Phase 2 Stream Geomorphic Assessment – Lite Version - for Lake Watershed Action Plans

Introduction for Phase 2 LITE:

This Phase 2 LITE protocol is intended to be completed by people with some level of background and/or training in the VT Stream Geomorphic Assessment (SGA) Protocol. This is intended to be a stream walk with some data collection that can provide guidance on the less technical stream project types. This type of assessment is focused on streams with a watershed size of less than 2 sq. miles. These smaller streams around a lake are often 1^{st} and 2^{nd} order streams that feed directly into the lake, and not part of a larger stream network. If you are looking for more detailed information, want to collect information on streams with watershed size greater than 2 sq. miles, or explore a broader suite of project types, we would suggest you coordinate with your Regional River Scientist to look at SGA projects and priorities for your region.

If the assessment is conducted by persons with limited or no training in the VT SGA protocols or is more limited in data collection to a simple stream walk, then the type of projects that are identified and supported should be focused on more basic projects. Assessments supported with persons with more training in the SGA protocols and are collecting more data may look to include more complex project types.

Project types that are supported coming out of this limited assessment:

- Buffer plantings
- Identifying stormwater inputs
- Undersized culverts
- Berm removals
- Dam removals

Project types that would require a more detailed assessment completed by someone with formal training in the VT DEC SGA Protocol to determine if they are appropriate include:

- Bank stabilization
- LWD/BDA
- Channel or floodplain restoration – except for berm removals
- Headcuts
- River Corridor Easements

Purpose: A Phase 2 SGA – lite has been developed to allow of a collection of the minimum amount of data to understand stream type and process that guide appropriate restoration/protection projects and support other regulatory and monitoring efforts within the Division.

Below is a list of the primary parameters necessary to be collected to gain an understanding of the general physical condition of a segment. Parameters and methods are based on the full Phase 2 Stream Geomorphic Assessment (SGA) Protocols. https://dec.vermont.gov/watershed/rivers/river-corridor-and-floodplain-protection/geomorphic-assessment Refer to the full Phase 2 SGA protocols for additional details and/or background information about the parameters measured in Phase 2 SGA-lite.

Primary Parameters: These parameters are considered essential to collect to provide the minimum type and amount of data to base stream characterizations on and needed to understand stream process and condition.

- Confinement
- Bankfull width
- W/D ratio
- Entrenchment
- Channel type
- Incision
- Stream type

- Bed form
- RGA – Geomorphic Condition
- CEM
- Sensitivity

Depending on the primary purpose of the assessment and the nature of the segment, the secondary parameters listed below may also be useful to collect, especially if the assessment is the basis for developing conceptual designs for a restoration project. While walking the reach recording observations of:

Secondary Parameters:

- Depositional features, alluvial fans, and headcuts
- Grade controls
- Constrictions
- Erosion, gullies, and mass failures
- Habitat features
- Substrate composition – pebble count

<u>Assessment Process:</u> A key area of measurement that will need to be completed is the channel cross-section. Performing a cross section will allow you to determine.

- Bankfull width
- W/D ratio
- Entrenchment
- Incision
- Stream type
- Sensitivity
- RGA worksheet

Where to Conduct a cross-section: Measurements of channel dimensions, such as bankfull width, maximum depth and flood prone width (Figure 1.), are conducted at the channel "cross-over" locations (Figure 2). In a meandering stream, a cross-over is the area where the main current or flow in the channel crosses over from one side of the channel to the other. Riffles are usually located at cross-over locations. In steep gradient channels that run relatively straight, the main flow of the channel does not usually move from side to side across the channel, but rather cascades over cobble and boulder steps or runs straight over a uniform channel bottom. In these stream types, channel dimensions should be measured at these cascades, steps, or uniform runs. In a very low gradient stream where distinct riffles may not form, you should still perform channel measurements at cross-over locations, which may resemble shallow runs. **Do not take channel measurements at pools or you will overestimate the channel width and maximum depth. Be sure to mark on your sketch where you take cross section measurements.**

