Sensitive Plant Species Survey Report

NorthMet Project

Prepared for
Poly Met Mining, Inc.

September 2018

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Sensitive Plant Species Survey Report

September 2018

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CD (on back cover) includes:

Representative Photographs of Sensitive Species within the Survey Area
DNR Observation Database Spreadsheet
GIS Shapefile
Electronic Version of Sensitive Plant Species Report (PDF)

1.0 Executive Summary

Poly Met Mining, Inc. (PolyMet) is proposing to construct the NorthMet Project (Project), located in St. Louis County on the eastern end of the Mesabi Iron Range, about 60 miles north of Duluth, and 6 miles south of Babbitt, Minnesota (Large Figure 1). The main Project components include the Mine Site and the Plant Site, which includes the tailings basin and plant processing facilities (Large Figure 2). The Mine Site and the Plant Site will be connected by the Transportation and Utility Corridors. An additional pipeline corridor (Colby Lake Pipeline Corridor) will supply water to the Plant Site when needed. The area of land that encompasses these Project components is referred to as the Mining Area (Large Figure 2). Large Figure 2 identifies the areas of construction/disturbance that will occur in the Mining Area.

Botanists Daniel Jones from Salix Environmental LLC (Salix) and Dan Engel from Barr Engineering Company (Barr) conducted a sensitive plant species survey for state-endangered *Caltha natans* (floating marsh marigold) and state-endangered or threatened *Botrychium* (moonwort) species on June 14, 15, 18, 19, and 20, 2018. The survey areas within the Mining Area are shown on Large Figure 2.

No federally-listed plant species were observed within the survey areas. State-endangered *Caltha natans*, state-endangered *Botrychium ascendens* (upswept moonwort), state-endangered *Botrychium spathulatum* (spatulate moonwort), state-special concern *Botrychium simplex* (least moonwort), and state-special concern *Botrychium campestre* (prairie moonwort) were located within the survey areas (Large Figure 3). Minnesota's endangered species law (Minnesota Statute 84.0895) and associated rules (Minnesota Rules, part 6212.1800) require a permit for the removal of state-endangered and state-threatened species (a "take permit"), but not for state-special concern species; therefore, a take permit would be required from the Minnesota Department of Natural Resources (DNR) for the *Caltha natans*, *Botrychium ascendens,* and *Botrychium spathulatum*, which are located in areas of construction/disturbance.

This report includes a discussion of methods and results from the June 2018 sensitive plant species survey. The Sensitive Plant Species Survey work plan, which was submitted to the DNR on May 24, 2018, is provided in Appendix A. Detailed information on each sensitive plant species location is provided on the DNR Rare Feature Reporting Forms in Appendix B. Representative photographs are provided in Appendix C. An attached CD (on the back cover of this report) includes an electronic version of this report, along with the DNR Observation Database spreadsheet and GIS file. All collected field specimens were submitted to the DNR on July 6, 2018. A flash drive was delivered to the DNR on July 24, 2018 with over 100 high-resolution digital photos of all collected specimens and a photograph log, which represented all the high-resolution photographs that were taken during the field work in June 2018.

2.0 Project Background

The Mining Area is located within the Laurentian Uplands and the Nashwauk Uplands subsections of the Laurentian Mixed Forest province (DNR 2018a) and contains a combination of habitats, from highly disturbed former mining and industrial areas to minimally disturbed or undisturbed wetlands and mixed hardwood-conifer forested uplands.

PolyMet conducted several endangered, threatened, and special concern (ETSC) species surveys in the vicinity of the Mining Area between 1999 and 2017 in order to identify whether any vascular plant species listed by the state of Minnesota as endangered or threatened were present. These surveys are summarized in the *Sensitive Plant Species Survey Work Plan* submitted to the DNR on May 24, 2018 (Appendix A).

PolyMet originally submitted an application for a Permit to Take Endangered or Threatened Species on November 28, 2017. This application was required because a *Caltha natans* population was observed within an area of construction/disturbance by Gary Walton in 2004 (Section 1 of Township 59N, Range 13W; Large Figure 2). The DNR issued comments regarding PolyMet's 2017 application for a Permit to Take Endangered or Threatened Species on April 18, 2018, (DNR 2018b). The DNR comments stated that because the Project footprint has been modified several times since the Project was first proposed, surveys for *Caltha natans* and state-endangered or threatened *Botrychium* species should be conducted within additional areas in June 2018 (DNR 2018b).

The survey areas for *Caltha nat*ans and state-endangered or threatened *Botrychium* species are shown on Large Figure 3. Surveys for *Caltha natans* were conducted in Sections 1 and 10 of Township 59N and Range 13W, where it was previously documented in 2004 and where Project construction/disturbance will occur. In addition, surveys for *Caltha natans* were conducted within Section 3 of Township 59N and Range 14W in areas not previously surveyed, where suitable habitat exists, and where Project construction will occur.

Surveys for state-endangered or threatened *Botrychium* species were conducted in Section 9 of Township 59N and Range 14W and Section 33 of Township 60N and Range 14W, where state-endangered or threatened *Botrychium* species were documented in 2017, but the identifications were inconclusive. In addition, surveys for state endangered or threatened *Botrychium* were conducted within Sections 16, 23, and 24 of Township 59N and Range 14W in areas not previously surveyed, where suitable habitat exists, and where Project construction will occur.

In addition to the ETSC surveys that were conducted between 1999 and 2018 (Appendix A), PolyMet has also conducted other biological field surveys with relevant botanical components that were led or staffed by qualified botanists, several of whom hold DNR special permits to handle endangered or threatened plant species. These surveys include the following:

- A cultural landscape survey (CLS) conducted in 2010 to help satisfy the Section 106 compliance certification for the Project's U.S. Army Corps of Engineers (USACE) Section 404 permitting. The

botanical component of the CLS included installation of approximately 50 DNR-style relevés by Barr botanical and biological staff, including several relevés installed jointly by Barr botanists and an independent botanist hired by three tribal bands of the Great Lakes Ojibwe. The CLS documented the distribution and abundance of vascular plants within the Project area and surrounding region.

- A baseline vegetation monitoring relevé installation program initiated in 2015. The purpose of the baseline vegetation monitoring program is to collect relevé-level vegetation data adjacent to the series of groundwater monitoring wells that have been installed throughout and near the Project area. The baseline data will be used in the future to detect vegetation community changes potentially influenced by groundwater level variations. Three field crews installed over 60 relevés; each crew was led by a qualified Barr botanist holding a valid MNDNR special permits to handle endangered or threatened plant species.
- A focused survey was conducted by Barr botanists and Wildlands Ecological Services former Minnesota Biological Survey (MBS) biologist Scott Zager in 2012. The purpose of the survey was to conduct detailed vegetation studies of the bogs and bog-like areas on the Project site as requested by the USACE for the Section 404 permitting.
- Finally, there have been wetland delineation efforts and refinements of those efforts since 2004. These wetland delineations included, as a required component of the USACE delineation methodology, a thorough accounting of the plant species present and their abundance.

Taken together as a complete body of botanical work, the specific ETSC surveys conducted between 1999 and 2018, along with the additional detailed field botanical studies listed above, enable PolyMet to state unequivocally that the vascular plant species composition of the Project area has been thoroughly documented by qualified professional botanists dating back nearly 20 years. If any of the field botanists had located an ETSC plant species during the course of one of the non-ETSC botanical surveys listed above, the finding would have been reported to the DNR.

Most if not all of the Project area has experienced some degree of human disturbance in the recent past. Sources of disturbance include logging and iron-ore mining. The mining activities have resulted in construction of a tailings basin and a processing plant facility with its ancillary buildings and network of haul roads and other internal roads. A high-voltage transmission line and a railroad run roughly east-west through most of the Project area. In addition, exploratory drilling and further logging have contributed to the disturbance history of the Project area. As a result, much of the Project area offers little in the way of suitable habitat to most ETSC plant species. However, the available ETSC plant habitat on the Project site also includes disturbed roadsides and graded areas that supported the former Plant operations. These types of habitats are favored by early-successional species such as those in the genus *Botrychium*.

3.0 Methods

Following discussions with the DNR, Barr submitted a final *Sensitive Plant Species Survey Work Plan* to the DNR on May 24, 2018 (Appendix A). The methodology used for the sensitive plant species survey is summarized in the May 24, 2018 work plan (Appendix A).

The sensitive plant species survey was conducted on June 14, 15, 18, 19, and 20, 2018 by Daniel Jones (Salix) and Dan Engel (Barr). Daniel Jones has a current special collection permit for taking and possessing endangered or threatened species (DNR Special Permit 23224; issued June 14, 2018), is listed on the DNR's *General List of Botanical Consultants for Hire*, and is on the DNR's list of qualified *Botrychium* surveyors.

The locations of sensitive plant species observed during the sensitive plant survey were recorded using a Global Positioning System (GPS) unit to obtain geographic coordinates. Coordinates were recorded in the Universal Transverse Mercator system (Zone 15 North, meters) using the NAD83 datum. Digital photographs of the sensitive plant species were taken, and samples were collected following the DNR's *Guidance on Documenting and Collecting Rare Plants* (DNR 2018c). *Botrychium* species identified in the field were collected and submitted to DNR State Botanist Welby Smith, per the conditions of the special collection permit.

Botrychium species found during the sensitive plant survey were identified primarily using *Systematics of Moonworts: Botrychium Subgenus Botrychium* (Farrar 2006). A secondary source for identifying *Botrychium* was "Ophioglossaceae C. Agardh" in *Flora of North America* (FNA), *Volume 2: Pteridophytes and Gymnosperms* (Wagner and Wagner 1993) and *Systematics of Moonworts; Botrychium subgenus Botrychium* (Farrar 2006). *Caltha natans* identification was verified based on *Manual of Vascular Plants of Northeastern United States and Canada*, 2nd ed., Gleason and Cronquist 1991 (Gleason and Cronquist 1991).

Daniel Jones and Dan Engel made preliminary identifications of specimens of potential ETSC plant species collected in the study area. These specimens were placed in a Pacific Papers professional plant press with proper paper, blotters and ventilators. Specimens were placed in the press in as timely a manner as possible, allowing for time to examine the specimen to make an identification prior to pressing the plants. On average, collected specimens were placed into the press within 5 minutes of being removed from the soil. For each collected specimen, a series of digital photographs were taken to further aid in the species identification.

A selection of the digital photos from the June 14-15, 2018 fieldwork (Specimens S01-S06) was e-mailed to DNR State Botanist Welby Smith on June 17, 2018, as a status update on the sensitive plant species survey and to provide him with specimens for review.

Daniel Jones dried the initial set of specimens in a forced-air heat plant dryer on June 16, 2018. Drying time was approximately 2 hours. Dried specimens were then transferred, pressed within their newsprint between pieces of corrugated ventilator board, to a cool, dry location. The second set of specimens was

collected on June 18-20, 2018 and was similarly dried and stored. The entire set of specimens was delivered to DNR State Botanist Welby Smith on July 6, 2018.

4.0 Results

During the sensitive plant species survey, two locations of state-endangered *Caltha natans* were documented within the Mine Site in Section 1 of Township 59 and Range 13 (Large Figure 3). The two locations are likely parts of one larger discreet population, considering their proximity to each other and the fact that they occur in the same water body. Both locations were located within a ponded marsh and associated ditch with water depths ranging from 3 feet in the center (estimate) and 11 inches near shore. The pond is not a natural basin, and was likely excavated more than 20 years ago to assist with drainage along Dunka Road. The pond is immediately adjacent to the north edge of Dunka Road, near the security gate that separates PolyMet property from Northshore Mining property. The pond is mostly open water, with sedge and bulrush islands. Near-shore soils are saturated, with a muck substrate beginning not far from the edge of the pond.

Four *Botrychium* species were observed within the survey areas. The botanists documented state-endangered *Botrychium ascendens* (upswept moonwort), state-endangered *Botrychium spathulatum* (spatulate moonwort), state-special concern *Botrychium simplex* (least moonwort), and state-special concern *Botrychium campestre* (prairie moonwort). Subsequent review by DNR State Botanist Welby Smith and his outside consultant Malcolm MacFarland determined that at least one specimen that was identified in the field as *Botrychium minganense* is actually the state-endangered *Botrychium spathulatum*. Malcolm MacFarland also determined that two other specimens identified in the field as *Botrychium minganense* were *Botrychium ascendens*. The soils in the survey areas where these *Botrychium* species were documented consist primarily of fine sandy gravel road fill and/or tailings grit; the extent of bare soil in these areas varied from approximately 5% to 20%. Overall, these disturbed, human-influenced site conditions typically provide habitat for select *Botrychium* species, including those identified in the survey areas:

- One population of *Botrychium ascendens* was documented within the open grass/forb habitat near the Process Plant Area in Section 9 of Township 59 and Range 14 (Large Figure 3).
- One population of *Botrychium spathulatum* was documented along the lower slopes of the disturbed northern edge of the proposed FTB Seepage Containment System in Section 33 of Township 60 and Range 14.
- Two populations of *Botrychium simplex* were documented in open grass/forb communities, one on an old dirt road adjacent to a railroad in the Transportation and Utility Corridors (in Section 24 of Township 59 and Range 14) and another in the southern part of the Plant Site in Section 16 of Township 59 and Range 14 (Large Figure 3).
- One population of *Botrychium campestre* was documented in the open grass/forb community on the side of a gravel road just off of Dunka Road in Section 14 of Township 59 and Range 14 (Large Figure 3).

As discussed in Section 3.0, specimens of sensitive plant species collected at each location were pressed and dried. Each specimen was documented with a herbarium label and submitted to DNR State Botanist Welby Smith for verification of the sensitive species identification.

Table 1 summarizes the species documented during the 2018 sensitive plant species survey, their state status, the UTM coordinates, the number or estimated number of individual plants located, and the habitat characteristics where the sensitive plant species were found. For each location of the sensitive plant species listed in Table 1, a DNR Rare Feature Reporting Form was prepared; these forms are compiled in Appendix B. A DNR Observation Database spreadsheet, similar to Table 1, was submitted electronically along with this report.

Documentation for this report includes the *Sensitive Plant Species Survey Work Plan* (May 24, 2018; Appendix A), Rare Feature Reporting Forms (Appendix B), representative photographs taken of sensitive species within the survey area (Appendix C), DNR Observation Database spreadsheet (on CD), GIS file (on CD), and an electronic version of this report (on CD).

