

Final Report
For
2018 Jordan River Watershed Assessment

Prepared For:

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INTRODUCTION

Great Lakes Environmental Center, Inc. (GLEC) has completed an assessment for the Friends of the Jordan River Watershed, Inc. at five tributaries to the Jordan River. The assessment consisted of the quantification of physical habitat and macroinvertebrate populations, in-situ measurements of water temperature, dissolved oxygen (DO), pH, and specific conductance, stream discharge calculations, and the collection of samples for total phosphorus (TP) and nitrate/nitrite-nitrogen (N) analysis at each of the five sites. The study was conducted to document existing conditions and serve as a baseline environmental assessment that would support future trend analyses.

Listed below are the five study sites that were sampled in 2018:

1. Severance Creek at Mount Bliss Road:

Lat: 45.103551, Lon: -85.089728

2. Bartholomew Creek at M-66:

Lat: 45.097862, Lon: -85.107849

3. Sutton Creek at Mount Bliss Road:

Lat: 45.062311, Lon: -85.055542

4. Cokirs Creek at Chestonia Bridge Road MDNR Access Site:

Lat: 45.060332, Lon: -85.071867

5. Landslide Creek at Pinney Bridge Road:

Latitude (Lat): 45.012343, Longitude (Lon): -85.023313

METHODS

For each site, a 50 meter stretch of river, upstream of the coordinates and road/stream crossing, served as the study area. The Michigan Department of Environmental Quality (MDEQ) Great Lakes Environmental Assessment Section (GLEAS), Procedure 51 (P51), Qualitative Biological and Habitat Survey Protocols for Wadeable Streams and Rivers, Revised December 2008

(MDEQ 2008) was followed for a habitat and macroinvertebrate assessment at each study site. In-situ data, stream discharge measurements, and nutrient chemistry samples were collected and analyzed according to GLEC's Standard Operating Procedures (SOPs). GLEC's Nutrient Chemistry laboratory is certified by the National Environmental Laboratory Accreditation Program (NELAP).

Macroinvertebrate Collection

The abundance and diversity of aquatic macroinvertebrate communities are commonly used as indicators of the overall quality of a stream. Assessment of the macroinvertebrate communities at five tributaries to the Jordan River was completed to characterize the stream condition at each location. All locations were assessed using the MDEQ GLEAS Procedure 51 which is accepted by both federal and state agencies as an accurate, consistent, and repeatable sampling and analytical protocol for Michigan streams.

Macroinvertebrate samples were collected from the five study sites on August 1, 2018. A D-frame dip net with 500-micron mesh was used to collect macroinvertebrates, in an upstream direction, from a 50 meter length of stream at each site. All available habitats were sampled, including fast and slow moving water areas, hard and soft substrates, vegetated areas, undercut banks, and woody material. Large cobble and logs were sampled by hand picking larger macroinvertebrates. Debris collected at each site was composited into a bucket with a 500-micron mesh screen bottom. Following collection, the debris in the bucket was placed in 1-Liter Nalgene bottles and preserved with 90% ethanol. Macroinvertebrate samples were returned to the laboratory where they were identified to the family level using a 10x dissecting microscope, until a total count of 300 or more organisms per sample was reached.

Scoring and interpretation of macroinvertebrate community data also followed the methods outlined in Procedure 51. A set of nine metrics was used to score community data in comparison to sites considered as Excellent within the North Central Hardwood Forests Ecoregion. Each metric was given a score of 1 (better than average), 0 (average), or -1 (worse than average). Scores for each metric were summed for a final site score. The Procedure 51 data results were entered into a spreadsheet and used to calculate the following nine metrics for each study site in order to provide a qualitative rating of the macroinvertebrate community.

- Total number of taxa. Taxa (taxa is plural for taxon, which refers to a taxonomic category, such as family, genus, or species) richness and species diversity are standard indicators of healthy and stable biological communities. This metric evaluates the total number of taxa found and rates diverse systems higher than monotypic communities.
- Number of mayfly taxa. The total number of mayfly taxa is used as an overall indicator of stream quality. Mayflies are, as a group, considered to be intolerant to pollution and degraded habitats. Their presence, in abundance, is therefore rated high in this metric.
- Number of caddisfly taxa. Like mayflies, caddisflies are pollution intolerant. Areas containing high numbers of caddisflies are given higher metric values. However, several species can tolerate varying degrees of habitat degradation.
- Number of stonefly taxa. Stoneflies are the most sensitive to, and intolerant of, poor water quality and degraded habitats. Their presence is often an indicator of excellent water quality.
- Percent mayfly composition. This metric weights the presence of mayflies in relation to the total number of species found. As with the total number of mayfly taxa, the percent composition of mayflies can drastically decline with stream quality degradation.
- Percent caddisfly composition. This metric weights the number of caddisflies found in relation to the total number of species found within the sample area.
- Percent contribution of dominant taxa. This metric calculates the ratio of the number of dominant taxa found to the total number of organisms collected. The results provide an indication of community structure and balance. Those areas dominated by few species, or composed of several taxa but strongly dominated by one, indicate lower quality systems.
- Percent isopods, snails, and leeches. Taxa from these 3 groups are tolerant to a wide variety and range of environmental conditions. High percent abundance of these animals is a good indicator of degraded stream habitats and low water quality.
- Percent surface air breathers. Surface dependent taxa are tolerant of poor water quality and refer to invertebrates that obtain oxygen through direct atmospheric exchange, usually at the air/water interface. High abundance of these animals is an indication of diurnal oxygen changes or other biological or chemical oxygen use. These taxa are also found in streams with higher temperatures and lower, erratic flows that typically have low or fluctuating dissolved oxygen concentrations.

The application of the Procedure 51 protocol results in a score based on a scale of -9 to 9; -9 to -5 is rated as Poor, -4 to 4 is rated as Acceptable, and a score greater than 4 is rated as Excellent. Generally speaking, flowing waters which harbor a high diversity of macroinvertebrates, including taxa sensitive to pollution and habitat degradation (e.g., mayfly, caddisfly, and stonefly taxa), are of high water and habitat quality. Water bodies with low diversity of the macroinvertebrate community often have very high numbers of tolerant organisms, due to their ability to thrive in degraded conditions with little competition or predation.

Habitat

The physical characteristics of each site were documented using MDEQ's Habitat Assessment Stream Card and Field Data Sheet, included in the 2008 Procedure 51 protocol. The following stream habitat characteristics were documented: riparian vegetation, watershed features, stream characterization, instream features, aquatic vegetation, water quality, and sediment characterization. Ten metrics were used to score habitat quality. Data collection was based on visual observations and best professional judgment.

In-situ measurements of Water Temperature, Dissolved Oxygen, pH, Specific Conductance, and Stream Discharge

In-situ measurements of water temperature, dissolved oxygen, pH, and specific conductance were taken at each site using a YSI Pro DSS multiparameter meter. The meter was calibrated prior to use following the user manual and GLEC SOP FLD 6030. Measurements were taken at mid-depth of the thalweg (approximately the center of the stream current). Stream discharge was calculated using a series of width, depth, and velocity measurements from one cross-section of the stream. Velocity measurements were taken using an OTT MF Pro Stream Portable Flow Meter and following GLEC SOP FLD 6034.

Nutrient Chemistry Samples: Total Phosphorus and Nitrate/Nitrite-Nitrogen

Samples for total phosphorus and nitrate/nitrite-nitrogen were collected in pre-preserved glass sample bottles and stored on ice immediately after collection. Samples were submitted to the GLEC Nutrient Chemistry laboratory where they were stored at 0 to 6°C until analysis. Samples were analyzed according to GLEC SOPs: CHM 2001 and CHM 2008 and all tests were

performed within the maximum holding times. Results have met or exceeded QC criteria and are in compliance with The NELAC Institute Standards.

RESULTS

Macroinvertebrate Assessment

Macroinvertebrate samples from the five study sites in the Jordan River Watershed contained 39 different taxa. Chironomidae (midges) dominated the sample collections in three of the five study sites; Severance Creek, Bartholomew Creek, and Landslide Creek. Sutton Creek was dominated by amphipods, closely followed by Baetidae (mayflies) and Nemouridae (stoneflies). Cokirs Creek was dominated by Hydropsychidae (caddisflies), closely followed by Baetidae (mayflies) (Appendix 1). Invertebrates considered sensitive to poor water and habitat quality (i.e., mayflies, caddisflies, or stoneflies) were collected at all five sites. Taxa richness ranged from 17 to 26 taxa per site. The macroinvertebrate community scores at all five sites scored as either Acceptable or Excellent. Severance Creek, Bartholomew Creek, Sutton Creek, and Landslide Creek scored Acceptable tending towards Excellent and Cokirs Creek scored Excellent (Table 1, Appendix 1).

Table 1. Macroinvertebrate Community Ratings for the Jordan River Watershed Assessment, August 2018.

Study Site	Macroinvertebrate Community Score and Rating, August 2018
Severance Creek at Mount Bliss Road	2 (Acceptable tending towards Excellent)
Bartholomew Creek at M-66	2 (Acceptable tending towards Excellent)
Sutton Creek at Mount Bliss Road	4 (Acceptable tending towards Excellent)
Cokirs Creek at Chestonia Bridge Rd. MDNR Access Site	5 (Excellent)
Landslide Creek at Pinney Bridge Road	3 (Acceptable tending towards Excellent)

An additional description of the macroinvertebrate samples and community ratings from each site is provided below.

Severance Creek at Mount Bliss Road

Chironomidae (midges) dominated the macroinvertebrate sample (40%) collected at Severance Creek. A total of 20 different taxa were present including two families of mayflies, one family of stoneflies, and two families of caddisflies. These organisms are considered sensitive to poor water and habitat quality. The macroinvertebrate community score rated as 2 (Acceptable tending towards Excellent) at this location.

Bartholomew Creek at M-66

Chironomidae was the dominant taxa in this sample (24%), followed closely by Amphipods (scuds) (23%). Twenty five total taxa were found at this site including two families of mayflies, five families of caddisflies, and one family of stoneflies. The macroinvertebrate community score rated as 2 (Acceptable tending towards Excellent) for Bartholomew Creek.

Sutton Creek at Mound Bliss Road

Sutton Creek was dominated by Amphipods (21%), followed closely by Baetidae (mayflies) and Nemouridae (stoneflies) (both 20%). A total of 18 different taxa were found in Sutton Creek

including two families of mayflies, three families of caddisflies, and one family of stoneflies. The Sutton Creek community score for this location rated as 4 (Acceptable tending towards Excellent) for 2018.

Cokirs Creek at Chestonia Bridge Road/Access Site

Cokirs Creek was dominated by Hydropsychidae (caddisflies) (22%), followed closely by Baetidae mayflies (22%). Seventeen different taxa were found in 2018 including three families of mayflies and four families of caddisflies. No stoneflies were found at this site. The macroinvertebrate community score rated as 5 (Excellent) for this location.

Landslide Creek at Pinney Bridge Road

Landslide Creek was dominated by Chironomidae (33%). At this location, 26 different taxa were found including two families of mayflies, seven families of caddisflies, and one family of stoneflies. The macroinvertebrate community score for Landslide Creek was 3 (Acceptable tending towards Excellent) in 2018.

Habitat Assessment

The study sites were located in Michigan's North Central Hardwood Forest ecoregion. At the time of observation and sampling, all streams were running at stable, baseflow discharges with average depths ranging between 0.3 and 2.0 feet. Severance Creek and Sutton Creek were rated as Good and Bartholomew Creek, Cokirs Creek, and Landslide Creek were rated as Excellent during the rapid physical habitat assessment. Habitat assessment scores are presented in Table 2 and copies of the habitat field datasheets are included in Appendix 2.

