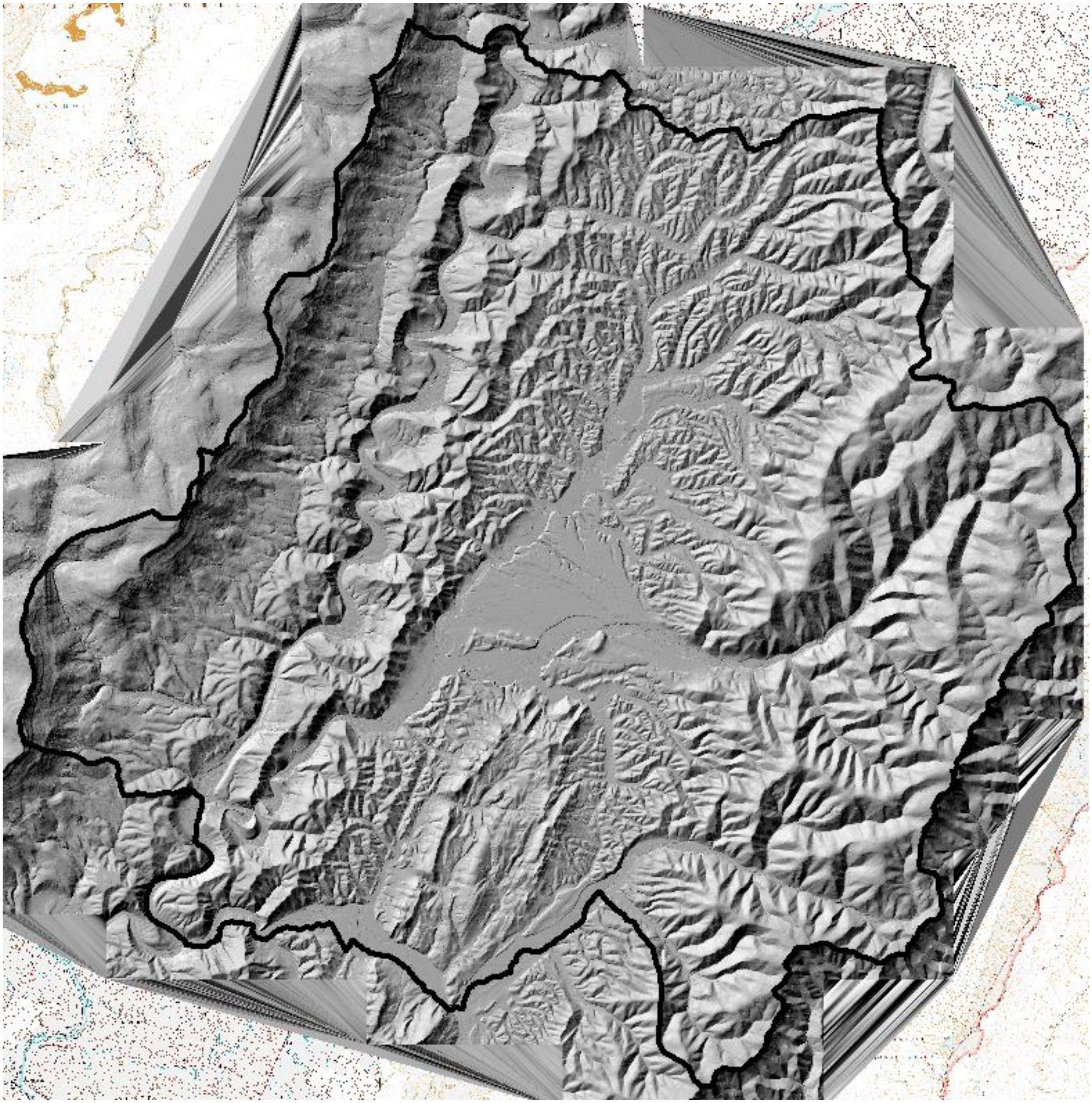
Rapid Aquatic Habitat Assessment Protocol
Deer Creek Project Area



Monongahela National Forest, WV

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Pre-survey Assessment

Stream Reaches: Stream reaches will be coarsely identified using GIS or maps to document expected slope breaks, tributary nodes, and other morphological features or land use that would be expected to influence stream habitat at a coarse level across a stream reach (e.g., private lands, extensive beaver activity, road networks, geologic boundaries, logging etc.). Note: the presence of these features or activities does not require a stream reach break but should be considered with respect to the influence on stream habitat across the reach.

