

Investigation of the Aquatic Communities of the Salmon Trout River, Yellow Dog River, and Cedar Creek in Marquette County, Michigan, 2011.

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List of Abbreviations, Acronyms, and Symbols

AEM	Advanced Ecological Management LLC
\bar{x}	Average
CC	Cedar Creek
CAS No.	Chemical abstract service number
°C	Degrees Celcius
EQL	Estimated quantification limit
ft	Feet
e.g.	For example
gpm	Gallons per minute
GLEAS	Great Lakes and Environmental Assessment Section
KEMC	Kennecott Eagle Minerals Company
KME	King & MacGregor Environmental
pH	Measure of acidity or alkalinity of a solution
MDEQ	Michigan Department of Environmental Quality
MNFI	Michigan Natural Features Inventory
$\mu\text{S/cm}$	MicroSiemens per centimeter
$\text{mg O}_2/\text{L}$	Milligrams of oxygen per liter of water
mg/kg	Milligrams per kilogram
ml	Milliliters
MDL	Minimum detection limit
N	North
n.a.	Not applicable
n.m.	Not measured
n.s.	Not sampled
P-51	Procedure Number 51
R	Range
n	Sample size
Sec	Section
s	Standard deviation
STRE	Salmon Trout River East Branch
STRM	Salmon Trout River Main Branch
T	Township
W	West
WCR	Wetland and Coastal Resources
YDR	Yellow Dog River

1.0 EXECUTIVE SUMMARY

Advanced Ecological Management (AEM) conducted aquatic surveys during 2011 at the Eagle Project site for use by Kennecott Eagle Minerals Company (KEMC), and to maintain compliance with mine permit requirements. The Eagle Project is located in northern Marquette County, Michigan as shown on Figure 1-1. KEMC is currently developing mining facilities at the site. Previous aquatic surveys have been conducted in the area, some within several of the same stations as these surveys. These surveys are similar in scope to the 2006 Aquatics survey (AEM, 2007) and are consistent with most of the stations sampled in the 2008 aquatic surveys (AEM, 2009). Where applicable, aquatic surveys at each station 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. Although all ten stations were sampled in the summer of 2008, high water due to beaver dams prohibited sampling of Station 4 in Cedar Creek and Station 8 in a tributary to the East Branch of the Salmon Trout River in their historic locations during the 2011 aquatic survey.

The aquatic systems that were investigated for these surveys are predominantly functioning as coldwater trout streams. Because most of the fish communities of the Salmon Trout River and its tributaries and the Yellow Dog River 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 (WCR), and the Michigan Department of Environmental Quality (MDEQ; AEM, 2009; AEM, 2008a; AEM, 2007; WCR, 2005; MDEQ/Premo et al., 2005, 2006).

The aquatic habitat was rated as excellent or good by AEM. The 2011 aquatic habitat scores were generally consistent with previous evaluations that were conducted by AEM

(AEM, 2009; AEM, 2008a and b). 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, 2009, 2008a and b; AEM, 2007). This 2011 aquatic community surveys represents the first aquatic survey that has conducted by AEM on behalf of KEMC since 2008. This 2011 aquatic survey is intended to satisfy mine permit requirements (Permit Condition L-40) and 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 (e.g., Stations 6 and 7), and high-gradient segments flowing through forested and hilly terrain with beaver dams intermittent (e.g., Stations 1 and 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.

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4.0 METHODS

The 2011 aquatic survey was conducted according to the MDEQ's Surface Water Quality Division *Procedure #51 Survey Protocols for Wadable Rivers* (P-51; MDEQ, 2002). Ten stream segments (stations) were sampled in the summer of 2011 using the P-51 survey protocol (Figure 1-2).

These sample stations are situated in the same sample locations, or close to the sample locations that were surveyed by AEM in 2008. The 2011 aquatic survey follows protocol established in the Wetland and 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

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 the third pass and subsequent fish identification, fish were released within the station.

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; Becker, 1983). The Michigan County Element List (MNFI, 2011) 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

Sampling of aquatic macroinvertebrates, including mussels and crayfish (Decapoda), was conducted according to the P-51 protocol. Upon completion of fish sampling, macroinvertebrates 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 250 ml plastic wide-mouth jars containing 70% ethanol, and were identified using various taxonomic references (Merritt et al., 2008; Bright, 2007; McCafferty, 1998; 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 in-stream habitats were qualitatively described for each station during the aquatic survey. A description of stream morphology included run/riffle/pool/shallow pool configurations, substrate, substrate embeddedness, in-stream 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, 2008):

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

Habitat conditions, water quality, and stream dimensions were documented during the aquatic survey. Photographs were taken at each station to illustrate the conditions during the sampling period (Exhibit C). Water temperature, dissolved oxygen, pH, and conductivity were measured as part of the stream habitat evaluation. These water quality parameters were measured using a Yellow Springs Instrument Professional Plus 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 Flo-Mate 2000®.

5.0 RESULTS

A total of ten stations were surveyed during summer 2011, 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). Aquatic community sampling was conducted from 20 June 2011 through 14 July 2011. Due to high-water conditions, sampling was conducted during two separate periods. Stations 2, 3, 6, 7, 8, 9, and 10 in the Salmon Trout River were sampled from 20 June 2011 through 23 June 2011. Station 1 in the Salmon Trout River, Station 4 in Cedar Creek, and Station 5 in the Yellow Dog River were sampled on 14 July 2011.

5.1 Fish

A total of 322 fish were collected from all stations with 57% of the total being capture in Station 6 (Table 5-2). Among all stations, a total of ten species of fish were observed during the aquatic survey (Table 5-2). Northern redbelly dace (*Phoxinus eos*), blacknose dace (*Rhinichthys obtusus*), and brook trout (*Salvelinus fontinalis*) were the most frequently collected species.

