



## MEMORANDUM

**TO:** Mike Rolband  
**FROM:** Alison Robinson  
**CC:** Ben Rosner, Mark Headly, Frank Graziano  
**RE:** Northern Virginia Stream Restoration Bank  
The Glade- Design Reaches 5 and 6  
Supplemental Biological Monitoring Year 4 (2014)  
WSSI #20030, Task M3a  
**DATE:** October 9, 2014

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Per maintenance and monitoring requirements defined in the “Northern Virginia Stream Restoration Bank Banking Instrument”, Section VI.B.2.(i), biological monitoring will be conducted prior to stream restoration, then in years 1, 5, and 10 in The Glade- Design Reaches 5 and 6<sup>1</sup>. However, monitoring was undertaken voluntarily in Year 4 (2014)<sup>2</sup> at biomonitoring Reaches 1-A through 1-C to better understand and document the effects of stream restoration on the benthic community within The Glade Watershed<sup>3</sup>. Field work was conducted by WSSI environmental scientists Beth Clements, PWS, PWD, CT<sup>4</sup>, and Matthew Johnson<sup>5</sup>, WPIT, CAE, CT on April 9, 2014. Benthic macroinvertebrate habitat field data sheets and benthic macroinvertebrate bench sheets for each reach are enclosed within.

Habitat results for Year 4 (Post-Construction) show that all of the biomonitoring reaches sampled in The Glade have “Optimal” habitat conditions ([Table 1](#), [Figure 1](#)). The average habitat assessment score for all restored biomonitoring reaches assessed in Year 4 (2014) is 179 (Optimal) out of 200 following restoration. These results show improved habitat conditions following restoration, with scores exceeding the pre-restoration average of 154 (Sub-Optimal) out of 200. Improved habitat assessment scores following restoration relate to the continued success of the vegetated and stabilized banks with little erosion and depositional zones present in the restored portions of the monitoring reaches, as well as the continued stability of the non-restored portions of the Glade.

The results of our data analysis indicate that the benthic macroinvertebrate community at all three biomonitoring reaches were in “Severe Stress” in Year 4, based on their Stream Condition

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<sup>1</sup> *Biomonitoring reach locations were selected prior to the design phase; therefore, biomonitoring reaches 1-A through 1-C are located within Design Reaches 5 and 6.*

<sup>2</sup> *Voluntary biomonitoring was conducted in Year 2 (2012) and Year 3 (2013) as described in previous memos.*

<sup>3</sup> *Note that Reach 1-A is 10% restored and Reach 1-B is 50% restored. Reach 1-C is the only fully restored reach in Design Reaches 5 and 6.*

<sup>4</sup> *Professional Wetland Scientist #2350, Society of Wetland Scientists Certification Program, Inc., VA Certified Professional Wetland Delineator #3402-0000146, and North American Benthological Society (NABS) Certified Family Level Taxonomist: All Phyla*

