

MEMORANDUM

TO: Mike Rolband

FROM: Alison Robinson

CC: Ben Rosner, Mark Headly, Scott Petrey

RE: Northern Virginia Stream Restoration Bank

The Glade- Design Reaches 5 and 6

Supplemental Biological Monitoring 2012 (Year 2)

WSSI #20030, Task M1a

DATE: November 27, 2012

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 6¹. However, monitoring was undertaken voluntarily in Year 2 (2012) 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 Watershed². Field work was conducted by WSSI environmental scientists Lauren Shaffer and Mark Navarro on April 14, 2012. Benthic macroinvertebrate habitat field data sheets and benthic macroinvertebrate bench sheets for each reach are enclosed within.

Habitat results for Year 2 (Post-Construction) show that all of the biomonitoring reaches sampled in The Glade have "Optimal" habitat conditions (<u>Table 1</u>, <u>Figure 1</u>). The average habitat assessment score for all restored biomonitoring reaches assessed in 2012 is 166 (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 2012, based on their Stream Condition Index for Virginia Non-coastal Streams (VA-SCI)³ scores (<u>Table 2</u>, <u>Figure 2</u>). The average VA-SCI numerical score for all reaches assessed in 2012 is 20.07 ("Severe Stress"). The 2012 average VA-SCI score is still lower than the pre-restoration average of 34.34 ("Severe Stress"); however, biomonitoring reaches 1-B and 1-C showed individual improvement from the 2011 post-construction VA-SCI scores. Note that biomonitoring reach 1-A showed almost no difference from its 2011 post-construction VA-SCI score, but that this area was impacted by a

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.

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.

The VA-SCI is a multi-metric Index of Biotic Integrity developed for the DEQ to assess Streams of the Commonwealth.

storm event in September 2011 which resulted in the reconstruction of the portion of Design Reach 6 immediately upstream from biomonitoring reach 1-A.

In conclusion, the results of the 2012 supplemental monitoring indicate that there has been a continued improvement of habitat scores and a slight improvement of the benthic community composition in the 2012 sampled reaches as compared to the first year following restoration in 2011.

Enclosures

Table 1. 2012 Total Habitat Assessment Scores										
BIOMONITORING REACH	Total Habitat	Narrative Rating								
1-A (10% Restored)	146	Suboptimal								
1-B (50% Restored)	172	Optimal								
1-C (100% Restored) 180 Optimal										
Average										

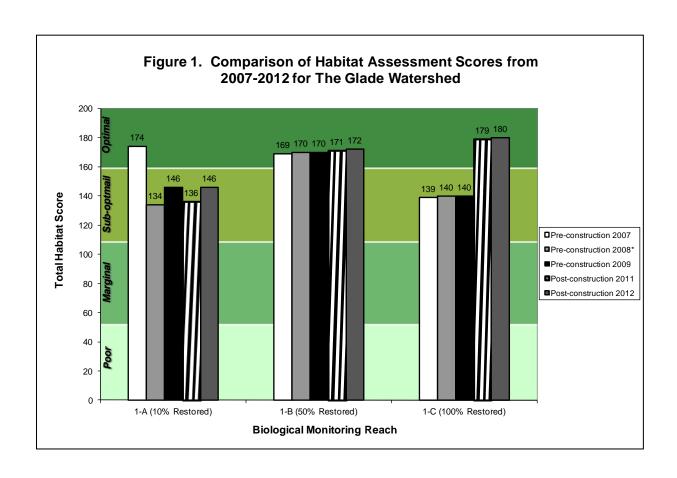
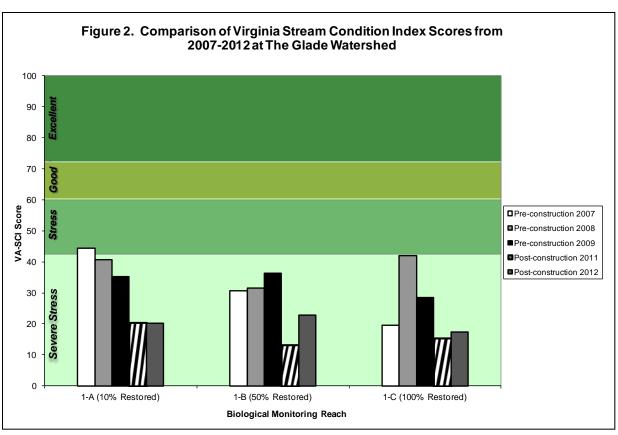


