

Appendix D

Biological Assessment and Biological Evaluation

Biological Assessment

**U.S. Army Corps of Engineers
St. Paul, Minnesota**

**U.S. Department of Agriculture Forest Service
Laurentian Ranger District
Superior National Forest
Aurora, Minnesota**



Biological Assessment for the Proposed NorthMet Project and Land Exchange

April 2015

Biological Assessment

NorthMet Project and Land Exchange

U.S. Army Corps of Engineers
St. Paul, Minnesota

U.S. Department of Agriculture Forest Service
Laurentian Ranger District
Superior National Forest
Aurora, Minnesota

April 2015

Executive Summary

Poly Met Mining Inc. (PolyMet) proposes to construct an open pit mine in northern Minnesota to extract low- to medium-quality copper-nickel-PGE minerals with low sulfide content. . This project, called the NorthMet Project (Project), is located in St. Louis County on the eastern end of the Mesabi Iron Range, about 60 miles north of the City of Duluth, and 6 miles south of the City of Babbitt, Minnesota. The Project areas include the Mine Site (3,015 acres), Plant Site (4,515 acres), and Transportation and Utility Corridors (120 acres) that connects the Mine Site to the Plant Site.¹

PolyMet plans to mine and process polymetallic ore from the northwestern portion of the Duluth Complex, a rock formation that forms much of the bedrock of northeastern Minnesota. The ore contains copper, nickel, gold, platinum, palladium, and cobalt. The Project would mine ore for approximately 20 years, using open pit mining methods similar to those currently in use at ferrous metallic mining operations on the Iron Range. The Plant Site was previously used as a taconite processing facility by the LTV Steel Mining Company (LTVSMC). PolyMet would upgrade existing facilities and construct new facilities to produce copper concentrates, nickel concentrates, and base and precious metal precipitates for off-site shipment and treatment. Tailings from ore processing would be placed in a tailings basin built atop the existing LTVSMC taconite tailings basin.

The Mine Site is used by wildlife, including Canada lynx (lynx), gray wolf (wolf), northern long-eared bat, and other species of concern to federal and state agencies. A 2014 Forest Service study also confirmed that northern long-eared bats utilize the Plant Site and Utility Corridor (USDA Forest Service 2014a). About 1,719 acres of the Mine Site would be directly disturbed by mining activities. Of these, 1,667 acres are administered by the Forest Service and 52 acres are privately owned. Habitats that would potentially be affected by the Project include coniferous forest (comprised primarily of black spruce², jack pine, tamarack, and balsam fir), deciduous forest (comprised primarily of trembling aspen and paper birch), mixed coniferous/deciduous forest, riparian (dominated by speckled alder, red-osier dogwood, and willow), and wetland (dominated by sedges, cattail, bog Labrador-tea, leatherleaf, and sphagnum moss).

Of the approximately 3,015 acres on the Mine Site, approximately 2,719 acres are owned by the United States (U.S.) Government (Government) and administered by the U.S. Department of Agriculture (USDA) Forest Service (Forest Service). In addition, about 3,776 acres adjacent to the Mine Site are owned by the Government and administered by the Forest Service.

The Forest Service is considering transferring approximately 6,495 acres (federal lands) to PolyMet in exchange for lands (non-federal lands) of similar value that have been offered for consideration by PolyMet. All lands potentially involved in the land exchange would be independently appraised according to the Uniform Appraisal Standards for Federal Land Acquisitions. The appraisals would determine the market value of the properties.

¹ Acreages given in this report are based on Geographic Information System (GIS) analysis. Acreages associated with the legal descriptions of the lands are based on original surveys performed by the Bureau of Land Management, Government Land Office (GLO) surveyors between 1858 and 1907. As such, GLO acreages are used as part of the project description for the Final Environmental Impact Statement (FEIS being prepared for the Project and would also be used to define the real estate transaction if the Land Exchange Proposed Action was approved. The analysis of effects presented in this Biological Assessment (BA) is based upon GIS data. GIS values indicate the actual size of the lands discussed in this BA, which may be different than the GLO legal acreage.

² Common and scientific names of plants and animals given in this report are provided in **Appendix A**.

EXECUTIVE SUMMARY

Information collected during wildlife and wetland functions and values studies would be used by the Forest Service in the land exchange appraisal, and would be used to evaluate impacts to wetlands, and wildlife and their habitats, for a Final Environmental Impact Statement (FEIS) for the Project and land exchange.

Assuming a land exchange occurs, the portions of the Mine Site, Dunka Road and Utility Corridor, and lands adjacent to the Mine Site that are administered by the Forest Service would no longer be part of the National Forest and therefore would not be subject to Forest Service management plans and policies. A land exchange for land adjustment is consistent with the 2004 *Land and Resource Management Plan for the Superior National Forest*.

To fulfill land exchange requirements, PolyMet is proposing to purchase and transfer all or a portion of 7,075 acres of non-federal lands to the Forest Service. The non-federal lands consist of Hay Lake Lands (4,926 acres), Hunting Club Lands (160 acres), Lake County Lands (382 acres), McFarland Lake Lands (31 acres), and Wolf Lands (1,576 acres). All lands are dominated by second-growth deciduous and coniferous forest habitats and a variety of wildlife, including lynx, wolf, and other species of concern, have been observed on or near the non-federal lands.

Assuming a land exchange occurs, the non-federal lands would be administered by the Forest Service. The non-federal lands are associated with four Forest Plan Management Areas, as designated by the Forest Service, which include General Forest, General Forest – Longer Rotation, Riparian Emphasis Area, and Candidate Research Natural Areas. If all or portions of the non-federal lands are acquired by the Forest Service, they would be administered by the Forest Service to meet the goals of these management areas.

The Project would directly impact an estimated 913 acres of wetlands, including about 758 acres at the Mine Site, 147 acres at the Plant Site, and 7.5 acres within the transportation corridors. PolyMet is proposing to purchase 2,169 acres (Wetland Mitigation Sites) as mitigation for wetland impacts from the Project. On the Wetland Mitigation Sites, 1,603 acres would be restored or converted to wetlands and 197 acres would be used as upland buffer.

Section 7 of the federal Endangered Species Act (ESA) requires that federal agencies “insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat of such species.” The U.S. Army Corps of Engineers (USACE), Minnesota Department of Natural Resources (MDNR) and Forest Service are co-lead agencies for an FEIS that is evaluating the impacts of the Project on federally listed species and other natural, cultural, and social resources. This Biological Assessment (BA) is prepared in accordance with the ESA and analyzes potential effects to federally listed threatened and endangered species, and species proposed for listing, and their designated critical habitats, as a result of the Project.

The lynx is a federally listed threatened species that has been sighted on and near the Project area. In the Great Lakes region, the lynx is found primarily in mixed forest habitats where snowshoe hare are common. On March 24, 2000, the lynx was federally listed as a threatened species in several states in the Northeast, Great Lakes Region (including Minnesota), and Southern Rockies. On November 9, 2006, the U.S. Department of the Interior (USDOI), U.S. Fish and Wildlife Service (USFWS), designated 319 square miles (mi²) as critical habitat in Voyageurs National Park. On February 25, 2009, the USFWS re-designated lynx critical habitat to include portions of Cook, Koochiching, Lake, and St. Louis Counties, including most of the federal lands and all of the non-federal lands. A total of 8,065 mi² were designated as critical habitat in Minnesota in 2009. The Wetland

Mitigation Sites are not included within designated critical habitat. The federal and non-federal lands and Wetland Mitigation Sites are located near the western edge of the lynx's range in the Great Lakes region. Lynx and/or their sign have been observed on or near the federal and non-federal lands.

The northern long-eared bat is a federally listed threatened species. The listing of the northern long-eared bat as a threatened species was determined by the USFWS on April 2, 2015 (USFWS 2015). The USFWS also announced interim 4(d) rules concurrent with the listing determination. However, the USFWS has deferred designation of critical habitat for northern long-eared bat to a later date.

The wolf was federally listed as an endangered species under the ESA in 1974, and was reclassified as threatened in 1977. On December 28, 2011, the wolf was delisted by the USFWS. However, on December 19, 2014, a federal court reversed the USFWS decision to delist the gray wolf, restoring federal threatened status and critical habitat designation in Minnesota. Approximately 9,800 mi² were identified as critical habitat for wolves in Minnesota. The federal and non-federal lands are within, but the Wetland Mitigation Sites are outside, the designated critical habitat zone.

The USACE and Forest Service have initiated consultation with the USFWS seeking concurrence with the determination of effects in this BA. Based on the analysis in this BA, the Project would affect lynx, and those effects would not be insignificant or discountable. Thus, the Project **is likely to adversely affect** Canada lynx. The Project would also directly affect about 1,719 acres of lynx critical habitat within the Mine Site. While project lands are rarely used by lynx, the Project would affect only about 0.03% of lynx designated critical habitat in Minnesota, including Primary Constituent Elements (PCEs) of lynx critical habitat. Suitable lynx habitat could be restored on about 397 acres that would be reclaimed after mining, but due to the time inherent in the successional process, it could be 10 or more years after mining before revegetation results in much suitable habitat for lynx. Thus, the Project **is likely to adversely affect** Canada lynx critical habitat.

Based on analysis in this BA, the Project is **likely to adversely affect the northern long-eared bat**. This is because of the potential loss of available summer roost habitat. There is no effect determination on northern long-eared bat critical habitat, because the USFWS has not designated critical habitat for the species.

Based on the analysis in this BA, the Project would affect gray wolves, and those effects would not be insignificant or discountable. Thus the Project **is likely to adversely affect gray wolves**. The Project would directly affect approximately 1,719 acres of gray wolf critical habitat. The 1,719 acres directly affected by the Project are about 0.03% of the over 6.3 million acres of wolf critical habitat in Minnesota, but include PCEs for wolf critical habitat. Approximately 397 acres of disturbed lands would be reclaimed after mining and could provide suitable gray wolf habitat 10 to 20 years after mining. Thus, the Project **is likely to adversely affect** gray wolf critical habitat.

Table of Contents

1.0 Introduction	1-1
1.1 Overview	1-1
1.2 Purpose for the Biological Assessment	1-4
2.0 Consultation	2-1
3.0 Description of the Proposed Action.....	3-1
3.1 Overview	3-1
3.2 Mine Site	3-1
3.2.1 Pre-production Mine Development	3-5
3.2.2 Mining Activities.....	3-5
3.2.3 Fueling and Maintenance Facilities	3-9
3.3 Plant Site.....	3-9
3.3.1 Ore Processing.....	3-11
3.3.2 Flotation Tailings Basin	3-12
3.3.3 Hydrometallurgical Residue Facility	3-12
3.3.4 Plant Site Water Management	3-13
3.4 Transportation and Utility Corridors	3-13
3.4.1 Dunka Road and Utility Corridor	3-15
3.4.2 Railroad Connection Corridor	3-15
3.5 Traffic	3-16
3.5.1 Transport of Consumables and Products	3-16
3.5.2 Traffic from Employees and Service Providers	3-16
3.6 Project Reclamation	3-17
3.6.1 Building and Structure Demolition and Equipment Removal	3-17
3.6.2 Reclamation of Mine Site	3-18
3.6.3 Reclamation of Plant Site.....	3-22
3.6.4 Long-Term Closure Activities	3-24
3.7 Federal and Non-federal Lands	3-25
3.7.1 Land Exchange Process	3-25
3.7.2 Federal Lands	3-25
3.7.3 Non-federal Lands.....	3-26
3.8 Wetland Mitigation Sites	3-27
3.8.1 On-site Restoration.....	3-28
3.8.2 Off-site Mitigation.....	3-28

TABLE OF CONTENTS

4.0 Description of the Lands Affected by the Project.....	4-1
4.1 Federal Lands	4-1
4.1.1 Mine Site	4-1
4.1.2 Federal Lands Surrounding the Mine Site.....	4-3
4.2 Plant Site and Transportation and Utility Corridors	4-4
4.3 Non-federal Lands	4-4
4.3.1 Hay Lake Lands	4-4
4.3.2 Hunting Club Lands	4-8
4.3.3 Lake County Lands	4-10
4.3.4 McFarland Lake Lands	4-11
4.3.5 Wolf Lands.....	4-11
4.4 Wetland Mitigation Lands	4-14
4.4.1 On-site Restoration	4-14
4.4.2 Off-site Mitigation	4-14
 5.0 Biological Assessment Methodology	 5-1
5.1 Literature Review.....	5-1
5.1.1 Biological Assessments and Biological Opinions.....	5-1
5.1.2 Other Sources of Information	5-2
5.2 Database Inquiries.....	5-4
5.3 Consultation with Biologists with Local Knowledge of the Species	5-4
5.4 Field Studies.....	5-5
5.4.1 Project Lynx Survey	5-5
5.4.2 Other Lynx Surveys near Project Area.....	5-5
5.4.3 Other Field Surveys	5-5
 6.0 Baseline Analysis and Assessment of Effects	 6-1
6.1 Canada Lynx	6-2
6.1.1 Environmental Baseline	6-2
6.1.2 Analysis of Direct and Indirect Effects to Lynx and Its Critical Habitat	6-20
6.1.3 Interrelated and Interdependent Effects.....	6-56
6.1.4 Cumulative Effects.....	6-56
6.2 Northern Long-eared Bat	6-65
6.2.1 Environmental Baseline	6-65
6.2.2 Analysis of Direct and Indirect Effects to Northern Long-eared Bat	6-71
6.2.3 Effects of Interrelated and Interdependent Actions	6-78
6.2.4 Cumulative Effects.....	6-78

6.3	Gray Wolf.....	6-80
6.3.1	Environmental Baseline	6-80
6.3.2	Analysis of Direct and Indirect Effects to Gray Wolf.....	6-90
6.3.3	Effects of Interrelated and Interdependent Actions.....	6-100
6.3.4	Cumulative Effects.....	6-100
7.0	Conservation Measures	7-1
7.1	Reclaim Project Area	7-1
7.2	Maintain Vegetated Buffers.....	7-1
7.3	Limit Public Access to Project Area.....	7-1
7.4	Minimize Road Construction and Reclaim Unused Roads	7-1
7.5	Educate Workers and Public.....	7-2
7.6	Lynx Monitoring	7-2
7.7	Preserve and Protect Habitat.....	7-2
8.0	Determination of Effects	8-1
9.0	References.....	9-1

Appendixes

Appendix A	Common and Scientific Names of Plants and Animals Given in this Biological Assessment
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List of Figures

1	Project Location.....	1-2
2	Federal and Non-federal Lands	1-4
3	Iron Range and Project Site.....	3-2
4	Mine Site Plan.....	3-3
5	Plant Site Layout.....	3-9
6	Transportation and Utility Corridors.....	3-13
7	Mine Site Plan Long-term Closure	3-18
8	Plant Site Layout Long-term Closure	3-21
9	GAP Land Cover/Habitat Types – Federal Lands.....	4-2
10	GAP Land Cover/Habitat Types – Plant Site	4-5
11	GAP Land Cover/Habitat Types – Hay Lake Lands, Lake County Lands, and Wolf Lands 1 and 2.....	4-6
12	GAP Land Cover/Habitat Types - Hunting Club Lands, McFarland Lake Lands, and Wolf Lands 3 and 4	4-8
13	GAP Land Cover/Habitat Types – Wetland Mitigation Sites	4-14
14	Canada Lynx Critical Habitat.....	6-3
15	Contiguous United States Range of the Canada Lynx	6-5
16	Lynx Analysis Units	6-15
17	Canada Lynx Sightings in Northeastern Minnesota 2000-2006	6-18
18	Lynx Survey Routes and Lynx Observations near Project Areas	6-19
19	Management Indicator Habitat Types and Age Classes – Federal Lands.....	6-48
20	Management Indicator Habitat Types and Age Classes – Hay Lake Lands, Lake County Lands, and Wolf Lands 1 and 2	6-49
21	Management Indicator Habitat Types and Age Classes – Hunting Club Lands, McFarland Lake Lands, and Wolf Lands 3 and 4.....	6-50
22	Arrowhead Region of Minnesota and Ecological Subsections	6-55
23	Wildlife Travel Corridors	6-62
24	Wolf Critical Habitat	6-79

List of Tables

1	Maximum Pit Dimensions.....	3-5
2	Waste Rock Properties.....	3-6
3	Maximum Stockpile Dimensions - Approximate	3-6
4	GAP Cover Types Affected by the Project at the Mine Site	4-3
5	Suitable and Unsuitable Lynx Habitat within Lynx Analysis Units (for acreage under all ownerships within the LAU/for acreage administered by the Forest Service within the LAU) before and After the Project for the Federal and Non-federal Lands	6-16
6	Superior National Forest Genetic Reference Collection Records	6-20
7	GAP Cover Type and MIH Habitat (acres) on Federal and Non-federal Lands	6-25
8	Lynx Analysis Indicators and Primary Constituent Elements.....	6-44
9	Lynx Analysis Indicators for Lands Administered by the Forest Service within the Lynx Analysis Units for Federal and Non-federal Lands for Existing Conditions and under the Proposed Action.....	6-45
10	Unsuitable Habitat and Road/Trail Density within the Lynx Analysis Units Affected by the Project.....	6-57
11	Gray Wolf Habitat on the Federal and Non-federal Lands.....	6-89
12	Wolf Risk Analysis Indicators.....	6-96

List of Acronyms

ANFO	Ammonium Nitrate and Fuel Oil
BA	Biological Assessment
Barr	Barr Engineering, Inc.
BO	Biological Opinion
BWCAW	Boundary Waters Canoe Area Wilderness
CESA	Cumulative Effects Study Area
C.F.R.	Code of Federal Regulations
dBa	A-weighted decibels
dbh	Diameter-at-breast-height
DPS	Distinct Population Segment
e.g.	Exempli gratia, meaning “for example”
EIS	Environmental Impact Statement
ESA	Endangered Species Act
EIS	Environmental Impact Statement
etc.	et cetera
FEIS	Final Environmental Impact Statement
Forest Service	U.S. Forest Service
FTB	Flotation Tailings Basin
GAP	Gap Analysis Program
GIS	Geographic Information System
GLO	Government Land Office
Government	U.S. Government
HRF	Hydrometallurgical Residue Facility
i.e.	in otherwords
km ²	square kilometers
kV	kilovolts
LAU	Lynx Analysis Unit
LTVSMC	LTV Steel Mining Company
mi ²	Square miles
MIH	Management Indicator Habitat
mg/l	milligrams per liter
MDNR	Minnesota Department of Natural Resources
MPCA	Minnesota Pollution Control Agency
n	number
NA	Not Applicable
NMFS	National Marine Fisheries Service
NRRI	Natural Resources Research Institute
OML	Objective Maintenance Level
PCE	Primary Constituent Elements
PolyMet	Poly Met Mining Incorporated
Project	NorthMet Project
ROW	Rights-of-Way
SNF	Superior National Forest

ACRONYMS

SEIS	Supplemental Environmental Impact Statement
SUV	Sports Utility Vehicle
SWPPP	Stormwater Pollution Prevention Plan
U.S.	United States
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USDOI	U.S. Department of the Interior
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service

1.0 Introduction

1.1 Overview

Poly Met Mining Inc. (PolyMet) proposes to construct an open pit mine in northern Minnesota to extract low-to medium-quality copper-nickel-PGE minerals with low sulfide content. . This project, called the NorthMet Project (Project), is located in St. Louis County on the eastern end of the Mesabi Iron Range, about 60 miles north of the City of Duluth, and 6 miles south of the City of Babbitt, Minnesota. The Project areas include the Mine Site (3,015 acres), Plant Site (4,515 acres), and Transportation and Utility Corridors (120 acres) that connect the Mine Site to the Plant Site³ (**Figure 1**).

PolyMet plans to mine and process polymetallic ore from the northwestern portion of the Duluth Complex. The Duluth Complex is an ore complex that forms much of the bedrock of northeastern Minnesota. The ore contains copper, nickel, gold, platinum, palladium, and cobalt. The Plant Site was previously used as a taconite processing facility by the LTV Steel Mining Company (LTVSMC). PolyMet would upgrade existing facilities and construct new facilities to produce copper concentrates, nickel concentrates, and base and precious metal precipitates for off-site shipment and treatment.

The Mine Site is used by wildlife, including Canada lynx (lynx), gray wolf (wolf), the northern long-eared bat, and other species of concern to federal and state agencies. About 1,719 acres of the Mine Site would be directly disturbed by mining activities. Of these, 1,667 acres are administered by the Forest Service and 52 acres are privately owned. Habitats that would potentially be affected by the Project include coniferous forest (comprised primarily of black spruce⁴, jack pine, tamarack, and balsam fir), deciduous forest (comprised primarily of trembling aspen and paper birch), mixed deciduous/coniferous forest, riparian (dominated by speckled alder, red-osier dogwood, and willow), and wetland (dominated by sedges, cattail, bog Labrador-tea, leatherleaf, and sphagnum moss). The Transportation and Utility Corridors are mostly disturbed lands and is little used by wildlife. The Plant Site has been operated as an industrial facility for decades, and also has little value to wildlife.

