

Baseline Assessment – Stream Attributes

Reach S-L11 (Pipeline ROW) Intermittent Spread E Greenbrier County, West Virginia

Data	Included
Photos	✓
SWVM Form	✓
FCI Calculator and HGM Form	✓
RBP Physical Characteristics Form	✓
Water Quality Data	✓
RBP Habitat Form	✓
RBP Benthic Form	✓
Benthic Identification Sheet	N/A – Low flow, insufficient riffle habitat
Wolman Pebble Count	✓
Reference Reach Software Pebble Count Data	✓
Longitudinal Profile and Cross Sections	✓

Spread E Stream S-L11 (Pipeline ROW) Greenbrier County



Photo Type: DS, US View
Location, Orientation, Photographer Initials: Downstream Edge of ROW, Upstream View, MD
Lat: 37.938229 Long: -80.746912

Spread E Stream S-L11 (Pipeline ROW) Greenbrier County



Photo Type: DS, DS View

Location, Orientation, Photographer Initials: Downstream Edge of ROW, Downstream View, MD

Lat: 37.938229 Long: -80.746912

Spread E Stream S-L11 (Pipeline ROW) Greenbrier County



Photo Type: US View at Center
Location, Orientation, Photographer Initials: Center ROW, Upstream View, MD
Lat: 37.938229 Long: -80.746912

Spread E Stream S-L11 (Pipeline ROW) Greenbrier County



Photo Type: DS View at Center
Location, Orientation, Photographer Initials: ROW Center, Downstream View, MD
Lat: 37.938229 Long: -80.746912

Spread E Stream S-L11 (Pipeline ROW) Greenbrier County



Photo Type: US, US View

Location, Orientation, Photographer Initials: Upstream Edge of ROW, Upstream View, MD
Lat: 37.938229 Long: -80.746912

Spread E Stream S-L11 (Pipeline ROW) Greenbrier County



Photo Type: US, DS View

Location, Orientation, Photographer Initials: Upstream Edge of ROW, Downstream View, MD
Lat: 37.938229 Long: -80.746912

Spread E Stream S-L11 (Pipeline ROW) Greenbrier County



Photo Type: Pool, DS View
Location, Orientation, Photographer Initials: Upstream of Pool, Downstream View, RH/VM
Lat: 37.938229 Long: -80.746912



Photo Type: Pool, US View
Location, Orientation, Photographer Initials: Downstream of Pool, Upstream View, RH/VM
Lat: 37.938229 Long: -80.746912

USACE FILE NO./ Project Name: <small>(v2.1, Sept 2016)</small>	Mountain Valley Pipeline	IMPACT COORDINATES: (in Decimal Degrees)	Lat.	37.983229	Lon.	-80.746912	WEATHER:	Sunny	DATE:	9/10/2021
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IMPACT STREAM/SITE ID AND SITE DESCRIPTION: <small>(watershed size (acreage), unaltered or impairments)</small>	S-L11	MITIGATION STREAM CLASS./SITE ID AND SITE DESCRIPTION: <small>(watershed size (acreage), unaltered or impairments)</small>	Comments:							
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STREAM IMPACT LENGTH:	26	FORM OF MITIGATION:	RESTORATION (Levels I-III)	MIT COORDINATES: (in Decimal Degrees)	Lat.		Lon.		PRECIPITATION PAST 48 HRS:		Mitigation Length:
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Column No. 1- Impact Existing Condition (Debit)	Column No. 2- Mitigation Existing Condition - Baseline (Credit)	Column No. 3- Mitigation Projected at Five Years Post Completion (Credit)	Column No. 4- Mitigation Projected at Ten Years Post Completion (Credit)	Column No. 5- Mitigation Projected at Maturity (Credit)
Stream Classification: Intermittent	Stream Classification:	Stream Classification: 0	Stream Classification: 0	Stream Classification: 0
Percent Stream Channel Slope: 16.4	Percent Stream Channel Slope:	Percent Stream Channel Slope: 0	Percent Stream Channel Slope: 0	Percent Stream Channel Slope: 0
HGM Score (attach data forms):	HGM Score (attach data forms):	HGM Score (attach data forms):	HGM Score (attach data forms):	HGM Score (attach data forms):
Hydrology: 0.18 Biogeochemical Cycling: 0.15 Habitat: 0.68 Average: 0.13666667	Hydrology: 0 Biogeochemical Cycling: 0 Habitat: 0 Average: 0	Hydrology: 0 Biogeochemical Cycling: 0 Habitat: 0 Average: 0	Hydrology: 0 Biogeochemical Cycling: 0 Habitat: 0 Average: 0	Hydrology: 0 Biogeochemical Cycling: 0 Habitat: 0 Average: 0
PART I - Physical, Chemical and Biological Indicators	PART I - Physical, Chemical and Biological Indicators	PART I - Physical, Chemical and Biological Indicators	PART I - Physical, Chemical and Biological Indicators	PART I - Physical, Chemical and Biological Indicators
PHYSICAL INDICATOR (Applies to all streams classifications)	PHYSICAL INDICATOR (Applies to all streams classifications)	PHYSICAL INDICATOR (Applies to all streams classifications)	PHYSICAL INDICATOR (Applies to all streams classifications)	PHYSICAL INDICATOR (Applies to all streams classifications)
USEPA RBP (High Gradient Data Sheet)	USEPA RBP (Low Gradient Data Sheet)	USEPA RBP (High Gradient Data Sheet)	USEPA RBP (High Gradient Data Sheet)	USEPA RBP (High Gradient Data Sheet)
1. Epifaunal Substrate/Available Cover: 0.20, 15 2. Embeddedness: 0.20, 3 3. Velocity/Depth Regime: 0.20, 2 4. Sediment Deposition: 0.20, 12 5. Channel Flow Status: 0.20, 7 6. Channel Alteration: 0.20, 18 7. Frequency of Rifles (or bends): 0.20, 0 8. Bank Stability (LB & RB): 0.20, 14 9. Vegetative Protection (LB & RB): 0.20, 18 10. Riparian Vegetative Zone Width (LB & RB): 0.20, 4 Total RBP Score: Marginal, 93 Sub-Total: 0.465	1. Epifaunal Substrate/Available Cover: 0.20, 0 2. Pool Substrate Characterization: 0.20, 0 3. Pool Variability: 0.20, 0 4. Sediment Deposition: 0.20, 0 5. Channel Flow Status: 0.20, 0-1 6. Channel Alteration: 0.20, 0-1 7. Channel Sinuosity: 0.20, 0 8. Bank Stability (LB & RB): 0.20, 0 9. Vegetative Protection (LB & RB): 0.20, 0 10. Riparian Vegetative Zone Width (LB & RB): 0.20, 0 Total RBP Score: Poor, 0 Sub-Total: 0	1. Epifaunal Substrate/Available Cover: 0.20, 0 2. Embeddedness: 0.20, 0 3. Velocity/Depth Regime: 0.20, 0 4. Sediment Deposition: 0.20, 0 5. Channel Flow Status: 0.20, 0-1 6. Channel Alteration: 0.20, 0-1 7. Frequency of Rifles (or bends): 0.20, 0 8. Bank Stability (LB & RB): 0.20, 0 9. Vegetative Protection (LB & RB): 0.20, 0 10. Riparian Vegetative Zone Width (LB & RB): 0.20, 0 Total RBP Score: Poor, 0 Sub-Total: 0	1. Epifaunal Substrate/Available Cover: 0.20, 0 2. Embeddedness: 0.20, 0 3. Velocity/Depth Regime: 0.20, 0 4. Sediment Deposition: 0.20, 0 5. Channel Flow Status: 0.20, 0-1 6. Channel Alteration: 0.20, 0-1 7. Frequency of Rifles (or bends): 0.20, 0 8. Bank Stability (LB & RB): 0.20, 0 9. Vegetative Protection (LB & RB): 0.20, 0 10. Riparian Vegetative Zone Width (LB & RB): 0.20, 0 Total RBP Score: Poor, 0 Sub-Total: 0	1. Epifaunal Substrate/Available Cover: 0.20, 0 2. Embeddedness: 0.20, 0 3. Velocity/Depth Regime: 0.20, 0 4. Sediment Deposition: 0.20, 0 5. Channel Flow Status: 0.20, 0-1 6. Channel Alteration: 0.20, 0-1 7. Frequency of Rifles (or bends): 0.20, 0 8. Bank Stability (LB & RB): 0.20, 0 9. Vegetative Protection (LB & RB): 0.20, 0 10. Riparian Vegetative Zone Width (LB & RB): 0.20, 0 Total RBP Score: Poor, 0 Sub-Total: 0
CHEMICAL INDICATOR (Applies to Intermittent and Perennial Streams)	CHEMICAL INDICATOR (Applies to Intermittent and Perennial Streams)	CHEMICAL INDICATOR (Applies to Intermittent and Perennial Streams)	CHEMICAL INDICATOR (Applies to Intermittent and Perennial Streams)	CHEMICAL INDICATOR (Applies to Intermittent and Perennial Streams)
WVDEP Water Quality Indicators (General)	WVDEP Water Quality Indicators (General)	WVDEP Water Quality Indicators (General)	WVDEP Water Quality Indicators (General)	WVDEP Water Quality Indicators (General)
Specific Conductivity: <99 = 90 points, 39	Specific Conductivity: 0-90, 0	Specific Conductivity: 0-90, 0	Specific Conductivity: 0-90, 0	Specific Conductivity: 0-90, 0
pH: 6.0-8.0 = 80 points, 6.81	pH: 5-90, 0-1, 0	pH: 5-90, 0-1, 0	pH: 5-90, 0-1, 0	pH: 5-90, 0-1, 0
DO: >5.0 = 30 points, 6.39	DO: 10-30, 0	DO: 10-30, 0	DO: 10-30, 0	DO: 10-30, 0
Sub-Total: 1	Sub-Total: 0	Sub-Total: 0	Sub-Total: 0	Sub-Total: 0
BIOLOGICAL INDICATOR (Applies to Intermittent and Perennial Streams)	BIOLOGICAL INDICATOR (Applies to Intermittent and Perennial Streams)	BIOLOGICAL INDICATOR (Applies to Intermittent and Perennial Streams)	BIOLOGICAL INDICATOR (Applies to Intermittent and Perennial Streams)	BIOLOGICAL INDICATOR (Applies to Intermittent and Perennial Streams)
WV Stream Condition Index (WVSCI)	WV Stream Condition Index (WVSCI)	WV Stream Condition Index (WVSCI)	WV Stream Condition Index (WVSCI)	WV Stream Condition Index (WVSCI)
Sub-Total: 0	Sub-Total: 0	Sub-Total: 0	Sub-Total: 0	Sub-Total: 0