Access: Stream accessibility will be assessed using **road and ownership layers** to determine the best areas to begin and end daily surveys and prevent trespass on private property. If needed, landowners will be contacted to obtain permission to access rivers though their lands.

Daily Coverage Areas: The total area to be surveyed will be broken down into areas that can be reasonably surveyed in one day. Consider areas where stream and other assessments could be accomplished in tandem.

Priority and Strategy: There are over 300 miles of stream in the project area, approximately, half on National Forest managed lands and half on private property. To facilitate efficiency in the data collected, the following is the order of priority for streams in the project area:

- 1st to 3rd order streams on National Forest within large contiguous blocks of NF lands (e.g., upper North Fork Deer Creek and tributaries, Galford/Stony Run)
- 1st to 3rd order streams on National Forest in smaller blocks of NF lands (e.g., Spillman Run, Roaring Spring Run).
- Stream segments on private lands where permission has been obtained, especially areas of restoration interest by partners
- >3rd order streams, including Greenbrier River main stem and Deer Creek mainstem. If time and funding allow, assessments may be conducted on these streams; however, such assessments will not follow this protocol.

Streams should generally be assessed when streamflow is between baseflow and moderate flow stages. If streamflow is high enough to obscure large wood within the stream, homogenize habitat features, or turbidity makes observations difficult, the assessment should not occur until flows subside.

Field Survey

Data Collection

Hard copy data sheets will be used to tally habitat observations. A data dictionary in a GPS unit may be used to assist with streamlining data collection and processing into subsequent GIS outputs. If a data dictionary is not available, hard copy data will be precisely paired with stream reach codes in order to facilitate accurate data summation. If more than one data sheet is required for a single stream reach, record the number in the data sheet header (e.g., 1 of 2, 2 of 2).

Reach Identification

Stream Reaches:

Reaches will be identified in the field using GPS and maps as a guide with observed field conditions refining the identification of reach breaks. Start reaches and reach coding at downstream working, upstream. Reaches will be started/ended at natural break points in the stream where obvious and sustained changes are apparent in slope, habitat type, stream size due to confluences, stream channel type (e.g., Rosgen classification), etc. Other factors that may influence stream reach breaks include morphological features or land use that would be expected to influence stream habitat at a coarse level across a stream reach (e.g., private lands, extensive beaver activity, road networks, geologic boundaries, logging etc.). Note: the presence of these features or activities does not require a stream reach break but should be considered with respect to the influence on stream habitat across the reach. Reaches should generally not be less than 200 m nor greater than 1000 m. When terminating at a confluence, the reach break is made upstream of the confluence in the main channel. Upstream reaches should be terminated where indicators of perennial conditions end (e.g., lack of fish presence, macroinvertebrate community changes, consistent hydraulic scour indicators, etc.). Upstream terminations will contain some subjectivity, so err on including some intermittent reaches rather than terminating too soon. The designation of perennial and intermittent stream reaches can be aided by NHD GIS attribute data.

Reach Codes: Use the following coding convention to name stream reaches for this survey.

Reaches in **named streams** = Stream name + R#, where R# is the sequential stream reach number starting with 1 for the reach that was surveyed furthest downstream (*i.e.* at or closest to the stream's confluence).

> Example: HuntersR1 = the first (most downstream) delineated reach that was surveyed on the main stem of Hunters Run

Reaches in **unnamed streams/tributaries** = Stream name + T# + R#, where T# is the sequential number for unnamed tributaries starting with 1 for the tributary identified furthest downstream, and R# is the sequential reach number of that tributary starting with 1 for the reach that was surveyed furthest downstream.