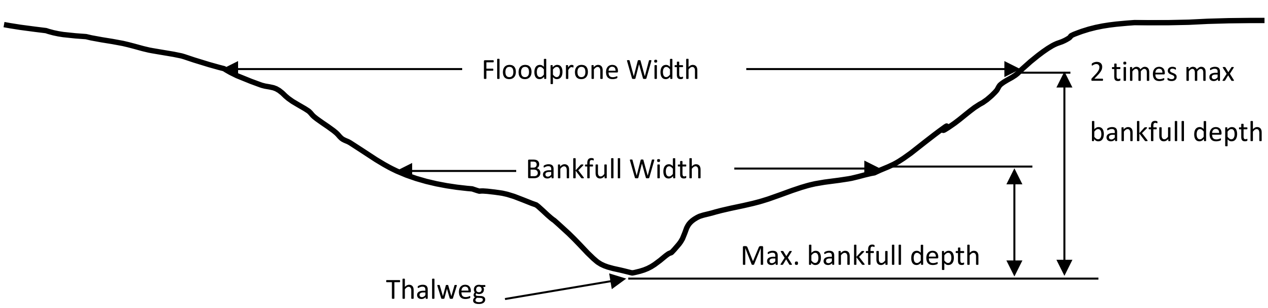


Figure 1.- Channel dimensions - cross-section view

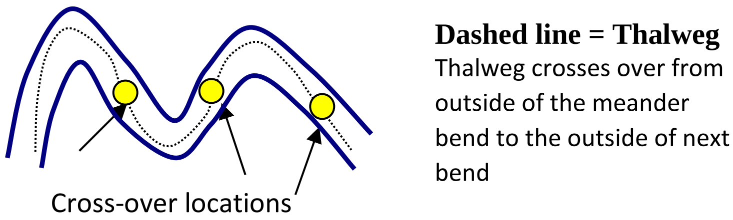


Figure 2. Cross-over locations - plan view

Recording Cross-section Data: A separate "Cross-section Worksheet" is provided at the end of these instructions to record distance and depth measurements. If you complete several cross-sections, do **not** record an average of channel dimensions at these cross-sections on the Field Notes form, but rather the set of values from the cross-section that is most typical of the segment (or reach). You are trying to capture the channel dimensions most prevalent throughout the segment (or reach). The Worksheet also provides an area for drawing and labeling a typical cross-section and for calculating stream bed particle size percentages at different bed features (from Pebble count). The information from this worksheet will then be transferred to an Excel workbook (https://dec.vermont.gov/sites/dec/files/wsm/rivers/docs/assessment-protocol-appendices/Phase-3-Spreadsheet-v5-81.xlsx). For projects that have Phase 1 and/or Phase 2 Stream geomorphic assessment (SGA) project the Excel workbook will be uploaded to the Stream Geomorphic Assessment Data management system (https://anrweb.vt.gov/DEC/SGA/Default.aspx) for each reach. For projects outside of the Phase 1/Phase 2 SGA work, the Excel worksheet provides a way to store data for the users work and data evaluation. The Excel workbook provides a worksheet for entering several cross-sections for a segment. This is a good way of insuring that you have collected the need information and confirm what you had calculated for channel information.

Setting up the cross-section:

It is important when doing a cross section to collect enough data to adequately characterize the relationship between the river, its floodplain, and the valley. Make sure the cross section goes beyond the top of bank, and where feasible go out to the toe of the valley walls on either side of the channel. **Survey as much of the valley bottom as is reasonable keeping in mind the objective of depicting as complete a representation of the valley and channel morphology as possible given the time available.**

Capturing features within the channel:

Bankfull width: Remember that this measurement should be taken over a riffle or similar feature, such as a step, cascade, or run in steep channels. To measure bankfull width, stretch a measuring tape taut across the channel, perpendicular to the flow direction, from the point of bankfull elevation on the left bank across the stream to the bankfull elevation on the right bank (Figure 1). Pin the tape at these two points at the bankfull elevation. View the stretched tape from downstream to be sure that it is level. Also check the levelness of your tape with a hand level if you have one, or use your measuring rod along the tape to make sure it is running equal distant from the water surface. Record the width to the nearest foot.

- **This feature may or may not be at the top of bank.** Be sure to leave a few blank spaces at the start of cross-section data sheet to collect data above and/or beyond the left bankfull pin for data on the left bank / floodplain.