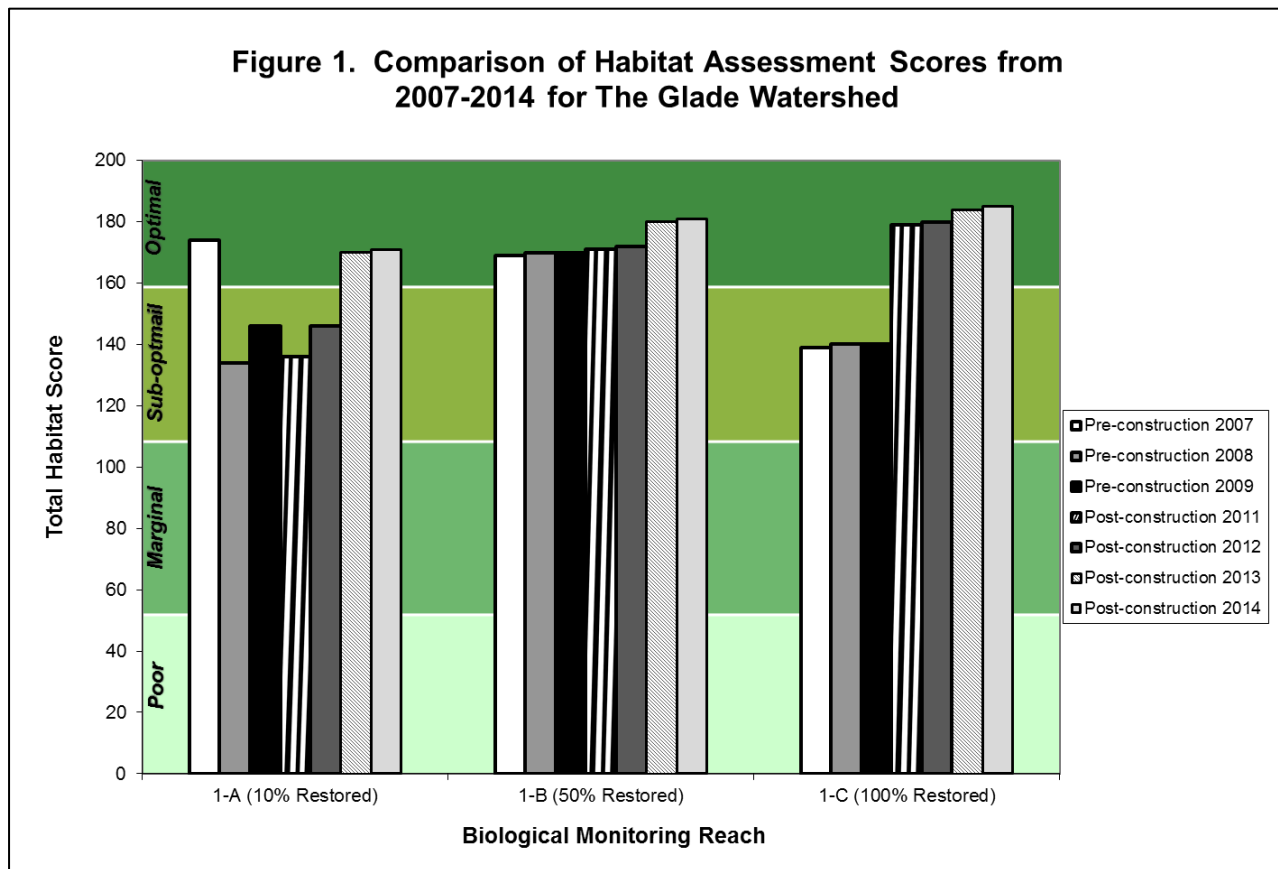
<sup>5</sup> *Wetland Professional In Training, Society of Wetlands Scientists Certification Program, Inc.; Ecological Society of America, Certified Associated Ecologist; Society of Freshwater Science Certified Family Level Taxonomist: All Taxa.*

Index for Virginia Non-coastal Streams (VA-SCI)<sup>6</sup> scores (Table 2, Figure 2). The average VA-SCI numerical score for all reaches assessed in 2014 is 26.49 (“Severe Stress”) which is slightly less than the 2013 average of 27.16 but is above 2011 and 2012 VA-SCI scores (16.31 and 20.07, respectively).

In conclusion, the results of the 2014 supplemental monitoring indicate that there has been a continued improvement of habitat scores and a slight decline in the health of the benthic community composition in the 2014 sampled reaches as compared to the Year 3 (2013) supplemental monitoring. Such year to year variability is expected.

