Appendix C

Sheets used in field assessments of the watershed

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CHANNEL-STABILITY INDEX RANKING SCHEME*

Station # **Scheme Sheet #:**

Date: **Crew:**_____ **Site Coordinates:**_____

Pictures: ☐ U/S ☐ D/S ☐ X-section ☐ LB ☐ RB **Samples:**_____

Pattern: ☐ Meandering ☐ Straight ☐ Braided ☐ Drainage Ditch**

Field Measurements:
Reach length:_____ Est. Reach Slope:_____
Avg channel widths: (top)_____(bottom)_____ Avg/Max channel depth:_____
/_____
LB angle (avg):_____ RB angle (avg):_____
Primary bank material:_____ Primary bed material: *(See #1)*
(GP=gravel; SP=sand; ML=silt; CL=clay; BR=bedrock)

1. Primary bed material

Bedrock	*Boulder/Cobble*	*Gravel*	*Sand*	*Silt/Clay*	
0	1	2	3	4	

2. Bed Protection

a) *Yes*
OR 0 *#Banks Protection*
b) *No* *(with)* *One (L or R)* *Both*
1 2 3

3. Degree of floodplain separation/incision** (Relative elevation of "normal" low water; floodplain/terrace @100%)

0-10%	*11-25%*	*26-50%*	*51-75%*	*76-100%*	
4	3	2	1	0	

4. Degree of constriction (Relative decrease in top-bank width from up to downstream)

0-10%	*11-25%*	*26-50%*	*51-75%*	*76-100%*	
0	1	2	3	4	

5. Streambank erosion (Each bank over reach length)

	None	*Fluvial*	*Mass wasting (failures)*	
Left	0	1	2	
Right	0	1	2	

6. Stream bank instability (Percent of each bank failing over reach length)

	0-10%	*11-25%*	*26-50%*	*51-75%*	*76-100%*	
Left	0	0.5	1	1.5	2	
Right	0	0.5	1	1.5	2	

7. Established woody vegetative cover (Percent of each bank face over reach length)

	0-10%	*11-25%*	*26-50%*	*51-75%*	*76-100%*	
Left	2	1.5	1	0.5	0	
Right	2	1.5	1	0.5	0	

8. Occurrence of bank/bar accretion (Percent of each bank with fluvial deposition over reach length)

	0-10%	*11-25%*	*26-50%*	*51-75%*	*76-100%*	
Left	2	1.5	1	0.5	0	
Right	2	1.5	1	0.5	0	

9. Stage of Channel Evolution (If applicable)

I	*II*	*III*	*IV*	*V*	*VI*	
0	1	2	4	3	1.5	

OTHER OBSERVATIONS:

Total Score: ☐

* Adapted from Kuhnle and Simon (2000)

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Sheets used in field assessments of the watershed

BIOLOGICAL/HABITAT INDEX RANKING SCHEME (low gradient streams)*

Station # Station Description:

Date: Crew:_____ Samples Taken:

Pictures: ☐ U/S: ☐ LB ☐ RB ☐ Channel Bed ☐ _____

☐ D/S: ☐ LB ☐ RB ☐ LB Riparian Zone ☐ _____

☐ RB Riparian Zone ☐ _____

1. Availability of favorable habitat *(snags, submerged logs undercut banks; average of LWD and detritus)*

>50%	*30-50%*	*10-30%*	*<10%*	
4	3	2	1	

2. Pool-substrate composition

GP & firm SP	*Soft SP & ML-CL*	*All ML-CL or All SP*	*Hardpan/ Bedrock*	
4	3	2	1	

3. Pool-variability character

Mix large/small & deep/shallow	*Majority large-deep pools*	*Shallow pools more prevalent*	*Majority small-shallow or absent*	
4	3	2	1	

4. Active streambed/bar deposition

0-20%	*21-50%*	*51-80%*	*81-100%*	
4	3	2	1	

5. Streambed exposure

0-5%	*5-25%*	*25-75%*	*75-100%*	
4	3	2	1	

6. Degree of "hard" channel alteration (channelization, dredging, embankments/shoring structures, gabion/cement)

Channelization/ dreding absent	*Minor or historic*	*40-80% reach disrupted*	*>80% Disrupted/ habitat altered*	
4	3	2	1	