Mean Depth: While the tape is still stretched across the channel at bankfull elevation use a depth rod to measure 10 depths at evenly spaced intervals across the channel (Figure 1). Average the ten measurements to determine a mean bankfull depth. The spacing interval used to measure depths across the channel is determined by dividing the bankfull width by 11. For instance, if the bankfull width is 50 feet, take a depth measurement approximately every 4.5 feet across the channel. At each interval record the distance across the channel (from the left bankfull pin) and the corresponding depth from the tape to the stream bed on the Cross-section Worksheet

Max Depth: While collecting the evenly spaced interval measures to obtain the mean depth you will also collect the bankfull maximum depth. With the depth rod, find the deepest depth between the tape and the stream bed; this is called the thalweg (Figure 1). Record the distance from the left bankfull pin and depth from the tape to the streambed measurement to the nearest tenth of a foot.

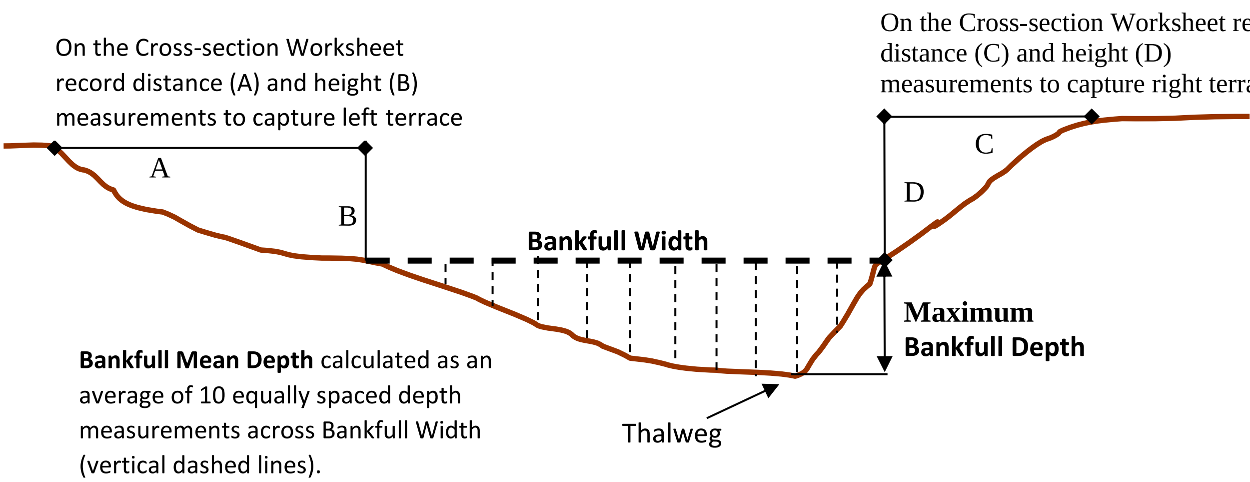


Figure 3: Diagram of bankfull width, maximum depth, mean depth and terrace measurements

Edge of Water: In addition to getting the depths at the given intervals, capture the depth (from the tape to the streambed) at the left and right edge of water

Additional features to make note of (Figure 3):

- Right and Left Top of Bank. This may or may not be at the same elevation as your bankfull feature. If the channel has incised the top of bank may be above your bank full feature.
- Significant changes in slope along the bank and/or channel bed

Capturing features outside the channel:
Recently Abandoned Floodplain (RAF): Stretch a tape taut and level across the channel from the top of the lowest of the two banks to a measuring rod positioned at the thalweg (Figure 4). Record the height of the recently abandoned floodplain to the nearest tenth of a foot, which is the distance between the measuring tape and the streambed at the thalweg. Record at least one point out beyond the top of bank point to help with determining if the feature continues at the same elevation for some distance or changes slope within a give distance

- The RAF height is divided by bankfull maximum depth to determine the incision ratio for the channel. In some cases where the stream has not incised there will not be an abandoned floodplain and the bankfull elevation and the current floodplain elevation will be the same. If the bankfull maximum depth is identical to the height of the RAF then the same number will be recorded for both parameters on the Cross-section form. The incision ratio should be 1.

