Lake Champlain Basin Fish Passage Initiative 2008- Final report

Timothy B. Mihuc
Eileen Allen
Edwin Romanowicz

Lake Champlain Research Institute and Center for Earth and Environmental Science
SUNY Plattsburgh

and

Mark Malchoff

Lake Champlain Sea Grant program

Project Summary:

This project, funded by the Greater Adirondack Resource Conservation and Development Council (RC&D) in cooperation with the U.S. Fish and Wildlife Service, served as a pilot study to identify and prioritize aquatic organism barriers at stream road crossings in the Lake Champlain Basin. Our goal was to develop specific protocols targeted for regional species, primarily Brook Trout, in the Lake Champlain Basin. We also developed a scoring system to rate high, medium and low priority sites for barrier replacement. Our assessment team completed barrier assessments at 47 crossing structures in 9 sub-watersheds in Clinton and Essex Counties of New York. Of those inventoried, 27% of the crossing structures ranked as medium or high priority for replacement based on impediments to fish passage. Finally, we organized a workshop for local, state and federal partners to discuss the results of the pilot watershed assessment and facilitate training for future work in other watersheds.

Introduction:

Rationale: Recent evidence suggests that fish passage at the sub-watershed level may be impaired in the Champlain Basin (Bates and Kim 2007). Road culverts, bridge structures, small dams and other human engineered infra-structure often place demands on small fishes that may exceed swimming burst speed and/or leaping abilities (Clarkin et al. 2005). Often road crossing structures have interfered with hydrological processes that normally serve to maintain upstream-downstream connections and could threaten local fish populations with extinction (Letcher et al. 2007). Accumulating evidence points to the need/opportunity to remedy these problems as culverts and bridges fail or are replaced during road upgrades. Recently numerous State and Federal agencies have developed assessment methods and field protocols for determining fish passage impediments. We adapted an existing protocol from Vermont and applied it in New York watersheds in the Lake Champlain Basin (Bates and Kim 2007). A site scoring system, based on four simple to measure physical parameters, was created to prioritize individual culverts and bridges for replacement based on the impairment of fish passage.

Objective: Develop field protocols and methods to assess and prioritize fish passage impediments in selected study watersheds in the Champlain Basin.

Project goals:

1) Organize and develop field and lab procedures for fish passage assessments in the New York portion of the Lake Champlain Basin
2) Implement assessment procedures in study sub-watersheds
3) Host a workshop for federal, state and local experts to disseminate results and develop procedures for future fish passage projects (see Appendix III).

Goal 1) Organize and develop field and lab procedures for fish passage assessments

We implemented field assessment protocols based on the protocol used by Vermont with modifications based on Powell et al. (2004). Modifications included addition of velocity measurements (taken with a Global Water FP 101 velocity meter) and other protocol changes. Changes to the data collection sheets used by the Vermont Agency of Natural resources are summarized below. Project field data sheets can be found in Appendix I.

The following items were modified from the data sheets used by Vermont Agency of Natural Resources.

1. Added **highway** to road types. This modification was made to distinguish small two-lane roads from larger divided highways.
2. Changed **longitude and latitude** to **UTM (meters)**
3. Changed **State Structure Number** to **DOT Identify Number**.
4. Changed **Bank Erosion** to include **left and right bank** assessments for both upstream and downstream.
5. Changed **Hard Bank Armoring** to include **left and right bank** assessments for both upstream and downstream.

The following items were removed from the data sheets used by Vermont Agency of Natural Resources.

1. Removed **Structure Skewed to Roadway** the information was replaced with azimuthal data

The following items were added to the data sheets used by Vermont Agency of Natural Resources.

1. **Time In** and **Time Out** for purpose for tracking how long it takes to complete an assessment.
2. **Azimuth Compass Direction**s of **Down Stream** and **Road** to quantify structure skewness relative to the road
3. **Wetted Width in structure** is the measured with of the channel passing through the structure
4. **Water Depth under Structure** is the measured depth of water under the structure.
5. **Uniform Wetted Width under Structure** is a yes or no response to determine if the wetted width is relatively constant through the structure
6. **Standing Waves under Structure** is a yes or no response to determine if standing waves occur under the structure. The standing waves are most likely due to irregularities in the structure that affect the flow of water.
7. **Bankfull Measurement Table**, **Bankfull Site Criteria** and **Map of Stream Reach** were added to further detail bankfull measurements, thalweg depth and stage height of stream relative to bankfull height. These additions were modified from Powell et al. (2004)
8. **Stream Longitudinal Profile** and Stream **Bankfull Cross Section Profile** data sheets were added for use where a more quantitative assessment of stream hydraulic gradient and cross sectional profiles were completed using laser level or other surveying instruments.

All field data was recorded on waterproof field sheets and entered into a data base using Microsoft Access. All variables for each site were stored in the Access database.

Goal 2) Implement procedures in a study sub-watershed

Our field crew consisted of two undergraduate students. After a field training day with Vermont staff we assessed the stream-road crossing sites in two headwater Brook Trout streams (True Brook in Clinton County, and Spruce Mill Brook in Essex county). Briefly, field methods involved a two person crew, sometimes three, assessing each data parameter for in-structure, upstream and downstream parameters. Upstream parameters were taken at 10 m intervals starting at least 25 m upstream of the structure to avoid influences of the road crossing on upstream parameters. In addition digital images at each site were taken looking upstream and down-stream from the structure and catalogued. We completed the initial two catchments and were able to assess seven other small watersheds in Clinton and Essex counties in 2007. Watersheds were selected in consultation with Trout Unlimited, Greater Adirondack Resource Conservation and Development Council (RC&D) and the U.S. Fish and Wildlife Service and were targeted as representative Brook Trout waters in the Adirondack Uplands or Clinton and Essex County. A Summary of the study watersheds appears in Table 1.