Table 1 Summary of Findings from the June 2018 Sensitive Plant Species Survey

Record ID	MNDNR Identification			UTM Easting	UTM Northing	Approximate Number of Individuals	Specimen Collected; Specimen #	Habitat Remarks
	Scientific Name	Common Name	MN Status[1]					
PM-20180614-DJE-P001	*Botrychium ascendens*	Upswept moonwort	E	[redacted]	[redacted]	33	Yes; PM-20180614-DWJ-S01; PM-20180614-DWJ-S02; PM-20180614-DWJ-S03	Among *Bromus inermis*, *Poa compressa*, *Hieracium aurianticum*, *Carex aurea*, with a few *Populus balsamifera* seedlings.
PM-20180614-DJE-P003	*Botrychium spathulatum*	Spatulate Moonwort	E	[redacted]	[redacted]	6	Yes; PM-20180620-DWJ-S08	Among *Galium* species, *Astragalus canadensis, Lotus corniculatus*, *Hieracium aurianticum*, with a few *Populus tremuloides*, *Betula papyrifera*, and *Salix discolor* also present.
PM-20180615-DJE-P004	*Botrychium simplex*	Least moonwort	SC	[redacted]	[redacted]	10	Yes; PM-20180615-DWJ-S04	Among *Bromus inermis*, *Hieracium caespitosum*, *Phalaris arundinacea*, *Solidago canadensis*, *Meliotus officinale*.
PM-20180615-DJE-P005	*Botrychium campestre*	Prairie moonwort	SC	[redacted]	[redacted]	15	Yes; PM-20180615-DWJ-S05	Among *Hieracium caespitosum*, *Danthonia* species, *Trifolium repens*, *Meliotus officinale*, with a few *Populus balsamifera*, *Betula papyrifera*, and *Salix discolor* also present.
PM-20180615-DJE-P006	*Botrychium simplex*	Least moonwort	SC	[redacted]	[redacted]	1	Yes; PM-20180615-DWJ-S06	Among *Poa compressa*, *Trifolium repens*, *Achillea millefolium*, with a few *Alnus viridus*.

Record ID	MNDNR Identification			UTM Easting	UTM Northing	Approximate Number of Individuals	Specimen Collected; Specimen #	Habitat Remarks
	Scientific Name	Common Name	MN Status(1)					
PM-20180618-DJE-P007	*Caltha natans*	Floating marsh marigold	E	[redacted]	[redacted]	5	Yes; PM-20180618-DWJ-S07	Edge of deep marsh/ditch
PM-20180618-DJE-P008	*Caltha natans*	Floating marsh marigold	E	[redacted]	[redacted]	2	No	Edge of deep marsh/ditch

Note: This table summarizes data provided to DNR for the Natural History Information System (NHIS) database. The DNR Observation Database spreadsheet was submitted electronically on the CD provided with this report.
(1) Minnesota status: E - endangered; T - threatened; SC - special concern

5.0 Conclusions

Minnesota's endangered species law (Minnesota Statute 84.0895) and associated rules (Minnesota Rules, part 6212.1800) require a permit for the removal of state-endangered and state-threatened species (a "take permit"), but not for state-special concern species; therefore, a take permit from DNR is required for the *Caltha natans*, *Botrychium ascendens*, and *Botrychium spathulatum* that are located in areas of Project construction/disturbance.

6.0 References

Farrar, D.R. 2006. Systematics of Moonworts *Botrychium* Subgenus *Botrychium*. s.l.: Iowa State University.

Gleason, H.A. and A. Cronquist. 1991. Manual of Vascular Plants of Northeastern United States and Canada, 2nd ed. The New York Botanical Garden Press. Bronx, NY.

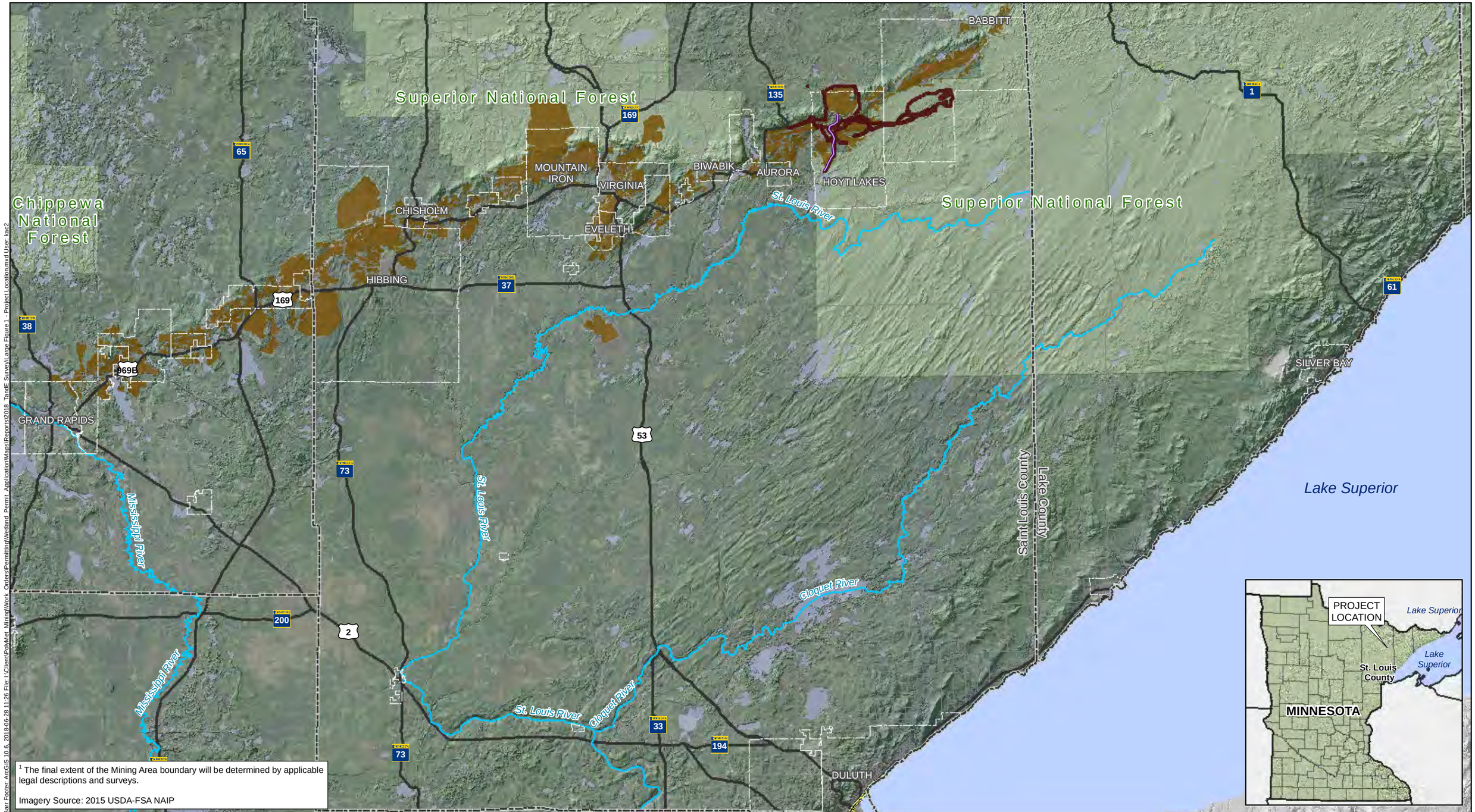
Minnesota Department of Natural Resources (DNR). 2018a. Ecological Classification System. [Online] 2018. http://www.dnr.state.mn.us/ecs/index.html.

—. 2018b. 20180418 Response to NorthMet Taking Permit Application. April 18, 2018.

—. 2018c. Guidance on Documenting and Collecting Rare Plants.

Wagner, W.H., Jr. and F.S. Wagner. 1993. Flora of North America, Volume 2: Pteridophytes and Gymnosperms. New York: Oxford University Press.

Large Figures



[1] The final extent of the Mining Area boundary will be determined by applicable legal descriptions and surveys.

Imagery Source: 2015 USDA-FSA NAIP

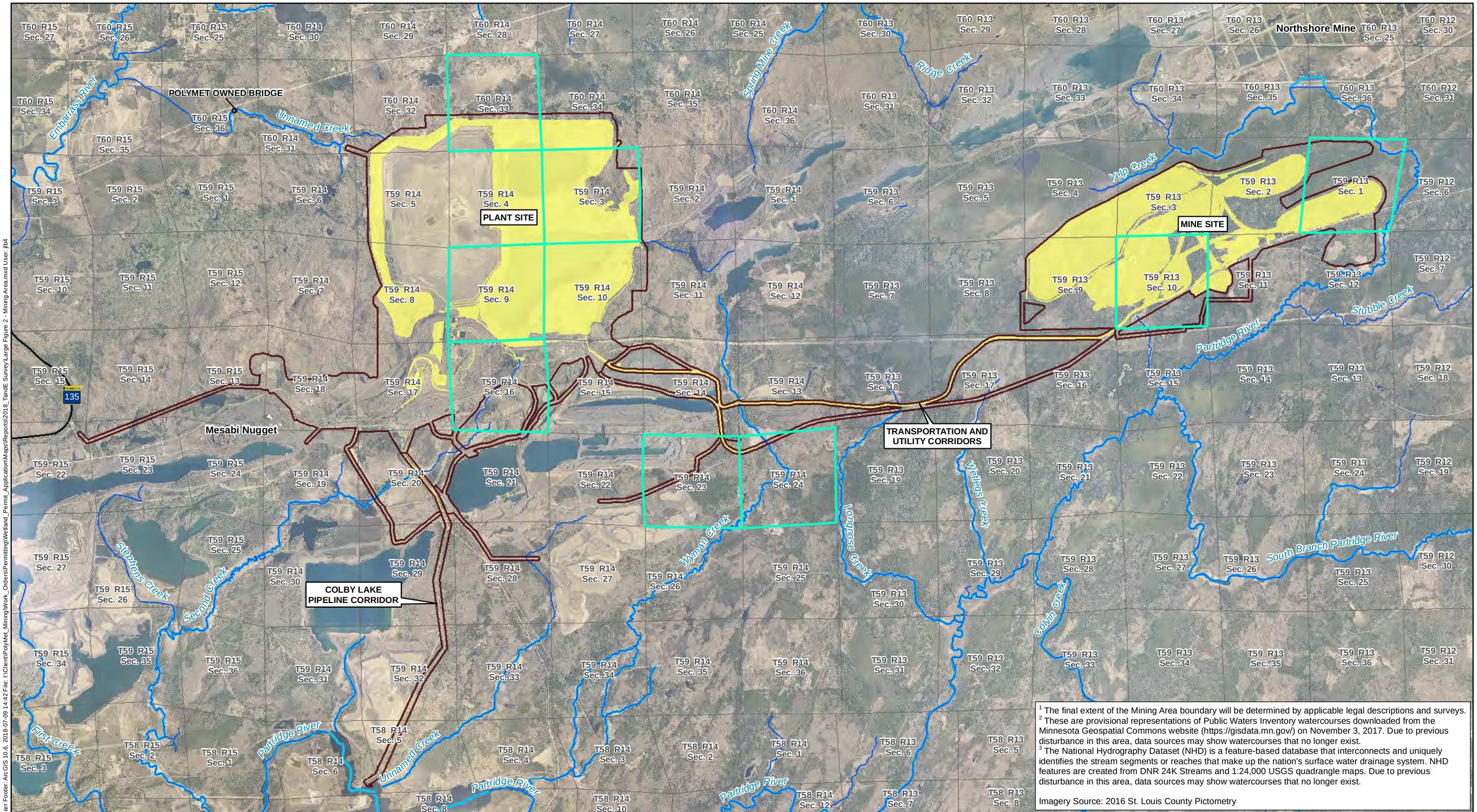
Mining Area[1]
Mesabi Iron Range
National Forest Boundary
County Boundaries
City Boundaries
Major River
Lakes

0 3.5 7 14
Miles

PROJECT LOCATION
NorthMet Project
Poly Met Mining, Inc.

Large Figure 1
Sensitive Plant Species Survey Report

Barr Footer: ArcGIS 10.6, 2018-06-28 11:26 File: I:\Client\PolyMet_Mining\Work_Orders\Permitting\Wetland_Permit_Application\Maps\Reports\2018_TandE_Survey\Large Figure 1 - Project Location.mxd User: kac2



[1] The final extent of the Mining Area boundary will be determined by applicable legal descriptions and surveys.
[2] These are provisional representations of Public Waters Inventory watercourses downloaded from the Minnesota Geospatial Commons website (https://gisdata.mn.gov/) on November 3, 2017. Due to previous disturbance in this area, data sources may show watercourses that no longer exist.
[3] The National Hydrography Dataset (NHD) is a feature-based database that interconnects and uniquely identifies the stream segments or reaches that make up the nation's surface water drainage system. NHD features are created from DNR 24K Streams and 1:24,000 USGS quadrangle maps. Due to previous disturbance in this area, data sources may show watercourses that no longer exist.

Imagery Source: 2016 St. Louis County Pictometry

- Mining Area[1]
- Construction/Disturbance Areas
- Survey Areas
- Section Lines
- Public Waters Inventory (PWI) Watercourses[2]
- National Hydrography Dataset (NHD) Rivers & Streams[3]

0 0.5 1 2
Miles

MINING AREA
NorthMet Project
Poly Met Mining, Inc.

Large Figure 2
Sensitive Plant Species Survey Report

Large Figure 3 Sensitive Plant Species Locations

Page was redacted to protect sensitive plant location data.

Appendices

Appendix A

Sensitive Plant Species Survey Work Plan

resourceful. naturally.
engineering and environmental consultants

BARR

Technical Memorandum

To: Lisa Joyal – DNR Ecological Services
From: Cheryl Feigum; Daniel Jones, Salix Environmental LLC
Subject: Work Plan – Sensitive Plant Species Survey
Date: May 24, 2018
Project: 23690862.11
c: Brad Moore and Kevin Pylka, Poly Met Mining, Inc.

