P.O. Box 217
Elizabethtown, NY 12932
518-873-3752
info@ausableriver.org

Working to protect and enhance the natural and cultural resources of the Au Sable watershed

Final Report

Annual Priority Grant
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Project Manager: Carol Treadwell-Steitz
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Introduction & Background

The Au Sable River flows from its headwaters, 2000 feet above sea level, down the steep slopes of the Adirondack High Peaks to its mouth 100 feet above sea level at Lake Champlain. Consequently, the Au Sable has one of the steepest gradients of any river in New York State. It begins as two mountain streams known as the East Branch and the West Branch. The West Branch begins at the confluence of Marcy and South Meadow Brooks in the High Peaks and flows 35 miles northeast to Au Sable Forks. The East Branch begins in the Ausable Lakes and flows 32 miles to Au Sable Forks. The Main Stem completes the trip from Au Sable Forks to Lake Champlain in 24 miles. In total the Ausable River drains 516 square miles of land.

The Ausable River is included in the National Park Service's *Nationwide Rivers Inventory*, and is designated part of the Wild, Scenic, and Recreational Rivers System of New York State. It is a renowned trout fishery and the West Branch hosts one of the longest stretches of catch-and-release fishing in New York State.

Despite the West Branch's success as a fishery, parts of the watershed are listed as having "reduced" trout populations on the "NY State Trout Population" map. One possible cause of habitat reduction is excess stream sedimentation. The Au Sable River Association (ASRA) has long recognized the importance and need for reducing sediment runoff into the river. Excess sediment and its impact to the aquatic ecosystem along the Ausable River have been noted by NYSDEC in their non-point source pollution Priority Waterbodies List and by embededness studies conducted by the Boquet and Au Sable River Associations. This study continued the work of inventorying the stream in order to assess where sediment sources from eroding stream banks and to identify river reaches that may need stabilization efforts.

Methods & Materials

For this study two forms of data were collected. Field data was collect on stream geomorphic characteristics and existing data were collected from other studies conducted by the ASRA.

Data on erosion and bank height was collected using the Vermont SGA protocol. The river was divided into reaches by the ASRA Executive Director (ED) and then the Stream corridor was waded by the ASRA ED and volunteers. Each reach was marked at its starting and ending point using a handheld GPS unit. The reaches were assessed for the amount of bank erosion present and bank height according to the table listed below.

Table 1. Stream Geomorphic Assessment Protocol

Amount of Erosion Present:
High – Bank erosion observed along ≥30% of the reach length
Low – Bank erosion observed along <30% of the reach length
None – No bank erosion observed
Not Evaluated – The reach was not assessed
Bank Height:
High - >15 ft from streambed to top of bank or slope
Medium – 5-15 ft from streambed to top of bank or slope
Low - <5ft from streambed to top of bank or slope
Not Evaluated – The reach was not assessed

Following completion of the field inventory the GPS data points were downloaded to a table in ARcViewMap and a map of erosion and bank height were created (Figure 1).

Other Data:
The project plan calls for other available GIS data on Stream Bank Erosion in the Au Sable to be collected. The following personnel and agencies were contacted for information:

Cornell Cooperative Extension – Anita Deming
NYDEC – Brian Finlayson (GIS Department head)
APA – John Barge (GIS Specialist); Arial Diggory, (summer intern).
Essex County Soil and Water – Rob Bissig

Cornell did a fly over of the Ausable Watershed in 1999 to identify channel erosion hot spots. A video was produced but no GIS database resulted. Any reports or video copies were not retained by the ASRA. NYDEC and APA reported they owned no erosion studies or databases on Ausable resources. The Soil and Water District had agricultural data but not in GIS format and no data that could be released due to confidentiality agreements with farmers.

Three other stream geomorphic assessments (SGA) have been conducted on the Ausable by the ASRA. The first SGA was conducted in 1999-2000 by the Boquet and Au Sable River Associations on 4 locations widely spread throughout the watershed. A second SGA was conducted in 2005 on the East Branch between Keene Valley and Keene. The Boquet River Association also conducted embededness studies on the Ausable in 1993 and 1994.

