

**Investigation of the Aquatic
Communities of the Salmon Trout
River, Yellow Dog River, and Cedar
Creek in Marquette County,
Michigan.**

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Prepared for:

Kennecott Eagle Minerals Company

Prepared by:

ADVANCED ECOLOGICAL MANAGEMENT

2692 165th Avenue

Morley, MI 49336

**ADVANCED
ECOLOGICAL
MANAGEMENT**

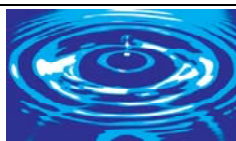


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1.0 EXECUTIVE SUMMARY

Advanced Ecological Management (AEM) conducted a follow-up aquatics survey in June, 2007 at the Eagle Project site for use by Kennecott Eagle Minerals Company (KEMC). The Eagle Project is located in northern Marquette County, Michigan as shown on Figure 1-1. KEMC is planning to develop mining facilities at the site. Previous aquatics surveys have been conducted in the area, some within several of the same stations as this survey. This survey is similar in scope to the 2006 Aquatics survey performed by AEM (AEM, 2007). During 2007, an additional fall fish survey was performed and is documented separately (AEM, 2008). Where applicable, the aquatics surveys at the stations included fish, macroinvertebrate, and habitat community ratings according to the metrics outlined in the Great Lakes and Environmental Assessment Section (GLEAS) Procedure Number 51 (P-51), a survey protocol for wadable streams and rivers.

Fish were collected from ten locations including stations within the Salmon Trout River, tributaries in the East Branch of the Salmon Trout River, the Yellow Dog River, and Cedar Creek. Station locations are shown on Figure 1-2. Most fish were collected from Station 6, which is located in the vicinity of the ore body in the Salmon Trout River. Northern redbelly dace (*Phoxinus eos*), brook stickleback (*Culaea inconstans*), and blacknose dace (*Rhinichthys atratulus*) were the most abundant species in Station 6.

The aquatic systems that were investigated for this survey are predominantly functioning as coldwater trout streams. Because some of the fish communities of the Salmon Trout River and its tributaries, the Yellow Dog River, and Cedar Creek were comprised of trout greater than 1% of the fish community composition, the P-51 fish community scores were determined from the macroinvertebrate community ratings for those streams.

The macroinvertebrate communities within the Salmon Trout River have been scored by AEM as excellent or acceptable communities. In most stations, the macroinvertebrate community rating was consistent with previous sampling efforts conducted by AEM, Wetland and Coastal Resources, and the MDEQ (Advanced Ecological Management 2007; Wetland and Coastal Resources 2005; MDEQ/ Premo et al. 2005, 2006).

The aquatic habitat was rated as excellent or good by AEM. The 2007 aquatic habitat scores are generally consistent with previous evaluations that were conducted by AEM (AEM 2007).

A summary of P-51 macroinvertebrate and aquatic habitat scores appears on Table 1-1.

2.0 INTRODUCTION

In December 2007, Kennecott Eagle Minerals Company (KEMC) was granted a set of permits from the Michigan Department of Environmental Quality (MDEQ) to mine ore from an ore body located on the Yellow Dog Plains near the Main Branch of the Salmon Trout River (Figure 1-2). As part of a pre-mining environmental baseline, aquatic community investigations have been conducted within the Salmon Trout River and its tributaries, the Yellow Dog River, and Cedar Creek. These studies have been completed by Wetland and Coastal Resources (WCR, 2005), King & MacGregor Environmental (KME, 2005), the Michigan Department of Environmental Quality (MDEQ/Premo et al., 2005, 2006), and Advanced Ecological Management (AEM, 2007). This report contains information regarding the aquatic community survey that was conducted by AEM during 2007, and is intended to provide another year of baseline data.

3.0 STUDY AREA

The principle area investigated for this study included portions of the Salmon Trout River and its tributaries, the Yellow Dog River, and Cedar Creek (Figure 1-2). These systems are all coldwater streams that flow through relatively undeveloped watersheds that are predominantly forested. The ore body and proposed mine site are located near the headwaters of the Salmon Trout River Main Branch, which flows in a northeastern direction (Figure 1-2). The Salmon Trout River is characterized by a variety of habitat types in the vicinity of the stream segments investigated and includes slow-flowing segments with a silt substrate that have been heavily influenced by beaver activity (Stations 6, 7), and high-gradient segments flowing through forested and hilly terrain (Station 8).

The Yellow Dog River flows to the west along the southern boundary of the Yellow Dog Plains (Figure 1-2). Cedar Creek flows to the north and is not located within the same watershed as the proposed mining project. Cedar Creek serves as a reference stream for the Eagle Project.

4.0 METHODS

The 2007 aquatic survey was conducted according to the Michigan Department of Environmental Quality's Surface Water Quality Division GLEAS *Procedure #51 Survey Protocols for Wadable Rivers* (MDEQ, 2002). Ten stream segments (stations) were sampled in 2007 using the P-51 survey protocol (Figure 1-2). Except for Stations 8, 9, and 10, these sample stations are situated in the same sample locations that were surveyed by Advanced Ecological Management (AEM) in 2006. At the request of the MDEQ, Stations 8 and 9 were relocated from previous surveys and

Station 10 was added in order to provide additional sampling points on tributaries to the East Branch of the Salmon Trout River.

This report follows the protocol established in the Wetland & Coastal Resources survey of 2004, (WCR, 2005) in that fish collection data are summarized and P-51 scores are provided for macroinvertebrates and habitat quality.

