

Vermont Stream Geomorphic Assessment Adjusted Phase 2 Field Forms for Stand-Alone Reach Habitat Assessment (RHA)

*****Yellow cells required for RHA Protocol*****

Field Notes Form for Steps 1 - 5

Cross-Section Worksheet

Field Quick Refer Tables

Quality Assurance Data Sheet

Rapid Habitat Assessment (RHA)

Rapid Geomorphic Assessment (RGA)

Rapid Stream Assessment Field Notes

Stream Name: _____
 Location: _____
 Observers: _____
 Organization /Agency: _____
 USGS Map Name(s): _____
 Weather: _____

Rain Storm within past 7 days: Y / N Flood history known: Y / N

Segment I.D.: _____
 Date: _____ ☐ Sub-Reach
 Town: _____
 Elevation: _____ ft.
 Latitude (N/S): _____
 Longitude (E/W): _____
 Drainage Area: _____ sq. mi.
 Segment Length: _____ ft.
 Segment Not Assessed: W/I/N/G/B/O

1. Valley and River Corridor

1.1 Segmentation: GC/CD/SS/PS/DF/CE/BB/FS/PA/SR/VW/OT/None

1.2 Alluvial Fan (FIT): Yes/No/UK

1.3 River Corridor Encroachments (FIT)	Reach or Segment Length			1.4 Slope of the Adjacent Terrace or Hillside	
	One Bank	Both Banks	Height from tw	Left Corridor	Right Corridor
Berms				flat (0-3%) hilly (4-8%) steep (9-15%)	flat (0-3%) hilly (4-8%) steep (9-15%)
Roads				very steep (16-25%) x-steep (>25%)	very steep (16-25%) x-steep (>25%)
Railroads				Continuous w/bank A / S / N	Continuous w/bank A / S / N
Improved Paths				Within 1x Wbkf A / S / N	Within 1x Wbkf A / S / N
Development			NA	Texture of Exposed Slope till boulder/cobble gravel sand silt clay bedrock other Not Evaluated	Texture of Exposed Slope till boulder/cobble gravel sand silt clay bedrock other Not Evaluated

1.5 Confinement	1.6 Grade Controls (FIT)		Total Height (0.0 ft)	Height Above Water Surface (0.0 ft)	Photo Yes / No
Valley width / Channel width Valley Width: _____ <input type="checkbox"/> Gorge Estimated / Measured <input type="checkbox"/> Human caused change in valley width	Location in Reach (record locations on field map) Waterfall // Ledge // Dam // Weir	Fill out height fields for grade controls if applicable →			
Narrowly Confined (>=1 & <2)					
Semi-confined (>2 & <4)					
Narrow (>= 4 & <6)					
Broad (>= 6 & <10)					
Very Broad (>= 10)					

2. Stream Channel

2.1 Bankfull Width: _____ ft. 2.1a Wetted Width: _____ ft. 2.1b Ratio (W_{wetted} / W_{bkf}): _____
 2.2 Max. Bankfull Depth: _____ ft. 2.3 Mean Bankfull Depth: _____ ft.
 2.4 Floodprone Width: _____ ft. 2.5 Recently Abandoned FP : _____ ft. 2.6 Ratio W/d_{mean} : _____
 2.7 Entrenchment: _____ 2.8 Incision Ratio: IR_{het} : _____ 2.9 Sinuosity: _____
 2.10 Riffles/Steps: complete / eroded / sedimented / NA / NE 2.11 Riffle/Step Spacing: _____ ft.
 (partial or none) (diagonal or continuous)
 2.12 Bed Substrate Composition (percent):

1 Bedrock	2 Boulder >10 in >256 mm	3 Cobble 2.5 - 10 in 64-256 mm	4 Gravel Course 0.6-2.5in 16-64mm	5 Sand 0.002-0.1in .062-2mm	6 Silt or Clay (present)	Embeddedness		2.13 Avg. Size of Largest Particles on:
			Fine 0.08-0.63in 2-16 mm			Mean Channel	Mean Margin	Bed: _____ Bar: _____ circle: inches or millimeters
					Y / N			2.13a % Exp. Substrate: _____

2.14 Stream Type: A G F B E C D 1 2 3 4 5 6 a b c

Cascade Step-Pool Plane Bed Riffle-Pool Ripple-Dune Braided

Stream Type

☐ Reference Type

3. Riparian banks, Buffers, and Corridors

3.1	Typical Bank Slope		shallow moderate steep undercut (evaluate on the higher of the two banks)							
	Bank Texture-RB	Lower	bedrock	boulder/cobble	gravel	sand	silt/clay	mix	cohesive / non-cohesive	
		Upper	bedrock	boulder/cobble	gravel	sand	silt/clay	mix	cohesive / non-cohesive	
	Bank Texture-LB	Lower	bedrock	boulder/cobble	gravel	sand	silt/clay	mix	cohesive / non-cohesive	
		Upper	bedrock	boulder/cobble	gravel	sand	silt/clay	mix	cohesive / non-cohesive	
	Bank Erosion (FIT)	Left	Length: ft. Height: ft.		Bank Revetment Type:		Length: ft.			
		Right	Length: ft. Height: ft.		Bank Revetment Type:		Length: ft.			
	Near Bank Vegetation Type	Trees	L % cover	Invasive	Conifer	Deciduous	R % cover	Invasive	Conifer	Deciduous
		Shrubs / Saps.	L % cover	Invasive	WADs	Saplings	R % cover	Invasive	WADs	Saplings
		Herbs	L % cover	Invasive	Grasses	Forbs	R % cover	Invasive	Grasses	Forbs
Bank Canopy	Left	76 - 100%	51 - 75%	26 - 50%	1 - 25%	0%	Channel Canopy Open Closed			
	Right	76 - 100%	51 - 75%	26 - 50%	1 - 25%	0%				
3.2	Buffer Width (dom/sub) (FIT 0-25 ft)	Left	0 – 25 ft.		26 – 50 ft.		51 – 100 ft.		> 100 ft none (SD).	
		Right	0 – 25 ft.		26 – 50 ft.		51 – 100 ft.		> 100 ft none (SD).	
	Buffer Vegetation Type	Trees	L % cover	Invasive	Conifer	Deciduous	R % cover	Invasive	Conifer	Deciduous
		Shrubs / Saps.	L % cover	Invasive	WADs	Saplings	R % cover	Invasive	WADs	Saplings
		Herbs	L % cover	Invasive	Grasses	Forbs	R % cover	Invasive	Grasses	Forbs
3.3	Riparian Corridor (dom/sub)	Left	forest shrub-sapling crop/pasture/hay commercial/industrial residential bare none (SD)							
		Right	forest shrub-sapling crop/pasture/hay commercial/industrial residential bare none (SD)							

4.1 Springs or Seeps: extensive / present / minimum / none / altered

4.2 Adjacent Wetlands: extensive / present / minimum / none / altered 4.3 Flow status: base / low / avg.

4.4 Current Debris Jams (FIT): # _____ 4.5 Flow Regs. & Withdrawals (FIT): TYPE: w|thdrawal / bypass / r-o-r / store & release / none / unk

4.7 Flow Regulation (FIT): SIZE : small / large ; USE: drinking / irrigation, flood-control / hydro-electric / recreation / other

4.6 Upstream/Downstream Flow Regs. : upstream / downstream / both / none

4.7 Stormwater Inputs (FIT): tile drain ____ / road ditch ____ / urban stormwater ____ / field ditch ____ / overland flow ____

4.8 Constrictions ☐ none menu: instream culvert // bridge // old abutment // bedrock outcrop // other

					Problems (check all that apply)						
Constriction Type (from menu)	Width (ft)	Photo Yes / No		channel constriction	floodprone constriction	deposition above	deposition below	scour above	scour below	alignment	none
				<input type="checkbox"/>	<input type="checkbox"/>						
				<input type="checkbox"/>	<input type="checkbox"/>						
				<input type="checkbox"/>	<input type="checkbox"/>						
				<input type="checkbox"/>	<input type="checkbox"/>						

4.9 Beaver Dams (FIT): # _____ ft. of the segment affected. ☐ Bridge & Culvert Assessments

5. Channel Bed and Planform Changes

(5.0 to 5.3 record on tally sheet)

5.4 Stream Ford or Animal Crossing (FIT): Yes / No

5.5 Channel Alterations (FIT) (circle all that apply): dredging gravel mining commercial mining none

Length of Straightening: _____ (With Windrowing : Yes / No)

Comments:

Sketch Form for Sites – Segments – Reaches

Stream Name: _____

Date: _____

Observers: _____

Organization /Agency: _____

Segment or Site ID: _____

Town: _____

Elevation: _____ Ft.

Site Sketch - see reverse side for sketch codes and tally columns for left and right bank erosion, revetments, and corridor developments and calculating the total length of the segment affected by beaver flowages.



Scale:

Height of bankfull features above water surface (Ft.)