Table 3. 2012 Biotic Metric an	d Index Weightii	ng and VA-SCI a	t The Glade.
	BIOLOG	GICAL MONITORING	REACH
WEIGHTED METRIC	1-A	1-B	1-C
	(10% Restored)	(50% Restored)	(100% Restored)
Total Taxa	31.82	27.27	27.27
EPT Taxa	27.27	0.00	18.18
Percent Ephemeroptera	1.50	0.00	0.00
Percent Plecoptera + Trichoptera	2.50	0.00	F 20
(Excluding Hydropsychidae)	2.58	0.00	5.30
Percent Scrapers	1.78	0.00	5.48
Percent Chironomidae	20.18	66.67	9.43
Percent Top Two Dominant	18.56	28.34	8.18
HBI	57.20	60.41	64.23
VA-SCI Numerical Score	20.11	22.84	17.26
VA-SCI Narrative Score	Severe Stress	Severe Stress	Severe Stress
Average VA-SCI Numerical Score	20.07		
Average VA-SCI Narrative Score	Severe Stress		



^{*}Note that biological monitoring reach 1-G was not sampled in 2008 and 2009 and biological monitoring reach 3-A was not sampled in 2009 due to the lack of flowing water during the time of the sampling fieldwork.



EXHIBIT 6: HABITAT ASSESSMENT FIELD DATA SHEET - SUMMARY WORKSHEET

Project Na	ame an	d WSSI Nur	nber: North	ern Virginia	Stream Rest	toration Bar	k: The Gla	de (WSSI # 2	20030)	WALLET WOLL	KOHELI				
Stream ID	: The C	alade and U	nnamed Trib	utaries of T	he Glade		Date: 4/26/12								
Evaluator	s: LLS/I	MN					HUC: 020	70008						·	
Assessme	ent Peri	od:	Po	st-constru	ıction - Year	2									
_						Condition	n Category								
Assessi			Embedded-		Sediment		Channel	Frequency of	Bank	Vegetation	Riparian	TOTAL		Reach	Stream
Reach N		Substrate	ness	Velocity	Depostion	Flow Status	Alteration	Riffles	Stability*	Protection*	Zone*	SCORE	Condition	Length	Туре
Stream 1	1-A		Suboptimal	Optimal	Suboptimal	Optimal	Optimal	Marginal	Suboptimal	Suboptimal	Optimal	146	Suboptimal		R3
	1-B	Optimal	Suboptimal	Marginal	Optimal	Optimal	Optimal	Optimal	Suboptimal	Optimal	Optimal	172	Optimal	300	R3
	1-C	Optimal	Optimal	Optimal	Optimal	Optimal	Optimal	Optimal	Optimal		Suboptimal	180	Optimal	300	R3
	1-D		-	-	-	-	-	-	-	-	-	metaria de comencia de la como de	THE RESERVE AND ASSESSED.		To the second property
	1-E	-	-	-	-	-	-	1-	-	4	-	C.M.A. or Comp. (Apr. 16)	With the terminal memory and	a state. Springer and a contract	TO AND THE PERSON NAMED OF
	1-F	-	-	-	(A)	-	-	-	-	-	-	STREET, STREET		-	-
	1-G	-	7 - -	-		-	-	-	-	-	-	-	A About the Committee of the Market (B) of	-	STANSON REPORT OF THE PROPERTY OF THE
Stream 2	2-A		-	*	-	-	-	-	-	-	-	MALACATION AT 1997	Similar Arthur Arbura Jerbannen Jean	The state of the s	CONTRACTOR AND COMMENTS
Stream 3 3-A											-	Committee of the Commit	HIT WITH A CANA B. JOHN HA M. I	T 400 - 1 T.W. E. W. A. W. C.	-
											Average	166	Total	900	

 $^{^{\}star}$ The score for Bank Stability, Vegetation Protection and Riparian Zone combines the left and right bank scores.

^{**} The stream is characterized as non-perennial by Fairfax County and is thus either intermittent or ephemeral.



