Head Cuts: 0	Straightening Length (ft.):	0
Side: 5	Braiding: 0	Steep Riffles: 0	Trib Rejuv.: No	5.5 Dredging:	None

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:	6.4 Sediment Deposition:	Stream Gradient Type	Left	Right
6.2 Pool Substrate:	6.5 Channel Flow Status:	6.8 Bank Stability:		
6.3 Pool Variability:	6.6 Channel Alteration:	6.9 Bank Vegetation Protection		
Total Score: 0	6.7 Channel Sinuosity:	6.10 Riparian Veg. Zone Width:		
Habitat Rating: 0.00				
Habitat Stream Condition:				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Unconfined	Score	STD	Historic		
7.1 Channel Degradation		14	None	No	Geomorphic Rating	0.65
7.2 Channel Aggradation		13	None	No	Channel Evolution Model	D
7.3 Widening Channel		13	None	No	Channel Evolution Stage	IIb
7.4 Change in Planform		12	None	No	Geomorphic Condition	Good
Total Score		52			Stream Sensitivity	Moderate



Stream Geomorphic Assessment

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Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream: **Willow Brook**
Reach: **T2.05-B**
Segment Length(ft): **939**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Fitzgerald Environmental**
Observers: **JHB, MPL**
Completion Date: **8/21/2014**
Quality Control Status - Consultant: **Provisional**
Quality Control Status - Staff: **Provisional**

Step 0 - Location: **This segment begins at the segmentation point at the rush meadow road crossing and continues upstream to reach break about 250 upstream of the second Rush Meadow Rd crossing.**

Step 5 - Notes:

Step 7 - Narrative: **This short segment is E-type by reference and had moderate incision. We did not observe any evidence of widening or planform adjustment, therefore we assessed this segment as Stage II. The short stretch upstream of the Rush Meadow bridge is highly encroached by the road and is departed to F-type.**

Step 1. Valley and Floodplain

1.1 Segmentation: Channel Dimensions	1.4 Adjacent Side	<u>Left</u>	<u>Right</u>	1.5 Valley Features
1.2 Alluvial Fan: None	Hillside Slope:	Hilly	Hilly	Valley Width (ft): 180
1.3 Corridor Encroachments:	Continuous w/ Bank:	Never	Sometimes	Width Determination: Estimated
<u>Length (ft)</u> <u>One</u> <u>Height</u> <u>Both</u> <u>Height</u>	Within 1 Bankfull W:	Sometimes	Sometimes	Confinement Type: VB
Berm: 0	Texture:	Mixed	Mixed	In Rock Gorge: No
Road: 939 8 0				Human Caused Change in Valley Width?: Yes
Railroad: 0				
Imp. Path: 0				
Dev.: 183 0				

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	9.0	6.0	No	
Ledge	Mid-segment	2.0	1.0	No	



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Willow Brook**

Reach: **T2.05-B**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	10.80	2.11 Riffle/Step Spacing:	130 ft.	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	2.60	2.12 Substrate Composition		Bed:	280 mm
2.3 Mean Depth (ft.):	1.97	Bedrock:	0.0 %	Bar:	N/A mm
2.4 Floodprone Width (ft.):	95.00	Boulder:	5.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	3.90	Cobble:	28.0 %	Stream Type:	E
Human Elev FloodPln (ft.):		Coarse Gravel:	42.0 %	Bed Material:	Gravel
2.6 Width/Depth Ratio:	5.48	Fine Gravel:	9.0 %	Subclass Slope:	None
2.7 Entrenchment Ratio:	8.80	Sand:	16.0 %	Bed Form:	Riffle-Pool
2.8 Incision Ratio:	1.50	Silt and Smaller:	0.0 %	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	No	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	Low	Detritus:	3.0 %	Reference Stream Type:	E
2.10 Riffles Type:	Sedimented	# Large Woody Debris:	14	Reference Bed Material:	Gravel
				Reference Subclass Slope:	None
				Reference Bedform:	Riffle-Pool

Step 3. Riparian Features

3.1 Stream Banks			Typical Bank Slope:	Steep	
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	0.0	129.2
Material Type:	Mix	Mix	Erosion Height (ft.):	0.0	3.0
Consistency:	Non-cohesive	Non-cohesive	Revetment Type:	None	Rip-Rap
Lower			Revetment Length:	0.0	199.0
Material Type:	Mix	Mix			
Consistency:	Non-cohesive	Non-cohesive			
			Near Bank Vegetation Type	<u>Left</u>	<u>Right</u>
			Dominant:	Herbaceous	Herbaceous
			Sub-dominant:	Shrubs/Sapling	Shrubs/Sapling
			Bank Canopy		
			Canopy %:	51-75	26-50
			Mid-Channel Canopy:	Open	

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>	Corridor Land
Dominant	51-100	0-25	Dominant
Sub-Dominant	26-50	26-50	Sub-dominant
W less than 25	0	536	(Legacy)
Buffer Vegetation Type			Failures
Dominant	Herbaceous	Herbaceous	Gullies
Sub-Dominant	Shrubs/Sapling	Shrubs/Sapling	

3.3 Riparian Corridor

	<u>Left</u>	<u>Right</u>		<u>Left</u>	<u>Right</u>
	Shrubs/Sapling	Pasture	Mass Failures		
	Commercial	Shrubs/Sapling	Height		
	<u>Amount</u>	<u>Mean Hieght</u>	Gullies Number	0	
	None		Gullies Length	0	
	None				



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: Willow Brook

Reach: T2.05-B

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	Abundant	4.5 Flow Regulation Type	None	4.7 Stormwater Inputs	None
4.2 Adjacent Wetlands:	Minimal	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	Low	Impoundments:		Other:	Tile Drain:
4.4 # of Debris Jams:	3	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	0
		(old) Upstrm Flow Reg.:		Affected Length (ft):	0

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	10	Yes	No	Yes	Yes	None

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal: 0	5.2 Other Features	Neck Cutoff: 0	5.4 Stream Ford or Animal Crossing:	No
Mid: 0	Delta: 0	Flood chutes: 0	Avulsion: 0	5.5 Straightening:	Straightening
Point: 0	Island: 0	5.3 Steep Riffles and Head Cuts	Head Cuts: 0	Straightening Length (ft.):	378
Side: 1	Braiding: 0	Steep Riffles: 0	Trib Rejuv.: No	5.5 Dredging:	None

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:	6.4 Sediment Deposition:	Stream Gradient Type	<u>Left</u>	<u>Right</u>
6.2 Pool Substrate:	6.5 Channel Flow Status:	6.8 Bank Stability:		
6.3 Pool Variability:	6.6 Channel Alteration:	6.9 Bank Vegetation Protection		
Total Score: 0	6.7 Channel Sinuosity:	6.10 Riparian Veg. Zone Width:		
Habitat Rating: 0.00				
Habitat Stream Condition:				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Unconfined	Score	STD	Historic		
7.1 Channel Degradation		9	None	No	Geomorphic Rating	0.55
7.2 Channel Aggradation		10	None	No	Channel Evolution Model	F
7.3 Widening Channel		12	None	No	Channel Evolution Stage	II
7.4 Change in Planform		13	None	No	Geomorphic Condition	Fair
Total Score		44			Stream Sensitivity	Extreme



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Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream: **Reading Hill Brook**
Reach: **T3.01-0**
Segment Length(ft): **3,017**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Fitzgerald Environmental**
Observers: **JHB, MPL**
Completion Date: **8/7/2014**
Quality Control Status - Consultant: **Provisional**
Quality Control Status - Staff: **Provisional**

Step 0 - Location: **Begins at the reach break South of the intersection of Vt-106 and Agony Hill Rd and continues upstream to the next reach break just south of the talc mine storage ponds**

Step 5 - Notes:

Step 7 - Narrative: **This segment had a unique bedform and channel characteristics. It is E-type currently and likely also by reference. We observed numerous grade controls that represented most of the vertical drop within the reach. Riffles below the grade controls were very clean cobble substrate, the remainder of the reach consisted of deep runs and pools. Encroachment from Rt 106 decreased the floodplain throughout, especially in the upper reach where the road was immediately adjacent to the channel. Most of the reach was likely historically straightened, however the grade controls limited incision decreasing the impact. We assessed the reach as stage IIc with some observed aggradation and planform changes.**

Step 1. Valley and Floodplain

1.1 Segmentation: None	1.4 Adjacent Side	<u>Left</u>	<u>Right</u>	1.5 Valley Features
1.2 Alluvial Fan: None	Hillside Slope:	Steep	Hilly	Valley Width (ft): 200
1.3 Corridor Encroachments:	Continuous w/ Bank:	Never	Never	Width Determination: Measured
<u>Length (ft)</u> <u>One</u> <u>Height</u> <u>Both</u> <u>Height</u>	Within 1 Bankfull W:	Sometimes	Never	Confinement Type: BD
Berm: 123 11 0	Texture:	Mixed	Mixed	In Rock Gorge: No
Road: 1,771 10 0				Human Caused Change in Valley Width?: Yes
Railroad: 0 0				
Imp. Path: 0 0				
Dev.: 180 0				

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	5.0	3.0	No	
Ledge	Mid-segment	2.0	0.0	No	
Ledge	Mid-segment	1.0	0.0	No	
Ledge	Mid-segment	3.0	2.0	No	
Ledge	Mid-segment	1.0	0.0	No	
Ledge	Mid-segment	2.0	1.0	No	
Ledge	Mid-segment	3.0	2.0	No	
Ledge	Mid-segment	4.0	2.0	No	
Ledge	Mid-segment	0.0	0.0	No	
Ledge	Mid-segment	4.0	2.0	No	



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Reading Hill Brook**

Reach: **T3.01-0**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	14.00	2.11 Riffle/Step Spacing:	120 ft.	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	2.65	2.12 Substrate Composition		Bed:	400 mm
2.3 Mean Depth (ft.):	1.96	Bedrock:	0.0 %	Bar:	N/A mm
2.4 Floodprone Width (ft.):	560.00	Boulder:	1.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	3.65	Cobble:	40.0 %	Stream Type:	E
Human Elev FloodPln (ft.):		Coarse Gravel:	46.0 %	Bed Material:	Gravel
2.6 Width/Depth Ratio:	7.14	Fine Gravel:	8.0 %	Subclass Slope:	None
2.7 Entrenchment Ratio:	40.00	Sand:	5.0 %	Bed Form:	Plane Bed
2.8 Incision Ratio:	1.38	Silt and Smaller:	0.0 %	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	No	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	High	Detritus:	4.0 %	Reference Stream Type:	
2.10 Riffles Type:	Sedimented	# Large Woody Debris:	25	Reference Bed Material:	
				Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks			Typical Bank Slope:	Steep	
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	59.3	220.9
Material Type:	Mix	Mix	Erosion Height (ft.):	2.3	3.4
Consistency:	Non-cohesive	Non-cohesive	Revetment Type:	Rip-Rap	Rip-Rap
Lower			Revetment Length:	234.6	463.7
Material Type:	Mix	Mix			
Consistency:	Non-cohesive	Non-cohesive			
			Near Bank Vegetation Type	<u>Left</u>	<u>Right</u>
			Dominant:	Shrubs/Sapling	Herbaceous
			Sub-dominant:	Herbaceous	Shrubs/Sapling
			Bank Canopy		
			Canopy %:	26-50	51-75
			Mid-Channel Canopy:	Open	

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>
Dominant	>100	0-25
Sub-Dominant	0-25	51-100
W less than 25	390	1,533
Buffer Vegetation Type		
Dominant	Herbaceous	Herbaceous
Sub-Dominant	Shrubs/Sapling	Shrubs/Sapling

3.3 Riparian Corridor

Corridor Land	<u>Left</u>	<u>Right</u>	<u>Left</u>	<u>Right</u>
Dominant	Shrubs/Sapling	Commercial	Mass Failures	
Sub-dominant	Residential	Residential	Height	
(Legacy)	<u>Amount</u>	<u>Mean Hieght</u>	Gullies Number	0
Failures	None		Gullies Length	0
Gullies	None			



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: Reading Hill Brook

Reach: T3.01-0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	Abundant	4.5 Flow Regulation Type	Small Withdrawal	4.7 Stormwater Inputs	
4.2 Adjacent Wetlands:	Abundant	Flow Reg. Use:	Other	Field Ditch:	0 Road Ditch: 1
4.3 Flow Status:	Low	Impoundments:		Other:	0 Tile Drain: 0
4.4 # of Debris Jams:	1	Impoundment Loc.:		Overland Flow:	0 Urb Strm Wtr Pipe: 0
		4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	0
		(old) Upstrm Flow Reg.:		Affected Length (ft):	0

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Old Abutment	11.5	No	No	Yes	Yes	None
Bridge	17	Yes	No	No	Yes	Deposition Above,Deposition Below
Bridge	14.5	Yes	No	No	Yes	Deposition Below
Bridge	32	Yes	No	No	Yes	Deposition Above,Deposition Below,Scour Above,Scour Below
Bridge	12	Yes	No	Yes	Yes	Deposition Above,Deposition Below

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	1	5.2 Other Features	Neck Cutoff:	0	5.4 Stream Ford or Animal Crossing:	No
Mid:	4	Delta:	0	Flood chutes:	0	5.5 Straightening:	Straightening
Point:	0	Island:	0	5.3 Steep Riffles and Head Cuts	Head Cuts:	0	Straightening Length (ft.): 994
Side:	4	Braiding:	0	Steep Riffles:	3	Trib Rejuv.:	No
						5.5 Dredging:	None

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradient Type	<u>Left</u>	<u>Right</u>
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:		
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection		
Total Score:	0	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:		
Habitat Rating:	0.00					
Habitat Stream Condition:						

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Unconfined	Score	STD	Historic		
7.1 Channel Degradation		13	None	Yes	Geomorphic Rating	0.57
7.2 Channel Aggradation		11	None	No	Channel Evolution Model	D
7.3 Widening Channel		13	None	No	Channel Evolution Stage	IIc
7.4 Change in Planform		9	None	No	Geomorphic Condition	Fair
Total Score		46			Stream Sensitivity	Extreme



Stream Geomorphic Assessment

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Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream:	Reading Hill Brook	SGAT Version:	4.56
Reach:	T3.02-A	Organization:	Fitzgerald Environmental
Segment Length(ft):	1,161	Observers:	JHB, MPL
Rain:	Yes	Completion Date:	8/7/2014
		Quality Control Status - Consultant:	Provisional
		Quality Control Status - Staff:	Provisional
		Why Not Assessed:	bedrock gorge

Step 0 - Location: This segment spans the length of the talc mine storage ponds and is bound by the reach break downstream and the segmentation point upstream. The segment was walked (quickly) but not fully assessed due to property access concerns. Effectively a gorge.

Step 5 - Notes: Entire segment was a blasted channel around the talc mine ponds.

Step 7 - Narrative: The constructed channel was blasted bedrock in the lower and upper portions of the segment, and poured concrete in the middle section. Some bed scour was visible but the channel appeared stable. A small area of bank instability was observed immediately downstream of the poured concrete, this area could result in a catastrophic failure of the berm holding the large pond on the left floodplain. Recent survey marking indicate that this instability is being addressed. No floodplain areas were observed and this reach has no opportunities for widening or planform adjustment. It will be stuck in Stage II as an F-type channel for a long time.

Step 1. Valley and Floodplain

1.1 Segmentation: Subreach	1.4 Adjacent Side	<u>Left</u>	<u>Right</u>	1.5 Valley Features
1.2 Alluvial Fan: None	Hillside Slope:	Extr.Steep	Extr.Steep	Valley Width (ft): 45
1.3 Corridor Encroachments:	Continuous w/ Bank:	Sometimes	Always	Width Determination: Measured
<u>Length (ft)</u> <u>One</u> <u>Height</u> <u>Both</u> <u>Height</u>	Within 1 Bankfull W:	Always	Always	Confinement Type: NC
Berm: 1,103 20 0	Texture:	Other	Bedrock	In Rock Gorge: Yes
Road: 1,161 10 0				Human Caused Change in Valley Width?: Yes
Railroad: 0 0				
Imp. Path: 0 0				
Dev.: 0 0				

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	4.0	2.0	No	
Ledge	Mid-segment	3.0	0.0	No	



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Reading Hill Brook**

Reach: **T3.02-A**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):		2.11 Riffle/Step Spacing:		2.13 Average Largest Particle on	
2.2 Max Depth (ft.):		2.12 Substrate Composition		Bed:	
2.3 Mean Depth (ft.):		Bedrock:	%	Bar:	
2.4 Floodprone Width (ft.):		Boulder:	%	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):		Cobble:	%	Stream Type:	F
Human Elev FloodPln (ft.):		Coarse Gravel:	%	Bed Material:	Bedrock
2.6 Width/Depth Ratio:	0.00	Fine Gravel:	%	Subclass Slope:	
2.7 Entrenchment Ratio:	0.00	Sand:	%	Bed Form:	Plane Bed
2.8 Incision Ratio:	0.00	Silt and Smaller:	%	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:		2.15 Sub-reach Stream Type	
2.9 Sinuosity:		Detritus:	0.0 %	Reference Stream Type:	B
2.10 Riffles Type:		# Large Woody Debris:		Reference Bed Material:	Boulder
				Reference Subclass Slope:	
				Reference Bedform:	Step-Pool

Step 3. Riparian Features

3.1 Stream Banks					Typical Bank Slope:			
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>	Near Bank Vegetation Type		
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	0.0	0.0	Dominant:	Herbaceous	Coniferous
Material Type:	Bedrock	Bedrock	Erosion Height (ft.):	0.0	0.0	Sub-dominant:	Shrubs/Sapling	Shrubs/Sapling
Consistency:	Cohesive	Cohesive	Revetment Type:	Multiple	Rip-Rap	Bank Canopy		
Lower			Revetment Length:	1,005.0	461.6	Canopy %:	1-25	76-100
Material Type:	Bedrock	Bedrock				Mid-Channel Canopy:	Closed	
Consistency:	Cohesive	Cohesive						

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>	Corridor Land	
Dominant	26-50	26-50	Dominant	
Sub-Dominant	0-25	51-100	Sub-dominant	
W less than 25	0	0	(Legacy)	
Buffer Vegetation Type			Failures	
Dominant	Herbaceous	Mixed Trees	Gullies	
Sub-Dominant	Shrubs/Sapling	Herbaceous		

3.3 Riparian Corridor

	<u>Left</u>	<u>Right</u>		<u>Left</u>	<u>Right</u>		<u>Left</u>	<u>Right</u>
Dominant	26-50	26-50	Dominant	Industrial	Forest	Mass Failures	38.079	25
Sub-Dominant	0-25	51-100	Sub-dominant	Shrubs/Sapling	Commercial	Height	15.0	
W less than 25	0	0	(Legacy)	<u>Amount</u>	<u>Mean Hieght</u>	Gullies Number	0	
Buffer Vegetation Type			Failures	One	15.0	Gullies Length	0	
Dominant	Herbaceous	Mixed Trees	Gullies	None				
Sub-Dominant	Shrubs/Sapling	Herbaceous						



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: Reading Hill Brook

Reach: T3.02-A

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	Abundant	4.5 Flow Regulation Type	None	4.7 Stormwater Inputs	
4.2 Adjacent Wetlands:	None	Flow Reg. Use:		Field Ditch:	0 Road Ditch: 1
4.3 Flow Status:	Low	Impoundments:		Other:	0 Tile Drain: 0
4.4 # of Debris Jams:	0	Impoundment Loc.:		Overland Flow:	0 Urb Strm Wtr Pipe: 0
		4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	0
		(old) Upstrm Flow Reg.:		Affected Length (ft):	0

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Other	10	Yes	No	Yes	Yes	None
Other	12	Yes	No	Yes	Yes	None
Instream Culvert	15	Yes	No	Yes	Yes	Deposition Above

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal: 0	5.2 Other Features	Neck Cutoff: 0	5.4 Stream Ford or Animal Crossing:	No
Mid: 0	Delta: 0	Flood chutes: 0	Avulsion: 0	5.5 Straightening:	Straightening
Point: 0	Island: 0	5.3 Steep Riffles and Head Cuts	Head Cuts: 0	Straightening Length (ft.):	1,161
Side: 0	Braiding: 0	Steep Riffles: 0	Trib Rejuv.: No	5.5 Dredging:	None

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:	6.4 Sediment Deposition:	Stream Gradient Type	<u>Left</u>	<u>Right</u>
6.2 Pool Substrate:	6.5 Channel Flow Status:	6.8 Bank Stability:		
6.3 Pool Variability:	6.6 Channel Alteration:	6.9 Bank Vegetation Protection		
Total Score:	6.7 Channel Sinuosity:	6.10 Riparian Veg. Zone Width:		
Habitat Rating:				
Habitat Stream Condition:				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Confined	<u>Score</u>	<u>STD</u>	<u>Historic</u>	Geomorphic Rating
7.1 Channel Degradation					Channel Evolution Model
7.2 Channel Aggradation					F
7.3 Widening Channel					Channel Evolution Stage
7.4 Change in Planform					II
Total Score					Geomorphic Condition
					Poor
					Stream Sensitivity
					High



Stream Geomorphic Assessment

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Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream:	Reading Hill Brook	SGAT Version:	4.56
Reach:	T3.02-B	Organization:	Fitzgerald Environmental
Segment Length(ft):	3,649	Observers:	JHB, MPL
Rain:	Yes	Completion Date:	8/7/2014
		Quality Control Status - Consultant:	Provisional
		Quality Control Status - Staff:	Provisional

Step 0 - Location: This reach begins at the segmentation point upstream of the talc mine storage ponds and continues upstream to the reach break downstream of the intersection of Rt-106 and Reading Farms Rd

Step 5 - Notes:

Step 7 - Narrative: This E-type reach has some areas of historic straightening that remain straightened. The remainder of the reach is adjusting planform and we observed several potential neck cutoffs and a few active cutoffs and flood chutes. Many beaver dams were recently mechanically removed from the segment, leading to some areas of temporary erosion as the bed adjusts slope.

Step 1. Valley and Floodplain

1.1 Segmentation: Subreach	1.4 Adjacent Side	<u>Left</u>	<u>Right</u>	1.5 Valley Features
1.2 Alluvial Fan: None	Hillside Slope:	Hilly	Steep	Valley Width (ft): 290
1.3 Corridor Encroachments:	Continuous w/ Bank:	Never	Never	Width Determination: Estimated
<u>Length (ft)</u> <u>One</u> <u>Height</u> <u>Both</u> <u>Height</u>	Within 1 Bankfull W:	Never	Never	Confinement Type: VB
Berm: 0	Texture:	Mixed	Mixed	In Rock Gorge: No
Road: 2,139 10 0				Human Caused Change in Valley Width?: Yes
Railroad: 0 0				
Imp. Path: 0 0				
Dev.: 0 0				

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	0.0	0.0	No	
Ledge	Mid-segment	0.0	0.0	No	
Ledge	Mid-segment	5.0	2.0	No	
Ledge	Mid-segment	3.0	1.0	No	
Ledge	Mid-segment	1.0	0.0	No	
Ledge	Mid-segment	0.0	0.0	No	
Ledge	Mid-segment	1.0	0.0	No	
Ledge	Mid-segment	0.0	0.0	No	
Ledge	Mid-segment	0.0	0.0	No	
Ledge	Mid-segment	3.5	2.0	No	



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Reading Hill Brook**

Reach: **T3.02-B**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	12.20	2.11 Riffle/Step Spacing:	90 ft.	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	2.90	2.12 Substrate Composition		Bed:	120 mm
2.3 Mean Depth (ft.):	2.31	Bedrock:	0.0 %	Bar:	40 mm
2.4 Floodprone Width (ft.):	150.00	Boulder:	0.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	4.10	Cobble:	2.0 %	Stream Type:	E
Human Elev FloodPln (ft.):		Coarse Gravel:	59.0 %	Bed Material:	Gravel
2.6 Width/Depth Ratio:	5.28	Fine Gravel:	22.0 %	Subclass Slope:	None
2.7 Entrenchment Ratio:	12.30	Sand:	17.0 %	Bed Form:	Riffle-Pool
2.8 Incision Ratio:	1.41	Silt and Smaller:	0.0 %	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	No	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	High	Detritus:	6.0 %	Reference Stream Type:	
2.10 Riffles Type:	Sedimented	# Large Woody Debris:	26	Reference Bed Material:	
				Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks			Typical Bank Slope:	Steep	
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	247.4	197.5
Material Type:	Mix	Mix	Erosion Height (ft.):	2.6	2.2
Consistency:	Non-cohesive	Non-cohesive	Revetment Type:	Rip-Rap	Rip-Rap
Lower			Revetment Length:	251.4	350.3
Material Type:	Mix	Mix			
Consistency:	Non-cohesive	Non-cohesive			
			Near Bank Vegetation Type	<u>Left</u>	<u>Right</u>
			Dominant:	Shrubs/Sapling	Shrubs/Sapling
			Sub-dominant:	Herbaceous	Herbaceous
			Bank Canopy		
			Canopy %:	1-25	1-25
			Mid-Channel Canopy:	Open	

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>	Corridor Land	<u>Left</u>	<u>Right</u>
Dominant	>100	51-100	Dominant	Shrubs/Sapling	Commercial
Sub-Dominant	0-25	0-25	Sub-dominant	Residential	Shrubs/Sapling
W less than 25	833	1,783	(Legacy)	<u>Amount</u>	<u>Mean Hieght</u>
Buffer Vegetation Type			Failures	None	
Dominant	Herbaceous	Herbaceous	Gullies	None	
Sub-Dominant	Shrubs/Sapling	Shrubs/Sapling			

3.3 Riparian Corridor

Mass Failures		
Height		
Gullies Number	0	
Gullies Length	0	



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: Reading Hill Brook

Reach: T3.02-B

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	Abundant	4.5 Flow Regulation Type	None	4.7 Stormwater Inputs	
4.2 Adjacent Wetlands:	Abundant	Flow Reg. Use:		Field Ditch:	0 Road Ditch: 4
4.3 Flow Status:	Low	Impoundments:		Other:	0 Tile Drain: 0
4.4 # of Debris Jams:	2	Impoundment Loc.:		Overland Flow:	0 Urb Strm Wtr Pipe: 0
		4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	2
		(old) Upstrm Flow Reg.:		Affected Length (ft):	85

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Old Abutment	10	Yes	No	Yes	Yes	None

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal: 0	5.2 Other Features	Neck Cutoff: 1	5.4 Stream Ford or Animal Crossing:	No
Mid: 0	Delta: 0	Flood chutes: 0	Avulsion: 0	5.5 Straightening:	Straightening
Point: 5	Island: 0	5.3 Steep Riffles and Head Cuts	Head Cuts: 0	Straightening Length (ft.):	776
Side: 2	Braiding: 0	Steep Riffles: 1	Trib Rejuv.: No	5.5 Dredging:	None

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradient Type	Left	Right
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:		
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection		
Total Score:	0	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:		
Habitat Rating:	0.00					
Habitat Stream Condition:						

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Unconfined	Score	STD	Historic		
7.1 Channel Degradation		13	None	No	Geomorphic Rating	0.65
7.2 Channel Aggradation		15	None	No	Channel Evolution Model	F
7.3 Widening Channel		15	None	No	Channel Evolution Stage	IV
7.4 Change in Planform		9	None	No	Geomorphic Condition	Good
Total Score		52			Stream Sensitivity	High



Stream Geomorphic Assessment

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Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream:	Reading Hill Brook	SGAT Version:	4.56
Reach:	T3.03-0	Organization:	Fitzgerald Environmental
Segment Length(ft):	3,090	Observers:	JHB, MPL
Rain:	Yes	Completion Date:	8/7/2014
		Quality Control Status - Consultant:	Provisional
		Quality Control Status - Staff:	Provisional

- Step 0 - Location: This reach follows Rt-106. The lower reach break is found near Reading Farms Rd., and the upper reach break is found east of the intersection of Whitmore Circle and Jenne Road.
- Step 5 - Notes: Head cut is due to an abandoned beaver dam, not indicative of channel degradation. There is a short stretch (400-500 ft) of the reach downstream of the Whitmore Circle crossing that has numerous grade controls and different stream morphology. This stretch has C-type geometry in a narrow valley settings. This area was not segmented out during surveys due to its short length.
- Step 7 - Narrative: The lower portion of the reach has one recently removed beaver dam and alternates between reference C and reference E. Above the Whitmore Circle culvert the reach flows through an active beaver meadow. Much of this portion is highly impacted by beaver dams with multiple channels and deep deposition. The cross-section was collected near the top of the reach where the channel returns to a single thread and is E-type.

Step 1. Valley and Floodplain

1.1 Segmentation: None	1.4 Adjacent Side	<u>Left</u>	<u>Right</u>	1.5 Valley Features
1.2 Alluvial Fan: None	Hillside Slope:	Hilly	Hilly	Valley Width (ft): 200
1.3 Corridor Encroachments:	Continuous w/ Bank:	Never	Never	Width Determination: Estimated
<u>Length (ft)</u> <u>One</u> <u>Height</u> <u>Both</u> <u>Height</u>	Within 1 Bankfull W:	Never	Never	Confinement Type: VB
Berm: 0 0	Texture:	Mixed	Mixed	In Rock Gorge: No
Road: 1,924 10 0				Human Caused Change in Valley Width?: Yes
Railroad: 0 0				
Imp. Path: 0 0				
Dev.: 0 0				

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	0.0	0.0	No	
Ledge	Mid-segment	2.0	1.0	No	
Ledge	Mid-segment	0.0	0.0	No	
Ledge	Mid-segment	2.0	1.0	No	
Ledge	Mid-segment	4.0	3.0	No	
Ledge	Mid-segment	2.0	1.0	No	
Ledge	Mid-segment	1.0	0.0	No	
Ledge	Mid-segment	2.0	1.0	No	



Stream Geomorphic Assessment

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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Reading Hill Brook**

Reach: **T3.03-0**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	11.20	2.11 Riffle/Step Spacing:	70 ft.	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	1.80	2.12 Substrate Composition		Bed:	140 mm
2.3 Mean Depth (ft.):	1.40	Bedrock:	0.0 %	Bar:	50 mm
2.4 Floodprone Width (ft.):	200.00	Boulder:	0.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	2.60	Cobble:	17.0 %	Stream Type:	E
Human Elev FloodPln (ft.):		Coarse Gravel:	52.0 %	Bed Material:	Gravel
2.6 Width/Depth Ratio:	8.00	Fine Gravel:	21.0 %	Subclass Slope:	None
2.7 Entrenchment Ratio:	17.86	Sand:	10.0 %	Bed Form:	Riffle-Pool
2.8 Incision Ratio:	1.44	Silt and Smaller:	0.0 %	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	No	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	High	Detritus:	8.0 %	Reference Stream Type:	
2.10 Riffles Type:	Complete	# Large Woody Debris:	69	Reference Bed Material:	
				Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks			Typical Bank Slope:	Steep	
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	150.0	28.8
Material Type:	Mix	Mix	Erosion Height (ft.):	2.8	3.0
Consistency:	Non-cohesive	Non-cohesive	Revetment Type:	Rip-Rap	Rip-Rap
Lower			Revetment Length:	1,025.0	48.5
Material Type:	Mix	Mix			
Consistency:	Non-cohesive	Non-cohesive			
			Near Bank Vegetation Type	<u>Left</u>	<u>Right</u>
			Dominant:	Herbaceous	Herbaceous
			Sub-dominant:	Shrubs/Sapling	Shrubs/Sapling
			Bank Canopy		
			Canopy %:	1-25	1-25
			Mid-Channel Canopy:	Open	

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>
Dominant	>100	>100
Sub-Dominant	0-25	26-50
W less than 25	1,067	104
Buffer Vegetation Type		
Dominant	Herbaceous	Herbaceous
Sub-Dominant	Shrubs/Sapling	Shrubs/Sapling

3.3 Riparian Corridor

Corridor Land	<u>Left</u>	<u>Right</u>		<u>Left</u>	<u>Right</u>
Dominant	Shrubs/Sapling	Shrubs/Sapling	Mass Failures		
Sub-dominant	Commercial	Forest	Height		
(Legacy)	<u>Amount</u>	<u>Mean Height</u>	Gullies Number	0	
Failures	None		Gullies Length	0	
Gullies	None				



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: Reading Hill Brook

Reach: T3.03-0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	Abundant	4.5 Flow Regulation Type	None	4.7 Stormwater Inputs	
4.2 Adjacent Wetlands:	Abundant	Flow Reg. Use:		Field Ditch:	0 Road Ditch: 3
4.3 Flow Status:	Low	Impoundments:		Other:	0 Tile Drain: 0
4.4 # of Debris Jams:	8	Impoundment Loc.:		Overland Flow:	0 Urb Strm Wtr Pipe: 0
		4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	3
		(old) Upstrm Flow Reg.:		Affected Length (ft):	450

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Instream Culvert	5	Yes	No	Yes	Yes	Deposition Above,Deposition Below
Instream Culvert	12	Yes	Yes	Yes	Yes	Deposition Above,Deposition Below

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal: 0	5.2 Other Features	Neck Cutoff: 3	5.4 Stream Ford or Animal Crossing:	No
Mid: 6	Delta: 0	Flood chutes: 1	Avulsion: 0	5.5 Straightening:	Straightening
Point: 0	Island: 0	5.3 Steep Riffles and Head Cuts	Head Cuts: 1	Straightening Length (ft.):	479
Side: 7	Braiding: 0	Steep Riffles: 0	Trib Rejuv.: No	5.5 Dredging:	None

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:	6.4 Sediment Deposition:	Stream Gradient Type	<u>Left</u>	<u>Right</u>
6.2 Pool Substrate:	6.5 Channel Flow Status:	6.8 Bank Stability:		
6.3 Pool Variability:	6.6 Channel Alteration:	6.9 Bank Vegetation Protection		
Total Score: 0	6.7 Channel Sinuosity:	6.10 Riparian Veg. Zone Width:		
Habitat Rating: 0.00				
Habitat Stream Condition:				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Unconfined	Score	STD	Historic		
7.1 Channel Degradation		11	None	No	Geomorphic Rating	0.51
7.2 Channel Aggradation		10	None	No	Channel Evolution Model	F
7.3 Widening Channel		11	None	No	Channel Evolution Stage	IV
7.4 Change in Planform		9	None	Yes	Geomorphic Condition	Fair
Total Score		41			Stream Sensitivity	Extreme



Stream Geomorphic Assessment

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Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream: **Reading Hill Brook**
Reach: **T3.04-0**
Segment Length(ft): **2,902**
Rain: **No**

SGAT Version: **4.56**
Organization: **Fitzgerald Environmental**
Observers: **JHB, MPL**
Completion Date: **8/27/2014**
Quality Control Status - Consultant: **Provisional**
Quality Control Status - Staff: **Provisional**

Step 0 - Location: **This reach follows Rt-106. The lower reach break is found east of the intersection of Whitmore Circle and Jenne Road. The upper reach break is found at a change in valley confinement approx. 1/2 mile to the north along Rt 106.**

Step 5 - Notes:

Step 7 - Narrative: **The lowest portion of the reach transitions from a B-type with a small low floodplain and some planform adjustments to a narrowly confined reference B or Ab reach that is highly encroached by Rt 106. This encroachment likely pushed the stream against the valley walls and has removed all floodplain resulting in a departure to F. The stream bed and banks are primarily bedrock or heavy rip-rap along the embankment, leaving little to no opportunity for channel adjustment vertically or laterally.**

Step 1. Valley and Floodplain

1.1 Segmentation: None	1.4 Adjacent Side	<u>Left</u>	<u>Right</u>	1.5 Valley Features
1.2 Alluvial Fan: None	Hillside Slope:	Extr.Steep	Very Steep	Valley Width (ft): 35
1.3 Corridor Encroachments:	Continuous w/ Bank:	Sometimes	Sometimes	Width Determination: Estimated
<u>Length (ft)</u> <u>One</u> <u>Height</u> <u>Both</u> <u>Height</u>	Within 1 Bankfull W:	Always	Always	Confinement Type: NC
Berm: 0	Texture:	Bedrock	Boulder	In Rock Gorge: No
Road: 2,902 10 0	Human Caused Change in Valley Width?: Yes			
Railroad: 0 0				
Imp. Path: 0 0				
Dev.: 0 0				

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	2.0	1.0	No	
Ledge	Mid-segment	6.0	2.0	No	
Ledge	Mid-segment	2.0	1.0	No	
Ledge	Mid-segment	4.0	7.0	No	
Waterfall	Mid-segment	10.0	9.0	No	
Ledge	Mid-segment	5.0	3.0	No	
Ledge	Mid-segment	2.0	1.0	No	
Ledge	Mid-segment	2.0	1.0	No	
Ledge	Mid-segment	5.0	2.5	No	
Ledge	Mid-segment	1.0	0.0	No	
Ledge	Mid-segment	1.0	0.0	No	
Ledge	Mid-segment	6.0	3.0	Yes	
Ledge	Mid-segment	2.0	1.0	No	
Ledge	Mid-segment	5.0	1.0	No	



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Reading Hill Brook**

Reach: **T3.04-0**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	13.77	2.11 Riffle/Step Spacing:	80 ft.	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	2.00	2.12 Substrate Composition		Bed:	450 mm
2.3 Mean Depth (ft.):	1.27	Bedrock:	70.0 %	Bar:	N/A mm
2.4 Floodprone Width (ft.):	17.00	Boulder:	0.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	4.65	Cobble:	1.0 %	Stream Type:	F
Human Elev FloodPln (ft.):		Coarse Gravel:	3.0 %	Bed Material:	Bedrock
2.6 Width/Depth Ratio:	10.84	Fine Gravel:	11.0 %	Subclass Slope:	None
2.7 Entrenchment Ratio:	1.23	Sand:	15.0 %	Bed Form:	Step-Pool
2.8 Incision Ratio:	2.33	Silt and Smaller:	0.0 %	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	No	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	Low	Detritus:	3.0 %	Reference Stream Type:	
2.10 Riffles Type:	Sedimented	# Large Woody Debris:	71	Reference Bed Material:	
				Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks					Typical Bank Slope: Steep				
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>	Near Bank Vegetation Type <u>Left</u>			<u>Right</u>
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	78.6	95.2	Dominant:	Coniferous	Herbaceous	
Material Type:	Bedrock	Mix	Erosion Height (ft.):	3.0	6.7	Sub-dominant:	Herbaceous	Shrubs/Sapling	
Consistency:	Cohesive	Non-cohesive	Revetment Type:	Rip-Rap	Rip-Rap	Bank Canopy			
Lower			Revetment Length:	521.9	1,500.4	Canopy %:	76-100	26-50	
Material Type:	Bedrock	Boulder/Cobble				Mid-Channel Canopy:		Closed	
Consistency:	Cohesive	Non-cohesive							

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>	Corridor Land	<u>Left</u>	<u>Right</u>
Dominant	>100	0-25	Dominant	Forest	Commercial
Sub-Dominant	0-25	51-100	Sub-dominant	Commercial	Shrubs/Sapling
W less than 25	1,431	1,386	(Legacy)	<u>Amount</u>	<u>Mean Height</u>
Buffer Vegetation Type			Failures	One	20.0
Dominant	Coniferous	Herbaceous	Gullies	None	
Sub-Dominant	Shrubs/Sapling	Shrubs/Sapling			

3.3 Riparian Corridor

Mass Failures	25,014	Height	59	Gullies Number	0
Gullies Length	0				



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: Reading Hill Brook

Reach: T3.04-0

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	Abundant	4.5 Flow Regulation Type	None	4.7 Stormwater Inputs	
4.2 Adjacent Wetlands:	Minimal	Flow Reg. Use:		Field Ditch:	0 Road Ditch: 5
4.3 Flow Status:	Low	Impoundments:		Other:	0 Tile Drain: 0
4.4 # of Debris Jams:	8	Impoundment Loc.:		Overland Flow:	0 Urb Strm Wtr Pipe: 0
		4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	0
		(old) Upstrm Flow Reg.:		Affected Length (ft):	0

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bedrock Outcrops	7	Yes	Yes	Yes	Yes	None
Bedrock Outcrops	3	Yes	No	Yes	Yes	None
Other	12	Yes	Yes	No	Yes	None
Instream Culvert	10.5	Yes	No	No	Yes	None

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal: 1	5.2 Other Features	Neck Cutoff: 0	5.4 Stream Ford or Animal Crossing:	No
Mid: 4	Delta: 0	Flood chutes: 0	Avulsion: 1	5.5 Straightening:	None
Point: 0	Island: 0	5.3 Steep Riffles and Head Cuts	Head Cuts: 0	Straightening Length (ft.):	0
Side: 3	Braiding: 0	Steep Riffles: 0	Trib Rejuv.: No	5.5 Dredging:	Dredging

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:	6.4 Sediment Deposition:	Stream Gradient Type	<u>Left</u>	<u>Right</u>
6.2 Pool Substrate:	6.5 Channel Flow Status:	6.8 Bank Stability:		
6.3 Pool Variability:	6.6 Channel Alteration:	6.9 Bank Vegetation Protection		
Total Score: 0	6.7 Channel Sinuosity:	6.10 Riparian Veg. Zone Width:		
Habitat Rating: 0.00				
Habitat Stream Condition:				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Confined	Score	STD	Historic		
7.1 Channel Degradation		4	B to F	Yes	Geomorphic Rating	0.41
7.2 Channel Aggradation		11	None	No	Channel Evolution Model	F
7.3 Widening Channel		10	None	No	Channel Evolution Stage	II
7.4 Change in Planform		8	None	No	Geomorphic Condition	Fair
Total Score		33			Stream Sensitivity	High



Stream Geomorphic Assessment

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Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream: **Bailey Brook**
Reach: **T4.01-A**
Segment Length(ft): **2,130**
Rain: **Yes**

SGAT Version: **4.56**
Organization: **Fitzgerald Environmental**
Observers: **EPF, JHB**
Completion Date: **8/28/2014**
Quality Control Status - Consultant: **Provisional**
Quality Control Status - Staff: **Provisional**

- Step 0 - Location: This segment begins at the confluence of Bailey's Brook and Mill brook and extends upstream to the bridge next to the Bailey's Mills bed and breakfast
- Step 5 - Notes: Alluvial fan setting had major deposition of coarse sediment and debris during T.S. Irene in 2011, clogging Bailey's Mills Road arch structure and causing overbank flow down the road. Channel sediment and debris was cleared upstream of road and downstream at Smith's property. Clearing and windrowing left berms along the right (south) bank upstream of the crossing. Severe sediment deposition girdled numerous trees in floodplain. The area upstream of Bailey's Mills Road culvert should be considered for floodplain restoration.
- Step 7 - Narrative: Severe vertical and lateral adjustments throughout reach due to alluvial fan setting, undersized crossing, and post-flood recovery work that left channel prone to ongoing erosion. In lower segment below Bailey's Mills Road, entrenchment ratios are <2.0 due to severe channel widening. Upstream of Bailey's Mills Road, some berms left from flood recovery work are confining flood flows. Stream type departure varies between C->D and C->F depending on limits of berming. D-type departure chosen due to severe aggradation and braiding throughout, and presence of grade controls.

Step 1. Valley and Floodplain

1.1 Segmentation: Channel Dimensions	1.4 Adjacent Side	<u>Left</u>	<u>Right</u>	1.5 Valley Features
1.2 Alluvial Fan: Yes	Hillside Slope:	Hilly	Steep	Valley Width (ft): 200
1.3 Corridor Encroachments:	Continuous w/ Bank:	Never	Sometimes	Width Determination: Measured
<u>Length (ft)</u> <u>One</u> <u>Height</u> <u>Both</u> <u>Height</u>	Within 1 Bankfull W:	Sometimes	Sometimes	Confinement Type: BD
Berm: 131 5 0	Texture:	N.E.	Mixed	In Rock Gorge: No
Road: 2,122 15 0				Human Caused Change in Valley Width?: No
Railroad: 0 0				
Imp. Path: 0 0				
Dev.: 450 0				

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	4.0	2.0	No	



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Bailey Brook**

Reach: **T4.01-A**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	45.89	2.11 Riffle/Step Spacing:	275 ft.	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	3.00	2.12 Substrate Composition		Bed:	350 mm
2.3 Mean Depth (ft.):	1.10	Bedrock:	0.0 %	Bar:	110 mm
2.4 Floodprone Width (ft.):	54.00	Boulder:	8.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	3.70	Cobble:	34.0 %	Stream Type:	D
Human Elev FloodPln (ft.):	6.70	Coarse Gravel:	28.0 %	Bed Material:	Gravel
2.6 Width/Depth Ratio:	41.72	Fine Gravel:	4.0 %	Subclass Slope:	None
2.7 Entrenchment Ratio:	1.18	Sand:	26.0 %	Bed Form:	Braided
2.8 Incision Ratio:	1.23	Silt and Smaller:	0.0 %	Field Measured Slope:	
Human Elevated Inc. Rat.:	2.23	Silt/Clay Present:	Yes	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	Low	Detritus:	4.0 %	Reference Stream Type:	C
2.10 Riffles Type:	Sedimented	# Large Woody Debris:	24	Reference Bed Material:	Gravel
				Reference Subclass Slope:	b
				Reference Bedform:	Riffle-Pool

Step 3. Riparian Features

3.1 Stream Banks			Typical Bank Slope:	Steep	
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	787.0	455.1
Material Type:	Gravel	Gravel	Erosion Height (ft.):	6.6	4.2
Consistency:	Non-cohesive	Non-cohesive	Revetment Type:	None	Rip-Rap
Lower			Revetment Length:	0.0	20.6
Material Type:	Boulder/Cobble	Boulder/Cobble			
Consistency:	Non-cohesive	Non-cohesive			
			Near Bank Vegetation Type	<u>Left</u>	<u>Right</u>
			Dominant:	Herbaceous	Deciduous
			Sub-dominant:	Shrubs/Sapling	Shrubs/Sapling
			Bank Canopy		
			Canopy %:	26-50	26-50
			Mid-Channel Canopy:	Open	

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>
Dominant	26-50	26-50
Sub-Dominant	0-25	0-25
W less than 25	755	0
Buffer Vegetation Type		
Dominant	Herbaceous	Deciduous
Sub-Dominant	Deciduous	Herbaceous

3.3 Riparian Corridor

Corridor Land	<u>Left</u>	<u>Right</u>	<u>Left</u>	<u>Right</u>
Dominant	Commercial	Commercial	Mass Failures	
Sub-dominant	Residential	Forest	Height	
(Legacy)	<u>Amount</u>	<u>Mean Height</u>	Gullies Number	0
Failures	None		Gullies Length	0
Gullies	None			



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Bailey Brook**

Reach: **T4.01-A**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	Minimal	4.5 Flow Regulation Type	None	4.7 Stormwater Inputs	
4.2 Adjacent Wetlands:	Minimal	Flow Reg. Use:		Field Ditch:	0 Road Ditch: 1
4.3 Flow Status:	Moderate	Impoundments:		Other:	0 Tile Drain: 0
4.4 # of Debris Jams:	2	Impoundment Loc.:		Overland Flow:	0 Urb Strm Wtr Pipe: 0
		4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	0
		(old) Upstrm Flow Reg.:		Affected Length (ft):	0

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bridge	19	No	No	Yes	Yes	Deposition Above
Bridge	20	Yes	No	No	Yes	Deposition Below, Scour Above, Scour Below

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal: 0	5.2 Other Features	Neck Cutoff: 0	5.4 Stream Ford or Animal Crossing:	No
Mid: 3	Delta: 0	Flood chutes: 0	Avulsion: 0	5.5 Straightening:	None
Point: 7	Island: 0	5.3 Steep Riffles and Head Cuts	Head Cuts: 0	Straightening Length (ft.):	0
Side: 3	Braiding: 1	Steep Riffles: 3	Trib Rejuv.: No	5.5 Dredging:	Dredging

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:	6.4 Sediment Deposition:	Stream Gradient Type	Left	Right
6.2 Pool Substrate:	6.5 Channel Flow Status:	6.8 Bank Stability:		
6.3 Pool Variability:	6.6 Channel Alteration:	6.9 Bank Vegetation Protection		
Total Score: 0	6.7 Channel Sinuosity:	6.10 Riparian Veg. Zone Width:		
Habitat Rating: 0.00				
Habitat Stream Condition:				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Unconfined	Score	STD	Historic		
7.1 Channel Degradation	5	None	No	Geomorphic Rating	0.21	
7.2 Channel Aggradation	3	C to D	No	Channel Evolution Model	D	
7.3 Widening Channel	3	None	No	Channel Evolution Stage	Ild	
7.4 Change in Planform	6	None	No	Geomorphic Condition	Poor	
Total Score	17			Stream Sensitivity	Extreme	



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Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream: **Bailey Brook**
Reach: **T4.01-B**
Segment Length(ft): **2,040**
Rain: **No**

SGAT Version: **4.56**
Organization: **Fitzgerald Environmental**
Observers: **JHB, MPL, EPF**
Completion Date: **8/28/2014**
Quality Control Status - Consultant: **Provisional**
Quality Control Status - Staff: **Provisional**

- Step 0 - Location: This segment begins at the segment point at the bridge by Bailey's Mills bed and breakfast and extends upstream to the segment point southeast to the intersection of Baileys Mills and Kittridge Pasture Rd
- Step 5 - Notes: Huge side bars fill most of the channel margins that were widened to 80 to 100ft during TSI. Some areas of widening were filling in with large mid bars, however most of the reach is scouring down and not currently aggrading sediments.
- Step 7 - Narrative: This segment was massively scoured during T.S. Irene and typically widened to 50-80 feet. The scoured channel was then buried in 4-8ft of gravel/cobble. The stream is currently cutting down through these deposits and was observed to be well below the pre-Irene bed elevation in several areas. Floodplain access was non-existent and only minimal storage was possible on top of flood sediments in areas where the channel was wider. This reach is actively cutting down and is deeply incised, assessed as a B to F departure and stage II.

Step 1. Valley and Floodplain

1.1 Segmentation: Channel Dimensions	1.4 Adjacent Side	<u>Left</u>	<u>Right</u>	1.5 Valley Features
1.2 Alluvial Fan: None	Hillside Slope:	Extr.Steep	Extr.Steep	Valley Width (ft): 150
1.3 Corridor Encroachments:	Continuous w/ Bank:	Sometimes	Sometimes	Width Determination: Estimated
<u>Length (ft)</u> <u>One</u> <u>Height</u> <u>Both</u> <u>Height</u>	Within 1 Bankfull W:	Always	Always	Confinement Type: NW
Berm: 235 10 0	Texture:	N.E.	N.E.	In Rock Gorge: No
Road: 29 15 0	Human Caused Change in Valley Width?: No			
Railroad: 0 0				
Imp. Path: 0 0				
Dev.: 135 0				

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	4.0	3.0	Yes	
Ledge	Mid-segment	3.0	1.0	No	
Ledge	Mid-segment	5.0	4.0	No	



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Bailey Brook**

Reach: **T4.01-B**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	29.70	2.11 Riffle/Step Spacing:	180 ft.	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	2.30	2.12 Substrate Composition		Bed:	550 mm
2.3 Mean Depth (ft.):	1.11	Bedrock:	0.0 %	Bar:	240 mm
2.4 Floodprone Width (ft.):	34.00	Boulder:	15.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	8.65	Cobble:	30.0 %	Stream Type:	F
Human Elev FloodPln (ft.):		Coarse Gravel:	26.0 %	Bed Material:	Gravel
2.6 Width/Depth Ratio:	26.76	Fine Gravel:	7.0 %	Subclass Slope:	None
2.7 Entrenchment Ratio:	1.14	Sand:	13.0 %	Bed Form:	Plane Bed
2.8 Incision Ratio:	3.76	Silt and Smaller:	9.0 %	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	Yes	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	Low	Detritus:	5.0 %	Reference Stream Type:	B
2.10 Riffles Type:	Sedimented	# Large Woody Debris:	50	Reference Bed Material:	Cobble
				Reference Subclass Slope:	
				Reference Bedform:	Step-Pool

Step 3. Riparian Features

3.1 Stream Banks			Typical Bank Slope:	Steep	
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	429.3	485.9
Material Type:	Mix	Mix	Erosion Height (ft.):	8.9	6.4
Consistency:	Non-cohesive	Non-cohesive	Revetment Type:	None	None
Lower			Revetment Length:	0.0	0.0
Material Type:	Clay	Clay	Canopy %:	76-100	76-100
Consistency:	Cohesive	Cohesive	Mid-Channel Canopy:	Closed	

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>
Dominant	>100	>100
Sub-Dominant	0-25	0-25
W less than 25	224	228
Buffer Vegetation Type		
Dominant	Deciduous	Deciduous
Sub-Dominant	Shrubs/Sapling	Herbaceous

3.3 Riparian Corridor

Corridor Land	<u>Left</u>	<u>Right</u>		<u>Left</u>	<u>Right</u>
Dominant	Forest	Forest	Mass Failures	284.64	352.28
Sub-dominant	Shrubs/Sapling	Shrubs/Sapling	Height	19.2	21.3
(Legacy)	<u>Amount</u>	<u>Mean Hieght</u>	Gullies Number	0	
Failures	Multiple	18.8	Gullies Length	0	
Gullies	None				



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Bailey Brook**

Reach: **T4.01-B**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	Abundant	4.5 Flow Regulation Type	None	4.7 Stormwater Inputs	None
4.2 Adjacent Wetlands:	Minimal	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	Low	Impoundments:		Other:	Tile Drain:
4.4 # of Debris Jams:	2	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	0
		(old) Upstrm Flow Reg.:		Affected Length (ft):	0
4.8 Channel Constrictions:	None				

Step 5. Channel Bed and Planform Changes

5.1 Bar Types		Diagonal:	1	5.2 Other Features		Neck Cutoff:	0	5.4 Stream Ford or Animal Crossing:		No	
Mid:	5	Delta:	1	Flood chutes:		0	Avulsion:	1	5.5 Straightening:		None
Point:	1	Island:	0	5.3 Steep Riffles and Head Cuts			Head Cuts:	0	Straightening Length (ft.):		0
Side:	10	Braiding:	1	Steep Riffles:		0	Trib Rejuv.:	No	5.5 Dredging:		Dredging

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradient Type	<u>Left</u>	<u>Right</u>
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:		
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection		
Total Score:	0	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:		
Habitat Rating:	0.00					
Habitat Stream Condition:						

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Unconfined	Score	STD	Historic		
7.1 Channel Degradation		5	B to F	No	Geomorphic Rating	0.32
7.2 Channel Aggradation		7	None	No	Channel Evolution Model	F
7.3 Widening Channel		6	None	No	Channel Evolution Stage	II
7.4 Change in Planform		8	None	No	Geomorphic Condition	Poor
Total Score		26			Stream Sensitivity	Extreme



Stream Geomorphic Assessment

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Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream: **Bailey Brook**
Reach: **T4.01-C**
Segment Length(ft): **3,743**
Rain: **No**

SGAT Version: **4.56**
Organization: **Fitzgerald Environmental**
Observers: **EPF, JHB, MPL**
Completion Date: **8/28/2014**
Quality Control Status - Consultant: **Provisional**
Quality Control Status - Staff: **Provisional**

- Step 0 - Location: This reach begins at the segmentation point southeast of the intersection of Baileys Mills and Kittridge Pasture Rd and extends upstream to the next reach break along Kittridge Pasture Rd
- Step 5 - Notes: This reach was a massive sediment source and storage area. Near continuous bank erosion and mass failure are contributing huge volumes of sediment to the channel. Numerous debris jams and grade controls are also storing huge volumes of sediment.
- Step 7 - Narrative: This reach also massively widened during T. S. Irene, scouring from valley wall to valley wall throughout. Huge volumes of cobbles and gravels were deposited and continue to work through the reach. This segment is very different from T4.01B. However, the ongoing deposition is filling the channel leading to floodplain access and planform adjustment. Some grade control was observed and huge debris jams were also helping to hold the bed in place and allow for aggradation. This widening, aggradation, and planform adjustment led to a B to D departure and an assessment as type IIc.