Selected BKF Height

Constrictions

α

LWD tally
Debris Jams
Stormwater

Tally Sheet (page 1)

Stream Name: _____

Location: _____

Segment I.D: _____

Date: _____

☐ Sub-Reach

Step 2.1 Height of bankfull above water surface

Bankfull Height	Chan. Wdth	Comments (describe indicators)

Step 3.1 Bank Erosion **FIT**

Left Bank Length	Height	Right Bank Length	Height
Total:	Avg.	Total:	Avg.

Step 5. Channel Bed and Planform Changes

Record actual number of features			Tally
5.1	Depositional Features (Bar Type)	Mid	
		Point	
		Side	
		Diagonal	
		Delta	
		Island	
5.2 FIT	Flood Chutes		
	Neck Cut-offs		
	Channel Avulsions		
	Braiding		
	Migration		
5.3 FIT	Aggrade	Steep Riffles	
	Degrade	Head Cuts	
Tributary Rejuvenation?			Yes / No

Step 3.3 Mass Failures and Gullies **FIT**

Mass Fail - Length		Height	Gully - Length		Length
Left	Right		Left	Right	

Step 3.1 Bank Revetment **FIT**

Length	
Left Bank	Right Bank
Total:	Total:

Step 4.8 Channel Constrictions

[illegible]

Step 1.3 River Corridor Encroachments **FIT**

Type	Length		Height of Fill
	One Side	Both Sides	

Step 4.6 Stormwater **FIT** **Tally**

Field Ditch	
Overland Flow	
Road Ditch	
Tile Drain	
Urban Stormwater	
Other	

Tally Sheet (page 2)

Stream Name: _____
 Location: _____

Segment I.D.: _____
 Date: _____

☐ Sub-Reach

Note CPOM, algae, location of fines

6.1 Large Woody Debris and Jams

Rank	D _{large} (ft)	L (w _{bkf})	Tally	#	%
1	0.5 - 1.0	< 0.5			
2	0.5 - 1.0	> 0.5			
3	1.0 - 2.0	< 0.5			
4	1.0 - 2.0	> 0.5			
5	> 2.0	< 0.5			
6	> 2.0	> 0.5			
Total LWDs					
# LWDs / mile					
# Debris jams					
# Debris jams / mile					

6.2 Pools (note vegetative cover, surface turbulence, fines)

Rank	D (ft)	L, W (w _{bkf})	Tally	#	%
1	1.0 - 2.0	< 0.5			
2	1.0 - 2.0	> 0.5			
3	2.0 - 3.0	< 0.5			
4	2.0 - 3.0	> 0.5			
5	> 3.0	< 0.5			
6	> 3.0	> 0.5			
7	> 3.0	≥ 1.0			
Total pools					
# Pools / mile					

6.3 Refuge Areas / Connections

ID	Location	Q _{access}	Notes
	in / out	low / bkf	
	in / out	low / bkf	
	in / out	low / bkf	
	in / out	low / bkf	
	in / out	low / bkf	
	in / out	low / bkf	
	in / out	low / bkf	

6.4 Undercut Banks (note stability, overhanging vegetation)

Rank	D _{max} (ft)	L (ft)	Tally	#	%
1	0.5 - 1.0	< 2.0			
2	0.5 - 1.0	> 2.0			
3	1.0 - 2.0	< 2.0			
4	1.0 - 2.0	> 2.0			
5	> 2.0	< 2.0			
6	> 2.0	> 2.0			
Total undercuts					
# undercut banks / mile					

Cross-Section Worksheet

Stream Name:

Location: _____

Observers:

Reach-Segment:

Date: _____

[illegible]

Cross-Section Notes Codes

LTER = Left Terrace

LFPA = Left Flood Plane

LTOB = Left Top of Bank

LBF = Left Bankfull Stage

LEW = Left Edge of Water

RAF = Recently Abandoned Floodplain

| RTER = Right Terrace

RFPA = Right Flood Plane

RTOB = Right Top of Bank

RBF = Right Bankfull Stage

REW = Right Edge of Water

TW = Thalweg

LPIN = Left Pin

RPIN = Right Pin

Comments:

BKF Height

--	--

Cross-sections - Number and Location Description:

[illegible]

Drawing of Typical Cross-Section

Size Class	Millimeters	Inches	Relative Size			Distribution of 100 Particles			Percent	
1-Bedrock	> 4096	> 160	Bigger than a VW Bug							
2-Boulder	256 – 4096	10.1 – 160	Basketball to VW Bug							
3-Cobble	64 – 256	2.5 – 10.1	Tennis ball to basketball							
4-Coarse Gravel	16 – 64	0.63 – 2.5	Marble to tennis ball							
4-Fine Gravel	2 – 16	0.08 – 0.63	Pepper corn to marble							
5-Sand or Smaller	< 2.00	< 0.08	Smaller than a pepper corn							
Embeddedness	Ch1	Ch2	Ch3	Ch4	Ch5	Ma1	Ma2	Ma3	Ma4	Ma5
Largest mobile particles	Bd1	Bd2	Bd3	Bd4	Bd5	Br1	Br2	Br3	Br4	Br5

VTANR REACH HABITAT ASSESSMENT ----- RIFFLE-POOL STREAM TYPE

Page 1

(Also use this form for dune-ripple stream type.)

Stream Name: _____
 Location: _____
 Observers: _____
 Organization /Agency: _____
 USGS Map Name(s): _____
 Weather: _____
 Flow: base / low / avg. Storm within past 7 days: Y / N

Segment I.D.: _____
 Date: _____
 Town: _____
 Elevation: _____ ft.
 Latitude (N/S): _____
 Longitude (E/W): _____
 Drainage Area: _____ sq. mi.
 Segment Length: _____ ft.