					and Solution				
		Benth	nic Macro	oinvertebra	te and	Habitat Fi	eld Dat	a Sheet	
Station ID:	Reach 1-A		Ecoregion:	Piedmont		Land Use:	Urban		
Field Team:	LLS/MN		Survey Reason	Year 2 Biomonito	ring	Start time:	1		
Stream Name:	Glade		Location:	Reston, Virginia		Finish time:			
Date	4/26/2012		Latitude:	38°55'50"		Longitude	-77°19'29"		
Stream Phys	siochemical M	easuremen	its						
Instrument ID r	number:	N,	/A	pl	1:	N/A			
Temperature:		N/A	°C	Co	onductivity:	N/A	uS/cm		
Dissolved Oxygo	en:	N/A	mg/L		Did ins	trument pass all	post-calibrat	ion checks?	N/A
					If NO- w	hich parameter(s	s) failed and a	action taken:	N/A
Benthic Mad	croinvertebrat	e Collection	n						
Method Used:		Sin	gle Habitat (Riff	le):		Multi Ha	bitat (Logs, F	Plants, etc.):	Х
Riffle Quality:		Good		Marginal	Х	Poor		None	
Habitats Sample	ed:	Riffle	Х	Snags_	Х	 Banks	Х	Vegetation	X
	# Jabs	s:	9	_	2	_	8		1
Weather Ob	servations								
Current Weathe	er:	Cloudy	X	Clear		Rain/Snow		Foggy	
Recent Precipita	ation:	Clear	Х	Showers		Rain			
Stream Flow:		Low		Normal	Х	_ Above Normal		Flood	
Biological O	bservations								
eriphyton	-	2		Salamanders		0		Other	Iron Oxidizing Bacteria=1
ilamentous Alg	gae	0		Warmwater Fish		1		0= Not observe	d
Submerged Mad	crophytes	0		Coldwater Fish		0		1= Sparse	
mergent Macre	ophytes	2		Beavers		0		2= Common to	Abundant
Crayfish	_	0		Muskrats		0		3= Dominant-	
Corbicula	-	0		Ducks/Geese		0		abnormally hig	sh density where other taxa
unionidae 0		Snakes		0	_		in relation to the dominant		
Operculate Snai	ls	0		Turtles		0			be situations where multip
Non-operculate	Snails	0		Frogs/Tadpoles		0		taxa are domina	ant such as algae and snails

High Gradient Habitat Data

Notes

Habitat Parameter		Con	dition Category	EN WASHINGTON	
Habitat Parameter	Optimal	Suboptimal	Marginal	Poor	Score
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. 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 maintainance 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	15
2. Embeddedness	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	12
Velocity/Depth Regime	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	16
4. Sediment Deposition	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 pools prevalent.	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	11



CONTRACTOR OF STREET, SALES		Water House Carried Wall		ASISTERIAL PROPERTY.	The STATE OF			
Habitat Parameter	SCIENTIFICATION AND AND AND AND AND AND AND AND AND AN	Con	dition Category		a revenue			
Habitat Parameter	Optimal	Suboptimal Marginal Poor						
5. Channel Flow status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the availible channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the availible channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.				
Score	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	16			
6. Channel Alteration	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.	Channeliztion 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.				
Score	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	16			
7. Frequency of Riffles								
Score	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	10			
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 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.				
Score Left Bank	10 9	8 7 6	5 4 3	2 1 0	8			
Score Right Bank	10 9	8 7 6	5 4 3	2 1 0	7			
9. Vegetation Protection (score each bank) Note: Determine left or right side by facing downstream.	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.				
Score Left Bank	10 9	8 7 6	5 4 3	2 1 0	8			
Score Right Bank	10 9	8 7 6	5 4 3	2 1 0	8			
10. Riparian Vegetative Zone Width (score each pank 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 riperian zone <6 meters; little or no riparian vegetation due to human activities.				
Score Left Bank	10 9	8 7 6	5 4 3	2 1 0	9			
Score Right Bank	10 9	8 7 6	5 4 3	2 1 0	10			
	THE COMPANY OF THE PARTY OF THE	Total Score			146			