7 (low). Sinuosity

3-4	*2-3*	*1-2*	*Straight*	
4	3	2	1	

7 (high). Pool-riffle sequence (% Pool + % Riffle)

>80%	*51-80%*	*20-50%*	*<20%*	
4	3	2	1	

8. Bank Instability (Percent each bank failing)

	0-5%	*6-30%*	*31-60%*	*61-100%*	
Left	2	1.5	1	0.5	
Right	2	1.5	1	0.5	

9. Vegetative Bank Protection (Bank face):

	>90% covered w/mix of veg.	*70-90% cover*	*50-70% cover; disruption obvious; bare patches*	*<50% veg disruption high*	
Left	2	1.5	1	0.5	
Right	2	1.5	1	0.5	

10. Riparian-zone width (out from edge of water)

	>20m	*10-20 m*	*5-10 m*	*<5m*	
Left	2	1.5	1	0.5	
Right	2	1.5	1	0.5	

Total Score: ☐

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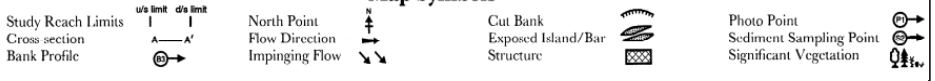
Sheets used in field assessments of the watershed

Geomorphic Assessment Stream-Evaluation Data Sheet

Supplemental Sketch Sheet# _____

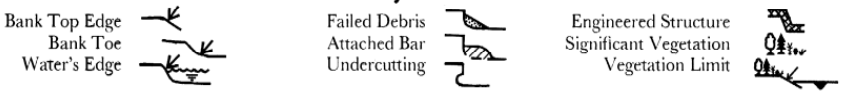
☐ Planform Sketch

Map Symbols



☐ Bank Sketch (Left or Right)

Profile Symbols



EVALUATION SHEET #:	SITE #:	DATE:	

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Sheets used in field assessments of the watershed

BANK HEIGHT/SLOPE (BHS) MEASUREMENT NOTES

NOTE #:	**DATE:**	**CREW:**	**UNITS:** Metric / English
STREAM:	**TIME:**	**REACH LOCATION:**	
CROSS-SECTION # **of**		**DISTANCE FROM U/S REACH:**	
Measurement instruments: **Distance method:** tape / laser rangefinder / acoustic device / pace / other **Inclination method:** Abney level / Brunton / clinometer / hypsometer / rod & tape / other level			

Cross-section sketch for instrument and shot locations (see examples)**:**

LB RB

STANDING ON BANK (Left/ Right)	Shot ID	Location of Target on Bank*	Location of Instrument*	Height of Instrument	Distance (indicate units)	Angle (degrees)	Calculated Height from Level (M-N)
	A						
	B						
	<D						
	3						
	4						
	5						
	6						
		Scenario #1 (A, B)	**Scenario #2 (A, B, <D)**	**1**	**2**	**3**	**4**
Ht of Opposite Bank:							
Angle of Opposite Bank:							
Ht of Near Bank:							
Angle of Near Bank:							
Channel Width @ TOB:							

* **TOB/VF**=top of bank/vertical face; **UB**=upper bank; **SL**=slough line; **DS**=deposition surface; **EOW**=edge of water; **CB**=cutbank; **CS/Bar**=channel shelf