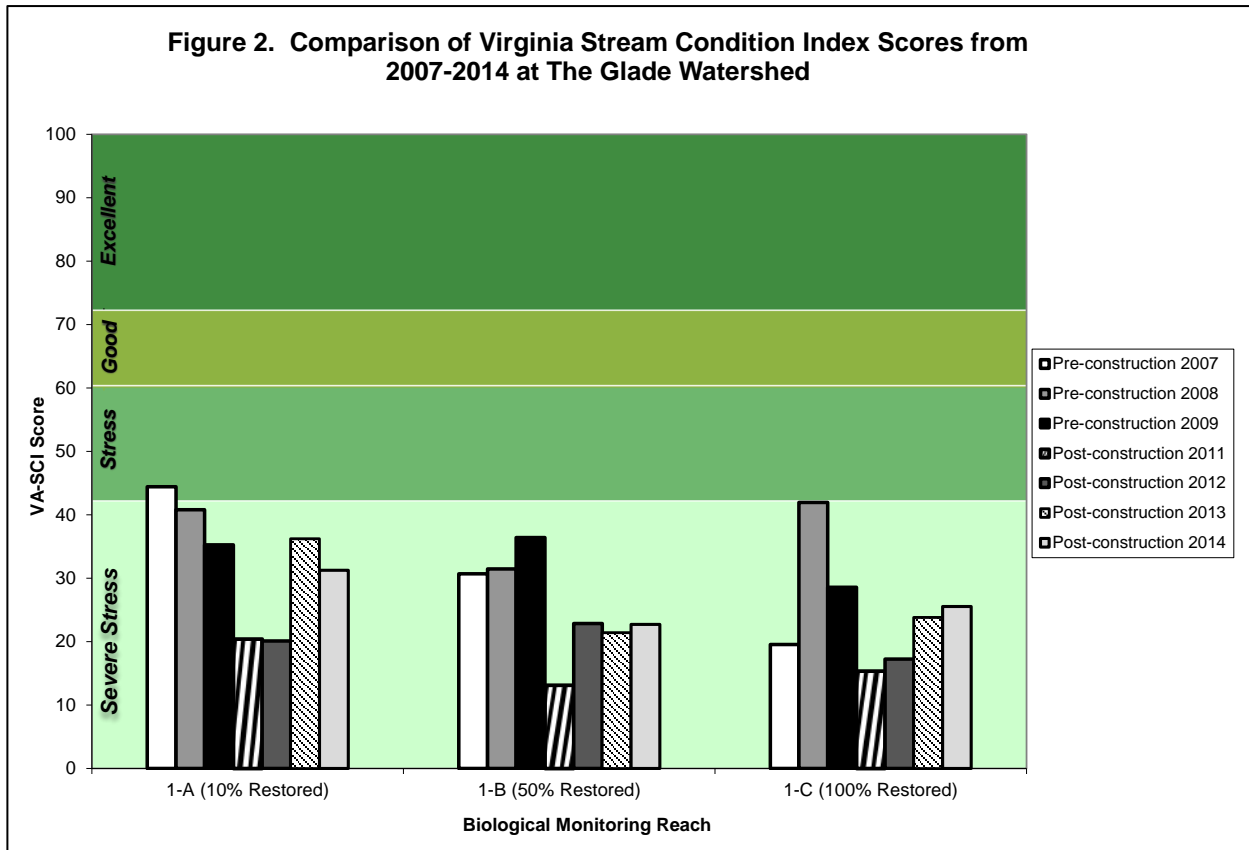
Enclosures

Table 1. 2014 Total Habitat Assessment Scores		
BIOMONITORING REACH	Total Habitat	Narrative Rating
1-A (10% Restored)	171	Optimal
1-B (50% Restored)	181	Optimal
1-C (100% Restored)	185	Optimal
<b>Average</b>	<b>179</b>	<b>Optimal</b>



<sup>6</sup> The VA-SCI is a multi-metric Index of Biotic Integrity developed for the DEQ to assess streams of the Commonwealth.

Table 2. 2014 Biotic Metric and Index Weighting and VA-SCI at The Glade.			
WEIGHTED METRIC	BIOLOGICAL MONITORING REACH		
	1-A (10% Restored)	1-B (50% Restored)	1-C (100% Restored)
Total Taxa	59.09	31.82	45.45
EPT Taxa	27.27	0.00	9.09
Percent Ephemeroptera	8.41	0.00	0.00
Percent Plecoptera + Trichoptera (Excluding Hydropsychidae)	0.00	0.00	0.00
Percent Scrapers	13.99	2.23	7.45
Percent Chironomidae	35.05	43.68	41.35
Percent Top Two Dominant	32.78	24.92	23.62
HBI	73.38	78.94	77.35
<b>VA-SCI Numerical Score</b>	31.25	22.70	25.54
<b>VA-SCI Narrative Score</b>	Severe Stress	Severe Stress	Severe Stress
<b>Average VA-SCI Numerical Score</b>	<b>26.49</b>		
<b>Average VA-SCI Narrative Score</b>	<b>Severe Stress</b>		





## Benthic Macroinvertebrate and Habitat Field Data Sheet - High Gradient

Job # Task	20030, Task M3a				
Station ID:	Reach 1-A	Ecoregion:	Piedmont	Land Use:	Urban
Field Team:	BAC / MJ	Location:	Reston, VA	Start time:	
Site:	The Glade	Latitude:	38°55'49"	Finish time:	
Date:	4/9/2014	Longitude:	77°19'29"	Survey Reason:	Year 4 Biomonitoring

### Stream Physiochemical Measurements

Instrument ID number:	N/A	pH:	N/A
Temperature:	N/A °C	Conductivity:	N/A uS/cm
Dissolved Oxygen:	N/A mg/L	Did instrument pass all post-calibration checks?	N/A
		If NO- which parameter(s) failed and action taken:	N/A