Talk Mil. 10				ACROINVERTEBRA				
Job Name/#	AS LEGISLA	Glade - 200	30	Sample subsorted by:	B	NR	- — Wetland)—···-
Station ID:		Reach 1-A	١	Date Subsorted:	9/	4/12	Studies and Solutions, 1	
Stream Name		The Glade		# of Grids subsorted		6	- are and 2010thouse.	
Date Sampled	d: Section 1	4/26/12	,	Total # of subsorted insec	ts:	120	Total # identified:	109
Sampling Met	hod:	Multihabita	ıt	Sample Identified by:		BR	Date Identified:	
		Water Carlot		campio identifica by.		DIT	Date identified.	9/27/12
Taxa Collect	ted:					,		
Porifera	Spongillidae	1	٦	Metretopodidae Neoephemeridae		4	Lepidostomatidae	
Ostracoda	Unknown		1	Oligoneuridae		-	Leptoceridae Limnephilidae	
Flatworms	Tricladida		1	Psuedironidae		1	Molannidae	
	Planariidae		1	Polymitarcyidae		1	Odontoceridae	
Gastropoda	Unknown]	Potamanthidae			Philopotamidae	
Limpets	Ancylidae]	Siphlonuridae			Phryganeidae	
Snails	Immature		1	Tricorythidae]	Polycentropodidae	1
	Lymnaeidae		Zygoptera	Early Instar and/or damaged			Psychomyiidae	
	Physidae		-	Calopterygidae			Ryacophilidae	
	Planorbidae Hvdrobiidae	+	-	Coenagrionidae Lestidae	8	4	Sericostomatidae	
	Pleuroceridae		1	Protoneuridae		Lenidontora	Uenoidae	
	Viviparidae		Anisopteera	Early Instar and/or damaged		Lepidoptera	Early Instar and/or damaged Pyralidae	
Bivalvia	Immature			Aeshnidae		Coleoptera	Early Instar and/or damaged	
	Corbiculidae		1	Cordulegastridae			Chrysomelidae	
	Sphaeriidae		1	Corduliidae		1	Curculionidae	
	Unionidae			Gomphidae			Dryopidae	
Oligochaeta	Unknown	1	1	Libellulidae]	Dytiscidae	
Lumbriculida	1		-	Macromiidae			Elmidae	
Tubificida	Lumbriculidae		-	Petaluridae			Gyrinidae	
Tubilicida	Enchytraeidae		Plecoptera	Cordullidae/Libelluidae Early Instar and/or damaged			Haliplidae	
	Naididae		riecoptera	Capniidae			Helodidae Helophoridae	
	Tubificidae		1	Chloroperlidae		1	Hydraenidae	
Haplotaxida			1	Leuctridae			Hydrochidae	
	Haplotaxidae		1	Nemouridae			Hydrophilidae	
Leeches	Hirudinea]	Peltoperlidae		1	Limnichidae	
	Erpobdellidae			Perlidae			Noteridae	
	Glossiphoniidae		1	Perlodidae			Psephenidae	
	Hirudinidae Pisciolidae			Pteronarcyidae			Ptilodactylidae	
Branchiobdellida	Branchiobdellidae		Hemiptera	Taeniopeterygidae Early Instar and/or damaged		Dinter	Scirtidae	
Copepoda	Unknown		riemptera	Belostomatidae		Diptera	Early Instar and/or damaged Athericidae	
Decapoda	Cambaridae	-	1	Corixidae			Blephariceridae	
	Portunidae			Gelastocoridae			Canaceidae	
Shrimp			1	Gerridae			Ceratopogonidae	
	Palaemonidae			Hebridae			Choaboridae	
Isopoda				Hydrometridae			Chironomidae	87
Amphinada	Asellidae			Mesoveliidae			Culicidae	
Amphipoda	Crangonyctidae		1	Naucoridae Nanidae			Dixidae	
	Gammaridae			Nepidae Notonectidae			Dolichopodidae	
	Talitridae			Veliidae			Epididae	
Water Mites				Pleidae			Ephydridae Muscidae	
	Hydracarina		Neuroptera				Nymphomyiidae	
Ephemeroptera	Early Instar and/or damaged		· .	Sisyridae			Pelecorhynchidae	
	Acanthometropodidae		Megaloptera				Psychodidae	
	Ameletidae			Corydalidae			Ptychopteridae	
	Baetidae		<u></u>	Sialidae			Sciomyzidae	
	Baetiscidae		Trichoptera	Early Instar and/or damaged			Simuliidae	7
	Behningiidae			Branchycentridae			Stratiomyidae	
	Caenidae Ephemerellidae			Calamoceratidae			Syrphidae	
	Ephemeridae Ephemeridae			Glossosomatidae Goeridae			Tabanidae Tapudaridae	
	Heptageniidae	1		Heliicopsychidae			Tanyderidae Thaumaleidae	
	Isonychiidae			Hydropsychidae	1		Tripulidae	
	Leptophlebiidae			Hydroptilida	7		· -panddo	95
TOTAL:		2	TOTAL:		12	TOTAL:		