No Michigan Natural Features Inventory (MNFI) listed threatened or endangered fish species were identified in the stations investigated in the Salmon Trout River and its tributaries, Yellow Dog River, or Cedar Creek in Marquette County, Michigan (MNFI, 2011).

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

Northern redbelly dace, brook stickleback, and brook trout were the most frequently observed species among all seven stations within the Salmon Trout River system (Table 5-2). Brook trout were the only species collected in Stations 1, 2, 8, 9, and 10 during June and July 2011.

In Station 6, a total of 184 fish were collected in June 2011 and northern redbelly dace was the most abundant species. The 2011 total catch from Station 6 was much lower than was observed in 2008 (total catch = 837 fish). All of the fish collected from Station 6 were approximately three inches or less in length.

A total of three brook trout and one northern redbelly dace were collected from Stations 2 and 3, and a total of eight brook trout were collected from Stations 9 and 10 (Table 5-2). Stations 2, 3, 9 and 10 were surveyed during bankfull conditions that occurred during a substantial rain event. Because of high streamflows, block nets may not have adequately blocked fish movement in and out of the stations possibly resulting in slightly lower fish samples for these Stations.

Consistent with previous surveys, habitat conditions from beaver activity in Station 7 made it difficult to adequately block the station. Therefore, a multi-pass removal was not conducted within this station.

5.1.2 Yellow Dog River: Station 5

Station 5 is located in the Yellow Dog River and a total of 52 fish were collected during July 2011. The Station 5 fish community was comprised of eight species, including blacknose dace, brook trout, brown trout (*Salmo trutta*), creek chubs, northern redbelly dace, brook stickleback, slimy sculpin (*Cottus cognatus*) and white suckers (*Catostomus commersonii*, Table 5-2).

5.1.3 Cedar Creek: Station 4

Station 4 is located in Cedar Creek outside of the project area drainage basin. Except for October 2008, all Station 4 aquatic surveys have been conducted south (upstream) of Northwestern Road. Beavers constructed a dam upstream of Northwestern Road in the fall of 2008 and the dam and floodwaters now extend all the way to the Northwestern Road crossing (Photograph C-1). Because of high water conditions caused by beaver activity, the 2011 aquatic survey was conducted north (downstream) of Northwestern Road. In addition, because of a braided channel occurred throughout much of the station, adequate blocking with nets was not possible. Therefore, a single pass removal was conducted in Station 4. A total of 44 brook trout were collected in Station 4 (Table 5-2). Brook trout ranged in length from 1.7 inches to 8.3 inches, with an average length of 3.5 inches (standard deviation $s = 1.8$ inches; sample size $n = 44$).

5.2 Macroinvertebrates

A total of 1,536 macroinvertebrates were collected from all ten stations that were investigated in 2011. Because of beaver dams in the vicinity of Station 6 and Station 7, the P-51 macroinvertebrate metrics evaluation 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 1,265 macroinvertebrates representing 49 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 and its tributaries during 2011. The greatest numbers of macroinvertebrates were collected from Station 6 and the fewest number of macroinvertebrates were collected from Station 9 (Table 5-3).

A total of 158 macroinvertebrates were collected in Station 1. Ephemeropterans (mayflies), plecopterans (stone flies), and trichopterans (caddisflies) were the most frequently collected macroinvertebrates in Station 1 (Table 5-3).

A total of 152 macroinvertebrates were collected from Station 2 with caddisflies and Dipterans (flies) being the most frequently collected macroinvertebrates in this station. A total of 133 macroinvertebrates were collected from Station 3 with caddisflies, and flies being the most frequently collected macroinvertebrates (Table 5-3).

A total of 229 macroinvertebrates were collected from Station 6, where physids and planorbids (snails), amphipods (scuds), and caddisflies were the most frequently collected macroinvertebrates (Table 5-3). A total of 135 macroinvertebrates were collected from Station 7 in 2011. Similar to Station 6, snails and scuds were the most frequently collected organisms in Station 7 (Table 5-3).

A total of 187 macroinvertebrates were collected from Station 8 (Table 5-3). Among Stations 8, 9, and 10 caddisflies, mayflies, and flies were frequently collected.

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, 8, 9, and 10 were rated as “Excellent”, and Stations 2 and 3 were rated as “Acceptable” in 2011.

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5.2.2 Yellow Dog River: Station 5

A total of 82 macroinvertebrates representing 16 taxa identified to the Family level were collected in Station 5 from the Yellow Dog River (Table 5-3). Dragonflies and damselflies, and caddisflies were the most frequently collected macroinvertebrates. The macroinvertebrate community of Station 5 was rated as "Acceptable" in 2011 (Table 5-4).

5.2.3 Cedar Creek: Station 4

A total of 189 macroinvertebrates representing 22 taxa identified to the Family level were collected from Cedar Creek in Station 4 during 2011 (Table 5-3). Caddisflies, flies, and mayflies were the most frequently collected macroinvertebrates. The macroinvertebrate community of Station 4 was rated as "Acceptable" in 2011 (Table 5-4).

5.3 Stream Habitat

Stream habitat during 2011 was evaluated for the KEMC Eagle project for the first time since 2008. Although beaver activity affected several stations and required relocating two stations to conduct the survey, habitat conditions in most stations remained consistent with conditions observed by AEM during 2008. 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 7.3 feet ($s = 1.6$ feet, $n = 3$), and average depth of 0.3 feet ($s = 0.1$ feet, $n = 9$, Table 5-5). Stream flow was measured at the downstream extent of Station 1 and discharge was estimated at 991 gallons per minute (gpm, Table 5-5).

The streambanks of Station 1 appeared consistent with conditions observed in 2008, and were vegetated with herbaceous and woody vegetation (Photographs C-2 and C-3). The streambed was characterized by a relatively steep gradient and the substrate was comprised of a variety of particles including sand, gravel, cobble, and boulders (Photographs C-2 and C-3). Woody debris was frequently observed throughout the station.

