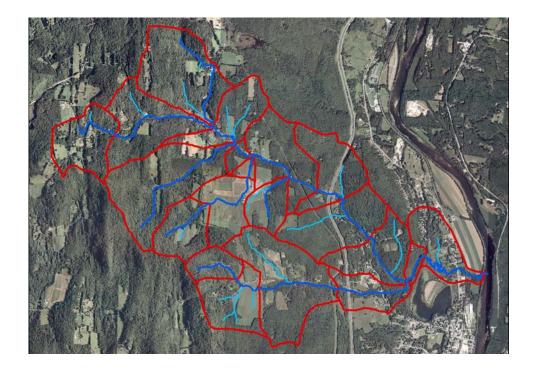
Hubbard Brook Phase 1 Stream Geomorphic Assessment Summary

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Executive Summary

- Fitzgerald Environmental Associates, LLC. (FEA) was retained by the Southern Windsor County Regional Planning Commission (SWCRPC) in 2008 to carry out Phase 1 assessments on the Hubbard Brook watershed following the VTANR Stream Geomorphic Assessment (SGA) Protocols.
- The Hubbard Brook watershed is located in the towns of Windsor and West Windsor. It has a drainage area of 6.3 square miles and outlets to the Connecticut River east of Route 5, just upstream of downtown Windsor. Its main stem surface waters extend to the west into West Windsor. Four major tributaries and one minor tributary were identified for Phase 1 assessment.
- A total of 20 reaches along 13.1 river miles were identified during the Phase 1 analysis. 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 SGA 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 two-thirds (65%) of the assessed reaches are found in a confined valley setting that would naturally support sediment transport channels with A or B-type geometry. The remaining reaches (35%) are found in an unconfined valley setting with meandering, depositional C or E-type channel geometry.
- Approximately 73% of the watershed is forested, with agricultural land use representing approximately 21%. Developed lands (4.3%) are found mainly around the village center of Windsor. Wetlands and other surface waters represent 2.2% of the watershed area.
- 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 9.4, with a maximum score of 15 and a minimum score of 2.
- Based on the Phase 1 impact ratings, a total of 9 high-priority reaches are recommended for Phase 2 assessment, including 8 mainstem reaches and 1 tributary reach. The selected reaches have a total channel length of 5.3 miles. In addition, 3 medium-priority reaches were selected for consideration due to their relatively high impact ratings.

1.0 Project Background

1.1 Introduction and Study Goals

The Southern Windsor County Regional Planning Commission (SWCRPC), the Paradise Park Commission (PPC), and the Vermont Department of Environmental Conservation (VTDEC) identified the Hubbard Brook watershed in southeastern Vermont for assessment of fluvial geomorphic conditions. Fitzgerald Environmental Associates, LLC (FEA) was retained by SWCRPC in 2008 to carry out Phase 1 assessments following the Stream Geomorphic Assessment (SGA) Protocols developed by the Vermont River Management Program (RMP). The study was initiated to identify the extent of geomorphic stressors throughout the watershed (e.g., encroachment, development, etc), and to collect preliminary data on the brook's condition within Paradise Park. In the future this data will be used to help locate specific sources of sediment upstream of the park, and identify potential restoration projects at the watershed level.

FEA used the Stream Geomorphic Assessment Tool (SGAT) to develop the baseline GIS data for the watershed in the spring of 2008. During the summer of 2008 the remaining Phase 1 data was collected via windshield surveys and historical research. A total of 20 reaches along 13.1 river miles were identified during the Phase 1 analysis. 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).

The overall goal of the RMP 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, 2007a) achieved through:

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

The Phase 1 assessment of the Hubbard Brook watershed provides the basis for identifying reaches for future Phase 2 assessment. Detailed, reach-level data collected from the Phase 2 surveys will be used for project identification and development activities that meet the RMP goals stated above.

2.0 Watershed Background

2.1 Geographic Setting and Land Use History

The Hubbard Brook watershed is located in Eastern Windsor County, Vermont (Figure 1). This area of the state is part of the Lower Connecticut River Basin. The Hubbard Brook watershed has a drainage area of 6.3 square miles and outlets to the Connecticut River east of the Route 5 crossing, just upstream (north) of downtown Windsor. The watershed is found predominately in the town of Windsor, but the headwaters span into West Windsor (Figure 2). Four (4) major tributaries and one sub-tributary were identified in this study. The largest tributary, Kimball Brook, branches off in the Paradise Park west of Lake Runnemede, and extends westward into an agricultural area. The three other tributaries branch off the mainstem in the north or south direction. No labels were present on the USGS topological maps for these tributaries, so the name of the nearest adjacent road was used to reference the tributaries. An unnamed sub-tributary located east of the Southeast State Correctional Facility was also included in this study. This surface water enters the mainstem approximately 2,000 feet upstream of the Interstate-91 crossing.

Land cover data based on imagery from 2006 (NOAA, 2008a) are summarized in Table 1. The Hubbard Brook watershed is drained by a rural watershed, with forest representing the dominant cover type (72.7%). Agricultural lands cover 20.9% of the watershed, with a majority of large farmlands found in the middle of the watershed surrounding the State Farm Prison, and to the south surrounding the headwaters of Kimball Brook. Much of the agricultural lands within the Hubbard Brook watershed are for hay production and pasture land (NOAA, 2008a). There is limited developed land in the watershed, with only 4.3% coverage. Concentrated areas of residential development are primarily found to the east of Interstate-91 in downtown Windsor.

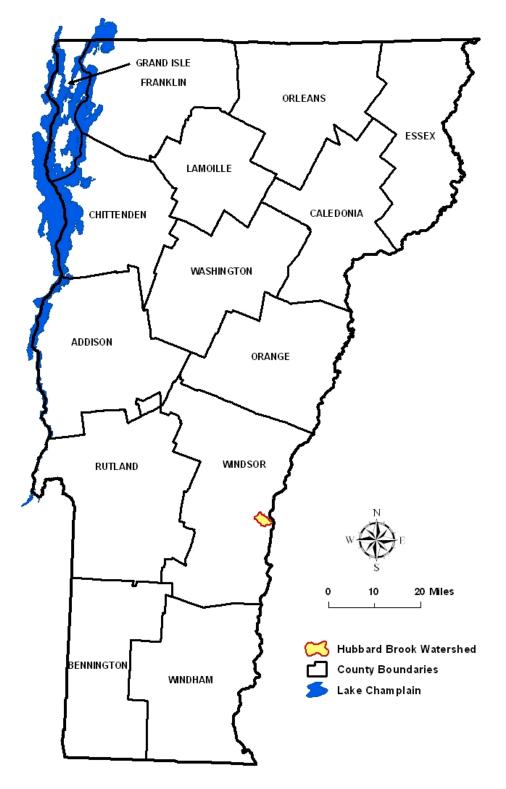


Figure 1. Watershed location map for the Hubbard Brook watershed

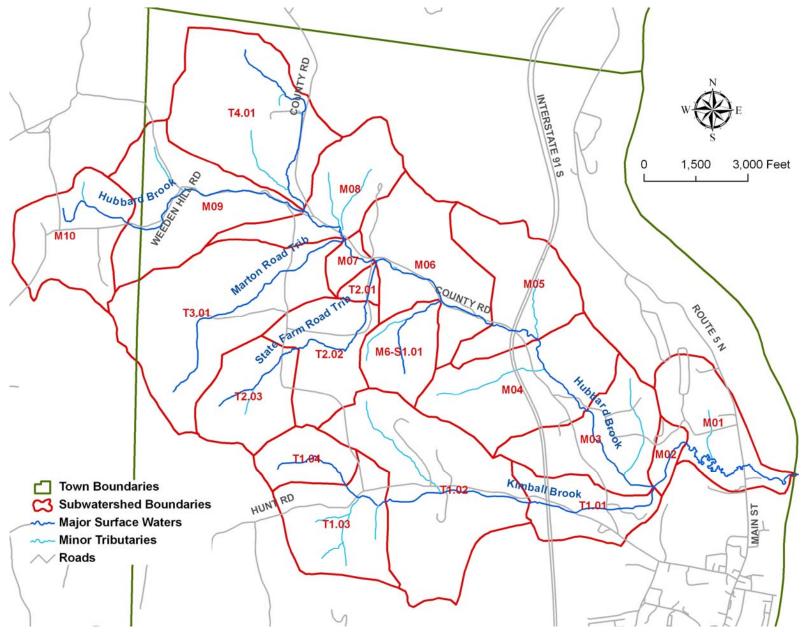


Figure 2. Hubbard Brook subwatersheds, surface waters, roads, and town boundaries

Table 1. Land cover data for Hubbard Brook watershed		
Coverage		
4.3%		
20.9%		
72.7%		
2.0%		
0.2%		

 Table 1. Land cover data for Hubbard Brook watershed

Historical Land Uses

Historically, the impacts of agricultural practices on the Vermont landscape played an integral role in the legacy effects on waterways like Hubbard Brook. Prior to the deforestation associated with human settlement, the watershed would have been a mixture of deciduous species on the valley floors, as well as large stands of white pines (*Pinus strobus*) in areas that are in younger successional seres. The upper elevations of the watershed may have some transitional species, but it would be mostly hardwoods like maple (*Acer saccharum and Acer rubrum*), American beech (*Fagus grandifolia*), and yellow birch (*Betula alleghaniensis*). Wet and rocky sites on the valley slopes would likely be occupied by eastern hemlock (*Tsuga canadensis*). The 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 Hubbard Brook. Exposed, highly-erodibe soils (e.g., glacial tills and lacustrine soils) on steep slopes were carried to the valley floors where it 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 found on marginal lands were given up, the forests continued to recover. Today, approximately 72 percent of the Hubbard Brook 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.

2.2 Geologic and Geomorphic Setting

Geologic Setting

The underlying geology of the Hubbard watershed is comprised of a mixture of rock types from the Lower Devonian and Upper Silurian eras (Doll et al., 1961). The Waits River Formation, which contains a mixture of schist and marble, is found in the western section of the watershed. The Standing Pond Volcanic member is also observed as a subset of the Waits River formation. The Gile Mountain formation, a metamorphic rock type, is found in the eastern section of the watershed. This formation contains a mixture of schists and phyllites.

The presence of Glacial Lake Hitchcock also had a significant effect on the surficial geology of the lower watershed, perhaps as far upslope as reach M04. This lake occupied the Connecticut River Valley from central Connecticut north to 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.

Geomorphic Setting

Hubbard brook is a small drainage basin that enters directly into the Connecticut River. It has one main branch, with four significant tributaries and a minimum of one small subtributary. The mainstem of Hubbard Brook has an overall channel slope of 2.6%. The watershed tends to have unconfined valley types where the channel passes through the historic floodplain of the Connecticut River (M01), and becomes confined as it winds its way up into the eastern edge of the Green Mountains. The basin's largest tributary, Kimball Brook (T1), has an overall channel slope of 6.6%. This tributary enters the main stem in Paradise Park and has a drainage area of 1.3 sq. mi. The other three tributaries and sub-tributary have smaller drainage areas and their slopes vary. The State Farm Road tributary (T2) extends southward in a confined setting. Then, the valley opens on a large terrace before rising again to the headwaters. The Marton Road tributary (T3) is found in a similar setting as the State Farm Road tributary, but it remains confined throughout its ascent into the headwaters. County Road tributary (T4) extends north toward the town of Hartland. The unnamed tributary (M6-S1.01) has the steepest slope (13.2%) and is found in confined valley setting. A summary of the average channel slopes for the main stem and tributaries is found below in Table 2.

Table 2. Average Channel Slopes for Mainstern and Tributary Channels			
Channel (SGA Reaches)	Average Slope		
Hubbard Brook (M01 - M10)	2.6%		
Kimball Brook (T1.01 - T1.04)	6.6%		
State Farm Road Tributary (T2.01 - T2.03)	6.5%		
Marton Road Tributary (T3.01)	7.1%		
County Road Tributary (T4.01)	4.0%		
Unnamed Subtributary (M6-S1.01)	13.1%		

Table 2. Average Channel Slopes for Mainstem and Tributary Channels

2.3 Ecological Setting

The entire Hubbard Brook watershed is within the Southern Vermont Piedmont (SP) Biophysical Region (Thompson and Sorenson, 2000). This 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 (e.g., granitic plutons), such as Ascutney Mountain and Black Mountain to the west Brattleboro, 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 the mainstem and tributary valleys of the Hubbard Brook watershed.

Elevations within the watershed range from 303 feet at the confluence with the Connecticut River, up to approximately 1261 feet in the headwaters of the Marton Road tributary. With an average annual rainfall of 41.3 inches^{*} (NOAA, 2008b) and a temperate climate, the forest cover is comprised primarily of mixed hardwood tree species, with areas of white pine (*Pinus strobus*) and eastern hemlock (*Tsuga Canadensis*) found within younger growth and along steeper slopes, respectively.

Wetlands occupy several significant areas within the watershed (NWI, 2003). The most concentrated area of wetlands can be found in the lower watershed (M01), north of Lake Runnemede. Upstream of this area wetlands are sparsely encountered on the mainstem until the headwaters (M10), which has several water-saturated areas. The lower-sloped reaches of Kimball Brook (T1.03) and the State Farm Road tributary (T2.02) also have

^{*} Annual rainfall data is taken from Woodstock, Vermont at an elevation of 751 feet.

large wetland areas. Wetlands provide important flood control and water quality protection functions, and support continued inputs of subsurface and groundwater during the low flow periods of the year. These functions are maximized in areas where the wetland is contiguous with the channel and undisturbed by agricultural ditching or development.

3.0 Data Collection

3.1 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 instream biological habitat. The protocols are based on defensible scientific principles and have been tested widely in many watersheds throughout the state.

The SGA protocols include three phases (VTANR, 2007b):

• 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 4 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 impacts in the future. Table 4 summarizes the parameters collected and verified in Phase 2 using the Feature Indexing Tool (FIT).

Table 3. Parameters Collected with FIT					
Phase 1 Phase 2 Data					
Step	Step	Туре	Impact	Sub-Impact	
3.1	1.2	Point	Alluvial Fan	NA	
				Dam	
3.2	1.6	Point	Grade Control	Ledge	
3.2	1.0	Font	Orace Control	Waterfall	
				Weir	
NA	3.3	Point	Mass Failure	NA	
				Dredging	
5.5	5.5	Point	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	
				Neck Cut Off	
NT A	5.2 Po	Point	Migration	Flood chute	
NA				Avulsion	
				Braiding	
NA	5.3 Point	Doint	Steep Riffle or	Head Cut	
INA		Point	Head Cut	Steep Riffle	
NT A	5.4 Point	Doint	Stroom Crossing	Stream Ford	
NA	5.4	Point	Stream Crossing	Animal Crossing	
NA	3.3	Point	Gully NA		
6.2	1.3	Line	Development	NA	
	1 1.3 Line			Berm	
(1		Lina		Improved Path	
6.1		Line	Encroachment	Road	
				Railroad	
			Bank Armoring or	Rip-Rap	
5.3	3.1	Line	Revetment	Hard Bank	
			Revenuent	Other	
7.2	3.1	Line	Erosion	NA	
		-		Straightening	
5.4	5.5	Line	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.

FEA used SGAT to develop the baseline data layers for the watershed. The remaining Phase 1 data has been collected remotely and with windshield surveys for the 20 reaches along 13.1 river miles. All major human impacts and natural features were indexed in a GIS using the Feature Indexing Tool (FIT; VTANR, 2007b).

3.2 Phase 1 Quality Assurance

The RMP Quality Assurance (QA) protocols outlined in the SGA protocols (VTANR, 2007b) were followed in order to ensure a complete and accurate dataset. RMP staff shared responsibility with FEA for the QA of the finalized Phase 1 dataset. All metadata describing the data sources were entered in the Data Management System (DMS), with extraordinary sources noted in the comments section in Step 7. Two separate QA reviews were completed by RMP staff following the completion of Steps 2 and 7. A written record of QA issues raised by RMP, and responses from FEA is included in Appendix C.

4.0 Results

4.1 Reach Delineations

The 13.1 miles of assessed surface waters within the Hubbard Brook watershed were divided into 20 reaches during the SGAT analysis. Reach divisions were based on changes in valley geometry, channel slope, and the size and influence of tributaries entering the mainstem channel (VTANR, 2007b). Four (4) major tributaries (e.g., drainage area exceeds 10% of mainstem drainage area at confluence) were identified during the SGAT analysis (see Figure 3). Table 4 summarizes data for the mainstem and tributary watersheds. Detailed information about each reach location is found in the reach reports in Appendix B.

DMS ID	Name	Watershed Area (square miles)	Assessed River Length (mi)*	Number of Assessed Reaches*
М	Hubbard Mainstem*	6.3	6.7	11
T1	Kimball Brook	1.3	2.4	4
T2	State Farm Rd. Tributary	0.6	1.4	3
T3	Marton Rd. Tributary	0.7	1.4	1
T4	County Rd. Tributary	0.6	1.1	1

Table 4. Mainstem and Tributary Summary Data

* Includes subtributary reach M6-S1.01 (unnamed subtributary)

4.2 Reference Stream Types

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 expected in a particular geologic and geomorphic setting without human influences. Detailed information about each reach reference stream type is found in the watershed summary data and reach reports found in Appendices A and B, respectively. Table 5 presents general valley and channel characteristics associated with reference stream types found in the Hubbard Brook watershed.

Table 5. Reference Stream Type Characteristics					
Stream Type	Valley Confinement	Channel Slope	Sinuosity	Bedform	Number of Study Reaches*
А	Confined	>4%	Low	Cascade or Step-pool	9 (45%)
В	Confined	2-4%	Low	Step-pool or Plane bed	4 (20%)
С	Unconfined	< 2%	Moderate	Riffle Pool	6 (30%)
Е	Unconfined	< 2%	High	Riffle Pool or Dune-Ripple	1 (5.0%)

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

Figure 3 presents the location of the reference stream types developed for the Hubbard watershed. A majority of the reaches (45%) in the watershed are A-type under reference conditions. This stream type is characterized by channels with very little sinuosity that are found in narrow or semi-confined valley settings. A high degree of slope (>4%) is usually observed with this stream type, making the geomorphic processes dominantly

transport based. Thirty (30) percent of the reaches in the watershed are C-type under reference conditions. This stream type is 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. Only one (1) reach was characterized as an E-type channel, where very broad valley settings and sediment depositional processes support a sinuous channel planfom.

The high slopes observed throughout the watershed (Table 2) make sediment transport the dominant process observed in the basin. Only in areas of negligible slope (e.g., M01) were E-type channels found. Also, in the middle portion of the basin where slope was reduced, C-type channels were common (e.g., T1.03 and T2.02).

4.3 Watershed Geology and Soils

The NRCS soils data (NRCS, 2008) was utilized to review the parent material of the watershed. Figure 4 depicts the main classes of parent materials distributed across the watershed, as well as areas of known and potential alluvial fans. One grade control was observed in the field during the windshield survey and is displayed in Figure 4. This feature was photographed and mapped because of its close proximity to the road. The presence of numerous other grade controls in the headwaters reaches is likely where bedrock outcroppings are present. Detailed geologic information about each reach is found in the reach reports found in Appendix B.

Five alluvial fan locations have been noted in the watershed. Each of these locations marks areas where steep sloped transport reaches have abrupt changes in slope. This rapid change in slope causes the fallout of sediment from the water, resulting in sediment deposition. Alluvial fans are characterized by highly active channels with a propensity for lateral migration and avulsion; even where they have been historically managed (e.g., dredged and straightened). The alluvial fan point located upstream of the confluence with Marton Road tributary can be attributed to the flow of a small ephemeral, or intermittent tributary coming from the north valley slope that seems to behave similarly to the fan points located within the channel.

The area of alluvial outwash near the confluence of Kimball Brook and the mainstem could also be a potential location of an alluvial fan; it was not mapped because topographic maps did not show any diagnostic contour lines that suggest the presence of alluvial fans.