### Benthic Macroinvertebrate Collection

Method Used:	Single Habitat (Riffle)	Multi Habitat (Logs, Plants, etc.)	X
Riffle Quality:	Good X	Marginal	Poor
	Woody		None
Habitats Sampled:	Riffle X	Debris X	Banks X
	Vegetation		
# Jabs:	10	4	6

### Weather Observations

Current Weather	Cloudy	Clear X	Rain/Snow	Foggy
Recent Precipitation	Clear X	Showers	Rain	Storms
Stream Flow	Low	Normal X	Above Normal	Flood

### Biological Observations

Periphyton	2	Salamanders	0	Other....	
Filamentous Algae	2	Warmwater Fish	2	0= Not observed	
Submerged Macrophytes	2	Coldwater Fish	0	1= Sparse	
Emergent Macrophytes	0	Beavers	0	2= Common to Abundant	
Crayfish	1	Muskrats	0	3= Dominant-	
Corbicula	0	Ducks/Geese	0	Abnormally high density where other taxa are insignificant in relation to the dominant taxa.	
Unionidae	0	Snakes	0	There can be situations where multiple taxa are dominant such as algae and snails	
Operculate Snails	0	Turtles	1		
Non-operculate Snails	0	Frogs/Tadpoles	1		

High Gradient Habitat Data Sheet					
Habitat Parameter	Condition Category				
	Optimal	Suboptimal	Marginal	Poor	Score
<b>1. Epifaunal Substrate/ Available Cover</b>	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. snags/logs that are not new fall and not transient).	40-70% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization.	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.	
Score	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	18
<b>2. Embeddedness</b>	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.	
Score	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	17
<b>Velocity/Depth Regime</b>	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast shallow)(slow is <0.3m/s, deep is >0.5 m).	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/depth regime (usually slow-deep).	
Score	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	15
<b>4. Sediment Deposition</b>	Little or no enlargement of islands or point bars and <5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand, or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand, or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.	
Score	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	14




**Benthic Macroinvertebrate and Habitat Field Data Sheet - High Gradient**

Habitat Parameter	Condition Category					Score
	Optimal	Suboptimal	Marginal	Poor		
<b>5. Channel Flow Status</b>	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.		
<i>Score</i>	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0		18
<b>6. Channel Alteration</b>	Channelization or dredging absent or minimal; stream width normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e. dredging, may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% 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.		
<i>Score</i>	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0		18
<b>7. Frequency of Riffles</b>	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; distances 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.		
<i>Score</i>	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0		14
<b>8. Bank Stability (score each bank)</b> <b>Note: Determine left or right side by facing downstream.</b>	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 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.		
<i>Score Left Bank</i>	10 9	8 7 6	5 4 3	2 1 0		10
<i>Score Right Bank</i>	10 9	8 7 6	5 4 3	2 1 0		10
<b>9. Vegetation Protection (score each bank)</b>	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes; vegetation 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.		
<i>Score Left Bank</i>	10 9	8 7 6	5 4 3	2 1 0		9
<i>Score Right Bank</i>	10 9	8 7 6	5 4 3	2 1 0		9
<b>10. Riparian Vegetative Zone Width (score each banks riparian zone)</b>	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.		
<i>Score Left Bank</i>	10 9	8 7 6	5 4 3	2 1 0		10
<i>Score Right Bank</i>	10 9	8 7 6	5 4 3	2 1 0		9
<b>Total Score</b>						171

Notes:

## WSSI BENTHIC MACROINVERTEBRATE BENCH SHEET

Job Name/#	Glade - 20030	Sample subsorted by:	RD		
Station ID:	Reach 1-A	Date Subsorted:	5/5/14		
Stream Name:	The Glade	# of Grids subsorted	7		
Date Sampled:	4/9/14	Total # of subsorted insects:	101		
Sampling Method:	Multihabitat	Sample Identified by:	ABR		
		Total # identified:	97	Date Identified:	8/29/14