Station 2 is located south of Triple A Road and Station 3 is located north of Triple A Road (Figure 1-2 and Table 5-1). Station 2 was 100 feet in length and Station 3 was

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200 feet in length. Average width of Station 2 was 6.5 feet ($n = 3$; $s = 0.5$ feet), and average width of Station 3 was 5.6 feet ($n = 3$; $s = 0.5$ feet, Table 5-5). Average depth in Station 2 was 0.8 feet ($n = 9$; $s = 0.2$ feet), and average depth in Station 3 was 0.5 feet ($n = 9$; $s = 0.3$ feet). Stream flow for Stations 2 and 3 was measured at the upstream extent of Station 3, and discharge was estimated at 996 gpm (Table 5-5).

Station 2 was surrounded by an abundance of speckled alder (*Alnus rugosa*) and bluejoint grass (*Calamagrostis canadensis*, Photographs C-4 to C-5). Evidence of recent beaver activity was present with the upstream extent of Station 2. Two partially constructed dams were present within the stream channel, and silt and organic matter appeared to be more abundant within the upstream extent compared to previous surveys.

The streambank vegetation within Station 3 appeared similar to conditions observed in 2008. The vegetation within Station 3 was predominantly speckled alder with an understory of bluejoint grass and sedge (*Carex* sp., Photographs C-6 to C-7). Watercress (*Nasturtium* sp.) was present within portions of the stream channel of Station 3.

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. The average width of Station 6 was 18.8 feet ($n = 3$; $s = 3.9$ feet) and the average depth was 2.2 feet ($n = 9$; $s = 0.4$ feet, Table 5-5), which was 0.8 feet deeper than the average depth in 2008. Stream flow was measured at the middle extent of Station 6 and discharge was estimated at 345 gpm in the (Table 5-5).

The streambanks in Station 6 appeared similar to conditions observed in 2008, and were characterized by tussock sedge (*Carex stricta*), iris (*Iris* sp.), rush (*Juncus* sp.), willows (*Salix* sp.) and speckled alder (Photographs C-8 to C-9). Much of the aquatic vegetation seen during the summer sampling event 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. 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 a beaver dam is located at the upstream extent of this station. The average width of Station 7 was 5.7 feet ($n = 3$; $s = 0.3$ feet) and the average depth was 1.4 feet ($n = 9$; $s = 0.2$ feet, Table 5-5). 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, tussock sedge, rush, and iris (Photographs C-10 and C-11), and appeared similar to conditions observed in 2008. The substrate was comprised of organic matter and silt. Woody debris was abundant throughout this station.

Because of high water from a beaver dam that was constructed in 2008, Station 8 was relocated from approximately 50 feet southwest of Northwestern Road to approximately 75 feet northeast of Northwestern Road, and extending downstream (northeast) for 135 feet (Figure 1-2, Table 5-1). The average width of Station 8 was 10.0 feet ($n = 3$; $s = 0.3$ feet) and the average depth was 0.8 feet ($n = 9$; $s = 0.2$ feet, Table 5-5). Stream flow was measured at the middle extent of Station 8 and discharge was estimated at 3,178 gpm (Table 5-5).

The stream channel of Station 8 was largely shaded by a dense canopy of speckled alder with an abundance of sedge growing along the streambank (Photograph C-12 and Photograph C-13). Small woody debris and undercut banks were present throughout the station, and the stream substrate was predominantly comprised of sand and small gravel.

Station 9 is located immediately southwest of Northwestern Road and is approximately 85 feet in length (Figure 1-2). The average width of Station 9 was 8.6 feet ($n = 3$; $s = 1.1$ feet) and average depth was 0.8 feet ($n = 9$; $s = 0.4$ feet, Table 5-5). Stream flow was measured at the downstream extent of Station 9 and discharge was estimated at 1,323 gpm (Table 5-5).

Habitat conditions within Station 9 appeared similar to conditions observed in 2008. The understory of Station 9 was predominately sedge, while speckled alder covered much of

the stream channel and contributed to in-stream cover (Photographs C-14 to C-15). The substrate was predominantly comprised of sand and silt.

Station 10 is located immediately southwest of Northwestern Road and is approximately 100 feet in length (Figure 1-2). Average width of Station 10 was 6.0 feet ($n = 3$; $s = 0.5$ feet) and average depth was 0.6 feet ($n = 9$; $s = 0.2$ feet, Table 5-5). Stream flow was measured at the downstream extent of Station 10 and discharge was estimated at 373 gpm (Table 5-5).

The streambanks within Station 10 were vegetated with large deciduous trees, speckled alder, and other herbaceous vegetation (Photographs C-16 and C-17), and appeared similar to conditions observed in 2008. Woody debris and undercut banks provided in-stream cover throughout this station. The substrate was predominantly comprised of sand, silt and some gravel; although cobble and large boulders were also present (Photographs C-16 and C-17).

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 20.9 feet ($n = 3$; $s = 1.1$ feet) and average depth of 1.8 feet ($n = 9$; $s = 0.4$ feet, Table 5-5). Stream flow was measured at the downstream extent of Station 5 and discharge was estimated at 3,677 gpm (Table 5-5).

Streambanks appeared consistent with the 2008 survey and were vegetated with a dense covering of speckled alder, which contributed to in-stream cover and woody debris within the channel (Photographs C-18 to C-19). The substrate was predominantly comprised of sand and silt.

5.3.3 Cedar Creek: Station 4

The downstream extent of Station 4 was relocated from approximately 117 feet upstream (south) of Northwestern Road to approximately 300 feet downstream (north) of Northwestern Road because of high water from beaver dams (Figure 1-2). Station 4 was 300 feet in length, with an average width of 24.6 feet ($n = 3$; $s = 3.8$ feet) and

average depth of 0.9 feet ($n = 9$; $s = 0.3$ feet, Table 5-5). Stream flow was measured at the upstream extent of Station 4 and discharge was estimated at 4,096 gpm (Table 5-5).

