P-51 Stream Assessments

Second River at Wolf Lake Road

Marquette County, Michigan

Prepared for:

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INTRODUCTION & BACKGROUND

King & MacGregor Environmental, Inc. (KME) was retained by Kennecott Eagle Minerals Company to conduct GLEAS Procedure #51 (P-51) stream assessments at proposed road crossing locations. The initial assessments were completed in 2008 and data were included within a report that was issued to Kennecott Eagle Minerals Company (KME 2009). This report is an addendum to the original report. Proposed road route realignment necessitated the analysis of stream ecological condition of the Second River near the current Wolf Lake Road crossing site.

METHODS

Prior to conducting field assessments, KME reviewed published information pertaining to the presence of fish species within the northern Upper Peninsula of Michigan. This included information maintained by the Michigan Natural Features Inventory (MNFI) and Michigan Department of Natural Resources (MDNR) Fisheries Division. An investigation was conducted on October 4 and 5, 2010 to assess stream ecological condition at three locations near the existing Wolf Lake Road crossing of Second River (Section 25, T48N-R29W) (Figures 1a and 1b). A 100-foot assessment station was selected where the stream diverges from the road corridor, downstream of the main culvert. Another 100-foot assessment station was selected where Second River flows parallel to the road and within 10 feet of the west shoulder. A third 100-foot assessment station was selected upstream of the existing main culvert. The purpose of the upper assessment station was to obtain reference data. Each stream assessment station was selected according to Michigan Department of Environmental Quality (MDEQ) Great Lakes and Environmental Assessment Section (GLEAS) Procedure #51 (P-51) guidelines (MDEQ 1997; MDEQ 2002).

Fish sampling was conducted immediately upon arrival at each assessment station so that most fish could be captured before they were able to hide or flee. A Smith-Root LR-24 electrofishing unit was used to temporarily capture fish at each assessment station (Reynolds 1996, Smith-Root, Inc. 2008) according to the GLEAS P-51 protocol. Fish were identified using a regional identification key (Hubbs and Lagler 1964) and immediately released. Fish species richness was calculated for each assessment station. Fish species presence/absence, species relative abundance, and fish community richness are all useful data for determining an ecological baseline within an area of investigation and can be useful as a general supplemental Indicator of Biological Integrity (IBI). However, GLEAS P-51 IBI protocol metrics for evaluating fish communities of coldwater/coolwater wadable streams in Michigan have not yet been fully developed and published. Therefore, only aquatic macroinvertebrate data were scored to determine the biological integrity and water quality at each stream assessment station.

A YSI 556 multiparameter instrument was used to measure concentration of dissolved oxygen, percent saturation of dissolved oxygen, temperature, oxidation/reduction potential (ORP), pH, and conductivity at each P-51 assessment site. Multiparameter instrument data do not show integrated effects over time, so this type of data is primarily used as an optional supplement to the GLEAS P-51. Local habitat assessment utilizing the updated GLEAS P-51 Habitat Characterization protocol was also conducted at each station (MDEQ 2002). The Habitat Characterization protocol describes 10 habitat metrics for characterizing local stream habitat. The individual scores of any of the 10 habitat metrics can help determine what habitat components have been most impacted and why biological integrity may have been affected. However, because of inherent subjectivity of the practitioner, the Habitat Characterization protocol is typically employed only as a secondary indicator of a stream's condition.

Aquatic macroinvertebrates were collected from all available substrates at each of the three stream assessment stations. Macroinvertebrates were sub-sampled in the field. Samples were preserved in ethanol solution and transported to a laboratory where they were identified to the necessary taxonomic resolution using appropriate regional keys (Pennak 1989; Peckarsky 1990; Merritt and Cummins 1996). The GLEAS P-51 macroinvertebrate-based Index of Biological Integrity protocol metrics designed for streams within the Northern Lakes and Forest eco-region (Omernik 1987) were used to determine the aquatic macroinvertebrate community characteristics and the overall biological integrity and water quality at each of the stream assessment stations.