Table 1. Study watersheds for 2008 fish passage assessments.

Watershed	County, town	# of road crossings	Drainage basin
	Clinton County		
Behan Brook	Dannemora	2	Saranac River
Deep Inlet Brook	Dannemora	1	Great Chazy River
Mud Pond Brook	Saranac	1	Saranac River
True Brook	Saranac	14	Saranac River
	Essex County		
Burpee Brook	Elizabethtown	3	Boquet River
Phelps Brook	Elizabethtown	1	Boquet River
Spruce Mill Brook	Elizabethtown	6	Boquet River
Styles Brook	Jay	8	Ausable River
Rocky Branch	Jay	4	Ausable River

Development of a fish barrier assessment protocol:

Using the field data we developed a four part scoring system to prioritize road crossings into three major categories: high, medium, and low priority for replacement based on impediments to fish movement. High priority sites were classified based on a combination of traits that prove unsuitable for fish passage. Each Site was prioritized based on four criteria selected from the measured suite of physical variables that best represent the impacts of a crossing on fish passage. The scoring criteria for each variable are based on suitability for Brook Trout movement, adapted from Bates and Kim (2007). The four criteria represent the two most critical parameters often cited as impediments to fish movement at a crossing (outlet drop and in-structure water velocity) and two in-structure to upstream ratios that represent the potential impact of the structure on water depth and stream width:

The scoring criteria used to assign points for each site were:

- Outlet drop
  - 4 inch for juvenile, 8 inch drop for adult movement
- Culvert (or bridge) structure to in-stream width ratio
  - target was a structure >80% of the in-stream width
- In-structure water velocity
  - Greater than 2.6 ft/sec can impact Brook Trout movement
- Culvert (or bridge) structure to in-stream water depth
  - a structure water depth below 75% of in-stream depth could impact fish movement

Other than outlet drop, culvert or bridge measurements (width and depth) were taken at the upstream entry to each structure. Up-stream measurements were based on a set of three transects spaced 10 m apart that were located at least 25 m above the structure. Up-stream measurements included wetted channel width, bankfull width, thalweg water depth and thalweg water velocity. Figure 1 depicts the scoring system used for each of the criterion. Points are assigned based on potential impact of that criterion has on fish passage with 0 points indicating no impact, 1 point for moderate impact and 2 points for high impact.

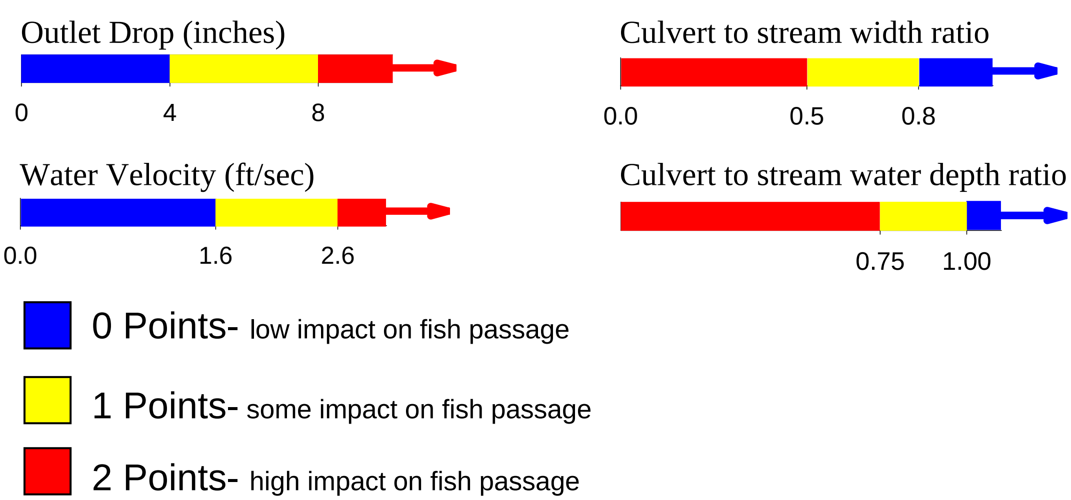

Figure 1. Scoring used for the four variables to assess fish passage at each road crossing structure (bridge or culvert).

To determine a site score the value of all four variables were summed. Site scores were assigned as high, low or medium priority for structure replacement or retro-fitting based on the criteria in table 2. A high priority site will most likely serve as an impediment to fish passage, based the sum of the four scores totaling > 5 points or an outlet drop in excess of 8 inches regardless of the total score.

Table 2. Criteria for ranking sites for structure replacement priority.

Map color code	Ranking	Site score
	Low Priority	<3 points
	Medium Priority	3-4 points
	High Priority	>5 points Or > 8 inches for outlet drop height

Barrier Assessment Results by County:

In Clinton County we assessed 20 road structures in four watersheds (Behan, Deep Inlet, Mud Pond, True Brook; Figure 2). Of 20 sites, 2 rated as high priority for impairing fish passage with 4 rated as medium priority. True Brook was the largest watershed in this study with 14 crossing sites and one high priority site. This site was listed as high priority due to the outlet drop exceeding 8 inches.