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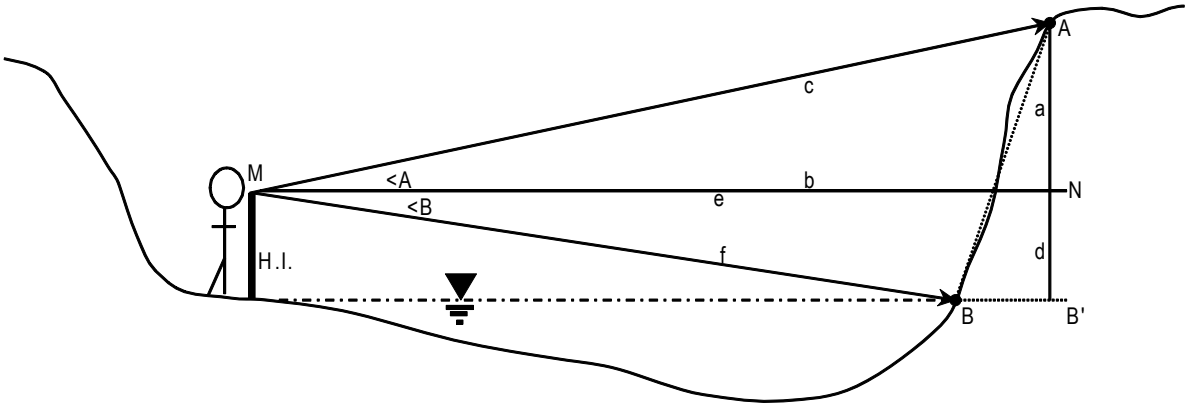
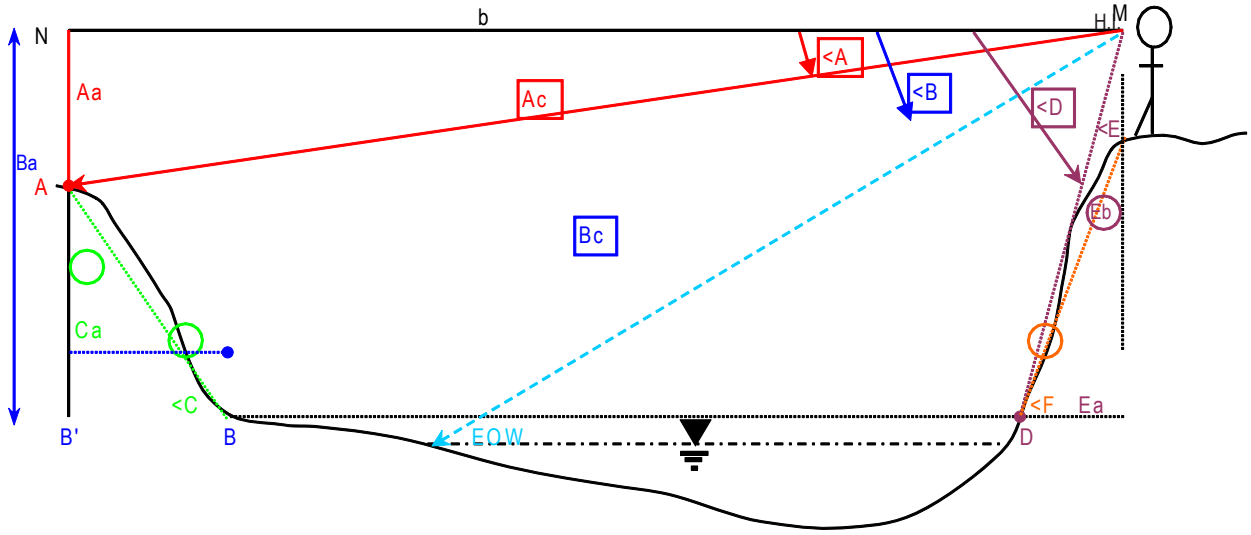
Sheets used in field assessments of the watershed



Measure:
1) Shoot points A and B with rangefinder to get lengths c and f.
2) Measure <A and <B with level to get inclination in degrees.

Height of Bank (Distance AB'): $a + d = (c * \sin{<A}) + (f * \sin{<B})$

Average Slope of Bank (in degrees): $\tan{<Z} = \frac{a + d}{A - B}$



Measure:
1) Shoot points A and B with rangefinder to get lengths Ac and Bc.

2) Measure <A, <B, and <D with level to get inclination in degrees.