4.1 Fish Collection

The ten survey stations were blocked at the upstream and downstream extents using seines that measured 4 feet by 50 feet, with a 0.19-inch mesh size. When adequate habitat conditions permitted, a multi-pass removal technique was used to evaluate fish abundance throughout each station (Van Deventer and Platts, 1983). A backpack electroshocker was used in narrow (approximately ≤ 10 feet) or difficult-to-access stations (e.g., areas with abundant woody debris). A barge-mounted electroshocker was used to sample stations that were deep (approximately 2 to 3 feet), wide (approximately > 10 feet), and where woody debris was sparse enough to permit the passage of the barge unit. Three consecutive passes were conducted, each in an upstream direction. The duration of electroshocking was recorded for each pass and stunned fish were placed in a live well for identification and enumeration. Following each pass and subsequent fish identification, the enumerated fish were released approximately 100 feet upstream of the station so that they would not be re-collected in subsequent passes.

As part of the enumeration process, the number of each species present was recorded. One representative of each species that was not identifiable in the field was placed in a voucher jar containing 10% formalin for later identification. Each voucher jar was labeled according to the sample location and date. Fish were identified to species using various taxonomic references (Bailey et al., 2003; Coon, 2001; McCafferty, 1998; Pflieger, 1997; Page and Burr, 1991; Becker, 1983). The Michigan County Element List (MNFI, 2007) was also reviewed to determine if any threatened, endangered, or special concern aquatic species occurred within the Salmon Trout River and its tributaries, the Yellow Dog River, or Cedar Creek.

4.2 Macroinvertebrates

Upon completion of fish sampling, aquatic macroinvertebrates, including mussels and decapods (crayfish), were collected within each station using D-framed kick-nets (Merritt et al., 1996). Stations were sampled for 45 minutes using two kick nets (total sample time = 1.5 hours) and samples were collected in all habitat types within each station to characterize the macroinvertebrate community. Collected specimens were stored in 500 ml plastic wide-mouth jars containing 70% ethanol, and were identified using various taxonomic references (Merritt et al., 2008; Bright 2007; Cummings and Mayer, 1992; Peckarsky et al., 1990; Pennak, 1990).

The macroinvertebrate data were analyzed according to nine metrics identified in the P-51 methodology. The sum of the macroinvertebrate scores can range from -9 to +9; and are graded as excellent, acceptable, or poor according to the summation of the metric scores.

4.3 Stream Habitat Evaluation

Riparian and instream habitats were qualitatively described for each station. A description of stream morphology included run/riffle/pool/shallow pool configurations, substrate, substrate embeddedness, instream cover, vegetation, flow stability, and bank stability. Stream habitat was rated as excellent, good, marginal, or poor based on P-51 scores interpreted from 10 habitat metrics. Habitat was rated according to the following P-51 habitat scores (MDEQ, 2002):

Habitat Characterization	Total Point Score
1. Excellent	> 154
2. Good	105 – 154
3. Marginal	56 – 104
4. Poor	< 56

Photographs were taken at each station to illustrate the conditions during the sampling period (Exhibit C). Water temperature, pH, dissolved oxygen, and conductivity were measured as part of the stream habitat evaluation. These water quality parameters were measured using a Yellow Springs Instrument Model YSI 556 water quality meter.

Wetted stream width was measured at the lower, middle, and upper extent of each sample station. Depth was measured in the center, and at 20% and 80% of each stream width cross section. Stream flow was measured with a Marsh-McBirney Flow Mate 2000®.

5.0 RESULTS

Aquatic community sampling was conducted by AEM from June 8, 2007 through June 28, 2007 within the Salmon Trout River and its tributaries, the Yellow Dog River, and Cedar Creek. A total of ten stations were sampled, including one station in the Yellow Dog River, one station in Cedar Creek, five stations in the Main Branch of the Salmon Trout River, and three stations in tributaries of the East Branch of the Salmon Trout River (Table 5-1 and Figure 1-2).

5.1 Fish

Fish were collected from all stations with over 70% of the total being captured in Station 6. A total of five species of fish were observed among all ten stations (Table 5-2).

No MNFI listed threatened or endangered fish species were identified in the stations investigated in the Salmon Trout River and its tributaries, Yellow Dog River, and Cedar Creek in Marquette County, Michigan (MNFI, 2007).

5.1.1 Salmon Trout River and its tributaries: Stations 1, 2, 3, 6, 7, 8, 9 and 10

Northern redbelly dace (*Phoxinus eos*), brook stickleback (*Culaea inconstans*), blacknose dace (*Rhinichthys atratulus*), and brook trout (*Salvelinus fontinalis*) were the most frequently observed species among all seven stations within the Salmon Trout River system (Table 5-2). Brook trout were observed within stations 1, 2, 3, 6, 8, 9 and 10 during June, 2007.

Brook trout were the only species collected in Stations 1, 2, 3, 9, and 10. The number of brook trout collected from the Salmon Trout River ranged from zero fish in Station 7 to 29 fish in Station 9 (Table 5-2).

A total of 650 fish were collected from Station 6 by AEM in 2007 (Table 5-2). Fish from this station were predominantly northern redbelly dace, blacknose dace, and brook sticklebacks. All of the fish collected from Station 6 were approximately three-inches or less in length.

Twelve blacknose dace and one brook stickleback were collected by AEM in Station 7. Because habitat conditions from beaver activity made it difficult to adequately block the stream, a multi-pass removal method was not possible within this station.

Twelve brook trout and two brook sticklebacks were collected from Station 8. Because habitat conditions from a braided stream channel made it difficult to adequately block the stream, a multi-pass removal method was not possible within this station.

5.1.2 Yellow Dog River: Station 5

Station 5 is located in the Yellow Dog River. A total of 37 fish were collected in Station 5, including 25 blacknose dace (*Rhinichthys atratulus*), seven creek chubs (*Semotilus atromaculatus*), and five brook trout (Table 5-2).

5.1.3 Cedar Creek: Station 4

Station 4 is located in Cedar Creek outside of the project area drainage basin. A total of 98 fish, all brook trout, were collected in Station 4 (Table 5-2). Brook trout ranged in length from 0.9 inches to 8.3 inches, with an average length of 4.2 inches (sample size = 98; standard deviation = 2.0 inches).