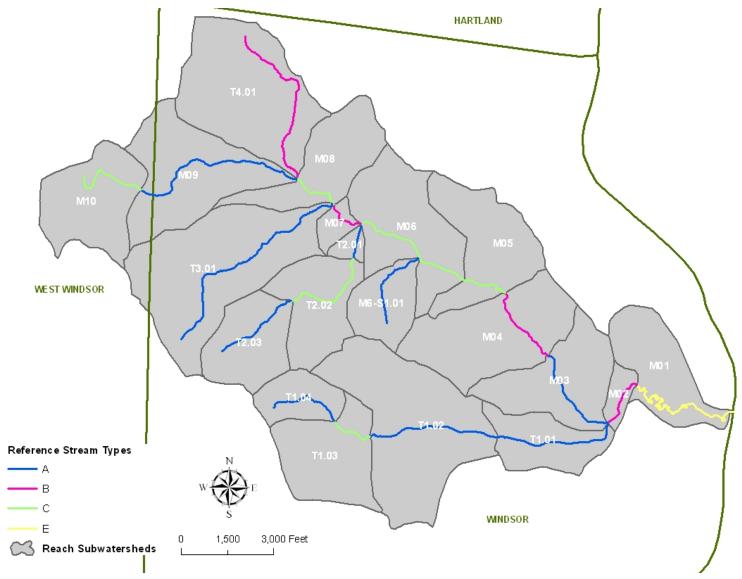


Figure 3. Reference stream types per Rosgen (1994) for the Hubbard Brook watershed

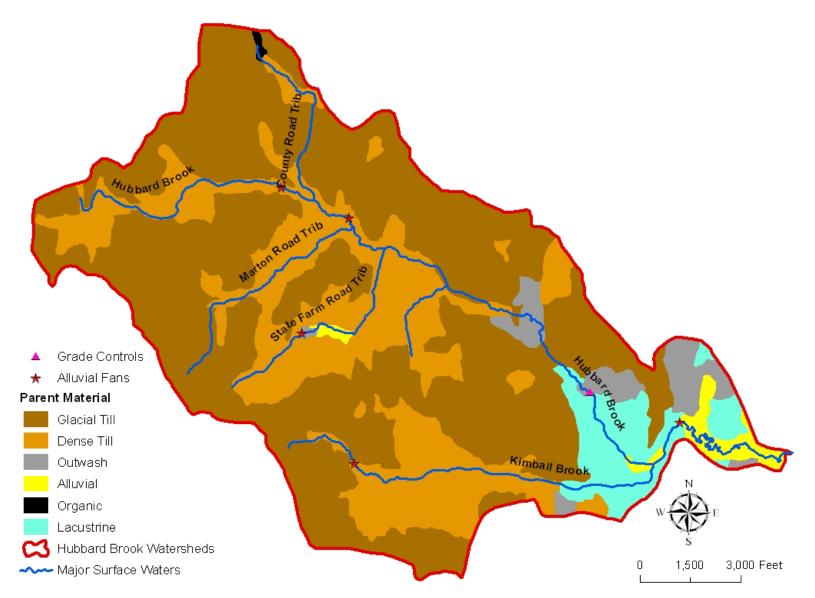


Figure 4. Parent Materials, Alluvial Fans, and Natural Grade Controls within the Hubbard Brook watershed

4.4 Land Cover and Reach Hydrology

Step 4 of the Phase 1 protocols evaluates the impacts of watershed land use, riparian vegetative cover, and other reach-scale controls on hydrologic processes. Conversion of natural forest cover to urban and agricultural land uses in a watershed, even at low levels (e.g., 10% of watershed area), has been shown to have measurable deleterious effects on channel stability and aquatic biota (Paul and Meyer, 2001; CWP, 2003). Loss of forest cover reduces the infiltration capacity of soils, and typically results in increased runoff during infrequent storm events and reduced baseflow during the dry periods of the year. In addition, direct impacts to riparian cover along the river bank and within the corridor are also known to have negative impacts on channel stability (e.g., loss of boundary resistance) and available habitat for biota (e.g., canopy shading, large woody debris, etc.). Other local-scale influences on reach hydrology include adjacent wetlands, small tributaries, and other sources of groundwater inputs. These areas provide important inputs of cooler waters that are critical for microhabitats, especially during the late summer and fall months when water temperatures can become elevated to levels that are harmful to native stenotherms.

Land cover in the Hubbard Brook watershed was summarized with the SGAT tool using data derived from 1992 satellite imagery (VCGI, 2003). This dataset was clipped to the local watershed (e.g., area draining directly to reach) and stream corridor to understand the impacts to each reach at each scale. Impact ratings were automatically generated upon upload of the data to the DMS based on the rankings provided in Table 6. In addition to the DMS summarized data, more recent land cover data was summarized at the watershed scale, as previously reviewed in Table 1 in Section 2.1.

Table 6. SGA Land Use Impact Ratings				
Impact Rating Land Cover Value				
High	10% or more of reach watershed is crop and/or urban			
Low	Between 2 - 10% of reach watershed is crop and/or urban			
Not Significant	Less than 2% of reach watershed is crop and/or urban			

Historic land cover data for the reach watershed and corridor scales was reviewed using a series of aerial photographs of the study area from 1963 available through the UVM Baily/Howe Library. The images were georectified and overlain on the subwatershed mapping to understand land use changes over the last 40 years. In general, that watershed was a mixture between agriculture and forest lands in the 1960's, however the forest

stands were likely much younger and homogenous. The current dominant land cover type for the entire watershed is forest, because much of the suboptimal farmland was abandoned. Along the mainstem of Lower Hubbard Brook, between Route 5 and Lake Runnemede the land was historically used for agricultural activities (Figure 5). That land has been abandoned sometime within the last 40 years and is now unmanaged wetlands (Figure 6).

The watershed has seen some urbanization since the 1960's, but much of the developed land predates 1963. The upper watershed (M09 and M10) and lower watershed (M01, M02, and M03) have "high" impact scores, as well as tributaries M6-S1.01 and T1 (reaches T1.01 and T1.02). The rest of the watershed received "low" ratings for the watershed land cover with between 5 and 10 percent urban coverage within each subwatershed. The corridor land use was variable with many of the mid-watershed reaches that have had extensive agriculture scoring "high." Several reaches including M02, M03, and T1.04 had less than 5 percent of the corridor developed; because of this those reaches received "not significant" impact ratings.

Riparian buffer widths were estimated remotely and verified in the field where possible during the windshield surveys. Areas where the buffer widths were less than 25 feet were mapped remotely and indexed using the FIT. Areas that received high impact scores for the lack of a healthy riparian buffer were those associated with alluvial and dense till valleys where adjacent lands have been intensively used for agricultural or residential land uses including the presence of roadways. Reaches in this condition include M06, M6-S1.01, M07, M08, T1.03, T2, and T4.01.

Groundwater and small tributary inputs were reviewed for each reach using the National Wetlands Inventory (NWI, 2003) and the Vermont Hydrography Dataset. Additional detailed information about each Step 4 parameter for all reaches is found in the watershed summary data and reach reports found in Appendices A and B, respectively.

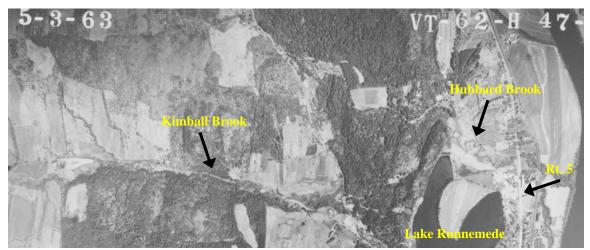


Figure 5. 1963 aerial photograph of the lower Hubbard Brook watershed



Figure 6. 2003 aerial photograph of the lower Hubbard Brook watershed

4.5 Instream Channel Modifications

Data collected as part of SGA Step 5 aids in the understanding of how direct impacts to the channel boundaries have altered the sediment supply and transport regimes at the reach scale. Flow-regulating structures that span the channel impact the natural flow variability in downstream reaches, and interrupt the sediment supply along the channel network. These features often result in reduced instream habitat as well as channel incision in downstream areas where the sediment transport capacity exceeds the limited supply from upslope. Bridges and culverts that are inadequately sized to accommodate channel forming flows have similar impacts to habitat and sediment transport as flow-regulating structures. In addition, culverts that have severely "perched" outlets create a discontinuity in habitat along the channel by preventing fish passage. Bank armoring,

channel straightening, and dredging are human impacts that increase the sediment transport capacity of the channel through the increased resistance to lateral migration and channel slope. Further discussion of the impacts of instream channel modifications is provided in the SGA Phase 1 Handbook (VTANR, 2007b). Reaches with significant impacts from these features are summarized below. Additional detailed information about each Step 4 parameter for all reaches is found in the watershed summary data and reach reports found in Appendices A and B, respectively.

Impoundments and Flow Regulations

Flow regulations have been reviewed and mapped using the VTANR Dam Inventory (VTANR, 2005), as well as further field observations and discussions with VTDEC staff. These features are summarized below for the mainstem and tributary reaches. Each of the flow regulations indexed with the FIT is considered a run-of-the-river feature (e.g., no current water withdrawals).

Using aerial imagery, a total of three impoundments were observed in the basin. All three of these features were considered large run-of-the-river because the width of the impounded area was larger than that of the channel. The only flow regulation feature located on the mainstem was found in the headwaters reach M10 where the channel has been backed up to create a pond near a residence. The other impoundments were located on Kimball Brook and Marton Road tributary. The Kimball Brook impoundment, located on reach T1.03, was directly upstream of the Hunt Road crossing and a large area used for grazing cattle (Figure 7). The other impoundment is located in the headwaters of reach T3.01, along side of Pond Road. The correctional facility along State Farm Road has a small water withdrawal used to fill their fire pond (Cueto, 2008). The fire pond was too small to show up on the imagery and no water withdrawal was indexed using FIT, because the exact location is unknown.

Bridges and Culverts

The locations and lengths of bridge and culvert crossings were mapped remotely and were verified in the field where possible. A total of 39 structures were noted on the 20 assessed reaches. Reaches M05, M06, M08, M09, T1.01, and T2.01 had impact ratings of "low," where at least 5 percent of the channel length is occupied by a bridge or culvert. Reach M05 is intersected by Interstate 91, and had the greatest single impact with approximately 200 feet of the channel piped under the highway in a culvert. Culverts and bridges can also act as a constriction point to the channel at various flow depths, or inhibit the passage of wildlife like the perched culvert observed in reach M07 (Figure 8).



Figure 7. Impoundment upstream of Hunt Road

Figure 8. Perched culvert at the State Farm Road Crossing

Bank Armoring

Bank armoring and revetments were noted in as much detail as possible during the windshield surveys. Only one reach had significant amounts of bank armoring. This

reach, T2.01 was heavily armored and riprapped as part of an effort to stabilize the left bank of the channel where it was encroached upon by the road (Figure 9). In total approximately 1045 feet of the channel bank was stabilized using large boulders piled on a 45° slope to a height of about 25 feet. This effort has significantly affected the natural course of the stream.

Channel Straightening and Dredging Historic aerial photographs from 1962 and



Figure 9. Rip-rap on the left bank of reach T2.01 along State Farm Road

recent NAIP color imagery from 2003 were utilized to identify areas of channel straightening. In addition, field observations were made to verify areas of inferred channel straightening from available mapping. These areas are summarized below for the mainstem and tributary reaches in Table 7.

It is not known whether or not dredging has occurred historically at the alluvial fan locations or elsewhere in the watershed to manage the build up of sediment. Due to the relatively small watershed size (6.3 sq. mi.), the transport capacity of the channel is not as

high as it would be for larger drainage basins. Under these conditions areas of large gravel deposition are not as likely to occur, therefore obviating the need for dredging.

Tuble 7. Summary of Chamiler Straightening and Dreaging						
Pronch / Tributory Nome	Reach ID	Channel Strai	Dredging			
Branch/ Tributary Name		% of Reach	Impact	Туре	Impact	
Hubbard Mainstem	M01	17.1	Low	None		
Hubbard Mainstem	M05	59.9	High	None		
Hubbard Mainstem	M06	4.2	N.S.	None		
Unnamed Subtributary	M6-S1.01	54.7	High	None		
Hubbard Mainstem	M10	24.0	High	None		
Kimball Brook	T1.03	47.7	High	None		
State Farm Road Tributary	T2.01	90.3	High	None		
State Farm Road Tributary	T2.02	19.1	Low	None		

 Table 7. Summary of Channel Straightening and Dredging

In addition to a high degree of channel straightening in Reach T1.03 (Kimball Brook) this area has been greatly influence by other anthropogenic activities. There, the channelized stream bed has been left open for grazing cattle. Not only does this damage the stream banks, increasing sediment loads, but it acts as a point source for phosphorus and nitrogen pollution (Figure 10).

4.6 Floodplain Modifications and Planform Changes



Figure 10. Cows watering in the channel in Kimball Brook reach T1.03

Due to the historical development of road networks and settlement patterns in the lowland areas of Vermont, many alluvial rivers and their floodplains have been encroachned upon by roads and development over the years. As discussed in the previous section, many of these areas have also been historically manipulated and straightened to maintain an unnaturally steep slope in a state of sediment transport, allowing for a shortterm sense of security from flooding and subsequent encroachment of infrastructure in the floodplain. 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., berming) has resulted in an increase in channel depth (VTANR, 2007a). Channel depths have typically been increased through the encroachment on the floodplain by roads, development 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).

These human impacts tend to induce a series of channel adjustments that begin with channel incision, leading to widening and eventually a redevelopment of a sinuous planform in alluvial reaches. Reaches with significant impacts associated with the above-described human impacts are summarized below according to the SGA impact ratings listed in Table 8. Reaches affected by an increase in depositional or migrational features are also summarized below. Additional detailed information about each Step 5 parameter for all reaches is found in the watershed summary data and reach reports found in Appendices A and B, respectively.

Table 8. Impact Ratings for Corridor Encroachments and Development				
Impact Rating	Impact Criteria			
High	Greater than 20% of reach length affected.			
Low	Between 5 - 20% of reach length affected.			
Not Significant	Less than 5% of reach length affected.			

Encroachments

Following the Phase 1 protocol, any berms, roads, driveways, railroads and/or improved paths found within the stream corridor were indexed using the FIT. These areas were identified using the 2003 NAIP aerial imagery, and were confirmed and/or refined during the field observations. Figure 11 depicts the reaches where encroachment has significantly impacted the stream corridor, with ratings based on the percentage of the reach length that was impacted as indicated in Table 8. All encroachments noted in the watershed were from roads (Figure 12), however further Phase 2 assessments may reveal additional berm encroachments that were not observed remotely or during the windshield surveys.

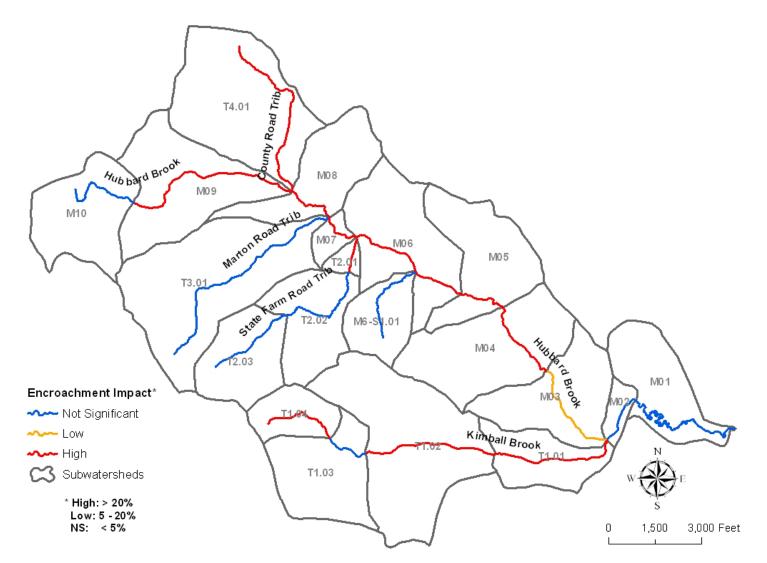


Figure 11. Impacts from corridor encroachments in the Hubbard Brook watershed

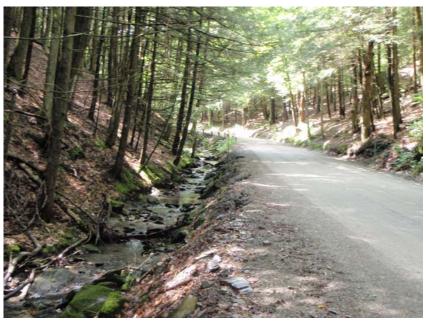


Figure 12. Corridor encroachment along Weeden Hill Road in reach M09

Development

The impact of development within the stream corridor was evaluated using the 2003 NAIP aerial imagery, and confirmed and/or refined during the field observations. The presence of development was indexed using the FIT, and impact ratings for each reach were developed based on SGA criteria presented in Table 8. The majority of the development observed on the mainstem was on mid and upper reaches M04, M05, M06, M07, M08 and M10. The lower watershed is either abandoned agricultural land that has since become wetland (M01), or protected in Paradise Park (M02 & M03). These factors keep the lower watershed relatively void of any significant development. With the exception of reach T4.01 and M6-S1.01, the tributaries of the Hubbard Brook were mostly undeveloped. These two reaches had an impact rating of low, from a scattered house or farm that was within the stream corridor.

Depositional Features

Sediment depositional features (e.g., point bars, mid channel bars, etc.) were evaluated using the 2003 NAIP aerial imagery, and were confirmed and/or refined during the field observations. Reaches with multiple types of depositional features indicated where upslope sediment supply exceeded the transport capacity. These areas represent conditions that are favorable for increased lateral channel migration that could endanger adjacent infrastructure and properties. For most of the watershed it was difficult to access the stream channel remotely (due to the channel's small size), or to get a clear sense of

the depositional processes at the access points during the windshield surveys. Given the relatively small size of the watershed, and forest cover over much of the area, only about one-half of the reaches were assessed for depositional features. Despite the drawbacks in reach accessibility, several reaches were deemed to have a "low" impact from depositional material and one reach had a "high" impact rating. This reach, M04, had an abundance of sediment on the point bars upstream and downstream of the Juniper Hill Road crossing. Here, the upslope sediment supply greatly exceeds the transport capacity of the channel (Figure 13). Additional detailed data about the types of depositional features and their relative impacts for all reaches are found in the reach reports found in Appendix A.



Figure 13. High degree of deposition on the point bars of reach M04

Meander Migration

Recent and historic aerial photographs and imagery were reviewed to identify areas of channel migration, bifurcation, and avulsions on the Hubbard Brook mainstem and its tributaries. Historical photographs from 1963 were reviewed. For areas where significant channel migration was noted, the historical imagery was georectified using ArcGIS software to transform the mapping into the NAD 1983 State Plane Meter projections. Previous channel locations (1963) were compared with the Vermont Hydrography Dataset stream centerlines developed from the aerial photographs taken in 1994 for the watershed. M01 showed a dramatic change in planform with extensive meander

migration. Some of the geomorphic changes that have occurred over the last 40 years are highlighted in Figure 14.

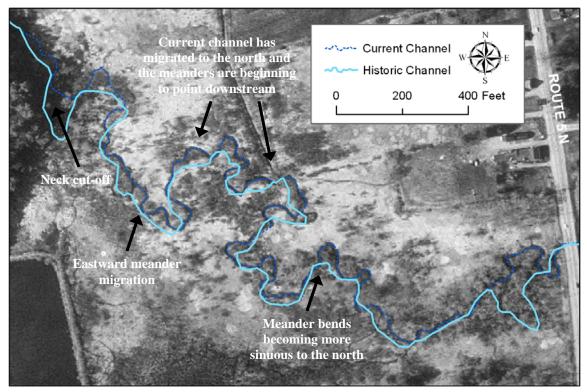


Figure 14. The changes in channel planform from 1963 to 1994 on reach M01

Meander Geometry

For reaches characterized within unconfined valley settings (C or E-type channels), meander geometry was reviewed following the Phase 1 protocols. Shapefiles were developed to indicate the areas where meander width and wavelength was measured. In some cases, multiple meanders were measured and an average of the measurements was entered in the DMS. Where the meander wavelengths and widths fell outside of the range of expected values relative to the predicted channel width, impact ratings of high or low were assigned according to the degree of departure (VTANR, 2007b). Only seven of the 20 total reaches assessed were set in a valley suitable for meander geometry risk assessments. In addition to Reach M01 (Figure 14), M05 and T1.03 also received a "high" impact scores for both meander geometry criteria.