The riparian vegetation throughout much of the relocated Station 4 was mature northern white cedars (*Thuja occidentalis*), and white pines (*Pinus strobus*). Speckled alder was also present along the stream channel in the upstream and downstream extents of the station (Photographs C-20 and C-21). The river channel was braided throughout the middle portion of the station, with frequent undercut banks, large woody debris and variety of substrate, including sand, gravel, cobble and boulders contributing to habitat complexity.

5.3.4 P-51 Habitat Scores

Stations sampled during 2011 were rated as “Good” or “Excellent” habitat quality (Table 5-6). The 2011 P-51 habitat ratings for Stations 1 through 10 were generally consistent with previous surveys conducted by AEM (AEM, 2007; AEM, 2008a).

5.4 Water Quality

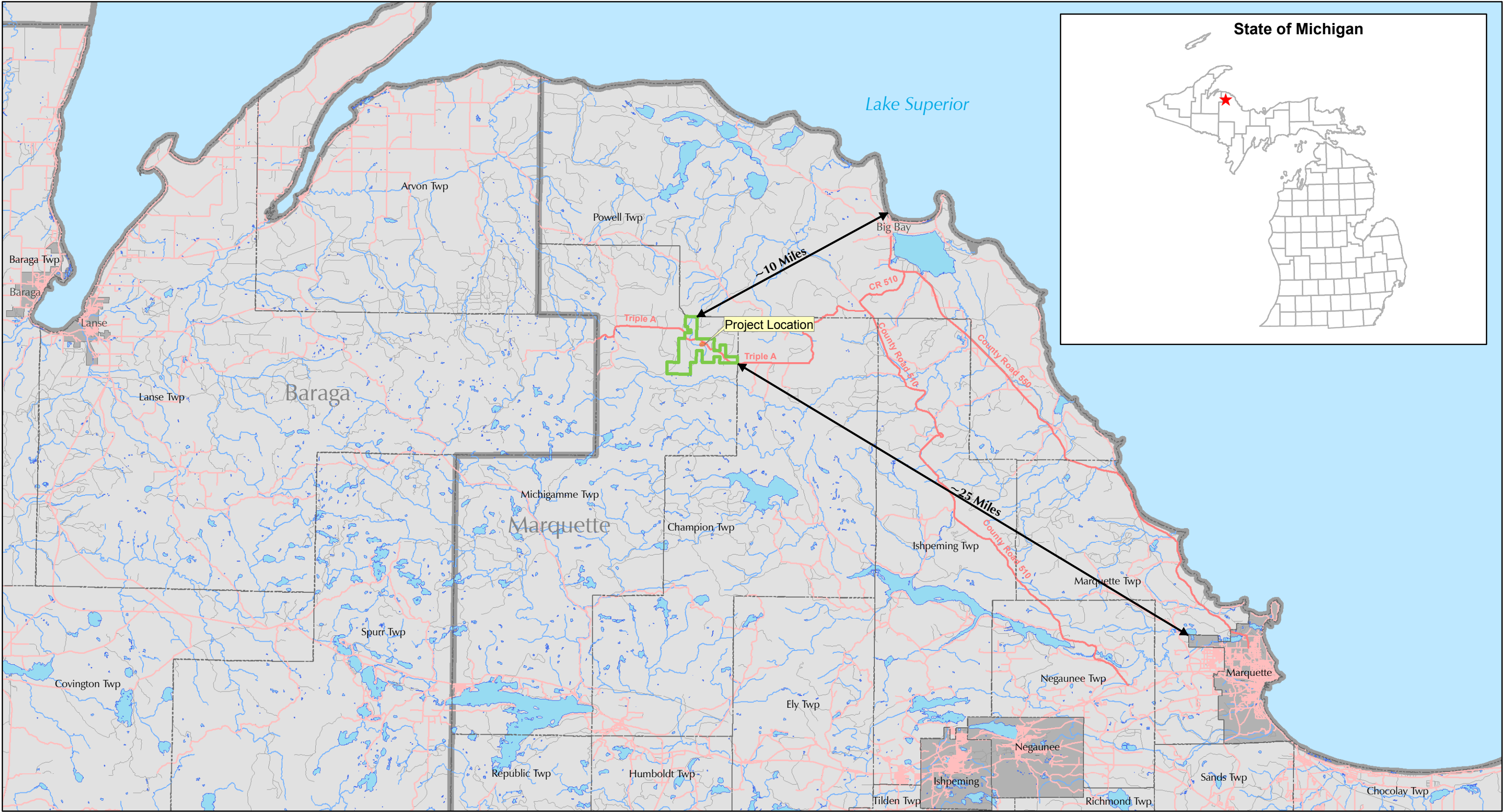
Water temperature ranged from 10.1°C in Station 9 to 17.9°C in Station 5 during 2011 (Table 5-7). Dissolved oxygen ranged from 4.9 mg/L in Station 6 to 10.4 mg/L in Station 9 during. Dissolved oxygen in Station 6 was much lower than values observed in 2008 (average dissolved oxygen = 8.3 mg/L), which may account for the lower total fish catch in 2011. Average pH ranged from 5.8 in Station 7 to 8.1 in Station 4. Conductivity was low in all stations, ranging from 32 microSiemens per cm ($\mu\text{S}/\text{cm}$) in Station 7 to 110 $\mu\text{S}/\text{cm}$ in Station 4 (Table 5-7).