5.2 Macroinvertebrates

Macroinvertebrates were collected from all ten stations that were investigated in 2007. However, because of beaver dams in the vicinity of Station 6 and Station 7 (Figure 5-1), the P-51 macroinvertebrate metrics protocol was not applied in these locations.

5.2.1 Salmon Trout River: Stations 1, 2, 3, 6, 7, 8, 9 and 10

A total of 1,250 macroinvertebrates representing 56 taxa identified to the Family level were observed collectively from Stations 1, 2, 3, 6, 7, 8, 9 and 10 in the Salmon Trout River. The greatest number of macroinvertebrates were collected from Station 8 and the fewest number of macroinvertebrates were collected from Station 2 (Table 5-3).

Mayflies (Ephemeroptera) were the most frequently collected macroinvertebrates followed by caddisflies (Trichoptera) in Station 1 (Table 5-3). A total of 89 macroinvertebrates were collected from Station 2 with flies (Dipterans) and Odonates (dragonflies and damselflies) being the most frequently collected macroinvertebrates in this station.

A total of 95 macroinvertebrates were collected from Station 3 with flies and mayflies being the most frequently collected macroinvertebrate (Table 5-3). A total of 179 macroinvertebrates were collected from Station 6 (Table 5-3). Scuds (amphipods), mollusks, flies, and caddisflies were the most frequently collected macroinvertebrates from this station.

A total of 97 macroinvertebrates were collected from Station 7 in 2007 (Table 5-3). Similar to Station 6, mollusks and scuds were the most frequently collected organisms in Station 7. A total of 354 macroinvertebrates were collected from Station 8 (Table 5-3). Among Stations 8, 9, and

10 flies, caddisflies, and mayflies were frequently collected. Scuds were also frequently collected in Station 8 and Odonates were frequently collected in Station 10.

Where possible, macroinvertebrate collection data have been evaluated in accordance with the metrics outlined in P-51. Table 5-4 summarizes the values and scores for the nine metrics for each station. Stations 1, 3, 9 and 10 were rated as “Excellent”, and Stations 2 and 8 were rated as “Acceptable” in 2007.

5.2.2 Yellow Dog River: Station 5

A total of 72 macroinvertebrates representing 24 taxa identified to the Family level were collected in Station 5 from the Yellow Dog River (Table 5-3). Mollusks and caddisflies were the most frequently collected macroinvertebrates. The macroinvertebrate community of Station 5 was rated as “Acceptable” in 2007 (Table 5-4).

5.2.3 Cedar Creek: Station 4

A total of 167 macroinvertebrates representing 22 taxa identified to the Family level were collected from Cedar Creek in Station 4 during 2007 (Table 5-3). Caddisflies and mayflies were the most frequently collected macroinvertebrates. The macroinvertebrate community of Station 4 was rated as “Acceptable” in 2007 (Table 5-4).

5.3 Stream Habitat

The stream habitat within Stations 1, 2, 3, 4, 5, 6, and 7 was consistent with conditions observed by AEM during 2006. The habitat conditions for all stations surveyed are described below.

5.3.1 Salmon Trout River: Stations 1, 2, 3, 6, 7, 8, 9 and 10

Station 1 is located in a narrow valley with relatively steep slopes rising more than 100 feet to the Yellow Dog Plains. Station 1 was 120 feet in length with an average width of 6.4 feet (sample size, $n = 3$; standard deviation, $s = 3.6$ feet), and average depth was 0.4 feet ($n = 9$; $s = 0.1$ feet). Stream flow was measured at the downstream extent of Station 1 and discharge was estimated at 1,373 gallons per minute (gpm; Table 5-5).

The streambanks of Station 1 were vegetated with herbaceous and woody vegetation (Photograph C-1). The streambed is characterized by a relatively steep gradient and the substrate was comprised of a variety of particles including sand, gravel, cobble, and boulders. Woody debris was frequently observed throughout the station (Photograph C-2).

Station 2 is located south of Triple A Road and Station 3 is located north of Triple A Road (Figures 1-2 and 5-1). Station 2 was 100 feet in length and Station 3 was 200 feet in length. Average width of Station 2 was 7.7 feet ($n = 3$; $s = 1.8$ feet) and was 6.7 feet ($n = 3$; $s = 0.9$ feet) in Station 3. Average depth in Station 2 was 0.9 feet ($n = 9$; $s = 0.4$ feet) and was 0.4 feet ($n = 9$; $s = 0.3$ feet) in Station 3. Stream flow for Stations 2 and 3 was measured at the downstream extent of Station 2 and discharge was estimated at 874 gpm (Table 5-5).

Station 2 was surrounded by an abundance of speckled alder (*Alnus rugosa*) and bluejoint grass (*Calamagrostis canadensis*, Photograph C-3 and Photograph C-4). The vegetation within Station 3 was predominantly characterized as speckled alder, which contributed woody debris to the stream (Photograph C-5). Watercress (*Nasturtium* sp.) was present within the stream channel of Station 3 (Photograph C-6).

Station 6 is located in the vicinity of the ore body (Figure 1-2). Station 6 is 300 feet in length and was influenced by beaver dams that were located downstream of the station. Stream flow was measured at the downstream extent of Station 6 and discharge was estimated at 625 gpm (Table 5-5).

The streambanks are characterized by sedge (*Carex* sp.), iris (*Iris* sp.), rush (*Juncus* sp.), willows (*Salix* sp.) and speckled alder (Photograph C-7 and Photograph C-8). Much of the aquatic vegetation was growing on organic matter that appeared to function as a floating mat of vegetation. The substrate of Station 6 was predominantly comprised of organic matter and fine sediments, such as silt and clay. Large woody debris was present throughout the stream channel.