RESULTS

A total of 50 individual fish of seven different species were captured and processed at the three assessment stations. Fish species richness ranged from six species at SR-LOWER station to four species at SR-ROADSIDE station (Table 1). SR-UPPER station had a fish species richness of five. The most common fish species were central mudminnow (*Umbra limi*), creek chub (*Semotilus atromaculatus*), mottled sculpin (*Cottus bairdii*), and western blacknose dace (*Rhinichthys obtusus*). A total of four brook trout (*Salvelinus fontinalis*) were caught. No federally-listed or Michigan-listed threatened, endangered, or special concern fish species were encountered during the electrofishing surveys.

The physical/chemical attributes recorded by the YSI 556 multiparameter instrument were all within the normal, seasonal range that would be expected. Approximately 100 macroinvertebrates were processed and identified from each of the three assessment stations (Table 2). GLEAS P-51 macroinvertebrate-based IBI scores for stations ranged from 0 to 3 on a scale of -9 to 9. All three of the stream assessment stations were classified according to the GLEAS P-51 macroinvertebrate-based IBI protocol as exhibiting at least an “acceptable” level of biological integrity and water quality. The macroinvertebrate IBI results were generally similar to the Habitat Characterization protocol ratings for each assessment station (Tables 3 and 4). Table 4 summarizes stream meta data (e.g., assessment station names, dates, locations) and assessment results.

DISCUSSION

Although physical habitat metrics can be useful for determining which habitat components have been most impacted, a robust macroinvertebrate IBI such as the GLEAS P-51 can often characterize a stream’s ecological condition more accurately and objectively than direct observation and measurement of specific habitat parameters. Macroinvertebrate communities respond predictably to environmental perturbations or impacts over time. When environmental degradation occurs, sensitive or specialized taxa tend to decline while tolerant and generalist taxa typically become relatively more abundant.

Fish community assemblages collected at each assessment station were similar to fish community assemblages typically found within other relatively slow headwater streams flowing through low-gradient areas of the Upper Peninsula’s Northern Lake & Forest ecoregion. A high level of beaver activity in the vicinity of the Second River assessment stations have slowed stream velocities, causing some burial of complex benthic substrates, somewhat lower dissolved oxygen concentrations, likely occasional warming above brook trout tolerance

thresholds during late summer, and potential impediments to brook trout dispersal. Although relatively few trout were caught within the P-51 assessment stations during October 2010, overall fish species community composition was similar to data from fish surveys previously conducted by MDNR staff at nearby locations on the Second River (MDNRE Fisheries Division 1991, 1995, 2000, 2008).

Despite flowing parallel to and within close proximity to Wolf Lake Road, the SR-ROADSIDE station had “acceptable” biological integrity and water quality as determined by the P-51 IBI calculations based on the macroinvertebrate community assemblage. The presence of brook trout indicates that this portion of the stream meets its coldwater fishery designation. However, local habitat characterization scores (Table 3) indicate that habitat along this portion of Second River is likely affected by the existing road. The total local habitat score of 108 barely attains the “good” habitat classification. A somewhat depressed score would be expected for a stream reach that has been historically straightened and exists so close to a sandy road.