6.0 REFERENCES

- AEM (Advanced Ecological Management). 2007 (2006 Survey). Investigation of the aquatic communities of the Salmon Trout River, Yellow Dog River, and Cedar Creek in Marquette County, Michigan.
- AEM (Advanced Ecological Management). 2008a (2007 Survey). Investigation of the aquatic communities of the Salmon Trout River, Yellow Dog River, and Cedar Creek in Marquette County, Michigan.
- AEM (Advanced Ecological Management). 2008b. Memo: Eagle Project, Investigation of the Main Branch of the Salmon Trout River, Tributaries in the East Branch of the Salmon Trout River, the Yellow Dog River, and Cedar Creek. February 28, 2008. Memo to Foth Infrastructure & Environment, LLC.
- AEM, 2008c. Memo: Eagle Project, Summary of 2008 brook trout metals data. November 21, 2008. Memo to Kennecott Eagle Minerals Company.
- AEM (Advanced Ecological Management). 2009 (2008 Survey). Investigation of the aquatic communities of the Salmon Trout River, Yellow Dog River, and Cedar Creek in Marquette County, Michigan.
- Bailey, R. M., W. C. Latta, and G. R. Smith. 2003. An atlas of Michigan fishes with keys and illustrations for their identification. Miscellaneous Publications, Museum of Zoology, No. 192, University of Michigan, Ann Arbor, MI.
- Becker, G. C. 1983. Fishes of Wisconsin. The University of Wisconsin Press, Madison, WI.
- Bright, E. 2007. "Aquatic Insects of Michigan." Museum of Zoology Insect Division and School of Natural Resources and Environment. University of Michigan, Ann Arbor, MI. Website, <[#](http://www.insects.ummz.lsa.umich.edu)> (Accessed 11/10/2008).
- Coon, T. G. 2001. Key to the fishes of Michigan. Michigan State University. East Lansing, MI.
- Cummings, K. S., and C. Mayer. 1992. Field guide to freshwater mussels of the Midwest. Illinois Natural History Survey, Champaign, IL.
- KME (King & MacGregor Environmental) 2005. Described in Foth & Van Dyke, Eagle Project Mine Permit Application, Volume II Environmental Impact Assessment, February, 2006, Section 3.15.
- McCafferty, W. P. 1998. Aquatic entomology, the fishermen's and ecologists' illustrated guide to insects and their relatives. Jones and Bartlett Publishers, Sudbury, MA.
- Merritt, R. W., K. W. Cummins, and M. B. Berg. 2008. An Introduction to the Aquatic Insects of North America, Fourth Edition. Kendall/Hunt Publishing Co., Dubuque, Iowa.

- Merritt, R. W., V. H. Resh, and K. W. Cummins. 1996. Design of aquatic insect studies: Collecting sampling and rearing procedures. *in* An Introduction to the Aquatic Insects of North America (second edition), Merritt, R. W., Cummins, K.W. editors. Kendall/Hunt: Dubuque, Iowa; 12-28.
- MDEQ/Premo, D., K. Premo, and B. Premo. 2005. Baseline limnological studies of streams in the vicinity of a proposed sulfide mine in Marquette County, Michigan. White Water Associates, Inc. Report: MI/DEQ/WB-05/029.
- MDEQ (Michigan Department of Environmental Quality). 2008. Qualitative biological and habitat survey protocols for wadable streams and rivers, Great Lakes and Environmental Assessment Section Procedure Number 51 (Revised May 2008). Michigan Department of Environmental Quality, Surface Water Quality Division, Lansing, MI.
- MDEQ/Premo, D., K. Premo, and B. Premo. 2006. Baseline limnological studies of the East Branch of the Salmon Trout River in the vicinity of a proposed sulfide mine in Marquette County, Michigan. White Water Associates, Inc. Report: MI/DEQ/WB-06/042.
- MNFI (Michigan Natural Features Inventory). 2008. Marquette County Element Data. Michigan State University. East Lansing, MI.
- Peckarsky, B. L., D. J., Conklin Jr., P. R. Fraissinet, and M. A. Penton. 1990. Freshwater macroinvertebrates of northeastern North America. Cornell University Press.
- Pennak, R. W. 1990. Freshwater invertebrates of the United States: protozoa to mollusca. 4th ed. John Wiley and Sons, Inc. 656 pp.
- Van Deventer, J. S., and W. S. Platts. 1983. Sampling and estimating fish populations from streams. Transactions of the North American Wildlife and Natural Resources Conference. 48: 349-354.
- WCR (Wetland and Coastal Resources). 2005. Aquatic Assessment, Kennecott Mineral Company Eagle Project, Marquette County, Michigan.

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:		DM	DATE: NOV. '08
APPROVED BY:		RDW	DATE: NOV. '08
APPROVED BY:			DATE:



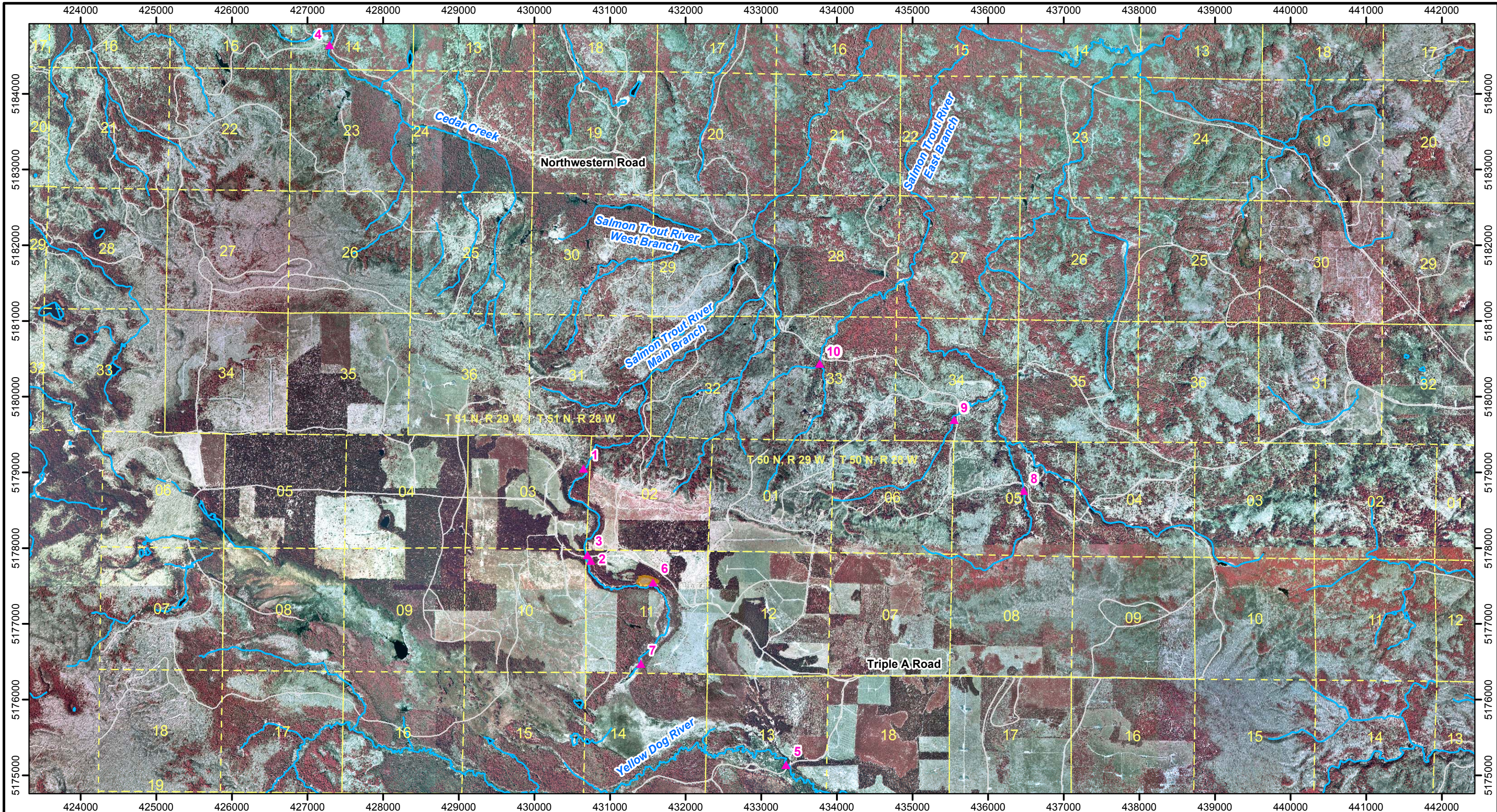
FIGURE 1-1
PROJECT LOCATION

Scale: Miles

Date: NOVEMBER 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: DM		DATE: NOV. '08	
APPROVED BY: RDW		DATE: NOV. '08	
APPROVED BY:		DATE:	




FIGURE 1-2

KENNECOTT EAGLE PROJECT

2011 AQUATIC SAMPLING LOCATIONS

Scale: 0 600 1,200 Meters

Date: NOVEMBER 2008

Prepared by: DAT

Scope: 04W018

EXHIBIT B
REPORT TABLES

Table 1-1. Summary of the Procedure 51 Macroinvertebrate and Aquatic Habitat Scores for All Stations, 2011.

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	Acceptable	Acceptable	Acceptable	n.a.	n.a.	Excellent	Excellent	Excellent
Stream Habitat Score	Excellent	Good	Excellent	Excellent	Good	n.a.	n.a.	Excellent	Excellent	Excellent

STRM – Salmon Trout River Main Branch**STRE – Salmon Trout River East Branch****CC – Cedar Creek****YDR – Yellow Dog River****n.a. – Not applicable**

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 46.76130 W 87.90807	Michigamme Twp. T50N, R29W, Sec 3	Approximately 5,220 feet S of AAA Road and continuing S 120 feet.
2	Salmon Trout River Main Branch	N 46.75059 W 87.90720	Michigamme Twp. T50N, R29W, Sec. 11	Upstream extent located immediately S 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	Downstream extent located immediately N 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 300 feet N of Northwestern Road and continuing upstream to road crossing.
5	Yellow Dog River	N 46.72694 W 87.87268	Michigamme Twp. T50N, R29W, Sec. 13	Downstream extent located immediately upstream of unnamed 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 N 100 feet.
8	Tributary to the East Branch of the Salmon Trout River	N 46.760113 W 87.83224	Champion Twp. T50N, R28W, Sec. 5	Upstream extent located 75 feet NE of Northwestern Road and continuing NE for 135 feet.
9	Tributary to the East Branch of the Salmon Trout River	N 46.76862 W 87.84377	Powell Twp. T51N, R28W, Sec. 34	Downstream extent located immediately SW of Northwestern Road and continuing SW for 85 feet.
10	Tributary to the East Branch of the Salmon Trout River	N 46.77471 W 87.86767	Powell Twp. T51N, R29W, Sec. 33	Downstream extent located immediately SW of Northwestern Road and continuing SW for 100 feet.

Table 5-2. 2011 Summer Fish Collection Data – Stations 1-10.

					Station Number						
Scientific Name	Common Name	1	2	3	4	5	6	7	8	9	10
Summer Data											
<i>Catostomus commersonii</i>	White sucker					2					
<i>Cottus cognatus</i>	Slimy sculpin					2					
<i>Culaea inconstans</i>	Brook stickleback					1	14	4			
<i>Margariscus margarita</i>	Pearl dace						11				
<i>Phoxinus eos</i>	Northern redbelly dace			1		1	143	9			
<i>Phoxinus neogaeus</i>	Finescale dace						16				
<i>Rhinichthys obtusus</i>	Blacknose dace					26					
<i>Salmo trutta</i>	Brown trout					1					
<i>Salvelinus fontinalis</i>	Brook trout	10	2	1	44	2			7	4	4
<i>Semotilus atromaculatus</i>	Creek chub					17					
	Total Number	10	2	2	44	52	184	13	7	4	4

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

Stations 8, 9 and 10 - Salmon Trout River East Branch

Station 4 - Cedar Creek

Station 5 - Yellow Dog River

Table 5-3. 2011 Macroinvertebrate Community – Stations 1-10.