PART II - Index and Unit Score		
Index	Linear Feet	Unit Score
0.435	26	11,299.1667

PART II - Index and Unit Score		
Index	Linear Feet	Unit Score
0	0	0

PART II - Index and Unit Score		
Index	Linear Feet	Unit Score
0	0	0

PART II - Index and Unit Score		
Index	Linear Feet	Unit Score
0	0	0

PART II - Index and Unit Score		
Index	Linear Feet	Unit Score
0	0	0

FCI Calculator for the High-Gradient Headwater Streams in Appalachia

To ensure accurate calculations, the **UPPERMOST STRATUM** of the plant community is determined based on the calculated value for $V_{CCANOPY}$ ($\geq 20\%$ cover is required for tree/sapling strata). Go to the SAR Data Entry tab and enter site characteristics and data in the yellow cells. For information on determining how to split a project into SARs, see Chapter 5 of the Operational Draft Regional Guidebook for the Functional Assessment of High-Gradient Headwater Streams and Low-Gradient Perennial Streams in Appalachia (Environmental Laboratory U.S. Army Corps of Engineers 2017).

Project Name: MVP Preliminary Assessment

Location: Greenbrier County, Spread E

Sampling Date: 9/24/21

Project Site Before Project

Subclass for this SAR:

Intermittent Stream

Uppermost stratum present at this SAR:

Shrub/Herb Strata

SAR number: S-L11

Functional Results Summary:

Enter Results in Section A of the Mitigation Sufficiency Calculator

Function	Functional Capacity Index
Hydrology	0.18
Biogeochemical Cycling	0.15
Habitat	0.08

Variable Measure and Subindex Summary:

Variable	Name	Average Measure	Subindex
$V_{CCANOPY}$	Percent canopy over channel.	Not Used, <20%	Not Used
V_{EMBED}	Average embeddedness of channel.	1.00	0.10
$V_{SUBSTRATE}$	Median stream channel substrate particle size.	0.08	0.04
V_{BERO}	Total percent of eroded stream channel bank.	0.00	1.00
V_{LWD}	Number of down woody stems per 100 feet of stream.	0.00	0.00
V_{TDBH}	Average dbh of trees.	Not Used	Not Used
V_{SNAG}	Number of snags per 100 feet of stream.	6.71	0.63
V_{SSD}	Number of saplings and shrubs per 100 feet of stream.	503.36	1.00
V_{SRICH}	Riparian vegetation species richness.	0.00	0.00
$V_{DETRITUS}$	Average percent cover of leaves, sticks, etc.	16.25	0.20
V_{HERB}	Average percent cover of herbaceous vegetation.	72.50	0.97
V_{WLUSE}	Weighted Average of Runoff Score for Catchment.	0.32	0.34