Height of Opposite Bank (Distance AB'=Ca):

Ba = Bc * sin<B
Aa = Ac * sin<A
Ca = Ba-Aa

Average Slope of Opposite Bank (in degrees):

<C = 90-(tan-1 [Ca / (A-B)])

Height of Near Bank (Eb):

Eb = Ba - H.I.

Average Slope of Near Bank (in degrees):

<E = 90 - <D
Ea = Ba * tan<E
<F = 90-(tan-1 [Eb/Ea])

Channel Width at TOB (b):

$b = \sqrt{(Ac^2 - Aa^2)}$

Drawings adapted and modified from Compton (1962).

Appendix C

Sheets used in field assessments of the watershed (Sheet 1)

Geomorphic Assessment Stream-Evaluation Data Sheet

Adapted from Kuhnle and Simon (2000), Rhoads (2003) and Thorne (1998)

☐ Metric ☐ English

SITE INFORMATION				
STATION#:	DATE:	CREW:	EVALUATION SHEET #:	
SITE NUMBER:	STREAM NAME:		MAJOR WATERSHED:	
NEAREST GAGING STATION:	DRAINAGE AREA:		COUNTY:	
QUAD SHEET:	COORDINATES (Lat/Long or TRS):			
WEATHER (current):	WEATHER (past 24 hours):			
GENERAL STREAMFLOW CONDITIONS				
FLOW TYPE: (none, smooth, pool/riffle, run, rapid-tumbling)	*FLOW WIDTH:*		FLOW DEPTH: (@ center)	
APPEARANCE OF WATER:	*AVG SURFACE VELOCITY:*		FLOW (cfs): (if available or [high, medium, low])	
HIGH FLOW PLANFORM: (straight, mildly sinuous, meandering, tortuous, braided, anabranching)			SINUOSITY: (channel length/valley length)	
LOW FLOW PLANFORM: (straight, mildly sinuous, meandering, tortuous, braided, anabranching)			*SINUOSITY:* (channel length/valley length)	
GENERAL CHANNEL DESCRIPTION				
REACH LENGTH:	TOP-BANK WIDTH: *Mid Reach:*		*U/S end:* *D/S end:*	
MAXIMUM CHANNELWIDTH (for entire reach):	and *CORRESPONDING CHANNEL DEPTH:*			
MAXIMUM CHANNEL DEPTH (for entire reach):	and CORRESPONDING CHANNEL WIDTH:			
GRADIENT:	STRUCTURES: (none, bridge, grade control, culverts, bank)		*%DETRITUS:*	*% LWD:*
% POOL:	*% RIFFLE:*	% RUN:	CROSS SECTION TAKEN (yes / no)?	
[If applicable]	(Pool + Riffle + Run = 100%)		Location of Record:	
BED WIDTH:	Method:	BERM WIDTH:	Method:	*CEM:*
(Method: T=tape; R=rangefinder (type); A=acoustic device; P=pace)				(I, II, III, IV, V, VI)
BANKFULL INDICATORS (circle any): none-incised / active floodplain / berm / woody veg / bar tops				
% RELATIVE ELEVATION AT BANKFULL:	*% RELATIVE ELEVATION AT LOW WATER:*			
(Assume top height = 100%, N/A if appropriate)				
WIDTH OF RIPARIAN ZONE (Top of Left Bank):	*WIDTH OF RIPARIAN ZONE (Top of Right Bank):*			
FLOODPLAIN LANDUSE (urban, forest, pasture, row crop/riparian buffer-width): Left:_____/_____/_____ Right: _____/_____/_____				

Sheets used in field assessments of the watershed (Sheet 2)

CHANNEL BED DESCRIPTION

BED MORPHOLOGY: (flat, uniform; scour holes; pool-riffle sequence)	*BED CONTROLS:* (none; bedrock; cohesive materials; armoured; structure; rip-rap)
PRIMARY BED-MATERIAL TYPE:	*SECONDARY BED-MATERIAL TYPE:*
(GP=gravel; SP=sand; ML=silt; CL=clay; BR=bedrock)	
POOL SUBSTRATE: (GP with firm SP; Soft SP with ML-CL; All ML-CL; All SP; Hard Pan CL; Rock)	*ACTIVE BED DEPOSITION (Type and % area):* (GP-SP, SP, ML, CL)