Sedge meadow species dominated the riparian vegetation at Bartholomew Creek and Landslide Creek. Severance Creek was dominated by willows while Sutton Creek and Cokirs Creek were dominated by various pine tree species. In-stream aquatic vegetation was sparse at most of the study sites with the exception of Bartholomew Creek. Bartholomew Creek meanders through a wetland sedge meadow near the crossing with M-66 which resulted in 100% of the reach containing rooted emergent aquatic vegetation. The reach sampled in Cokirs Creek was

approximately 5% covered with rooted submergent aquatic vegetation while Severance Creek, Sutton Creek, and Landslide Creek had little to no in-stream aquatic vegetation.

Stream substrates for Cokirs Creek and Landslide Creek consisted of a mixture of sand, gravel, cobble, and boulder with Cokirs Creek dominated by cobble and Landslide Creek dominated by sand. Severance Creek, Sutton Creek, and Bartholomew Creek were dominated by sandy substrate with lesser amounts of silt, gravel, and cobble. Large woody debris was sparse at Severance Creek, Bartholomew Creek, and Cokirs Creek, present in a moderate amount at Sutton Creek and extensive at Landslide Creek. Undercut banks were extensive at Bartholomew Creek and Landslide Creek and sparse at the remaining sites. Overhanging vegetation was sparse to moderate at all sites except Bartholomew Creek where the entire stream was covered by overhanging wetland plants.

Table 2. Habitat Characterization Ratings for the Jordan River Watershed Assessment, August 2018.

Study Site	Rapid Habitat Score and Rating, August 2018
Severance Creek at Mount Bliss Road	152 (Good)
Bartholomew Creek at M-66	166 (Excellent)
Sutton Creek at Mount Bliss Road	138 (Good)
Cokirs Creek at Chestonia Bridge Rd./Access Site	171 (Excellent)
Landslide Creek at Pinney Bridge Road	171 (Excellent)

In-situ Measurements, Stream Discharge and Nutrient Chemistry Results

Water temperature ranged from 14.4°C at Bartholomew Creek to 18.5°C at Severance Creek. Dissolved oxygen ranged from 8.7 mg/L at Severance Creek to 10.5 mg/L at Landslide Creek. pH values were very similar for all sites and ranged from 7.84 to 7.98. Similarly, specific conductance readings had a narrow range between sites and ranged from 374 µS/cm at Landslide Creek to 471 µS/cm at Sutton Creek (Table 3).

Stream discharge ranged from 9,875 gallons/hour at Severance Creek to 809,165 gallons/hour at Landslide Creek (Table 3).

Landslide Creek had the lowest total phosphorus concentration (0.0057 mg/L) and highest nitrogen concentration (0.530 mg/L). Cokirs Creek had the highest total phosphorus concentration (0.0133 mg/L). Severance Creek had the lowest nitrogen concentration (0.051 mg/L) (Table 3 and Appendix 3).

Table 3. In-situ Measurements, Stream Discharge and Nutrient Chemistry Results for the Jordan River Watershed Assessment, August 2018.

Study Site	Water Temperature (°C)	Dissolved Oxygen (mg/L)	pH	Specific Conductance (µS/cm)	Stream Discharge (gallons/hour)	Total Phosphorus (mg/L)	Nitrate/Nitrite – Nitrogen (mg/L)
Severance Creek at Mount Bliss Road	18.5	8.7	7.95	441	9,875	0.0091	0.051
Bartholomew Creek at M-66	14.4	10.2	7.90	429	26,566	0.0103	0.268
Sutton Creek at Mount Bliss Road	14.6	10.4	7.98	471	19,876	0.0105	0.103
Cokirs Creek at Chestonia Bridge Rd./Access Site	17.2	9.1	7.87	399	11,466	0.0133	0.468
Landslide Creek at Pinney Bridge Road	15.4	10.5	7.84	374	809,165	0.0057	0.530

CONCLUSIONS

GLEC staff completed a macroinvertebrate and habitat assessment, recorded in-situ measurements for water temperature, dissolved oxygen, pH, and specific conductance, calculated stream discharge, and collected nutrient samples at five tributaries to the Jordan River: Severance Creek, Bartholomew Creek, Sutton Creek, Cokirs Creek, and Landslide Creek, during the summer of 2018. Sample collections for the macroinvertebrate and habitat assessment, and the scoring and interpretation of data, followed MDEQ Procedure 51, which describes qualitative biological and habitat survey protocols for wadeable streams. Summaries of the assessments and Procedure 51 results are presented in Tables 1-2. In-situ measurements, stream discharge, and nutrient chemistry results are presented in Table 3 and were collected and analyzed according to GLEC SOPs.

Severance Creek scored as Acceptable for the macroinvertebrate community and rated Good for physical habitat. It appeared that the stream channel had recently shifted to a new location during a high flow event and therefore the stream banks were only moderately stable and riparian vegetation had not yet reestablished along the immediate riparian zone. Deep pools were frequent and the bottom substrate was not yet fully prepared for colonization by macroinvertebrates. However, the stream channel was sinuous and the riparian zones on either side were wide and full of established, mature vegetation. Severance Creek had a low percentage of mayfly taxa and a high percent dominance of one taxa (chironomids). There was a low percentage of isopods/snails/leeches and of surface dependent taxa, and a high total number of taxa found.

The macroinvertebrate community rated as Acceptable for Bartholomew Creek because it had a low percentage of mayflies and high percentage of isopods/snails/leeches. However, 25 total taxa were found including a high number of caddisfly taxa. There were also very few surface dependent taxa found. The physical habitat at Bartholomew Creek rated as Excellent. The surrounding wetland meadow and mixed forest created excellent vegetative protection of the stream banks which resulted in stable substrates and maintained stream flow. The riparian zone was wide on both sides and was minimally impacted by human activities.

The macroinvertebrate community at Sutton Creek rated as Acceptable and the habitat scored as Good. Although Sutton Creek had the lowest percent dominance of one taxa of all the sites visited and a low percentage of isopods/snails/leeches, it also had a low percentage of caddisfly taxa and the highest percentage of surface dependent taxa of all sites visited which reduced its macroinvertebrate community score. The banks of Sutton Creek were stable and it appeared that the stream flow is maintained continuously with little evidence of high flow events. However, human activities (pasture) are impacting the riparian zone on the right bank and sediment deposition is causing some embeddedness of the substrate.

The macroinvertebrate community at Cokirs Creek rated as Excellent because it had a high number of mayfly and caddisfly taxa for that size stream and also a low percent dominance of one taxa, low percentage of isopods/snails/leeches, and low percentage of surface dependent taxa. The physical habitat at Cokirs Creek also rated as Excellent; it had a good mix of stable habitat to allow for colonization by macroinvertebrates, a stable stream channel, a good mix of bends and riffles, and good vegetative protection in the immediate riparian zone.

Landslide Creek had a low percentage of surface dependent macroinvertebrates, the highest total number of taxa found of all the sites visited, and seven different families of caddisflies. However, the percent dominance of one taxa (chironomids) was high and we would expect to find more mayfly taxa for this size stream. For these reasons, the macroinvertebrate community rated as Acceptable. The physical habitat, however, scored very high and rated as Excellent. Both banks were very stable and well protected from erosion due to established riparian vegetation. The channel had minimal alteration and it was evident that the stream flow is consistent. Large woody debris was found frequently in the channel which provides colonization potential for fish and macroinvertebrates.

For all study sites, in-situ measurements were within acceptable ranges for flowing waters in Northern Michigan and met or exceeded the Michigan surface water standards and criteria. The slightly higher water temperatures recorded at Severance Creek and Cokirs Creek may indicate that these creeks have a greater proportion of surface water input than the others. Stream

discharges were calculated to document existing conditions and serve as a baseline to support future studies.

GLEC's Nutrient Chemistry laboratory analyzed samples collected at each study site for total phosphorus (TP) and nitrate/nitrite-nitrogen (N) levels. Average background concentrations of TP and N in Michigan rivers are 0.0300 mg/L and 0.500 mg/L, respectively. In our experience working with Northern Michigan rivers, TP levels in good water quality streams range from 0.0030 mg/L to 0.0150 mg/L. TP values at all sites visited during this study fell within this range. N values between 0.010 mg/L and 0.100 mg/L are considered low in Michigan rivers and 0.500 mg/L and below is typical for Northern Michigan rivers. The highest concentration of N found at the study sites was 0.530 mg/L at Landslide Creek while Severance Creek and Sutton Creek had N values near or below 0.100 mg/L. Therefore, N values for all study sites fell within the typical range found in Northern Michigan rivers.

Recommendations for Future Work

This study was conducted to document existing conditions and to serve as a baseline environmental assessment that would support future trend analyses. It is recommended that these sites be visited again in three years.

REFERENCES

GLEC SOP CHM 2001. Standard Operating Procedure for the Determination of Total Phosphorus in Water Samples.

GLEC SOP CHM 2008. Standard Operating Procedure for the Determination of Nitrate plus Nitrite Nitrogen in Water Samples – Automated Hydrazine Reduction.

GLEC SOP FLD 6030. Standard Operating Procedure for Use of the YSI ProDSS Multiparameter Meter.

GLEC SOP FLD 6034. Standard Operating Procedure for Measuring Velocity and Discharge with an OTT MF Pro Portable Flow Meter.

Michigan Department of Natural Resources (MDEQ). 2008. Qualitative Biological and Habitat Survey Protocols for Wadeable Streams and Rivers (Procedure 51). Great Lakes and Environmental Assessment Section, Revised December 2008. Michigan Department of Natural Resources. Lansing, Michigan.

APPENDIX 1

Macroinvertebrate Communities

APPENDIX 1

Macroinvertebrate Scores for five study sites in the Jordan River Watershed Ecoregion: North Central Hardwood Forest

Severance Creek	Value	2018 Score
Total Taxa	20	1
Mayfly Taxa	2	1
Caddisfly Taxa	2	0
Stonefly Taxa	1	0
% Mayfly	2.8%	-1
% Caddisfly	24%	0
% Dominance	40%	-1
% Isopod, Snail, Leech	0.6%	1
% Surface Dependent	0.3%	1
Total Score		2 Acceptable, tending towards Excellent

Bartholomew Creek	Value	2018 Score
Total Taxa	25	1
Mayfly Taxa	2	1
Caddisfly Taxa	5	1
Stonefly Taxa	1	0
% Mayfly	7.8%	-1
% Caddisfly	20%	0
% Dominance	24%	0
% Isopod, Snail, Leech	2.5%	-1
% Surface Dependent	0.9%	1
Total Score		2 Acceptable, tending towards Excellent

APPENDIX 1

Sutton Creek	Value	2018 Score
Total Taxa	18	1
Mayfly Taxa	2	1
Caddisfly Taxa	3	1
Stonefly Taxa	1	0
% Mayfly	21%	0
% Caddisfly	3.2%	-1
% Dominance	21%	1
% Isopod, Snail, Leech	0.9%	1
% Surface Dependent	1.2%	0
Total Score		4 Acceptable, tending towards Excellent

Cokirs Creek	Value	2018 Score
Total Taxa	17	1
Mayfly Taxa	3	1
Caddisfly Taxa	4	1
Stonefly Taxa	0	-1
% Mayfly	29%	0
% Caddisfly	32%	0
% Dominance	22%	1
% Isopod, Snail, Leech	0%	1
% Surface Dependent	0%	1
Total Score		5 Excellent

APPENDIX 1

Landslide Creek	Value	2018 Score
Total Taxa	26	1
Mayfly Taxa	2	0
Caddisfly Taxa	7	1
Stonefly Taxa	1	0
% Mayfly	22%	0
% Caddisfly	21%	0
% Dominance	33%	0
% Isopod, Snail, Leech	1.9%	0
% Surface Dependent	0.5%	1
Total Score		3 Acceptable, tending towards Excellent