**Taxa Collected:**

Porifera	Spongillidae						
Ostracoda	Unknown						
Flatworms	Tricladida						
	Planariidae						
Gastropoda	Unknown						
Limpets	Ancylidae						
Snails	Immature						
	Lymnaeidae		Zygoptera				
	Physidae						
	Planorbidae						
	Hydrobiidae						
	Pleuroceridae						
	Viviparidae		Anisoptera				
Bivalvia	Immature						
	Corbiculidae						
	Sphaeriidae	2					
	Unionidae						
Oligochaeta	Unknown	12					
Lumbriculida							
	Lumbriculidae						
Tubificida							
	Enchytraeidae		Plecoptera				
	Naididae						
	Tubificidae						
Haplotaxida							
	Haplotaxidae						
Leeches	Hirudinea						
	Erpobdellidae						
	Glossiphoniidae						
	Hirudinidae						
	Piscioidae						
Branchiobdellida	Branchiobdellidae		Hemiptera				
Copepoda	Unknown						
Decapoda	Cambaridae						
	Portunidae						
Shrimp							
	Palaemonidae						
Isopoda		1					
	Asellidae						
Amphipoda							
	Crangonyctidae						
	Gammaridae						
	Talitridae						
Water Mites							
	Hydracarina		Neuroptera				
Ephemeroptera	Early Instar and/or damaged						
	Acanthometropodidae		Megaloptera				
	Ameletidae						
	Baetidae	1					
	Baetiscidae		Trichoptera				
	Behningiidae						
	Caenidae						
	Ephemerellidae						
	Ephemeridae						
	Heptageniidae	4					
	Isonychiidae						
	Leptophlebiidae						
TOTAL:		20	TOTAL:		6	TOTAL:	



## Benthic Macroinvertebrate and Habitat Field Data Sheet - High Gradient

Job # Task	20030, Task M3a				
Station ID:	Reach 1-B	Ecoregion:	Piedmont	Land Use:	Urban
Field Team:	BAC / MJ	Location:	Reston, VA	Start time:	
Site:	The Glade	Latitude:	38°55'25"	Finish time:	
Date:	4/9/2014	Longitude:	77°19'54"	Survey Reason:	Year 4 Biomonitoring

### Stream Physiochemical Measurements

Instrument ID number:	N/A	pH:	N/A
Temperature:	N/A °C	Conductivity:	N/A uS/cm
Dissolved Oxygen:	N/A mg/L	Did instrument pass all post-calibration checks?	N/A
		If NO- which parameter(s) failed and action taken:	N/A

### Benthic Macroinvertebrate Collection

Method Used:	Single Habitat (Riffle) _____	Multi Habitat (Logs, Plants, etc.)	X
Riffle Quality:	Good X _____	Marginal _____	Poor _____
		Woody _____	None _____
Habitats Sampled:	Riffle X _____	Debris _____	Banks X _____
			Vegetation X _____
# Jabs:	15 _____		3 _____
			2 _____

### Weather Observations

Current Weather	Cloudy _____	Clear X _____	Rain/Snow _____	Foggy _____
Recent Precipitation	Clear X _____	Showers _____	Rain _____	Storms _____
Stream Flow	Low _____	Normal X _____	Above Normal _____	Flood _____

### Biological Observations

Periphyton	2	Salamanders	0	Other....	_____
Filamentous Algae	2	Warmwater Fish	0	0= Not observed	
Submerged Macrophytes	2	Coldwater Fish	0	1= Sparse	
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Crayfish	0	Muskrats	0	3= Dominant-	
Corbicula	0	Ducks/Geese	0	Abnormally high density where other taxa are insignificant in relation to the dominant taxa.	
Unionidae	0	Snakes	1	There can be situations where multiple taxa are dominant such as algae and snails	
Operculate Snails	1	Turtles	0		
Non-operculate Snails	0	Frogs/Tadpoles	2		

## High Gradient Habitat Data Sheet

Habitat Parameter	Condition Category					Score
	Optimal	Suboptimal	Marginal	Poor		
<b>1. Epifaunal Substrate/ Available Cover</b>	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. snags/logs that are not new fall and not transient).	40-70% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization.	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.		
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<b>Velocity/Depth Regime</b>	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast shallow)(slow is <0.3m/s, deep is >0.5 m).	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/depth regime (usually slow-deep).		
<i>Score</i>	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0		15
<b>4. Sediment Deposition</b>	Little or no enlargement of islands or point bars and <5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand, or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand, or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.		
<i>Score</i>	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0		19