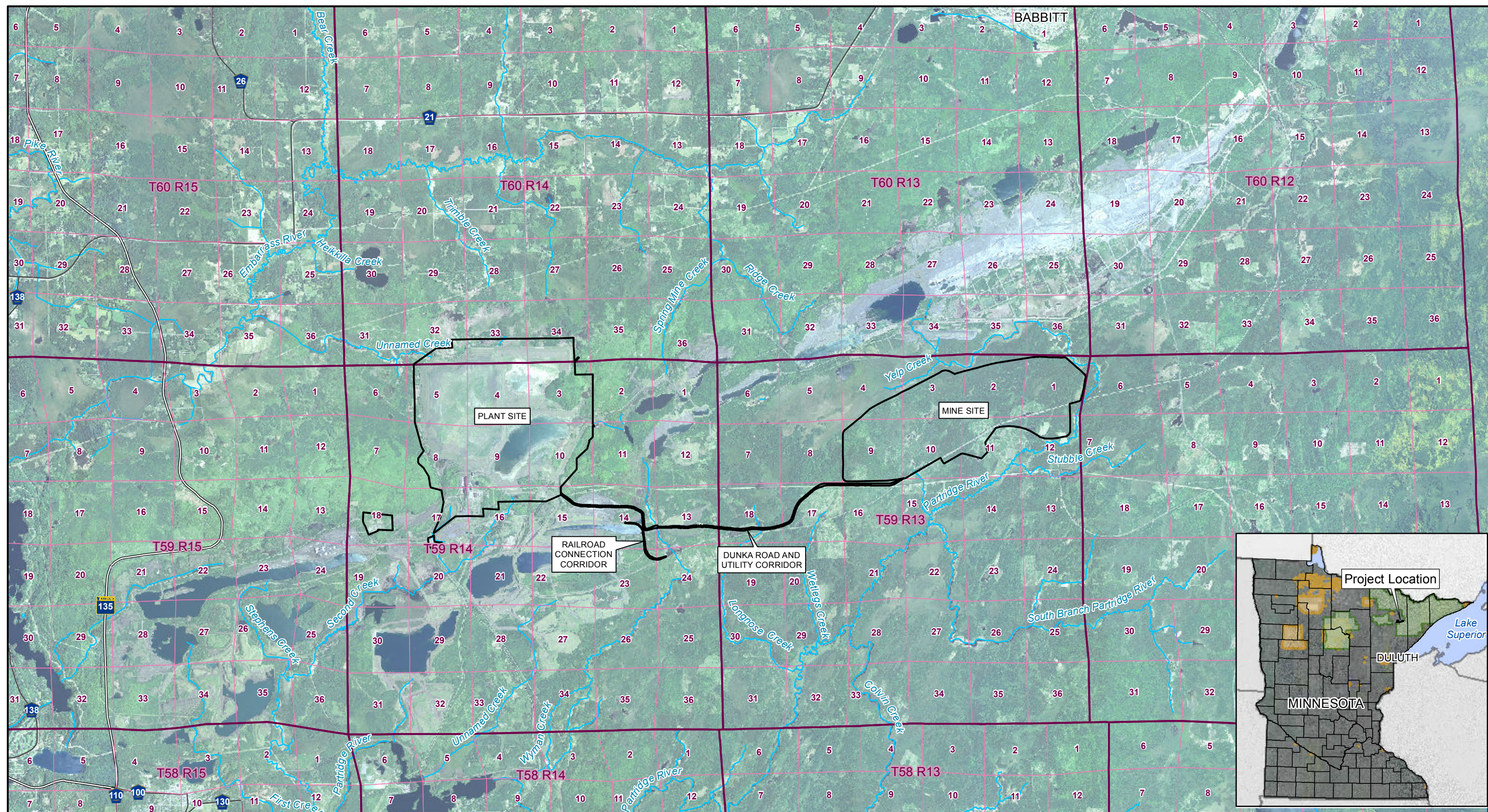
Of the approximately 3,015 acres on the Mine Site, approximately 2,719 acres are owned by the United States (U.S.) Government (Government) and administered by the U.S. Department of Agriculture (USDA) Forest Service (Forest Service). In addition, about 3,776 acres adjacent to the Mine Site are owned by the Government and administered by the Forest Service.

³ Acreages given in this report are based on Geographic Information System (GIS) analysis. Acreages associated with the legal descriptions of the lands are based on original surveys performed by the Bureau of Land Management, Government Land Office (GLO) surveyors between 1858 and 1907. As such, GLO acreages are used as part of the project description for the Final Environmental Impact Statement (FEIS) being prepared for the Project and would also be used to define the real estate transaction if the land exchange was approved. The analysis of effects presented in this Biological Assessment (BA) is based upon GIS data. The GIS values indicate the actual size of the lands discussed in this BA, which may be different than the GLO legal acreage.

⁴ Common and scientific names of plants and animals given in this report are provided in **Appendix A**.

INTRODUCTION

The Forest Service is considering transferring approximately 6,495 acres (federal lands) to PolyMet in exchange for lands (non-federal lands) of similar value that have been offered for consideration by PolyMet. Assuming a land exchange occurs, the portions of the Mine Site, Dunka Road and Utility Corridor, and



- Project Areas
- Township Lines
- Section Lines
- Rivers & Streams



Figure 1
Project Location
 Biological Assessment for the NorthMet Project and Land Exchange
 St. Louis County, Minnesota

INTRODUCTION

lands adjacent to the Mine Site that are administered by the Forest Service would no longer be part of the National Forest and therefore would not be subject to Forest Service management plans and policies. A land exchange for land adjustment is consistent with the 2004 *Land and Resource Management Plan for the Superior National Forest* (2004 Forest Plan; USDA Forest Service 2004a).

To fulfill exchange requirements, PolyMet is proposing to purchase and transfer 7,075 acres of non-federal lands to the Forest Service. The non-federal lands consist of Hay Lake Lands (4,926 acres), McFarland Lake Lands (31 acres), Lake County Lands (382 acres), Hunting Club Lands (160 acres), and Wolf Lands (1,576 acres; **Figure 2**). All non-federal lands are dominated by second-growth deciduous and coniferous forest habitats and a variety of wildlife, including lynx, wolf, and other species of concern, have been observed on or near the non-federal lands.

Assuming a land exchange occurs, the non-federal lands would be administered by the Forest Service. The non-federal lands are associated with four Forest Plan Management Areas, as designated by the Forest Service, which include General Forest, General Forest – Longer Rotation, Riparian Emphasis Area, and Candidate Research Natural Areas. If all or a portion of the non-federal lands are acquired by the Forest Service, they would be administered by the Forest Service to meet the goals of these management areas.

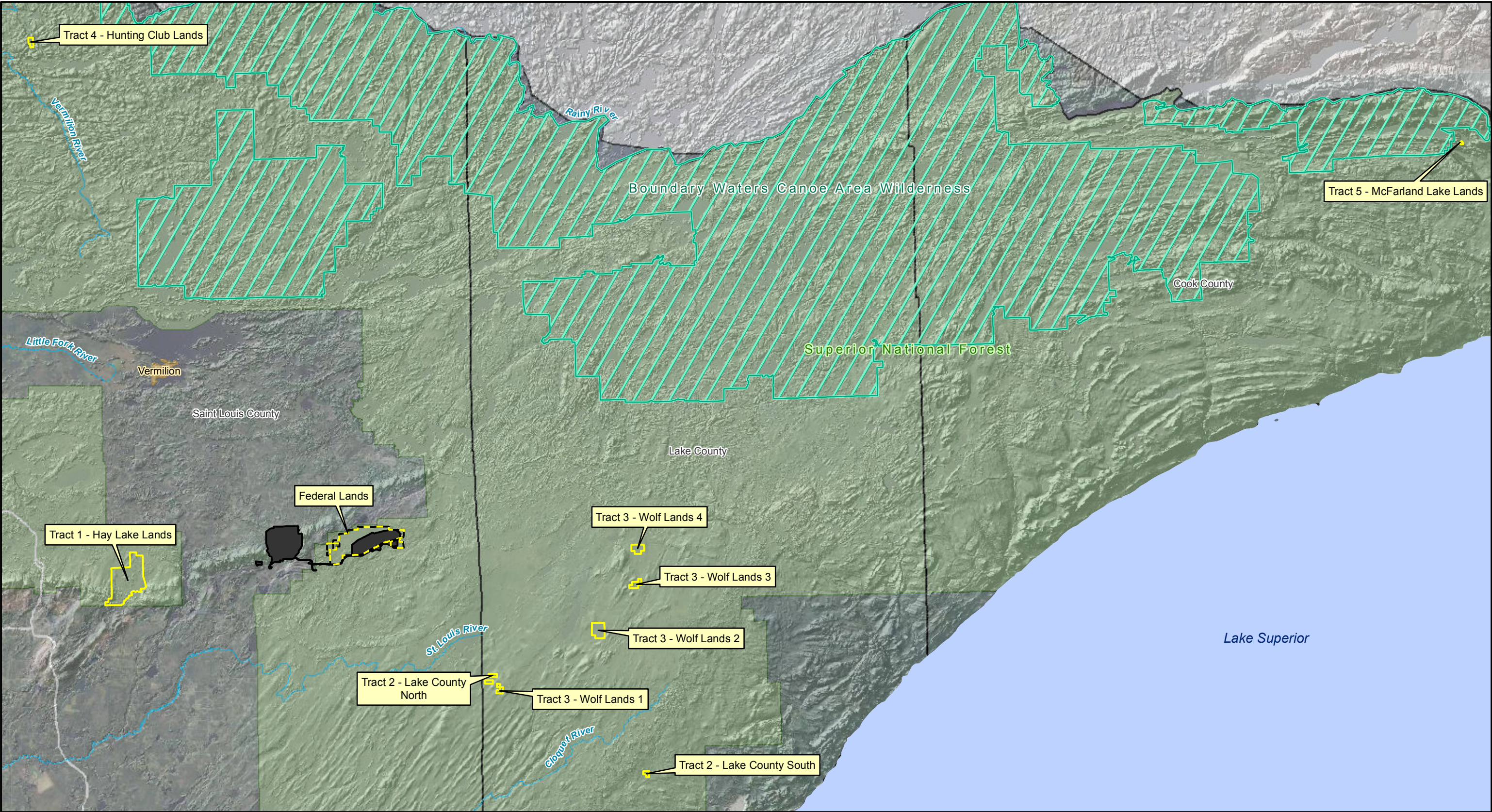
The Regional Forester or other authorized officer must decide if the proposed land exchange complies with the Forest Plan, is a fair value exchange, and is in the public interest. All lands potentially involved in the land exchange would be independently appraised according to the Uniform Appraisal Standards for Federal Land Acquisitions. The appraisals would determine the market value of the properties. Information collected during wildlife and wetland functions and values studies would be used by the Forest Service in the land exchange appraisal, and would be used to evaluate impacts to wetlands, and wildlife and their habitats for a *NorthMet Mining Project and Land Exchange Supplemental Environmental Impact Statement* (SEIS) for the Project and land exchange (Minnesota Department of Natural Resources [MDNR] et al. 2015).

The Project would directly impact an estimated 914 acres of wetlands, mostly within the Mine Site. A U.S. Army Corps of Engineers (USACE) permit would be required under Section 404 of the Clean Water Act for impacts to wetlands and other waters of the U.S., PolyMet is proposing to purchase 2,169 acres (Wetland Mitigation Sites) as mitigation for wetland impacts from the Project. On the Wetland Mitigation Sites, 1,620 acres would be restored or converted to wetlands and 197 acres would be used for upland buffer.

The Project and land exchange constitute the proposed actions of the two federal agencies, USFS and USACE. For convenience in this BA, the Project is referenced as the proposed action. The proposed action is further defined in Section 3.0.

1.2 Purpose for the Biological Assessment

In accordance with Section 7 of the federal Endangered Species Act (ESA) of 1973, as amended (19 United States Code [U.S.C.] §1536 [c], 50 Code of Federal Regulations (C.F.R.) § 402.14[c]), federal agencies must “insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat of such species.” The purpose of the ESA is to provide a means for conserving the ecosystems upon which endangered species and threatened species depend, and to provide a program for protecting these species.



<ul style="list-style-type: none"> Project Areas Federal Lands Non-federal Lands Boundary Waters Canoe Area Wilderness National Forest Boundary Native American Reservation Major River 	<p>US Army Corps of Engineers St. Paul District</p>	<p>FOREST SERVICE U.S. DEPARTMENT OF AGRICULTURE</p>	<p>0 3.75 7.5 15 Miles</p>	<p>Figure 2 Federal and Non-federal Lands Biological Assessment for the NorthMet Project and Land Exchange St. Louis County, Minnesota</p>
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INTRODUCTION

Under Section 7 of the ESA, federal agencies are required to consult with the U.S. Department of the Interior (USDOI) U.S. Fish and Wildlife Service (USFWS), and/or National Oceanic and Atmospheric Administration National Marine Fisheries Service (NMFS; collectively the Services), to: 1) determine what species and critical habitats could be affected by the action; 2) determine what effect the action may have on these species or critical habitats; 3) explore ways to modify the action to reduce or remove adverse effects to the species or critical habitats; 4) determine the need to enter into formal consultation for listed species or designated critical habitats, or conference for species proposed for listing or proposed critical habitats; and 5) explore the design or modification of an action to benefit the species.

The USACE, MDNR, and Forest Service are co-lead agencies for the FEIS that is being prepared to evaluate the adverse and beneficial impacts from the Project, including the land exchange. As federal agencies that would authorize actions under the FEIS Record of Decision for the Project, the USACE and Forest Service must consult with the Services on their respective actions related to the Project and the land exchange.

The purpose of this Biological Assessment (BA) is to evaluate the effects of the Project and the land exchange on federally listed threatened and endangered species, species proposed for listing, and their critical habitats, as a result of the Project. The ESA defines an endangered species as a species that is in danger of extinction throughout all or a major portion of its range. A threatened species is defined as any species that is likely to become an endangered species within the foreseeable future throughout all or a major portion of its range. A species proposed for listing is a species for which the Services have sufficient information on its biological status and threats to propose it as endangered or threatened. Critical habitat is defined as “specific area within the geographical area occupied by the species...on which are found those physical and biological features (a) essential to the conservation of the species and (b) which may require special management considerations or protection” (USDOI USFWS and NMFS 1998).

The lynx is a federally listed threatened species that may use the Project area. The lynx is under the jurisdiction of the USFWS. In the Great Lakes region, the lynx is found primarily in mixed coniferous/deciduous forest habitat where snowshoe hare are common. The Project is located near the western edge of the lynx’s range in the region. Lynx have been sighted on and near the Project area. In addition, most of the federal and all of the non-federal lands are part of designated critical habitat for the lynx in Minnesota. The Wetland Mitigation Sites are not included within designated critical habitat.

Because the Project has the potential to modify the physical environment, this BA was prepared to analyze the potential effects of Project activities on the lynx and its designated critical habitat. This BA will be used by the USFWS to facilitate compliance with the requirements of Section 7(c) of the ESA. In addition, the BA will outline conservation measures to minimize or eliminate effects to lynx associated with the proposed action.

The northern long-eared bat is found across much of the eastern and north central United States and all Canadian provinces from the Atlantic coast west to the southern Northwest Territories and eastern British Columbia (USDOI USFWS 2013a). White-nose syndrome, a fungal disease known to affect bats, is currently the predominant threat to the northern long-eared bat, especially throughout the Northeast where the species has declined by up to 99% from pre-white-nose syndrome levels at many hibernation sites. White-nose syndrome has spread rapidly throughout the East and is currently spreading through the Midwest. Although the disease has not yet spread throughout the northern long-eared bat’s entire range (white-nose syndrome is currently found in at least 22 of 39 states where the northern long-eared bat occurs), it continues to spread. Other threats to the species include wind energy development, habitat destruction or disturbance (e.g.,

vandalism to hibernacula, roost tree removal), climate change, and contaminants. Although no significant population declines have been observed due to these threats, they may now be important factors affecting this bat's ability to persist while experiencing dramatic declines caused by white-nose syndrome.

The northern long-eared bat was listed as a federally threatened species on April 2, 2015. The listing determination included announcement of interim 4(d) rules, which will allow certain activities to be excepted from the ESA prohibition of take of northern long-eared bats, provided USFWS-proscribed conservation measures are followed. The April 2, 2015 listing decision deferred designation of critical habitat for northern long-eared bat to a later date.

The wolf is the largest wild member of the dog family (Canidae) and is common on and near the Project area. The wolf was determined to be endangered in 1967 under the Endangered Species Preservation Act of 1966, in response to their vastly declining numbers range-wide at that time. In 1974, the species was formally listed as endangered through the authority of the ESA, and the Minnesota population was reclassified to threatened in 1977. In April 2003, wolf populations in the United States were separated into three Distinct Population Segments (DPS) to more effectively manage the species. The Minnesota population was a designated portion of the Eastern DPS. In 1978, wolf critical habitat was designated for the Eastern DPS. That rule identified critical habitat in Isle Royale National Park, Michigan, and Minnesota wolf management zones 1, 2, and 3. In northeastern and northcentral Minnesota, wolf management zones 1, 2, and 3 comprised approximately 9,800 square miles (mi²) and included all of the Superior National Forest and portions of the Chippewa National Forest. Hunting Club and McFarland Lake lands were in Zone 1, while the federal lands and other non-federal lands were in Zone 2. The Wetland Mitigation Sites were outside the critical habitat zones.

On December 28, 2011, the USFWS revised the 1978 listing of the Minnesota population of wolf to conform to statutory and policy requirements. The USFWS renamed what was previously listed as the Minnesota population of gray wolf in the Eastern DPS as the Western Great Lakes DPS, and delineated the boundaries of the expanded Minnesota population segment to include all of Minnesota, Wisconsin, and Michigan and portions of the adjacent states. The USFWS December 2011 decision removed the Western Great Lakes DPS from the list of endangered and threatened wildlife. This final rule also removed the designated critical habitat for the gray wolf in Minnesota and Michigan and the special regulations under Section 4(d) of the ESA for wolves in Minnesota.

However, on December 19, 2014, a federal court reversed the USFWS decision to delist the gray wolf, restoring federal threatened status and critical habitat designation in Minnesota. Approximately 9,800 mi² were identified as critical habitat for wolves in Minnesota. The federal and non-federal lands are within, but the Wetland Mitigation Sites are outside, the formerly designated critical habitat zone.

2.0 Consultation

The consultation process is designed to assist federal agencies in complying with the ESA. The USACE, Forest Service, and USFWS initiated informal consultation on February 26, 2010, when the agencies met on the Project area to discuss the Project. The USACE met with the USFWS on May 3, 2011. The agencies held a conference call to discuss the project on September 1, 2011. The USACE also met with the USFWS on February 28, 2013. The USACE, USFWS, and Forest Service met in summer 2014 to identify tasks to be accomplished in the development of the BA.

Consultation can either be informal or formal, depending on the determination of effects in the BA. In making the determinations in this BA the following conclusions were considered, based on guidance in the *Endangered Species Consultation Handbook* (USDOJ USFWS and NMFS 1998).

No affect – the appropriate conclusion when the action agency determines its proposed action will not affect a listed species or its designated critical habitat.

May affect - the appropriate conclusion when a proposed action may pose any effects on listed species or designated critical habitat. When the Federal agency proposing the action determines that a “may affect” situation exists, then they must either initiate formal consultation or seek written concurrence from the USFWS that the action “is not likely to adversely affect” (see definition below) listed species.

Is not likely to adversely affect – the appropriate conclusion when effects on listed species, or their critical habitat, are expected to be discountable, insignificant, or completely beneficial. Beneficial effects are contemporaneous positive effects without any adverse effects to the species. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur. Based on best professional judgment, a person would not: 1) be able to meaningfully measure, detect, or evaluate insignificant effects; or 2) expect discountable effects to occur.

Is not likely to jeopardize proposed species – the appropriate conclusion when the action agency or the USFWS determines that the proposed action is not likely to jeopardize the proposed species or adversely modify the proposed critical habitat.

Is likely to adversely affect – the appropriate finding in a BA (or conclusion during informal consultation) if any adverse effect to listed species, or their critical habitat, may occur as a direct or indirect result of the proposed action or its interrelated or independent actions, and the effect is not discountable, insignificant, or interdependent actions, or beneficial. In the event the overall effect of the proposed action is beneficial to the listed species, but is also likely to cause some adverse effects, then the proposed action “is likely to adversely affect” the listed species. If incidental take is anticipated to occur as a result of the proposed action, then an “is likely to adversely affect” determination should be made.

Is likely to jeopardize proposed species – the appropriate conclusion when the action agency or the USFWS determines that the proposed action is likely to jeopardize the proposed species or adversely modify the proposed critical habitat.

If the BA concludes that the project “is not likely to adversely affect” listed species or critical habitat, the lead federal agencies (USACE and Forest Service) have the discretion to choose either informal or formal consultation. If informal consultation is chosen, the agency asks for written concurrence by the USFWS for the

CONSULTATION

BA's conclusion. Informal consultation is complete if a concurrence letter is obtained from the USFWS. If the BA concludes that the project is "likely to adversely affect" listed species or critical habitat, the agency must request formal consultation. When formal consultation is requested by the agency, the USFWS prepares and issues a Biological Opinion (BO), which completes the consultation. For proposed species, if the BA determines that the project is "likely to jeopardize a proposed species," the agency must request a conference with the USFWS.

