

Technical Memorandum

To: Nathan Schroeder, Northshore Mining Company
From: Louise Segroves and Rachel Walker, Barr Engineering Company
Subject: Wild Rice Literature Review and 2013 Field Survey for the Peter Mitchell Mine
Date: December 11, 2013
Project: 23/38-1039

Introduction

The Minnesota Pollution Control Agency (MPCA) sent a letter (Attachment A) to Cliffs Natural Resources, Northshore Mining Company (Northshore) dated April 2, 2013 requesting a literature review and a wild rice (*Zizania palustris* L.) field survey of water bodies identified as receiving waters (Study Area) downstream of the Peter Mitchell Mine Area. These receiving waters are associated with Northshore's Peter Mitchell Mine, which is permitted under NPDES Permit MN0046981.

The wild rice field survey and water quality monitoring results are presented in this memorandum and include observations of the following water bodies as listed in the MPCA letter and shown on Figure 1:

- **Area 001:** Unnamed Creek to Dunka River
- **Area 002:** Unnamed Creek to Langley Creek to Dunka River to Birch Lake
- **Area 003:** Unnamed Creek to Yelp Creek to Partridge River to the Dunka Road Crossing

These water bodies (shown on Figure 1) make up the Study Area for the literature review and fieldwork described in this memorandum. Based on an April 29, 2013 discussion between Northshore and MPCA staff, fieldwork was not conducted in 2013 for Dunka Bay in Birch Lake. Instead, this memorandum references 2011 surveys completed by Barr Engineering Company (Barr) on behalf of Cliffs Erie, LLC (CE) for this portion of the Study Area. The 2013 fieldwork and literature review were conducted by Barr on behalf of Northshore.

Literature Review

Barr reviewed publicly available documents containing information on the presence and absence of wild rice. The Minnesota Department of Natural Resources (MNDNR) Fisheries maintains files and reports

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related to Study Area water bodies at the MNDNR office in Tower, Minnesota. Wild rice investigational reports with regional or statewide significance were downloaded from digital or internet sources. State regulatory databases were also reviewed for information pertaining to wild rice. The results of the literature review are described below.

Literature Review Findings: MNDNR Lake/Stream Survey Files

Each MNDNR Fisheries Office has maintained files on select surface waters within its management zone since the early part of the 1900s. These files include documentation of MNDNR surveys to monitor fish populations, lake and stream habitat, and water chemistry. Seasonal sampling times also vary with some water bodies sampled immediately after ice-out and others sampled in late summer. The surveys' purpose has not been to document wild rice presence. Wild rice data has been collected sporadically as part of documenting fish habitat information, which includes aquatic macrophytes. All water bodies in this Study Area are within the management zone of the MNDNR Fisheries office in Tower, which is where this documentation was reviewed. The following is a summary of the documentation reviewed from each Study Area water body file. Only information pertaining to wild rice is included.

Birch Lake

A file for Birch Lake was located in the Fisheries Office and contained numerous records dating back to 1954.

Aquatic vegetation was documented in a 1954 Lake Survey Report, but no observations of wild rice were recorded. The 1954 report indicates a sulfate concentration of "0.0 p.p.m" and notes that "Birch Lake is a soft water lake of moderate fertility. It is low in phosphorus and sulphates [sic] are lacking."

The 1975 Lake Survey Report indicated that emergent vegetation covered less than 1 percent of the lake, in "scattered spots around the shoreline [in] shallow bays protected from wind action." Wild rice was observed during the 1975 survey and was given a rating of "rare," although the report recorded "substantial wild rice beds in the lower part of Birch River."

In 1997, the MNDNR completed 50 vegetation transects along the Birch Lake shoreline. Of the 28 transects that contained vegetation, wild rice was listed as "rare" in nine and "abundant" in two. Wild rice was estimated to account for 22 percent of the rare emergent macrophytes documented in this survey. Values for "maximum vegetation depth" range from 1 to 4 feet for those 11 transects. Shoalwater substrate information was also collected in 1997 and indicated that substrate around the lake was

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composed mostly of bedrock, boulders, and rubble. The only readily observable pattern was that the substrates of the two transects containing abundant wild rice had abundant muck. Field notes indicate that “wild rice continues to increase in abundance.” A review of the field maps indicated that the rice occurred primarily in the farthest reaches of the bays.

The 2004, 2006, and 2009 Standard Lake Survey Reports do not record the presence of wild rice in the report, but each of these reports noted that “Aquatic vegetation grows to a depth of 5 feet and is sparse, with small clusters in protected bays; water lilies, various pondweeds, and floatingleaf burreeds are the most common plants. Birch Lake ranks as mesotrophic-to-eutrophic according to Carson’s Trophic State Index.”

Dunka River

A file for Dunka River was located in the Fisheries Office, which contained a Stream Survey Summary, dated June 17, 1968. Aquatic vegetation of the river was included in the survey summary; wild rice was not among the listed species.

Unnamed Creek, which flows to Dunka River, was not referenced in this file, and no other file was found about this water body in the Fisheries Office.

Langley Creek

A file for Langley Creek was located in the Fisheries Office, which contained two records describing vegetation and physical habitat conditions in Langley Creek. Wild rice and other macrophytes are not mentioned in these Stream Survey Reports for 1975 and 1984.

Unnamed Creek, which flows to Langley Creek, was not referenced in this file, and no other file was found about this water body in the Fisheries Office.

Partridge River

A file for Partridge River was located in the Fisheries Office, which contained a Stream Survey Summary, dated June 17, 1968. The aquatic vegetation of the river was included in the summary; wild rice was not among the listed species.

Yelp Creek and Unnamed Creek to Yelp Creek

There was no file for Yelp Creek or the Unnamed Creek to Yelp Creek found in the Fisheries Office.

Literature Review Findings: Regional Resource Documents

Wild rice investigational reports and publically available information with regional or statewide significance were also reviewed. Many of the documents did not contain any information about wild rice within the Study Area. We include a brief description of each document reviewed and cite information pertaining to wild rice that was found in each document.

- Trygg. 1966. *Composite Map of the United States Land Surveyors Original Plats and Field Notes* (Reference (1))
J. William Trygg published a compilation of 1858 map resources and land surveys. These resources documented wetlands, lakes, streams, forests, trails, roads, settlements, fields, mill sites, and other local features and cultural resources. None of the Study Area waters are listed in these maps and notes as wild rice resources.
- Moyle. 1941. Investigational Report #22. *Report on Minnesota Wild Rice for 1940*. Bureau of Fisheries Research, Division of Game and Fish – MNDNR (Reference (2))
John B. Moyle is one of the first MNDNR biologists to research wild rice and publish his findings. His research is cited, in part, as the basis for the wild rice sulfate standard. None of the Study Area waters are listed in this report as wild rice resources.
- Moyle. 1942. Investigational Report #40. *The 1941 Minnesota Wild Rice Crop*. Bureau of Fisheries Research Division of Game and Fish – MNDNR. (Reference (3))
Birch Lake is listed in this document as a wild rice resource, but no information is given on location, acreage, density, or quality of wild rice in the lake.
- Moyle, J. and Krueger, P. MNDNR. 1969. *Informational Leaflet #5*. State of Minnesota Department of Conservation, Division of Game and Fish (Reference (4))
None of the Study Area waters are listed in this report as a wild rice resource.
- MNDNR. 2007. *Minnesota Natural Wild Rice Harvester Survey: A Study of Harvesters' Activities and Opinions* (Reference (5))
This study was completed following the MNDNR's administration of a harvester survey and is based on 1,365 survey responses. Of the Study Area waters, only Birch Lake is listed as a wild rice resource; however, no information is provided regarding the location, acreage, density or quality of wild rice in the lake.