**Benthic Macroinvertebrate and Habitat Field Data Sheet - High Gradient**

Habitat Parameter	Condition Category					Score
	Optimal	Suboptimal	Marginal	Poor		
<b>5. Channel Flow Status</b>	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.		
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<i>Score</i>	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0		19
<b>8. Bank Stability (score each bank)</b> <b>Note: Determine left or right side by facing downstream.</b>	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 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.		
<i>Score Left Bank</i>	10 9	8 7 6	5 4 3	2 1 0		9
<i>Score Right Bank</i>	10 9	8 7 6	5 4 3	2 1 0		9
<b>9. Vegetation Protection (score each bank)</b>	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes; vegetation 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.		
<i>Score Left Bank</i>	10 9	8 7 6	5 4 3	2 1 0		10
<i>Score Right Bank</i>	10 9	8 7 6	5 4 3	2 1 0		10
<b>10. Riparian Vegetative Zone Width (score each banks riparian zone)</b>	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.		
<i>Score Left Bank</i>	10 9	8 7 6	5 4 3	2 1 0		9
<i>Score Right Bank</i>	10 9	8 7 6	5 4 3	2 1 0		10
<b>Total Score</b>						<b>181</b>

Notes:



# WSSI BENTHIC MACROINVERTEBRATE BENCH SHEET

Job Name/#	Glade - 20030	Sample subsorted by:	MJ		
Station ID:	Reach 1-B	Date Subsorted:	4/14/14		
Stream Name:	The Glade	# of Grids subsorted	15		
Date Sampled:	4/9/14	Total # of subsorted insects:	101	Total # identified:	87
Sampling Method:	Multihabitat	Sample Identified by:	ABR	Date Identified:	9/19/14

**Taxa Collected:**

Porifera	Spongillidae				Lepidostomatidae
Ostracoda	Unknown				Leptoceridae
Flatworms	Tricladida				Limnephilidae
	Planariidae				Molannidae
Gastropoda	Unknown				Odontoceridae
Limpets	Ancylidae	1			Philopotamidae
Snails	Immature		Zygoptera		Phryganeidae
	Lymnaeidae				Polycentropodidae
	Physidae				Psychomyiidae
	Planorbidae				Ryacophilidae
	Hydrobiidae				Sericostomatidae
	Pleuroceridae				Uenoidae
	Viviparidae		Anisoptera		Early Instar and/or damaged
Bivalvia	Immature				Pyrilidae
	Corbiculidae				Early Instar and/or damaged
	Sphaeriidae	10			Chrysomelidae
	Unionidae				Curculionidae
Oligochaeta	Unknown	23			Dryopidae
Lumbriculida					Dytiscidae
	Lumbriculidae				Elmidae
Tubificida					Gyrinidae
	Enchytraeidae		Plecoptera		Halipidae
	Naididae				Helodidae
	Tubificidae				Helophoridae
Haplotaxida					Hydraenidae
	Haplotaxidae				Hydrochidae
Leeches	Hirudinea				Hydrophilidae
	Erpobdellidae				Limnichidae
	Glossiphoniidae				Noteridae
	Hirudinidae				Psephenidae
	Piscioidae				Ptilodactylidae
Branchiobdellida	Branchiobdellidae		Hemiptera		Scirtidae
Copepoda	Unknown				Early Instar and/or damaged
Decapoda	Cambaridae				Athericidae
	Portunidae				Blephariceridae
Shrimp					Canaceidae
	Palaemonidae				Ceratopogonidae
Isopoda					Choaboridae
	Asellidae				Chironomidae
Amphipoda					49
	Crangonyctidae				Culicidae
	Gammaridae				Dixidae
	Talitridae				Dolichopodidae
Water Mites					Empididae
	Hydracarina	1	Neuroptera		Ephydriidae
Ephemeroptera	Early Instar and/or damaged				Muscidae
	Acanthometropodidae				Nymphomyiidae
	Ameletidae		Megaloptera		Pelecorhynchidae
	Baetidae				Psychodidae
	Baetiscidae				Ptychopteridae
	Behningiidae		Trichoptera		Sciomyzidae
	Caenidae				Simuliidae
	Ephemerellidae				Stratiomyidae
	Ephemeridae				Syrphidae
	Heptageniidae				Tabanidae
	Isonychiidae				Tanyderidae
	Leptophlebiidae				Thaumaleidae
TOTAL:		35	TOTAL:	1	TOTAL:
					51



## Benthic Macroinvertebrate and Habitat Field Data Sheet - High Gradient

Job # Task	20030, Task M3a				
Station ID:	Reach 1-C	Ecoregion:	Piedmont	Land Use:	Urban
Field Team:	BAC / MJ	Location:	Reston, VA	Start time:	
Site:	The Glade	Latitude:	38°55'22"	Finish time:	
Date:	4/9/2014	Longitude:	77°20'12"	Survey Reason:	Year 4 Biomonitoring