Using information obtained in the BA, the USFWS will provide an opinion in the BO on whether the Project is: 1) "likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of critical habitat" (a "jeopardy" biological opinion), or 2) "not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of critical habitat" (a "no jeopardy" biological opinion). If the USFWS issues a "jeopardy" opinion, it must include any "reasonable and prudent alternatives" to the project that would avoid jeopardy. If the USFWS issues a "no jeopardy" opinion, it may include discretionary "conservation recommendations," which are steps the USFWS believes could be taken to further minimize potential effects on listed species or critical habitat.

3.0 Description of the Proposed Action

3.1 Overview

The USACE and the USFS have separate proposed actions on which consultation is occurring. The USACE has an application under the Clean Water Act to impact wetlands and other waters of the U.S. associated with the construction and operation of the NorthMet mine. The USFS is evaluating a land exchange of federal and non-federal lands. For convenience, the impacts are described in terms of the Project and its associated activities.

PolyMet proposes to construct an open pit mine in northern Minnesota to extract low- to medium-quality copper-nickel-PGE minerals with low sulfide content. This Project is located in Sections 5, 6, 8, 9, 13, 14, 15, 16, 17, 23, and 24, Township 58 North, Range 14 West; Sections 1, 2, 3, 4, 9, 10, 11, 12, 15, 16, 17, and 18, Township 59 North, Range 13 West; Sections 3, 4, 5, 8, 9, 10, 11, 13, 14, 15, 16, 17, 20, 23, 24, 29, and 32, Township 59 North, Range 14 West; and Sections 32, 33, and 34, Township 60 North, Range 14 West, in St. Louis County on the eastern end of the Mesabi Iron Range, about 60 miles north of the City of Duluth, and 6 miles south of the City of Babbitt, Minnesota (**Figure 3**).

This section describes specific Project features that could have effects on lynx, wolf, northern long-eared bat, and lynx and wolf critical habitat. Additional Project features that are not relevant to potential effects on lynx or wolf and their critical habitats are listed in this section, but are not described in detail. Full Project details are available in the FEIS (MDNR et al. 2013).

Ore would be excavated at the Mine Site and hauled by railroad approximately 8 miles west to the Plant Site for processing. Corridors for roads, railroad, utilities, and water pipelines would connect the Mine Site and the Plant Site. The four Project areas are shown on **Figure 3** and include:

- Mine Site
- Plant Site
- Dunka Road and Utility Corridor
- Railroad Connection Corridor

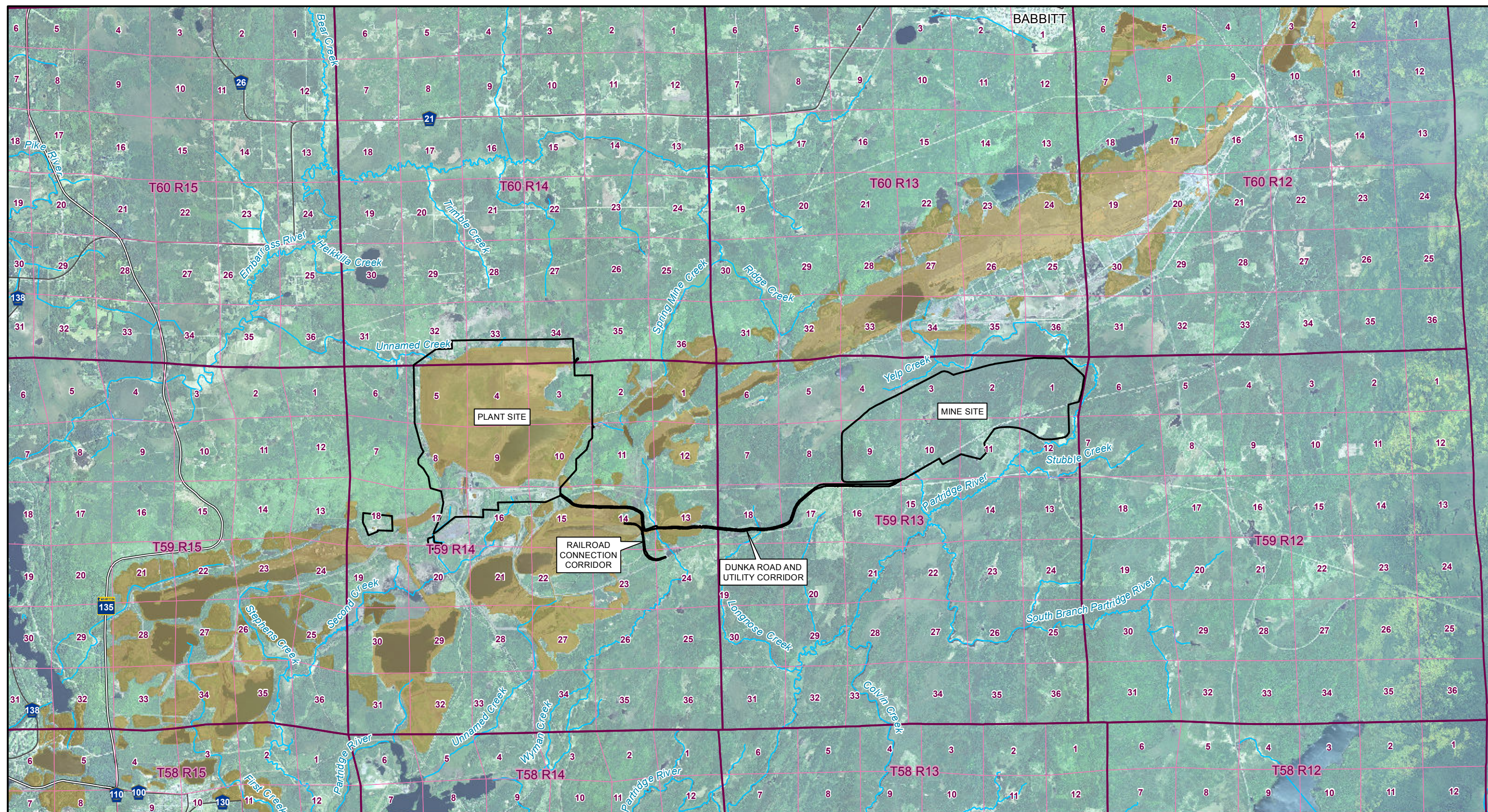
3.2 Mine Site

The Mine Site, approximately 3,015 acres, would be developed at a greenfield site that has previous disturbance from logging and mining exploration activities. The Project would develop open mine pits (up to 528 acres), stockpiles (up to 794 acres), and supporting infrastructure (up to 397 acres). The location and dimensions of Mine Site features are shown on **Figure 4**. The Project features at the Mine Site would include:

- mine pits;
- ore storage and handling facilities, including an Ore Surge Pile and a Rail Transfer Hopper;

DESCRIPTION OF THE PROPOSED ACTION

- stockpiles for overburden and waste rock with engineered systems to manage potential water resource impacts (such as liners, covers, and the Category 1 Waste Rock Stockpile Groundwater Containment System);
- a Waste Water Treatment Facility and process water collection systems to collect and treat water from the mine pits, waste rock stockpiles, ore handling facilities, and haul roads,



- Project Areas
- Township Lines
- Section Lines
- Mesabi Range (existing mine pits, tailings basins, stockpiles and other mine features)
- Rivers & Streams

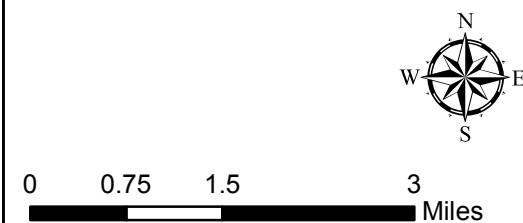
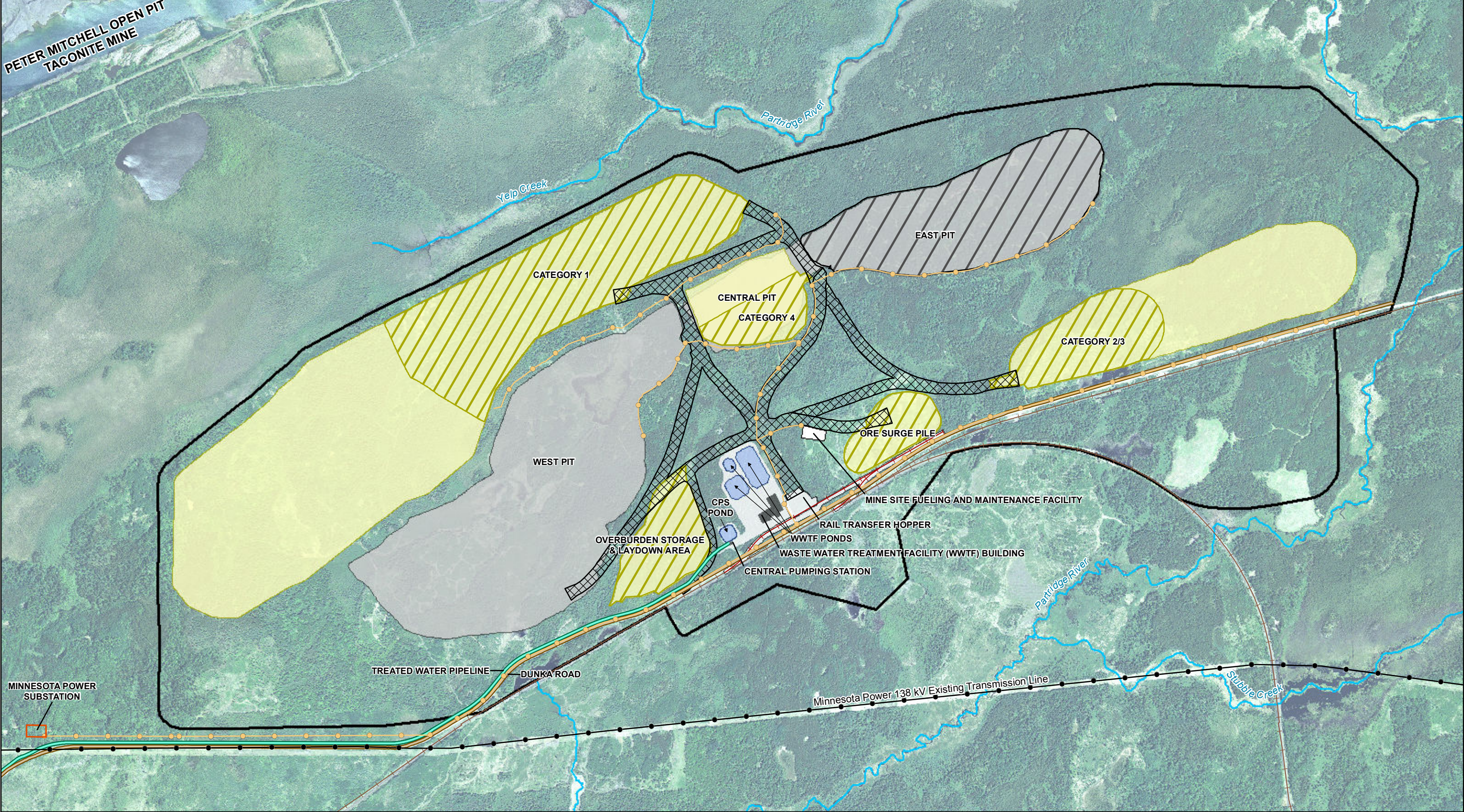


Figure 3
Iron Range and Project Site
 Biological Assessment for the NorthMet Project and Land Exchange
 St. Louis County, Minnesota



Mine Site	Haul Roads
Year 1 Mine Pits	Treated Water Pipeline
Year 11 Mine Pits	Dunka Road
Year 1 Stockpiles	Existing Private Railroad
Year 11 Stockpiles	Proposed Railroad Track

Figure 4
Mine Site Plan
Biological Assessment for the NorthMet Project and Land Exchange
St. Louis County, Minnesota

- a Central Pumping Station and Treated Water Pipeline to transport water from the Mine Site to the Plant Site; and
- supporting infrastructure (such as roads, electrical supply, rail connections, and fueling and maintenance facilities).

3.2.1 Pre-production Mine Development

Mine Site infrastructure would be constructed during the estimated 12 to 18 months of pre-production mine development. Pre-production mine development would be followed by a gradual ramp-up of ore output over 6 to 12 months. The following Project features would be constructed during pre-production mine development:

- Roads - site access roads, haul roads, and Dunka Road upgrades.
- Railroad infrastructure - the Rail Transfer Hopper, the rail spur connecting the Rail Transfer Hopper with Cliffs Erie railroad track, and the rail spur between the Cliffs Erie railroad track and PolyMet railroad track that serves the Coarse Crusher Building.
- Surface water management features – dikes, ditches, water collection ponds, and sumps.
- Overburden Storage and Laydown Area.
- Stockpile liners and containment systems.
- Waste Water Treatment Facility, Treated Water Pipeline, and Central Pumping Station.
- Substation drop from the 138 kilovolt (kV) Minnesota Power transmission line and a 13.8 kV Mine Site power distribution system.
- Mine Site Fueling and Maintenance Facility.

3.2.2 Mining Activities

PolyMet expects to mine a total of 533 million tons of waste rock and ore over 20 years, which would include 225 million tons of ore and 308 million tons of waste rock. Mining activities include overburden removal, open pit mining, drilling and blasting, excavation and haulage, ore storage and loading for transport to the Process Plant, waste rock stockpiling, and mine site water management.

3.2.2.1 Overburden Removal

The marketable timber would be cleared and the overburden removed from the footprints of the mine pits, the Ore Surge Pile, and the waste rock stockpiles, as necessary. PolyMet would follow the USFWS northern long-eared bat interim guidance for tree removal (USFWS 2014).

Overburden, which has been defined for this Project as the material that lies on top of bedrock, would be stripped incrementally as needed for mine development in order to minimize the amount of bedrock exposed at any one time. After removal of overburden from the initial mining area, additional overburden stripping could take place concurrently with the mining of ore and waste rock. Approximately 32% of the required overburden

DESCRIPTION OF THE PROPOSED ACTION

stripping for the pit development would be done in the first 2 years of mine operation. All of the overburden that needs to be stripped from the pits would be removed by the end of Mine Year 11.

3.2.2.2 Open Pit Mining

The Project would use open pit mining methods similar to those used at ferrous metallic mining operations on the Iron Range. The mine would consist of three separate open pits known as the East, Central, and West pits. For approximately the first 10 years of operations, mining would take place in the East and West pits simultaneously, with the East Pit mining ending in Mine Year 11. The Central Pit mining would occur between Mine Years 11 and 16. During Central Pit mining, the East and Central pits would converge into one pit which would then be referred to as the East Pit.

At its maximum size, each pit is projected to have the approximate maximum area and depth shown in **Table 1**.

Table 1
Maximum Pit Dimensions

Mine Pit	Area (acres)	Maximum Depth (feet below ground surface)
East	155	696
Central	52	356
West	321	630

Drilling and blasting would be conducted to remove waste rock and extract ore. Two conventional electric or diesel powered rotary drilling rigs would be used. Blasting of ore and waste rock is anticipated to take place approximately every 2 to 3 days.

After being drilled and blasted, the ore would be loaded by excavators into haul trucks that would haul the ore to the Rail Transfer Hopper or to the Ore Surge Pile for temporary storage and haul the waste rock to the stockpiles or the East Pit. Up to nine haul trucks would be in service with a maximum speed of 34 miles per hour loaded, however their speed would typically be lower.

Mining operations would be supported by mine auxiliary vehicles (for example [e.g.], water trucks, dozers, graders) traveling on access and haul roads within the Mine Site.

3.2.2.3 Ore Storage and Loading

Ore would be loaded for transport to the Plant Site at the Rail Transfer Hopper. The Rail Transfer Hopper would consist of a raised platform from which haul trucks dump into a hopper over a pan feeder into rail cars. The Rail Transfer Hopper would be located to the south of the mine pits and would be connected to the existing Cliffs Erie main line track by a new spur line (**Figure 4**).

An Ore Surge Pile would be constructed adjacent to the Rail Transfer Hopper to allow for temporary storage of ore until it could fit into the processing schedule or as required by operational delays. Drainage from the Ore Surge Pile would be collected on a liner and routed to a sump for pumping to the Waste Water Treatment Facility.

3.2.2.4 Stockpiling

Waste rock and overburden would be managed according to its geochemical properties as determined using a sampling and analysis program approved by the MDNR. PolyMet has categorized waste rock into four categories defined according to its sulfur content, in ascending order of reactivity. These waste rock categories are summarized in **Table 2**.

The Category 1 Waste Rock Stockpile would be the only permanent stockpile for the Project. During Mine Years 1 through 11, Category 2, 3 and 4 waste rock would be placed on the temporary Category 2/3 or Category 4 Waste Rock Stockpiles (**Figure 4**). When at its maximum size, each stockpile is projected to have the approximate area, height, and elevation shown in **Table 3**.

Table 2
Waste Rock Properties

Waste Rock Categorization	Sulfur Content (percent) ¹	Approximate Percent of Total Waste Rock Produced during Mining (percent)
Category 1	≤ 0.12	70
Category 2	> 0.12 to ≤ 0.31	24
Category 3	> 0.31 to ≤ 0.60	3
Category 4	> 0.6	3

¹In general, the higher the rock's sulfur content, the higher it's potential for generating acid rock drainage or leaching heavy metals.

Table 3
Maximum Stockpile Dimensions - Approximate

Stockpile	Mine Year of Maximum Footprint	Maximum Footprint (acres)	Maximum Height (feet)	Maximum Elevation (feet above sea level)
Category 1 waste rock	6/21 ¹	508/526 ¹	280	1,880
Category 2/3 waste rock	6	180	200	1,770
Category 4 waste rock	3	57	180	1,790
Ore Surge Pile	NA ²	31	120	1,690

¹The Category 1 Waste Rock Stockpile has a maximum footprint of 508 acres while active. It would reach this size by Mine Year 6. The stockpile would be re-graded as part of reclamation with a final footprint of 526 acres.

²The Ore Surge Pile would have ore moving in and out as needed to meet mine and plant operations.

All waste rock stockpiles would be engineered to manage water resource impacts. The temporary Category 2/3 and Category 4 Waste Rock Stockpiles, which have the potential to generate acid rock drainage, would have liner systems to capture water passing through the stockpile. The permanent Category 1 Waste Rock Stockpile, which does not have the potential to generate acid rock drainage, would be constructed with a groundwater containment system to collect stockpile drainage from around the entire stockpile.

3.2.2.5 Progressive Reclamation

Reclamation of the East Pit and the temporary waste rock stockpiles would begin during operations. The temporary Category 2/3 and Category 4 Waste Rock Stockpiles would be relocated to the East Pit starting in

DESCRIPTION OF THE PROPOSED ACTION

Mine Year 11. The infrastructure associated with the temporary stockpiles (pipes, pumps, liners, et cetera [etc.]) would be removed and the footprint of each area would be reclaimed.

After the temporary stockpiles are reclaimed, all future Category 2, 3, and 4 waste rock would be placed in the East Pit. Most of the Category 1 waste rock mined after Mine Year 12 would also be placed in the East Pit. Ultimately, approximately 45% of the total waste rock mined would be backfilled to the East Pit.

The East Pit would be flooded to keep the waste rock in a subaqueous environment to reduce the environmental impact associated with further oxidation and dissolution of sulfide minerals. If natural inflow of water into the East Pit is insufficient to keep the waste rock submerged, water could be pumped from the Waste Water Treatment Facility. During periods of high precipitation or during spring snowmelt, dewatering (to the Waste Water Treatment Facility and ultimately to the Flotation Tailings Basin) may be required to allow safe placement of the waste rock.

Reclamation of the Category 1 Waste Rock Stockpile would also begin during operations. A cover system would be added incrementally after Mine Year 13 to limit infiltration through the stockpile. The stockpile would be sloped and graded, an engineered geomembrane system would be installed, soil would be placed on top of the cover, and vegetation would be planted to meet the requirements of Minnesota Rules, part 6132.2200, subpart 2, item B. The cover system would be designed to promote runoff with minimal erosion.

3.2.2.6 Mine Site Water Management

This section summarizes information from the Water Management Plan - Mine, which would become part of the MDNR Permit to Mine and Water Appropriations permits and Minnesota Pollution Control Agency (MPCA) National Pollutant Discharge Elimination System/State Disposal System permit. These plans include water management system designs, operating and maintenance plans, water quality monitoring plans, reporting requirements, and adaptive management approach.

In addition to the stockpile liners, the stockpile cover, and the groundwater containment system, water management at the Mine Site would include pit dewatering, stormwater dikes and ditches, and the Waste Water Treatment Facility that would treat water that comes in contact with mining features. During operations, there would be no direct discharge of treated waste water to public waters.

It would be necessary to dewater the pits during mining to remove groundwater flow and precipitation runoff. These waters would be directed to low areas in the pits where it would be collected in sumps and pumped to the Waste Water Treatment Facility.

Non-contact stormwater, the result of precipitation that falls on natural or reclaimed vegetated surfaces, would be routed through sedimentation ponds prior to discharge to a small watercourse that flows to the Partridge River. A system of dikes and ditches constructed at the Mine Site perimeter would minimize the amount of surface water flowing onto the site and into the mine pits, manage the amount of water that comes into contact with mining features, and control non-contact stormwater flowing off the site.