Step 1. Valley and Floodplain

1.1 Segmentation: Channel Dimensions

1.2 Alluvial Fan: **None**

1.3 Corridor Encroachments:

<u>Length (ft)</u>	<u>One</u>	<u>Height</u>	<u>Both</u>	<u>Height</u>
Berm:	0		0	
Road:	0		0	
Railroad:	0		0	
Imp. Path:	0		0	
Dev.:	0		0	

1.4 Adjacent Side

	<u>Left</u>	<u>Right</u>
Hillside Slope:	Extr.Steep	Very Steep
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Always	Always
Texture:	Mixed	Mixed

1.5 Valley Features

Valley Width (ft):	150
Width Determination:	Estimated
Confinement Type:	NW
In Rock Gorge:	No
Human Caused Change in Valley Width?:	No

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Ledge	Mid-segment	6.0	4.0	No	
Ledge	Mid-segment	6.0	4.0	No	



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Bailey Brook**

Reach: **T4.01-C**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	45.72	2.11 Riffle/Step Spacing:	160 ft.	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	2.15	2.12 Substrate Composition		Bed:	600 mm
2.3 Mean Depth (ft.):	1.07	Bedrock:	0.0 %	Bar:	240 mm
2.4 Floodprone Width (ft.):	116.00	Boulder:	6.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	3.70	Cobble:	45.0 %	Stream Type:	D
Human Elev FloodPln (ft.):		Coarse Gravel:	27.0 %	Bed Material:	Cobble
2.6 Width/Depth Ratio:	42.73	Fine Gravel:	11.0 %	Subclass Slope:	None
2.7 Entrenchment Ratio:	2.54	Sand:	7.0 %	Bed Form:	Plane Bed
2.8 Incision Ratio:	1.72	Silt and Smaller:	4.0 %	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	Yes	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	Low	Detritus:	4.0 %	Reference Stream Type:	
2.10 Riffles Type:	Sedimented	# Large Woody Debris:	184	Reference Bed Material:	
				Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks			Typical Bank Slope:	Moderate	
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	975.6	265.5
Material Type:	Mix	Mix	Erosion Height (ft.):	10.1	6.4
Consistency:	Non-cohesive	Non-cohesive	Revetment Type:	None	None
Lower			Revetment Length:	0.0	0.0
Material Type:	Silt	Clay	Canopy %:	76-100	76-100
Consistency:	Cohesive	Cohesive	Mid-Channel Canopy:	Closed	

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>	Corridor Land	<u>Left</u>	<u>Right</u>
Dominant	>100	>100	Dominant	Forest	Forest
Sub-Dominant	51-100	None	Sub-dominant	Commercial	None
W less than 25	0	0	(Legacy)	<u>Amount</u>	<u>Mean Hieght</u>
Buffer Vegetation Type			Failures	Multiple	40.0
Dominant	Deciduous	Deciduous	Gullies	None	
Sub-Dominant	Shrubs/Sapling	Herbaceous			

3.3 Riparian Corridor

Mass Failures	454.42	764.83		
Height	49.8	42.4		
Gullies Number	0			
Gullies Length	0			



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Bailey Brook**

Reach: **T4.01-C**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps: **Minimal**

4.2 Adjacent Wetlands: **None**

4.3 Flow Status: **Low**

4.4 # of Debris Jams: **9**

4.5 Flow Regulation Type **None**

Flow Reg. Use:

Impoundments:

Impoundment Loc.:

4.6 Up/Down Strm flow reg.: **None**

(old) Upstrm Flow Reg.:

4.7 Stormwater Inputs **None**

Field Ditch: Road Ditch:

Other: Tile Drain:

Overland Flow: Urb Strm Wtr Pipe:

4.9 # of Beaver Dams: **0**

Affected Length (ft): **0**

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Bedrock Outcrops	20	No	No	Yes	Yes	Deposition Above, Scour Below, Alignment

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal: 1	5.2 Other Features	Neck Cutoff: 0	5.4 Stream Ford or Animal Crossing: Yes
Mid: 10	Delta: 0	Flood chutes: 7	Avulsion: 1	5.5 Straightening: None
Point: 3	Island: 0	5.3 Steep Riffles and Head Cuts	Head Cuts: 0	Straightening Length (ft.): 0
Side: 23	Braiding: 1	Steep Riffles: 6	Trib Rejuv.: No	5.5 Dredging: None

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:	6.4 Sediment Deposition:	Stream Gradient Type	<u>Left</u>	<u>Right</u>
6.2 Pool Substrate:	6.5 Channel Flow Status:	6.8 Bank Stability:		
6.3 Pool Variability:	6.6 Channel Alteration:	6.9 Bank Vegetation Protection		
Total Score: 0	6.7 Channel Sinuosity:	6.10 Riparian Veg. Zone Width:		
Habitat Rating: 0.00				
Habitat Stream Condition:				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Unconfined	Score	STD	Historic		
7.1 Channel Degradation		12	None	No	Geomorphic Rating	0.31
7.2 Channel Aggradation		4	B to D	No	Channel Evolution Model	D
7.3 Widening Channel		4	None	No	Channel Evolution Stage	IIc
7.4 Change in Planform		5	None	No	Geomorphic Condition	Poor
Total Score		25			Stream Sensitivity	Extreme



Stream Geomorphic Assessment

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Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream: **Bailey Brook**
Reach: **T4.02-A**
Segment Length(ft): **4,101**
Rain: **No**

SGAT Version: **4.56**
Organization: **Fitzgerald Environmental**
Observers: **JHB, MPL**
Completion Date: **8/28/2014**
Quality Control Status - Consultant: **Provisional**
Quality Control Status - Staff: **Provisional**

- Step 0 - Location: **This reach is bound by the first reach break and segment point northwest of the intersection of Kitteridge Pasture and Stone Chimney Rd.**
- Step 5 - Notes: **Huge deposition features were observed throughout the segment along with numerous flood chutes and avulsions. Large mid bars with channel braiding were common.**
- Step 7 - Narrative: **Similar to T4.01.C, this segment scoured the entire valley during T.S. Irene and filled in with 6-8ft of cobble and gravel deposition. The channel is now carving through these deposits and adjusting planform. We assessed the CEM stage for this segment as Ild due to the areas of braiding and increased planform adjustment. Bankfull width and W/D were also lower and we assessed the segment as a departure from B to C.**

Step 1. Valley and Floodplain

1.1 Segmentation: Channel Dimensions	1.4 Adjacent Side	<u>Left</u>	<u>Right</u>	1.5 Valley Features
1.2 Alluvial Fan: None	Hillside Slope:	Extr.Steep	Extr.Steep	Valley Width (ft): 120
1.3 Corridor Encroachments:	Continuous w/ Bank:	Sometimes	Sometimes	Width Determination: Estimated
<u>Length (ft)</u> <u>One</u> <u>Height</u> <u>Both</u> <u>Height</u>	Within 1 Bankfull W:	Always	Always	Confinement Type: NW
Berm: 0	Texture:	Mixed	Mixed	In Rock Gorge: No
Road: 0				Human Caused Change in Valley Width?: No
Railroad: 0				
Imp. Path: 0				
Dev.: 0				
1.6 Grade Controls: None				



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Bailey Brook**

Reach: **T4.02-A**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	24.25	2.11 Riffle/Step Spacing:	180 ft.	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	2.30	2.12 Substrate Composition		Bed:	550 mm
2.3 Mean Depth (ft.):	1.45	Bedrock:	0.0 %	Bar:	150 mm
2.4 Floodprone Width (ft.):	59.00	Boulder:	12.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	2.95	Cobble:	37.0 %	Stream Type:	C
Human Elev FloodPln (ft.):		Coarse Gravel:	27.0 %	Bed Material:	Gravel
2.6 Width/Depth Ratio:	16.72	Fine Gravel:	9.0 %	Subclass Slope:	b
2.7 Entrenchment Ratio:	2.43	Sand:	15.0 %	Bed Form:	Braided
2.8 Incision Ratio:	1.28	Silt and Smaller:	0.0 %	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	Yes	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	Low	Detritus:	2.0 %	Reference Stream Type:	B
2.10 Riffles Type:	Sedimented	# Large Woody Debris:	242	Reference Bed Material:	Cobble
				Reference Subclass Slope:	None
				Reference Bedform:	Riffle-Pool

Step 3. Riparian Features

3.1 Stream Banks			Typical Bank Slope:	Steep	
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	929.4	545.6
Material Type:	Mix	Mix	Erosion Height (ft.):	5.0	6.0
Consistency:	Non-cohesive	Non-cohesive	Revetment Type:	None	None
Lower			Revetment Length:	0.0	0.0
Material Type:	Clay	Clay			
Consistency:	Cohesive	Cohesive			
			Near Bank Vegetation Type	<u>Left</u>	<u>Right</u>
			Dominant:	Deciduous	Deciduous
			Sub-dominant:	Shrubs/Sapling	Herbaceous
			Bank Canopy		
			Canopy %:	51-75	51-75
			Mid-Channel Canopy:	Open	

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>	Corridor Land
Dominant	>100	>100	Dominant
Sub-Dominant	None	51-100	Sub-dominant
W less than 25	0	0	(Legacy)
Buffer Vegetation Type			Failures
Dominant	Mixed Trees	Mixed Trees	Gullies
Sub-Dominant	Shrubs/Sapling	Shrubs/Sapling	

3.3 Riparian Corridor

	<u>Left</u>	<u>Right</u>		<u>Left</u>	<u>Right</u>
Dominant	Forest	Forest	Mass Failures	1430.4	874.23
Sub-Dominant	None	None	Height	57	55
W less than 25	0	0	Gullies Number	0	0
Buffer Vegetation Type			Gullies Length	0	0
Dominant	Mixed Trees	Mixed Trees			
Sub-Dominant	Shrubs/Sapling	Shrubs/Sapling			



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Bailey Brook**

Reach: **T4.02-A**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	Abundant	4.5 Flow Regulation Type	None	4.7 Stormwater Inputs	None
4.2 Adjacent Wetlands:	Minimal	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	Low	Impoundments:		Other:	Tile Drain:
4.4 # of Debris Jams:	5	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	0
		(old) Upstrm Flow Reg.:		Affected Length (ft):	0
4.8 Channel Constrictions:	None				

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal: 2	5.2 Other Features	Neck Cutoff: 0	5.4 Stream Ford or Animal Crossing:	No
Mid: 8	Delta: 0	Flood chutes: 3	Avulsion: 2	5.5 Straightening:	None
Point: 20	Island: 0	5.3 Steep Riffles and Head Cuts	Head Cuts: 0	Straightening Length (ft.):	0
Side: 6	Braiding: 1	Steep Riffles: 2	Trib Rejuv.: No	5.5 Dredging:	None

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradient Type	<u>Left</u>	<u>Right</u>
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:		
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection		
Total Score:	0	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:		
Habitat Rating:	0.00					
Habitat Stream Condition:						

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Unconfined	Score	STD	Historic		
7.1 Channel Degradation		11	None	No	Geomorphic Rating	0.31
7.2 Channel Aggradation		5	Other	No	Channel Evolution Model	D
7.3 Widening Channel		4	None	No	Channel Evolution Stage	Ild
7.4 Change in Planform		5	None	No	Geomorphic Condition	Poor
Total Score		25			Stream Sensitivity	Very High



Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream: **Bailey Brook**
Reach: **T4.02-B**
Segment Length(ft): **4,680**
Rain: **No**

SGAT Version: **4.56**
Organization: **Fitzgerald Environmental**
Observers: **EPF, JHB, MPL**
Completion Date: **8/28/2014**
Quality Control Status - Consultant: **Provisional**
Quality Control Status - Staff: **Provisional**

Step 0 - Location: **This reach is bound by the segmentation point and reach break downstream and to the southwest of the Brown Schoolhouse Rd crossing.**

Step 5 - Notes:

Step 7 - Narrative: **Similar to T4.01C and T4.02A, this segment scoured the entire valley during T.S. Irene and filled in with approximately 2ft of cobble and gravel deposition. The channel is now carving through these deposits and adjusting planform. We assessed the segment as IID due to the areas of braiding and increased planform adjustment. Bankfull dimensions were relatively close to reference width and with only moderate incision. Most of the reach is lined with eroding banks and mass failures and it will remain highly active for a long time.**

Step 1. Valley and Floodplain

1.1 Segmentation: **Channel Dimensions**

1.2 Alluvial Fan: **None**

1.3 Corridor Encroachments:

	<u>Length (ft)</u>	<u>One</u>	<u>Height</u>	<u>Both</u>	<u>Height</u>
Berm:	0			0	
Road:	0			0	
Railroad:	0			0	
Imp. Path:	0			0	
Dev.:	0			0	

1.4 Adjacent Side

	<u>Left</u>	<u>Right</u>
Hillside Slope:	Extr.Steep	Extr.Steep
Continuous w/ Bank:	Sometimes	Sometimes
Within 1 Bankfull W:	Sometimes	Sometimes
Texture:	Mixed	Mixed

1.5 Valley Features

Valley Width (ft): **70**
Width Determination: **Estimated**
Confinement Type: **SC**
In Rock Gorge: **No**
Human Caused Change in Valley Width?: **No**

1.6 Grade Controls: **None**



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Bailey Brook**

Reach: **T4.02-B**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	19.73	2.11 Riffle/Step Spacing:	150 ft.	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	1.80	2.12 Substrate Composition		Bed:	400 mm
2.3 Mean Depth (ft.):	1.28	Bedrock:	0.0 %	Bar:	130 mm
2.4 Floodprone Width (ft.):	36.00	Boulder:	9.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	2.55	Cobble:	40.0 %	Stream Type:	B
Human Elev FloodPln (ft.):		Coarse Gravel:	24.0 %	Bed Material:	Gravel
2.6 Width/Depth Ratio:	15.41	Fine Gravel:	17.0 %	Subclass Slope:	None
2.7 Entrenchment Ratio:	1.82	Sand:	10.0 %	Bed Form:	Step-Pool
2.8 Incision Ratio:	1.42	Silt and Smaller:	0.0 %	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	Yes	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	Low	Detritus:	3.0 %	Reference Stream Type:	
2.10 Riffles Type:	Sedimented	# Large Woody Debris:	289	Reference Bed Material:	
				Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks					Typical Bank Slope: Steep				
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>	Near Bank Vegetation Type <u>Left</u>			<u>Right</u>
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	389.3	697.0	Dominant:	Deciduous	Deciduous	
Material Type:	Gravel	Gravel	Erosion Height (ft.):	7.1	7.3	Sub-dominant:	Herbaceous	Herbaceous	
Consistency:	Non-cohesive	Non-cohesive	Revetment Type:	None	None	Bank Canopy			
Lower			Revetment Length:	0.0	0.0	Canopy %:	76-100	76-100	
Material Type:	Boulder/Cobbles	Boulder/Cobbles				Mid-Channel Canopy: Closed			
Consistency:	Non-cohesive	Non-cohesive							

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>	Corridor Land
Dominant	>100	>100	Dominant
Sub-Dominant	None	None	Sub-dominant
W less than 25	0	0	(Legacy)
Buffer Vegetation Type			Failures
Dominant	Mixed Trees	Mixed Trees	Gullies
Sub-Dominant	Shrubs/Sapling	Shrubs/Sapling	

3.3 Riparian Corridor

	<u>Left</u>	<u>Right</u>		<u>Left</u>	<u>Right</u>
Dominant	Forest	Forest	Mass Failures	1169.4	990.12
Sub-Dominant	None	None	Height	68	12
W less than 25	0	0	Gullies Number	37.5	52.2
Buffer Vegetation Type			Gullies Length	1	
Dominant	Multiple	37.1			
Sub-Dominant	One	3.0			



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Bailey Brook**

Reach: **T4.02-B**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	Abundant	4.5 Flow Regulation Type	None	4.7 Stormwater Inputs	None
4.2 Adjacent Wetlands:	Abundant	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	Low	Impoundments:		Other:	Tile Drain:
4.4 # of Debris Jams:	19	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	0
		(old) Upstrm Flow Reg.:		Affected Length (ft):	0

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Instream Culvert	8	Yes	No	Yes	Yes	Deposition Above, Scour Below

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal: 0	5.2 Other Features	Neck Cutoff: 0	5.4 Stream Ford or Animal Crossing:	No
Mid: 5	Delta: 0	Flood chutes: 7	Avulsion: 0	5.5 Straightening:	None
Point: 5	Island: 0	5.3 Steep Riffles and Head Cuts	Head Cuts: 1	Straightening Length (ft.):	0
Side: 10	Braiding: 1	Steep Riffles: 1	Trib Rejuv.: No	5.5 Dredging:	None

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:	6.4 Sediment Deposition:	Stream Gradient Type	<u>Left</u>	<u>Right</u>
6.2 Pool Substrate:	6.5 Channel Flow Status:	6.8 Bank Stability:		
6.3 Pool Variability:	6.6 Channel Alteration:	6.9 Bank Vegetation Protection		
Total Score: 0	6.7 Channel Sinuosity:	6.10 Riparian Veg. Zone Width:		
Habitat Rating: 0.00				
Habitat Stream Condition:				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Confined	Score	STD	Historic		
7.1 Channel Degradation		11	None	No	Geomorphic Rating	0.34
7.2 Channel Aggradation		7	None	No	Channel Evolution Model	D
7.3 Widening Channel		5	None	No	Channel Evolution Stage	Ild
7.4 Change in Planform		4	None	No	Geomorphic Condition	Poor
Total Score		27			Stream Sensitivity	High



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Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream: **Bailey Brook**
Reach: **T4.02-C**
Segment Length(ft): **6,758**
Rain: **No**

SGAT Version: **4.56**
Organization: **Fitzgerald Environmental**
Observers: **EPF**
Completion Date: **2/17/2015**
Quality Control Status - Consultant:
Quality Control Status - Staff:
Why Not Assessed:

Provisional
Provisional
Other (to be explained in comments)

Step 0 - Location: **Begins immediately upstream of Brown Schoolhouse Road and continues to headwaters. Reach was not included in Ph2 assessment scope.**

Step 5 - Notes:

Step 7 - Narrative:

Step 1. Valley and Floodplain

1.1 Segmentation:	1.4 Adjacent Side	<u>Left</u>	<u>Right</u>	1.5 Valley Features
1.2 Alluvial Fan:	Hillside Slope:			Valley Width (ft):
1.3 Corridor Encroachments:	Continuous w/ Bank:			Width Determination:
<u>Length (ft)</u> <u>One</u> <u>Height</u> <u>Both</u> <u>Height</u>	Within 1 Bankfull W:			Confinement Type:
Berm:	Texture:			In Rock Gorge:
Road:				Human Caused Change in Valley Width?:
Railroad:				
Imp. Path:				
Dev.:				
1.6 Grade Controls:				



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Bailey Brook**

Reach: **T4.02-C**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	2.11 Riffle/Step Spacing:	2.13 Average Largest Particle on
2.2 Max Depth (ft.):	2.12 Substrate Composition	Bed:
2.3 Mean Depth (ft.):	Bedrock: %	Bar:
2.4 Floodprone Width (ft.):	Boulder: %	2.14 Stream Type
2.5 Aband. Floodpn (ft.):	Cobble: %	Stream Type:
Human Elev FloodPln (ft.):	Coarse Gravel: %	Bed Material:
2.6 Width/Depth Ratio: 0.00	Fine Gravel: %	Subclass Slope:
2.7 Entrenchment Ratio: 0.00	Sand: %	Bed Form:
2.8 Incision Ratio: 0.00	Silt and Smaller: %	Field Measured Slope:
Human Elevated Inc. Rat.: 0.00	Silt/Clay Present:	2.15 Sub-reach Stream Type
2.9 Sinuosity:	Detritus: %	Reference Stream Type:
2.10 Riffles Type:	# Large Woody Debris:	Reference Bed Material:
		Reference Subclass Slope:
		Reference Bedform:

Step 3. Riparian Features

3.1 Stream Banks	Typical Bank Slope:			
Bank Texture	Bank Erosion	<u>Left</u>	<u>Right</u>	Near Bank Vegetation Type <u>Left</u> <u>Right</u>
Upper	Erosion Length (ft.):			Dominant:
Material Type:	Erosion Height (ft.):			Sub-dominant:
Consistency:	Revetment Type:			Bank Canopy
Lower	Revetment Length:			Canopy %:
Material Type:				Mid-Channel Canopy:
Consistency:				

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>
Dominant		
Sub-Dominant		
W less than 25		
Buffer Vegetation Type		
Dominant		
Sub-Dominant		

3.3 Riparian Corridor

Corridor Land	<u>Left</u>	<u>Right</u>	<u>Left</u>	<u>Right</u>
Dominant				
Sub-dominant				
(Legacy)	<u>Amount</u>	<u>Mean Hieght</u>		
Failures				
Gullies				
			Mass Failures	
			Height	
			Gullies Number	
			Gullies Length	



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Bailey Brook**

Reach: **T4.02-C**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	4.5 Flow Regulation Type	4.7 Stormwater Inputs None
4.2 Adjacent Wetlands:	Flow Reg. Use:	Field Ditch: Road Ditch:
4.3 Flow Status:	Impoundments:	Other: Tile Drain:
4.4 # of Debris Jams:	Impoundment Loc.:	Overland Flow: Urb Strm Wtr Pipe:
	4.6 Up/Down Strm flow reg.:	4.9 # of Beaver Dams:
	(old) Upstrm Flow Reg.:	Affected Length (ft):

4.8 Channel Constrictions:

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	5.2 Other Features	Neck Cutoff:	5.4 Stream Ford or Animal Crossing:
Mid:	Delta:	Flood chutes:	Avulsion:	5.5 Straightening:
Point:	Island:	5.3 Steep Riffles and Head Cuts	Head Cuts:	Straightening Length (ft.): 0
Side:	Braiding:	Steep Riffles:	Trib Rejuv.:	5.5 Dredging:

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:	6.4 Sediment Deposition:	Stream Gradient Type	<u>Left</u>	<u>Right</u>
6.2 Pool Substrate:	6.5 Channel Flow Status:	6.8 Bank Stability:		
6.3 Pool Variability:	6.6 Channel Alteration:	6.9 Bank Vegetation Protection		
Total Score:	6.7 Channel Sinuosity:	6.10 Riparian Veg. Zone Width:		
Habitat Rating:				
Habitat Stream Condition:				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Score	STD	Historic	Geomorphic Rating
7.1 Channel Degradation				Channel Evolution Model
7.2 Channel Aggradation				Channel Evolution Stage
7.3 Widening Channel				Geomorphic Condition
7.4 Change in Planform				Stream Sensitivity
Total Score				



Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream:	Unnamed Trib 02 to Beaver Brook	SGAT Version:	4.56
Reach:	T1.01.S4.01-A	Organization:	Fitzgerald Environmental
Segment Length(ft):	1,127	Observers:	EPF
Rain:	No	Completion Date:	7/1/2014
		Quality Control Status - Consultant:	Provisional
		Quality Control Status - Staff:	Provisional

- Step 0 - Location: This reach begins downstream of the brownsville-hartland and sheddsville Rd intersection and extends upstream to the first segmentation point along Sheddsville road.
- Step 5 - Notes: Channel is affected by encroachment and buffer impacts from Sheddsville Road for most of the segment. Significant channel erosion and roadway damage occurred during T.S. Irene in 2011. Mass failures along bank opposite road will likely worsen over time given the extensive hard bank armoring.
- Step 7 - Narrative: Channel is heavily encroached by Sheddsville Road and armored for >50% of segment. Rip rap installed following T.S. Irene in 2011 projects out into the channel beyond where the pre-flood banks were located, based on treeline. Channel may incise more, however there are significant fine sediment inputs from mass failures on the north bank opposite the road.

Step 1. Valley and Floodplain

1.1 Segmentation: Channel Dimensions	1.4 Adjacent Side	<u>Left</u>	<u>Right</u>	1.5 Valley Features
1.2 Alluvial Fan: None	Hillside Slope:	Extr.Steep	Very Steep	Valley Width (ft): 60
1.3 Corridor Encroachments:	Continuous w/ Bank:	Sometimes	Sometimes	Width Determination: Measured
<u>Length (ft)</u> <u>One</u> <u>Height</u> <u>Both</u> <u>Height</u>	Within 1 Bankfull W:	Always	Sometimes	Confinement Type: SC
Berm: 0 0	Texture:	Mixed	N.E.	In Rock Gorge: No
Road: 1,117 10 0				Human Caused Change in Valley Width?: Yes
Railroad: 0 0				
Imp. Path: 0 0				
Dev.: 101 0				
1.6 Grade Controls: None				



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Unnamed Trib 02 to Beaver Brook**

Reach: **T1.01.S4.01-A**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	15.50	2.11 Riffle/Step Spacing:		2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	1.55	2.12 Substrate Composition		Bed:	275 mm
2.3 Mean Depth (ft.):	0.99	Bedrock:	0.0 %	Bar:	N/A mm
2.4 Floodprone Width (ft.):	18.00	Boulder:	4.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	7.05	Cobble:	34.0 %	Stream Type:	F
Human Elev FloodPln (ft.):		Coarse Gravel:	12.0 %	Bed Material:	Gravel
2.6 Width/Depth Ratio:	15.66	Fine Gravel:	24.0 %	Subclass Slope:	b
2.7 Entrenchment Ratio:	1.16	Sand:	26.0 %	Bed Form:	Plane Bed
2.8 Incision Ratio:	4.55	Silt and Smaller:	0.0 %	Field Measured Slope:	3.9
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	No	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	Low	Detritus:	4.0 %	Reference Stream Type:	B
2.10 Riffles Type:	Eroded	# Large Woody Debris:	19	Reference Bed Material:	Cobble
				Reference Subclass Slope:	None
				Reference Bedform:	Step-Pool

Step 3. Riparian Features

3.1 Stream Banks				Typical Bank Slope:	Steep		
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>	Near Bank Vegetation Type	<u>Left</u> <u>Right</u>
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	57.2	63.8	Dominant:	Deciduous Herbaceous
Material Type:	Mix	Boulder/Cobble	Erosion Height (ft.):	9.0	6.0	Sub-dominant:	Coniferous Deciduous
Consistency:	Cohesive	Non-cohesive	Revetment Type:	None	Rip-Rap	Bank Canopy	
Lower			Revetment Length:	0.0	570.4	Canopy %:	76-100 26-50
Material Type:	Boulder/Cobble	Sand				Mid-Channel Canopy:	Closed
Consistency:	Non-cohesive	Non-cohesive					

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>
Dominant	>100	0-25
Sub-Dominant	51-100	26-50
W less than 25	0	900
Buffer Vegetation Type		
Dominant	Mixed Trees	Herbaceous
Sub-Dominant	Shrubs/Sapling	Deciduous

3.3 Riparian Corridor

Corridor Land	<u>Left</u>	<u>Right</u>		<u>Left</u>	<u>Right</u>
Dominant	Forest	Commercial	Mass Failures	91.290	5
Sub-dominant	Residential	Forest	Height	15.0	
(Legacy)	<u>Amount</u>	<u>Mean Height</u>	Gullies Number	0	
Failures	One	15.0	Gullies Length	0	
Gullies	None				



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Unnamed Trib 02 to Beaver Brook**

Reach: **T1.01.S4.01-A**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps: Minimal	4.5 Flow Regulation Type None	4.7 Stormwater Inputs
4.2 Adjacent Wetlands: None	Flow Reg. Use:	Field Ditch: 0 Road Ditch: 2
4.3 Flow Status: Low	Impoundments:	Other: 0 Tile Drain: 0
4.4 # of Debris Jams: 2	Impoundment Loc.:	Overland Flow: 0 Urb Strm Wtr Pipe: 0
	4.6 Up/Down Strm flow reg.: None	4.9 # of Beaver Dams: 0
	(old) Upstrm Flow Reg.:	Affected Length (ft): 0

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Instream Culvert	12	Yes	No	Yes	Yes	None
Bridge	18	Yes	No	No	Yes	None

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal: 0	5.2 Other Features	Neck Cutoff: 0	5.4 Stream Ford or Animal Crossing: No
Mid: 0	Delta: 0	Flood chutes: 0	Avulsion: 0	5.5 Straightening: None
Point: 0	Island: 0	5.3 Steep Riffles and Head Cuts	Head Cuts: 0	Straightening Length (ft.): 0
Side: 1	Braiding: 0	Steep Riffles: 0	Trib Rejuv.: No	5.5 Dredging: None

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:	6.4 Sediment Deposition:	Stream Gradient Type	<u>Left</u>	<u>Right</u>
6.2 Pool Substrate:	6.5 Channel Flow Status:	6.8 Bank Stability:		
6.3 Pool Variability:	6.6 Channel Alteration:	6.9 Bank Vegetation Protection		
Total Score: 0	6.7 Channel Sinuosity:	6.10 Riparian Veg. Zone Width:		
Habitat Rating: 0.00				
Habitat Stream Condition:				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Confined	Score	STD	Historic		
7.1 Channel Degradation		4	B to F	No	Geomorphic Rating	0.32
7.2 Channel Aggradation		5	None	No	Channel Evolution Model	F
7.3 Widening Channel		10	None	No	Channel Evolution Stage	II
7.4 Change in Planform		7	None	No	Geomorphic Condition	Poor
Total Score		26			Stream Sensitivity	Extreme



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Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream:	Unnamed Trib 02 to Beaver Brook	SGAT Version:	4.56
Reach:	T1.01.S4.01-B	Organization:	Fitzgerald Environmental
Segment Length(ft):	3,640	Observers:	EPF
Rain:	Yes	Completion Date:	7/1/2014
		Quality Control Status - Consultant:	Provisional
		Quality Control Status - Staff:	Provisional

Step 0 - Location: This reach is located between the two segmentation points along Sheddsville Rd.

Step 5 - Notes: Evidence of historical channel straightening throughout reach. Buffer impacts from horse farm greatest in lower segment. At upstream reach break there is a transition from higher gradient channel upstream, leading to coarse sediment deposition. Some dredging was noted in upper segment.

Step 7 - Narrative: Channel morphology has not departed significantly from reference, but sinuosity is low due to historical straightening. Channel likely aggraded coarse material during T.S. Irene in 2011. Aggradation and widening may occur in near future. Unless channel is armored or managed in future, natural planform may begin to redevelop upstream of the Sheddsville Road crossing. A severely undersized culvert is located on a private driveway mid-segment.

Step 1. Valley and Floodplain

1.1 Segmentation: Channel Dimensions	1.4 Adjacent Side	<u>Left</u>	<u>Right</u>	1.5 Valley Features
1.2 Alluvial Fan: None	Hillside Slope:	Steep	Flat	Valley Width (ft): 415
1.3 Corridor Encroachments:	Continuous w/ Bank:	Sometimes	Never	Width Determination: Measured
<u>Length (ft)</u> <u>One</u> <u>Height</u> <u>Both</u> <u>Height</u>	Within 1 Bankfull W:	Sometimes	Never	Confinement Type: VB
Berm: 0 0	Texture:	N.E.	N.E.	In Rock Gorge: No
Road: 1,183 10 0				Human Caused Change in Valley Width?: Yes
Railroad: 0 0				
Imp. Path: 0 0				
Dev.: 53 0				
1.6 Grade Controls: None				



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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Unnamed Trib 02 to Beaver Brook**

Reach: **T1.01.S4.01-B**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	11.00	2.11 Riffle/Step Spacing:	80 ft.	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	1.30	2.12 Substrate Composition		Bed:	5 inches
2.3 Mean Depth (ft.):	1.18	Bedrock:	0.0 %	Bar:	2.5 inches
2.4 Floodprone Width (ft.):	30.00	Boulder:	0.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	1.80	Cobble:	12.0 %	Stream Type:	E
Human Elev FloodPln (ft.):		Coarse Gravel:	25.0 %	Bed Material:	Gravel
2.6 Width/Depth Ratio:	9.32	Fine Gravel:	35.0 %	Subclass Slope:	None
2.7 Entrenchment Ratio:	2.73	Sand:	23.0 %	Bed Form:	Riffle-Pool
2.8 Incision Ratio:	1.38	Silt and Smaller:	5.0 %	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	No	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	Low	Detritus:	4.0 %	Reference Stream Type:	E
2.10 Riffles Type:	Complete	# Large Woody Debris:	38	Reference Bed Material:	Gravel
				Reference Subclass Slope:	None
				Reference Bedform:	Riffle-Pool

Step 3. Riparian Features

3.1 Stream Banks			Typical Bank Slope:	Steep	
Bank Texture			Bank Erosion	<u>Left</u> <u>Right</u>	Near Bank Vegetation Type <u>Left</u> <u>Right</u>
Upper	<u>Left</u> <u>Right</u>		Erosion Length (ft.):	107.0 22.7	Dominant: Herbaceous Deciduous
Material Type:	Sand Sand		Erosion Height (ft.):	3.2 3.0	Sub-dominant: Shrubs/Sapling Herbaceous
Consistency:	Non-cohesive Non-cohesive		Revetment Type:	Rip-Rap Rip-Rap	Bank Canopy
Lower			Revetment Length:	77.3 244.8	Canopy %: 1-25 51-75
Material Type:	Gravel Gravel				Mid-Channel Canopy: Open
Consistency:	Non-cohesive Non-cohesive				

3.2 Riparian Buffer

Buffer Width	<u>Left</u> <u>Right</u>	
Dominant	0-25 >100	
Sub-Dominant	26-50 0-25	
W less than 25	2,433 1,502	
Buffer Vegetation Type		
Dominant	Herbaceous Mixed Trees	
Sub-Dominant	Shrubs/Sapling Shrubs/Sapling	

3.3 Riparian Corridor

Corridor Land	<u>Left</u> <u>Right</u>		<u>Left</u> <u>Right</u>
Dominant	Hay Forest	Mass Failures	
Sub-dominant	Shrubs/Sapling Residential	Height	
(Legacy)	<u>Amount</u> <u>Mean Hieght</u>	Gullies Number	0
Failures	None	Gullies Length	0
Gullies	None		



Stream Geomorphic Assessment

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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Unnamed Trib 02 to Beaver Brook**

Reach: **T1.01.S4.01-B**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	Abundant	4.5 Flow Regulation Type	None	4.7 Stormwater Inputs	None
4.2 Adjacent Wetlands:	Abundant	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	Low	Impoundments:		Other:	Tile Drain:
4.4 # of Debris Jams:	3	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	0
		(old) Upstrm Flow Reg.:		Affected Length (ft):	0

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Instream Culvert	6	Yes	No	Yes	Yes	None
Instream Culvert	4.5	Yes	No	Yes	Yes	None

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal: 0	5.2 Other Features	Neck Cutoff: 0	5.4 Stream Ford or Animal Crossing:	Yes
Mid: 2	Delta: 0	Flood chutes: 0	Avulsion: 0	5.5 Straightening:	Straightening
Point: 12	Island: 0	5.3 Steep Riffles and Head Cuts	Head Cuts: 0	Straightening Length (ft.):	3,092
Side: 7	Braiding: 0	Steep Riffles: 0	Trib Rejuv.: No	5.5 Dredging:	Dredging

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:	6.4 Sediment Deposition:	Stream Gradient Type	<u>Left</u>	<u>Right</u>
6.2 Pool Substrate:	6.5 Channel Flow Status:	6.8 Bank Stability:		
6.3 Pool Variability:	6.6 Channel Alteration:	6.9 Bank Vegetation Protection		
Total Score: 0	6.7 Channel Sinuosity:	6.10 Riparian Veg. Zone Width:		
Habitat Rating: 0.00				
Habitat Stream Condition:				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Unconfined	Score	STD	Historic		
7.1 Channel Degradation	12	None	No	Geomorphic Rating	0.63	
7.2 Channel Aggradation	13	None	No	Channel Evolution Model	F	
7.3 Widening Channel	15	None	No	Channel Evolution Stage	II	
7.4 Change in Planform	10	None	No	Geomorphic Condition	Fair	
Total Score	50			Stream Sensitivity	Very High	



Stream Geomorphic Assessment

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Phase 2 Segment Summary Report Mill Brook - Basin 13

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Stream:	Unnamed Trib 02 to Beaver Brook	SGAT Version:	4.56
Reach:	T1.01.S4.01-C	Organization:	Fitzgerald Environmental
Segment Length(ft):	1,493	Observers:	EPF
Rain:	No	Completion Date:	7/1/2014
		Quality Control Status - Consultant:	Provisional
		Quality Control Status - Staff:	Provisional

- Step 0 - Location: This reach begins at the segmentation point downstream of the Bible Hill Rd crossing and extends upstream to where the VHD incorrectly crosses Sheddsville Road. The stream is actually flowing along the south side of the road.
- Step 5 - Notes: The VHD incorrectly shows the stream crossing Sheddsville Road multiple times. The stream centerline for this segment stays on the southwest side of the road. Mass failures opposite the roadway armoring are contributing large amounts of fine sediment to the channel.
- Step 7 - Narrative: Channel is encroached by Sheddsville Road for over half the segment length. Some areas of road armor (ie, rip rap) have constricted the channel by ~30%. Although no incision is reported (no natural floodplain for A-type channel), stage II CEM was selected to characterize the roadway impacts. Channel may incise in the future as there are no grade controls.

Step 1. Valley and Floodplain

1.1 Segmentation: Channel Dimensions	1.4 Adjacent Side	<u>Left</u>	<u>Right</u>	1.5 Valley Features
1.2 Alluvial Fan: None	Hillside Slope:	Extr.Steep	Extr.Steep	Valley Width (ft): 25
1.3 Corridor Encroachments:	Continuous w/ Bank:	Sometimes	Sometimes	Width Determination: Measured
<u>Length (ft)</u> <u>One</u> <u>Height</u> <u>Both</u> <u>Height</u>	Within 1 Bankfull W:	Always	Always	Confinement Type: NC
Berm: 0 0	Texture:	Mixed	Mixed	In Rock Gorge: No
Road: 904 10 0				Human Caused Change in Valley Width?: Yes
Railroad: 0 0				
Imp. Path: 0 0				
Dev.: 0 0				
1.6 Grade Controls: None				



Stream Geomorphic Assessment

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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Unnamed Trib 02 to Beaver Brook**

Reach: **T1.01.S4.01-C**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):	11.50	2.11 Riffle/Step Spacing:	60 ft.	2.13 Average Largest Particle on	
2.2 Max Depth (ft.):	1.70	2.12 Substrate Composition		Bed:	40 inches
2.3 Mean Depth (ft.):	1.15	Bedrock:	0.0 %	Bar:	N/A inches
2.4 Floodprone Width (ft.):	12.00	Boulder:	12.0 %	2.14 Stream Type	
2.5 Aband. Floodpn (ft.):	1.70	Cobble:	24.0 %	Stream Type:	A
Human Elev FloodPln (ft.):		Coarse Gravel:	18.0 %	Bed Material:	Gravel
2.6 Width/Depth Ratio:	10.00	Fine Gravel:	12.0 %	Subclass Slope:	None
2.7 Entrenchment Ratio:	1.04	Sand:	30.0 %	Bed Form:	Plane Bed
2.8 Incision Ratio:	1.00	Silt and Smaller:	4.0 %	Field Measured Slope:	
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:	No	2.15 Sub-reach Stream Type	
2.9 Sinuosity:	Low	Detritus:	0.0 %	Reference Stream Type:	
2.10 Riffles Type:	Eroded	# Large Woody Debris:	43	Reference Bed Material:	
				Reference Subclass Slope:	
				Reference Bedform:	

Step 3. Riparian Features

3.1 Stream Banks					Typical Bank Slope: Steep				
Bank Texture			Bank Erosion	<u>Left</u>	<u>Right</u>	Near Bank Vegetation Type <u>Left</u>			<u>Right</u>
Upper	<u>Left</u>	<u>Right</u>	Erosion Length (ft.):	0.0	43.3	Dominant:	Herbaceous	Deciduous	
Material Type:	Mix	Mix	Erosion Height (ft.):	0.0	4.0	Sub-dominant:	Deciduous	Shrubs/Sapling	
Consistency:	Cohesive	Cohesive	Revetment Type:	Rip-Rap	None	Bank Canopy			
Lower			Revetment Length:	328.9	0.0	Canopy %:	26-50	76-100	
Material Type:	Boulder/Cobbles	Boulder/Cobbles				Mid-Channel Canopy:		Closed	
Consistency:	Non-cohesive	Non-cohesive							

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>	Corridor Land	<u>Left</u>	<u>Right</u>
Dominant	51-100	>100	Dominant	Residential	Forest
Sub-Dominant	0-25	0-25	Sub-dominant	Forest	None
W less than 25	512	43	(Legacy)	<u>Amount</u>	<u>Mean Height</u>
Buffer Vegetation Type			Failures	Multiple	14.4
Dominant	Herbaceous	Mixed Trees	Gullies	None	
Sub-Dominant	Shrubs/Sapling	Shrubs/Sapling			

3.3 Riparian Corridor

	<u>Left</u>	<u>Right</u>		<u>Left</u>	<u>Right</u>
Mass Failures	48.020	377.14			
Height	87	64			
Gullies Number	0				
Gullies Length	0				



Stream Geomorphic Assessment

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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Unnamed Trib 02 to Beaver Brook**

Reach: **T1.01.S4.01-C**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	Minimal	4.5 Flow Regulation Type	None	4.7 Stormwater Inputs	None
4.2 Adjacent Wetlands:	None	Flow Reg. Use:		Field Ditch:	Road Ditch:
4.3 Flow Status:	Moderate	Impoundments:		Other:	Tile Drain:
4.4 # of Debris Jams:	5	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
		4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	0
		(old) Upstrm Flow Reg.:		Affected Length (ft):	0

4.8 Channel Constrictions:

Type	Width	Photo Taken?	GPS Taken?	Channel Constriction?	Floodprone Constriction?	Problems
Other	9	Yes	No	Yes	Yes	None
Bridge	20	Yes	No	No	Yes	None

Step 5. Channel Bed and Planform Changes

5.1 Bar Types		Diagonal:	0	5.2 Other Features		Neck Cutoff:	0	5.4 Stream Ford or Animal Crossing:		No	
Mid:	4	Delta:	0	Flood chutes:		0	Avulsion:	0	5.5 Straightening:		None
Point:	5	Island:	0	5.3 Steep Riffles and Head Cuts		Head Cuts:	0	Straightening Length (ft.):		0	
Side:	0	Braiding:	0	Steep Riffles:		0	Trib Rejuv.:	No	5.5 Dredging:		None

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:		6.4 Sediment Deposition:		Stream Gradient Type	<u>Left</u>	<u>Right</u>
6.2 Pool Substrate:		6.5 Channel Flow Status:		6.8 Bank Stability:		
6.3 Pool Variability:		6.6 Channel Alteration:		6.9 Bank Vegetation Protection		
Total Score:	0	6.7 Channel Sinuosity:		6.10 Riparian Veg. Zone Width:		
Habitat Rating:	0.00					
Habitat Stream Condition:						

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	Confined	Score	STD	Historic		
7.1 Channel Degradation		7	None	No	Geomorphic Rating	0.51
7.2 Channel Aggradation		13	None	No	Channel Evolution Model	F
7.3 Widening Channel		11	None	No	Channel Evolution Stage	II
7.4 Change in Planforml		10	None	No	Geomorphic Condition	Fair
Total Score		41			Stream Sensitivity	Very High



Stream Geomorphic Assessment

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Phase 2 Segment Summary Report Mill Brook - Basin 13

Page 1

Stream: **Unnamed Trib 02 to Beaver Brook** SGAT Version: **4.56**
Reach: **T1.01.S4.01-D** Organization: **Fitzgerald Environmental**
Segment Length(ft): **5,298** Observers: **EPF**
Rain: Completion Date:
Quality Control Status - Consultant: **Provisional**
Quality Control Status - Staff: **Provisional**
Why Not Assessed: **Other (to be explained in comments)**

Step 0 - Location: **This segment starts at the segment break near the incorrect VHD crossing of Sheddsville Rd. This segment was not assessed due to the scope of the project and the very small size of the watershed.**

Step 5 - Notes:

Step 7 - Narrative:

Step 1. Valley and Floodplain

1.1 Segmentation:	1.4 Adjacent Side	<u>Left</u>	<u>Right</u>	1.5 Valley Features
1.2 Alluvial Fan: None	Hillside Slope:			Valley Width (ft):
1.3 Corridor Encroachments:	Continuous w/ Bank:			Width Determination:
<u>Length (ft)</u> <u>One</u> <u>Height</u> <u>Both</u> <u>Height</u>	Within 1 Bankfull W:			Confinement Type:
Berm: 0	Texture:			In Rock Gorge:
Road: 1,122 10 0				Human Caused Change in Valley Width?:
Railroad: 0 0				
Imp. Path: 0 0				
Dev.: 270 0				

1.6 Grade Controls:

Type	Location	Total Height	Total Height Above Water	Photo Taken?	GPS Taken?
Dam	Mid-segment	0.0	0.0	No	
Dam	Mid-segment	0.0	0.0	No	



Stream Geomorphic Assessment

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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Unnamed Trib 02 to Beaver Brook**

Reach: **T1.01.S4.01-D**

Step 2. Stream Channel

2.1 Bankfull Width (ft.):		2.11 Riffle/Step Spacing:		2.13 Average Largest Particle on
2.2 Max Depth (ft.):		2.12 Substrate Composition		Bed:
2.3 Mean Depth (ft):		Bedrock:	%	Bar:
2.4 Floodprone Width (ft.):		Boulder:	%	2.14 Stream Type
2.5 Aband. Floodpn (ft.):		Cobble:	%	Stream Type:
Human Elev FloodPln (ft.):		Coarse Gravel:	%	Bed Material:
2.6 Width/Depth Ratio:	0.00	Fine Gravel:	%	Subclass Slope:
2.7 Entrenchment Ratio:	0.00	Sand:	%	Bed Form:
2.8 Incision Ratio:	0.00	Silt and Smaller:	%	Field Measured Slope:
Human Elevated Inc. Rat.:	0.00	Silt/Clay Present:		2.15 Sub-reach Stream Type
2.9 Sinuosity:		Detritus:	%	Reference Stream Type:
2.10 Riffles Type:		# Large Woody Debris:		Reference Bed Material:
				Reference Subclass Slope:
				Reference Bedform:

Step 3. Riparian Features

3.1 Stream Banks				Typical Bank Slope:
Bank Texture				
Upper	<u>Left</u>	<u>Right</u>	Bank Erosion	<u>Left</u> <u>Right</u> Near Bank Vegetation Type <u>Left</u> <u>Right</u>
Material Type:			Erosion Length (ft.):	0.0 0.0 Dominant:
Consistency:			Erosion Height (ft.):	0.0 0.0 Sub-dominant:
Lower			Revetment Type:	None None Bank Canopy
Material Type:			Revetment Length:	0.0 0.0 Canopy %:
Consistency:				Mid-Channel Canopy:

3.2 Riparian Buffer

Buffer Width	<u>Left</u>	<u>Right</u>
Dominant		
Sub-Dominant		
W less than 25	0	0
Buffer Vegetation Type		
Dominant		
Sub-Dominant		

3.3 Riparian Corridor

Corridor Land	<u>Left</u>	<u>Right</u>	<u>Left</u>	<u>Right</u>
Dominant				
Sub-dominant				
(Legacy)	<u>Amount</u>	<u>Mean Hieght</u>	Mass Failures	
Failures	None		Height	
Gullies	None		Gullies Number	0
			Gullies Length	0



Stream Geomorphic Assessment

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Phase 2 Segment Summary Report

Mill Brook - Basin 13

Stream: **Unnamed Trib 02 to Beaver Brook**

Reach: **T1.01.S4.01-D**

Step 4. Flow & Flow Modifiers

4.1 Springs / Seeps:	4.5 Flow Regulation Type	Small Run of River	4.7 Stormwater Inputs	None
4.2 Adjacent Wetlands:	Flow Reg. Use:	Recreation	Field Ditch:	Road Ditch:
4.3 Flow Status:	Impoundments:		Other:	Tile Drain:
4.4 # of Debris Jams: 0	Impoundment Loc.:		Overland Flow:	Urb Strm Wtr Pipe:
	4.6 Up/Down Strm flow reg.:	None	4.9 # of Beaver Dams:	0
	(old) Upstrm Flow Reg.:		Affected Length (ft):	0

4.8 Channel Constrictions:

Step 5. Channel Bed and Planform Changes

5.1 Bar Types	Diagonal:	5.2 Other Features	Neck Cutoff:	0	5.4 Stream Ford or Animal Crossing:	No	
Mid:	Delta:	Flood chutes:	0	Avulsion:	0	5.5 Straightening:	None
Point:	Island:	5.3 Steep Riffles and Head Cuts	Head Cuts:	0	Straightening Length (ft.):	0	
Side:	Braiding:	0	Steep Riffles:	0	Trib Rejuv.:	5.5 Dredging:	None

Step 6. Rapid Habitat Assessment Data

6.1 Epifaunal Substrate - Avl.:	6.4 Sediment Deposition:	Stream Gradient Type	<u>Left</u>	<u>Right</u>
6.2 Pool Substrate:	6.5 Channel Flow Status:	6.8 Bank Stability:		
6.3 Pool Variability:	6.6 Channel Alteration:	6.9 Bank Vegetation Protection		
Total Score:	6.7 Channel Sinuosity:	6.10 Riparian Veg. Zone Width:		
Habitat Rating:				
Habitat Stream Condition:				

Step 7. Rapid Geomorphic Assessment Data

Confinement Type	<u>Score</u>	<u>STD</u>	<u>Historic</u>
7.1 Channel Degradation			
7.2 Channel Aggradation			
7.3 Widening Channel			
7.4 Change in Planform			
Total Score			

Geomorphic Rating
Channel Evolution Model
Channel Evolution Stage
Geomorphic Condition
Stream Sensitivity

APPENDIX C:

REACH HABITAT DATA SUMMARY SHEETS

Rapid Habitat Assessment and Substrate Summary

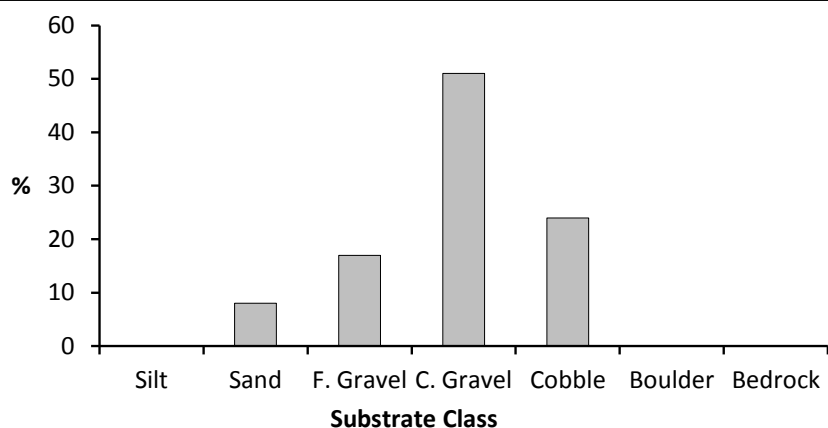
Fitzgerald Environmental Associates, LLC.

Mill Brook Phase 2

Mill Brook Main Stem

Reach/Segment Information

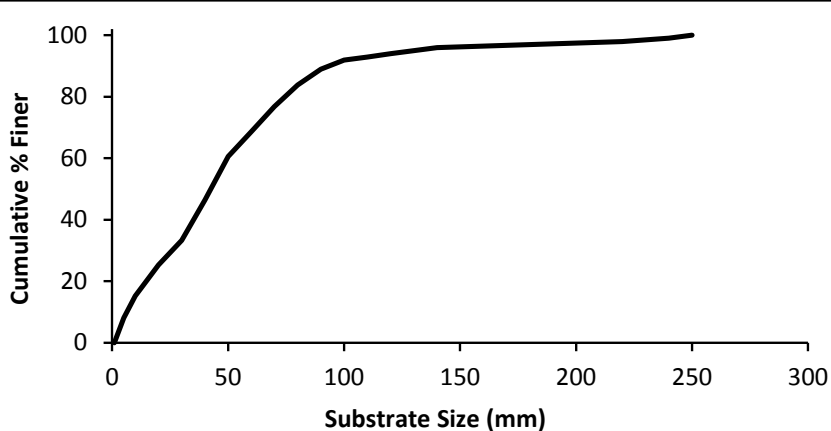
SGA ID:	M02
Length (ft):	3,807
Reference Bedform Type:	Riffle-Pool
Total RHA Score:	65
RHA Percentage:	41%
Overall Habitat Condition:	Fair



Sediment Composition and Mobility

Class	Range (mm)	Percent
Silt	< 0.06	0
Sand	0.06 - 2	8
F. Gravel	2 - 16	17
C. Gravel	16 - 64	51
Cobble	64 - 256	24
Boulder	256 - 4096	0
Bedrock	> 4096	0

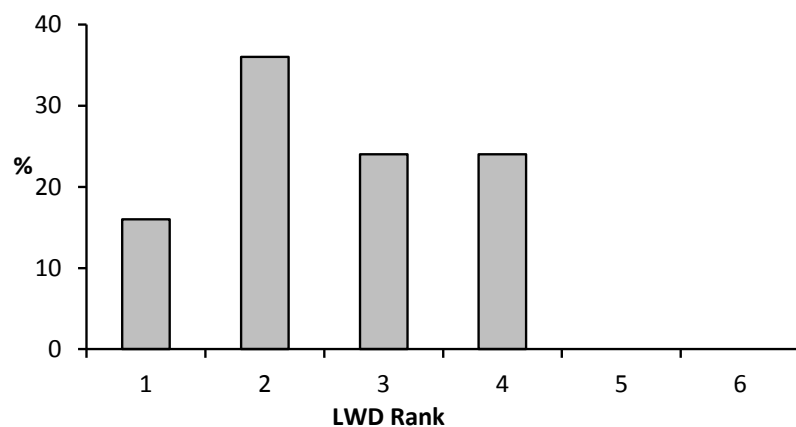
Median Substrate Size:	40	mm
Avg. Largest Particle (Bar):	140	mm
Riffle Stability Index (RSI):	96	%



Large Woody Debris (LWD)

Rank	Diameter (ft)	L (W_{bkt})	#
1	$0.5 \leq D < 1.0$	< 0.5	4
2	$0.5 \leq D < 1.0$	≥ 0.5	9
3	$1.0 \leq D < 2.0$	< 0.5	6
4	$1.0 \leq D < 2.0$	≥ 0.5	6
5	$D \geq 2.0$	< 0.5	0
6	$D \geq 2.0$	≥ 0.5	0

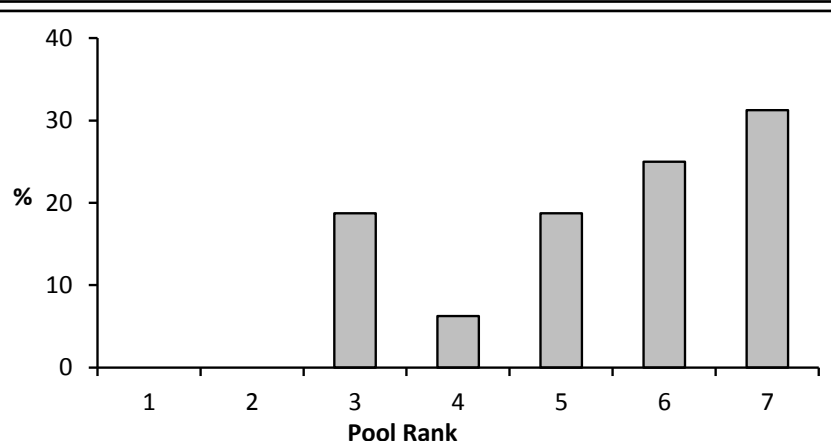
LWDs/mile: 35



Pools

Rank	Depth (ft)	L (W_{bkt})	#
1	$1.0 \leq D < 2.0$	< 0.5	0
2	$1.0 \leq D < 2.0$	≥ 0.5	0
3	$2.0 \leq D < 3.0$	< 0.5	3
4	$2.0 \leq D < 3.0$	≥ 0.5	1
5	$D \geq 3.0$	< 0.5	3
6	$D \geq 3.0$	≥ 0.5	4
7	$D \geq 3.0$	≥ 1.0	5

Pools/mile: 22



Rapid Habitat Assessment and Substrate Summary

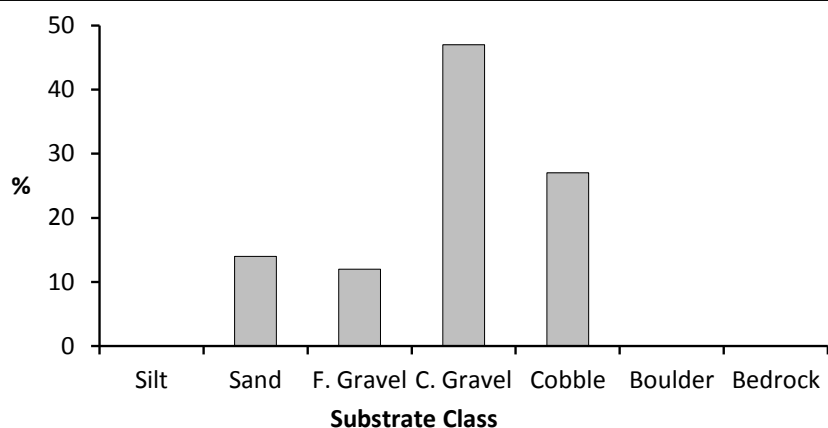
Fitzgerald Environmental Associates, LLC.

Mill Brook Phase 2

Mill Brook Main Stem

Reach/Segment Information

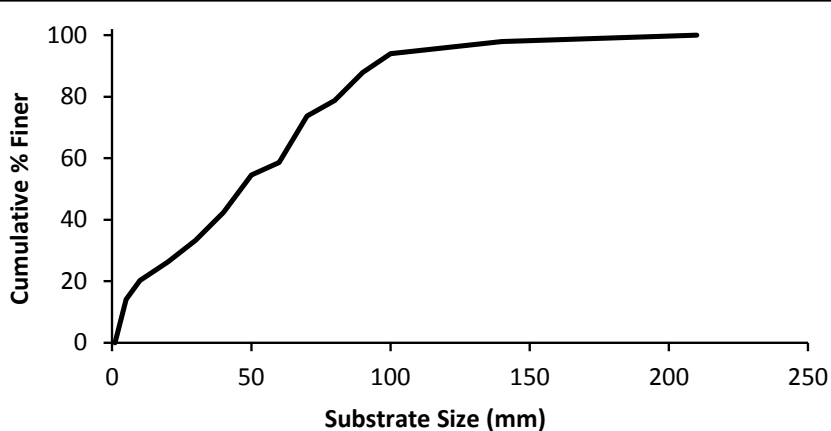
SGA ID:	M04
Length (ft):	8,067
Reference Bedform Type:	Riffle-Pool
Total RHA Score:	80
RHA Percentage:	50%
Overall Habitat Condition:	Fair



Sediment Composition and Mobility

Class	Range (mm)	Percent
Silt	< 0.06	0
Sand	0.06 - 2	14
F. Gravel	2 - 16	12
C. Gravel	16 - 64	47
Cobble	64 - 256	27
Boulder	256 - 4096	0
Bedrock	> 4096	0

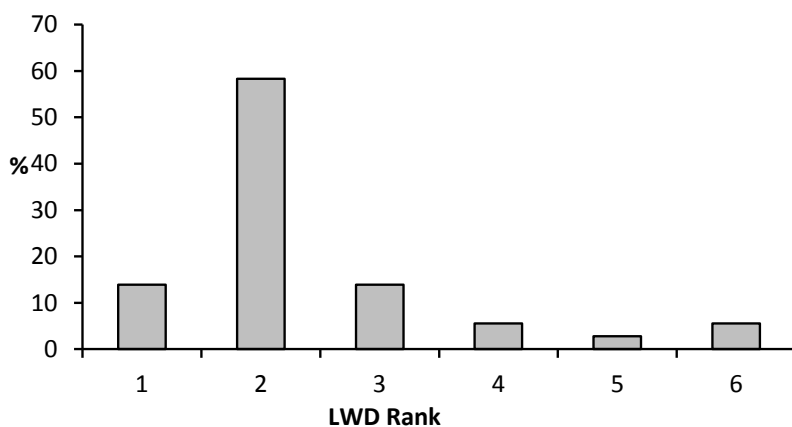
Median Substrate Size:	40	mm
Avg. Largest Particle (Bar):	120	mm
Riffle Stability Index (RSI):	96	%



Large Woody Debris (LWD)

Rank	Diameter (ft)	L (W_{bkt})	#
1	$0.5 \leq D < 1.0$	< 0.5	5
2	$0.5 \leq D < 1.0$	≥ 0.5	21
3	$1.0 \leq D < 2.0$	< 0.5	5
4	$1.0 \leq D < 2.0$	≥ 0.5	2
5	$D \geq 2.0$	< 0.5	1
6	$D \geq 2.0$	≥ 0.5	2

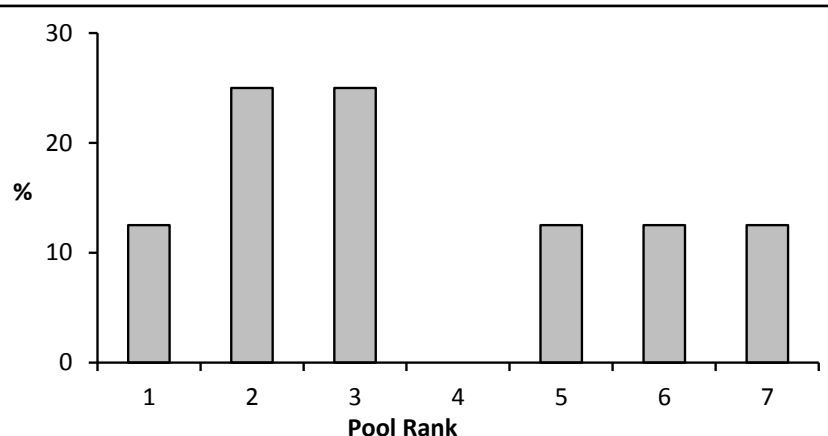
LWDs/mile: 24



Pools

Rank	Depth (ft)	L (W_{bkt})	#
1	$1.0 \leq D < 2.0$	< 0.5	1
2	$1.0 \leq D < 2.0$	≥ 0.5	2
3	$2.0 \leq D < 3.0$	< 0.5	2
4	$2.0 \leq D < 3.0$	≥ 0.5	0
5	$D \geq 3.0$	< 0.5	1
6	$D \geq 3.0$	≥ 0.5	1
7	$D \geq 3.0$	≥ 1.0	1

Pools/mile: 5



Rapid Habitat Assessment and Substrate Summary

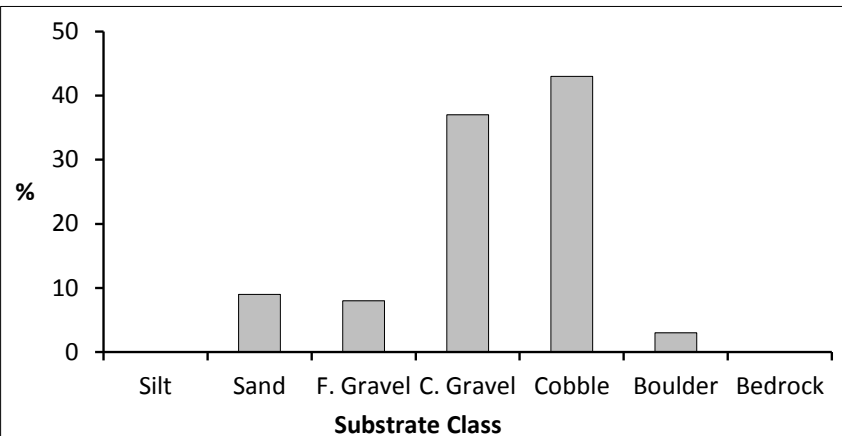
Fitzgerald Environmental Associates, LLC.