High-Gradient Headwater Streams in Appalachia Field Data Sheet and Calculator

Team: **RH, VM** Latitude/UTM Northing: **37.938229**
 Project Name: **MVP Preliminary Assessment** Longitude/UTM Easting: **-80.746912**
 Location: **Greenbrier County, Spread E** Sampling Date: **9/24/21**
 SAR Number: **S-L11** Reach Length (ft): **14.9** Stream Type: **Intermittent Stream**
 Top Strata: **Shrub/Herb Strata** (determined from percent calculated in V_{CANOPY})
 Site and Timing: **Project Site** Before Project

Sample Variables 1-4 in stream channel

1 V_{CANOPY} Average percent cover over channel by tree and sapling canopy. Measure at no fewer than 10 roughly equidistant points along the stream. Measure only if tree/sapling cover is at least 20%. (If less than 20%, enter at least one value between 0 and 19 to trigger Top Strata choice.) Not Used, <20%
 List the percent cover measurements at each point below:

0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---

2 V_{EMBED} Average embeddedness of the stream channel. Measure at no fewer than 30 roughly equidistant points along the stream. Select a particle from the bed. Before moving it, determine the percentage of the surface and area surrounding the particle that is covered by fine sediment, and enter the rating according to the following table. If the bed is an artificial surface, or composed of fine sediments, use a rating score of 1. If the bed is composed of bedrock, use a rating score of 5. 1.0
 Embeddedness rating for gravel, cobble and boulder particles (rescaled from Platts, Megahan, and Minshall 1983)

Rating	Rating Description
5	<5 percent of surface covered, surrounded, or buried by fine sediment (or bedrock)
4	5 to 25 percent of surface covered, surrounded, or buried by fine sediment
3	26 to 50 percent of surface covered, surrounded, or buried by fine sediment
2	51 to 75 percent of surface covered, surrounded, or buried by fine sediment
1	>75 percent of surface covered, surrounded, or buried by fine sediment (or artificial surface)

 List the ratings at each point below:

1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1

3 $V_{SUBSTRATE}$ Median stream channel substrate particle size. Measure at no fewer than 30 roughly equidistant points along the stream; use the same points and particles as used in V_{EMBED} . 0.08 in
 Enter particle size in inches to the nearest 0.1 inch at each point below (bedrock should be counted as 99 in, asphalt or concrete as 0.0 in, sand or finer particles as 0.08 in):

0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.08	0.08	0.08
0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08

4 V_{BERO} Total percent of eroded stream channel bank. Enter the total number of feet of eroded bank on each side and the total percentage will be calculated. If both banks are eroded, total erosion for the stream may be up to 200%. 0 %
 Left Bank: **0 ft** Right Bank: **0 ft**

Sample Variables 5-9 within the entire riparian/buffer zone adjacent to the stream channel (25 feet from each bank).

5 V_{LWD} Number of down woody stems (at least 4 inches in diameter and 36 inches in length) per 100 feet of stream reach. Enter the number from the entire 50'-wide buffer and within the channel, and the amount per 100 feet of stream will be calculated. 0.0
 Number of downed woody stems: **0**

6 V_{TDBH} Average dbh of trees (measure only if V_{CANOPY} tree/sapling cover is at least 20%). Trees are at least 4 inches (10 cm) in diameter. Enter tree DBHs in inches. Not Used
 List the dbh measurements of individual trees (at least 4 in) within the buffer on each side of the stream below:

Left Side				Right Side			
0				0			

7 V_{SNAG} Number of snags (at least 4" dbh and 36" tall) per 100 feet of stream. Enter number of snags on each side of the stream, and the amount per 100 feet will be calculated. 6.7
 Left Side: **1** Right Side: **0**

8 V_{SSD} Number of saplings and shrubs (woody stems up to 4 inches dbh) per 100 feet of stream (measure only if tree cover is <20%). Enter number of saplings and shrubs on each side of the stream, and the amount per 100 ft of stream will be calculated. 503.4
 Left Side: **65** Right Side: **10**

9	V _{SRICH}	Riparian vegetation species richness per 100 feet of stream reach. Check all species present from Group 1 in the tallest stratum. Check all exotic and invasive species present in all strata. Species richness per 100 feet and the subindex will be calculated from these data.	0.00
Group 1 = 1.0		Group 2 (-1.0)	
<input type="checkbox"/>	<i>Acer rubrum</i>	<input type="checkbox"/>	<i>Magnolia tripetala</i>
<input type="checkbox"/>	<i>Acer saccharum</i>	<input type="checkbox"/>	<i>Nyssa sylvatica</i>
<input type="checkbox"/>	<i>Aesculus flava</i>	<input type="checkbox"/>	<i>Oxydendrum arboreum</i>
<input type="checkbox"/>	<i>Asimina triloba</i>	<input type="checkbox"/>	<i>Prunus serotina</i>
<input type="checkbox"/>	<i>Betula alleghaniensis</i>	<input type="checkbox"/>	<i>Quercus alba</i>
<input type="checkbox"/>	<i>Betula lenta</i>	<input type="checkbox"/>	<i>Quercus coccinea</i>
<input type="checkbox"/>	<i>Carya alba</i>	<input type="checkbox"/>	<i>Quercus imbricaria</i>
<input type="checkbox"/>	<i>Carya glabra</i>	<input type="checkbox"/>	<i>Quercus prinus</i>
<input type="checkbox"/>	<i>Carya ovalis</i>	<input type="checkbox"/>	<i>Quercus rubra</i>
<input type="checkbox"/>	<i>Carya ovata</i>	<input type="checkbox"/>	<i>Quercus velutina</i>
<input type="checkbox"/>	<i>Cornus florida</i>	<input type="checkbox"/>	<i>Sassafras albidum</i>
<input type="checkbox"/>	<i>Fagus grandifolia</i>	<input type="checkbox"/>	<i>Tilia americana</i>
<input type="checkbox"/>	<i>Fraxinus americana</i>	<input type="checkbox"/>	<i>Tsuga canadensis</i>
<input type="checkbox"/>	<i>Liriodendron tulipifera</i>	<input type="checkbox"/>	<i>Ulmus americana</i>
<input type="checkbox"/>	<i>Magnolia acuminata</i>		
0 Species in Group 1		0 Species in Group 2	

Sample Variables 10-11 within at least 8 subplots (40" x 40", or 1m x 1m) in the riparian/buffer zone within 25 feet from each bank. The four subplots should be placed roughly equidistantly along each side of the stream.