### Stream Physiochemical Measurements

Instrument ID number:	N/A	pH:	N/A
Temperature:	N/A °C	Conductivity:	N/A uS/cm
Dissolved Oxygen:	N/A mg/L	Did instrument pass all post-calibration checks?	N/A
		If NO- which parameter(s) failed and action taken:	N/A

### Benthic Macroinvertebrate Collection

Method Used:	Single Habitat (Riffle) _____	Multi Habitat (Logs, Plants, etc.)	X
Riffle Quality:	Good X _____	Marginal _____	Poor _____
		Woody _____	None _____
Habitats Sampled:	Riffle X _____	Debris _____	Banks _____
	# Jabs: 18 _____		Vegetation X _____
			2 _____

### Weather Observations

Current Weather	Cloudy _____	Clear X _____	Rain/Snow _____	Foggy _____
Recent Precipitation	Clear X _____	Showers _____	Rain _____	Storms _____
Stream Flow	Low X _____	Normal _____	Above Normal _____	Flood _____

### Biological Observations

Periphyton	2	Salamanders	0	Other....	_____
Filamentous Algae	2	Warmwater Fish	1	0= Not observed	
Submerged Macrophytes	1	Coldwater Fish	0	1= Sparse	
Emergent Macrophytes	0	Beavers	0	2= Common to Abundant	
Crayfish	1	Muskrats	0	3= Dominant-	
Corbicula	0	Ducks/Geese	0	Abnormally high density where other taxa are insignificant in relation to the dominant taxa.	
Unionidae	0	Snakes	1	There can be situations where multiple taxa are dominant such as algae and snails	
Operculate Snails	0	Turtles	0		
Non-operculate Snails	0	Frogs/Tadpoles	1		

## High Gradient Habitat Data Sheet

Habitat Parameter	Condition Category					Score
	Optimal	Suboptimal	Marginal	Poor		
<b>1. Epifaunal Substrate/ Available Cover</b>	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. snags/logs that are not new fall and not transient).	40-70% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization.	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.		
<i>Score</i>	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0		18
<b>2. Embeddedness</b>	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.		
<i>Score</i>	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0		19
<b>Velocity/Depth Regime</b>	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast shallow)(slow is <0.3m/s, deep is >0.5 m).	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/depth regime (usually slow-deep).		
<i>Score</i>	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0		16
<b>4. Sediment Deposition</b>	Little or no enlargement of islands or point bars and <5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand, or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand, or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.		
<i>Score</i>	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0		17




**Benthic Macroinvertebrate and Habitat Field Data Sheet - High Gradient**

Habitat Parameter	Condition Category					Score
	Optimal	Suboptimal	Marginal	Poor		
<b>5. Channel Flow Status</b>	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.		
<i>Score</i>	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0		19
<b>6. Channel Alteration</b>	Channelization or dredging absent or minimal; stream width normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e. dredging, may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% 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.		
<i>Score</i>	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0		18
<b>7. Frequency of Riffles</b>	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; distances 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.		
<i>Score</i>	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0		18
<b>8. Bank Stability (score each bank)</b> <b>Note: Determine left or right side by facing downstream.</b>	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 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.		
<i>Score Left Bank</i>	10 9	8 7 6	5 4 3	2 1 0		10
<i>Score Right Bank</i>	10 9	8 7 6	5 4 3	2 1 0		10
<b>9. Vegetation Protection (score each bank)</b>	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes; vegetation 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.		
<i>Score Left Bank</i>	10 9	8 7 6	5 4 3	2 1 0		10
<i>Score Right Bank</i>	10 9	8 7 6	5 4 3	2 1 0		10
<b>10. Riparian Vegetative Zone Width (score each banks riparian zone)</b>	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.		
<i>Score Left Bank</i>	10 9	8 7 6	5 4 3	2 1 0		10
<i>Score Right Bank</i>	10 9	8 7 6	5 4 3	2 1 0		10
<i>Total Score</i>						185

Notes:

# WSSI BENTHIC MACROINVERTEBRATE BENCH SHEET

Job Name/#	Glade - 20030	Sample subsorted by:	JMC		
Station ID:	Reach 1-C	Date Subsorted:	5/14/14		
Stream Name:	The Glade	# of Grids subsorted	8		
Date Sampled:	4/9/14	Total # of subsorted insects:	108		
Sampling Method:	Multihabitat	Sample Identified by:	ABR	Date Identified:	8/22/14