Mill Brook Phase 2

Mill Brook Main Stem

Reach/Segment Information

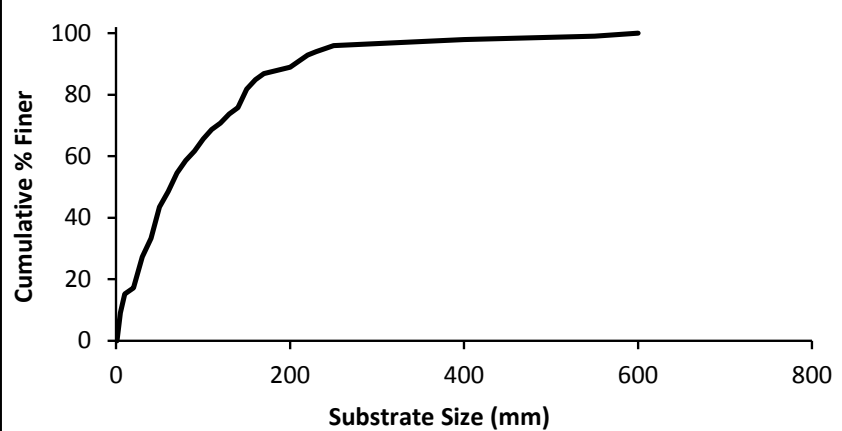
SGA ID:	M05.A
Length (ft):	7,170
Reference Bedform Type:	Riffle-Pool
Total RHA Score:	79
RHA Percentage:	49%
Overall Habitat Condition:	Fair



Sediment Composition and Mobility

Class	Range (mm)	Percent
Silt	< 0.06	0
Sand	0.06 - 2	9
F. Gravel	2 - 16	8
C. Gravel	16 - 64	37
Cobble	64 - 256	43
Boulder	256 - 4096	3
Bedrock	> 4096	0

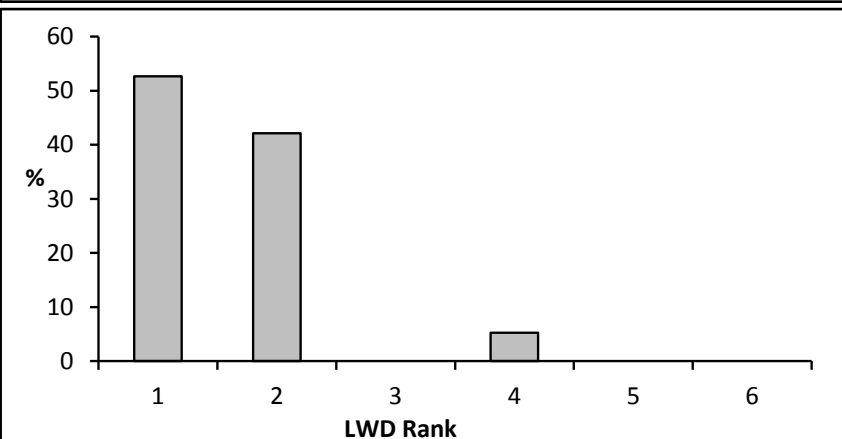
Median Substrate Size:	60	mm
Avg. Largest Particle (Bar):	140	mm
Riffle Stability Index (RSI):	76	%



Large Woody Debris (LWD)

Rank	Diameter (ft)	L (W_{bkt})	#
1	$0.5 \leq D < 1.0$	< 0.5	10
2	$0.5 \leq D < 1.0$	≥ 0.5	8
3	$1.0 \leq D < 2.0$	< 0.5	0
4	$1.0 \leq D < 2.0$	≥ 0.5	1
5	$D \geq 2.0$	< 0.5	0
6	$D \geq 2.0$	≥ 0.5	0

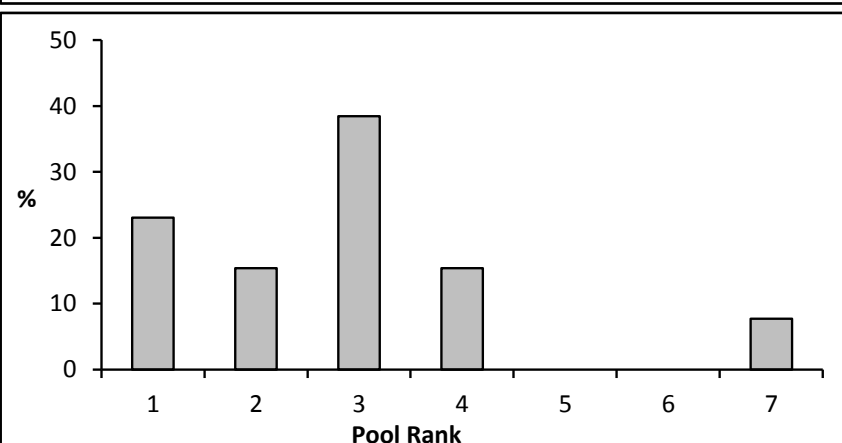
LWDs/mile: 14



Pools

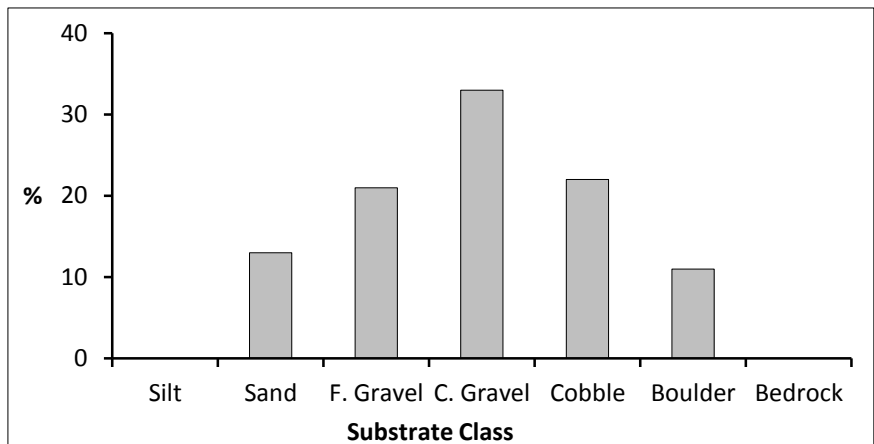
Rank	Depth (ft)	L (W_{bkt})	#
1	$1.0 \leq D < 2.0$	< 0.5	3
2	$1.0 \leq D < 2.0$	≥ 0.5	2
3	$2.0 \leq D < 3.0$	< 0.5	5
4	$2.0 \leq D < 3.0$	≥ 0.5	2
5	$D \geq 3.0$	< 0.5	0
6	$D \geq 3.0$	≥ 0.5	0
7	$D \geq 3.0$	≥ 1.0	1

Pools/mile: 10



Reach/Segment Information

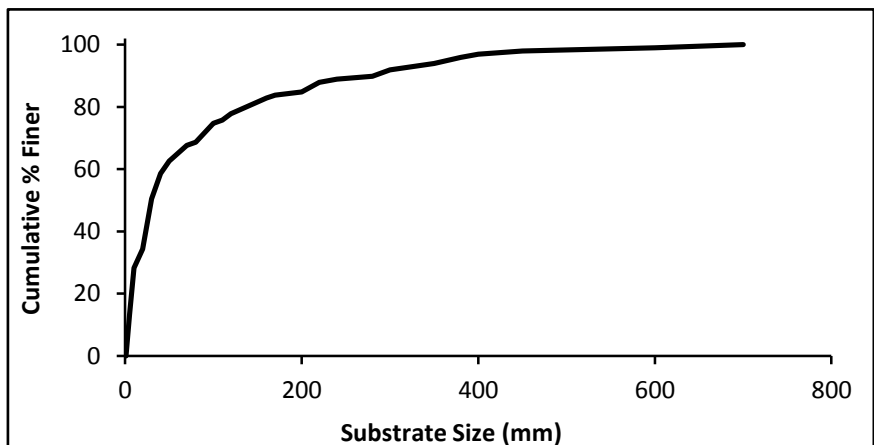
SGA ID:	M05.B
Length (ft):	5,345
Reference Bedform Type:	Riffle-Pool
Total RHA Score:	66
RHA Percentage:	41%
Overall Habitat Condition:	Fair



Sediment Composition and Mobility

Class	Range (mm)	Percent
Silt	< 0.06	0
Sand	0.06 - 2	13
F. Gravel	2 - 16	21
C. Gravel	16 - 64	33
Cobble	64 - 256	22
Boulder	256 - 4096	11
Bedrock	> 4096	0

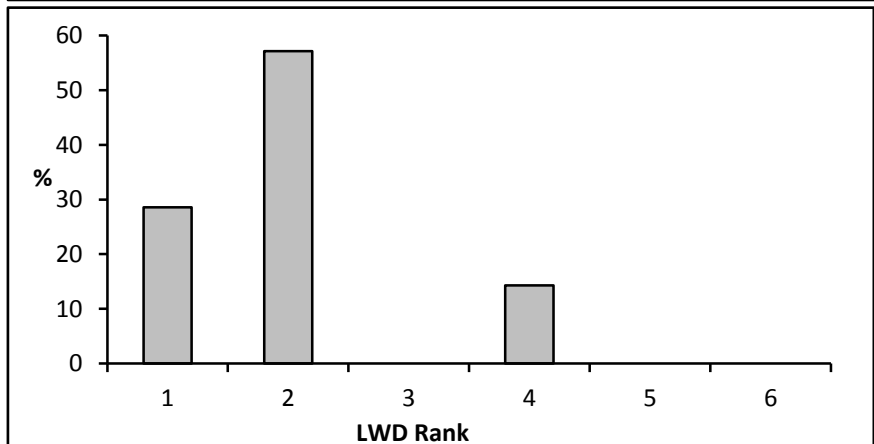
Median Substrate Size:	25	mm
Avg. Largest Particle (Bar):	100	mm
Riffle Stability Index (RSI):	75	%



Large Woody Debris (LWD)

Rank	Diameter (ft)	L (W_{bkt})	#
1	$0.5 \leq D < 1.0$	< 0.5	2
2	$0.5 \leq D < 1.0$	≥ 0.5	4
3	$1.0 \leq D < 2.0$	< 0.5	0
4	$1.0 \leq D < 2.0$	≥ 0.5	1
5	$D \geq 2.0$	< 0.5	0
6	$D \geq 2.0$	≥ 0.5	0

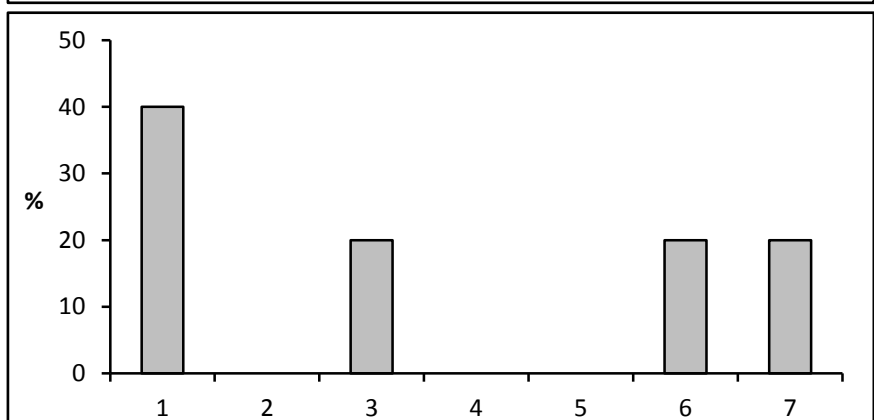
LWDs/mile: 7



Pools

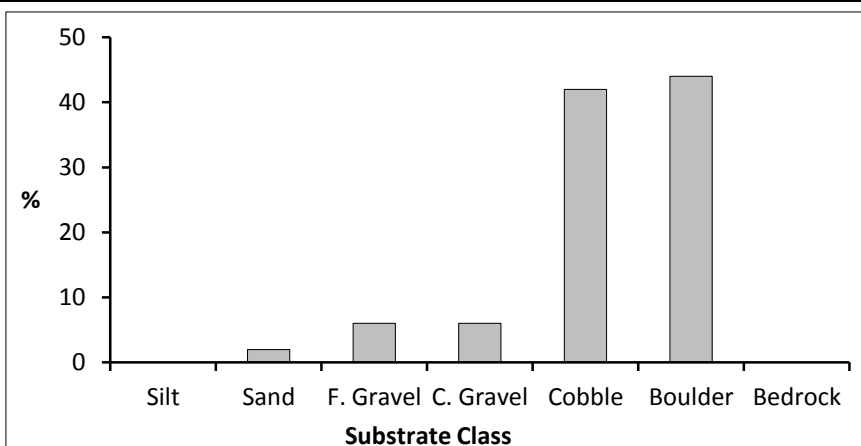
Rank	Depth (ft)	L (W_{bkt})	#
1	$1.0 \leq D < 2.0$	< 0.5	2
2	$1.0 \leq D < 2.0$	≥ 0.5	0
3	$2.0 \leq D < 3.0$	< 0.5	1
4	$2.0 \leq D < 3.0$	≥ 0.5	0
5	$D \geq 3.0$	< 0.5	0
6	$D \geq 3.0$	≥ 0.5	1
7	$D \geq 3.0$	≥ 1.0	1

Pools/mile: 5



Reach/Segment Information

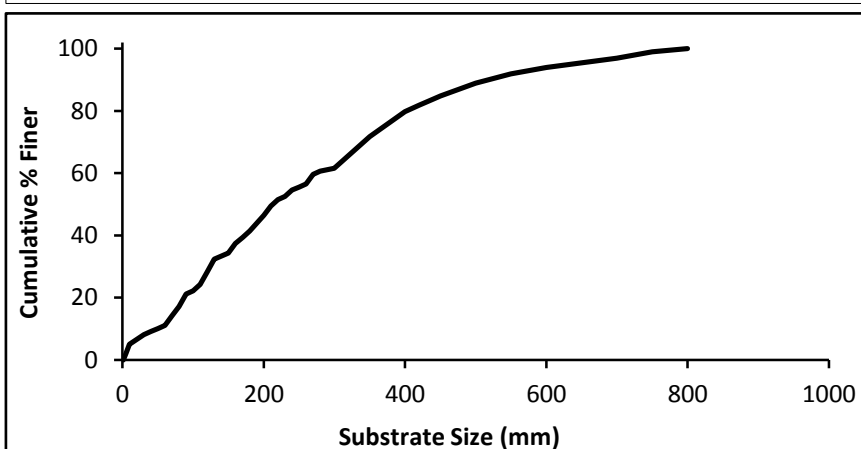
SGA ID:	M05.C
Length (ft):	1,841
Reference Bedform Type:	Riffle-Pool
Total RHA Score:	91
RHA Percentage:	57%
Overall Habitat Condition:	Fair



Sediment Composition and Mobility

Class	Range (mm)	Percent
Silt	< 0.06	0
Sand	0.06 - 2	2
F. Gravel	2 - 16	6
C. Gravel	16 - 64	6
Cobble	64 - 256	42
Boulder	256 - 4096	44
Bedrock	> 4096	0

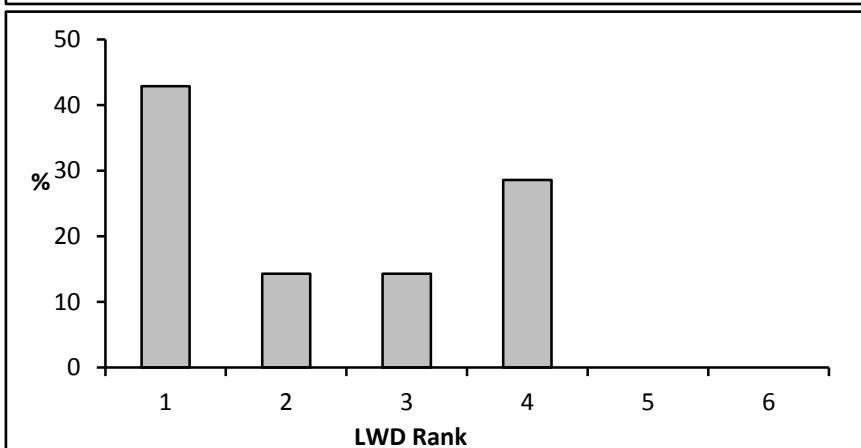
Median Substrate Size:	210	mm
Avg. Largest Particle (Bar):	220	mm
Riffle Stability Index (RSI):	52	%



Large Woody Debris (LWD)

Rank	Diameter (ft)	L (W_{bkt})	#
1	$0.5 \leq D < 1.0$	< 0.5	3
2	$0.5 \leq D < 1.0$	≥ 0.5	1
3	$1.0 \leq D < 2.0$	< 0.5	1
4	$1.0 \leq D < 2.0$	≥ 0.5	2
5	$D \geq 2.0$	< 0.5	0
6	$D \geq 2.0$	≥ 0.5	0

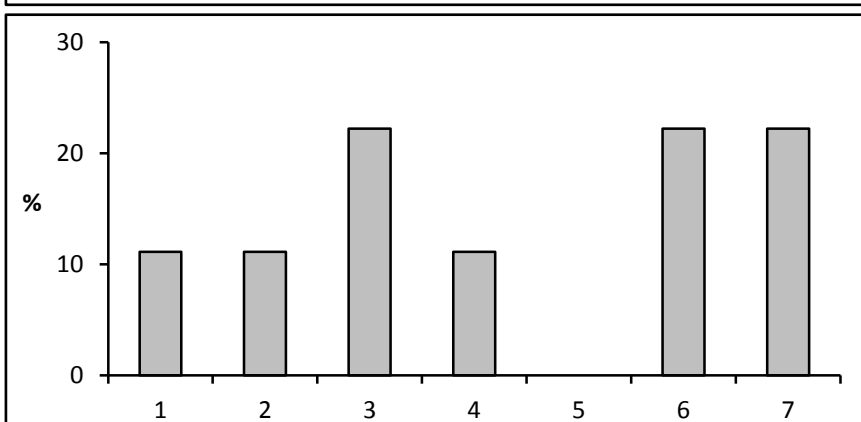
LWDs/mile: 20



Pools

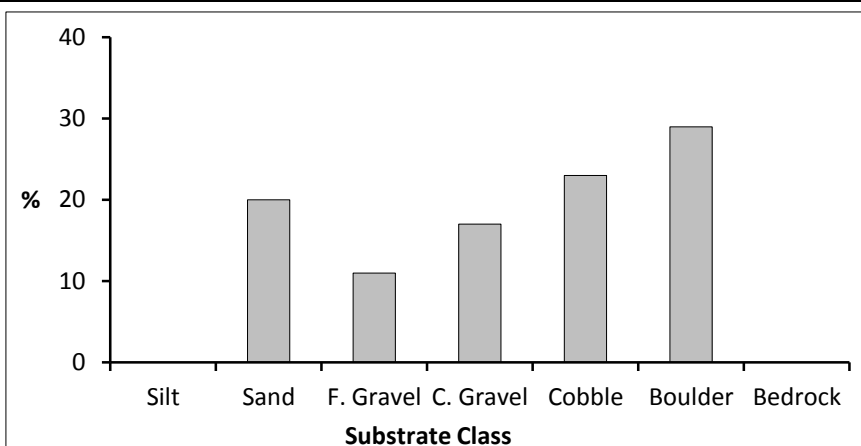
Rank	Depth (ft)	L (W_{bkt})	#
1	$1.0 \leq D < 2.0$	< 0.5	1
2	$1.0 \leq D < 2.0$	≥ 0.5	1
3	$2.0 \leq D < 3.0$	< 0.5	2
4	$2.0 \leq D < 3.0$	≥ 0.5	1
5	$D \geq 3.0$	< 0.5	0
6	$D \geq 3.0$	≥ 0.5	2
7	$D \geq 3.0$	≥ 1.0	2

Pools/mile: 26



Reach/Segment Information

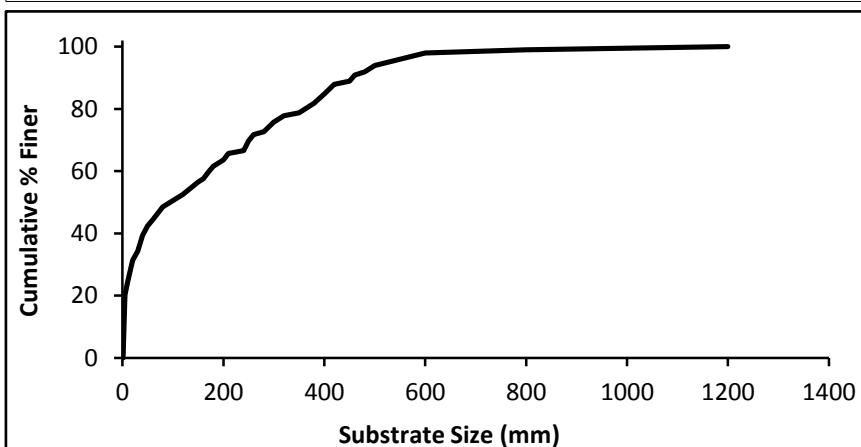
SGA ID:	M06
Length (ft):	6,224
Reference Bedform Type:	Riffle-Pool
Total RHA Score:	79
RHA Percentage:	49%
Overall Habitat Condition:	Fair



Sediment Composition and Mobility

Class	Range (mm)	Percent
Silt	< 0.06	0
Sand	0.06 - 2	20
F. Gravel	2 - 16	11
C. Gravel	16 - 64	17
Cobble	64 - 256	23
Boulder	256 - 4096	29
Bedrock	> 4096	0

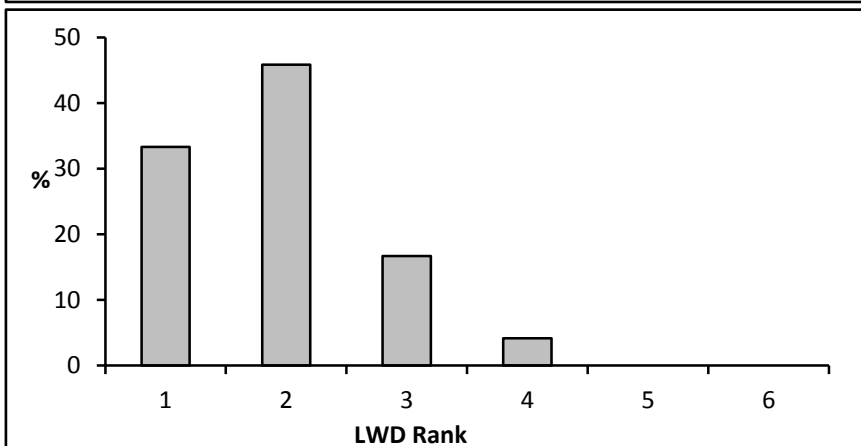
Median Substrate Size:	80	mm
Avg. Largest Particle (Bar):	180	mm
Riffle Stability Index (RSI):	62	%



Large Woody Debris (LWD)

Rank	Diameter (ft)	L (W_{bkt})	#
1	0.5 ≤ D < 1.0	< 0.5	8
2	0.5 ≤ D < 1.0	≥ 0.5	11
3	1.0 ≤ D < 2.0	< 0.5	4
4	1.0 ≤ D < 2.0	≥ 0.5	1
5	D ≥ 2.0	< 0.5	0
6	D ≥ 2.0	≥ 0.5	0

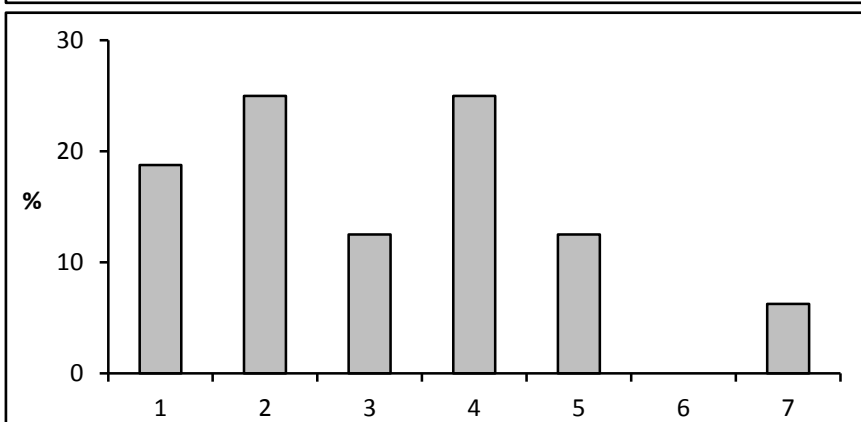
LWDs/mile: 20



Pools

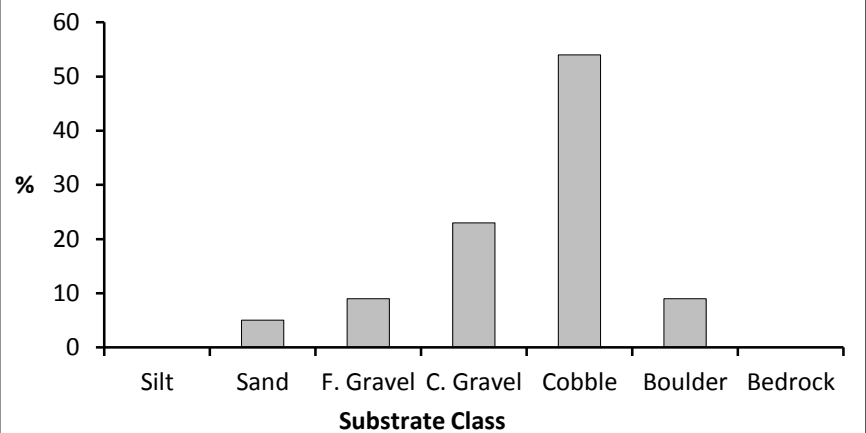
Rank	Depth (ft)	L (W_{bkt})	#
1	1.0 ≤ D < 2.0	< 0.5	3
2	1.0 ≤ D < 2.0	≥ 0.5	4
3	2.0 ≤ D < 3.0	< 0.5	2
4	2.0 ≤ D < 3.0	≥ 0.5	4
5	D ≥ 3.0	< 0.5	2
6	D ≥ 3.0	≥ 0.5	0
7	D ≥ 3.0	≥ 1.0	1

Pools/mile: 14



Reach/Segment Information

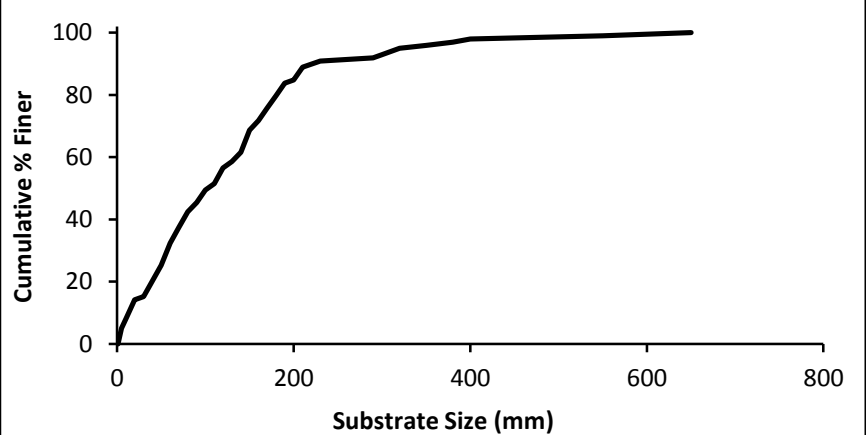
SGA ID:	M07.A
Length (ft):	1,300
Reference Bedform Type:	Riffle-Pool
Total RHA Score:	104
RHA Percentage:	65%
Overall Habitat Condition:	Good



Sediment Composition and Mobility

Class	Range (mm)	Percent
Silt	< 0.06	0
Sand	0.06 - 2	5
F. Gravel	2 - 16	9
C. Gravel	16 - 64	23
Cobble	64 - 256	54
Boulder	256 - 4096	9
Bedrock	> 4096	0

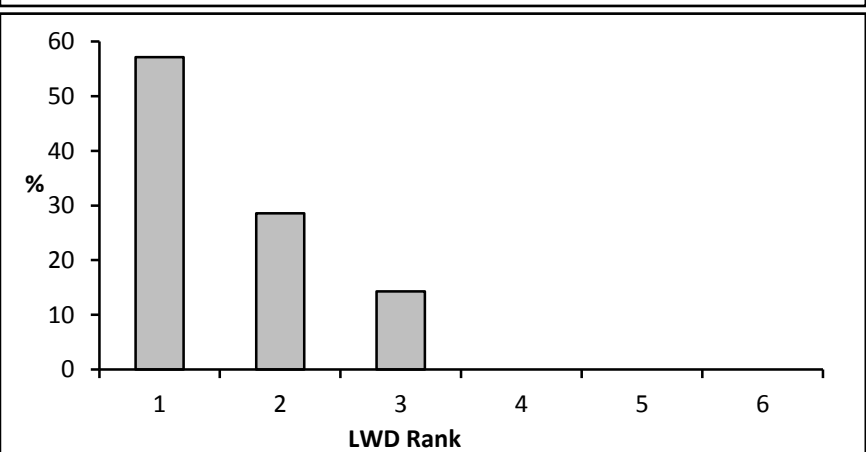
Median Substrate Size:	100	mm
Avg. Largest Particle (Bar):	150	mm
Riffle Stability Index (RSI):	69	%



Large Woody Debris (LWD)

Rank	Diameter (ft)	L (W_{bkt})	#
1	$0.5 \leq D < 1.0$	< 0.5	4
2	$0.5 \leq D < 1.0$	≥ 0.5	2
3	$1.0 \leq D < 2.0$	< 0.5	1
4	$1.0 \leq D < 2.0$	≥ 0.5	0
5	$D \geq 2.0$	< 0.5	0
6	$D \geq 2.0$	≥ 0.5	0

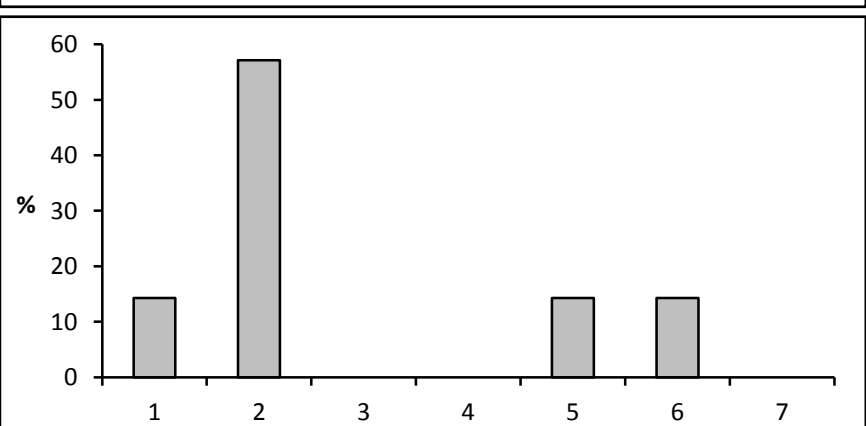
LWDs/mile: 28



Pools

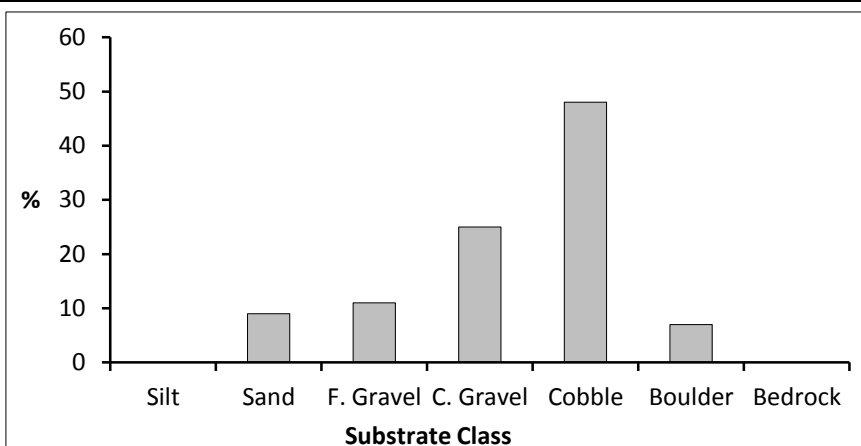
Rank	Depth (ft)	L (W_{bkt})	#
1	$1.0 \leq D < 2.0$	< 0.5	1
2	$1.0 \leq D < 2.0$	≥ 0.5	4
3	$2.0 \leq D < 3.0$	< 0.5	0
4	$2.0 \leq D < 3.0$	≥ 0.5	0
5	$D \geq 3.0$	< 0.5	1
6	$D \geq 3.0$	≥ 0.5	1
7	$D \geq 3.0$	≥ 1.0	0

Pools/mile: 28



Reach/Segment Information

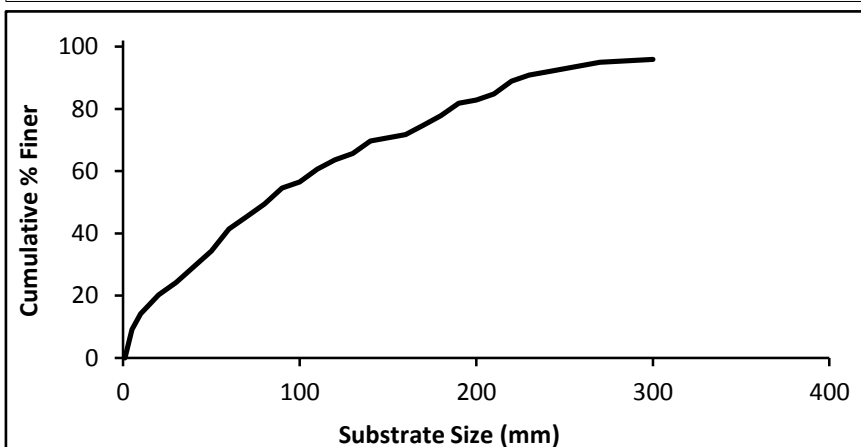
SGA ID:	M07.B
Length (ft):	6,234
Reference Bedform Type:	Riffle-Pool
Total RHA Score:	72
RHA Percentage:	45%
Overall Habitat Condition:	Fair



Sediment Composition and Mobility

Class	Range (mm)	Percent
Silt	< 0.06	0
Sand	0.06 - 2	9
F. Gravel	2 - 16	11
C. Gravel	16 - 64	25
Cobble	64 - 256	48
Boulder	256 - 4096	7
Bedrock	> 4096	0

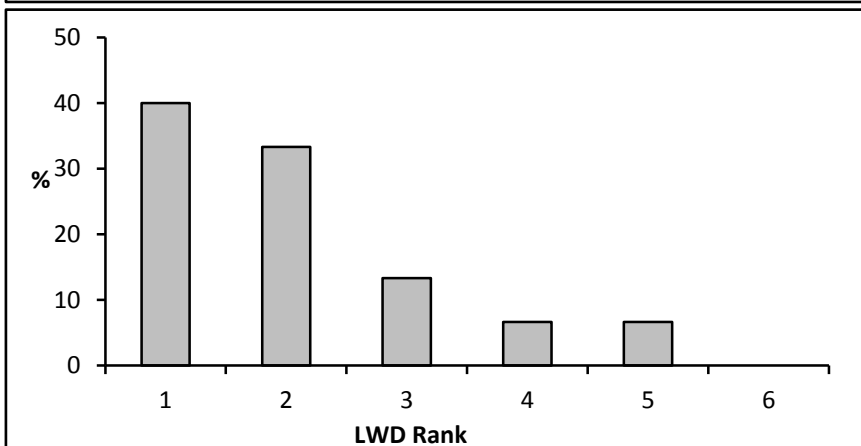
Median Substrate Size:	80	mm
Avg. Largest Particle (Bar):	120	mm
Riffle Stability Index (RSI):	64	%



Large Woody Debris (LWD)

Rank	Diameter (ft)	L (W_{bkt})	#
1	0.5 ≤ D < 1.0	< 0.5	6
2	0.5 ≤ D < 1.0	≥ 0.5	5
3	1.0 ≤ D < 2.0	< 0.5	2
4	1.0 ≤ D < 2.0	≥ 0.5	1
5	D ≥ 2.0	< 0.5	1
6	D ≥ 2.0	≥ 0.5	0

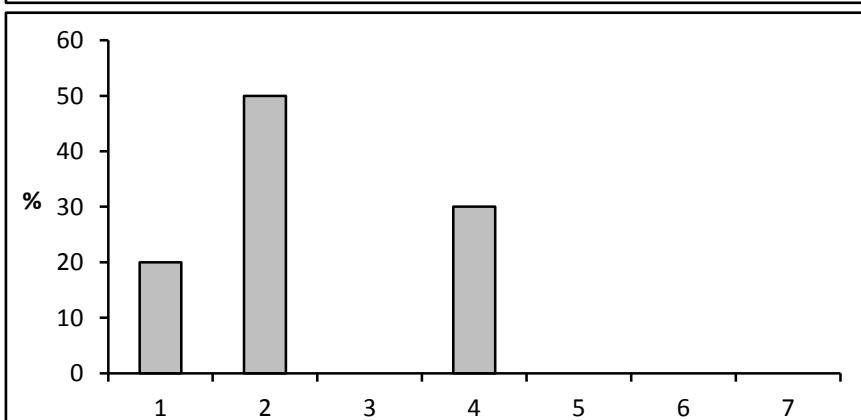
LWDs/mile: 13



Pools

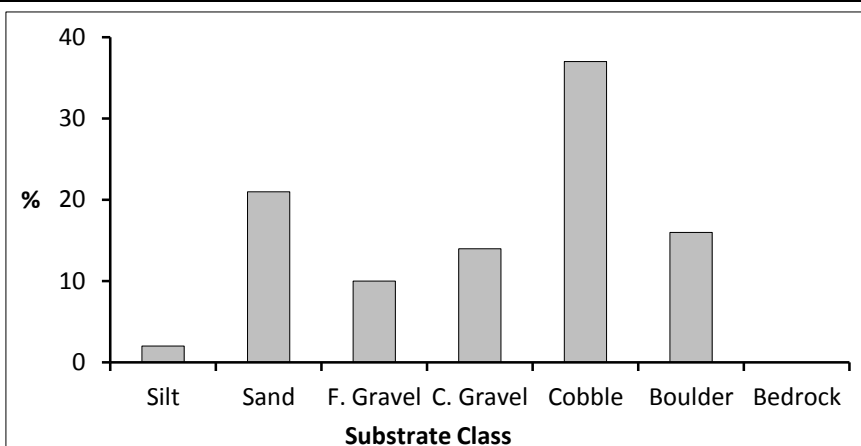
Rank	Depth (ft)	L (W_{bkt})	#
1	1.0 ≤ D < 2.0	< 0.5	2
2	1.0 ≤ D < 2.0	≥ 0.5	5
3	2.0 ≤ D < 3.0	< 0.5	0
4	2.0 ≤ D < 3.0	≥ 0.5	3
5	D ≥ 3.0	< 0.5	0
6	D ≥ 3.0	≥ 0.5	0
7	D ≥ 3.0	≥ 1.0	0

Pools/mile: 8



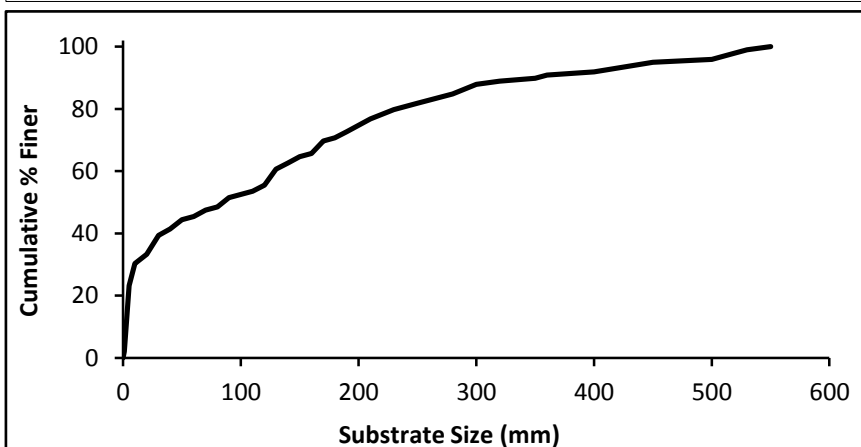
Reach/Segment Information

SGA ID:	M08
Length (ft):	2,087
Reference Bedform Type:	Riffle-Pool
Total RHA Score:	97
RHA Percentage:	61%
Overall Habitat Condition:	Fair

**Sediment Composition and Mobility**

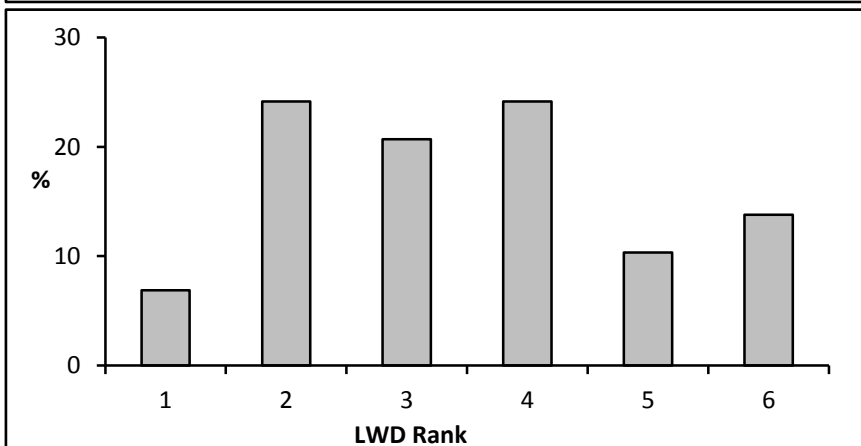
Class	Range (mm)	Percent
Silt	< 0.06	2
Sand	0.06 - 2	21
F. Gravel	2 - 16	10
C. Gravel	16 - 64	14
Cobble	64 - 256	37
Boulder	256 - 4096	16
Bedrock	> 4096	0

Median Substrate Size:	80	mm
Avg. Largest Particle (Bar):	110	mm
Riffle Stability Index (RSI):	54	%

**Large Woody Debris (LWD)**

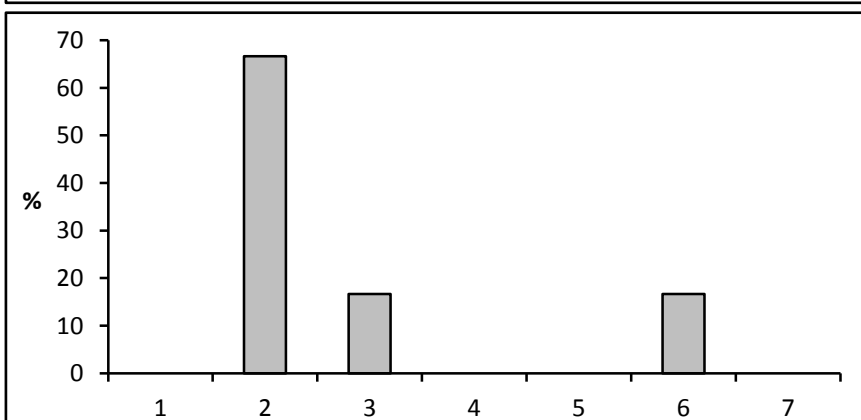
Rank	Diameter (ft)	L (W_{bkt})	#
1	$0.5 \leq D < 1.0$	< 0.5	2
2	$0.5 \leq D < 1.0$	≥ 0.5	7
3	$1.0 \leq D < 2.0$	< 0.5	6
4	$1.0 \leq D < 2.0$	≥ 0.5	7
5	$D \geq 2.0$	< 0.5	3
6	$D \geq 2.0$	≥ 0.5	4

LWDs/mile: 73

**Pools**

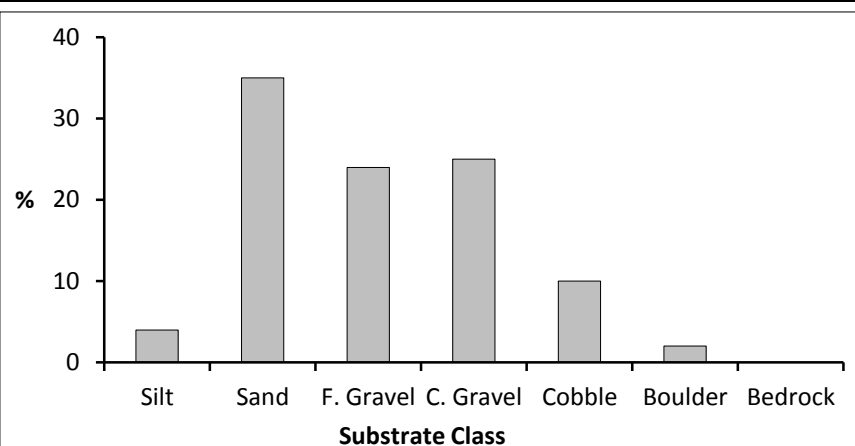
Rank	Depth (ft)	L (W_{bkt})	#
1	$1.0 \leq D < 2.0$	< 0.5	0
2	$1.0 \leq D < 2.0$	≥ 0.5	4
3	$2.0 \leq D < 3.0$	< 0.5	1
4	$2.0 \leq D < 3.0$	≥ 0.5	0
5	$D \geq 3.0$	< 0.5	0
6	$D \geq 3.0$	≥ 0.5	1
7	$D \geq 3.0$	≥ 1.0	0

Pools/mile: 15



Reach/Segment Information

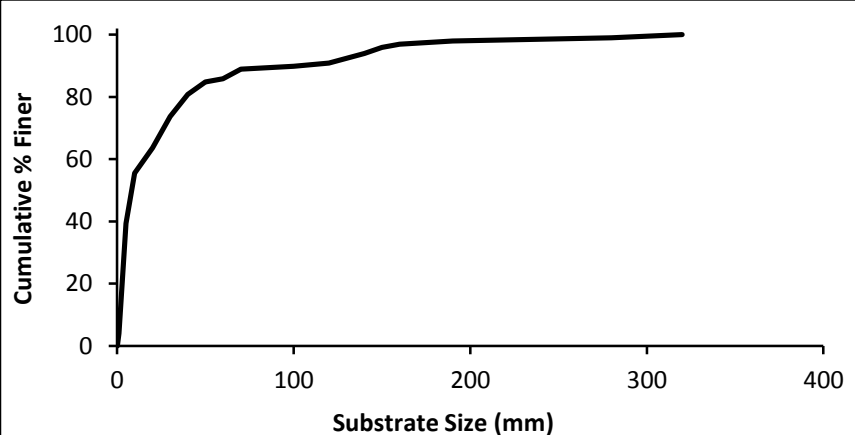
SGA ID:	M09.A
Length (ft):	3,021
Reference Bedform Type:	Riffle-Pool
Total RHA Score:	69
RHA Percentage:	43%
Overall Habitat Condition:	Fair



Sediment Composition and Mobility

Class	Range (mm)	Percent
Silt	< 0.06	4
Sand	0.06 - 2	35
F. Gravel	2 - 16	24
C. Gravel	16 - 64	25
Cobble	64 - 256	10
Boulder	256 - 4096	2
Bedrock	> 4096	0

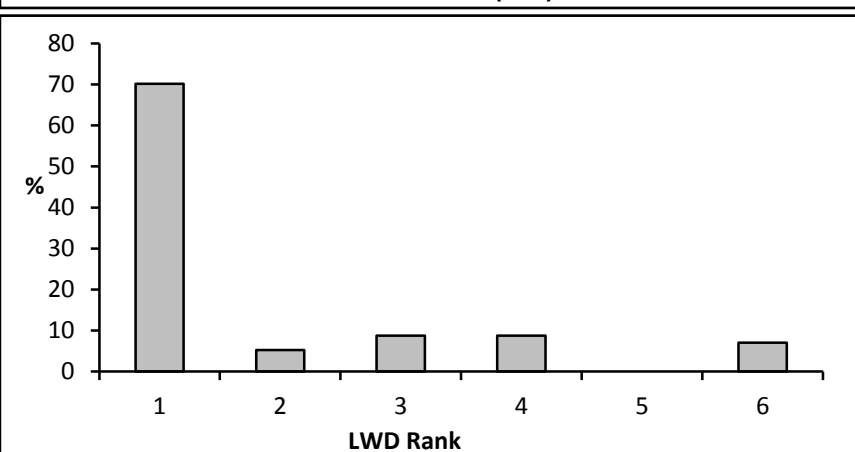
Median Substrate Size:	5	mm
Avg. Largest Particle (Bar):	N/A	mm
Riffle Stability Index (RSI):	N/A	%



Large Woody Debris (LWD)

Rank	Diameter (ft)	L (W_{bkt})	#
1	$0.5 \leq D < 1.0$	< 0.5	40
2	$0.5 \leq D < 1.0$	≥ 0.5	3
3	$1.0 \leq D < 2.0$	< 0.5	5
4	$1.0 \leq D < 2.0$	≥ 0.5	5
5	$D \geq 2.0$	< 0.5	0
6	$D \geq 2.0$	≥ 0.5	4

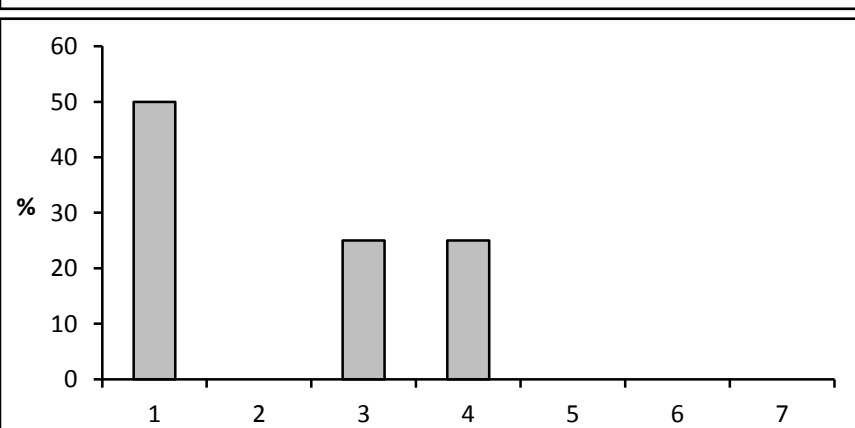
LWDs/mile: 100



Pools

Rank	Depth (ft)	L (W_{bkt})	#
1	$1.0 \leq D < 2.0$	< 0.5	10
2	$1.0 \leq D < 2.0$	≥ 0.5	0
3	$2.0 \leq D < 3.0$	< 0.5	5
4	$2.0 \leq D < 3.0$	≥ 0.5	5
5	$D \geq 3.0$	< 0.5	0
6	$D \geq 3.0$	≥ 0.5	0
7	$D \geq 3.0$	≥ 1.0	0

Pools/mile: 35



Rapid Habitat Assessment and Substrate Summary

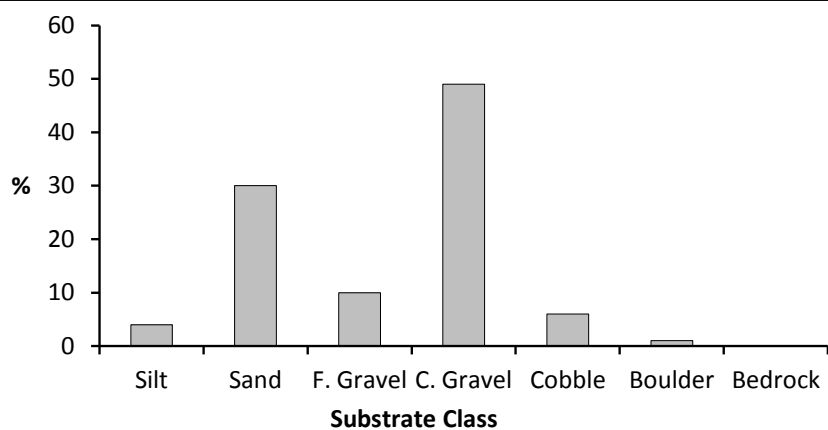
Fitzgerald Environmental Associates, LLC.

Mill Brook Phase 2

Mill Brook Main Stem

Reach/Segment Information

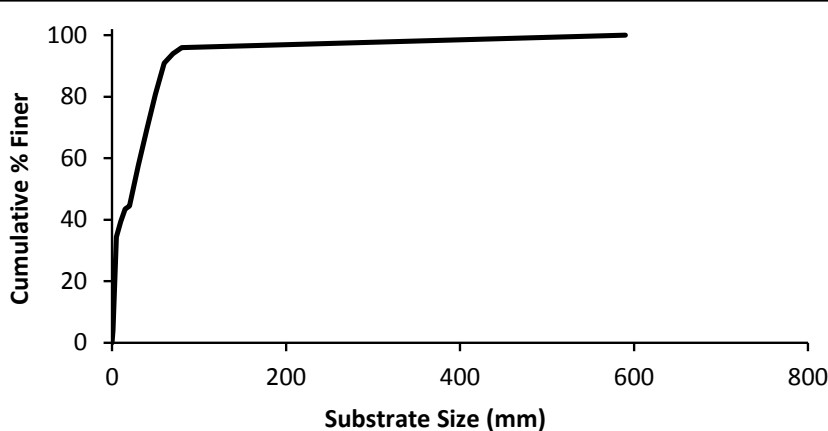
SGA ID:	M09.B
Length (ft):	8,525
Reference Bedform Type:	Riffle-Pool
Total RHA Score:	85
RHA Percentage:	53%
Overall Habitat Condition:	Fair



Sediment Composition and Mobility

Class	Range (mm)	Percent
Silt	< 0.06	4
Sand	0.06 - 2	30
F. Gravel	2 - 16	10
C. Gravel	16 - 64	49
Cobble	64 - 256	6
Boulder	256 - 4096	1
Bedrock	> 4096	0

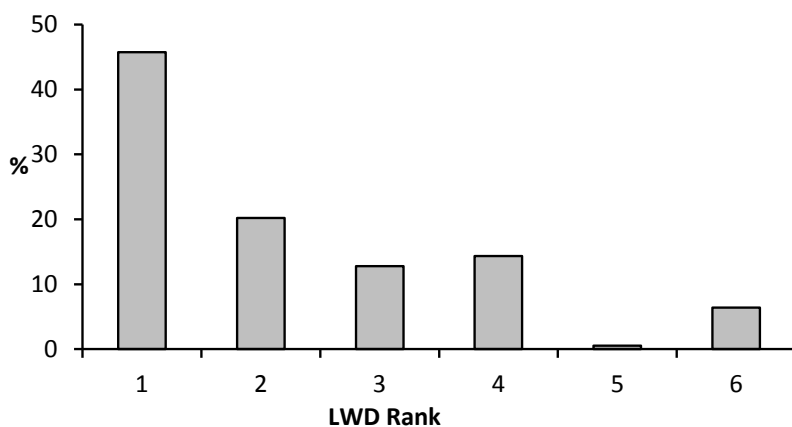
Median Substrate Size:	20	mm
Avg. Largest Particle (Bar):	64	mm
Riffle Stability Index (RSI):	93	%



Large Woody Debris (LWD)

Rank	Diameter (ft)	L (W_{bkt})	#
1	$0.5 \leq D < 1.0$	< 0.5	86
2	$0.5 \leq D < 1.0$	≥ 0.5	38
3	$1.0 \leq D < 2.0$	< 0.5	24
4	$1.0 \leq D < 2.0$	≥ 0.5	27
5	$D \geq 2.0$	< 0.5	1
6	$D \geq 2.0$	≥ 0.5	12

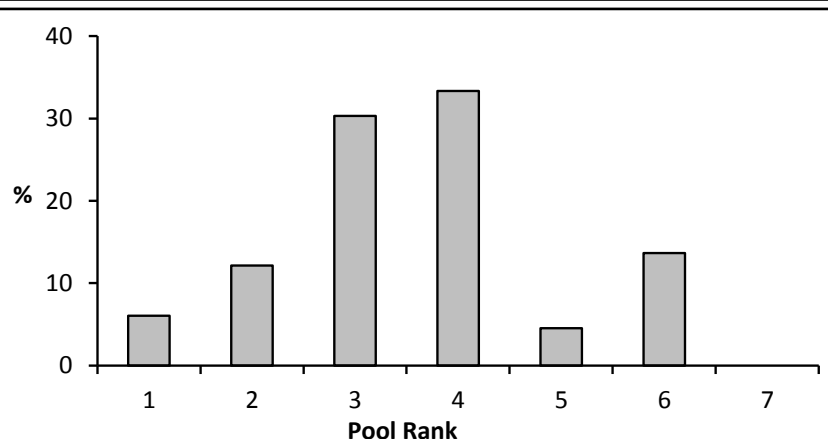
LWDs/mile: 116



Pools

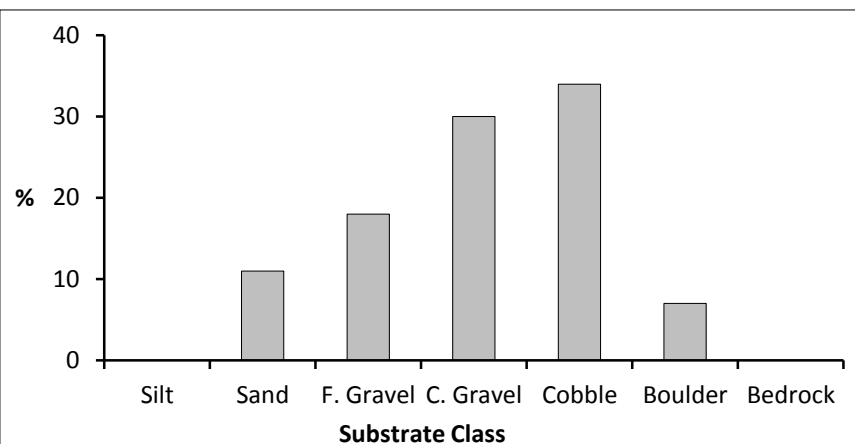
Rank	Depth (ft)	L (W_{bkt})	#
1	$1.0 \leq D < 2.0$	< 0.5	4
2	$1.0 \leq D < 2.0$	≥ 0.5	8
3	$2.0 \leq D < 3.0$	< 0.5	20
4	$2.0 \leq D < 3.0$	≥ 0.5	22
5	$D \geq 3.0$	< 0.5	3
6	$D \geq 3.0$	≥ 0.5	9
7	$D \geq 3.0$	≥ 1.0	0

Pools/mile: 41



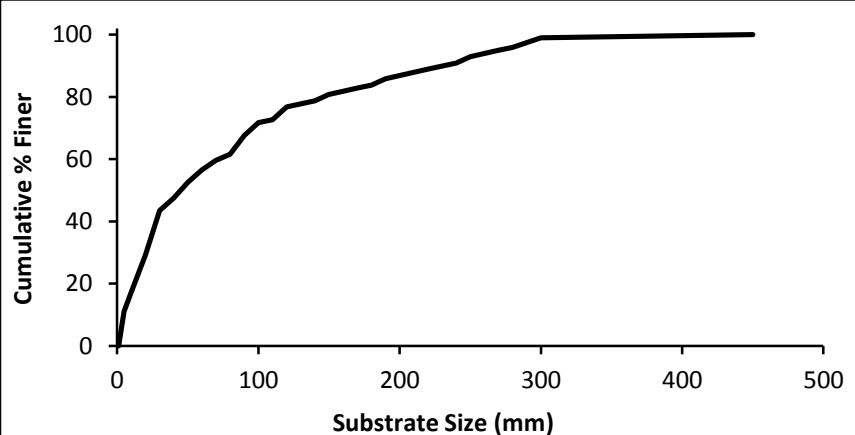
Reach/Segment Information

SGA ID:	M10
Length (ft):	1,908
Reference Bedform Type:	Riffle-Pool
Total RHA Score:	83
RHA Percentage:	82%
Overall Habitat Condition:	Fair

**Sediment Composition and Mobility**

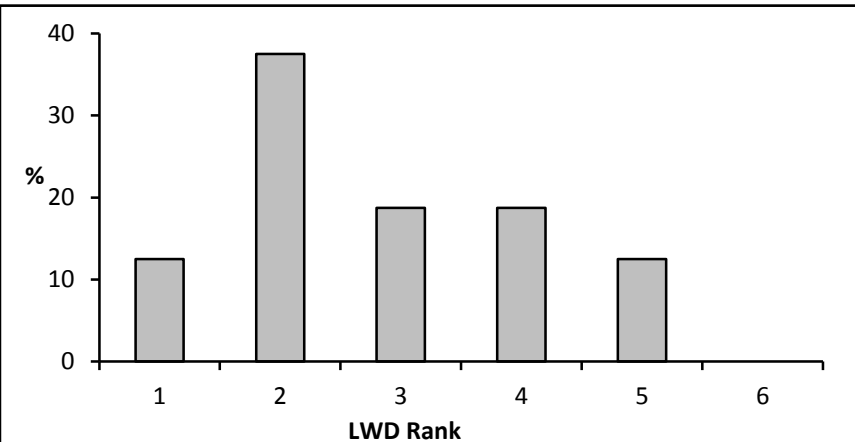
Class	Range (mm)	Percent
Silt	< 0.06	0
Sand	0.06 - 2	11
F. Gravel	2 - 16	18
C. Gravel	16 - 64	30
Cobble	64 - 256	34
Boulder	256 - 4096	7
Bedrock	> 4096	0

Median Substrate Size:	40	mm
Avg. Largest Particle (Bar):	120	mm
Riffle Stability Index (RSI):	77	%

**Large Woody Debris (LWD)**

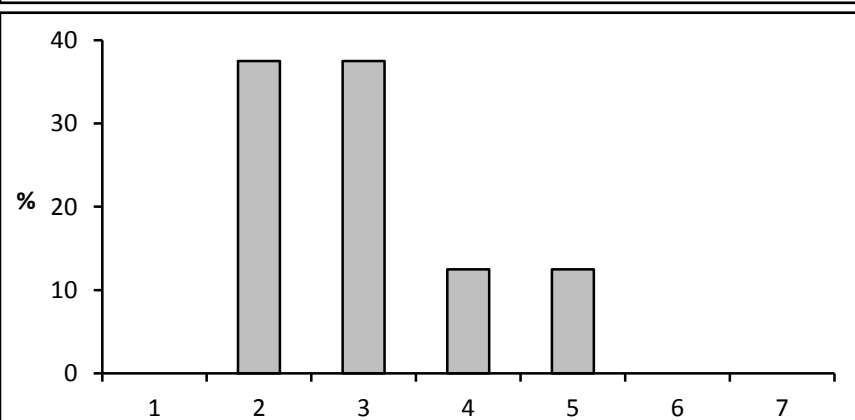
Rank	Diameter (ft)	L (W_{bkf})	#
1	$0.5 \leq D < 1.0$	< 0.5	2
2	$0.5 \leq D < 1.0$	≥ 0.5	6
3	$1.0 \leq D < 2.0$	< 0.5	3
4	$1.0 \leq D < 2.0$	≥ 0.5	3
5	$D \geq 2.0$	< 0.5	2
6	$D \geq 2.0$	≥ 0.5	0

LWDs/mile: 44

**Pools**

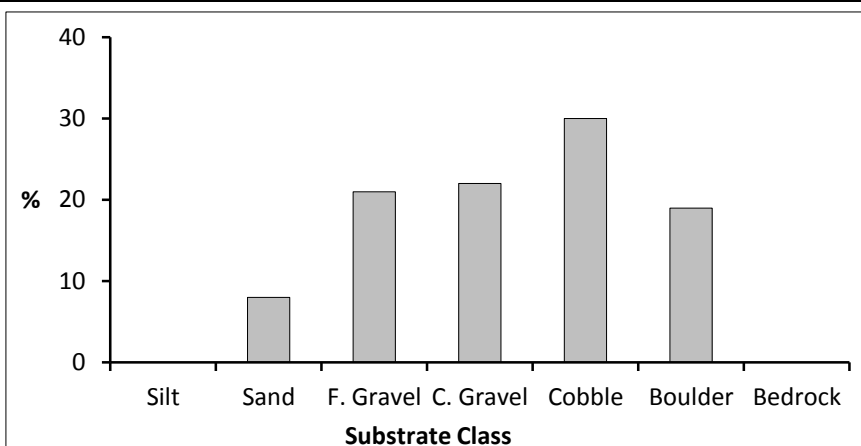
Rank	Depth (ft)	L (W_{bkf})	#
1	$1.0 \leq D < 2.0$	< 0.5	0
2	$1.0 \leq D < 2.0$	≥ 0.5	3
3	$2.0 \leq D < 3.0$	< 0.5	3
4	$2.0 \leq D < 3.0$	≥ 0.5	1
5	$D \geq 3.0$	< 0.5	1
6	$D \geq 3.0$	≥ 0.5	0
7	$D \geq 3.0$	≥ 1.0	0

Pools/mile: 22



Reach/Segment Information

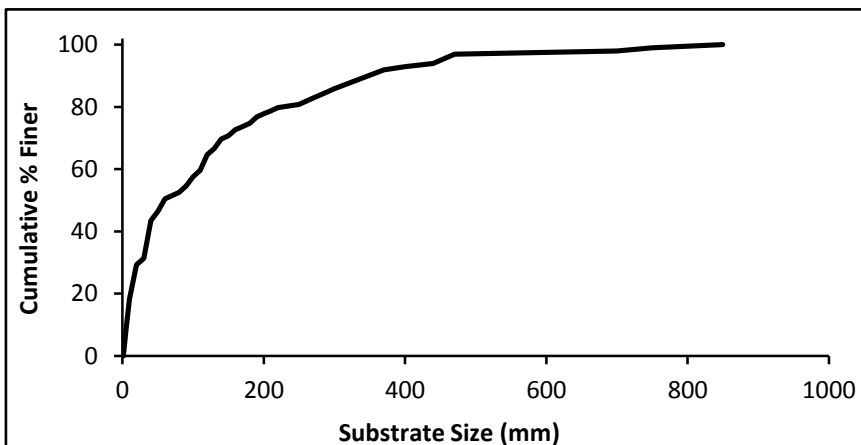
SGA ID:	M11
Length (ft):	3,980
Reference Bedform Type:	Riffle-Pool
Total RHA Score:	83
RHA Percentage:	52%
Overall Habitat Condition:	Fair



Sediment Composition and Mobility

Class	Range (mm)	Percent
Silt	< 0.06	0
Sand	0.06 - 2	8
F. Gravel	2 - 16	21
C. Gravel	16 - 64	22
Cobble	64 - 256	30
Boulder	256 - 4096	19
Bedrock	> 4096	0

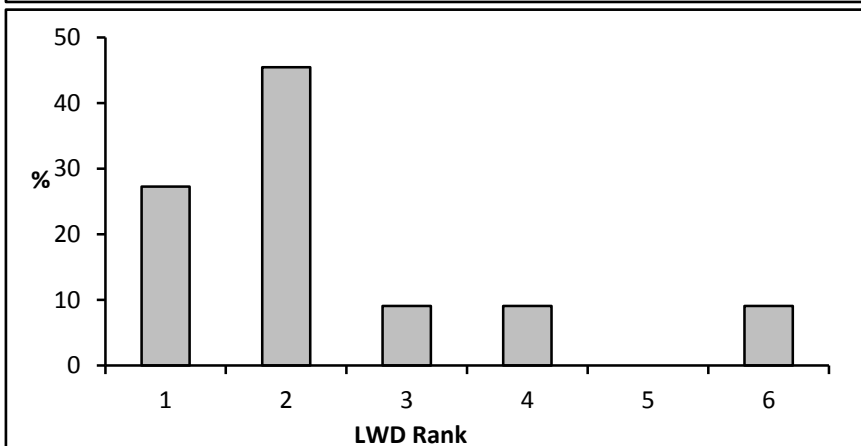
Median Substrate Size:	55	mm
Avg. Largest Particle (Bar):	160	mm
Riffle Stability Index (RSI):	73	%



Large Woody Debris (LWD)

Rank	Diameter (ft)	L (W_{bkt})	#
1	$0.5 \leq D < 1.0$	< 0.5	6
2	$0.5 \leq D < 1.0$	≥ 0.5	10
3	$1.0 \leq D < 2.0$	< 0.5	2
4	$1.0 \leq D < 2.0$	≥ 0.5	2
5	$D \geq 2.0$	< 0.5	0
6	$D \geq 2.0$	≥ 0.5	2

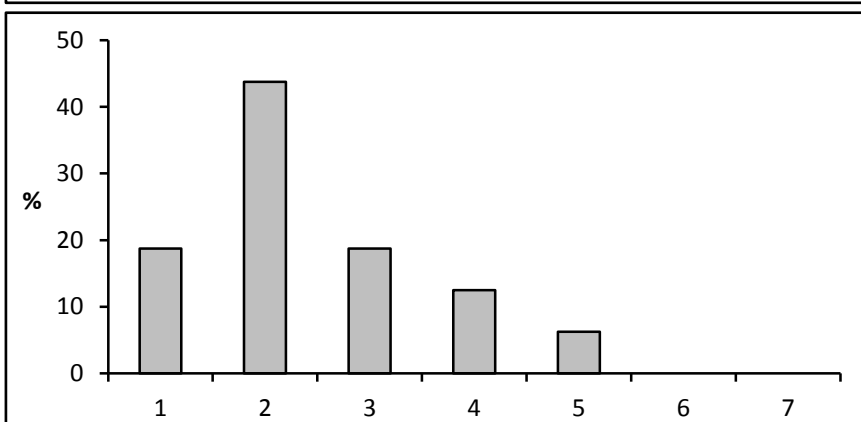
LWDs/mile: 29



Pools

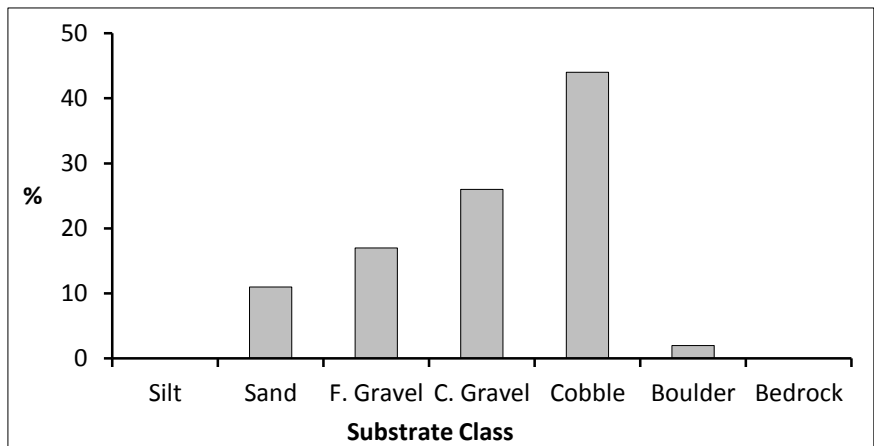
Rank	Depth (ft)	L (W_{bkt})	#
1	$1.0 \leq D < 2.0$	< 0.5	3
2	$1.0 \leq D < 2.0$	≥ 0.5	7
3	$2.0 \leq D < 3.0$	< 0.5	3
4	$2.0 \leq D < 3.0$	≥ 0.5	2
5	$D \geq 3.0$	< 0.5	1
6	$D \geq 3.0$	≥ 0.5	0
7	$D \geq 3.0$	≥ 1.0	0

Pools/mile: 21



Reach/Segment Information

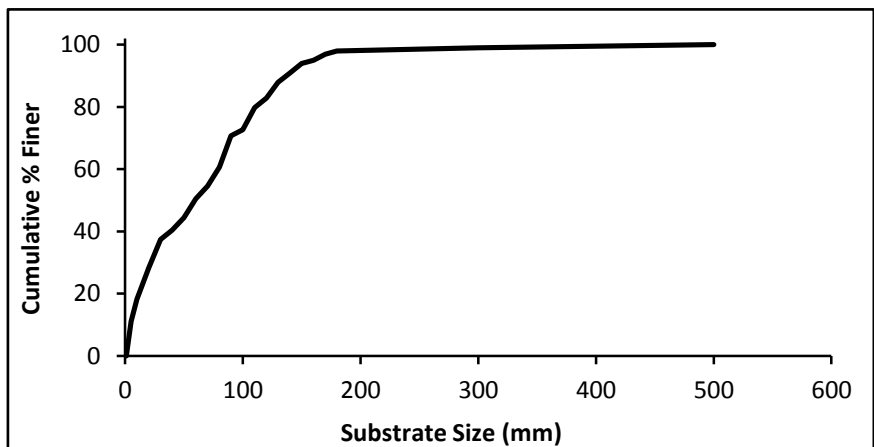
SGA ID:	M12.B
Length (ft):	3,288
Reference Bedform Type:	Riffle-Pool
Total RHA Score:	73
RHA Percentage:	46%
Overall Habitat Condition:	Fair



Sediment Composition and Mobility

Class	Range (mm)	Percent
Silt	< 0.06	0
Sand	0.06 - 2	11
F. Gravel	2 - 16	17
C. Gravel	16 - 64	26
Cobble	64 - 256	44
Boulder	256 - 4096	2
Bedrock	> 4096	0

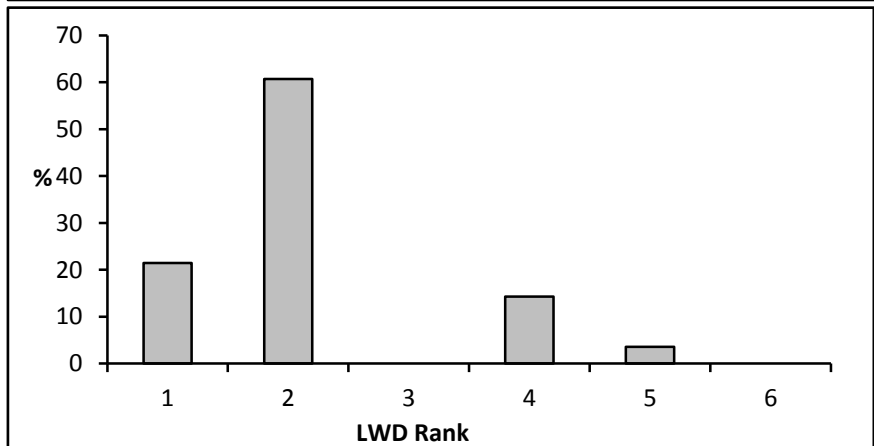
Median Substrate Size:	55	mm
Avg. Largest Particle (Bar):	110	mm
Riffle Stability Index (RSI):	80	%



Large Woody Debris (LWD)

Rank	Diameter (ft)	L (W_{bkt})	#
1	$0.5 \leq D < 1.0$	< 0.5	6
2	$0.5 \leq D < 1.0$	≥ 0.5	17
3	$1.0 \leq D < 2.0$	< 0.5	0
4	$1.0 \leq D < 2.0$	≥ 0.5	4
5	$D \geq 2.0$	< 0.5	1
6	$D \geq 2.0$	≥ 0.5	0

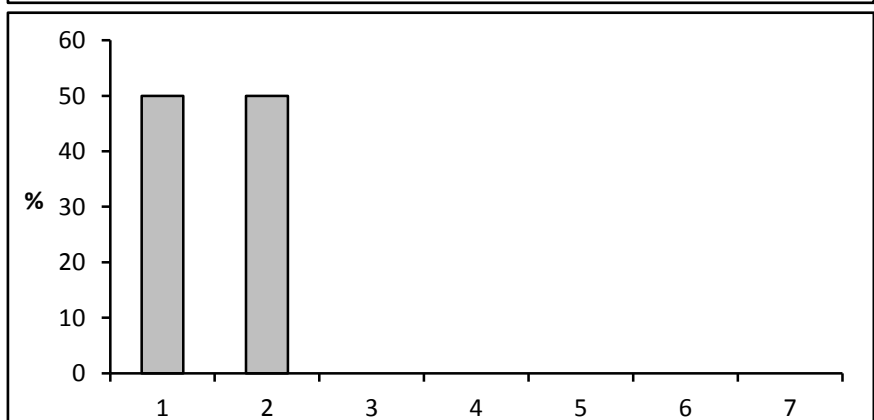
LWDs/mile: 45



Pools

Rank	Depth (ft)	L (W_{bkt})	#
1	$1.0 \leq D < 2.0$	< 0.5	5
2	$1.0 \leq D < 2.0$	≥ 0.5	5
3	$2.0 \leq D < 3.0$	< 0.5	0
4	$2.0 \leq D < 3.0$	≥ 0.5	0
5	$D \geq 3.0$	< 0.5	0
6	$D \geq 3.0$	≥ 0.5	0
7	$D \geq 3.0$	≥ 1.0	0

Pools/mile: 16



Rapid Habitat Assessment and Substrate Summary

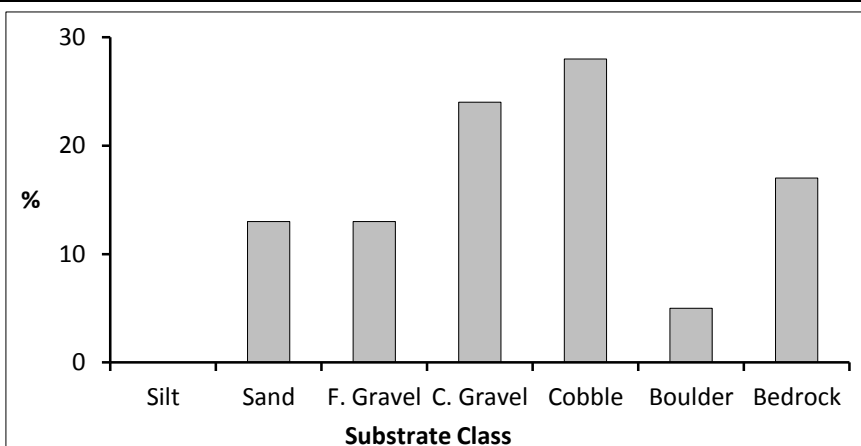
Fitzgerald Environmental Associates, LLC.