Station 7 is located near the headwaters of the Salmon Trout River and is influenced by beaver dams throughout the vicinity. Station 7 is 100 feet in length and an active beaver dam is located at the upstream extent of this station. The average width of Station 7 was 5.0 feet ($n = 3$; $s = 1.2$ feet) and the average depth was 1.5 feet ($n = 9$; $s = 0.3$ feet). Stream flow was not measured in Station 7 because of channel braiding due to beaver activity.

The streambanks of Station 7 were vegetated with speckled alder, sedge, rush, and iris (Photograph C-9 and Photograph C-10). The substrate was comprised of organic matter and silt. Woody debris was abundant throughout this station.

Station 8 is located approximately 50 ft south of Northwestern Road and is 135 feet in length (Figure 1-2). The average width of Station 8 was 10.5 feet ($n = 3$; $s = 1.7$ feet) and the average depth was 0.8 feet ($n = 9$; $s = 0.5$ feet; Table 2). Stream flow was measured at the downstream extent of Station 8 and discharge was estimated at 1,718 gpm (Table 5-5).

The stream channel was braided upstream and downstream of the station and streambanks were predominately vegetated with speckled alder and tussock sedge (Photograph C-11 and Photograph C-12). Substrate was predominantly comprised of sand and silt throughout Station 8.

Station 9 is located immediately west of Northwestern Road and is approximately 85 feet in length (Figure 1-2). The average width of Station 9 was 7.9 feet ($n = 3$; $s = 1.6$ feet) and average depth was 0.8 feet ($n = 9$; $s = 0.3$ feet). Stream flow was measured at the downstream extent of Station 9 and discharge was estimated at 929 gpm (Table 5-5).

Speckled alder covered much of the stream channel and contributed to in-stream cover, while the understory was predominately tussock sedge (Photograph C-13 and Photograph C-14). The substrate was predominantly comprised of sand and silt.

Station 10 is located immediately south of Northwestern Road and is approximately 100 feet in length (Figure 1-2). Average width of Station 10 was 5.9 feet ($n = 3$; $s = 0.8$ feet) and average depth was 0.4 feet ($n = 9$; $s = 0.2$ feet). Stream flow was measured at the downstream extent of Station 10 and discharge was estimated at 178 gpm (Table 5-5).

The streambanks within Station 10 were vegetated with large deciduous trees, speckled alder, and other herbaceous vegetation (Photograph C-15). Large woody debris and undercut banks provided in-stream cover throughout this station (Photograph C-16). The substrate was predominantly comprised of sand and silt, although cobble and large boulders were also present.

5.3.2 Yellow Dog River: Station 5

Station 5 is located immediately west of an unnamed road that crosses the Yellow Dog River in a north-south orientation and links to Triple A Road approximately 1.5 miles north of the river (Figure 1-2). The station is 300 feet in length, with an average width of 24.0 feet ($n = 3$; $s = 5.1$ feet) and average depth of 1.4 feet ($n = 9$; $s = 0.7$ feet). Stream flow was measured at the downstream extent of Station 5 and discharge was estimated at 7,079 gpm (Table 5-5).

Streambanks were vegetated with a dense covering of speckled alder, which contributed to instream cover and woody debris within the channel (Photograph C-17 and Photograph C-18). The substrate was predominantly comprised of sand and silt.

5.3.3 Cedar Creek: Station 4

The downstream extent of Station 4 was located approximately 117 feet upstream of Northwestern Road (Figure 1-2). Station 4 was 300 feet in length, with an average width of 14.3 feet ($n = 3$; $s = 1.2$ feet) and average depth of 1.5 feet ($n = 9$; $s = 0.2$ feet). Stream flow was measured at the downstream extent of Station 4 and discharge was estimated at 5,994 gpm (Table 5-5).

The riparian vegetation throughout much of the station was predominantly speckled alder (Photograph C-19). Herbaceous vegetation was more abundant near the upstream and downstream extents of the station. A beaver dam was located near the upstream extent of the station and appeared to impound some water (Photograph C-20).

5.3.4 P-51 Habitat Scores

The stations sampled in 2007 were rated as good or excellent habitat quality (Table 5-6). No changes were observed to the stream habitat during the 2007 survey compared to stream habitat conditions observed by AEM in 2006. The 2007 P-51 habitat ratings for Stations 1 through 7 were consistent with the 2006 sampling that was conducted by AEM, (AEM, 2007).

Station 5 was the only station not given an excellent rating in the 2007 survey, but the score was very close to an excellent rating (152 points with good ranging from 105 – 154 points). See Section 4.3 for further explanation of ratings. All locations investigated by AEM were relatively undisturbed in the immediate vicinity of each station and contributed to the habitat diversity of their respective river system.