In Essex County, 27 road structures were assessed in 5 watersheds (Burpee, Phelps, Spruce Mill, Styles, and Rocky Branch; Figure 2). There were 2 high priority and 5 medium priority sites for impaired fish passage in Essex County. The two high priority sites were also a result of outlet drop, in one case a 6 ft drop from the structure to stream bed.

In total 27 % of the study sites from the demonstration watersheds were listed as either medium or high priority for impairing fish passage. The primary contributor to high priority site scores was outlet drop, mainly due to the criterion that any drop > 8 inches automatically resulted in a high priority site score. However the combination of structure width to stream bed width ratio and/or water depth also contributed to site scores, contributing to most of the medium priority site scores. Of the four criteria used, most structures had a suitable water velocity for

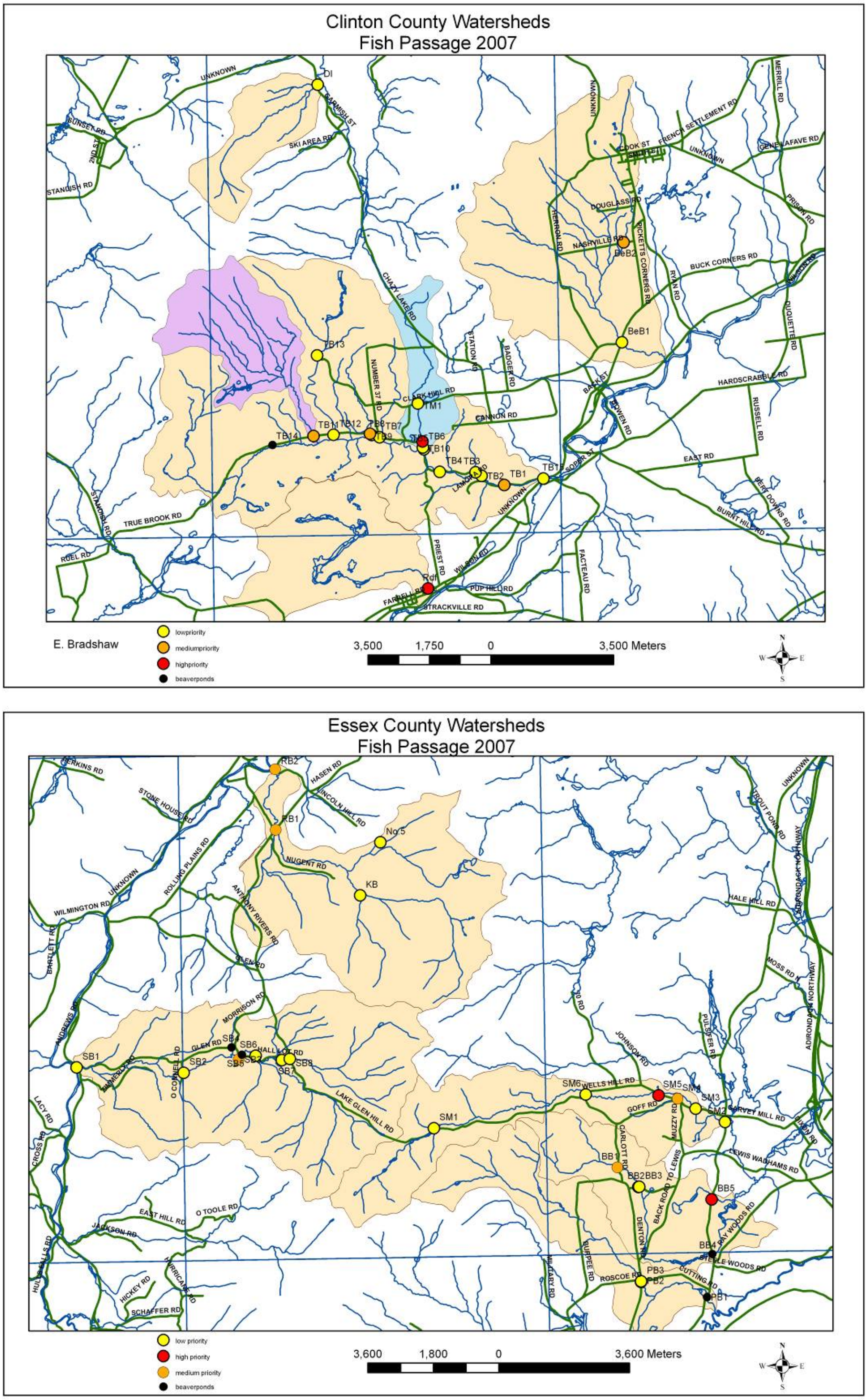

Figure 2. Clinton (top panel) and Essex (bottom panel) road crossing site scores for fish passage. Site color codes are described in Table 2.

fish movement based measurements in June and July 2007 during summer flow conditions. In general the in structure water depth, structure width and outlet drop often combined to create a high site score indicating a hydrologic regime within the structure that is not conducive to fish passage. Raw data and score values for each study site are found in Appendix II.

Examples: High Priority sites

Figures 3 and 4 depict examples of two typical high priority sites for barrier replacement in a culvert (Fig. 3) and a concrete box culvert (Fig. 4). These examples illustrate the raw data and scoring system used to prioritize sites. In both cases the site rates as a high impact on fish passage due to both the outlet drop and cumulative score for all variables.