During operations, the Waste Water Treatment Facility would treat water that comes into contact with the waste rock stockpiles, haul roads, Ore Surge Pile, and mine pits. For the first approximately 10 years, all Waste Water Treatment Facility effluent would be pumped to the Plant Site Flotation Tailings Basin Pond for reuse in the beneficiation process. Reuse of the Mine Site process water at the Plant Site would eliminate the

need to discharge any process water to surface waters during operations. Starting in Mine Year 11, some Waste Water Treatment Facility effluent would be sent to the East Pit to augment flooding as the pit is backfilled, with the remainder of the effluent continuing to go to the Flotation Tailings Basin. The purpose of the Waste Water Treatment Facility is to maintain water quality in the Flotation Tailings Basin pond at concentrations that do not have an adverse impact on Beneficiation Plant operations or future reclamation of the Flotation Tailings Basin.

Mine Site water would be managed in accordance with a future MPCA National Pollutant Discharge Elimination System/State Disposal System permit, which would include a Stormwater Pollution Prevention Plan (SWPPP). The SWPPP would identify and describe Best Management Practices for the Mine Site to minimize the discharge of potential pollutants in stormwater runoff.

3.2.3 Fueling and Maintenance Facilities

The Mine Site Fueling and Maintenance Facility would consist of two buildings, one for fueling mobile equipment, and one for minor service and repair of mobile equipment. Major scheduled maintenance and repair work lasting several days on most mobile equipment would be done in the refurbished and reactivated former LTVSMC Area 1 Shop. Stationary or slow-moving equipment such as excavators, dozers, drill rigs, and light plants would be fueled in the field using mobile fuel tankers.

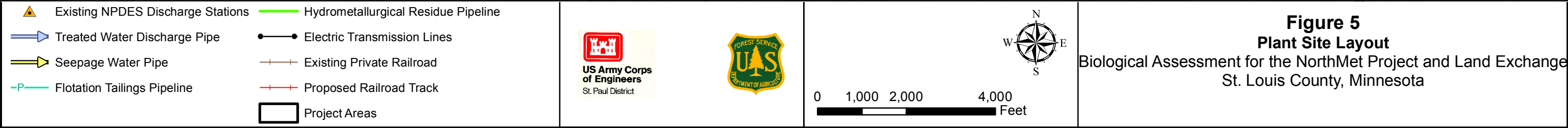
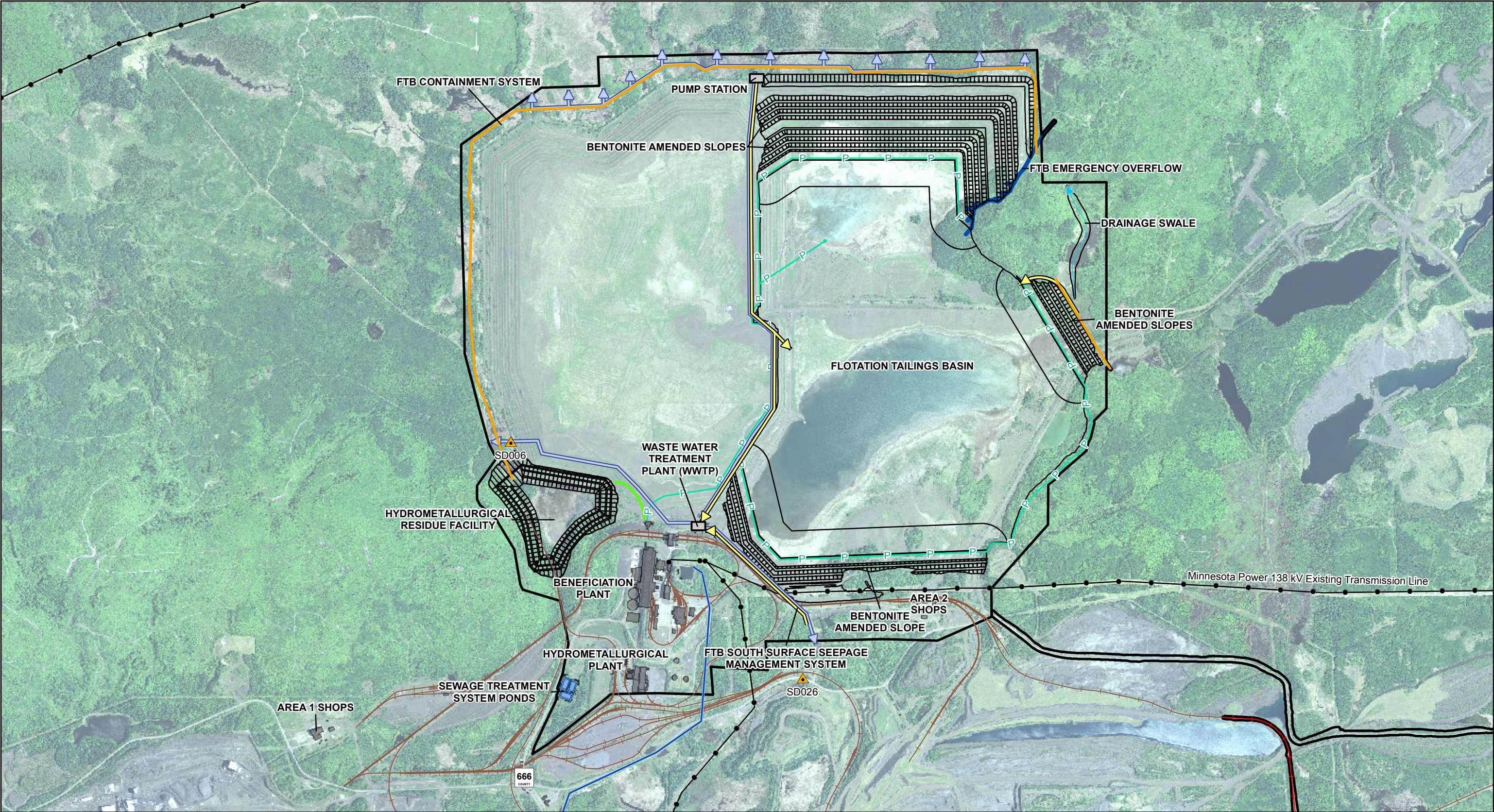
The former LTVSMC Area 2 Shop, about 1 mile east of the Process Plant, would be reactivated to provide office space for mining and railroad operations supervision and management, as well as clothes changing facilities, toilets, lunch rooms, first aid facility, emergency response center, and training and meeting rooms for mining and railroad crews. The Area 2 Shop facilities would include a Locomotive Fueling Station, Locomotive Service Building, and Mine Reporting Building.

3.3 Plant Site

The Plant Site was previously used as a taconite processing facility by the LTVSMC. The location and dimensions of Plant Site features are shown on **Figure 5**.

At the Plant Site, the Project would upgrade existing facilities (Beneficiation Plant, Tailings Basin, Area 1 Shop, sewage collection system, rail connections, access roads) and construct new facilities (Hydrometallurgical Plant, Hydrometallurgical Residue Facility, Concentrate Dewatering/Storage Building, Sewage Treatment System Ponds, and Waste Water Treatment Plant) within a brownfield facility. The Flotation Tailings would be stored atop the existing LTVSMC Tailings Basin by staged construction of new dams. The Plant Site also includes supporting infrastructure (e.g., roads, electrical supply, rail connections, Area 1 Shop, and Area 2 Shop).

Plant Site environmental controls would include cover systems to limit infiltration of oxygen and water through the Flotation Tailings Basin dams, beaches, and pond bottom and seepage capture systems to collect seepage from the Flotation Tailings Basin. Most water used in processing would be recycled for use. A Waste Water Treatment Plant would be constructed, including reverse osmosis or similar membrane separation technology, to treat any water that could not be recycled prior to discharge to the environment. If makeup water is needed for processing, it may be provided via the Colby Lake Water Pipeline. No new construction is required for the Colby Lake Water Pipeline.



3.3.1 Ore Processing

A Beneficiation Plant and Hydrometallurgical Plant would process the ore at the Plant Site to recover base metals, gold, and platinum group metals. The purpose of the beneficiation process would be to produce final separate concentrates. One of the separate concentrates would be a copper concentrate. The other separate concentrates would be differing grades of nickel concentrate. The concentrates could be shipped to customers, used as a feedstock to the hydrometallurgical process, or divided for both uses. PolyMet expects that the Beneficiation Plant would be operational several years before the Hydrometallurgical Plant and during that period all concentrates would be shipped to customers. Once the Hydrometallurgical Plant becomes operational, some or all of the nickel concentrates would be feedstock to the hydrometallurgical process. The decision to ship or process concentrates would be based on equipment maintenance schedules, customer requirements, and overall Project economics.

3.3.1.1 Beneficiation Plant

The Beneficiation Plant processes would include ore crushing, grinding, flotation, dewatering, storage, and shipping. Crushing and grinding would occur in the existing Coarse Crusher Building, Fine Crusher Building, and Concentrator Building. Flotation would occur in a new Flotation Building located on previously disturbed ground immediately to the west of the Concentrator Building. Dewatering, storage, and shipping would occur in a new Concentrate Dewatering/Storage Building located on previously disturbed ground.

3.3.1.2 Hydrometallurgical Plant

Hydrometallurgical processing technology would be used for the treatment of nickel concentrates. This process would involve high pressure and temperature autoclave leaching followed by solution purification steps to extract and isolate platinum group metals, precious metals, and base metals. All equipment used in the hydrometallurgical process would be located in a new Hydrometallurgical Plant Building. Should spillage of process fluids occur, it would remain within the Hydrometallurgical Plant Building and be returned to the appropriate process streams.

3.3.1.3 Plant Site Infrastructure

Plant Site infrastructure that exists at this site includes:

- County Road 666 ends at the Main Gate for the industrial area that includes the Process Plant, Area 1 Shop, and Area 2 Shop.
- The Canadian National Railroad serves the industrial area that would include the Process Plant. The PolyMet railroad would connect to the Area 1 Shop and the Area 2 Shop.
- Three Minnesota Power Company 138 kV transmission lines serve the Project substation.
- The existing mechanical Sewage Treatment Plant would be replaced with new Sewage Treatment System Ponds, and the existing sewage collection system would be upgraded to meet current construction and performance standards and sized as appropriate.

- The Process Plant potable water treatment plant located near the Plant Reservoir would be refurbished and reactivated. The potable water distribution system extends to the Area 1 Shop and Area 2 Shop. This water would be used for showers and sinks and would be treated (chlorinated) to be drinkable. However, bottled water would be brought in for drinking as well.
- Area 1 Shop and Area 2 Shop.

3.3.2 Flotation Tailings Basin

Flotation Tailings from the flotation process at the Beneficiation Plant would be pumped to the Flotation Tailings Basin, which would be constructed on top of cells 1E and 2E of the existing LTVSMC Tailings Basin. Treated water from the Waste Water Treatment Facility would also be pumped to the Flotation Tailings Basin, enabling it to serve as the primary collection and distribution point for water used in the beneficiation process.

The existing LTVSMC Tailings Basin is unlined and was constructed in stages beginning in the 1950s. It has been inactive since January 2001, except for reclamation activities consistent with a MDNR-approved Closure Plan currently managed by Cliffs Erie.

The future Flotation Tailings Basin perimeter dams would be raised using upstream construction methods. The dams would be constructed using compacted LTVSMC tailings borrowed from the existing Tailings Basin. Once the LTVSMC tailings supply has been completely used for dam construction, offsite borrow from MDNR-approved sources would be utilized. Material from LTVSMC Area 5 would be a likely source, but other sources could also be considered.

Emergency overflow channels would be provided to protect the dams in the unlikely event that freeboard within the Flotation Tailings Basin is not sufficient to contain all water from an extreme storm event. Even though there is a low likelihood of overflow, it is standard practice in dam design to accommodate overflows in a manner that protects the integrity of the dams.

Seepage from the Flotation Tailings Basin would be collected by the Flotation Tailings Basin Containment System located around the northern, western, and portions of the eastern sides of the Tailings Basin and the Flotation Tailings Basin South Surface Seepage Management System located south of Tailings Basin Cell 1E. These two systems are collectively referred to as the Flotation Tailings Basin seepage capture systems. The Flotation Tailings Basin Containment System would include a low permeability cutoff wall so that it can collect seepage (from up-gradient), but avoid drawing in water from down-gradient wetlands.

3.3.3 Hydrometallurgical Residue Facility

The Hydrometallurgical Residue Facility would be constructed to manage residues generated by the hydrometallurgical process. The Hydrometallurgical Residue Facility would consist of one-lined cell located adjacent to the southwest corner of Tailings Basin, on previously disturbed ground (**Figure 5**).

The Hydrometallurgical Residue Facility liner system would be a double liner system consisting of two barrier layers separated by a leakage collection layer. This system would substantially remove all hydraulic head from the lower liner, virtually eliminating leakage from the Hydrometallurgical Residue Facility.

Residue from the Hydrometallurgical Plant would be pumped to the Hydrometallurgical Residue Facility as slurry. A pond would be maintained within the Hydrometallurgical Residue Facility so that the solids in the slurry would settle out. Most of the liquid would be recovered by a pump system and returned to the plant for reuse.

3.3.4 Plant Site Water Management

This section summarizes information from the Water Management Plan - Plant, which is a support document for the MDNR Permit to Mine and Water Appropriations permits and MPCA National Pollutant Discharge Elimination System/State Disposal System permit. These plans include water management system designs, operating and maintenance plans, preliminary water quality monitoring plans, preliminary reporting requirements, and adaptive management approach. Final water quality monitoring and reporting requirements would be determined in the permits.

Water management features at the Plant Site would include the Flotation Tailings Basin and seepage capture systems, Hydrometallurgical Residue Facility, stormwater dikes and ditches, drainage swale, Waste Water Treatment Plant, and stream augmentation. With the exception of the Flotation Tailings Basin seepage containment system, all Plant Site water management features would be located on previously disturbed areas.

3.3.4.1 Waste Water Treatment Plant

The Waste Water Treatment Plant would treat any water collected by the Flotation Tailings Basin seepage capture systems that cannot be reused as process water. It would include a reverse osmosis unit, or similar membrane separation technology, designed to achieve an effluent sulfate concentration that meets the sulfate standard for waters used for the production of wild rice (10 milligrams per liter (mg/l)). Water would be treated to meet appropriate discharge limits, then discharged along the west, northwest, and north perimeter of the Flotation Tailings Basin, beyond the Flotation Tailings Basin Containment System, and to Second Creek at the south end of the Flotation Tailings Basin to replenish the flow to the surrounding wetlands and streams. This discharge strategy would limit the potential for indirect wetland impacts due to reduced seepage from the Tailings Basin to the wetlands.

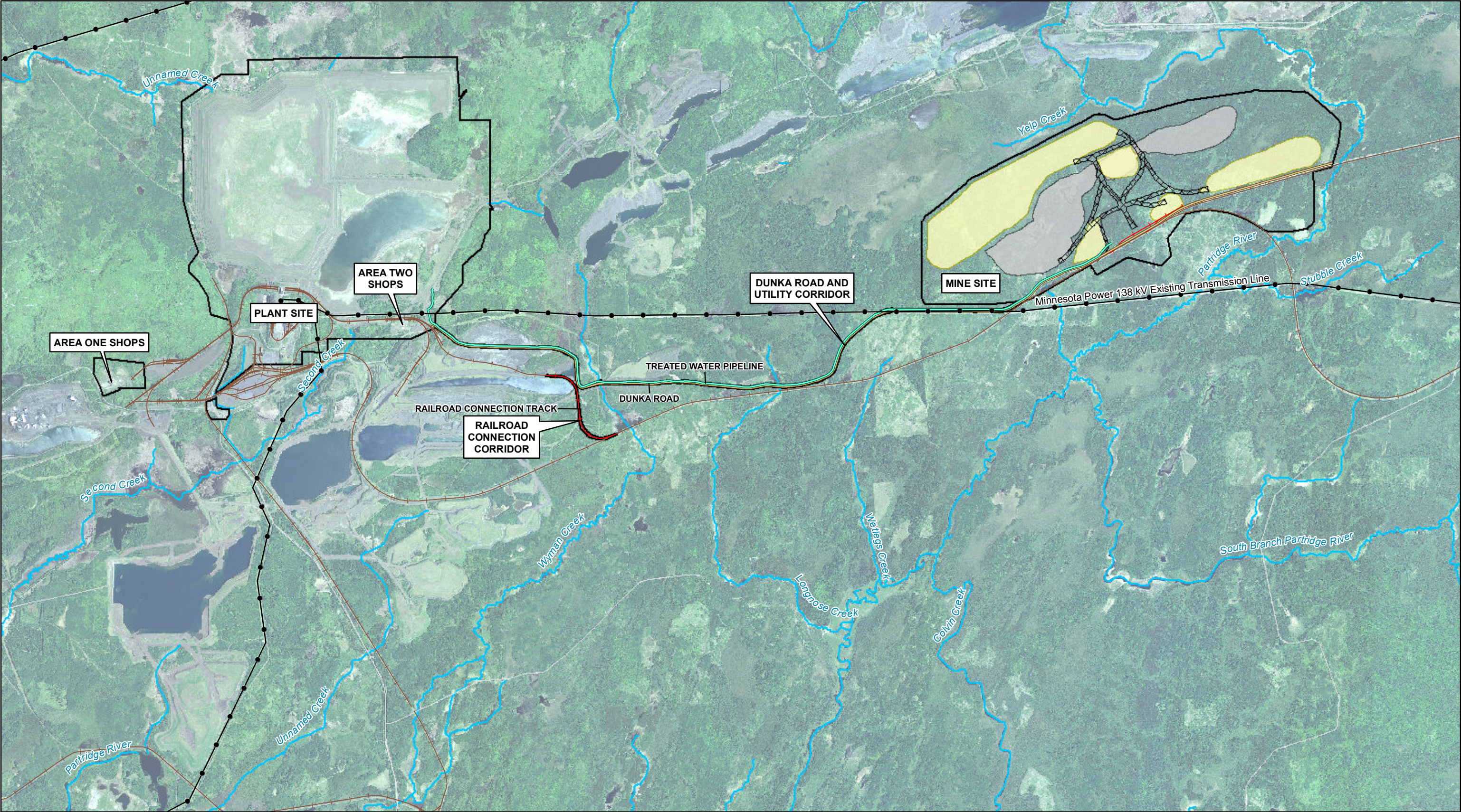
3.3.4.2 Stream Augmentation

Construction of the Flotation Tailings Basin Containment System would reduce the amount of seepage that is currently leaving the existing Tailings Basin. Consequently, the stream flow in the four tributaries around the Tailings Basin (Unnamed Creek, Second Creek, Trimble Creek, and Mud Lake Creek) would be reduced from current levels. Flow to Unnamed Creek, Second Creek, and Trimble Creek would be augmented by treated water from the Waste Water Treatment Plant. Flow to Mud Lake Creek would be augmented by construction of a drainage swale east of the Flotation Tailings Basin.

3.4 Transportation and Utility Corridors

The remaining Project components are linear corridor features, including the following (**Figure 6**):

- Dunka Road and Utility Corridor
- Railroad Connection Corridor



<ul style="list-style-type: none">Treated Water PipelineDunka RoadExisting Private RailroadProposed Railroad TrackElectric Transmission Lines	<ul style="list-style-type: none">Project AreasStockpilesMine PitsHaul Roads	 		<p>Figure 6 Transportation and Utility Corridor Biological Assessment for the NorthMet Project and Land Exchange St. Louis County, Minnesota</p>
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This section describes Project features in the Transportation and Utility Corridors and presents information on the types of traffic that would result from the Project.

3.4.1 Dunka Road and Utility Corridor

Dunka Road is an existing, compacted-gravel, private road that extends from near the LTVSMC Plant Site to the Mine Site, then continues roughly northeast toward Babbitt, Minnesota. The portion of Dunka Road that connects the Plant Site to the Mine Site would be widened. The Treated Water Pipeline would be constructed parallel and adjacent to the Dunka Road in the Utility Corridor to transport treated water from the Mine Site to the Plant Site. The distance along Dunka Road from the Plant Site gate to the Mine Site gate is approximately 6.4 miles. Including the road segments located within the Plant Site and the Mine Site, the total distance from the ore processing area at the Plant Site to the ore loading area at the Mine Site is approximately 8.5 miles.

Traffic on Dunka Road would include light trucks and automobiles, sport utility vehicles (SUVs), fuel trucks, supply and waste trucks, and haul trucks needing maintenance.

- Automobiles, light trucks, or SUVs transporting employees would travel between the Area 2 Shops and the Mine Site each day, at speeds of 30 to 45 miles per hour.
- Trucks carrying fuel and blasting agents would travel to the Mine Site every day, at speeds of 25 to 40 miles per hour. These trucks would travel from County Highway 666 to Dunka Road.
- Trucks transporting supplies and waste to and from the Waste Water Treatment Plant and the Waste Water Treatment facility would travel between the Plant Site and the Mine Site each day, at speeds of 25 to 40 miles per hour.
- Haul trucks would travel from the Mine Site to the Area 1 Shop for maintenance occasionally, at a maximum speed of 35 miles per hour.