**Taxa Collected:**

Phylum	Family	Count	Class	Family	Count	Class	Family	Count
Porifera	Spongillidae			Metretopodidae			Lepidostomatidae	
Ostracoda	Unknown			Neophemeridae			Leptoceridae	1
Flatworms	Tricladida			Oligoneuridae			Limnephilidae	
	Planariidae			Psuedironidae			Molannidae	
Gastropoda	Unknown			Polymitarciidae			Odontoceridae	
Limpets	Ancylidae			Potamanthidae			Philopotamidae	
Snails	Immature			Siphonuridae			Phryganeidae	
	Lymnaeidae	3	Zygotera	Tricorythidae			Polycentropodidae	
	Physidae			Early Instar and/or damaged			Psychomyiidae	
	Planorbidae	1		Calopterygidae			Ryacophilidae	
	Hydrobiidae			Coenagrionidae			Sericostomatidae	
	Pleuroceridae			Lestidae			Uenoidae	
	Viviparidae		Anisoptera	Protoneuridae		Lepidoptera	Early Instar and/or damaged	
Bivalvia	Immature			Early Instar and/or damaged			Pyralidae	
	Corbiculidae			Aeshnidae		Coleoptera	Early Instar and/or damaged	
	Sphaeriidae	4		Cordulegastridae			Chrysomelidae	
	Unionidae			Corduliidae			Curculionidae	
Oligochaeta	Unknown	16		Gomphidae			Dryopidae	
Lumbriculida				Libellulidae			Dytiscidae	
	Lumbriculidae			Macromiidae			Elmidae	3
Tubificida				Petaluridae			Gyrinidae	
	Enchytraeidae		Plecoptera	Cordulidae/Libellulidae			Haliplidae	
	Naididae			Early Instar and/or damaged			Helodidae	
	Tubificidae			Capniidae			Helophoridae	
Haplotaxida				Chloroperlidae			Hydraenidae	
	Haplotaxidae			Leuctridae			Hydrochidae	
Leeches	Hirudinea			Nemouridae			Hydrophilidae	
	Erpobdellidae			Peltoperlidae			Limnichidae	
	Glossiphoniidae			Perlidae			Noteridae	
	Hirudinidae			Perlodidae			Psephenidae	
	Piscioidae			Pteronarcyidae			Ptilodactylidae	
Branchiobdellida	Branchiobdellidae		Hemiptera	Taeniopterygidae			Scirtidae	
Copepoda	Unknown	3		Early Instar and/or damaged		Diptera	Early Instar and/or damaged	
Decapoda	Cambaridae			Belostomatidae			Athericidae	
	Portunidae			Corixidae			Blephariceridae	
Shrimp				Gelastocoridae			Canaceidae	
	Palaemonidae			Gerridae			Ceratopogonidae	2
Isopoda				Hebridae			Choaboridae	
	Asellidae			Hydrometridae			Chironomidae	62
Amphipoda				Mesoveliidae			Culicidae	
	Crangonyctidae			Naucoridae			Dixidae	
	Gammaridae			Nepidae			Dolichopodidae	
	Talitridae			Notonectidae			Empididae	2
Water Mites				Veliidae			Ephydriidae	
	Hydracarina		Neuroptera	Pleidae			Muscidae	
Ephemeroptera	Early Instar and/or damaged						Nymphomyiidae	
	Acanthometropodidae		Megaloptera	Sisyridae			Pelecorhynchidae	
	Ameletidae						Psychodidae	
	Baetidae			Corydalidae			Ptychopteridae	
	Baetiscidae		Trichoptera	Sialidae			Sciomyzidae	
	Behningiidae			Early Instar and/or damaged			Simuliidae	
	Caenidae			Branchycentridae			Stratiomyidae	
	Ephemerellidae			Calamoceratidae			Syrphidae	
	Ephemeridae			Glossosomatidae			Tabanidae	
	Heptageniidae			Goeridae			Tanyderidae	
	Isonychiidae			Helicopsychidae			Thaumaleidae	
	Leptophlebiidae			Hydropsychidae			Tipulidae	
				Hydroptilidae				70
<b>TOTAL:</b>		<b>27</b>		<b>TOTAL:</b>	<b>0</b>		<b>TOTAL:</b>	