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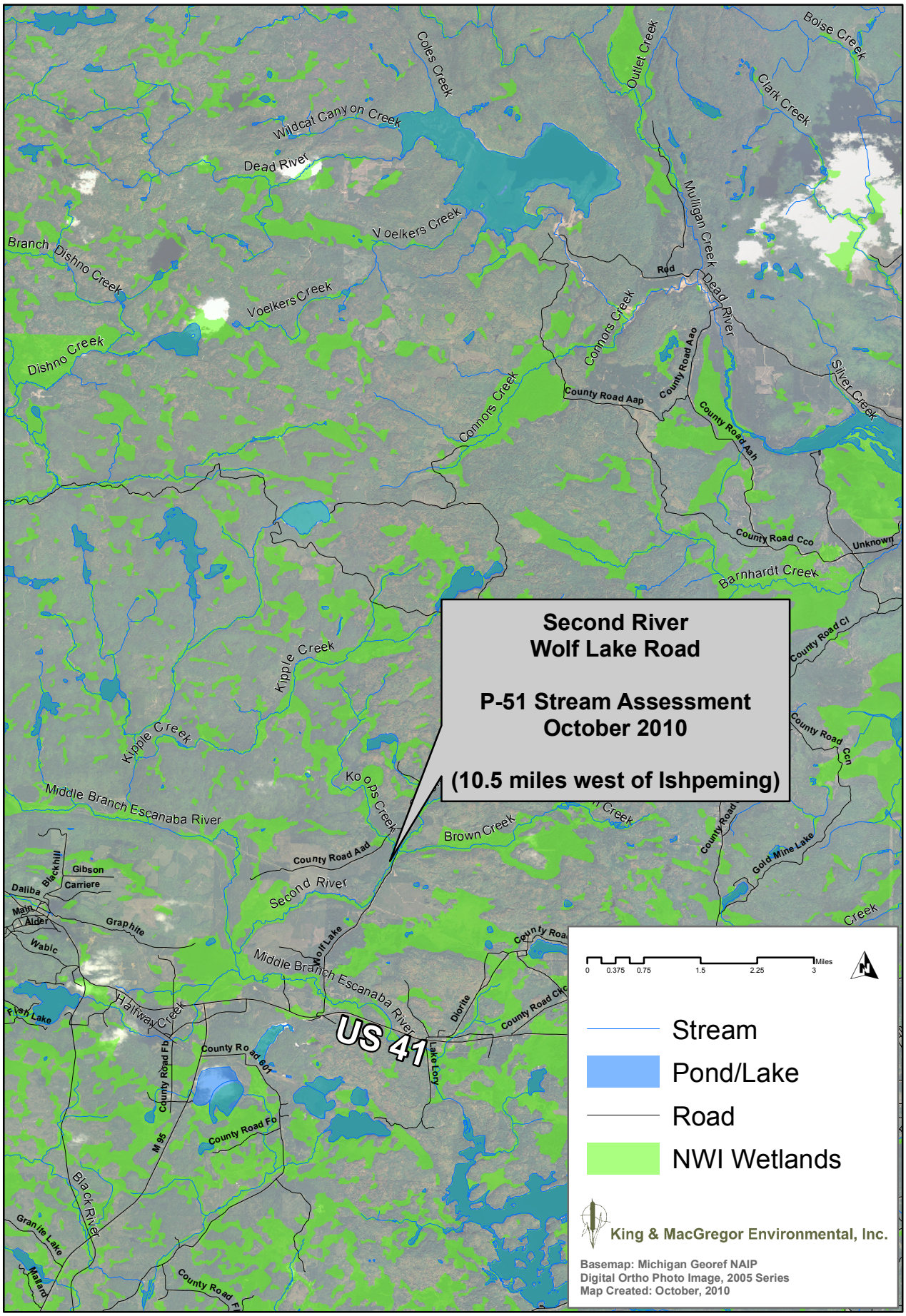