TAXA	1	2	3	4	5	6	7	8	9	10
ANNELIDA (segmented worms)										
Hirudinea (leeches)						1	1			
Oligochaeta (worms)	5			2				1	6	9
ARTHROPODA										
Amphipoda (scuds)		14				69	55	3		1
Arachnoidea										
Hydracarina		3				1		1		5
Insecta										
Ephemeroptera (mayflies)										
Baetidae	27	3	3	6	1	1		41	24	1
Caenidae							5			
Ephemerellidae	26		4	4				3	4	9
Ephemeridae		6			1					5
Heptageniidae	2			1				1		2
Leptophlebiidae	1			1				20		3
Odonata										
Anisoptera (dragonflies)										
Aeshnidae		1	2		3	10				5
Cordulegastridae	10	17	17	5	18			5		25
Corduliidae						2	2			
Gomphidae					20					
Libellulidae						19	2			
Zygoptera (damselflies)										
Calopterygidae		5	2		5					3
Coenagrionidae						2	6			
Plecoptera (stoneflies)										
Leuctridae	1			1				1	4	4
Nemouridae	21			4				2		
Perlodidae	6									
Pteronarcyidae	3									
Hemiptera (true bugs)										
Belostomatidae						1	1			
Corixidae						6	4			
Gerridae	5			3	2		1			
Notonectidae						6	1			
Megaloptera										
Corydalidae (dobson flies)			2							
Sialidae (alder flies)					2			3		2
Trichoptera (caddisflies)										
Brachycentridae	8		1	1				1		
Glossosomatidae	3	1								
Hydropsychidae		5	3	3	12			15	3	9
Lepidostomatidae	7		2	83					1	5
Limnephilidae			11	2		29		7	6	

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 (Continued). 2011 Macroinvertebrate Community – Stations 1-10.

TAXA	1	2	3	4	5	6	7	8	9	10
Philopotamidae	22	24	32	5	7			59	1	32
Rhyacophilidae	1		1	2					5	
Uenoidae				5					28	
Coleoptera (beetles)										
Dytiscidae (total)								1	1	
Haliplidae (adults)						4	8			
Hydrophilidae (total)	1		2			1				1
Scirtidae (adults)							1			
Dryopidae	1									
Elmidae				4	1					
Gyrindae (larvae)					3					
Haliplidae (larvae)					2					
Diptera (flies)										
Athericidae				4						2
Ceratopogonidae				1			4			
Chironomidae	1	6	6	17	2	1	7	14	13	4
Dixidae										2
Simuliidae	6	61	41	34			11	7	29	5
Tabanidae	1				1			1	1	1
Tipulidae		1	4							10
MOLLUSCA										
Gastropoda (snails)										
Physidae		5		1		19				
Planorbidae					2	52	10			
Sphaeriidae (clams)						5	16	1		
Total	158	152	133	189	82	229	135	187	126	145
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. 2011 Macroinvertebrate Scores and Community Ratings – Stations 1-10.

Metric	1		2		3		4		5	
	Value	Score	Value	Score	Value	Score	Value	Score	Value	Score
Total Number of Taxa	21	1	14	0	16	0	22	0	14	1
Number of Mayfly Taxa	4	1	2	0	2	0	4	0	2	1
Number of Caddisfly Taxa	5	0	3	0	6	1	7	1	2	-1
Number of Stonefly Taxa	4	1	0	-1	0	-1	2	1	0	0
Percent Mayfly Comp.	35.44	1	5.92	0	5.26	0	6.35	0	2.44	0
Percent Caddisfly Comp.	35.95	0	19.74	0	37.59	1	53.44	1	23.17	0
Percent Dominant Taxon	17.09	0	40.13	-1	30.83	-1	43.92	-1	24.39	0
Percent Isopod, Snail, Leech	0.00	1	3.29	1	0.00	1	0.53	1	2.44	1
Percent Surf. Air Breathers	3.80	1	0.00	1	1.50	1	1.59	1	2.44	1
Total Score		6		0		2		4		3
Community Rating	Excellent		Acceptable		Acceptable		Acceptable		Acceptable	

Metric	6		7		8		9		10	
	Value	Score	Value	Score	Value	Score	Value	Score	Value	Score
Total Number of Taxa	18	1	17	1	20	1	14	0	23	1
Number of Mayfly Taxa	1	1	1	-1	4	0	2	0	5	1
Number of Caddisfly Taxa	1	-1	0	-1	4	0	6	1	3	0
Number of Stonefly Taxa	0	0	0	-1	2	1	1	0	1	1
Percent Mayfly Comp.	0.44	-1	3.70	0	34.76	1	22.22	1	13.79	0
Percent Caddisfly Comp.	12.66	0	0.00	-1	43.85	1	34.92	1	31.72	1
Percent Dominant Taxon	30.13	-1	40.74	-1	31.55	-1	23.02	0	22.07	0
Percent Isopod, Snail, Leech	31.44	-1	8.15	0	0.00	1	0.00	1	0.00	1
Percent Surf. Air Breathers	7.86	0	11.85	0	0.53	1	0.79	1	0.69	1
Total Score		-2		-4		5		5		6
Community Rating	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

n.a. – Not applicable

Table 5-5. 2011 Summer Physical Stream Dimensions – Stations 1-10.