3.4.2 Railroad Connection Corridor

The railroad route from the Mine Site to the Plant Site would be from a new spur at the Rail Transfer Hopper, to the existing track on the Cliffs Erie private railroad, to a new approximately 1.1 mile connecting railroad track between the Cliffs Erie railroad track and existing PolyMet track railroad that serves the Coarse Crusher Building at the Process Plant (**Figure 6**).

Each ore train would consist of 16 to 20 100-ton side dumping ore cars and one diesel-electric “Gen-Set” or “Multi-Engine” locomotive. Ore trains would make approximately 22 roundtrips per day delivering ore from the Mine Site to the Plant Site, traveling between 15 to 25 miles per hour.

To minimize the amount of ore that escapes from rail cars, ore would be loaded into the center of the car so that fines would be located at the center of the car and the larger ore pieces would be at the edge. The result would be that fines would be kept from reaching the edge of the car where they would be subject to spillage through the hinge gaps. Large pieces that extend over the edge of the rail car would be pushed into the center of the car using a rubber-tired dozer or a front-end loader. In the event that a large ore piece would fall over the top edge of the cars during transit, it would be recovered during routine track maintenance.

In order to guard against possible adverse impacts from spilled ore, monitoring and mitigation activities can be developed. It is expected that the surface water quality sampling in the two streams traversed by the rail line would be included in permit monitoring. Mitigation measures could include alterations to the stream crossings (bridges or culverts) to collect any spilled material or the physical collection of spilled ore from the top of the rail ballast.

3.5 Traffic

Transportation of Project consumables and products would result in traffic on public roads and commercial railroads. Public roads would also have additional traffic from employees and service providers.

3.5.1 Transport of Consumables and Products

Process consumables and products would be transported to and from the Plant Site by truck and rail. This section describes the traffic on public roads and commercial railroad lines that would result from the Project.

Trucks transporting raw materials needed for the beneficiation process and the hydrometallurgical process would make approximately 80 round trips per month, entering the Plant Site from Highway 135. Trucks transporting copper and nickel concentrates would make up to approximately four round trips per day, also entering the Plant Site from Highway 135.

A locomotive, similar to the locomotives that would be hauling ore from the Mine Site to the Plant Site, would transfer loaded and empty cars carrying process consumables and concentrates to and from the interchange location with the Canadian National Railroad. Cars carrying process consumables and concentrate would meet railroad common carrier requirements.

Product shipment would require an approximately 100-car train once per month and a 30-car train 4 times per month, year-round. Process consumables would require an approximately 100-car train once per week, April through October. It is expected that outgoing PolyMet products would go by rail from the Plant Site to Virginia, Minnesota, with about half going south to Duluth, Minnesota, and the other half going north to International Falls, Minnesota. Product transport beyond Virginia is likely to be a part of the existing commercial rail traffic, with limited potential to generate additional commercial train trips. Process consumables would arrive at the Plant Site from the south from Duluth through Virginia. This movement is likely to be a part of the existing commercial rail traffic, with limited potential to generate additional commercial train trips.

3.5.2 Traffic from Employees and Service Providers

The Project would employ as many as 500 full-time workers over an 18-month period during peak construction period, and about 360 full-time workers during operation. There would be approximately 38 employee vehicles per day and 4 service vehicles per day entering the Main Gate (from County Road 666). In addition, there would be approximately 113 employee vehicles per day and 36 service vehicles per day entering the North Gate (from Highway 135).

3.6 Project Reclamation

Mining is expected to be completed approximately 20 years after operations begin. This section summarizes information from the Reclamation Plan, which is a support document for the MDNR Permit to Mine, and focuses on those aspects of Project Reclamation that have potential effects on lynx, northern long-eared bat, and wolf. Additional information on Project reclamation is available in the FEIS (MDNR et al. 2015).

In general, Project facilities have been designed and would be operated to allow for progressive reclamation, or “mining in a manner that creates areas that can be reclaimed as soon after initiation of the operation as practical and as continuously as practical throughout the life of operation” (Minnesota Rules, part 6132.0100). This would leave a smaller portion of the Project area needing to be reclaimed after closure. Project features that would be progressively reclaimed include the Waste Rock Stockpiles, the East Pit, the exterior slopes of the Flotation Tailings Basin, and the Hydrometallurgical Residue Facility. The Waste Water Treatment Facility and the Waste Water Treatment Plant would remain operative during reclamation and long-term closure⁵.

3.6.1 Building and Structure Demolition and Equipment Removal

The buildings and structures would be removed and foundations razed. All mining, dewatering, and electrical equipment would be removed from the mine pit and scrapped, decommissioned, or sold. Debris and equipment would be removed from the Mine Site and Plant Site. Most roads, parking areas, or storage pads built to access these facilities would be demolished. Utility tunnels would be sealed and reclaimed in place. After demolition, these areas would be reclaimed and vegetated according to Minnesota Rules, part 6132.2700. All areas would be stabilized as required for stormwater management.

Demolition waste from structure removal would be disposed of in the existing on-site demolition landfill located northwest of the Area 1 Shop. Most concrete from demolition would be crushed and used for structural fill, placed in the basements of the Plant Site buildings, or placed in the existing on-site industrial landfill. Asphalt from paved surfaces would be removed and recycled or properly disposed of. Railroad track and ties that were not used by common carriers would be removed and recycled. All disturbed areas would be reclaimed and vegetated.

Any roads, including Mine Site access roads that may develop into unofficial off-road vehicle trails, would require a variance from MDNR reclamation rules to allow a 15-foot-wide unpaved, unvegetated track down the centerline of the road. Such approvals would also be coordinated with the St. Louis County Mine Inspector’s Office.

Special materials would be disposed of appropriately during reclamation:

- Any ore remaining in the Rail Transfer Hopper, the Ore Surge Pile, or anywhere else in the vicinity of the Rail Transfer Hopper, as well as sediment removed from ditches and process

⁵ “Long-term closure” is defined as being the time period when the West Pit has filled with water and the Waste Water Treatment Facility is discharging water to the outlet channel to the Upper Partridge River. This will likely occur during the post-closure maintenance period of reclamation.

water ponds, would be placed in the East Pit.

- Asbestos-containing materials would be removed intact, properly packaged, and disposed of in the on-site demolition landfill. The locations of asbestos-containing materials in the landfill would be noted on the property deed. Any asbestos-containing materials found in utility tunnels would be sealed before the utility tunnel is sealed.
- Fluorescent and sodium halide bulbs, nuclear sources, oil-stained concrete, and partially used paint, chemical, and petroleum products would be removed and recycled or properly disposed of.
- Any materials remaining in storage tanks would be sent to appropriate recycling or waste disposal facility. All storage tanks would be cleaned, disassembled, and recycled or disposed of appropriately. Tank foundations would be removed and all disturbed areas would be vegetated.
- Material remaining in the equipment and process piping would be properly disposed of in the Hydrometallurgical Residue Facility or other MPCA-approved locations.
- On-site sewer and water systems, powerlines, pipelines, and culverts would be closed according to regulatory requirements.

3.6.2 Reclamation of Mine Site

Mine Site reclamation would include building and structure demolition and equipment removal, mine pit reclamation, stockpile reclamation and watershed restoration. Mine Site reclamation would begin as soon as practical throughout mining operations, with reclamation of the East Pit and Waste Rock Stockpiles commencing before mining activities cease.

3.6.2.1 Mine Pit Reclamation

Mine pit reclamation would include pit flooding, construction of overflows and outlet control structures, sloping and vegetation of pit walls, and fencing to control access to the pits. East Pit reclamation would begin during operations, while West Pit reclamation would commence when mining activity ceases.

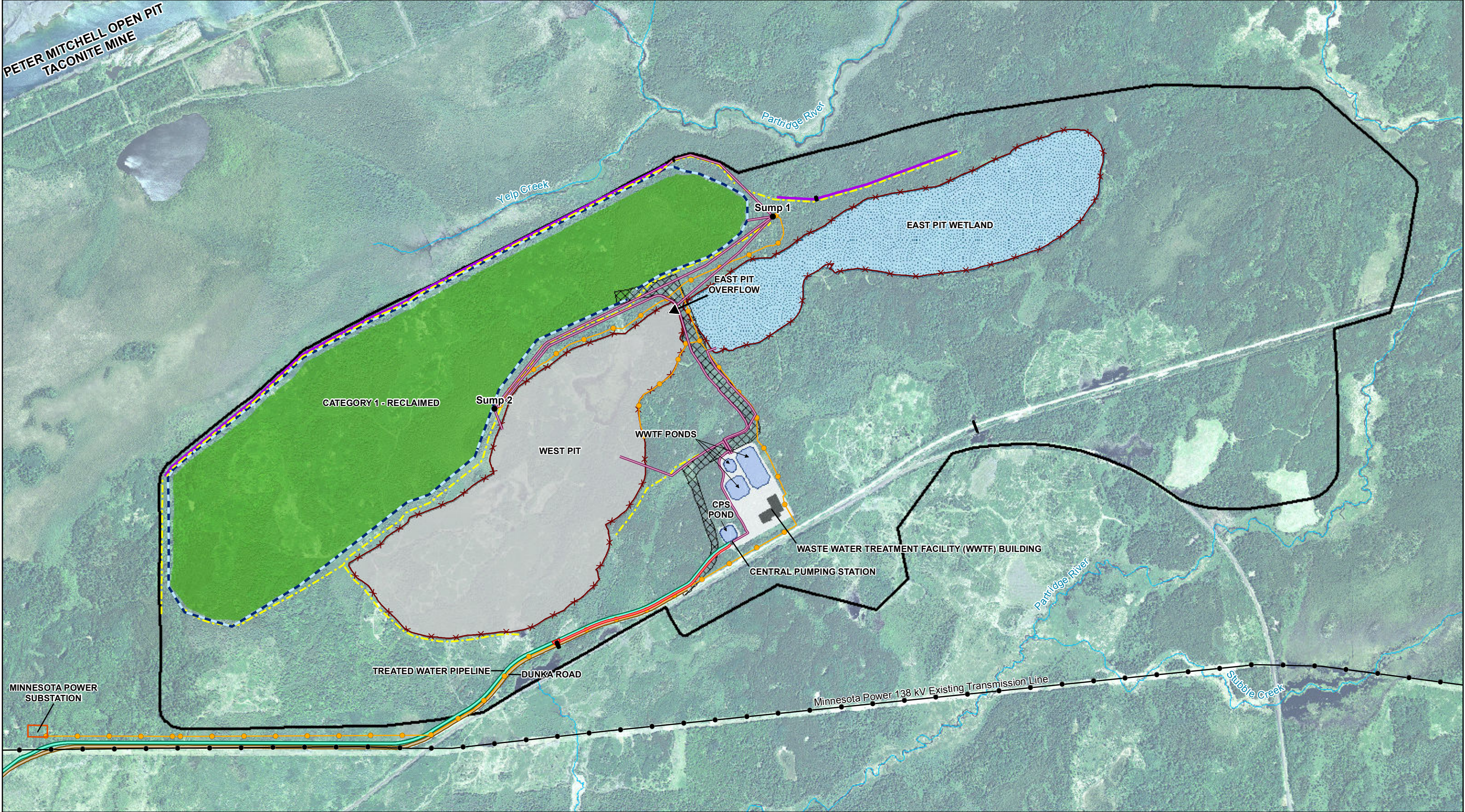
Mine pit dewatering systems would be removed from the pits and the pits would be allowed to flood with water. All areas disturbed during pipe removal would be graded and revegetated. Some temporary pumps may remain in the pits for dewatering that would be performed during pit flooding.

East Pit flooding would start in Mine Year 11 and be completed by Mine Year 20. Overflow from the East Pit would flow to the West Pit through a new ditch. An East Pit outlet structure would be built, which would establish the steady-state water level in the East Pit. The East Pit would be revegetated with wetland vegetation, resulting in approximately 207 acres of wetland (**Figure 7**).

Upon completion of mining operations, the West Pit would begin to flood naturally with groundwater, precipitation, and surface runoff from the tributary watershed. West Pit flooding would be accelerated with treated water from the Plant Site. With the addition of water pumped from the Plant Site to the West Pit,

DESCRIPTION OF THE PROPOSED ACTION

West Pit flooding is projected to be completed between Mine Years 40 and 45. The West Pit would remain an open pit lake (MDNR et al. 2013).



- | | | |
|-------------------|--------------------------------|----------|
| Mine Site | Groundwater Containment System | Culverts |
| Covered Stockpile | Process Water Pipe | Fence |
| West Pit | Stormwater Collection Ditch | |
| East Pit Wetland | Perimeter Dike | |
| Haul Roads | Discharge Pipe | |



0 750 1,500 3,000 Feet

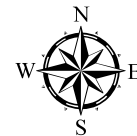


Figure 7
Mine Site Plan Long-term Closure
 Biological Assessment for the NorthMet Project and Land Exchange
 St. Louis County, Minnesota

When the West Pit is full, discharge would be prevented by pumping West Pit water to the Waste Water Treatment Facility for treatment. The Waste Water Treatment Facility would be upgraded to include reverse osmosis or similar membrane separation technology to achieve an effluent concentration that meets the sulfate standard for waters used for the production of wild rice (10 mg/l). After the upgrade, effluent would be discharged through Dunka Road into an existing wetland, and eventually into the Partridge River through an existing tributary channel.

The overburden portions of the pit walls would be sloped, graded, and vegetated in accordance with Minnesota Rules, part 6132.2300. Lift heights would be selected based on the need to protect public safety, the location of the pit wall in relation to the surrounding land uses, the soil types and their erosion characteristics, the variability of overburden thickness, and the potential use of the pit following mining.

A pit perimeter fencing system would be installed consisting of fences, rock barricades, ditches, stockpiles, and berms. The barrier system plan would be submitted to the St. Louis County mine inspector for review and approval before installation. Safe access would be provided to the bottom of each mine pit via selected haul roads built during pit development. The access road would be selected such that, as pit water level rises, there would always be a clear path to the water surface. A gated entrance would be placed at each pit access location.

3.6.2.2 Stockpile Reclamation

Stockpile reclamation would begin during operations. Upon full reclamation of the Category 1 Waste Rock Stockpile, runoff from the top and sides of the stockpile would be classified as non-contact stormwater and discharged into the natural drainage system. The Category 1 Waste Rock Stockpile Groundwater Containment System would continue to collect drainage from the stockpile during reclamation, with drainage treated at the Waste Water Treatment Facility. The Category 1 Waste Rock Stockpile would be reclaimed as a grass/forb community and shrubs and trees would be removed to prevent damaging the liner system. The other stockpiles (Category 2/3 and Lean Ore) would be removed, the areas would be initially planted with grasses, with a successional trajectory towards forest.

3.6.2.3 Watershed Restoration

During mining operations, stormwater runoff from reclaimed stockpile areas and natural (undisturbed) areas would be routed via dikes and ditches to stormwater sedimentation ponds. During reclamation, dikes and ditches that were no longer needed would be removed or filled and ponds would be filled. The reclaimed surfaces would then be scarified, topsoil placed on the surface, and the area revegetated with native species.

Surface runoff inflows would be routed to the mine pits using a combination of existing and new ditches. Some portions of the pit rim dikes may be left in place, if needed, to prevent an uncontrolled flow to or from the pits and potential erosion (head cutting) of the pits walls.

All stormwater ponds, the Overburden Storage and Laydown Area process water pond, haul road process water ponds, and all stockpile sumps and overflow ponds would be filled with overburden and peat (that was removed from the site during construction and stored in the Overburden Storage Area), and covered with topsoil and revegetated, or converted into wetlands. If the process water ponds were converted into wetlands, any sedimentation that occurred within the pond would be evaluated to determine if removal of sediment or

covering of the pond would be necessary prior to restoration. Stormwater pond outlet control structures would remain in place as necessary to manage water flows.

3.6.3 Reclamation of Plant Site

Plant Site reclamation would include building and structure demolition and equipment removal, Flotation Tailings Basin reclamation, and Hydrometallurgical Residue Facility reclamation. Similar to the Mine Site,

Plant Site facilities have been designed and would be operated to allow for progressive reclamation. Features that would remain at the Plant Site are shown on **Figure 8**.

The Waste Water Treatment Plant, Flotation Tailings Basin Seepage Management Systems, and Hydrometallurgical Residue Facility Leakage Collection System would continue to operate during reclamation, although seepage and leakage rates would be progressively reduced. Seepage and leakage would be recycled back into the Flotation Tailings Basin Pond or treated at the Waste Water Treatment Plant and pumped to the Mine Site to aid in West Pit flooding, or discharged.

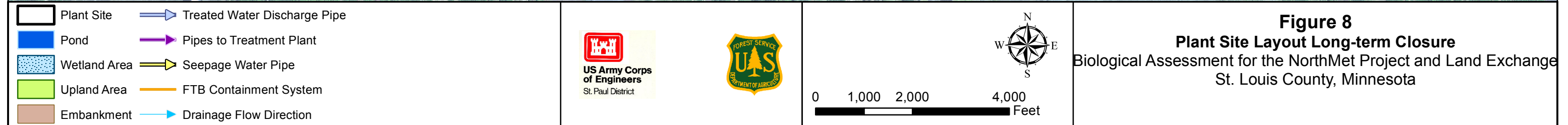
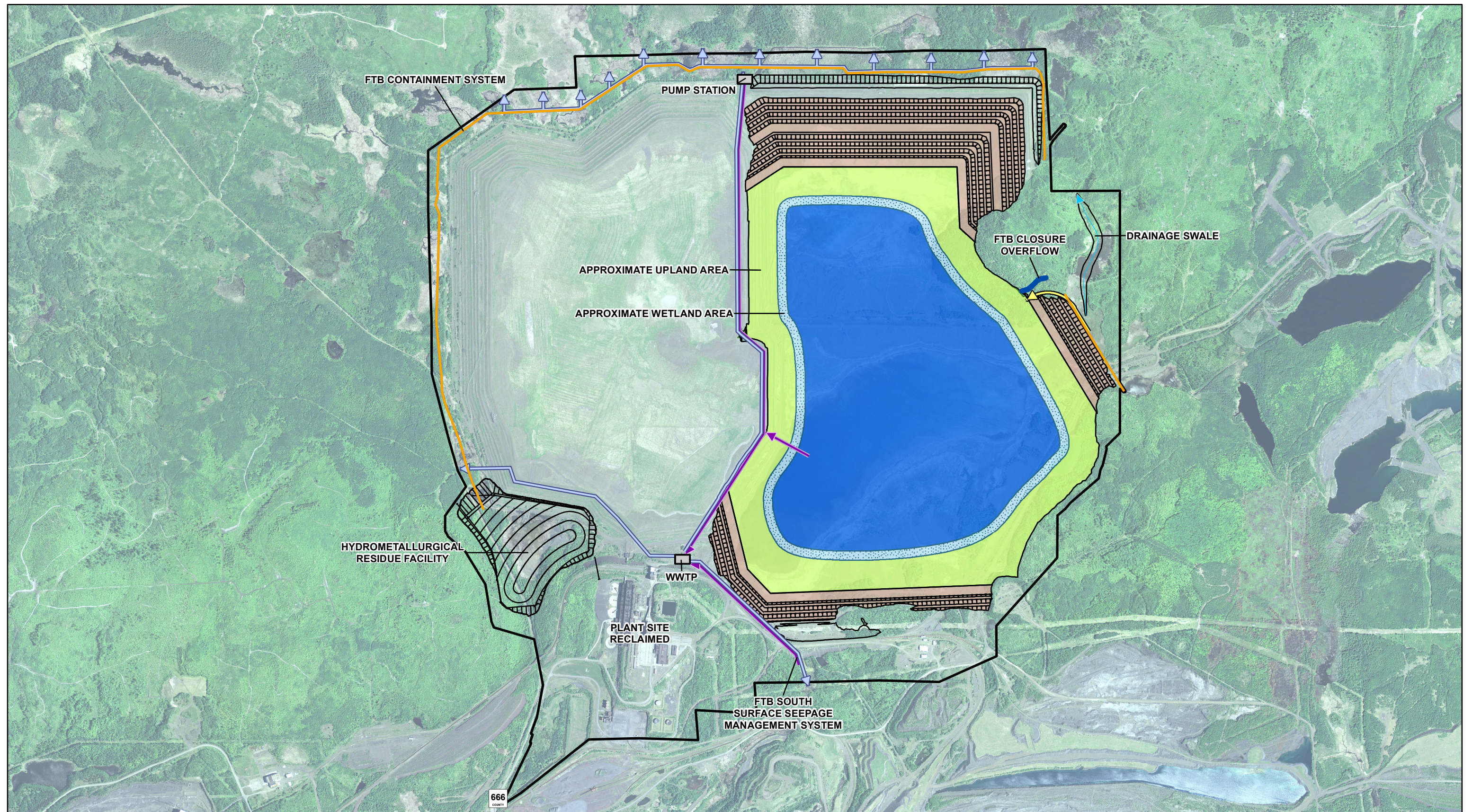
3.6.3.1 Flotation Tailings Basin Reclamation

Permanent vegetation would be established on the Flotation Tailings Basin to control fugitive dust. Flotation Tailings Basin exterior dam surfaces would be reclaimed progressively, while interior areas would be seeded and mulched after closure.