Figure 1a. Overview Map

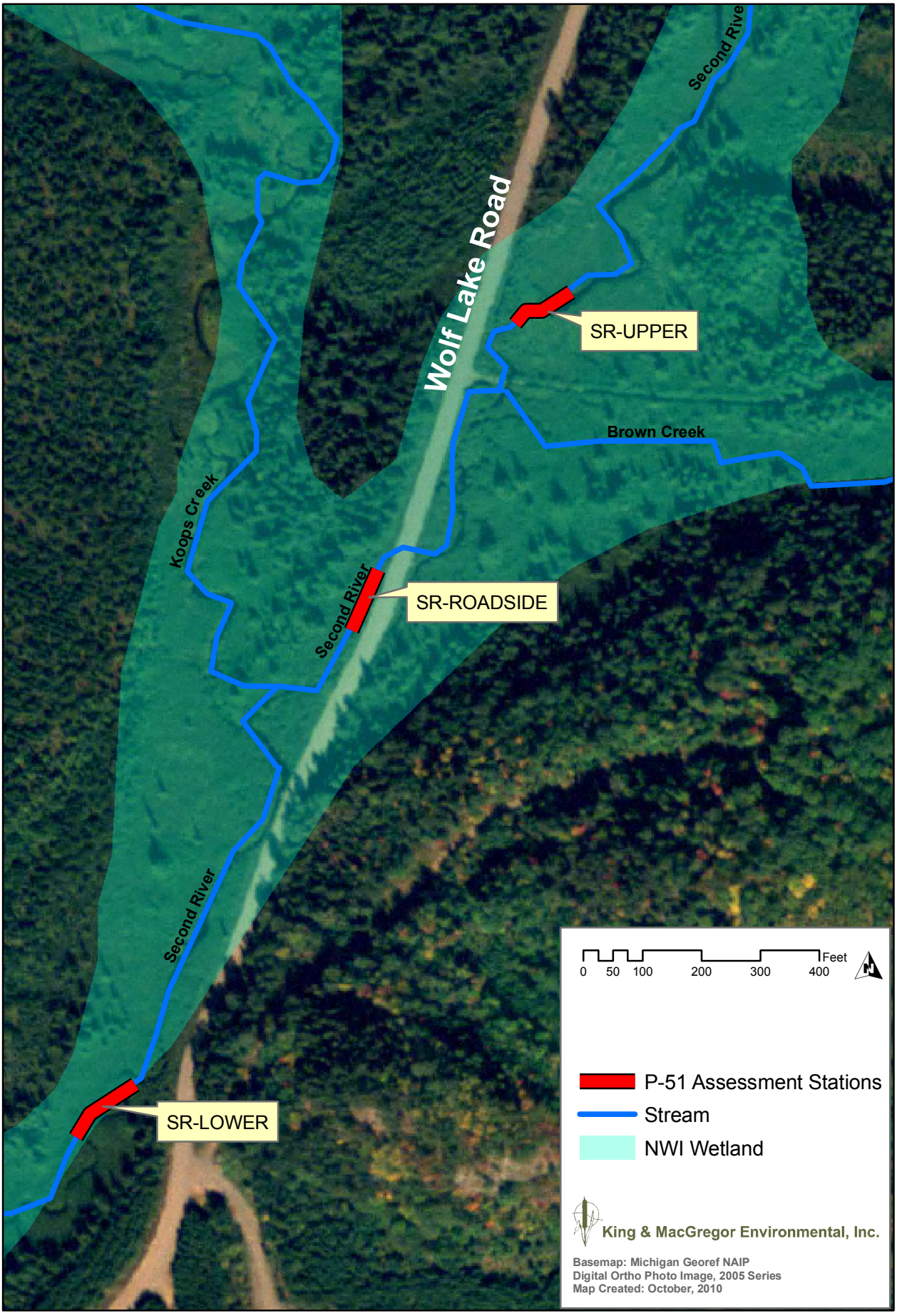

Figure 1b. Detailed Map Showing P-51 Assessment Station Locations at Second River, October 2010

Table 1. Fish Species Caught at Each Station, October 4 and 5, 2010

Stream Assessment Station Name	*Catostomus commersonii*	*Cottus bairdii*	*Culaea inconstans*	*Etheostoma exile*	*Luxilus cornutus*	*Oncorhynchus mykiss*	*Phoxinus neogaeus*	*Rhinichthys cataractae*	*Rhinichthys obtusus*	*Salmo trutta*	*Salvelinus fontinalis*	*Semotilus atromaculatus*	*Umbra limi*		
Second River, Wolf Lake Road Crossing (SR-UPPER)	0	4	0	2	0	0	0	0	0	0	2	1	4	13	Richness= 5
Second River, Wolf Lake Road Crossing (SR-ROADSIDE)	0	4	0	0	0	0	0	0	0	0	1	2	5	12	Richness= 4
Second River, Wolf Lake Road Crossing (SR-LOWER)	0	1	0	0	2	0	0	0	7	0	1	8	6	25	Richness= 6
	0	9	0	2	2	0	0	0	7	0	4	11	15	**50**	

Table 2a. P-51 Macroinvertebrate Sample
Second River; Lower Assessment Station; October 4, 2010

Ephemeroptera

Ametropodidae		0.00%
Baetiscidae		0.00%
Baetidae		0.00%
Caenidae		0.00%
Ephemerellidae		0.00%
Ephemeridae		0.00%
Heptageniidae		0.00%
Isonychiidae		0.00%
Leptophlebiidae	33	36.67%
Metretopodidae		0.00%
Polymitarcyidae		0.00%
Potamanthidae		0.00%
Siphlonuridae		0.00%
Tricorythidae		0.00%
		36.67%

Odonata

Aeshnidae	4	4.44%
Cordulegastridae	2	2.22%
Corduliidae		0.00%
Gomphidae		0.00%
Libellulidae		0.00%
Macromiidae		0.00%
Calopterygidae	3	3.33%
Coenagrionidae		0.00%
Lestidae		0.00%
		4.44%