BED EXPOSED: (% Area out of water)	EXPOSED BED FORMS: (attached point bar, mid channel, alternate)	COHESION (kg/cm^2): (shear testing device; 14.2258)
KNICKPOINT PRESENT? (Yes / No)	HEIGHT:	MATERIAL: (GP, SP, ML, CL, BR)

Planform Sketch:

Map Symbols

Study Reach Limits	u/s limit d/s limit	North Point	N	Cut Bank		Photo Point	P1
Cross-section	A — A′	Flow Direction		Exposed Island/Bar		Sediment Sampling Point	S2
Bank Profile	B3	Impinging Flow		Structure		Significant Vegetation	

SEDIMENT SAMPLES:		CH_____	CH_____	CH_____	CH_____

Appendix C

Sheets used in field assessments of the watershed (Sheet 3)

LEFT BANK DESCRIPTION

REACH TYPE: (I=inside; O=outside; S=straight	BANK HEIGHT: (average or range)	*BANK ANGLE (degrees):* (average; degrees from horizontal)
% WOODY COVER:	*% HERBACEOUS COVER:*	% OTHER:

DENDROGEOMORPHIC INDICATORS [corrasion scars/tilt sprouts/tree age/tree ring anomalies] (circle):

BANK SURFACES (yes, no):

VF_____	UB_____	SL_____	*DS*_____	CB_____	*CS/Bar*_____

(VF=vertical face; UB=upper bank; SL=slough line; DS=depositional surface; CB=cutbank; CS/Bar=channel shelf)

HEIGHT OF CB:	HEIGHT OF VF:	DIST. OF TENSION CRACK FROM VF:	SHEAR STRENGTH (kg/cm^2): (shear testing device; 14.2258)

SURFICIAL MATERIAL (Origin / Type):

VF____/____	UB____/____	SL____/____	DS____/____	CB____/____	CS/Bar___/___

(I=insitu [M=modern; PM=pre-modern], D=deposited, F=failed) **/** (CL=clay, ML=silt, SP=sand, GP=gravel, BR=bedrock**)**

TYPE OF ACCRETED SEDIMENT: **(N=none,** CL=clay, ML=silt, SP=sand, GP=gravel**)**	*% BANK WITH FLUVIAL DEPOSITION:*	*% BANK FAILING:*

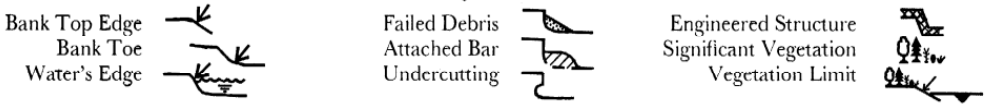
DOMINANT TYPE OF EROSION PROCESS ON:

VF_____	UB_____	SL_____	DS_____	CB_____	CS/Bar_____

(N=none-stable, MW=mass wasting, F=fluvial erosion, S=sapping, D=deposition)

Bank Sketch:

Profile Symbols



SEDIMENT SAMPLES:		LB_____	LB_____	LB_____	LB_____

Appendix C

Sheets used in field assessments of the watershed (Sheet 4)