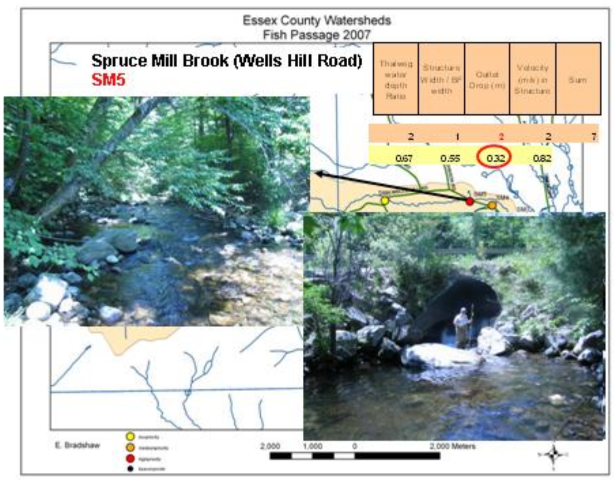

Figure 3. Study site SM 5 on Spruce Mill Brook in Essex County. Raw data plus site scores.

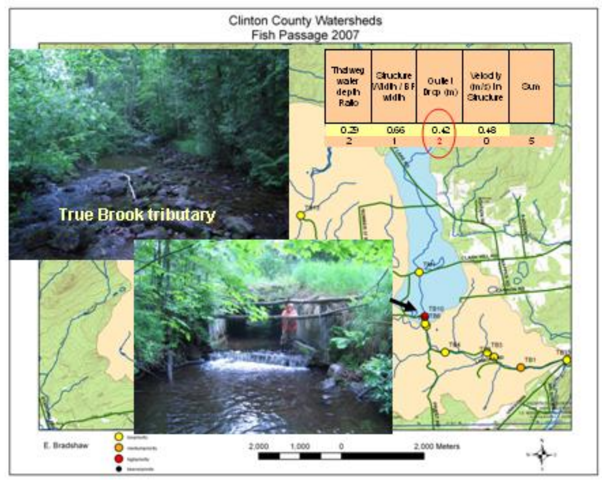

Figure 4. Study site TB10 on True Brook in Clinton County. Raw data plus site scores.

Conclusions:

Our results indicate that fish passage obstructions do occur in headwater systems in Clinton and Essex counties. However, only 27% of the sites were scored as medium or high potential to impair fish movement suggesting that many structures do indeed pass fish effectively. The scoring criteria developed herein relies on a few simple measurements to classify a structure and prioritize its impact on fish movement. If entire watersheds can be assessed and critical sites identified using this scoring system then resources for improving road crossing structures can be directed to where they will improve conditions for the entire fishery. Many other studies have suggested the simple engineering designs required to accomplish improved fish passage such as placing structures of appropriate width and slope as close to the natural stream bed as possible. Our simple data collection and site scoring system will allow targeted site by site assessment of a sub-set of the thousands of road crossing structures in the Adirondack region and hopefully will facilitate identification of the critical locations where action is needed to preserve and protect the fishery.

References:

Bates, K.K. and R. Kim. 2007. Guidelines for the design of stream/road crossings for passage of aquatic organisms in Vermont. VT Fish and Wildlife report, March 2007.

Clarkin, K., A. Connor, M.J. Furniss, B. Gubernick, M Love, K. Moynan, S. WilsonMusser. 2005. NATIONAL INVENTORY AND ASSESSMENT PROCEDURE—For Identifying Barriers to Aquatic Organism Passage at Road-Stream Crossings. United States Department of Agriculture Forest Service, National Technology and Development Program 7700—Transportation Mgmt. November 2005

Letcher, B.H., K. H. Nislow, J. A. Coombs, M. J. O'Donnell, T. Dubreuil1. 2007. Population Response to Habitat Fragmentation in a Stream-Dwelling Brook Trout Population. Plosone (Nov. 2007), issue 11, p 1-11.

Powell, R.O., S.J. Miller, B.E. Westergard, C.I. Mulvihill, B. P. Baldigo, A.S. Gallagher and R.R. Starr, 2004, *Guidelines for Surveying Bankfull Channel Geometry and Developing Regional Hydraulic-Geometry Relations for Streams in New York State*, U.S. Geological Survey Open-File Report 03-92, U.S. Geological Survey: Troy, NY, 17 p.

Appendix I

Data Sheets Used by SUNY Plattsburgh

Bridge & Arch Assessment - Geomorphic & Habitat Parameters

Structure Type: **bridge / arch** Field Map # ______

Stream Name		Site Identification		Town	
Observer(s) / Organization(s)		Time: In		Date	
		Time: Out		GPS Datum	
Road Name				UTM, North, m	
DOT Identifying #				UTM, East, m	
Road Type	**Highway Paved Gravel Trail Railroad**			High Flow Stage	**yes no**
Structure Width (road width)	(m)	Structure Material	**aluminum, wrought iron, cast iron** **concrete** **masonry (arches) & slabs** **prestressed concrete/post-tensioned** **steel** **timber** **other**	# of bridge piers or # arches at crossing	
Structure Clearance	(m)			Azimuth Compass Direction: Down Stream	
Structure Span	(m)			Azimuth Compass Direction: Road	
Wetted Width	(m)				
Water Depth Under Structure	(m)	Uniform Wetted Width Under Structure	**Yes No**	Standing Waves Under Structure	**Yes No**