> Example: HuntersT1R1 = the first surveyed reach of the first unnamed tributary identified in Hunters Run as enumerated beginning from its confluence

> Example: HuntersT2T1R1 = the first surveyed reach of the first unnamed tributary that flows into the second unnamed tributary of Hunters Run

Figure 1. Example of reach coding solely based on stream nodes and tributaries.

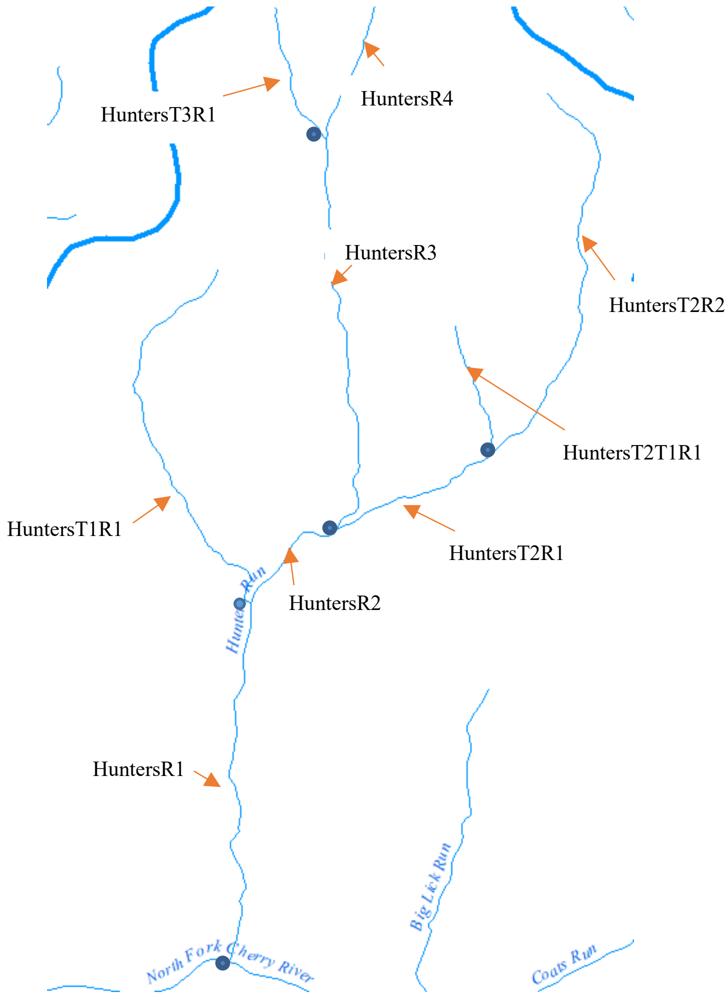
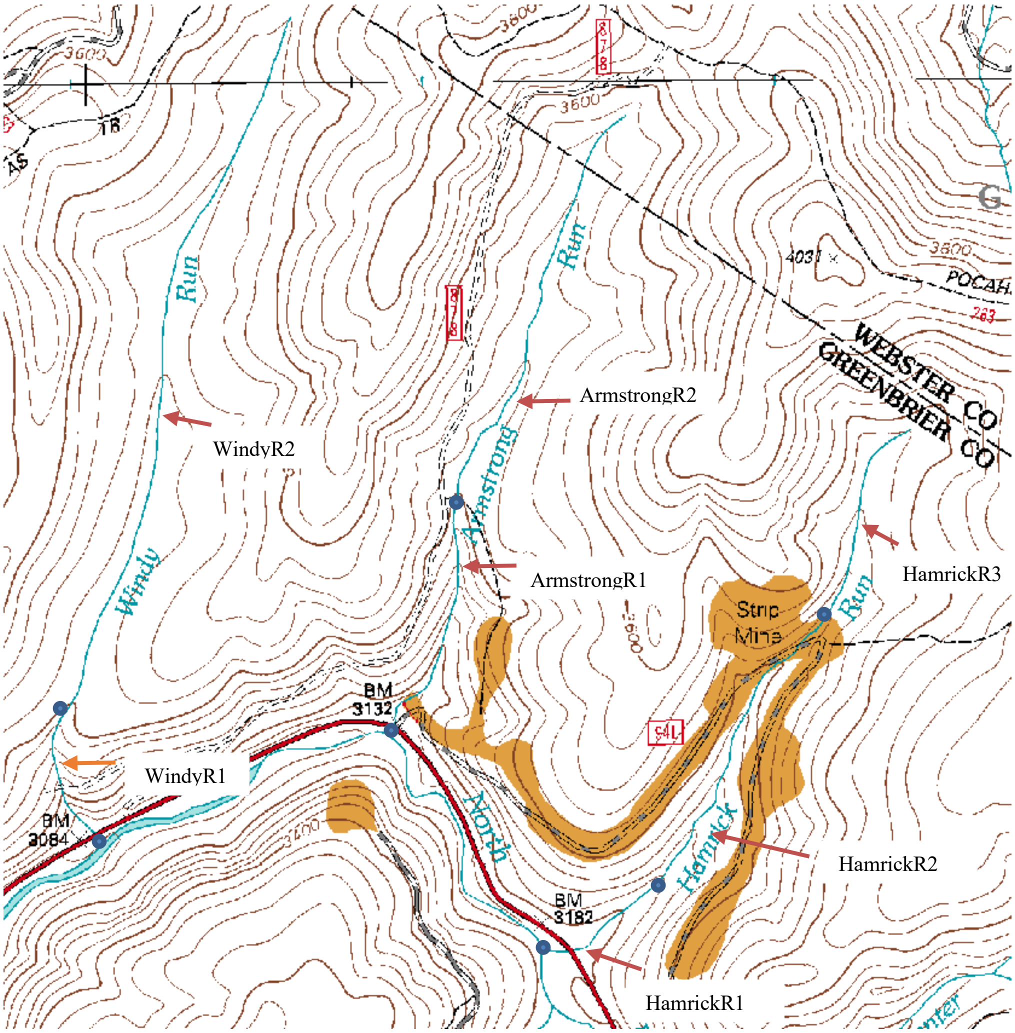