Results

The 2006 Ausable stream survey has been the most comprehensive in length of stream assessed. The 2005 results were merged with the 2006 survey to complete a GIS map of Erosion and Bank Height (Figure 1). The 1999 and 2005 surveys resulted in very detailed data and a copious number of calculated variables and ratios to represent stream health and character. The 1999 data will be discussed separately.

Figure 1 shows a map of erosion and bank height. Erosion is shown with color and bank height is displayed as thickness of the line representing the stream segment. High, Low, No Erosion are represented by red, green, and yellow respectively. High, Medium, Low Bank Height are represented by thick, medium, and thin lines respectively. Excluded from coverage are the steep headwater channels of the West and East Branch (12 miles), a steep section between Wilmington and Au Sable Forks, and Ausable Chasm which has 100 foot waterfalls and steep cliff walls making walking survey impossible.

An Arc View query on this map indicates that there are 19.8 miles of channel that are highly eroded; 25 miles show low erosion and 8.4 miles show no erosion. 0.8 miles have low erosion on one bank but high erosion on the opposite bank due to changes in geology on either side of the channel.

When queried for bank height, the database calculates 13.6 miles of high banks (greater than 15 ft. high), 4.2 miles of low banks (less than 5 feet high), and 36 miles of banks with 5 to 15 feet high (medium).

Over all, only 1.8 miles are recorded as having high banks and high erosion, but 18 miles have high erosion and medium banks. These high erosion spots occur on the West Branch between the Route 73 Highway Bridge and High Falls Gorge. On the East Branch high erosion was noted on meander bends on the southern margin of Keene Valley, and also from Rivermede Farm on the northern edge of Keene Valley to the intersection of Grist Mill and Hulls Falls Roads. 8.6 out of 11 miles of stream between Lacy Bridge and Stickney Bridge on the East Branch are highly eroded with medium to high banks. On the Main Stem two locations show high erosion and high banks: the foot bridge in Keeseville and 1 mile upstream from the mouth where the railroad crosses the river.

Figure 1. The Au Sable Watershed showing erosion and bank height from 2005-2006 SGA and study locations from other State, ASRA, and BRASS studies. DEC numbers (brown) indicate NYSDEC non-point Priority Waterbodies list. A and EA numbers correspond to embededness and numbers correspond to detailed geomorphic assessments. Colors mimic those described in the upper left corner of the Figure for erosion segments.

Results from other studies:

The NYSDEC non-point source Priority Waterbodies lists 47 miles of impacted channel on the Ausable.

Segment #	Stream miles impacted
1004-0022	6 miles, main Stem from Au Sable Forks to Clintonville
1004-0014	24 miles, East Branch from St. Huberts to Au Sable Forks
1004-0013	15 miles, West Branch from Lake Placid to Wilmington
1004-0042	2 miles, West Branch along County Route 19 to Little Black Brook

The 1999 "Stability and Inventory of AuSable" study conducted intensive geomorphic survey on 4 sites within the watershed.

Study Area #	Location
1a, 1b	West Branch Catch and release area from Holcomb Brook tributary to the Rt. 86 bridge
2	Black Brook, a tributary to the West Branch in the Town of Black Brook
3	The Bush, 2 mile segment between black brook and Au Sable Forks
4	Gulf Book, a tributary to the East Branch in Keene

The complete results of these studies are found in Appendix A of this report. The results pertain to erosion quantities and channel stability is summarized below:

Study Stream	Pfankuch Channel Stability*	Bank Erosion Potential**	Considered Stable or Unstable
1a	Poor	Moderate	Stable
1b	Fair	Stable	Moderate
2	Good	Low to Moderate	Stable
3	Good	Low	Stable
4	Fair	Low	Stable

*Incorporates measurement of upper and lower bank and channel bottom cover, slope, vegetation, and scour or evidence of deposition.
** Utilizes bank height/bank full height ratio, root depth and density, and bank angle.

Embededness results:
The NYSDEC NPS PWPs for Essex County lists 132 miles of embedded streams that stress or threaten fisheries habitat. Fifty-eight (58) miles of the Ausable are embedded; the source of embedding material according to DEC is winter road sand. Studies on the Boquet, however, found that bank erosion is the predominant source of in-stream sedimentation.