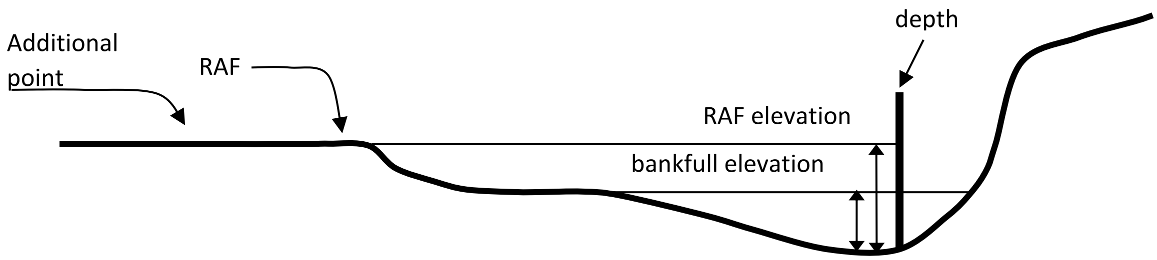


Figure 4: Measuring Recently Abandoned Floodplain (RAF)

Floodprone Width: The floodprone width is measured at an elevation that is 2 times the bankfull maximum depth (Figure 1). For example, if the bankfull maximum depth is 3 ft., you would move the tape up to 6 ft. on the depth rod to reach the floodprone elevation. To measure your floodprone distance at the floodprone elevation, start at your bankfull pin, set the base of your depth rod at the bankfull elevation. Now go move your tape up the depth rod to height of the bankfull max depth; you are now at the same 2 times the bankfull max depth as you would be if you were standing in the channel at the thalweg. Stretch the measuring tape out level across the adjacent floodplain until you intersect the next adjacent terrace or hillside at the floodprone elevation on either side of the channel. This total distance across the channel and floodplain area on both sides of the channel, measured at the floodprone elevation, is the floodprone width.

- Record at least two elevations across the floodplain before encountering a terrace and/or valley wall feature. Where there is large variability in the elevation across the floodplain, record elevations of features

Adjacent Terrace: To capture adjacent terraces on either side of the channel (Figure 3) record the elevation at the top of the break in slope and at least one point out beyond that point to help with determining if that feature remains at the same elevation for some distance or changes within a given distance. Be sure to leave space on your cross-section sheet to record these measurements.

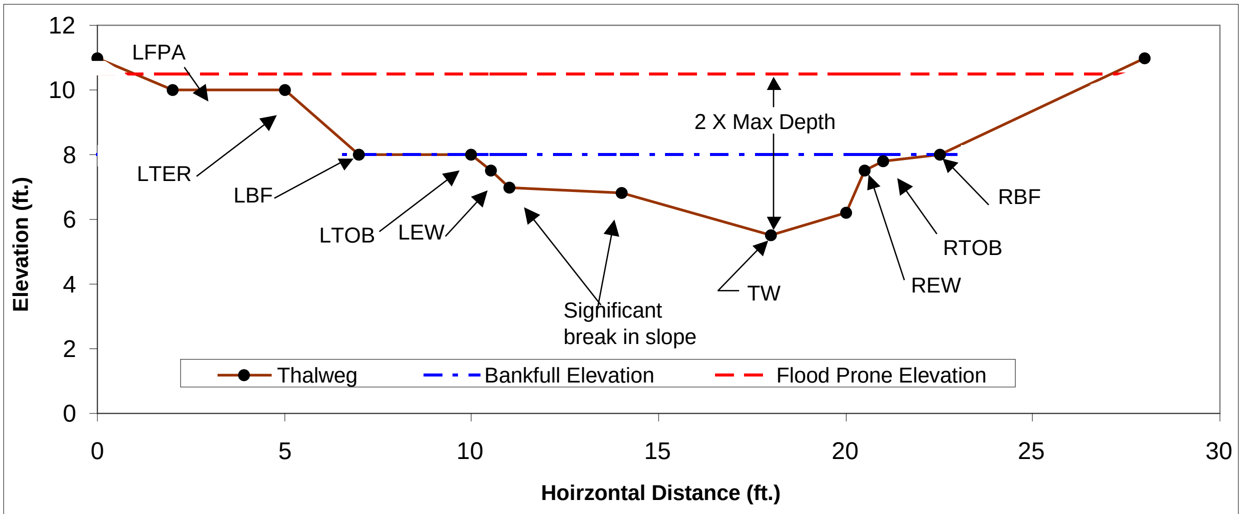


Figure 5: Example of Cross-section features to capture on field form.