Habitat Parameter	Condition (Departure) Category																			
	Reference (None)					Good (Minor)					Fair (Major)					Poor (Severe)				
6.1 Woody Debris Cover LWD size rank variable only used if ≥ 10 pieces	<input type="checkbox"/> LWD pieces / mile > 100 <input type="checkbox"/> LWD size rank 3-6 $> 50\%$ <input type="checkbox"/> debris jams / mile > 5 <input type="checkbox"/> high woody debris recruitment potential <input type="checkbox"/> CPOM present in channel and margins					<input type="checkbox"/> $100 \geq$ LWD / mile > 50 <input type="checkbox"/> $50 \geq$ LWD rank 3-6 $> 25\%$ <input type="checkbox"/> $5 \geq$ jams / mile > 3 <input type="checkbox"/> moderate woody debris recruitment potential <input type="checkbox"/> CPOM limited in channel and present in margins					<input type="checkbox"/> $50 \geq$ LWD / mile > 25 <input type="checkbox"/> $25 \geq$ LWD rank 3-6 $> 10\%$ <input type="checkbox"/> $3 \geq$ jams / mile > 1 <input type="checkbox"/> low woody debris recruitment potential <input type="checkbox"/> CPOM limited in both channel and margins					<input type="checkbox"/> LWD / mile ≤ 25 <input type="checkbox"/> LWD size rank 3-6 $\leq 10\%$ <input type="checkbox"/> debris jams absent <input type="checkbox"/> no woody debris recruitment potential <input type="checkbox"/> CPOM absent				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
6.2 Bed Substrate Cover *fines: sand if $d_{50} \geq$ gravel, otherwise silt. (Dune-ripple stream type: Fining only.)	<input type="checkbox"/> riffle embeddedness $< 20\%$ margin embeddedness $< 40\%$ <input type="checkbox"/> fining* $< 10\%$ <input type="checkbox"/> Riffle stability index $< 70\%$ <input type="checkbox"/> sediment apparently stable & sorted <input type="checkbox"/> substrate free of dense algae growth					<input type="checkbox"/> $20 \leq emb_{riffle} < 40\%$ $40 \leq emb_{margin} < 60\%$ <input type="checkbox"/> $10 \leq fining^* < 20\%$ <input type="checkbox"/> $70 \leq RSI < 80\%$ <input type="checkbox"/> some evidence of sediment mobility & lack of sorting <input type="checkbox"/> small substrate patches covered by dense algae growth					<input type="checkbox"/> $40 \leq emb_{riffle} < 75\%$ $60 \leq emb_{margin} < 80\%$ <input type="checkbox"/> $20 \leq fining^* < 40\%$ <input type="checkbox"/> $80 \leq RSI < 90\%$ <input type="checkbox"/> major evidence of sediment mobility & lack of sorting <input type="checkbox"/> large substrate patches covered by dense algae growth					<input type="checkbox"/> riffle embeddedness $\geq 75\%$ margin embeddedness $\geq 80\%$ <input type="checkbox"/> fining* $\geq 40\%$ <input type="checkbox"/> $RSI \geq 90\%$ <input type="checkbox"/> sediments unstable, unsorted, soft underfoot <input type="checkbox"/> most of substrate covered by dense algae growth				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
6.3 Scour and Deposition Features (Dune-ripple stream type: Only evaluate pools and ripples.) <i>Depth-velocity combinations</i> fast-shallow fast-deep slow-shallow slow-deep (cutoffs: 1.0 fps, 1.5 ft) Pool size rank variable only used if ≥ 5 pools	<input type="checkbox"/> pools / mile > 40 <input type="checkbox"/> pool size rank 3-7 $> 50\%$ <input type="checkbox"/> good cover $> 75\%$ of total pool surface area <input type="checkbox"/> riffle (ripple) coverage $> 25\%$ reach area, distinctly formed and complete <input type="checkbox"/> $5 \leq$ riffle spacing ≤ 7 bankfull channel widths (w_{bkf}) <input type="checkbox"/> well-defined riffle-run-pool-glide pattern with all four depth-velocity combinations present <input type="checkbox"/> finer deposition located entirely in slack water below larger substrates/debris, and along margins					<input type="checkbox"/> $40 \geq$ pools / mile > 20 <input type="checkbox"/> $50 \geq$ pool rank 3-7 $> 25\%$ <input type="checkbox"/> $75 \geq$ good cover $> 50\%$ of total pool surface area <input type="checkbox"/> $25 \geq$ riffle coverage $> 10\%$ reach area, moderately well formed and complete <input type="checkbox"/> $3 \leq$ riffle spacing < 5 , or $7 < riffle spacing \leq 10 \times w_{bkf}$ <input type="checkbox"/> well-defined riffle-run-pool-glide pattern with three depth-velocity combinations dominant <input type="checkbox"/> finer deposition located in slack water below larger substrates/debris, signs of mid-channel accumulation					<input type="checkbox"/> $20 \geq$ pools / mile > 10 <input type="checkbox"/> $25 \geq$ pool rank 3-7 $> 10\%$ <input type="checkbox"/> $50 \geq$ good cover $> 25\%$ of total pool surface area <input type="checkbox"/> $25 \geq$ riffle coverage $> 10\%$ reach area, poorly formed and incomplete <input type="checkbox"/> $1 \leq$ riffle spacing < 3 , or $10 < riffle spacing \leq 12 \times w_{bkf}$ <input type="checkbox"/> moderately defined riffle-run-pool-glide pattern with two depth-velocity combinations dominant <input type="checkbox"/> very large depositional features below larger substrates/debris, abundant mid-channel accumulation					<input type="checkbox"/> pools / mile ≤ 10 <input type="checkbox"/> pool size rank 3-7 $\leq 10\%$ <input type="checkbox"/> good cover $\leq 25\%$ of total pool surface area <input type="checkbox"/> riffle (ripple) coverage $\leq 10\%$ reach area, or mostly indistinct <input type="checkbox"/> riffle spacing ≥ 12 bankfull channel widths <input type="checkbox"/> poorly defined riffle-run-pool-glide pattern with one depth-velocity combination dominant <input type="checkbox"/> finer deposition throughout channel, even filling pools, larger substrates almost buried or bed largely incised				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
6.4 Channel Morphology	<input type="checkbox"/> width/depth < 15 , natural <input type="checkbox"/> entrenchment ratio ≥ 1.4 , incision ratio < 1.2 , good floodplain access <input type="checkbox"/> no evidence of channel alteration					<input type="checkbox"/> $15 \leq w / d < 25$, widening <input type="checkbox"/> entrenchment ratio ≥ 1.4 , $1.2 \leq$ incision ratio < 1.4 , reduced floodplain access <input type="checkbox"/> evidence of minor historic channel alteration					<input type="checkbox"/> $25 \leq w / d < 40$, widening <input type="checkbox"/> entrenchment ratio ≥ 1.4 , $1.4 \leq$ incision ratio < 2.0 , limited floodplain access <input type="checkbox"/> major historic or minor recent channel alteration					<input type="checkbox"/> $w / d > 40$, over-widening <input type="checkbox"/> entrenchment ratio < 1.4 or incision ratio ≥ 2.0 , floodplain access unlikely <input type="checkbox"/> extensive historic or major recent channel alteration				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1

Habitat Parameter	Condition (Departure) Category																			
	Reference (None)					Good (Minor)					Fair (Major)					Poor (Severe)				
6.5 Hydrologic Characteristics <input type="checkbox"/> wetted width / $W_{bkf} > 0.75$ <input type="checkbox"/> exposed substrate $< 20\%$ <input type="checkbox"/> adjacent springs, seeps, and wetlands extensive <input type="checkbox"/> no known flow alteration	<input type="checkbox"/> $0.75 \geq W_{wet} / W_{bkf} > 0.50$ <input type="checkbox"/> $20 \leq \text{exp. substrate} < 40\%$ <input type="checkbox"/> adjacent springs, seeps, and wetlands present <input type="checkbox"/> minor flow alteration likely due to flow regulation and/or land use changes					<input type="checkbox"/> $0.50 \geq W_{wet} / W_{bkf} > 0.25$ <input type="checkbox"/> $40 \leq \text{exp. substrate} < 60\%$ <input type="checkbox"/> adjacent springs, seeps, and wetlands minimal <input type="checkbox"/> major flow alteration likely due to flow regulation and/or land use changes					<input type="checkbox"/> $W_{wet} / W_{bkf} \leq 0.25$ <input type="checkbox"/> exposed substrate $\geq 60\%$ <input type="checkbox"/> adjacent springs, seeps, and wetlands absent or altered <input type="checkbox"/> runoff characteristics completely altered due to flow regulation and storm water influence									
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
6.6 Connectivity Tend towards a higher/lower score for natural/man-made obstructions <input type="checkbox"/> no obstructions in reach that block longitudinal movement of aquatic species over all but the lowest flows <input type="checkbox"/> system obstructions absent <input type="checkbox"/> abundant low and high flow refuge	<input type="checkbox"/> one or two small low flow obstructions present in reach that block movement of aquatic species <input type="checkbox"/> limited system obstructions <input type="checkbox"/> abundant refuge, with low or high flow refuge limited					<input type="checkbox"/> one or two small to medium bankfull obstructions present in reach that block movement of aquatic species <input type="checkbox"/> system obstructions present <input type="checkbox"/> limited low and high flow refuge					<input type="checkbox"/> more than two bankfull obstructions present in reach that block movement of aquatic species <input type="checkbox"/> many system obstructions <input type="checkbox"/> refuge absent									
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
6.7 River Banks Select different boxes for LB and RB if necessary Undercut size rank variable only used if ≥ 5 undercuts (score each bank)	<input type="checkbox"/> bank erosion $< 10\%$, typical of natural conditions, little or no bank revetments <input type="checkbox"/> bank vegetation $> 90\%$ in tree, shrub and herb layers, diverse assemblages, plants create good cover and roots help stabilize bank <input type="checkbox"/> bank canopy $> 90\%$ <input type="checkbox"/> undercut banks / mile > 30 <input type="checkbox"/> undercut bank size rank 3-6 $> 50\%$ <input type="checkbox"/> undercut banks with mostly stable boundaries, abundant overhanging vegetation, and consistent water adjacency <input type="checkbox"/> no mass failures in valley					<input type="checkbox"/> $10 \leq \text{bank erosion} < 30\%$, infrequent small areas, some bank revetments <input type="checkbox"/> $90 \geq \text{bank vegetation} > 75\%$ in each layer, diverse assemblages, plants create good cover and roots help stabilize bank <input type="checkbox"/> $90 \geq \text{bank canopy} > 75\%$ <input type="checkbox"/> $30 \geq \text{undercuts} / \text{mile} > 15$ <input type="checkbox"/> $50 \geq \text{undercut bank size rank } 3-6 > 25\%$ <input type="checkbox"/> undercuts with some unstable boundaries or reduced overhanging vegetation, and consistent water adjacency <input type="checkbox"/> 1 mass failure in valley					<input type="checkbox"/> $30 \leq \text{bank erosion} < 60\%$, mod. unstable banks, and/or extensive bank revetments <input type="checkbox"/> $75 \geq \text{bank vegetation} > 50\%$, in two of three layers, reduced diversity, plants create limited cover and roots do not stabilize bank <input type="checkbox"/> $75 \geq \text{bank canopy} > 50\%$ <input type="checkbox"/> $15 \geq \text{undercuts} / \text{mile} > 5$ <input type="checkbox"/> $25 \geq \text{undercut bank size rank } 3-6 > 10\%$ <input type="checkbox"/> undercuts with some unstable boundaries or reduced overhanging vegetation, and reduced water adjacency <input type="checkbox"/> 1 - 2 mass failures in valley					<input type="checkbox"/> bank erosion $\geq 60\%$, banks unstable, extensive erosion, and failing bank revetments <input type="checkbox"/> bank vegetation $\leq 50\%$ in two of three layers, limited diversity, plants create no cover and roots do not stabilize bank <input type="checkbox"/> bank canopy $\leq 50\%$ <input type="checkbox"/> undercuts / mile ≤ 5 <input type="checkbox"/> undercut bank size rank 3-6 $\leq 10\%$ <input type="checkbox"/> undercuts with mostly unstable boundaries, no overhanging vegetation, and reduced water adjacency <input type="checkbox"/> ≥ 3 mass failures in valley				
SCORE (LB)	Left Bank	10	9			8	7	6			5	4	3			2		1		
SCORE (RB)	Right Bank	10	9			8	7	6			5	4	3			2		1		
6.8 Riparian Area Select different boxes for LB and RB if necessary (score each side of the channel)	<input type="checkbox"/> buffer width > 150 ft <input type="checkbox"/> rip. vegetation $> 75\%$ in tree, shrub and herb layers, diverse assemblages, no invasives, maximum channel canopy <input type="checkbox"/> river corridor development and infrastructure absent					<input type="checkbox"/> $150 \geq \text{buffer width} > 100$ ft <input type="checkbox"/> $75 \geq \text{rip. veg.} > 50\%$ in each layer, one plant type absent, minimal invasives, maximum channel canopy <input type="checkbox"/> river corridor development and infrastructure minimal					<input type="checkbox"/> $100 \geq \text{buffer width} > 50$ ft <input type="checkbox"/> $75 \geq \text{rip. veg.} > 50\%$ in each layer, several types absent, altered patches, invasives present, reduced canopy <input type="checkbox"/> river corridor development and infrastructure common					<input type="checkbox"/> buffer width ≤ 50 ft <input type="checkbox"/> rip. veg. $\leq 50\%$ in each layer, several types absent, large altered areas, invasives present, reduced canopy <input type="checkbox"/> river corridor development and infrastructure abundant				
SCORE (LB)	Left Bank	10	9			8	7	6			5	4	3			2		1		
SCORE (RB)	Right Bank	10	9			8	7	6			5	4	3			2		1		