- MNDNR. 2008. *2008 Natural Wild Rice in Minnesota Report* (Reference (6))
This study was mandated by the Minnesota Legislature as part of the 2007 legislation on wild rice. The study's purpose was to estimate potential threats to natural wild rice stands including those from genetically engineered strains. Of the Study Area waters, only Birch Lake is listed as a wild rice resource, with an estimated wild rice coverage of 381 acres. No further information is provided as to the location, density or quality of wild rice in the lake.
- MNDNR. 2010. *Wild Rice Management Workgroup's "350 Significant Wild Rice Waters in Minnesota"* (Reference (7))
Following the passage of the Minnesota Legislature's bill on wild rice in 2007, a wild rice management working group was organized by the MNDNR and other stakeholders interested in wild rice. Its members included many of the same authors of the MNDNR *2008 Natural Wild Rice in Minnesota Report*. Of the Study Area waters, only Birch Lake is listed. It is noted as having easy access, low harvesting pressure, and good harvest potential; however, no information is provided as to the location, acreage, density or quality of wild rice in the lake.
- 1854 Treaty Authority. 2013. *Wild Rice Monitoring and Abundance in the 1854 Ceded Territory (1998 – 2012)* (Reference (8))
The 1854 Treaty Authority has conducted wild rice surveys from 1996 to 2012 on 359 lakes and river segments within the 1854 ceded territory. The list was last updated in March 2013. Of the Study Area waters, Birch Lake (MNDNR No. 69000300), Dunka River, and the Upper and Lower Partridge Rivers are listed as wild rice resources. No MNDNR identification numbers are listed for Dunka River or the Upper and Lower Partridge Rivers. No further information is provided as to the location, acreage, density or quality of wild rice in these water bodies.

Literature Review Findings: State Regulatory Databases

The State of Minnesota has a database of wild rice documentation, MPCA's Minnesota Sulfate and Wild Rice Map Tool (also known as the MNDNR Zizania database - Reference (9)), which was reviewed as part of the literature review.. Of the Study Area waters, only Birch Lake is listed as a wild rice resource, with the same reference to 381 acres of wild rice cited in the MNDNR *2008 Natural Wild Rice Minnesota Report*.

Documentation regarding MNDNR aquatic plant management permit applications for either removal of wild rice plants or the introduction (planting) of wild rice was not readily available.

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Literature Review Conclusion

A review of MNDNR Fisheries Office files and regional resource documents indicates that wild rice has only been documented in the following water bodies of the Study Area: Birch Lake, Dunka River and the Upper and Lower Partridge Rivers.

Field Survey

The purpose of the qualitative vegetation survey and water quality sampling was to document the presence or absence of wild rice and its relative stand density, as well as to evaluate water body habitat suitability for wild rice and collect surface water samples for sulfate analysis in or near any wild rice stands. The field survey was conducted by Barr in August 2013 for the Study Area water bodies. The wild rice survey summary below also references 2011 surveys completed by Barr on behalf of CE for Dunka Bay.

Methods

Survey Methods

Barr staff followed 1854 Treaty Authority survey methods as documented in Reference (8) and other vegetation plot data survey methods to quantify *in situ* plant species (e.g., *A Handbook for Collecting Vegetation Plot Data in Minnesota: The Relevé Method* (Reference (10))). Where possible, the Study Area water bodies (Figure 1 and Figure 2) were surveyed by kayak.

In the April 2, 2013 letter (Attachment A), the MPCA requested that the survey “observe whether wild rice is actually present in all waters potentially impacted by the discharges that were determined to have potential for wild rice, either based on the literature search above or those that have characteristics which may encourage wild rice production.” If wild rice was encountered during field observations, field crews recorded the GPS location, documented the location, took photographs, and recorded a brief description of the wild rice stand. Additionally, dominant vegetation was noted along the water bodies surveyed and samples were collected as described below.

The MPCA’s April 2, 2013 letter also requested that Northshore “attempt to collect at least one grab sample in each water where wild rice is found to be present” and analyze the sample for sulfate.

A wild rice density rating scale of 1 to 5 was applied to any observation of wild rice. The density rating is used to qualitatively assess the density of wild rice. The rating references approximate percent coverage

of wild rice over a given area in a water body. Table 1 relates wild rice density scale ratings to the approximate percent coverage of wild rice, also shown by example in the photos included in Attachment C. As discussed above, a similar rating scale was used by the 1854 Treaty Authority.

Table 1 Wild Rice Density Scale

Wild Rice Density Rating	Description
1	<10% Wild Rice Cover
2	10–25 % Wild Rice Cover
3	25–50% Wild Rice Cover
4	50–75% Wild Rice Cover
5	>75% Wild Rice Cover

The 1854 Treaty Authority only surveyed known wild rice water bodies and did not include reconnaissance of small stream systems. Some of the stream reaches for the Northshore water bodies were unnavigable by kayak and could not be easily accessed by foot due to the physical characteristics of the habitat. These same characteristics that limited physical access to certain stream sections are also characteristics that limit the suitability of habitat for wild rice and include:

- Very low water levels (depths less than 1 foot)
- Predominantly rocky or sandy substrate
- Narrow channel conditions with little to no open water, often due to thick vegetation growth (*Typha* spp., *Phalaris arundinacea*, *Calamagrostis canadensis*, etc.) or channel morphology
- Dense algal growth
- Dense overhanging vegetation
- The presence of shrub or forest species such as *Alnus* spp., *Fraxinus nigra*, *Betula* spp., *Picea mariana*, and *Populus tremuloides*

Wild rice typically grows in open water with direct sunlight. Other conditions that favor wild rice growth include some flowing water (water bodies with an inlet and an outlet), water depths ranging from 1 to 4 feet, and predominantly mucky substrate. Stream reaches that were unnavigable by kayak or difficult to access by foot were surveyed by consulting aerial photographs and by observing stream conditions from the nearest accessible points on the stream, as described below in the Field Survey Findings section.

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Other Macrophyte Sampling Methods

As part of the 2013 wild rice survey, field surveyors identified the dominant aquatic and emergent macrophytes in the water bodies, with staff trained to distinguish wild rice from other aquatic and emergent macrophytes commonly growing in similar habitats in northern Minnesota. The field surveyors also assessed the suitability of the habitat for wild rice (including the presence and abundance of other macrophytes). A subset of aquatic and emergent macrophyte observations included collection of plant specimens to verify field identification. .

Water Quality Sampling Methods

The MPCA's April 2, 2013 letter requested that Northshore "attempt to collect at least one grab sample in each water where wild rice is found to be present" and analyze the sample for sulfate.

No wild rice was encountered in water bodies surveyed in 2013; therefore no water sampling was required. The 2011 surface water sampling in Dunka Bay was conducted following Barr's standard operating procedure (SOP), *Collection of Surface Water Samples* (Reference (11)); these methods are included as Attachment D. Upon collection, unfiltered samples were placed in a cooler with ice and submitted to Pace Analytical Laboratory in Virginia, Minnesota for analysis.

In 2011, water samples were analyzed for concentrations of sulfate (SO_4^{2-}), major cations (Mg^{2+} , Ca^{2+} , K^+ , and Na^+), and major anions (HCO_3^- and Cl^-). The major cations were analyzed using EPA method 6010, sulfate and chloride were analyzed using EPA method 300.0, and bicarbonate was measured as bicarbonate alkalinity and reported as CaCO_3 using SM 2320B.