The purpose of this technical memorandum is to describe the work plan that Barr Engineering Company (Barr) is proposing for conducting a sensitive plant species survey for Poly Met Mining, Inc. (PolyMet) in support of permitting requirements for the NorthMet Mine and Ore Processing Facilities Project (Project). Prior to initiating this survey, Barr is providing the Minnesota Department of Natural Resources (DNR) with this work plan, to ensure that the survey and report are based on DNR-approved methods.

The Project is located in St. Louis County on the eastern end of the Mesabi Iron Range, about 60 miles north of Duluth, and 6 miles south of Babbitt, Minnesota (Large Figure 1). The main Project components include the Mine Site and the Plant Site, which includes the tailings basin and plant processing facilities (Large Figure 2). The Mine Site and the Plant Site will be connected by the Transportation and Utility Corridors. An additional pipeline corridor (Colby Lake Pipeline Corridor) will supply water to the Plant Site when needed. The area of land that encompasses these Project components is referred to as the Mining Area (Large Figure 2). Large Figure 3 identifies the areas of construction/disturbance that will occur in the Mining Area.

The Mining Area is located within the Laurentian Uplands and the Nashwauk Uplands subsections of the Laurentian Mixed Forest province (DNR 2018a) and contains a combination of habitats, from highly disturbed former mining and industrial areas to less-disturbed wetlands and mixed hardwood-conifer forested uplands.

1.0 Previous Sensitive Plant Species Surveys

PolyMet conducted several sensitive plant species surveys in the vicinity of the Mining Area in order to identify whether any vascular plant species listed by the state of Minnesota as endangered or threatened were present. These surveys are summarized below and the areas where the surveys were conducted are shown on Large Figure 4.

- Foth & Van Dyke Associates, Inc. conducted a sensitive plant species survey in Sections 2, 3, and 10 of Township 59N and Range 13W in 1999, prior to on-site mineral exploration by PolyMet (Foth & Van Dyke Associates, Inc. 1999). No state endangered or threatened vascular plant

species were identified during this survey per Minnesota's 2013 List of Endangered, Threatened, and Special Concern Species (DNR 2013).

- Cindy Johnson-Groh conducted a sensitive plant species survey in Sections 2, 3, 10, 11, and 16 of Township 59N and Range 13W in July 2004 to assess the presence of *Botrychium* species in the vicinity of the Project (Johnson-Groh 2004). No state endangered or threatened vascular plant species were identified during this survey per Minnesota's 2013 List of Endangered, Threatened, and Special Concern Species (DNR 2013).

- Deborah Pomroy conducted a sensitive plant species survey in Sections 3, 4, 9, and 10 of Township 59N and Range 13W in spring 2004 (Pomroy and Barnes 2004). No state endangered or threatened vascular plant species were identified during this survey per Minnesota's 2013 List of Endangered, Threatened, and Special Concern Species (DNR 2013).

- Gary Walton conducted a sensitive plant species survey in Sections 1, 2, 11, and 12 of Township 59N and Range 13W in spring 2004 (Walton 2004). This survey documented one state-endangered plant species, *Caltha natans* (floating marsh marigold). *Caltha natans* was documented in five locations in the Mine Site (Sections 1 and 10 of Township 59N, Range 13W) and in eight locations adjacent to the Mine Site (Sections 1, 11, and 12 of Township 59N, Range 13W) (Table 1). *Caltha natans* was only documented in one location where there will be Project disturbance/construction (Category 2/3 Waste Rock Stockpile) within the Mine Site (Section 1 of Township 59N and Range 13W). Therefore, adverse impacts to this *Caltha natans* population is expected from the Project.

- Daniel Jones conducted a sensitive plant species survey for *Botrychium* species in Sections 1, 2, 3, 9, 10, and 11 of Township 59N and Range 13W along the internal road network at the Mine Site; and in Sections 1, 9, 10, and 11of Township 59N and Range 13W along Dunka Road adjacent to the Mine Site (Barr 2007). No state endangered or threatened vascular plant species were identified during this survey per Minnesota's 2013 List of Endangered, Threatened, and Special Concern Species (DNR 2013).

- Daniel Jones conducted a sensitive plant species survey in Sections 16, 17, and 18 of Township 59N and Range 13W and Sections 13, 14, and 15 of Township 59N and Range 14W along Dunka Road and the proposed pipeline alignment from the west end of the Mine Site to the Plant Site in June and July 2008 (Barr 2012). No state endangered or threatened vascular plant species were identified during this survey per Minnesota's 2013 List of Endangered, Threatened, and Special Concern Species (DNR 2013).

- Midwest Natural Resources Inc. conducted a sensitive plant species survey in Sections 3, 4, 5, and 9 of Township 59N and Range 13W in 2008 (Barr 2011). No state endangered or threatened

vascular plant species were identified during this survey per Minnesota's 2013 List of Endangered, Threatened, and Special Concern Species (DNR 2013).

- Daniel Jones conducted a sensitive plant species survey in Sections 3-10, 14, 15, and 17 in Township 59, Range 14 and Sections 32-34 in Township 60, Range 14W within the Plant Site in 2017 (Barr 2017). The initial survey results identified one state-endangered plant species, *Botrychium ascendens* (upswept moonwort), and one state-threatened plant species, *Botrychium lunaria* (common moonwort). Both *Botrychium* species were documented at the Plant Site (Section 33 of Township 60N, Range 14W). However, the DNR State Botanist determined that the *Botrychium ascendens* was *Botrychium pallidum* (special concern), and that the *Botrychium lunaria* identification could not be conclusively verified. The survey also identified *Botrychium ascendens* in the processing area (Section 9 of Township 59N, Range 14W). However, the DNR State Botanist determined that the identification could not be conclusively verified. As a result of the survey and the DNR verifications, there is no verified presence of endangered or threatened plant species at the Plant Site per Minnesota's 2013 List of Endangered, Threatened, and Special Concern Species (DNR 2013).

2.0 Proposed Work Plan

Barr submitted an application on behalf of PolyMet on November 28, 2017, for a Permit to Take Endangered or Threatened Species associated with the *Caltha natans* population identified in 2004 by Gary Walton in the south end of the Category 2/3 Waste Rock Stockpile (Section 1 of Township 59N, Range 13W; Large Figure 5). On April 18, 2018, the DNR issued comments regarding PolyMet's 2018 application for a Permit to Take Endangered or Threatened Species (DNR 2018b). The DNR comments stated that because the Project footprint has been modified several times since the Project was first proposed, surveys for *Caltha natans* and *Botrychium* species should be conducted in June 2018 (DNR 2018b).

The proposed work plan for conducting these sensitive plant species surveys for *Caltha natans* and *Botrychium* species is summarized below and follows the DNR's 2015 *Guidance on Documenting and Collecting Rare Plants* (DNR 2015), 2016 *Rare Species Survey Process* (DNR 2016a), 2016 *Rare Species Survey Proposals and Reports* (DNR 2016b), and the Endangered and Threatened Species permit website (DNR 2018c).

2.1 Pre-field Research and Preparation

The sensitive plant species survey will only include *Caltha natans* and state endangered or threatened *Botrychium* species. The state endangered and threatened *Botrychium* species likely to be found in St. Louis County are summarized in Table 1.

Table 1. State Endangered and Threatened *Botrychium* Species Likely to be found in St. Louis County, MN

Scientific Name	Common Name	Minnesota Status	Habitat
Botrychium ascendens	Upswept moonwort	Endangered	Disturbed areas; road sides
Botrychium lanceolatum	Narrow triangle moonwort	Threatened	Moist rich maple-basswood forest
Botrychium lineare	Slender moonwort	Endangered	Gravel roadsides, meadows, seeps, terraces of limestone cliffs
Botrychium lunaria	Common moonwort	Threatened	Disturbed areas; gravel banks
Botrychium mormo	Goblin fern	Threatened	Rich mesic maple-basswood forest
Botrychium oneidense	Blunt-lobed grapefern	Threatened	Mesic hardwood forest, low areas

Based on the habitat information obtained for the state endangered and threatened *Botrychium* species, the survey will focus on *Botrychium ascendens*, *Botrychium lineare*, and *Botrychium lunaria*, as suitable habitat for these species is present within the Mining Area (in disturbed areas and along roadsides). Since the hardwood forest habitat suitable for *Botrychium lanceolatum, Botrychium mormo, and Botrychium oneidense* species is not likely to be present in the Mining Area, these species are not likely to be found in the Mining Area, and therefore would not be part of the survey effort.

2.1.1 Proposed 2018 Survey Area for *Caltha natans*

Re-surveys for *Caltha natans* will be conducted within the Mining Area where both of the following conditions are met: 1) *Caltha natans* was previously documented in 2004 (Large Figure 4); and 2) Project construction/disturbance will occur (Large Figure 4). Areas to be re-surveyed for *Caltha natans* are located in Sections 1 and 10 of Township 59N and Range 13W (Large Figure 5).

Surveys for *Caltha natans* will be also be conducted within the Mining Area where all three of the following conditions are met: 1) areas that were not previously surveyed (Large Figure 4); 2) areas where suitable habitat exists (shallow (2 to 2.5 feet deep), slow-moving water in streams, creeks, pools, ditches, sheltered lake margins, swamps, and beaver ponds); and 3) Project construction/disturbance will occur (Large Figure 4). Additional areas to be surveyed for *Caltha natans* are located in Section 3 of Township 59N and Range 14W (Large Figure 5).

2.1.2 Proposed 2018 Survey Area for *Botrychium*

Re-surveys for state endangered or threatened *Botrychium* species will be conducted within the Mining Area where both of the following conditions are met: 1) state endangered or threatened *Botrychium* species were documented in 2017, but the identifications were inconclusive (Large Figure 4); and 2) Project construction/disturbance will occur (Large Figure 4). Areas to be re-surveyed for state endangered

or threatened *Botrychium* species are located in Section 9 of Township 59N and Range 14W and Section 33 of Township 60N and Range 14W (Large Figure 5).

Surveys for state endangered or threatened *Botrychium* will also be conducted within the Mining Area where all three of the following conditions are met: 1) areas that were not previously surveyed (Large Figure 4); 2) where suitable habitat exists (disturbed areas/roadsides); and 3) Project construction/disturbance will occur (Large Figure 4). Additional areas to be surveyed for state endangered or threatened *Botrychium* are located in Sections 16, 23, and 24 of Township 59N and Range 14W (Large Figure 5).

2.2 Survey Information

The survey areas for *Caltha natans* and state endangered or threatened *Botrychium* species are described in Sections 2.1.1 and 2.1.2, respectively, and shown on Large Figure 5. The approximate timeframe for the survey will be between late-June and mid-July 2018, depending on phenology. Rationale for the survey timeframe will be provided in the report (see Section 2.3).

2.2.1 Botanists

The sensitive plant species survey will be led by Barr subcontractor, Daniel Jones of Salix Environmental LLC. Daniel Jones is listed on the DNR's "General List of Botanical Consultants for hire" document, and is on the DNR's list of qualified *Botrychium* surveyors. Daniel Jones will be assisted by Dan Engel, who is not a DNR-certified botanist, however he has been completing vegetation surveys in northern Minnesota since 2004 and has assisted Daniel Jones with sensitive plant species surveys since 2011.

2.2.2 Field Work

At the beginning of the sensitive plant species survey, the botanists will make an initial reconnaissance of the survey areas to identify vegetative cover and best habitat conditions for listed species. They will then conduct a more comprehensive botanical survey, utilizing intuitive meander search patterns to search for *Caltha natans* and state endangered and threatened *Botrychium* species and to evaluate the site's potential for supporting these listed species. This type of search pattern is essentially a meandering traverse, focusing on the specific habitats and plant associations of listed species. Over the course of the survey, the botanical team will compile lists of vascular plant species observed. This is not intended to be a complete floristic study of the site; rather, it will provide additional background information on vascular plant species in the Project area.

2.2.3 Sampling and Recording Procedures

The methods proposed follow DNR's 2015 *Guidance on Documenting and Collecting Rare Plants* (DNR 2018) during sensitive plant species surveys. If any sensitive plant species are located during the survey, they will be documented using the following procedures:

1) The location(s) of sensitive plant species will be flagged using bright fluorescent tape.

2) A handheld GPS unit will be used to obtain UTM coordinates of the site. Standard quarter-quarter section legal descriptions will also be recorded.

3) At least two digital photographs of the sensitive plant species will be taken.

4) Habitat, associated species, population size, phenology, and other pertinent data will be recorded.

5) Collection of sensitive plant species samples will follow the DNR's 2015 *Guidance on Documenting and Collecting Rare Plants* (DNR 2015), as it pertains to *Caltha natans* and *Botrychium* species. This guidance includes the following methods for field collections:

    a. No more than one individual of a particular species will be collected per 40 acres of habitat.

    b. A new voucher will be collected if the DNR's Rare Features Database indicates that is has been more than 30 years since the last voucher was collected from the population.

    c. Collections will only be made when distinguishing characters are present.

    d. Full-plant collections (roots and above-ground portions) will be made only from populations with more than 100 individuals.

    e. In populations of less than 100, only the distinguishing portion of the plant will be collected, and a close-up photograph will be taken.

    f. For *Botrychium* species, an above-ground portion of the plant will be collected regardless of population size or state status of the species

    g. For aquatic species, only the portion of the stem with leaves and fruits or flowers will be collected. No roots will be collected.

Identification of plant species will follow taxonomic keys and references that are the currently acknowledged standards in field botany. All specimens collected will be pressed as early after collection as is practicable, and dried following standard accepted practices for drying and preserving vascular plant specimens. The botanists will prepare herbarium labels for each specimen, and submit all collected specimens to DNR within 3 months of collection for verification by the DNR State Botanist.

In addition, the botanists conducting the survey will follow the DNR's recommendation for the identification of state endangered and threatened *Botrychium* species, as outlined in the DNR's April 18, 2018 comments regarding PolyMet's 2018 application for a Permit to Take Endangered or Threatened Species (DNR 2018b). The DNR stated the following:

> "Since the identification of *Botrychium* species can be challenging, we recommend that surveyors plan to be in daily contact with DNR staff to agree on procedures for resolving any uncertainty that may

arise during the survey. These procedures may include collecting more vouchers than would usually be required, providing a DNR representative to accompany the surveyor in the field, and/or seeking additional expertise on specimen identification (DNR 2018b)."