10	V _{DETRITUS}	Average percent cover of leaves, sticks, or other organic material. Woody debris <4" diameter and <36" long are include. Enter the percent cover of the detrital layer at each subplot.	16.25 %																								
		<table border="1"> <tr> <th colspan="4">Left Side</th> <th colspan="4">Right Side</th> </tr> <tr> <td>5</td> <td>5</td> <td>10</td> <td>10</td> <td>30</td> <td>30</td> <td>10</td> <td>30</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>	Left Side				Right Side				5	5	10	10	30	30	10	30									
Left Side				Right Side																							
5	5	10	10	30	30	10	30																				
11	V _{HERB}	Average percentage cover of herbaceous vegetation (measure only if tree cover is <20%). Do not include woody stems at least 4" dbh and 36" tall. Because there may be several layers of ground cover vegetation percentages up through 200% are accepted. Enter the percent cover of ground vegetation at each subplot.	73 %																								
		<table border="1"> <tr> <th colspan="4">Left Side</th> <th colspan="4">Right Side</th> </tr> <tr> <td>90</td> <td>90</td> <td>90</td> <td>90</td> <td>30</td> <td>50</td> <td>80</td> <td>60</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>	Left Side				Right Side				90	90	90	90	30	50	80	60									
Left Side				Right Side																							
90	90	90	90	30	50	80	60																				

Sample Variable 12 within the entire catchment of the stream.

12	V _{WLUSE}	Weighted Average of Runoff Score for watershed:	0.32																																				
		<table border="1"> <thead> <tr> <th>Land Use (Choose From Drop List)</th> <th>Runoff Score</th> <th>% in Catchment</th> <th>Running Percent (not >100)</th> </tr> </thead> <tbody> <tr> <td>Forest and native range (<50% ground cover)</td> <td>0.5</td> <td>54.76</td> <td>54.76</td> </tr> <tr> <td>Residential districts, 2 acres (12% cover)</td> <td>0.3</td> <td>3.57</td> <td>58.33</td> </tr> <tr> <td>Open space (pasture, lawns, parks, etc.), grass cover <50%</td> <td>0.1</td> <td>39.29</td> <td>97.62</td> </tr> <tr> <td>Newly graded areas (bare soil, no vegetation or pavement)</td> <td>0</td> <td>2.38</td> <td>100</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Land Use (Choose From Drop List)	Runoff Score	% in Catchment	Running Percent (not >100)	Forest and native range (<50% ground cover)	0.5	54.76	54.76	Residential districts, 2 acres (12% cover)	0.3	3.57	58.33	Open space (pasture, lawns, parks, etc.), grass cover <50%	0.1	39.29	97.62	Newly graded areas (bare soil, no vegetation or pavement)	0	2.38	100																	
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S-L11			Notes:
Variable	Value	VSI	
V _{CCANOPY}	Not Used, <20%	Not Used	
V _{EMBED}	1.0	0.10	
V _{SUBSTRATE}	0.08 in	0.04	
V _{BERO}	0 %	1.00	
V _{LWD}	0.0	0.00	
V _{TDBH}	Not Used	Not Used	
V _{SNAG}	6.7	0.63	
V _{SSD}	503.4	1.00	
V _{SRICH}	0.00	0.00	
V _{DETRITUS}	16.3 %	0.20	
V _{HERB}	73 %	0.97	
V _{WLUSE}	0.32	0.34	

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME _____	LOCATION _____	
STATION # _____ RIVERMILE _____	STREAM CLASS _____	
LAT _____ LONG _____	RIVER BASIN _____	
STORET # _____	AGENCY _____	
INVESTIGATORS _____		
FORM COMPLETED BY _____	DATE _____ TIME _____	REASON FOR SURVEY _____

WEATHER CONDITIONS	<p>Now</p> <p>storm (heavy rain) _____ rain (steady rain) _____ showers (intermittent) _____ %cloud cover _____ clear/sunny _____</p>	<p>Past 24 hours</p> <p>_____ %</p>	<p>Has there been a heavy rain in the last 7 days? Yes No</p> <p>Air Temperature _____ °C</p> <p>Other _____</p>
SITE LOCATION/MAP	<p>Draw a map of the site and indicate the areas sampled (or attach a photograph)</p> <div style="text-align: center;"> </div>		
STREAM CHARACTERIZATION	<p>Stream Subsystem Perennial Intermittent Tidal</p> <p>Stream Origin Glacial _____ Non-glacial montane _____ Swamp and bog _____</p> <p>Stream Type Coldwater _____ Warmwater _____</p> <p>Catchment Area _____ km²</p> <p style="text-align: center;">S-L 11</p>		

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES	Predominant Surrounding Landuse Forest _____ Field/Pasture _____ Agricultural _____ Residential _____ Commercial _____ Industrial _____ Other _____	Local Watershed NPS Pollution No evidence <input type="checkbox"/> Some potential sources Obvious sources _____ Local Watershed Erosion None _____ Moderate _____ Heavy _____
RIPARIAN VEGETATION (18 meter buffer)	Indicate the dominant type and record the dominant species present Trees _____ Shrubs _____ Grasses _____ Herbaceous _____ Dominant species present _____	
INSTREAM FEATURES	Estimated Reach Length _____ m Estimated Stream Width _____ m Sampling Reach Area _____ m ² Area in km ² (m ² x1000) _____ km ² Estimated Stream Depth _____ m Surface Velocity _____ m/sec (at thalweg)	Canopy Cover Partly open _____ Partly shaded _____ Shaded _____ High Water Mark _____ m Proportion of Reach Represented by Stream Morphology Types Riffle _____ % Run _____ % Pool _____ % Channelized Yes _____ No _____ Dam Present Yes _____ No _____
LARGE WOODY DEBRIS	LWD _____ m ² Density of LWD _____ m ² /km ² (LWD/ reach area)	
AQUATIC VEGETATION	Indicate the dominant type and record the dominant species present Rooted emergent _____ Rooted submergent _____ Rooted floating _____ Free floating _____ Floating Algae _____ Attached Algae _____ Dominant species present _____ Portion of the reach with aquatic vegetation _____ %	
WATER QUALITY (DS, US)	Temperature _____ °C Specific Conductance _____ Dissolved Oxygen _____ pH _____ Turbidity _____ WQ Instrument Used _____	Water Odors Normal/None _____ Sewage _____ Petroleum _____ Chemical _____ Fishy _____ Other _____ Water Surface Oils Slick _____ Sheen _____ Globs _____ Flecks _____ None _____ Other _____ Turbidity (if not measured) Clear <input type="checkbox"/> Slightly turbid _____ Turbid _____ Opaque _____ Stained _____ Other _____
SEDIMENT/SUBSTRATE	Odors Normal _____ Sewage _____ Petroleum _____ Chemical _____ Anaerobic _____ None _____ Other _____ Oils Absent _____ Slight _____ Moderate _____ Profuse _____ Deposits Sludge _____ Sawdust _____ Paper fiber _____ Sand _____ Relict shells _____ Other _____ Looking at stones which are not deeply embedded, are the undersides black in color? Yes _____ No _____	

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")		Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")				
Sand	0.06-2mm (gritty)		Marl	grey, shell fragments	
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

HABITAT ASSESSMENT FIELD DATA SHEET - HG - USE ON ALL STREAMS (FRONT)