Field Survey Findings

After surveying approximately 21 miles of streams within the Study Area in 2013, no wild rice was found. During 2011 surveys of shoreline in the Dunka Bay, where Dunka River flows into Birch Lake, several stands of wild rice were observed, as shown on Figure 2. Observations from the wild rice survey of each water body are summarized below. Photographs of the Study Area are included as Attachment B.

Water Bodies Where Wild Rice Was Observed

Dunka Bay– Surveyed 8/15/2011

During the 2011 surveys for CE, wild rice with a density of 3 was observed in Dunka Bay where the Dunka River flows into Birch Lake (Figure 2), with stands with a density of 1 and 2 within Birch Lake immediately outside of Dunka Bay. Stands within Dunka Bay were generally located near the shoreline,

in water approximately 1 to 3 feet deep. Stand sizes within the depicted extents on Figure 2 ranged from approximately 0.001 to 6.5 acres (smaller stands are included within the depictions of wild rice extents). *Potamogeton* spp. was identified growing in the wild rice stands identified nearest to the mouth of the Dunka River, comprising approximately 40% of the vegetation present in those stands. Other plant species growing near or within these wild rice stands included *Sparganium* spp., *Calamagrostis canadensis*, *Scirpus* spp., *Typha* spp., and *Carex* spp. The shore was dominated by dense forest species. The results of two water quality samples collected in this survey area are presented in Table 2 and discussed further under Water Quality Monitoring Results.

Water Bodies Where Wild Rice Was Not Observed

Wild rice was not identified in any of the water bodies surveyed in 2013 (Figure 1). Surveyed water bodies without wild rice present are described below.

Dunka River from Langley Creek to Birch Lake – Surveyed 8/22/13 to 8/23/13

No wild rice was observed on the Dunka River. The Dunka River survey began at the confluence of Langley Creek and Dunka River (Dunka River Mile 10.5) as shown on Figure 1. The width of the river channel in this stretch ranged from 65-100 feet, with a depth of 25-43 inches and an increasing presence of aquatic vegetation through Dunka River Mile 11.5. Near Mile 12, the river was 50 to 65 feet wide, with a depth ranging from 15 to 45 inches and with little aquatic vegetation present. The substrate in this area was composed of coarse sand and rocks. These general conditions continued through Mile 13.5, with a few beaver dams and sand bars present near Mile 13.5. Nearing Mile 14, the river channel became shallow, steep and bouldery with very little aquatic vegetation present in the channel and with upland vegetation present right up to the river banks.

At Mile 13.9, the field survey crew encountered a boulder/riffle stretch from Mile 13.9 to Mile 14.1 with very shallow water (3-12 inches deep) that was inaccessible by kayak. The crew left the river and put in further downriver, from where they paddled upriver to Mile 14.1 and viewed the boulder/riffle section from downstream. No wild rice was observed in this river section when viewed from the upstream and downstream ends, and no wild rice stands or areas of suitable wild rice habitat were identified on aerial photographs along this section. The river section from Mile 13.9 to Mile 14.1 was bouldery, with shallow and fast flow. The habitat in this section is not conducive to the growth of wild rice.

Surveying by kayak continued on Dunka River at Mile 14.1, as shown on Figure 1. This reach was characterized by slow moving water and low water levels, although signs of faster moving water

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(deposition along the shoreline) and higher water levels were present along the banks. Sandy substrate was observed, with large cobble/boulders present in the channel throughout this stretch. River depths ranged from 10 to 50 inches and width ranged from 10 to 20 feet. The river widened to 35 to 50 feet near Dunka River Mile 14.5, although the flow along this reach was slower, with almost no boulders present. Past Mile 14.5, the river narrowed to 25 to 35 feet and became shallower with cobbly substrate. The channel continued to narrow near Mile 14.75 with sandy substrate and more rocks and boulders present in the channel. Mile 14.5 was also the starting point for the 2011 survey conducted for CE, during which no wild rice was observed on the Dunka River between Mile 14.5 and Birch Lake.

From Mile 15 to 15.5, the substrate transitioned from primarily cobble to muck with few boulders present. At Mile 15.5, river navigation became challenging due to a transition from muck to sand and large boulders, and survey by kayak was determined to be unsafe. The direct survey was suspended between Mile 15.5 and 16.3. Based on review of aerial photographs and past surveys conducted on foot along this reach (surveyed in 2009), these channel stretches comprised continuous rocky and sandy substrate, several sets of rapids, dense overhanging vegetation along the shore, and water depths ranging from 4 to 6 inches. No areas of suitable wild rice habitat were identified in these stream reaches in previous surveys or on aerial photographs.

The direct survey was resumed from approximately Mile 16.3 to Mile 16.4 (accessed via a transmission line corridor). This reach of river was generally characterized by a fine sand substrate, with mud flats on the shoreline adjacent to exposed banks. The width of the river along this reach ranged from 20 to 120 feet. Water depths ranged from approximately 6 inches to 4 feet. Dominant vegetation included *Fraxinus nigra*, *Alnus* spp., and *Chamaedaphne calyculata*.

The remaining segment of Dunka River, from Mile 16.4 to the outlet at Dunka Bay, was not surveyed by kayak or foot in 2013. Based on review of aerial photographs and past surveys conducted on foot along this reach (surveyed in 2009), this channel stretch comprises continuous rocky and sandy substrate, several sets of rapids, dense overhanging vegetation along the shore, and water depths ranging from 4 to 6 inches. No areas of suitable wild rice habitat were identified in this stream reach in previous surveys or on aerial photographs.

Macrophytes observed during the 2013 survey are identified in Large Table 1 and discussed generally under "Other Macrophytes Observed."

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Unnamed Creek to Dunka River – Surveyed 8/27/2013

No wild rice was observed along Unnamed Creek to Dunka River. A majority of Unnamed Creek upstream (west) of Dunka Road was not directly surveyed on foot or kayak due to poor accessibility. Observations (from Dunka Road) for the area upstream of the road indicated a marsh cattail wetland area with shallow water and no apparent channel. The direct survey began at Dunka Road and ended just downstream of the railroad crossing east of Dunka Road, at which point the channel entered a section with thick alder growth over the channel. Water levels in this unnamed tributary to Dunka River were very low. Large amounts of aquatic vegetation, including alder, were present with the tree and shrub canopy along the banks extending over the creek itself. Macrophytes observed during this survey are identified in Large Table 1 and discussed generally under “Other Macrophytes Observed.”

Based on the field survey and examination of aerial photographs, this channel does not contain habitat conducive to wild rice, due to the presence of thick overhanging vegetation, dense vegetation in the stream, and shallow water levels.

Langley Creek to Dunka River – Surveyed 8/20/2013

No wild rice was observed on Langley Creek. Near Mile 0, conditions did not allow direct survey via kayak due to large boulders and thick alder growth overhanging the stream. Therefore, this portion of the stream was indirectly surveyed from an observation point where the creek crosses Cliffs’ railroad track (approximately Mile 0.2). This section with poor access was also observed from the downstream end at approximately Mile 1. This stretch of creek was observed to be densely vegetated and ponded in areas within the stream. Even though the stream was ponded in areas, the dense, overhanging vegetation was not conducive to wild rice growth. No wild rice stands or areas of suitable wild rice habitat were identified on aerial photographs along this stretch.

Direct survey by kayak began near Mile 1, with the channel width approximately 5 feet and water depth approximately 4 to 10 inches. From Mile 1 to 1.5, boulders were abundant with alder overhanging the channel. This stream stretch had a noticeable current with some pool and riffle morphology, very little aquatic vegetation, and an abrupt transition from channel to shoreline banks.