Infiltration would be reduced through the dam faces, beaches, and pond bottom of the Flotation Tailings Basin by bentonite amendment. The exterior face of the dams would be reclaimed progressively, with a bentonite layer added as they are constructed to limit oxygen diffusion. The exposed beaches and dam tops would be amended with a bentonite layer to limit oxygen diffusion. The pond bottom would be covered with a bentonite layer to maintain a permanent pond that would limit oxygen diffusion.

During reclamation, several sources of water from the Flotation Tailings Basin would require management. The sources and a summary of the type of management needed are described as follows:

- Ponded water within the Flotation Tailings Basin – a pond and wetland would remain in the Flotation Tailings Basin. The pond and wetland would receive surface water runoff from the crest and beaches of the basin and natural terrain adjacent to the Flotation Tailings Basin. The pond and wetland would continue to lose water via seepage, but at a reduced rate as compared to during operations as a result of the bentonite augmentation of the Flotation Tailings Basin pond bottom. Excess water would be pumped from the Flotation Tailings Basin pond to the Waste Water Treatment Plant for treatment prior to discharge.
- Stormwater management would include grading to provide a gently sloping surface that effectively routes surface water runoff to the interior of the Flotation Tailings Basin, and to accommodate future differential settlement of the underlying Flotation Tailings.
- An emergency overflow channel would be constructed to carry stormwater from the pond to the adjacent wetland in case of an extreme storm or snowmelt event after reclamation. The conceptual location of the emergency overflow channel is from the combined Cell 1/2E to the adjoining land.



3.6.3.2 Hydrometallurgical Residue Facility Reclamation

Reclamation of the Hydrometallurgical Residue Facility cell would include removal of ponded water from the cell surface, removal of pore water from the residue, construction of the cell cover system, establishment of vegetation, and surface water runoff control.

Ponded water remaining in the cell would be removed and treated at the Waste Water Treatment Plant. Drainage would be collected from the base of the cell at the geocomposite drainage system and managed as described for ponded water. The rate of drainage would decrease over time as the pore water within the Hydrometallurgical Residue Facility was collected and removed.

The Hydrometallurgical Residue Facility cell area would be graded into a gently sloping surface, and an engineered cover system would be installed to limit infiltration. Permanent vegetation would be established over the cover system. The turf and final cover would be inspected, mowed once per year or as needed, fertilized if vegetation growth is poor, and repaired as needed.

The cover would slope gently toward the site perimeter to accommodate natural drainage of the runoff. Final cover slopes on the cell interior would be relatively shallow to minimize surface water runoff flow velocity and the associated erosion. Runoff channeled along the cell perimeter would be routed downslope via rip-rapped drainage swales or plug-resistant inlet structures and piping systems. Once runoff was conveyed down the cell exterior dam slope, it would be routed to the surrounding natural drainage system. All runoff would be from reclaimed cover or dam exterior slopes, which would be constructed of MDNR-approved material.

3.6.4 Long-Term Closure Activities

Mechanical water treatment systems (the Waste Water Treatment Facility and the Waste Water Treatment Plant) would continue to operate during long-term closure. The water collected by the Category 1 Waste Rock Stockpile Groundwater Containment System and the West Pit water would be treated using the Waste Water Treatment Facility (upgraded to reverse osmosis or similar membrane separation technology) to ensure that the discharge meets applicable water quality discharge limits. The Waste Water Treatment Plant would treat water collected by the Flotation Tailings Basin seepage capture systems, Hydrometallurgical Residue Facility Leakage Collection System, and excess Flotation Tailings Basin pond water, to meet applicable water quality discharge limits. Inspection, water treatment maintenance, and reporting activities would continue while the mechanical treatment systems operated during long-term closure.

Surface water and groundwater quality would be monitored. These long-term closure activities would be expected to be ongoing until such time as the various facility features are deemed environmentally acceptable, in a self-sustaining and stable condition.

Other long-term closure activities would include repair of stockpile and Flotation Tailings Basin dam slope erosion, up-keep of constructed wetlands and outflow structures, removal of shrubs and trees from the Hydrometallurgical Residue Facility and Category 1 Waste Rock Stockpile cover systems, and on-going operation/maintenance and inspection of the seepage capture systems at the Category 1 Waste Rock Stockpile and Flotation Tailings Basin.

When PolyMet has completed all reclamation and long-term closure activities required under the Permit to Mine, a Request for Release per Minnesota Rules, part 6132.1400 would be submitted to the MDNR. This

request would provide the Commissioner of the MDNR with detailed information on the final closure status of the Project.

3.7 Federal and Non-federal Lands

3.7.1 Land Exchange Process

The federal lands are in St. Louis County, approximately 70 miles north of the City of Duluth, 20 miles south of the Boundary Waters Canoe Area Wilderness (BWCAW), and 6 miles south of the City of Babbitt. The federal lands are bounded on the north by the Northshore taconite mine and on the south by the Dunka Road and Utility Corridor. The federal lands include a portion of the Mine Site and Dunka Road and Utility Corridor.

The proposed land exchange between the Government, acting through the Forest Service, and PolyMet is an assembled land exchange. The exchange is proposed under the authority of the Weeks Act of March 1, 1911 as amended; General Exchange Act of March 20, 1922; Federal Land Exchange Facilitation Act of 1988; and the Federal Land, Policy and Management Act of October 21, 1976.

The federal lands are located within the General Forest and General Forest - Longer Rotation Management Area. The theme of the General Forest – Longer Rotation Management Area emphasizes land and resource conditions that provide a wide variety of goods, uses, and services. The characteristics and use of the General Forest Management Area are similar to the General Forest – Longer Rotation Management Area, except that harvests are more frequent, more uniform in age, and more extensive. The General Forest Management Area has the highest amount of young forest and the largest-sized timber harvest units.

Land ownership adjustment direction for these Management Areas allows the exchange of federal lands, with the desired condition described as “Land ownership patterns (federal, state, county, corporation and private) are consolidated, promote efficient administration and reduce the costs of managing resources.” A detailed discussion of the Land Exchange Process is provided in Chapter 3.3 of the SDEIS.

3.7.2 Federal Lands

The federal lands include approximately 2,719 acres of the 3,015-acre Mine Site and 3,776 acres of lands surrounding the Mine Site that are owned by the Government and administered by the Forest Service. The federal lands are located in Sections 6 and 7, Township 59 North, Range 12 West; Sections 1 to 12 and 16 to 18, Township 59 North, Range 13 West; Sections 1, 12, and 13, Township 59 North, Range 14 West; Section 31, Township 60 North, Range 12 West; and Sections 32 to 36, Township 60 North, Range 13 West. Most of the federal lands are part of the General Forest – Longer Rotation Management Area, while the remainder is within the General Forest Management Area.

The federal lands include a portion of One Hundred Mile Swamp, a large black spruce, tamarack, and northern white cedar wetland, and Mud Lake. Most of One Hundred Mile Swamp will not be affected by the Project. Refer to Figure 4 to see the limits of active mining at the Mine Site. Federal lands, including most of One Hundred Mile Swamp, outside of the active mining areas will not be affected by the Project. Yelp Creek and the Partridge River flow through the federal lands on the north, east, and southeast. Management of the 3,776 acres surrounding the Mine Site may include some upland timber management that could enhance wildlife habitat.

3.7.3 Non-federal Lands

PolyMet has acquired non-federal lands for transfer to the Government that encourage efficient land ownership patterns, with the desired condition of consolidating federal, state, county, corporate and private ownership to promote efficient administration and reduce the cost of managing resources to the Forest Service. The non-federal lands would be incorporated with adjacent federal ownership and managed in accordance with Forest Service's Forest Plan direction for that particular area. Lands with obvious recreational values would be managed to enhance those public recreation opportunities. The non-federal lands are assembled in five different tracts totaling approximately 7,075 acres that consist primarily of forest and wetland habitat (**Figure 2**).

3.7.3.1 Hay Lake Lands

Hay Lake Lands are in central St. Louis County, Minnesota, and are approximately 3 miles west of Biwabik, Minnesota. The lands, located at the eastern end of the Mesabi Iron Range, include approximately 4,926 acres in all or portions of Sections 9, 16, 19, 20, 21, 27, 28, 29, 30, 31, and 32 in Township 59 North, Range 16 West. The lands are moderately hilly and consist predominantly of second- or third-growth deciduous and coniferous forest uplands and emergent, shrub swamp, and forested wetlands. Approximately 59% (2,931 acres) of Hay Lake Lands consists of wetlands. The lands include Hay Lake, identified as a Wild Rice Water by the MDNR, and Little Rice Lake, and are bordered on the east by the Pike River. Forest Service lands border the lands to the north, east, and west. Forest Service lands adjacent to the lands are managed as General Forest and Candidate Research Natural Areas. Research Natural Areas are areas that the Forest Service has designated to be permanently protected and maintained in natural condition. These protected natural areas include unique ecosystems or ecological features; rare or sensitive species of plants and animals and their habitat; and/or high-quality examples of widespread ecosystems. Candidate Research Natural Areas are those areas which are in various stages of review for possible establishment as a Research Natural Area.

3.7.3.2 Hunting Club Lands

Hunting Club Lands are in northern St. Louis County, Minnesota, and includes approximately 160 acres in Section 17, Township 66 North, Range 17 West. The lands are nearly level and consist predominantly of second- or third-growth deciduous and mixed deciduous and coniferous forest uplands and emergent, shrub swamp, and forested wetlands. Approximately 40% (64 acres) of Hunting Club Lands consists of wetlands. The lands are bordered by Forest Service and county lands. Nearby Forest Service lands are managed as General Forest – Longer Rotation.

3.7.3.3 Lake County Lands

Lake County Lands consist of approximately 382 acres, with 265 acres in Sections 5 and 6, Township 57 North, Range 11 West (Lake County Lands North), and 117 acres in Section 17, Township 56 North, Range 9 West (Lake County Lands South) in Lake County, Minnesota. The lands are administered by Lake County. The lands are nearly level and consist predominantly of second- or third-growth mixed coniferous/deciduous forest uplands and bog, emergent, shrub swamp, and forested wetlands. Much of Lake County Lands South was recently logged. Approximately 74% (283 acres) of Lake County Lands consists of wetlands. The lands are bordered by the Superior National Forest. Forest Service lands near Lake County Lands North are managed as Riparian Emphasis Area and General Forest – Longer Rotation. Forest Service lands near Lake County Lands South are managed as General Forest – Longer Rotation. In Riparian Emphasis Areas, riparian

ecological functions are actively restored, protected, and enhanced in areas where ecosystem processes are sensitive to degradation. This includes maintaining and restoring native vegetation communities; maintaining and restoring riparian/hydrologic functions such as shoreline stability, wildlife habitat, coarse woody debris recruitment to aquatic and riparian ecosystems, and temperature regulation; and controlling non-native invasive species. Restoration focuses on components of the ecosystem that are not functioning at or within the range of desired conditions. Those components that are functioning properly are protected. These areas are also managed for recreational opportunities and visual quality adjacent to bodies of water.

3.7.3.4 McFarland Lake Lands

McFarland Lake Lands are approximately 31 acres in Section 9, Township 64 North, Range 3 East, in Cook County, Minnesota. These lands are approximately 3 miles west of the U.S. - Canada border and 10 miles north of Hovland, Minnesota. The lands are mostly on a hillslope and consist of second- or third-growth deciduous and coniferous upland forest. McFarland Lake is an entry point to the BWCAW. There are no wetlands on the lands. The lands are bordered by Forest Service land. Forest Service lands near McFarland Lake Lands are managed as General Forest – Longer Rotation.

3.7.3.5 Wolf Lands

Wolf Lands total 1,576 acres and are comprised of 126 acres in Section 8, Township 57 North, Range 11 West (Wolf Lands 1); 769 acres in Sections 15 and 22, Township 58 North, Range 10 West (Wolf Lands 2); 277 acres in Sections 30 and 31, Township 59 North, Range 9 West (Wolf Lands 3); and 405 acres in Sections 7, 8, 15, 17, and 18, Township 59 North, Range 9 West (Wolf Lands 4) in Lake County, Minnesota. The lands are nearly level and consist predominantly of second- or third-growth mixed deciduous and coniferous forest uplands and bog, emergent, shrub swamp, and forested wetlands. Much of Wolf Lands 3 has been recently logged. Approximately 88% (1,392 acres) of Wolf Lands consists of wetlands. Forest Service lands border portions of all of Wolf Lands and are managed as General Forest (Wolf Lands 2, 3, and 4) and General Forest – Longer Rotation (Wolf Lands 1). These lands would supplement National Forest ownership by reducing federal exterior boundaries and would eliminate several private in-holdings.

3.8 Wetland Mitigation Sites

The Project would directly impact an estimated 914 acres of wetlands, mostly within the Mine Site. A USACE permit would be required under Section 404 of the Clean Water Act for impacts to wetlands and other waters of the U.S. The majority of the direct wetland impacts would occur at the Mine Site (about 758 acres) and the Flotation Tailings Basin (141 Acres), with an additional 7 acres associated with Dunka Road and Railroad construction and 7.5 acres at the proposed Hydrometallurgical Facility.

PolyMet is proposing to purchase 2,169 acres (Wetland Mitigation Sites) as mitigation for wetland impacts from the Project. On the Wetland Mitigation Sites, 1,603 acres would be restored or converted to wetlands and 197 acres would be used for upland buffer. Wetland monitoring would be conducted to identify potential indirect impacts to wetlands caused by mining activities. PolyMet would work with USACE and MDNR to mitigate indirect impacts as appropriate.

Compensation for wetland impacts is required under Section 404 of the federal Clean Water Act and the Minnesota Wetland Conservation Act (Minnesota Rules part 8420.0100). The wetland mitigation planning process for the Project relied on the Wetland Conservation Act wetland replacement siting rules (Minnesota

DESCRIPTION OF THE PROPOSED ACTION

Rules part 8420.0522), state compensatory mitigation requirements under state water quality standards (Minnesota Rules part 7050.0186), and the USACE St. Paul District Policy for Wetland Compensatory Mitigation in Minnesota (USACE 2009), which prioritizes the location of project-specific compensation to first replace lost wetlands on-site, then within the same watershed or county, and finally within adjacent watersheds.

3.8.1 On-site Restoration

In accordance with the USACE St. Paul District Policy for Wetland Compensatory Mitigation in Minnesota and state guidelines, the potential for creating wetlands on-site was considered first. Approximately 102 acres of onsite wetland creation opportunities were identified, which may occur at Project closure (Barr Engineering [Barr] 2012).

3.8.2 Off-site Mitigation

It was not possible to identify sufficient acreage on-site to mitigate for wetland impacts from the Project. Thus, potential wetland mitigation sites were identified and evaluated to determine their relative potential for mitigation, the level of risk and uncertainty, and the likely costs.

Sites were initially eliminated from further consideration due to issues that included unwilling landowners, significant private properties that would be hydrologically impacted by wetland restoration, insufficient agricultural history, insufficient wetland drainage to qualify for restoration credit, considerable existing upstream drainage through the site, or active pursuit of the properties by others. Three sites were identified that had the potential to accomplish compensatory wetland mitigation for the Project. These are the 1,070 acre Aitkin Site, 530 acre Hinckley Site, and the 569 acre Zim Site, which includes Zim North (481 acres) and Zim South (88 acres) (Figure 2; Barr 2007, 2014a, 2014b, 2014c, 2014d). Of these 2,169 acres, about 1,603 acres would be restored to wetland habitat.

3.8.2.1 Aitkin Site

The Aitkin Site is 1,070 acres in Section 6, Township 47 North, Range 26 West, and Section 1, Township 47 North, Range 27 West in Aitkin County, near Aitkin, Minnesota, and within the Mississippi River-Brainerd watershed. The site is a sod farm. PolyMet proposes to restore 808 acres of wetland and preserve 83 acres of upland buffer at the site (Barr 2007, 2014a, 2014d).

Initially, the internal drainage system at the site would be removed and outlets would be constructed to maintain desired hydrological conditions (Barr 2012, 2014a). Once desired hydrological conditions have been achieved, wetland vegetation would be promoted on the site by allowing native species that are present in the seed bank or that may be transported to the area from adjacent wetlands to develop on the site. Diverse, native wetland vegetation is expected to develop in the wetland. Wetland habitats likely to develop on the site include shallow marsh, shrub-carr, hardwood swamp, and coniferous swamp. Non-native and other invasive vegetation on the site would be removed through mechanical means or herbicide application. If vegetation development is not adequate to meet the success criteria, seed may be installed after the first or second growing season.

Hardwood and coniferous swamp would require herbaceous and woody species seedings and plantings.

Vegetation in the upland areas would be managed to promote natural succession of the existing plant communities. The primary maintenance activity would be control of non-native and other invasive species.

At completion of the monitoring period required to establish the wetland credits, the land would be conveyed to the third party that performs the construction to create the wetland mitigation credits. That ownership would also be subject to conservation easements (Pylka 2013a).

3.8.2.2 Hinckley Site

The Hinckley Site is 530 acres in Section 5, Township 39 North, Range 22 West, in Pine County, near Hinckley, Minnesota, and within the Snake River watershed. PolyMet proposes to restore 286 acres of wetlands and preserve 91 acres of upland buffer. The overall objective of the Hinckley restoration plan is to restore the hydrologic connection between upstream watersheds and the restoration site and to disable the internal drainage system on the site (Barr 2007a, 2014b, 2014d).

Initial activities would be focused on developing desired hydrological conditions (Barr 2014b). Restoration of wetlands would follow a similar process as that described for the Aitkin Site and would include the use of native seedbank and seed dispersal mechanisms to establish wetland vegetation on the site. Wetland habitats likely to develop on the site include sedge/wet meadow, shrub-carr, alder thicket, and hardwood swamp. Site management would include control of non-native and other invasive vegetation, and seeding and plantings of coniferous trees.

PolyMet would continue to own the land after the credits are created. At the time the credits were accepted it could be determined that PolyMet keeps the lands or transfers the lands to another third party subject to the conservation easement placed upon the lands for the creation of the credits (Pylka 2013a).

3.8.2.3 Zim North

The Zim North Site is 481 acres in Sections 2, 3, 10, 11, 14, and 15, Township 55 North, Range 18 West, in St. Louis County, approximately 12 miles southwest of Eveleth, and within the St. Louis River watershed. PolyMet proposes to restore the site to coniferous bog and shallow, open water wetland. Approximately 352 acres of coniferous bog and 7 acres of shallow, open water would be created on the Zim North site. In addition, 18 acres of ditches would be filled, 44 acres of partially drained wooded areas would be restored, and 12 acres of forested woodland and 12 acres upland buffer would be preserved. Approximately 36 acres of roads and other lands would not be restored. The overall objectives of the Zim North restoration plan would be to restore the native coniferous bog wetland community, restore the hydrologic connection between upstream watersheds and the restoration site, and disable the internal drainage system on site. Developing a bog community is highly dependent on soil and groundwater parameters that may be difficult to control. Therefore, a coniferous swamp community would be the contingent community if the soil and groundwater conditions are not adequate for bog regeneration. Coniferous bog or swamp is the target for the whole site, however, where trees do not successfully establish, the target community would be a shallow, open water wetland.

3.8.2.4 Zim South

The Zim South Site is 88 acres in Sections 26, 27, 34, and 35, Township 55 North, Range 18 West, in St. Louis County, approximately 16 miles southwest of Eveleth, and within the St. Louis River watershed. PolyMet proposes to restore the site to coniferous bog and shallow, open water wetland. Approximately 50

DESCRIPTION OF THE PROPOSED ACTION

acres of coniferous bog and 1 acre of shallow, open water would be created on the Zim South site. In addition, 3 acres of ditches would be filled, 5 acres of partially drained wooded areas would be restored, and 17 acres of forested woodland and 10 acres upland buffer would be preserved. Approximately 2 acres of roads and open ditches would not be restored. The overall objectives of the Zim North restoration plan would be to restore the native coniferous bog wetland community, restore the hydrologic connection between upstream watersheds and the restoration site, and disable the internal drainage system on site. As mentioned above, developing a bog community is highly dependent on soil and groundwater parameters that may be difficult to control. Therefore, a coniferous swamp community would be the contingent community if the soil and groundwater conditions are not adequate for bog regeneration. Coniferous bog or swamp is the target for the whole site, however, where trees do not successfully establish, the target community would be a shallow, open water wetland.

Initial activities at both sites would be focused on developing desired hydrological conditions through site grading to fill ditches and break drain tiles (Barr 2014c, 2014d). Restoration of wetlands include finding suitable donor bog materials, transporting materials to the site, spreading bog materials over areas to be restored, spreading fresh straw mulch over bog plant fragments, and applying slow-release fertilizer. Trees and shrubs would be planted 1 to 3 years after spreading of bog materials. In addition, several ponds would be excavated to a depth no greater than 6 feet to allow for development of shallow, open water wetland communities. Site management would include control of non-native and other invasive vegetation.

PolyMet would convey the land to the third party that performs the construction to create the wetland credits upon acceptance of the credits. This ownership is also subject to conservation easements that would be placed upon it during the mitigation period (Pylka 2013a).

4.0 Description of the Lands Affected by the Project

4.1 Federal Lands

The federal lands include approximately 2,719 acres at the 3,015-acre Mine Site and 3,776 acres bordering the Mine Site that are owned by the Government and administered by the Forest Service.