5.3.5 Water Quality

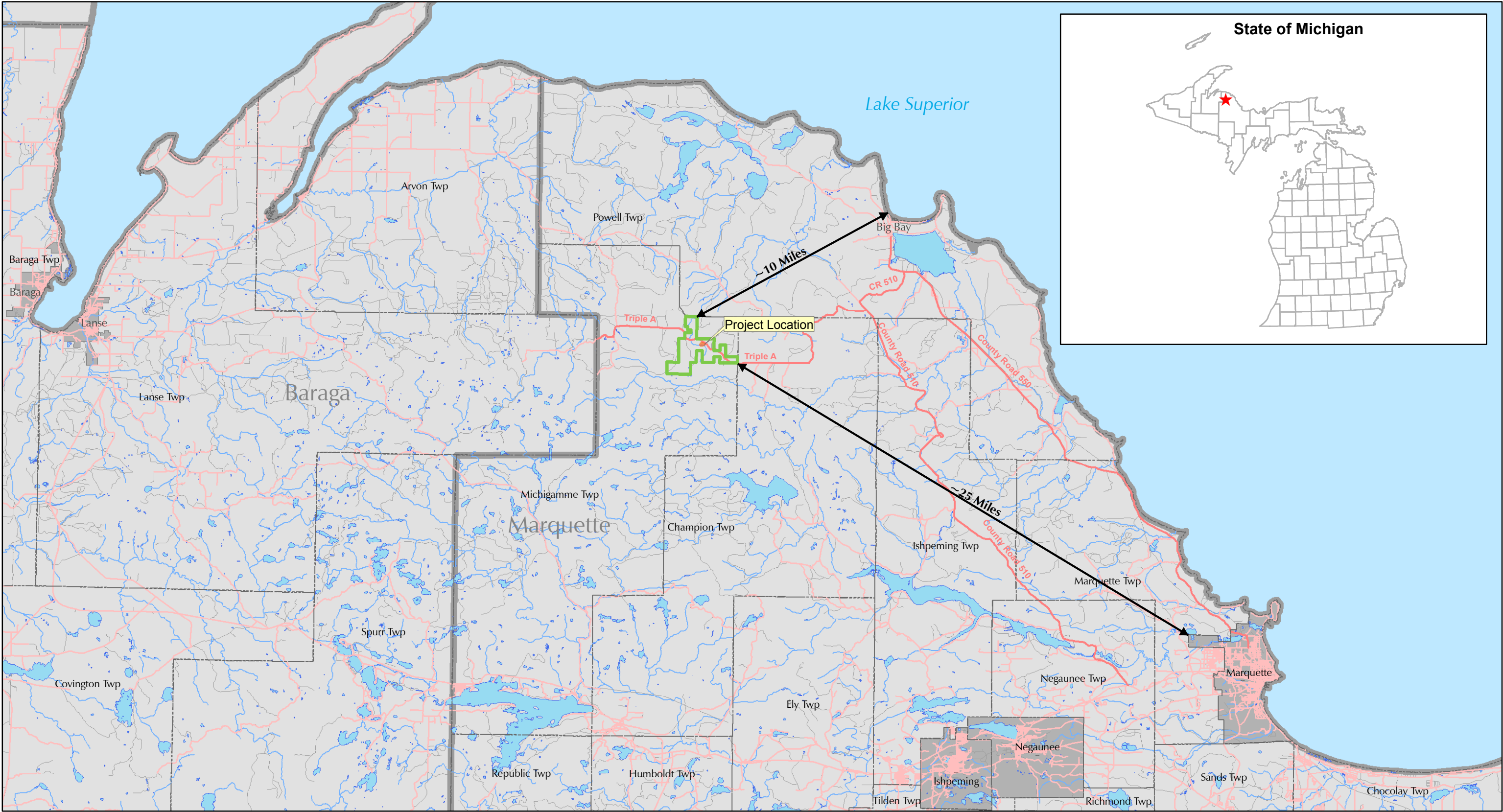
Water temperature ranged from 11.9°C in Station 9 to 19.1°C in Station 7 during June 2007 (Table 5-5). The average pH was 6.6 and varied little among stations ($n = 10$; $s = 0.6$). Conductivity was low in all stations. Conductivity was greater than 100 microSiemens per cm ($\mu\text{S}/\text{cm}$) in Stations 4, 8, 9, 10. Because of an equipment malfunction, dissolved oxygen was not measured during the 2007 June sample event.

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EXHIBIT A
REPORT FIGURES



NOTES

- 1. Surface property boundary as of November 18, 2004 supplied by Kennecott via Golder & Associates Inc., August, 2005.
- 2. Horizontal datum based on NAD 83/94.
Horizontal coordinates based on UTM Zone 16.
- 3. All base information downloaded from Michigan Center of Geographic Information (<http://www.michigan.gov/cgi>).
- 4. Site Location - Project Site within Sections 11 & 12, T50N, R29W, Town of Michigamme, Marquette County, Michigan.

LEGEND

- Counties
- Minor Civil Divisions
- Kennecott Surface Ownership
- Lakes and Rivers
- Highways
- Major Roads
- Minor Roads