Mill Brook Phase 2

Mill Brook Main Stem

Reach/Segment Information

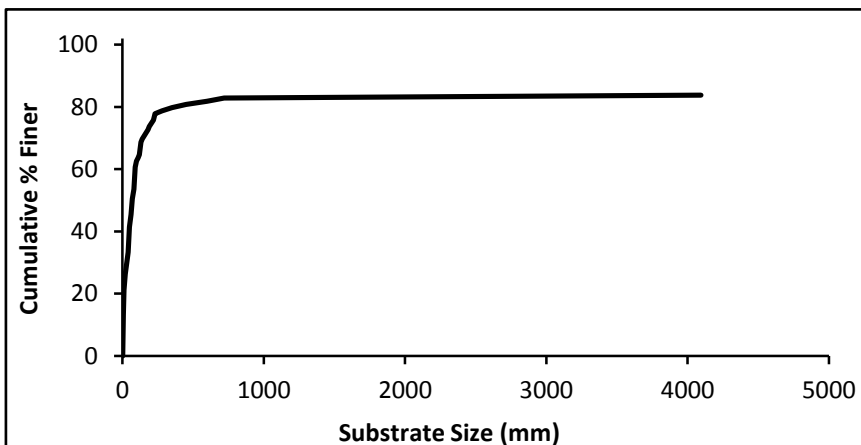
SGA ID:	M13
Length (ft):	7,217
Reference Bedform Type:	Riffle-Pool
Total RHA Score:	77
RHA Percentage:	48%
Overall Habitat Condition:	Fair



Sediment Composition and Mobility

Class	Range (mm)	Percent
Silt	< 0.06	0
Sand	0.06 - 2	13
F. Gravel	2 - 16	13
C. Gravel	16 - 64	24
Cobble	64 - 256	28
Boulder	256 - 4096	5
Bedrock	> 4096	17

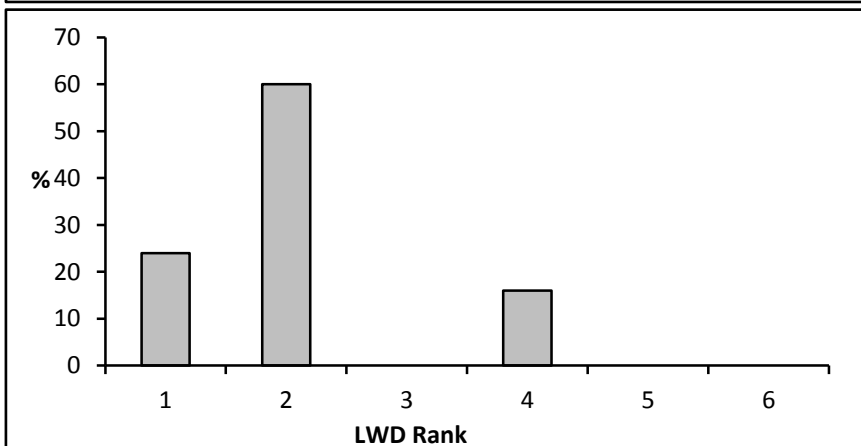
Median Substrate Size:	65	mm
Avg. Largest Particle (Bar):	220	mm
Riffle Stability Index (RSI):	76	%



Large Woody Debris (LWD)

Rank	Diameter (ft)	L (W_{bkt})	#
1	$0.5 \leq D < 1.0$	< 0.5	6
2	$0.5 \leq D < 1.0$	≥ 0.5	15
3	$1.0 \leq D < 2.0$	< 0.5	0
4	$1.0 \leq D < 2.0$	≥ 0.5	4
5	$D \geq 2.0$	< 0.5	0
6	$D \geq 2.0$	≥ 0.5	0

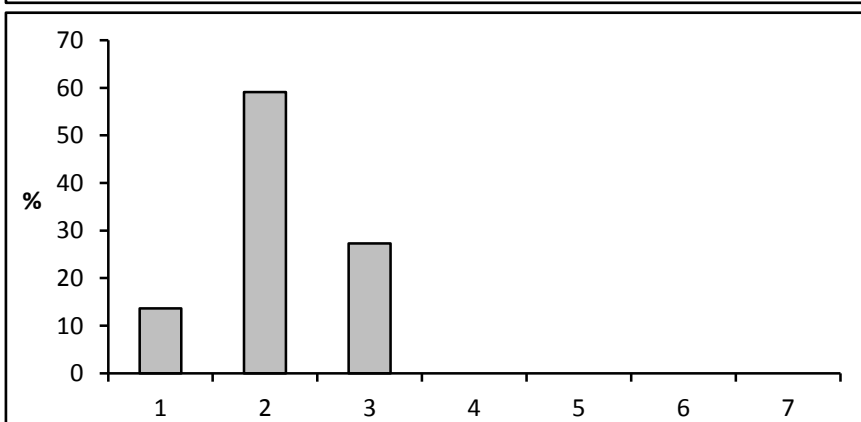
LWDs/mile: 18



Pools

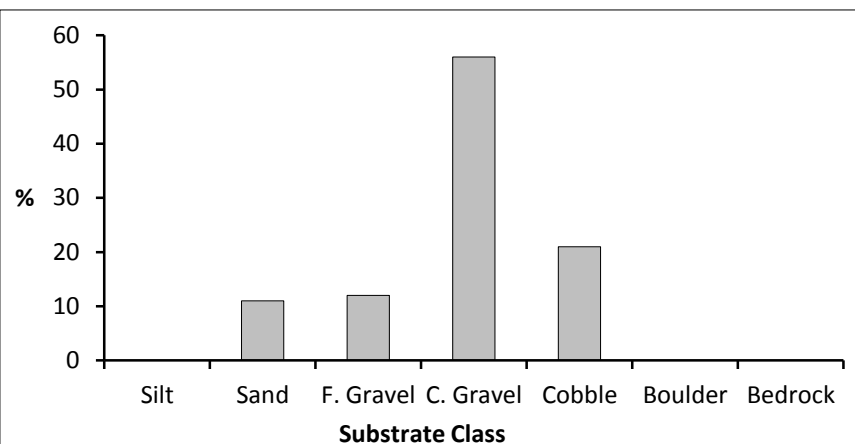
Rank	Depth (ft)	L (W_{bkt})	#
1	$1.0 \leq D < 2.0$	< 0.5	3
2	$1.0 \leq D < 2.0$	≥ 0.5	13
3	$2.0 \leq D < 3.0$	< 0.5	6
4	$2.0 \leq D < 3.0$	≥ 0.5	0
5	$D \geq 3.0$	< 0.5	0
6	$D \geq 3.0$	≥ 0.5	0
7	$D \geq 3.0$	≥ 1.0	0

Pools/mile: 16



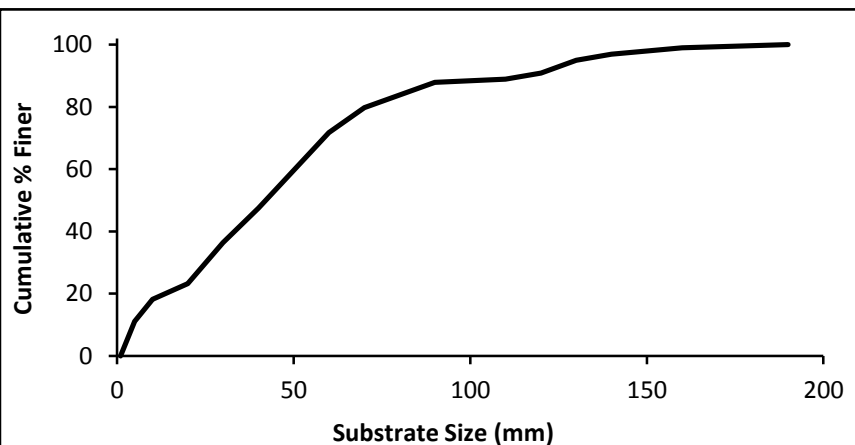
Reach/Segment Information

SGA ID:	M14.A
Length (ft):	1,999
Reference Bedform Type:	Riffle-Pool
Total RHA Score:	84
RHA Percentage:	53%
Overall Habitat Condition:	Fair

**Sediment Composition and Mobility**

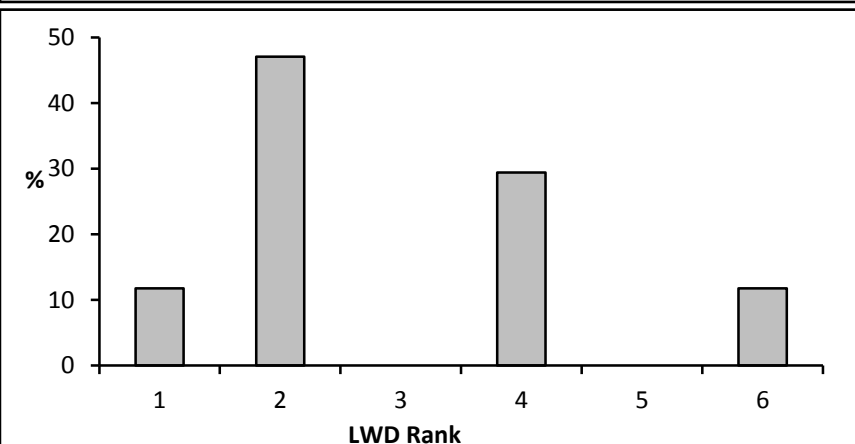
Class	Range (mm)	Percent
Silt	< 0.06	0
Sand	0.06 - 2	11
F. Gravel	2 - 16	12
C. Gravel	16 - 64	56
Cobble	64 - 256	21
Boulder	256 - 4096	0
Bedrock	> 4096	0

Median Substrate Size:	40	mm
Avg. Largest Particle (Bar):	150	mm
Riffle Stability Index (RSI):	98	%

**Large Woody Debris (LWD)**

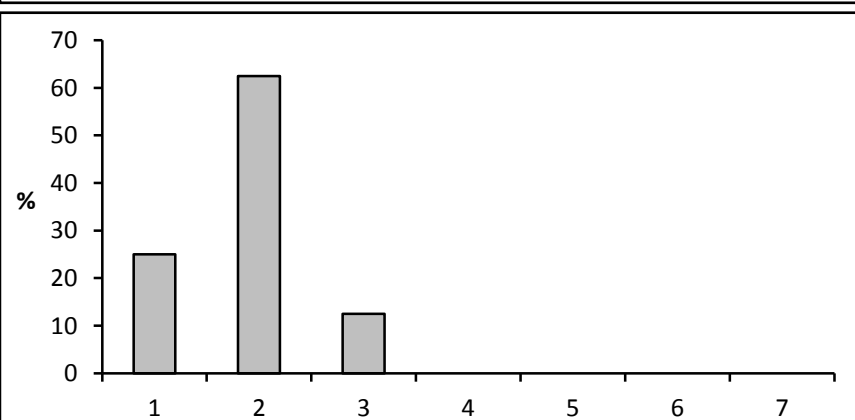
Rank	Diameter (ft)	L (W_{bkt})	#
1	$0.5 \leq D < 1.0$	< 0.5	2
2	$0.5 \leq D < 1.0$	≥ 0.5	8
3	$1.0 \leq D < 2.0$	< 0.5	0
4	$1.0 \leq D < 2.0$	≥ 0.5	5
5	$D \geq 2.0$	< 0.5	0
6	$D \geq 2.0$	≥ 0.5	2

LWDs/mile: 45

**Pools**

Rank	Depth (ft)	L (W_{bkt})	#
1	$1.0 \leq D < 2.0$	< 0.5	2
2	$1.0 \leq D < 2.0$	≥ 0.5	5
3	$2.0 \leq D < 3.0$	< 0.5	1
4	$2.0 \leq D < 3.0$	≥ 0.5	0
5	$D \geq 3.0$	< 0.5	0
6	$D \geq 3.0$	≥ 0.5	0
7	$D \geq 3.0$	≥ 1.0	0

Pools/mile: 21



Rapid Habitat Assessment and Substrate Summary

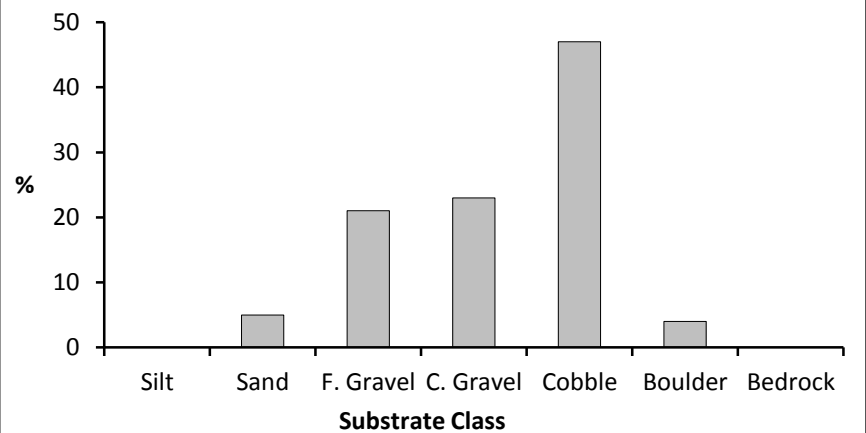
Fitzgerald Environmental Associates, LLC.

Mill Brook Phase 2

Mill Brook Main Stem

Reach/Segment Information

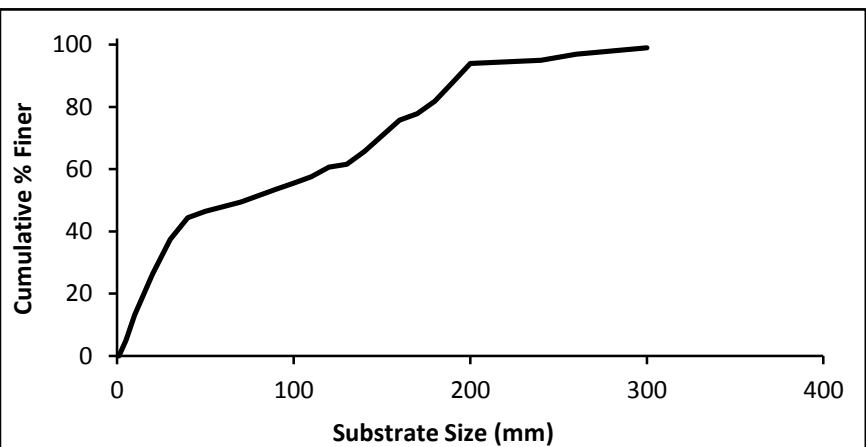
SGA ID:	M14.B
Length (ft):	1,868
Reference Bedform Type:	Riffle-Pool
Total RHA Score:	55
RHA Percentage:	34%
Overall Habitat Condition:	Poor



Sediment Composition and Mobility

Class	Range (mm)	Percent
Silt	< 0.06	0
Sand	0.06 - 2	5
F. Gravel	2 - 16	21
C. Gravel	16 - 64	23
Cobble	64 - 256	47
Boulder	256 - 4096	4
Bedrock	> 4096	0

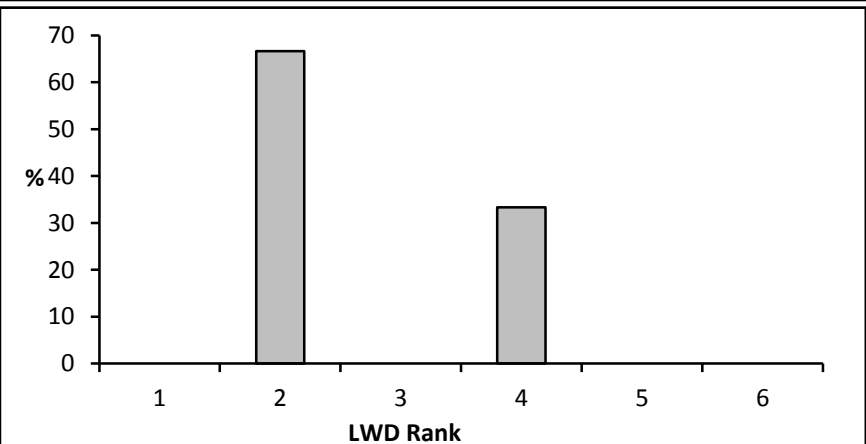
Median Substrate Size:	70	mm
Avg. Largest Particle (Bar):	250	mm
Riffle Stability Index (RSI):	96	%



Large Woody Debris (LWD)

Rank	Diameter (ft)	L (W_{bkt})	#
1	$0.5 \leq D < 1.0$	< 0.5	0
2	$0.5 \leq D < 1.0$	≥ 0.5	2
3	$1.0 \leq D < 2.0$	< 0.5	0
4	$1.0 \leq D < 2.0$	≥ 0.5	1
5	$D \geq 2.0$	< 0.5	0
6	$D \geq 2.0$	≥ 0.5	0

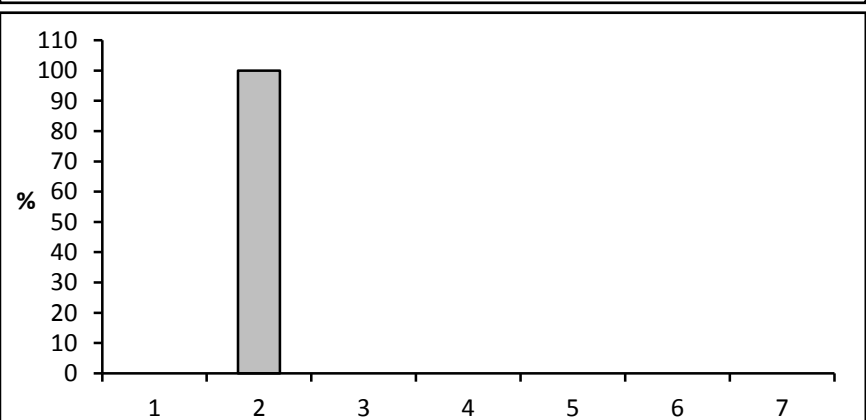
LWDs/mile: 8



Pools

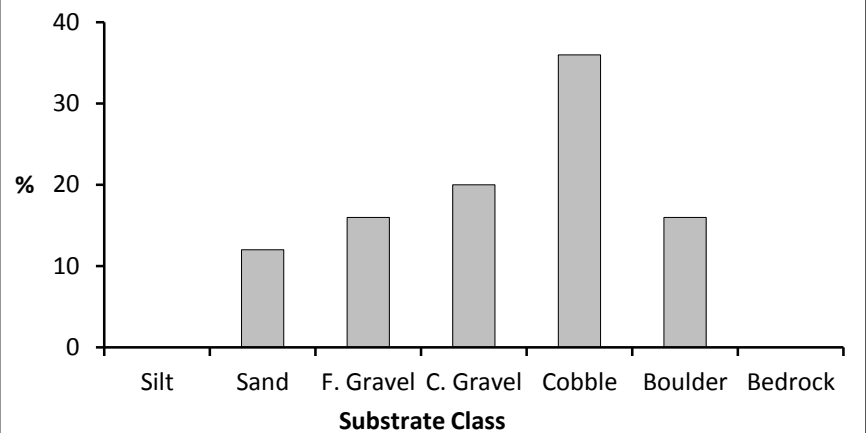
Rank	Depth (ft)	L (W_{bkt})	#
1	$1.0 \leq D < 2.0$	< 0.5	0
2	$1.0 \leq D < 2.0$	≥ 0.5	1
3	$2.0 \leq D < 3.0$	< 0.5	0
4	$2.0 \leq D < 3.0$	≥ 0.5	0
5	$D \geq 3.0$	< 0.5	0
6	$D \geq 3.0$	≥ 0.5	0
7	$D \geq 3.0$	≥ 1.0	0

Pools/mile: 3



Reach/Segment Information

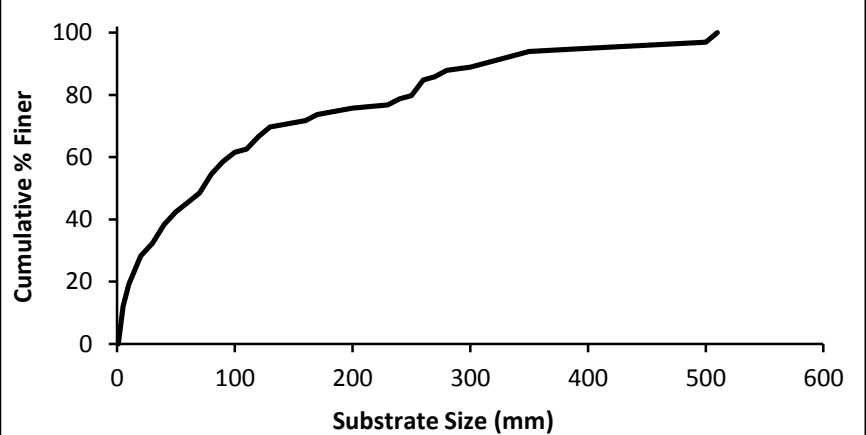
SGA ID:	M14.C
Length (ft):	3,631
Reference Bedform Type:	Riffle-Pool
Total RHA Score:	97
RHA Percentage:	61%
Overall Habitat Condition:	Fair



Sediment Composition and Mobility

Class	Range (mm)	Percent
Silt	< 0.06	0
Sand	0.06 - 2	12
F. Gravel	2 - 16	16
C. Gravel	16 - 64	20
Cobble	64 - 256	36
Boulder	256 - 4096	16
Bedrock	> 4096	0

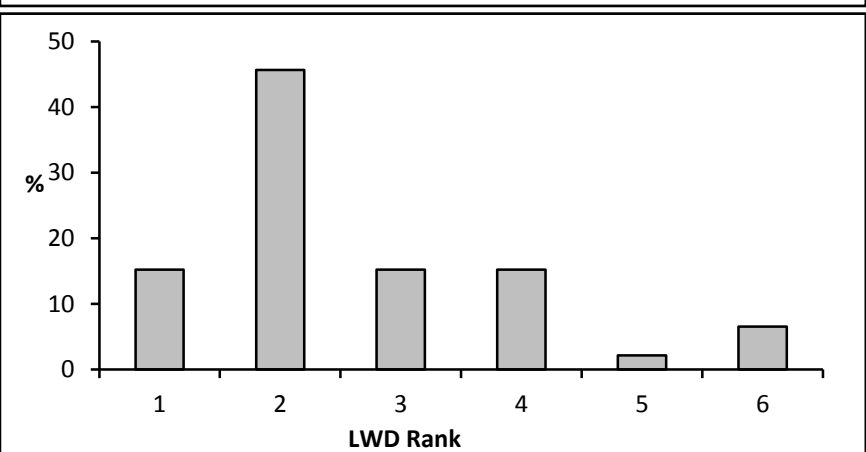
Median Substrate Size:	70	mm
Avg. Largest Particle (Bar):	180	mm
Riffle Stability Index (RSI):	75	%



Large Woody Debris (LWD)

Rank	Diameter (ft)	L (W_{bkt})	#
1	$0.5 \leq D < 1.0$	< 0.5	7
2	$0.5 \leq D < 1.0$	≥ 0.5	21
3	$1.0 \leq D < 2.0$	< 0.5	7
4	$1.0 \leq D < 2.0$	≥ 0.5	7
5	$D \geq 2.0$	< 0.5	1
6	$D \geq 2.0$	≥ 0.5	3

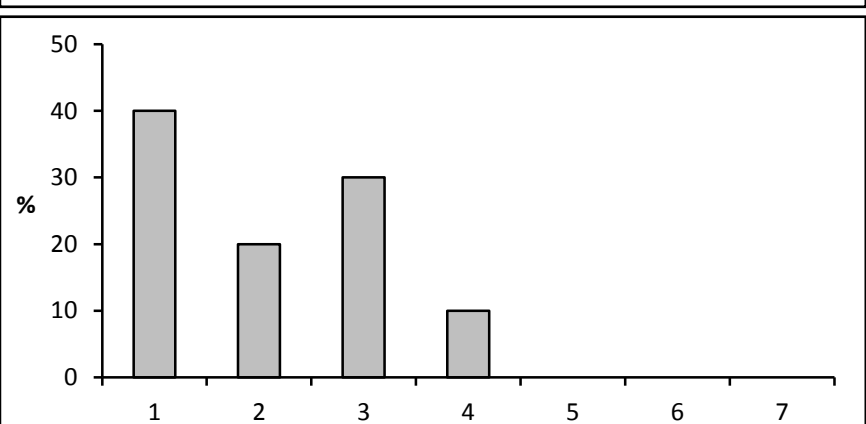
LWDs/mile: 67



Pools

Rank	Depth (ft)	L (W_{bkt})	#
1	$1.0 \leq D < 2.0$	< 0.5	4
2	$1.0 \leq D < 2.0$	≥ 0.5	2
3	$2.0 \leq D < 3.0$	< 0.5	3
4	$2.0 \leq D < 3.0$	≥ 0.5	1
5	$D \geq 3.0$	< 0.5	0
6	$D \geq 3.0$	≥ 0.5	0
7	$D \geq 3.0$	≥ 1.0	0

Pools/mile: 15



Rapid Habitat Assessment and Substrate Summary

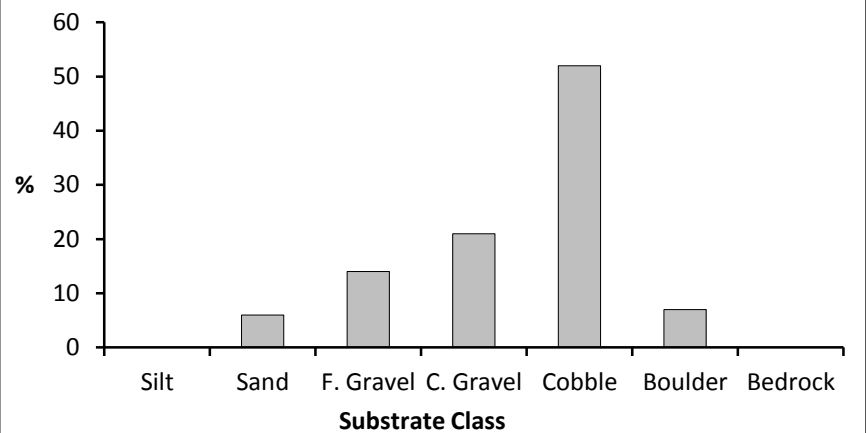
Fitzgerald Environmental Associates, LLC.

Mill Brook Phase 2

Mill Brook Main Stem

Reach/Segment Information

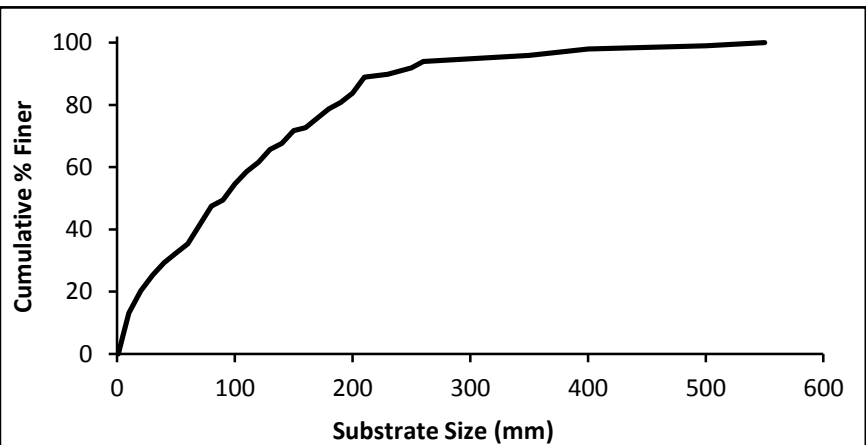
SGA ID:	M15.A
Length (ft):	986
Reference Bedform Type:	Riffle-Pool
Total RHA Score:	119
RHA Percentage:	74%
Overall Habitat Condition:	Good



Sediment Composition and Mobility

Class	Range (mm)	Percent
Silt	< 0.06	0
Sand	0.06 - 2	6
F. Gravel	2 - 16	14
C. Gravel	16 - 64	21
Cobble	64 - 256	52
Boulder	256 - 4096	7
Bedrock	> 4096	0

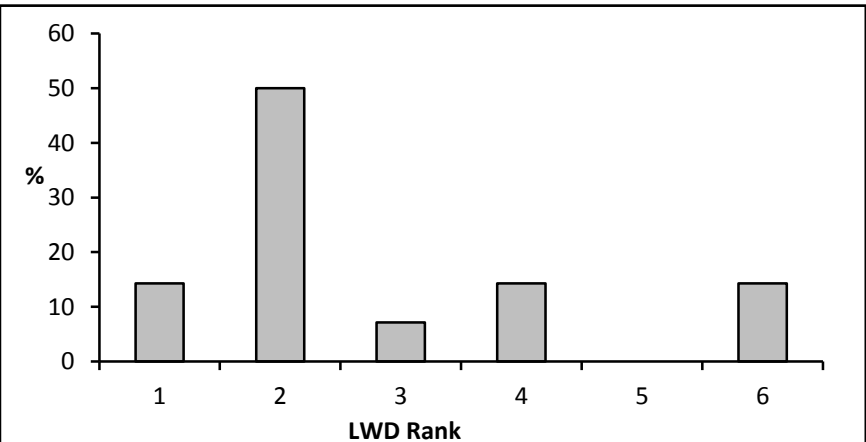
Median Substrate Size:	90	mm
Avg. Largest Particle (Bar):	170	mm
Riffle Stability Index (RSI):	76	%



Large Woody Debris (LWD)

Rank	Diameter (ft)	L (W_{bkt})	#
1	$0.5 \leq D < 1.0$	< 0.5	2
2	$0.5 \leq D < 1.0$	≥ 0.5	7
3	$1.0 \leq D < 2.0$	< 0.5	1
4	$1.0 \leq D < 2.0$	≥ 0.5	2
5	$D \geq 2.0$	< 0.5	0
6	$D \geq 2.0$	≥ 0.5	2

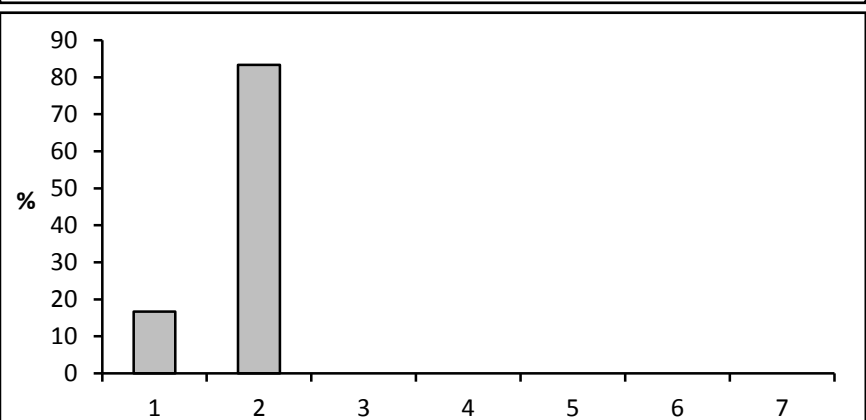
LWDs/mile: 75



Pools

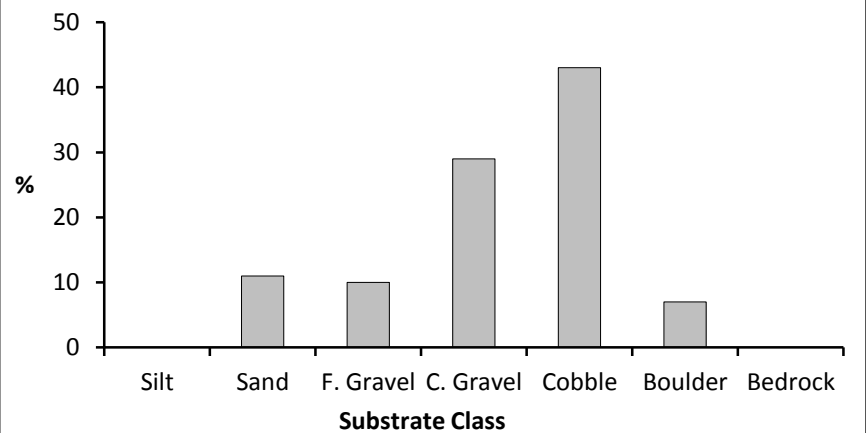
Rank	Depth (ft)	L (W_{bkt})	#
1	$1.0 \leq D < 2.0$	< 0.5	1
2	$1.0 \leq D < 2.0$	≥ 0.5	5
3	$2.0 \leq D < 3.0$	< 0.5	0
4	$2.0 \leq D < 3.0$	≥ 0.5	0
5	$D \geq 3.0$	< 0.5	0
6	$D \geq 3.0$	≥ 0.5	0
7	$D \geq 3.0$	≥ 1.0	0

Pools/mile: 32



Reach/Segment Information

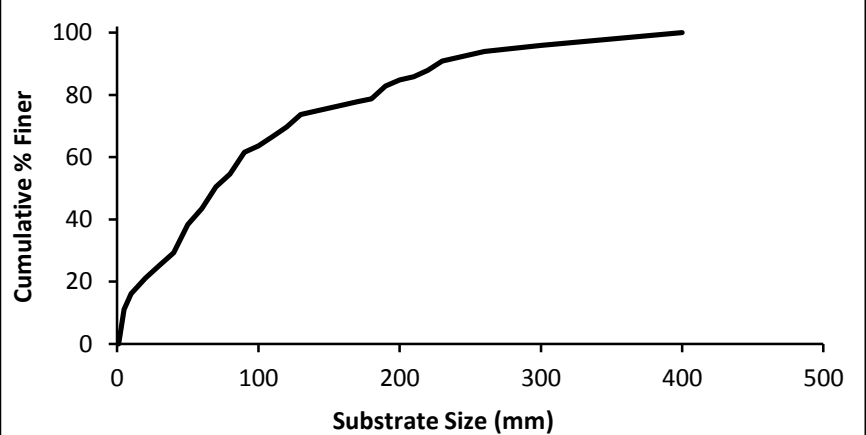
SGA ID:	M15.B
Length (ft):	4,325
Reference Bedform Type:	Riffle-Pool
Total RHA Score:	89
RHA Percentage:	56%
Overall Habitat Condition:	Fair



Sediment Composition and Mobility

Class	Range (mm)	Percent
Silt	< 0.06	0
Sand	0.06 - 2	11
F. Gravel	2 - 16	10
C. Gravel	16 - 64	29
Cobble	64 - 256	43
Boulder	256 - 4096	7
Bedrock	> 4096	0

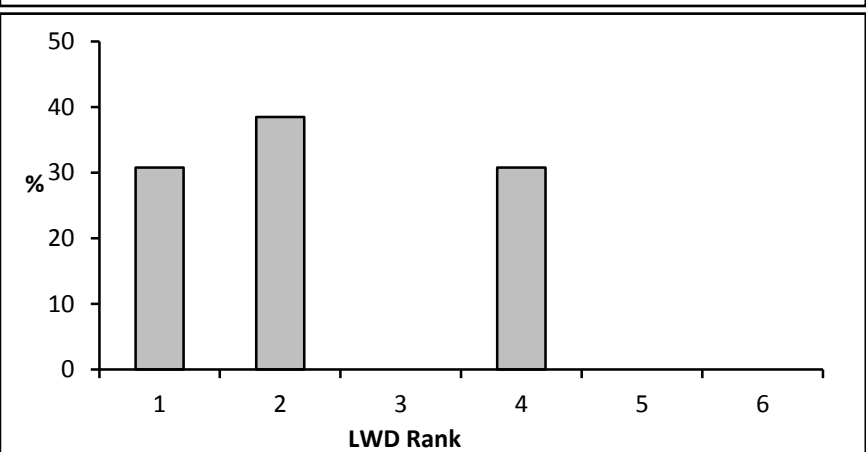
Median Substrate Size:	65	mm
Avg. Largest Particle (Bar):	180	mm
Riffle Stability Index (RSI):	79	%



Large Woody Debris (LWD)

Rank	Diameter (ft)	L (W_{bkt})	#
1	$0.5 \leq D < 1.0$	< 0.5	8
2	$0.5 \leq D < 1.0$	≥ 0.5	10
3	$1.0 \leq D < 2.0$	< 0.5	0
4	$1.0 \leq D < 2.0$	≥ 0.5	8
5	$D \geq 2.0$	< 0.5	0
6	$D \geq 2.0$	≥ 0.5	0

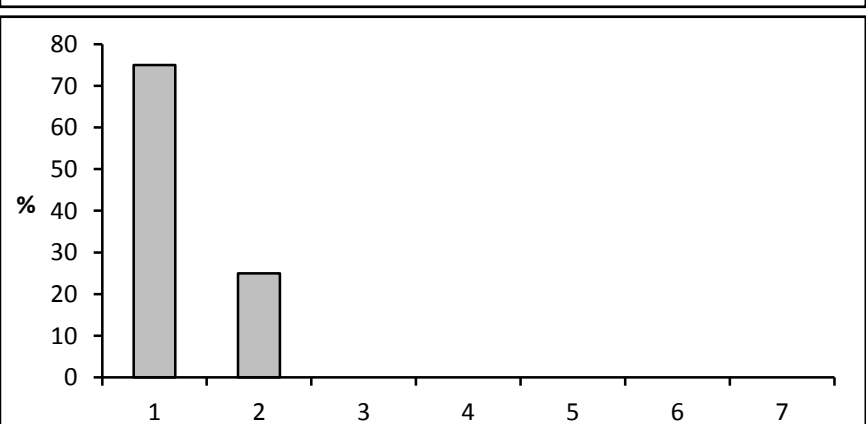
LWDs/mile: 32



Pools

Rank	Depth (ft)	L (W_{bkt})	#
1	$1.0 \leq D < 2.0$	< 0.5	3
2	$1.0 \leq D < 2.0$	≥ 0.5	1
3	$2.0 \leq D < 3.0$	< 0.5	0
4	$2.0 \leq D < 3.0$	≥ 0.5	0
5	$D \geq 3.0$	< 0.5	0
6	$D \geq 3.0$	≥ 0.5	0
7	$D \geq 3.0$	≥ 1.0	0

Pools/mile: 5



Rapid Habitat Assessment and Substrate Summary

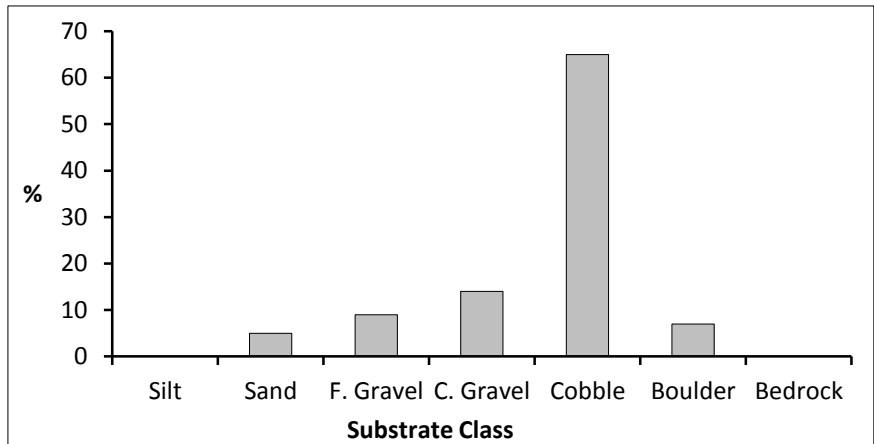
Fitzgerald Environmental Associates, LLC.

Mill Brook Phase 2

Mill Brook Main Stem

Reach/Segment Information

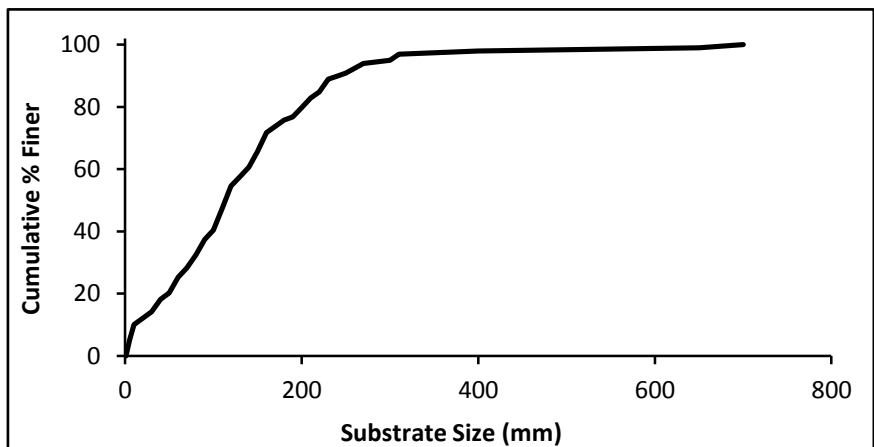
SGA ID:	M16.A
Length (ft):	2,413
Reference Bedform Type:	Riffle-Pool
Total RHA Score:	104
RHA Percentage:	65%
Overall Habitat Condition:	Good



Sediment Composition and Mobility

Class	Range (mm)	Percent
Silt	< 0.06	0
Sand	0.06 - 2	5
F. Gravel	2 - 16	9
C. Gravel	16 - 64	14
Cobble	64 - 256	65
Boulder	256 - 4096	7
Bedrock	> 4096	0

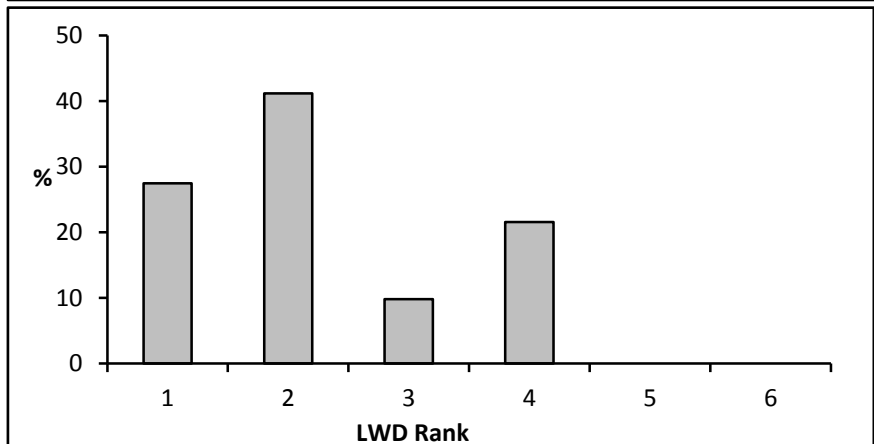
Median Substrate Size:	110	mm
Avg. Largest Particle (Bar):	200	mm
Riffle Stability Index (RSI):	80	%



Large Woody Debris (LWD)

Rank	Diameter (ft)	L (W_{bkt})	#
1	0.5 ≤ D < 1.0	< 0.5	14
2	0.5 ≤ D < 1.0	≥ 0.5	21
3	1.0 ≤ D < 2.0	< 0.5	5
4	1.0 ≤ D < 2.0	≥ 0.5	11
5	D ≥ 2.0	< 0.5	0
6	D ≥ 2.0	≥ 0.5	0

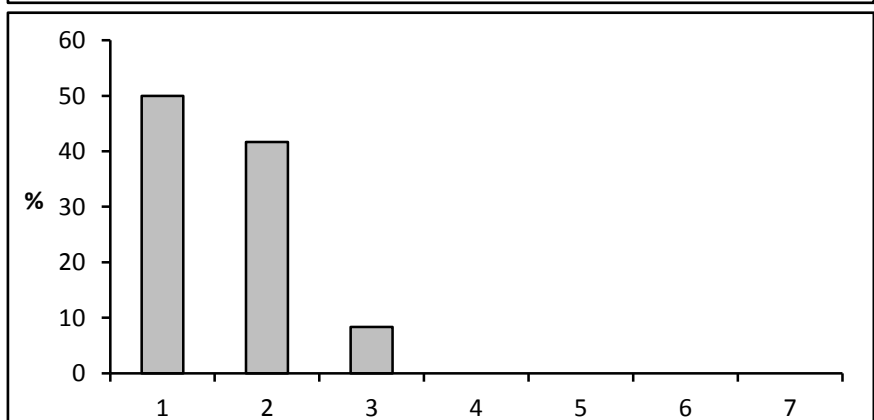
LWDs/mile: 112



Pools

Rank	Depth (ft)	L (W_{bkt})	#
1	1.0 ≤ D < 2.0	< 0.5	6
2	1.0 ≤ D < 2.0	≥ 0.5	5
3	2.0 ≤ D < 3.0	< 0.5	1
4	2.0 ≤ D < 3.0	≥ 0.5	0
5	D ≥ 3.0	< 0.5	0
6	D ≥ 3.0	≥ 0.5	0
7	D ≥ 3.0	≥ 1.0	0

Pools/mile: 26



Rapid Habitat Assessment and Substrate Summary

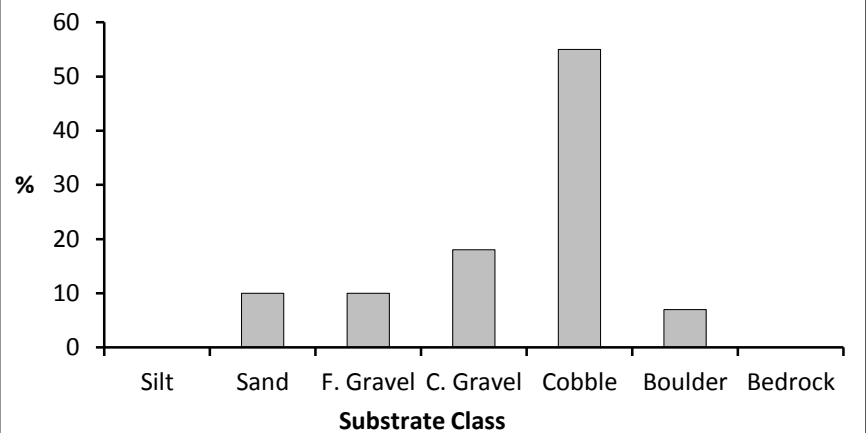
Fitzgerald Environmental Associates, LLC.