4.1.1 Mine Site

The Mine Site encompasses 3,015 acres; 2,719 acres are Government owned while 296 acres are privately owned. The Mine Site has little topographic relief. It consists of a mosaic of slightly elevated upland areas surrounded by wetlands, and slopes toward the east-northeast, in the direction of the Partridge River. About 57% of the Mine Site is upland habitat, and 43% is wetland habitat. Most upland habitat is associated with the central portion of the Mine Site. One Hundred Mile Swamp, northwest of the Mine Site, is the dominant feature on the landscape. The Partridge River drains this swamp and flows along and outside the northeastern and eastern boundary of the Mine Site (ENSR 2000, 2005).

Habitat observed on the Mine Site is typical of habitats associated with much of the Iron Range. Forest vegetation dominates the Mine Site (**Figure 9; Table 4**). Most forest stands contain trees that are 12 inches diameter-at-breast-height (dbh) or less.

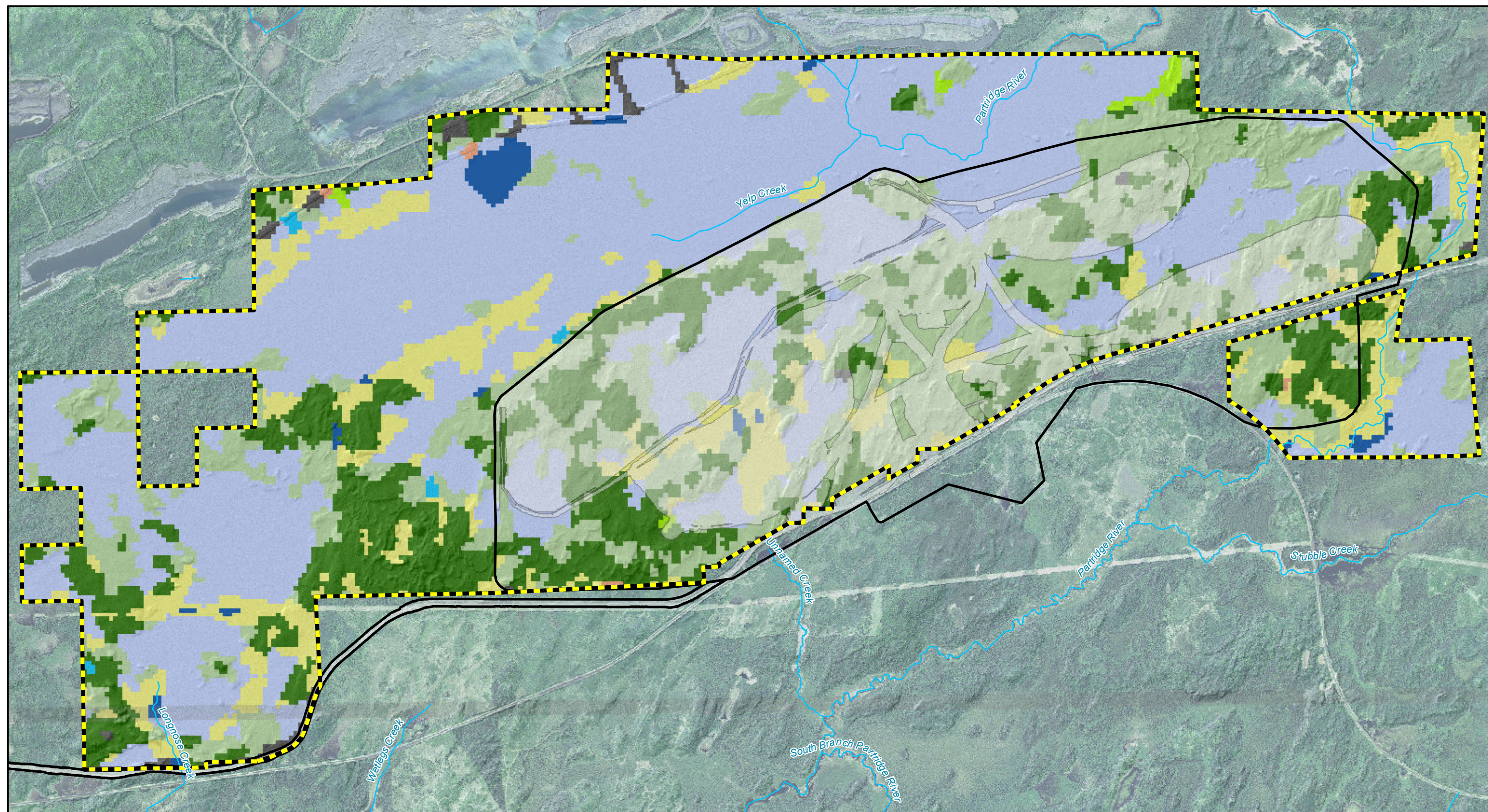
The site can be divided into three general areas. The northwest area is dominated by lowland black spruce, with scattered stands of trembling aspen and balsam fir/trembling aspen; tamarack is also scattered throughout these stands. Most trees are estimated to be 60 years or older (USDA Forest Service 2000). Interspersed within forest stands are brush/young tree stands that were recently logged and provide habitat for white-tailed deer and moose. Young trees are generally up to 4 inches dbh and 10 years of age.

The northeastern area is dominated by nearly equal amounts of jack pine and black spruce, with scattered trembling aspen stands and speckled alder swamps (ENSR 2000, 2005). Although there are scattered black spruce stands containing trees greater than 60 years in age, most trees, especially jack pine, are 30 to 70 years in age (USDA Forest Service 2000a). There are a few recently logged areas within this area. Several large wetlands are found in this area. Most shrub/young tree habitat is associated with these wetlands and drainages.

The southern area contains a nearly equal mix of lowland and upland black spruce, jack pine, and trembling aspen, with some balsam fir and paper birch (ENSR 2000, 2005). Most tree stands are from 40 to 80+ years of age, although jack pine tree stands along Dunka Road are from 20 to 40 years of age.

Vegetation in the recently logged areas consists of grasses and ferns with trembling aspen saplings and speckled alder (ENSR 2000, 2005). The areas of more mature upland forests consist of jack pine, balsam fir, and trembling aspen, with lesser amounts of paper birch, red pine, and white pine. The mature lowland areas consist mainly of black spruce and tamarack growing on a bed of sphagnum moss and club moss with speckled alder, bog Labrador-tea, and leatherleaf. The open wetland areas consist of grasses, sedges, cattails, speckled alder, and pussywillow.

Approximately 1,719 acres of the Mine Site would be affected by the Project. **Table 4** shows the cover types that would be affected by the Project, using the MDNR Gap Analysis Program (GAP) land cover types



- | | | |
|------------------------------------|--------------------------|------------------------------|
| Federal Lands | GAP Land Cover | Non-vegetated |
| Project Areas | Aquatic Environments | Shrubland |
| Areas Affected by Project Features | Crop/Grass | Upland Conifer Forest |
| | Lowland Conifer Forest | Upland Conifer-Deciduous mix |
| | Lowland Deciduous Forest | Upland Deciduous Forest |



0 1,000 2,000 4,000 Feet



Figure 9
GAP Land Cover/Habitat Types - Federal Lands
 Biological Assessment for the NorthMet Project and Land Exchange
 St. Louis County, Minnesota

(MDNR et al. 2013). The GAP land cover system is a hierarchical land classification system that organizes vegetation communities into 1-acre blocks and was developed by the MDNR.

4.1.2 Federal Lands Surrounding the Mine Site

Federal lands surrounding the Mine Site encompass about 3,776 acres and border the Mine Site to the west, north, and east. This area has little topographic relief. The lands consist of a mosaic of slightly elevated upland areas surrounded by wetlands, and slope toward the east-northeast in the direction of the Partridge River. Most (76%) of the area is wetland habitat, including a portion of One Hundred Mile Swamp, although upland habitat (24%) is an important component in the western portions of the area (**Figure 9**). Yelp Creek flows from One Hundred Mile Swamp to the Partridge River, which flows around the northern, eastern, and southeastern edges of the federal lands, outside of the Mine Site (AECOM 2011a). Under the Proposed Action, the areas not disturbed by the Project on the lands adjacent to the Mine Site would be managed for wildlife habitat, including timber management.

Forest vegetation dominates the federal lands. Most forest stands contain trees that are 12 inches dbh or less. The area can be divided into three general parts (AECOM 2011a). The eastern portion is dominated by the Partridge River. Large stands of lowland black spruce with scattered northern white cedar and tamarack are found in low areas associated with the river. Emergent and shrub swamp speckled alder wetland is adjacent to most of the river. Stands of immature (trees from 5 to 11 inches dbh, and from about 10 to 80 years of age) and mature (trees greater than 11 inches dbh and over 80 years of age) mixed coniferous/deciduous forest, coniferous forest dominated by jack pine, and smaller patches of immature deciduous forest, are found at higher elevations (USDA Forest Service 2000a).

Table 4
GAP Cover Types Affected by the Project at the Mine Site

Cover Type	Affected Acres	Non-affected Acres	Total Cover Type Acres	Percent of Cover Type Affected
Upland coniferous forest	742	454	1,196	62
Lowland coniferous forest	437	344	781	56
Upland deciduous forest	355	293	648	55
Shrubland	133	109	242	55
Disturbed	44	84	128	34
Aquatic environments	6	7	13	47
Upland coniferous-deciduous forest	2	1	2	63
Cropland/grassland	<1	5	5	4
Lowland deciduous forest	0	<1	<1	0
Total	1,719	1,296	3,015	57

Source: MDNR et al. (2013).

The northern portion of the federal lands surrounding the Mine Site includes a portion of One Hundred Mile Swamp. The swamp is comprised of some young (trees less than 5 inches dbh and 10 years of age), but mostly immature and mature black spruce, northern white cedar, and tamarack forests. Northern white cedar is prevalent in the northcentral portion of the northern area, while black spruce and tamarack are more common

DESCRIPTION OF LANDS AFFECTED BY PROJECT

in the remaining areas. Scattered stands of speckled alder are associated with the swamp, as are bog and emergent wetlands, especially along the Partridge River.

There are scattered “islands” of mature deciduous and mixed coniferous/deciduous forest. Most of the forest stands are 90 years or older, with many of the remaining stands 70 to 90 years of age (USDA Forest Service 2000a).

The western portion of the federal lands surrounding the Mine Site is dominated by lowland immature black spruce forest in its center, bordered by bog wetlands and wetlands dominated by speckled alder and red-osier dogwood. A large area dominated by cattail is associated with the transmission line rights-of-way (ROW). Upland immature and mature deciduous and mixed coniferous/deciduous forest, with scattered stands of coniferous forest, surround the centrally located black spruce forest. Clearings comprised of grasses, forbs, and shrubs are associated with the transmission line ROW, while scattered low areas, dominated by emergent and shrub swamp wetland vegetation, are interspersed within upland forest habitats.

4.2 Plant Site and Transportation and Utility Corridors

The Plant Site encompasses about 4,515 acres, which includes the former LTVSMC processing plant, existing LTVSMC Tailings Basin, Area 1 Shop, Hydrometallurgical Residue Facility, and administration buildings.

The southwestern corner of the Plant Site, the former LTVSMC processing plant, has almost entirely been disturbed by past mining activities. No wetlands are present within this portion of the Plant Site, although there is a plant reservoir located east of the concentrator that is not regulated as a wetland (Poly Met 2014a). The regulated wetlands within the Plant Site include a total of 52 wetlands covering approximately 245 acres. About 147 acres would be directly impacted by filling or excavation. Approximately 61% (2,756 acres) of the Plant Site is disturbed and supports little vegetation. The remaining areas consist of trembling aspen and trembling aspen-paper birch forest (14%), aquatic habitat (14%), grass/shrubland (7%), upland coniferous forest (2%), and lowland coniferous forest (1%; **Figure 10**; MDNR et al. 2013).

The Dunka Road and Utility Corridor is approximately 108 acres and the Railroad Connection Corridor is approximately 12 acres. Because of prior use during the former LTVSMC taconite mining operation, the Dunka Road and Utility Corridor is now defined as having a “disturbed” cover type. The remaining MDNR GAP land cover types that are not disturbed include cropland/grassland (8%), shrubland (6%), and smaller acreages of the remaining types. A total of 25 wetlands, encompassing approximately 7 acres, have been identified within the Dunka Road and Utility Corridor (MDNR et al. 2013). Approximately 7 acres of wetlands would be directly affected.

4.3 Non-federal Lands

4.3.1 Hay Lake Lands

Hay Lake Lands are approximately 4,926 acres and have moderate topographic relief. The lands consists of a mosaic of slightly elevated upland areas surrounded by wetlands, and slope toward the east-northeast, in the direction of the Pike River (AECOM 2011b).

Most (59%) of Hay Lake Lands is wetland habitat, although upland habitat (41%) is an important component in the central and western portions of the lands (**Figure 11**). The Pike River, Hay Lake, and Little Rice Lake are dominant features of the landscape. The Pike River flows along the eastern boundary of the lands.

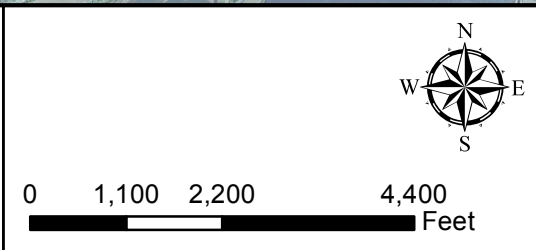
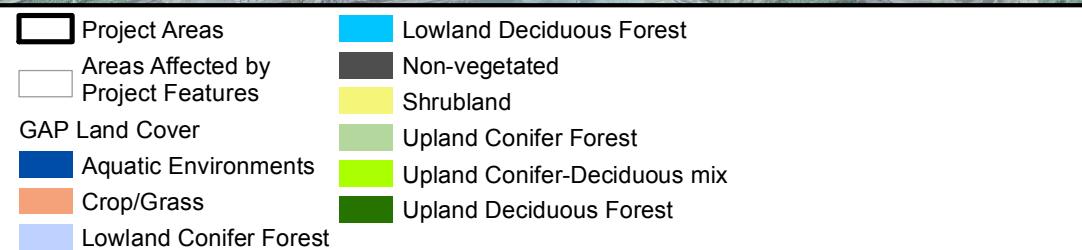
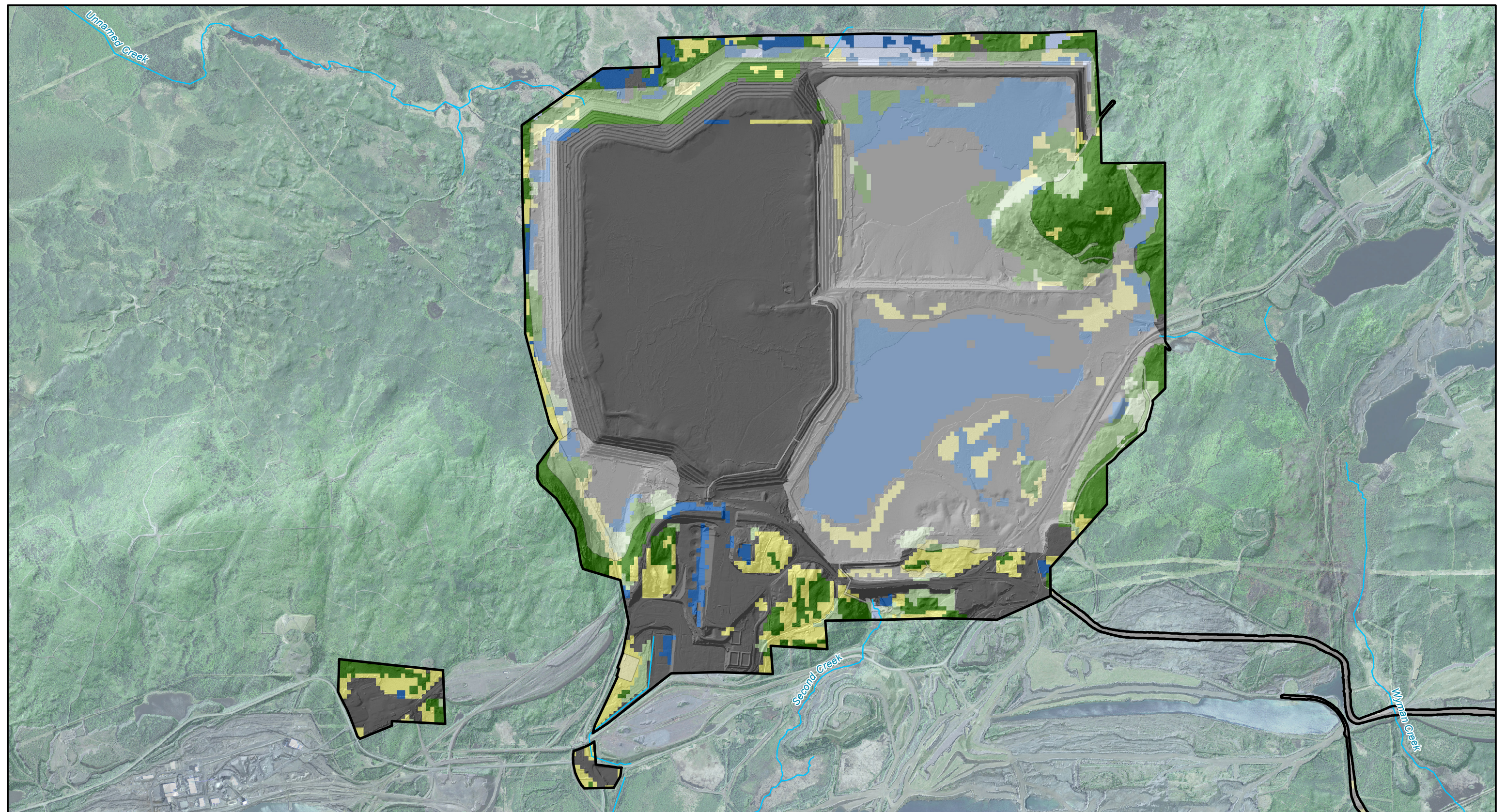


Figure 10
GAP Land Cover/Habitat Types - Plant Site
 Biological Assessment for the NorthMet Project and Land Exchange
 St. Louis County, Minnesota