Cross-Section Codes: LFPA = Left Floodplain, LTER = Left Terrace, LTOB = Left Top of Bank, LBF = Left Bankfull Stage, LEW = Left Edge of Water; TW = Thalweg, REW = Right Edge of Water; RTOB = Right Top of Bank, RBF = Right Bankfull Stage

<u>Cross-section and Floodplain Calculations:</u>

Width/ Depth Ratio: Divide the bankfull width by the **mean** bankfull depth . Example: If the stream has a bankfull width of 30 ft. and a mean depth of 2.0 ft., the width/depth ratio is 30 ÷ 2 = 15.

Entrenchment Ratio: Can be a visual estimate based on the width of the valley at an elevation twice the bankfull depth compared to the bankfull width; or if measurements have been done, divide the width of the floodprone area by the bankfull width to determine the entrenchment ratio. Example: If the stream has a floodprone width of 100 and a width of 20 the entrenchment ration is 5.

Table 1:

Entrenchment	Description	Ratio
Fully	No accessible floodplain	ER<1.4
Moderate	Some accessible floodplain at higher flows	ER=1.4-2.2
Minor	Accessible floodplain at 1-2 year flow recurrence interval	ER> 2.2

Incision Ratio: This can be a visual estimate based on the comparison of the height of the top of bank compared to the bankfull height; or if measurements have been done, divide the recently abandoned floodplain (RAF) by the bankfull maximum depth. Values will always be greater than or equal to one.

Table 2:

Incision	Description	Ratio
Major	Sharp change in slope and/or multiple headcuts present, riffles/dunes/steps replaced by planebed features, extensive historic channel straightening, gravel mining, and/or recent channel avulsion, major existing flow alterations, greater flows and/or reduced sediment load	IR >2

Moderate	Sharp change in slope, headcuts present, riffles/steps/ dunes may appear incomplete/eroded, dominated by runs, evidence of historic straightening, dredging, gravel mining, and/or channel avulsions, major historic flow alteration, greater flows, and/or reduction in sediment load	IR ≥1.4 and <2
Minor	Minor localized slope increase or nickpoints, riffles/steps/dunes mostly complete but may appear shorter, evidence of minor historic dredging and/or channel avulsion	IR ≥1.2 and <1.4
Reference	Little evidence of localized slope increase or nickpoints, riffles/steps/dunes complete, no evidence of historic channel alteration (straightening, dredging) or avulsions. No known flow alterations	IR ≥1 and <1.2

Confinement: Can be a visual estimate (or coarse map measurement) based on ratio of bankfull width to valley width. Make note of whether there is a human caused change in confinement (for example, a road narrowing the valley).

Table 3:

Confinement	Valley Width / Channel Width Ratio
Narrowly confined	≥1 and < 2
Semi Confined	≥2 and < 4
Narrow	≥4 and < 6
Broad	≥6 and < 10
Very broad	≥1 10

Stream and Bedform Determination:

Stream Type: Using the measurements made above, and referring to Table 4 below, determine the existing stream type for the segment (or reach). Streams are placed into the different stream types based on their entrenchment, width-depth ratio, sinuosity, channel slope, substrate size, and bed features. If the stream type has been based on the use of the +/- factors allowed for entrenchment and width/depth; be sure to include in your comments why those factors were used.

Table 4: Stream Type parameters (1-3) are in order of priority for typing (Rosgen 1996).