APPENDIX 1

2018 Macroinvertebrate Identification Results for Jordan River Watershed Assessment

	Order	Family	Severance Creek	Bartholomew Creek	Sutton Creek	Cokirs Creek	Landslide Creek
Nematoda							1
Oligochaeta			5	39	8	2	11
Crustacea		Amphipoda	26	73	72		
		Isopoda	1	1	2		1
Arachnoidea		Hydracarina	3	3	5	2	7
Insecta	Ephemeroptera	Baetidae		16	70	93	73
		Ephemerellidae	1	9		29	19
		Heptageniidae	8		1	2	
	Odonata	Aeshnidae	1	1	5	2	
		Calopterygidae	9			20	
	Plecoptera	Nemouridae	5	2	70		2
	Hemiptera	Gerridae		1	1		
		Velidae	1	1	3		
	Megaloptera	Corydalidae	2			1	
		Sialidae	1	1			
	Trichoptera	Brachycentridae				2	23
		Glossosomatidae				25	
		Hydropsychidae	45	42	7	95	1
		Lepidostomatidae		11	3		50
		Limnephilidae		5			1
		Phryganeidae		1			
		Polycentropodidae					3
		Philopotamidae	31	5		17	4
		Rhyacophilidae			1		9
	Lepidoptera	Pyralidae					1
	Coleoptera	Dytiscidae		1			
		Elmidae	10	1	40	5	28
		Gyrinidae					2
	Diptera	Ceratopogonidae	2	1		1	2
		Chironomidae	128	75	49	85	139
		Dixidae		2			1
		Empididae	5	3			10
		Psychodidae				1	
		Simuliidae	36	18	4	50	20
		Tipulidae			1		3
	Gastropoda	Ancylidae	1				
		Hydrobiidae		1			1
		Physidae		6	1		6
	Pelecypoda	Sphaeriidae					8
		Total Individuals	321	319	343	432	426
		Total Taxa	20	25	18	17	26

APPENDIX 2

Habitat Evaluation

Severance Creek

APPENDIX J. STREAM CARD

Shaded fields are entered into database

STREAM NAME <u>SEVERANCE CREEK</u>		LOCATION (road crossing) <u>1ST MOUNT BLISS RD</u>
COUNTY/TOWNSHIP	T R S	
LAT(dd)	LONG(dd)	RIVER BASIN <u>JORDAN RIVER</u>
STORET #	HUC CODE	ECOREGION
INVESTIGATOR(S) <u>J. Stricko</u> <u>M. Van Den Brand</u>	DATE <u>8/1/2018</u> TIME <u>1000</u> <u>AM</u> PM	REASON FOR SURVEY <input checked="" type="checkbox"/> Targeted: comment _____ <input type="checkbox"/> Randomized: VSEC # _____ VSEC description (eg. cold small) _____

WEATHER CONDITIONS	
Current <input type="checkbox"/> Sunny <input checked="" type="checkbox"/> Partly Cloudy <input type="checkbox"/> Cloudy <input type="checkbox"/> Rainy	Has there been a significant rain in the last 7 days? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Don't Know Air Temperature <u>80</u> °F

RIPARIAN VEGETATION	
Indicate the dominant type and record the dominant species	
<input checked="" type="checkbox"/> Trees <input type="checkbox"/> Grasses Estimate buffer width (left) <u>100</u> ft (right) <u>100</u> ft	<input type="checkbox"/> Shrubs <input type="checkbox"/> Herbaceous Species: <u>Willow</u>

WATERSHED FEATURES	
Predominant Surrounding Land Use <input type="checkbox"/> Forest <input type="checkbox"/> Commercial <input type="checkbox"/> Field/Pasture <input type="checkbox"/> Industrial <input type="checkbox"/> Agricultural <input type="checkbox"/> Residential <input type="checkbox"/> Other _____	Local Watershed NPS Pollution <input checked="" type="checkbox"/> No evidence <input type="checkbox"/> Some potential sources <input type="checkbox"/> Obvious Sources Local Watershed Erosion <input type="checkbox"/> None <input checked="" type="checkbox"/> Moderate <input type="checkbox"/> Heavy

STREAM CHARACTERIZATION	
Stream Subsystem <input checked="" type="checkbox"/> Perennial <input type="checkbox"/> Intermittent <input type="checkbox"/> Lake Outlet Influenced <input type="checkbox"/> Dam Influenced	Stream Modifications <input checked="" type="checkbox"/> None <input type="checkbox"/> Dredged <input type="checkbox"/> Canopy Removal <input type="checkbox"/> Snagging <input type="checkbox"/> Impounded <input type="checkbox"/> Relocated <input type="checkbox"/> Bank Stabilization <input type="checkbox"/> Habitat Improvement
Stream Origin <input type="checkbox"/> Spring Fed <input type="checkbox"/> Lake/Pond <input checked="" type="checkbox"/> Swamp, Marsh, Bog <input type="checkbox"/> Mixture of origins <input type="checkbox"/> Other _____	Stream Type <input type="checkbox"/> Coldwater <input checked="" type="checkbox"/> Warmwater

INSTREAM FEATURES	
Avg. Stream Width <u>45</u> ft	Avg. Stream Depth <u>0.5</u> ft
Surface Velocity _____ ft/sec	Est. Flow _____ cfs
(at thalweg)	
Est. Survey Reach Length <u>50</u> ft	
Survey Reach Area _____ ft ²	High Water Mark _____ ft
Canopy Cover: <u>30</u> % Shaded	

AQUATIC VEGETATION	
<input type="checkbox"/> Rooted emergent <input type="checkbox"/> Rooted submergent <input type="checkbox"/> Rooted floating	<input type="checkbox"/> Free Floating <input type="checkbox"/> Floating algae <input type="checkbox"/> Attached algae
Portion of the reach with aquatic vegetation <u>0</u> %	
Nuisance aquatic plants or slimes present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	
Dominant species present _____	

WATER QUALITY	
Temperature <u>68</u> °F	Solids, Turbidity <input checked="" type="checkbox"/> Clear <input type="checkbox"/> Slightly turbid <input type="checkbox"/> Turbid <input type="checkbox"/> Floating solids <input type="checkbox"/> Suspended solids <input type="checkbox"/> Settleable solids <input type="checkbox"/> Foams
Water Samples Taken <input type="checkbox"/> None <input checked="" type="checkbox"/> Other <u>TP1N</u> <input type="checkbox"/> GA <input type="checkbox"/> GN <input type="checkbox"/> MA <input type="checkbox"/> MN <input type="checkbox"/> VOA <input type="checkbox"/> ON	Color <input checked="" type="checkbox"/> Clear <input type="checkbox"/> Stained <input type="checkbox"/> Opaque <input type="checkbox"/> Colored _____ <input type="checkbox"/> Other _____
	Surface Oils <input checked="" type="checkbox"/> None <input type="checkbox"/> Sheen <input type="checkbox"/> Globbs <input type="checkbox"/> Flecks <input type="checkbox"/> Slick <input type="checkbox"/> Other _____
	Water Odors <input checked="" type="checkbox"/> Normal/None <input type="checkbox"/> Sewage <input type="checkbox"/> Petroleum <input type="checkbox"/> Chemical <input type="checkbox"/> Fishy <input type="checkbox"/> Other _____

SEDIMENT	
Sediment Samples Taken <input checked="" type="checkbox"/> None <input type="checkbox"/> Other _____ <input type="checkbox"/> MS <input type="checkbox"/> GS <input type="checkbox"/> VOA <input type="checkbox"/> OS/BNA	Oils <input checked="" type="checkbox"/> Absent <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Profuse
Looking at stones that are not deeply embedded, are the undersides black in color? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Sediment Odors <input checked="" type="checkbox"/> Normal/None <input type="checkbox"/> Sewage <input type="checkbox"/> Petroleum <input type="checkbox"/> Chemical <input type="checkbox"/> Anaerobic <input type="checkbox"/> Other _____
	Deposits <input checked="" type="checkbox"/> None <input type="checkbox"/> Sludge <input type="checkbox"/> Sawdust <input type="checkbox"/> Paper fiber <input type="checkbox"/> Sand <input type="checkbox"/> Relict shells <input type="checkbox"/> Other _____

Severance Creek

APPENDIX J (Continued)

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 Reach
Bedrock		0	Detritus	Sticks, wood, coarse plant material (CPOM)	5
Boulder	>10"	0	Muck-Mud	black, very fine organic (FPOM)	10
Cobble	2.5"-10"	5	Other		
Gravel	0.1"-2.5"	10			
Sand	Gritty (course)	20 40			
Silt	Gritty (fine)	45			
Clay	slick				

Proportion of Reach Represented by Stream

Morphology Types

- ☒ Riffle 5 %
☒ Run 85 %
☒ Pool 10 %
☐ Depositional _____ %

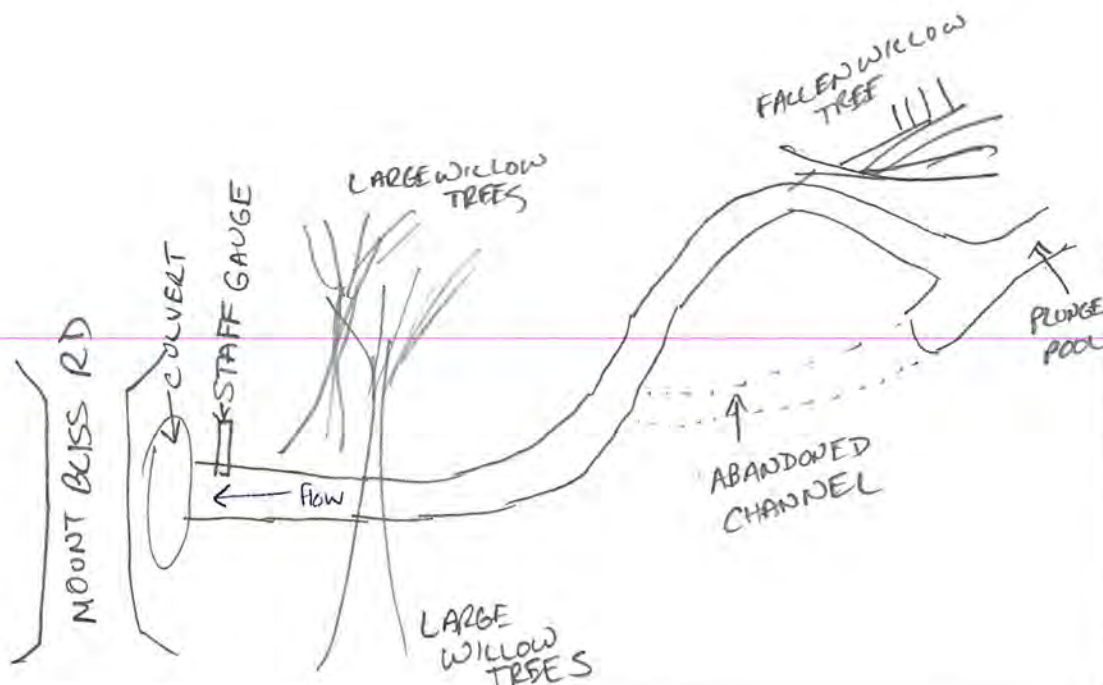
Additional Structure Available for Macroinvertebrate Colonization

	Extensive	Moderate	Sparse	Absent
Undercut banks	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Overhanging vegetation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Large woody debris	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Aquatic macrophytes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Rootwads	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

SITE LOCATION MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)

- ☐ Further investigation necessary (explain)
☐ Obvious pollution source/expression



Appendix J (continued)