Figure 2. Examples of potential reach breaks based on morphology and land use (note slope breaks and strip mine).



Habitat Descriptions & Assessment

General Definitions:

Step/Cascade**:** A step is a **fast-shallow** bed feature common in high gradient streams. Steps are composed of large boulders and cobbles lined up across the stream that result in a near-vertical drop in the streambed. Cascades are fast-shallow features with slope ≥12%; highly turbulent series of short falls and small scour basins, with very rapid water movement; also include sheets (shallow water flowing over bedrock) and chutes (rapidly flowing water within narrow, steep slots of bedrock) if gradient ≥12%

Riffle**:** A riffle is a **fast-shallow** bed feature common in moderate gradient streams. A riffle has relatively shallow depths, coarser bed material and a steeper gradient when compared to the rest of the channel. Riffles are usually found between pools and in straight reaches.

Run: Runs are **fast-deep** bed features common in high and moderate gradient streams. Runs are often located just downstream of riffles, leading into pools in stable pool-riffle streams. They are

also found along straight sections of channel and gentle meanders. Runs may be the dominant bed feature in disturbed stream channels.
Pool: Pools are **slow-deep** bed features, generally found at the outside of meander bends in riffle-pool streams, and between steps in step-pool streams. Pools are also commonly associated with large woody material, large boulders and bedrock, and similar channel obstructions that result in scour of the channel bed. Typically pool bed material is finer than the material found in riffles.
Glide: Glides are **slow-shallow** water that form where the bed of the channel rises from the deep scour of the pool to the head of a riffle. A glide is often called a "pool tail".

Slow Water Unit definition: Slow water habitat is classified as glide or pool habitat units consisting of little or no surface turbulence present during moderate flow conditions.

Slow Water length: Measure the length of the habitat unit to the nearest 1 meter with a measuring tape, stadia rod, or field surveyor's rope from the upstream to downstream extent of the unit. All slow water habitat lengths are measured, but only residual pool depth of primary pool habitat is measured.

Fast Water Unit definition: Any habitat that does not meet slow water criteria will be considered fast water (riffles, runs, steps, cascades).