STREAM NAME		LOCATION	
STATION # _____ RIVERMILE _____		STREAM CLASS	
LAT _____ LONG _____		RIVER BASIN	
STORET #		AGENCY	
INVESTIGATORS			
FORM COMPLETED BY		DATE _____ TIME _____ AM PM	REASON FOR SURVEY

	Habitat Parameter	Condition Category			
		Optimal	Suboptimal	Marginal	Poor
Parameters to be evaluated in sampling reach	1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).			
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.			
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)			
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.			
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.			
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Habitat Parameter	Condition Category																				
	Optimal					Suboptimal					Marginal					Poor					
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.					Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.					Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.					Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.					Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.					Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.					Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.					Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.					Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.					Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.					
Note: determine left or right side by facing downstream.																					
SCORE ____ (LB)	Left Bank	10	9			8	7	6			5	4	3			2	1	0			
SCORE ____ (RB)	Right Bank	10	9			8	7	6			5	4	3			2	1	0			
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.					70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.					50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.					Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.					
SCORE ____ (LB)	Left Bank	10	9			8	7	6			5	4	3			2	1	0			
SCORE ____ (RB)	Right Bank	10	9			8	7	6			5	4	3			2	1	0			
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.					Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.					Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.					Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.					
SCORE ____ (LB)	Left Bank	10	9			8	7	6			5	4	3			2	1	0			
SCORE ____ (RB)	Right Bank	10	9			8	7	6			5	4	3			2	1	0			

Total Score _____

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME	LOCATION	
STATION # _____ RIVERMILE _____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS	LOT NUMBER	
FORM COMPLETED BY	DATE _____ TIME _____	REASON FOR SURVEY

HABITAT TYPES	Indicate the percentage of each habitat type present Cobble _____% Snags _____% Vegetated Banks _____% Sand _____% Submerged Macrophytes _____% Other (_____) _____%
SAMPLE COLLECTION	Gear used D-frame kick-net Other _____ How were the samples collected? wading from bank from boat Indicate the number of jabs/kicks taken in each habitat type. Cobble _____ Snags _____ Vegetated Banks _____ Sand _____ Submerged Macrophytes _____ Other (_____) _____
GENERAL COMMENTS	

QUALITATIVE LISTING OF AQUATIC BIOTA

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3= Abundant, 4 = Dominant

Periphyton	0	1	2	3	4	Slimes	0	1	2	3	4
Filamentous Algae	0	1	2	3	4	Macroinvertebrates	0	1	2	3	4
Macrophytes	0	1	2	3	4	Fish	0	1	2	3	4

FIELD OBSERVATIONS OF MACROBENTHOS

Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare (1-3 organisms), 2 = Common (3-9 organisms), 3= Abundant (>10 organisms), 4 = Dominant (>50 organisms)

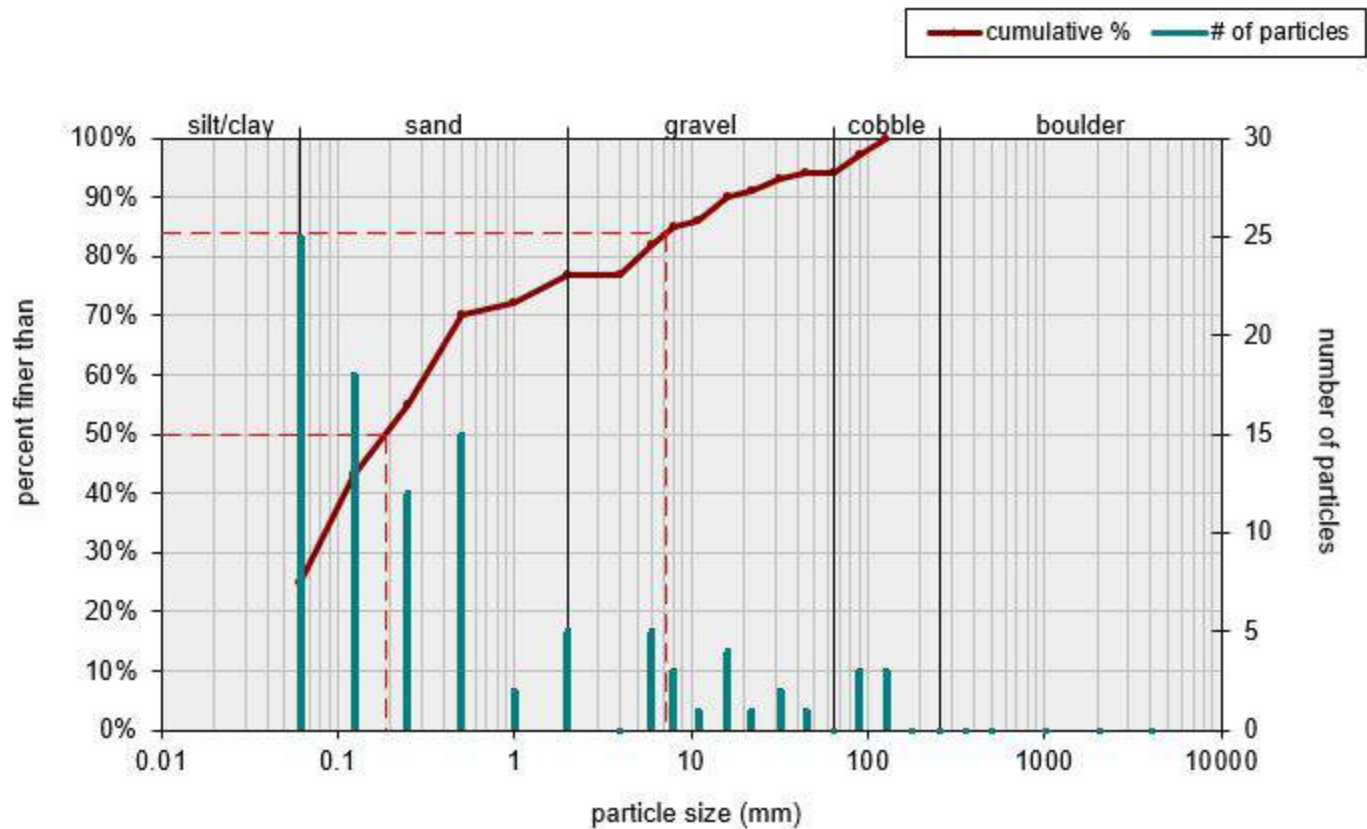
Porifera	0	1	2	3	4	Anisoptera	0	1	2	3	4	Chironomidae	0	1	2	3	4
Hydrozoa	0	1	2	3	4	Zygoptera	0	1	2	3	4	Ephemeroptera	0	1	2	3	4
Platyhelminthes	0	1	2	3	4	Hemiptera	0	1	2	3	4	Trichoptera	0	1	2	3	4
Turbellaria	0	1	2	3	4	Coleoptera	0	1	2	3	4	Other	0	1	2	3	4
Hirudinea	0	1	2	3	4	Lepidoptera	0	1	2	3	4						
Oligochaeta	0	1	2	3	4	Sialidae	0	1	2	3	4						
Isopoda	0	1	2	3	4	Corydalidae	0	1	2	3	4						
Amphipoda	0	1	2	3	4	Tipulidae	0	1	2	3	4						
Decapoda	0	1	2	3	4	Empididae	0	1	2	3	4						
Gastropoda	0	1	2	3	4	Simuliidae	0	1	2	3	4						
Bivalvia	0	1	2	3	4	Tabinidae	0	1	2	3	4						
						Culcidae	0	1	2	3	4						