2.3 Reporting Procedures

Barr will prepare a report with the results of the survey for *Caltha natans* and state endangered or threatened *Botrychium* species. The report will be submitted to the DNR for review and approval (DNR 2018b). For all specimens collected, Barr will also provide a DNR Rare Features Report Form, a completed DNR Observation Database Excel file, GIS shapefiles of species locations, and photographs of collected specimens and their habitats.

2.4 References

Barr Engineering Co. (Barr). 2007. Results of Autumn 2007 Field Surveys for *Botrychium rugulosum* at PolyMet Mine Site Technical Memorandum to Rich Baker, MDNR. November 7, 2007.

—. 2012. Results of Sensitive Plant Species Surveys along Dunka Road and Pipeline Route. Revised February 3, 2012.

—. 2011. Summaries of Sensitive Species Surveys Conducted by MNRI and Additional Sensitive Species Locations from the MNDNR NHIS Database.

—. 2017. Sensitive Plant Species Survey Report: PolyMet Plant Site. October 5, 2017.

Foth & Van Dyke Associates, Inc. 1999. Supplemental Site Specific Resource Information. PolyMet Mining Corporation NorthMet 1999 Exploration Project. Report Prepared for PolyMet Mining. 1999.

Johnson-Groh, Cindy. 2004. *Botrychium* (Moonwort) Rare Plant Surveys for PolyMet Project July 2004.

Minnesota Department of Natural Resources (DNR). 2013. Minnesota's 2013 List of Endangered, Threatened, and Special Concern Species [Online] 2018. http://files.dnr.state.mn.us/natural_resources/ets/endlist.pdf.

—. 2018. Guidance on Documenting and Collecting Rare Plants.

—. 2016a. Rare Species Survey Process.

—. 2016b. Rare Species Survey Proposals and Reports.

—. 2018a. Ecological Classification System. [Online] 2018. http://www.dnr.state.mn.us/ecs/index.html.

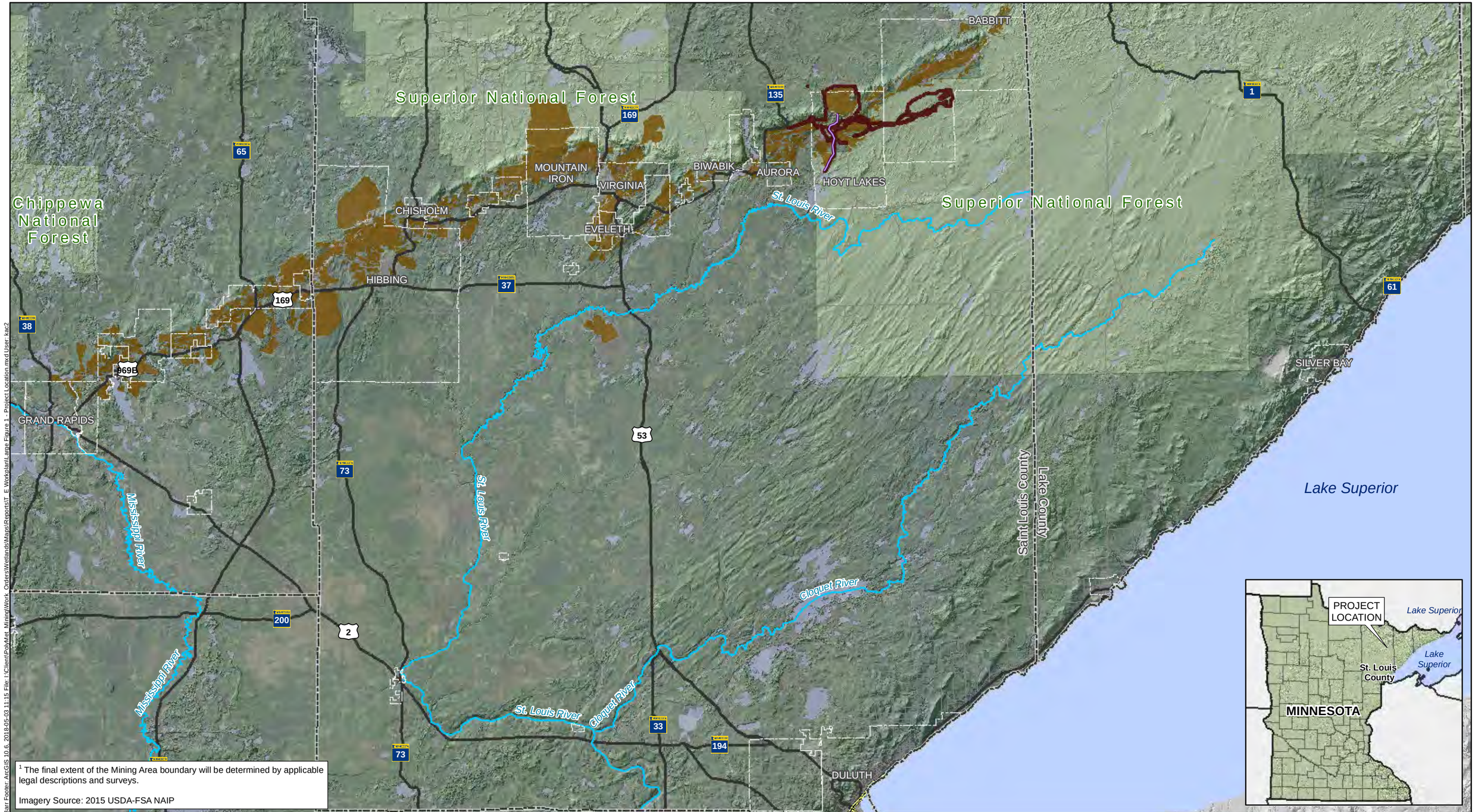
—. 2018b. 20180418 Response to NorthMet Taking Permit Application. April 18, 2018.

—. 2018c. Endangered and Threatened Species Permit Website. [Online] 2018. http://www.dnr.state.mn.us/nhnrp/endangered_permits.html.

Pomroy, Deborah and Raymond Barnes. 2004. 2004 Rare Plant Survey at the PolyMet Mine Site Located in T59N R13W.

Walton, Gary. 2004. Data Summary: Rare Plant Survey.

Large Figures



[1] The final extent of the Mining Area boundary will be determined by applicable legal descriptions and surveys.

Imagery Source: 2015 USDA-FSA NAIP

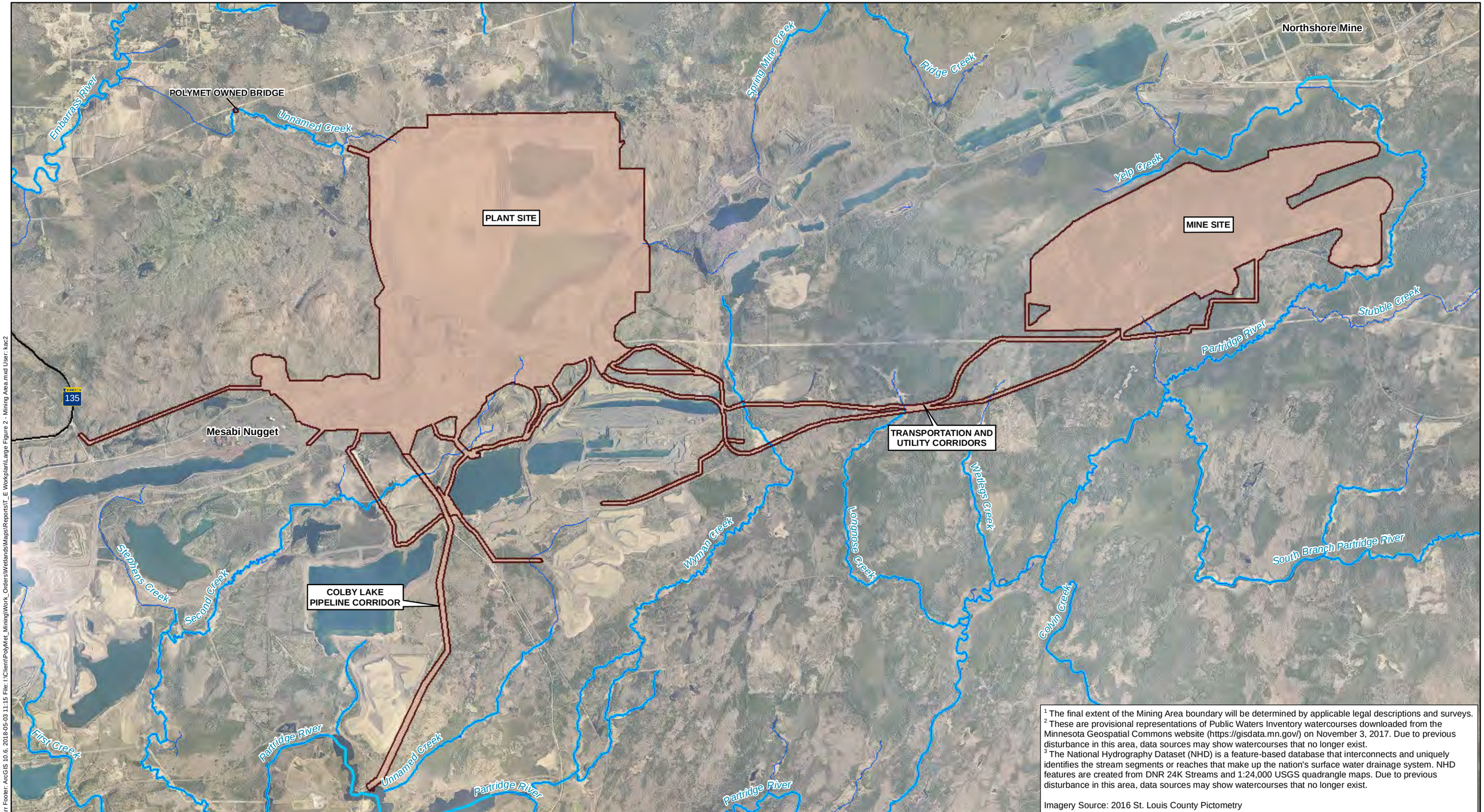
Mining Area[1]
Mesabi Iron Range
National Forest Boundary
County Boundaries
City Boundaries
Major River
Lakes

0 3.5 7 14
Miles

PROJECT LOCATION
NorthMet Project
Poly Met Mining, Inc.

Large Figure 1
Sensitive Plant Species Survey Work Plan

Barr Footer: ArcGIS 10.6, 2018-05-03 11:15 File: I:\Client\PolyMet_Mining\Work_Orders\Wetlands\Maps\Reports\T_E Workplan\Large Figure 1 - Project Location.mxd User: kac2



[1] The final extent of the Mining Area boundary will be determined by applicable legal descriptions and surveys.
[2] These are provisional representations of Public Waters Inventory watercourses downloaded from the Minnesota Geospatial Commons website (https://gisdata.mn.gov/) on November 3, 2017. Due to previous disturbance in this area, data sources may show watercourses that no longer exist.
[3] The National Hydrography Dataset (NHD) is a feature-based database that interconnects and uniquely identifies the stream segments or reaches that make up the nation's surface water drainage system. NHD features are created from DNR 24K Streams and 1:24,000 USGS quadrangle maps. Due to previous disturbance in this area, data sources may show watercourses that no longer exist.

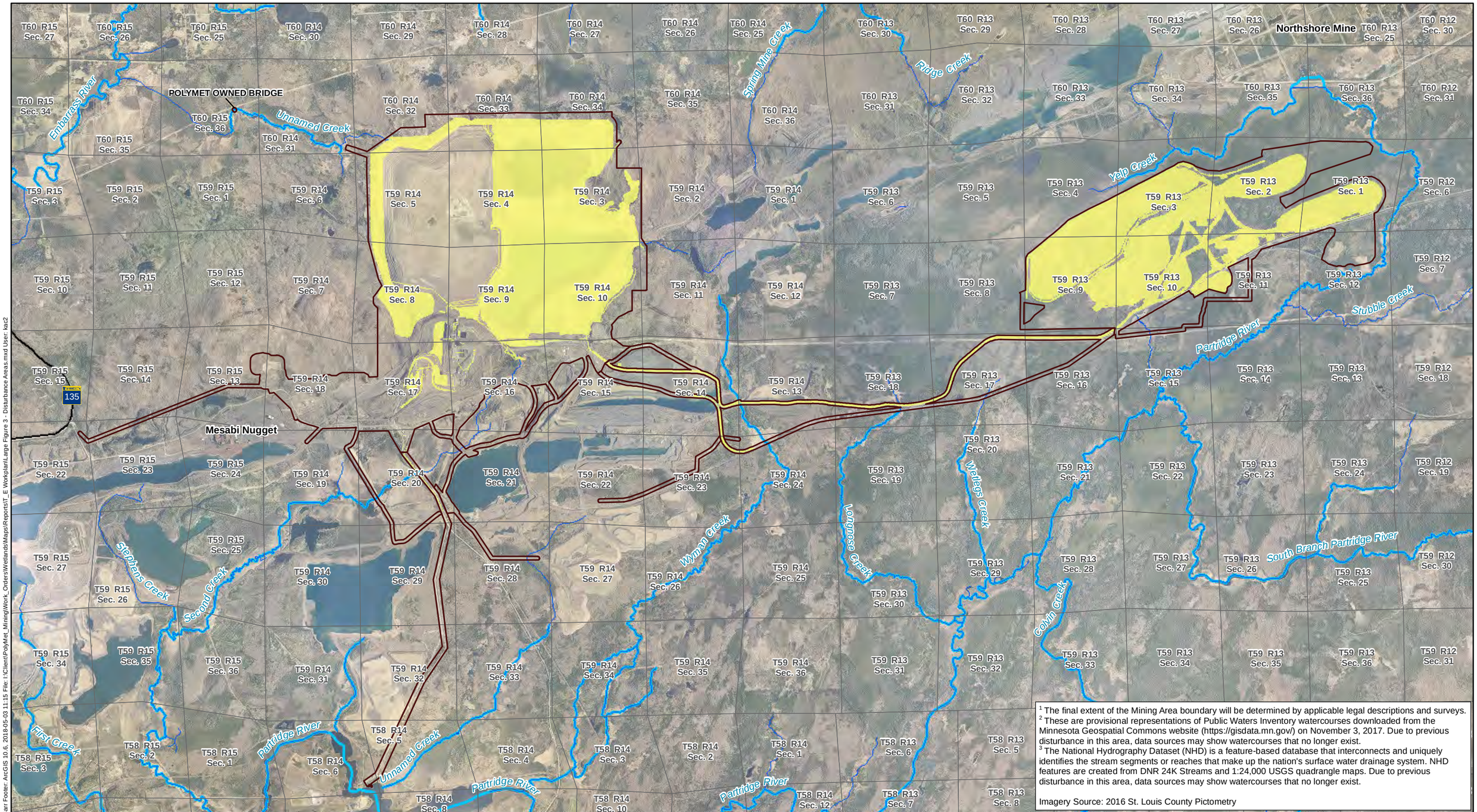
Imagery Source: 2016 St. Louis County Pictometry

Mining Area[1]
Public Waters Inventory (PWI) Watercourses[2]
National Hydrography Dataset (NHD) Rivers & Streams[3]

0 0.5 1 2
Miles

MINING AREA
NorthMet Project
Poly Met Mining, Inc.