From Mile 1.5 to the confluence with Dunka River, the stream channel was generally open with little aquatic vegetation. The stream morphology was glide without pools or riffles, substrate was mucky, and banks were low near the water. Channel width ranged from 15 to 35 feet, and water depth ranged from 10 to 25 inches. Sedge and grass lowland hummocky terrain exists between the creek and uplands.

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Macrophytes observed during the survey are identified in Large Table 1 and discussed generally under “Other Macrophytes Observed.”

Unnamed Creek to Langley Creek – Surveyed 8/27/2013

No wild rice was observed in Unnamed Creek to its confluence with Langley Creek. A direct survey was carried out from the start of Unnamed Creek for about three quarters mile by observing the creek from the adjacent roadway. Near the headwaters of the creek, the channel was rocky with a mucky bottom and ranged in water depth 1 to 3 inches. The length of the creek was dominated by aquatic vegetation, stagnant marshes, and beaver dams near the confluence with Langley Creek. The channel became difficult to distinguish after three quarters mile and the direct survey was discontinued. Based on consultation of aerial photographs of the remaining portion of Unnamed Creek (to Mile 0 of Langley Creek), the presence of dense vegetation and no defined stream channel was confirmed. These results suggest that conditions are not conducive to wild rice growth.

Macrophytes observed during the survey are identified in Large Table 1 and discussed generally under “Other Macrophytes Observed.”

Partridge River to the Dunka Road Crossing – Surveyed 8/21/2013

No wild rice was observed on the Partridge River. In the initial surveyed stretch (Mile 0 to near Mile 2), the river was approximately 16 feet wide and 60 inches deep. Water was calm with glide morphology. Aquatic vegetation formed the boundary between land and river, with water depth rapidly increasing from the shoreline to the main channel. The substrate was observed to be organic and silty. Nearing Mile 2, the channel widened to approximately 35 feet, and depth decreased to 2.5 to 3.5 feet. This stretch was characterized by open water with few to no aquatic plants. Near Mile 2.5, the channel became shallower (~16 inches). The stream morphology was glide, although a directional current was present. Woody debris was present on the stream bed. The channel narrowed near Mile 3, becoming bouldery with a strong current. Through Mile 4, the river channel narrowed and widened with corresponding changes in current, with little change in substrate. Near the end of the surveyed reach by the Dunka Road crossing, the substrate became sandy and firm with a water depth of approximately 20 inches.

Macrophytes observed during the survey are identified in Large Table 1 and discussed generally under “Other Macrophytes Observed.”

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Yelp Creek to Partridge River – Surveyed 8/26/2013

No wild rice was observed on Yelp Creek. The survey of Yelp Creek began at the confluence of Partridge River and Yelp Creek and ended upstream when the stream channel disappeared into a large tamarack swamp (Figure 1). On Figure 1, it is possible to see where crews were forced slightly south when the stream channel was no longer visible. Many beaver dams were present on Yelp Creek. Channel depth varied from approximately 10 to 50 inches, with a mucky substrate. Aquatic vegetation was abundant. Based on consultation of aerial photographs for the area near the end of the direct survey, no channel is visible, and conditions are not conducive for wild rice growth.

Macrophytes observed during the survey are identified in Large Table 1 and discussed generally under “Other Macrophytes Observed.”

Unnamed Creek to Partridge River – Surveyed 8/26/2013

No wild rice was observed on Unnamed Creek. A direct survey was conducted from the creek’s confluence with Partridge River to the direct survey’s end approximately one half mile upstream from the confluence (Figure 1). Upstream of the direct survey’s end, the channel became unnavigable by foot or kayak, with dense, overhanging vegetation comprising mainly alder. Crews also drove to additional upstream observation points (shown as “Observation Point” and “Two 36-inch Culverts” on Figure 1) and were able to determine that direct survey was not warranted from the north. Based on consultation of aerial photographs of the remaining creek channel and observations made at accessible locations in the upstream section of the creek, conditions are not conducive to wild rice growth in the sections of the creek that were not directly surveyed.

Macrophytes observed during the survey are identified in Large Table 1 and discussed generally under “Other Macrophytes Observed.”

2011 Dunka Bay Water Quality Sampling Results

Results of water quality sampling conducted during the 2011 wild rice survey are presented in Table 2. Two samples were obtained in 2011 from Dunka Bay from within wild rice stands. Wild rice was not found in the stream segments surveyed in 2013; therefore no water samples were collected.

Table 2 Water Quality Data Collected During the 2011-2013 Wild Rice Surveys

Parameter			Alkalinity, bicarbonate, as CaCO ₃	Calcium	Chloride	Magnesium	Potassium	Sodium	Sulfate, as SO ₄
Unit			mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Fraction			NA	Total	NA	Total	Total	Total	NA
Water Body	Location	Date							
Birch Lake	TM-BIR-RMK-04	8/17/2011	56.6	14.5	5.32	9.91	0.96	5.67	21.0
Birch Lake	TM-BIR-RMK-05	8/17/2011	64.0	17.4	5.97	11.2	1.14	6.64	23.6

The laboratory results were evaluated using Barr’s standard operating procedures for routine level data review, which are based on the USEPA National Functional Guidelines for Organic and Inorganic Data Review. The quality control procedures conducted at the laboratory included the use of approved methodologies, analysis of method (laboratory) blank samples, laboratory control samples (LCS), and matrix spike (MS) and matrix spike duplicate (MSD) samples. No significant QA/QC issues were identified from these procedures. The data met the prescribed acceptance criterion for preparative and analytical holding times. The data are deemed acceptable for the purposes of this project with no qualifications assigned during the data evaluation process.

Other Macrophyte Survey Results

Macrophytes observed in surveyed water bodies consisted mainly of common aquatic species typical in the region. Over 25 taxa were documented in the Study Area water bodies. Most could be confidently identified to species, but in some cases, identification was possible only to genus because diagnostic characters were lacking. The most abundant shoreline or emergent vascular plant species included bluejoint (*Calamagrostis canadensis*), sedges (*Carex* spp. including *C. pseudocyperus* and *C. utriculata*), and cattails (*Typha* spp.). Common aquatic species encountered include water-milfoil (*Myriophyllum* spp.), yellow pond-lily (*Nuphar lutea*), pondweeds (*Potamogeton* spp. including *P. natans*), arrowheads (*Sagittaria* spp. including *S. latifolia*), and bur-reeds (*Sparganium* spp.). Macrophytes observed during the survey are listed in Large Table 1.

Field Survey Summary

The Northshore wild rice survey consisted of documenting the presence or absence of wild rice in the following water bodies (Figure 1):

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- Unnamed Creek to Dunka River (Area 001)
- Unnamed Creek to Langley Creek to Dunka River to Birch Lake (Area 002)
- Unnamed Creek to Yelp Creek to Partridge River to the Dunka Road Crossing (Area 003)

Fieldwork consisted of evaluating approximately 21 miles of streams (as listed above) in August 2013 and approximately one mile of Dunka Bay shoreline in August 2011.

Several stands of wild rice with a density rating of one to three (on a scale of 1 to 5) were identified in Dunka Bay in 2011 (Figure 2). Wild rice was not identified along the 21 miles of streams surveyed in 2013. A majority of channel conditions in the streams, including sections with very low water levels, a narrow stream channel, the presence of overhanging dense vegetation and forest species such as *Alnus* spp., were not conducive to the growth of wild rice. These conditions also made portions of the streams difficult to navigate by kayak or on foot.