WOLMAN PEBBLE COUNT FORM

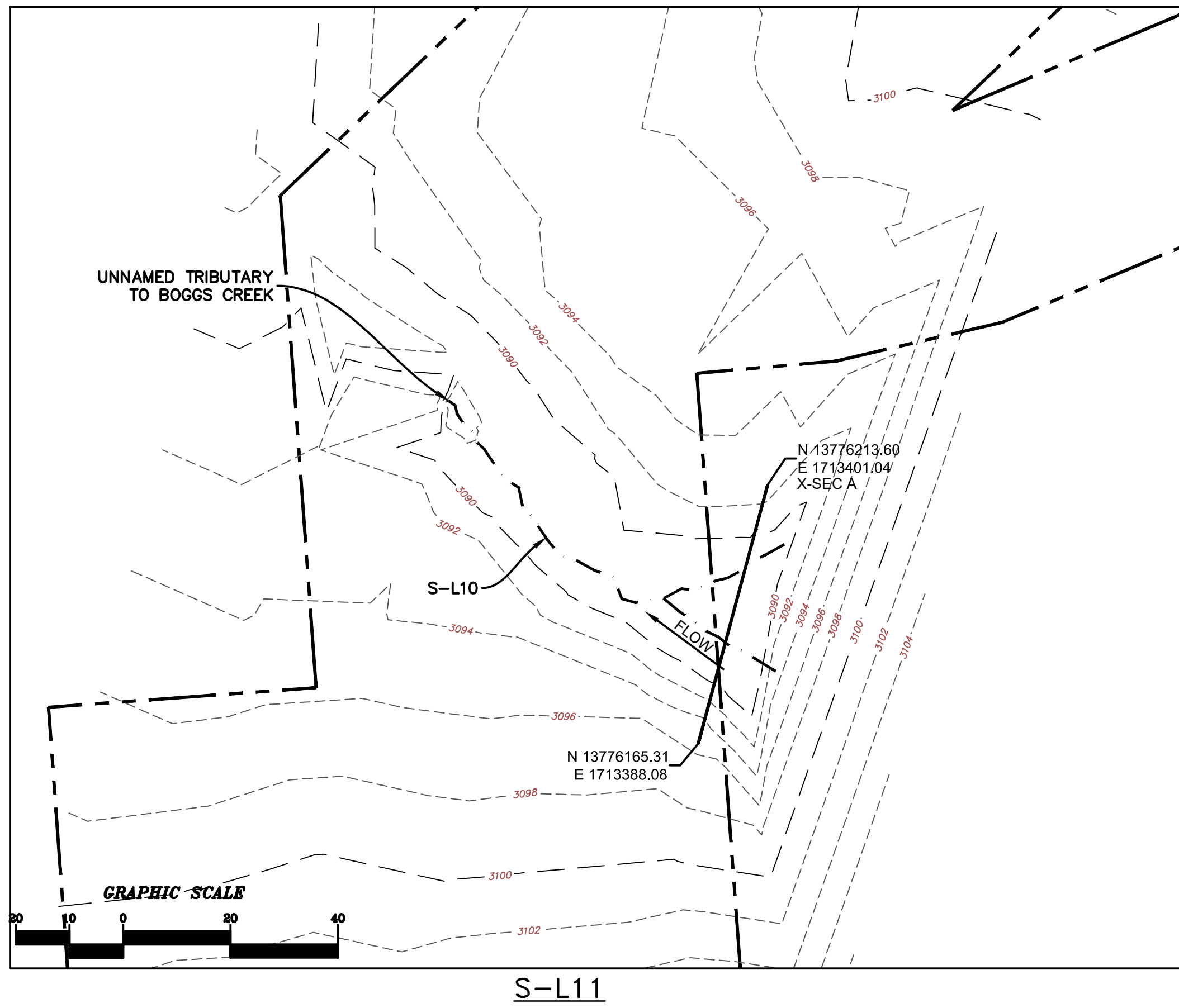
County: Greenbrier Stream ID: S-L11
 Stream Name: UNT to Boggs Creek
 HUC Code: Basin:
 Survey Date: 9/10/2021
 Surveyors: EG JD MD Impact Reach: 4.55 m
 Type: Bankfull Channel

PEBBLE COUNT							
Inches	PARTICLE	Millimeters		Particle Count	Total #	Item %	% Cum
	Silt/Clay	< .062	S/C	▲ ▼	25	25.00	25.00
	Very Fine	.062-.125	S A N D	▲ ▼	18	18.00	43.00
	Fine	.125-.25		▲ ▼	12	12.00	55.00
	Medium	.25-.5		▲ ▼	15	15.00	70.00
	Coarse	.50-1.0		▲ ▼	2	2.00	72.00
.04-.08	Very Coarse	1.0-2		▲ ▼	5	5.00	77.00
.08-.16	Very Fine	2-4		G R A V E L	▲ ▼	0	0.00
.16-.22	Fine	4-5.7	▲ ▼		5	5.00	82.00
.22-.31	Fine	5.7-8	▲ ▼		3	3.00	85.00
.31-.44	Medium	8-11.3	▲ ▼		1	1.00	86.00
.44-.63	Medium	11.3-16	▲ ▼		4	4.00	90.00
.63-.89	Coarse	16-22.6	▲ ▼		1	1.00	91.00
.89-1.26	Coarse	22.6-32	▲ ▼		2	2.00	93.00
1.26-1.77	Vry Coarse	32-45	▲ ▼		1	1.00	94.00
1.77-2.5	Vry Coarse	45-64	▲ ▼		0	0.00	94.00
2.5-3.5	Small	64-90	C O B B L E		▲ ▼	3	3.00
3.5-5.0	Small	90-128		▲ ▼	3	3.00	100.00
5.0-7.1	Large	128-180		▲ ▼	0	0.00	100.00
7.1-10.1	Large	180-256		▲ ▼	0	0.00	100.00
10.1-14.3	Small	256-362	B O U L D E R	▲ ▼	0	0.00	100.00
14.3-20	Small	362-512		▲ ▼	0	0.00	100.00
20-40	Medium	512-1024		▲ ▼	0	0.00	100.00
40-80	Large	1024-2048		▲ ▼	0	0.00	100.00
80-160	Vry Large	2048-4096		▲ ▼	0	0.00	100.00
	Bedrock		BDRK	▲ ▼	0	0.00	100.00
				Totals:	100		
Total Tally:							