Plecoptera

Capniidae		0.00%
Chloroperlidae		0.00%
Leuctridae		0.00%
Nemouridae		0.00%
Peltoperlidae		0.00%
Perlidae		0.00%
Perlodidae		0.00%
Pteronarcyidae		0.00%
Taeniopterygidae		0.00%
		0.00%

Hemiptera

Belostomatidae		0.00%
Corixidae		0.00%
Gelastocoridae		0.00%
Gerridae		0.00%
Mesoveliidae		0.00%
Naucoridae		0.00%
Nepidae		0.00%
Notonectidae		0.00%
Pleidae		0.00%
Saldidae		0.00%
Veliidae		0.00%
		0.00%

Megaloptera

Corydalidae		0.00%
Sialidae	14	15.56%
		15.56%

Neuroptera

Sisyridae		0.00%
		0.00%

Trichoptera

Brachycentridae		0.00%
Glossosomatidae		0.00%
Helicopsychidae		0.00%
Hydropsychidae		0.00%
Hydroptilidae		0.00%
Lepidostomatidae		0.00%
Leptoceridae		0.00%
Limnephilidae		0.00%
Molannidae		0.00%
Odontoceridae		0.00%
Philopotamidae		0.00%
Phryganeidae	2	2.22%
Polycentropodidae		0.00%
Psychomyiidae		0.00%
Rhyacophilidae		0.00%
Sericostomatidae		0.00%
Uenoidae		0.00%
		2.22%

Lepidoptera

Noctuidae		0.00%
Pyralidae		0.00%
		0.00%

Coleoptera

Dryopidae		0.00%
Dytiscidae		0.00%
Elmidae		0.00%
Gyrinidae (A)	4	4.44%
Gyrinidae (L)		0.00%
Haliplidae (A)		0.00%
Haliplidae (L)		0.00%
Heteroceridae		0.00%
Hydraenidae		0.00%
Hydrophilidae		0.00%
Lampyridae (A)		0.00%
Lampyridae (L)		0.00%
Noteridae (A)		0.00%
Noteridae (L)		0.00%
Psephenidae(A)		0.00%
Psephenidae (L)		0.00%
Ptilodactylidae (A)		0.00%
Ptilodactylidae (L)		0.00%
Scirtidae (A)		0.00%
Scirtidae (L)		0.00%
		4.44%

Diptera

Athericidae		0.00%
Ceratopogonidae		0.00%
Chaoboridae		0.00%
Chironomidae	20	22.22%
Culicidae		0.00%
Dixidae		0.00%
Dolichopodidae		0.00%
Empididae		0.00%
Ephydridae		0.00%
Muscidae		0.00%
Ptychopteridae		0.00%
Psychodidae		0.00%
Sciomyzidae		0.00%
Simuliidae	2	2.22%
Stratiomyidae		0.00%
Syrphidae		0.00%
Tabanidae	1	1.11%
Thaumaleidae		0.00%
Tipulidae		0.00%
		22.22%

Gastropoda

Ancylidae		0.00%
Bithyniidae		0.00%
Hydrobiidae		0.00%
Lymnaeidae		0.00%
Physidae		0.00%
Planorbidae	1	1.11%
Pleuroceridae		0.00%
Pomatiopsidae		0.00%
Valvatidae		0.00%
Viviparidae		0.00%
		1.11%

Pelecypoda

Dreissenidae		0.00%
Pisidiidae		0.00%
Sphaeriidae	4	4.44%
Unionidae		0.00%
		4.44%

Misc.

Porifera		0.00%
Turbellaria		0.00%
Nematomorpha		0.00%
Bryozoa		0.00%
Hirudinea		0.00%
Oligochaeta		0.00%
Amphipoda		0.00%
Decapoda		0.00%
Isopoda		0.00%
Hydracarina		0.00%
		0.00%

Total Individuals: **90**

Table 2b. P-51 Macroinvertebrate Sample
Second River; Roadside Assessment Station; October 4, 2010