		Bent	hic Macre	oinvertebra	te and	Habitat Fi	eld Data	Sheet	5 000 医皮肤的	
Station ID:	1-B		Ecoregion:	Piedmont		Land Use:	Urban			
Field Team:	LLS/MN		Survey Reason	YR 2 Biomonitorin	ıg	Start time:				
Stream Name:	Glade		Location	Glade		Finish time:				
Date:	4/26/2012		Latitude:	38°55'26"		Longitude	-77°19'55"			
Stream Phys	iochemical M	leasureme	nts							
Instrument ID r	umber:	١	N/A	pl	1:	N/A				
Temperature:	_	N/A	_°C	Co	onductivity:	N/A	uS/cm			
Dissolved Oxyg	en:	N/A	mg/L		Did ins	trument pass all	oost-calibratio	n checks?	N/A	
			_		If NO- w	hich parameter(s) failed and ac	tion taken:	N/A	
Benthic Mad	roinvertebrat	e Collection	on					_		
Method Used:		Si	ngle Habitat (Rif	fle)		Multi Ha	abitat (Logs, Pl	ants, etc.)	Х	
Riffle Quality:		Good	1 <u>x</u>	Marginal		Poor		None		
Habitats Sample	ed:	Riffle	2 X	Snags		Banks	Х	Vegetation		
	# Jab	s:	15	_		_	5			
Weather Ob	servations							_		
Current Weathe	er	Cloudy	/X	Clear		Rain/Snow		Foggy		
Recent Precipita	ition	Clear	X	Showers		Rain		Storms		
Stream Flow		Low		Normal	Х	Above Normal		Flood		
Biological Ol	servations									
Periphyton		0	_	Salamanders		0		Other		
Filamentous Alg	ae	3	_	Warmwater Fish		1		0= Not observed		
Submerged Mad	· · · —	1		Coldwater Fish		0		1= Sparse		
Emergent Macro	ophytes	0	_	Beavers		0		2= Common to Al	oundant	
Crayfish	_	0	_	Muskrats		0		3= Dominant-		
Corbicula		0	_	Ducks/Geese		0		abnormally high		
unionidae	_	0	-	Snakes		0		are insignificant in		
Operculate Snai	s	0	_	Turtles 0			taxa. There can b		•	
Non-operculate	Snails	0		Frogs/Tadpoles		0		taxa are dominan	t such as algae	and snails
Notes										

High Gradient Habitat Data

		High Gradient Hai			
Habitat Parameter		Con	dition Category		CENTRAL PROPERTY.
Trabitat i arameter	Optimal	Suboptimal	Marginal	Poor	Score
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. 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 maintainance 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	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	17
2. Embeddedness	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			10 9 8 7 6	5 4 3 2 1 0	18
Velocity/Depth Regime	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	10
4. Sediment Deposition	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 pools prevalent.	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	19



	TO CASE AND LINE WAR OUT	WEST WARRANTS OF	Habitat Field Data	STATE OF THE PERSON	
Habitat Danswater	BELLEY COLOR SOLE KENN	Con	dition Category	MANUAL MANUAL STATES	Marie Barre
Habitat Parameter	Optimal	Suboptimal	Marginal	Poor	Scor
5. Channel Flow status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the availible channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the availible channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.	
Score	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	19
6. Channel Alteration	absent or minimal: stream width				
Score	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	16
7. Frequency of Riffles	ItO (), Astieta of papitat is key in				
Score	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	20
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 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.	
Score Left Bank	10 9	8 7 6	5 4 3	2 1 0	7
Score Right Bank	10 9	8 7 6	5 4 3	2 1 0	9
9. Vegetation Protection (score each bank) Note: Determine left or ight side by facing downstream.	Protection (score covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes; vegetation disruption through grazing or moving minimal or not evident: more than one-half of the		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 Left Bank	10 9	8 7 6	5 4 3	2 1 0	9
Score Right Bank	10 9	8 7 6	5 4 3	2 1 0	9
10. Riparian Vegetative Zone Width (score each ank 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 riperian zone <6 meters; little or no riparian vegetation due to human activities.	
Score Left Bank	10 9	8 7 6	5 4 3	2 1 0	10
Score Right Bank	10 9	8 7 6	5 4 3	2 1 0	9
White is the world of the second	CANADA PARA PARA PARA PARA PARA PARA PARA P	Total Score	The state of the s		172