Mill Brook Phase 2

Mill Brook Main Stem

Reach/Segment Information

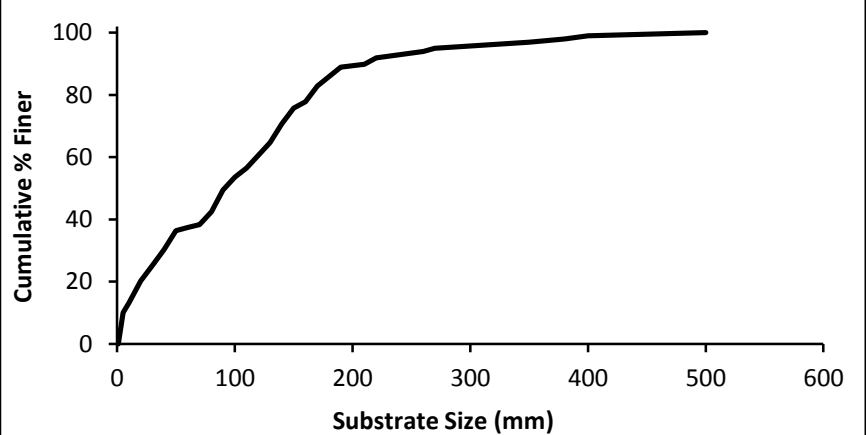
SGA ID:	M16.B
Length (ft):	2,616
Reference Bedform Type:	Riffle-Pool
Total RHA Score:	81
RHA Percentage:	51%
Overall Habitat Condition:	Fair



Sediment Composition and Mobility

Class	Range (mm)	Percent
Silt	< 0.06	0
Sand	0.06 - 2	10
F. Gravel	2 - 16	10
C. Gravel	16 - 64	18
Cobble	64 - 256	55
Boulder	256 - 4096	7
Bedrock	> 4096	0

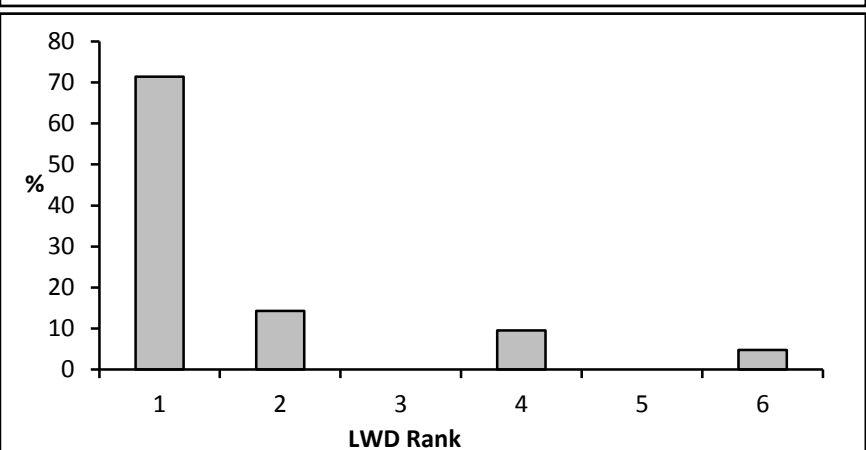
Median Substrate Size:	90	mm
Avg. Largest Particle (Bar):	150	mm
Riffle Stability Index (RSI):	76	%



Large Woody Debris (LWD)

Rank	Diameter (ft)	L (W_{bkt})	#
1	0.5 ≤ D < 1.0	< 0.5	15
2	0.5 ≤ D < 1.0	≥ 0.5	3
3	1.0 ≤ D < 2.0	< 0.5	0
4	1.0 ≤ D < 2.0	≥ 0.5	2
5	D ≥ 2.0	< 0.5	0
6	D ≥ 2.0	≥ 0.5	1

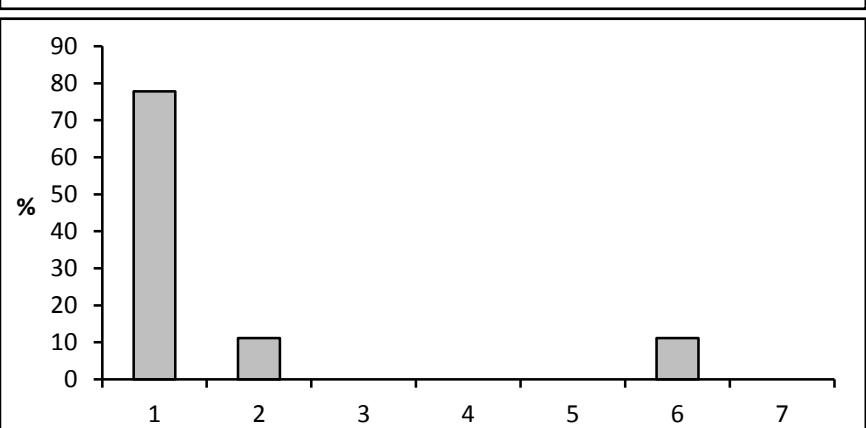
LWDs/mile: 42



Pools

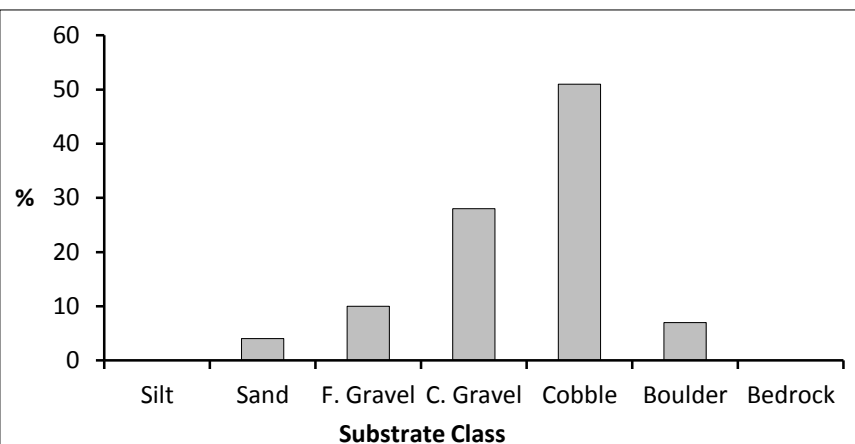
Rank	Depth (ft)	L (W_{bkt})	#
1	1.0 ≤ D < 2.0	< 0.5	7
2	1.0 ≤ D < 2.0	≥ 0.5	1
3	2.0 ≤ D < 3.0	< 0.5	0
4	2.0 ≤ D < 3.0	≥ 0.5	0
5	D ≥ 3.0	< 0.5	0
6	D ≥ 3.0	≥ 0.5	1
7	D ≥ 3.0	≥ 1.0	0

Pools/mile: 18



Reach/Segment Information

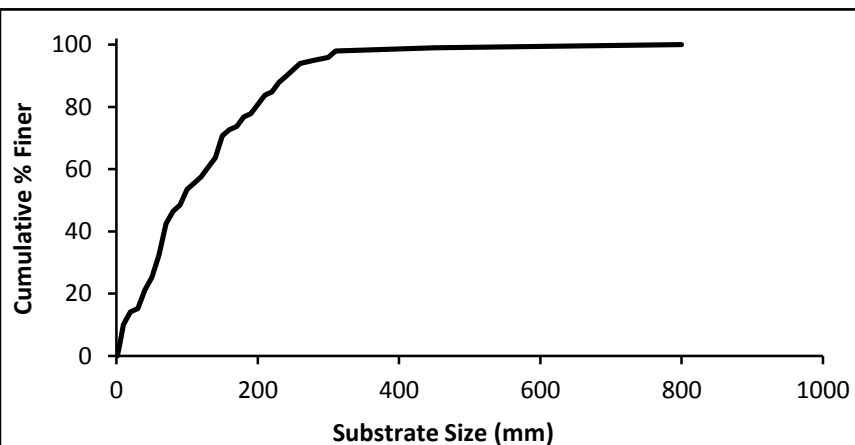
SGA ID:	T1.01
Length (ft):	6,569
Reference Bedform Type:	Riffle-Pool
Total RHA Score:	113
RHA Percentage:	71%
Overall Habitat Condition:	Good



Sediment Composition and Mobility

Class	Range (mm)	Percent
Silt	< 0.06	0
Sand	0.06 - 2	4
F. Gravel	2 - 16	10
C. Gravel	16 - 64	28
Cobble	64 - 256	51
Boulder	256 - 4096	7
Bedrock	> 4096	0

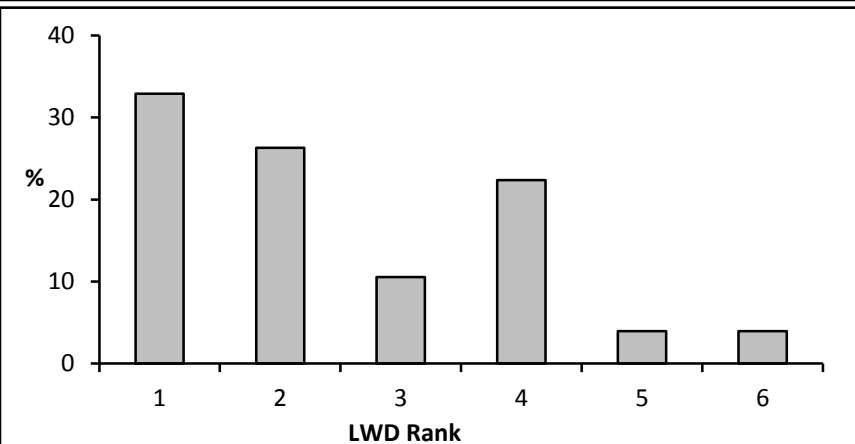
Median Substrate Size:	90	mm
Avg. Largest Particle (Bar):	120	mm
Riffle Stability Index (RSI):	58	%



Large Woody Debris (LWD)

Rank	Diameter (ft)	L (W_{bkt})	#
1	$0.5 \leq D < 1.0$	< 0.5	25
2	$0.5 \leq D < 1.0$	≥ 0.5	20
3	$1.0 \leq D < 2.0$	< 0.5	8
4	$1.0 \leq D < 2.0$	≥ 0.5	17
5	$D \geq 2.0$	< 0.5	3
6	$D \geq 2.0$	≥ 0.5	3

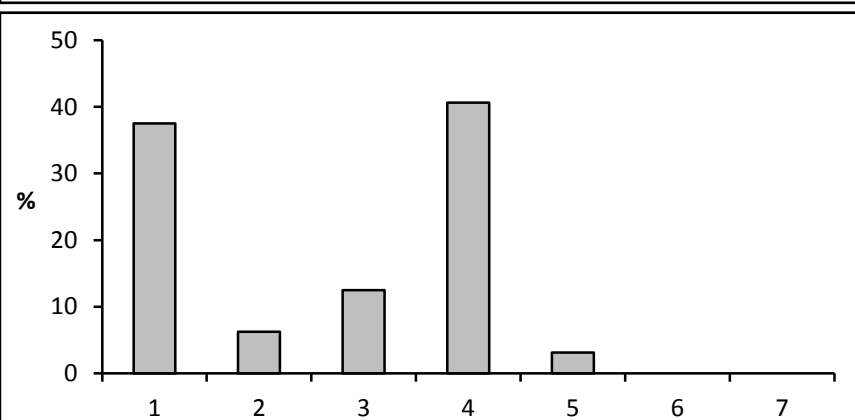
LWDs/mile: 61



Pools

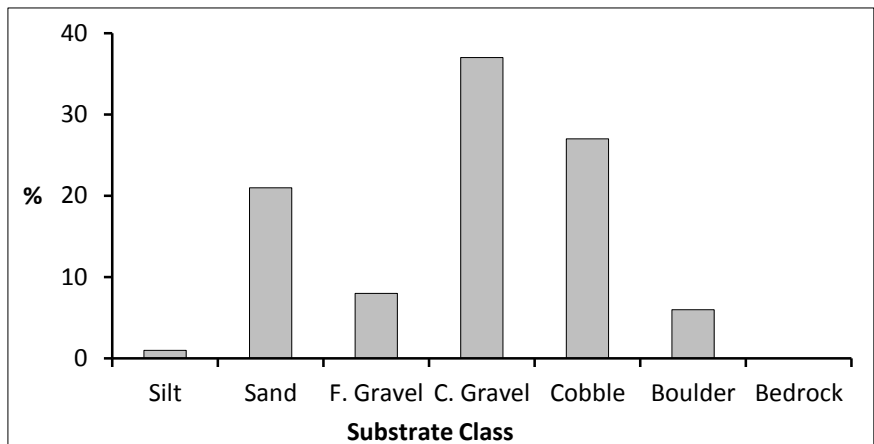
Rank	Depth (ft)	L (W_{bkt})	#
1	$1.0 \leq D < 2.0$	< 0.5	12
2	$1.0 \leq D < 2.0$	≥ 0.5	2
3	$2.0 \leq D < 3.0$	< 0.5	4
4	$2.0 \leq D < 3.0$	≥ 0.5	13
5	$D \geq 3.0$	< 0.5	1
6	$D \geq 3.0$	≥ 0.5	0
7	$D \geq 3.0$	≥ 1.0	0

Pools/mile: 26



Reach/Segment Information

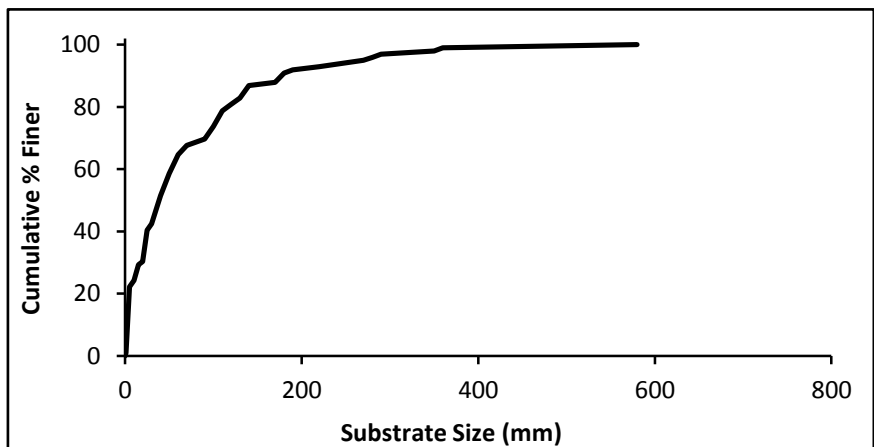
SGA ID:	T1.02.A
Length (ft):	5,171
Reference Bedform Type:	Riffle-Pool
Total RHA Score:	99
RHA Percentage:	62%
Overall Habitat Condition:	Fair



Sediment Composition and Mobility

Class	Range (mm)	Percent
Silt	< 0.06	1
Sand	0.06 - 2	21
F. Gravel	2 - 16	8
C. Gravel	16 - 64	37
Cobble	64 - 256	27
Boulder	256 - 4096	6
Bedrock	> 4096	0

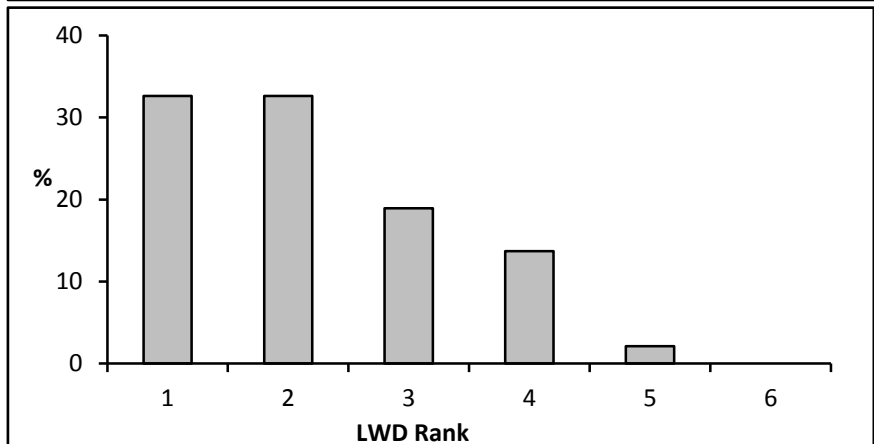
Median Substrate Size:	30	mm
Avg. Largest Particle (Bar):	90	mm
Riffle Stability Index (RSI):	70	%



Large Woody Debris (LWD)

Rank	Diameter (ft)	L (W_{bkt})	#
1	$0.5 \leq D < 1.0$	< 0.5	31
2	$0.5 \leq D < 1.0$	≥ 0.5	31
3	$1.0 \leq D < 2.0$	< 0.5	18
4	$1.0 \leq D < 2.0$	≥ 0.5	13
5	$D \geq 2.0$	< 0.5	2
6	$D \geq 2.0$	≥ 0.5	0

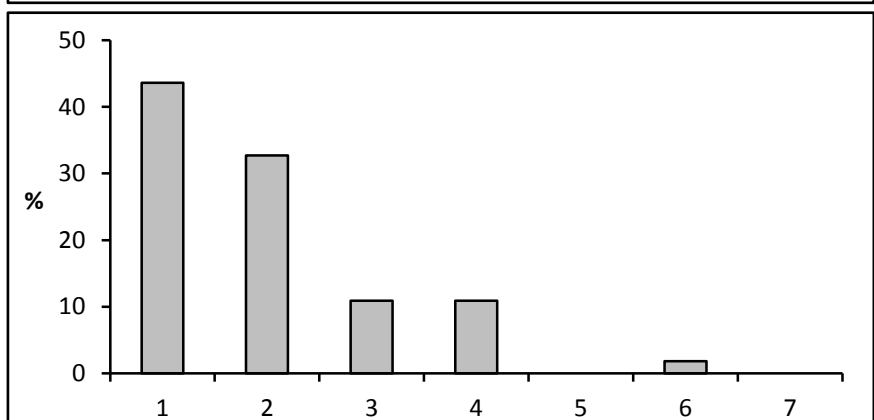
LWDs/mile: 97



Pools

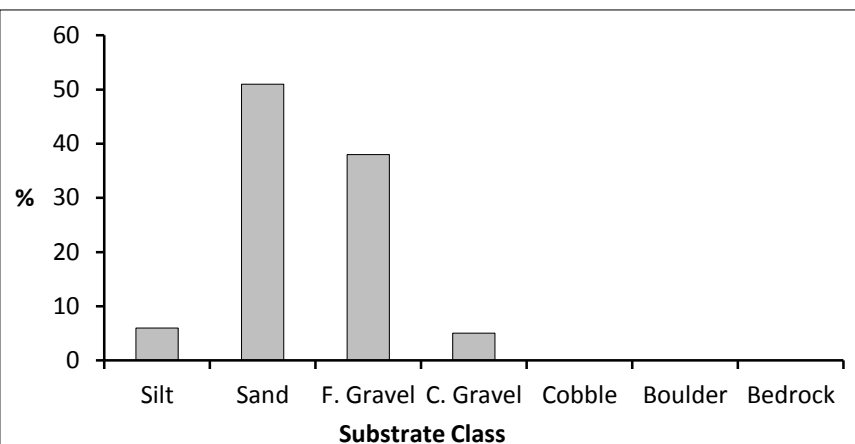
Rank	Depth (ft)	L (W_{bkt})	#
1	$1.0 \leq D < 2.0$	< 0.5	24
2	$1.0 \leq D < 2.0$	≥ 0.5	18
3	$2.0 \leq D < 3.0$	< 0.5	6
4	$2.0 \leq D < 3.0$	≥ 0.5	6
5	$D \geq 3.0$	< 0.5	0
6	$D \geq 3.0$	≥ 0.5	1
7	$D \geq 3.0$	≥ 1.0	0

Pools/mile: 56



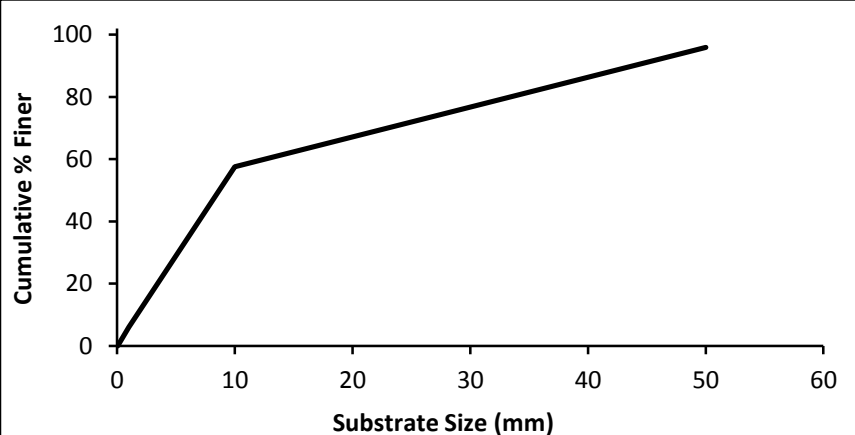
Reach/Segment Information

SGA ID:	T1.02.B
Length (ft):	1,114
Reference Bedform Type:	Riffle-Pool
Total RHA Score:	94
RHA Percentage:	59%
Overall Habitat Condition:	Fair

**Sediment Composition and Mobility**

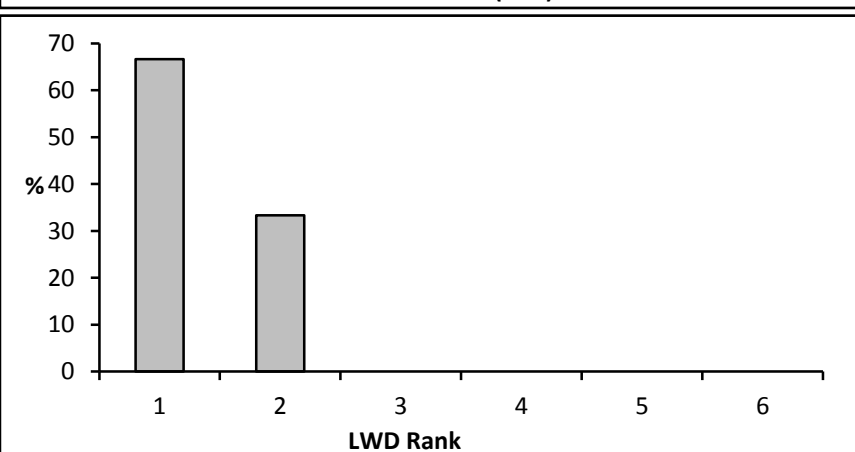
Class	Range (mm)	Percent
Silt	< 0.06	6
Sand	0.06 - 2	51
F. Gravel	2 - 16	38
C. Gravel	16 - 64	5
Cobble	64 - 256	0
Boulder	256 - 4096	0
Bedrock	> 4096	0

Median Substrate Size:	1	mm
Avg. Largest Particle (Bar):	35	mm
Riffle Stability Index (RSI):	78	%

**Large Woody Debris (LWD)**

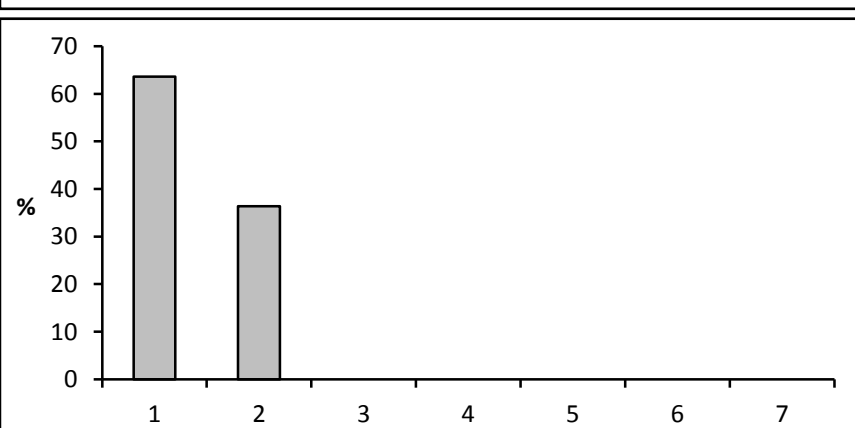
Rank	Diameter (ft)	L (W_{bkt})	#
1	$0.5 \leq D < 1.0$	< 0.5	24
2	$0.5 \leq D < 1.0$	≥ 0.5	12
3	$1.0 \leq D < 2.0$	< 0.5	0
4	$1.0 \leq D < 2.0$	≥ 0.5	0
5	$D \geq 2.0$	< 0.5	0
6	$D \geq 2.0$	≥ 0.5	0

LWDs/mile: 171

**Pools**

Rank	Depth (ft)	L (W_{bkt})	#
1	$1.0 \leq D < 2.0$	< 0.5	28
2	$1.0 \leq D < 2.0$	≥ 0.5	16
3	$2.0 \leq D < 3.0$	< 0.5	0
4	$2.0 \leq D < 3.0$	≥ 0.5	0
5	$D \geq 3.0$	< 0.5	0
6	$D \geq 3.0$	≥ 0.5	0
7	$D \geq 3.0$	≥ 1.0	0

Pools/mile: 209



Reach/Segment Information

SGA ID: T1.01.S4.01.A

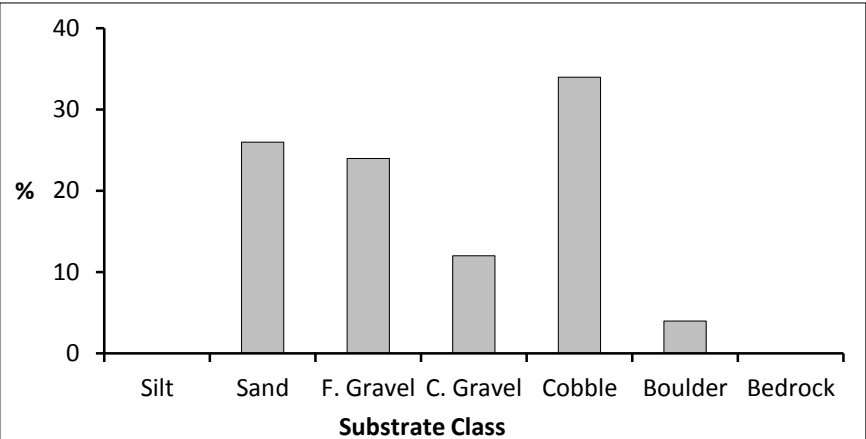
Length (ft): 1,127

Reference Bedform Type: Step-Pool

Total RHA Score: 55

RHA Percentage: 34%

Overall Habitat Condition: Poor



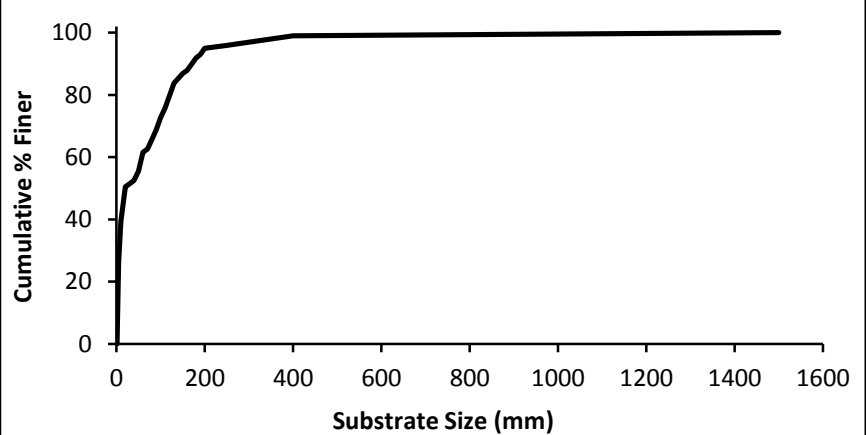
Sediment Composition and Mobility

Class	Range (mm)	Percent
Silt	< 0.06	0
Sand	0.06 - 2	26
F. Gravel	2 - 16	24
C. Gravel	16 - 64	12
Cobble	64 - 256	34
Boulder	256 - 4096	4
Bedrock	> 4096	0

Median Substrate Size: 15 mm

Avg. Largest Particle (Bar): N/A mm

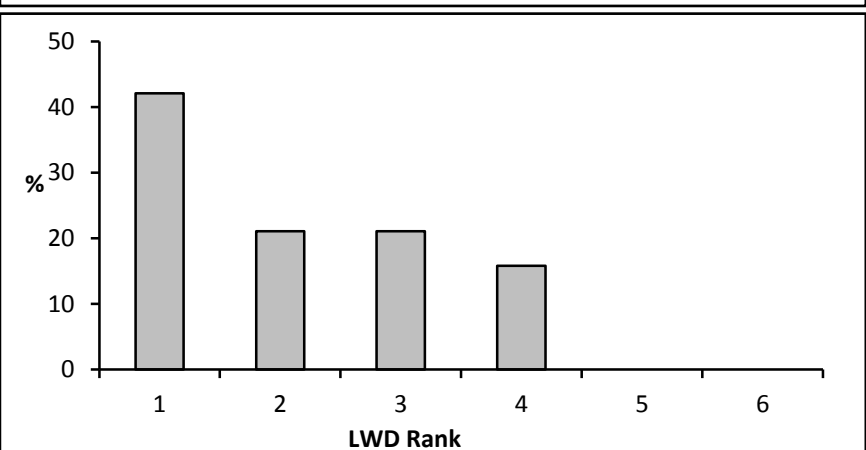
Riffle Stability Index (RSI): N/A %



Large Woody Debris (LWD)

Rank	Diameter (ft)	L (W_{bkt})	#
1	$0.5 \leq D < 1.0$	< 0.5	8
2	$0.5 \leq D < 1.0$	≥ 0.5	4
3	$1.0 \leq D < 2.0$	< 0.5	4
4	$1.0 \leq D < 2.0$	≥ 0.5	3
5	$D \geq 2.0$	< 0.5	0
6	$D \geq 2.0$	≥ 0.5	0

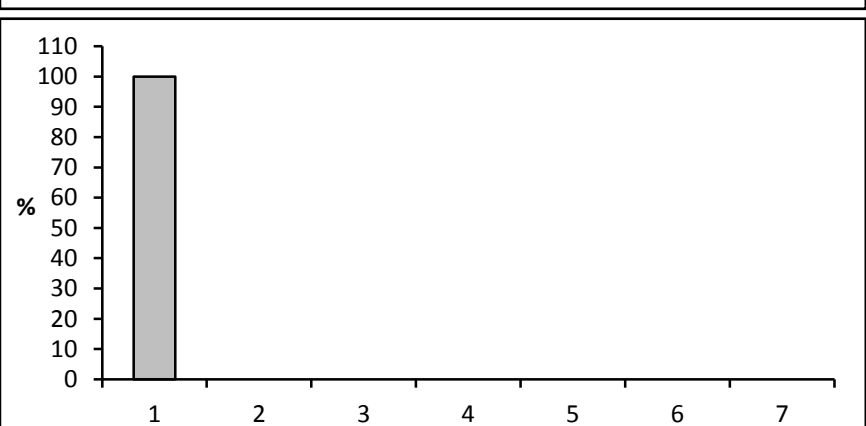
LWDs/mile: 89



Pools

Rank	Depth (ft)	L (W_{bkt})	#
1	$1.0 \leq D < 2.0$	< 0.5	5
2	$1.0 \leq D < 2.0$	≥ 0.5	0
3	$2.0 \leq D < 3.0$	< 0.5	0
4	$2.0 \leq D < 3.0$	≥ 0.5	0
5	$D \geq 3.0$	< 0.5	0
6	$D \geq 3.0$	≥ 0.5	0
7	$D \geq 3.0$	≥ 1.0	0

Pools/mile: 23



Reach/Segment Information

SGA ID: T1.01.S4.01.B

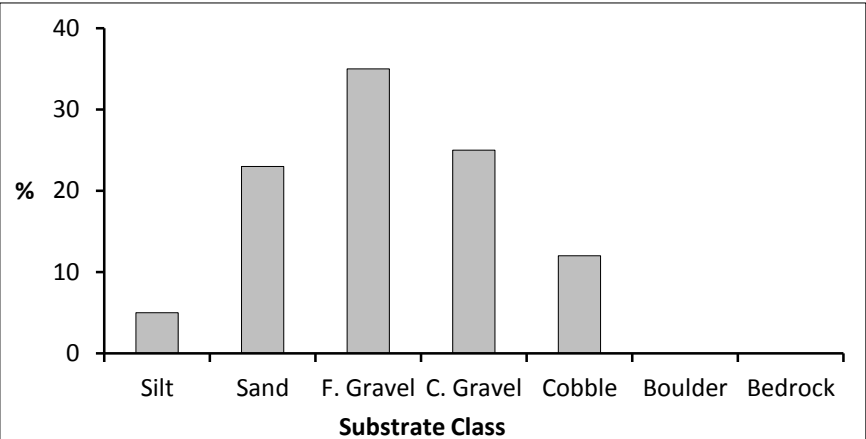
Length (ft): 3,640

Reference Bedform Type: Riffle-Pool

Total RHA Score: 87

RHA Percentage: 54%

Overall Habitat Condition: Fair



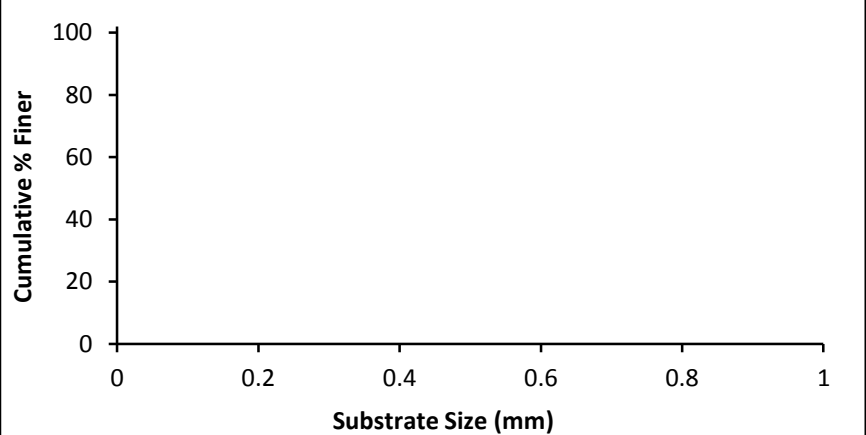
Sediment Composition and Mobility

Class	Range (mm)	Percent
Silt	< 0.06	5
Sand	0.06 - 2	23
F. Gravel	2 - 16	35
C. Gravel	16 - 64	25
Cobble	64 - 256	12
Boulder	256 - 4096	0
Bedrock	> 4096	0

Median Substrate Size: 10 mm

Avg. Largest Particle (Bar): 64 mm

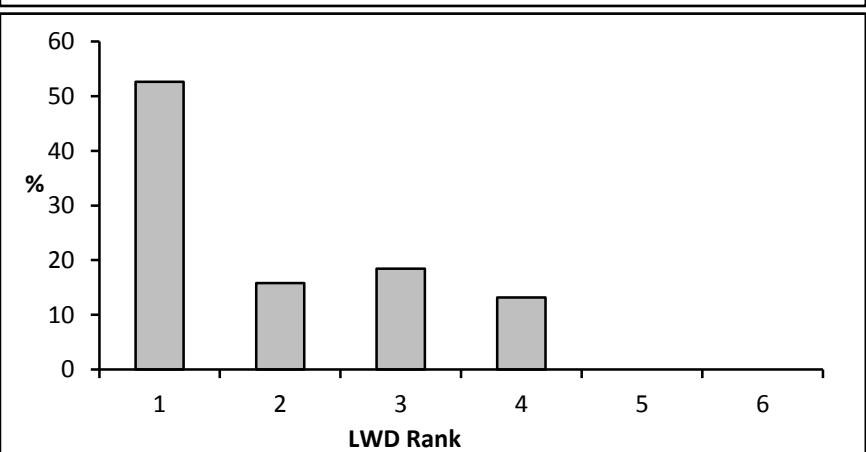
Riffle Stability Index (RSI): 88 %



Large Woody Debris (LWD)

Rank	Diameter (ft)	L (W_{bkt})	#
1	$0.5 \leq D < 1.0$	< 0.5	20
2	$0.5 \leq D < 1.0$	≥ 0.5	6
3	$1.0 \leq D < 2.0$	< 0.5	7
4	$1.0 \leq D < 2.0$	≥ 0.5	5
5	$D \geq 2.0$	< 0.5	0
6	$D \geq 2.0$	≥ 0.5	0

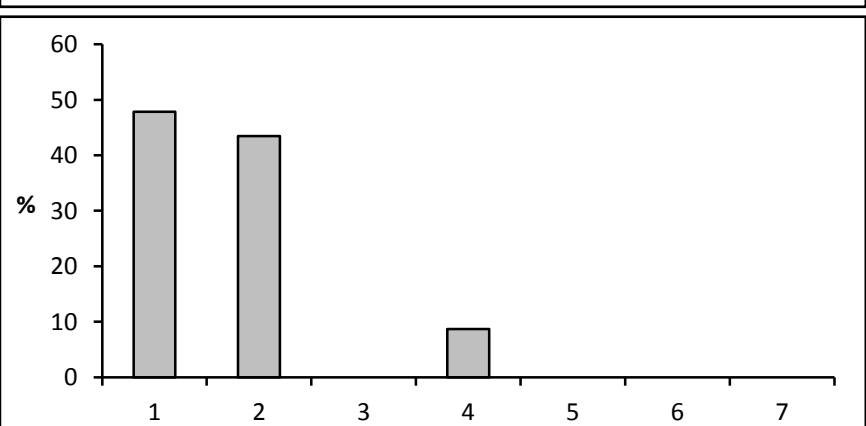
LWDs/mile: 55



Pools

Rank	Depth (ft)	L (W_{bkt})	#
1	$1.0 \leq D < 2.0$	< 0.5	11
2	$1.0 \leq D < 2.0$	≥ 0.5	10
3	$2.0 \leq D < 3.0$	< 0.5	0
4	$2.0 \leq D < 3.0$	≥ 0.5	2
5	$D \geq 3.0$	< 0.5	0
6	$D \geq 3.0$	≥ 0.5	0
7	$D \geq 3.0$	≥ 1.0	0

Pools/mile: 33



Reach/Segment Information

SGA ID: T1.01.S4.01.C

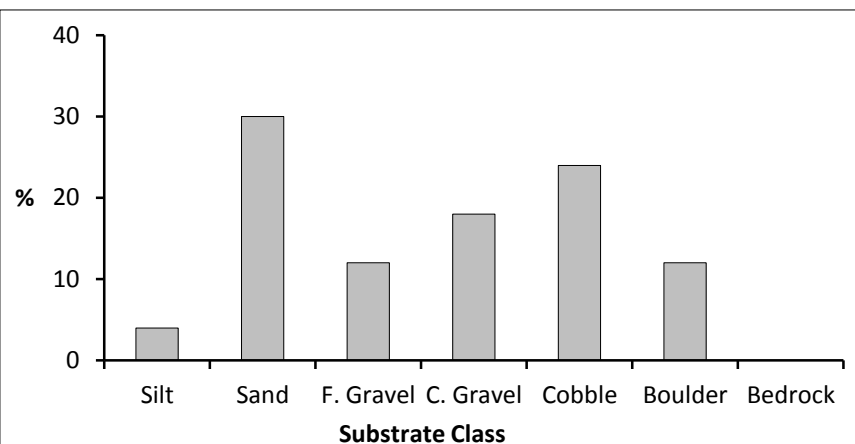
Length (ft): 1,493

Reference Bedform Type: Step-Pool

Total RHA Score: 73

RHA Percentage: 46%

Overall Habitat Condition: Fair



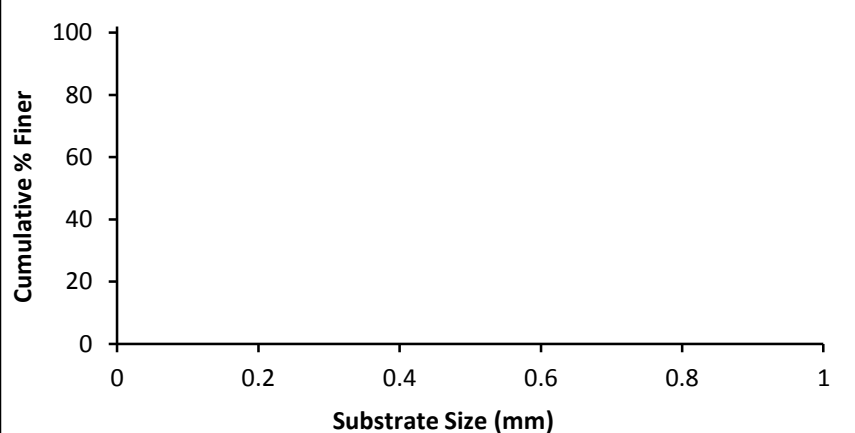
Sediment Composition and Mobility

Class	Range (mm)	Percent
Silt	< 0.06	4
Sand	0.06 - 2	30
F. Gravel	2 - 16	12
C. Gravel	16 - 64	18
Cobble	64 - 256	24
Boulder	256 - 4096	12
Bedrock	> 4096	0

Median Substrate Size: 50 mm

Avg. Largest Particle (Bar): N/A mm

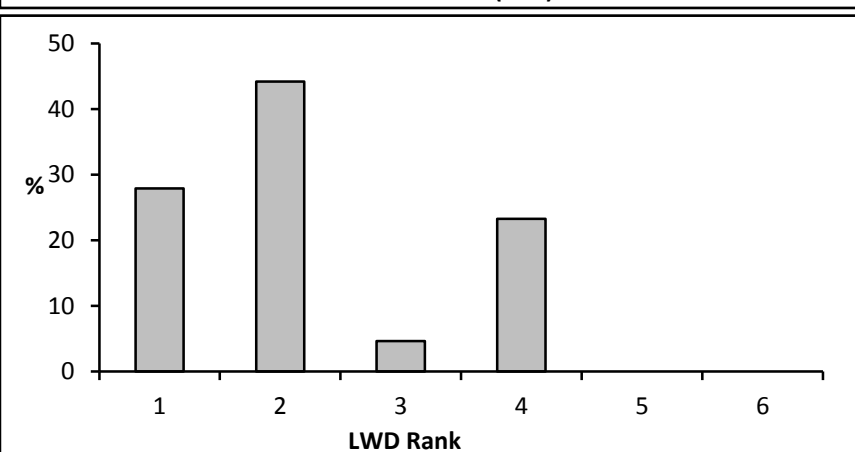
Riffle Stability Index (RSI): N/A %



Large Woody Debris (LWD)

Rank	Diameter (ft)	L (W_{bkt})	#
1	$0.5 \leq D < 1.0$	< 0.5	12
2	$0.5 \leq D < 1.0$	≥ 0.5	19
3	$1.0 \leq D < 2.0$	< 0.5	2
4	$1.0 \leq D < 2.0$	≥ 0.5	10
5	$D \geq 2.0$	< 0.5	0
6	$D \geq 2.0$	≥ 0.5	0

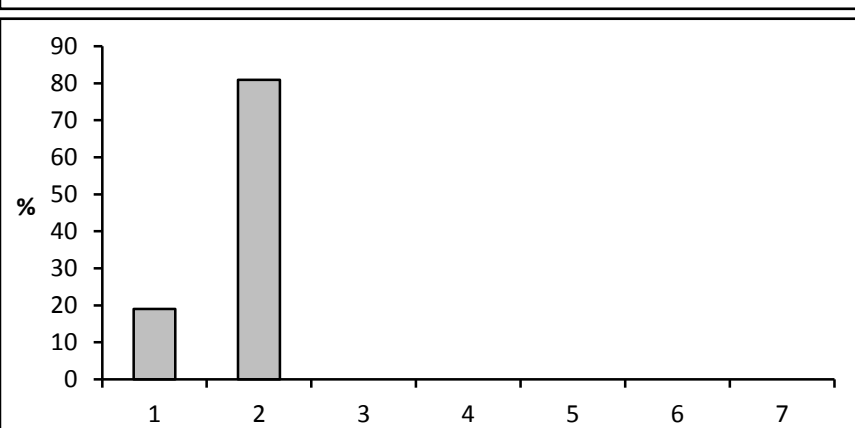
LWDs/mile: 152



Pools

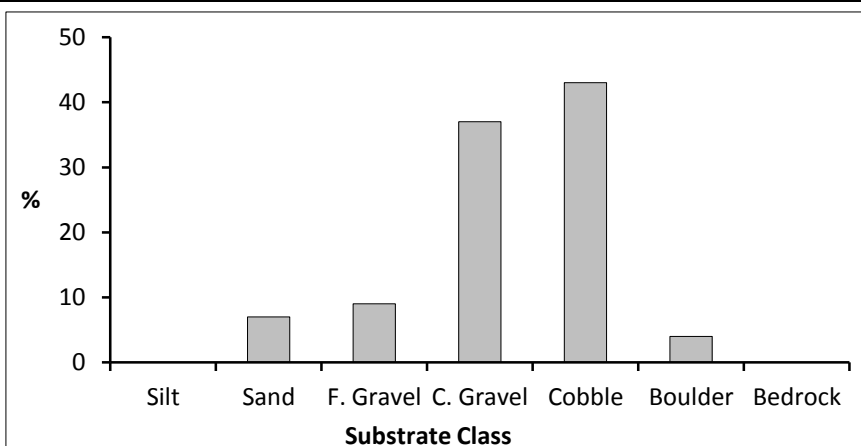
Rank	Depth (ft)	L (W_{bkt})	#
1	$1.0 \leq D < 2.0$	< 0.5	4
2	$1.0 \leq D < 2.0$	≥ 0.5	17
3	$2.0 \leq D < 3.0$	< 0.5	0
4	$2.0 \leq D < 3.0$	≥ 0.5	0
5	$D \geq 3.0$	< 0.5	0
6	$D \geq 3.0$	≥ 0.5	0
7	$D \geq 3.0$	≥ 1.0	0

Pools/mile: 74



Reach/Segment Information

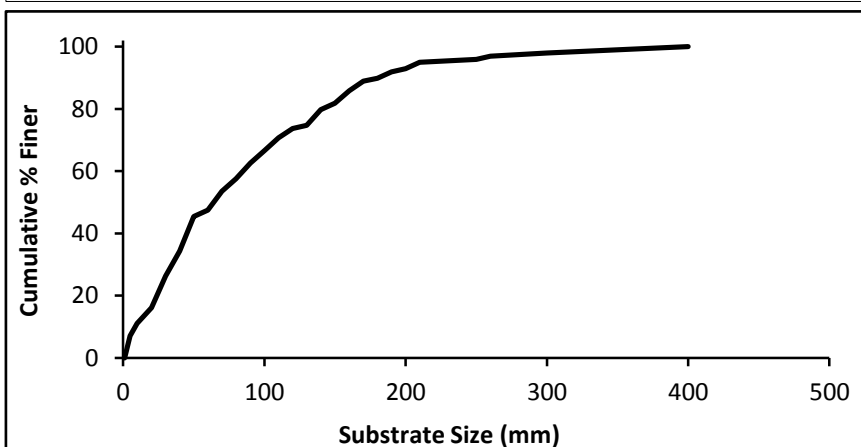
SGA ID:	T2.01.A
Length (ft):	2,527
Reference Bedform Type:	Riffle-Pool
Total RHA Score:	76
RHA Percentage:	48%
Overall Habitat Condition:	Fair



Sediment Composition and Mobility

Class	Range (mm)	Percent
Silt	< 0.06	0
Sand	0.06 - 2	7
F. Gravel	2 - 16	9
C. Gravel	16 - 64	37
Cobble	64 - 256	43
Boulder	256 - 4096	4
Bedrock	> 4096	0

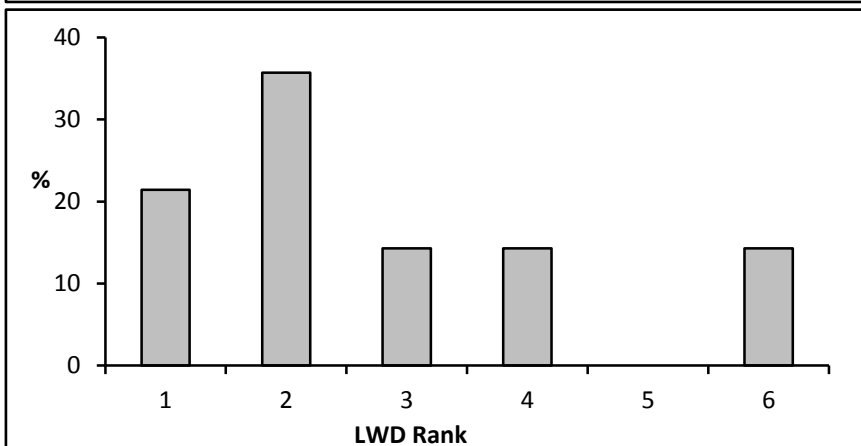
Median Substrate Size:	60	mm
Avg. Largest Particle (Bar):	40	mm
Riffle Stability Index (RSI):	34	%



Large Woody Debris (LWD)

Rank	Diameter (ft)	L (W_{bkt})	#
1	0.5 ≤ D < 1.0	< 0.5	3
2	0.5 ≤ D < 1.0	≥ 0.5	5
3	1.0 ≤ D < 2.0	< 0.5	2
4	1.0 ≤ D < 2.0	≥ 0.5	2
5	D ≥ 2.0	< 0.5	0
6	D ≥ 2.0	≥ 0.5	2

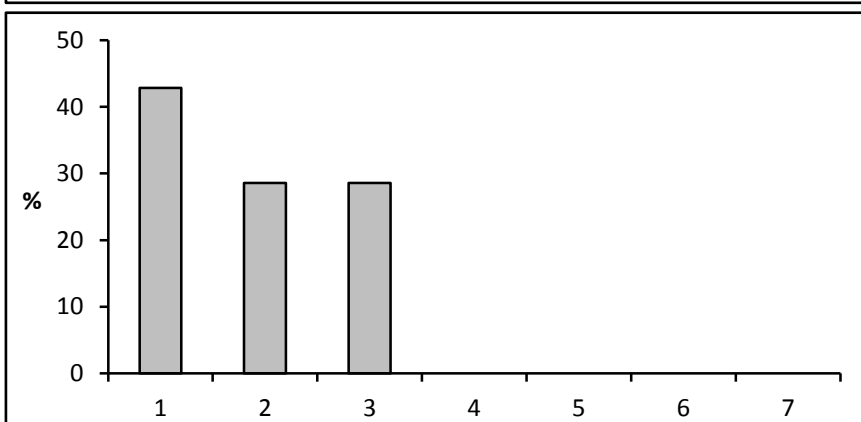
LWDs/mile: 29



Pools

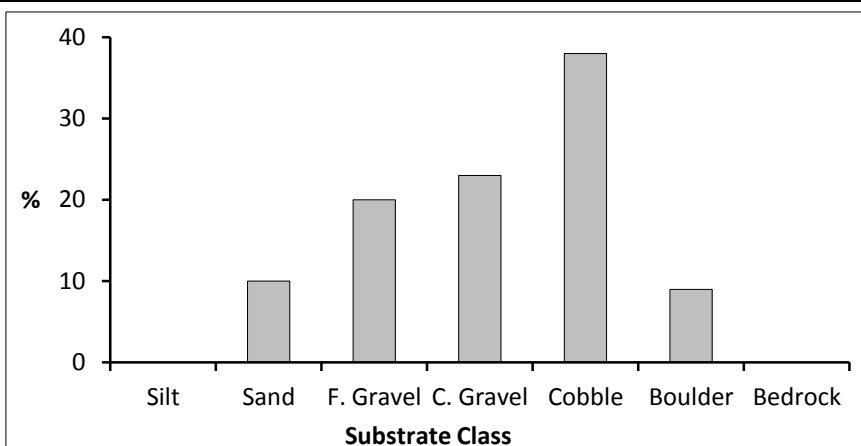
Rank	Depth (ft)	L (W_{bkt})	#
1	1.0 ≤ D < 2.0	< 0.5	3
2	1.0 ≤ D < 2.0	≥ 0.5	2
3	2.0 ≤ D < 3.0	< 0.5	2
4	2.0 ≤ D < 3.0	≥ 0.5	0
5	D ≥ 3.0	< 0.5	0
6	D ≥ 3.0	≥ 0.5	0
7	D ≥ 3.0	≥ 1.0	0

Pools/mile: 15



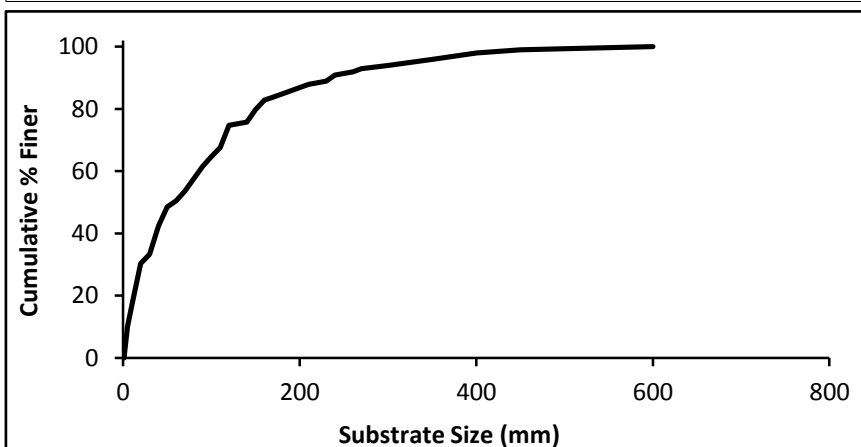
Reach/Segment Information

SGA ID:	T2.01.B
Length (ft):	1,500
Reference Bedform Type:	Riffle-Pool
Total RHA Score:	99
RHA Percentage:	62%
Overall Habitat Condition:	Fair

**Sediment Composition and Mobility**

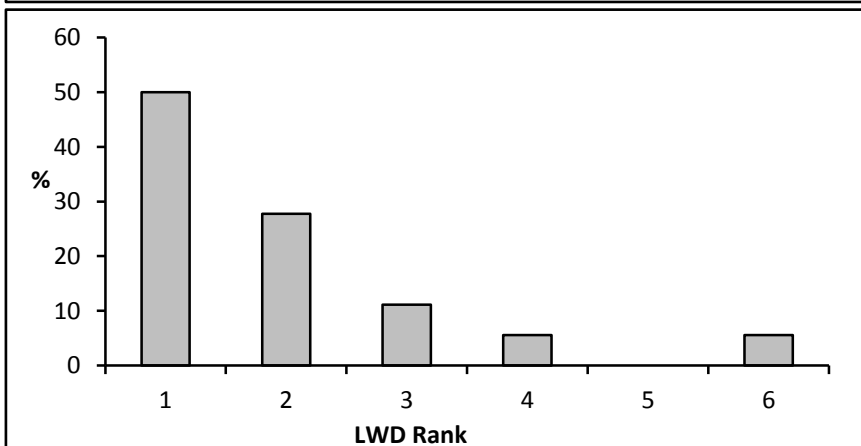
Class	Range (mm)	Percent
Silt	< 0.06	0
Sand	0.06 - 2	10
F. Gravel	2 - 16	20
C. Gravel	16 - 64	23
Cobble	64 - 256	38
Boulder	256 - 4096	9
Bedrock	> 4096	0

Median Substrate Size:	55	mm
Avg. Largest Particle (Bar):	150	mm
Riffle Stability Index (RSI):	80	%

**Large Woody Debris (LWD)**

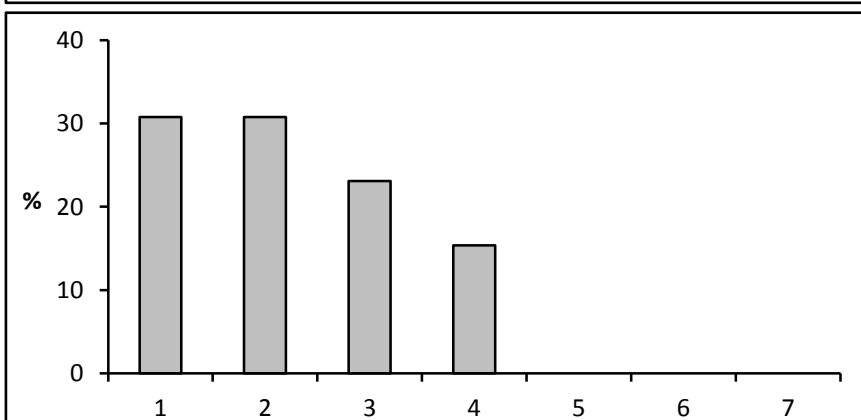
Rank	Diameter (ft)	L (W_{bkt})	#
1	0.5 ≤ D < 1.0	< 0.5	9
2	0.5 ≤ D < 1.0	≥ 0.5	5
3	1.0 ≤ D < 2.0	< 0.5	2
4	1.0 ≤ D < 2.0	≥ 0.5	1
5	D ≥ 2.0	< 0.5	0
6	D ≥ 2.0	≥ 0.5	1

LWDs/mile: 63

**Pools**

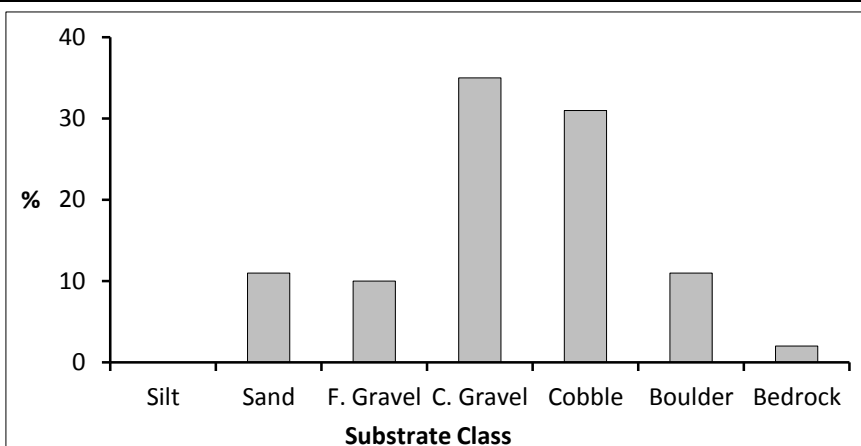
Rank	Depth (ft)	L (W_{bkt})	#
1	1.0 ≤ D < 2.0	< 0.5	4
2	1.0 ≤ D < 2.0	≥ 0.5	4
3	2.0 ≤ D < 3.0	< 0.5	3
4	2.0 ≤ D < 3.0	≥ 0.5	2
5	D ≥ 3.0	< 0.5	0
6	D ≥ 3.0	≥ 0.5	0
7	D ≥ 3.0	≥ 1.0	0

Pools/mile: 46



Reach/Segment Information

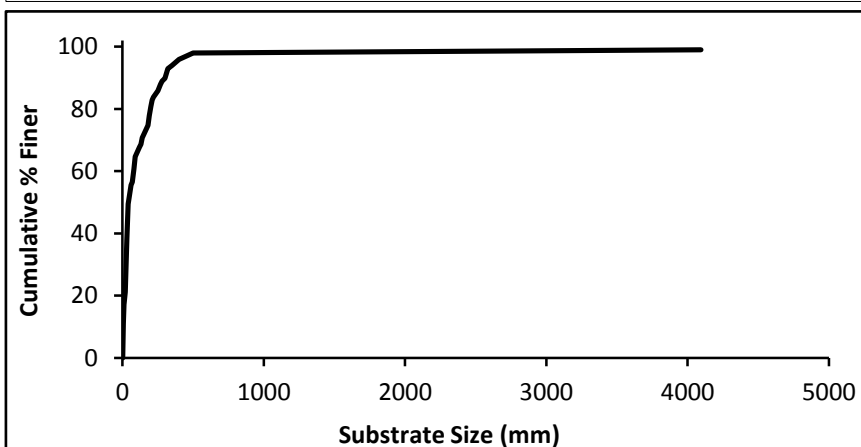
SGA ID:	T2.02
Length (ft):	3,213
Reference Bedform Type:	Step-Pool
Total RHA Score:	71
RHA Percentage:	44%
Overall Habitat Condition:	Fair



Sediment Composition and Mobility

Class	Range (mm)	Percent
Silt	< 0.06	0
Sand	0.06 - 2	11
F. Gravel	2 - 16	10
C. Gravel	16 - 64	35
Cobble	64 - 256	31
Boulder	256 - 4096	11
Bedrock	> 4096	2

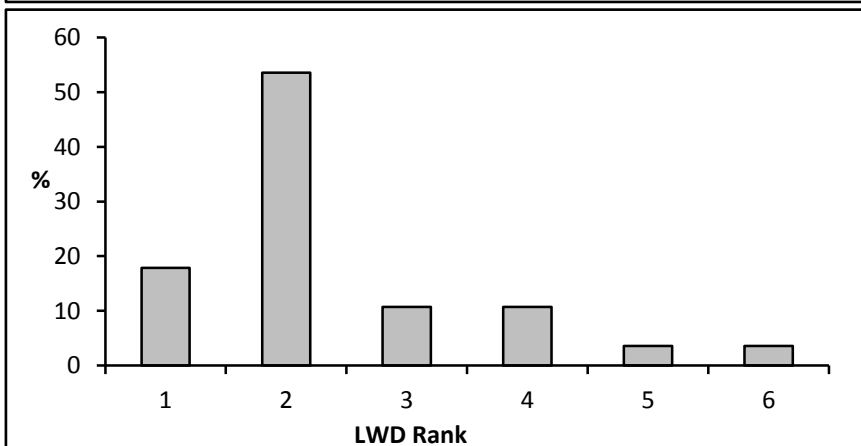
Median Substrate Size:	40	mm
Avg. Largest Particle (Bar):	N/A	mm
Riffle Stability Index (RSI):	N/A	%



Large Woody Debris (LWD)

Rank	Diameter (ft)	L (W_{bkt})	#
1	$0.5 \leq D < 1.0$	< 0.5	5
2	$0.5 \leq D < 1.0$	≥ 0.5	15
3	$1.0 \leq D < 2.0$	< 0.5	3
4	$1.0 \leq D < 2.0$	≥ 0.5	3
5	$D \geq 2.0$	< 0.5	1
6	$D \geq 2.0$	≥ 0.5	1

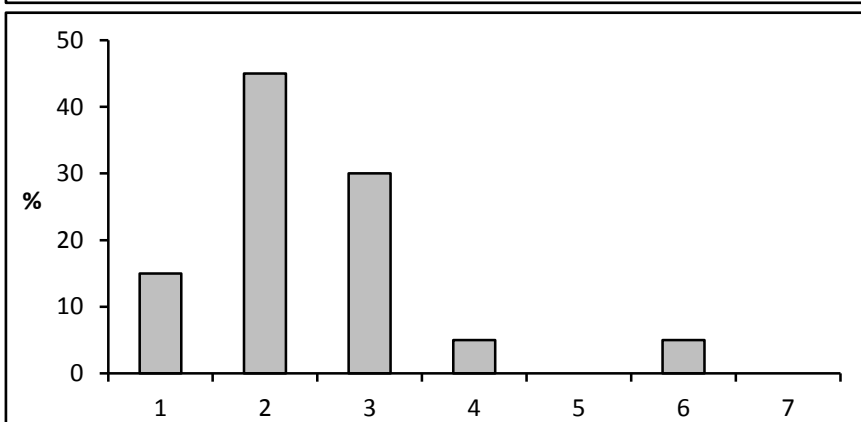
LWDs/mile: 46



Pools

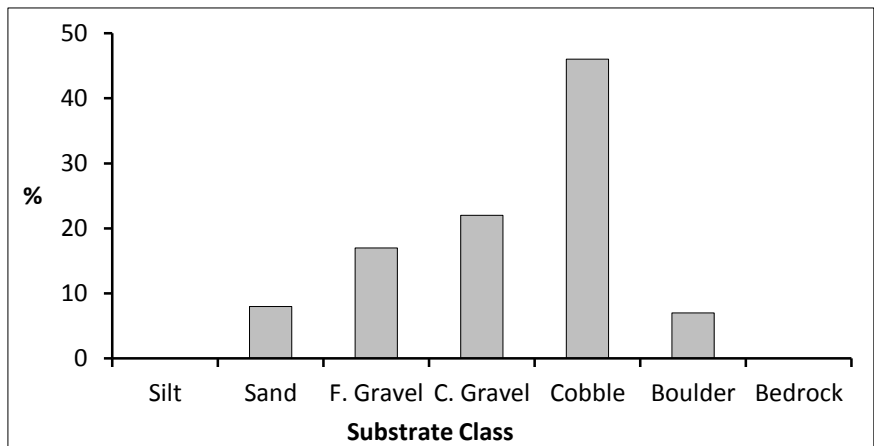
Rank	Depth (ft)	L (W_{bkt})	#
1	$1.0 \leq D < 2.0$	< 0.5	3
2	$1.0 \leq D < 2.0$	≥ 0.5	9
3	$2.0 \leq D < 3.0$	< 0.5	6
4	$2.0 \leq D < 3.0$	≥ 0.5	1
5	$D \geq 3.0$	< 0.5	0
6	$D \geq 3.0$	≥ 0.5	1
7	$D \geq 3.0$	≥ 1.0	0

Pools/mile: 33



Reach/Segment Information

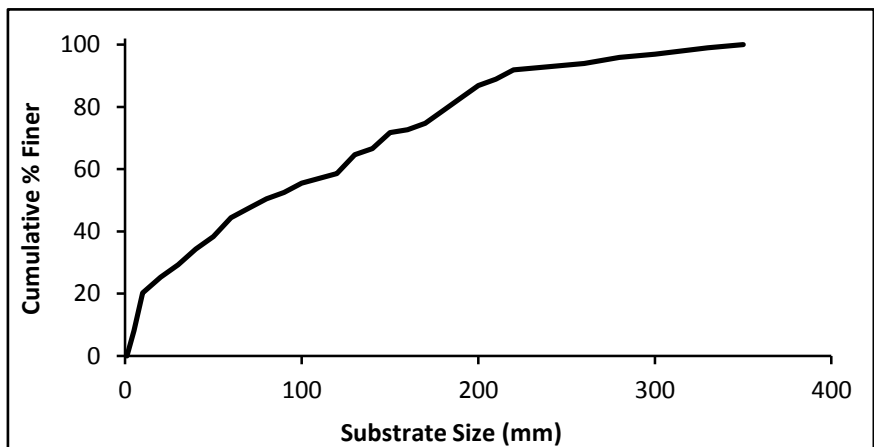
SGA ID:	T2.03.A
Length (ft):	2,412
Reference Bedform Type:	Riffle-Pool
Total RHA Score:	83
RHA Percentage:	52%
Overall Habitat Condition:	Fair



Sediment Composition and Mobility

Class	Range (mm)	Percent
Silt	< 0.06	0
Sand	0.06 - 2	8
F. Gravel	2 - 16	17
C. Gravel	16 - 64	22
Cobble	64 - 256	46
Boulder	256 - 4096	7
Bedrock	> 4096	0

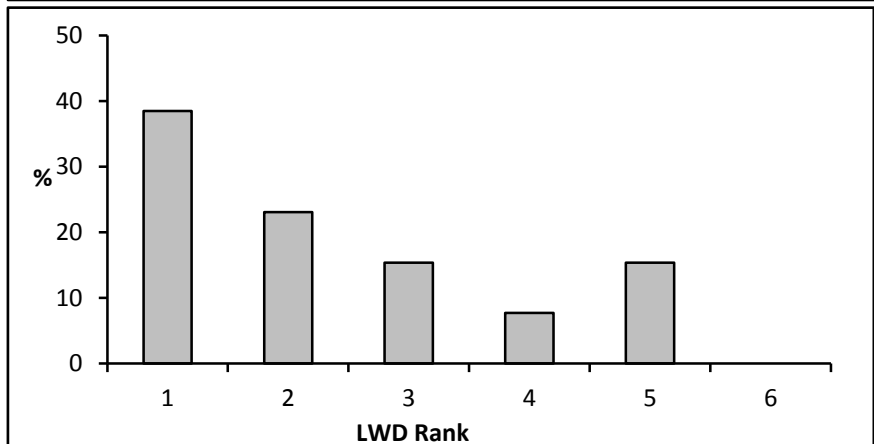
Median Substrate Size:	75	mm
Avg. Largest Particle (Bar):	80	mm
Riffle Stability Index (RSI):	51	%



Large Woody Debris (LWD)

Rank	Diameter (ft)	L (W_{bkt})	#
1	0.5 ≤ D < 1.0	< 0.5	5
2	0.5 ≤ D < 1.0	≥ 0.5	3
3	1.0 ≤ D < 2.0	< 0.5	2
4	1.0 ≤ D < 2.0	≥ 0.5	1
5	D ≥ 2.0	< 0.5	2
6	D ≥ 2.0	≥ 0.5	0

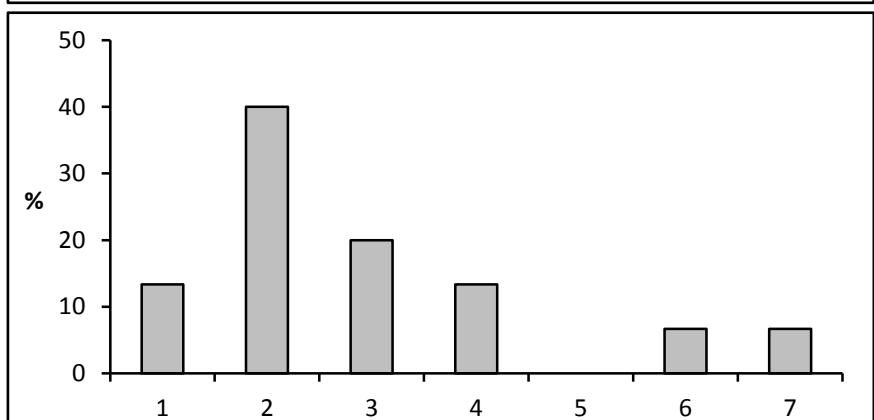
LWDs/mile: 28



Pools

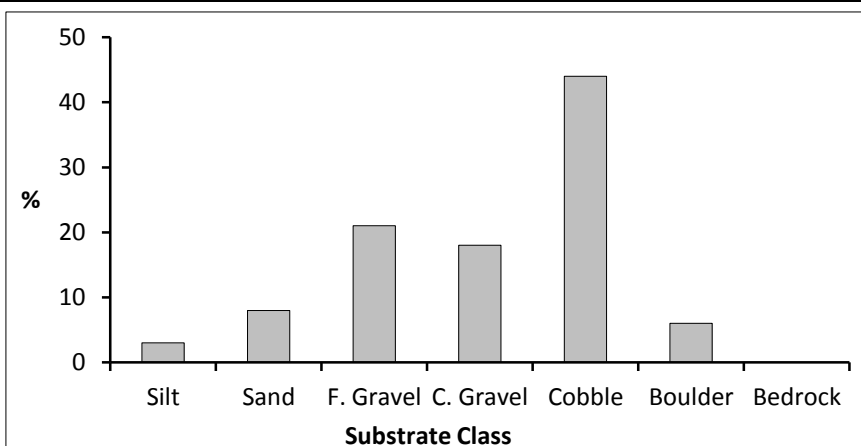
Rank	Depth (ft)	L (W_{bkt})	#
1	1.0 ≤ D < 2.0	< 0.5	2
2	1.0 ≤ D < 2.0	≥ 0.5	6
3	2.0 ≤ D < 3.0	< 0.5	3
4	2.0 ≤ D < 3.0	≥ 0.5	2
5	D ≥ 3.0	< 0.5	0
6	D ≥ 3.0	≥ 0.5	1
7	D ≥ 3.0	≥ 1.0	1