Ephemeroptera

Ametropodidae		0.00%
Baetiscidae		0.00%
Baetidae		0.00%
Caenidae	1	0.96%
Ephemerellidae		0.00%
Ephemeridae		0.00%
Heptageniidae	5	4.81%
Isonychiidae		0.00%
Leptophlebiidae	47	45.19%
Metretopodidae		0.00%
Polymitarcyidae		0.00%
Potamanthidae		0.00%
Siphlonuridae		0.00%
Tricorythidae		0.00%
		45.19%

Odonata

Aeshnidae	1	0.96%
Cordulegastridae	2	1.92%
Corduliidae		0.00%
Gomphidae		0.00%
Libellulidae		0.00%
Macromiidae		0.00%
Calopterygidae		0.00%
Coenagrionidae		0.00%
Lestidae		0.00%
		1.92%

Plecoptera

Capniidae		0.00%
Chloroperlidae		0.00%
Leuctridae		0.00%
Nemouridae		0.00%
Peltoperlidae		0.00%
Perlidae		0.00%
Perlodidae		0.00%
Pteronarcyidae		0.00%
Taeniopterygidae		0.00%
		0.00%

Hemiptera

Belostomatidae		0.00%
Corixidae		0.00%
Gelastocoridae		0.00%
Gerridae		0.00%
Mesoveliidae		0.00%
Naucoridae		0.00%
Nepidae		0.00%
Notonectidae		0.00%
Pleidae		0.00%
Saldidae		0.00%
Veliidae		0.00%
		0.00%

Megaloptera

Corydalidae		0.00%
Sialidae	8	7.69%
		7.69%

Neuroptera

Sisyridae		0.00%
		0.00%

Trichoptera

Brachycentridae		0.00%
Glossosomatidae		0.00%
Helicopsychidae		0.00%
Hydropsychidae	1	0.96%
Hydroptilidae		0.00%
Lepidostomatidae		0.00%
Leptoceridae		0.00%
Limnephilidae		0.00%
Molannidae		0.00%
Odontoceridae		0.00%
Philopotamidae		0.00%
Phryganeidae	3	2.88%
Polycentropodidae		0.00%
Psychomyiidae		0.00%
Rhyacophilidae	2	1.92%
Sericostomatidae		0.00%
Uenoidae		0.00%
		2.88%

Lepidoptera

Noctuidae		0.00%
Pyralidae		0.00%
		0.00%

Coleoptera

Dryopidae		0.00%
Dytiscidae		0.00%
Elmidae		0.00%
Gyrinidae (A)	5	4.81%
Gyrinidae (L)		0.00%
Haliplidae (A)		0.00%
Haliplidae (L)		0.00%
Heteroceridae		0.00%
Hydraenidae		0.00%
Hydrophilidae		0.00%
Lampyridae (A)		0.00%
Lampyridae (L)		0.00%
Noteridae (A)		0.00%
Noteridae (L)		0.00%
Psephenidae(A)		0.00%
Psephenidae (L)		0.00%
Ptilodactylidae (A)		0.00%
Ptilodactylidae (L)		0.00%
Scirtidae (A)		0.00%
Scirtidae (L)		0.00%
		4.81%

Diptera

Athericidae		0.00%
Ceratopogonidae		0.00%
Chaoboridae		0.00%
Chironomidae	17	16.35%
Culicidae		0.00%
Dixidae		0.00%
Dolichopodidae		0.00%
Empididae		0.00%
Ephydridae		0.00%
Muscidae		0.00%
Ptychopteridae	1	0.96%
Psychodidae		0.00%
Sciomyzidae		0.00%
Simuliidae	2	1.92%
Stratiomyidae		0.00%
Syrphidae		0.00%
Tabanidae		0.00%
Thaumaleidae		0.00%
Tipulidae		0.00%
		16.35%

Gastropoda

Ancylidae		0.00%
Bithyniidae		0.00%
Hydrobiidae		0.00%
Lymnaeidae		0.00%
Physidae	1	0.96%
Planorbidae	1	0.96%
Pleuroceridae		0.00%
Pomatiopsidae		0.00%
Valvatidae		0.00%
Viviparidae		0.00%
		0.96%

Pelecypoda

Dreissenidae		0.00%
Pisidiidae		0.00%
Sphaeriidae	2	1.92%
Unionidae		0.00%
		1.92%

Misc.