	W	SSI BEN	ITHIC M	ACROINVERTEBR/	ATE BEN	ICH SHE	ET	
Job Name/#	THE STATE OF	Glade - 200		Sample subsorted by:		\BR		
Station ID:	H102 (11 12 10 1	Reach 1-E	3	Date Subsorted:	9/	26/12	- — Wetland	
Stream Name		The Glade	9	# of Grids subsorted		7	S_{tudies} and Solutions,	inc.
Date Sample	<u></u>	4/26/12		Total # of subsorted insec	oto:		Total # identified	100
Sampling Met		Multihabita	nt			103	Total # identified:	102
		Williabile		Sample Identified by:	P	BR	Date Identified:	9/26/12
Taxa Collect	ted:					-		
Porifera	Spongillidae	1	7	Metretopodidae Neoephemeridae		-	Lepidostomatidae	
Ostracoda	Unknown		-	Oligoneuridae		1	Leptoceridae Limnephilidae	
Flatworms	Tricladida		1	Psuedironidae		1	Molannidae	
	Planariidae	1	1	Polymitarcyidae		1	Odontoceridae	
Gastropoda	Unknown			Potamanthidae		1	Philopotamidae	
Limpets	Ancylidae		1	Siphlonuridae		1	Phryganeidae	
Snails	Immature]	Tricorythidae		1	Polycentropodidae	
	Lymnaeidae		Zygoptera	Early Instar and/or damaged		1	Psychomyiidae	
	Physidae			Calopterygidae		1	Ryacophilidae	
	Planorbidae]	Coenagrionidae]	Sericostomatidae	
	Hydrobiidae			Lestidae		1	Uenoidae	
	Pleuroceridae		1.	Protoneuridae		Lepidoptera	Early Instar and/or damaged	
Bivalvia	Viviparida e		Anisopteera	Early Instar and/or damaged			Pyralidae	
Divaivia	Immature Corbiculidae	-	-	Aeshnidae		Coleoptera	Early Instar and/or damaged	
	Sphaeriidae	48	-	Cordulegastridae	1		Chrysomelidae	
	Unionidae	40	-	Corduliidae Gomphidae		-	Curculionidae	
Oligochaeta	Unknown	16	1	Libellulidae		1	Dryopidae	
Lumbriculida			1	Macromiida e		-	Dytiscidae Elmidae	
	Lumbriculidae		1	Petaluridae		1	Gyrinidae	
Tubificida			1	Cordullidae/Libelluidae	├──	-	Haliplidae	
	Enchytraeidae		Plecoptera	Early Instar and/or damaged		1	Helodidae	
	Naididae			Capniidae		1	Helophoridae	
	Tubificidae		1	Chloroperlidae			Hydraenidae	
Haplotaxida]	Leuctridae		1	Hydrochidae	
	Haplotaxidae]	Nemouridae		1	Hydrophilida e	
Leeches	Hirudinea	1]	Peltoperlida e		1	Limnichidae	
	Erpobdellidae			Perlidae			Noteridae	
	Glossiphoniidae		1	Perlodidae			Psephenidae	
	Hirudinidae Pisciolidae		-	Pteronarcyidae			Ptilodactylidae	
Branchiobdellida	Branchiobdellidae		Homintoro	Taeniopeterygidae Early Instar and/or damaged			Scirtidae	
Copepoda	Unknown		Hemiptera	Belostomatidae		Diptera	Early Instar and/or damaged	
Decapoda	Cambaridae		1	Corixidae			Athericidae	
,	Portunidae			Gelastocoridae			Blephariceridae Canaceidae	
Shrimp			1	Gerridae			Ceratopogonidae	
	Palaemonidae		1	Hebridae			Choaboridae	
Isopoda				Hydrometridae			Chironomida e	34
	Asellidae			Mesoveliida e			Culicidae	
Amphipoda		1]	Naucoridae			Dixidae	
	Crangonyctidae			Nepidae			Dolichopodidae	
	Gammaridae			Notonectida e			Epididae	
344 . 345	Talitridae			Veliidae			Ephydridae	
Water Mites				Pleidae			Muscidae	
Ephemeroptera	Hydracarina Early Instar and/or damaged		Neuroptera	Oii-l			Nymphomyiidae	
Lpriemeroptera	Acanthometropodidae		Magalantara	Sisyridae			Pelecorhynchidae	
	Ameletidae		Megaloptera	Corydalidae			Psychodidae	
	Baetidae			Sialidae			Ptychopteridae Scientificae	
	Baetiscidae		Trichoptera	Early Instar and/or damaged			Sciomyzidae Simuliidae	
	Behningiidae		optolu	Branchycentridae			Stratiomyidae	
	Caenidae		1	Calamoceratidae			Syrphidae	
	Ephemerellidae			Glossosomatidae			Tabanidae	
	Ephemeridae			Goeridae			Tanyderidae	
	Heptageniidae			Heliicopsychidae			Thaumaleida e	
	Isonychiida e			Hydropsychidae			Tipulidae	1
	Leptophlebiidae			Hydroptilida		1		35
TOTAL:		66	TOTAL:		1	TOTAL:		