4.7 Bed and Bank Windshield Surveys

Windshield surveys were completed following the initial classification of stream type and substrate based on remotely sensed data alone. Surveys were completed in mid-July on

all reaches accessible by public roads. Eighteen (18) of the 20 total reaches in the study area were at least partially accessible by roads and were viewed. Only subtributary M6-S1.01 and M02 were located in inaccessible terrain were not evaluated. The DMS metadata for Step 2 has been revised and indicates whether or not the reach was evaluated in the field. The Phase 1 parameters verified and/or evaluated during the field surveys included:

- General stream and valley geometry, including valley width and confinement, bed substrate, and bedform features (Step 2).
- Grade controls and areas of known or potential alluvial fans (Step 3).
- Impacts on the buffer and stream corridor, including areas of reduced buffer vegetation, road encroachments, and the presence of development within the stream corridor (Steps 4 and 6).
- Types of stream crossing structures (e.g., bridges and culverts), and their potential for causing ice and debris jams (Steps 5 and 7).
- Areas of bank erosion and armoring (Steps 5 and 7).
- Areas of increased sediment deposition and meander migration (Step 6).

Of the parameters listed above, particular attention was paid to recording bank erosion and ice/debris jam potential at the stream crossings. Due to limited direct accessibility on most reaches, bank erosion along the entire channel length was not practical; rather, bank erosion plainly visible along roads or at stream crossings was indexed using the FIT. Therefore the relative length of the reach impacted by bank erosion was likely underestimated compared to typical Phase 2 field observations. Debris and ice jam potential at points of channel constrictions associated with stream crossings and sharp channel bends were recorded in the field. Qualitative ratings of the impact of these areas on sediment and debris continuity were developed and entered into the DMS. Table 9 summarizes those reaches where impacts from bank erosion or ice and debris jam potential were noted.

Branch or Tributary	Reach ID	Bank Erosion		Ice and Debris Jams	
Name	Keach ID	% of Reach	Height (ft)	Types	Impact
Hubbard Mainstem	M09*	16.4%	3.0	Culvert	High
Kimball Brook	T1.01	0.0%	NE	Multiple**	High
County Rd. Tributary	T4.01*	8.2%	3.0	Culvert	Low

Table 9. Select Reaches with Observed Bank Erosion or Ice and Debris Jam Potential

*Both reaches with bank erosion had impact ratings of "low"

** "Multiple" potentials was used when no one source could be identified as dominent NE: Not evaluated

5.0 Data Analysis

Impact scores have been generated for each of the Phase 1 steps for the 20 study reaches. The Phase 1 dataset in the DMS summarizes these scores under 4 separate impact categories as summarized in Table 11. Impact scores range from zero ("not significant") to 2 ("high") depending on the degree of impact recorded for each parameter. The 16 parameters evaluated for impacts and summarized for each study reach are presented in Table 10. Figure 15 presents the impact scores for each study reach, with the scores organized by quartiles. An additional table in Appendix A summarizes the impact scores by reach.

Table 10. Final Impact Score Parameters for Phase 1 Dataset				
Phase 1	Phase 1 Parameter	Impact		
4.1	Local Watershed Land Cover/Land Use			
4.2	Corridor Watershed Land Cover/Land Use	Land Use		
4.3	Riparian Buffer Width			
5.1	Flow Regulations			
5.2	Bridges and Culverts	Channel		
5.3	Bank Armoring	Modifications		
5.4	Channel Straightening	ening		
5.5	Dredging and Gravel Mining			
6.1	River Corridor Encroachments			
6.2	River Corridor Development	Floodplain		
6.3	Depositional Features	Modifications		
6.4	Meander Migration	and Planform		
6.5	Meander Belt Width Departure	Changes		
6.6	Meander Wavelength Departure			
7.2	Bank Erosion	Bed and Bank		
7.3	Debris and Ice Jam Potential	Conditions		

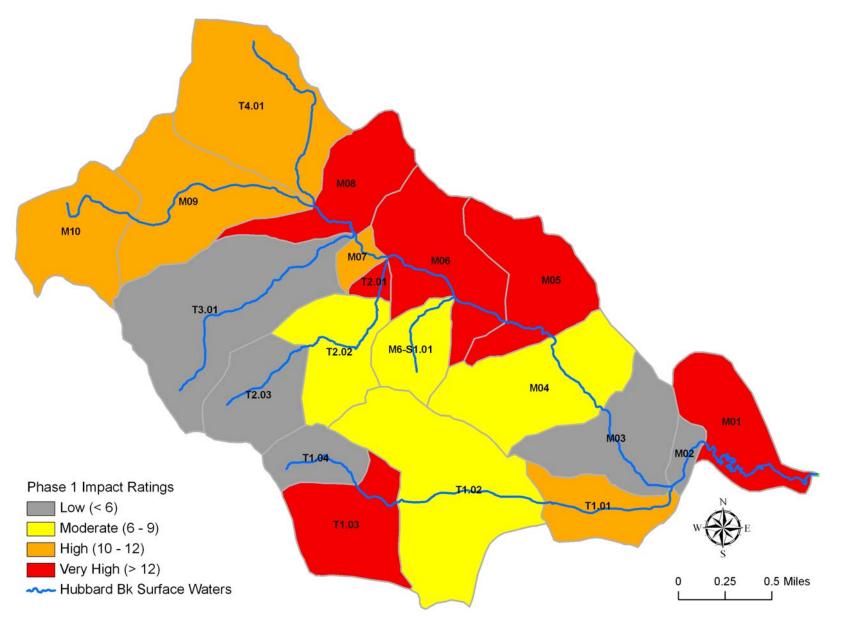


Figure 15. Phase 1 final impact ratings for the Hubbard Brook subwatersheds and reaches

Based on the Phase 1 impact scores, the DMS also develops predictions for channel adjustment processes (VTANR, 2007b). 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). 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 (page 76; VTANR, 2007b). Table 11 outlines the four possible geomorphic ratings based on the SGA methods. An additional table in Appendix A summarizes the predicted reach adjustment processes, as well as stream sensitivity ratings. Both of these parameters have been used in conjunction with the overall impact scores in developing recommendations for further Phase 2 assessment.

	Table 11. 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 t

Table 11 SGA Peach Condition Patings

6.0 Phase 2 Recommendations

Using the Phase 1 Impact Ratings as the primary basis for reach selection, a list of high and medium-priority reaches has been compiled for further Phase 2 surveys. Figure 16 presents the selected reaches by location in the watershed. Table 12 summarizes the selected reaches based on watershed location, channel length, and preliminary reference stream type.

High Priority Reaches

Nine (9) reaches are considered high-priority for assessment, including 8 reaches on the main stem and 1 reach on Kimball Brook. The total channel length for the selected reaches is 5.3 miles. Reaches M02 and M03 were considered high priority reaches for phase 2 assessments, despite their lower impact scores, because it will be important to have a continuous dataset of along the channel network from M01 upslope. These reaches received relatively low scores because there were limited roads and areas of development in the vicinity of Paradise Park.

Medium Priority Reaches

Three (3) additional reaches have been included as medium-priority reaches due to their relative impact ranking and location in the watershed. Kimball Brook reaches T1.02 and T2.03 were chosen because of the significant size of the upslope drainage area and their high impact scores. T1.03 had extensive impacts from agricultural activities and could be a potential site for a buffer enhancement project (see Figure 10). State Farm Road tributary, reach T2.01, was also chosen as a medium priority reach because of the extensive restoration project that was done to manage erosion of the left bank. Field observations revealed a mass failure that may be related to the recent restoration efforts.

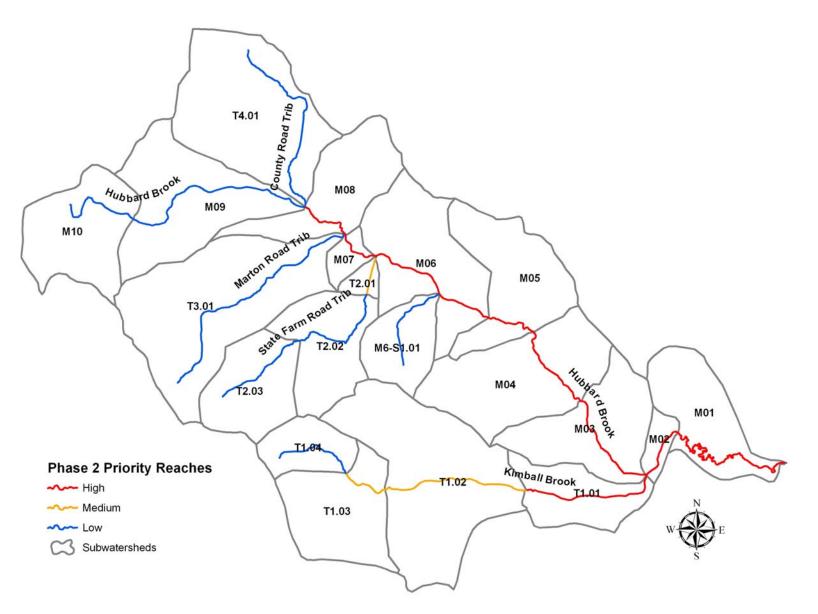


Figure 16. Selected reaches for Phase 2 assessment

Reach II	D Surface Water	Channel Length (ft)	Stream Type	Bed Material	Bedform	Impact Score	Phase 2 Priority
M01	Hubbard Brook	6,763	E	Gravel	Dune-Ripple	14	High
M02	Hubbard Brook	1,788	B _c	Cobble	Riffle-Pool	2	High
M03	Hubbard Brook	3,388	А	Cobble	Step-Pool	4	High
M04	Hubbard Brook	2,801	B _c	Gravel	Riffle-Pool	9	High
M05	Hubbard Brook	1,630	C _b	Cobble	Riffle-Pool	15	High
M06	Hubbard Brook	4,190	C _b	Cobble	Riffle-Pool	13	High
M07	Hubbard Brook	1,313	В	Cobble	Plane Bed	10	High
M08	Hubbard Brook	1,767	C _b	Cobble	Riffle-Pool	13	High
T1.01	Kimball Brook	4,131	А	Cobble	Step-Pool	10	High
T1.02	Kimball Brook	4,393	А	Cobble	Step-Pool	8	Medium
T1.03	Kimball Brook	1,483	C _b	Gravel	Riffle-Pool	14	Medium
T2.01	State Farm Rd. Tributary	1,106	А	Cobble	Step-Pool	14	Medium
		# of Reaches	Miles				
	*High Priority Reaches	9	5.3				
**Hi	gh and Medium Priority Reaches	12	6.6				

 Table 12. Selected Reaches for Phase 2 Assessments

7.0 Conclusions

The following are some of the key conclusions from this work that will help the SWCRPC and PPC look forward to additional data collection and restoration planning in the watershed.

- Approximately two-thirds of reaches are dominated by sediment transport processes, with the remaining dominated by depositional processes under natural conditions. However, sediment transport processes in the upper watershed have likely been increased by extensive stream corridor and floodplain encroachment from County Road. This may be resulting in increased deposition of sediment in the lower reaches of the watershed in the vicinity of Paradise Park.
- Increased sediment deposition in Reach M01 below Paradise Park is likely attributable to a high sediment supply from upslope reaches, the redevelopment of a meandering channel form following past channel straightening, and the presence of beaver dams in areas that were historically managed to be free of beavers.

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- The highly erodible glacio-lacustrine soils in the lower watershed cause naturally high rates of hill slope erosion and gully formation in the steep areas around Paradise Park. Runoff from the paved roads on steep terrain around the park (e.g., Juniper Hill Road) needs to be properly managed to prevent additional gully formation on the steep slopes leading down to the park.
- Additional work to inventory stormwater conveyances and outfalls directly to Hubbard and Kimball Brooks would be highly valuable and supportive of Phase 2 geomorphic assessment data. Stormwater outfalls draining directly to the channel that carry large amounts of fine sediment could be targeted for mitigation.
 Financial assistance is available from the Vermont Clean and Clear and Better Backroads programs for these purposes.

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Appendix A

Watershed Summary Data

	Elev	ation	Valley	Valley	Channel	Channel		Watershed	Channel	Valley				
	Up	Down	Length	Slope	Length	Slope		Area	Width	Width	Confir	nement	Reference	
Reach ID	(ft.)	(ft.)	(ft.)	(%)	(ft.)	(%)	Sinuosity	(sq. mi.)	(ft.)	(ft.)	Ratio	Type*	Stream Type	Bedform
M01	322	303	3695	0.51	6763	0.28	1.83	6.26	29.4	464	15.8	VB	E	Dune-Ripple
M02	340	322	1687	1.07	1788	1.01	1.06	5.98	28.8	95	3.3	SC	В	Riffle-Pool
M03	480	340	3300	4.24	3388	4.13	1.03	4.6	25.7	60	2.3	SC	А	Step-Pool
M04	531	480	2600	1.96	2801	1.82	1.08	4.27	24.8	100	4	NW	В	Riffle-Pool
M05	570	531	1430	2.73	1630	2.39	1.14	3.82	23.6	112	4.7	NW	С	Riffle-Pool
M06	685	570	4060	2.83	4190	2.74	1.03	3.48	22.7	105	4.6	NW	С	Riffle-Pool
M07	718	685	1275	2.59	1313	2.51	1.03	2.34	19.1	75	3.9	SC	В	Plane Bed
M08	766	718	1600	3.00	1767	2.72	1.1	2.29	18.9	85	4.5	NW	С	Riffle-Pool
M09	1158	766	5900	6.64	6079	6.45	1.03	0.77	11.7	35	3	SC	А	Step-Pool
M10	1210	1158	2676	1.94	2803	1.86	1.05	0.32	8	218	27.3	VB	С	Riffle-Pool
M6-S1.01	996	621	2760	13.59	2852	13.15	1.03	0.17	6.1	12	2	NC	А	Cascade
T1.01	580	340	4100	5.85	4131	5.81	1.01	1.32	14.8	35	2.4	SC	А	Step-Pool
T1.02	837	580	4210	6.10	4393	5.85	1.04	1.11	13.7	25	1.8	NC	А	Step-Pool
T1.03	883	837	1467	3.14	1483	3.10	1.01	0.45	9.2	180	19.5	VB	С	Riffle-Pool
T1.04	1168	883	2470	11.54	2574	11.07	1.04	0.14	5.5	20	3.6	SC	А	Step-Pool
T2.01	791	688	1100	9.36	1106	9.31	1.01	0.55	10.1	18	1.8	NC	А	Step-Pool
T2.02	867	791	3173	2.40	3349	2.27	1.06	0.52	9.8	226	22.9	VB	С	Riffle-Pool
T2.03	1173	867	2875	10.64	2978	10.28	1.04	0.25	7.2	25	3.5	SC	А	Step-Pool
T3.01	1261	720	7350	7.36	7621	7.10	1.04	0.67	11	30	2.7	SC	А	Step-Pool
T4.01	1012	767	5875	4.17	6055	4.05	1.03	0.56	10.2	50	4.9	NW	В	Step-Pool

Hubbard Brook Preliminary Stream Types (Step 2)

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

							Step	o Numb	er [†] with	Impact	Score*						Total
Reach ID	4.1	4.2	4.3	5.1	5.2	5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.2	7.3	Score
M01	2	2	1	0	0	0	1	0	0	0	1	2	2	2	0	1	14
M02	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
M03	2	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	4
M04	1	2	0	0	0	0	0	0	2	1	2	0	0	0	0	1	9
M05	1	2	0	0	1	0	2	0	2	2	0	0	2	2	0	1	15
M06	1	2	2	0	1	0	0	0	2	1	1	0	2	0	0	1	13
M07	1	2	2	0	0	0	0	0	2	2	0	0	0	0	0	1	10
M08	1	2	2	0	1	0	0	0	2	2	0	0	2	0	0	1	13
M09	2	2	1	0	1	0	0	0	2	0	1	0	0	0	1	2	12
M10	2	1	1	2	0	0	2	0	0	1	0	0	1	1	0	0	11
M6-S1.01	2	1	2	0	0	0	2	0	0	1	0	0	0	0	0	0	8
T1.01	2	2	0	0	1	0	0	0	2	0	1	0	0	0	0	2	10
T1.02	2	2	0	0	0	0	0	0	2	0	1	0	0	0	0	1	8
T1.03	1	2	2	2	0	0	2	0	0	0	0	0	2	2	0	1	14
T1.04	1	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	4
T2.01	1	2	2	0	1	2	2	0	2	0	1	0	0	0	0	1	14
T2.02	1	1	2	0	0	0	1	0	0	0	0	0	1	1	0	0	7
T2.03	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	1	5
T3.01	1	1	0	2	0	0	0	0	0	0	0	0	0	0	0	1	5
T4.01	1	2	2	0	0	0	0	0	2	1	0	0	0	0	1	1	10

Hubbard Brook Impact Ratings (Step 8)

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

† Step 4: Land Cover and Reach Hydrology

Step 5: Channel Modifications

Step 6: Floodplain Modifications and Planform Changes

Step 7: Bed and Bank Condition

	9.1	Predicted Adjus	tment Scores	5	9.2 Reach	Condition	9.3 Reach
Reach ID	Degradation	Aggradation	Widening	Planform	Project*	Statewide*	Sensitivity
M01	5	7	5	7	Fair	Good	High
M02	4	2	2	0	Good	Reference	Moderate
M03	4	2	2	0	Good	Reference	High
M04	4	3	2	0	Good	Reference	Moderate
M05	9	5	3	8	Fair	Good	Moderate
M06	5	7	5	7	Fair	Good	Moderate
M07	6	7	5	5	Fair	Good	Moderate
M08	7	7	5	9	Poor	Good	Moderate
M09	7	9	5	2	Fair	Good	High
M10	8	8	7	8	Poor	Fair	Moderate
M6-S1.01	6	7	7	0	Fair	Good	Very Low
T1.01	7	8	5	2	Fair	Good	High
T1.02	6	6	5	0	Fair	Good	High
T1.03	6	9	7	10	Poor	Fair	High
T1.04	4	2	0	0	Reference	Reference	Very Low
T2.01	9	7	5	0	Fair	Good	High
T2.02	3	4	2	3	Good	Reference	Moderate
T2.03	2	4	2	0	Good	Reference	High
T3.01	4	4	2	0	Good	Reference	High
T4.01	4	5	4	4	Fair	Good	Moderate

Hubbard Brook Predicted Channel Adjustment Processes (Step 9)

* Conditions relative to the Saxtons River watershed ("project") versus overall Vermont ("statewide")

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

Appendix B

Phase 1 Reach Reports

5											
Basin:	Lower Conn					-					
Stream Name:	Hubbard Bro	ok Mai	nstem			Rea	ach	M01			
Topo Maps:	WINDSOR										
Date Last Edited:	Sun, Novem	•									
Watershed:	Black & Ottt	auquec	hee Ri	ivers							
Sub-watershed:	Connecticut	River -	- Whit	e Rive	r to S	ugar F	River				
Is Reach an Impoundment?	No	Q	uality C	Control	Statu	s: Ste	ep 2 de	one			
Step 1. Reach Location											
1.1 Reach Description:	From the co	onfluen	ce witl	n the C	Conne	cticut	River	, this	reach	n exte	nds
1.2 Towns:	Windsor										
1.3 Downstream Latitude:	43.49			ep 4. L		over -	Reach	n Hydr	ology		
1.3 Downstream Longitude	: -72.38			Wate							
Step 2. Stream Type	222			storic L					eld	74 0	
2.1 Elevation Upstream:2.1 Elevation Downstream:	322 303			Irrent E				-		71.() %
2.1 Is Gradient Gentle?	No			Corrie		omma	il Lan			Dall	
2.2 Valley Length:	3695 feet.	0.70 Mil	<i></i> ر: Li:/	torio I	and C	Novor i		C:	eld		
2.3 Valley Slope:	0.51 %								••••	1 201	n 0/
2.4.Channel Length:	6763 feet.	1.28Mil	es	urrent I Irrent S							0 %
2.5 Channel Slope:	0.28 %			Ripar			ii Lan				t Bank
2.6 Sinuosity: 2.7 Watershed Area:	1.83	are Mile	_	minan				>10		>100	
2.7 Watershed Area. 2.8 Channel Width:	6 Squ 29	feet.	.0	b-dom				0-2	-	0-25	
2.9 Valley Width:	464	feet.		ngth w			25 ft.:	234		212	
2.10 Confinement Ratio:	16	1001.		Grour					undar	nt	
2.10 Confinement Type:	Very Broa	d	· · ·	5. Ins							
2.11 Reference Stream Ty		_		Flow	Regul	ation -		Nor	ne		
Bedform:	Dune-Ripp	ole		pe:			None				
Sub-class Slope:	None		Us		00.000		orto	2		1 %	/
Bed Material:	Gravel			Bridg Bank			ens.	2		1 % 0.0	0
Step 3. Basin Characteristics	_		0.0		_eft 0	~ ~	Rio	ht 0.0		0.0	
3.1 Alluvial Fan:	None		5.4	Chan				115		17 %	
3.2 Grade Control:	None	00 (55	Dredg		•	•	Non	е		
3.3 Dominant Geologic Ma		98.2 Glacial	² [%] Ste	p 6. Fl	oodpla	ain Mo	dificat	ions			
3.3 Sub-dominant Geologic 3.4 Left Valley Side	Flat	Siaciai	6.1 E	Berms	and R	oads		ld 0.0		0.0	
3.4 Right Valley Side	Flat		_					Dne Si		Both S	Sides
3.5 Soils	Tat			ad:				0.0	ft. C		ft.
Hydrologic Group:	С	97.5 %		ilroad: rm:).0	ft. C		ft.
Flooding:	Frequent	97.5 %	DC	provec	l Dath).0).0	ft. C ft. C		ft.
Water Table Deep:	1.5	97.5 %		Devel).0).0	ft. C		ft.
Water Table Shallow:	0.0	97.5 %		Chan				Poi			ft.
Erodibility:	slight	0.3 %		Mean			n:		tiple		
7.4 Comments:				Mean		-			0.0 Ra	atio:	1.7
Reach has appeared to mov	va a lot sinco t	ho		Wave					0.0 Ra		3.1
1960's and may have had e			Step	7. Wi	ndshie	eld Sur	vey				
straightening, prior to taking			7.1	Bank	Erosio	on:		().00 ft		
		с-туре	7.2	Bank	Heigh	t:		0.	00 ft.		
geometry.			7.3	Ice/D	ebris J	lam Po	otentia	l: Be	nd		
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	7.2	Total
			0.1	0.2	0.0	0.4	0.0	0.0	1.1	1.2	
2 2 1 0	0 0 1	0	0	0	1	2	2	2	0	1	14
High High Low N.S. N	.S. N.S. Lov	/ N.S.	Unk.	N.S.	Low	High	High	High	N.S.	Low	