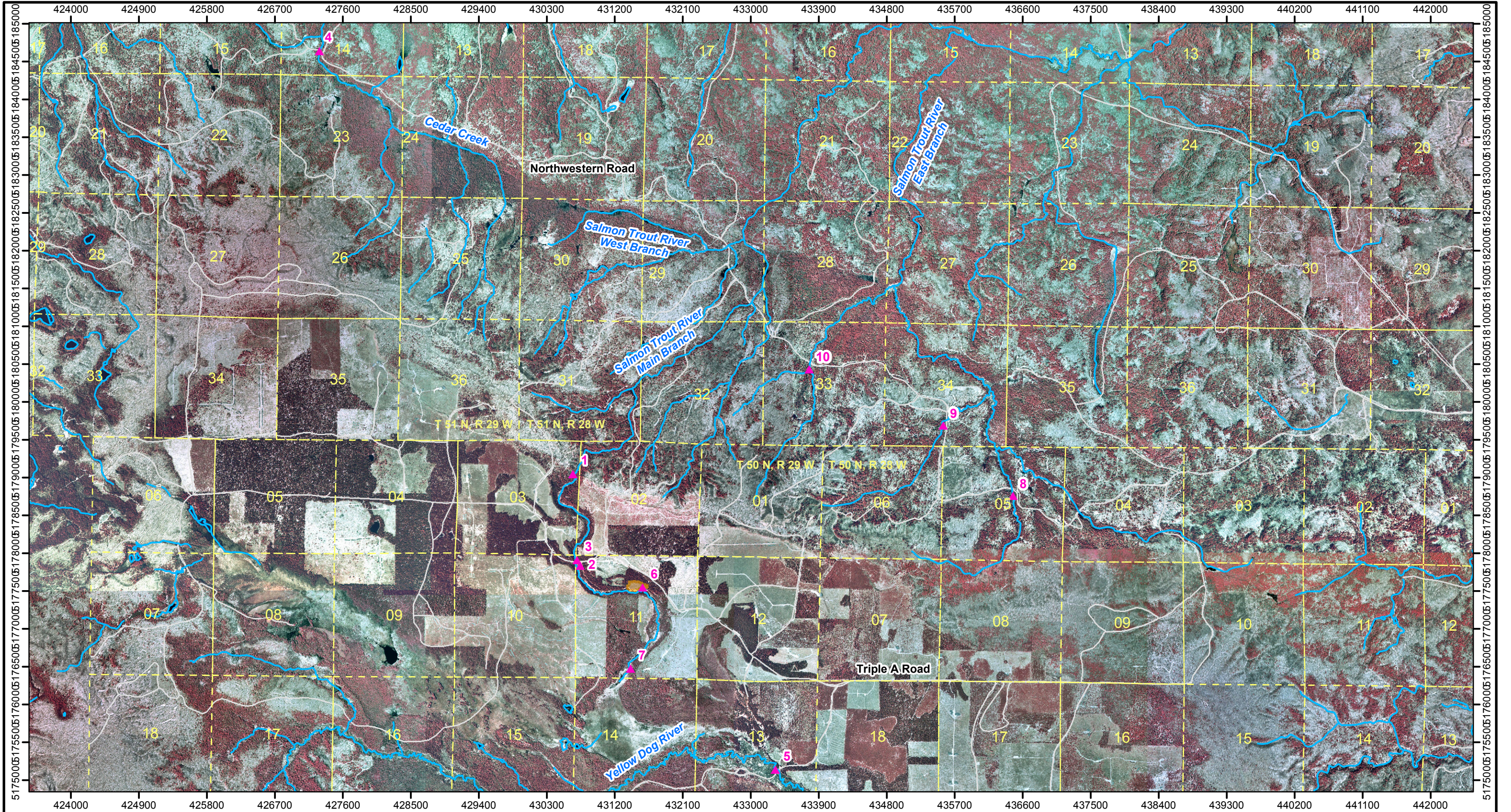


Foth Infrastructure & Environment, LLC			
REVISED	DATE	BY	DESCRIPTION
CHECKED BY:		AKM	DATE: MAR. '08
APPROVED BY:		SVD1	DATE: MAR. '08
APPROVED BY:			DATE:



FIGURE 1-1
PROJECT LOCATION

Scale:	Date: MARCH 2008
Prepared by: DAT	Scope: 04W018



NOTES

1. Surface Property Boundary, Ore Body, and Orthophotography supplied by Kennecott via Golder Associates Inc., August, 2005.

2. Horizontal datum based on NAD 83/94.
Horizontal coordinates based on UTM Zone 16.

3. Site Location - Project Site within Sections 11 & 12, T50N, R29W, Town of Michigamme, Marquette County, Michigan.

LEGEND

6 ▲ Aquatic Sampling Location and Number

— River

■ Ore Body



**ADVANCED
ECOLOGICAL
MANAGEMENT**

Foth
Foth Infrastructure & Environment, LLC

Foth Infrastructure & Environment, LLC				
REVISED	DATE	BY	DESCRIPTION	
CHECKED BY:		AKM		DATE: FEB. '08
APPROVED BY:				DATE:
APPROVED BY:				DATE:



FIGURE 2

KENNECOTT EAGLE PROJECT

2007 AQUATIC SAMPLING LOCATIONS

Scale: 0 600 1,200 Meters

Date: FEBRUARY 2008

Prepared by: PEP1

Scope: 04W018

EXHIBIT B
REPORT TABLES

Table 1-1. Summary of the Procedure 51 Macroinvertebrate and Aquatic Habitat Scores for All Stations.

System		STRM	STRM	STRM	CC	YDR	STRM	STRM	STRE	STRE	STRE
Station Number		1	2	3	4	5	6	7	8	9	10
Fish Score		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Macroinvertebrate Score		Excellent	Acceptable	Excellent	Acceptable	Acceptable	n/a	n/a	Acceptable	Excellent	Excellent
Stream	Habitat	Excellent	Excellent	Excellent	Excellent	Good	n/a	n/a	Excellent	Excellent	Excellent
Score											

STRM – Salmon Trout River Main Branch

STRE – Salmon Trout River East Branch

CC – Cedar Creek

YDR – Yellow Dog River

Table 5-1. Sample Station Location Description.

Station Number	Stream Name	Latitude/Longitude NAD 1983	Township/Range/Section	Location Description
1	Salmon Trout River Main Branch	N 46.761302 W 87.90807	Michigamme Twp. T50N, R29W, Sec 3	Approximately 5,220 feet south of AAA Road and continuing south 120 feet.
2	Salmon Trout River Main Branch	N 46.75059 W 87.90720	Michigamme Twp. T50N, R29W, Sec. 11	Downstream extent located immediately south of AAA Road and continuing upstream 100 feet.
3	Salmon Trout River Main Branch	N 46.75148 W 87.90736	Michigamme Twp. T50N, R29W, Sec. 11	Upstream extent located immediately north of AAA Road and continuing downstream 200 feet.
4	Cedar Creek	N 46.81066 W 87.95323	Powell Twp. T51N, R29W, Sec. 14	Downstream extent located 100 feet south of Northwestern Road and continuing upstream 300 feet.
5	Yellow Dog River	N 46.72694 W 87.87268	Michigamme Twp. T50N, R29W, Sec. 13	Downstream extent located immediately upstream of road and continuing upstream 300 feet.
6	Salmon Trout River Main Branch	N 46.74793 W 89.89584	Michigamme Twp. T50N, R29W, Sec. 11	Downstream extent located approximately 4,600 feet upstream of AAA Road and continuing upstream 300 feet.
7	Salmon Trout River Main Branch	N 46.73808 W 87.89810	Michigamme Twp. T50N, R29W, Sec. 11	Near headwaters and north 100 feet.
8	Tributary to the East Branch of the Salmon Trout River	N 46.760113 W 87.83224	Michigamme Twp. T50N, R28W, Sec. 5	Downstream extent located 50 feet south of Northwestern Road and continuing south for 135 feet.
9	Tributary to the East Branch of the Salmon Trout River	N 46.76862 W 87.84377	Michigamme Twp. T51N, R28W, Sec. 34	Downstream extent located immediately south of Northwestern Road and continuing south for 85 feet.
10	Tributary to the East Branch of the Salmon Trout River	N 46.77471 W 87.86767	Michigamme Twp. T51N, R28W, Sec. 33	Downstream extent located immediately south of Northwestern Road and continuing south for 100 feet.