BRASS examined eight locations along the East Branch of the Ausable for embededness in 1993 and repeated the study in 1994. Transects were established at each location and embededness was evaluated at each bank and 25, 50, and 75% of the distance across the river. A 4 foot diameter area was assessed for dominant particle size and percent embededness.

Results from the East Branch shows that two (2) of the eight (8) sites studied had embededness percentages above what is considered to impair fish reproduction (Figure 2). Site A-2 (mile 20 Styles Brook Road) had the highest embededness in the Ausable. It has a good gradient (0.027 ft/ft but velocities are slow (.59 fps) and bank scour and road sand contributions are evident. The Upper Jay parking area (EA-2) and Au Sable Forks (EA-5) also had high embededness percentages. Velocity at both locations was slightly higher - 0.98 and 0.96 fps - and sand was the dominant embedding material.

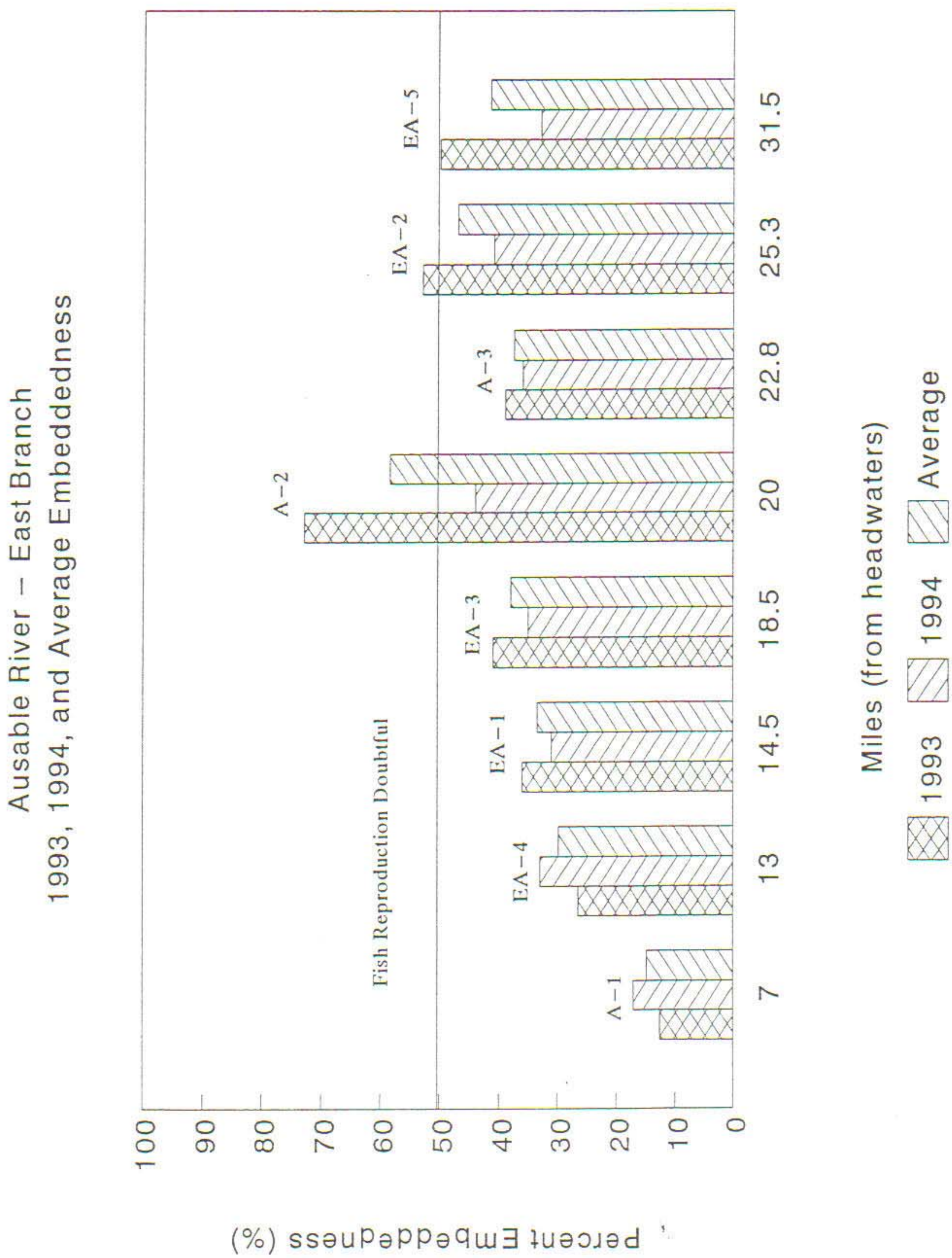

Figure 2. Embededness percentages from a 1993-194 study conducted by the Boquet River Association (Brass). See table below for location names.