6.9 Score: front _____ + back _____ = total _____

Percentage: total score _____ x (100 / 160) = _____

Overall Physical Habitat Condition: _____

SHTD ☐ Existing Stream Habitat Type: _____

Score	Percentage	Condition (Departure)
136 – 160	85 – 100	Reference (None)
104 – 135	65 – 84	Good (Minor)
56 – 103	35 – 64	Fair (Major)
0 – 55	0 – 34	Poor (Severe)

VTANR REACH HABITAT ASSESSMENT ----- STEP-POOL STREAM TYPE

Page 1

(Also use this form for cascade and bedrock stream types.)

Stream Name: _____
 Location: _____
 Observers: _____
 Organization /Agency: _____
 USGS Map Name(s): _____
 Weather: _____
 Flow: base / low / avg. Storm within past 7 days: Y / N

Segment I.D: _____
 Date: _____
 Town: _____
 Elevation: _____ ft.
 Latitude (N/S): _____
 Longitude (E/W): _____
 Drainage Area: _____ sq. mi.
 Segment Length: _____ ft.

Habitat Parameter	Condition (Departure) Category																			
	Reference (None)					Good (Minor)					Fair (Major)					Poor (Severe)				
6.1 Woody Debris Cover LWD size rank variable only used if ≥ 10 pieces	<input type="checkbox"/> LWD pieces / mile > 200 <input type="checkbox"/> LWD size rank 3-6 $> 75\%$ <input type="checkbox"/> debris jams / mile > 25 <input type="checkbox"/> high woody debris recruitment potential <input type="checkbox"/> CPOM present in channel and margins					<input type="checkbox"/> $200 \geq$ LWD / mile > 100 <input type="checkbox"/> $75 \geq$ LWD rank 3-6 $> 50\%$ <input type="checkbox"/> $25 \geq$ jams / mile > 15 <input type="checkbox"/> moderate woody debris recruitment potential <input type="checkbox"/> CPOM limited in channel and present in margins					<input type="checkbox"/> $100 \geq$ LWD / mile > 50 <input type="checkbox"/> $50 \geq$ LWD rank 3-6 $> 25\%$ <input type="checkbox"/> $15 \geq$ jams / mile > 5 <input type="checkbox"/> low woody debris recruitment potential <input type="checkbox"/> CPOM limited in both channel and margins					<input type="checkbox"/> LWD / mile ≤ 50 <input type="checkbox"/> LWD size rank 3-6 $\leq 25\%$ <input type="checkbox"/> jams / mile ≤ 5 <input type="checkbox"/> no woody debris recruitment potential <input type="checkbox"/> CPOM absent				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
6.2 Bed Substrate Cover *fines: sand if $d_{50} \geq$ gravel, otherwise silt.	<input type="checkbox"/> pool embeddedness $< 25\%$ margin embeddedness $< 40\%$ <input type="checkbox"/> fining* $< 10\%$ <input type="checkbox"/> sediment apparently stable & sorted <input type="checkbox"/> substrate free of dense algae growth					<input type="checkbox"/> $25 \leq$ emb _{pool} $< 50\%$ $40 \leq$ emb _{margin} $< 60\%$ <input type="checkbox"/> $10 \leq$ fining* $< 20\%$ <input type="checkbox"/> some evidence of sediment mobility & lack of sorting <input type="checkbox"/> small substrate patches covered by dense algae growth					<input type="checkbox"/> $50 \leq$ emb _{pool} $< 75\%$ $60 \leq$ emb _{margin} $< 80\%$ <input type="checkbox"/> $20 \leq$ fining* $< 40\%$ <input type="checkbox"/> major evidence of sediment mobility & lack of sorting <input type="checkbox"/> large substrate patches covered by dense algae growth					<input type="checkbox"/> pool embeddedness $\geq 75\%$ margin embeddedness $\geq 80\%$ <input type="checkbox"/> fining* $\geq 40\%$ <input type="checkbox"/> sediments unstable, unsorted, soft underfoot <input type="checkbox"/> most of substrate covered by dense algae growth				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
6.3 Scour and Deposition Features <i>Depth-velocity combinations</i> fast-shallow fast-deep slow-shallow slow-deep (cutoffs: 1.0 fps, 1.5 ft) Pool size rank variable only used if ≥ 5 pools (Cascade and bedrock stream types: Do not evaluate variables related to step pattern.)	<input type="checkbox"/> pools / mile > 70 <input type="checkbox"/> pool size rank 3-7 $> 50\%$ <input type="checkbox"/> good cover $> 75\%$ of total pool surface area <input type="checkbox"/> steps are distinctly formed, complete and stable <input type="checkbox"/> $5 \leq$ step spacing ≤ 7 bankfull channel widths (w_{bkr}) <input type="checkbox"/> more than two depth-velocity combinations present <input type="checkbox"/> finer deposition located entirely in slack water below larger substrates/debris, and along margins					<input type="checkbox"/> $70 \geq$ pools / mile > 50 <input type="checkbox"/> $50 \geq$ pool rank 3-7 $> 25\%$ <input type="checkbox"/> $75 \geq$ good cover $> 50\%$ of total pool surface area <input type="checkbox"/> steps are moderately well formed, complete and stable <input type="checkbox"/> $3 \leq$ step spacing < 5 , or $7 < \text{step spacing} \leq 10 \times w_{bkr}$ <input type="checkbox"/> two depth-velocity combinations present <input type="checkbox"/> finer deposition located in slack water below larger substrates/debris, signs of mid-channel accumulation					<input type="checkbox"/> $50 \geq$ pools / mile > 30 <input type="checkbox"/> $25 \geq$ pool rank 3-7 $> 10\%$ <input type="checkbox"/> $50 \geq$ good cover $> 25\%$ of total pool surface area <input type="checkbox"/> steps are poorly formed, incomplete and unstable <input type="checkbox"/> $1 \leq$ step spacing < 3 , or $10 < \text{step spacing} \leq 15 \times w_{bkr}$ <input type="checkbox"/> one or two depth-velocity combinations present <input type="checkbox"/> very large depositional features below larger substrates/debris, abundant mid-channel accumulation					<input type="checkbox"/> pools / mile ≤ 30 <input type="checkbox"/> pool size rank 3-7 $\leq 10\%$ <input type="checkbox"/> good cover over $\leq 25\%$ of total pool surface area <input type="checkbox"/> steps are indistinct or absent, or very unstable <input type="checkbox"/> step spacing ≥ 15 bankfull channel widths <input type="checkbox"/> one depth-velocity combination present <input type="checkbox"/> finer deposition throughout channel, even filling pools, larger substrates almost buried or bed largely incised				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
6.4 Channel Morphology	<input type="checkbox"/> width/depth < 12 , natural <input type="checkbox"/> entrenchment ratio ≥ 1.2 , incision ratio < 1.2 , good floodplain access <input type="checkbox"/> no evidence of channel alteration					<input type="checkbox"/> $12 \leq w / d < 15$, widening <input type="checkbox"/> entrenchment ratio ≥ 1.2 , $1.2 \leq$ incision ratio < 1.4 , reduced floodplain access <input type="checkbox"/> evidence of minor historic channel alteration					<input type="checkbox"/> $15 \leq w / d < 25$, widening <input type="checkbox"/> entrenchment ratio ≥ 1.2 , $1.4 \leq$ incision ratio < 2.0 , limited floodplain access <input type="checkbox"/> major historic or minor recent alteration					<input type="checkbox"/> $w / d \geq 25$, over-widening <input type="checkbox"/> entrenchment ratio < 1.2 or incision ratio ≥ 2.0 , floodplain access unlikely <input type="checkbox"/> extensive historic or major recent alteration				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1