Porifera		0.00%
Turbellaria		0.00%
Nematomorpha		0.00%
Bryozoa		0.00%
Hirudinea	1	0.96%
Oligochaeta		0.00%
Amphipoda	3	2.88%
Decapoda	1	0.96%
Isopoda		0.00%
Hydracarina		0.00%
		2.88%

Total Individuals: **104**

Table 2c. P-51 Macroinvertebrate Sample
Second River; Upper Assessment Station; October 5, 2010

Ephemeroptera

Ametropodidae		0.00%
Baetiscidae		0.00%
Baetidae		0.00%
Caenidae		0.00%
Ephemerellidae		0.00%
Ephemeridae		0.00%
Heptageniidae		0.00%
Isonychiidae		0.00%
Leptophlebiidae	10	9.62%
Metretopodidae		0.00%
Polymitarcyidae		0.00%
Potamanthidae		0.00%
Siphlonuridae		0.00%
Tricorythidae		0.00%
		9.62%

Odonata

Aeshnidae	2	1.92%
Cordulegastridae		0.00%
Corduliidae		0.00%
Gomphidae		0.00%
Libellulidae		0.00%
Macromiidae		0.00%
Calopterygidae		0.00%
Coenagrionidae		0.00%
Lestidae		0.00%
		1.92%

Plecoptera

Capniidae		0.00%
Chloroperlidae		0.00%
Leuctridae		0.00%
Nemouridae		0.00%
Peltoperlidae		0.00%
Perlidae		0.00%
Perlodidae		0.00%
Pteronarcyidae		0.00%
Taeniopterygidae		0.00%
		0.00%

Hemiptera

Belostomatidae	1	0.96%
Corixidae		0.00%
Gelastocoridae		0.00%
Gerridae		0.00%
Mesoveliidae		0.00%
Naucoridae		0.00%
Nepidae		0.00%
Notonectidae		0.00%
Pleidae		0.00%
Saldidae		0.00%
Veliidae		0.00%
		0.96%

Megaloptera

Corydalidae		0.00%
Sialidae	9	8.65%
		8.65%

Neuroptera

Sisyridae		0.00%
		0.00%

Trichoptera

Brachycentridae		0.00%
Glossosomatidae		0.00%
Helicopsychidae		0.00%
Hydropsychidae		0.00%
Hydroptilidae		0.00%
Lepidostomatidae		0.00%
Leptoceridae		0.00%
Limnephilidae		0.00%
Molannidae		0.00%
Odontoceridae		0.00%
Philopotamidae		0.00%
Phryganeidae		0.00%
Polycentropodidae	2	1.92%
Psychomyiidae		0.00%
Rhyacophilidae		0.00%
Sericostomatidae		0.00%
Uenoidae		0.00%
		1.92%

Lepidoptera

Noctuidae		0.00%
Pyralidae		0.00%
		0.00%

Coleoptera

Dryopidae		0.00%
Dytiscidae	5	4.81%
Elmidae		0.00%
Gyrinidae (A)	6	5.77%
Gyrinidae (L)		0.00%
Haliplidae (A)		0.00%
Haliplidae (L)		0.00%
Heteroceridae		0.00%
Hydraenidae		0.00%
Hydrophilidae		0.00%
Lampyridae (A)		0.00%
Lampyridae (L)		0.00%
Noteridae (A)		0.00%
Noteridae (L)		0.00%
Psephenidae(A)		0.00%
Psephenidae (L)		0.00%
Ptilodactylidae (A)		0.00%
Ptilodactylidae (L)		0.00%
Scirtidae (A)		0.00%
Scirtidae (L)		0.00%
		5.77%

Diptera

Athericidae		0.00%
Ceratopogonidae		0.00%
Chaoboridae		0.00%
Chironomidae	21	20.19%
Culicidae		0.00%
Dixidae		0.00%
Dolichopodidae		0.00%
Empididae		0.00%
Ephydridae		0.00%
Muscidae		0.00%
Ptychopteridae	1	0.96%
Psychodidae		0.00%
Sciomyzidae		0.00%
Simuliidae		0.00%
Stratiomyidae		0.00%
Syrphidae		0.00%
Tabanidae		0.00%
Thaumaleidae		0.00%
Tipulidae		0.00%
		20.19%

Gastropoda

Ancylidae		0.00%
Bithyniidae		0.00%
Hydrobiidae		0.00%
Lymnaeidae		0.00%
Physidae		0.00%
Planorbidae		0.00%
Pleuroceridae		0.00%
Pomatiopsidae		0.00%
Valvatidae		0.00%
Viviparidae		0.00%
		0.00%

Pelecypoda

Dreissenidae		0.00%
Pisidiidae		0.00%
Sphaeriidae	29	27.88%
Unionidae		0.00%
		27.88%

Misc.