Pools/mile: 33



Reach/Segment Information

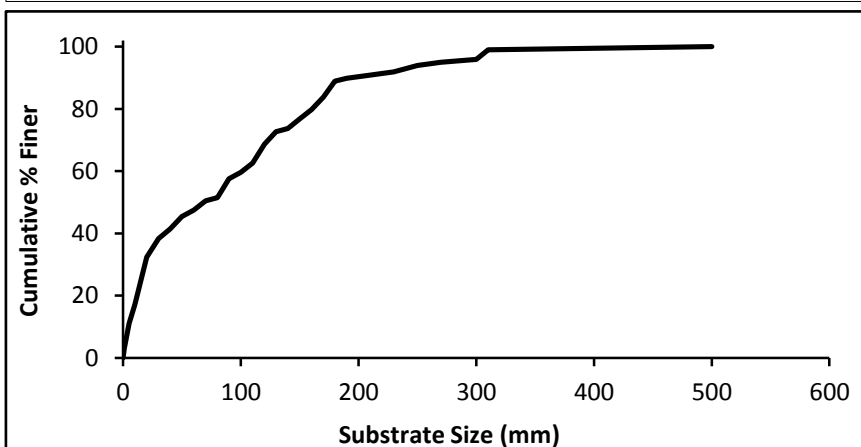
SGA ID:	T2.03.B
Length (ft):	4,406
Reference Bedform Type:	Riffle-Pool
Total RHA Score:	73
RHA Percentage:	46%
Overall Habitat Condition:	Fair



Sediment Composition and Mobility

Class	Range (mm)	Percent
Silt	< 0.06	3
Sand	0.06 - 2	8
F. Gravel	2 - 16	21
C. Gravel	16 - 64	18
Cobble	64 - 256	44
Boulder	256 - 4096	6
Bedrock	> 4096	0

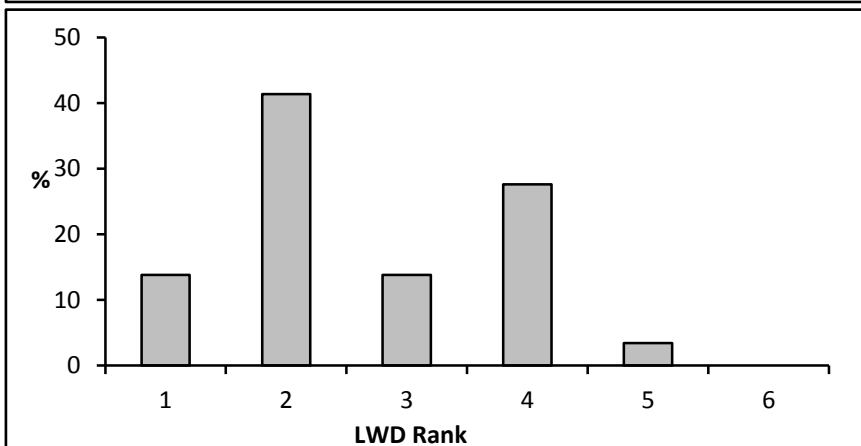
Median Substrate Size:	65	mm
Avg. Largest Particle (Bar):	190	mm
Riffle Stability Index (RSI):	90	%



Large Woody Debris (LWD)

Rank	Diameter (ft)	L (W_{bkf})	#
1	$0.5 \leq D < 1.0$	< 0.5	4
2	$0.5 \leq D < 1.0$	≥ 0.5	12
3	$1.0 \leq D < 2.0$	< 0.5	4
4	$1.0 \leq D < 2.0$	≥ 0.5	8
5	$D \geq 2.0$	< 0.5	1
6	$D \geq 2.0$	≥ 0.5	0

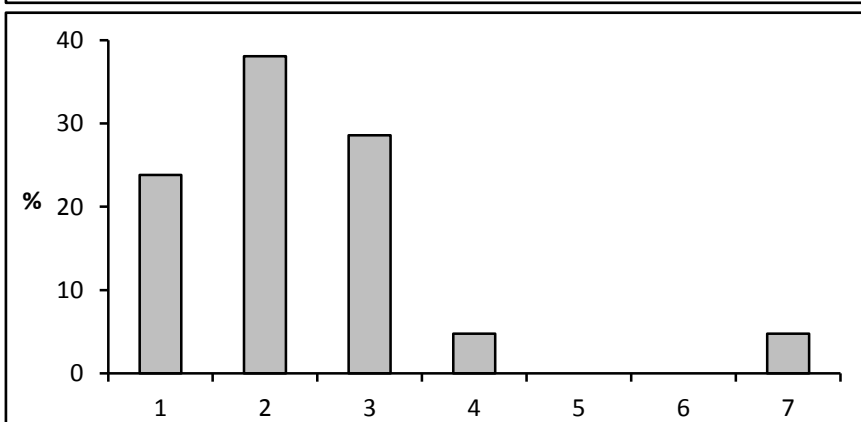
LWDs/mile: 35



Pools

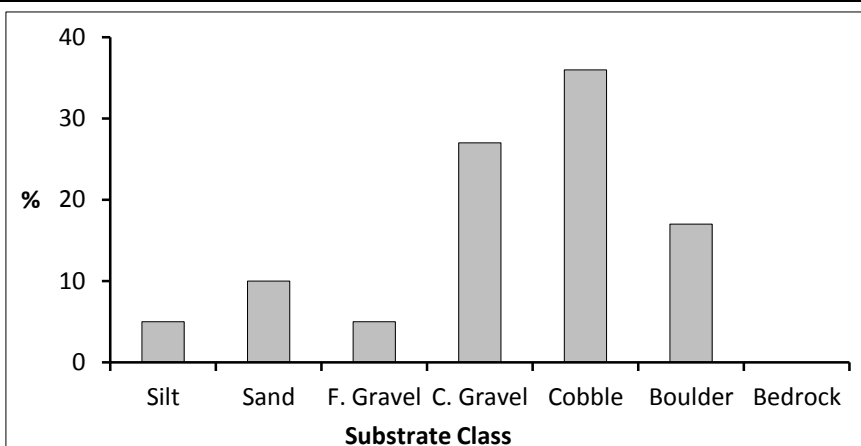
Rank	Depth (ft)	L (W_{bkf})	#
1	$1.0 \leq D < 2.0$	< 0.5	5
2	$1.0 \leq D < 2.0$	≥ 0.5	8
3	$2.0 \leq D < 3.0$	< 0.5	6
4	$2.0 \leq D < 3.0$	≥ 0.5	1
5	$D \geq 3.0$	< 0.5	0
6	$D \geq 3.0$	≥ 0.5	0
7	$D \geq 3.0$	≥ 1.0	1

Pools/mile: 25



Reach/Segment Information

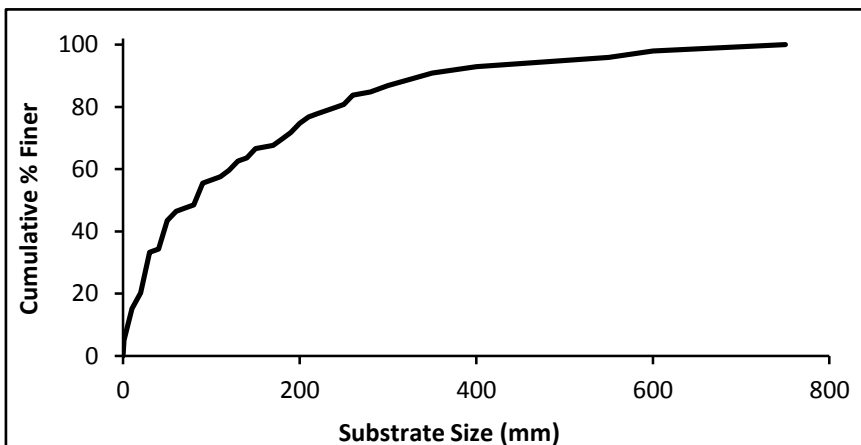
SGA ID:	T2.04
Length (ft):	3,051
Reference Bedform Type:	Riffle-Pool
Total RHA Score:	112
RHA Percentage:	70%
Overall Habitat Condition:	Good



Sediment Composition and Mobility

Class	Range (mm)	Percent
Silt	< 0.06	5
Sand	0.06 - 2	10
F. Gravel	2 - 16	5
C. Gravel	16 - 64	27
Cobble	64 - 256	36
Boulder	256 - 4096	17
Bedrock	> 4096	0

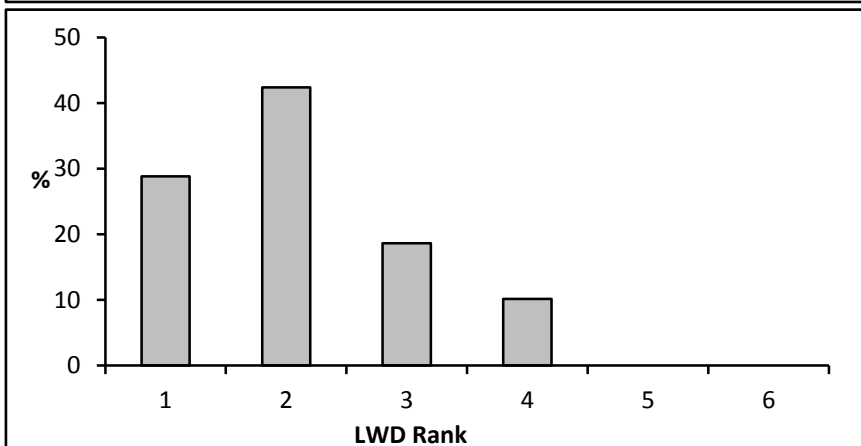
Median Substrate Size:	80	mm
Avg. Largest Particle (Bar):	230	mm
Riffle Stability Index (RSI):	79	%



Large Woody Debris (LWD)

Rank	Diameter (ft)	L (W_{bkt})	#
1	0.5 ≤ D < 1.0	< 0.5	17
2	0.5 ≤ D < 1.0	≥ 0.5	25
3	1.0 ≤ D < 2.0	< 0.5	11
4	1.0 ≤ D < 2.0	≥ 0.5	6
5	D ≥ 2.0	< 0.5	0
6	D ≥ 2.0	≥ 0.5	0

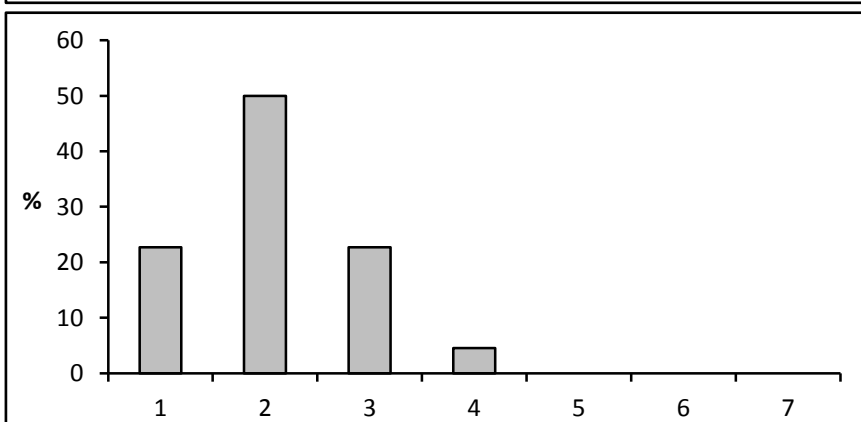
LWDs/mile: 102



Pools

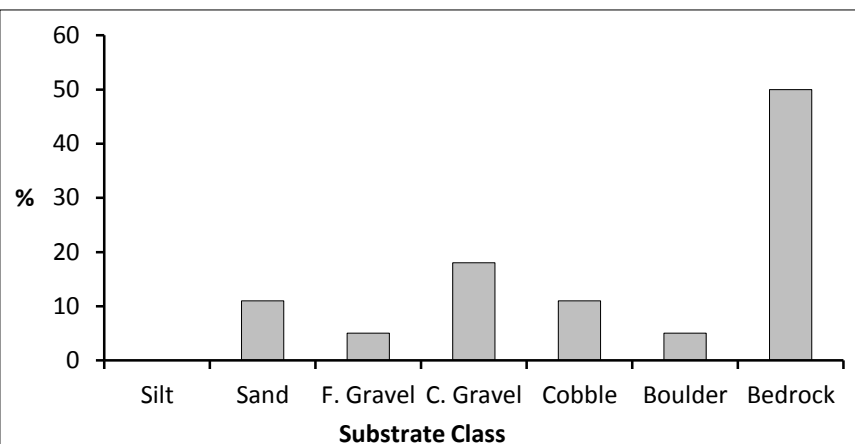
Rank	Depth (ft)	L (W_{bkt})	#
1	1.0 ≤ D < 2.0	< 0.5	5
2	1.0 ≤ D < 2.0	≥ 0.5	11
3	2.0 ≤ D < 3.0	< 0.5	5
4	2.0 ≤ D < 3.0	≥ 0.5	1
5	D ≥ 3.0	< 0.5	0
6	D ≥ 3.0	≥ 0.5	0
7	D ≥ 3.0	≥ 1.0	0

Pools/mile: 38



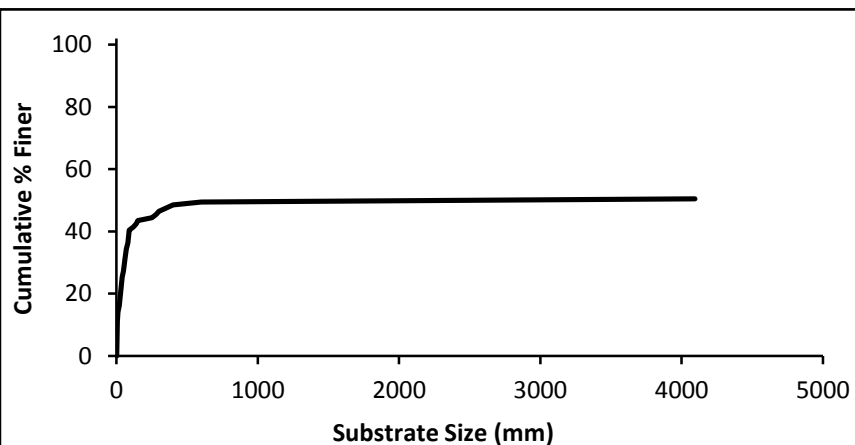
Reach/Segment Information

SGA ID:	T2.05.A
Length (ft):	1,049
Reference Bedform Type:	Riffle-Pool
Total RHA Score:	105
RHA Percentage:	66%
Overall Habitat Condition:	Good

**Sediment Composition and Mobility**

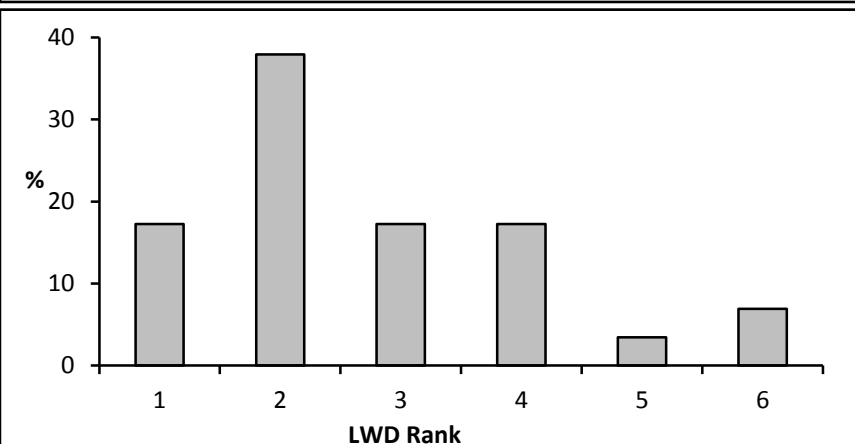
Class	Range (mm)	Percent
Silt	< 0.06	0
Sand	0.06 - 2	11
F. Gravel	2 - 16	5
C. Gravel	16 - 64	18
Cobble	64 - 256	11
Boulder	256 - 4096	5
Bedrock	> 4096	50

Median Substrate Size:	2348	mm
Avg. Largest Particle (Bar):	180	mm
Riffle Stability Index (RSI):	43	%

**Large Woody Debris (LWD)**

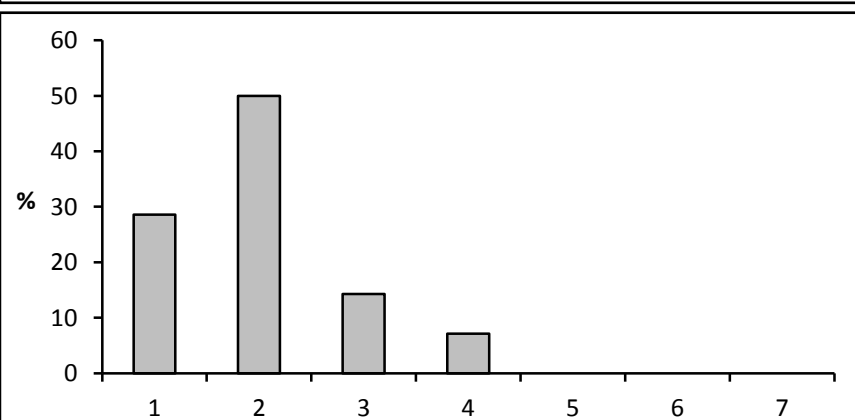
Rank	Diameter (ft)	L (W_{bkt})	#
1	$0.5 \leq D < 1.0$	< 0.5	5
2	$0.5 \leq D < 1.0$	≥ 0.5	11
3	$1.0 \leq D < 2.0$	< 0.5	5
4	$1.0 \leq D < 2.0$	≥ 0.5	5
5	$D \geq 2.0$	< 0.5	1
6	$D \geq 2.0$	≥ 0.5	2

LWDs/mile: 146

**Pools**

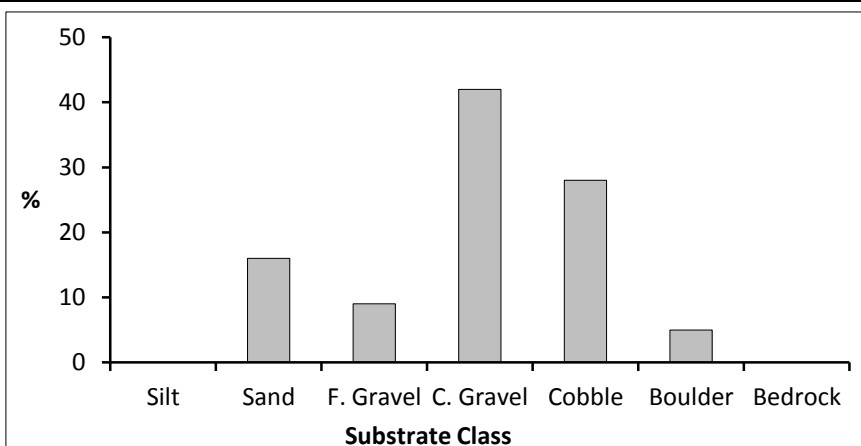
Rank	Depth (ft)	L (W_{bkt})	#
1	$1.0 \leq D < 2.0$	< 0.5	4
2	$1.0 \leq D < 2.0$	≥ 0.5	7
3	$2.0 \leq D < 3.0$	< 0.5	2
4	$2.0 \leq D < 3.0$	≥ 0.5	1
5	$D \geq 3.0$	< 0.5	0
6	$D \geq 3.0$	≥ 0.5	0
7	$D \geq 3.0$	≥ 1.0	0

Pools/mile: 70



Reach/Segment Information

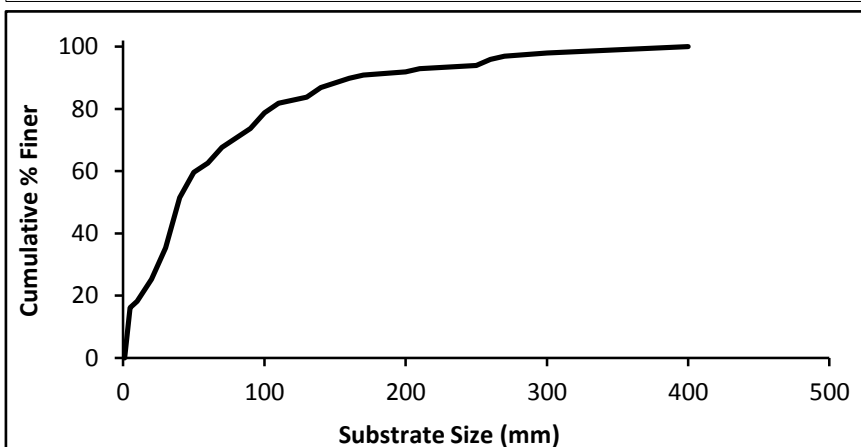
SGA ID:	T2.05.B
Length (ft):	939
Reference Bedform Type:	Riffle-Pool
Total RHA Score:	92
RHA Percentage:	58%
Overall Habitat Condition:	Fair



Sediment Composition and Mobility

Class	Range (mm)	Percent
Silt	< 0.06	0
Sand	0.06 - 2	16
F. Gravel	2 - 16	9
C. Gravel	16 - 64	42
Cobble	64 - 256	28
Boulder	256 - 4096	5
Bedrock	> 4096	0

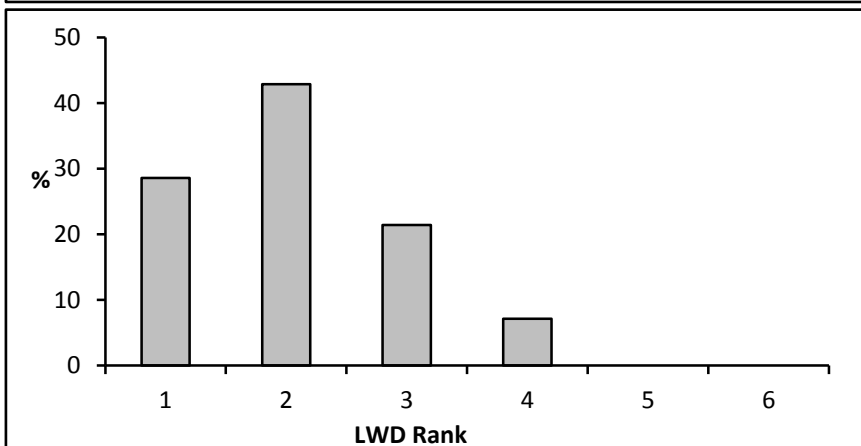
Median Substrate Size:	30	mm
Avg. Largest Particle (Bar):	N/A	mm
Riffle Stability Index (RSI):	N/A	%



Large Woody Debris (LWD)

Rank	Diameter (ft)	L (W_{bkt})	#
1	0.5 ≤ D < 1.0	< 0.5	4
2	0.5 ≤ D < 1.0	≥ 0.5	6
3	1.0 ≤ D < 2.0	< 0.5	3
4	1.0 ≤ D < 2.0	≥ 0.5	1
5	D ≥ 2.0	< 0.5	0
6	D ≥ 2.0	≥ 0.5	0

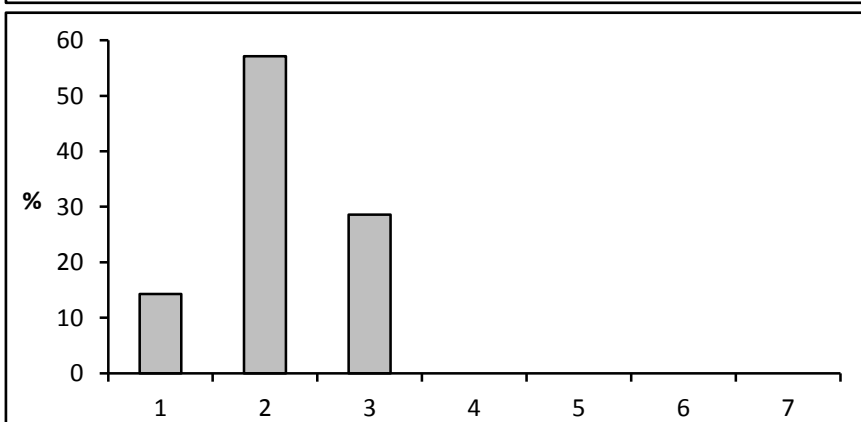
LWDs/mile: 79



Pools

Rank	Depth (ft)	L (W_{bkt})	#
1	1.0 ≤ D < 2.0	< 0.5	1
2	1.0 ≤ D < 2.0	≥ 0.5	4
3	2.0 ≤ D < 3.0	< 0.5	2
4	2.0 ≤ D < 3.0	≥ 0.5	0
5	D ≥ 3.0	< 0.5	0
6	D ≥ 3.0	≥ 0.5	0
7	D ≥ 3.0	≥ 1.0	0

Pools/mile: 39



Rapid Habitat Assessment and Substrate Summary

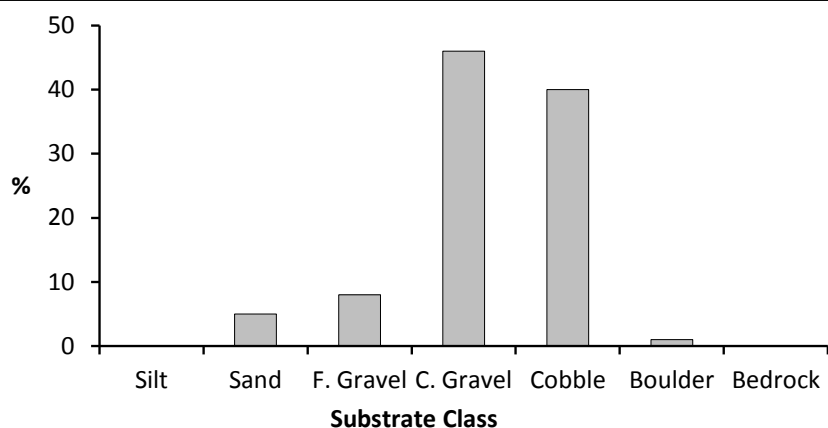
Fitzgerald Environmental Associates, LLC.

Mill Brook Phase 2

Reading Brook

Reach/Segment Information

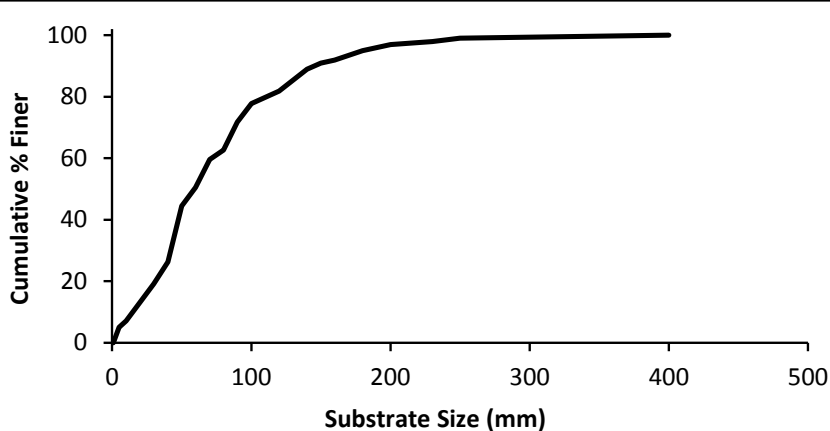
SGA ID:	T3.01
Length (ft):	3,017
Reference Bedform Type:	Riffle-Pool
Total RHA Score:	86
RHA Percentage:	54%
Overall Habitat Condition:	Fair



Sediment Composition and Mobility

Class	Range (mm)	Percent
Silt	< 0.06	0
Sand	0.06 - 2	5
F. Gravel	2 - 16	8
C. Gravel	16 - 64	46
Cobble	64 - 256	40
Boulder	256 - 4096	1
Bedrock	> 4096	0

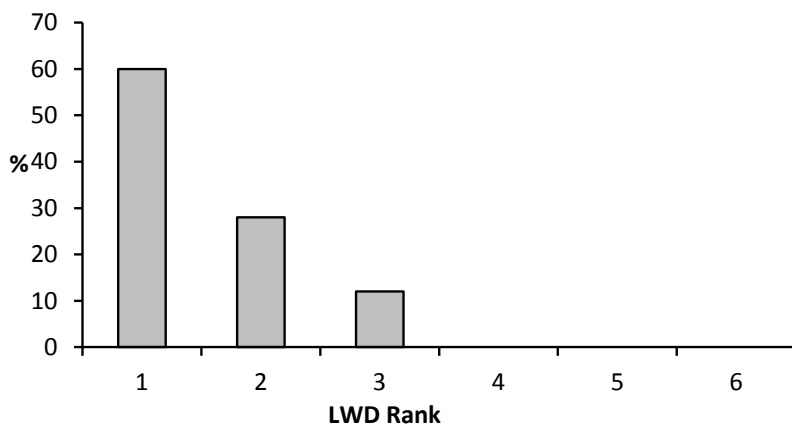
Median Substrate Size:	55	mm
Avg. Largest Particle (Bar):	N/A	mm
Riffle Stability Index (RSI):	N/A	%



Large Woody Debris (LWD)

Rank	Diameter (ft)	L (W_{bkt})	#
1	$0.5 \leq D < 1.0$	< 0.5	15
2	$0.5 \leq D < 1.0$	≥ 0.5	7
3	$1.0 \leq D < 2.0$	< 0.5	3
4	$1.0 \leq D < 2.0$	≥ 0.5	0
5	$D \geq 2.0$	< 0.5	0
6	$D \geq 2.0$	≥ 0.5	0

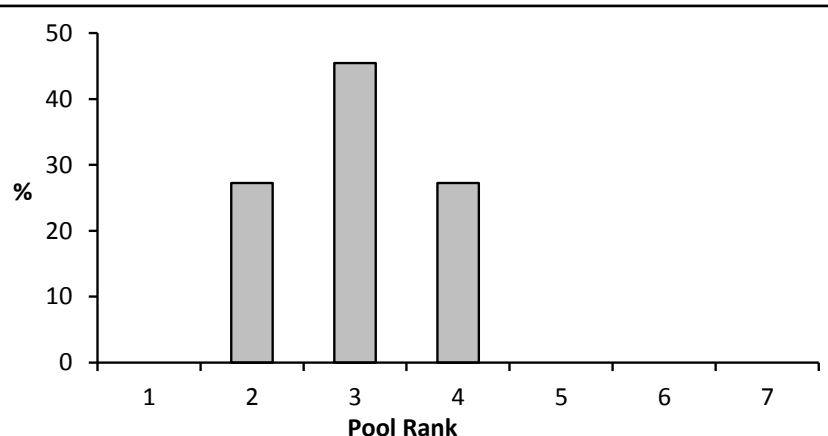
LWDs/mile: 44



Pools

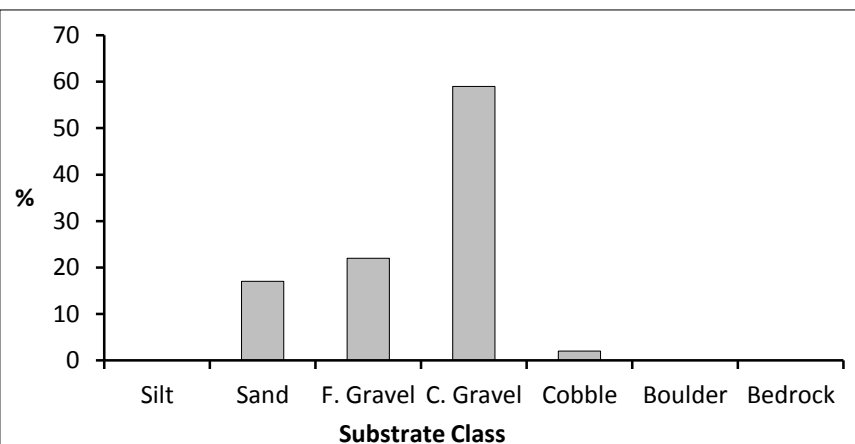
Rank	Depth (ft)	L (W_{bkt})	#
1	$1.0 \leq D < 2.0$	< 0.5	0
2	$1.0 \leq D < 2.0$	≥ 0.5	3
3	$2.0 \leq D < 3.0$	< 0.5	5
4	$2.0 \leq D < 3.0$	≥ 0.5	3
5	$D \geq 3.0$	< 0.5	0
6	$D \geq 3.0$	≥ 0.5	0
7	$D \geq 3.0$	≥ 1.0	0

Pools/mile: 19



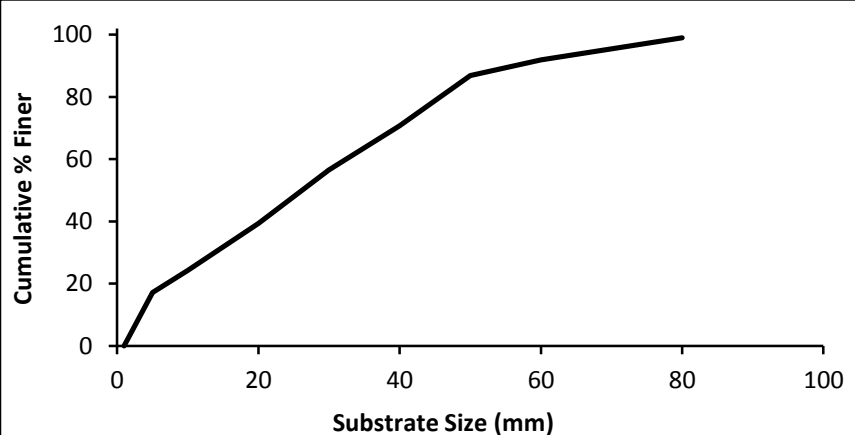
Reach/Segment Information

SGA ID:	T3.02.B
Length (ft):	3,649
Reference Bedform Type:	Riffle-Pool
Total RHA Score:	90
RHA Percentage:	56%
Overall Habitat Condition:	Fair

**Sediment Composition and Mobility**

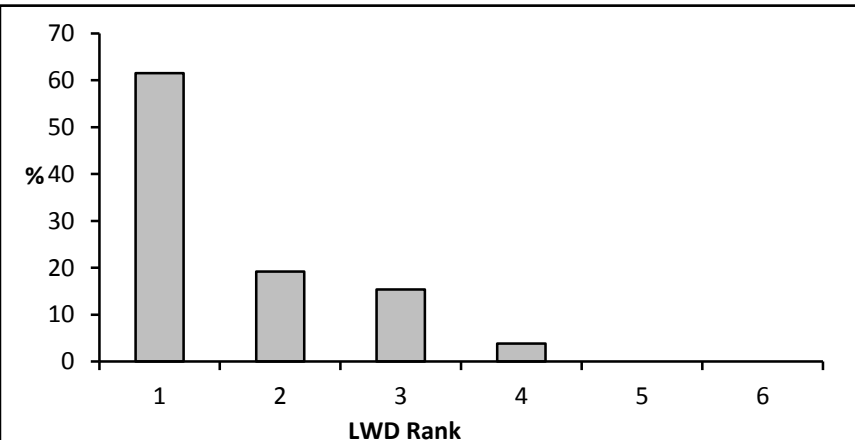
Class	Range (mm)	Percent
Silt	< 0.06	0
Sand	0.06 - 2	17
F. Gravel	2 - 16	22
C. Gravel	16 - 64	59
Cobble	64 - 256	2
Boulder	256 - 4096	0
Bedrock	> 4096	0

Median Substrate Size:	20	mm
Avg. Largest Particle (Bar):	40	mm
Riffle Stability Index (RSI):	71	%

**Large Woody Debris (LWD)**

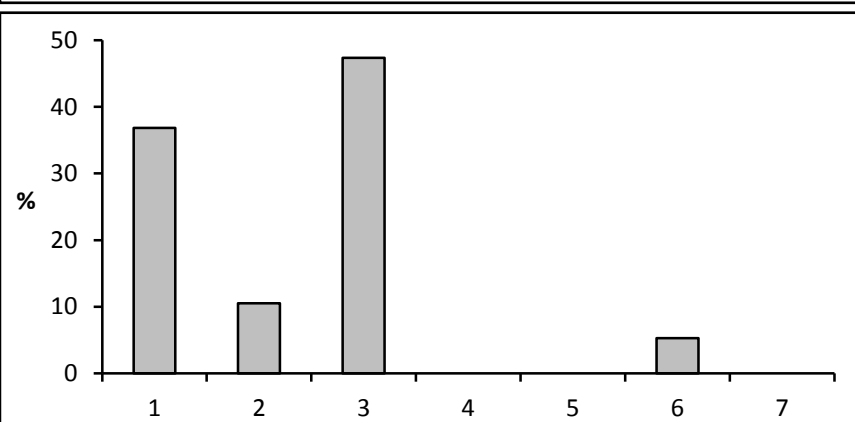
Rank	Diameter (ft)	L (W_{bkt})	#
1	0.5 ≤ D < 1.0	< 0.5	16
2	0.5 ≤ D < 1.0	≥ 0.5	5
3	1.0 ≤ D < 2.0	< 0.5	4
4	1.0 ≤ D < 2.0	≥ 0.5	1
5	D ≥ 2.0	< 0.5	0
6	D ≥ 2.0	≥ 0.5	0

LWDs/mile: 38

**Pools**

Rank	Depth (ft)	L (W_{bkt})	#
1	1.0 ≤ D < 2.0	< 0.5	7
2	1.0 ≤ D < 2.0	≥ 0.5	2
3	2.0 ≤ D < 3.0	< 0.5	9
4	2.0 ≤ D < 3.0	≥ 0.5	0
5	D ≥ 3.0	< 0.5	0
6	D ≥ 3.0	≥ 0.5	1
7	D ≥ 3.0	≥ 1.0	0

Pools/mile: 27



Rapid Habitat Assessment and Substrate Summary

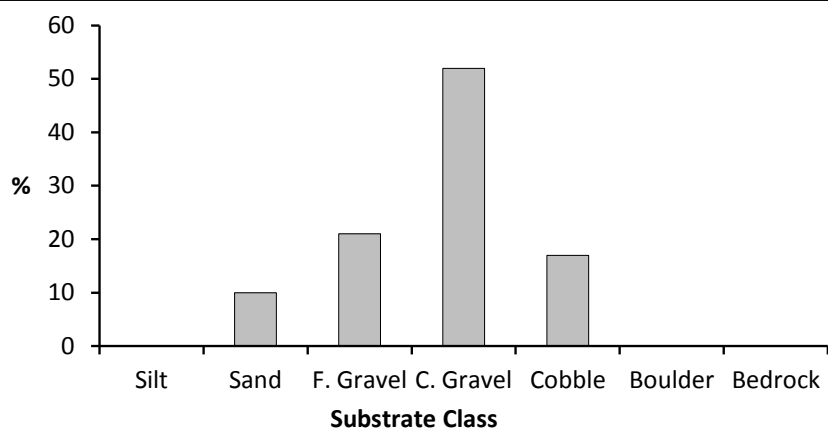
Fitzgerald Environmental Associates, LLC.

Mill Brook Phase 2

Reading Brook

Reach/Segment Information

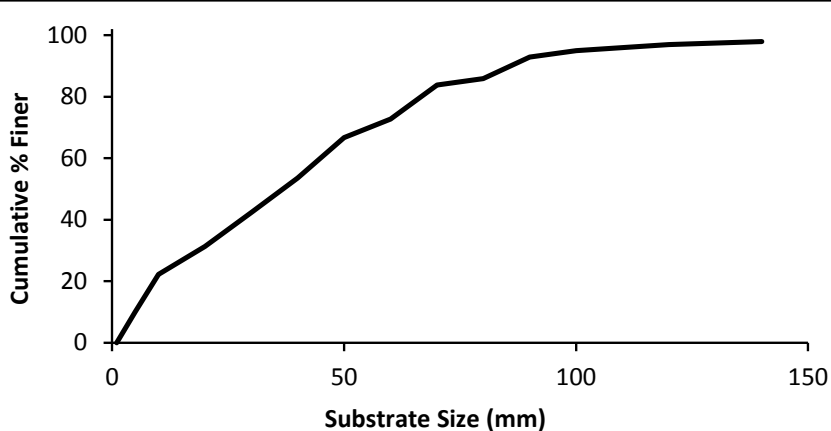
SGA ID:	T3.03
Length (ft):	3,090
Reference Bedform Type:	Riffle-Pool
Total RHA Score:	98
RHA Percentage:	61%
Overall Habitat Condition:	Fair



Sediment Composition and Mobility

Class	Range (mm)	Percent
Silt	< 0.06	0
Sand	0.06 - 2	10
F. Gravel	2 - 16	21
C. Gravel	16 - 64	52
Cobble	64 - 256	17
Boulder	256 - 4096	0
Bedrock	> 4096	0

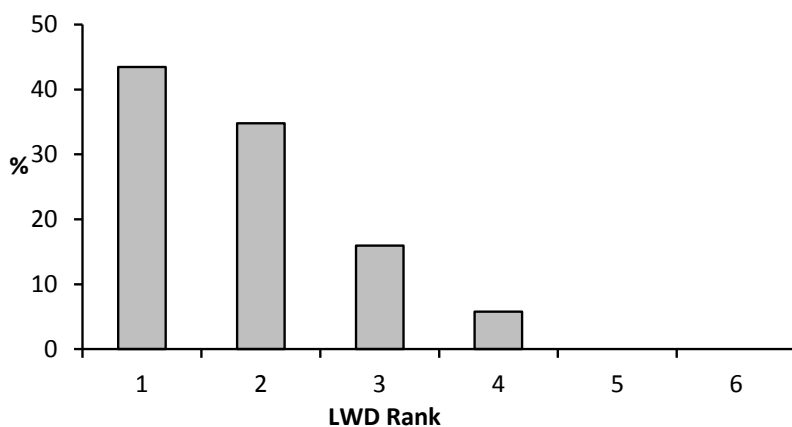
Median Substrate Size:	30	mm
Avg. Largest Particle (Bar):	50	mm
Riffle Stability Index (RSI):	67	%



Large Woody Debris (LWD)

Rank	Diameter (ft)	L (W_{bkt})	#
1	$0.5 \leq D < 1.0$	< 0.5	30
2	$0.5 \leq D < 1.0$	≥ 0.5	24
3	$1.0 \leq D < 2.0$	< 0.5	11
4	$1.0 \leq D < 2.0$	≥ 0.5	4
5	$D \geq 2.0$	< 0.5	0
6	$D \geq 2.0$	≥ 0.5	0

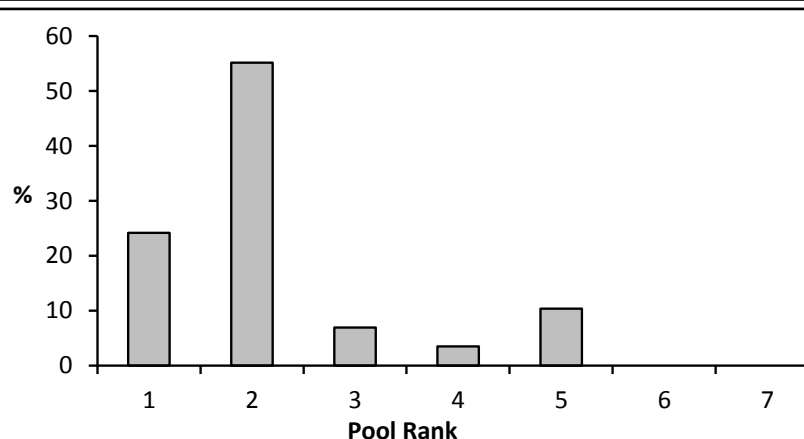
LWDs/mile: 118



Pools

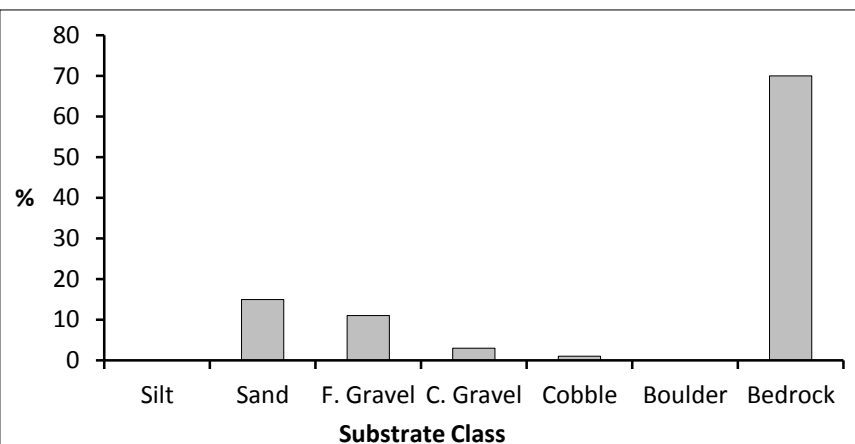
Rank	Depth (ft)	L (W_{bkt})	#
1	$1.0 \leq D < 2.0$	< 0.5	7
2	$1.0 \leq D < 2.0$	≥ 0.5	16
3	$2.0 \leq D < 3.0$	< 0.5	2
4	$2.0 \leq D < 3.0$	≥ 0.5	1
5	$D \geq 3.0$	< 0.5	3
6	$D \geq 3.0$	≥ 0.5	0
7	$D \geq 3.0$	≥ 1.0	0

Pools/mile: 50



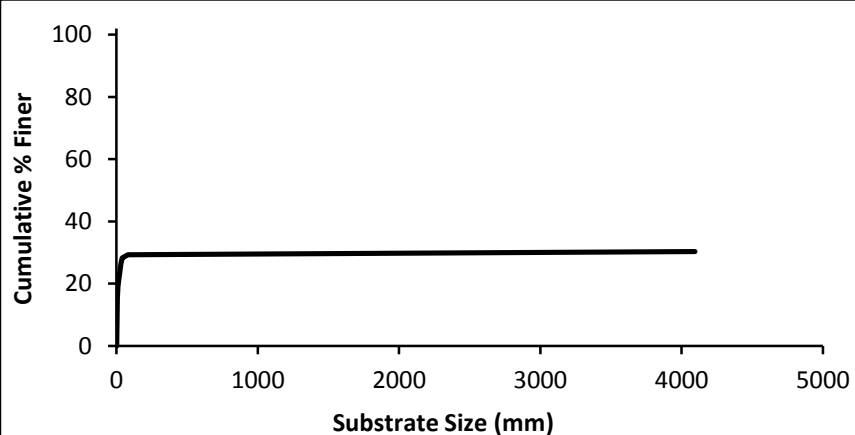
Reach/Segment Information

SGA ID:	T3.04
Length (ft):	2,901
Reference Bedform Type:	Step-Pool
Total RHA Score:	79
RHA Percentage:	49%
Overall Habitat Condition:	Fair

**Sediment Composition and Mobility**

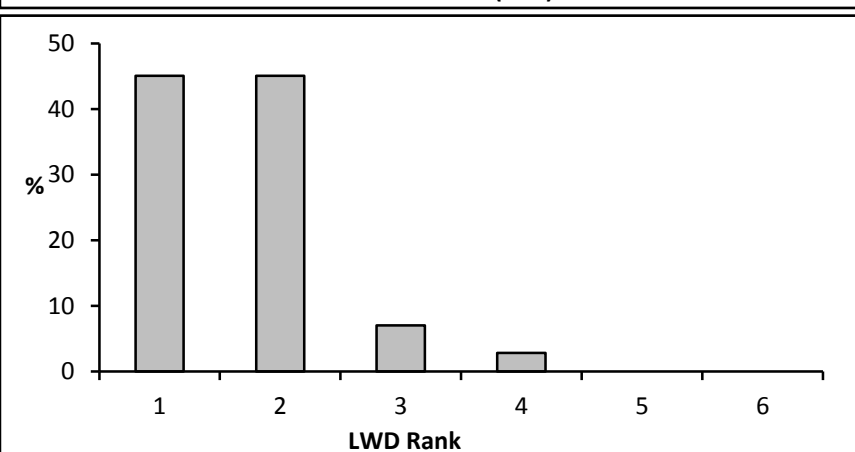
Class	Range (mm)	Percent
Silt	< 0.06	0
Sand	0.06 - 2	15
F. Gravel	2 - 16	11
C. Gravel	16 - 64	3
Cobble	64 - 256	1
Boulder	256 - 4096	0
Bedrock	> 4096	70

Median Substrate Size: 4096 mm
Avg. Largest Particle (Bar): 1 mm
Riffle Stability Index (RSI): 0 %

**Large Woody Debris (LWD)**

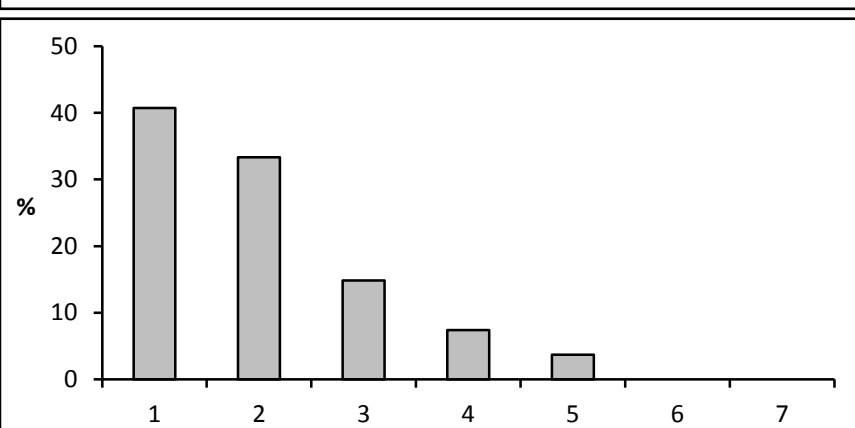
Rank	Diameter (ft)	L (W_{bkt})	#
1	0.5 ≤ D < 1.0	< 0.5	32
2	0.5 ≤ D < 1.0	≥ 0.5	32
3	1.0 ≤ D < 2.0	< 0.5	5
4	1.0 ≤ D < 2.0	≥ 0.5	2
5	D ≥ 2.0	< 0.5	0
6	D ≥ 2.0	≥ 0.5	0

LWDs/mile: 129

**Pools**

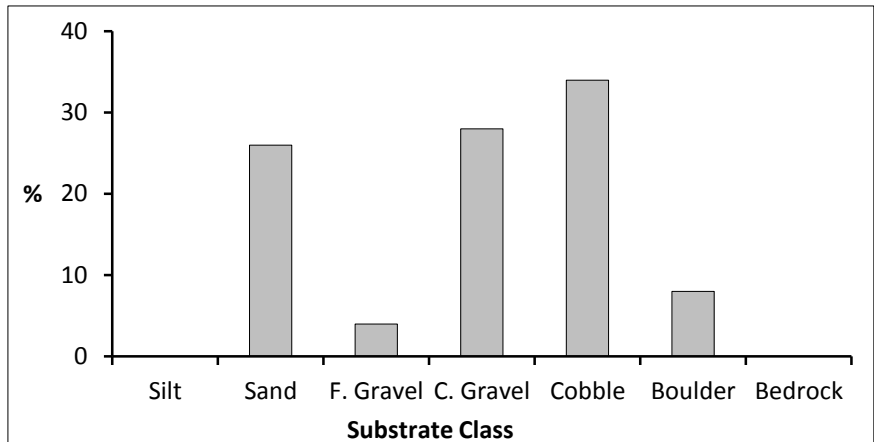
Rank	Depth (ft)	L (W_{bkt})	#
1	1.0 ≤ D < 2.0	< 0.5	11
2	1.0 ≤ D < 2.0	≥ 0.5	9
3	2.0 ≤ D < 3.0	< 0.5	4
4	2.0 ≤ D < 3.0	≥ 0.5	2
5	D ≥ 3.0	< 0.5	1
6	D ≥ 3.0	≥ 0.5	0
7	D ≥ 3.0	≥ 1.0	0

Pools/mile: 49



Reach/Segment Information

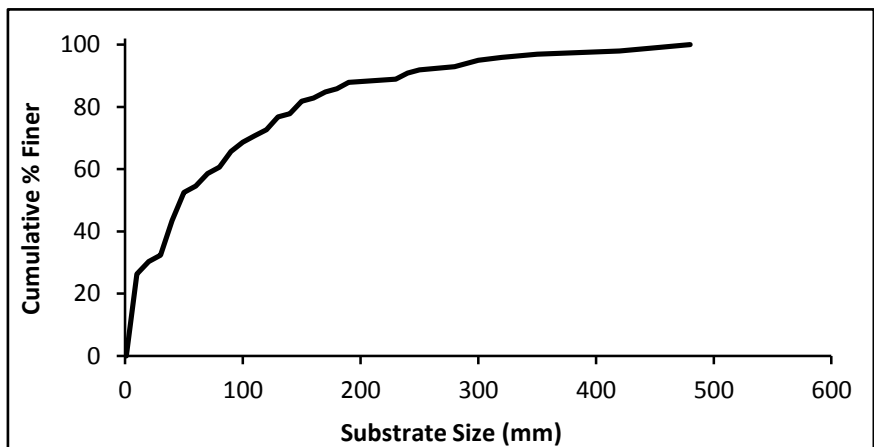
SGA ID:	T4.01.A
Length (ft):	2,130
Reference Bedform Type:	Riffle-Pool
Total RHA Score:	64
RHA Percentage:	40%
Overall Habitat Condition:	Fair



Sediment Composition and Mobility

Class	Range (mm)	Percent
Silt	< 0.06	0
Sand	0.06 - 2	26
F. Gravel	2 - 16	4
C. Gravel	16 - 64	28
Cobble	64 - 256	34
Boulder	256 - 4096	8
Bedrock	> 4096	0

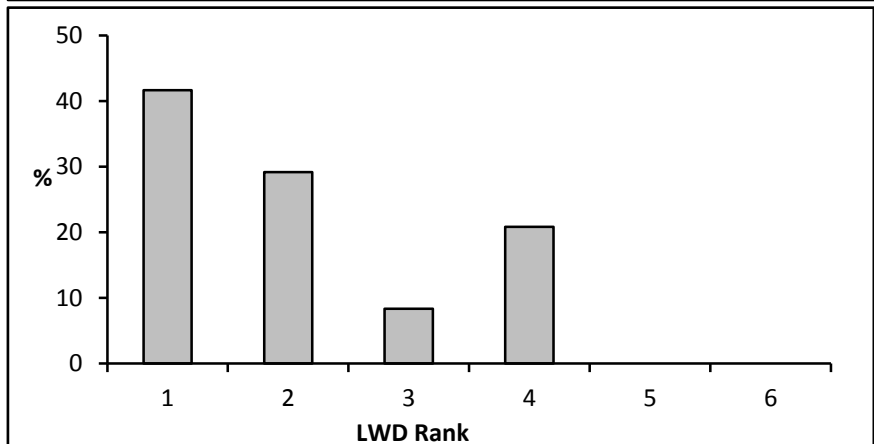
Median Substrate Size:	40	mm
Avg. Largest Particle (Bar):	110	mm
Riffle Stability Index (RSI):	71	%



Large Woody Debris (LWD)

Rank	Diameter (ft)	L (W_{bkt})	#
1	$0.5 \leq D < 1.0$	< 0.5	10
2	$0.5 \leq D < 1.0$	≥ 0.5	7
3	$1.0 \leq D < 2.0$	< 0.5	2
4	$1.0 \leq D < 2.0$	≥ 0.5	5
5	$D \geq 2.0$	< 0.5	0
6	$D \geq 2.0$	≥ 0.5	0

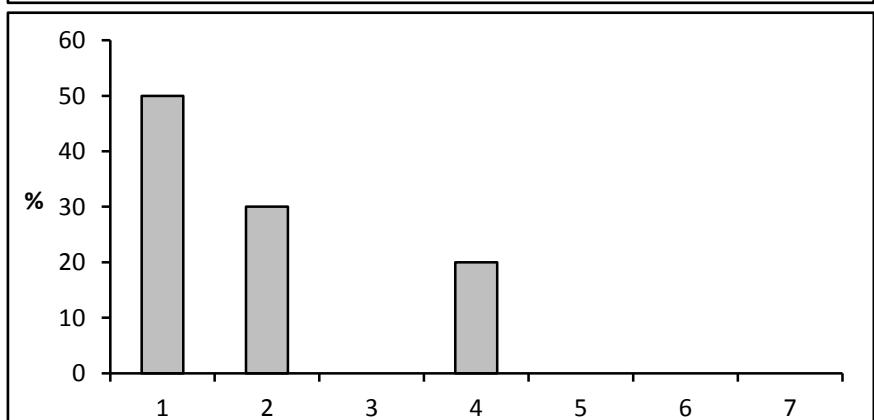
LWDs/mile: 59



Pools

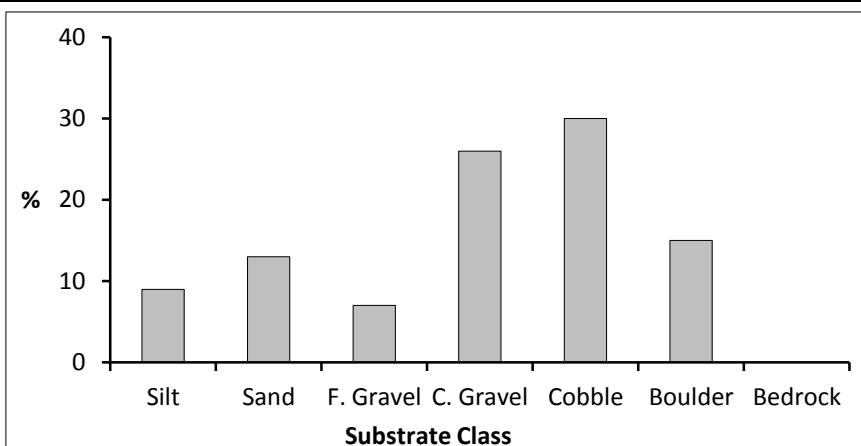
Rank	Depth (ft)	L (W_{bkt})	#
1	$1.0 \leq D < 2.0$	< 0.5	5
2	$1.0 \leq D < 2.0$	≥ 0.5	3
3	$2.0 \leq D < 3.0$	< 0.5	0
4	$2.0 \leq D < 3.0$	≥ 0.5	2
5	$D \geq 3.0$	< 0.5	0
6	$D \geq 3.0$	≥ 0.5	0
7	$D \geq 3.0$	≥ 1.0	0

Pools/mile: 25



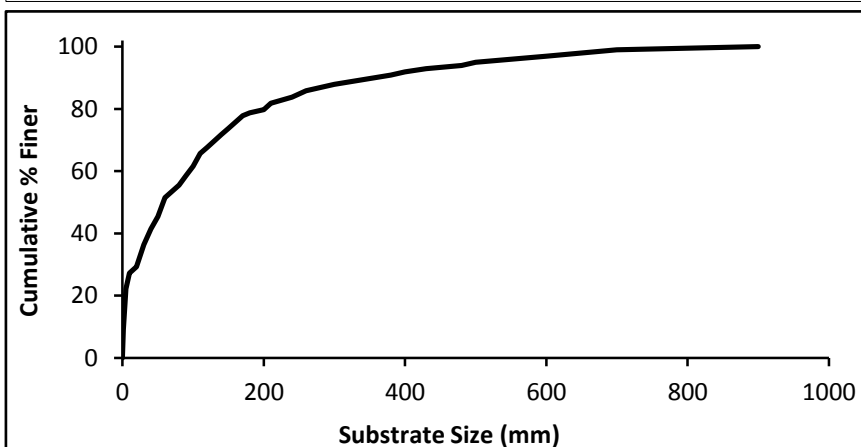
Reach/Segment Information

SGA ID:	T4.01.B
Length (ft):	2,040
Reference Bedform Type:	Riffle-Pool
Total RHA Score:	76
RHA Percentage:	48%
Overall Habitat Condition:	Fair

**Sediment Composition and Mobility**

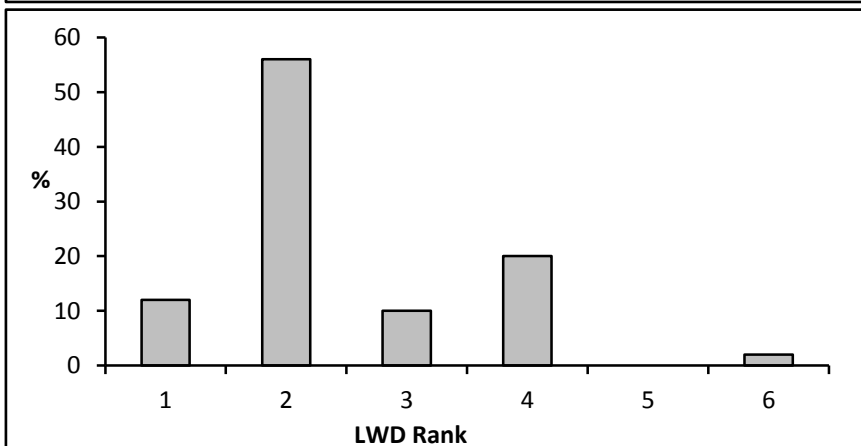
Class	Range (mm)	Percent
Silt	< 0.06	9
Sand	0.06 - 2	13
F. Gravel	2 - 16	7
C. Gravel	16 - 64	26
Cobble	64 - 256	30
Boulder	256 - 4096	15
Bedrock	> 4096	0

Median Substrate Size:	50	mm
Avg. Largest Particle (Bar):	240	mm
Riffle Stability Index (RSI):	84	%