Station	Length (ft)	Wetted width (ft)		Depth (ft)		Discharge (gpm)
		Average*	s	Average	s	
1	120	7.3 (3)	1.6	0.3 (9)	0.1	991
2	100	6.5 (3)	0.5	0.8 (9)	0.2	996
3	200	5.6 (3)	0.5	0.5 (9)	0.3	996
4	300	24.6 (3)	3.8	0.9 (9)	0.3	4,096
5	300	20.9 (3)	1.1	1.8 (9)	0.4	3,677
6	300	18.8 (3)	3.9	2.2 (9)	0.4	345
7	100	5.7 (3)	0.3	1.4 (9)	0.2	n.m.
8	135	10.0 (3)	0.3	0.8 (9)	0.2	3,178
9	85	8.6 (3)	1.1	0.8 (9)	0.4	1,323
10	100	6.0 (3)	0.5	0.6 (9)	0.2	373

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

***sample size is indicated within ()**

s = standard deviation

gpm = Gallons per minute

n.m. = Not measured

Table 5-6. 2011 Procedure 51 Habitat Evaluation Scores – Stations 1-10.

Habitat Metric	Sample Station									
	1 riffle/run	2 glide/pool	3 riffle/run	4 Riffle/run	5 glide/pool	6 n.a.	7 n.a.	8 riffle/run	9 glide/pool	10 riffle/run
Substrate and In-stream Cover										
Epifaunal Substrate/Avail. Cover	19	13	18	18	10	-	-	15	13	18
Embeddedness	19		14	14		-	-	18		15
Pool Substrate Characterization		13			10	-	-		11	
Velocity Depth Regime	15		14	14		-	-	15		10
Pool Variability		10			14	-	-	9	13	
Sediment Deposition	15	12	15	13	14	-	-	17	14	17
Channel Morphology										
Maintained Flow Volume	9	9	9	9	9	-	-	9	10	7
Flashiness	9	7	8	9	7	-	-	9	8	7
Channel Alteration	20	16	18	19	20	-	-	20	15	15
Frequency of Riffles/Bends	19		15	15		-	-	12		17
Channel Sinuosity		12			14	-	-		14	
Riparian and Bank Structure										
Bank Stability (L)	9	9	9	9	7	-	-	9	10	10
Bank Stability (R)	9	9	9	9	7	-	-	9	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	150	169	169	152	n.a.	n.a.	182	159	183
Habitat Rating	Excellent	Good	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

n.a. – Not applicable

Table 5-7. 2011 Average Water Quality Parameters – Stations 1-10.

Station Number	Date	Time	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Percent Dissolved Oxygen	pH	Conductivity (µS/cm)
1	7/14/2011	18:09	14.6 (0.0)	9.2 (0.5)	89.9 (5.2)	7.8 (0.1)	60 (0.2)
2	6/20/2011	20:20	15.5 (0.2)	7.5 (0.2)	74.8 (2.8)	6.7 (0.2)	50 (1.0)
3	6/20/2011	20:35	15.2 (0.1)	8.1 (0.2)	80.3 (1.8)	6.6 (0.1)	49 (1.3)
4	7/14/2011	11:30	12.6 (0.1)	9.4 (0.1)	88.3 (1.3)	8.1 (0.2)	110 (0.2)
5	7/14/2011	15:08	17.9 (0.1)	8.1 (0.4)	85.5 (4.2)	7.4 (0.1)	66 (0.1)
6	6/21/2011	16:49	13.5 (0.1)	4.9 (0.3)	47.1 (2.8)	6.0 (0.1)	38 (1.5)
7	6/23/2011	16:56	14.2 (0.1)	5.8 (0.1)	56.5 (1.0)	5.8 (0.1)	32 (0.1)
8	6/23/2011	14:08	10.7 (0.0)	9.5 (0.1)	85.2 (1.1)	6.9 (0.0)	78 (0.2)
9	6/20/2011	19:30	10.1 (0.0)	10.4 (0.4)	92.7 (4.1)	7.2 (0.0)	85 (0.1)
10	6/20/2011	18:56	13.5 (0.2)	8.8 (0.4)	85.1 (3.4)	7.0 (0.0)	87 (0.7)

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

°C = Degrees Celsius

mg/L = Milligrams per liter

µS/cm = Microsiemens per centimeter

standard deviation is indicated within ()

EXHIBIT C
STATION PHOTOGRAPHS



Photograph C-1. Cedar Creek upstream of Northwestern Road. South View, July, 2011.



Photograph C-2. Station 1 – Upstream Extent North View, July, 2011.



Photograph C-3. Station 1 - Downstream Extent View South, July, 2011.



Photograph C-4. Station 2 – Upstream Extent View North, June, 2011.



Photograph C-5. Station 2 – Downstream Extent View South, June, 2011.



Photograph C-6. Station 3 – Upstream Extent View North, June, 2011.



Photograph C-7. Station 3 –Downstream Extent View South, June, 2011.



Photograph C-8. Station 6 – Upstream Extent View Southwest, June, 2011.



Photograph C-9. Station 6 – Downstream Extent View Southwest, June, 2011.



Photograph C-10. Station 7 – Downstream Extent View Southwest, June, 2011.



Photograph C-11. Station 7 – Upstream Extent View North, June, 2011.



Photograph C-12. Station 8 – Downstream Extent View South, June, 2011.



Photograph C-13. Station 8 – Upstream Extent View North, June, 2011.



Photograph C-14. Station 9 – Downstream Extent View Southwest, June, 2011.



Photograph C-15. Station 9 – Upstream Extent View Northeast, June, 2011.



Photograph C-16. Station 10 – Downstream Extent View Southwest, June, 2011.



Photograph C-17. Station 10 – Upstream Extent View Northeast, June, 2011.



Photograph C-18. Station 5 – Downstream Extent View West, July, 2011.



Photograph C-19. Station 5 – Upstream Extent View East, July, 2011.



Photograph C-20. Station 4 – Downstream Extent View South, July, 2011.



Photograph C-21. Station 4 – Upstream Extent View North, July, 2011.