Large Figure 2
Sensitive Plant Species Survey Work Plan



[1] The final extent of the Mining Area boundary will be determined by applicable legal descriptions and surveys.
[2] These are provisional representations of Public Waters Inventory watercourses downloaded from the Minnesota Geospatial Commons website (https://gisdata.mn.gov/) on November 3, 2017. Due to previous disturbance in this area, data sources may show watercourses that no longer exist.
[3] The National Hydrography Dataset (NHD) is a feature-based database that interconnects and uniquely identifies the stream segments or reaches that make up the nation's surface water drainage system. NHD features are created from DNR 24K Streams and 1:24,000 USGS quadrangle maps. Due to previous disturbance in this area, data sources may show watercourses that no longer exist.

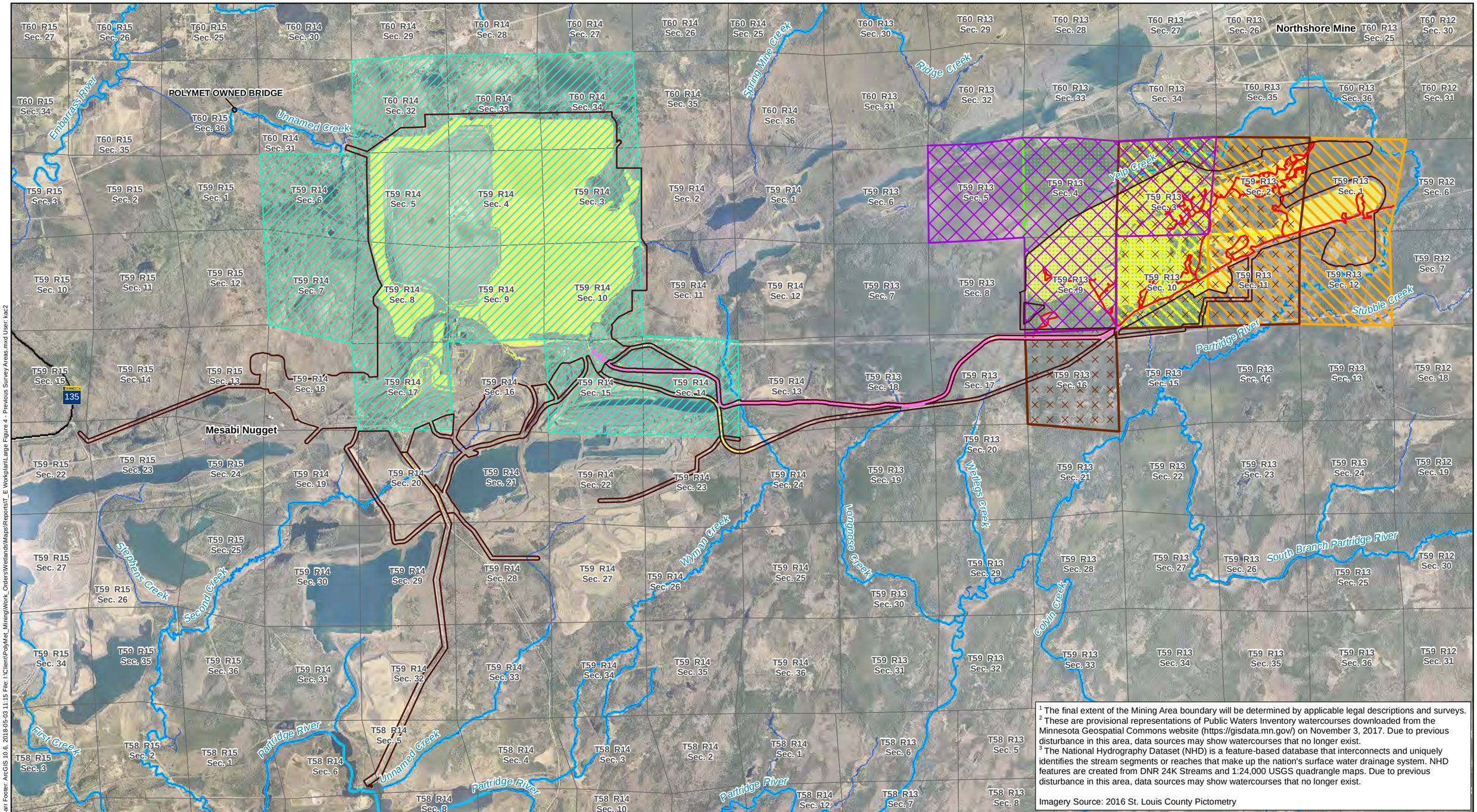
Imagery Source: 2016 St. Louis County Pictometry

Mining Area[1]
Construction/Disturbance Areas
Section Lines
Public Waters Inventory (PWI) Watercourses[2]
National Hydrography Dataset (NHD) Rivers & Streams[3]

0 0.5 1 2
Miles

DISTURBANCE AREAS
NorthMet Project
Poly Met Mining, Inc.

Large Figure 3
Sensitive Plant Species Survey Work Plan



[1] The final extent of the Mining Area boundary will be determined by applicable legal descriptions and surveys.
[2] These are provisional representations of Public Waters Inventory watercourses downloaded from the Minnesota Geospatial Commons website (https://gisdata.mn.gov/) on November 3, 2017. Due to previous disturbance in this area, data sources may show watercourses that no longer exist.
[3] The National Hydrography Dataset (NHD) is a feature-based database that interconnects and uniquely identifies the stream segments or reaches that make up the nation's surface water drainage system. NHD features are created from DNR 24K Streams and 1:24,000 USGS quadrangle maps. Due to previous disturbance in this area, data sources may show watercourses that no longer exist.

Imagery Source: 2016 St. Louis County Pictometry

- Mining Area[1]
- Construction/Disturbance Areas
- Section Lines
- Public Waters Inventory (PWI) Watercourses[2]
- National Hydrography Dataset (NHD) Rivers & Streams[3]

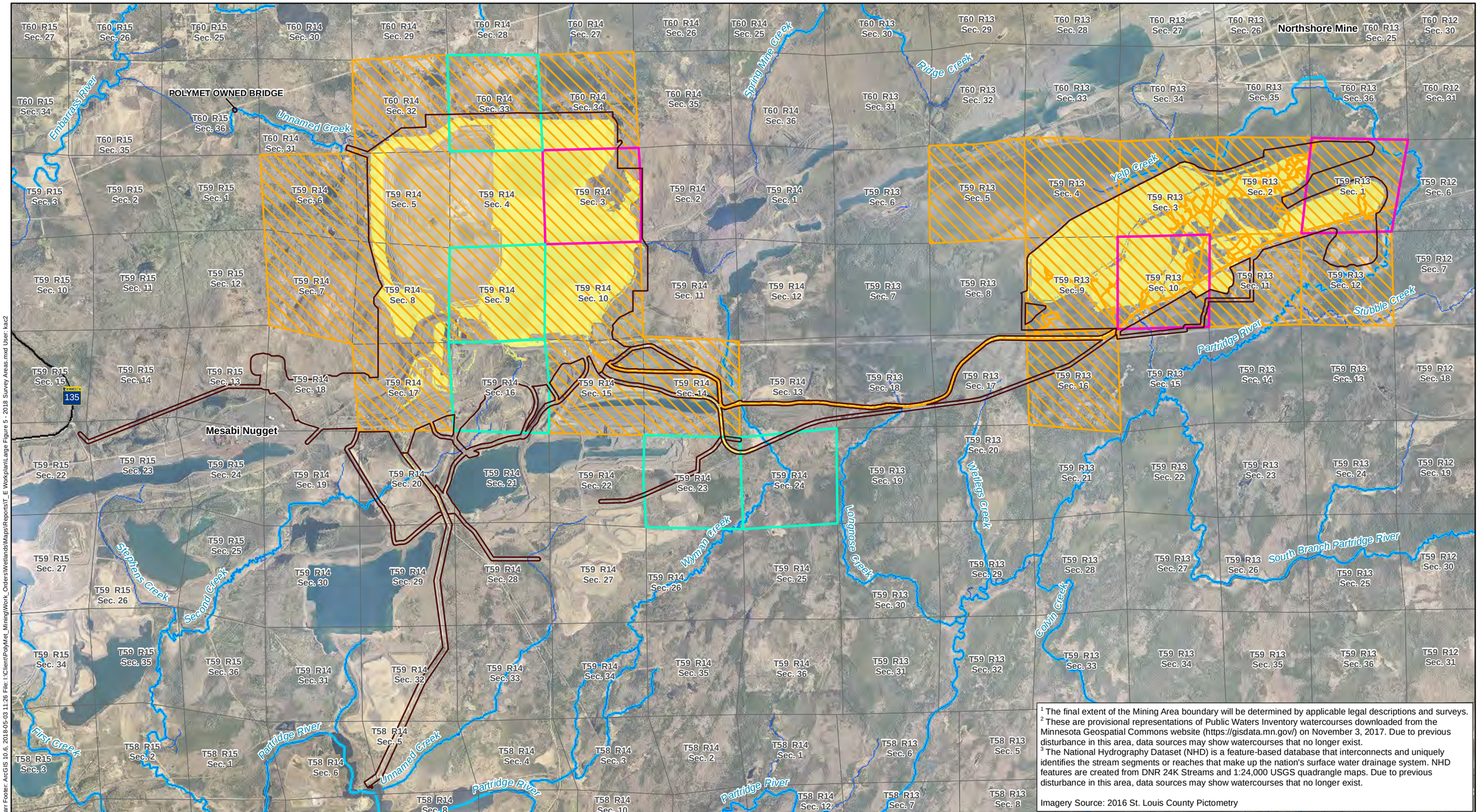
Previous Botanical Surveys

- Foth & Van Dyke and Associates, Inc. (1999)
- Deborah Pomroy (Spring 2004)
- Gary Walton (Spring 2004)
- Cindy Johnson-Groh (July 2004)
- Daniel Jones (2007)
- Daniel Jones (June/July 2008)
- Midwest Natural Resources Inc. (2008)
- Daniel Jones (2017)

0 0.5 1 2
Miles

PREVIOUS SURVEY AREAS
NorthMet Project
Poly Met Mining, Inc.

Large Figure 4
Sensitive Plant Species Survey Work Plan



[1] The final extent of the Mining Area boundary will be determined by applicable legal descriptions and surveys.
[2] These are provisional representations of Public Waters Inventory watercourses downloaded from the Minnesota Geospatial Commons website (https://gisdata.mn.gov/) on November 3, 2017. Due to previous disturbance in this area, data sources may show watercourses that no longer exist.
[3] The National Hydrography Dataset (NHD) is a feature-based database that interconnects and uniquely identifies the stream segments or reaches that make up the nation's surface water drainage system. NHD features are created from DNR 24K Streams and 1:24,000 USGS quadrangle maps. Due to previous disturbance in this area, data sources may show watercourses that no longer exist.

Imagery Source: 2016 St. Louis County Pictometry

- Mining Area[1]
- Construction/Disturbance Areas
- Section Lines
- Public Waters Inventory (PWI) Watercourses[2]
- National Hydrography Dataset (NHD) Rivers & Streams[3]
- Previous Botanical Surveys
- *Botrychium* Survey Area
- *Caltha natans* Survey Area

0 0.5 1 2
Miles

2018 SURVEY AREAS
NorthMet Project
Poly Met Mining, Inc.

Large Figure 5
Sensitive Plant Species Survey Work Plan

Appendix B

DNR Rare Feature Reporting Forms

Minnesota Natural Heritage Information System

Rare Feature Reporting Form – Plants (public form)

Scientific Name: *Botrychium ascendens*

Common Name: Upswept moonwort

Date: June 14, 2018 Time: 11:40

Observer(s): Daniel W. Jones (Salix Env.), Dan Engel (Barr Eng.)

Barr Record ID: PM-20180614-DJE-P001

LOCATION

State: Minnesota County: St. Louis

Quad Name(s): Isaac Lake

Twp: 59 Rng: 14 Sec: 09 [redacted]

Twp: _____ Rng: _____ Sec: _____

Twp: _____ Rng: _____ Sec: _____

Twp: _____ Rng: _____ Sec: _____

or

UTM: Northing [redacted] Easting [redacted] Zone 15N *(Zone 15 preferred!)*

NAD83 or NAD27? (circle one) *(NAD83 preferred!)* Source (e.g. GPS, quad): Trimble Geo7X GPS

or

Latitude: _____ deg. _____ min. _____ sec. Longitude: _____ deg. _____ min. _____ sec. *(provide degrees, minutes, and seconds)* Source: _____

FOR DATABASE PERSONNEL USE ONLY

El.Code: _____ Occ#: _____

Single Source EO / Multi-Source EO

Search effort: _____ min./(A/person)

Data security? Yes No

Mapped _____ QC1 _____

Entered _____ QC2 _____

Comments: _____

Map: *A map should accompany this form. The map may be a photocopy of a USGS 7.5 min. topographic quadrangle and a hand-drawn shape, or in electronic format such as a pdf or shapefile. Draw a dashed line around the area searched,if applicable.*

Directions/comments/description of location: Barr specimen#s PM-20180614-DWJ-S01, PM-20180614-DWJ-S02, PM-20180614-DWJ-S03 . This species was found in disturbed, graded soils north of the former LTV Steel Mining Company (SMC) plant, on restricted-access private property. Access to the site is by permission of Poly Met Mining, Inc. only. Access to the site is via the main road from the guard house up to and through the former plant site. Total population is 33 stems.