Stream Type	**(1) Entrenchment Ratio (+/– 0.2 units)**	**(2) Width/depth (+/– 2 units)**	**(3) Sinuosity (+/– 0.2 units)**	**Slope % (See Note)**
A – Single Thread	**<1.4** - Entrenched	**<12** – Low	**<1.2** – Low	**4-10**
G – Single Thread	**<1.4** - Entrenched	**<12** – Low	**>1.2** – Low to Mod.	**2-4**
F – Single Thread	**<1.4** - Entrenched	**>12** – Mod. to High	**>1.2** – Low to Mod.	**<2**
B – Single Thread	**1.4 -2.2** – Moderately Entrenched	**>12** – Moderate	**>1.2** – Low to Mod.	**2-4**
E – Single Thread	**>2.2** – Slightly Entrenched	**<12** – Very Low	**>1.5** – Very High	**<2**
C – Single Thread	**>2.2** – Slightly Entrenched	**>12** – Mod. to High	**>1.2** – Moderate	**<2**
D – Multiple Thread		**>40** – Very high	**<1.2** - Low	**<4**

Determining Bed Forms: The Phase 2 determination of bed forms is a visual assessment. Using the descriptions provided in Table 2 circle a dominant bed form on the Field Notes form for the segment (or reach). Use the dominant

Table 5: Stream Type Bed Forms from Montgomery and Buffington (1997) and Rosgen (1996)

bed form in the Stream Type description box. If the segment exhibits more than one bed form, circle both the dominant and sub-dominant bed forms and write "dom" and "sub-dom" under them on the Field Notes form.

Bed Features	Description
Cascade	Generally occur in very steep channels, narrowly confined by valley walls. Characterized by longitudinally and laterally disorganized bed materials, typically bedrock, boulders, and cobbles. Small, partial channel-spanning pools spaced < 1 channel width apart common.
Step-Pool	Often associated with steep channels, low width/depth ratios and confining valleys. Characterized by longitudinal steps formed by large particles (boulder/cobbles) organized into discrete channel-spanning accumulations that separate pools, which contain smaller sized materials. Step-pool systems exhibit pool spacing of 1 to 4 channel widths.
Plane Bed	Occur in low to high gradient and relatively straight channels, have low to high width/depth ratios, and may be either unconfined or confined by valley walls. Composed of sand to small boulder-sized particles, but dominated by gravel and cobble substrates in reference stream condition. Channel lacks discrete bed features (such as pools, riffles, and point bars) and may have long stretches of featureless bed.
Riffle-Pool	Occur in moderate to low gradient and moderately sinuous channels, generally in unconfined valleys, and has well-established floodplain. Channel has undulating bed that defines a sequence of riffles, runs, pools, and bars. Pools spaced every 5 to 7 channel widths in a self-formed (alluvial) riffle-pool channel.
Dune-Ripple	Usually associated with low gradient and highly sinuous channels. Dominated by sand-sized substrates. Channel may exhibit point bars or other bedforms forced by channel geometry. Typically undulating bed does not establish distinct pools and riffles.
Bedrock	Lack a continuous alluvial bed. Some alluvial material may be temporarily stored in scour holes, or behind obstructions. Often confined by valley walls.
Braided	Multiple channel system found on steep depositional fans and deltas. Channel gradient is generally the same as the valley slope. Ongoing deposition leads to high bank erosion rates. Bed features result from the convergence/divergence process of local bed scour and sediment deposition. Unvegetated islands may shift position frequently during runoff events. High bankfull widths and very low meander (belt) widths.

Bed Sediment Composition: Using a pebble count methodology, record the percentage of each of the sediment size classes (Table 6) in the stream segment (or reach).

Table 6: Sediment size classes.

Size Class	Millimeters	Inches	Relative Size
1-Bedrock	> 4096	> 160	Bigger than a Volkswagen Bug
2-Boulder	256 – 4096	10.1 - 160	Basketball to Volkswagen 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	< 2.00	< 0.08	Smaller than a pepper corn
6-Silt	<.062	<.002	Smaller than sand

Determining Dominant adjustment processes:

This can be a visual assessment of the current dominant adjustment process based on visual observations of degree of incision, depositional features, presence and location of erosion, and other channel adjustment characteristics. More than one adjustment process may be active at a given time (for example, both widening and planform adjustment).

Table 7: Adjustment Processes

Process	Description

Degradation	Channel is actively incising, or has incised historically but has not progressed to later stages of channel evolution (potentially due to channel armoring). Nick points may be present; bed features may be eroded.
Aggradation	Channel is actively aggrading. Presence of depositional features such as mid channel bars, diagonal bars, side bars, and steep riffles.
Widening	Channel is actively widening. Presence of bank erosion and low w/d ratio. Bed features may be sedimented.
Planform	Channel is moving laterally. Evidence of active flood chutes, avulsions, erosion on outside bends of meanders.