										-					· , · · ·	-p
Basin:				Lo	wer C	onne	cticut									
Strean	n Name	e:		Hu	bbard	d Broc	ok Mai	nstem	1		Rea	ach	M02	1		
Topo I	Maps:			WI	NDSC	DR										
•	∟ast Ed	ited:		Su	n, No	vemb	er 30,	2008								
Waters	shed:			Bla	ack &	Ottta	Janec	hee R	ivers							
Sub-w	atershe	ed:					•		e Rive	r to S	ugar I	River				
	ich an l		ndmer						Control		-		ono			
									20111101	Olalu	<u>. o</u>	<u> </u>				
	1. Read			C	onfind	nd ara	a that	ovton	ds fro	m tha	roach	hraa	k ta ti		fluon	~~
	leach E owns:	Jesch	JUON.		indso		a mai	exten	us 110	m the	react	i pred	K IO II	le coi	muen	Ce
	owns. Iownstr	eam l	atitud		3.49	, i		Ste	ep 4. L	and C	over -	Reac	h Hvdi	roloav		
	ownstr			0.					Wate							
	2. Strea							Hi	storic L	and C	Cover:		Fo	orest		
	levatio				40			Cu	urrent E	Domin	ant lar	nd Cov	/er: Fc	orest	73.0) %
	levatio				22			Cu	urrent S	Sub-Do	omina	nt Lan	d Cov	er: Ur	ban	
-	Gradi						0014:1	4.2	2 Corrio	dor						
	alley Le				687 fe 1.07	et. 0	.321/11	^{es.} Hi	storic L	and C	Cover:		Sł	nrub		
	′alley S hannel		łh		1.07 788 fe		.34 Mil		urrent l	Domin	ant la	nd Cov	ver: Fo	orest	53.0	0%
	Channel					% %	.3410111	^{εδ.} Cι	urrent S	Sub-Do	omina	nt Lan	d Cov	er: Ur	ban	
	Sinuosit				.06	/0			8 Ripar		Iffer		Left	Bank	Righ	it Bank
	Vatersh		ea:		6	Squa	re Mile	.0	ominan				>10		>100	
2.8 C	hanne	Width	ו:		<u>29</u>	f	eet.		ib-dom			о г 4.	No	ne	None	9
	alley W		-		95	f	eet.		ngth w				0	. :	0	
	Confine				3	C			Grour 5. Ins		-			nimal		
	Confine Refere					confir	iea	<u> </u>	Flow							
	edform:		licaili		B Riffle-	Pool			pe:	Negui		None				
	b-class		2.		C	1 001		Us								
	ed Mate				Cobbl	e		5.2	2 Bridge	es and	d Culv	erts:	0		0 %	6
Step 3.			octerist		00000	C		5.3	Bank	Armo	ring:				0.0	
<u>.</u>	Iluvial				Yes					_eft 0			9.0 pht			
	Grade C				Non	e			Chan		-	-	0.0		0.0	
	Domina			Mat.:	Glad	ial La	ke68. 1	5.5 ا%	Dredo p 6. Fl	ging H	istory:	-1:C 1	Non	е		
	ub-don		•		Mat.:	AI	luvial		<u>р 6. Fi</u>			alficat			• •	
	eft Vall					ely St		6.1 I	Berms	and R	oads	0	old 0.0 Dne Si		0.0 Both S	idos
	light Va	alley S	ide			ely St	-	Rr	bad:				0.0	ide ft. (
3.5 S								Ra	ailroad:				0.0	ft. C		ft.
	rologic	Group	D:	В		-	5.6 %	Be	erm:				0.0	ft. (ft.
	oding:				one/R		8.1 %	lm	provec	d Path	:		0.0	ft. (ft. ft.
	ter Tab		•	6.			8.1 %	0.2	Devel	lopme	nt:	(0.0	ft. (rt. ft.
	ter Tab	le Sha	allow:	6.			8.1 %	0.0	B Chan				No	Data		11.
	dibility:			50	evere	6	8.1 %	0.4	Mean		•	n:				
7.4 Co	ommen	its:							5 Mean					N/A Ra		0.0
Potent	tial allu	vial fa	n on th	ne lowe	er read	ch wer	e the		Wave	•			1	N/A Ra	atio:	0.0
slope o	change	s rapi	dly an	d the v	valley	widens	6.	·	57. Wi			vey				
	Ŭ	•	-						Bank					0.00 ft		
									2 Bank	0		otoptio		.00 ft.	ام مهم دا	
								1.3	B Ice/D				11: INO	i ⊏val	uated	
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	7.2	Total
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
High	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.	
																,

									-					·)	
Basin:			Lo	wer C	onne	cticut									
Stream N	lame:		Hu	bbarc	d Broo	ok Mai	nstem	۱		Rea	ach	M03			
Торо Ма	os:		WI	NDSC)R										
Date Las	t Edited:		Su	n, No	vemb	er 30,	2008								
Watershe	ed:		Bla	ack &	Ottta	uquec	hee R	ivers							
Sub-wate	ershed:		Co	nnect	ticut F	River -	- Whit	e Rive	r to S	ugar I	River				
Is Reach	an Impou	ndmen	t? No)		Qı	uality (Control	Statu	s: Ste	ep 2 de	one			
Step 1, R	Reach Loc	ation									-				
	ch Descrip		R	each e	extend	ds up f	from o	conflue	ence v	with K	imbal	l Broc	ok to t	he rea	ach
1.2 Tow	•			indso											
	nstream L			3.49			St	ep 4. L	and C	over -	Reac	h Hydi	rology		
	nstream L	•	de: -7	72.40				1 Wate							
	tream Typ		_					storic L					orest		
	ation Ups			80				urrent [-		74.0)%
	ation Dow radient Ge			40 No				urrent S		omina	nt Lan	d Cov	er: Ur	ban	
	ey Length:		יי 3	300 fe	et O	63Mil	4.2 es	? <i>Corri</i> o storic L	or			_			
	ey Slope:		2	1.24	%							-	prest		• • •
	nnel Leng	th:		388 fe		. 64 Mil	es	urrent							0%
	nnel Slope	e:		-	%			urrent S			nt Lan				
2.6 Sinu			1	.03	•			8 Ripar ominan		Iffer				•	t Bank
	ershed Ar		-	5	•	re Mile		ib-dom				>10 Noi	-	>100 None	
	nnel Width ey Width:	1:		26 60		ieet. ieet.		ngth w			25 ft.:	0		0	5
	nfinement	Ratio [.]		2		eet.		Grou				-	nimal	Ū	
	nfinement			_ Semi-o	confir	ned		5. Ins							
	ference St						5.1	Flow	Regul	ation -			ne		
Bedfo	orm:		ę	Step-F	Pool			pe:			None	ļ			
Sub-c	lass Slope	e:	I	None				se:				•		•	,
Bed N	/laterial:		(Cobbl	е			2 Bridg			erts:	0		0 %	6
Step 3. Ba	asin Chara	acteristi	ics:				5.3	Bank	_eft 0	0	Dic	ht 0.0		0.0	
3.1 Alluv				Non			54	l Chan				0.0		0.0	
	de Control			Led	ge					•	•		e	010	
	ninant Geo	<u> </u>		Glac		ke77.t	⁵ %Ste	5 Dredo p 6. Fl	oodpla	ain Mo	dificat	ions	•		
	-dominant		-			iuviai	6.1	Berms	and R	oads	0	ld 17'	1.2 ft.	5 %	
	Valley Sic It Valley S			ery St	-							Dne Si		Both S	Sides
3.5 Soils	•	lue	Ve	ery St	eep			bad:				171.2	ft. C		ft.
	, ogic Grou	o.	В		1	00. %		ailroad:				0.0	ft. C		ft.
Floodin	U 1	0.		one/R		2.2 %	De	erm:	l Dath			0.0	ft. (ft.
	Table Dee	ep:	6.			7.6 %		proved 2 Deve				0.0 109	ft. C ft. C		ft.
	Table Sha	•	6.			7.6 %	0.2	3 Chan				Poi		.0	ft.
Erodibi	ility:		Ve	ery Se	evere8	2.2 %		Mean			n:	1 011			
7.4 Com	ments:							5 Mean		•		N	V/A Ra	atio:	0.0
	ntial for ice	a and a	lobric	iome i	o unki			6 Wave					VA Ra		0.0
•	this reach			•			Step	o 7. Wi	ndshie	eld Su	rvey				
	ich break		•	662260	u upsi	ream,	7.1	Bank	Erosio	on:		(0.00 ft		
al ine rea	ICH DIEak		04.				7.2	2 Bank	Heigh	it:		0.	00 ft.		
							7.3	B Ice/D	ebris J	Jam Po	otentia	il: No	t Eval	uated	
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	7.2	Total
2	0 0	0	0	0	0	0	1	0	1	0	0	0	0	0	4
High N.	S. N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	Low	N.S.	Low	N.S.	N/A	N/A	N.S.	N.S.	
								1						1	

								-	iidou						· / · · ·	
Basin:				Lo	wer C	onne	cticut									
Stream	n Name	e:		Hu	bbarc	d Broo	ok Mai	nste	m		Rea	ach	M04	I		
	Maps:			WI	NDSC)R										
•	ast Ed	ited:		Su	n, No	vemb	er 30,	2008	;							
Waters	shed:								Rivers							
Sub-w	atershe	ed:					•		ite Rive	r to S	uqar F	River				
	ch an I		ndmer						Control		•		one			
	I. Read	-					<u> </u>	Janey	001110	Clara			•			
	each D			P	arallal	ina C	ountv	ВЧ	this rea	ch ev	tonde	throu	nh a r	onfin	od for	ost
	owns:	7030np	50011.		indso		ounty	ING.			lenus	unou	gna			031
	ownstr	eam L	atitud		3.49			S	Step 4. L	and C	over -	Reac	h Hydi	rology		
	ownstr			ide: -7	72.40				.1 Wate							
	2. Strea								listoric l				-	nrub		
	levatio				31				Current I				-		75.0	%
	levatio	-			80				Current S		omina	nt Lan	d Cov	er: Ur	ban	
	Gradie alley Le					t 0	. 49 Mil	~~	.2 Corri							
	alley S					%	.43	Г	listoric l				-	orest		
	hannel		th:		801 fe		.53Mil	es –	Current)%
	hannel					%		C	Current S			nt Lan				
	inuosit			1	.08	_		-	.3 Ripar		Iffer				•	t Bank
	/atersh			-	4	•	re Mile	.0	Dominar				>10	-	>100	
	hannel		า:		25		eet.		Sub-dom .ength w			25 ft ·	26- 0	50	None 0	•
	alley W		Ratio [.]		00 4	1	eet.		.4 Grou				-	nimal	U	
	Confine				Narro	N			ep 5. Ins							
	Refere								.1 Flow							
	dform:				Riffle-	Pool			ype:	0		None				
Su	b-class	s Slope	e:	(Jse:							
	d Mate				Grave	I			.2 Bridg			erts:	1		1 %	0
Step 3.	Basin	Chara	acterist	ics:				5	.3 Bank	Armoi Left 0		Die	ght 0.0		0.0	
3.1 A	lluvial F	Fan:			Non			5	.4 Chan				0.0		0.0	
	irade C				Non	е		_				•		þ	0.0	
	omina		0		Till		39.1	1 % S	.5 Drede	oodpla	ain Mo	dificat	ions	•		
	ub-don			•		Ice-(Conta	ct 6.1	Berms	and R	oads	C	ld 594	4 ft.	21 %	
	eft Vall	,			eep								Dne Si		Both S	ides
3.4 R 3.5 S	ight Va	alley S	lue	51	eep				Road:				594	ft. (ft.
	rologic	Grour	. .	В		6	0.4 %		Railroad				0.0	ft. (ft.
•	iding:	Group	5.		one/R		00. %	L	Berm:				0.0	ft. (ft.
	er Tab	le Dee	n.	6.			5.3 %		mproved				0.0 547	ft. (ft.
	ter Tab		•	6.			5.3 %	0	.2 Deve .3 Chan			ł	Poi	ft. (J.U	ft.
	dibility:						00. %	0	.4 Mear			n.		i i i		
7 4 Cc	ommen	ite.			-				.5 Mear		•		N	V/A Ra	atio:	0.0
				diaataa	that t	ha lau	10 F		.6 Wave					VA Ra		0.0
	indshie		-						ep 7. Wi	•		rvey				
•	n of this						•	7	.1 Bank	Erosio	on:			0.00 ft		
•	avel su					•	sope		.2 Bank					00 ft.		
and co	onfinem	ient in	me up	phet te	ach is	s me			.3 Ice/D	0		otentia	al: Cu	lvert		
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	7.2	Total
4.1	4.2	ч.0	J. I	J.Z	0.0	5.4	0.0	0.1	0.2	0.0	0.4	0.0	0.0	1.1	1.2	i Ulai
1	2	0	0	0	0	0	0	2	1	2	0	0	0	0	1	9
Low	High	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	Higl	h Low	High	N.S.	N/A	N/A	N.S.	Low	
						I	1	I	1	1	I		I	I	1	

						-						
Basin:	Lower C	onne	cticut									
Stream Name:	Hubbard	Broc	ok Mai	nstem	1		Rea	ach	M05			
Topo Maps:	HARTLA	ND, V	VINDS	OR								
Date Last Edited:	Sun, No	vemb	er 30,	2008								
Watershed:	Black &	Ottta	uquec	hee R	ivers							
Sub-watershed:	Connect	ticut F	River -	- Whit	e Rive	r to S	ugar F	River				
Is Reach an Impoundment?	No		Q	uality C	Control	Statu	s: Ste	ep 2 de	one			
Step 1. Reach Location				•								
1.1 Reach Description:	From th	e rea	ch bre	ak thi	s reac	h exte	ends i	upstre	am to	iust		
1.2 Towns:	Windso									J 0.01		
1.3 Downstream Latitude:	43.50			Ste	ep 4. L	and C	over -	Reach	n Hydr	ology		
1.3 Downstream Longitude	e: -72.41				Wate							
Step 2. Stream Type					storic L				-	orest		
2.1 Elevation Upstream:	570				Irrent [-		75.0)%
2.1 Elevation Downstream 2.1 Is Gradient Gentle?	: 531 No				Irrent S		omina	nt Lan	d Cov	er: Ur	ban	
2.2 Valley Length:	1430 fe	et O	. 27 Mil	~~	Corrie							
2.3 Valley Slope:	2.73				storic L					nrub		• • • •
2.4.Channel Length:	1630 fe		.31 Mil	es	urrent							0%
2.5 Channel Slope:		%			Irrent S			nt Lan				
2.6 Sinuosity:	1.14	0		_	Ripar Ripar		Iffer				•	t Bank
2.7 Watershed Area:	4	•	re Mile	.0	ib-dom				>10 26-	-	>100 26-5	
2.8 Channel Width: 2.9 Valley Width:	24 112		feet. feet.		ngth w			25 ft.:	0	50	0	0
2.10 Confinement Ratio:	5		eel.		Grou				-	nimal	Ū	
2.10 Confinement Type:	Narrov	N			5. Ins		-					
2.11 Reference Stream Ty				5.1	Flow	Regul	ation -			ne		
Bedform:	Riffle-	Pool			pe:			None				
Sub-class Slope:	b			Us					•		40 0	,
Bed Material:	Cobbl	е			Bridg			erts:	3		12 %	6
Step 3. Basin Characteristics	<u>s:</u>			5.3	Bank	Armo Left 0	<u> </u>	Rio	ht 0.0		0.0	
3.1 Alluvial Fan:	Non			5.4	Chan				975		59 %	
3.2 Grade Control:	Non			55	Dred		-	-	Non			
3.3 Dominant Geologic Ma			ct 51.9		p 6. Fl				-	-		
3.3 Sub-dominant Geologi			Till	6.1 E	Berms	and R	oads	0	ld 916	6 ft.	56 %	
3.4 Left Valley Side 3.4 Right Valley Side	Steep Steep							(Dne Si	de l	Both S	Sides
3.5 Soils	Sleep				ad:				916	ft. C		ft.
Hydrologic Group:	В	5	1.3 %		ilroad:				0.0	ft. C		ft.
Flooding:	None/R		00. %	De	erm:	1 Dath			0.0	ft. (ft.
Water Table Deep:	2.5		1.3 %		proved Deve).0 571	ft. C ft. C		ft.
Water Table Shallow:	1.5		1.3 %	0.2	Chan			•		Data		ft.
Erodibility:	Very Se			0.0	Mean			n:		- 414		
7.4 Comments:					Mean		•		2	3.6 Ra	atio:	1.0
Channel heavily impacted b	w the leter	etata	01		Wave					3.6 Ra		1.0
		siale-	וט		97. Wi	0		rvey				
crossing.				7.1	Bank	Erosio	on:		(0.00 ft		
				7.2	Bank	Heigh	it:		0.	00 ft.		
				7.3	Ice/D	ebris .	Jam Po	otentia	l: Cu	lvert		
4.1 4.2 4.3 5.1 5	5.2 5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.2	Total
		0.4	0.0	0.1	0.2	0.0	0.7	0.0	0.0	/.1	1.2	
1 2 0 0	1 0	2	0	2	2	0	0	2	2	0	1	15
Low High N.S. N.S. L	ow N.S.	High	N.S.	High	High	N.S.	N.S.	High	High	N.S.	Low	