Habitat Parameter	Condition (Departure) Category																			
	Reference (None)					Good (Minor)					Fair (Major)					Poor (Severe)				
6.5 Hydrologic Characteristics <input type="checkbox"/> wetted width / $W_{bkr} > 0.75$ <input type="checkbox"/> exposed substrate $< 10\%$ <input type="checkbox"/> adjacent springs, seeps, and wetlands extensive <input type="checkbox"/> no known flow alteration	<input type="checkbox"/> $0.75 \geq W_{wet} / W_{bkr} > 0.50$ <input type="checkbox"/> $10 \leq \text{exp. substrate} < 30\%$ <input type="checkbox"/> adjacent springs, seeps, and wetlands present <input type="checkbox"/> minor flow alteration likely due to flow regulation and/or land use changes					<input type="checkbox"/> $0.50 \geq W_{wet} / W_{bkr} > 0.25$ <input type="checkbox"/> $30 \leq \text{exp. substrate} < 50\%$ <input type="checkbox"/> adjacent springs, seeps, and wetlands minimal <input type="checkbox"/> major flow alteration likely due to flow regulation and/or land use changes					<input type="checkbox"/> $W_{wet} / W_{bkr} \leq 0.25$ <input type="checkbox"/> exposed substrate $\geq 50\%$ <input type="checkbox"/> adjacent springs, seeps, and wetlands absent or altered <input type="checkbox"/> runoff characteristics completely altered due to flow regulation and storm water influence									
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
6.6 Connectivity Tend towards a higher/lower score for natural/man-made obstructions <input type="checkbox"/> no obstructions in reach that block longitudinal movement of aquatic species over all but the lowest flows <input type="checkbox"/> system obstructions absent <input type="checkbox"/> abundant low and high flow refuge	<input type="checkbox"/> one or two small low flow obstructions present in reach that block movement of aquatic species <input type="checkbox"/> limited system obstructions <input type="checkbox"/> abundant refuge, with low or high flow refuge limited					<input type="checkbox"/> one or two small to medium bankfull obstructions present in reach that block movement of aquatic species <input type="checkbox"/> system obstructions present <input type="checkbox"/> limited low and high flow refuge					<input type="checkbox"/> more than two bankfull obstructions present in reach that block movement of aquatic species <input type="checkbox"/> many system obstructions <input type="checkbox"/> refuge absent									
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
6.7 River Banks Select different boxes for LB and RB if necessary Undercut size rank variable only used if ≥ 5 undercuts (score each bank)	<input type="checkbox"/> bank erosion $< 10\%$, typical of natural conditions, little or no bank revetments <input type="checkbox"/> bank vegetation $> 90\%$ in tree, shrub and herb layers, diverse assemblages, plants create good cover and roots help stabilize bank <input type="checkbox"/> bank canopy $> 90\%$ <input type="checkbox"/> undercut banks / mile > 15 <input type="checkbox"/> undercut bank size rank 3-6 $> 50\%$ <input type="checkbox"/> undercut banks with mostly stable boundaries, abundant overhanging vegetation, and consistent water adjacency <input type="checkbox"/> no mass failures in valley					<input type="checkbox"/> $10 \leq \text{bank erosion} < 20\%$, infrequent small areas, some bank revetments <input type="checkbox"/> $90 \geq \text{bank vegetation} > 75\%$ in each layer, diverse assemblages, plants create good cover and roots help stabilize bank <input type="checkbox"/> $90 > \text{bank canopy} > 80\%$ <input type="checkbox"/> $15 \geq \text{undercuts} / \text{mile} > 10$ <input type="checkbox"/> $50 \geq \text{undercut bank size rank } 3-6 > 25\%$ <input type="checkbox"/> undercuts with some unstable boundaries or reduced overhanging vegetation, and consistent water adjacency <input type="checkbox"/> 1 mass failure in valley					<input type="checkbox"/> $20 \leq \text{bank erosion} < 50\%$, mod. unstable banks, and/or extensive bank revetments <input type="checkbox"/> $75 \geq \text{bank vegetation} > 50\%$, in two of three layers, reduced diversity, plants create limited cover and roots do not stabilize bank <input type="checkbox"/> $80 \geq \text{bank canopy} > 60\%$ <input type="checkbox"/> $10 \geq \text{undercuts} / \text{mile} > 5$ <input type="checkbox"/> $25 \geq \text{undercut bank size rank } 3-6 > 10\%$ <input type="checkbox"/> undercuts with some unstable boundaries or reduced overhanging vegetation, and reduced water adjacency <input type="checkbox"/> 1 - 2 mass failures in valley					<input type="checkbox"/> bank erosion $\geq 50\%$, banks unstable, extensive erosion, and failing bank revetments <input type="checkbox"/> bank vegetation $\leq 50\%$ in two of three layers, limited diversity, plants create no cover and roots do not stabilize bank <input type="checkbox"/> bank canopy $\leq 60\%$ <input type="checkbox"/> undercuts / mile ≤ 5 <input type="checkbox"/> undercut bank size rank 3-6 $\leq 10\%$ <input type="checkbox"/> undercuts with mostly unstable boundaries, no overhanging vegetation, and reduced water adjacency <input type="checkbox"/> > 3 mass failures in valley				
SCORE (LB)	Left Bank	10	9			8	7	6			5	4	3			2		1		
SCORE (RB)	Right Bank	10	9			8	7	6			5	4	3			2		1		
6.8 Riparian Area Select different boxes for LB and RB if necessary (score each side of the channel)	<input type="checkbox"/> buffer width > 200 ft <input type="checkbox"/> rip. vegetation $> 90\%$ in tree, shrub and herb layers, diverse assemblages, no invasives, maximum channel canopy <input type="checkbox"/> river corridor development and infrastructure absent					<input type="checkbox"/> $200 \geq \text{buffer width} > 150$ ft <input type="checkbox"/> $90 \geq \text{rip. veg.} > 75\%$ in each layer, one plant type absent, minimal invasives, maximum channel canopy <input type="checkbox"/> river corridor development and infrastructure minimal					<input type="checkbox"/> $150 \geq \text{buffer width} > 100$ ft <input type="checkbox"/> $75 \geq \text{rip. veg.} > 50\%$ in each layer, several types absent, altered patches, invasives present, reduced canopy <input type="checkbox"/> river corridor development and infrastructure common					<input type="checkbox"/> buffer width ≤ 100 ft <input type="checkbox"/> rip. veg. $\leq 50\%$ in each layer, several types absent, large altered areas, invasives present, reduced canopy <input type="checkbox"/> river corridor development and infrastructure abundant				
SCORE (LB)	Left Bank	10	9			8	7	6			5	4	3			2		1		
SCORE (RB)	Right Bank	10	9			8	7	6			5	4	3			2		1		

6.9 Score: front _____ + back _____ = total _____

Percentage: total score _____ x (100 / 160) = _____

Overall Physical Habitat Condition: _____

SHTD ☐ Existing Stream Habitat Type: _____

Score	Percentage	Condition (Departure)
136-160	85 – 100	Reference (None)
104 – 135	65 – 84	Good (Minor)
56 – 103	35 – 64	Fair (Major)
0 – 55	0 – 34	Poor (Severe)

Stream Name: _____
 Location: _____
 Observers: _____
 Organization /Agency: _____
 USGS Map Name(s): _____
 Weather: _____
 Flow: base / low / avg. Storm within past 7 days: Y / N

Segment I.D: _____
 Date: _____
 Town: _____
 Elevation: _____ ft.
 Latitude (N/S): _____
 Longitude (E/W): _____
 Drainage Area: _____ sq. mi.
 Segment Length: _____ ft.