RIGHT BANK DESCRIPTION					
REACH TYPE: (I=inside; O=outside; S=straight		BANK HEIGHT: (average or range)		*BANK ANGLE (degrees):* (average; degrees from horizontal)	
% WOODY COVER:		*% HERBACEOUS COVER:*		% OTHER:	
DENDROGEOMORPHIC INDICATORS [corrasion scars/tilt sprouts/tree age/tree ring anomalies] (circle):					
BANK SURFACES (yes, no):					
VF_____	UB_____	SL_____	*DS*_____	CB_____	*CS/Bar*_____
(VF=vertical face; UB=upper bank; SL=slough line; DS=depositional surface; CB=cutbank; CS/Bar=channel shelf)					
HEIGHT OF CB:	HEIGHT OF VF:	DIST. OF TENSION CRACK FROM VF:		SHEAR STRENGTH (kg/cm^2): (shear testing device; 14.2258)	
SURFICIAL MATERIAL (Origin / Type):					
VF____/____	UB____/____	SL____/____	DS____/____	CB____/____	CS/Bar___/___
(I=insitu [M=modern; PM=pre-modern], D=deposited, F=failed) **/** (CL=clay, ML=silt, SP=sand, GP=gravel, BR=bedrock**)**					
TYPE OF ACCRETED SEDIMENT: **(N=none,** CL=clay, ML=silt, SP=sand, GP=gravel**)**		*% BANK WITH FLUVIAL DEPOSITION:*		*% BANK FAILING:*	
DOMINANT TYPE OF EROSION PROCESS ON:					
VF_____	UB_____	SL_____	DS_____	CB_____	CS/Bar_____
(N=none-stable, MW=mass wasting, F=fluvial erosion, S=sapping, D=deposition)					
Bank Sketch: **Profile Symbols** Bank Top Edge Bank Toe Water's Edge  Failed Debris Attached Bar Undercutting  Engineered Structure Significant Vegetation Vegetation Limit 					
SEDIMENT SAMPLES:		RB_____	RB_____	RB_____	RB_____

Sheets used in field assessments of the watershed (Sheet 5)

PHOTOGRAPHIC RECORD				
DATE:	CAMERA TYPE:			PHOTOGRAPHER:
PHOTO CHECKLIST:				
	☐ U/S	☐ Mid-reach	☐ D/S	*Remember: add a recognizable scale in all pictures; record photo number; and time of day (shadows)*
	☐ Channel Bed	☐ Left Bank	☐ Right Bank	
	☐ Structures	☐ LB Riparian	☐ RB Riparian	
PHOTO #	DESCRIPTION			
MISCELLANEOUS OBSERVATIONS				

Sheets used in field assessments of the watershed (Sheet 6)

FIELD CHECKLIST

- ☐ Binoculars
- ☐ Bottled water
- ☐ Calculator
- ☐ Camera (preferrably digital)
- ☐ Cell phone
- ☐ Clipboard (field sheets)
- ☐ Compass (Silva/Brunton)
- ☐ Field backpack
- ☐ Field book
- ☐ Field Sheets
- ☐ First-aid kit (small)
- ☐ Geologic hammer
- ☐ Grain size chart
- ☐ Gravelometer
- ☐ Handheld GPS
- ☐ Increment borer
- ☐ Insect repellent
- ☐ Laser rangefinder / Hypsometer
- ☐ Level (Abney level/clinometer)
- ☐ Map: Air Photos
- ☐ Map: Bedrock
- ☐ Map: Plat (landowner info)
- ☐ Map: Road atlas
- ☐ Map: Surficial materials
- ☐ Map: Topographic
- ☐ Measuring tape/stakes/pins
- ☐ Pocket Rod/Surveying Rod/ Range Pole/Staff
- ☐ Probe rod (tile probe, etc.)
- ☐ Raingear
- ☐ Soil Probe (bank sampling)
- ☐ Trenching tool/plastic bags/ permanent marker
- ☐ Wading boots
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____

Material Size Classification:

GW Well-graded gravels, Gravel-sand mistures, little or no fines

GP Poorly-graded gravels, Gravel-sand mixtures, little or no fines

GM Silty gravels, gravel-sand-silt mixtures

GC Clayey gravels, gravel-sand-clay mixtures

SW Well-graded sands, gravelly sands, little or no fines

SP Poorly-graded sands, gravelly sands, little or no fines

SM Silty-sands, sand-silt mixtures

SC Clayey sands, sand-clay mixtures

ML Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity

CL Inorganic clays of low to mideium plasticity, gravelly clays, sandy clays, silty clays, lean clays

OL Organic silts and organic silty clays of low plasticity

MH Inorganic silts, micaceous or diatomaceous fine sand or silty soils

CH Inorganic clays of high plasticity, fat clays

OH Organic clays of medium to high plasticity, organic silts

PT Peat, humus, swamp soils with high organic content