Table 2. Embededness Transect Locations	
Site	**Location**
A-1	Ausable Club
EA-4	Beede Road (Keene Valley)
EA-1	Fish Weir on Rt. 73
EA-3	Lacy Road
A-2	Styles Brook Road
A-3	Upper Jay
EA-2	Upper Jay Parking Area
E-5	Au Sable Forks

Sediment Box Collectors: BRASS placed sediment collection boxes in the stream at location corresponding to the embededness transects in order to asses the amount, size, and type of sediment accumulating on the stream bed (Figure 3). Highly embedded sites were not necessarily areas of heavy sand collection. The Styles Brook Road transect (A-2) had high embededness and the transect above it, Lacy Road (EA-3), had high sediment collection but the two downstream sites, Upper Jay Parking (EA-2) and Au Sable Forks (EA-5) had high embededness but low weight of sediment collection.

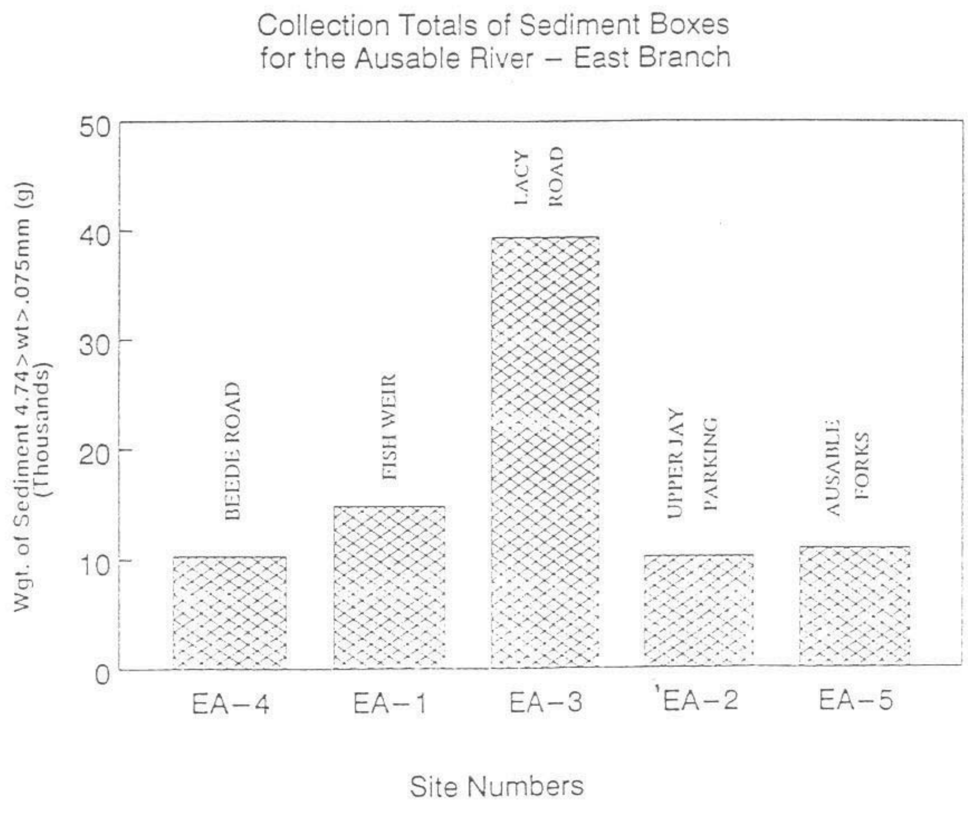

Figure 3. Weight of sediment larger than silt smaller than course sand trapped in sediment traps on the bed of the Ausable River. Location correspond to embededness transects listed above.