Geomorphic and Fish Passage Data

General

Floodplain filled by roadway approaches: **entirely partially not significant**

Structure located at a significant break in valley slope: **yes no unsure**

Upstream

Is structure opening partially obstructed by (circle all that apply): **wood debris sediment deformation none**

Steep riffle present immediately upstream of structure: **yes no**

If channel avulses, stream will: **cross road follow road unsure**

Estimated distance avulsion would follow road: ____________ (m)

Angle of stream flow approaching structure: **sharp bend mild bend naturally straight channelized straight**

Downstream

Pool present immediately downstream of structure: **yes no**

Downstream bank heights are substantially higher than upstream bank heights: **yes no**

Stepped footers: **yes no**

Stream Geomorphic Assessment Field Sheet Modified from VT Agency of Natural Resources
May, 2007 - 1 -

Culvert Assessment - Geomorphic & Habitat Parameters

Field Map # ______

Stream Name		Site Identification			Town	
Observer(s) / Organization(s)		Time	In		Date	
			Out		GPS Datum	
Road Name					UTM, North, m	
DOT Identifying #					UTM, East, m	
Road Type	**Highway Paved Gravel Trail Railroad**				High Flow Stage	**yes no**
Number of Culverts		Structure Material	**concrete plastic corrugated plastic smooth tank steel corrugated stone aluminum corrugated other mixed**		Overflow pipe(s)	**yes no**
Culvert Length	(m)				Azimuth Compass Direction: Down Stream	
Culvert Height	(m.)					
Culvert Width	(m)				Road	
Water Depth Under Structure	(m)	Uniform Wetted Width Under Structure	**Yes No**		Standing Waves Under Structure	**Yes No**

Geomorphic and Fish Passage Data

General

Floodplain filled by roadway approaches: **entirely partially not significant**

Structure located at a significant break in valley slope: **yes no unsure**

Culvert slope as compared with the channel slope is: **higher lower same**

Channel Width (curve measured) (m)

Upstream

Is structure opening partially obstructed by (circle all that apply): **wood debris sediment deformation none**

Steep riffle present immediately upstream of structure: **yes no**

If channel avulses, stream will: **cross road follow road unsure**

Estimated distance avulsion would follow road: __________ (m)

Angle of stream flow approaching structure: **sharp bend mild bend naturally straight channelized straight**

Downstream

Water depth in culvert (at outlet): __________ (0.0 m)

Culvert outlet invert: **at grade cascade free fall** Outlet drop (invert to water surface): __________ (0.0 m)

Pool present immediately downstream of structure: **yes no** Pool depth at point of streamflow entry: __________ (0.0 m)

Maximum pool depth: __________ (0.0 m or >1 m)

Downstream bank heights are substantially higher than upstream bank heights: **yes no**

Stream Geomorphic Assessment Field Sheet
May, 2007 - 2 - Modified from VT Agency of Natural Resources

Geomorphic and Fish Passage Data	UPSTREAM	DOWNSTREAM	IN STRUCTURE
Dominant bed material at structure	**1 2 3 4 5 UK** bedrock present: **yes no**	**1 2 3 4 5 UK** bedrock present: **yes no**	**1 2 3 4 5 UK** bedrock present: **yes no**
Sediment deposit types	**none delta side** **point mid-channel**	**none delta side** **point mid-channel**	**none delta side** **point mid-channel**
Elevation of sediment deposits is greater than or equal to ½ bankfull elevation:	**yes no**	**yes no**	**yes no**

	UPSTREAM LEFT	UPSTREAM RIGHT	DOWNSTREAM LEFT	DOWNSTREAM RIGHT
(left/right bank determined facing downstream)	**LEFT**	**RIGHT**	**LEFT**	**RIGHT**
Bank erosion (**H**igh, **L**ow, **N**one)				
Hard bank armoring (Indicate for each bank) **I**ntact, **F**ailing, **N**one, **U**nknown				
Streambed scour causing undermining around/under structure (circle all that apply)	**none abutments** **footers wing walls**		**none abutments** **footers wing walls**	
Beaver dam near structure Distance from structure to dam	**yes no** **distance: __________ ft.**		**yes no** **distance: __________ ft.**	

Bed Material Codes
- **1-**bedrock
- **2-**boulder
- **3-**cobble
- **4-**gravel
- **5-**sand
- **UK-**unknown

Wildlife Data	UPSTREAM LEFT	UPSTREAM RIGHT	DOWNSTREAM LEFT	DOWNSTREAM RIGHT
(left/right bank determined facing downstream)	**LEFT**	**RIGHT**	**LEFT**	**RIGHT**
Dominant vegetation type				
Does a band of shrub/forest vegetation that is at least 50' wide start within 25' of structure and extend 500' or more up/downstream?	**yes no**	**yes no**	**yes no**	**yes no**
Road-killed wildlife within ¼ mile of structure? (circle none or list species)	**species:** **none**			

Vegetation Type Codes
- **C-**coniferous forest
- **D-**deciduous forest
- **M-**mixed forest
- **S-**shrub/sapling
- **H-**herbaceous/grass
- **B-**bare
- **R-**road embankment

	Outside Structure		Inside Structure	
Wildlife sign and species observed near (up/downstream) and inside structure (circle none or list species and sign types)	species (none)	sign	species (none)	sign

Spatial data collected w/GPS: **yes no** Photos taken: **yes no** Please complete photo log	**Comments:**