Geomorphic condition: This can be a visual estimate of the streams degree of departure from reference equilibrium condition. To determine a more value based condition, an observer can use the Rapid Geomorphic Assessment forms (appendix x / https://dec.vermont.gov/sites/dec/files/wsm/rivers/docs/assessment-protocol-appendices/A4-Appendix-A-12-Phase-2-RGA-Forms-2012.pdf)

Table 8: Geomorphic Condition

Stream Condition	Description
Poor	**stream reach in *poor* condition that** is experiencing *extreme* adjustment outside the expected range of natural variability for the reference stream type; likely exhibiting a new stream type; and is expected to continue to adjust, either evolving back to the historic reference stream type or to a new stream type consistent with watershed inputs and boundary conditions
Fair	**A stream reach in *fair* condition that** has experienced *major change* in channel form and fluvial processes outside the expected range of natural variability; and may be poised for additional adjustment with future flooding or changes in watershed inputs that could change the stream type
Good	**A stream reach in *good* condition that** is in dynamic equilibrium which may involve localized, *minimal change* to its shape or location while maintaining the fluvial processes and functions of its watershed over time and within the range of natural variability.
Reference	**A stream reach in *reference* condition that** is in dynamic equilibrium which may involve localized, *insignificant change* to its shape or location while maintaining the fluvial processes and functions of its watershed over time and within the range of natural variability.

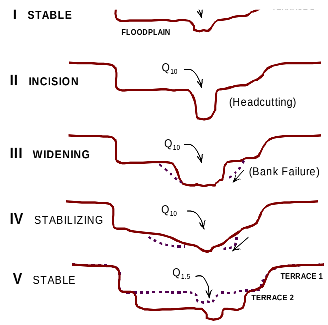
Stream Sensitivity: Sensitivity refers to the likelihood that a stream will respond to a watershed or local disturbance or stressor. With the help of Table 9, use the existing stream type and the stream condition to evaluate the sensitivity of your segment or reach. If the existing stream type represents a departure from a reference or modified reference stream type then you will use the far right-hand column of Table 9.

Table 9:

Existing Geomorphic Stream Type	**Sensitivity**		
	Reference or Good Condition	**Fair-Poor Condition in Major Adjustment**	**Poor Condition, Represents a Stream Type Departure**
A1, A2, B1, B2	Very Low	Very Low	Low
C1, C2	Very Low	Low	Moderate
G1, G2	Low	Moderate	High
F1, F2	Low	Moderate	High

B3, B4, B5	Moderate	High	High
B3c, C3, E3	Moderate	High	High
C4, C5, B4c, B5c	High	Very High	Very High
A3, A4, A5, G3, F3	High	Very High	Extreme
G4, G5, F4, F5	Very High	Very High	Extreme
D3, D4, D5	Extreme	Extreme	Extreme
C6, E4, E5, E6	High	Extreme	Extreme

***Channel Evolution Sequence (figure 6)*:** This can be a visual assessment of the current dominant adjustment process based on visual observations of degree of incision, depositional features, presence and location of erosion, and other channel adjustment characteristics.



igure 1. Five Stages of channel evolution showing headcutting that leads to
ed lowering and floodplain redevelopment

In regime, reference to good condition, insignificant to minimal adjustment.

Fair to poor condition, major to extreme channel degradation.

Fair to poor condition, major to extreme widening and aggradation.

Fair to good condition, major reducing to minor aggradation, widening, and planform adjustments

In regime, reference to good condition, insignificant to minimal adjustment.

Figure 6: Five Stages of Channel Evolution (Schumm, 1977 and 1984), the channel condition and adjustment processes often observed during each stage

Data Collection and Analysis – Existing vs. Reference:

This table serves as a simple field form and first-cut analysis of data to evaluate the degree to which a segment has departed from equilibrium condition. Some of the “expected” values could come from (or be inferred from) Phase 1 SGA when available and would be useful to populate prior to fieldwork. The adjustment process column would allow you to designate an adjustment process that would explain any differences between existing and reference conditions and help inform the overall evaluation of channel condition.