		Bent	hic Macro	oinvertebrat	e and	Habitat Fi	eld Data Sheet
Station ID:	1-C		Ecoregion:	Piedmont		Land Use:	Urban
Field Team:	LLS/MN		Survey Reason	YR 2 Biomonitoring	g	Start time:	
Stream Name:	Glade		Location:	Reston, Virginia		Finish time:	1
Date:	4/26/2012		Latitude:	38°55'23"		Longitude	-77°20'12"
Stream Phys	siochemical N	/leasureme	nts				
Instrument ID r	number:		N/A	рН	:	N/A	
Temperature:	_	N/A	° C	Coi	nductivity:	N/A	uS/cm
Dissolved Oxyg	en:	N/A	mg/L		Did ins	trument pass all	post-calibration checks? N/A
							s) failed and action taken: N/A
Benthic Mad	roinvertebra	te Collectio	n				
Method Used:		Si	ngle Habitat (Rifi	ie):		Multi Ha	abitat (Logs, Plants, etc.):
Riffle Quality:		Good	X	Marginal		Poor	None
Habitats Sample	ed:	Riffle	X	Snags		Banks:	
	# Ja	bs	20	<u></u>		_	
Weather Ob	servations						
Current Weath	er:	Cloudy	X	Clear		Rain/Snow	Foggy
Recent Precipita	ation:	Clear	X	Showers		Rain	
Stream Flow:		Low		Normal	X	Above Normal	
Biological O	bservations						
Periphyton	_	1		Salamanders		0	Other
Filamentous Alg	_	3		Warmwater Fish		1	0= Not observed
Submerged Ma	- '	0		Coldwater Fish		0	1= Sparse
Emergent Macr	ophytes _	0		Beavers		0	2= Common to Abundant
Crayfish	_	0		Muskrats		0	3= Dominant-
Corbicula	_	0		Ducks/Geese		0	abnormally high density where other taxa
unionidae	_	0		Snakes		0	are insignificant in relation to the dominant
Operculate Snai	_	0		Turtles		0	taxa. There can be situations where multiple taxa are dominant such as algae and snails
Non-operculate	Snails _	0		Frogs/Tadpoles		0	taxa are dominant such as algae and shalls
Votes							

High Gradient Habitat Data

nigh Gradient Habitat Data								
Habitat Parameter	Condition Category							
	Optimal	Optimal Suboptimal Marginal		Poor	Score			
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. 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 maintainance 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	19			
2. Embeddedness	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	18			
Velocity/Depth Regime	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	18			
4. Sediment Deposition	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 pools prevalent.	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	17			



	Benthic Macro	invertebrate and I	Habitat Field Data	Sheet				
			dition Catagoria					
Habitat Parameter	Condition Category Optimal Suboptimal Marginal Poor Score							
5. Channel Flow status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the availible channel; or <25% of channel substrate is exposed.		Very little water in channel and mostly present as standing pools.	Score			
Score	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	19			
6. Channel Alteration	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.	Channeliztion 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.				
Score	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	16			
7. Frequency of Riffles	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.				
Score	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	19			
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 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.				
Score Left Bank	10 9	8 7 6	5 4 3	2 1 0	9			
Score Right Bank	10 9	8 7 6	5 4 3	2 1 0	9			
9. Vegetation Protection (score each bank) Note: Determine left or right side by facing downstream.	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.	treambank surfaces and immediate riparian zone vered 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. 70-90% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation; common; less than 50% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation; disruption common; less than 50% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation; disruption of vegetation common; less than 50% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation; disruption obvious; patches of bare soil or closely cropped vegetation; disruption obvious; patches of bare soil or closely cropped vegetation; disruption obvious; patches of bare soil or closely cropped vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than 50% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation; disruption obvious; patches of bare soil or closely cropped vegetation; disruption obvious; patches of bare soil or closely cropped vegetation; disruption obvious; patches of bare soil or closely cropped vegetation; disruption obvious; patches of bare soil or closely cropped vegetation; disruption obvious; patches of bare soil or closely cropped vegetation; disruption obvious; patches of bare soil or closely cropped vegetation; disruption obvious; patches of bare soil or closely cropped vegetation; disruption obvious; patches of bare soil or closely cropped vegetation; disruption obvious; patches of bare soil or closely cropped vegetation; disruption obvious; patches of bare soil or closely cropped vegetation; disruption obvious;		streambank surfaces covered by vegetation; disruption of streambank vegetation is very				
Score Left Bank	10 9	8 7 6	5 4 3	2 1 0	10			
Score Right Bank	10 9	8 7 6	5 4 3	2 1 0	9			
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e. parking lots, roadbeds, clearcuts, 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 riperian zone <6 meters; little or no riparian vegetation due to human activities.				
Score Left Bank	10 9	8 7 6	5 4 3	2 1 0	10			
Score Right Bank	10 9	8 7 6	5 4 3	2 1 0	7			
		Total Score		AND THE PARTY OF T	180			