Bankfull Channel Pebble Count, S-L11



Size (mm)	Size Distribution	Type
D16 0.062	mean 0.7	silt/clay 25%
D35 0.092	dispersion 20.7	sand 52%
D50 0.19	skewness 0.38	gravel 17%
D65 0.4		cobble 6%
D84 7.3		boulder 0%
D95 72		



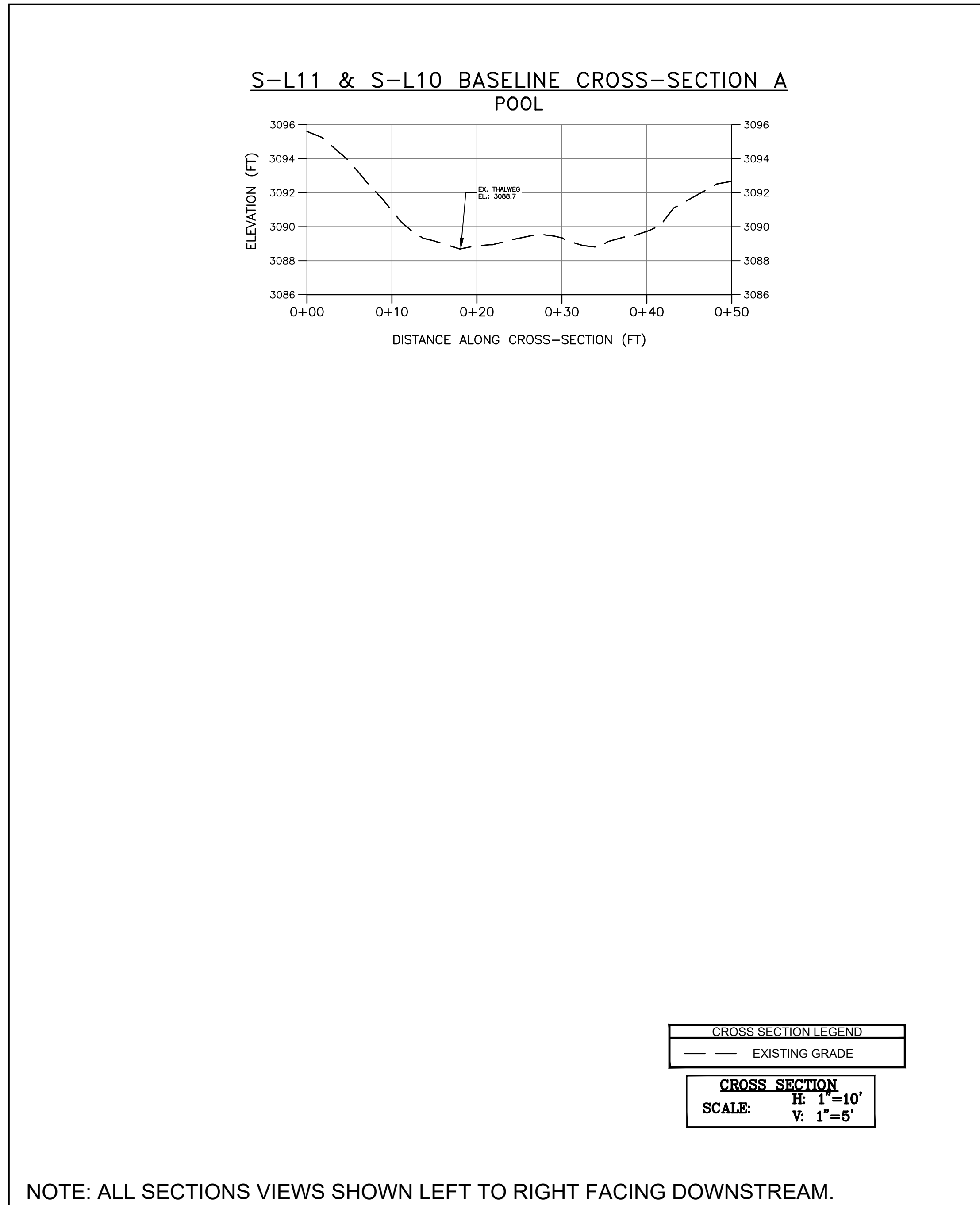
LEGEND

--- STUDY AREA (EASEMENT)

--- EXISTING SURVEY-LOCATED THALWEG

1176.87 + EXISTING SURVEYED GROUND SHOT ELEVATION

- SURVEY NOTES:
- THIS MAP HAS BEEN ORIENTED TO NAD 1983 UTM ZONE 17N, AND VERTICALLY TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88), USING REAL TIME DGPS. FIELD LOCATIONS WERE COMPLETED ON SEPTEMBER 10, 2021.
 - EASEMENT LINES SHOWN ON PLAN VIEW WERE PROVIDED BY MOUNTAIN VALLEY PIPELINE.
 - SURVEY POINTS FOR CROSS SECTIONS AND THALWEG PROFILES COLLECTED IN 2021 HAVE BEEN USED IN COMBINATION WITH SURVEY POINTS COLLECTED PREVIOUSLY IN 2020 IN ORDER TO GENERATE THE PRE-CROSSING SURFACE SHOWN IN PLAN. DUE TO NATURAL EROSIONAL STREAM PROCESSES THAT CAN OCCUR OVER TIME, MINOR ADJUSTMENTS TO THE PROFILE ALIGNMENTS MAY HAVE BEEN REQUIRED IN ORDER TO GENERATE A CLEAN PRE-CROSSING SURFACE.
 - ALL SECTION VIEWS SHOWN LEFT TO RIGHT FACING DOWNSTREAM.
 - POST-CROSSING SURVEY INFORMATION SHOWN IN RED. DATA PENDING.
 - POST-CROSSING SURVEY POINTS FOR CROSS SECTIONS AND THALWEG ARE PROJECTED ONTO PRE-CROSSING SECTION AND PROFILE VIEWS FOR COMPARISON.