Fast Water length: Measure the total reach length (in meters) by collecting your tracks with the GPS unit whenever possible. The total length of fast water units will be determined for the purpose of this survey as: total reach length – total length of all slow water units in the reach. Use a measuring tape or surveyor's rope to measure fast water sections in between slow water units only if GPS isn't able to provide the reach length. Do not delineate individual fast water channel units for this assessment.

Water Temperature

Record water temperature at the start of each reach in a well-mixed section of the stream allowing adequate time for the thermometer to adjust. Reach breaks associated with confluences will consist of a temperature measurement in the tributary and a measurement in the main stem upstream of the confluence as part of the next reaches. The objective is to categorize the influence of tributaries on temperature dynamics.

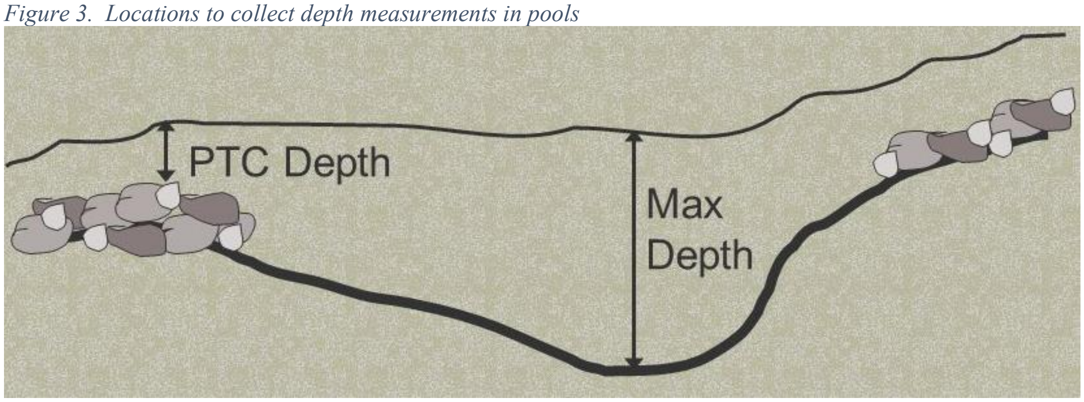
Photos

Use a waterproof camera, with geotagging set to "on" to photo document stream reaches. Set the camera aspect ratio to 16:9 to provide more ability to document stream width. Hold a marker board with the stream reach code and direction of the photo (e.g., HuntersR2, US) written on it approximately 5-10 m from the camera. Photos are taken at the start, end, and approximately every 200 m within the reach. Marker board photos are collected at the start and end points; photos within the reach do not require the marker board. At each point, photos are taken facing upstream and downstream, from within the channel or from a point adjacent to the channel that allows the most unobstructed view of the stream. A level camera is preferred because inclination complicates the perspective of the view and makes accurate duplication of repeat photographs difficult. Attempt to include stable features in the riparian or stream which would facilitate comparisons at a later date. Save the images regularly in a consistent, designated location.

Residual Pool Depth Assessment

In each slow water unit collect residual pool depth by measuring the maximum water depth to the nearest 0.01m in the slow water habitat and subtracting the thalweg depth along the pool tail crest. In dammed pooled, collect the subtracting depth at the head of the pool. In large beaver ponds, estimate depth to the best of ability. Residual pool depth should only be collected on pools that are primary habitat features.

Figure 3. Locations to collect depth measurements in pools



Large Wood Material Assessment

General Definitions:
Primary Habitat: A habitat feature that dominates the stream section and that best represents the most prevalent habitat characteristics of the unit. As a rule of thumb, the length of the long axis of a primary habitat unit should approach or exceed the approximate width of the channel.

Secondary Habitat: A habitat feature that exists as a minor component of a primary habitat unit and possesses habitat type characteristics that are distinctly different than the primary habitat type that it is associated with. As a rule of thumb, the length of the long axis of a secondary habitat unit is less than the approximate width of the channel.

Base flow: Stream flows that are solely the product of groundwater contributions during normal soil moisture conditions (*i.e.* stream discharge during periods when soil moisture is neither saturated nor droughty).
Bankfull: The high flow event that completely fills the channel and begins to spill over into the floodplain (*i.e.* stream discharge that is primarily responsible for channel forming processes). The incipient point of flooding. Discharge frequencies for these flows are 1-2 years on average.