HABITAT ASSESSMENT FIELD DATA SHEET - GLIDE/POOL STREAMS

Habitat Parameter	Condition Category																				
	Excellent					Good					Marginal					Poor					
1. Epifaunal Substrate/ Available Cover	Greater than 50% 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 not new fall and not transient).					30-50% mix of stable habitat, well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).					10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.					Less than 10% 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
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.					Mixture of soft sand, mud, or clay; mud may be dominant, some root mats and submerged vegetation present.					All mud or clay or sand bottom; little or no root mat; no submerged vegetation.					Hard-pan clay or bedrock; no root mat or vegetation.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.					Majority of pools large-deep; very few shallow.					Shallow pools much more prevalent than deep pools.					Majority of pools small-shallow or pools absent.					
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 island or point bars and less than <20% of the bottom affected by sediment deposition.					Some new increase in bar formation, mostly from gravel, sand, or fine sediment; 20-50% of the bottom affected; slight deposition in pools.					Moderate deposition of new gravel, sand, or fine sediment on old and new bars; 50-80% 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 80% 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
5a. Channel Flow Status - Maintained Flow Volume	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.					
SCORE	10	9	8	7	6	5	4	3	2	1	0	0	0	0	0	2	1	0	0	0	
5b. Channel Flow Status - Flashiness	Vegetation along the stream bank is complete nearly to the waters edge. Little or no evidence of frequent changes in discharge and/or frequent high water events that scours stream bank vegetation. Large woody debris (if present) stable and extending laterally across the stream channel.					Some evidence of bank scour approximately 4-8 inches above the waters surface. Large woody debris (if present) mostly stable and extending partially into the active stream channel.					Bank scour evidence 9-18 inches above the waters surface. Large woody debris (if present) tend to lay more against the stream bank rather than extending into the active channel.					Bank scour (>20 inches) along the stream channel. Large woody debris are generally absent from the active channel and/or may exist as woody debris jams along the stream bank above the active channel.					
SCORE	10	9	8	7	6	5	4	3	2	1	0	0	0	0	0	2	1	0	0	0	
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 is continuous but not recent (>5 years). Embankments without mature trees and dominated by grasses and shrubs.					Stream reach has been recently channelized (<5 years). OR Banks shored with gabion, rock, cement or bare earth. Instream habitat greatly altered or removed entirely. Bank vegetation moderately dense to absent.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Severance Creek

Appendix J (continued)

Habitat Parameter	Condition Category															
	Excellent				Good				Marginal				Poor			
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas)				The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.				The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line. (Note: lack of sinuosity may be due to channelization)				Channel straight; waterway has been channelized for a long distance.			
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5
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.			
SCORE (LB)	Left Bank	10	9			8	7	6			5	4	3			2
SCORE (RB)	Right Bank	10	9			8	7	6			5	4	3			2
9. Vegetative 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 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 1 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 has been removed to 2 inches or less in average stubble height.			
SCORE (LB)	Left Bank	10	9			8	7	6			5	4	3			2
SCORE (RB)	Right Bank	10	9			8	7	6			5	4	3			2
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >150 feet and dominated by native vegetation including trees, shrubs, or non-woody macrophytes or wetlands; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally. Human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.				Width of riparian zone 75-150 feet; human activities have impacted zone only minimally.				Width of riparian zone 10-75 feet; human activities have impacted zone a great deal.				Width of riparian zone <10 feet; little or no riparian vegetation due to human activities.			
SCORE (LB)	Left Bank	10	9			8	7	6			5	4	3			2
SCORE (RB)	Right Bank	10	9			8	7	6			5	4	3			2

Total Score 152
Good

Bartholomew Creek

APPENDIX J. STREAM CARD

Shaded fields are entered into database

STREAM NAME <u>BARTHOLOMEW CREEK</u>		LOCATION (road crossing) <u>UST M-66</u>
COUNTY/TOWNSHIP		T R S
LAT(dd)	LONG(dd)	RIVER BASIN <u>JORDAN RIVER</u>
STORET #	HUC CODE	ECOREGION
INVESTIGATOR(S) <u>J. Stricko</u> <u>M. Van Den Brand</u>	DATE <u>8/1/18</u> TIME <u>1105</u> AM PM	REASON FOR SURVEY <input checked="" type="checkbox"/> Targeted: comment _____ <input type="checkbox"/> Randomized: VSEC # _____ VSEC description (eg. cold small) _____

WEATHER CONDITIONS	
Current <input type="checkbox"/> Sunny <input checked="" type="checkbox"/> Partly Cloudy <input type="checkbox"/> Cloudy <input type="checkbox"/> Rainy	Has there been a significant rain in the last 7 days? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Don't Know Air Temperature _____ °F

RIPARIAN VEGETATION	
Indicate the dominant type and record the dominant species	
<input type="checkbox"/> Trees <input type="checkbox"/> Shrubs <input type="checkbox"/> Grasses <input checked="" type="checkbox"/> Herbaceous	Species: <u>SEDGE MEADOW</u>
Estimate buffer width (left) <u>100</u> ft (right) <u>100</u> ft	

WATERSHED FEATURES	
Predominant Surrounding Land Use <input type="checkbox"/> Forest <input type="checkbox"/> Commercial <input type="checkbox"/> Field/Pasture <input type="checkbox"/> Industrial <input type="checkbox"/> Agricultural <input type="checkbox"/> Residential <input checked="" type="checkbox"/> Other <u>WETLAND</u>	Local Watershed NPS Pollution <input checked="" type="checkbox"/> No evidence <input type="checkbox"/> Some potential sources <input type="checkbox"/> Obvious Sources Local Watershed Erosion <input checked="" type="checkbox"/> None <input type="checkbox"/> Moderate <input type="checkbox"/> Heavy

STREAM CHARACTERIZATION	
Stream Subsystem <input checked="" type="checkbox"/> Perennial <input type="checkbox"/> Intermittent <input type="checkbox"/> Lake Outlet Influenced <input type="checkbox"/> Dam Influenced	Stream Modifications <input checked="" type="checkbox"/> None <input type="checkbox"/> Dredged <input type="checkbox"/> Canopy Removal <input type="checkbox"/> Snagging <input type="checkbox"/> Impounded <input type="checkbox"/> Relocated <input type="checkbox"/> Bank Stabilization <input type="checkbox"/> Habitat Improvement
Stream Origin <input type="checkbox"/> Spring Fed <input type="checkbox"/> Lake/Pond <input checked="" type="checkbox"/> Swamp, Marsh, Bog <input type="checkbox"/> Mixture of origins <input type="checkbox"/> Other _____	Stream Type <input checked="" type="checkbox"/> Coldwater <input type="checkbox"/> Warmwater

INSTREAM FEATURES	
Avg. Stream Width <u>1.5</u> ft	Avg. Stream Depth <u>0.5</u> ft
Surface Velocity _____ ft/sec (at thalweg)	Est. Flow _____ cfs
Est. Survey Reach Length <u>50</u> ft	
Survey Reach Area _____ ft ²	High Water Mark _____ ft
Canopy Cover: <u>100</u> % Shaded <u>SHADED BY HERBACEOUS VEG</u>	

AQUATIC VEGETATION		Portion of the reach with aquatic vegetation <u>100</u> %
<input checked="" type="checkbox"/> Rooted emergent <input type="checkbox"/> Rooted submergent <input type="checkbox"/> Rooted floating	<input type="checkbox"/> Free Floating <input type="checkbox"/> Floating algae <input type="checkbox"/> Attached algae	Nuisance aquatic plants or slimes present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
		Dominant species present _____

WATER QUALITY		Solids, Turbidity		Color	Surface Oils	Water Odors
Temperature <u>65</u> °F	<input checked="" type="checkbox"/> Clear <input type="checkbox"/> Slightly turbid <input type="checkbox"/> Turbid	<input checked="" type="checkbox"/> Clear <input type="checkbox"/> Stained <input type="checkbox"/> Opaque <input type="checkbox"/> Colored _____ <input type="checkbox"/> Other _____	<input type="checkbox"/> Floating solids <input type="checkbox"/> Suspended solids <input type="checkbox"/> Settleable solids <input type="checkbox"/> Foams	<input type="checkbox"/> None <input type="checkbox"/> Sheen <input type="checkbox"/> Globbs <input type="checkbox"/> Flecks <input type="checkbox"/> Slick <input type="checkbox"/> Other _____	<input type="checkbox"/> Normal/None <input type="checkbox"/> Sewage <input type="checkbox"/> Petroleum <input type="checkbox"/> Chemical <input type="checkbox"/> Fishy <input type="checkbox"/> Other _____	
Water Samples Taken <input type="checkbox"/> None <input checked="" type="checkbox"/> Other <u>TPIN</u> <input type="checkbox"/> GA <input type="checkbox"/> GN <input type="checkbox"/> MA <input type="checkbox"/> MN <input type="checkbox"/> VOA <input type="checkbox"/> ON						

SEDIMENT		Sediment Odors		Deposits
Sediment Samples Taken <input checked="" type="checkbox"/> None <input type="checkbox"/> Other _____ <input type="checkbox"/> MS <input type="checkbox"/> GS <input type="checkbox"/> VOA <input type="checkbox"/> OS/BNA	Oils <input checked="" type="checkbox"/> Absent <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Profuse	<input checked="" type="checkbox"/> Normal/None <input type="checkbox"/> Sewage <input type="checkbox"/> Petroleum <input type="checkbox"/> Chemical <input type="checkbox"/> Anaerobic <input type="checkbox"/> Other _____	<input checked="" type="checkbox"/> None <input type="checkbox"/> Sludge <input type="checkbox"/> Sawdust <input type="checkbox"/> Paper fiber <input type="checkbox"/> Sand <input type="checkbox"/> Relict shells <input type="checkbox"/> Other _____	
Looking at stones that are not deeply embedded, are the undersides black in color? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				

Bartholomew Creek

APPENDIX J (Continued)

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 Reach
Bedrock		0	Detritus	Sticks, wood, coarse plant material (CPOM)	10
Boulder	>10"	0	Muck-Mud	black, very fine organic (FPOM)	5
Cobble	2.5"-10"	0	Other		
Gravel	0.1"-2.5"	20			
Sand	Gritty (course)	75			
Silt	Gritty (fine)	5			
Clay	sllick				

Proportion of Reach Represented by Stream

Morphology Types

- ☒ Riffle 50 %
☒ Run 50 %
☐ Pool _____ %
☐ Depositional _____ %

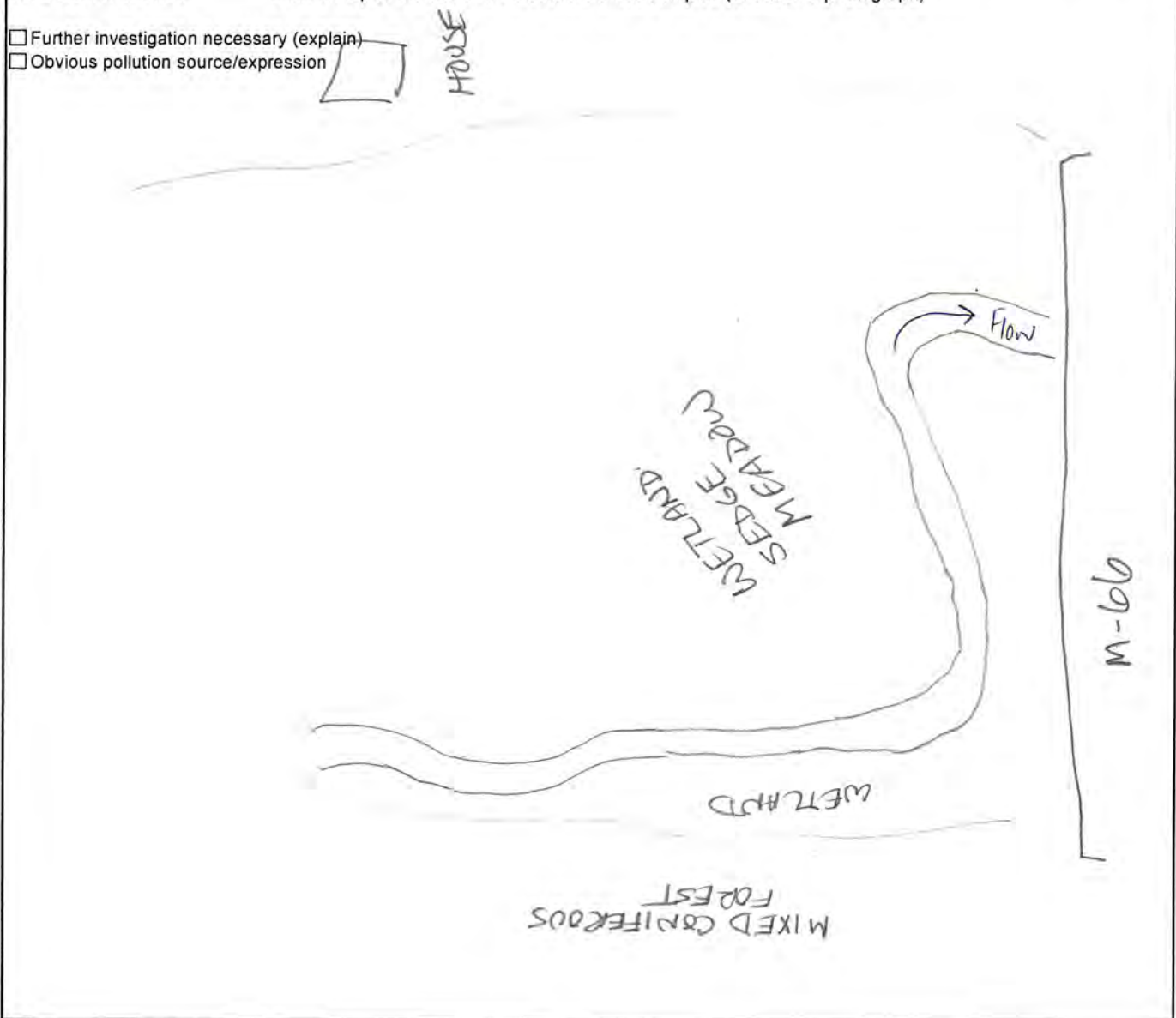
Additional Structure Available for Macroinvertebrate Colonization