OPT **SEARCH EFFORT** time actively searching _____ min. acres searched 0.1 # of observers 2

OPT **BIOLOGY** If the species was searched for but not found, check here: _____ Revisit needed? Y N When? _____

Population size: 33 stems or clonal stands (circle one) counted or estimated? (circle one)

Circle the description which most accurately fits the occurrence. **If you circle more than one description** in each line, on the line below the description indicate the percentage of the population in each stage.

Leaves:	dormant	budding	new leaf	full leaf	leaf fall	
	_____ +	_____ +	_____ +	100 +	_____	=100%
Flowers & Fruit:	dormant	budding	early flower	full flower	early fruit	mature fruit	dispersing seed
	_____	_____	_____	_____	____	100	_____
Age structure:	seedlings	immature	1st yr.(biennials)	mature		
	_____	_____	_____	100		
Vigor:	feeble	normal	vigorous			
	_____	70	30			

Evidence of reproduction?: Yes No If yes; Type: sexual asexual both (circle one)

Evidence: sporophores present with mature spores

Comments (e.g., note symbiosis, parasitism, disease, plant density or patchiness): _____

OPT **HABITAT**

Topography:	Moisture:	Light:	Aspect:	Slope:
crest	hydric	open	N NE	__0_____% or _____°
upper slope	wet-mesic	partial	E SE	Measured or estimated?
mid-slope	mesic	filtered	S SW	(circle one)
lower slope	dry-mesic	shade	W NW	
bottom	xeric		flat	Elevation:
	(circle all that apply)			_____m or _____ft.

Plant community: Among *Bromus inermis*, *Poa compressa*, *Hieracium aurantiacum*, *Carex aurea*, with a few *Populus balsamifera* seedlings

Soil/substrate type: Tailings aggregate.

Comments: Typical of most *Botrychium* habitat observed at old mining sites, on a flat graded area.

OPT **CONSERVATION**

List disturbances, if any: On flat graded area, most recently used as laydown area for old slurry pipe sections.

List threats, if any: Potentially removed by redevelopment of former LTV plant site for PolyMet purposes.

IDENTIFICATION

Specimen collected? Yes No If yes, Collector: Daniel W. Jones_____ Date of Collection: 06/14/2018_____

Collectors Address & Phone: c/o Salix Environmental LLC; 208 Linden Street South, Northfield, MN 55057; (507) 581-2517

Repository: _____ Accession #: U Minn Herbarium Collection #: _____

Specimens submitted to the NHNRP/MCBS will be accessioned into the U. Minn. Herbarium in St. Paul unless the collector requests another repository.

Photograph taken? Yes No

Basis for ID (list author, year, title and publisher for manuals, keys, experts, etc. consulted, if any): *Systematics of Moonworts: Botrychium Subgenus Botrychium*, Donald Farrar June 2006; *Flora of North America*, vol. 2, *Ophioglossaceae*, Wagner Jr. and Wagner, add'l *Botrychium* notes from Donald Farrar.

Comments: Initial field ID by D. Jones was *Botrychium minganense*. Collected specimens submitted to Welby Smith, whose outside consultant Malcolm MacFarland determined that the specimen was *B. ascendens*.

FOR DATABASE PERSONNEL USE ONLY
Verified by: _____ Date sent to Herbarium _____ Date collector notified of outcome: _____

OPT **SUMMARY** (circle one in each column)

Condition:	Quality:	Viability:	Defensability:
A – habitat pristine	A – stand large, productive, vigorous	A – quality likely to remain constant	A – protectable
B	B	B	B
C	C	C	C
D – habitat degraded	D – stand small, feeble	D – quality certain to deteriorate	D – not protectable

Rank: A B C or D (circle one) –summary of above factors

Comments: Species is located in an artificial, previously-disturbed habitat potentially in footprint of large-scale earthwork.

***OPT* = OPTIONAL Section (i.e., you are not required to fill in these sections to submit a record)**

Return to: Data Manager, Natural Heritage and Nongame Research Program, Minn. DNR, 500 Lafayette Rd. Box 25, St. Paul, MN 55155
Form may also be emailed to sharron.nelson@dnr.state.mn.us - emailed forms MUST be accompanied by a map of the observation, either in shapefile, pdf, or some other widely viewable format.

Minnesota Natural Heritage Information System

Rare Feature Reporting Form – Plants (public form)

Scientific Name: *Botrychium spathulatum*

Common Name: Common moonwort

Date: June 14,June 20, 2018 Time: NA

Observer(s): Daniel W. Jones (Salix Env.), Dan Engel (Barr Eng.)

Barr Record ID: PM-20180614-DJE-P003

FOR DATABASE PERSONNEL USE ONLY
El.Code: _____ Occ#: _____
Single Source EO / Multi-Source EO
Search effort: _____ min./(A/person)
Data security? Yes No
Mapped _____ QC1 _____
Entered _____ QC2 _____
Comments: _____

LOCATION

State: Minnesota County: St. Louis

Quad Name(s): _____ _____

Twp: 60 Rng: 14 Sec: 33 [redacted]

Twp: _____ Rng: _____ Sec: _____

Twp: _____ Rng: _____ Sec: _____

Twp: _____ Rng: _____ Sec: _____

or

UTM: Northing [redacted] Easting [redacted] Zone 15N *(Zone 15 preferred!)*

NAD83 or NAD27? (circle one) *(NAD83 preferred!)* Source (e.g. GPS, quad): Trimble Geo7X GPS

or

Latitude: _____ _____ _____ Longitude: _____ _____ _____ *(provide degrees, minutes, and seconds)*
deg. min. sec. deg. min. sec. Source: _____

Map: *A map should accompany this form. The map may be a photocopy of a USGS 7.5 min. topographic quadrangle and a hand-drawn shape, or in electronic format such as a pdf or shapefile. Draw a dashed line around the area searched,if applicable.*

Directions/comments/description of location: Barr specimen #PM-20180614-DWJ-S08. This species was found along the northern edge of the former LTV Steel Mining Company (SMC) tailings basin, on restricted-access private property. Access to the site is by permission of Poly Met Mining, Inc. only. Access to the site is via the lower access road located on the western and northwestern edge of the LTVSMC tailings basin.

OPT **SEARCH EFFORT** time actively searching _____ min. acres searched 0.1 # of observers 2

OPT **BIOLOGY** If the species was searched for but not found, check here: _____ Revisit needed? Y N When?_____

Population size: 6 stems or clonal stands (circle one) counted or estimated? (circle one)

Circle the description which most accurately fits the occurrence. **If you circle more than one description** in each line, on the line below the description indicate the percentage of the population in each stage.

Leaves:	dormant	budding	new leaf	full leaf	leaf fall		
	_____ +	_____ +	_____ +	100 +	_____	=100%	
Flowers & Fruit:	dormant	budding	early flower	full flower	early fruit	mature fruit	dispersing seed
	_____	_____	_____	_____	____	100	_____
Age structure:	seedlings	immature	1st yr.(biennials)	mature			
	_____	_____	_____	100			
Vigor:	feeble	normal	vigorous				
	_____	100	_____				

Evidence of reproduction?: Yes No If yes; Type: sexual asexual both (circle one)

Evidence: sporophores present with mature spores

Comments (e.g., note symbiosis, parasitism, disease, plant density or patchiness): _____

OPT **HABITAT**

Topography:	Moisture:	Light:	Aspect:	Slope:
crest	hydric	open	N NE	30 % or ____°
upper slope	wet-mesic	partial	E SE	Measured or estimated?
mid-slope	mesic	filtered	S SW	(circle one)
lower slope	dry-mesic	shade	W NW	
bottom	xeric		flat	Elevation:
	(circle all that apply)			____m or ____ft.

Plant community: Artificial open grass and legume-dominated forb reclamation area; *Galium boreale*, *Astragalus canadensis*, *Lotus corniculatus*, *Hieracium aurantiacum*, with a few *Populus tremuloides*, *Betula papyrifera*, and *Salix discolor* also present.

Soil/substrate type: Tailings aggregate used for tailings dam construction.

Comments: At mid-upper slope of lowest lift of tailings basin. Typical of most *Botrychium* habitat observed at old mining sites, but on steeper slopes than usual.

OPT **CONSERVATION**

List disturbances, if any: On slope of LTVSMC tailings basin berm. Berm has been seeded with a reclamation mix of grasses and leguminous species, dominated by *Astragalus canadensis* and *Lotus corniculata*. Occasional small groups of *Populus tremuloides* also present on the lower slopes.

List threats, if any: The northeastern edge of the LTVSMC tailings basin berm will be re-graded and amended to raise its elevation. As a result, the plant location will be removed.

IDENTIFICATION

Specimen collected? Yes No If yes, Collector: Daniel W. Jones Date of Collection: 06/14/2018

Collectors Address & Phone: c/o Salix Environmental LLC; 208 Linden Street South, Northfield, MN 55057; (507) 581-2517

Repository: _____ Accession #: U Minn Herbarium Collection #: _____

Specimens submitted to the NHNRP/MCBS will be accessioned into the U. Minn. Herbarium in St. Paul unless the collector requests another repository.

Photograph taken? Yes No

Basis for ID *(list author, year, title and publisher for manuals, keys, experts, etc. consulted, if any):* *Systematics of Moonworts: Botrychium Subgenus Botrychium*, Donald Farrar June 2006; *Flora of North America*, vol. 2, *Ophioglossaceae*,

Comments: Initial 6/14/18 field ID by D. Jones was inconclusive. Return visit on 6/20/18 led to *B. minganense*. Collected specimens were submitted to Welby Smith, whose outside consultant Malcolm McFarland ultimately identified the specimen as *B. spathulatum*.

FOR DATABASE PERSONNEL USE ONLY
Verified by: _____ Date sent to Herbarium _____ Date collector notified of outcome: _____

OPT **SUMMARY** (circle one in each column)

Condition:	Quality:	Viability:	Defensability:
A – habitat pristine	A – stand large, productive, vigorous	A – quality likely to remain constant	A – protectable
B	B	B	B
C	C	C	C
D – habitat degraded	D – stand small, feeble	D – quality certain to deteriorate	D – not protectable

Rank: A B C or D (circle one) –summary of above factors

Comments: Species is located in an artificial, previously-disturbed habitat in footprint of proposed large-scale earthwork.

***OPT* = OPTIONAL Section (i.e., you are not required to fill in these sections to submit a record)**

Return to: Data Manager, Natural Heritage and Nongame Research Program, Minn. DNR, 500 Lafayette Rd. Box 25, St. Paul, MN 55155
Form may also be emailed to sharron.nelson@dnr.state.mn.us - emailed forms MUST be accompanied by a map of the observation, either in shapefile, pdf, or some other widely viewable format.

Minnesota Natural Heritage Information System

Rare Feature Reporting Form – Plants (public form)

Scientific Name: *Botrychium simplex*

Common Name: Least moonwort

Date: June 15, 2018 Time: NA

Observer(s): Daniel W. Jones (Salix Env.), Dan Engel (Barr Eng.)

Barr Record ID: PM-20180615-DJE-P004

FOR DATABASE PERSONNEL USE ONLY
El.Code: _____ Occ#: _____
Single Source EO / Multi-Source EO
Search effort: _____ min./(A/person)
Data security? Yes No
Mapped _____ QC1 _____
Entered _____ QC2 _____
Comments: _____

LOCATION

State: Minnesota County: St. Louis

Quad Name(s): _____ _____

Twp: 59 Rng: 14 Sec: 14 [redacted]

Twp: _____ Rng: _____ Sec: _____

Twp: _____ Rng: _____ Sec: _____

Twp: _____ Rng: _____ Sec: _____

or

UTM: Northing [redacted] Easting [redacted] Zone 15N *(Zone 15 preferred!)*

NAD83 or NAD27? (circle one) *(NAD83 preferred!)* Source (e.g. GPS, quad): Trimble Geo7X GPS

or

Latitude: _____ deg. _____ min. _____ sec. Longitude: _____ deg. _____ min. _____ sec. *(provide degrees, minutes, and seconds)* Source: _____

Map: *A map should accompany this form. The map may be a photocopy of a USGS 7.5 min. topographic quadrangle and a hand-drawn shape, or in electronic format such as a pdf or shapefile. Draw a dashed line around the area searched,if applicable.*

Directions/comments/description of location: Barr specimen #PM-20180615-DWJ-S04. This species was located in a broad, open field, in a formerly disturbed area associated with the former LTVSMC plant site, on restricted-access private property. Access to the site is by permission of Poly Met Mining, Inc. only. Access to the site is via the internal road network of the former LTVSMC plant site.

OPT **SEARCH EFFORT** time actively searching _____ min. acres searched 0.01 # of observers 2

OPT **BIOLOGY** If the species was searched for but not found, check here: _____ Revisit needed? Y N When?_____

Population size: 10 stems or clonal stands (circle one) counted or estimated? (circle one)

Circle the description which most accurately fits the occurrence. **If you circle more than one description** in each line, on the line below the description indicate the percentage of the population in each stage.

Leaves:	dormant	budding	new leaf	full leaf	leaf fall		
	_____ +	_____ +	_____ +	100 +	_____	=100%	
Flowers & Fruit:	dormant	budding	early flower	full flower	early fruit	mature fruit	dispersing seed
	_____	_____	_____	_____	____	100	_____
Age structure:	seedlings	immature	1st yr.(biennials)	mature			
	_____	_____	_____	100			
Vigor:	feeble	normal	vigorous				
	_____	100	_____				

Evidence of reproduction?: Yes No If yes; Type: sexual asexual both (circle one)

Evidence: sporophores present with mature spores

Comments (e.g., note symbiosis, parasitism, disease, plant density or patchiness): _____

OPT **HABITAT**

Topography:	Moisture:	Light:	Aspect:	Slope:
crest	hydric	open	N NE	0-1 % or _____°
upper slope	wet-mesic	partial	E SE	Measured or estimated?
mid-slope	mesic	filtered	S SW	(circle one)
lower slope	dry-mesic	shade	W NW	
bottom	xeric		flat	Elevation:
	(circle all that apply)			_____m or _____ft.