Barr collected surface water samples in two locations near wild rice stands in Dunka Bay in 2011. Laboratory results indicate that sulfate concentrations at these stands are greater than 10 mg/L.

References

1. **Trygg, J.W.M.** Composite Map of United States Land Surveyors' Original Plats and Field Notes (1907-1858), Map Sheet No. 17. 1966.
2. **Moyle, J.** The 1940 Minnesota Wild Rice Crop. *Bureau of Fisheries Research Division of Game and Fish. Investigational Report #22.* 1941.
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4. **Moyle, J. and Krueger, P.** Wild Rice in Minnesota. *Informational Leaflet 5, State of Minnesota Department of Conservation, Division of Game and Fish.* 1968.
5. **Norrgard, R., Drotts, G., Drewes, A., and Dietz, D.** Minnesota Natural Wild Rice Harvester Survey: A Study of Harvesters' Activities and Opinions. Management Section of Wildlife, Division of Fish and Wildlife, Minnesota Department of Natural Resources. 2007. p. 139.
6. **Minnesota Department of Natural Resources.** Natural Wild Rice in Minnesota Report. 2008.
7. **Wild Rice Management Workgroup.** 350 Significant Wild Rice Waters in Minnesota. 2010.
8. **1854 Treaty Authority.** Wild Rice Monitoring and Abundance in the 1854 Ceded Territory (1998-2008). 2008.
9. **Minnesota Pollution Control Agency.** Minnesota's sulfate standard to protect wild rice. [Online] November 8, 2013. <http://www.pca.state.mn.us/index.php/water/water-permits-and-rules/water-rulemaking/minnesotas-sulfate-standard-to-protect-wild-rice.html#assessment>.
10. **Minnesota Department of Natural Resources.** A Handbook for Collecting Vegetation Plot Data in Minnesota: The Relevé Method. 2007.
11. **Barr Engineering Company.** Standard Operating Procedure Collection of Surface Water Samples, Revision 5. April 2011.

12. **Minnesota Department of Natural Resources.** A document on summary of river survey of the Partridge River. 1968.

Large Tables

Large Table 1 Other Macrophytes Observed during 2013 Field Survey

Species	Common Name	Dunka River and unnamed tributary		Langley Creek and unnamed tributary		Partridge River		Yelp Creek and unnamed tributary	
		WR ¹	NWR ¹	WR ¹	NWR ¹	WR ¹	NWR ¹	WR ¹	NWR ¹
<i>Calamagrostis canadensis</i>	Canada bluejoint	n=0 ²	n=24 ²	n=0 ²	n=19 ²	n=0 ²	n=14 ²	n=0 ²	n=6 ²
<i>Calla palustris</i>	Water arum		2		2				4
<i>Carex spp.</i>	Unidentified sedge species						1		4
<i>Carex pseudocyperus</i>	Unidentified sedge species				2		1		
<i>Carex utriculata</i>	Unidentified sedge species		2						3
<i>Comarum palustre</i>	Marsh cinquefoil						1		1
<i>Dulichium arundinaceum</i>	Threeway sedge								1
<i>Eleocharis palustris</i>	Common spikerush		3						
<i>Eleocharis spp.</i>	Spikesedge						1		
<i>Equisetum fluviatile</i>	River horsetail						1		
<i>Glyceria borealis</i>	Northern manna grass		1		1				
<i>Glyceria canadensis</i>	Rattlesnake manna grass								2
<i>Glyceria grandis</i>	American manna grass		2						
<i>Impatiens capensis</i>	Jewelweed								1
<i>Myriophyllum spp.</i>	Unidentified water-milfoil species		2		4				1
<i>Nuphar lutea</i>	Yellow pond-lily		8		6				
<i>Phalaris arundinacea</i>	Reed canary grass		1						
<i>Potamogeton spp.</i>	Unidentified pondweed species				5		3		
<i>Potamogeton natans</i>	Floating pondweed		5				3		1
<i>Sagittaria spp.</i>	Unidentified arrowhead species				2		4		
<i>Sagittaria latifolia</i>	Broadleaf arrowhead		2						
<i>Scirpus cyperinus</i>	Woolgrass		2						
<i>Sparganium cf. fluctuans</i>	Bur-reed		6		1		3		1
<i>Typha spp.</i>	Cattails		1		11		2		3
<i>Utricularia macrorhiza</i>	Common bladderwort		1						
<i>cf. Nitella spp.</i>	Unidentified algae species				1				

¹WR = sample points at which wild rice was present; NWR = sample points at which no wild rice was present.

²n = total number of sample points at which macrophyte presence or absence was documented, categorized by whether wild rice was also present or not.

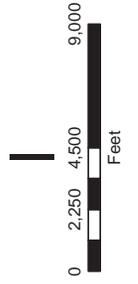
Note: When a plant could only be identified confidently to genus, it is designated "Genus spp." When a likely genus or species identification could be made, but without complete confidence, it is indicated with "cf."