Habitat Parameter	Condition (Departure) Category																			
	Reference (None)					Good (Minor)					Fair (Major)					Poor (Severe)				
6.1 Woody Debris Cover LWD size rank variable only used if ≥ 10 pieces	<input type="checkbox"/> LWD pieces / mile > 50 <input type="checkbox"/> LWD size rank 3-6 $> 50\%$ <input type="checkbox"/> debris jams / mile > 5 <input type="checkbox"/> high woody debris recruitment potential <input type="checkbox"/> CPOM present in channel and margins					<input type="checkbox"/> $50 \geq$ LWD / mile > 25 <input type="checkbox"/> $50 \geq$ LWD rank 3-6 $> 25\%$ <input type="checkbox"/> $5 \geq$ jams / mile > 3 <input type="checkbox"/> moderate woody debris recruitment potential <input type="checkbox"/> CPOM limited in channel and present in margins					<input type="checkbox"/> $25 \geq$ LWD / mile > 10 <input type="checkbox"/> $25 \geq$ LWD rank 3-6 $> 10\%$ <input type="checkbox"/> $3 \geq$ jams / mile > 1 <input type="checkbox"/> low woody debris recruitment potential <input type="checkbox"/> CPOM limited in both channel and margins					<input type="checkbox"/> LWD / mile ≤ 10 <input type="checkbox"/> LWD size rank 3-6 $\leq 10\%$ <input type="checkbox"/> debris jams absent <input type="checkbox"/> no woody debris recruitment potential <input type="checkbox"/> CPOM absent				
	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
6.2 Bed Substrate Cover *fines: sand if $d_{50} \geq$ gravel, otherwise silt.	<input type="checkbox"/> run embeddedness $< 20\%$ margin embeddedness $< 40\%$ <input type="checkbox"/> fining* $< 10\%$ <input type="checkbox"/> sediment apparently stable & sorted <input type="checkbox"/> imbrication limited, or mostly with the short axis of particles overlapping in the direction of flow <input type="checkbox"/> substrate free of dense algae growth					<input type="checkbox"/> $20 \leq emb_{run} < 40\%$ $40 \leq emb_{margin} < 60\%$ <input type="checkbox"/> $10 \leq fining* < 20\%$ <input type="checkbox"/> some evidence of sediment mobility & lack of sorting <input type="checkbox"/> imbrication moderate, mostly with the short axis of particles overlapping in the direction of flow <input type="checkbox"/> small substrate patches covered by dense algae growth					<input type="checkbox"/> $40 \leq emb_{run} < 75\%$ $60 \leq emb_{margin} < 80\%$ <input type="checkbox"/> $20 \leq fining* < 40\%$ <input type="checkbox"/> major evidence of sediment mobility & lack of sorting <input type="checkbox"/> imbrication moderate, mostly with the long axis of particles overlapping in the direction of flow <input type="checkbox"/> large substrate patches covered by dense algae growth					<input type="checkbox"/> run embeddedness $\geq 75\%$ margin embeddedness $\geq 80\%$ <input type="checkbox"/> fining* $\geq 40\%$ <input type="checkbox"/> sediments unstable, unsorted, soft underfoot <input type="checkbox"/> imbrication extensive, mostly with the long axis of particles overlapping in the direction of flow <input type="checkbox"/> most of substrate covered by dense algae growth				
	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
6.3 Scour and Deposition Features <i>Depth-velocity combinations</i> fast-shallow fast-deep slow-shallow slow-deep (cutoffs: 1.0 fps, 1.5 ft)	<input type="checkbox"/> pool formation evident, with $\geq 50\%$ pool size rank 3-7 <input type="checkbox"/> widespread riffle formation <input type="checkbox"/> more than two depth-velocity combinations present <input type="checkbox"/> meandering thalweg clearly identifiable in cross section, with evidence of side and lateral bar formation <input type="checkbox"/> finer deposition located entirely in slack water below larger substrates/debris, and along margins					<input type="checkbox"/> pool formation evident, with $< 50\%$ pool size rank 3-7 <input type="checkbox"/> moderate riffle formation <input type="checkbox"/> two depth-velocity combinations present <input type="checkbox"/> meandering thalweg moderately identifiable in cross section, with some evidence of bar formation <input type="checkbox"/> finer deposition located in slack water below larger substrates/debris, signs of mid-channel accumulation					<input type="checkbox"/> limited trace of pool formation <input type="checkbox"/> limited riffle formation <input type="checkbox"/> one or two depth-velocity combinations present <input type="checkbox"/> meandering thalweg barely identifiable in the cross section, with minimal evidence of bar formation <input type="checkbox"/> very large depositional features below larger substrates/debris, abundant mid-channel accumulation					<input type="checkbox"/> pool formation completely absent <input type="checkbox"/> no riffle formation <input type="checkbox"/> one depth-velocity combination present <input type="checkbox"/> meandering thalweg not identifiable in the cross section, with no evidence of bar formation <input type="checkbox"/> finer deposition throughout channel, even filling pools, larger substrates almost buried or bed largely incised				
	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
6.4 Channel Morphology	<input type="checkbox"/> width/depth < 15 , natural <input type="checkbox"/> entrenchment ratio ≥ 1.4 , incision ratio < 1.2 , good floodplain access <input type="checkbox"/> no evidence of channel alteration					<input type="checkbox"/> $15 \leq w/d < 25$, widening <input type="checkbox"/> entrenchment ratio ≥ 1.4 , $1.2 \leq$ incision ratio < 1.4 , reduced floodplain access <input type="checkbox"/> evidence of minor historic channel alteration					<input type="checkbox"/> $25 \leq w/d < 40$, widening <input type="checkbox"/> entrenchment ratio ≥ 1.4 , $1.4 \leq$ incision ratio < 2.0 , limited floodplain access <input type="checkbox"/> major historic or minor recent channel alteration					<input type="checkbox"/> $w/d \geq 40$, over-widening <input type="checkbox"/> entrenchment ratio < 1.4 or incision ratio ≥ 2.0 , floodplain access unlikely <input type="checkbox"/> extensive historic or major recent channel alteration				
	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1

Habitat Parameter	Condition (Departure) Category																			
	Reference (None)					Good (Minor)					Fair (Major)					Poor (Severe)				
6.5 Hydrologic Characteristics <input type="checkbox"/> wetted width / $W_{bkf} > 0.75$ <input type="checkbox"/> exposed substrate $< 20\%$ <input type="checkbox"/> adjacent springs, seeps, and wetlands extensive <input type="checkbox"/> no known flow alteration	<input type="checkbox"/> $0.75 \geq W_{wet} / W_{bkf} > 0.50$ <input type="checkbox"/> $20 \leq \text{exp. substrate} < 40\%$ <input type="checkbox"/> adjacent springs, seeps, and wetlands present <input type="checkbox"/> minor flow alteration likely due to flow regulation and/or land use changes					<input type="checkbox"/> $0.50 \geq W_{wet} / W_{bkf} > 0.25$ <input type="checkbox"/> $40 \leq \text{exp. substrate} < 60\%$ <input type="checkbox"/> adjacent springs, seeps, and wetlands minimal <input type="checkbox"/> major flow alteration likely due to flow regulation and/or land use changes					<input type="checkbox"/> $W_{wet} / W_{bkf} \leq 0.25$ <input type="checkbox"/> exposed substrate $\geq 60\%$ <input type="checkbox"/> adjacent springs, seeps, and wetlands altered or absent <input type="checkbox"/> runoff characteristics completely altered due to flow regulation and storm water influence									
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
6.6 Connectivity Tend towards a higher/lower score for natural/man-made obstructions <input type="checkbox"/> no obstructions in reach that block longitudinal movement of aquatic species over all but the lowest flows <input type="checkbox"/> system obstructions absent <input type="checkbox"/> abundant low and high flow refuge	<input type="checkbox"/> one or two small low flow obstructions present in reach that block movement of aquatic species <input type="checkbox"/> limited system obstructions <input type="checkbox"/> abundant refuge, with low or high flow refuge limited					<input type="checkbox"/> one or two small to medium bankfull obstructions present in reach that block movement of aquatic species <input type="checkbox"/> system obstructions present <input type="checkbox"/> limited low and high flow refuge					<input type="checkbox"/> more than two bankfull obstructions present in reach that block movement of aquatic species <input type="checkbox"/> many system obstructions <input type="checkbox"/> refuge absent									
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
6.7 River Banks Select different boxes for LB and RB if necessary Undercut size rank variable only used if ≥ 5 undercuts (score each bank)	<input type="checkbox"/> bank erosion $< 10\%$, typical of natural conditions, little or no bank revetments <input type="checkbox"/> bank vegetation $> 90\%$ in tree, shrub and herb layers, diverse assemblages, plants create good cover and roots help stabilize bank <input type="checkbox"/> bank canopy $> 90\%$ <input type="checkbox"/> undercut banks / mile > 20 <input type="checkbox"/> undercut bank size rank 3-6 $> 50\%$ <input type="checkbox"/> undercut banks with mostly stable boundaries, abundant overhanging vegetation, and consistent water adjacency <input type="checkbox"/> no mass failures in valley					<input type="checkbox"/> $10 \leq \text{bank erosion} < 30\%$, infrequent small areas, some bank revetments <input type="checkbox"/> $90 \geq \text{bank vegetation} > 75\%$ in each layer, diverse assemblages, plants create good cover and roots help stabilize bank <input type="checkbox"/> $90 \geq \text{bank canopy} > 75\%$ <input type="checkbox"/> $20 \geq \text{undercuts} / \text{mile} > 15$ <input type="checkbox"/> $50 \geq \text{undercut bank size rank } 3-6 > 25\%$ <input type="checkbox"/> undercuts with some unstable boundaries or reduced overhanging vegetation, and consistent water adjacency <input type="checkbox"/> 1 mass failure in valley					<input type="checkbox"/> $30 \leq \text{bank erosion} < 60\%$, mod. unstable banks, and/or extensive bank revetments <input type="checkbox"/> $75 \geq \text{bank vegetation} > 50\%$, in two of three layers, reduced diversity, plants create limited cover and roots do not stabilize bank <input type="checkbox"/> $75 \geq \text{bank canopy} > 50\%$ <input type="checkbox"/> $15 \geq \text{undercuts} / \text{mile} > 5$ <input type="checkbox"/> $25 \geq \text{undercut bank size rank } 3-6 > 10\%$ <input type="checkbox"/> undercuts with some unstable boundaries or reduced overhanging vegetation, and reduced water adjacency <input type="checkbox"/> 1 - 2 mass failures in valley					<input type="checkbox"/> bank erosion $\geq 60\%$, banks unstable, extensive erosion, and failing bank revetments <input type="checkbox"/> bank vegetation $\leq 50\%$ in two of three layers, limited diversity, plants create no cover and roots do not stabilize bank <input type="checkbox"/> bank canopy $\leq 50\%$ <input type="checkbox"/> undercuts / mile ≤ 5 <input type="checkbox"/> undercut bank size rank 3-6 $\leq 10\%$ <input type="checkbox"/> undercuts with mostly unstable boundaries, no overhanging vegetation, and reduced water adjacency <input type="checkbox"/> > 3 mass failures in valley				
SCORE _____ (LB)	Left Bank	10	9	8	7	6	5	4	3	2	1									
SCORE _____ (RB)	Right Bank	10	9	8	7	6	5	4	3	2	1									
6.8 Riparian Area Select different boxes for LB and RB if necessary (score each side of the channel)	<input type="checkbox"/> buffer width > 150 ft <input type="checkbox"/> rip. vegetation $> 75\%$ in tree, shrub and herb layers, diverse assemblages, no invasives, maximum channel canopy <input type="checkbox"/> river corridor development and infrastructure absent					<input type="checkbox"/> $150 \geq \text{buffer width} > 100$ ft <input type="checkbox"/> $75 \geq \text{rip. veg.} > 50\%$ in each layer, one plant type absent, minimal invasives, maximum channel canopy <input type="checkbox"/> river corridor development and infrastructure minimal					<input type="checkbox"/> $100 \geq \text{buffer width} > 50$ ft <input type="checkbox"/> $75 \geq \text{rip. veg.} > 50\%$ in each layer, several types absent, altered patches, invasives present, reduced canopy <input type="checkbox"/> river corridor development and infrastructure common					<input type="checkbox"/> buffer width ≤ 50 ft <input type="checkbox"/> rip. veg. $\leq 50\%$ in each layer, several types absent, large altered areas, invasives present, reduced canopy <input type="checkbox"/> river corridor development and infrastructure abundant				
SCORE _____ (LB)	Left Bank	10	9	8	7	6	5	4	3	2	1									
SCORE _____ (RB)	Right Bank	10	9	8	7	6	5	4	3	2	1									