Plant community: Among *Bromus inermis, Hieracium caespitosum, Phalaris arundinacea, Solidago Canadensis, Meliotus officinale*.

Soil/substrate type: Tailings aggregate.

Comments: Typical of most *Botrychium* habitat observed at old mining sites.

OPT **CONSERVATION**

List disturbances, if any: On a flat open field within the former LTVSMC plant site. Adjacent to steep road embankments.

List threats, if any: The site has clearly been graded in the past, and may be re-graded as part of the planned renovation of the former LTV plant. As a result, the plant location may be removed.

IDENTIFICATION

Specimen collected? Yes No If yes, Collector: Daniel W. Jones Date of Collection: 06/15/2018

Collectors Address & Phone: c/o Salix Environmental LLC; 208 Linden Street South, Northfield, MN 55057; (507) 581-2517

Repository: _____ Accession #: U Minn Herbarium Collection #: _____

Specimens submitted to the NHNRP/MCBS will be accessioned into the U. Minn. Herbarium in St. Paul unless the collector requests another repository.

Photograph taken? Yes No

Basis for ID (list author, year, title and publisher for manuals, keys, experts, etc. consulted, if any): *Systematics of Moonworts: Botrychium Subgenus Botrychium*, Donald Farrar June 2006; *Flora of North America*, vol. 2, *Ophioglossaceae*, Wagner Jr. and Wagner, add'l *Botrychium* notes from Donald Farrar.

Comments: Initial field ID by D. Jones was *Botrychium simplex*. Collected specimens were submitted to Welby Smith, whose outside consultant Malcolm McFarland verified the ID.

FOR DATABASE PERSONNEL USE ONLY
Verified by: _____ Date sent to Herbarium _____ Date collector notified of outcome: _____

OPT **SUMMARY** (circle one in each column)

Condition:	Quality:	Viability:	Defensability:
A – habitat pristine	A – stand large, productive, vigorous	A – quality likely to remain constant	A – protectable
B	B	B	B
C	C	C	C
D – habitat degraded	D – stand small, feeble	D – quality certain to deteriorate	D – not protectable

Rank: A B C or D (circle one) –summary of above factors

Comments: Species is located in an artificial, previously-disturbed habitat.

***OPT* = OPTIONAL Section (i.e., you are not required to fill in these sections to submit a record)**

Return to: Data Manager, Natural Heritage and Nongame Research Program, Minn. DNR, 500 Lafayette Rd. Box 25, St. Paul, MN 55155
Form may also be emailed to sharron.nelson@dnr.state.mn.us - emailed forms MUST be accompanied by a map of the observation, either in shapefile, pdf, or some other widely viewable format.

Minnesota Natural Heritage Information System

Rare Feature Reporting Form – Plants (public form)

Scientific Name: *Botrychium campestre*

Common Name: Prairie moonwort

Date: June 15, 2018 Time: NA

Observer(s): Daniel W. Jones (Salix Env.), Dan Engel (Barr Eng.)

Barr Record ID: PM-20180615-DJE-P005

FOR DATABASE PERSONNEL USE ONLY
El.Code: _____ Occ#: _____
Single Source EO / Multi-Source EO
Search effort: _____ min./(A/person)
Data security? Yes No
Mapped _____ QC1 _____
Entered _____ QC2 _____
Comments: _____

LOCATION

State: Minnesota County: St. Louis

Quad Name(s): _____ _____

Twp: 59 Rng: 14 Sec: 23 [redacted]

Twp: _____ Rng: _____ Sec: _____

Twp: _____ Rng: _____ Sec: _____

Twp: _____ Rng: _____ Sec: _____

or

UTM: Northing [redacted] Easting [redacted] Zone 15N *(Zone 15 preferred!)*

NAD83 or NAD27? (circle one) *(NAD83 preferred!)* Source (e.g. GPS, quad): Trimble Geo7X GPS

or

Latitude: _____ deg. _____ min. _____ sec. Longitude: _____ deg. _____ min. _____ sec. *(provide degrees, minutes, and seconds)* Source: _____

Map: *A map should accompany this form. The map may be a photocopy of a USGS 7.5 min. topographic quadrangle and a hand-drawn shape, or in electronic format such as a pdf or shapefile. Draw a dashed line around the area searched,if applicable.*

Directions/comments/description of location: Barr specimen #PM-20180615-DWJ-S05. This species was located adjacent to an old gravel two-track road, near a formerly disturbed area associated with the former LTVSMC plant site, on restricted-access private property. Access to the site is by permission of Poly Met Mining, Inc. only. Access to the site is via the internal road network of the former LTVSMC plant site.

OPT **SEARCH EFFORT** time actively searching _____ min. acres searched 0.01 # of observers 2

OPT **BIOLOGY** If the species was searched for but not found, check here: _____ Revisit needed? Y N When?_____

Population size: 15 stems or clonal stands (circle one) counted or estimated? (circle one)

Circle the description which most accurately fits the occurrence. **If you circle more than one description** in each line, on the line below the description indicate the percentage of the population in each stage.

Leaves:	dormant	budding	new leaf	full leaf	leaf fall		
	_____ +	_____ +	_____ +	100 +	_____	=100%	
Flowers & Fruit:	dormant	budding	early flower	full flower	early fruit	mature fruit	dispersing seed
	_____	_____	_____	_____	____	100	_____
Age structure:	seedlings	immature	1st yr.(biennials)	mature			
	_____	_____	_____	100			
Vigor:	feeble	normal	vigorous				
	_____	100	_____				

Evidence of reproduction?: Yes No If yes; Type: sexual asexual both (circle one)

Evidence: sporophores present with mature spores

Comments (e.g., note symbiosis, parasitism, disease, plant density or patchiness): _____

OPT **HABITAT**

Topography:	Moisture:	Light:	Aspect:	Slope:
crest	hydric	open	N NE	0-1 % or _____°
upper slope	wet-mesic	partial	E SE	Measured or estimated?
mid-slope	mesic	filtered	S SW	(circle one)
lower slope	dry-mesic	shade	W NW	
bottom	xeric		flat	Elevation:
	(circle all that apply)			_____m or _____ft.

Plant community: Among *Hieracium caespitosum*, *Danthonia* species, *Trifolium repens*, *Meliotus officinale*, with a few *Populus balsamifera*, *Betula papyrifera*, and *Salix discolor* also present

Soil/substrate type: Gravel and Tailings aggregate.

Comments: Typical of most *Botrychium* habitat observed at old mining sites.

OPT **CONSERVATION**

List disturbances, if any: On a flat open field within the former LTVSMC plant site. Adjacent to steep road embankments.

List threats, if any: The site has clearly been graded in the past, and may be re-graded as part of the planned renovation of the former LTV plant. As a result, the plant location may be removed.

IDENTIFICATION

Specimen collected? Yes No If yes, Collector: Daniel W. Jones Date of Collection: 06/15/2018

Collectors Address & Phone: c/o Salix Environmental LLC; 208 Linden Street South, Northfield, MN 55057; (507) 581-2517

Repository: _____ Accession #: U Minn Herbarium Collection #: _____

Specimens submitted to the NHNRP/MCBS will be accessioned into the U. Minn. Herbarium in St. Paul unless the collector requests another repository.

Photograph taken? Yes No

Basis for ID (list author, year, title and publisher for manuals, keys, experts, etc. consulted, if any): *Systematics of Moonworts: Botrychium Subgenus Botrychium*, Donald Farrar June 2006; *Flora of North America*, vol. 2, *Ophioglossaceae*, Wagner Jr. and Wagner, add'l *Botrychium* notes from Donald Farrar.

Comments: Initial field ID by D. Jones was *Botrychium simplex*. Collected specimens were submitted to Welby Smith, whose outside consultant Malcolm McFarland verified the ID.

FOR DATABASE PERSONNEL USE ONLY
Verified by: _____ Date sent to Herbarium _____ Date collector notified of outcome: _____

OPT **SUMMARY** (circle one in each column)

Condition:	Quality:	Viability:	Defensability:
A – habitat pristine	A – stand large, productive, vigorous	A – quality likely to remain constant	A – protectable
B	B	B	B
C	C	C	C
D – habitat degraded	D – stand small, feeble	D – quality certain to deteriorate	D – not protectable

Rank: A B C or D (circle one) –summary of above factors

Comments: Species is located in an artificial, previously-disturbed habitat.

***OPT* = OPTIONAL Section (i.e., you are not required to fill in these sections to submit a record)**

Return to: Data Manager, Natural Heritage and Nongame Research Program, Minn. DNR, 500 Lafayette Rd. Box 25, St. Paul, MN 55155
Form may also be emailed to sharron.nelson@dnr.state.mn.us - emailed forms MUST be accompanied by a map of the observation, either in shapefile, pdf, or some other widely viewable format.

Minnesota Natural Heritage Information System

Rare Feature Reporting Form – Plants (public form)

Scientific Name: *Botrychium simplex*

Common Name: Least moonwort

Date: June 15, 2018 Time: NA

Observer(s): Daniel W. Jones (Salix Env.), Dan Engel (Barr Eng.)

Barr Record ID: PM-20180615-DJE-P006

FOR DATABASE PERSONNEL USE ONLY
El.Code: _____ Occ#: _____
Single Source EO / Multi-Source EO
Search effort: _____ min./(A/person)
Data security? Yes No
Mapped _____ QC1 _____
Entered _____ QC2 _____
Comments: _____

LOCATION

State: Minnesota County: St. Louis

Quad Name(s): _____ _____

Twp: 59 Rng: 14 Sec: 23 [redacted]

Twp: _____ Rng: _____ Sec: _____

Twp: _____ Rng: _____ Sec: _____

Twp: _____ Rng: _____ Sec: _____

or

UTM: Northing [redacted] Easting [redacted] Zone 15N *(Zone 15 preferred!)*

NAD83 or NAD27? (circle one) *(NAD83 preferred!)* Source (e.g. GPS, quad): Trimble Geo7X GPS

or

Latitude: _____ deg. _____ min. _____ sec. Longitude: _____ deg. _____ min. _____ sec. *(provide degrees, minutes, and seconds)* Source: _____

Map: *A map should accompany this form. The map may be a photocopy of a USGS 7.5 min. topographic quadrangle and a hand-drawn shape, or in electronic format such as a pdf or shapefile. Draw a dashed line around the area searched,if applicable.*

Directions/comments/description of location: Barr specimen #PM-20180615-DWJ-S06 This plant was found along an overgrown trail, in a formerly disturbed area associated with the former LTVSMC plant site, on restricted-access private property. Access to the site is by permission of Poly Met Mining, Inc. only. Access to the site is via the internal road network of the former LTVSMC plant site.

OPT **SEARCH EFFORT** time actively searching _____ min. acres searched 0.01 # of observers 2

OPT **BIOLOGY** If the species was searched for but not found, check here: _____ Revisit needed? Y N When?_____

Population size: 1 stems or clonal stands (circle one) counted or estimated? (circle one)

Circle the description which most accurately fits the occurrence. **If you circle more than one description** in each line, on the line below the description indicate the percentage of the population in each stage.

Leaves:	dormant	budding	new leaf	full leaf	leaf fall		
	_____ +	_____ +	_____ +	100 +	_____	=100%	
Flowers & Fruit:	dormant	budding	early flower	full flower	early fruit	mature fruit	dispersing seed
	_____	_____	_____	_____	____	100	_____
Age structure:	seedlings	immature	1st yr.(biennials)	mature			
	_____	_____	_____	100			
Vigor:	feeble	normal	vigorous				
	_____	100	_____				

Evidence of reproduction?: Yes No If yes; Type: sexual asexual both (circle one)

Evidence: sporophores present with mature spores

Comments (e.g., note symbiosis, parasitism, disease, plant density or patchiness): _____

OPT **HABITAT**

Topography:	Moisture:	Light:	Aspect:	Slope:
crest	hydric	open	N NE	0-1 % or _____°
upper slope	wet-mesic	partial	E SE	Measured or estimated?
mid-slope	mesic	filtered	S SW	(circle one)
lower slope	dry-mesic	shade	W NW	
bottom	xeric		flat	Elevation:
	(circle all that apply)			_____m or _____ft.

Plant community: Among *Poa compressa*, *Trifolium repens*, *Achillea millefolium*, with a few *Alnus sp.*

Soil/substrate type: Gravel and Tailings aggregate.

Comments: Typical of most *Botrychium* habitat observed at old mining sites.

OPT **CONSERVATION**

List disturbances, if any: On a flat open field within the former LTVSMC plant site. Adjacent to steep road embankments.

List threats, if any: The site has clearly been graded in the past, and may be re-graded as part of the planned renovation of the former LTV plant. As a result, the plant location may be removed.

IDENTIFICATION

Specimen collected? Yes No If yes, Collector: Daniel W. Jones_____ Date of Collection: 06/15/2018_____

Collectors Address & Phone: c/o Salix Environmental LLC; 208 Linden Street South, Northfield, MN 55057; (507) 581-2517

Repository: _____ Accession #: U Minn Herbarium Collection #: _____

Specimens submitted to the NHNRP/MCBS will be accessioned into the U. Minn. Herbarium in St. Paul unless the collector requests another repository.

Photograph taken? Yes No

Basis for ID (list author, year, title and publisher for manuals, keys, experts, etc. consulted, if any): *Systematics of Moonworts: Botrychium Subgenus Botrychium*, Donald Farrar June 2006; *Flora of North America*, vol. 2, *Ophioglossaceae*, Wagner Jr. and Wagner, add'l *Botrychium* notes from Donald Farrar.

Comments: Initial field ID by D. Jones was *Botrychium simplex*. Collected specimens were submitted to Welby Smith, whose outside consultant Malcolm McFarland verified the ID.

FOR DATABASE PERSONNEL USE ONLY
Verified by: _____ Date sent to Herbarium _____ Date collector notified of outcome: _____

OPT **SUMMARY** (circle one in each column)

Condition:	Quality:	Viability:	Defensability:
A – habitat pristine	A – stand large, productive, vigorous	A – quality likely to remain constant	A – protectable
B	B	B	B
C	C	C	C
D – habitat degraded	D – stand small, feeble	D – quality certain to deteriorate	D – not protectable

Rank: A B C or D (circle one) –summary of above factors

Comments: Species is located in an artificial, previously-disturbed habitat.