	Extensive	Moderate	Sparse	Absent
Undercut banks	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Overhanging vegetation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Large woody debris	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Aquatic macrophytes	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Rootwads	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

SITE LOCATION MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)

- ☐ Further investigation necessary (explain)
☐ Obvious pollution source/expression



8/1/2018

Appendix J (continued)

HABITAT ASSESSMENT FIELD DATA SHEET - RIFFLE/RUN STREAMS

Habitat Parameter	Condition Category			
	Excellent	Good	Marginal	Poor
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 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 new fall, but not yet prepared for colonization (may rate at high end of scale).	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
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
3. Velocity/Depth Regime	All 4 velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is <1.0 f/s, deep is >2 ft.)	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
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 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
5a. Channel Flow Status - Maintained Flow Volume	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.
SCORE	10 9	8 7 6	5 4 3	2 1 0
5b. Channel Flow Status - Flashiness	Vegetation along the stream bank is complete nearly to the waters edge. Little or no evidence of frequent changes in discharge and/or frequent high water events that scour stream bank vegetation. Channel retention devices (if present) stable and extending laterally across the stream channel.	Some evidence of bank scour approximately 4-8 inches above the waters surface. Channel retention devices (if present) mostly stable and extending partially into the active stream channel.	Bank scour evidence 9-18 inches above the waters surface. Channel retention devices (if present) tend to lay more against the stream bank rather than extending into the active channel.	Bank scour (>20 inches) along the stream channel. Channel retention devices are generally absent from the active channel and/or may exist as woody debris jams along the stream bank above the active channel.
SCORE	10 9	8 7 6	5 4 3	2 1 0

Bartholomew Creek

Appendix J (continued)

Habitat Parameter	Condition Category																				
	Excellent					Good					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 is continuous but not recent (>5 years). Embankments without mature trees and dominated by grasses and shrubs.					Stream reach has been recently channelized (<5 years). OR Banks shored with gabion, rock, cement or bare earth. Instream habitat greatly altered or removed entirely. Bank vegetation moderately dense to absent.					
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) Note: determine left or right side by facing downstream.	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.					
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 stream bank 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 stream bank surfaces covered by native vegetation, but 1 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 stream bank 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 stream bank surfaces covered by vegetation; disruption of stream bank vegetation is very high; vegetation has been removed to 2 inches 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 >150 feet and dominated by native vegetation including trees, shrubs, or non-woody macrophytes or wetlands; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally. Human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.					Width of riparian zone 75-150 feet; human activities have impacted zone only minimally.					Width of riparian zone 10-75 feet; human activities have impacted zone a great deal.					Width of riparian zone <10 feet; little or no riparian vegetation due to human activities.					
SCORE 10 (LB)	Left Bank 10 9					8 7 6					5 4 3					2 1 0					
SCORE 6 (RB)	Right Bank 10 9					8 7 6					5 4 3					2 1 0					

Total Score 116
Excellent

Sutton Creek

APPENDIX J. STREAM CARD

Shaded fields are entered into database

STREAM NAME <u>SUTTON CREEK</u>		LOCATION (road crossing) <u>UST MOUNT BLISS RD</u>
COUNTY/TOWNSHIP	T R S	
LAT(dd)	LONG (dd)	RIVER BASIN <u>JORDAN RIVER</u>
STORET #	HUC CODE	ECOREGION
INVESTIGATOR(S) <u>J. Stricko</u> <u>M. Van den Brand</u>	DATE <u>8/1/18</u> TIME <u>1:55</u> <u>(AM)</u> PM	REASON FOR SURVEY <input checked="" type="checkbox"/> Targeted: comment _____ <input type="checkbox"/> Randomized: VSEC # _____ VSEC description (eg. cold small) _____

WEATHER CONDITIONS Current <input type="checkbox"/> Sunny <input checked="" type="checkbox"/> Partly Cloudy <input type="checkbox"/> Cloudy <input type="checkbox"/> Rainy Has there been a significant rain in the last 7 days? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Don't Know Air Temperature <u>80</u> °F	WATERSHED FEATURES Predominant Surrounding Land Use <input checked="" type="checkbox"/> Forest <input type="checkbox"/> Commercial <input type="checkbox"/> Field/Pasture <input type="checkbox"/> Industrial <input type="checkbox"/> Agricultural <input type="checkbox"/> Residential <input type="checkbox"/> Other _____ Local Watershed NPS Pollution <input checked="" type="checkbox"/> No evidence <input type="checkbox"/> Some potential sources <input type="checkbox"/> Obvious Sources Local Watershed Erosion <input checked="" type="checkbox"/> None <input type="checkbox"/> Moderate <input type="checkbox"/> Heavy
RIPARIAN VEGETATION Indicate the dominant type and record the dominant species <input checked="" type="checkbox"/> Trees <input type="checkbox"/> Shrubs Species: <u>WHITE CEDAR</u> <input type="checkbox"/> Grasses <input type="checkbox"/> Herbaceous Estimate buffer width (left) <u>50</u> ft (right) <u>200</u> ft	

STREAM CHARACTERIZATION Stream Subsystem <input checked="" type="checkbox"/> Perennial <input type="checkbox"/> Intermittent <input type="checkbox"/> Lake Outlet Influenced <input type="checkbox"/> Dam Influenced Stream Origin <input type="checkbox"/> Spring Fed <input type="checkbox"/> Lake/Pond <input checked="" type="checkbox"/> Swamp, Marsh, Bog <input type="checkbox"/> Mixture of origins <input type="checkbox"/> Other _____ Stream Modifications <input checked="" type="checkbox"/> None <input type="checkbox"/> Dredged <input type="checkbox"/> Canopy Removal <input type="checkbox"/> Snagging <input type="checkbox"/> Impounded <input type="checkbox"/> Relocated <input type="checkbox"/> Bank Stabilization <input type="checkbox"/> Habitat Improvement Stream Type <input checked="" type="checkbox"/> Coldwater <input type="checkbox"/> Warmwater	INSTREAM FEATURES Avg. Stream Width <u>4</u> ft Avg. Stream Depth <u>0.4</u> ft Surface Velocity _____ ft/sec Est. Flow _____ cfs (at thalweg) Est. Survey Reach Length <u>50</u> ft Survey Reach Area _____ ft ² High Water Mark _____ ft Canopy Cover: <u>90</u> % Shaded
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AQUATIC VEGETATION <input type="checkbox"/> Rooted emergent <input type="checkbox"/> Rooted submergent <input type="checkbox"/> Rooted floating <input type="checkbox"/> Free Floating <input type="checkbox"/> Floating algae <input type="checkbox"/> Attached algae	Portion of the reach with aquatic vegetation <u>0</u> % Nuisance aquatic plants or slimes present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Dominant species present _____
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WATER QUALITY Temperature <u>68</u> °F Solids, Turbidity <input checked="" type="checkbox"/> Clear <input type="checkbox"/> Slightly turbid <input type="checkbox"/> Turbid Water Samples Taken <input type="checkbox"/> None <input checked="" type="checkbox"/> Other <u>TP & N</u> <input type="checkbox"/> GA <input type="checkbox"/> GN <input type="checkbox"/> MA <input type="checkbox"/> MN <input type="checkbox"/> VOA <input type="checkbox"/> ON <input type="checkbox"/> Floating solids <input type="checkbox"/> Suspended solids <input type="checkbox"/> Settleable solids <input type="checkbox"/> Foams	Color <input checked="" type="checkbox"/> Clear <input type="checkbox"/> Stained <input type="checkbox"/> Opaque <input type="checkbox"/> Colored _____ <input type="checkbox"/> Other _____ Surface Oils <input checked="" type="checkbox"/> None <input type="checkbox"/> Sheen <input type="checkbox"/> Globbs <input type="checkbox"/> Flecks <input type="checkbox"/> Slick <input type="checkbox"/> Other _____ Water Odors <input checked="" type="checkbox"/> Normal/None <input type="checkbox"/> Sewage <input type="checkbox"/> Petroleum <input type="checkbox"/> Chemical <input type="checkbox"/> Fishy <input type="checkbox"/> Other _____
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SEDIMENT Sediment Samples Taken <input checked="" type="checkbox"/> None <input type="checkbox"/> Other _____ <input type="checkbox"/> MS <input type="checkbox"/> GS <input type="checkbox"/> VOA <input type="checkbox"/> OS/BNA Oils <input checked="" type="checkbox"/> Absent <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Profuse Looking at stones that are not deeply embedded, are the undersides black in color? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Sediment Odors <input checked="" type="checkbox"/> Normal/None <input type="checkbox"/> Sewage <input type="checkbox"/> Petroleum <input type="checkbox"/> Chemical <input type="checkbox"/> Anaerobic <input type="checkbox"/> Other _____ Deposits <input checked="" type="checkbox"/> None <input type="checkbox"/> Sludge <input type="checkbox"/> Sawdust <input type="checkbox"/> Paper fiber <input type="checkbox"/> Sand <input type="checkbox"/> Relict shells <input type="checkbox"/> Other _____
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Sutton Creek

APPENDIX J (Continued)

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 Reach
Bedrock		0	Detritus	Sticks, wood, coarse plant material (CPOM)	10
Boulder	>10"	0	Muck-Mud	black, very fine organic (FPOM)	10
Cobble	2.5"-10"	0	Other		
Gravel	0.1"-2.5"	10			
Sand	Gritty (course)	85			
Silt	Gritty (fine)	5			
Clay	slick				