Figure 4. Same location at baseflow (top) and bankfull (bottom)

Single LWM Minimum Requirements: Individual pieces of LWM are inventoried with a simple tally sheet according to the criteria below:

- Must be greater than or equal to 10 centimeters in diameter as visually estimated at its thickest end
- Must be greater than or equal to 1 meter in length as visually estimated
- A portion of the LWM must occur within the three-dimensional area defined by the bankfull flow or the more obvious top of the stream bank; do not take the time to debate the subtleties of the more precise criteria for bankfull elevation
- LWM may be dead or living but must be down with at least two points of contact with the ground.

Aggregate LWM Minimum Requirements: A collection of multiple pieces of LWM whose fluvial geomorphic function is overwhelmingly a reflection of the sum of all LWM pieces together rather than a reflection of the individual pieces acting as separate entities.

- The LWM aggregate as a whole is more functional than the mere sum of its individual LWM pieces
- The function of the aggregate is different than the expected function of the individual pieces in isolation

LWM Functional Classification: Large woody material that meets the criteria for being a single piece or an aggregate will be tallied according to its existing fluvial geomorphic functionality. Each tally will be recorded into a high, moderate, or low classification according to the following definitions. If there is uncertainty about the classification of LWM, the observer should focus on the underlined portion of the definitions below.

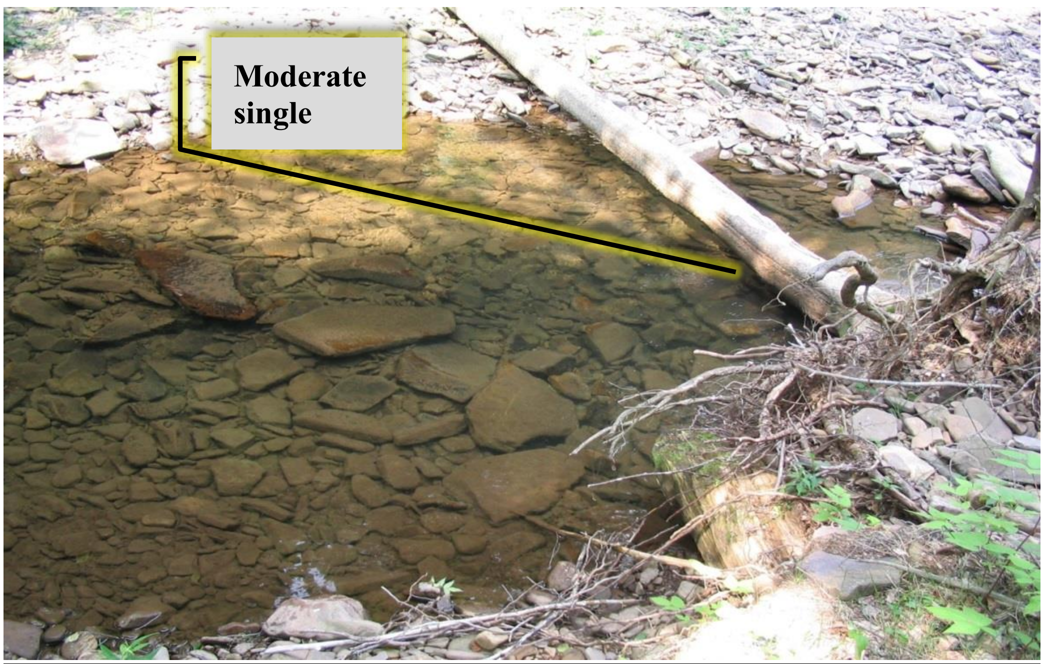
- **High:** Woody material has a pronounced influence on local hydraulic properties and has forced persistent physical channel alterations (*e.g.* flow diversion, channel constriction, bed scour, substrate deposition) that have ultimately resulted in the creation of one or more primary aquatic habitat units (*e.g.* well-developed pools, extensive sediment aggradation, etc.). Characteristics that are key to satisfying this classification include the following:
  - The woody material is the predominant formative feature for one or more primary aquatic habitat units. Removing the woody material would substantially change the dynamics of local hydraulic properties during channel forming flows (at a minimum) and result in the complete loss of the primary habitat or reduction to a secondary habitat feature.
  - The woody material appears relatively stable during direct interaction with bankfull flows.
  - The woody material is typically engaged with channel dynamics at base flow and bankfull flows.