Table 5-2. Fish Collection Data.

Scientific Name	Common Name	Station Number									
		1	2	3	4	5	6	7	8	9	10
<i>Culaea inconstans</i>	Brook stickleback						200	1	2		
<i>Phoxinus eos</i>	Northern redbelly dace						274				
<i>Rhinichthys atratulus</i>	Blacknose dace					25	167	12			
<i>Salvelinus fontinalis</i>	Brook trout	22	16	4	98	5	1		12	29	12
<i>Semotilus atromaculatus</i>	Creek chub					7	8				
Total Number		22	16	4	98	37	650	13	14	29	12

Stations 1, 2, 3, 6, 7 Salmon Trout River Main Branch

Stations 8, 9, 10 Salmon Trout River East Branch

Station 4 Cedar Creek

Station 5 Yellow Dog River

Table 5-3. Macroinvertebrates Collected by Station.

TAXA	1	2	3	4	5	6	7	8	9	10
ANNELIDA (segmented worms)										
Hirudinea (leeches)	1	1		1	2		2			
Oligochaeta (worms)				1					1	
ARTHROPODA										
Amphipoda (scuds)				4		61	29	76		
Isopoda (sowbugs)										1
Hydracarina									1	
Insecta										
Ephemeroptera (mayflies)										
Baetidae	13		1	7				56	17	4
Baetiscidae					1					
Caenidae			9	2	2	5	2			
Ephemerellidae	21	1	6	13		10		6	25	8
Ephemeridae			2							
Heptageniidae	6				2			1		1
Leptophlebiidae			5					1		4
Siphonuridae								1		
Odonata										
Anisoptera (dragonflies)										
Aeshnidae		3	3		1	6	5	3	1	9
Cordulegasteridae		7	5	6	4					22
Corduliidae						1	2			
Gomphidae					4					
Libellulidae						4	7			
Zygoptera (damselflies)										
Calopterygidae		6	8	1	1					5
Coenagrionidae						4	3			
Plecoptera (stoneflies)										
Capniidae									2	
Chloroperlidae	2									
Leuctridae		1							2	5
Nemouridae								1		
Perlodidae	5		1	2	1				5	
Taeniopterygidae									5	
Hemiptera (true bugs)										
Belostomatidae								1		
Corixidae					1	7	1	17		
Gerridae	2	11	6	1	2				2	2
Notonectidae						5			3	
Megaloptera										
Corydalidae (dobson flies)			1							
Sialidae (alder flies)		1	1	1	2			6	1	6
Trichoptera (caddisflies)										
Brachycentridae				1				14	1	
Hydropsychidae	1		5	13				5	18	10
Lepidostomatidae	10	2	6	87	2			11	12	56
Limnephilidae		5	3	6	15	18		39	6	1

Table 5-3 (Continued).

TAXA	1	2	3	4	5	6	7	8	9	10
Molannidae					1					
Odontoceridae					2					
Philopotamidae	7			1				7		16
Phryganeidae						3				
Polycentropodidae									1	
Rhyacophilidae	7								3	1
Uenoidae	9									
Lepidoptera (moths)										
Noctuidae									1	
Coleoptera (beetles)										
Curculionidae (adults)	4									
Dytiscidae (total)		5		2			1	7	5	
Elmidae			2							2
Gyrinidae (adults)		1				2				
Gyrinidae (larvae)					1					
Haliplidae (adults)				1	1	3				
Scirtidae (larvae)							1			
Diptera (flies)										
Athericidae				5						
Ceratopogonidae	1	1				4				
Chironomidae	2	13	4	9	3	15	9	84	18	5
Dixidae										1
Simuliidae	4	16	15					4	31	3
Tabanidae	1	1			1				1	3
Tipulidae	2	1	10	1	1			2		8
MOLLUSCA										
Gastropoda (snails)										
Physidae			2		1	15	2			1
Planorbidae		2			9	11	3			
Pelecypoda (bivalves)										
Pisidiidae		11		2	12	3	7	12	1	1
Sphaeriidae (clams)						2	23			
TOTAL INDIVIDUALS	98	89	95	167	72	179	97	354	163	175
Stations 1, 2, 3, 6, 7 Salmon Trout River Main Branch										
Stations 8, 9, 10 Salmon Trout River East Branch										
Station 4 Cedar Creek										
Station 5 Yellow Dog River										

Table 5-4. Macroinvertebrate Scores and Community Ratings by Station.

Metric	1		2		3		4		5	
	Value	Score	Value	Score	Value	Score	Value	Score	Value	Score
Total Number of Taxa	18	1	19	0	20	1	22	0	23	0
Number of Mayfly Taxa	3	1	1	-1	5	1	3	0	3	0
Number of Caddisfly Taxa	5	0	2	-1	3	0	5	0	4	0
Number of Stonefly Taxa	2	1	1	0	1	0	1	0	1	0
Percent Mayfly Comp.	40.82	1	1.12	0	24.21	1	13.17	0	6.94	0
Percent Caddisfly Comp.	34.69	1	7.87	0	14.74	0	64.67	1	27.78	0
Percent Dominant Taxon	21.43	0	17.98	0	15.79	1	52.10	-1	20.83	0
Percent Isopod, Snail, Leech	1.02	1	3.37	1	2.11	1	0.60	1	16.67	-1
Percent Surf. Air Breathers	6.12	0	19.10	-1	6.32	0	2.40	1	5.56	0
Total Score		6		-2		5		2		-1
Community Rating	Excellent		Acceptable		Excellent		Acceptable		Acceptable	