							-		-					J	
Basin:			Lo	wer C	onne	cticut									
Stream Nam	ne:		Hu	Ibbarc	Broc	ok Mai	nster	n		Rea	ach	M06	Ì		
Topo Maps:			HA	RTLA	ND										
Date Last E	dited:		Su	n, No	vemb	er 30,	2008								
Watershed:				•		uquec		Rivers							
Sub-watersh	ed.					•		te Rive	r to S	ugar I	River				
Is Reach an		ndmor			louti					•					
						Q	Jaility	Control	Statu	s: 5 te	ep z a	one			
Step 1. Rea															
1.1 Reach		otion:				ch bre	ak th	is reac	h exte	ends (upstre	am to	the c	onflue	ence
1.2 Towns:				indso	r		0	ham 4 1			Deeel	اماليما،			
1.3 Downst 1.3 Downst			•••	3.50 72 /1				tep 4. L <i>1 Wate</i>			Reac	п пуа	lology		
Step 2. Strea			iue	2.41				istoric L				Ec	orest		
2.1 Elevatio			6	85				urrent [-		75.0	%
2.1 Elevation				70				urrent S				-			///
2.1 Is Grad	ient Ge	entle?	1	lo			Λ	2 Corrie	dor						
2.2 Valley L	•		4	060 fe	et. 0	.77 Mil	^{es.} H	istoric L	_and C	Cover:		Fc	orest		
2.3 Valley S			4	2.05	/0		C	urrent				-		48.0) %
2.4.Channe	<u> </u>			190 fe 2.74	et. U %	.79 Mil		urrent S							,,,
2.5 Channe 2.6 Sinuosi		5.		.03	70		4.	3 Ripar	ian Bu	Iffer		Left	Bank	Righ	t Bank
2.7 Waters		ea:	•	3	Squa	re Mile	_	ominan					100	51-1(
2.8 Channe			2	23	•	eet.	S	ub-dom				0-2		0-25	
2.9 Valley \				05	t	eet.		ength w				304		596	
2.10 Confin				5				4 Grou					nimal		
2.10 Confin				Narro	N			p 5. Ins 1 Flow							
2.11 Refere Bedform		lieam		c Riffle-	Pool			ype:	Regui	au011 -	None		IE		
Sub-clas		<u>.</u>	_	b				se:				•			
Bed Mat	•	5.	-	o Cobbl	•			2 Bridg	es and	d Culv	erts:	3		5 %	6
Step 3. Basin		octerist			C			3 Bank						0.0	
3.1 Alluvial				Non	۵				Left 0			ght 0.0			
3.2 Grade (Non				4 Chan		•	•	176		4 %	
3.3 Domina			Mat.:	Till	-	100	. % 5.	5 Dredo ep 6. Fl	ging H	istory:		Non	е		
3.3 Sub-do		<u> </u>		Mat.:				эр 6. FI			odificat	ions			
3.4 Left Val			-	teep			6. I	Berms	and R	oads	0	ia 36 2 Dne Si	22.0ft.	86 % Both S	idoc
3.4 Right V	alley S	ide	Ve	ery St	eep		R	oad:				3476	ft. 1		lues
3.5 Soils							R	ailroad:				0.0	ft. (ft.
Hydrologic	c Group	D:	С			00. %	В	erm:				0.0	ft. C		ft.
Flooding:				one/R		00. %		nproved	d Path	:	(0.0	ft. (0.0	ft. ft.
Water Tak		•	2.			1.4 %	0.	2 Deve	•		-	729	ft. C).0	ft.
Water Tal		allow:	1.			1.4 %	0.	3 Chan				Side	e		11.
Erodibility			V	ery Se	verei	00. %	0.	4 Mean		•	n:				
7.4 Comme	nts:						-	5 Mean					5.0 Ra		2.9
Sediment loa	ad in u	pper re	each is	high t	from tl	he		6 Wave	•			20	0.0 Ra	atio: 8	8.8
bank failures	s in T2.	01 tha	t have	since	been			p 7. Wi			rvey				
addressed b	y a ma	ssive	bank a	rmorir	ng effo	ort.		1 Bank					0.00 ft	•	
								2 Bank	0		otontia		.00 ft. Iltiple		
							/.	3 Ice/D				11. IVIU			,
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	7.2	Total
1 2	2	0	1	0	0	0	2	1	1	0	2	0	0	1	13
Low High	High	N.S.	Low	N.S.	N.S.	N.S.	High	Low	Low	N.S.	High	N.S.	N.S.	Low	

										-					· · · ·	
Basin:				Lo	wer C	onne	cticut									
Stream	n Name	e:		Hu	bbarc	Broc	ok Mai	nster	n		Rea	ach	M07			
Topo N	Maps:			HA	RTLA	ND										
Date L	•	ited:		Su	n, No	vemb	er 30,	2008								
Waters	shed:			Bla	ack &	Ottta	uquec	hee F	Rivers							
Sub-wa	atershe	ed:					•		te Rive	r to S	ugar F	River				
ls Rea	ch an I	mpou	ndmer						Control		-		one			
Step 1	. Read	h Loc	ation					-								
	each D			Α	short	reach	hthat	exten	ds fror	n the	reach	break	c up to	o the d	crossi	na
	owns:				indso											3
	ownstr			•••	3.51				tep 4. L		over -	Reac	h Hydi	rology		
	ownstr			ide: -7	72.43				1 Wate							
Step 2				_	4.0				istoric L				-	orest		
	levatio				18 95				urrent [-		80.0)%
	levatio Gradie				85 No				urrent S		omina	nt Lan	d Cov	er: Ur	ban	
	alley Le					et. 0	.24Mil	~~	2 Corrie				-			
	alley S				2.59			п	istoric L				-	orest		• • • •
	hannel		th:		313 fe		.25 Mil) %
	hannel		e:		-	%			urrent S			nt Lan				4 Deele
	inuosit			1	.03	Caulo	ro Milo	_	3 Ripar ominan		mer			валк 100	×ign >100	t Bank
	/atersh hannel			4	2 9	•	re Mile [:] eet.	.0	ub-dom				0-2		None	
	alley M		1.		75		eet.		ength w			25 ft.:	327		0	
	Confine		Ratio		4	1	661.	4.	4 Groui	nd Wa	ter Inp	outs:	No	ne	-	
	Confine				Semi-	confir	ned		p 5. Ins					tions		
	Refere	nce St	ream						1 Flow	Regul	ation -			ne		
-	dform:	_			Plane	Bed			ype:			None	•			
	b-class		e:		None				SE: 2 Brida	00.000		orto	1		3 %	/
	d Mate				Cobbl	е			2 Bridg 3 Bank			ens.	I		0.0	0
Step 3.			cteris	tics:				0.		_eft 0		Ric	ht 0.0		0.0	
	lluvial I		_		Non			5.	4 Chan				0.0		0.0	
	rade C				Non Till	e	100	_{o/} 5.	5 Dredg	ging H	istory:	-	Non	е		
	ominaı ub-don		•				100	• ^° <u>Ste</u>	5 Dredo ep 6. Fl	oodpla	ain Mo	dificat	ions			
	eft Vall			0	teep			6.1	Berms	and R	oads	0			54 %	
	ight Va				teep				I				Dne Si		Both S	bides
3.5 S	-								oad: ailroad:				720.0	ft. (ft.
Hydı	rologic	Group) :	С		1	00. %		erm:				0.0 0.0	ft. (ft. (ft.
Floo	ding:			N	one/R	are 1	00. %		nprovec	l Path			0.0	ft. C		ft.
Wate	er Tab	le Dee	ep:	2.	0	1	00. %		2 Deve				388	ft. (ft. ft.
	er Tab	le Sha	allow:	1.			00. %	6.	3 Chan				No	Data		11.
Eroc	dibility:			Ve	ery Se	evere1	00. %	6.	4 Mean	der M	igratio	n:				
7.4 Cc	ommen	its:							5 Mean				Ν	N/A Ra	atio:	0.0
Note: E	Based	on lim	ited fie	eld obs	ervati	ons ar	nd the		6 Wave	•			Ν	VA Ra	atio: (0.0
channe	el slope	e, this	reach	was c	haract	erizec	las		p 7. Wi			rvey				
planeb									1 Bank					0.00 ft		
whethe						•			2 Bank	0				00 ft.		
[I				•		-	1	/.	3 Ice/D				u: CU	lvert	1)
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	7.2	Total
1	2	2	0	0	0	0	0	2	2	0	0	0	0	0	1	10
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.	Low	
	-	-						-	-	1	1	I	1	1	I	

										-					y	
Basin:					wer C											
Stream	n Nam	e:		Hu	bbarc	d Broo	ok Mai	nsten	n		Rea	ach	M08			
Topo I	Maps:			HA	RTLA	ND										
Date L	_ast Ec	dited:		Su	n, No	vemb	er 30,	2008								
Water	shed:			Bla	ack &	Ottta	uquec	hee R	livers							
Sub-w	atersh	ed:		Co	nnect	ticut F	River -	- Whi	te Rive	r to S	ugar F	River				
ls Rea	ich an	Impou	ndmer	nt? No)		Qı	uality	Control	Statu	s: Ste	ep 2 d	one			
Step 1	1. Read	ch Loc	ation													
	leach [Α	nothe	r shoi	t reac	h tha	t is hea	avilv i	nfluer	nced b	v roa	d cros	sinas	s. It
	owns:				indso										J	
			atitude	••	3.51				ep 4. L			Reac	h Hydi	rology		
			ongitu	ide: -7	72.43				1 Wate				_			
	2. Strea			7	<u>cc</u>				istoric L				-	prest		
			tream: /nstrea		66 18				urrent [80.0)%
	s Gradi				No				urrent S 2 <i>Corri</i> e		omina	nt Lan		er: Ur	ban	
	alley L			1	600 fe	et. 0	.30Mil	. <i>4.</i> es. ப	istoric L	ond C) over		CI	nrub		
	alley S	•		3	3.00	%							-		47 (n 0/
	hanne	<u> </u>			767 fe		.33 Mil	es	urrent l urrent S							0%
	hanne		Э:			%			3 Ripar			ni Lan				t Bank
	linuosii Vatersh		00.	1	.10 2	Sana	re Mile	_	ominan					100	51-1	
	hanne			-	2	•	feet.	.0	ub-dom				26-		0-25	
	alley V		••		85		feet.		ength w				43		467	
			Ratio:		5				4 Grou					nimal		
			Type:		Narro	N			p 5. Ins							
			tream			Deal			1 Flow	Regul	ation -	· (old): None		ne		
	edform:			_	Riffle-	2001			/pe: se:			None				
	b-clas	•	e:	-	0 0 - h h l	_			2 Bridg	es and	d Culv	erts:	3		6 %	6
Step 3.	d Mate		otorict		Cobbl	е			3 Bank			0110.	Ŭ		0.0	0
	Iluvial		acterist	105.	Vaa					_eft 0		Rig	ght 0.0			
	Grade C				Yes Non	۵			4 Chan		•	•	0.0		0.0	
			Dogic I	Mat ·	Till	C	100	. % 5.	5 Dredo	ging H	istory:		Non	е		
			Geolo					<u>Ste</u>	b Dredo ep 6. Fl	oodpla	ain Mo	odificat	ions			
	eft Val			-	teep			6.1	Berms	and R	loads	0	nu 14	14.5ft.		idee
3.4 R	light Va	alley S	ide		teep			D	oad:				Dne Si 1414. 5		Both S	laes
3.5 S	Soils				•				ailroad:				1414.3 0.0	ft. C		ft.
Hyd	rologic	: Group	o:	С		5	3.5 %		erm:				0.0	ft. C		ft.
	oding:				one/R		00. %	n In	nproved	l Path	:		0.0	ft. C		ft.
	ter Tab		•	2.			3.5 %	0.4	2 Deve	lopme	nt:		1105	ft. C	0.0	ft. ft.
	ter Tab		allow:	1.			3.5 %	0.0	3 Chan				No	Data		11.
	dibility:			V	ery 26	verei	00. %	0.	4 Mean		•	n:				
7.4 Co	ommer	nts:						-	5 Mean					5.0 Ra		2.9
Potent	tial allu	ivial fa	n comi	ng fro	m the	steep	slopes		6 Wave	•		nuovi	17	0.0 Ra	atio:	9.0
of the	tribs th	nat ente	er into	the lef	ft side	of the			p 7. Wi			ivey				
chann	el.								1 Bank					0.00 ft		
									2 Bank 3 Ice/D	0		otentia		00 ft. Ivert		
								1					а. СИ			I
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	7.2	Total
1	2	2	0	1	0	0	0	2	2	0	0	2	0	0	1	13
Low	High	– High	N.S.	Low	N.S.	N.S.	N.S.	High		N.S.	N.S.	High	N.S.	N.S.	Low	
		3						9.1	3.1							

High High Low

Phase 1 - Reach Summary Report

											· · · ·	
Basin:	Lower C	onneo	cticut									
Stream Name:	Hubbard	Broo	k Mai	nstem			Rea	ach	M09			
Topo Maps:	HARTLA	ND										
Date Last Edited:	Sun, No	vemb	er 30.	2008								
Watershed:	Black &		•		vers							
Sub-watershed:	Connect		•			r to S	uaarl	Divor				
							•					
Is Reach an Impoundment?	NO		Qı	uality C	Control	Statu	s: Ste	ep 2 de	one			
Step 1. Reach Location 1.1 Reach Description: 1.2 Towns:	Long re West W				ted by	Wee	den H	ill Rd.	the re	each e	ends a	it a
1.3 Downstream Latitude:	43.51	musu	· , •••••		n 4 I	and C	over -	Reach	n Hydr	vpolor		
1.3 Downstream Longitude					Wate		0101	ricaol	- i i y ai	lology		
Step 2. Stream Type					storic L		over:		Fo	orest		
2.1 Elevation Upstream:	1158			-				nd Cov			78.0) %
2.1 Elevation Downstream	766							nt Lan	-			,,,,
2.1 Is Gradient Gentle?	No			4.2	Corrie	dor						
2.2 Valley Length:	5900 fe		. 12 Mile	es. His	storic L	and C	Cover:		Fo	orest		
2.3 Valley Slope:	6.64							nd Cov	-		46.	0%
2.4.Channel Length:	6079 fe		.15 Mil	AS .				nt Lan				
2.5 Channel Slope: 2.6 Sinuosity:	6.45 1.03	%			Ripar							t Bank
2.7 Watershed Area:	1.05	Squar	re Mile	_	minan				>10		>100	
2.8 Channel Width:	12	•	eet.	Su	b-dom				26-	50	0-25	
2.9 Valley Width:	35		eet.		ngth w				0		328	
2.10 Confinement Ratio:	3				Grour					undar	nt	
2.10 Confinement Type:	Semi-	confin	ed					nel Mo				
2.11 Reference Stream Ty						Regul	ation -	(old):		ne		
Bedform:	Step-F	' 00l			pe:			None	1			
Sub-class Slope:	None			Us 5.2	e. Bridg	00 000		orte	5		6 %	4
Bed Material:	Cobbl	е			Bank			ents.	5		0.0	0
Step 3. Basin Characteristics				0.0		Left 0		Rio	jht 0.0		0.0	
3.1 Alluvial Fan:	Yes	_		5.4	Chan				0.0		0.0	
3.2 Grade Control:	Non	е	400					-	Non	е		
3.3 Dominant Geologic Ma			100	.%5.5 Stel	o 6. Fl	oodpla	ain Mo	dificat	ions			
3.3 Sub-dominant Geologi				6.1 E	Berms	and R	oads	0	ld 54	52 ft.	89 %	
3.4 Left Valley Side 3.4 Right Valley Side	Very St	•						C	Dne Si	ide	Both S	Sides
3.5 Soils	Extrem	ery Su	eep		ad:				5452	ft. (ft.
Hydrologic Group:	С	8	1.9 %		ilroad:				0.0	ft. (ft.
Flooding:	None/R			De	rm:	1 Dath			0.0	ft. (ft.
Water Table Deep:	2.0		1.9 %		provec Deve				D.0 149	ft. (ft. (ft.
Water Table Shallow:	1.0		1.9 %	0.2	Chan	•			Side		.0	ft.
Erodibility:	Very Se			0.0	Mean			n.	Olu			
7.4 Comments:	-			0.4	Mean		•		N	V/A Ra	atio:	0.0
			ha francis	66	Wave					VA Ra		0.0
Lots of road crossings and e		•			7. Wi	•		rvey	•			
the encroachment througho					Bank				90	97.11 ·	ft.	
alluvial fan on the lower rea		ie slop	e		Bank					.00 ft.		
changes and the valley wide	ens.					0		otentia		lvert		
		F 4									7.0	-
4.1 4.2 4.3 5.1 5	5.2 5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.2	Total
2 2 1 0	1 0	0	0	2	0	1	0	0	0	1	2	12

N.S. Low N.S. N.S. N.S. High N.S. Low N.S. N/A N/A Low High

										-			••••••		· / · · ·	-P
Basin	n:			Lo	wer C	onne	cticut									
Strea	m Name	e:		Hu	ubbarc	Broc	k Mai	nstem	1		Rea	ach	M10			
Τορο	Maps:			HA	ARTLA	ND										
•	Last Edi	ited [.]			ın, No		er 30	2008								
	rshed:	itou.			ack &				ivore							
		l.					•			- 1 - 0		- :				
	watershe								e Rive		-					
Is Re	ach an li	mpou	ndmer	nt? NC)		Qı	uality (Control	Statu	s: Ste	ep 2 d	one			
1.1 I 1.2 T 1.3 I 1.3 I 2.1 I 2.1 I 2.2 V 2.3 V 2.4 (2.5 (2.6 S 2.7 V 2.8 (2.9 V 2.1 0	1. Reach Reach D Towns: Downstre Downstre 2. Strean Elevation Elevation Is Gradie Valley Lev Valley SI Channel Sinuosity Watershe Channel Valley W Oconfine	escrip eam L eam L m Typ n Upst n Dow ent Ge ength: lope: Lengt Slope /: ed Are Width fidth: ement	atitud atitud ongitu e tream: tream: nstrea entle? th: ea: n: Ratio:	We: 4 ide: -7 im: 11 im: 11 2 2 1	Vest W 3.51 72.45 210 158 No 676 fe 1.94 2803 fe 1.86 .05 0 8 218 218 27	et. 0. % et. 0 % Squa f	em rea r .51 Mile	ch tha <u>Ste</u> <u>4.1</u> Hi: Cu 2.2 es. Hi: es. Cu 4.3 s Su 5 Le 4.4	at exte ep 4. L Wate storic L urrent S Corric storic L urrent S Ripar Ripar ominan b-dom ngth w	and C rshed and C rshed and C Domin Sub-D and C Domin Sub-D ian Bu t: iinant: '/ less nd Wa	rom tl over - Cover: ant lar omina Cover: ant la omina uffer than 2 ter Inp	ne rea React nd Cov nt Lan nd Cov nt Lan 25 ft.: outs:	h Hydi Fc Ver: Fc d Cov Ver: Fc d Cov Left >10 26- 0 Ab	rology prest prest er: Ur prest er: Ur Bank 00 50 undar	70.0 ban 67.0 ban Righ >100 0-25 350) %) % t Bank
) Confine				Very E	Broad		<u> </u>	5. Ins							
	Referen	nce St	ream			Deel			Flow	Regul	ation -		imp e Run	ound		
	edform:	Clan			Riffle-	P001			pe: e:			Othe			vei	
	ub-class		9:		None	_			Bridg	es and	d Culv		2		2 %	6
	ed Mate		otorio		Cobbl	е			Bank			0110.	-		0.0	0
.	B. Basin (ICLENS	ICS:				0.0		_eft 0		Ric	ght 0.0		0.0	
	Alluvial F				Non Dam			5.4	Chan	nel St	raighte				23 %	
	Grade Co				Till	1	100	_{o/} 5.5	5 Dredg	ging H	istory:		Non	е		
	Dominar Sub-dom		<u> </u>				100	∙ ⁷ °Ste	Dredo p 6. Fl	oodpla	ain Mo	odificat	tions			
	Left Valle			-	teep			6.1 [Berms	and R	oads	C	old 33.	0 ft.	1 %	
	Right Valle				illy			_					One Si		Both S	ides
	Soils	licy C			iiiy				ad:				33.0	ft. (ft.
	drologic	Grour):	D		9	1.3 %		ilroad:				0.0	ft. (ft.
•	oding:	0.004			one/R			De	erm: provec	l Dath			0.0 0.0	ft. (ft. (ft.
	ater Tabl	e Dee	ep:	1.			7.6 %		2 Deve				224	ft. (ft.
	ater Tabl			0.	0	8	7.6 %		Chan			-		Data		ft.
Erc	odibility:			V	ery Se	vere1	00. %		Mean			n.		Juiu		
7.40	Comment	ts:							Mean		•		2	5.0 Ra	atio:	3.1
			thaa	orial	hotoar	anhuu	100d i+	66	6 Wave					0.0 Ra		6.3
	n the qua	•			-			Ster	o 7. Wi	•		rvey				
	hard to a		•		•			71	Bank	Erosio	on:			0.00 ft		
	neander v		•						Bank					00 ft.		
small	meande	er dow	Instrea	am of t	ne rur	n of the	eriver		Ice/D	0		otentia		Data		
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	7.2	Total
4.1	4.2	4.0	J. I	J.Z	5.5	J.4	5.5	0.1	0.2	0.3	0.4	0.0	0.0	1.1	1.2	rular
2	1	1	2	Ο	0	2	Ο	Λ	1	0	0	1	1	0	0	11

7.1	т.2	ч.5	5.1	0.2	5.5	5.4	5.5	0.1	0.2	0.5	0.4	0.0	0.0	1.1	1.2	Totai
2	1	1	2	0	0	2	0	0	1	0	0	1	1	0	0	11
High	Low	Low	High	N.S.	N.S.	High	N.S.	N.S.	Low	N.S.	N.S.	Low	Low	N.S.	N.S.	