6.9 Score: front _____ + back _____ = total _____

Percentage: total score _____ x (100 / 160) = _____

Overall Physical Habitat Condition: _____

SHTD ☐ Existing Stream Habitat Type: _____

Score	Percentage	Condition (Departure)
136 – 160	85 – 100	Reference (None)
104 – 135	65 – 84	Good (Minor)
56 – 103	35 – 64	Fair (Major)
0 – 55	0 – 34	Poor (Severe)

VTANR REACH HABITAT ASSESSMENT ----- BRAIDED STREAM TYPE

Page 1

(Also use this form for alluvial fans.)

Stream Name: _____
 Location: _____

 Observers: _____
 Organization /Agency: _____
 USGS Map Name(s): _____
 Weather: _____
 Flow: base / low / avg. Storm within past 7 days: Y / N

Segment I.D: _____
 Date: _____
 Town: _____
 Elevation: _____ ft.
 Latitude (N/S): _____
 Longitude (E/W): _____
 Drainage Area: _____ sq. mi.
 Segment Length: _____ ft.

Habitat Parameter	Condition (Departure) Category																			
	Reference (None)					Good (Minor)					Fair (Major)					Poor (Severe)				
6.1 Woody Debris Cover LWD size rank variable only used if ≥ 10 pieces	<input type="checkbox"/> LWD pieces / mile > 100	<input type="checkbox"/> LWD size rank 3-6 > 50%	<input type="checkbox"/> debris jams / mile > 5	<input type="checkbox"/> high woody debris recruitment potential	<input type="checkbox"/> CPOM present in channel and margins	<input type="checkbox"/> 100 \geq LWD / mile > 50	<input type="checkbox"/> 50 \geq LWD rank 3-6 > 25%	<input type="checkbox"/> 5 \geq jams / mile > 3	<input type="checkbox"/> moderate woody debris recruitment potential	<input type="checkbox"/> CPOM limited in channel and present in margins	<input type="checkbox"/> 50 \geq LWD / mile > 25	<input type="checkbox"/> 25 \geq LWD rank 3-6 > 10%	<input type="checkbox"/> 3 \geq jams / mile > 1	<input type="checkbox"/> low woody debris recruitment potential	<input type="checkbox"/> CPOM limited in both channel and margins	<input type="checkbox"/> LWD / mile ≤ 25	<input type="checkbox"/> LWD size rank 3-6 $\leq 10\%$	<input type="checkbox"/> debris jams absent	<input type="checkbox"/> no woody debris recruitment potential	<input type="checkbox"/> CPOM absent
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
6.2 Bed Substrate Cover *fines: sand if $d_{50} \geq$ gravel, otherwise silt.	<input type="checkbox"/> riffle embeddedness < 20% margin embeddedness < 40%	<input type="checkbox"/> fining* < 10%	<input type="checkbox"/> Riffle stability index < 70%	<input type="checkbox"/> sediment apparently stable & sorted	<input type="checkbox"/> substrate free of dense algae growth	<input type="checkbox"/> 20 $\leq emb_{riffle}$ < 40% 40 $\leq emb_{margin}$ < 60%	<input type="checkbox"/> 10 $\leq fining$ * < 20%	<input type="checkbox"/> 70 $\leq RSI$ < 80%	<input type="checkbox"/> some evidence of sediment mobility & lack of sorting	<input type="checkbox"/> small substrate patches covered by dense algae growth	<input type="checkbox"/> 40 $\leq emb_{riffle}$ < 75% 60 $\leq emb_{margin}$ < 80%	<input type="checkbox"/> 20 $\leq fining$ * < 40%	<input type="checkbox"/> 80 $\leq RSI$ < 90%	<input type="checkbox"/> major evidence of sediment mobility & lack of sorting	<input type="checkbox"/> large substrate patches covered by dense algae growth	<input type="checkbox"/> riffle embeddedness $\geq 75\%$ margin embeddedness $\geq 80\%$	<input type="checkbox"/> fining* $\geq 40\%$	<input type="checkbox"/> RSI $\geq 90\%$	<input type="checkbox"/> sediments unstable, unsorted, soft underfoot	<input type="checkbox"/> most of substrate covered by dense algae growth
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
6.3 Scour and Deposition Features <i>Depth-velocity combinations</i> fast-shallow fast-deep slow-shallow slow-deep (cutoffs: 1.0 fps, 1.5 ft)	<input type="checkbox"/> pools / mile > 40	<input type="checkbox"/> pool size rank 3-7 > 50%	<input type="checkbox"/> good cover > 75% of total pool surface area	<input type="checkbox"/> riffle coverage > 25% reach area, distinctly formed and complete	<input type="checkbox"/> 5 \leq riffle spacing ≤ 7 bankfull channel widths (w_{bkr})	<input type="checkbox"/> 40 \geq pools / mile > 20	<input type="checkbox"/> 50 \geq pool rank 3-7 > 25%	<input type="checkbox"/> 75 \geq good cover > 50% of total pool surface area	<input type="checkbox"/> 25 \geq riffle coverage > 10% reach area, moderately well formed and complete	<input type="checkbox"/> 3 \leq riffle spacing < 5, or 7 < riffle spacing $\leq 10 \times w_{bkr}$	<input type="checkbox"/> 20 \geq pools / mile > 10	<input type="checkbox"/> 25 \geq pool rank 3-7 > 10%	<input type="checkbox"/> 50 \geq good cover > 25% of total pool surface area	<input type="checkbox"/> 25 \geq riffle coverage > 10% reach area, poorly formed and incomplete	<input type="checkbox"/> 1 \leq riffle spacing < 3, or 10 < riffle spacing $\leq 12 \times w_{bkr}$	<input type="checkbox"/> pools / mile ≤ 10	<input type="checkbox"/> pool size rank 3-7 $\leq 10\%$	<input type="checkbox"/> good cover $\leq 25\%$ of total pool surface area	<input type="checkbox"/> riffle coverage $\leq 10\%$ reach area, or mostly indistinct or absent	<input type="checkbox"/> riffle spacing ≥ 12 bankfull channel widths
Pool size rank variable only used if ≥ 5 pools	<input type="checkbox"/> well-defined riffle-run-pool-glide pattern with all four depth-velocity combinations present	<input type="checkbox"/> stable bars, vegetative cover on depositional features $\geq 50\%$, particles well-sorted	<input type="checkbox"/> well-defined riffle-run-pool-glide pattern with three depth-velocity combinations dominant	<input type="checkbox"/> mostly stable bars, vegetative cover on depositional features 50-25%, particles moderately sorted	<input type="checkbox"/> poorly defined riffle-run-pool-glide pattern with one depth-velocity combination dominant	<input type="checkbox"/> mostly unstable bars, vegetative cover on depositional features < 10%, particles not sorted														
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
6.4 Channel Morphology	<input type="checkbox"/> width/depth < 30, natural	<input type="checkbox"/> entrenchment ratio ≥ 2.0 , incision ratio < 1.0, good floodplain access	<input type="checkbox"/> no evidence of channel alteration	<input type="checkbox"/> 30 $\leq w/d$ < 40, widening	<input type="checkbox"/> entrenchment ratio ≥ 2.0 , 1.0 \leq incision ratio < 1.2, reduced floodplain access	<input type="checkbox"/> evidence of minor historic channel alteration	<input type="checkbox"/> 40 $\leq w/d$ < 50, widening	<input type="checkbox"/> entrenchment ratio ≥ 2.0 , 1.2 \leq incision ratio < 1.4, limited floodplain access	<input type="checkbox"/> major historic or minor recent channel alteration	<input type="checkbox"/> w / d ≥ 50 , over-widening	<input type="checkbox"/> entrenchment ratio < 2.0 or incision ratio ≥ 1.4 , floodplain access unlikely	<input type="checkbox"/> extensive historic or major recent channel alteration								
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1