Metric	6		7		8		9		10	
	Value	Score	Value	Score	Value	Score	Value	Score	Value	Score
Total Number of Taxa	19	0	14	1	21	0	24	1	24	1
Number of Mayfly Taxa	2	-1	1	0	5	1	2	0	4	1
Number of Caddisfly Taxa	2	-1	0	-1	5	0	6	1	5	0
Number of Stonefly Taxa	0	-1	0	-1	1	0	4	1	1	1
Percent Mayfly Comp.	8.38	0	2.06	0	18.36	0	25.77	1	9.71	0
Percent Caddisfly Comp.	11.73	0	0.00	-1	21.47	0	25.15	0	48.00	1
Percent Dominant Taxon	34.08	-1	29.90	-1	23.73	0	19.02	0	32.00	-1
Percent Isopod, Snail, Leech	14.53	-1	7.22	0	0.00	1	0.00	1	1.14	1
Percent Surf. Air Breathers	9.50	0	2.06	1	7.06	0	6.13	0	1.14	1
Total Score		-5		-2		2		5		5
Community Rating	n/a		n/a		Acceptable		Excellent		Excellent	

Stations 1, 2, 3, 6, 7 Salmon Trout River Main Branch

Stations 8, 9, 10 Salmon Trout River East Branch

Station 4 Cedar Creek

Station 5 Yellow Dog River

Table 5-5. Water Quality Data by Station.

Station Number	Date	Time	Water Temperature (°C)	pH	Conductivity (µSiemens/cm)	Discharge (gpm)
1	6/9/2007	14:20	14.68	6.75	72	1,373
2	6/9/2007	9:37	12.17	5.94	57	874
3	6/9/2007	9:37	12.17	5.94	57	874
4	6/10/2007	16:50	14.36	7.01	139	5,994
5	6/8/2007	15:50	16.66	6.89	67	7,079
6	6/8/2007	8:44	15.13	6.18	64	625
7	6/8/2007	17:24	19.11	5.97	47	nm
8	6/8/2007	19:25	14.64	7.23	117	1,718
9	6/10/2007	17:50	11.91	7.28	122	929
10	6/10/2007	17:05	18.27	7.30	158	178

nm – Not measured

Stations 1, 2, 3, 6, 7 Salmon Trout River Main Branch

Stations 8, 9, 10 Salmon Trout River East Branch

Station 4 Cedar Creek

Station 5 Yellow Dog River

Table 5-6. Habitat Evaluation by Station.

Habitat Metric	Sample Station									
	1 riffle/run	2 glide/pool	3 riffle/run	4 glide/pool	5 glide/pool	6 n/a	7 n/a	8 glide/pool	9 glide/pool	10 riffle/run
Substrate and Instream Cover										
Epifaunal Substrate/Avail. Cover	19	16	18	11	10	-	-	12	13	17
Embeddedness	19		14			-	-			15
Pool Substrate Characterization		14		15	10	-	-	16	12	
Velocity Depth Regime	15		14			-	-			10
Pool Variability		12		16	14	-	-	9	11	
Sediment Deposition	15	15	15	13	14	-	-	18	19	17
Channel Morphology										
Maintained Flow Volume	9	9	9	9	9	-	-	10	10	7
Flashiness	9	7	10	8	7	-	-	10	9	8
Channel Alteration	20	16	18	19	20	-	-	19	15	15
Frequency of Riffles/Bends	19		15			-	-			17
Channel Sinuosity		12		14	14	-	-	14	14	
Riparian and Bank Structure										
Bank Stability (L)	9	9	9	8	7	-	-	10	10	10
Bank Stability (R)	9	9	9	9	7	-	-	10	10	10
Vegetative Protection (L)	10	10	10	10	10	-	-	10	10	10
Vegetative Protection (R)	10	10	10	10	10	-	-	10	10	10
Riparian Veg. Zone Width (L)	10	10	10	10	10	-	-	10	10	10
Riparian Veg. Zone Width (R)	10	10	10	10	10	-	-	10	10	10
Total Score	183	159	171	162	152	n/a	n/a	168	163	183
Habitat Rating	Excellent	Excellent	Excellent	Excellent	Good	n/a	n/a	Excellent	Excellent	Excellent

Stations 1, 2, 3, 6, 7 Salmon Trout River Main Branch

Stations 8, 9, 10 Salmon Trout River East Branch

Station 4 Cedar Creek

Station 5 Yellow Dog River

EXHIBIT C
REPORT PHOTOGRAPHS



Photograph C-1. Station 1 - Downstream Extent View South.



Photograph C-2. Station 1 - Upstream Extent North View.



Photograph C-3. Station 2 – Downstream Extent View South.



Photograph C-4. Station 2 – Upstream Extent View South.



Photograph C-5. Station 3 – Upstream Extent View North.



Photograph C-6. Station 3 – Downstream Extent View South.



Photograph C-7. Station 6 – Upstream Extent View Southwest.



Photograph C-8. Station 6 – Downstream Extent View Southwest.



Photograph C-9. Station 7 – Downstream Extent View Southwest.



Photograph C-10. Station 7 – Upstream Extent View North.



Photograph C-11. Station 8 – Downstream Extent View North.



Photograph C-12. Station 8 – Upstream Extent View North.



Photograph C-13. Station 9 – Downstream Extent View Southwest.



Photograph C-14. Station 9 – Upstream Extent View Northeast.



Photograph C-15. Station 10 – Downstream Extent View West.



Photograph C-16. Station 10 – Upstream Extent View West.



Photograph C-17. Station 5 – Downstream Extent View West.



Photograph C-18. Station 5 – Upstream Extent View South.



Photograph C-19. Station 4 – Downstream Extent View South.



Photograph C-20. Station 4 – Upstream Extent View North.