Existing vs. Reference Conditions			
Parameter	Existing	Reference	Adjustment Process
Confinement			
Bankfull width			
W/D ratio			
Entrenchment			
Stream type			
Incision			
Bed form			
Dominant substrate size			
Evaluation of Current Condition			

Geomorphic Condition	
CEM Stage/Model	
Sensitivity	
Process Narrative	

<u>Secondary Parameters:</u> Depending on the primary purpose of the assessment and the nature of the segment, the secondary parameters listed below may also be useful to collect, especially if the assessment is the basis for developing conceptual designs for a restoration project.

Phase 2 Stream Geomorphic Assessment (SGA) Protocols. https://dec.vermont.gov/watershed/rivers/river-corridor-and-floodplain-protection/geomorphic-assessment Refer to the full Phase 2 SGA protocols for additional details and/or background information about theses parameters measured.

While walking the reach recording observations of:

Notes on Notable Features		
Depositional features,		
Steep Riffles/ Head-cuts		
Grade controls		
Constrictions		
Erosion,	Left	
	Right	
mass failures		
gullies,		
Habitat features (such as Debris Jams		

Cross-Section Worksheet

Stream Name:________________________________
Reach-Segment: ____________
Location: ________________________________
Date:______________
Observers: ________________________________

Cross-Section Notes Codes

LTER = Left Terrace	RTER = Right Terrace	TW = Thalweg
LFPA = Left Flood Plane	RFPA = Right Flood Plane	LPIN = Left Pin
LTOB = Left Top of Bank	RTOB = Right Top of Bank	RPIN = Right Pin
LBF = Left Bankfull Stage	RBF = Right Bankfull Stage	
LEW = Left Edge of Water	REW = Right Edge of Water	
RAF = Recently Abandoned Floodplain		

Cross-sections - Number and Location Description: (bkf height = _________)

Note	Distance	Depth	Note	Distance	Depth	Note	Distance	Depth
______	______	______	______	______	______	______	______	______
______	______	______	______	______	______	______	______	______
______	______	______	______	______	______	______	______	______
______	______	______	______	______	______	______	______	______
______	______	______	______	______	______	______	______	______
______	______	______	______	______	______	______	______	______
______	______	______	______	______	______	______	______	______
______	______	______	______	______	______	______	______	______
______	______	______	______	______	______	______	______	______
______	______	______	______	______	______	______	______	______
______	______	______	______	______	______	______	______	______
______	______	______	______	______	______	______	______	______
______	______	______	______	______	______	______	______	______
______	______	______	______	______	______	______	______	______
______	______	______	______	______	______	______	______	______
______	______	______	______	______	______	______	______	______
______	______	______	______	______	______	______	______	______

Bankfull Width	__________	Bankfull Width	__________	Bankfull Width	__________
Max. Depth	__________	Max. Depth	__________	Max. Depth	__________
Mean Depth	__________	Mean Depth	__________	Mean Depth	__________
Floodprone Width	__________	Floodprone Width	__________	Floodprone Width	__________
Low Bank Height	__________	Low Bank Height	__________	Low Bank Height	__________
Width/depth Ratio	__________	Width/depth Ratio	__________	Width/depth Ratio	__________
Entrenchment	__________	Entrenchment	__________	Entrenchment	__________
Incision Ratio	__________	Incision Ratio	__________	Incision Ratio	
IRhef	__________	IRhef	__________	IRhef	__________
Wetted Width	__________	Wetted Width	__________	Wetted Width	__________
Ratio (W_{wetted} / W_{bkf}):__________		Ratio (W_{wetted} / W_{bkf}):__________		Ratio (W_{wetted} / W_{bkf}):__________	
*Channel Enlargement	__________	* Channel Enlargement	__________	* Channel Enlargement	__________
XS Changed by Flooding	Yes/No	XS Changed by Flooding	Yes/No	XS Changed by Flooding	Yes/No
Altered by Flood Work	Yes/No	Altered by Flood Work	Yes/No	Altered by Flood Work	Yes/No

Drawing of Typical Cross-Section   * channel enlargement measure (***E*= A_{tob}/A_{curve} X 100)**

Bed Substrate Composition

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	