						-						-
Basin:	Lower Co	onne	cticut									
Stream Name:	Unname	d Sub	tribut	ary			Rea	ach	M6-	S1.01		
Topo Maps:	HARTLA	ND, V	VINDS	OR								
Date Last Edited:	Sun, Nov	-										
Watershed:	Black &		•		ivers							
Sub-watershed:	Connect		•			r to S	ugar F	Rivor				
							-					
Is Reach an Impoundmen			Q	uality (Control	Statu	s: Ste	ep 2 d	one			
Step 1. Reach Location												
1.1 Reach Description:	Small u		ed trik	outary	/ that b	oarde	ers the	e sout	heast	side	of the	
1.2 Towns:	Windson	r		C +	on 1 1			Deed	مالىما			
1.3 Downstream Latitude 1.3 Downstream Longitu					ep 4. L 1 <i>Wate</i>			Reac	п пуа	lology		
Step 2. Stream Type	ue12.42				storic L				Ci.	eld		
2.1 Elevation Upstream:	996				urrent [nd Cov			65.0) %
2.1 Elevation Downstream					urrent S				-			/0
2.1 Is Gradient Gentle?	No				2 Corrie		omma		u 001			
2.2 Valley Length:	2760 fee		. 52 Mil	~~	storic L		Cover.		Fi	eld		
2.3 Valley Slope:	13.59			C	urrent l			nd Cov			44 (0%
2.4.Channel Length:	2852 fee		.54 Mil	69	urrent S							
2.5 Channel Slope: 2.6 Sinuosity:	13.15 ዓ 1.03	/o			3 Ripar							t Bank
2.7 Watershed Area:		Squa	re Mile	_	ominan				0-2		>100	
2.8 Channel Width:	6	•	eet.	Sı	ub-dom				>10	00	0-25	
2.9 Valley Width:	-		eet.		ength w				111		373	
2.10 Confinement Ratio:	0				4 Grour					nimal		
2.10 Confinement Type:					o 5. Ins							
2.11 Reference Stream 7		da			1 Flow	Regui	ation -	(010): None		ne		
Bedform:	Casca	ae			/pe: se:			None	ļ			
Sub-class Slope:	None				2 Bridg	es and	d Culve	erts:	1		1 %	6
Bed Material: Step 3. Basin Characteristi	Bedroo	CK			3 Bank			01101	•		0.0	0
		_				_eft 0		Rig	ht 0.0			
3.1 Alluvial Fan: 3.2 Grade Control:	None None			5.4	4 Chan	nel St	raighte	ening:	156	1	54 %	
3.3 Dominant Geologic N		•	100	_% 5.5	5 Dredg	ging H	istory:		Non	е		
3.3 Sub-dominant Geologic N			100	• <u>Ste</u>	p Drede p 6. Fle	oodpla	ain Mo	dificat	ions			
3.4 Left Valley Side	Steep			6.1	Berms	and R	loads	0	iu u.u		0.0	
3.4 Right Valley Side	Very Ste	ep		D,	a a di				Dne Si		Both S	ldes
3.5 Soils		•			oad: ailroad:				0.0 0.0	ft. C ft. C		ft.
Hydrologic Group:	С	8	7.4 %		erm:				0.0	ft. C		ft.
Flooding:	None/Ra	are 1	00. %		provec	l Path	:		0.0	ft. C		ft.
Water Table Deep:	2.0		7.0 %	6.2	2 Devel				523	ft. C		ft. ft.
Water Table Shallow:	1.0		7.0 %	0.0	3 Chan	nel Ba	ars:		No	Data		Π.
Erodibility:	Very Sev	vere1	00. %	6.4	4 Mean	der M	igratio	n:				
7.4 Comments:					5 Mean					N/A Ra		0.0
Reach receiving impacts f	rom the peni	itentia	ry and		6 Wave				١	N/A Ra	atio: (0.0
its surrounding agricultura				Ste	p 7. Wi			rvey				
5 5					1 Bank					0.00 ft	•	
					2 Bank	0				00 ft.		
	I			1.3	3 Ice/D	ebris .	Jam Po	otentia	al: NO	t Eval	uated	· · · · · · · · ·
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	7.2	Total
2 1 2 0	0 0	2	0	0	1	0	0	0	0	0	0	8
High Low High N.S.	N.S. N.S.	High	N.S.	Unk.	Low	N.S.	N.S.	N/A	N/A	N.S.	N.S.	
			[1			1	1	

High High N.S.

N.S. Low N.S. N.S. N.S.

Phase 1 - Reach Summary Report

							1.00				· / · ·	opor
Basin:	Lower C	onne	cticut									
Stream Name:	Kimball	Brool	(Rea	ach	T1.0	1		
Topo Maps:	WINDSO	DR										
Date Last Edited:	Sun, No		er 30.	2008								
Watershed:	Black &		•		vers							
Sub-watershed:	Connec		•			r to S	unar I	River				
		licut r					•					
Is Reach an Impoundment?			Qu	uality C	ontrol	Statu	s: Ste	ep 2 de	one			
Step 1. Reach Location1.1 Reach Description:1.2 Towns:1.3 Downstream Latitude:1.3 Downstream LongitudeStep 2. Stream Type2.1 Elevation Upstream:2.1 Elevation Downstream2.1 Is Gradient Gentle?2.2 Valley Length:2.3 Valley Slope:	580	or eet. 0		Ste 4.1 His Cu 4.2 es. His	ep 4. L Wate storic L rrent I rrent S Corric storic L	and C rshed Land C Domina Sub-Do dor Land C	over - Cover: ant lar omina Cover:	React	h Hydr Fid ver: Fo d Cov Fo	rology eld orest er: Url	66.(ban)%
2.3 Valley Slope. 2.4.Channel Length:	5.65 4131 fe		.78 Mil	es				nd Co				0 %
2.5 Channel Slope:		% %		Cu				nt Lan	d Cov	er: Ur l	ban	
2.6 Sinuosity:	1.01		_	Ripar minan		Iffer				•	t Bank	
2.7 Watershed Area:	2.7 Watershed Area: 1 Square Mi								>10	-	>100	
2.8 Channel Width:	8 Channel Width: 15 feet.								51- 0	100	51-1 0	UU
2.9 Valley Width: 2.10 Confinement Ratio:	35 2	1	eet.		ngth w Groui				-	nimal	U	
2.10 Confinement Type:	Z Semi-	confir	hed					nel Mo				
2.11 Reference Stream Ty		comm	icu	.				(old):				
Bedform:	Step-l	Pool			pe:			None				
Sub-class Slope:	None			Us	e:							
Bed Material:	Cobb	е			Bridg			erts:	5			6
Step 3. Basin Characteristic				5.3	Bank			~ .			0.0	
3.1 Alluvial Fan:	Non	е		E A		Left 0			0.0 pht 0.0		0 0	
3.2 Grade Control:	Non	e			Chan					•	0.0	
3.3 Dominant Geologic Ma	at.: Glac	ial La	ke78.0 Till)% ^{3.3} Sto		oodnla	ain Mo	dificat	Non ions	C		
3.3 Sub-dominant Geolog			Till	615	Berms	and P	nade		id 1 21	34.8ft.	20 %	
3.4 Left Valley Side	Steep			0.1 L			Juus		Dne Si		Both S	
3.4 Right Valley Side	Steep			Ro	ad:				1079	ft. C		
3.5 Soils	в	-	0 0 0'	Ra	ilroad:			(0.0	ft. C	0.0	ft. ft.
Hydrologic Group:	B Nono/B		8.8 %	DC	rm:				0.0	ft. C		ft.
Flooding: Water Table Deep:	None/R 6.0		9.3 % 2.5 %		proved				155	ft. C		ft.
Water Table Shallow:	6.0 6.0		2.5 % 2.5 %	0.2	Deve				0.0 סיט	ft. C	J.U	ft.
Erodibility:	Very Se			0.0	Chan				Side	e		
•			J.J /0	0.4	Mean Mean		•)();	•		atic	0.0
7.4 Comments:					Wave					1/A Ra 1/A Ra		0.0 0.0
Reach had a lot of observa					7. Wi	<u> </u>		rvev	ľ		au0.	0.0
sediments through the Para				71	Bank			- <u> </u>	(0.00 ft		
reach, several large jams w	ere noted	upstre	eam of		Bank					00 ft.	-	
the Hunt Rd. crossing.						0		otentia		ltiple		
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	7.2	Total
2 2 0 0	1 0	0	0	2	0	1	0	0	0	0	2	10

High

N.S. Low N.S.

N/A

N/A

N.S. High

					1400						· / · ·	opor
Basin:	Lower C	onne	cticut									
Stream Name:	Kimball	Brool	(Rea	ach	T1.0	2		
Topo Maps:	WINDSC	R							_			
Date Last Edited:	Sun, No	vemb	er 30. 2	2008								
Watershed:	Black &		•		ivers							
Sub-watershed:	Connect		-			r ta S	ugar I	Divor				
		icut r					•					
Is Reach an Impoundment?	NO		Qu	ality C	Control	Statu	s: Ste	ep 2 de	one			
Step 1. Reach Location												
1.1 Reach Description:	This rea		tends	from	the re	ach b	reak,	in a co	onfine	ed set	ting, to	o the
1.2 Towns:	Windso	r		0.				D				
1.3 Downstream Latitude:	43.49				ep 4. L		over -	Reac	n Hydi	rology		
1.3 Downstream Longitude Step 2. Stream Type	12.41				Wate		Source:		E			
2.1 Elevation Upstream:	837				storic L Irrent E			nd Cov		orest	72.0	0/
2.1 Elevation Downstream:					irrent S				-			/0
2.1 Is Gradient Gentle?	No				Corric		omma		u 00v			
2.2 Valley Length:	4210 fe	et. 0	. 80 Mile	~	storic L		OVOr.		Fc	orest		
2.3 Valley Slope:		%			urrent I			nd Co			54 () %
2.4.Channel Length:	4393 fe		.83Mile	10	irrent S							J 70
2.5 Channel Slope:		%			8 Ripar							t Bank
2.6 Sinuosity: 2.7 Watershed Area:	1.04 1	Sona	re Mile	_	minan				>10		>100	
2.8 Channel Width:	14	•	eet.	0	ıb-dom				26-		None	
2.9 Valley Width:	25		eet.		ngth w				0		0	
2.10 Confinement Ratio:	2			4.4	Grour	nd Wa	ter Inp	outs:		nimal		
2.10 Confinement Type:	Narro	wly Co	onfine	d <u>Step</u>	5. Ins	tream	Chan	nel Mo	odifica	tions		
2.11 Reference Stream Typ					Flow	Regul	ation -			ne		
Bedform:	Step-F	' 001		Ty Us	pe:			None				
Sub-class Slope:	None				e. Bridge	es and	1 Culv	orte:	1		0 %	6
Bed Material:	Cobbl	е			Bank			0113.	•		0.0	0
Step 3. Basin Characteristics	_			0.0		_eft 0		Ric	ht 0.0)	0.0	
3.1 Alluvial Fan:	Non			5.4	Chan				0.0		0.0	
3.2 Grade Control:	Non t.: Till	e	100	_{o/} 5.5	Dredg	ging H	istory:	_	Non	e		
3.3 Dominant Geologic Ma 3.3 Sub-dominant Geologic			100.	^{∕⁰} Ste	Dredg p 6. Flo	oodpla	ain Mo	odificat	ions			
3.4 Left Valley Side	Steep			6.1 E	Berms	and R	oads	0	iu 13		35 %	
3.4 Right Valley Side	Extreme	olv St	een	-					Dne Si		Both S	ides
3.5 Soils		Jiy Ot	ουρ		ad:				1578	ft. (ft.
Hydrologic Group:	С	1	00. %		ailroad: erm:				0.0 0.0	ft. (ft. (ft.
Flooding:	None/R		00. %		provec	l Path			0.0 0.0	ft. (ft.
Water Table Deep:	2.0	9	9.0 %		2 Devel				0.0	ft. C		ft.
Water Table Shallow:	1.0	9	9.0 %		Chan				Side			ft.
Erodibility:	Very Se	vere1	00. %		Mean			n:				
7.4 Comments:					6 Mean		•		1	V/A Ra	atio:	0.0
				6.6	Wave	length	n:		١	V/A Ra	atio: (0.0
				Step	o 7. Wi	ndshie	eld Su	rvey				
				7.1	Bank	Erosio	on:			0.00 ft		
				7.2	Bank	Heigh	t:		0.	.00 ft.		
				7.3	lce/De	ebris J	lam P	otentia	l: Bri	idge		
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	7.2	Total
2 2 0 0 0	0 C	0	0	2	0	1	0	0	0	0	1	8
High High N.S. N.S. N.	.S. N.S.	N.S.	N.S.	High	N.S.	Low	N.S.	N/A	N/A	N.S.	Low	
		_		5	_		_			_		

Phase 1 - Reach Summary Report

N.S. N.S. N.S. High High N.S. Low

											· / · · ·	opon
Basin:	Lower C	onne	cticut									
Stream Name:	Kimball	Brool	(Rea	ach	T1.0	3		
Topo Maps:	WINDSC	R										
Date Last Edited:	Sun, No	vemb	er 30,	2008								
Watershed:	Black &				vers							
Sub-watershed:	Connect		•			r to S	ugar I	River				
Is Reach an Impoundment?		loati					•		.			
			Q	uality C		Statu	5. 3 16	ep z u	one			
Step 1. Reach Location 1.1 Reach Description: 1.2 Towns: 1.3 Downstream Latitude:	The stre Windso 43.49		s in an		nfined ep 4. L		-				its acı	OSS
1.3 Downstream Longitude					Wate					<u></u>		
Step 2. Stream Type					storic L		cover:		Fo	orest		
2.1 Elevation Upstream:	883			Cu	rrent D	Domina	ant lar	nd Cov	/er: Fc	orest	68.0) %
2.1 Elevation Downstream					rrent S		omina	nt Lan	d Cov	er: Fie	eld	
2.1 Is Gradient Gentle?	No 1467 fe	ot 0	20141	~~	Corrio							
2.2 Valley Length: 2.3 Valley Slope:	3.14		.201111		storic L					eld		
2.4.Channel Length:	1483 fe		.28 Mil	69	urrent l							0%
2.5 Channel Slope:		%	-	Cu	rrent S			nt Lan				
2.6 Sinuosity:	1.01	~		_	Ripar minan		itter				•	it Bank
2.7 Watershed Area:	0	•	re Mile	.0	b-dom				0-2 51-	ว 100	0-25 26-5	n
2.8 Channel Width: 2.9 Valley Width:	9 180		eet. eet.		ngth w			25 ft.:	717		692	0
2.10 Confinement Ratio:	20	,	661.		Grour				Ab	undar		
2.10 Confinement Type:	Very E	Broad			5. Ins							
2.11 Reference Stream Ty	pe: C				Flow	Regula	ation -			ound		
Bedform:	Riffle-	Pool			pe:			Large	e Run	of Riv	/er	
Sub-class Slope:	b			Us	e. Bridg	as and			2		4 %	6
Bed Material:	Grave	I			Bank			ento.	L		0.0	0
Step 3. Basin Characteristics				0.0		_eft 0		Ric	ht 0.0		010	
3.1 Alluvial Fan: 3.2 Grade Control:	Yes Dam			5.4	Chan	nel Sti	raighte		707		47 %	
3.3 Dominant Geologic Ma			100	_% 5.5	Dredg	ging H	istory:		Non	е		
3.3 Sub-dominant Geologic Ma			100	• 5.5 • <u>Ste</u>	p 6. Fl	oodpla	ain Mo	odificat	ions			
3.4 Left Valley Side	Steep			6.1 E	Berms	and R	oads	0	nu U.U		0.0	'ideo
3.4 Right Valley Side	Hilly			Do	ad:				Dne Si 0.0		Both S	ldes
3.5 Soils	-				ilroad:				0.0	ft. C ft. C		ft.
Hydrologic Group:	D		2.4 %	Be	rm:				0.0	ft. C		ft.
Flooding:	None/R		00. %	1111	provec	Path	:	(0.0	ft. C	0.0	ft. ft.
Water Table Deep:	1.5		2.4 %	0.2	Deve				0.0	ft. C	0.0	ft.
Water Table Shallow: Erodibility:	0.0 Very Se		2.4 %	0.0	Chan				No	Data		
•	very Se		UU. /0	0.4	Mean		•	n:				
7.4 Comments:					Mean					9.2 Ra		1.0
Cows were observed in the		-			Wave 7. Wi	•		rvev		9.2 Ra	alio:	1.0
windshield survey. Potentia					Bank				(0.00 ft		
upper reach were the slope	•		and		Bank					.00 ft.	•	
the valley widens, near the	ponded ar	ea.			Ice/D	0		otentia		lvert		
4.1 4.2 4.3 5.1 5	5.2 5.3	5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.2	Total
1 2 2 2	0 0	2	0	0	0	0	0	2	2	0	1	14
					1				1	1	1	1

N.S. High N.S.

Unk.

High N.S.