Possible sources of sediment are roadway sand or bank erosion. On the Boquet, tonnage of sand from bank collapse far out-weighed that from road sand. Studies of grain size in road sand vs. bank sand also showed two different populations of grain sizes with sand spread by DOT trucks being much courser than that captured in the in-stream sediment traps. The data was less conclusive on the East Ausable because tons of sediment from bank erosion was not known. Only 3 stream bank miles on the Ausable were assessed for bank collapse. DOT records showed that 4,000 tons of sand was applied to the roads adjacent to the East Branch (over 4 times the linear mileage applied to the Boquet). The 3 miles of stream bank studied contributed 1,811 tons of sand per year.

Discussion and Conclusion

Present and past stream geomorphic assessments and embededness studies clearly point out that the Ausable while scenically beautiful is tragically unhealthy from the stand point of stream geomorphology and habitat measures. 58 out of 94 miles of the main channel are embedded and NYSDEC non-point source Priority Waterbodies lists 47 miles of impacted channel. Furthermore, this study shows that 20 miles of river have highly eroded channels and banks.

Different data sources and studies concur that bank erosion and sediment choking are occurring on the Ausable. DEC Priority Waterbodies channel lengths (Figure 1 shown in brown) correspond to areas mapped as high erosion and/or high to medium bank height by this study. Detailed geomorphic assessment of four sites on the Ausable (Figure 1 numbers 1 – 4) indicate "Poor" and "Fair" channel stability where this study maps high erosion and bank height. Embededness surveys show high impact in the same reaches where high erosion is found in this study (Figure 1, "A" and "EA" numbers). While the source of this sediment was unclear in a 1993-1994 BRASS study of the Ausable, it seems clear from the relationship of eroded reaches to embedded reaches that bank erosion is a significant source of this sediment. The studies do not rule out road sand as a source. Road sanding and salting could be a contributor as most of the length of East, West, and Main Branch are in close proximity to roadways, and sometimes sit right at the top of the river bank.

Appendix I:
Results from 1999 SGA

classification	name/location	bankfull width ft.	length ft.	entrenchment ratio	width/depth ratio	sinuosity	channel slope %	D-50 substrate material
A4	Gulf Brook, AuSable trib	34	479	5.4*	12.5	1.1	4.87	gravel
B3	"The Bush," E.Br.AuSable	164	1430	1.5	34	1.2	.47	cobble
B3c	Boquet, Willsboro gaging station	128	3638	1.8	31.5	1.2	.286	cobble
B4c	Barton Brook 1, Boquet trib	15	527	1.5	10.8	1.2	.82	gravel
	Barton Brook 2, Boquet trib	17	688	2	15.5	1.2	1.24	gravel
C3	Black Brook, AuSable trib	46	708	3.3	15.8	1.1	.427	cobble
C4	Boquet, near New Russia	90	2245	4.2	22.4	1.5	.498	gravel
C4c	"Catch&Release 1," W.Br.AuSable	70	1442	3.4	11.5	1.1	.054	gravel
C5	Boquet, "Bailey" near Whallonsburg	90	1872	2.9	15	1.2	.039	sand
	Boquet, "Boquet Fields 1" in Wadhams	100	1590	6.2	12	1.0	.025	sand
C5c	Boquet, "Boquet Fields 2" in Wadhams	124	1825	4.0	25	1.7	.008	sand
	Boquet, "V.Pierce" in Wadhams	96	2140	6.1	14	1.4	.007	sand
	"Catch&Release 2," W.Br.AuSable	110	1221	5	23.1	1.2	.039	sand
D4	The Branch, Boquet trib Elizabethtown	65	1160	1.9	48	1.6	.69	gravel
F5	Boquet, "Boquet Fields 1.5 Wadhams	79	662	1.2	23	1.1	.015	sand

Entrenchment Ratio = Width of flood prone area/width of bankfull channel
Sinuousity = Stream Length/Valley Length