Porifera		0.00%
Turbellaria		0.00%
Nematomorpha		0.00%
Bryozoa		0.00%
Hirudinea	1	0.96%
Oligochaeta	2	1.92%
Amphipoda	15	14.42%
Decapoda		0.00%
Isopoda		0.00%
Hydracarina		0.00%
		14.42%

Total Individuals: **104**

Table 3a. Stream Habitat Characterization Overview

Stream Assessment Station Name	Flow Consistency	Average Velocity	Dominant Substrate	Average Stream Width at Station (ft)	Average Stream Depth at Station (ft)
Second River, Wolf Lake Road Crossing (SR-UPPER)	perennial	low	silt / deep silt	8	2
Second River, Wolf Lake Road Crossing (SR-ROADSIDE)	perennial	mod	sand / gravel	10	0.5
Second River, Wolf Lake Road Crossing (SR-LOWER)	perennial	mod	sand / gravel / roots/branches	10	1.5

Table 3b. Stream Habitat Characterization Scores at Each Station

Maximum of 20 pts for each Habitat Characterization Metric

Stream Assessment Station Name	Habitat Characterization Metrics									
	Epifaunal Substrate and Available Cover	Embeddedness or Pool Substrate	Velocity/Depth or Pool Variability	Sedimentation Deposition	Flow Status	Channel Alteration	Freq. of Riffles or Bends	Bank Stability	Vegetative Protection	Riparian Veg. Zone Width
Second River, Wolf Lake Road Crossing (SR-UPPER)	6	6	10	12	16	20	10	20	20	20
Second River, Wolf Lake Road Crossing (SR-ROADSIDE)	10	9	7	12	16	10	4	16	10	14
Second River, Wolf Lake Road Crossing (SR-LOWER)	10	10	8	12	16	20	10	20	20	18

Table 4. P-51 Stream Crossing Assessment Summary

Stream Assessment Station Name	Station Description	Location	Assessment Date	Station Length (ft)	GLEAS P-51 Macro-invertebrate IBI Score (-9 to +9)	GLEAS P-51 Biological Integrity	GLEAS P-51 Habitat Characterization Score	GLEAS P-51 Habitat Characterization	Fish Total	Fish Species Richness
Second River, Wolf Lake Road Crossing (SR-UPPER)	Upper Station Reach (station length = 100FT)	48N29W25 N46.527985 W-87.866669 (WGS 84)	10/5/2010	100	0	**Acceptable Biological Integrity and Water Quality**	140	**Good Local Habitat**	13	5
Second River, Wolf Lake Road Crossing (SR-ROADSIDE)	Roadside Station Reach (station length = 100FT)	48N29W25 N46.526768 W-87.867692 (WGS 84)	10/5/2010	100	3	**Acceptable Biological Integrity and Water Quality**	108	**Good Local Habitat**	12	4
Second River, Wolf Lake Road Crossing (SR-LOWER)	Lower Station Reach (station length = 100FT)	48N29W25 N46.524326 W-87.869255 (WGS 84)	10/4/2010	100	2	**Acceptable Biological Integrity and Water Quality**	144	**Good Local Habitat**	25	6

APPENDIX
Photographs of Second River; October 2010

Second River, lower station (SR-LOWER). The 100-foot station was dominated by alders. October 4, 2010.

Second River, lower station (SR-LOWER). October 4, 2010.

Second River, roadside station (SR-ROADSIDE). The 100-foot station was relatively straight and generally within ten feet of the shoulder of Wolf Lake Road. October 4, 2010.

Second River, roadside station (SR-ROADSIDE). October 4, 2010.

Second River, upper station (SR-UPPER). This 100-foot station was located on the upstream side of the main culverts. Deeper and slower flowing than both lower stations. October 5, 2010.

Second River, upper station (SR-UPPER). October 5, 2010.