Figures



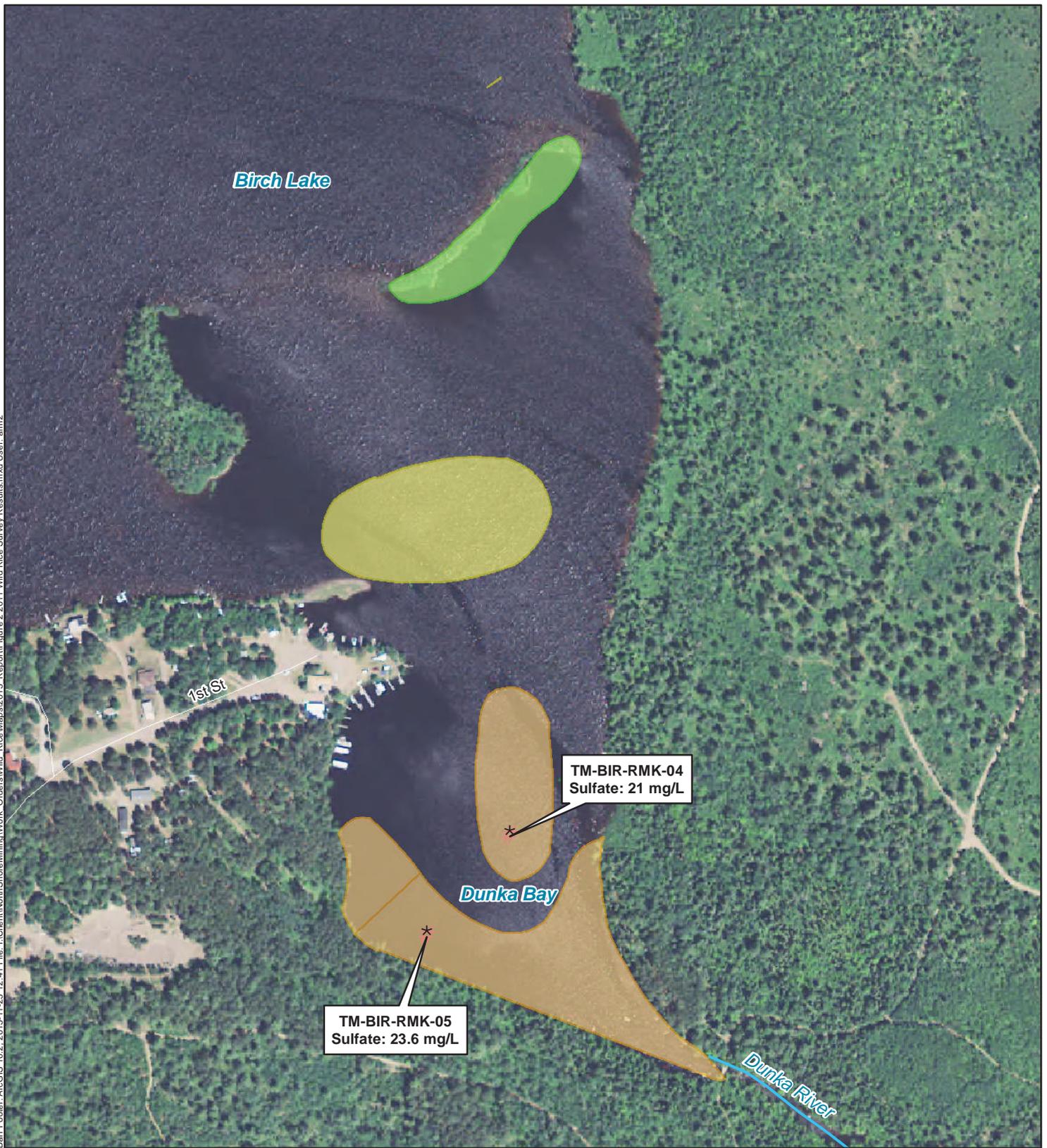
See Figure 2 for
2011 Survey Results

Figure 1
WILD RICE SURVEY LOCATIONS
Cliffs Natural Resources
Northshore Mining Company
St. Louis County, Minnesota



- NPDES Water Quality Monitoring Station
- Rivers and Streams
- Railroad
- River Miles
- Surveyed Shorelines - 2013
- Direct Survey
- Indirect Survey

Barr Footer: ArcGIS 10.2, 2013-11-25 12:41 File: I:\Client\NorthShoreMining\Work Orders\Wild Rice Maps\2013_Report\Figure 2 2011 Wild Rice Survey Results.mxd User: am2



-  2011 Water Sample Location
- Wild Rice Extents - 2011
-  1 <10% Wild Rice Coverage
-  2 10-25% Wild Rice Coverage
-  3 25-50% Wild Rice Coverage

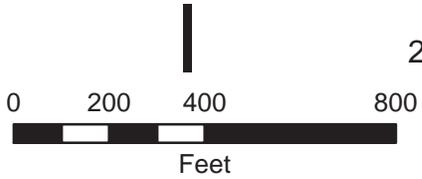


Figure 2
2011 WILD RICE SURVEY RESULTS
Cliffs Natural Resources
Northshore Mining Company
St. Louis County, Minnesota

Attachments

Attachment A

MPCA Letter



Minnesota Pollution Control Agency

520 Lafayette Road North | St. Paul, Minnesota 55155-4194 | 651-296-6300

800-657-3864 | 651-282-5332 TTY | www.pca.state.mn.us | Equal Opportunity Employer

April 2, 2013

Ms. Andrea Hayden
Cliffs Natural Resources
Northshore Mining Company
10 Outer Drive
Silver Bay, Minnesota 55614

RE: NPDES/SDS Permit No. MN0046981
Northshore Mining Company – Peter Mitchell Mine
Request for Information on Wild Rice

Dear Ms. Hayden:

The National Pollutant Discharge Elimination System/State Disposal System (NPDES/SDS) permit for the Northshore Mining Company – Peter Mitchell Mine is scheduled to expire in July of 2014. At that time, the Minnesota Pollution Control Agency (MPCA) will begin the process of reissuing the NPDES/SDS permit. One of the goals of the MPCA is to protect surface waters used for the production of wild rice. Over the last year, MPCA staff has been working to develop guidance to determine, on a case-by-case basis, what waters of the state are “used for the production of wild rice” and subject to the 10 mg/L sulfate standard under Minn. R. 7050.0224, Subp. 2. Such waters may be located downstream of the Peter Mitchell Mining Area.

Due to concerns regarding the concentration of sulfate in mine pit dewatering discharges and the resulting potential for impact to wild rice resources, the MPCA is requesting the company to gather additional information on the presence of wild rice waters downstream of the mine pit dewatering discharges including conducting a literature search to identify waters potentially containing wild rice followed by a field survey of those waters identified in the literature search. This information will be important for the permitting process to ensure that appropriate water quality standards are applied and to ensure that surface waters, including those used for the production of wild rice, are adequately protected.

We are requesting the company to include the following receiving waters, including any adjacent wetland areas, in the literature search and, as appropriate, in the subsequent field surveys.

MN0046981 Northshore Mining Company – Peter Mitchell Mine:

- **Area 001:** Unnamed Creek to Dunka River.
- **Area 002:** Unnamed Creek to Langley Creek to Dunka River to Birch Lake (including Dunka Bay).
- **Area 003:** Unnamed Creek to Yelp Creek to Partridge River to the Dunka Road Crossing.

Ms. Andrea Hayden

Page 2

April 2, 2013

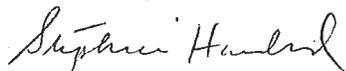
The company should provide the following information to the MPCA:

1. A literature search for wild rice in the downstream receiving waters listed above potentially impacted by the discharges. Some data sources that may be used to determine the potential for wild rice impacts include Appendix A of the "2008 DNR Wild Rice Report," the most recent "DNR Wild Rice Harvester Survey," and the "1854 Treaty Authority List." For waters listed in the "DNR Wild Rice Report," Gary Drotts at 218-833-8620 and Ann Geisen at 218-833-8625 may be contacted to gather all the available Department of Natural Resources (DNR) data on those sites. Information on any active or proposed DNR management activities designed to establish, protect, or enhance the wild rice resources of these waters would be helpful.
2. A field survey to observe whether wild rice is actually present in all waters potentially impacted by the discharges that were determined to have potential for wild rice, either based on the literature search above or those that have characteristics which may encourage wild rice production. When the field survey is conducted, it should be conducted by a qualified professional and should take into account the cyclic nature of the growth of this aquatic plant.
3. The results of water quality monitoring for sulfate in the waters potentially impacted by the discharges in which wild rice is found to be present. The company should attempt to collect at least one grab sample in each water where wild rice is found to be present.

The wild rice literature search and field survey work should be conducted in 2012. The company may incorporate into its submittal information from previous wild rice survey work that may have been done in the recent past or work collaboratively with other actual or potential dischargers to these waters on gathering any new information.

We appreciate your cooperation in this matter. If you have any questions regarding this request, please contact me at 651-757-2405 or by e-mail at stephanie.handeland@state.mn.us.

Sincerely,



Stephanie Handeland
Water Section
Industrial Division

SH:Img

cc: John Thomas, MPCA Duluth Regional Office
Rita Gabrielson, Cliffs Natural Resources, Silver Bay
Brett Ballavance, Cliffs Natural Resources, Duluth

Attachment B

Study Area Photographs



Unnamed Yelp Creek tributary, 8/26/2013 – no wild rice



Yelp Creek, 8/21/2013, near Mile 1.0 – no wild rice



Upper Partridge River, 8/21/2013, near Mile 1.75 – no wild rice



Upper Partridge River, 8/21/2013, near Mile 3.5 – no wild rice



Unnamed Langley Creek tributary, 8/27/2013, near mile 0.5 – no wild rice



Langley Creek, 8/20/2013, near of Mile 2.0 – no wild rice



Langley Creek, 8/20/2013, upstream from Mile 1.5 – no wild rice



Unnamed to Dunka River, 8/27/2013 – no wild rice



Dunka River, 8/22/2013, upstream from Mile 12.5 – no wild rice



Dunka River, 8/23/2013, upstream of Mile 15.0 – no wild rice



Birch Lake, 8/13/2013, wild rice near Dunka River outlet, facing north.