**Large Woody Debris (LWD)**

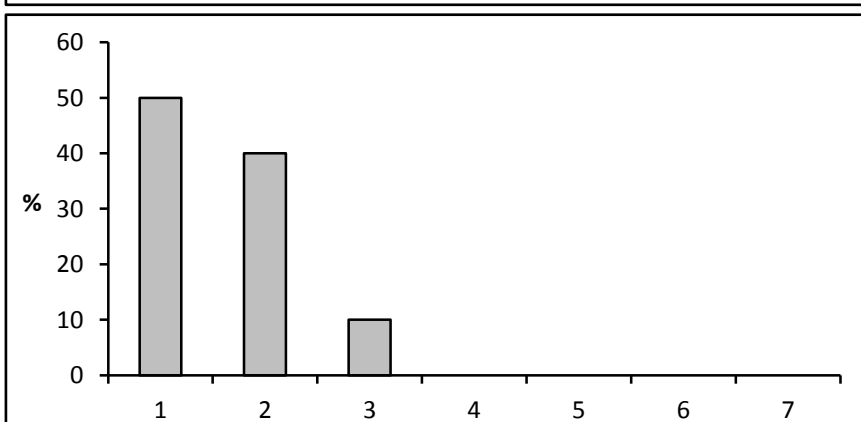
Rank	Diameter (ft)	L (W_{bkt})	#
1	$0.5 \leq D < 1.0$	< 0.5	6
2	$0.5 \leq D < 1.0$	≥ 0.5	28
3	$1.0 \leq D < 2.0$	< 0.5	5
4	$1.0 \leq D < 2.0$	≥ 0.5	10
5	$D \geq 2.0$	< 0.5	0
6	$D \geq 2.0$	≥ 0.5	1

LWDs/mile: 129

**Pools**

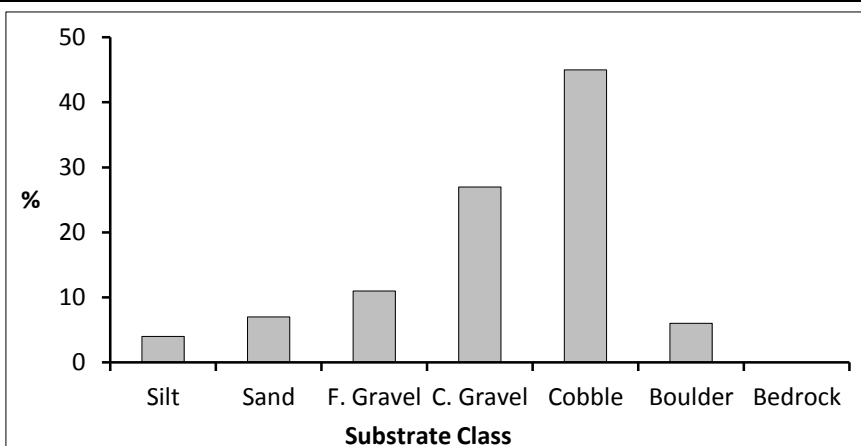
Rank	Depth (ft)	L (W_{bkt})	#
1	$1.0 \leq D < 2.0$	< 0.5	5
2	$1.0 \leq D < 2.0$	≥ 0.5	4
3	$2.0 \leq D < 3.0$	< 0.5	1
4	$2.0 \leq D < 3.0$	≥ 0.5	0
5	$D \geq 3.0$	< 0.5	0
6	$D \geq 3.0$	≥ 0.5	0
7	$D \geq 3.0$	≥ 1.0	0

Pools/mile: 26



Reach/Segment Information

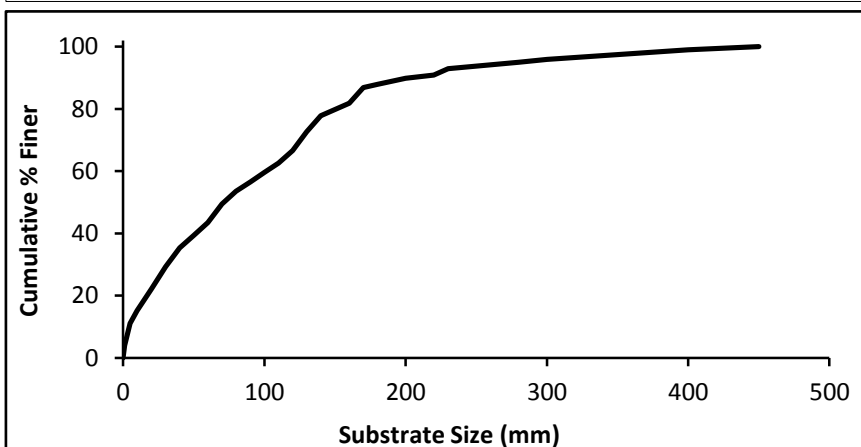
SGA ID:	T4.01.C
Length (ft):	3,743
Reference Bedform Type:	Riffle-Pool
Total RHA Score:	80
RHA Percentage:	50%
Overall Habitat Condition:	Fair



Sediment Composition and Mobility

Class	Range (mm)	Percent
Silt	< 0.06	4
Sand	0.06 - 2	7
F. Gravel	2 - 16	11
C. Gravel	16 - 64	27
Cobble	64 - 256	45
Boulder	256 - 4096	6
Bedrock	> 4096	0

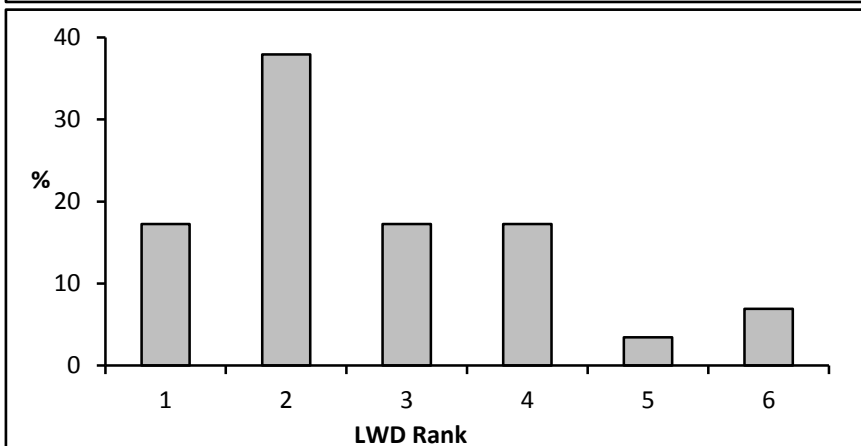
Median Substrate Size:	70	mm
Avg. Largest Particle (Bar):	240	mm
Riffle Stability Index (RSI):	94	%



Large Woody Debris (LWD)

Rank	Diameter (ft)	L (W_{bkt})	#
1	0.5 ≤ D < 1.0	< 0.5	26
2	0.5 ≤ D < 1.0	≥ 0.5	86
3	1.0 ≤ D < 2.0	< 0.5	13
4	1.0 ≤ D < 2.0	≥ 0.5	45
5	D ≥ 2.0	< 0.5	8
6	D ≥ 2.0	≥ 0.5	6

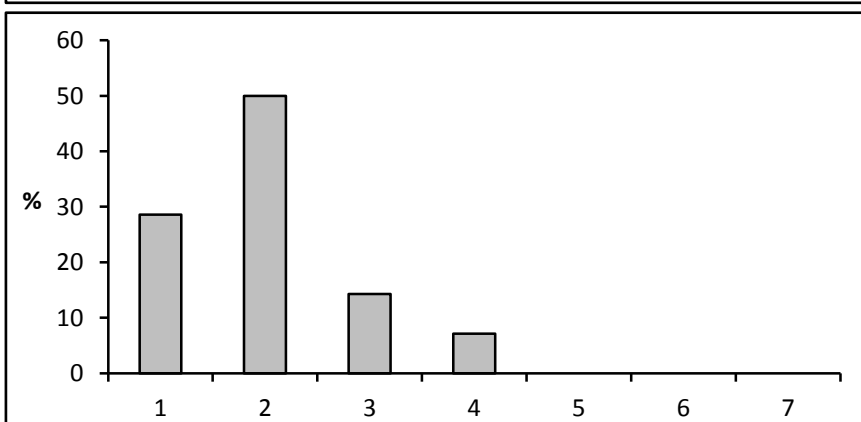
LWDs/mile: 260



Pools

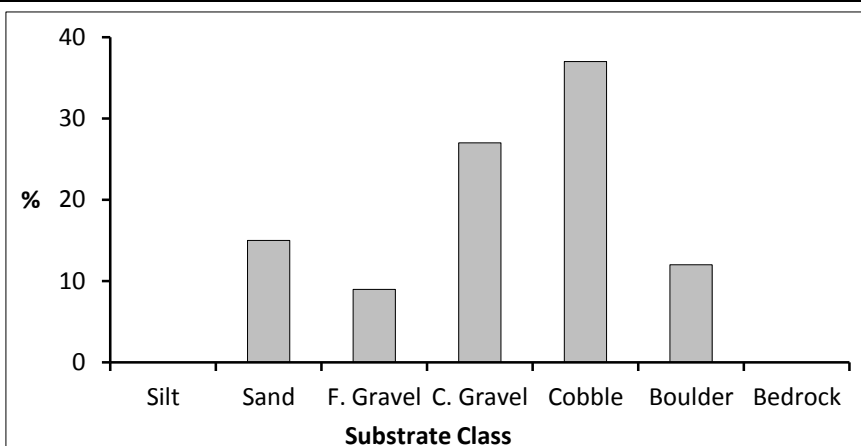
Rank	Depth (ft)	L (W_{bkt})	#
1	1.0 ≤ D < 2.0	< 0.5	16
2	1.0 ≤ D < 2.0	≥ 0.5	11
3	2.0 ≤ D < 3.0	< 0.5	2
4	2.0 ≤ D < 3.0	≥ 0.5	0
5	D ≥ 3.0	< 0.5	0
6	D ≥ 3.0	≥ 0.5	0
7	D ≥ 3.0	≥ 1.0	0

Pools/mile: 41



Reach/Segment Information

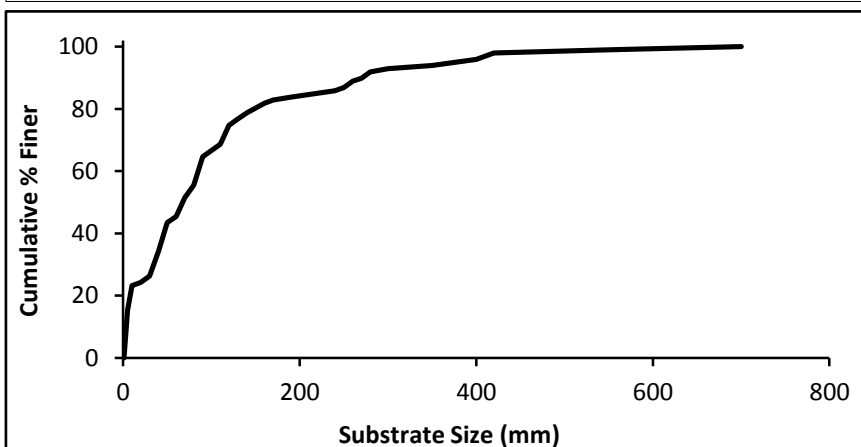
SGA ID:	T4.02.A
Length (ft):	4,101
Reference Bedform Type:	Riffle-Pool
Total RHA Score:	92
RHA Percentage:	58%
Overall Habitat Condition:	Fair



Sediment Composition and Mobility

Class	Range (mm)	Percent
Silt	< 0.06	0
Sand	0.06 - 2	15
F. Gravel	2 - 16	9
C. Gravel	16 - 64	27
Cobble	64 - 256	37
Boulder	256 - 4096	12
Bedrock	> 4096	0

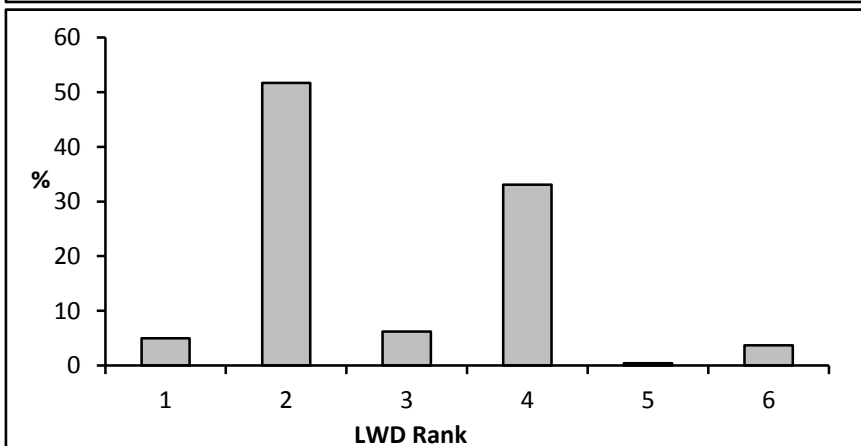
Median Substrate Size:	60	mm
Avg. Largest Particle (Bar):	150	mm
Riffle Stability Index (RSI):	80	%



Large Woody Debris (LWD)

Rank	Diameter (ft)	L (W_{bkt})	#
1	$0.5 \leq D < 1.0$	< 0.5	12
2	$0.5 \leq D < 1.0$	≥ 0.5	125
3	$1.0 \leq D < 2.0$	< 0.5	15
4	$1.0 \leq D < 2.0$	≥ 0.5	80
5	$D \geq 2.0$	< 0.5	1
6	$D \geq 2.0$	≥ 0.5	9

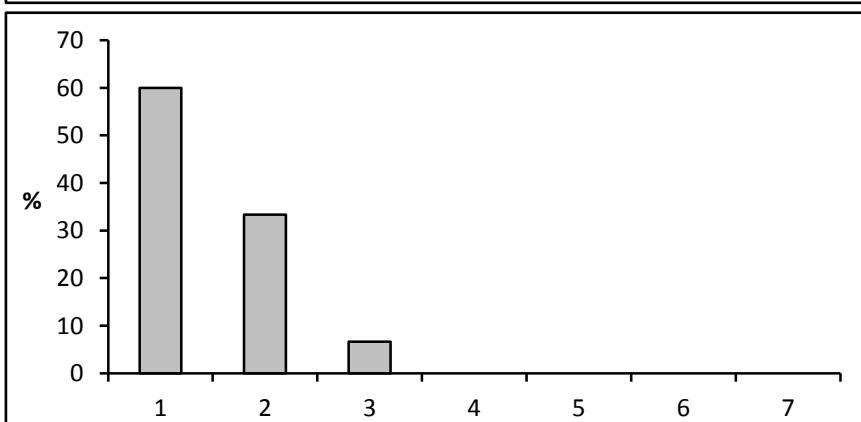
LWDs/mile: 312



Pools

Rank	Depth (ft)	L (W_{bkt})	#
1	$1.0 \leq D < 2.0$	< 0.5	9
2	$1.0 \leq D < 2.0$	≥ 0.5	5
3	$2.0 \leq D < 3.0$	< 0.5	1
4	$2.0 \leq D < 3.0$	≥ 0.5	0
5	$D \geq 3.0$	< 0.5	0
6	$D \geq 3.0$	≥ 0.5	0
7	$D \geq 3.0$	≥ 1.0	0

Pools/mile: 19



Rapid Habitat Assessment and Substrate Summary

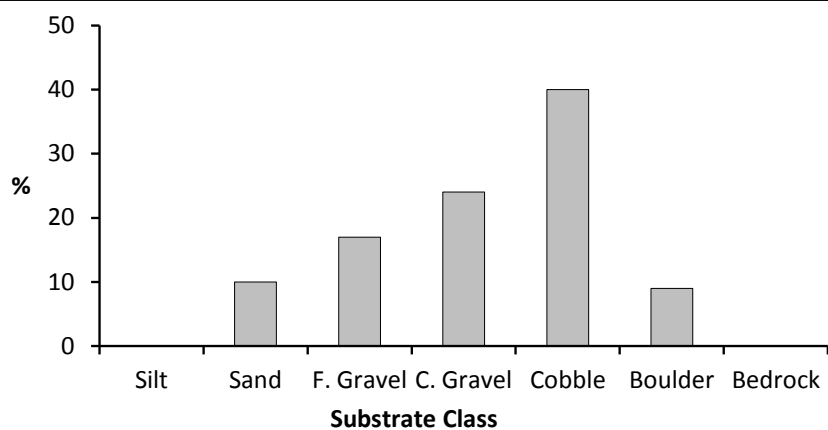
Fitzgerald Environmental Associates, LLC.

Mill Brook Phase 2

Bailey Brook

Reach/Segment Information

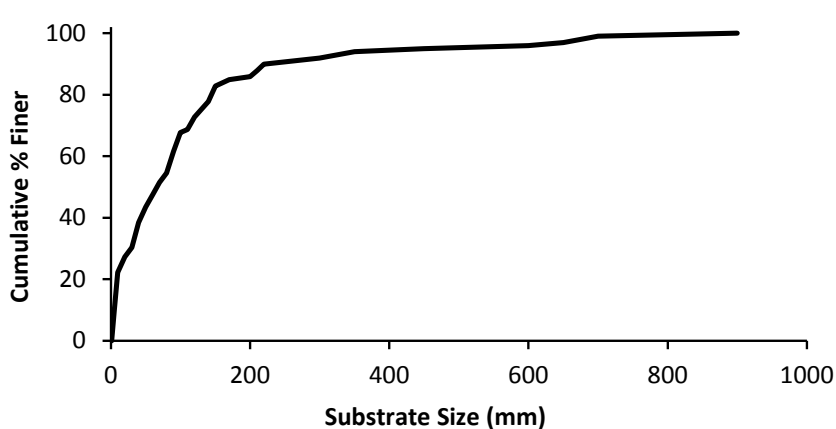
SGA ID:	T4.02.B
Length (ft):	4,680
Reference Bedform Type:	Step-Pool
Total RHA Score:	93
RHA Percentage:	58%
Overall Habitat Condition:	Fair



Sediment Composition and Mobility

Class	Range (mm)	Percent
Silt	< 0.06	0
Sand	0.06 - 2	10
F. Gravel	2 - 16	17
C. Gravel	16 - 64	24
Cobble	64 - 256	40
Boulder	256 - 4096	9
Bedrock	> 4096	0

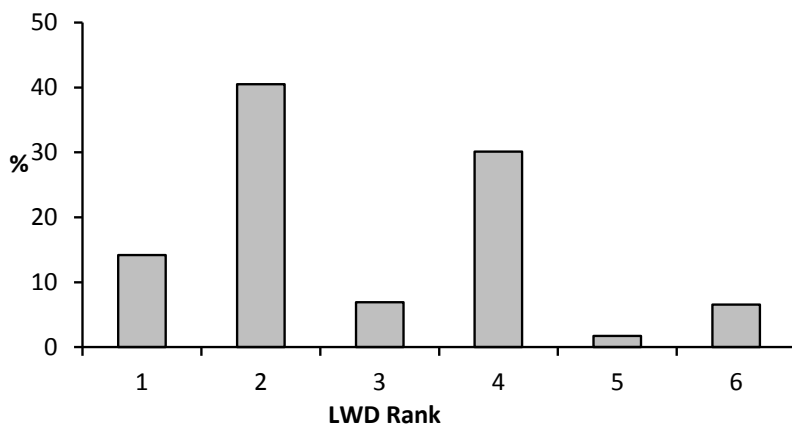
Median Substrate Size:	60	mm
Avg. Largest Particle (Bar):	130	mm
Riffle Stability Index (RSI):	76	%



Large Woody Debris (LWD)

Rank	Diameter (ft)	L (W_{bkt})	#
1	$0.5 \leq D < 1.0$	< 0.5	41
2	$0.5 \leq D < 1.0$	≥ 0.5	117
3	$1.0 \leq D < 2.0$	< 0.5	20
4	$1.0 \leq D < 2.0$	≥ 0.5	87
5	$D \geq 2.0$	< 0.5	5
6	$D \geq 2.0$	≥ 0.5	19

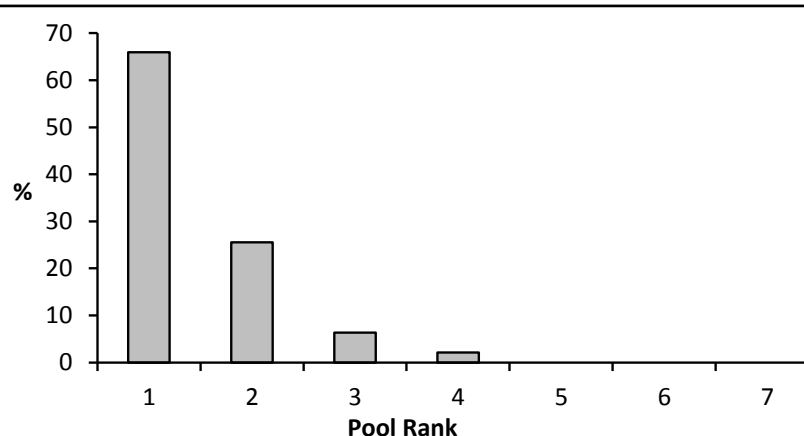
LWDs/mile: 326



Pools

Rank	Depth (ft)	L (W_{bkt})	#
1	$1.0 \leq D < 2.0$	< 0.5	31
2	$1.0 \leq D < 2.0$	≥ 0.5	12
3	$2.0 \leq D < 3.0$	< 0.5	3
4	$2.0 \leq D < 3.0$	≥ 0.5	1
5	$D \geq 3.0$	< 0.5	0
6	$D \geq 3.0$	≥ 0.5	0
7	$D \geq 3.0$	≥ 1.0	0

Pools/mile: 53

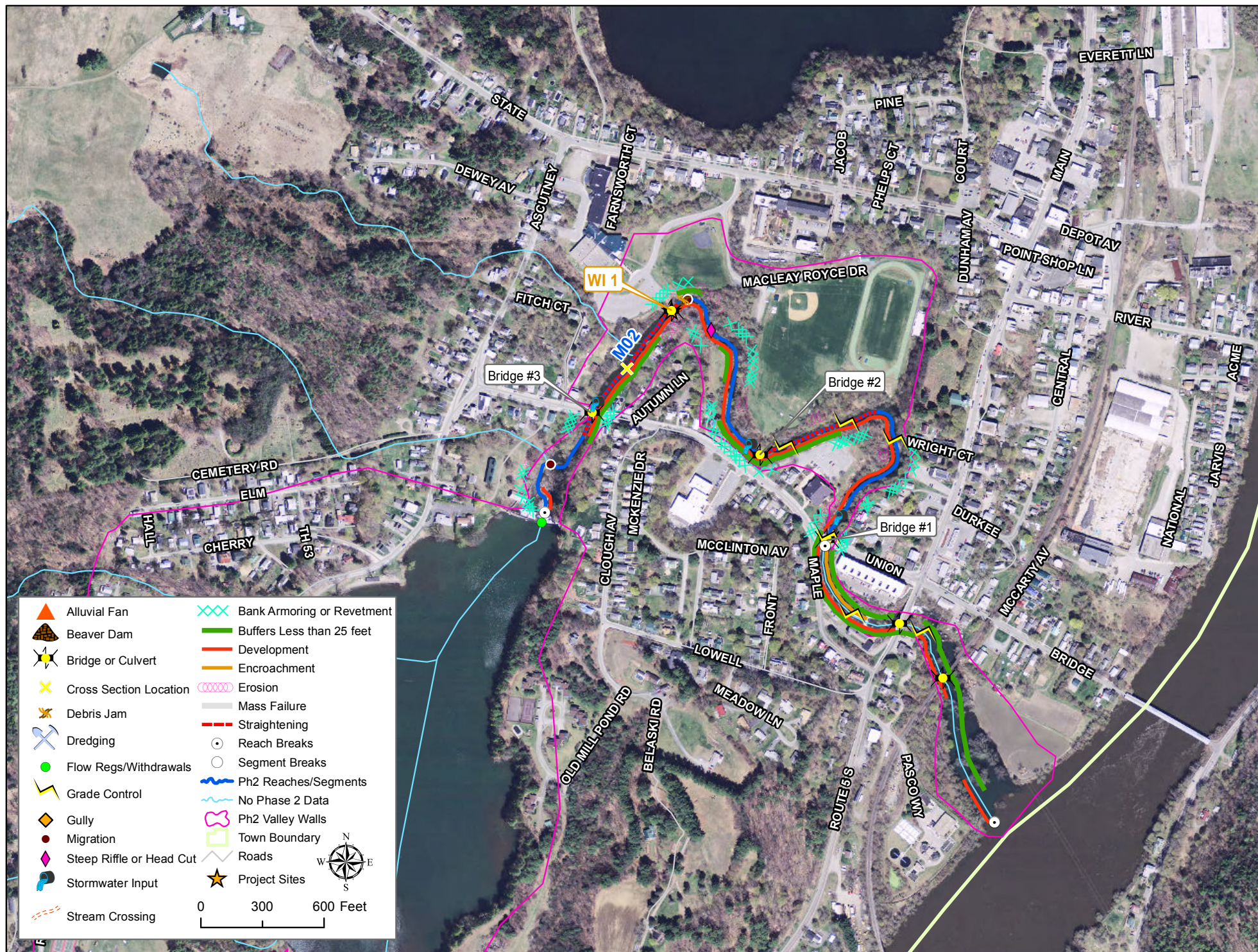


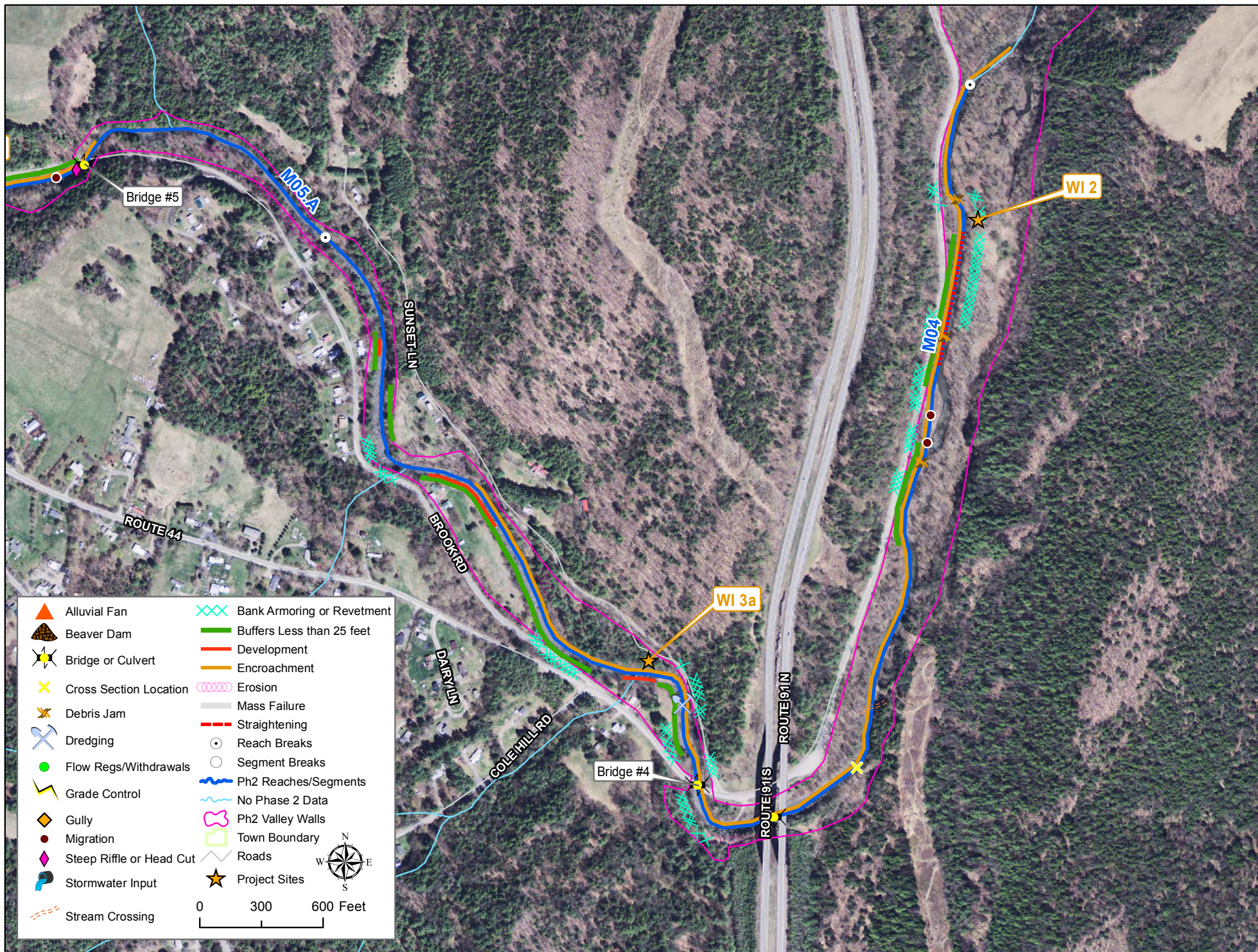
APPENDIX D:

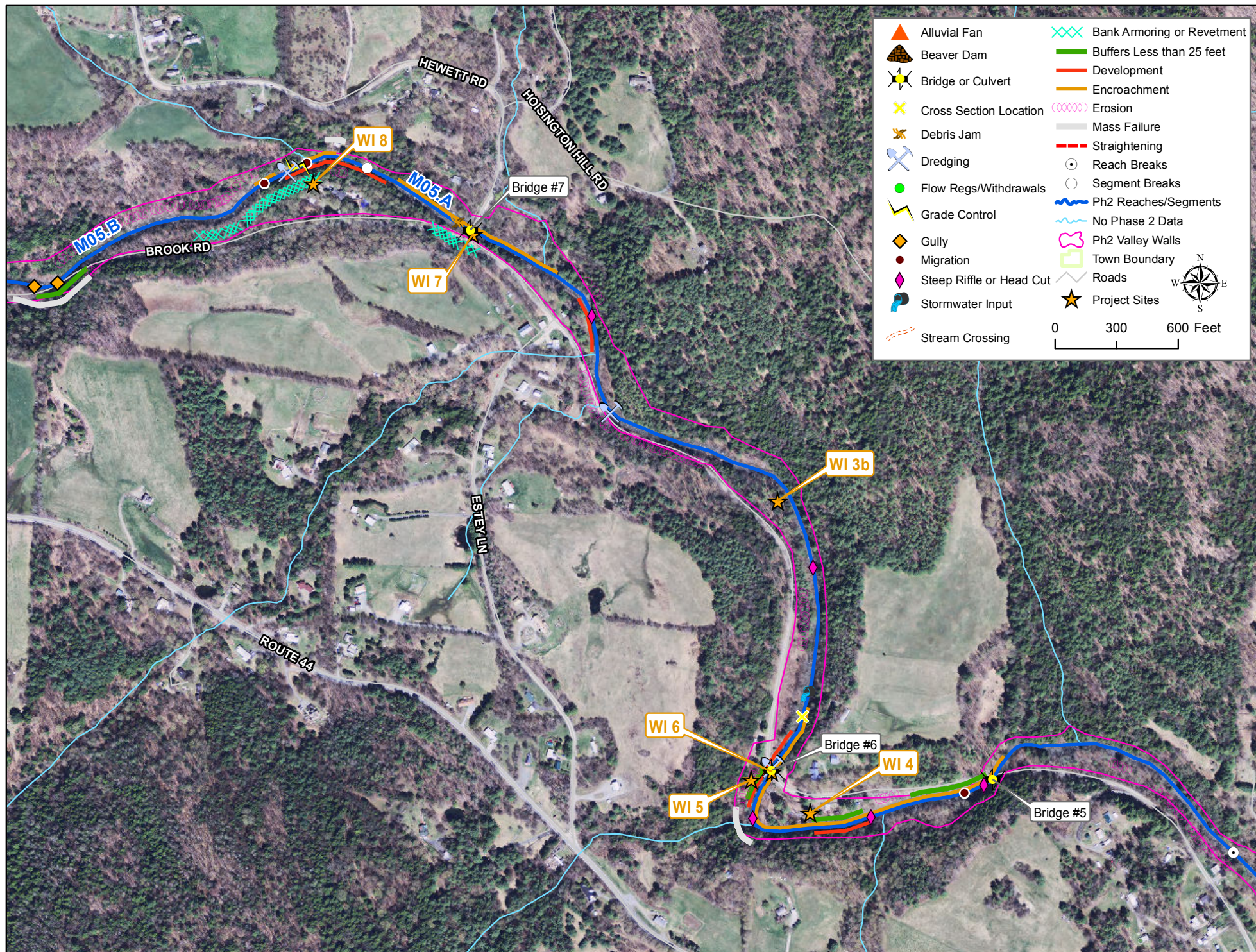
REACH STRESSOR AND PROJECT IDENTIFICATION MAPS