Habitat Parameter	Condition (Departure) Category																			
	Reference (None)					Good (Minor)					Fair (Major)					Poor (Severe)				
6.5 Hydrologic Characteristics <input type="checkbox"/> wetted width / $W_{bkr} > 0.50$ <input type="checkbox"/> exposed substrate $< 50\%$ <input type="checkbox"/> adjacent springs, seeps, and wetlands extensive <input type="checkbox"/> no known flow alteration	<input type="checkbox"/> $0.50 \geq W_{wet} / W_{bkr} > 0.30$ <input type="checkbox"/> $50 \leq \text{exp. substrate} < 60\%$ <input type="checkbox"/> adjacent springs, seeps, and wetlands present <input type="checkbox"/> minor flow alteration likely due to flow regulation and/or land use changes					<input type="checkbox"/> $0.30 \geq W_{wet} / W_{bkr} > 0.10$ <input type="checkbox"/> $60 \leq \text{exp. substrate} < 70\%$ <input type="checkbox"/> adjacent springs, seeps, and wetlands minimal <input type="checkbox"/> major flow alteration likely due to flow regulation and/or land use changes					<input type="checkbox"/> $W_{wet} / W_{bkr} \leq 0.10$ <input type="checkbox"/> exposed substrate $\geq 70\%$ <input type="checkbox"/> adjacent springs, seeps, and wetlands absent or altered <input type="checkbox"/> runoff characteristics completely altered due to flow regulation and storm water influence									
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
6.6 Connectivity Tend towards a higher/lower score for natural/man-made obstructions <input type="checkbox"/> no obstructions in reach that block longitudinal movement of aquatic species over all but the lowest flows <input type="checkbox"/> system obstructions absent <input type="checkbox"/> abundant low and high flow refuge	<input type="checkbox"/> one or two small low flow obstructions present in reach that block movement of aquatic species <input type="checkbox"/> limited system obstructions <input type="checkbox"/> abundant refuge, with low or high flow refuge limited					<input type="checkbox"/> one or two small to medium bankfull obstructions present in reach that block movement of aquatic species <input type="checkbox"/> system obstructions present <input type="checkbox"/> limited low and high flow refuge					<input type="checkbox"/> more than two bankfull obstructions present in reach that block movement of aquatic species <input type="checkbox"/> many system obstructions <input type="checkbox"/> refuge absent									
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
6.7 River Banks Select different boxes for LB and RB if necessary Undercut size rank variable only used if ≥ 5 undercuts (score each bank)	<input type="checkbox"/> bank erosion $< 10\%$, typical of natural conditions, little or no bank revetments <input type="checkbox"/> bank vegetation $> 90\%$ in tree, shrub and herb layers, diverse assemblages, plants create good cover and roots help stabilize bank <input type="checkbox"/> bank canopy $> 90\%$ <input type="checkbox"/> undercut banks / mile > 30 <input type="checkbox"/> undercut bank size rank 3-6 $> 50\%$ <input type="checkbox"/> undercut banks with mostly stable boundaries, abundant overhanging vegetation, and consistent water adjacency <input type="checkbox"/> no mass failures in valley					<input type="checkbox"/> $10 \leq \text{bank erosion} < 30\%$, infrequent small areas, some bank revetments <input type="checkbox"/> $90 \geq \text{bank vegetation} > 75\%$ in each layer, diverse assemblages, plants create good cover and roots help stabilize bank <input type="checkbox"/> $90 \geq \text{bank canopy} > 75\%$ <input type="checkbox"/> $30 \geq \text{undercuts} / \text{mile} > 15$ <input type="checkbox"/> $50 \geq \text{undercut bank size rank } 3-6 > 25\%$ <input type="checkbox"/> undercuts with some unstable boundaries or reduced overhanging vegetation, and consistent water adjacency <input type="checkbox"/> 1 mass failure in valley					<input type="checkbox"/> $30 \leq \text{bank erosion} < 60\%$, mod. unstable banks, and/or extensive bank revetments <input type="checkbox"/> $75 \geq \text{bank vegetation} > 50\%$, in two of three layers, reduced diversity, plants create limited cover and roots do not stabilize bank <input type="checkbox"/> $75 \geq \text{bank canopy} > 50\%$ <input type="checkbox"/> $15 \geq \text{undercuts} / \text{mile} > 5$ <input type="checkbox"/> $25 \geq \text{undercut bank size rank } 3-6 > 10\%$ <input type="checkbox"/> undercuts with some unstable boundaries or reduced overhanging vegetation, and reduced water adjacency <input type="checkbox"/> 1 - 2 mass failures in valley					<input type="checkbox"/> bank erosion $\geq 60\%$, banks unstable, extensive erosion, and failing bank revetments <input type="checkbox"/> bank vegetation $\leq 50\%$ in two of three layers, limited diversity, plants create no cover and roots do not stabilize bank <input type="checkbox"/> bank canopy $\leq 50\%$ <input type="checkbox"/> undercuts / mile ≤ 5 <input type="checkbox"/> undercut bank size rank 3-6 $\leq 10\%$ <input type="checkbox"/> undercuts with mostly unstable boundaries, no overhanging vegetation, and reduced water adjacency <input type="checkbox"/> > 3 mass failures in valley				
SCORE (LB)	Left Bank	10	9	8	7	6	5	4	3	2	1									
SCORE (RB)	Right Bank	10	9	8	7	6	5	4	3	2	1									
6.8 Riparian Area Select different boxes for LB and RB if necessary (score each side of the channel)	<input type="checkbox"/> buffer width > 150 ft <input type="checkbox"/> rip. vegetation $> 75\%$ in tree, shrub and herb layers, diverse assemblages, no invasives, maximum channel canopy <input type="checkbox"/> river corridor development and infrastructure absent					<input type="checkbox"/> $150 \geq \text{buffer width} > 100$ ft <input type="checkbox"/> $75 \geq \text{rip. veg.} > 50\%$ in each layer, one plant type absent, minimal invasives, maximum channel canopy <input type="checkbox"/> river corridor development and infrastructure minimal					<input type="checkbox"/> $100 \geq \text{buffer width} > 50$ ft <input type="checkbox"/> $75 \geq \text{rip. veg.} > 50\%$ in each layer, several types absent, altered patches, invasives present, reduced canopy <input type="checkbox"/> river corridor development and infrastructure common					<input type="checkbox"/> buffer width ≤ 50 ft <input type="checkbox"/> rip. veg. $\leq 50\%$ in each layer, several types absent, large altered areas, invasives present, reduced canopy <input type="checkbox"/> river corridor development and infrastructure abundant				
SCORE (LB)	Left Bank	10	9	8	7	6	5	4	3	2	1									
SCORE (RB)	Right Bank	10	9	8	7	6	5	4	3	2	1									

6.9 Score: front _____ + back _____ = total _____

Percentage: total score _____ x $(100 / 160) =$ _____

Overall Physical Habitat Condition: _____

SHTD ☐ Existing Stream Habitat Type: _____

Score	Percentage	Condition (Departure)
136 – 160	85 – 100	Reference (None)
104 – 135	65 – 84	Good (Minor)
56 – 103	35 – 64	Fair (Major)
0 – 55	0 – 34	Poor (Severe)