Job Name/# Glade - 2003		THIC MACROINVERTEBRATE Sample subsorted by:		ASO D	CSCEL				
						C,SG,EJ			
Station ID:		Reach 1-0		Date Subsorted:	6/2	29/12	Studies and Solutions,	Inc.	
Stream Name		The Glade	9	# of Grids subsorted		7	— aues and Solutions, man		
Date Sampled	i:	4/26/12	·	Total # of subsorted insects		119	Total # identified:	106	
Sampling Met	hod:	Multihabitat		Sample Identified by:	A	BR	Date Identified:	9/6/12	
Taxa Collect	ed:								
			_	Metretopodidae		1	Lepidostomatidae		
Porifera	Spongillidae			Neoephemeridae		1	Leptoceridae		
Ostracoda	Unknown		_	Oligoneuridae		1	Limnephilidae		
Flatworms	Tricladida]	Psuedironidae		1	Molannidae		
	Planariidae		_	Polymitarcyidae]	Odontoceridae		
Gastropoda	Unknown		_	Potamanthidae			Philopotamidae		
Limpets	Ancylidae		_	Siphlonuridae		1	Phryganeidae		
Snails	Immature		1	Tricorythidae]	Polycentropodidae		
	Lymnaeidae		Zygoptera	Early Instar and/or damaged			Psychomyiidae		
	Physidae		1	Calopterygidae			Ryacophilidae		
	Planorbidae		1	Coenagrionidae			Sericostomatidae		
	Hydrobiidae		4	Lestidae			Uenoidae		
	Pleuroceridae		4	Protoneuridae		Lepidoptera	Early Instar and/or damaged		
Pivoh:	Viviparidae		Anisopteera	Early Instar and/or damaged			Pyralidae		
Bivalvia	Immature		4	Aeshnidae		Coleoptera	Early Instar and/or damaged		
	Corbiculidae		4	Cordulegastridae			Chrysomelidae		
	Sphaeriidae		4	Corduliidae			Curculionidae		
Oligophoete	Unionidae		4	Gomphidae			Dryopidae		
Oligochaeta Lumbriculida	Unknown	4	-	Libellulidae			Dytiscidae		
Lumbriculida	Lumbriculida		-	Macromiidae			Elmidae	1	
Tubificida	Lumbriculidae		-	Petaluridae			Gyrinidae		
Tubiliciua	Enchytraeidae			Cordullidae/Libelluidae			Haliplidae		
	Naididae		Plecoptera	Early Instar and/or damaged			Helodidae		
	Tubificidae		1	Capniidae			Helophoridae		
Haplotaxida	Tubilicidae		1	Chloroperlidae Leuctridae			Hydraenidae		
паргоналиц	Haplotaxidae		1	Nemouridae			Hydrochidae		
Leeches	Hirudinea			Peltoperlidae			Hydrophilidae		
20001100	Erpobdellidae		1	Perlidae			Limnichidae		
	Glossiphoniidae		1	Perlodidae			Noteridae		
	Hirudinidae		1	Pteronarcyidae			Psephenidae		
	Pisciolidae		1	Taeniopeterygidae			Ptilodactylidae		
Branchiobdellida	Branchiobdellidae		Hemiptera	Early Instar and/or damaged		Diptera	Scirtidae Early Instar and/or damaged		
Copepoda	Unknown	2		Belostomatidae		Dipleia	Athericidae		
Decapoda	Cambaridae			Corixidae			Blephariceridae		
	Portunidae			Gelastocoridae			Canaceidae		
Shrimp				Gerridae			Ceratopogonidae		
	Palaemonidae			Hebridae			Choaboridae		
sopoda				Hydrometridae			Chironomidae	96	
	Asellidae			Mesoveliidae			Culicidae		
Amphipoda				Naucoridae			Dixidae		
	Crangonyctidae			Nepidae			Dolichopodidae		
	Gammaridae			Notonectidae			Epididae		
	Talitridae			Veliidae			Ephydridae		
Vater Mites				Pleidae			Muscidae		
	Hydracarina		Neuroptera			i	Nymphomyiidae		
phemeroptera	Early Instar and/or damaged			Sisyridae			Pelecorhynchidae		
	Acanthometropodidae		Megaloptera				Psychodidae		
	Ameletidae			Corydalidae			Ptychopteridae		
	Baetidae			Sialidae			Sciomyzidae		
	Baetiscidae		Trichoptera	Early Instar and/or damaged			Simuliidae		
	Behningiidae			Branchycentridae			Stratiomyidae		
	Caenidae			Calamoceratidae		ĺ	Syrphidae		
	Ephemerellidae			Glossosomatidae			Tabanidae		
	Ephemeridae			Goeridae			Tanyderidae		
	Heptageniidae			Heliicopsychidae			Thaumaleidae		
	Isonychiidae Leptophlebiidae			Hydropsychidae Hydroptilida	1		Tipulidae		
					2	_		97	