Stream Geomorphic Assessment Field Sheet
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Modified from VT Agency of Natural Resources

Photo Log

Roll and Frame Number or File Name	Photo View (See Abbreviations)	Comments

Abbreviations:

Left and right designations assume one is looking downstream

LBUS	left bank upstream	RBUS	right bank upstream	LBDS	left bank downstream
RBDS	right bank downstream	USFS	upstream from structure	DSTS	downstream toward structure
USTS	upstream toward structure	DSFS	downstream from structure		
LBF	left bankfull	RBF	right bankfull	LEW	left edge of water
LBFH	left bankfull high	RBFH	right bankfull high	REW	right edge of water
LBFM	left bankfull middle	RBFM	right bankfull middle	LTOB	left top bank
LBFL	left bankfull low	RBFL	right bankfull low	RTOB	right top bank
TOR	top of riffle	BOR	bottom of riffle	R	rebar
TOP	top of pool	BOP	bottom of pool	TP	turning point
LFP	left flood prone area	CIF	culvert inflow	WS	waster surface
RFP	right flood prone area	COF	culvert outflow		
RM	reference mark	PBM	permanent benchmark		
RP	reference point	BM#	benchmark w/ number		
TH	thalweg				

SITE RATING CRITERIA

0 = no or none
1 = slightly
2 = moderately
3 = yes or mostly

alluvial channel (bedrock negligible):	
single channel:	
20 channel widths long:	
conforms to single stream type:	
channel in equilibrium:	
bankfull indicators present:	
gage in reach:	
TOTAL:	

NOTES:

BANKFULL MEASUREMENTS:

Identifier	Width (m)	Bankfull Height	
		DAT (cm)	TOS (cm)

TOS Top of stream
DAT Depth at thalweg

Included following information in sketch:

North arrow
Structures
Culvert location
Locations of reference marks and points
Direction of flow
Bankfull identifiers

MAP OF STREAM REACH

Map Scale:

Landmarks
Structures
Pooling
Riparian area
Point bars, scours, bankfull indicators, Deposits
Locations of transects and bankfull determination

Stream Longitudinal Profile

Stream name: ________________________ Date: __________

Location: ________________________

Field Crew: ____

Station (meters from upstream)	Level Rod Reading (meters)	Elevation (meters)	Location Description	Comments

Left and right designations assume one is looking downstream

LBF	left bankfull	RBF	right bankfull	LEW	left edge of water
LBFH	left bankfull high	RBFH	right bankfull high	REW	right edge of water
LBFM	left bankfull middle	RBFM	right bankfull middle	LTOB	left top bank
LBFL	left bankfull low	RBFL	right bankfull low	RTOB	right top bank
TOR	top of riffle	BOR	bottom of riffle	R	rebar
TOP	top of pool	BOP	bottom of pool	TP	turning point

LFP	left flood prone area	CIF	culvert inflow
RFP	right flood prone area	COF	culvert outflow
RM	reference mark	PBM	permanent benchmark
RP	reference point	BM#	benchmark w/ number
TH	thalweg		
WS	waster surface		

Stream Bankfull Cross Section Profile

Stream name: ______________________ Date: __________

Location: ______________________

Field Crew: ____

Transect Number: _________________________

Complete transect from left bank to right bank (down stream perspective)

X (m)	Water Depth (cm)	Bankfull Height (cm)	Comments

Cross Section Profile of Bankfull Channel

Stream Geomorphic Assessment Field Sheet
May, 2007

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Modified from VT Agency of Natural Resources

Appendix II.

Data summary and site score summary.

Appendx I. DATA SUMMARY TABLE.