Proportion of Reach Represented by Stream Morphology Types

- ☒ Riffle 50 %
☒ Run 50 %
☐ Pool _____ %
☐ Depositional _____ %

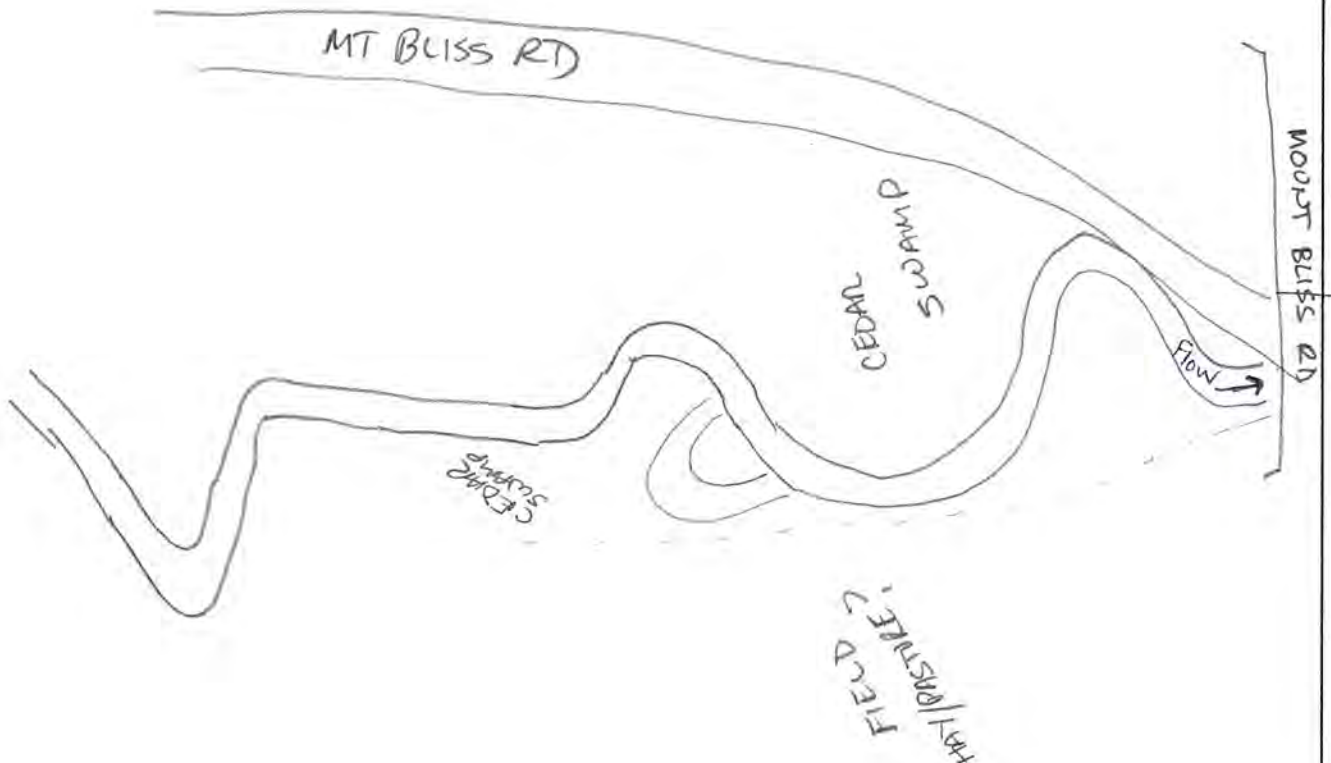
Additional Structure Available for Macroinvertebrate Colonization

	Extensive	Moderate	Sparse	Absent
Undercut banks	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Overhanging vegetation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Large woody debris	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Aquatic macrophytes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Rootwads	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

SITE LOCATION MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)

- ☐ Further investigation necessary (explain)
☐ Obvious pollution source/expression



HABITAT ASSESSMENT FIELD DATA SHEET - RIFFLE/RUN STREAMS

Habitat Parameter	Condition Category																				
	Excellent					Good					Marginal					Poor					
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 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 new fall, but not yet prepared for colonization (may rate at high end of scale).					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
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
3. Velocity/Depth Regime	All 4 velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is <1.0 f/s, deep is >2 ft.).					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 (usu ally slow-deep).					
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.					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 depositi on 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
5a. Channel Flow Status - Maintained Flow Volume	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 mostl y exposed.					Very little water in channel and mostly present as standing pools.					
SCORE	10	9				8	7	6			5	4	3			2	1	0			
5b. Channel Flow Status – Flashiness	Vegetation along the stream bank is complete nearly to the waters edge. Little or no evidence of frequent changes in discharge and/or frequent high water events that scour stream bank vegetation. Channel retention devices (if present) stable and extending laterally across the stream channel.					Some evidence of bank scour approximately 4-8 inches above the waters surface. Channel retention devices (if present) mostly stable and extending partially into the active stream channel.					Bank scour evidence 9-18 inches above the waters surface. Channel retention devices (if present) tend to lay more against the stream bank rather than extending into the active channel.					Bank scour (>20 inches) along the stream channel. Channel retention devices are generally absent from the active channel and/or may exist as woody debris jams along the stream bank above the active channel.					
SCORE	10	9				8	7	6			5	4	3			2	1	0			

Appendix J (continued)

Habitat Parameter	Condition Category																				
	Excellent					Good					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 is continuous but not recent (>5 years). Embankments without mature trees and dominated by grasses and shrubs.					Stream reach has been recently channelized (<5 years). OR Banks shored with gabion, rock, cement or bare earth. Instream habitat greatly altered or removed entirely. Bank vegetation moderately dense to absent.					
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.					
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 stream bank 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 stream bank surfaces covered by native vegetation, but 1 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 stream bank 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 stream bank surfaces covered by vegetation; disruption of stream bank vegetation is very high; vegetation has been removed to 2 inches 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 >150 feet and dominated by native vegetation including trees, shrubs, or non-woody macrophytes or wetlands; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally. Human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.					Width of riparian zone 75-150 feet; human activities have impacted zone only minimally.					Width of riparian zone 10-75 feet; human activities have impacted zone a great deal.					Width of riparian zone <10 feet; 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 138
Good

Cokirs Creek

APPENDIX J. STREAM CARD

Shaded fields are entered into database

STREAM NAME COKIRS CREEK		LOCATION (road crossing) CHESIDNA BRIDGE ACCESS
COUNTY/TOWNSHIP	T R S	
LAT(dd)	LONG(dd)	RIVER BASIN JORDAN RIVER
STORET #	HUC CODE	ECOREGION
INVESTIGATOR(S) J. Stricko M. VanDenBrand	DATE 8/1/18 TIME 1245 AM <input checked="" type="radio"/> PM	REASON FOR SURVEY <input checked="" type="checkbox"/> Targeted: comment _____ <input type="checkbox"/> Randomized: VSEC # _____ VSEC description (eg. cold small) _____

WEATHER CONDITIONS	
Current <input type="checkbox"/> Sunny <input checked="" type="checkbox"/> Partly Cloudy <input type="checkbox"/> Cloudy <input type="checkbox"/> Rainy	Has there been a significant rain in the last 7 days? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Don't Know Air Temperature 80 °F

RIPARIAN VEGETATION	
Indicate the dominant type and record the dominant species	
<input checked="" type="checkbox"/> Trees <input type="checkbox"/> Shrubs <input type="checkbox"/> Grasses <input type="checkbox"/> Herbaceous	Species: Pines
Estimate buffer width (left) 10 ft (right) 100 ft	

WATERSHED FEATURES	
Predominant Surrounding Land Use <input type="checkbox"/> Forest <input type="checkbox"/> Commercial <input type="checkbox"/> Field/Pasture <input type="checkbox"/> Industrial <input type="checkbox"/> Agricultural <input checked="" type="checkbox"/> Residential <input type="checkbox"/> Other _____	Local Watershed NPS Pollution <input type="checkbox"/> No evidence <input checked="" type="checkbox"/> Some potential sources <input type="checkbox"/> Obvious Sources Local Watershed Erosion <input type="checkbox"/> None <input checked="" type="checkbox"/> Moderate <input type="checkbox"/> Heavy

STREAM CHARACTERIZATION	
Stream Subsystem <input checked="" type="checkbox"/> Perennial <input type="checkbox"/> Intermittent <input type="checkbox"/> Lake Outlet Influenced <input type="checkbox"/> Dam Influenced	Stream Modifications <input type="checkbox"/> None <input checked="" type="checkbox"/> Dredged <input type="checkbox"/> Canopy Removal <input type="checkbox"/> Snagging <input type="checkbox"/> Impounded <input type="checkbox"/> Relocated <input checked="" type="checkbox"/> Bank Stabilization <input type="checkbox"/> Habitat Improvement
Stream Origin <input checked="" type="checkbox"/> Spring Fed <input type="checkbox"/> Lake/Pond <input type="checkbox"/> Swamp, Marsh, Bog <input type="checkbox"/> Mixture of origins <input type="checkbox"/> Other _____	Stream Type <input type="checkbox"/> Coldwater <input checked="" type="checkbox"/> Warmwater

INSTREAM FEATURES	
Avg. Stream Width 6 ft	Avg. Stream Depth 0.3 ft
Surface Velocity _____ ft/sec	Est. Flow _____ cfs
(at thalweg)	
Est. Survey Reach Length 50 ft	
Survey Reach Area _____ ft ²	High Water Mark _____ ft
Canopy Cover: 40 % Shaded	

AQUATIC VEGETATION	
<input type="checkbox"/> Rooted emergent <input checked="" type="checkbox"/> Rooted submergent <input type="checkbox"/> Rooted floating	<input type="checkbox"/> Free Floating <input type="checkbox"/> Floating algae <input type="checkbox"/> Attached algae
Portion of the reach with aquatic vegetation 5 %	
Nuisance aquatic plants or slimes present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	
Dominant species present _____	

WATER QUALITY	
Temperature 70 °F	Solids, Turbidity <input checked="" type="checkbox"/> Clear <input type="checkbox"/> Slightly turbid <input type="checkbox"/> Turbid <input type="checkbox"/> Floating solids <input type="checkbox"/> Suspended solids <input type="checkbox"/> Settleable solids <input type="checkbox"/> Foams
Water Samples Taken <input type="checkbox"/> None <input checked="" type="checkbox"/> Other TP+N <input type="checkbox"/> GA <input type="checkbox"/> GN <input type="checkbox"/> MA <input type="checkbox"/> MN <input type="checkbox"/> VOA <input type="checkbox"/> ON	Color <input checked="" type="checkbox"/> Clear <input type="checkbox"/> Stained <input type="checkbox"/> Opaque <input type="checkbox"/> Colored _____ <input type="checkbox"/> Other _____
	Surface Oils <input checked="" type="checkbox"/> None <input type="checkbox"/> Sheen <input type="checkbox"/> Globbs <input type="checkbox"/> Flecks <input type="checkbox"/> Slick <input type="checkbox"/> Other _____
	Water Odors <input checked="" type="checkbox"/> Normal/None <input type="checkbox"/> Sewage <input type="checkbox"/> Petroleum <input type="checkbox"/> Chemical <input type="checkbox"/> Fishy <input type="checkbox"/> Other _____

SEDIMENT	
Sediment Samples Taken <input checked="" type="checkbox"/> None <input type="checkbox"/> Other _____ <input type="checkbox"/> MS <input type="checkbox"/> GS <input type="checkbox"/> VOA <input type="checkbox"/> OS/BNA	Oils <input checked="" type="checkbox"/> Absent <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Profuse
Looking at stones that are not deeply embedded, are the undersides black in color? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Sediment Odors <input checked="" type="checkbox"/> Normal/None <input type="checkbox"/> Sewage <input type="checkbox"/> Petroleum <input type="checkbox"/> Chemical <input type="checkbox"/> Anaerobic <input type="checkbox"/> Other _____
	Deposits <input checked="" type="checkbox"/> None <input type="checkbox"/> Sludge <input type="checkbox"/> Sawdust <input type="checkbox"/> Paper fiber <input type="checkbox"/> Sand <input type="checkbox"/> Relict shells <input type="checkbox"/> Other _____

APPENDIX J (Continued)

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 Reach
Bedrock		0	Detritus	Sticks, wood, coarse plant material (CPOM)	15
Boulder	>10"	25	Muck-Mud	black, very fine organic (FPOM)	5
Cobble	2.5"-10"	50 35	Other		
Gravel	0.1"-2.5"	20			
Sand	Gritty (course)	20			
Silt	Gritty (fine)	0			
Clay	slick	0			