***OPT* = OPTIONAL Section (i.e., you are not required to fill in these sections to submit a record)**

Return to: Data Manager, Natural Heritage and Nongame Research Program, Minn. DNR, 500 Lafayette Rd. Box 25, St. Paul, MN 55155
Form may also be emailed to sharron.nelson@dnr.state.mn.us - emailed forms MUST be accompanied by a map of the observation, either in shapefile, pdf, or some other widely viewable format.

Minnesota Natural Heritage Information System

Rare Feature Reporting Form – Plants (public form)

Scientific Name: *Caltha natans*

Common Name: Floating marsh marigold

Date: June 18, 2018 Time: NA

Observer(s): Daniel W. Jones (Salix Env.), Dan Engel (Barr Eng.)

Barr Record ID: PM-20180615-DJE-P007

FOR DATABASE PERSONNEL USE ONLY
El.Code: _____ Occ#: _____
Single Source EO / Multi-Source EO
Search effort: _____ min./(A/person)
Data security? Yes No
Mapped _____ QC1 _____
Entered _____ QC2 _____
Comments: _____

LOCATION

State: Minnesota County: St. Louis

Quad Name(s): _____ _____

Twp: 59 Rng: 13 Sec: 1[redacted]

Twp: _____ Rng: _____ Sec: _____

Twp: _____ Rng: _____ Sec: _____

Twp: _____ Rng: _____ Sec: _____

or

UTM: Northing [redacted] Easting [redacted] Zone 15N *(Zone 15 preferred!)*

NAD83 or NAD27? (circle one) *(NAD83 preferred!)* Source (e.g. GPS, quad): Trimble Geo7X GPS

or

Latitude: _____ deg. _____ min. _____ sec. Longitude: _____ deg. _____ min. _____ sec. *(provide degrees, minutes, and seconds)* Source: _____

Map: *A map should accompany this form. The map may be a photocopy of a USGS 7.5 min. topographic quadrangle and a hand-drawn shape, or in electronic format such as a pdf or shapefile. Draw a dashed line around the area searched,if applicable.*

Directions/comments/description of location: Barr specimen #PM-20180615-DWJ-S07. This species was located at the edge of a pond, likely excavated 20+ years ago, near edge of Dunka Road (former mining road). Pond is mostly open water, varying depths, with sedge/bulrush islands. Access to the site is by permission of Poly Met Mining, Inc. only. Access to the site is via the internal road network of the former LTVSMC plant site.

OPT **SEARCH EFFORT** time actively searching _____ min. acres searched 0.01 # of observers 2

OPT **BIOLOGY** If the species was searched for but not found, check here: _____ Revisit needed? Y N When?_____

Population size: 5 stems or clonal stands (circle one) counted or estimated? (circle one)

Circle the description which most accurately fits the occurrence. **If you circle more than one description** in each line, on the line below the description indicate the percentage of the population in each stage.

Leaves:	dormant	budding	new leaf	full leaf	leaf fall		
	_____ +	_____ +	_____ +	100 +	_____	=100%	
Flowers & Fruit:	dormant	budding	early flower	full flower	early fruit	mature fruit	dispersing seed
	_____	_____	_____	50	_____	50	_____
Age structure:	seedlings	immature	1st yr.(biennials)	mature			
	_____	_____	_____	100			
Vigor:	feeble	normal	vigorous				
	_____	100	_____				

Evidence of reproduction?: Yes No If yes; Type: sexual asexual both (circle one)

Evidence: open flowers and mature seed pods

Comments (e.g., note symbiosis, parasitism, disease, plant density or patchiness): _____

OPT **HABITAT**

Topography:	Moisture:	Light:	Aspect:	Slope:
crest	hydric	open	N NE	0-1 % or _____°
upper slope	wet-mesic	partial	E SE	Measured or estimated?
mid-slope	mesic	filtered	S SW	(circle one)
lower slope	dry-mesic	shade	W NW	
bottom	xeric		flat	Elevation:
	(circle all that apply)			_____m or _____ft.

Plant community: Deep marsh/ditch; estimated 2'-3' at center, ~10"-12" at edges where plants are growing.

Soil/substrate type: saturated soils/muck

Comments:

OPT **CONSERVATION**

List disturbances, if any: The pond where this plant is found was excavated years ago; spoils piles are adjacent to the pond. The pond is immediately adjacent to Dunka Road and a security gate.

IDENTIFICATION

Specimen collected? Yes No If yes, Collector: Daniel W. Jones Date of Collection: 06/15/2018

Collectors Address & Phone: c/o Salix Environmental LLC; 208 Linden Street South, Northfield, MN 55057; (507) 581-2517

Repository: _____ Accession #: U Minn Herbarium Collection #: _____

Specimens submitted to the NHNRP/MCBS will be accessioned into the U. Minn. Herbarium in St. Paul unless the collector requests another repository.

Photograph taken? Yes No

Basis for ID (list author, year, title and publisher for manuals, keys, experts, etc. consulted, if any): none; consulted DNR rare species guide and other aquatic references.

Comments: Initial field ID by D. Jones was *Caltha natans*. Collected specimens were submitted to Welby Smith, who verified the ID.

FOR DATABASE PERSONNEL USE ONLY
Verified by: _____ Date sent to Herbarium _____ Date collector notified of outcome: _____

OPT **SUMMARY** (circle one in each column)

Condition:	Quality:	Viability:	Defensability:
A – habitat pristine	A – stand large, productive, vigorous	A – quality likely to remain constant	A – protectable
B	B	B	B
C	C	C	C
D – habitat degraded	D – stand small, feeble	D – quality certain to deteriorate	D – not protectable

Rank: A B C or D (circle one) –summary of above factors

Comments: Species is located in an artificial, previously-disturbed aquatic habitat.

***OPT* = OPTIONAL Section (i.e., you are not required to fill in these sections to submit a record)**

Return to: Data Manager, Natural Heritage and Nongame Research Program, Minn. DNR, 500 Lafayette Rd. Box 25, St. Paul, MN 55155
Form may also be emailed to sharron.nelson@dnr.state.mn.us - emailed forms MUST be accompanied by a map of the observation, either in shapefile, pdf, or some other widely viewable format.

Minnesota Natural Heritage Information System

Rare Feature Reporting Form – Plants (public form)

Scientific Name: *Caltha natans*

Common Name: Floating marsh marigold

Date: June 18, 2018 Time: NA

Observer(s): Daniel W. Jones (Salix Env.), Dan Engel (Barr Eng.)

Barr Record ID: PM-20180615-DJE-P008

FOR DATABASE PERSONNEL USE ONLY
El.Code: _____ Occ#: _____
Single Source EO / Multi-Source EO
Search effort: _____ min./(A/person)
Data security? Yes No
Mapped _____ QC1 _____
Entered _____ QC2 _____
Comments: _____

LOCATION

State: Minnesota County: St. Louis

Quad Name(s): _____ _____

Twp: 59 Rng: 13 Sec: 1 [redacted]

Twp: _____ Rng: _____ Sec: _____

Twp: _____ Rng: _____ Sec: _____

Twp: _____ Rng: _____ Sec: _____

or

UTM: Northing [redacted] Easting [redacted] Zone 15N *(Zone 15 preferred!)*

NAD83 or NAD27? (circle one) *(NAD83 preferred!)* Source (e.g. GPS, quad): Trimble Geo7X GPS

or

Latitude: _____ _____ _____ Longitude: _____ _____ _____ *(provide degrees, minutes, and seconds)*
deg. min. sec. deg. min. sec. Source: _____

Map: *A map should accompany this form. The map may be a photocopy of a USGS 7.5 min. topographic quadrangle and a hand-drawn shape, or in electronic format such as a pdf or shapefile. Draw a dashed line around the area searched,if applicable.*

Directions/comments/description of location: No specimen collected. This species was located at the edge of a pond, likely excavated 20+ years ago, near edge of Dunka Road (former mining road). Pond is mostly open water, varying depths, with sedge/bulrush islands. Access to the site is by permission of Poly Met Mining, Inc. only. Access to the site is via the internal road network of the former LTVSMC plant site.

OPT **SEARCH EFFORT** time actively searching _____ min. acres searched 0.01 # of observers 2

OPT **BIOLOGY** If the species was searched for but not found, check here: _____ Revisit needed? Y N When?_____

Population size: 2 stems or clonal stands (circle one) counted or estimated? (circle one)

Circle the description which most accurately fits the occurrence. **If you circle more than one description** in each line, on the line below the description indicate the percentage of the population in each stage.

Leaves:	dormant	budding	new leaf	full leaf	leaf fall	
	_____ +	_____ +	_____ +	100 +	_____	=100%
Flowers & Fruit:	dormant	budding	early flower	full flower	early fruit	mature fruit	dispersing seed
	_____	_____	_____	50	____	50	_____
Age structure:	seedlings	immature	1st yr.(biennials)	mature		
	_____	_____	_____	100		
Vigor:	feeble	normal	vigorous			
	_____	100	_____			

Evidence of reproduction?: Yes No If yes; Type: sexual asexual both (circle one)

Evidence: open flowers and mature seed pods

Comments (e.g., note symbiosis, parasitism, disease, plant density or patchiness): _____

OPT **HABITAT**

Topography:	Moisture:	Light:	Aspect:	Slope:
crest	hydric	open	N NE	0-1 % or _____°
upper slope	wet-mesic	partial	E SE	Measured or estimated?
mid-slope	mesic	filtered	S SW	(circle one)
lower slope	dry-mesic	shade	W NW	
bottom	xeric		flat	Elevation:
	(circle all that apply)			_____m or _____ft.

Plant community: Deep marsh/ditch; estimated 2'-3' at center, ~10"-12" at edges where plants are growing.

Soil/substrate type: saturated soils/muck

Comments:

OPT **CONSERVATION**

List disturbances, if any: The pond where this plant is found was excavated years ago; spoils piles are adjacent to the pond. The pond is immediately adjacent to Dunka Road and a security gate.

IDENTIFICATION

Specimen collected? Yes No If yes, Collector: _____ Date of Collection:

Collectors Address & Phone:

Repository: _____ Accession #: U Minn Herbarium Collection #: _____

Specimens submitted to the NHNRP/MCBS will be accessioned into the U. Minn. Herbarium in St. Paul unless the collector requests another repository.

Photograph taken? Yes No

Basis for ID (list author, year, title and publisher for manuals, keys, experts, etc. consulted, if any): none; consulted DNR rare species guide and other aquatic references.

Comments: Field ID by D. Jones was *Caltha natans*. No specimen was collected due to proximity to PM-20180618-DWJ-S07. Should be considered same population.

FOR DATABASE PERSONNEL USE ONLY
Verified by: _____ Date sent to Herbarium _____ Date collector notified of outcome: _____

OPT **SUMMARY** (circle one in each column)

Condition:	Quality:	Viability:	Defensability:
A – habitat pristine	A – stand large, productive, vigorous	A – quality likely to remain constant	A – protectable
B	B	B	B
C	C	C	C
D – habitat degraded	D – stand small, feeble	D – quality certain to deteriorate	D – not protectable

Rank: A B C or D (circle one) –summary of above factors

Comments: Species is located in an artificial, previously-disturbed aquatic habitat.

***OPT* = OPTIONAL Section (i.e., you are not required to fill in these sections to submit a record)**

Return to: Data Manager, Natural Heritage and Nongame Research Program, Minn. DNR, 500 Lafayette Rd. Box 25, St. Paul, MN 55155
Form may also be emailed to sharron.nelson@dnr.state.mn.us - emailed forms MUST be accompanied by a map of the observation, either in shapefile, pdf, or some other widely viewable format.

Appendix C

Representative Photographs from June 2018 Sensitive Plant Species Survey

Photograph 1. *Botrychium ascendens*
Report ID: PM-20180614-DJE-P001
Specimen #: PM-20180614-DWJ-S01

Photograph 2. *Botrychium ascendens* (detail)
Report ID: PM-20180614-DJE-P001
Specimen #: PM-20180614-DWJ-S01

Photograph 3. *Botrychium ascendens*
Report ID: PM-20180614-DJE-P001
Specimen #: PM-20180614-DWJ-S02

Photograph 4. *Botrychium ascendens*
Report ID: PM-20180614-DJE-P001
Specimen #: PM-20180614-DWJ-S02

Photograph 5. *Botrychium ascendens*
Report ID: PM-20180614-DJE-P001
Specimen #: PM-20180614-DWJ-S03

Photograph 6. *Botrychium ascendens*
(detail) Report ID: PM-20180614-DJE-P001
Specimen #: PM-20180614-DWJ-S03

Photograph 7. *Botrychium spathulatum*
Report ID: PM-20180614-DJE-P003
Specimen #: PM-20180620-DWJ-S08

Photograph 8. *Botrychium spathulatum* (detail)
Report ID: PM-20180614-DJE-P003
Specimen #: PM-20180620-DWJ-S08

Photograph 9. *Botrychium simplex*
Report ID: PM-20180615-DJE-P004
Specimen #: PM-20180615-DWJ-S04

Photograph 10. *Botrychium simplex* (detail)
Report ID: PM-20180615-DJE-P004
Specimen #: PM-20180615-DWJ-S04

Photograph 11. *Botrychium campestre*
Report ID: PM-20180615-DJE-P005
Specimen #: PM-20180615-DWJ-S05

Photograph 12. *Botrychium campestre* (detail)
Report ID: PM-20180615-DJE-P005
Specimen #: PM-20180615-DWJ-S05

Photograph 13. *Botrychium simplex*
Report ID: PM-20180615-DJE-P006
Specimen #: PM-20180615-DWJ-S06

Photograph 14. *Caltha natans*
Report ID: PM-20180618-DJE-P007
Specimen #: PM-20180618-DWJ-S07

Photograph 15. *Caltha natans* (detail)
Report ID: PM-20180618-DJE-P007
Specimen #: PM-20180618-DWJ-S07

Photograph 16. *Caltha natans*
Report ID: PM-20180618-DJE-P008
Specimen #: not collected

Photograph 17. *Caltha natans* (detail)
Report ID: PM-20180618-DJE-P008
Specimen #: not collected

CD on Back Cover

Information on CD was redacted to protect sensitive plant location data.