SITE	StreamName	RoadType	UTM Easting	UTM Northing	GPS Datum	RANKING CRITERIA DATA: Ratio Structure vs stream water depth	Ratio Sw/bfw	OutletDrop	Ave. Vel. In Structure (m/s)	RANKING SCORES: Thalweg water depth Ratio	Structure Width / BF width	Outlet Drop (m)	Velocity (m/s) in Structure	Sum	Site ranking
	Essex county sites:														
BB1	Burpee Brook	Gravel	612307	4899880	NAD83	0.36	0.53	0.15	0.57	2	1	1	1	5	Medium
BB2	Burpee Brook	Paved	612287	4902443	NAD83	0.81	0.33	0.00	0.72	1	2	0	1	4	Medium
BB3	Burpee Brook	Paved	612312	4902449	NAD83	0.44	0.93	0.00	0.65	2	0	0	1	3	Low
BB4	Burpee Brook	Paved	614322	4900598	NAD83	N/A	N/A	0.00	0.00	0		0	0	0	N/A
BB5	Burpee Brook	Paved	614304	4902096	NAD83	0.62	0.72	2.00	1.57	2	1	2	2	7	High
PB1	Phelps Brook	Paved	614176	4899408	NAD83	N/A	N/A	0.00	0.00	0		0	0	0	N/A
PB2	Phelps Brook	Paved	612362	4899828	NAD83	0.86	0.80	0.00	0.67	1	1	0	1	3	Low
PB3	Phelps Brook	Paved	612363	4899847	NAD83	1.78	0.20	0.00	0.72	0	2	0	1	3	Low
PB4	Phelps Brook	Paved	612307	4899880	NAD83	0.83	0.35	0.00	0.57	1	2	0	1	4	Medium
RB1	Rocky Branch	Paved	598675	4943583	NAD83	0.54	0.63	0.00	0.68	2	1	0	1	4	Medium
RB2	Rocky Branch	Paved	4943583	598675	NAD83	0.69	0.59	0.00	0.67	2	1	0	1	4	Medium
KB	Rocky branch- Kelly Basin	Gravel	604630	4910460	NAD83	0.89	0.59	0.00	0.00	1	1	0	0	2	Low
No.5	Rocky branch No. 5	Gravel	605185	4911921	NAD83	1.15	0.34	0.18	0.00	0	2	1	0	3	Low
SB1	Styles Brook	Paved	596829	4905727	NAD83	1.11	0.72	0.00	0.59	0	1	0	1	2	Low
SB2	Styles Brook	Gravel	599773	4905582	NAD83	1.36	0.81	0.00	0.18	0	0	0	0	0	Low
SB3	Styles Brook	Gravel	601293	4905954	NAD83	0.59	0.42	0.00	0.25	2	2	0	0	4	Medium
SB4	Styles Brook	Gravel	601093	4906281	NAD83	N/A	N/A	0.17	0.00			1	0		N/A
SB5	Styles Brook	Gravel	601376	4906077	NAD83	1.91	0.48	0.00	0.00	0	2	0	0	2	Low
SB6	Styles Brook	Gravel	601755	4906050	NAD83	2.78	0.60	0.00	0.12	0	1	0	0	1	Low
SB7	Styles Brook	Gravel	602475	4905928	NAD83	1.06	0.60	0.00	0.43	0	1	0	0	1	Low
SB8	Styles Brook	Paved	602696	4905965	NAD83	0.93	0.55	0.00	0.17	1	1	0	0	2	Low
SM1	Spruce Mill Brook	Gravel	606659	4904059	NAD83	0.92	0.15	0.05	0.28	1	2	0	0	3	Low
SM2	Spruce Mill Brook	Paved	614669	4904229	NAD83	1.06	0.59	0.00	0.59	0	1	0	1	2	Low
SM3	Spruce Mill Brook	Paved	613861	4904595	NAD83	0.94	0.55	0.00	0.79	1	1	0	1	3	Low
SM4	Spruce Mill Brook	Paved	613373	4904859	NAD83	0.61	0.37	0.00	0.36	2	2	0	0	4	Medium
SM5	Spruce Mill Brook	Paved	613370	4904872	NAD83	0.67	0.55	0.32	0.82	2	1	2	2	7	High
SM6	Spruce Mill Brook	Gravel	610840	4904983	NAD83	1.90	0.54	0.00	0.10	0	1	0	0	1	Low
	Clinton County sites:														
TB1	True Brook	Paved	597562	4943400	NAD83	0.41	0.63	0.00	1.00	2	1	0	2	5	Medium
TB10	True Brook	Paved	595237	4944636	NAD83	0.29	0.66	0.42	0.48	2	1	2	0	5	High
TB11	True Brook	Paved	592138	4944790	NAD83	0.83	0.16	0.15	0.57	1	2	1	1	5	Medium
TB12	True Brook	Paved	592708	4944828	NAD83	1.06	0.34	0.00	0.58	0	2	0	1	3	Low
TB13	True Brook	Gravel	592238	4947085	NAD83	0.79	0.75	0.00	0.48	1	1	0	0	2	Low
TB14	True Brook	Paved	590970	4944533	NAD83	N/A	N/A	0.10	0.00	0		0	0		N/A
TB15	True Brook	Paved	598675	4943583	NAD83	1.91	0.75	0.00	0.60	0	1	0	1	2	Low
TB2	True Brook	Paved	596919	4943656	NAD83	1.79	0.63	0.00	0.24	0	1	0	0	1	Low
TB3	True Brook	Paved	596745	4943761	NAD83	1.45	0.61	0.00	0.30	0	1	0	0	1	Low
TB4	True Brook	Paved	595729	4943771	NAD83	1.01	0.65	0.00	0.40	0	1	0	0	1	Low
TB5	True Brook	Paved	595274	494413	NAD83	1.18	0.83	0.00	0.86	0	0	0	2	2	Low
TB6	True Brook	Paved	595246	4944465	NAD83	1.32	0.02	0.00	0.77	0	2	0	1	3	Low
TB7	True Brook	Gravel	594017	4944754	NAD83	2.79	0.87	0.00	0.30	0	0	0	0	0	Low
TB8	True Brook	Gravel	593791	4944821	NAD83	1.30	0.76	0.00	0.44	0	1	0	0	1	Low
TB9	True Brook	Paved	593742	4944854	NAD83	0.61	0.15	0.00	0.55	2	2	0	1	5	Medium
TM1	Mihuc Brook	Paved	595104	4945712	NAD83	1.64	0.13	0.00	0.56	0	2	0	1	3	Low
BeB1	Behan Brook	Paved	600908	4947458	NAD83	1.65	0.75	0.00	0.21	0	1	0	0	1	Low
BeB2	Behan Brook	Paved	600956	4950297	NAD83	1.24	0.35	0.07	0.82	0	2	0	2	4	Medium
DI	Deep Inlet	Paved	592256	4954782	NAD83	2.22	0.23	0.00	0.00	0	2	0	0	2	Low
RB	True Brook	Paved	595398	4940454	NAD83	0.41	0.40	1.15	1.37	2	2	2	2	8	High

Appendix III.