PRE-CROSSING PHOTOS



PHOTO TAKEN LOOKING DOWNSTREAM FROM UPSTREAM IMPACT LIMITS



PHOTO TAKEN LOOKING UPSTREAM FROM DOWNSTREAM IMPACT LIMITS

POST-CROSSING PHOTOS

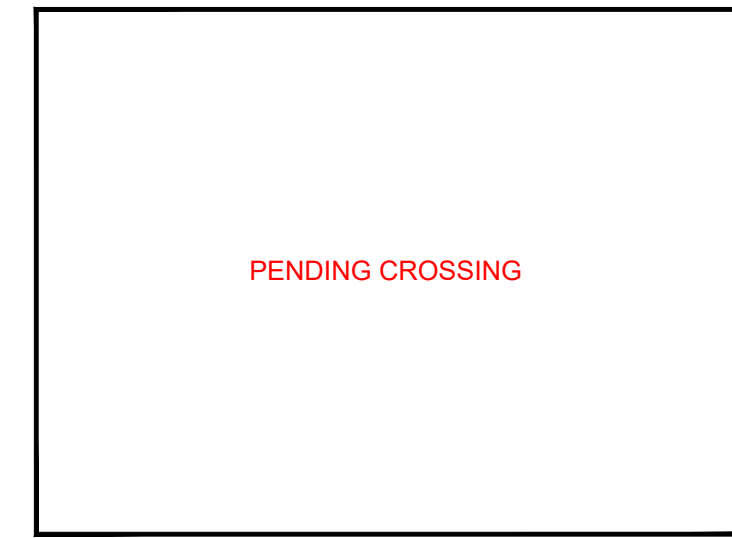


PHOTO TAKEN LOOKING DOWNSTREAM FROM UPSTREAM IMPACT LIMITS

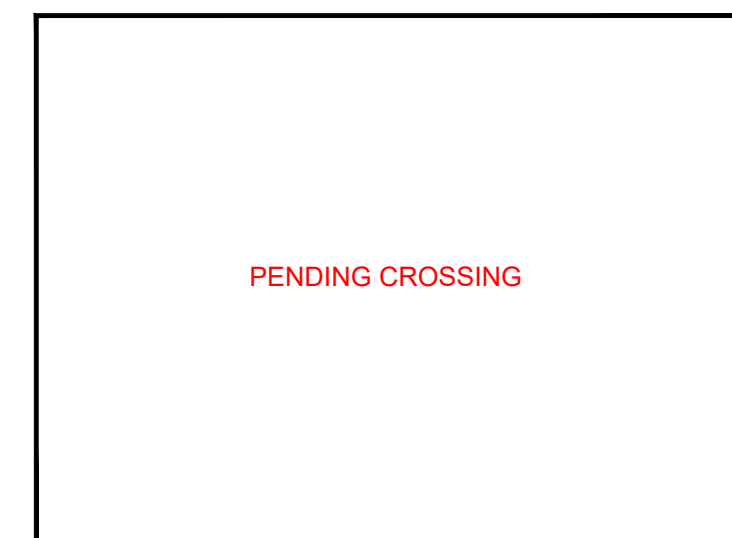
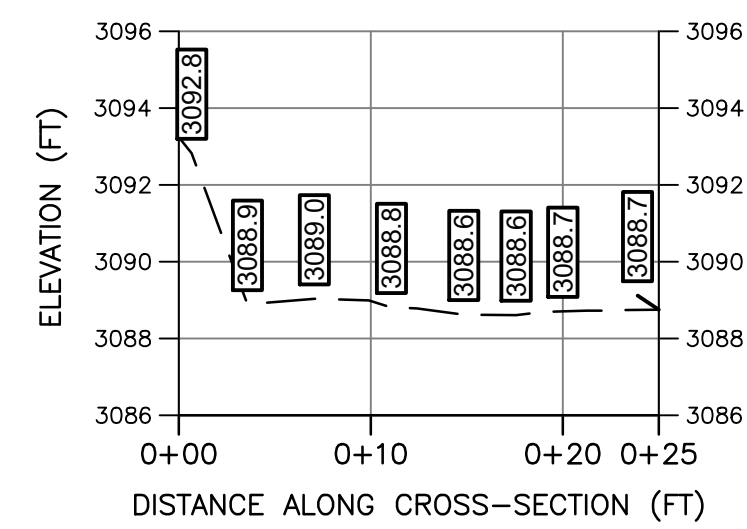


PHOTO TAKEN LOOKING UPSTREAM FROM DOWNSTREAM IMPACT LIMITS

PRE-CROSSING

S-L11 BASELINE THALWEG PROFILE

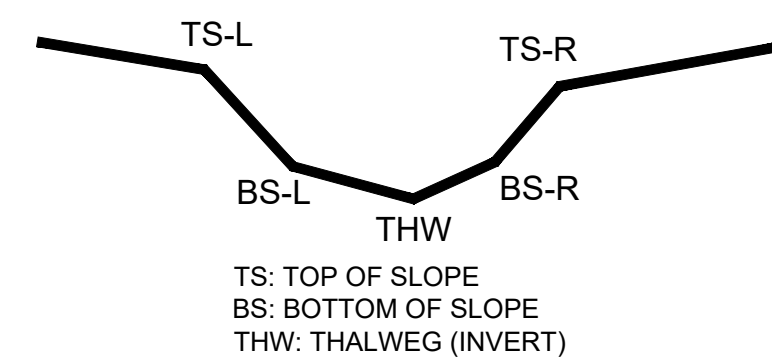


PROFILE LEGEND

EXISTING STREAM PROFILE
INVERT ALONG THALWEG

PROFILE SCALE: H: 1"=10'
V: 1"=5'

TYPICAL 5-POINT CROSS-SECTION (FACING DOWNSTREAM)



AS-BUILT TABLE: S-L10 & S-L11 CROSS SECTION A

PT. LOC.	PRE-CROSSING			AS-BUILT	
	NORTHING	EASTING	ELEV.	VERT. DIFF.	HORZ. DIFF.
TS-L	13776193.6200	1713394.8880	3089.358'		
BS-L	13776196.5100	1713395.4140	3088.993'		
THW	13776197.5200	1713395.9750	3088.815'		
BS-R	13776199.0800	1713396.9030	3088.854'		
TS-R	13776202.3300	1713397.5970	3089.500'		

CAD File No. JZ
Drawn GH
Checked GH
DW Approved
NOTED
Scale:
SEPT. 2021
Date:
112C07157
Project No.

TETRA TECH, INC.
881 ANDERSON DRIVE FOSTER PLAZA 7
PITTSBURGH, PA 15220
TEL: (412) 921-7090 FAX: (412) 921-4040
E-Mail Address: WWW.TETRATECH.COM

TETRA TECH
www.tetra-tech.com

Client:
MOUNTAIN VALLEY PIPELINE, LLC
2200 ENERGY DRIVE, 2ND FLOOR
CANONSBURG, PA 15317

Profile AND CROSS-SECTIONS
BASELINE SURVEY
CROSSING S-L10 - UNNAMED TRIB. TO
BOGGS CREEK (MP 148.29)
GREENBRIER COUNTY, WV

PRELIMINARY

File: I:\CADD\Projects\2021\2021-09-10 - S-L10 & S-L11 THALWEG SURVEY\100 MP 148.29\100 MP 148.29 - 100.00 - 100.00.dwg
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 PLOT DATE: 2021-09-10 10:00:00 AM
 PLOT TIME: 10:00:00 AM