Birch Lake, 8/13/2013, wild rice near Dunka River outlet, facing east

Attachment C

Photographs Depicting Range of Wild Rice Densities

Density Level 1



Density Level 2



Density Level 3



Density Level 4



Density Level 5



Attachment C
Photographs Depicting Range of Wild
Rice Densities (1-5)

Attachment D

Barr's standard operating procedure (SOP), *Collection of Surface Water Samples*

STANDARD OPERATING PROCEDURE

Collection of Surface Water Samples

Revision 5

April 29, 2011

Approved By: Andrea Nord Andrea Nord 4-29-10
Print QA Manager(s) Signature Date

Kim Johannessen Kim Johannessen 4-29-10
Print Field Technician(s) Signature Date



Barr Engineering Company
4700 West 77th Street • Minneapolis, MN 55435-4803
[Phone: 952-832-2600](tel:952-832-2600) • [Fax: 952-832-2601](tel:952-832-2601) • www.barr.com

Minneapolis, MN • Hibbing, MN • Duluth, MN • Ann Arbor, MI • Jefferson City, MO • Bismarck, ND

Annual Review of the SOP has been performed
and the SOP still reflects current practice.

Initials: KSJ Date: 2/21/2012

Initials: _____ Date: _____

Initials: _____ Date: _____

Initials: _____ Date: _____

Initials: _____ Date: _____

Standard Operating Procedures for the Collection of Surface Water Samples

Purpose

The purpose of this procedure is to describe the collection of water samples for volatiles, semivolatiles, metals, inorganics, bacteria, and dioxin from surface water.

Applicability

This procedure applies to the collection of surface water samples by the sampling technician(s).

Definitions

Headspace. Air space between the container top and water sample level.

Holding Time. Time interval between sample collection and sample analysis.

Sample Preservation. The stability of analytes depends upon the proper preservation technique and preservation acceptance criteria as defined by EPA Title 40 of the Code of Federal Regulations and corresponding method criteria.

Leachate The liquid product produced when water percolates through any permeable material.

Equipment

Sampler media	Nitrile Gloves
Pre-cleaned-certified Sampling Containers	Water Quality Meter
Coolers	Sample label
Ziploc® Baggy	Chain of Custody Form
Ice	Lead acetate test paper
Water-proof ink pen or pencil	Acetic acid buffer solution (pH of 4)

References

Procedures for Ground Water Monitoring, Minnesota Pollution Control Agency Guidelines, September 2006.

EPA: Title 40 of the Code of Federal Regulations

Discussion

- Surface water stations may include seep locations, lake sampling, influent and or effluent stream or river locations.
- Samples collected from a surface water location; water quality may vary from shore to shore. The sample should be integrated from top to bottom in the middle of the location.
- Samples collected in shallow water (less than 3 feet deep) should be collected at mid-depth, holding the container under the surface until filled. The mouth of the container

should face the flow. Samples can also be collected by the use of a peristaltic pump, with tubing attached to a telescoping pole for larger water bodies. The use of a pole allows access to the mid channel location without disturbing the bottom sediments. Refer to the SOP for peristaltic pump operation.

- When sampling extremely shallow water such as leachate seeps, care should be taken not to disturb the bottom sediments.
- When sampling shallow streams, collection should begin at the furthest downstream point and move upstream so that any disturbances caused by sampling will not affect the quality of the water sampled. When sampling deeper waters, such as rivers, collection should begin first at the upstream point, next to the downstream point, and finally to the sampling point closest to the apparent source of discharge, minimizing contaminants adhering to the sample apparatus.
- All unpreserved sample containers will be rinsed three times with sample water prior to collection as a precautionary measure to be sure containers are uncontaminated.
- Caution will be exercised in filling preserved containers to prevent loss of the preservative.

Responsibilities

The environmental technician(s) is responsible for the proper collection of surface water samples; sample identification; quality control procedures; sample filtering and documentation.

Procedure

1. Obtain sampling media-Approximately one week before the sampling event, the sample containers should be ordered from the laboratory.

Note: Container volume, type, and preservative are important considerations in sample collection. Container volume must be adequate to meet laboratory requirements for quality control, split samples, or repeat examinations. The container type or construction varies with the analysis required. The analytical laboratory will preserve the container before shipment. Preservation and shelf life vary; contact the laboratory to determine if an on-hand container is still useful.

2. Put on sampling gloves to protect the sample and skin.

Note: New sampling gloves should be used for each location.

3. Prepare sampling containers by filling out the label with the following information:
 - Project number
 - Location identification
 - Individual collecting the samples
 - Date and time of collection
 - Sample analysis (if required by the lab)

4. Remove cap from the first sample container. Make sure to collect low-level mercury and volatile samples prior to all other analytical method samples. Collect metals samples prior to cyanide samples.
5. Fill sampling container (do not overfill).

To ensure sample integrity, collect volatile samples first, then proceed to the least volatile method required for the site.

- A. Volatiles and WI Gasoline Range Organics (WIGRO) – Samples to be analyzed for volatile organics will be collected in two or three 40-ml vials with Teflon®-lined septum caps. Use caution because concentrated acid may be present. Do not rinse glass vials. Hold bottle in one hand, the cap right side up in the other. Allow a slow stream of water to run into the 40-ml vial. The vial should be held at an angle while filling to prevent water from falling directly to the bottom of the container and becoming overly disturbed. While holding the vial vertically, add the water sample until a small meniscus forms on the top of the sample container. Avoid air bubbles and overfilling the vial. Cap tightly, invert the bottle, and tap gently. If any air bubbles appear in the vial, discard and collect sample in a new vial. These samples will be cooled to approximately 4°C. After collecting the required number of vials, insert them in a zip-lock plastic bag and place in a cooler with ice.

If prescribed by site-specific situations a duplicate volatile sample may be collected and field checked with a pH indicator strip to assess the pH of the sample. If the pH is greater than 2, the laboratory will be instructed to reduce the holding time of that day's samples to the 7-day holding period used for unpreserved samples.

- B. Semivolatiles (includes: Pesticides, PCB, Herbicides, BNAs, Dioxin and Furans)– Samples to be analyzed for semivolatile organics will be collected in a 1-liter amber glass jar with a Teflon-lined septum cap for each fraction. Fill container slowly with a minimum headspace and cap tightly. Do not rinse glass containers. Place container directly in a cooler with ice. These samples will be cooled to approximately 4°C.
- C. WI Diesel Range Organics (WIDRO) – Samples to be analyzed for WIDRO are to be collected in a 1-liter amber glass jar with a Teflon-lined septum cap and preserved with 1:1 HCl to a pH or less than 2. Fill container slowly with a minimum of headspace and cap tightly. Do not rinse glass containers. Place container directly into a cooler with ice. These samples will be cooled to approximately 4°C.
- D. Other Organics – Containers may contain acid(s), use caution when handling. Fill containers completely minimizing headspace and avoiding spillage. Place container directly in a cooler with ice.
- E. Metals
 1. Total Metals – Samples to be analyzed for metals will be collected in a 500-mL or 1-liter polyethylene jar with a polyethylene-lined closure. These samples will be preserved in by the lab with a 1:1 (50%) solution of Nitric Acid to reduce the pH of the sample to less than 2.