Fish Passage Workshop Description
Workshop leader: Mark Malchoff, Lake Champlain Sea Grant
Where: SUNY Plattsburgh, January 17, 2008
Target Audience: Local, State and Federal partners. Fisheries managers, DPW, DOT, Trout Unlimited, staff at town, county, and state levels

Workshop Purpose/Objective: Audience members learned about the scope and seriousness of the fish habitat problem, learned new/correct passage technologies for fish species endemic to Lake Champlain Basin and how to document impediments.

We assembled experts in the fields of hydrology, engineering and fisheries in concert with VTDEC, Warren County SWCD, and USFWS staff in a one-day workshop setting in Plattsburgh, New York. A final agenda is given in Appendix III. An evaluation summary of the workshop is given in Appendix III. Important metrics of educational impact are given in the summaries to questions three and four. Over 95% of the workshop participants indicated that their knowledge of fish passage issues had increased as a result of this workshop. More importantly 71% of the respondents reported a 75% likelihood that they would implement at least some of this knowledge in the next 6-12 months. Additional narrative and verbal feedback from workshop participants was overwhelmingly positive. Of particular note is one testimonial that read… "I am "new" to this field and today's workshop was very informative. I will never look at a culvert the same way again!" Taken in total, the evaluation summary serves as an important statement of the need for this type of outreach, and the value placed upon it by the workshop participants.

This work was supportive of goals listed in Opportunities for Action, including the goal of *restoring and maintaining a healthy and diverse community of fish and wildlife for the people of the Lake Champlain Basin,* listed in Chapter Three of OFA. Specifically the work proposed here would enable specific steps in conserving, enhancing, and restoring [fisheries] habitat.

Stream Crossings Assessment Workshop

9:00-2:30 - January 17, 2008
Angell Center, SUNY Plattsburgh, Plattsburgh, NY

Sponsors:
US Fish and Wildlife Service, Greater Adirondack RC&D Council, and Lake Champlain Research Institute

Background: Road culverts, bridge structures, and small dams often limit fish migration, especially in small streams. Small watersheds may have numerous crossings which serve to isolate fish populations and damage fish habitat. Undersized structures also may complicate roadway maintenance problems. Emerging techniques now enable researchers, resource agency staff and highway personnel to quickly evaluate and rank structures based on stream characteristics and ability to pass desirable fish species. This workshop will review current assessment techniques, and scoring methods to prioritize problem crossings. Streambed models and a brief review of DEC permit processes will also be given.

Who should attend: Town, county, and state highway managers, fisheries personnel, conservationists and anglers

Location: Cardinal Lounge, Angell College Center (second floor). Parking available in lots 11, 12, and 16.

Agenda

9:00 Coffee and pastries

9:30 Introductions: **M. Malchoff**, LCRI; **Chris Smith**, USFWS; **Marc Usher**, Greater Adirondack RC&D Council;

9:45 Bridge and Culvert Assessment in Vermont. **Shayne Jaquith,** Vermont DEC

10:30 Fish passage assessments at stream road crossings: Essex and Clinton County demonstration watersheds. **Drs. Timothy Mihuc** and **Ed Romanowicz**, LCRI and Earth and Environmental Sciences Department, SUNY Plattsburgh

11:30 Question and Answer Roundtable

11:45 Buffet Lunch (provided).

12:30 Flume table demonstration: stream processes conveniently modeled. **Staci Pomeroy**, Vermont DEC

1:45 Break-out sessions (two concurrent groups). Discussion topics to include….

- Stream crossing assessments and prioritization of deficient crossings
- Feedback on NYSDEC Municipal General Permit process
- Funding Problems and Sources
- Other…………

2:30 Wrap-up

*************Workshop Evaluation************

(summary of evaluation handouts, n=45)

1. How did you learn about the workshop?
e-mail: 23 **51.1%**
postal mail: *3* **6.7%**
word of mouth: 15 **33.3%**
other (i.e. project affiliation): 4 **8.9%**

2. Workshop was organized, well publicized, well run and interesting
(*strongly disagree)* 1: 3 **6.7%**
2*:* 0 **0%**
3: 4 **8.9%**
4: 28 **62.2%**
(*strongly agree)* 5: 10 **22.2%**

3. Did your knowledge of fish passage issues increase as a result of this workshop?
Yes: 43 **95.6%**
No: 2 ***4.4%***

4. If "yes" to the above, what is the likelihood that you will implement any of this knowledge in the next 6-12 months?
Zero: 1 **2.2%**
25%: 5 **11.1%**
50%: 4 **8.9%**
75%: 32 **71.1%**
N/A: 3 **6.7%**

5. Please provide an overall score of the presentations:
Not useful: 45 **0%**
Somewhat useful: 6 **13.3%**
Very useful: 33 **73.3%**
Excellent: 6 **13.3%**

6. Please provide a score of the presentation entitled; *Fish passage assessments at stream road crossings: Essex and Clinton County demonstration watersheds* by **Mihuc** and **Romanowicz**
Not useful: 0 **0%**
Somewhat useful: 9 **20.0%**
Very useful: 26 **57.8%**
Excellent: 8 **17.8%**
No response 2 **4.4%**

7. The field protocols and assessments shown here should make it easier to develop listings of those culverts, bridges, etc. most deficient in their ability to pass native fish in the eastern Adirondack region.
(strongly disagree)1: 0 **0%**
2: 2 **4.4%**
3: 5 **11.1%**
4: 18 **40.0%**
(*strongly agree) 5:* 17 **37.8%**
No response: 3 **6.7%**