Low

High

High

			nasc		nca		Juin	mai	y iv	cpon
Basin:	Lower Connecti	icut								
Stream Name:	Kimball Brook				Rea	ach	T1.0	4		
Topo Maps:	WINDSOR									
Date Last Edited:	Sun, November	30. 200	8							
Watershed:	Black & Otttauq	-								
Sub-watershed:	Connecticut Riv	-		r to S	uaar F	Qivor				
Is Reach an Impoundment?					U					
· · ·	NO	Qualit	y Control	Statu	s: Ste	ep 2 d	one			
Step 1. Reach Location			_		_				_	
1.1 Reach Description:	From the reach	h break	at the va	lley fl	oor, T	1.04 e	xtend	ls up t	o the	
1.2 Towns:	Windsor 43.49		Stop 4 1	ond C	ovor	Doool	- Lludr	ology		
1.3 Downstream Latitude: 1.3 Downstream Longitude			Step 4. La 4.1 Water		over -	Reaci	г пуш	ology		
Step 2. Stream Type	512. -1 3		Historic L		over.		Fo	orest		
2.1 Elevation Upstream:	1168		Current E			nd Cov	-		85.0	%
2.1 Elevation Downstream			Current S							/0
2.1 Is Gradient Gentle?	No		4.2 Corric							
2.2 Valley Length:	2470 feet. 0.47	7Miles.	Historic L	and C	Cover:		Sh	nrub		
2.3 Valley Slope:	11.54 %		Current I			nd Cov	-		49.0) %
2.4.Channel Length: 2.5 Channel Slope:	2574 feet. 0.49 11.07 %	9Miles.	Current S							
2.6 Sinuosity:	1.04		4.3 Ripari						•	t Bank
2.7 Watershed Area:	0 Square		Dominan				>10		>100	
2.8 Channel Width:	6 fee		Sub-dom				0-2		None	9
2.9 Valley Width:	fee	J L.	Length w				314		0	
2.10 Confinement Ratio:	0		4.4 Grour					nimal		
2.10 Confinement Type:			tep 5. Ins 5.1 Flow							
2.11 Reference Stream Ty Bedform:	Step-Pool		Type:	Regul	alion -	None		ie		
Sub-class Slope:	None		Use:			None				
Bed Material:	Boulder		5.2 Bridge	es and	d Culve	erts:	0		0 %	6
Step 3. Basin Characteristics			5.3 Bank						0.0	
3.1 Alluvial Fan:	None		l	_eft 0.	.0		ht 0.0			
3.2 Grade Control:	None		5.4 Chan		•	•	0.0		0.0	
3.3 Dominant Geologic Ma	at.: Till	100.%	5.5 Dredg	ging H	istory:		Non	е		
3.3 Sub-dominant Geologi	cal Mat.:		5.5 Dredg Step 6. Flo		ain Mo	dificat	ions			
3.4 Left Valley Side	Very Steep	6.	1 Berms	and R	oads	0	iu 91:		35 %	idee
3.4 Right Valley Side	Very Steep		Road:				Dne Si).0	tt. 0	Both S	lues
3.5 Soils			Railroad:).0).0	ft. 0		ft.
Hydrologic Group:		6 %	Berm:				0.0	ft. 0		ft.
Flooding:	None/Rare 100		Improved	Path	:	ę	915	ft. O		ft. ft.
Water Table Deep:		0%	6.2 Devel	opme	nt:	(0.0	ft. O	0.0	ft.
Water Table Shallow:		n 0/	6.3 Chan				Nol	Data		11.
Erodibility:	Very Severe100		6.4 Mean		•	n:				
7.4 Comments:			6.5 Mean					N/A Ra		0.0
A small dirt road or improve	d path was noted		6.6 Wave	0			N	N/A Ra	atio: (0.0
along the upper end of this			tep 7. Wi			vey				
indexed as encroachment a	ccordingly.		7.1 Bank					0.00 ft.	•	
			7.2 Bank	0		stantia		00 ft.	u 6 4 6 6 7	
			7.3 Ice/De	SIIUE		Jientia	II: INO '		uated	I
4.1 4.2 4.3 5.1 5	5.2 5.3 5.4	5.5 6.	.1 6.2	6.3	6.4	6.5	6.6	7.1	7.2	Total
1 0 1 0	0 0 0	0 2	2 0	0	0	0	0	0	0	4
		- N.S. Hiq		N.S.	N.S.	N/A	N/A	N.S.	N.S.	
				<u> </u>	I]		L	I	l	

Basin: Stream Name: Topo Maps:	Lower C State Fa HARTLA	rm Ro		ibuta	ry		Rea	ach	T2.0)1		
Date Last Edited:	Sun, No	vemb	er 30, :	2008								
Watershed:	Black &	Ottta	uquec	hee R	livers							
Sub-watershed:	Connect	icut F	River	Whit	te Rive	r to S	ugar I	River				
Is Reach an Impoundment?					Control		-		one			
· · ·				Junty	00111101	Olulu	0. U I	<i>,</i> p <u> </u>				
Step 1. Reach Location 1.1 Reach Description: 1.2 Towns:	State Fa Windso		d. bro	ok be	gins a	t the c	onflu	ence	with N	/106 an	nd exte	ends
1.3 Downstream Latitude:	43.50	•		St	ep 4. L	and C	over -	Reac	h Hvdi	roloav		
1.3 Downstream Longitude					1 Wate							
Step 2. Stream Type					storic L		cover:		Fi	eld		
2.1 Elevation Upstream:	791			С	urrent [Domina	ant lar	nd Cov	er: Fo	orest	64.0	%
2.1 Elevation Downstream:	688			C	urrent S	Sub-Do	omina	nt Lan	d Cov	er: Fie	eld	
2.1 Is Gradient Gentle?	No	-			2 Corrie	dor						
2.2 Valley Length:	1100 fe		.21 Mile	^{əs.} Hi	storic L	_and C	Cover:		Fo	orest		
2.3 Valley Slope:	9.36		04 M 4:1	C	urrent			nd Co	ver: Ur	rban	51.0) %
2.4.Channel Length:	1106 fe 9.31	et. U %	.21 Mil		urrent S							
2.5 Channel Slope: 2.6 Sinuosity:	1.01	70		4.3	3 Ripar	ian Bu	iffer		Left	Bank	Righ	t Bank
2.7 Watershed Area:	1.01	Squa	re Mile	_	ominan				0-2		>100	
2.8 Channel Width:	10		eet.	Sı	ub-dom				No	ne	51-10	00
2.9 Valley Width:	18	f	feet.		ength w				110		0	
2.10 Confinement Ratio:	2				4 Groui				No			
2.10 Confinement Type:		wly Co	onfine	d <u>Ste</u>	p 5. Ins	tream	Chan	nel Mo	odifica	tions		
2.11 Reference Stream Ty					1 Flow	Regula	ation -			ne		
Bedform:	Step-F	' 00I			/pe: se:			None				
Sub-class Slope:	None			-	se. 2 Bridg	as and		orte	1		9 %	
Bed Material:	Cobbl	е			3 Bank			5113.	•		94 %	D
Step 3. Basin Characteristics	_			0.0		Left 1		Ric	ht 0.0		34 /0	
3.1 Alluvial Fan:	Non	е		5								
	Man	-		D.4	4 Chan	nel Sti	raighte	ening:	999		90 %	
3.2 Grade Control:	Non	е	100		4 Chan		•	•)	90 %	
3.3 Dominant Geologic Ma	t.: Till	e	100		4 Chan		•	•)	90 %	
3.3 Dominant Geologic Ma 3.3 Sub-dominant Geologic	t.: Till cal Mat.:		100	.% ^{5.8} Ste	4 Chan	ging H oodpla	istory: ain Mo	odificat		e	90 % 98 %	
3.3 Dominant Geologic Ma 3.3 Sub-dominant Geologic 3.4 Left Valley Side	t.: Till cal Mat.: Extreme	ely Ste	100 eep	5.8 <u>Ste</u> 6.1	4 Chan 5 Dredo p 6. Fl Berms	ging H oodpla	istory: ain Mo	odificat C	Non ions Id 108 One Si	e 85 ft. ide I	98 % Both S	ides
3.3 Dominant Geologic Ma3.3 Sub-dominant Geologic3.4 Left Valley Side3.4 Right Valley Side	t.: Till cal Mat.:	ely Ste	100. eep	5.5 <u>Ste</u> 6.1	4 Chan 5 Dredo p 6. Fl Berms oad:	ging H oodpla and R	istory: ain Mo	odificat C	Non ions Id 108 One Si 1085	85 ft. ide ft. ft. 0	98 % Both S).0	
 3.3 Dominant Geologic Ma 3.3 Sub-dominant Geologic 3.4 Left Valley Side 3.4 Right Valley Side 3.5 Soils 	t.: Till cal Mat.: Extreme Very Ste	ely Ste eep	еер	5.8 <u>Ste</u> 6.1 Re Re	4 Chan 5 Dredo ep 6. Fl Berms bad: ailroad:	ging H oodpla and R	istory: ain Mo	odificat c (Non ions Id 108 Dne Si 1085 0.0	85 ft. ide ft. ft. 0 ft. 0	98 % Both S).0).0	ides ft. ft.
 3.3 Dominant Geologic Ma 3.3 Sub-dominant Geologic 3.4 Left Valley Side 3.4 Right Valley Side 3.5 Soils Hydrologic Group: 	t.: Till cal Mat.: Extreme Very Ste C	ely Sto eep 1	eep 00. %	5.8 <u>Ste</u> 6.1 Re Be	4 Chan 5 Dredg p 6. Fl Berms bad: bad: ailroad: erm:	ging H oodpla and R	istory: ain Mo oads	odificat C (Non ions Id 108 Dne Si 1085 0.0 0.0	85 ft. ide ft. ft. 0 ft. 0 ft. 0	98 % Both S).0).0).0	ft.
 3.3 Dominant Geologic Ma 3.3 Sub-dominant Geologic 3.4 Left Valley Side 3.4 Right Valley Side 3.5 Soils Hydrologic Group: Flooding: 	t.: Till cal Mat.: Extreme Very Ste C None/R	ely Ste eep 1 are 1	eep 00. % 00. %	5.8 <u>Ste</u> 6.1 Re Be In	4 Chan 5 Dredg p 6. Fl Berms bad: ailroad: erm: provec	ging H oodpla and R d Path	istory: ain Mo oads	odificat C ((Non ions ild 108 Dne Si 1085 0.0 0.0 0.0	85 ft. ide ft. 0 ft. 0 ft. 0 ft. 0	98 % Both S).0).0).0).0	ft. ft. ft. ft.
 3.3 Dominant Geologic Ma 3.3 Sub-dominant Geologic 3.4 Left Valley Side 3.4 Right Valley Side 3.5 Soils Hydrologic Group: Flooding: Water Table Deep: 	t.: Till cal Mat.: Extreme Very Ste C None/Ra 2.0	ely Ste eep 1 are 1	eep 00. % 00. % 00. %	. %5. 6.1 Ri Bi Im 6.2	4 Chan 5 Dredg p 6. Fl Berms oad: ailroad: erm: provec 2 Deve	ging H oodpla and R d Path lopme	istory: ain Mo oads : nt:	odificat C ((Non ions Id 108 Dne Si 1085 0.0 0.0 0.0 0.0	e 85 ft. ide ft. 0 ft. 0 ft. 0 ft. 0 ft. 0	98 % Both S).0).0).0).0	ft. ft. ft.
 3.3 Dominant Geologic Ma 3.3 Sub-dominant Geologic 3.4 Left Valley Side 3.4 Right Valley Side 3.5 Soils Hydrologic Group: Flooding: 	t.: Till cal Mat.: Extreme Very Ste C None/R	ely Ste eep 1 are 1 1	eep 00. % 00. % 00. % 00. %	- % <u>Ste</u> 6.1 Ri Be Im 6.2	4 Chan 5 Dredg p 6. Fl Berms oad: ailroad: ailroad: erm: provec 2 Deve 3 Chan	ging H oodpla and R d Path lopme nel Ba	istory: ain Mo oads oads nt: ırs:	odificat C (((((Non ions ild 108 Dne Si 1085 0.0 0.0 0.0	e 85 ft. ide ft. 0 ft. 0 ft. 0 ft. 0 ft. 0	98 % Both S).0).0).0).0	ft. ft. ft. ft.
 3.3 Dominant Geologic Ma 3.3 Sub-dominant Geologic 3.4 Left Valley Side 3.4 Right Valley Side 3.5 Soils Hydrologic Group: Flooding: Water Table Deep: Water Table Shallow: Erodibility: 	t.: Till cal Mat.: Extreme Very Ste C None/Re 2.0 1.0	ely Ste eep 1 are 1 1	eep 00. % 00. % 00. % 00. %	- % <u>Ste</u> 6.1 Ri Be Im 6.2 6.4	4 Chan 5 Dredg p 6. Fl Berms oad: ailroad: ailroad: erm: provec 2 Devel 3 Chan 4 Mean	ging H oodpla and R d Path lopme nel Ba der M	istory: ain Mo oads nt: irs: igratio	odificat C (((((Non ions id 108 Dne Si 1085 0.0 0.0 0.0 0.0 Side	85 ft. ide ft. 0 ft. 0 ft. 0 ft. 0 ft. 0 ft. 0	98 % Both S).0).0).0).0).0	ft. ft. ft. ft. ft.
 3.3 Dominant Geologic Ma 3.3 Sub-dominant Geologic 3.4 Left Valley Side 3.4 Right Valley Side 3.5 Soils Hydrologic Group: Flooding: Water Table Deep: Water Table Shallow: Erodibility: 7.4 Comments: 	t.: Till cal Mat.: Extreme Very Ste C None/R 2.0 1.0 Very Se	ely Sto eep are 1 1 vere1	eep 00. % 00. % 00. % 00. %	5.5 6.1 6.1 Ri Bi 6.2 6.2 6.2	4 Chan 5 Dredg p 6. Fl Berms oad: ailroad: erm: provec 2 Devel 3 Chan 4 Mean 5 Mean	ging H oodpla and R and R lopme nel Ba der M der W	istory: ain Mo oads nt: irs: igratio ïdth:	odificat C (((((Non ions id 108 Dne Si 1085 0.0 0.0 0.0 0.0 Side	85 ft. ide ft. 0 ft. 0 ft. 0 ft. 0 ft. 0 ft. 0	98 % Both S).0).0).0).0).0).0	ft. ft. ft. ft. ft. 0.0
 3.3 Dominant Geologic Ma 3.3 Sub-dominant Geologic 3.4 Left Valley Side 3.4 Right Valley Side 3.5 Soils Hydrologic Group: Flooding: Water Table Deep: Water Table Shallow: Erodibility: 7.4 Comments: The entire left bank of this reference 	t.: Till cal Mat.: Extreme Very Sto C None/R 2.0 1.0 Very Se each has b	ely Ste eep are 1 1 2 evere1	eep 00. % 00. % 00. % 00. % neavily	- % <u>Ste</u> 6.1 Re Be In 6.2 6.4 6.4 6.4	4 Chan 5 Dredg p 6. Fl Berms oad: ailroad: ailroad: erm: provec 2 Devel 3 Chan 4 Mean 5 Mean 6 Wave	d Path and R lopme nel Ba der M length	istory: ain Mo oads nt: irs: igratio idth: i:	odificat C C C C C C C C C C C C C C C C C C C	Non ions id 108 Dne Si 1085 0.0 0.0 0.0 0.0 Side	85 ft. ide ft. 0 ft. 0 ft. 0 ft. 0 ft. 0 ft. 0	98 % Both S).0).0).0).0).0).0	ft. ft. ft. ft. ft.
 3.3 Dominant Geologic Ma 3.3 Sub-dominant Geologic 3.4 Left Valley Side 3.4 Right Valley Side 3.5 Soils Hydrologic Group: Flooding: Water Table Deep: Water Table Shallow: Erodibility: 7.4 Comments: The entire left bank of this recrip-rapped to prevent the error 	t.: Till cal Mat.: Extreme Very Sta C None/R 2.0 1.0 Very Se each has h osion of th	ely Sto eep are 1 1 vere1 svere1	eep 00. % 00. % 00. % 00. % neavily	. % <u>Ste</u> 6.1 Ri Bi 6.2 6.4 6.4 6.4 6.4 6.4 6.4 6.4 6.4 6.4	4 Chan 5 Dredg p 6. Fl Berms bad: ailroad: ailroad: erm: provec 2 Devel 3 Chan 4 Mean 5 Mean 5 Mean 6 Wave p 7. Wi	d Path and R and R d Path lopme nel Ba der M der W elength ndshie	istory: ain Mo oads oads it: igratio idth: a: ald Suu	odificat C C C C C C C C C C C C C C C C C C C	Non ions Id 108 Dne Si 1085 0.0 0.0 0.0 Side	85 ft. ide ft. 0 ft. 0 ft. 0 ft. 0 ft. 0 ft. 0 k/A Ra	98 % Both S).0).0).0).0).0).0).0	ft. ft. ft. ft. ft. 0.0
 3.3 Dominant Geologic Ma 3.3 Sub-dominant Geologic 3.4 Left Valley Side 3.4 Right Valley Side 3.5 Soils Hydrologic Group: Flooding: Water Table Deep: Water Table Shallow: Erodibility: 7.4 Comments: The entire left bank of this reprised to prevent the error Farm Rd. One "natural" means 	t.: Till cal Mat.: Extreme Very Sto C None/R 2.0 1.0 Very Se each has to sion of the ander ben	ely Ste eep are 1 1 2 vere1 been h e Stat d was	eep 00. % 00. % 00. % 00. % neavily	. % <u>Ste</u> 6.1 Re Be 6.2 6.4 6.4 6.4 6.4 6.4 7.7	4 Chan 5 Dredg p 6. Fl Berms oad: ailroad: ailroad: ailroad: 2 Devel 3 Chan 4 Mean 5 Mean 5 Mean 6 Wave p 7. Wi 1 Bank	d Path and R d Path lopme nel Ba der M der W elength ndshie Erosic	istory: ain Mo oads oads it: igratio idth: idth: ald Sur on:	odificat C C C C C C C C C C C C C C C C C C C	Non ions id 108 Dne Si 1085 0.0 0.0 0.0 Side	85 ft. ide l ft. 0 ft. 0 ft. 0 ft. 0 ft. 0 ft. 0 ft. 0 ft. 0 ft. 0	98 % Both S).0).0).0).0).0).0).0	ft. ft. ft. ft. ft. 0.0
 3.3 Dominant Geologic Ma 3.3 Sub-dominant Geologic 3.4 Left Valley Side 3.4 Right Valley Side 3.5 Soils Hydrologic Group: Flooding: Water Table Deep: Water Table Shallow: Erodibility: 7.4 Comments: The entire left bank of this recrip-rapped to prevent the error 	t.: Till cal Mat.: Extreme Very Sto C None/R 2.0 1.0 Very Se each has to sion of the ander ben	ely Ste eep are 1 1 2 vere1 been h e Stat d was	eep 00. % 00. % 00. % 00. % neavily	. % <u>Ste</u> 6.1 R(R) 6.2 6.2 6.2 6.2 6.2 6.2 6.2 7.7 7.2	4 Chan 5 Dredg p 6. Fl Berms oad: ailroad: ailroad: ailroad: ailroad: 2 Devel 3 Chan 4 Mean 5 Mean 6 Wave p 7. Wi 1 Bank 2 Bank	d Path and R d Path lopme der M der W elength ndshie Erosic Heigh	istory: ain Mo oads oads nt: irs: igratio idth: i: eld Sui on: t:	odificat C C C C C C C C C C C C C C C C C C C	Non ions id 108 Dne Si 1085 0.0 0.0 0.0 Side N 0.0	85 ft. ide ft. 0 ft. 0 f	98 % Both S).0).0).0).0).0).0).0	ft. ft. ft. ft. ft. 0.0
 3.3 Dominant Geologic Ma 3.3 Sub-dominant Geologic 3.4 Left Valley Side 3.4 Right Valley Side 3.5 Soils Hydrologic Group: Flooding: Water Table Deep: Water Table Shallow: Erodibility: 7.4 Comments: The entire left bank of this reprised to prevent the error Farm Rd. One "natural" measure engineered into the channel 	t.: Till cal Mat.: Extreme Very Sto C None/R 2.0 1.0 Very Se each has t osion of the ander bene during the	ely Ste eep are 1 1 vere1 been h e Stat d was e	eep 00. % 00. % 00. % 00. % neavily	5.5 <u>Ste</u> 6.1 Re Be 1m 6.2 6.4 6.4 6.4 6.4 6.4 7.2 7.2 7.2	4 Chan 5 Dredg p 6. Fl Berms oad: ailroad: ailroad: erm: provec 2 Devel 3 Chan 4 Mean 5 Mean 5 Mean 6 Wave p 7. Wi 1 Bank 2 Bank 3 Ice/Do	d Path and R d Path lopme nel Ba der M der W elength ndshie Erosic Heigh	istory: ain Mo oads oads nt: igratio idth: n: eld Sun on: t: lam Po	odificat	Non ions id 108 Dne Si 1085 0.0 0.0 0.0 0.0 Side N 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	85 ft. ide ft. 0 ft. 0	98 % Both S).0).0).0).0).0).0).0	ft. ft. ft. ft. 0.0
 3.3 Dominant Geologic Ma 3.3 Sub-dominant Geologic 3.4 Left Valley Side 3.4 Right Valley Side 3.5 Soils Hydrologic Group: Flooding: Water Table Deep: Water Table Shallow: Erodibility: 7.4 Comments: The entire left bank of this reprised to prevent the error Farm Rd. One "natural" measure engineered into the channel 	t.: Till cal Mat.: Extreme Very Sto C None/R 2.0 1.0 Very Se each has to sion of the ander ben	ely Ste eep are 1 1 2 vere1 been h e Stat d was	eep 00. % 00. % 00. % 00. % neavily	. % <u>Ste</u> 6.1 R(R) 6.2 6.2 6.2 6.2 6.2 6.2 6.2 7.7 7.2	4 Chan 5 Dredg p 6. Fl Berms oad: ailroad: ailroad: ailroad: ailroad: 2 Devel 3 Chan 4 Mean 5 Mean 6 Wave p 7. Wi 1 Bank 2 Bank	d Path and R d Path lopme der M der W elength ndshie Erosic Heigh	istory: ain Mo oads oads nt: irs: igratio idth: i: eld Sui on: t:	odificat C C C C C C C C C C C C C C C C C C C	Non ions id 108 Dne Si 1085 0.0 0.0 0.0 Side N 0.0	85 ft. ide ft. 0 ft. 0 f	98 % Both S).0).0).0).0).0).0).0	ft. ft. ft. ft. ft. 0.0
3.3 Dominant Geologic Ma3.3 Sub-dominant Geologic3.4 Left Valley Side3.4 Right Valley Side3.5 SoilsHydrologic Group:Flooding:Water Table Deep:Water Table Shallow:Erodibility:7.4 Comments:The entire left bank of this rerip-rapped to prevent the eroFarm Rd. One "natural" meaengineered into the channel4.14.24.14.35.15	t.: Till cal Mat.: Extreme Very Sta C None/R 2.0 1.0 Very Se each has to baion of the ander bene during the .2 5.3	ely Sto eep are 1 1 vere1 been h e Stat d was e 5.4	eep 00. % 00. % 00. % 00. % neavily te	5.5 <u>Ste</u> 6.1 Re Re Be Im 6.2 6.4 6.4 6.4 6.4 7.7 7.2 7.2 7.2 7.2 6.1	4 Chan 5 Dredg p 6. Fl Berms oad: ailroad: ailroad: erm: provec 2 Devel 3 Chan 4 Mean 5 Mean 5 Mean 6 Wave p 7. Wi 1 Bank 2 Bank 3 Ice/D 6.2	oodpla and R and R Path lopme nel Ba der M der W length ndshie Erosic Heigh ebris J 6.3	istory: ain Mo oads oads nt: irs: igratio idth: a: bld Sui on: t: lam Po 6.4	odificat	Non ions id 108 Dne Si 1085 0.0 0.0 0.0 0.0 Side N 0.0 0.1 E 6.6	85 ft. ide ft. 0 ft. 1 7.1	98 % Both S).0).0).0).0).0).0).0).0).0).0	ft. ft. ft. ft. 0.0 0.0
3.3 Dominant Geologic Ma3.3 Sub-dominant Geologic3.4 Left Valley Side3.4 Right Valley Side3.5 SoilsHydrologic Group:Flooding:Water Table Deep:Water Table Shallow:Erodibility:7.4 Comments:The entire left bank of this rerip-rapped to prevent the eroFarm Rd. One "natural" meaengineered into the channel4.14.24.35.15	t.: Till cal Mat.: Extreme Very Sto C None/R 2.0 1.0 Very Se each has t osion of the ander bene during the	ely Ste eep are 1 1 vere1 been h e Stat d was e	eep 00. % 00. % 00. % 00. % neavily	5.5 <u>Ste</u> 6.1 Re Be 1m 6.2 6.4 6.4 6.4 6.4 6.4 7.2 7.2 7.2	4 Chan 5 Dredg p 6. Fl Berms oad: ailroad: ailroad: erm: provec 2 Devel 3 Chan 4 Mean 5 Mean 5 Mean 6 Wave p 7. Wi 1 Bank 2 Bank 3 Ice/Do	d Path and R d Path lopme nel Ba der M der W elength ndshie Erosic Heigh	istory: ain Mo oads oads nt: igratio idth: n: eld Sun on: t: lam Po	odificat	Non ions id 108 Dne Si 1085 0.0 0.0 0.0 0.0 Side N 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	85 ft. ide ft. 0 ft. 0	98 % Both S).0).0).0).0).0).0).0	ft. ft. ft. ft. 0.0