2. Filtered Metals – Select the appropriate Corning filter size, either 250-ml or 500-ml volume (for further details regarding water sample filtration, see Standard Operating Procedures for Filtering Groundwater Samples). Pour filtered sample into metals sample container, minimizing headspace and avoiding spillage. Use caution handling metals containers because of nitric acid. Place directly in a cooler with ice.
- F. Oil and Grease by hexane extraction – Samples to be analyzed for Oil and Grease will be collected in a 1-liter glass jar with a Teflon-lined septum cap preserved to a pH or less than 2 with either 1:1 hydrochloric acid or 1:1 sulfuric acid. These samples will be cooled to approximately 4°C.
- G. Cyanide – Samples to be analyzed for cyanide will be collected in a 1-liter polyethylene container with a polyethylene cap and preserved with sodium hydroxide to pH greater than 12 and cooled to approximately 4°C. If elevated levels of sulfur components (i.e. sulfate, sulfide, sulfite, thiosulfate, thiocyanate, and aldehydes) are suspected, test water with a lead acetate test paper (previously moistened with 1-2 drops of acetic acid buffer solutions (pH of 4) to determine the presence of sulfur. If elevated concentrations of sulfur components are detected, contact the project's quality assurance manager, expedite sample shipment to the analytical laboratory on the same day of collection and coordinate rush analyses per the EPA guidelines.
- H. Collecting General Chemistry Samples – Samples to be analyzed for sulfate, chloride, carbonate, and bicarbonate will be collected in laboratory supplied containers (plastic or glass per the guidelines included in the analytical method(s)). These samples will be cooled to approximately 4°C.
- I. Bacteria – Plastic bottles or glass containers preserved with 10 mg of sodium thiosulfate are used for bacterial sample preservation. Care should be taken not to contaminate the container before collecting the sample. Fill the container within 1 inch of the top. This allows the laboratory to shake and mix the contents before analysis. Place directly in a cooler with ice and cool to approximately 4°C.
- Note:** 6 hour technical holding time for analysis.

Collecting Quality Control Samples

The effectiveness of the sample handling techniques is monitored by collecting both preserved and unpreserved field blank samples. For additional information, consult the Barr Engineering Co. SOP for the Collection of Quality Control Samples.

Field (or Masked) duplicate samples will be collected to measure relative sampling (and laboratory) precision. The ratio of quality control samples are generally 1 field blank/field duplicate per twenty samples, however, specific project requirements may be determined by the QAPP/SAP for the project. These samples are collected at the same time using the same procedures, equipment, and types of containers as the required samples. They are also preserved in the same manner and are either co-located or split and submitted for the same analyses as the native sample(s).

Trip blank samples are only applicable when sampling/analyzing for volatile organics. Their purpose is to determine if contamination has occurred as a result of improper sample

container cleaning, contaminated blank source water, sample contamination during storage and transport due to exposure to volatile organics, or other environmental conditions during sampling and analysis. The water will be free of contaminants. The trip blanks are prepared, sealed and labeled appropriately at the lab, and transported to the field in the same containers as the sample vials. These blanks are not opened in the field. They are transferred to the coolers designated for volatile sample storage and transport and accompany the samples to the analytical laboratory.

Field blank samples (or Rinsate Blanks) are used to evaluate the effects of sampling cross-contamination caused by inadequately decontaminated equipment. Their purpose is to determine if contamination has occurred as a result of improper equipment cleaning. Field blanks are prepared onsite by pouring analyte-free water through decontaminated sample collection equipment (bailer or pump) and collecting the rinsate in the appropriate sample container. The field blanks will be handled in the same manner as the sample group for which they are intended (i.e., blanks will be stored and transported with the sample group).

The volume of the sample obtained should be sufficient to perform all required analyses with an additional amount collected to satisfy the needs for quality control, split samples, or repeat examinations. The QA Staff should be consulted for any specific volume requirements.

The elapsed time between sample collection and initiation of each laboratory analysis will fall within a prescribed time frame. Holding times for samples required by this project are prescribed by EPA: Title 40 of the Code of Federal Regulations.

Water and Soil Sample Storage

The samples will be bubble wrapped or bagged immediately after collection, stored in a sample cooler, packed on double bagged wet ice and accompanied with the proper chain of custody documentation. Samples will be kept cold (approximately 4°C) until receipt at the laboratory, where they are to be stored in a refrigerated area. Custody seals may be present, but at minimum, the coolers must be taped shut with three straps of fiberglass tape. All samples will be kept secured to prevent tampering. If sample coolers are left in a vehicle or field office for temporary storage, the area will be locked and secured. The coolers must be delivered to the laboratory via hand or overnight delivery courier in accordance with all Federal, State and Local shipping regulations.

Note: Samples may have to be stored indoors in winter to prevent freezing.

After collection, all samples should be handled as few times as possible. Samplers should use extreme care to ensure that samples are not contaminated. If samples are placed in a cooler, samplers should ensure that melted ice cannot cause sample containers to become submerged, as this may result in cross-contamination. Plastic bags, such as Ziplock® bags, should be used when small sample containers (e.g., VOC vials) are placed in coolers to prevent cross-contamination.

Some compounds can be detected in the parts per billion and/or parts per trillion range. Extreme care will be taken to prevent cross-contamination of these samples. A clean pair of new, disposable gloves will be worn for each sample location. Sample containers for source samples or samples suspected of containing high concentrations of contaminants are placed in separate plastic bags and coolers immediately after collecting, preserving and tagging.

Sample collection activities will proceed progressively from the least contaminated area to the most contaminated area (when known).

Disposal

All waste generated by this process will be disposed of in accordance with Federal, State and Local regulations. When feasible, implement procedures to minimize environmental pollution.

Documentation

The technician(s) will document the type and number of samples collected during each field event. All sample information will be documented in the field notebook, field log data sheet and chain-of-custody record.

Attachments

- Attachment 1: Chain of Custody Form
- Attachment 2: Sample Label
- Attachment 3: Custody Seal – if applicable
- Attachment 4: Field Sampling Report
- Attachment 5: Field Log Data Sheet

Attachment 2
Example - Sample label



Client _____

Project Number _____

Date: _____ Time _____

Preservative: _____

Sampled By: _____

Sample Location: _____

Attachment 3
Custody Seal – if applicable

Custody Seal			
Date _____	Project _____		
Signature _____	Container# _____	of _____	

Attachment 4
Field Sampling Report



FIELD SAMPLING REPORT

Date:

Project:

Contact:

Barr Engineering Company
4700 W. 77th Street
Minneapolis, MN 55435-4803

Field Sampling

Field Report

Attachments:

-
-
-
-
-
-

Laboratory Analysis Status

<Name inserts here>
Environmental Technician

Document1

Barr Engineering Company · 4700 W. 77th Street · Minneapolis, MN 55435-4803 · 952/832-2600



Attachment 5
Field Log Data Sheet

Client:			Monitoring Point:						
Location:			Date:						
Project #:			Sample time:						
GENERAL DATA			STABILIZATION TEST						
Barr lock:		Time/ Volume	Temp. °C	Cond. @ 25	PH	ORP mV	D.O.	Turbidity Appearance	
Casing diameter:									
Total well depth:*		NA							
Static well level:*									
Water depth:*									
Well volume: (gal)									
Purge method:									
Sample method:									
Start time:		Odor:							
Stop time:		Purge Appearance:							
Duration: (minutes)		Sample Appearance:							
Rate, gpm:		Comments:							
Volume purged:									
Duplicate collected:									
Sample collection by:									
Others present:			Well condition:						
MW: groundwater monitoring well			WS: water supply well		SW: surface water		SE: sediment		Other: sump
VOC	Semi-volatile	General	Nutrient	Cyanide	DRO	Sulfide			
Oil, grease	Bacteria	Total Metal	Filtered Metal		Methane	Filter			
Others:									

* Measurements are referenced from the top of riser pipe, unless otherwise indicated.