Study Stream	*Pfankuch Channel Stability*	*Bank Erosion Potential*	*Considered stable (S) or unstable (U)*
Gulf Brook, AuSable trib	Good	Low	S
"The Bush," E. Branch AuSable River	Fair	Low	S
Barton Brook 1, Boquet tributary*	Poor	Low	S
Barton Brook 2, Boquet tributary*	Fair	Moderate	S
Black Brook, AuSable tributary	Good	Low to Moderate	S
Boquet River, near New Russia	Good	Low	S
"Catch & Release 1," W. Branch AuSable	Poor	Moderate	S
"Bailey," Boquet River near Whallonsburg**	Poor	Very High	U
"Boquet Fields 1," Boquet River in Wadhams**	Poor	Very High	U
"Boquet Fields 2," Boquet River in Wadhams**	Poor	Extreme	U
"V.Pierce," Boquet River in Wadhams***	Poor	Moderate	S
"Catch & Release 2," W. Branch AuSable	Fair	Moderate	S
The Branch, Boquet River tributary	Good	Moderate	U
"Boquet Fields 1.5," Boquet River in Wadhams	Good	Moderate	U

* Barton Brook frequently floods at its confluence with The Branch in Elizabethtown, necessitating evacuation of a trailer park. An upstream landowner requested BRASS assistance in determining whether a small dam should be repaired or taken out. If removed, the morphological surveys could provide a blueprint for channel restoration.

**These surveys are areas with current Fisheries Across America and Lake Champlain Basin Program funding for streambank erosion controls.

***This reach was selected as perhaps the most stable reference reach in the C5 classification on the Boquet River with similar land uses to the "Bailey" and "Boquet Fields" streambank erosion control sites. (See discussion on next page.)

Pfankuch Channel Stability incorporates measurements of the upper and lower bank and channel bottom cover, slope, vegetation, and scour or evidence of deposition.
Bank Erosion Potential utilizes bank height/bankfull height ratio, root depth and density, and bank angle.

CHANNEL STABILITY MEASURES
Rapid Geomorphic Assessment

In the table below, the percentage is given for the number of cross-sections exhibiting each stability indicator.

Aggradation					*Degradation*						*Widening*						*Planimetric adjustments*					
A-1	*A-2*	*A-3*	*A-4*	*A-5*	*D-1*	*D-2*	*D-3*	*D-4*	*D-5*	*D-6*	*W-1*	*W-2*	*W-3*	*W-4*	*W-5*	*W-6*	*P-1*	*P-2*	*P-3*	*stream classif.*	*considered stable(S) unstable(U)*	*reach name*
100	80										100	100					100			A4	S	Gulf Brook
80											60									B3	S	The Bush
80	80										100	100								B4c	S	Barton Br. 1
40	20	20	40								80	80			20				40	B4c	S	Barton Br. 2
60											100	100			20					C3	S	Black Brook
40	20		20								100	100			20		40			C4	S	New Russia
60	40	40	20								80	60			100	20	20			C4c	S	Catch&Rel. 1
N/A	N/A										80	80			80	10		100		C5	U	Bailey
N/A	N/A										60	20			20	20		100		C5	U	Boq. Fields 1
N/A	N/A		40	40							40	60			100	100		100		C5c	U	Boq. Fields 2
N/A	20		60								100	100			80	80		100		C5c	S	V.Pierce
20	40	20	20								20	40			60					C5c	S	Catch&Rel. 2
60	40	80	40								40	40			60	60	80			D4	U	The Branch
N/A	N/A			40							40	40			40	40		100		F5	U	Boq.Fields 1.5

A1= Embeddedness in riffles
A2= Siltation of pools
A3= Mid-channel bars
A4=Growing bars (w/no vegetation)
A5= Bar width >½ stream width, low flow

D1= Exposed infrastructures
D2= Undermined bank revetments
D3= Cut faces on bars
D4= Head cuts, steep riffles
D5= Suspended armor layer, bank
D6= Avg shear stress >critical shear stress

W1= Leaning trees, high % woody debris
W2= Exposed tree roots
W3= Basal scour on inside of meander bends
W4= Basal scour both sides of riffle
W5= Non-cohesive soils in steep banks
W6= Lack of vegetation at eroding banks

P1= Multiple-thread channels, flood chutes, cut-offs
P2= Run features replace riffle/pool features
P3= Thalweg alignment out of phase with meander form