LWM Classification Example - High

- **Moderate:** Woody material has some influence on local hydraulic properties and contributes toward physical channel alterations (*e.g.* flow diversion, channel constriction, bed scour, substrate deposition) that may ultimately enhance aquatic habitat but it does not create primary aquatic habitat units (*e.g.* well-developed pools). Characteristics that are key to this classification include the following:
    - <u>The woody material causes some alteration to the physical channel morphology (e.g. stream bed, banks, depositional features) but it is not the predominant formative feature for primary aquatic habitat units.</u>

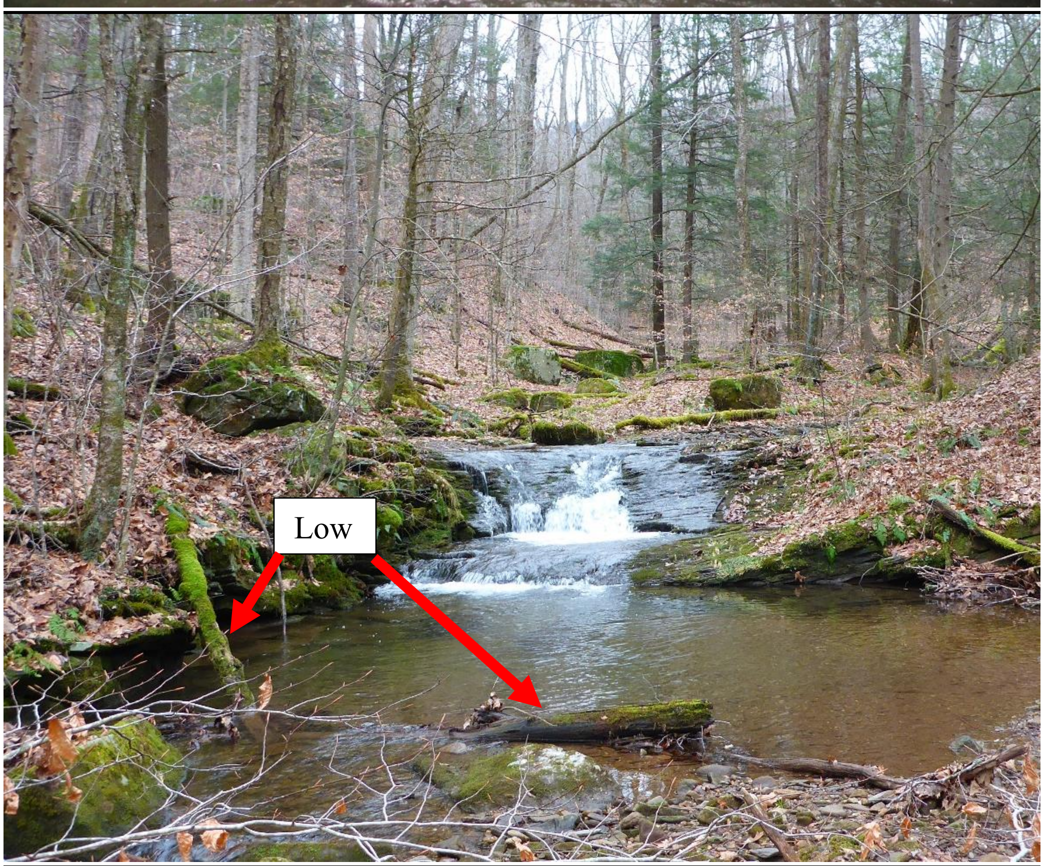
- The woody material may be the predominant formative feature for secondary aquatic habitat features and it may enhance the development of any habitat unit that would continue to persist in the absence of the wood.
- Removing the woody material would cause some change in local hydraulic properties during channel forming flows (at a minimum) and result in some alteration to the physical channel morphology (*e.g.* stream bed, banks, depositional features).
- The woody material may be engaged with channel dynamics only at base flow or bankfull conditions.