Proportion of Reach Represented by Stream

Morphology Types

- ☒ Riffle 50 %
☒ Run 45 %
☒ Pool 5 %
☒ Depositional 5 %

Additional Structure Available for Macroinvertebrate Colonization

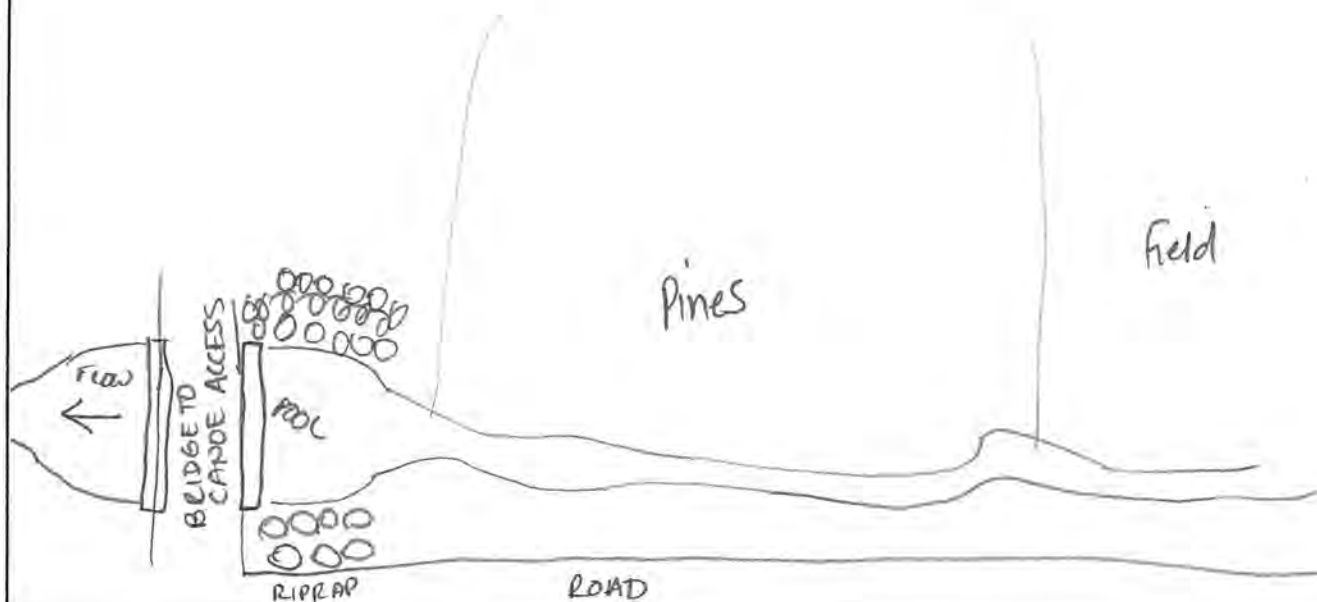
	Extensive	Moderate	Sparse	Absent
Undercut banks	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Overhanging vegetation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Large woody debris	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Aquatic macrophytes	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Rootwads	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

SITE LOCATION MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)

- ☐ Further investigation necessary (explain)
☐ Obvious pollution source/expression

BRIDGE HAS A TOO LARGE FOR STREAM
CONCRETE CULVERT INSTALLED
CAUSING SEDIMENT DEPOSITION



8/1/2018

HABITAT ASSESSMENT FIELD DATA SHEET - RIFFLE/RUN STREAMS

Habitat Parameter	Condition Category																				
	Excellent					Good					Marginal					Poor					
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 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 new fall, but not yet prepared for colonization (may rate at high end of scale).					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
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
3. Velocity/Depth Regime	All 4 velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is <1.0 f/s, deep is >2 ft).					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
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 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 deposit on 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 deposit on 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
5a. Channel Flow Status - Maintained Flow Volume	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.					
SCORE	10		9			8	7	6			5	4	3			2	1	0			
5b. Channel Flow Status – Flashiness	Vegetation along the stream bank is complete nearly to the waters edge. Little or no evidence of frequent changes in discharge and/or frequent high water events that scour stream bank vegetation. Channel retention devices (if present) stable and extending laterally across the stream channel.					Some evidence of bank scour approximately 4-8 inches above the waters surface. Channel retention devices (if present) mostly stable and extending partially into the active stream channel.					Bank scour evidence 9-18 inches above the waters surface. Channel retention devices (if present) tend to lay more against the stream bank rather than extending into the active channel.					Bank scour (>20 inches) along the stream channel. Channel retention devices are generally absent from the active channel and/or may exist as woody debris jams along the stream bank above the active channel.					
SCORE		10	9			8	7	6			5	4	3			2	1	0			

Appendix J (continued)

Habitat Parameter	Condition Category																				
	Excellent					Good					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 is continuous but not recent (>5 years). Embankments without mature trees and dominated by grasses and shrubs.					Stream reach has been recently channelized (<5 years). OR Banks shored with gabion, rock, cement or bare earth. Instream habitat greatly altered or removed entirely. Bank vegetation moderately dense to absent.					
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 stream bank 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 stream bank surfaces covered by native vegetation, but 1 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 stream bank 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 stream bank surfaces covered by vegetation; disruption of stream bank vegetation is very high; vegetation has been removed to 2 inches 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 >150 feet and dominated by native vegetation including trees, shrubs, or non-woody macrophytes or wetlands; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally. Human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.					Width of riparian zone 75-150 feet; human activities have impacted zone only minimally.					Width of riparian zone 10-75 feet; human activities have impacted zone a great deal.					Width of riparian zone <10 feet; 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 171
Excellent

Landslide creek

APPENDIX J. STREAM CARD

Shaded fields are entered into database

STREAM NAME LANDSLIDE CREEK		LOCATION (road crossing) OST PINEY BRIDGE ROAD	
COUNTY/TOWNSHIP		T R S	
LAT(dd)	LONG (dd)	RIVER BASIN JORDAN RIVER	
STORET #		HUC CODE	ECOREGION
INVESTIGATOR(S) J. Stricko M. VanDenBrand		REASON FOR SURVEY <input checked="" type="checkbox"/> Targeted: comment _____ <input type="checkbox"/> Randomized: VSEC # _____ VSEC description (eg. cold small) _____	
DATE 8/1/2018		TIME 1405 AM <input checked="" type="radio"/> PM	

WEATHER CONDITIONS		WATERSHED FEATURES	
Current <input type="checkbox"/> Sunny <input checked="" type="checkbox"/> Partly Cloudy <input type="checkbox"/> Cloudy <input type="checkbox"/> Rainy		Predominant Surrounding Land Use <input checked="" type="checkbox"/> Forest <input type="checkbox"/> Commercial <input type="checkbox"/> Field/Pasture <input type="checkbox"/> Industrial <input type="checkbox"/> Agricultural <input type="checkbox"/> Residential <input checked="" type="checkbox"/> Other Wetland	
Has there been a significant rain in the last 7 days? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know Air Temperature 75 °F		Local Watershed NPS Pollution <input type="checkbox"/> No evidence <input type="checkbox"/> Some potential sources <input type="checkbox"/> Obvious Sources Local Watershed Erosion <input type="checkbox"/> None <input type="checkbox"/> Moderate <input type="checkbox"/> Heavy	
RIPARIAN VEGETATION Indicate the dominant type and record the dominant species <input type="checkbox"/> Trees <input type="checkbox"/> Shrubs Species: Sedge meadow <input type="checkbox"/> Grasses <input checked="" type="checkbox"/> Herbaceous Fallen trees Estimate buffer width (left) 800 ft (right) 800 ft			

STREAM CHARACTERIZATION		INSTREAM FEATURES	
Stream Subsystem <input checked="" type="checkbox"/> Perennial <input type="checkbox"/> Intermittent <input type="checkbox"/> Lake Outlet Influenced <input type="checkbox"/> Dam Influenced Stream Origin <input type="checkbox"/> Spring Fed <input type="checkbox"/> Lake/Pond <input type="checkbox"/> Swamp, Marsh, Bog <input checked="" type="checkbox"/> Mixture of origins <input type="checkbox"/> Other _____		Stream Modifications <input checked="" type="checkbox"/> None <input type="checkbox"/> Dredged <input type="checkbox"/> Canopy Removal <input type="checkbox"/> Snagging <input type="checkbox"/> Impounded <input type="checkbox"/> Relocated <input type="checkbox"/> Bank Stabilization <input type="checkbox"/> Habitat Improvement Stream Type <input checked="" type="checkbox"/> Coldwater <input type="checkbox"/> Warmwater	
		Avg. Stream Width 15.5 ft Avg. Stream Depth 2.0 ft Surface Velocity _____ ft/sec Est. Flow _____ cfs (at thalweg) Est. Survey Reach Length 50 ft Survey Reach Area _____ ft ² High Water Mark _____ ft Canopy Cover: 5 % Shaded	

AQUATIC VEGETATION		Portion of the reach with aquatic vegetation _____ %
<input type="checkbox"/> Rooted emergent <input type="checkbox"/> Rooted submergent <input type="checkbox"/> Rooted floating	<input type="checkbox"/> Free Floating <input type="checkbox"/> Floating algae <input type="checkbox"/> Attached algae	Nuisance aquatic plants or slimes present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Dominant species present _____

WATER QUALITY		Solids, Turbidity		Color		Surface Oils		Water Odors	
Temperature 60 °F Water Samples Taken <input type="checkbox"/> None <input checked="" type="checkbox"/> Other TPIN <input type="checkbox"/> GA <input type="checkbox"/> GN <input type="checkbox"/> MA <input type="checkbox"/> MN <input type="checkbox"/> VOA <input type="checkbox"/> ON		<input checked="" type="checkbox"/> Clear <input type="checkbox"/> Slightly turbid <input type="checkbox"/> Turbid <input type="checkbox"/> Floating solids <input type="checkbox"/> Suspended solids <input type="checkbox"/> Settleable solids <input type="checkbox"/> Foams		<input checked="" type="checkbox"/> Clear <input type="checkbox"/> Stained <input type="checkbox"/> Opaque <input type="checkbox"/> Colored _____ <input type="checkbox"/> Other _____		<input checked="" type="checkbox"/> None <input type="checkbox"/> Sheen <input type="checkbox"/> Globbs <input type="checkbox"/> Flecks <input type="checkbox"/> Slick <input type="checkbox"/> Other _____		<input checked="" type="checkbox"/> Normal/None <input type="checkbox"/> Sewage <input type="checkbox"/> Petroleum <input type="checkbox"/> Chemical <input type="checkbox"/> Fishy <input type="checkbox"/> Other _____	

SEDIMENT		Sediment Odors		Deposits	
Sediment Samples Taken <input checked="" type="checkbox"/> None <input type="checkbox"/> Other _____ <input type="checkbox"/> MS <input type="checkbox"/> GS <input type="checkbox"/> VOA <input type="checkbox"/> OS/BNA		<input checked="" type="checkbox"/> Absent <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Profuse		<input checked="" type="checkbox"/> Normal/None <input type="checkbox"/> Sewage <input type="checkbox"/> Petroleum <input type="checkbox"/> Chemical <input type="checkbox"/> Anaerobic <input type="checkbox"/> Other _____	
Looking at stones that are not deeply embedded, are the undersides black in color? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				<input checked="" type="checkbox"/> None <input type="checkbox"/> Sludge <input type="checkbox"/> Sawdust <input type="checkbox"/> Paper fiber <input type="checkbox"/> Sand <input type="checkbox"/> Relict shells <input type="checkbox"/> Other _____	

Landslide Creek

APPENDIX J (Continued)

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 Reach
Bedrock		0	Detritus	Sticks, wood, coarse plant material (CPOM)	30
Boulder	>10"	1	Muck-Mud	black, very fine organic (FPOM)	10
Cobble	2.5"-10"	5			
Gravel	0.1"-2.5"	5			
Sand	Gritty (course)	89	Other		
Silt	Gritty (fine)	0			
Clay	slick	0			