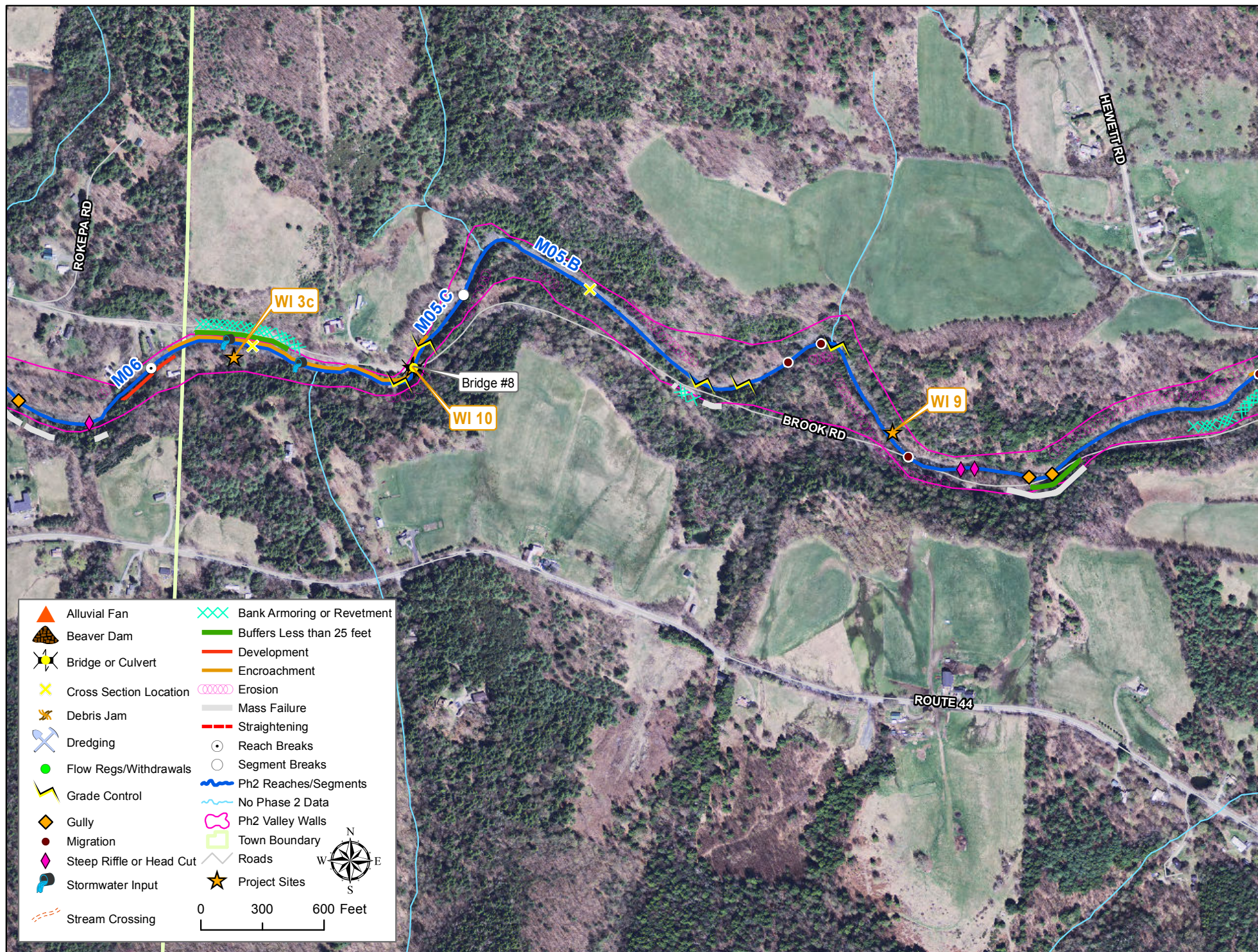
Windsor Study Reaches/Segments

Mill Brook M02 - M05.C









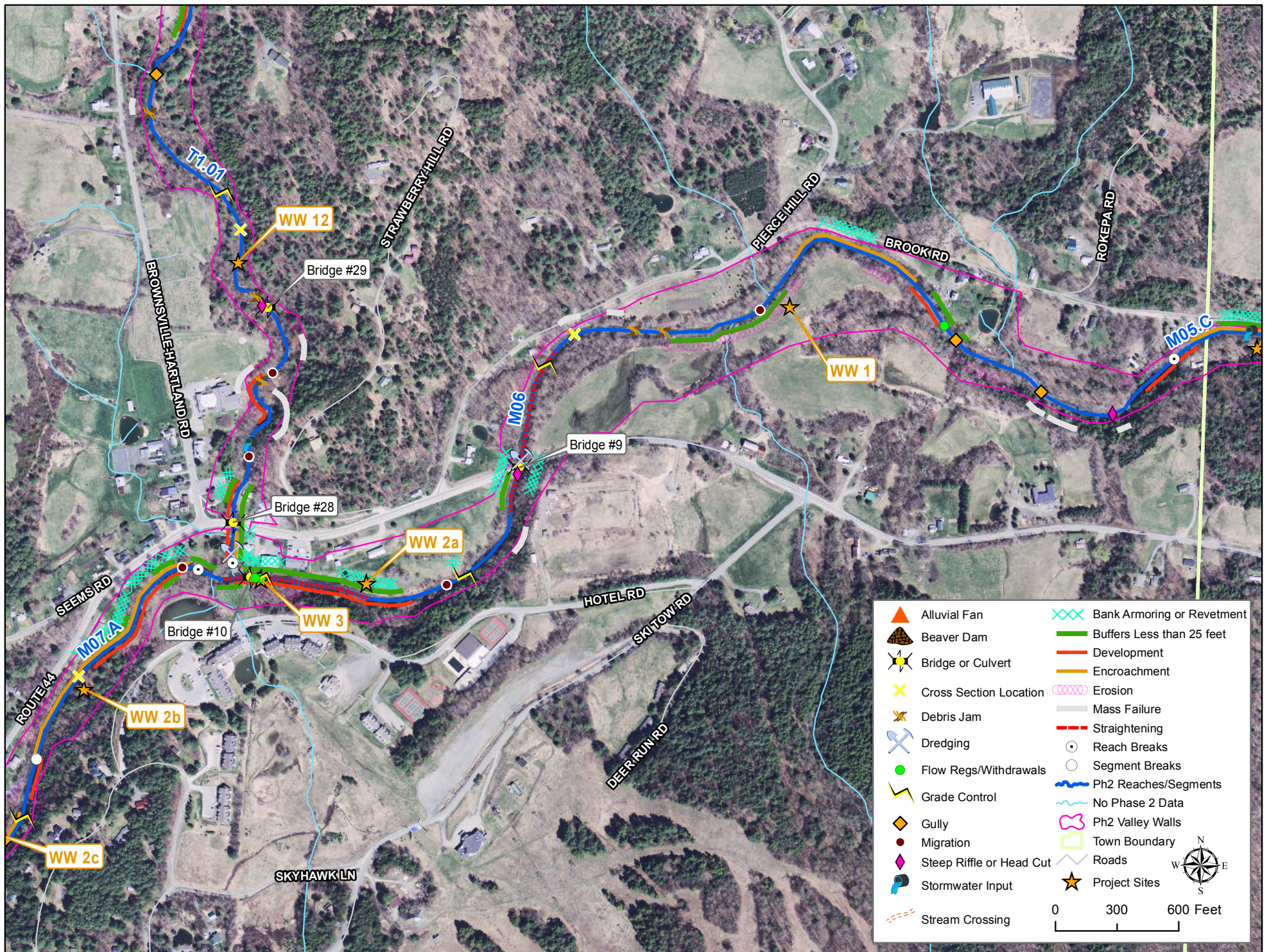
West Windsor Study Reaches/Segments

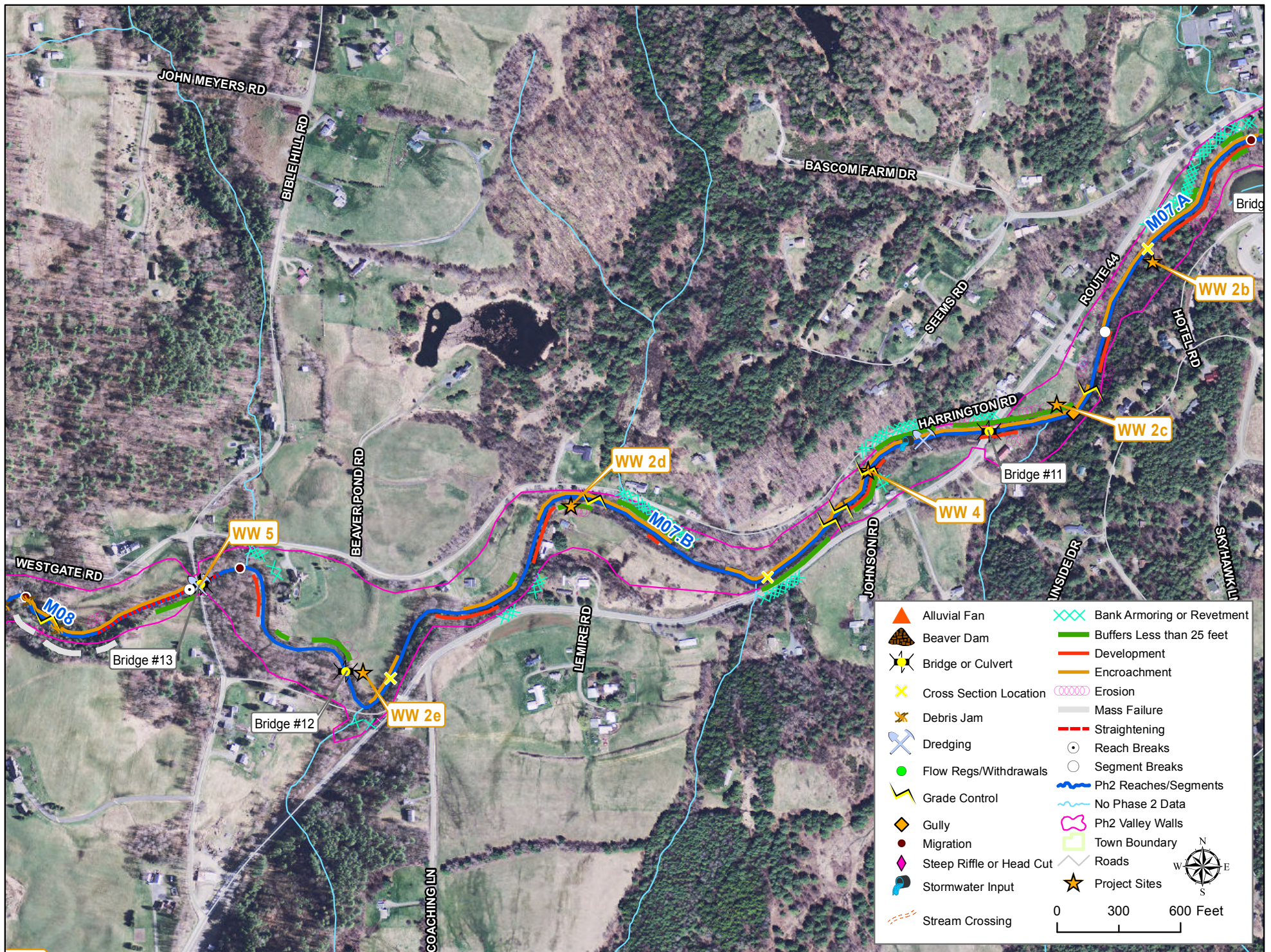
Mill Brook M06 - M12.B

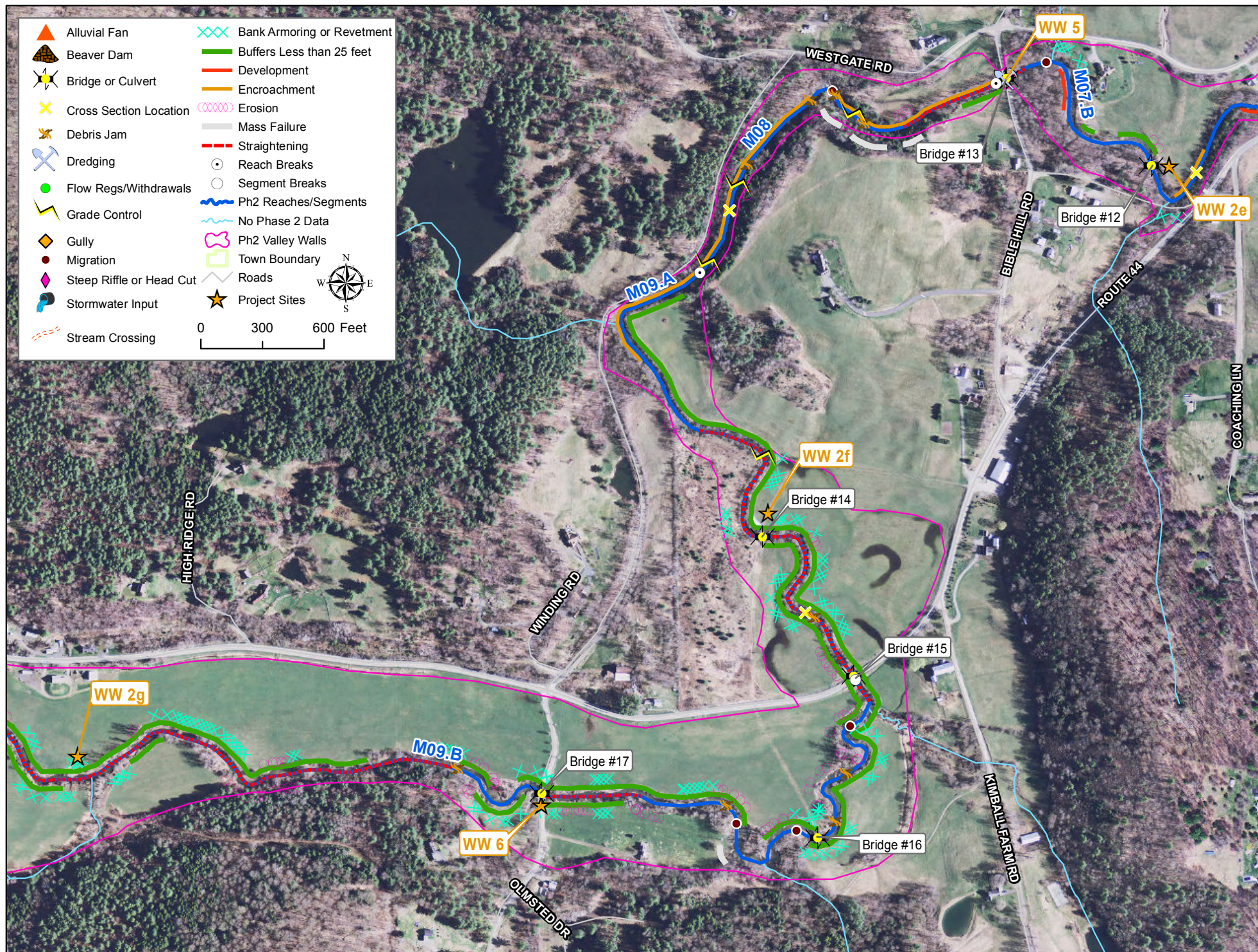
Beaver Brook

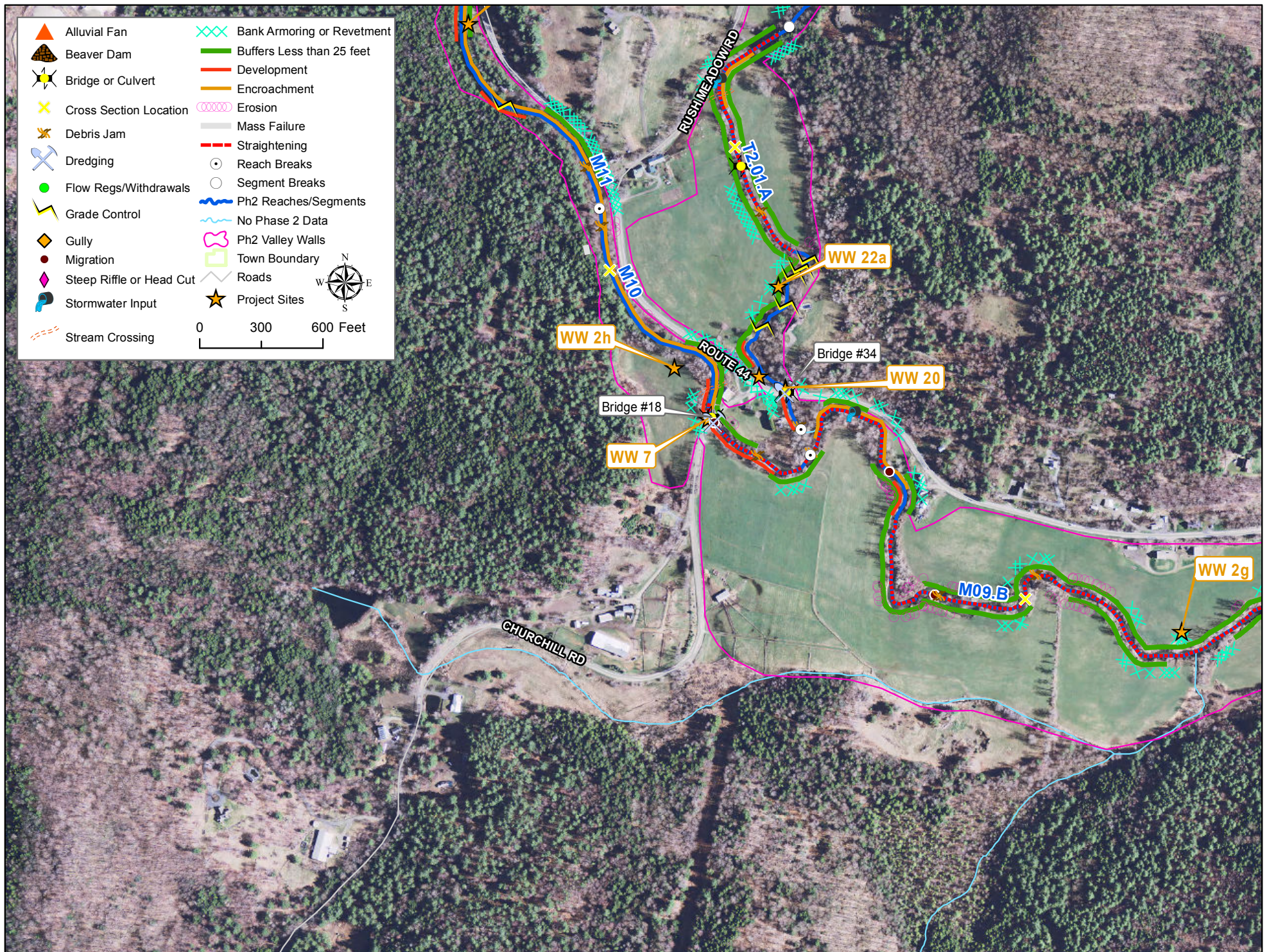
Beaver Brook Tributary

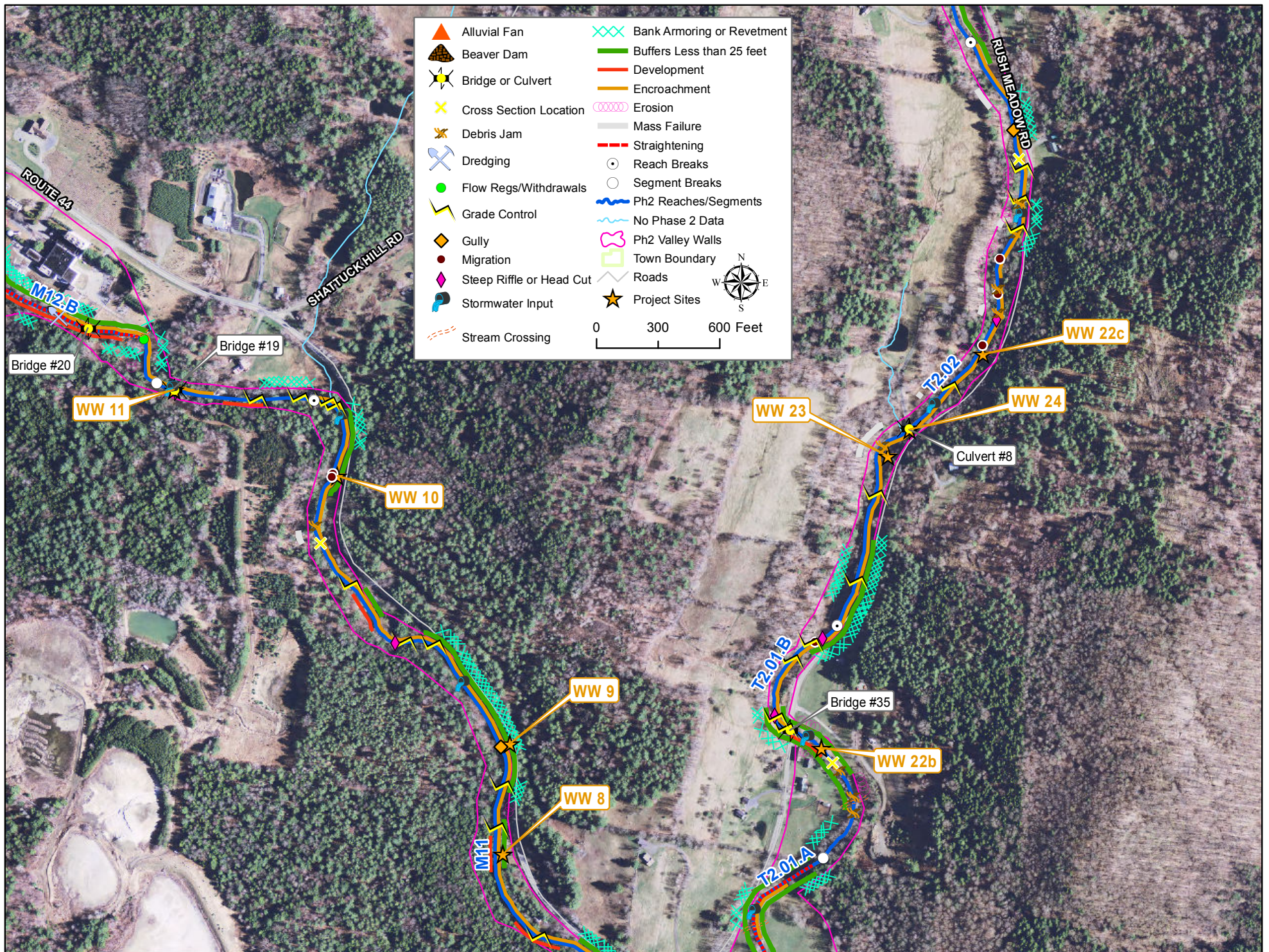
Willow Brook

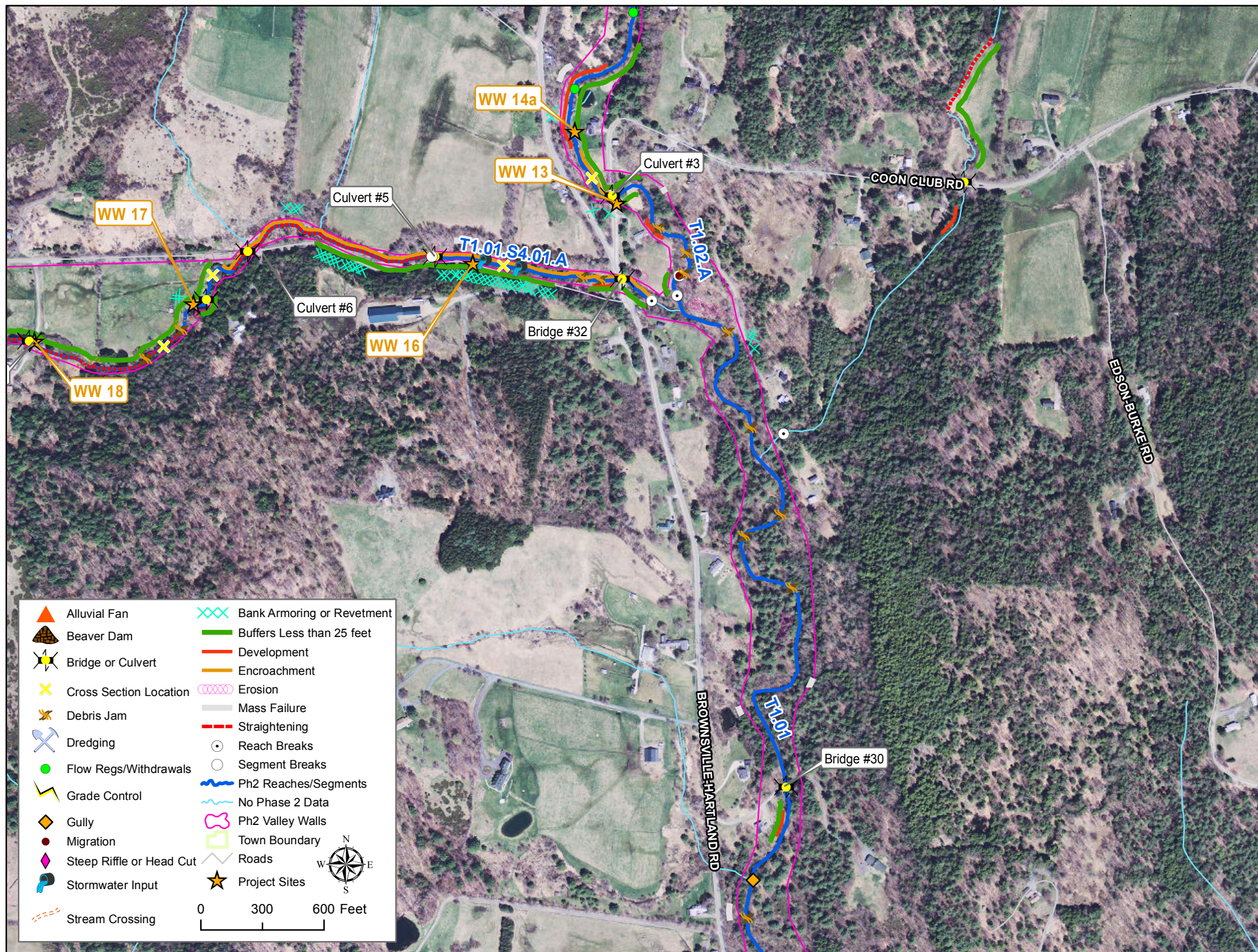


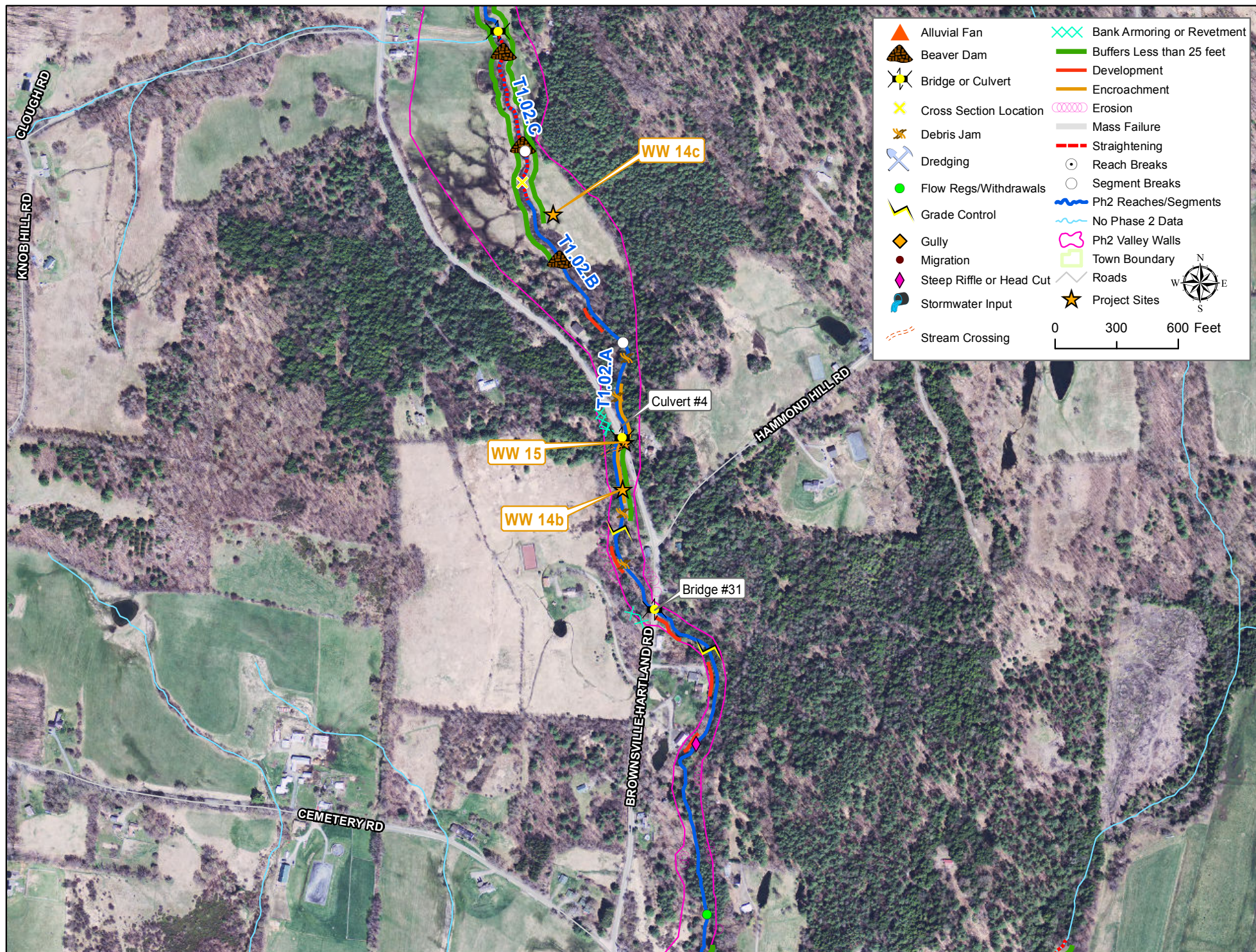


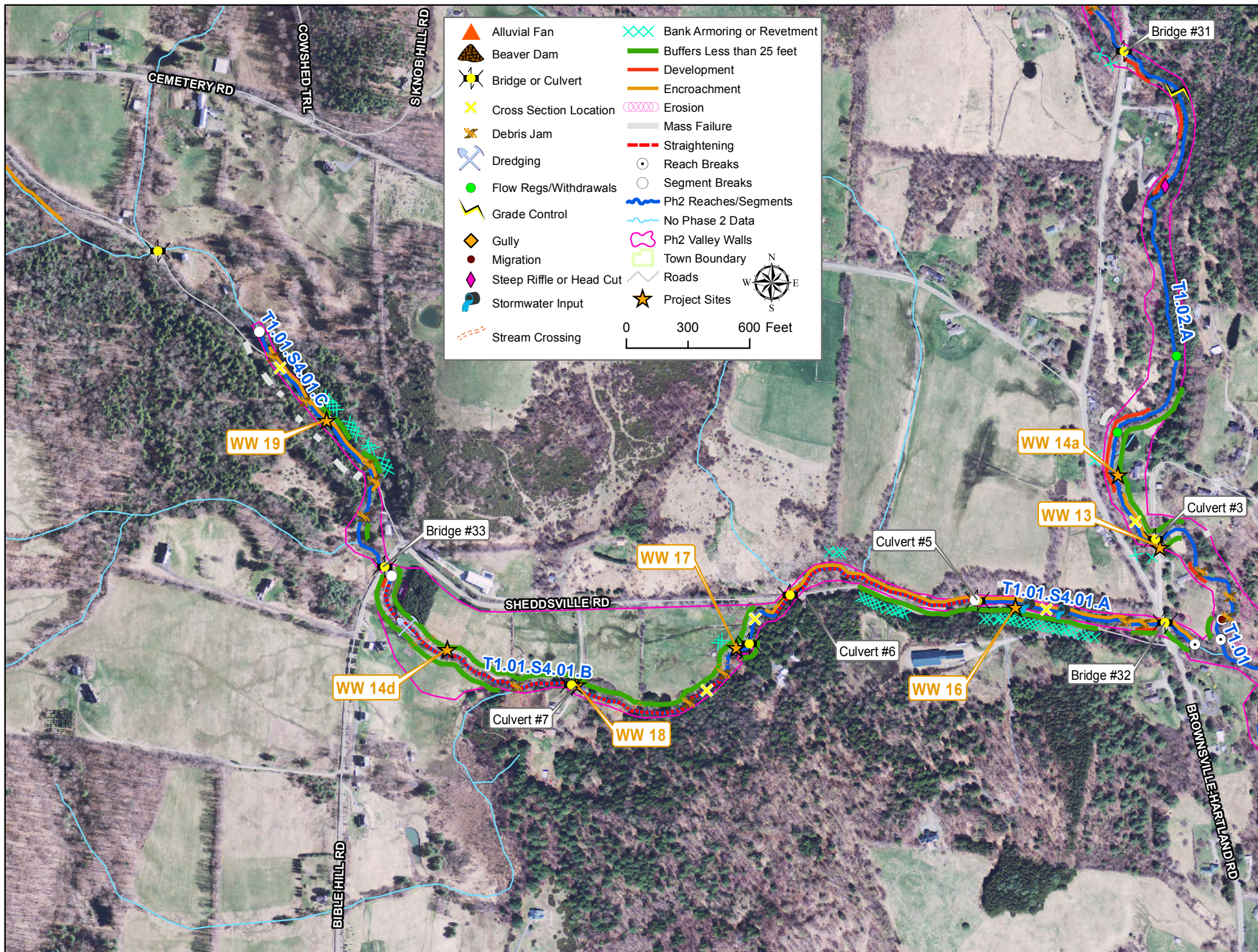


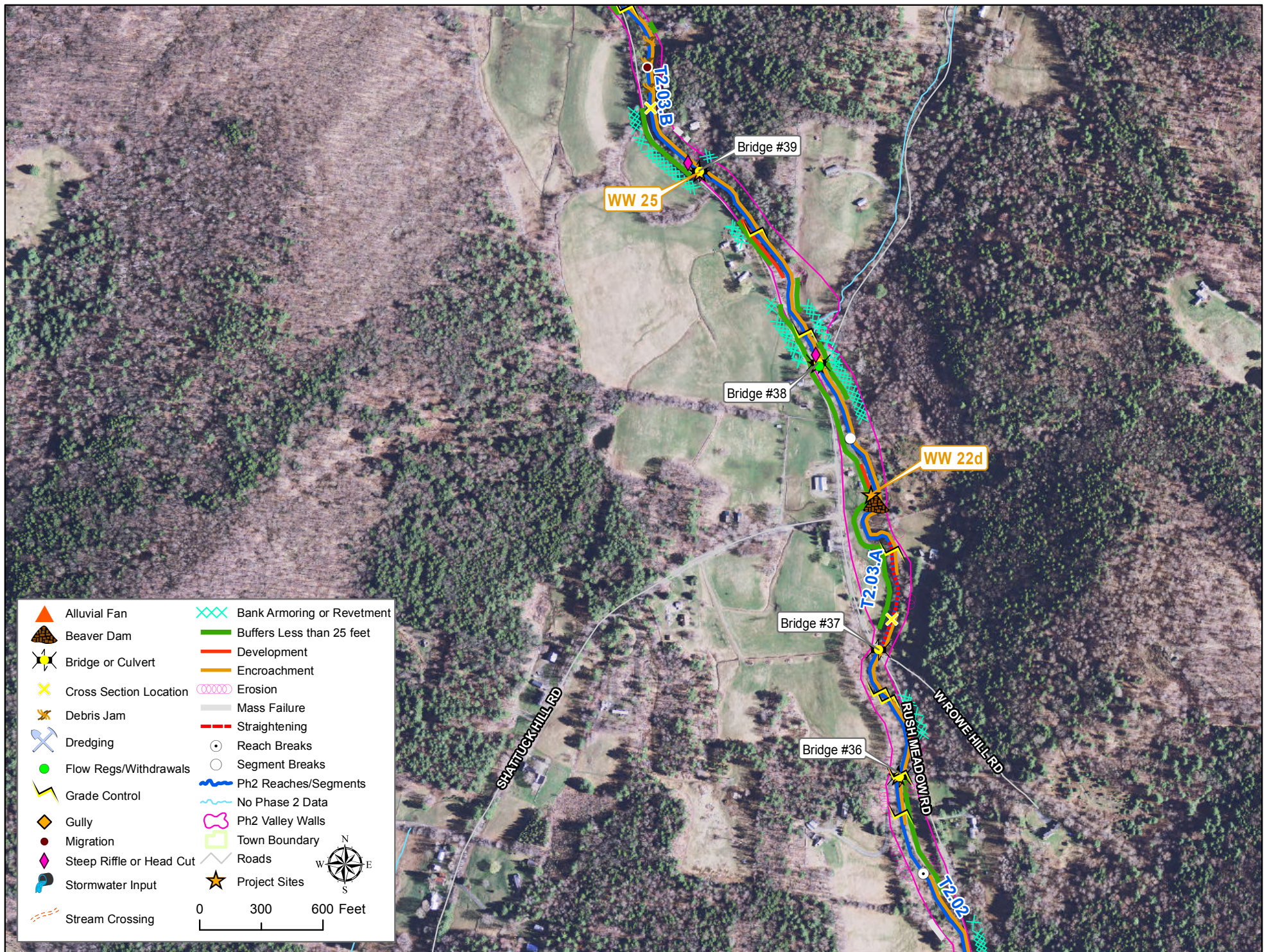


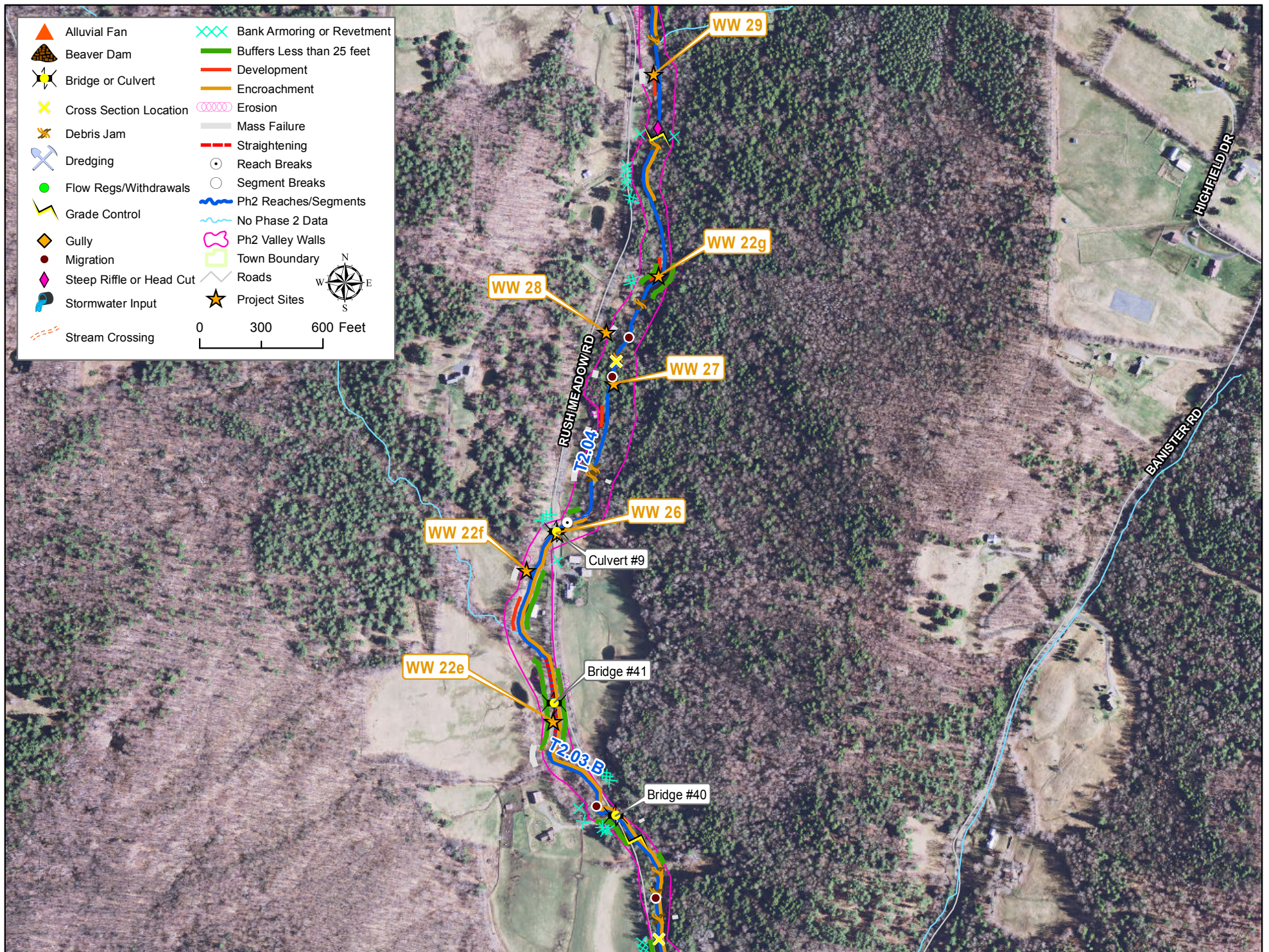


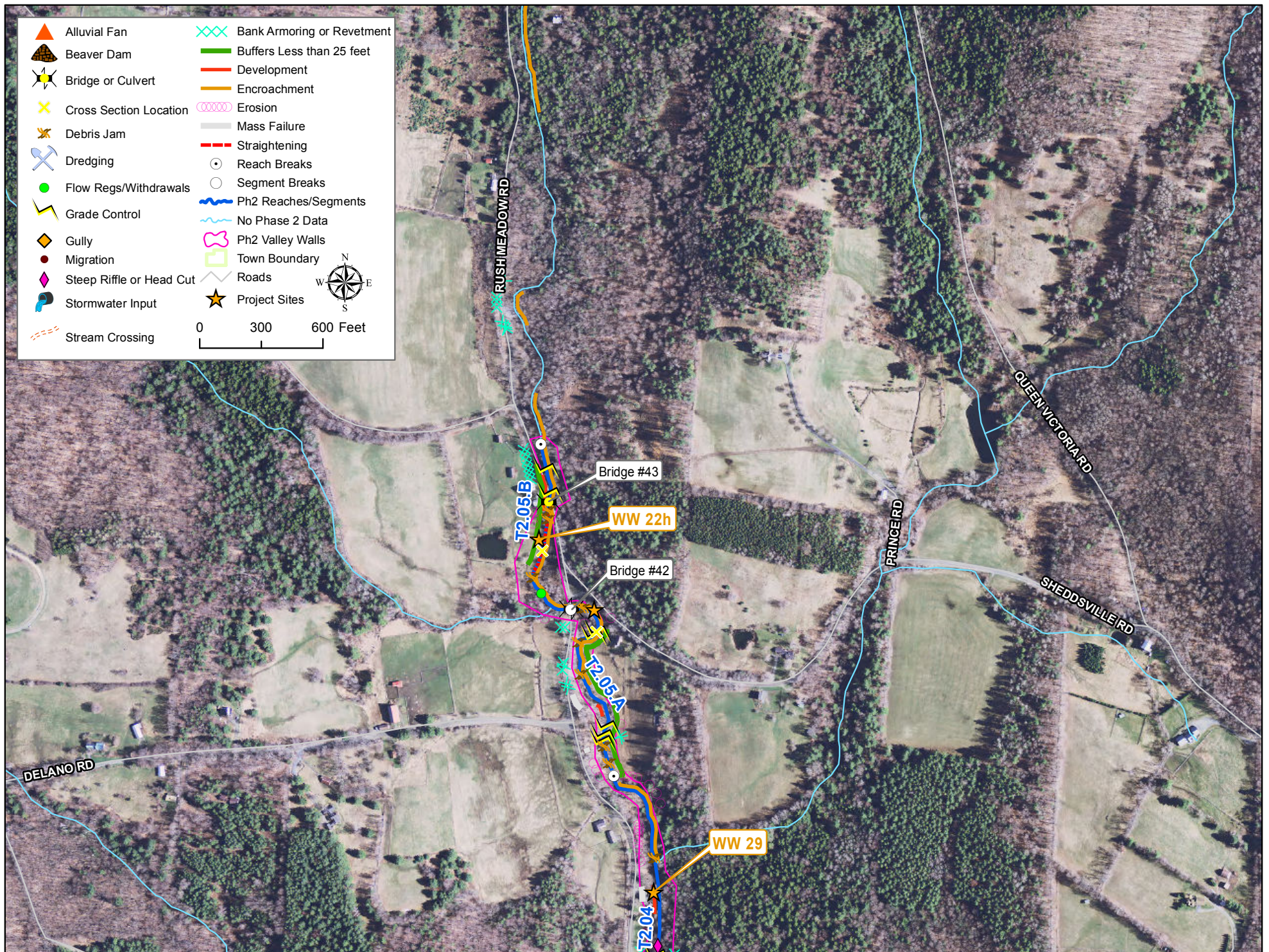










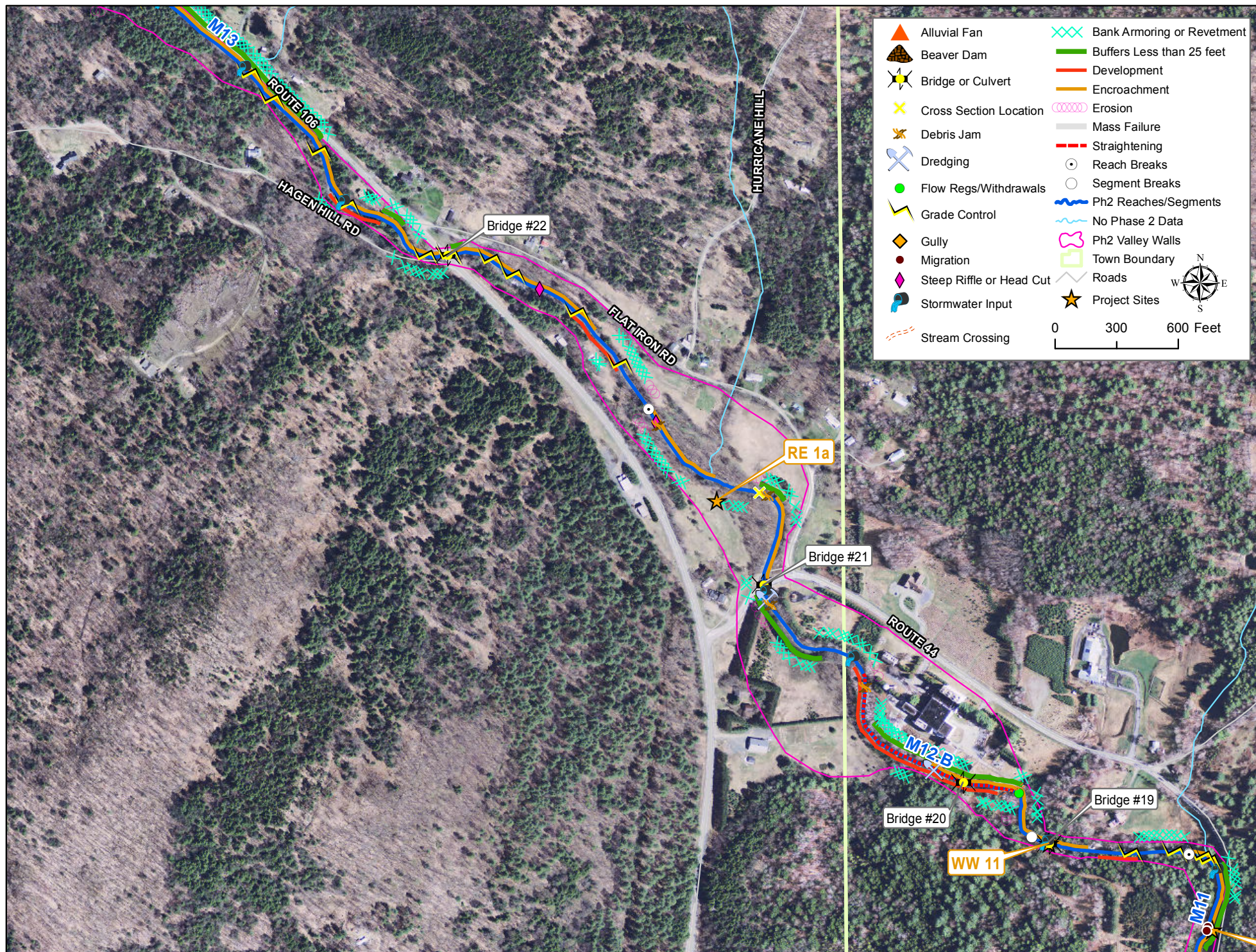


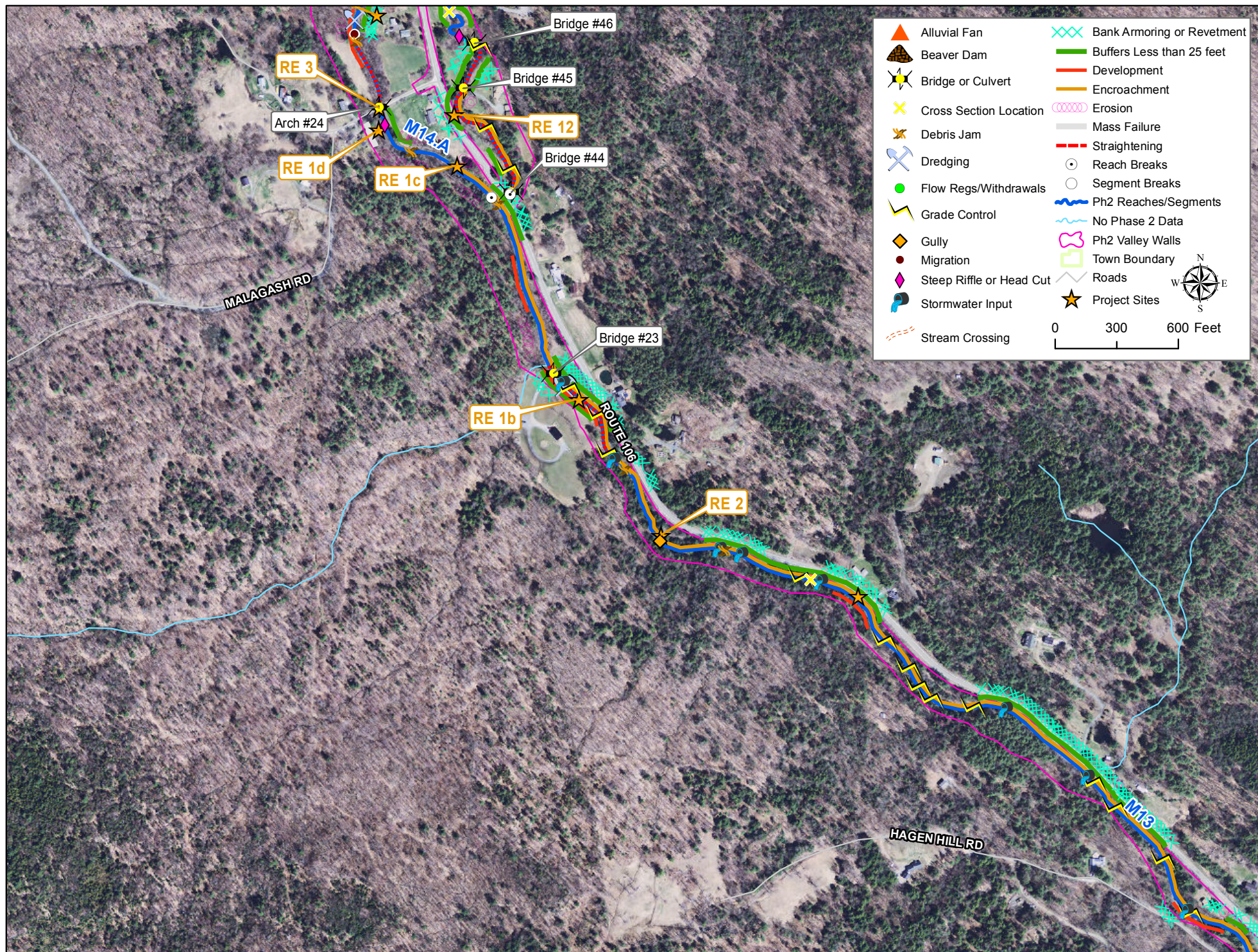
Reading Study Reaches/Segments

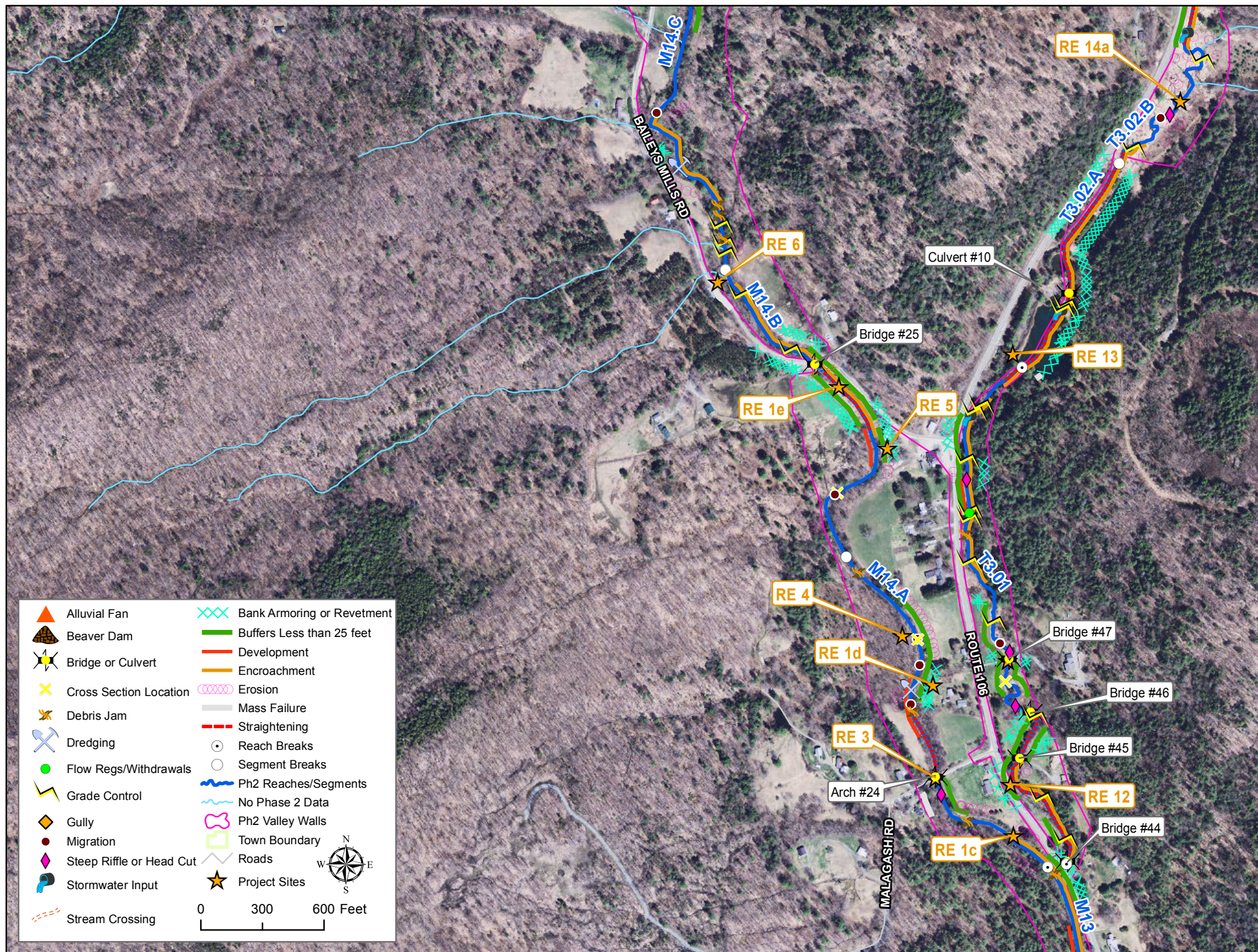
Mill Brook M13 - M16

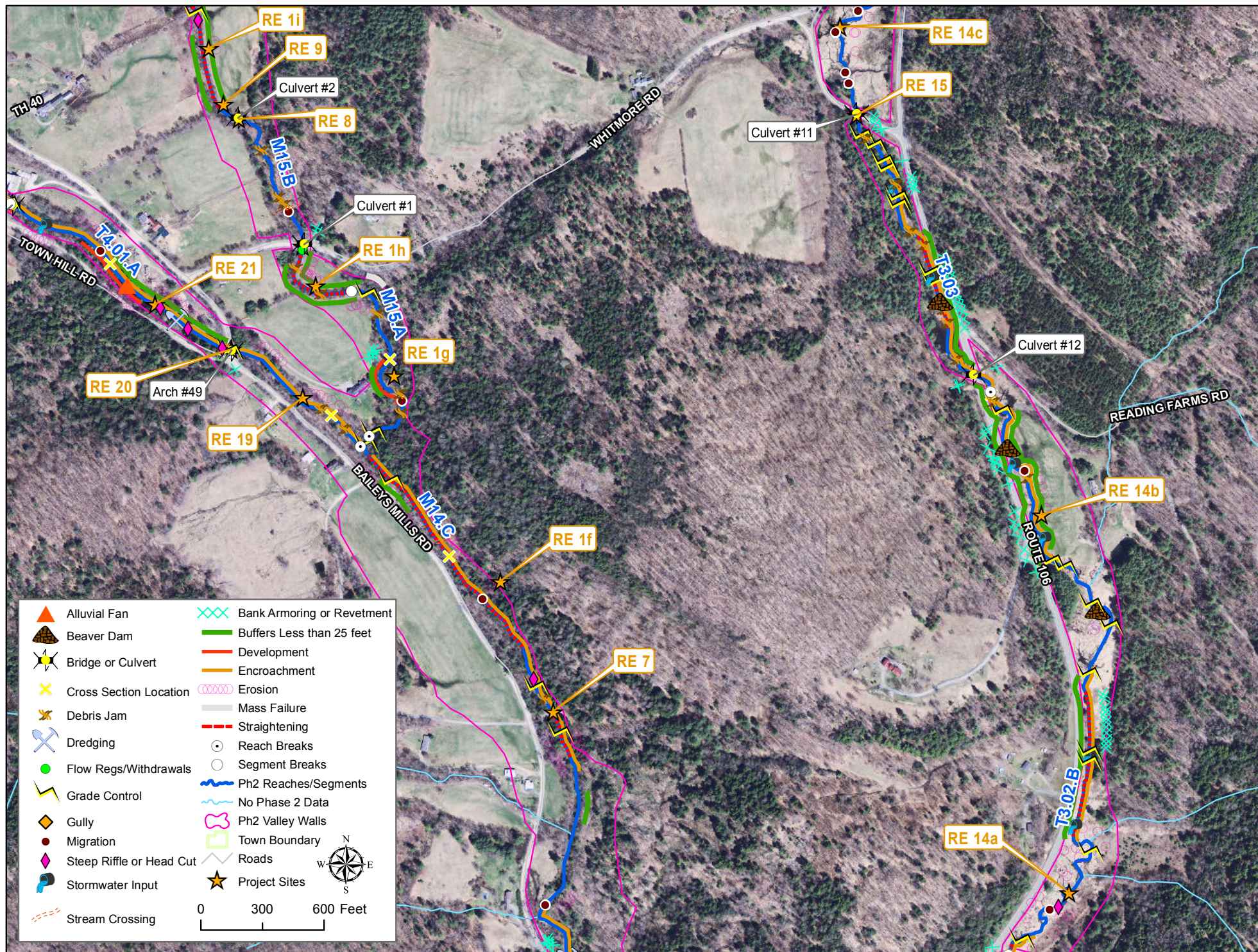
Reading Hill Brook

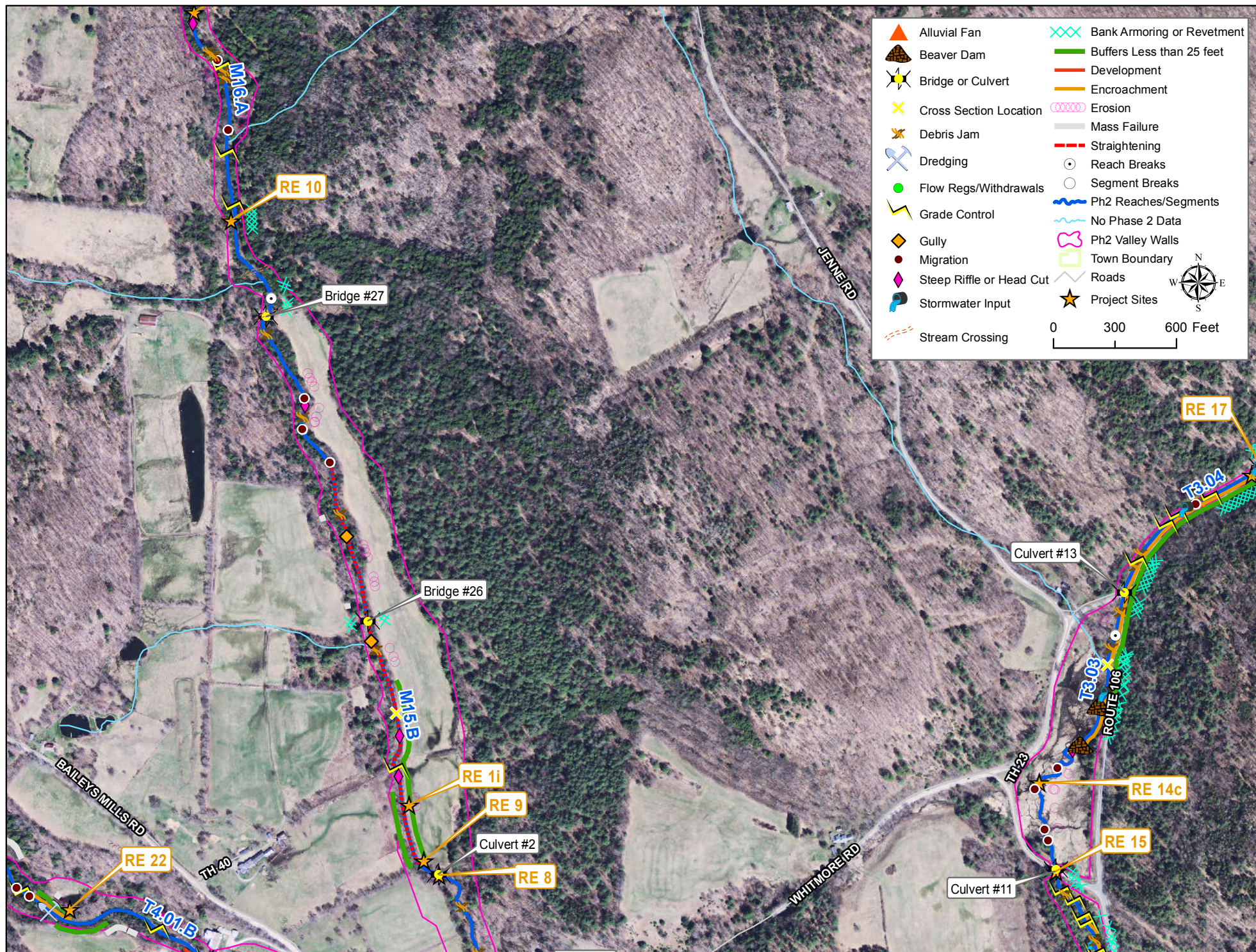
Bailey Brook

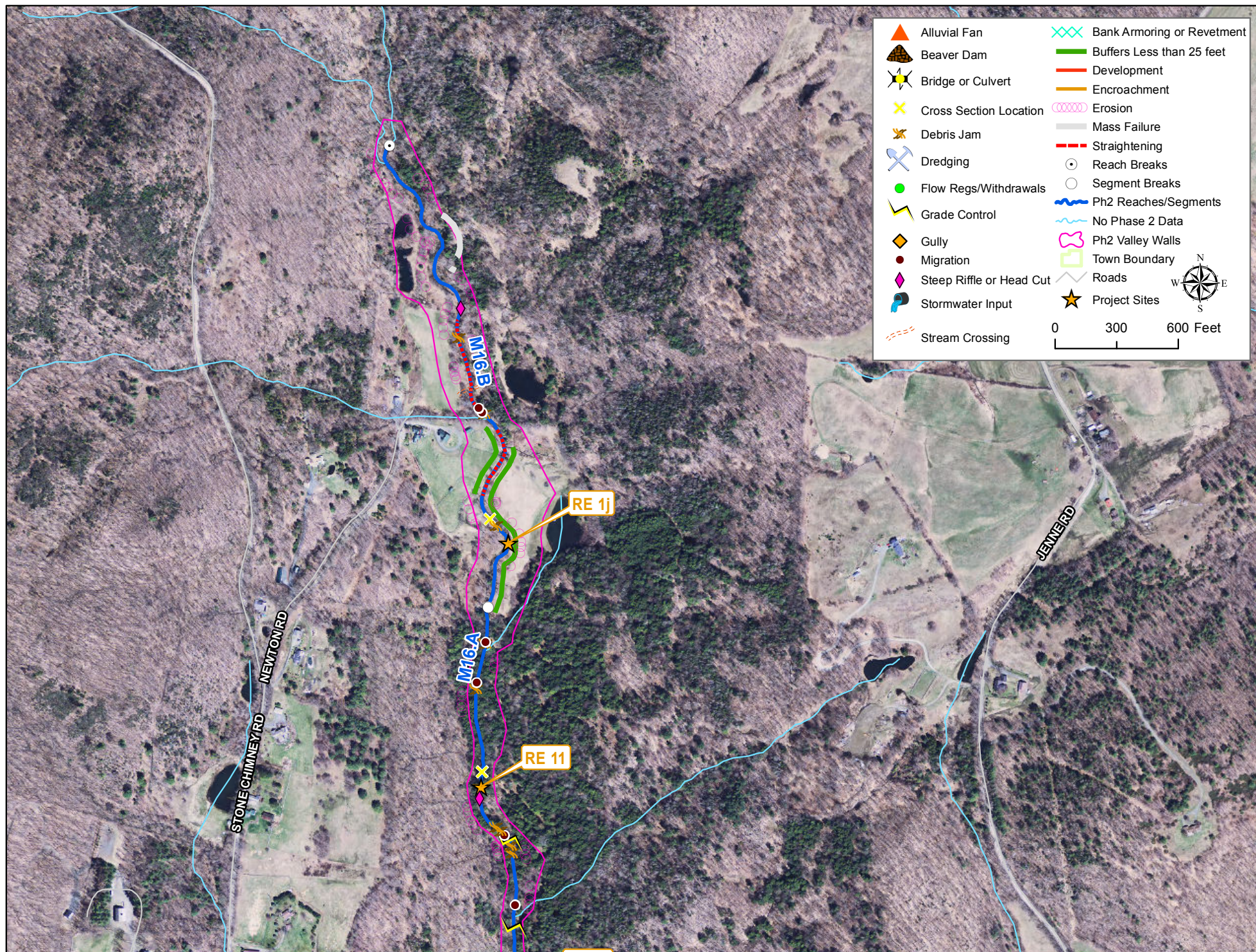


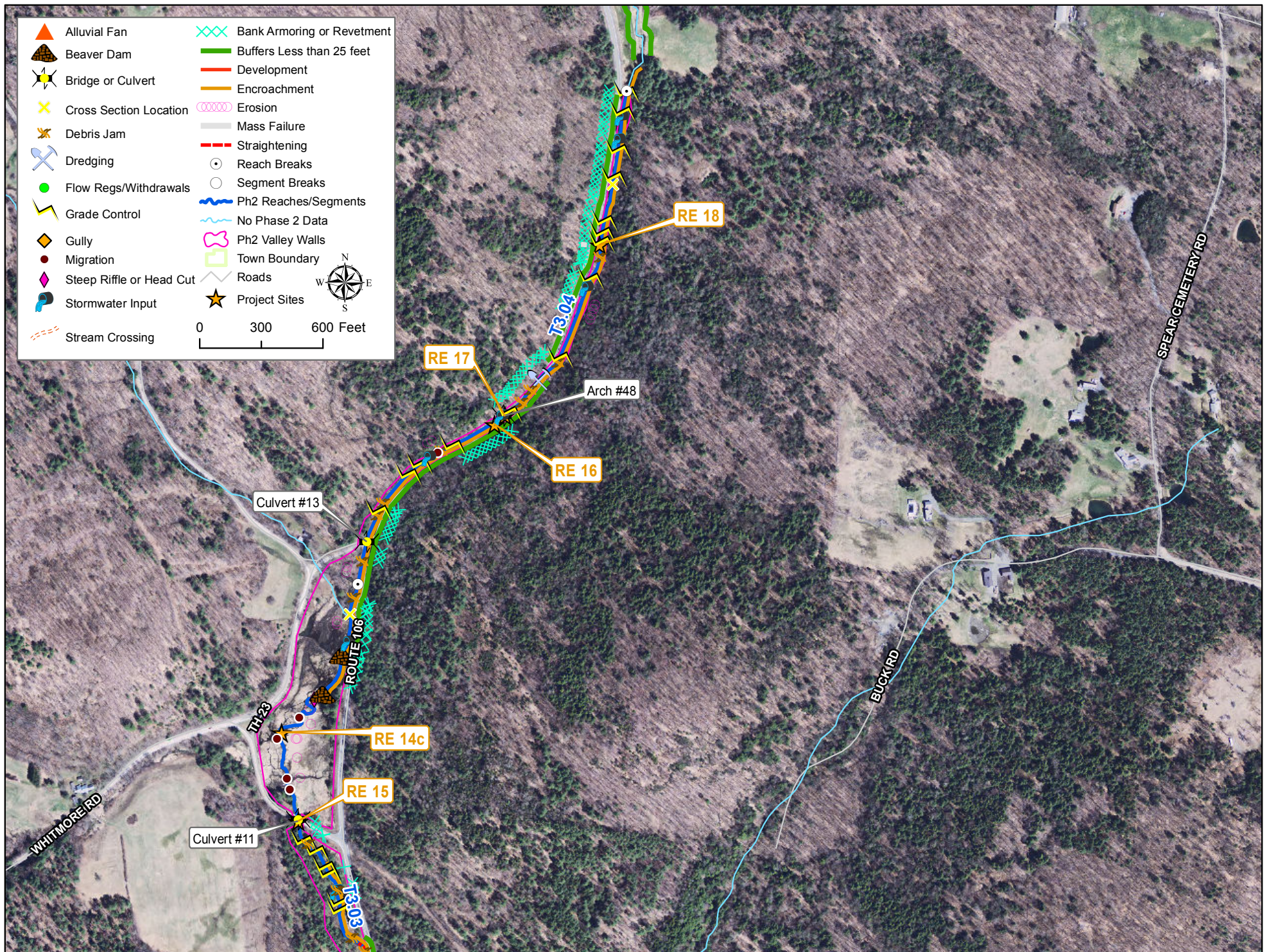


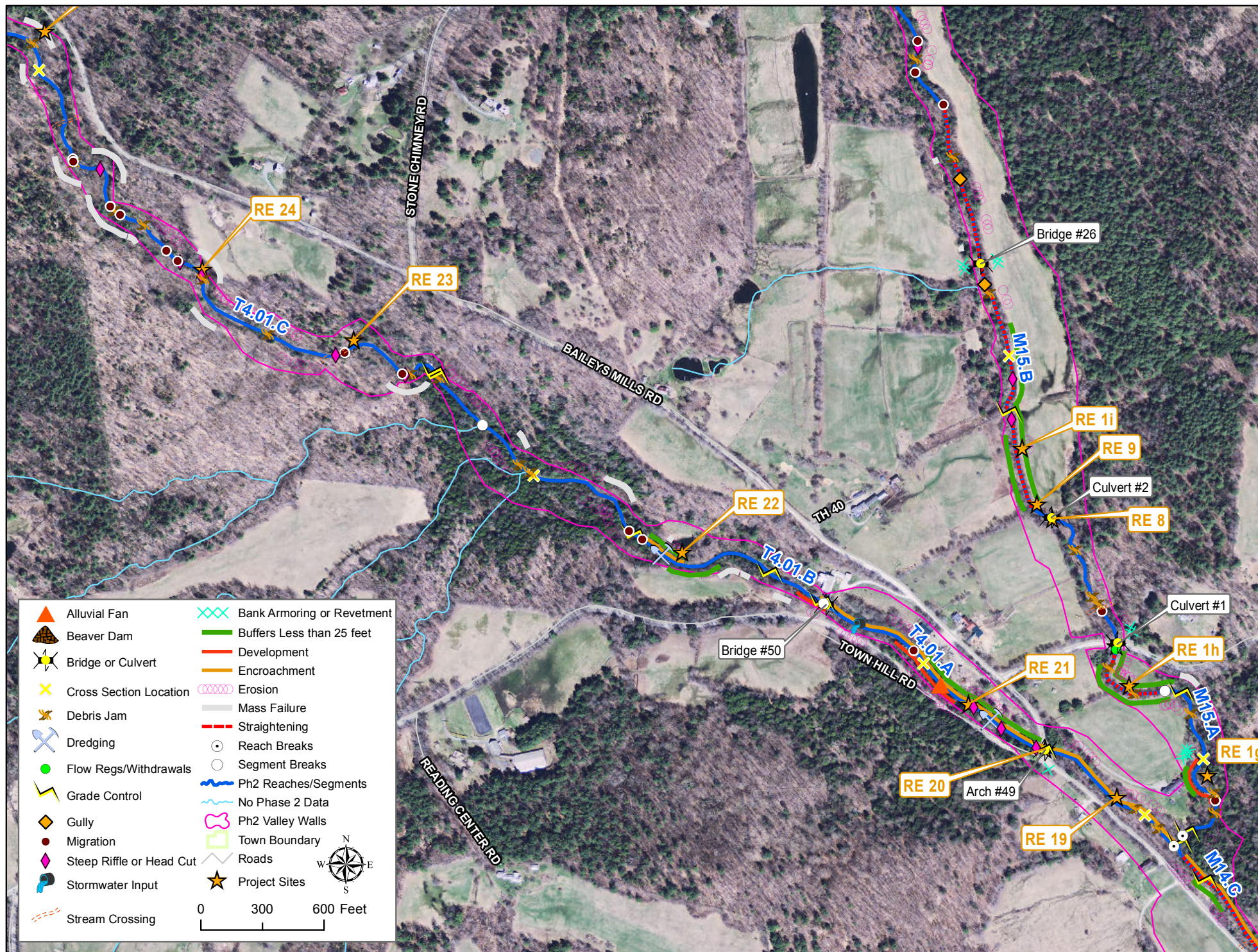


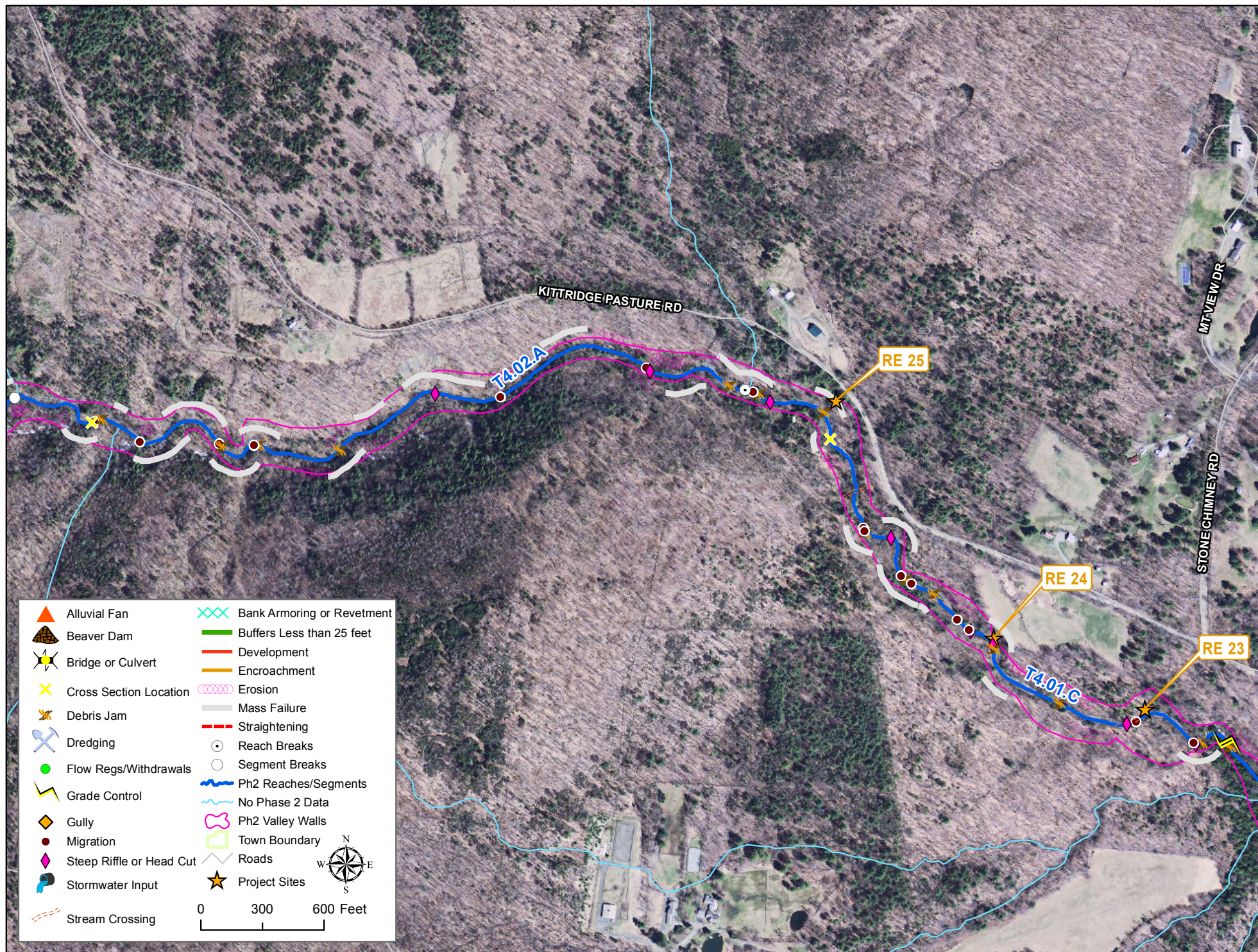


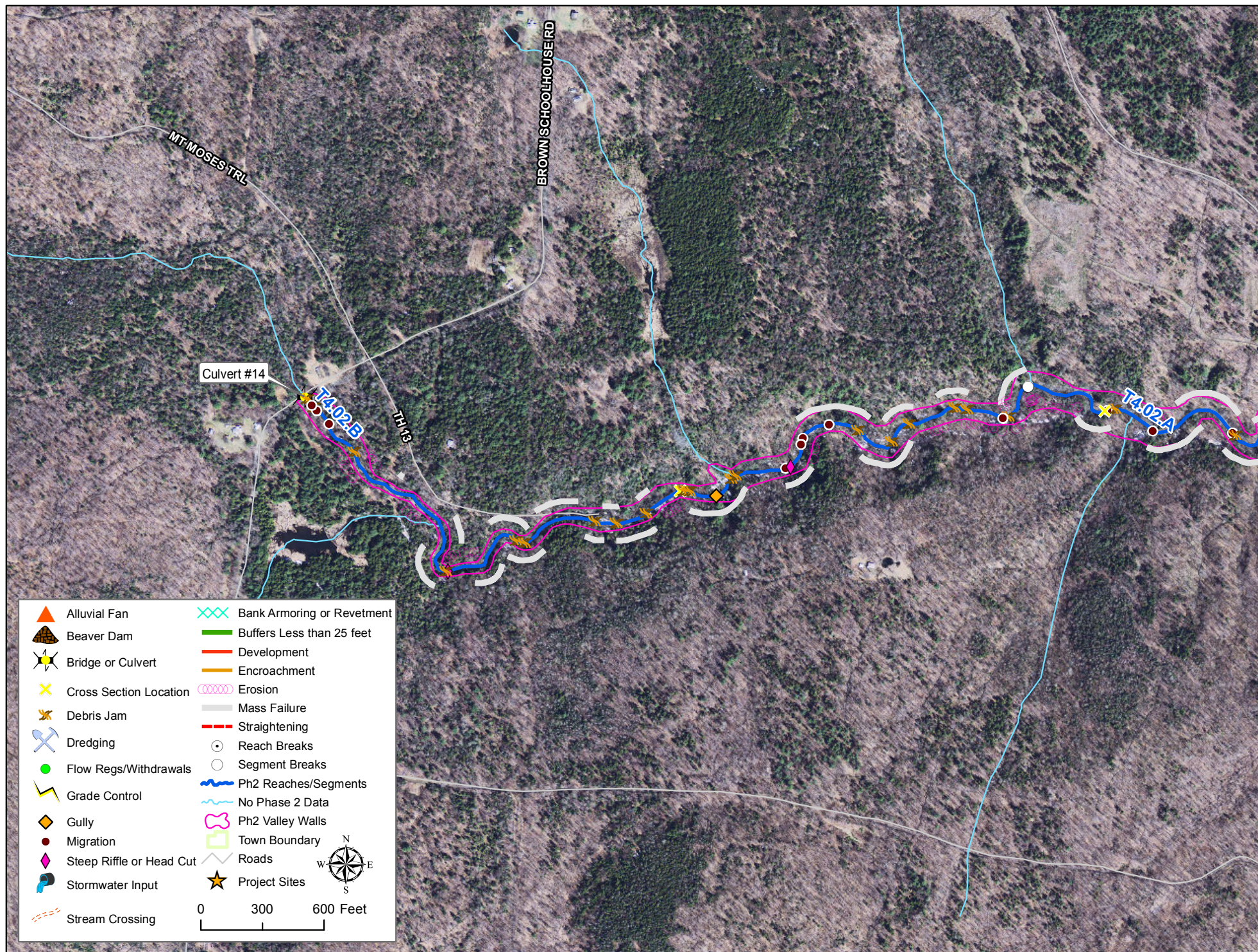












APPENDIX E:

PHASE 2 DATA QA/QC SUMMARY

To: Fitzgerald Environmental
From: Gretchen Alexander, VT DEC River Management
Date: 3/13/15

To: Gretchen Alexander, VT DEC River Management
From: Fitzgerald Environmental
Date: 4/2/15

Mill Brook Phase 2 SGA QA

The questions raised in this Quality Assurance assessment are meant to address potential discrepancies within the data set, uncover data entry errors, or otherwise clarify and confirm those observations that might not have been expected. It is important to take into consideration how data might be viewed or interpreted by the myriad of users who are familiar with the science and protocols but may be unfamiliar with the assessed reaches. While providing notes and comments, try to anticipate the types of questions that may arise due to outliers and exceptions observed within the reach. While attempting to clarify the data for those users wishing to utilize it years after collected, it's better to err on the side of making excessive comments than it is for them to be insufficient.

After reviewing the comments below, please update this document in a second color with what steps were (or were not) taken to address the comments/questions.

General comments:

For future assessments, I find it helpful to see photos of the ledge features. There are many reaches in this project where no photos were taken of ledge features. While it's not something necessarily required, for QA purposes it's just really helpful in getting a feel for the character of the reach. Did you include all the photos you took in your photolog or did you just submit a subset?

We did include all of our photos in the photo log. There are a number of reaches that had many grade controls for which we only took pictures of the prominent ones. We will make a point to take pictures of all grade controls during future assessments.

Step 2 Significant Flood Events: This section of the database is being used primarily to flag those locations where channel alterations associated with flood recovery efforts are severe and may hamper the ability to accurately describe channel adjustment processes or identify bankfull features based on the altered cross sectional geometry. It isn't clear to me if you are interpreting these fields in this way. Please refer to the attached memo for further clarification on the expectations related to this section of the database, specifically with regard to the channel enlargement calculation. Please review data in the DMS for this step to see if modifications to the data are necessary.

We have read through the memo and responded to your reach-specific comments below.

Reach specific comments:

M02

No comments

M04

You indicate in step 2.14 that the dominant bedform is planebed, so in step 6.9 you should indicate a SHTD from riffle-pool to planebed. **Plane Bed is too harsh for the reach; updated 2.14 to Riffle-Pool sub Plane Bed**

M05-A

In some of the photos it looks like headcutting is occurring through some of the aggradational features. By placing the reach in stage III of the F CEM are you implying that aggradational processes will likely overwhelm any incision that occurs through the deposits given the excess sediment working through the system? **Photo 215 definitely looks like a headcut - it is a log from the bank to the mid channel bar that created a scour pool. Yes we suspect that the huge volume of flood sediments working through the reach will dominate the future adjustment processes.**

M05-B

No comments

M05-C

Step 1.6 and your notes indicate the presence of grade controls, but I didn't see any photos in the file. Do you have any? **Picture 294 shows a small grade control in the lower reach, I added a windshield survey picture "61" showing the gorge mid segment.**

M06

x.s spreadsheet: small typo -- the x.s is labeled as segment "B", but this reach was not segmented. **Corrected and uploaded.**

Step 7.5 comment: small typo – change “effect” to “affect” **Updated.**

M07-A

No comments

M07-B

x.s spreadsheet: please indicate in the notes box the x.s. that you considered representative (the first one). **Updated and Uploaded.**

M08

Step 1.6 and 4.8: have a photo of one of the ledges and one of the outcrops – any others? **No additional pictures. We will make sure to photograph every GC and constriction in the future.**

Step 7.7: You assigned a sensitivity that is different than dictated by the protocols. Please either update or provide a justification. Thanks, we recently got rid of a departure to F and decided it was just a widened B. Sensitivity has been updated.

Phase 1 step 6.3: update to “multiple” to reflect Phase 2 observations. Updated.

M09-A

Step 2: From the photos it almost feels like an E stream type sub-reach by reference. Lots of meander scars in the valley indicating greater sinuosity than what is currently present, low valley slope, fine deposits... what do you think?

Good suggestion. We agree. Reference stream type changed to E for sub-reach.

M09-B

No comments

M10

No comments

M11

No comments

M12-A

No comments

M12-B

I have visited this site for an Act 250 case so am somewhat familiar with the lay of the land, and wonder about your valley wall delineation. This structure (red star) had water flowing through it during Irene, so I think it should be mapped within the valley (I think the left vw is somewhere on the opposite side of the road). I wonder if maybe the high banks were somewhat deceiving while you were mapping given the extreme level of incision that has occurred there?

Yes, this is likely true.

Also, I notice that you are mapping the valley wall based on road fill at road crossings. In these situations please approximate the valley wall in the absence of road fill. That is, if the bridge is on ledge, go ahead and map the valley wall that acknowledges the presence of an unerodible feature, but if there is fill at the approaches, map it as if the fill were not there. This results in smoother transitions of the river corridor at road crossings and helps acknowledge that road fill is vulnerable to catastrophic erosion at undersized crossings during flood events.

Edited VW to include the building and expanded at the bridge fill. We will use this approach for future VW mapping.



M13

No comments

M14-A

No comments

M14-B

Step 2.14: In your response to the question about channel dimensions being significantly altered by flood recovery efforts, are you referring to the presence of bank armoring? You didn't note any dredging, so I'm not quite certain what you are getting at. This section of the database is being used primarily to flag those locations where channel alterations associated with flood recovery efforts are severe and may hamper the ability to accurately describe channel adjustment processes or identify bankfull features based on the altered cross sectional geometry. It isn't clear to me if you are interpreting these fields in this way.

The channel along Baileys Mills Rd as it approaches the bridge is heavily modified with berming and armoring, however some of these impacts appear to be pre-Irene. Changed to "no".

M14-C

No comments

M15-A

From the photos the reach strikes me as more incised in some locations, but obviously hard to tell from just a photo. On your x.s. spreadsheet I am not seeing much of a feature at the elevation you are calling the RAF. Did you consider the flatish feature at elevation ~4.25? Either way, with this level of incision/floodplain disconnection, I wonder if we might expect to see more channel adjustment processes? Do you feel confident in calling it stage V / in regime? You are correct about the RAF – it should have been set at 4.25, which results in IR=1.4. Excel template has been revised and uploaded to DMS. We have updated RHA (6.4) and RGA (7.1 and 7.3) lines accordingly, but have not changed our overall scores as we think this difference is very minor and doesn't change our view of channel stability and habitat ratings. We consistently saw nice low floodplain benches throughout (see pictures 759, 776). Our cross-section was taken at the only riffle that wasn't influenced by ledge or LWD, it is likely a bit more incised there than typical for the reach. We did not observe any significant widening, scour, or planform adjustment, even following a very large storm event in July and would like to keep the reach as stage V.

M15-B

Phase 1 step 6.3: update to “multiple” to reflect Phase 2 observations. Updated but kept impact at "Low".

M16-A

Phase 1 step 6.3: update to “multiple” to reflect Phase 2 observations. Updated to "multiple" and "Low".

M16-B

Step 7 comment: Small typo here, think you meant to include the word “eroded” or “incised” or “scoured” ... “The channel bed of this segment was during TS Irene, removing lower benches.” Added "scoured", thanks.

T1.01

No comments

T1.01.S4.01-A

Based on your x.s. dimensions this is coming out as an “F” stream type, not “G”. Thoughts? We had chosen G because of the steep slope, but F is probably a better fit due to the width to depth ratio >12. Updated to F.

Phase 1 step 6.3: update to “multiple” to reflect Phase 2 observations. Updated

T1.01.S4.01-B

Based on your x.s. dimensions this is coming out as an “E” stream type, not “C”. Thoughts? Agree. There were some sections of the reach with C-type morphology, but both cross-sections have $w:d < 12$. Revised to E for existing and sub-reach reference.

T1.01.S4.01-C

It looks like there are floodplain features present in the upper part of the segment, as you noted in photo P113061. Did you feel this was not the dominant condition of the reach?

That photo was taken along a short stretch of different morphology at the most upstream end of the segment near the break. It was **not** the dominant condition of the reach.

You didn't map the valley wall for the upper portion of the segment. Is the "D" segment break in the correct location? The VHD is way off on this segment. The stream actually doesn't cross the road. After looking at this again, we've decided to move the C/D segment break downstream approximately 700' and extended the VW to encompass the updated segment.

T1.01.S4.01-D

No comments – not assessed

T1.01.S4.01.s4.01-D

I deleted this segment from the DMS as requested. Thanks

T1.02-A

No comments

T1.02-B

No comments

T1.02-C

No comments – not assessed

T2.01-A

Step 1.6: you note the presence of several grade controls. Do you believe these will prevent the degree of channel incision – ie, do you expect a transition to stage III in the absence of any channel management? Or given the low slope do you feel that planform adjustment will be a more dominant response (typical in low-slope E stream type settings where sometimes a D CEM predominates, which you indicated the channel might be by reference)?

All of the grade controls are in the lower third of the segment, the remainder is straightened and incised and didn't appear to have enough power to initiate planform adjustment or widening.

T2.01-B

No comments

T2.02

No comments

T2.03-A

No comments

T2.03-B

No comments

T2.04

No comments

T2.05-A

Step 7.7: You assigned a sensitivity that is different than dictated by the protocols. Please either update or provide a justification. Justification is described in Step 5. Pebble count indicates bedrock as the dominant substrate type, but cobble is likely the dominant substrate size throughout the reach. The best riffle for a cross-section happened to be in an area with more bedrock along the banks. Sensitivity will be assessed as a C3.

T2.05-B

No comments

T3.01

No comments

T3.02-A

Step 7.7: You assigned a sensitivity that is different than dictated by the protocols. Please either update or provide a justification. Given the highly manipulated nature of the segment and the potential for catastrophic failure, to you think an “Extreme” sensitivity could be justified (this is what we’d typically assign to an F3 in poor condition)? That was a typo, it's actually an F1 and therefore "High" sensitivity. The channel can't really go anywhere now that it is carved down to bedrock.

T3.02-B

No comments

T3.03

Did you consider segmentation to capture the differences between the upstream and downstream portions of the reach? We did consider segmentation however the bottom section with beaver dams has very similar geometry to the cross-section. The 400-500' stretch downstream of the culvert with numerous grade controls could be segmented, but we didn’t feel like this would add a lot of useful information to the dataset for planning purposes. We have added a note in Step 5 of the DMS to briefly summarize this section.

Phase 1 step 6.3: update to “multiple” to reflect Phase 2 observations. Updated to "Multiple" and "Low".

T3.04

No comments

T4.01-A

Step 1.2: Your step 5 and 7 comments note this as an alluvial fan setting, but you have not indicated this in FIT. Please update. **Indexed an alluvial fan in FIT.**

x.s spreadsheet: please indicate which spreadsheet you considered to be representative for data entry purposes in the DMS. **Updated and uploaded.**

T4.01-B

No comments

T4.01-C

No comments

T4.02-A

No comments

T4.02-B

No comments **I later noticed that Sensitivity was "Extreme" and should be "High" for a Poor condition B4 reach.**

T4.02-C

No comments – not assessed