						-						- P
Basin:	Lower C	onne	cticut									
Stream Name:	State Fa	rm Ro	oad Tri	ibutar	у		Rea	ach	T2.0	2		
Topo Maps:	HARTLA	ND, V	VINDS	OR	-							
Date Last Edited:	Sun, No	•										
Watershed:	Black &				ivers							
Sub-watershed:	Connect		•			r to S	ugar	Divor				
							•					
Is Reach an Impoundment?	NO		Qı	uality (Control	Statu	s: Ste	ep 2 de	one			
Step 1. Reach Location												
1.1 Reach Description:	This rea		not a	ccess	sible d	ue to	the pr	ison,	but th	ie cha	nnel g	goes
1.2 Towns:	Windso	r		0	4 1			D				
1.3 Downstream Latitude:	43.50				ep 4. L			Reac	n Hyai	rology		
1.3 Downstream Longitude Step 2. Stream Type	: -72.43				Wate					ام ا م		
2.1 Elevation Upstream:	867				storic L urrent [eld	67.0	0/
2.1 Elevation Opstream: 2.1 Elevation Downstream:					irrent S				-		67.0) %
2.1 Is Gradient Gentle?	No			42	Corrie	dor					JU	
2.2 Valley Length:	3173 fe	et. 0	. 60 Mile	<i>1.7</i> دىر 85.	etoria I		0000		E:	eld		
2.3 Valley Slope:	2.40	%									11	n 0/
2.4.Channel Length:	3349 fe		.63 Mil	es:	urrent l urrent S							0%
2.5 Channel Slope:		%			B Ripar			n Laii				t Bank
2.6 Sinuosity:	1.06	Sauc	ro Milo	_	minan		IIIEI		0-2		0-25	IL DAIIK
2.7 Watershed Area: 2.8 Channel Width:	1 10	•	re Mile [:] eet.	0	ib-dom				26-	-	26-5	n
2.9 Valley Width:	226		eet.		ngth w			25 ft.:	160		2790	
2.10 Confinement Ratio:	23	I	eet.		Grou					undar		
2.10 Confinement Type:	Very E	Broad			5. Ins				odifica	tions		
2.11 Reference Stream Ty				5.1	Flow	Regul	ation -	(old):	Nor	ne		
Bedform:	Riffle-	Pool			pe:			None	•			
Sub-class Slope:				Us								,
Bed Material:	Cobbl	е			2 Bridg			erts:	1		1 %	6
Step 3. Basin Characteristics	<u>;</u>			5.3	Bank	Armo Left 0		Die			0.0	
3.1 Alluvial Fan:	Non	е		5/	l Chan				0.0 pht 640		19 %	
3.2 Grade Control:	Non	е		5 5	5 Dredg		•	•	Non		13 /0	
3.3 Dominant Geologic Ma			54.9		p 6. Fl					C		
3.3 Sub-dominant Geologic			luvial		Berms				ld 159	a ft	4 %	
3.4 Left Valley Side	Very St	eep		0.11	Jennis		ouus		Dne Si		Both S	lides
3.4 Right Valley Side	Hilly			Ro	bad:				159	ft. (
3.5 Soils	•	•		Ra	ailroad:				0.0	ft. (0.0	ft. ft.
Hydrologic Group:	C		1.8 %	DC	erm:			(0.0	ft. C	0.0	ft.
Flooding:	None/R		3.2 %		proved				0.0	ft. C		ft.
Water Table Deep:	1.5 0.0		6.8 %	0.2	2 Deve	•			0.0	ft. C	0.0	ft.
Water Table Shallow: Erodibility:	0.0 Severe		6.8 % 3.2 %	0.0	3 Chan				No	Data		
2	Jevele	0	J.Z /0	0.4	Mean		•	n:	_			
7.4 Comments:					Mean					4.0 Ra		3.5
Expected to be a C-type cha	annel by re	eferen	се		6 Wave o 7. Wi	•			6	8.0 Ra	atio:	6.9
because of the valley shape	and the la	ack of		· · ·				vey				
sinuosity that would have gr	eatly lowe	ered th	е		Bank					0.00 ft		
channel slope.	-				2 Bank	0		atontia		.00 ft.	اء مدمد	
-	I			1.3	B Ice/D				u: INO		uated	
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	7.2	Total
												<u> </u>
1 1 2 0	0 0	1	0	0	0	0	0	1	1	0	0	7
Low Low High N.S. N	.S. N.S.	Low	N.S.	N.S.	N.S.	N.S.	N.S.	Low	Low	N.S.	N.S.	

Basin: Stream Name:	Lower Conn State Farm F		ibutar	у		Rea	ach	T2.0	3		·
Topo Maps:	WINDSOR										
Date Last Edited:	Sun, Novem	ber 30,	2008								
Watershed:	Black & Ottt	auquec	hee R	ivers							
Sub-watershed:	Connecticut	River -	- Whit	e Rive	r to S	ugar F	River				
Is Reach an Impoundment?	Νο	Qı	uality C	Control	Statu	s: Ste	ep 2 de	one			
Step 1. Reach Location							-				
1.1 Reach Description:	From the re	ach bro	ak the	. chan	nolo	rtonde	to ite	torm	inal n	oint a	hovo
1.2 Towns:	Windsor	ach bre	ak ine	e chan	nerez	lienus		sterm	inai p	omta	bove
1.3 Downstream Latitude:	43.50		Ste	ep 4. L	and C	over -	Reach	h Hydi	voloav		
1.3 Downstream Longitude				Wate		0101	Ttouol	riiyai	lology		
Step 2. Stream Type	•			storic L		lover.		Fo	orest		
2.1 Elevation Upstream:	1173			irrent [nd Cov	-		82.0) %
2.1 Elevation Downstream				irrent S				-			/0
2.1 Is Gradient Gentle?	No		42	Corrie	dor						
2.2 Valley Length:	2875 feet.	0.54 Mil	еs. ц.	storic I	and C	ovor:		Ec	orest		
2.3 Valley Slope:	10.64 %							-		20.0	n 0/
2.4.Channel Length:	2978 feet.	0.56 Mil	69	urrent							0%
2.5 Channel Slope:	10.28 %			Irrent S			nt Lan				
2.6 Sinuosity:	1.04		_	Ripar		itter				•	it Bank
2.7 Watershed Area:		are Mile	0	minan				>10		>100	
2.8 Channel Width:	7	feet.		b-dom			95 ft ·	0-2 340		0-25 453	
2.9 Valley Width:	0	feet.		Grou					, nimal	455	
2.10 Confinement Ratio:	0			5. Ins					-		
2.10 Confinement Type:	 no: A			Flow							
2.11 Reference Stream Ty Bedform:	Step-Pool			pe:	ixegui	alion -	None		IC		
	None		Us				None				
Sub-class Slope: Bed Material:				Bridg	es and	d Culve	erts:	1		1 %	6
	Cobble			Bank			01101	•		0.0	•
Step 3. Basin Characteristics	_		0.0		_eft 0		Rio	ht 0.0		0.0	
3.1 Alluvial Fan:	Yes		5.4	Chan				0.0		0.0	
3.2 Grade Control:	None	00 -		– –			•	Non	е		
3.3 Dominant Geologic Ma	_	92.1	_ [%] Ste	Dredo p 6. Fl	oodpla	ain Mo	dificat	ions			
3.3 Sub-dominant Geologi		-Conta	π 6.1 E	Berms	and R	oads	0	ld 0.0) ft.	0.0	
3.4 Left Valley Side	Steep							Dne Si		Both S	Sides
3.4 Right Valley Side	Steep		Ro	ad:			(0.0	ft. C	0.0	f+
3.5 Soils	•		Ra	ilroad:			(0.0	ft. C	0.0	ft. ft.
Hydrologic Group:	C	88.9 %		rm:			(0.0	ft. C	0.0	ft.
Flooding:	None/Rare			proved				0.0	ft. C		ft.
Water Table Deep:		63.6 %	0.2	Deve			(0.0	ft. C	0.0	ft.
Water Table Shallow:		63.6 %	0.0	Chan	nel Ba	ars:		No	Data		
Erodibility:	Very Severe	100. %	6.4	Mean	der M	igratio	n:				
7.4 Comments:			6.5	Mean	der W	idth:			V/A Ra		0.0
Potential alluvial fan located	l downstream o	of		Wave	•			Ν	V/A Ra	atio:	0.0
Watson Rd. where the slope			Step	97. Wi	ndshie	eld Sur	rvey				
valley widens.			7.1	Bank	Erosic	on:		(0.00 ft		
			7.2	Bank	Heigh	it:		0.	00 ft.		
			7.3	Ice/D	ebris .	Jam Po	otentia	l: Cu	lvert		
			<u> </u>				0 -				-
4.1 4.2 4.3 5.1 5	5.2 5.3 5.4	5.5	6.1	6.2	6.3	6.4	6.5	6.6	7.1	7.2	Total
					_	_	_	_	_		
1 1 2 0	0 0 0	0	0	0	0	0	0	0	0	1	5
Low Low High N.S. N	I.S. N.S. N.S	. N.S.	Unk.	N.S.	N.S.	N.S.	N/A	N/A	N.S.	Low	1

					lasc		1100		Jan	ma	· y · · ·	cpon
Basin:	Lower Co	onneo	cticut									
Stream Name:	Marton R	oad ⁻	Tributa	ary			Rea	ach	T3.0)1		
Topo Maps:	HARTLA	ND, V	VINDS	OR								
Date Last Edited:	Sun, Nov	embe	er 30, i	2008								
Watershed:	Black & (Otttau	Iquec	hee R	ivers							
Sub-watershed:	Connecti	cut R	liver -	· Whit	e Rive	r to S	ugar l	River				
Is Reach an Impoundment?	No		Qı	uality (Control	Statu	s: Ste	ep 2 de	one			
Step 1. Reach Location			~~~	iointy (Clara			•			
1.1 Reach Description:	A long r	each	heain	nina :	at the d	conflu	ience	with t	he ma	ainste	m rea	ch
1.2 Towns:	Windsor		begin	ining (oonne					in rea	011
1.3 Downstream Latitude:	43.51			Ste	ep 4. L	and C	over -	Reac	h Hydi	rology		
1.3 Downstream Longitude	: -72.43				Wate							
Step 2. Stream Type	4004				storic L				-	orest		
2.1 Elevation Upstream: 2.1 Elevation Downstream:	1261 720				urrent E urrent S						86.0	%
2.1 Is Gradient Gentle?	No				2 Corrie		omina	nt Lan		er. rie	ala	
2.2 Valley Length:	7350 fee	et. 1 .	. 39 Mile	~~	storic L		over.		Fc	orest		
2.3 Valley Slope:	7.36 %			<u> </u>	urrent l			nd Co			47 () %
2.4.Channel Length:	7621 fee		.44Mil		urrent S							7 0
2.5 Channel Slope: 2.6 Sinuosity:	7.10 % 1.04	0			8 Ripar							t Bank
2.7 Watershed Area:		Squai	re Mile	s Do	ominan	it:			>10		>100	
2.8 Channel Width:	11	•	eet.	Sı	ib-dom					100	None	9
2.9 Valley Width:	30	f	eet.		ngth w Grour				0	. :	0	
2.10 Confinement Ratio:	3 Semi-c	onfin	ad		5. Ins					tions		
2.10 Confinement Type: 2.11 Reference Stream Typ		onin	leu		Flow						ment	
Bedform:	Step-P	ool			pe:					of Riv		
Sub-class Slope:	None			Ús	se:			Othe				
Bed Material:	Cobble	;			2 Bridg			erts:	2		1 %	0
Step 3. Basin Characteristics	:			5.3	Bank	Armo Left 0		Die	ght 0.0		0.0	
3.1 Alluvial Fan:	None	;		5.4	Chan				0.0		0.0	
3.2 Grade Control:	Dam		400					-		е	••••	
3.3 Dominant Geologic Ma			100	" [%] Ste	Dredg p 6. Fl	oodpla	ain Mc	odificat	ions			
3.3 Sub-dominant Geologic 3.4 Left Valley Side	Steep			6.1	Berms	and R	oads	0	nu 31.		4 %	
3.4 Right Valley Side	Steep								Dne Si		Both S	ides
3.5 Soils	Cloop				oad: ailroad:				313 0.0	ft. C ft. C		ft.
Hydrologic Group:	С	8	6.4 %		erm:				0.0	ft. C		ft.
Flooding:	None/Ra			Im	provec	d Path	:		0.0	ft. C		ft.
Water Table Deep:	2.5		8.2 %	0.2	Devel			(0.0	ft. C	0.0	ft. ft.
Water Table Shallow:	1.5 Vorv So		8.2 %	0.0	8 Chan				No	Data		11.
Erodibility:	Very Sev	verei	UU. %	0	Mean		•	n:	_			
7.4 Comments:					5 Mean							0.0
					6 Wave 5 7. Wi			rvev	ľ	N/A Ra	atio:	0.0
					Bank			ivey		0.00 ft		
					2 Bank					.00 ft.	•	
					B Ice/D	0		otentia				
	0											_
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	7.2	Total
1 1 0 2 0	0 0	0	0	0	0	0	0	0	0	0	1	5
Low Low N.S. High N	.S. N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N/A	N/A	N.S.	Low	
												·

Phase 1 - Reach Summary Report

Basin:				١o	wer C	onne	eticut										
Stream Name:					ounty l			arv			Ro	ach	T4.0	1			
Topo Maps:							mbut	ar y			I\C		14.0				
-	Last Ec	litad			HARTLAND Sun, November 30, 2008												
		meu.			-		-		luere								
Water		. 1			ack &		•										
	atersh								e Rive		•						
Is Rea	ach an	Impou	ndmer	nt? No	No Quality Control Status: Step 2 done												
1.1 R 1.2 T 1.3 D 1.3 D	1. Read leach I lowns: lownsti lownsti lownsti	Descrip ream L ream L	otion: Latitud	W e: 4	′indso 3.51		jins at	<u>Ste</u> 4. 1	e confluence with M08 and extends to its Step 4. Land Cover - Reach Hydrology 4.1 Watershed								
Step 2. Stream Type 2.1 Elevation Upstream:					012				Historic Land Cover: Forest Current Dominant land Cover: Forest 81.0 %								
2.1 Elevation Opstream: 2.1 Elevation Downstream:					67				Current Dominant land Cover: Forest 81.0 % Current Sub-Dominant Land Cover: Urban								
2.1 Is Gradient Gentle?					No			42	4.2 Corridor								
2.2 Valley Length:				5	875 fe	et. 1	. 11 Mil	es. Hi	storic L	and C	Cover:		Fc	orest			
2.3 Valley Slope:					Ŧ. I <i>1</i>	/0			Current Dominant land Cover: Forest 410 %								
2.4.Channel Length:					055 fe 1.05	et. 1 %	.15 Mil		Current Sub-Dominant Land Cover: Urban								
2.5 Channel Slope: 2.6 Sinuosity:					+.03 .03	70		4.3	4.3 Riparian Buffer Left Bank Right Bank								
2.7 Watershed Area:				•	1	Squa	re Mile	_	Dominant: >100 >100								
2.8 Channel Width:				1	0	f	eet.		Sub-dominant: 0-25 0-25								
2.9 Valley Width:					50	f	eet.		Length w/ less than 25 ft.: 676 1261								
	Confin				5				4.4 Ground Water Inputs: Abundant Step 5. Instream Channel Modifications								
	Confin				Narro	N		<u> </u>	5.1 Flow Regulation - (old): None								
2.11 Reference Stream Typ Bedform:					ь Step-F	Pool			Type: None								
Sub-class Slope:					a	001			Use:								
Bed Material:					a Cobbl	e		5.2	5.2 Bridges and Culverts: 5 2 %								
Step 3. Basin Characteristics						•		5.3	Bank	Armo	ring:				0.0		
	lluvial				Non	e				Left 0			ht 0.0				
3.2 Grade Control:					Non				Chan		•	•	0.0		0.0		
3.3 Dominant Geologic Mat					Till		92.8						Non	e			
3.3 S	ub-dor	ninant	Geolo	ogical I	Mat.:	C	ther		Step 6. Floodplain Modifications								
3.4 Left Valley Side					ery St	еер		0.11	One Side Both Sides								
3.4 Right Valley Side 3.5 Soils					teep			Ro	Road: 1824 ft. 0.0								
		O 10 1		_		F	n n 0/	Ra	ilroad:				0.0	ft. C		ft. ft.	
Hydrologic Group: D Flooding: Non					one/R		2.8 % 00. %	DC	Berm: 0. (π. υ.υ _{ft}			
	ter Tab	6.			7.2 %		Improved Path: 0.0 ft. 0.0							ft.			
			•	6.			7.2 %	0.2	6.2 Development: 754 ft. 0.0 6.3 Channel Bars:No Data).0	ft.	
Water Table Shallow: 6.0 37.2 % 6.3 Channel Bars: No Data II. Erodibility: Very Severe92.8 % 6.4 Meander Migration:																	
7.4 Comments: 6.5 Meander Width: N/A Ratio: 0.0														n n			
Channel is encroached upon by County Rd. and 6.6 Wavelength: N/A Ratio: 0.0																	
						-			7. Wi	0		rvey	-				
in several areas the channel has eroded the banks and parts of the roadbed. 7.1 Bank Erosion: 496.24 ft.																	
DAILIKS	anu pa	ai 15 01	11610	auveu					7.2 Bank Height: 3.00 ft.								
								7.3	Ice/D	ebris J	Jam P	otentia	l: Cu	lvert			
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	7.2	Total	
1	2	2	0	0	0	0	0	2	1	0	0	0	0	1	1	10	

Low High High N.S. N.S. N.S. N.S. High Low N.S. N.S. N/A Low Low

APPENDIX C.

QA SUMMARY (CD-ROM)

APPENDIX D.

WINDHSIELD SURVEY PHOTOS & LOG (CD-ROM)