Proportion of Reach Represented by Stream

Morphology Types

- ☐ Riffle _____ %
☒ Run 50.5 %
☒ Pool 25 %
☐ Depositional _____ %

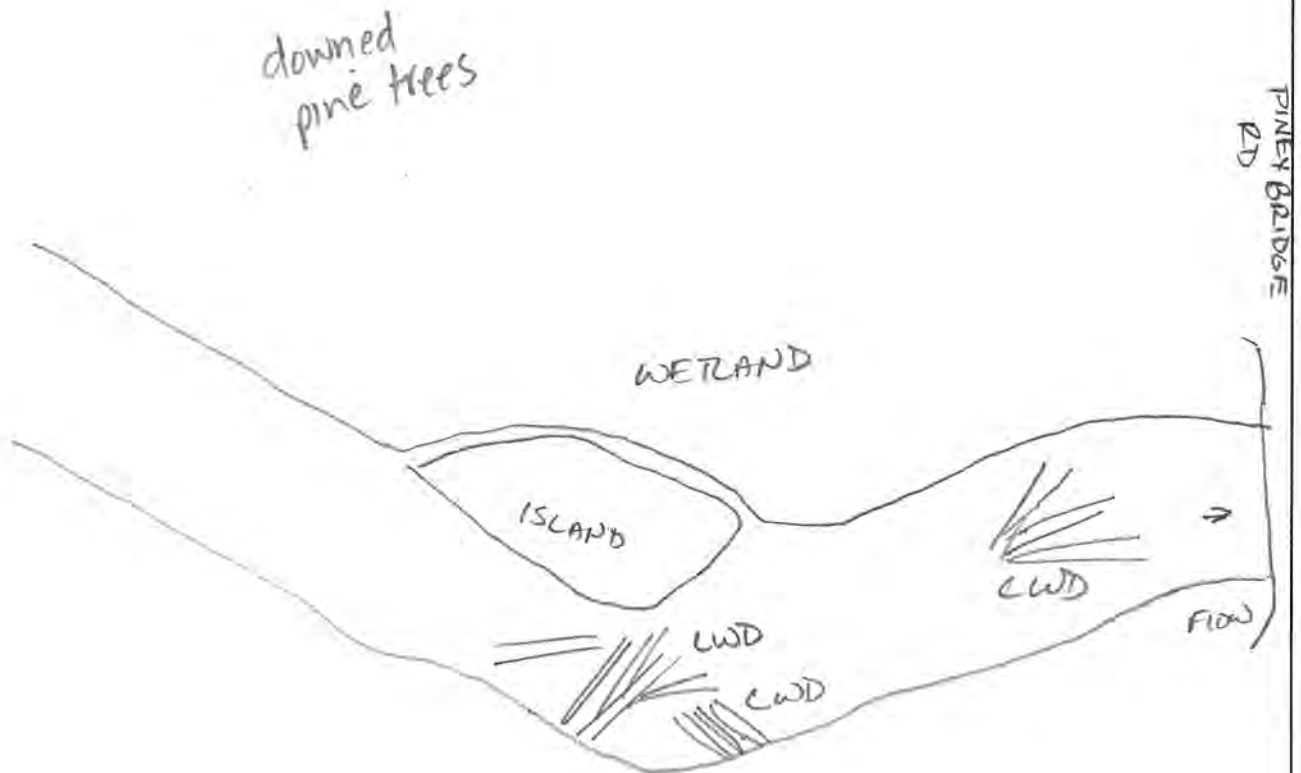
Additional Structure Available for Macroinvertebrate Colonization

	Extensive	Moderate	Sparse	Absent
Undercut banks	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Overhanging vegetation	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Large woody debris	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Aquatic macrophytes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Rootwads	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

SITE LOCATION MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)

- ☐ Further investigation necessary (explain)
☐ Obvious pollution source/expression



Appendix J (continued)

HABITAT ASSESSMENT FIELD DATA SHEET - GLIDE/POOL STREAMS

Habitat Parameter	Condition Category																				
	Excellent					Good					Marginal					Poor					
1. Epifaunal Substrate/ Available Cover	Greater than 50% 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 not new fall and not transient).					30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of new fall, but not yet prepared for colonization (may rate at high end of scale).					10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.					Less than 10% 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
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.					Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.					All mud or clay or sand bottom; little or no root mat; no submerged vegetation.					Hard-pan clay or bedrock, no root mat or vegetation.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.					Majority of pools large-deep; very few shallow.					Shallow pools much more prevalent than deep pools.					Majority of pools small-shallow or pools absent.					
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 island or point bars and less than <20% of the bottom affected by sediment deposition.					Some new increase in bar formation, mostly from gravel, sand, or fine sediment; 20-50% of the bottom affected; slight deposition in pools.					Moderate deposition of new gravel, sand, or fine sediment on old and new bars; 50-80% 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 80% 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
5a. Channel Flow Status - Maintained Flow Volume	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.					
SCORE	10	9				8	7	6			5	4	3			2	1	0			
5b. Channel Flow Status - Flashiness	Vegetation along the stream bank is complete nearly to the waters edge. Little or no evidence of frequent changes in discharge and/or frequent high water events that scours stream bank vegetation. Large woody debris (if present) stable and extending laterally across the stream channel.					Some evidence of bank scour approximately 4-8 inches above the waters surface. Large woody debris (if present) mostly stable and extending partially into the active stream channel.					Bank scour evidence 9-18 inches above the waters surface. Large woody debris (if present) tend to lay more against the stream bank rather than extending into the active channel.					Bank scour (>20 inches) along the stream channel. Large woody debris are generally absent from the active channel and/or may exist as woody debris jams along the stream bank above the active channel.					
SCORE	10	9				8	7	6			5	4	3			2	1	0			
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 is continuous but not recent (>5 years). Embankments without mature trees and dominated by grasses and shrubs.					Stream reach has been recently channelized (<5 years). OR Banks shored with gabion, rock, cement or bare earth. Instream habitat greatly altered or removed entirely. Bank vegetation moderately dense to absent.					
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Landslide Creek

Appendix J (continued)

Habitat Parameter	Condition Category															
	Excellent				Good				Marginal				Poor			
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)				The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.				The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line. (Note: lack of sinuosity may be due to channelization)				Channel straight; waterway has been channelized for a long distance.			
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5
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.			
SCORE (LB)	Left Bank	10	9			8	7	6			5	4	3			2
SCORE (RB)	Right Bank	10	9			8	7	6			5	4	3			2
9. Vegetative 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 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 1 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 has been removed to 2 inches or less in average stubble height.			
SCORE (LB)	Left Bank	10	9			8	7	6			5	4	3			2
SCORE (RB)	Right Bank	10	9			8	7	6			5	4	3			2
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >150 feet and dominated by native vegetation including trees, shrubs, or non-woody macrophytes or wetlands; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally. Human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.				Width of riparian zone 75-150 feet; human activities have impacted zone only minimally.				Width of riparian zone 10-75 feet; human activities have impacted zone a great deal.				Width of riparian zone <10 feet; little or no riparian vegetation due to human activities.			
SCORE (LB)	Left Bank	10	9			8	7	6			5	4	3			2
SCORE (RB)	Right Bank	10	9			8	7	6			5	4	3			2

Total Score 171

Excellent

APPENDIX 3

Nutrient Chemistry Report



Project Number: 2365-00

August 16, 2018

**Jordan River
739 Hastings Street
Traverse City, MI 49686
Attention: Michelle VanDenBrand**

Project Description: Water Quality Samples

Dear Client,

Enclosed is a copy of your laboratory report relating to samples, as they were received. All tests were performed within the maximum holding times and have met or exceeded QC criteria. Test results are in compliance with The NELAC Institute Standards. Visit our web site for a full list of tests for which we are accredited through the New Hampshire Environmental Laboratory Accreditation Program (NH ELAP).

Please don't hesitate to call if you have questions or require further information.

Sincerely,

A handwritten signature in blue ink that reads "Michelle A. Moore".

**Michelle A. Moore
Laboratory Coordinator and Research Scientist/Nutrient Chemistry**



Great Lakes Environmental Center

739 Hastings St., Traverse City MI 49686 - (231) 941-2230 - FAX: (231) 941-2240

Client ID: 2365-00

Jordan River

REPORT OF ANALYSIS

Total Phosphorus

LabSampleID	SampleDescription	Sample Date	Result	Units	Rep Limit	MDL	Lab Qualifie	AnalysisDate	Comments	Initials
JR08010001	Servance Creek	8/1/2018	0.0091	mg/L	0.003	0.0022		8/10/2018		BSC
JR08010002	Bartholomew Creek	8/1/2018	0.0103	mg/L	0.003	0.0022		8/10/2018		BSC
JR08010003	Sutton Creek	8/1/2018	0.0105	mg/L	0.003	0.0022		8/10/2018		BSC
JR08010004	Cokirs Creek	8/1/2018	0.0133	mg/L	0.003	0.0022		8/10/2018		BSC
JR08010005	Landslide Creek	8/1/2018	0.0057	mg/L	0.003	0.0022		8/10/2018		BSC

LabQualifiers:

U - Analyte not detected.

J - Result between MDL and RL should be considered estimated.

Page 1 of 1

Thursday, August 16, 2018

Method: SM 4500-P F

Great Lakes Environmental Center

739 Hastings St., Traverse City MI 49686 - (231) 941-2230 - FAX: (231) 941-2240

Client ID: 2365-00

Jordan River

REPORT OF ANALYSIS

Nitrate/Nitrite-Nitrogen

LabSampleID	SampleDescription	Sample Date	Result	Units	Rep Limit	MDL	Lab Qualifie	AnalysisDate	Comments	Initials
JR08010001	Servance Creek	8/1/2018	0.0507	mg/L	0.005	0.0038		8/15/2018		BSC
JR08010002	Bartholomew Creek	8/1/2018	0.268	mg/L	0.02	0.0152		8/15/2018		BSC
JR08010003	Sutton Creek	8/1/2018	0.1026	mg/L	0.005	0.0038		8/15/2018		BSC
JR08010004	Cokirs Creek	8/1/2018	0.468	mg/L	0.02	0.0152		8/15/2018		BSC
JR08010005	Landslide Creek	8/1/2018	0.530	mg/L	0.05	0.038		8/15/2018		BSC

LabQualifiers:

U - Analyte not detected.

J - Result between MDL and RL should be considered estimated.

Page 1 of 1

Thursday, August 16, 2018

Method: SM 4500-NO3(H)-N



Great Lakes Environmental Center

GREAT LAKES ENVIRONMENTAL CENTER, INC.

CHAIN OF CUSTODY RECORD

Traverse City, MI - Laboratory
739 Hastings Street
Traverse City, MI 49686

www.glec.com
Phone (231)941-2230
Fax (231)941-2240

Section I.

Submitting Company:

Report Results To:

Address:

Phone:

E-mail:

Section II.

Project Name:

Project Number:

P.O.#:

Sampled by: (initials)
☒ GLEC MLV ☐ Client

Section IV.

Requested Analysis

Section III.

Sample Information at Collection

#	GLEC No.	Sample Identification			Grab or Composite	Preservative	Filtered Y or N	Sample Containers		pH of Sample Upon Receipt
		Date	Time	Matrix				Type	Size	No.
1		Severance Creek	8/1/18	0950	SW	G				
2		Bartholomew Creek	8/1/18	1105		H2SO4				
3		Sutton Creek	8/1/18	1155						
4		Lokivs Creek	8/1/18	1245						
5		Landslide Creek	8/1/18	1405	SW	G				
6						H2SO4				
7										
8										

Client Notes:

RELEASED BY / ORGANIZATION

Print Name & Organization:

Signature: Michelle VanderBrand, GLEC

Print Name & Organization

Signature

RECEIVED BY / ORGANIZATION

Print Name & Organization

Signature

Print Name & Organization

Signature

FOR LAB USE ONLY

Temperature of Samples: 2.7 °C

Initials: MLV

Notes/Anomalies/Discrepancies:

Bottle ID #, if applicable 20361

☒ Received on Wet Ice

MATRIX CODES:

S = SEDIMENT

SW = SURFACE WATER

E = EFFLUENT

GW = GROUNDWATER

SL = SLUDGE

AO = AQUATIC ORGANISM