LWM Classification Example - Moderate



- **Low:** Woody material has minor influence on hydraulic properties that force physical channel alterations (*e.g.* flow diversion, channel constriction, bed scour, substrate deposition). It may function primarily as aquatic cover during certain flow levels, provide bank protection or collect organic material, or influence hydraulics only at bankfull stage without an associated aquatic habitat unit. Woody material in this category typically has one or more of the following characteristics.
  - <u>Although the woody material may be relatively stable, it offers minor resistance (*i.e.* obstruction) to hydraulic forces during channel forming flows.</u>
  - The woody material provides minor function in forming primary or secondary aquatic habitat units.
  - If the woody material is removed, there would be little to no change in local channel morphology including significant alterations to stream banks, stream bed, or depositional features.
  - The woody material meets minimum criteria for being LWM but cannot be categorized into either the high or moderate functional classifications.

LWM Classification Example - Low



Dominant Substrate

Record the **size class code** of substrate material that covers the greatest and next greatest amount of surface area in the wetted channel of the reach based on visual observation.

Code	Particle	Size (in)	Upper Limit Examples
S	sand/silt/clay	< 0.1”	Thickness of a nickel
G	gravel	0.1” – 2.5”	Racquetball
C	cobble	2.5” – 10”	Basketball
B	boulder	10” – 161”	VW beetle
BD	bedrock	> 161” (~13’)	none

Pool Formative Feature

Record the feature responsible for pool formation within the reach and coded as follows: Wood (W), boulder (B), bedrock (BD), beaver (V), meander (M), standing tree (T), confluence (C), landslide (L), culvert (Cu), artificial (A), or other (O). More than one feature may be responsible for pool formation. Record the dominant feature first and the secondary feature(s) subsequently.

Figure 5. Pool formed by meander and wood; coded as (MW)

Notes

Note any added influences on stream health within the reach such as beaver activity, open riparian, extensive ATV use, excessive bank instability, etc. Any notable condition not being quantified as part of this assessment that is outside the typical conditions of the stream should be noted.

Reach Name: TackerR2 **6th Level HUC:** 050500030106 **6th HUC Name:** __Outlet Deer Creek
Survey Date(s): ____5/30/2021_ ____ **Crew:** ____M. Jagger K. Richards **H20 Temp**____11 C__
Dominant Substrate _______C/S_____ **Data Sheet for Reach**: _1_ of _2_

Unit Type (S or F)		Individual Wood Tally			Aggregate Wood Tally			Pool Features	
	Length (m)	High	Moderate	Low	High	Moderate	Low	PFF	RPD
S	3	1		2				W	0.55
F				3					
F				2					
S	2			3		1		B	0.28
F			1	4					
F									
S	3		1	5				M/W	0.72
F				4					
F				2					
S	7		1	3				Note: no PFF or RPD for this slow water unit (glide)	
F	Rely on GPS for total length to derive F water length								
S	1	1						W	.50
S	1							w	.32

Pool Formative Features (PFF): Wood (W), boulder (B), bedrock (BD), beaver (V), meander (M), standing tree (T), confluence (C), landslide (L), culvert (Cu), artificial (A), or other (O). Dominant Substrate: Sand/silt/clay (S), gravel (G), cobble (C), boulder (B), bedrock (BD)

General Equipment

Job Hazard Analysis		Lunch
Backpack	First Aid Kit	Drinking Water
Rain Gear	FS Portable Radio, Batteries	Toilet Paper
Field Vest	SPOT Unit	
Insect Repellant (optional)	Wading Boots/Waders	

Stream Survey Equipment

Clip Board	GPS Unit
Topographic maps	Waterproof Camera (fully charged)
Aerial Photos (optional)	Stadia Rod/Measuring Rod
Survey Manual/Field Guide	Flagging
Waterproof Data Forms (extras)	Pencils/Markers
Field Notebook	Extra Batteries (for All Electronic Equipment)
Marker Board & Pen	Thermometers
Stream Tape	Solar-powered Calculator