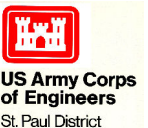
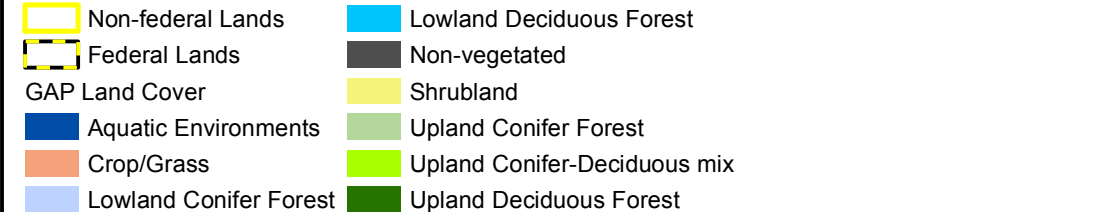
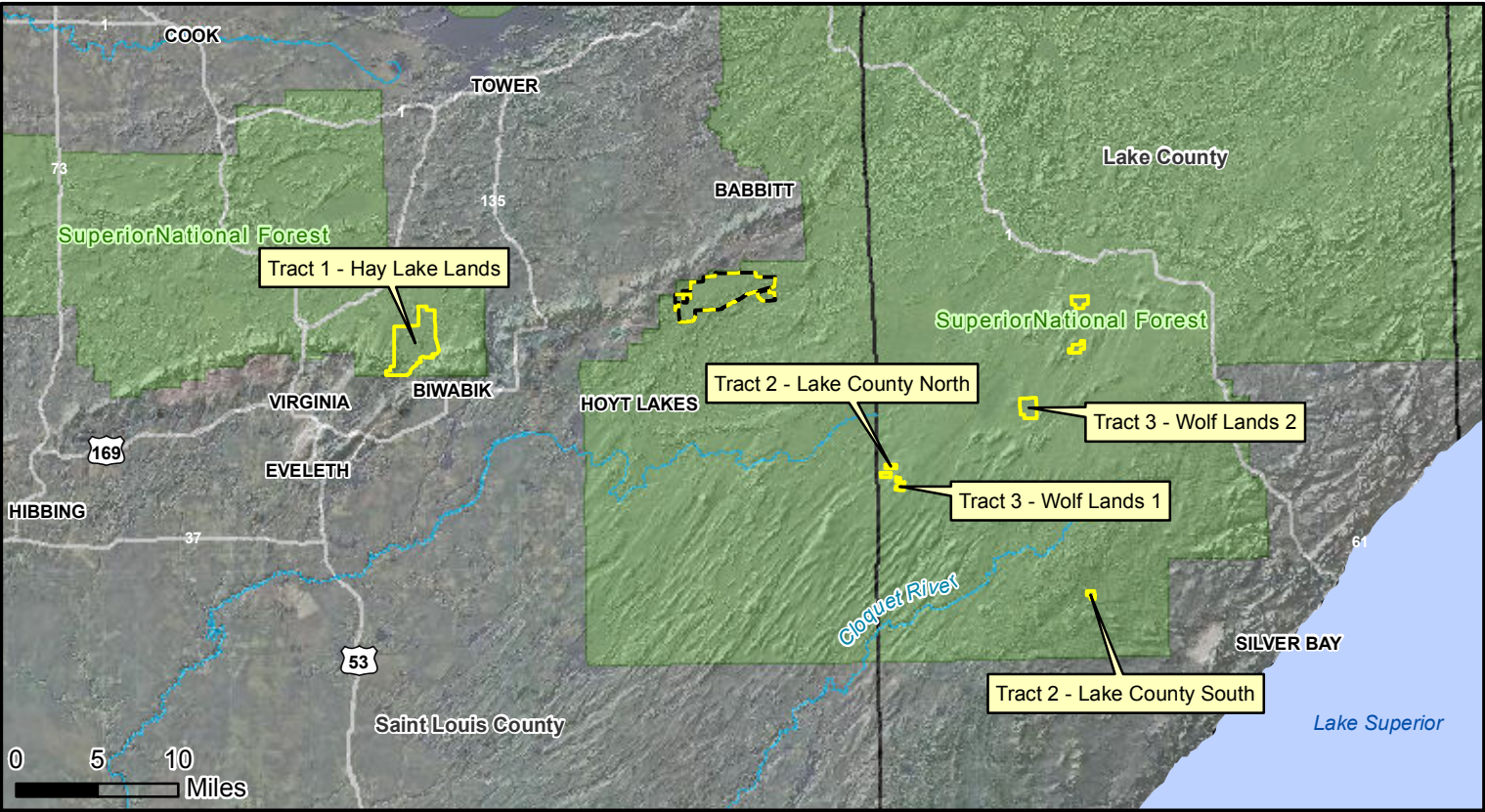
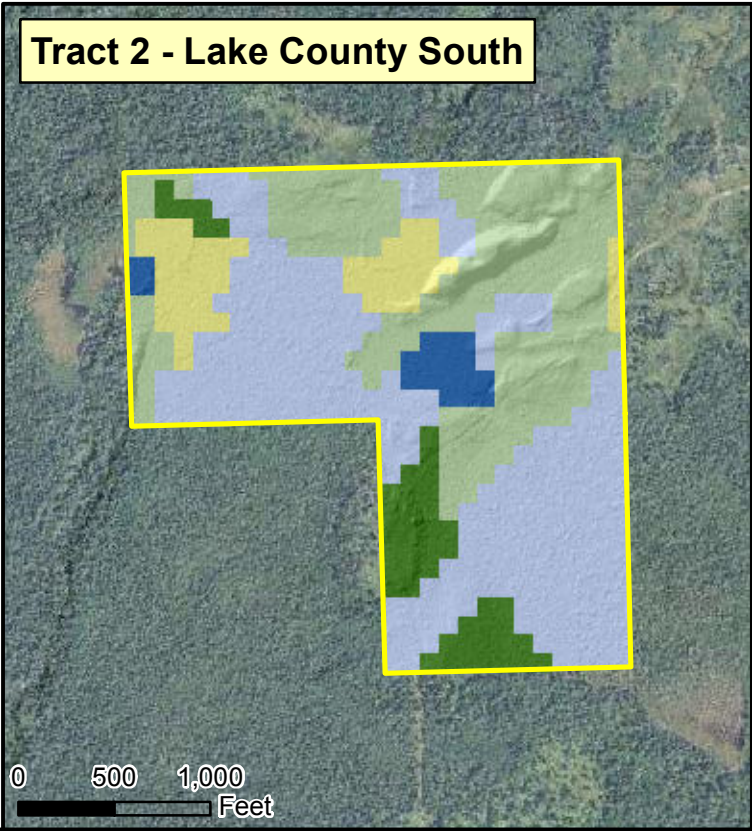
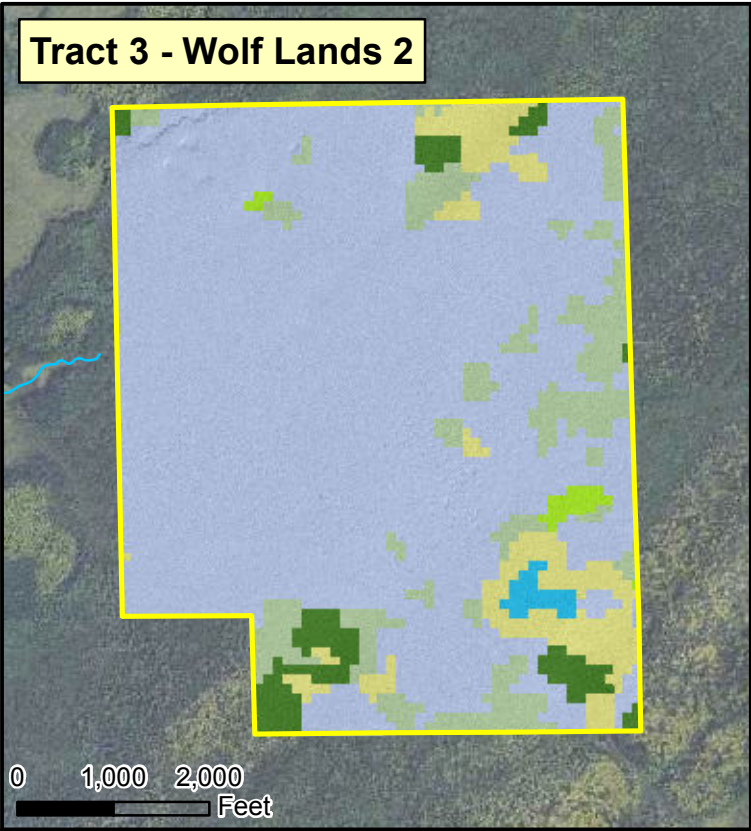
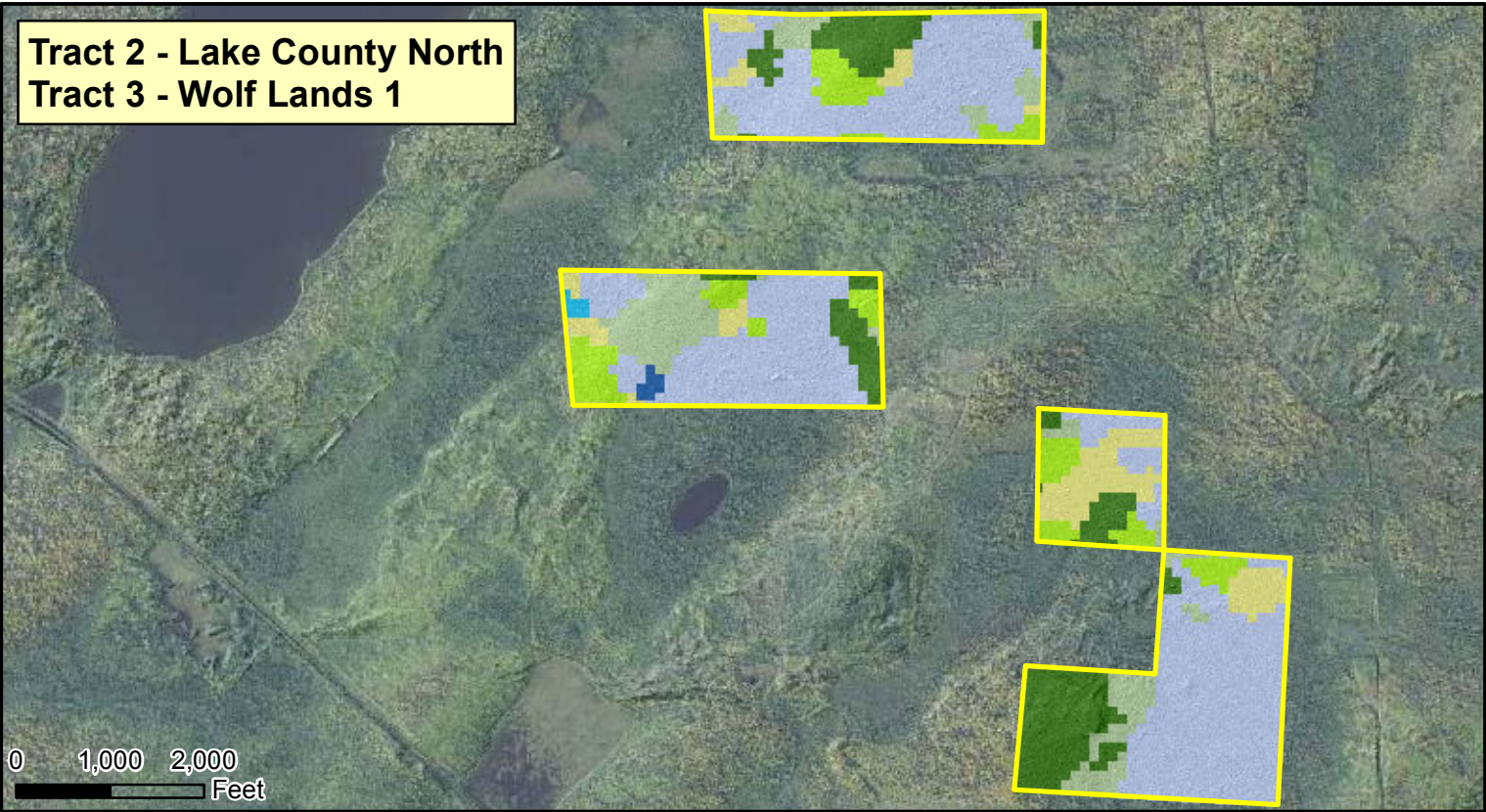
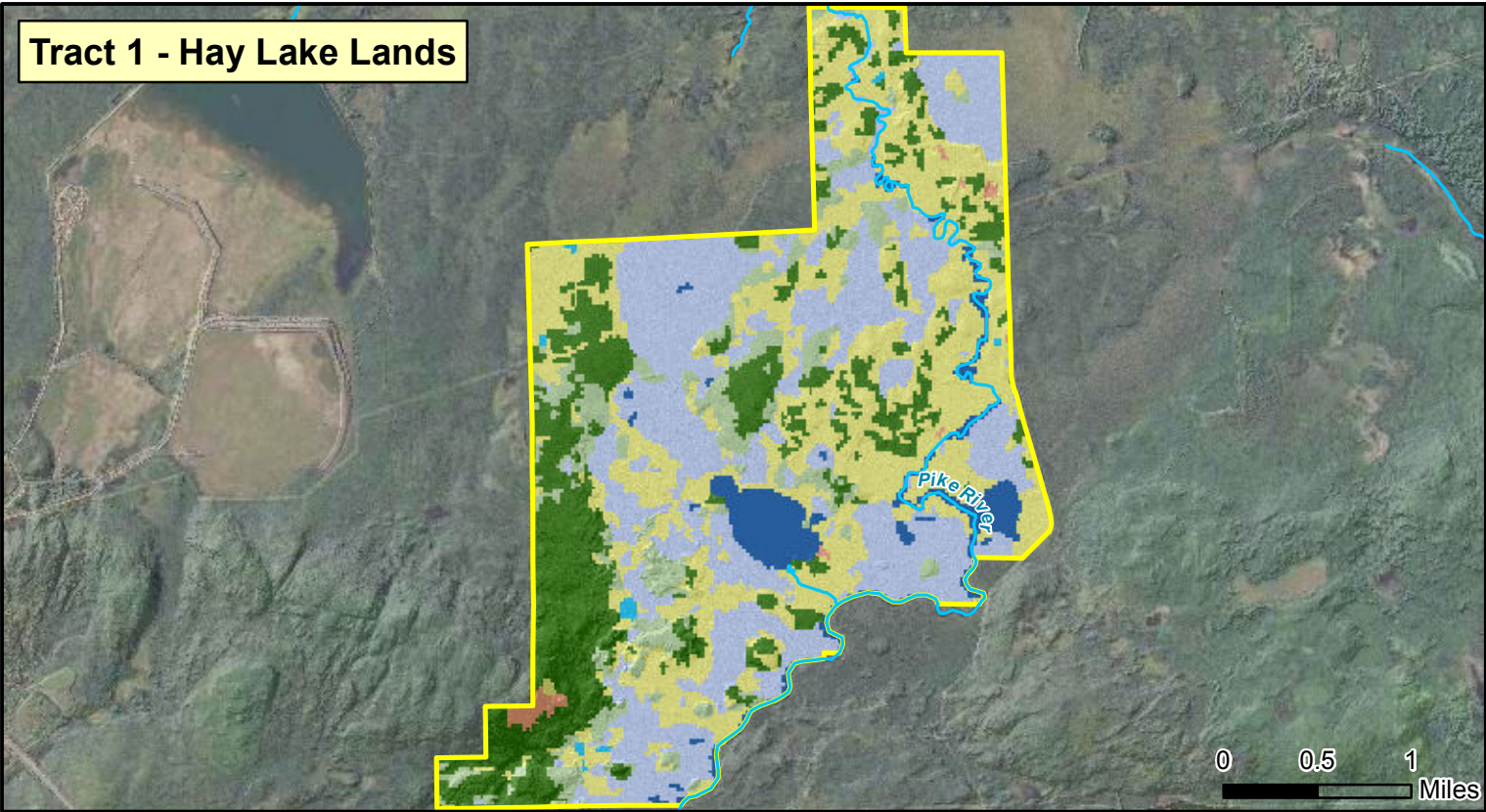


Figure 11
GAP Land Cover/Habitat Types -
Hay Lake Lands, Lake County Lands, and Wolf Lands 1 and 2
Biological Assessment for the NorthMet Project and Land Exchange
St. Louis County, Minnesota

DESCRIPTION OF LANDS AFFECTED BY PROJECT

Forest vegetation dominates Hay Lake Lands. Nearly all forest stands contain trees that are 12 inches dbh or less, and most of the upland trees are 8 inches dbh or less. The lands can be divided into four general habitats. The eastern portion is dominated by the Pike River. Floodplain associated with river is dominated by emergent wetland with sedge and grass habitat, and shrub swamp wetland with speckled alder habitat. Wetland areas to the west of the river are dominated by lowland black spruce forest, with scattered northern white cedar and tamarack, and shrub swamp wetlands, especially in areas with evidence of past disturbance by logging activities.

Higher elevations in the northern, central, and western portions of the lands are dominated by upland deciduous and mixed coniferous/deciduous forest. Upland forest stands in the northern, central, and southwestern portions of the lands are immature to mature in size and age, while stands in the western portion of the lands are young to immature in size and age, having been harvested in recent years. Most trees are estimated to be 60 years or younger. Two transmission line ROWs are found on the lands. Emergent wetland and upland grassland/shrubland vegetation dominates the ROWs. Abandoned logging roads are also found on the lands. Low areas along roads are dominated by emergent wetland vegetation consisting of sedges and grasses, while upland portions of roads are dominated by grasses and forbs.

4.3.2 Hunting Club Lands

Hunting Club Lands are approximately 160 acres, of which about 64 acres are wetland (**Figure 12**). The lands drain to the north and then northeast via an unnamed creek. Several beaver dams are found along the creek. From this low area, the lands slope upward to the east and west. The lands consist primarily of shrub swamp wetland, with lesser amounts of emergent wetland, and upland immature and mature deciduous forests (AECOM 2011c).

Beaver ponds and dams are the dominant wetland features on the lands. Open water habitat is typical near the dams. Emergent vegetation, consisting of Canada bluejoint, narrow-leaved cattail, and sedges, is found in water from 12 to 24 inches deep, while speckled alder shrub swamp wetlands are found near ponds at water depths from 6 to 18 inches. Speckled alder makes up to 80% of the cover in the shrub swamp wetlands. A large immature black spruce forest is found in the middle of Hunting Club Lands. The midstory consists of speckled alder, while leatherleaf, bog Labrador-tea, and sphagnum moss are found below the speckled alder. Immature black ash is found in a drainage leading to wetlands on the lands.

Habitat in the northwestern and northeastern portions and near the southern boundary of the lands are comprised of upland mature mixed coniferous/deciduous forest, dominated by eastern white pine to 24 inches dbh, and paper birch and trembling aspen to 12 inches dbh. The midstory consists primarily of balsam fir, while beaked hazel is found in the shrub layer.

The eastern and southern portions of the lands consist of patches of upland young and immature trembling aspen. The midstory consists of beaked hazel, with scattered black spruce and balsam fir. There is little ground cover.

An “island” of trembling aspen-eastern white pine forest is found within the young/immature trembling aspen forest. It is mature forest comprised of trembling aspen and eastern white pine to 16 inches dbh and black spruce to 12 inches dbh. There are many downed trees and much woody debris on the ground.

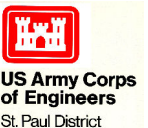
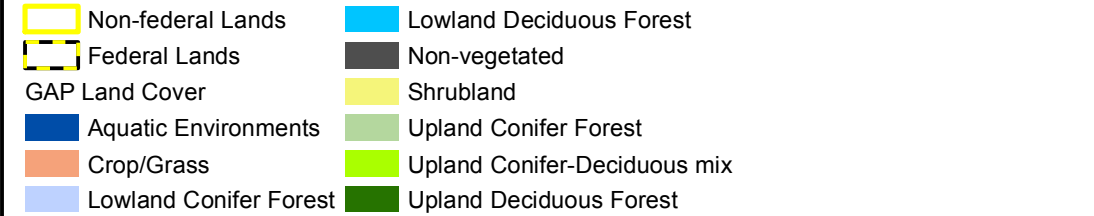
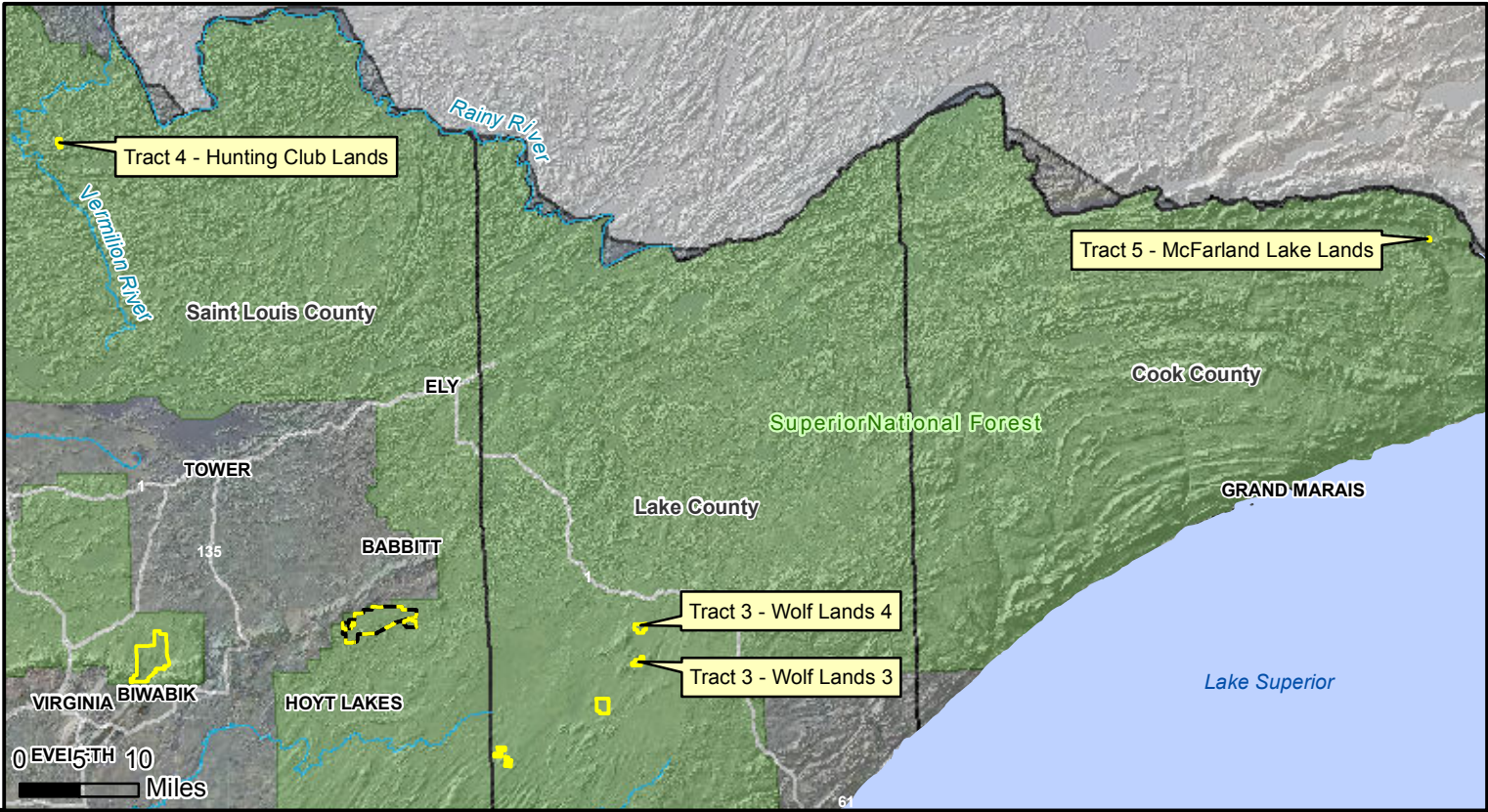
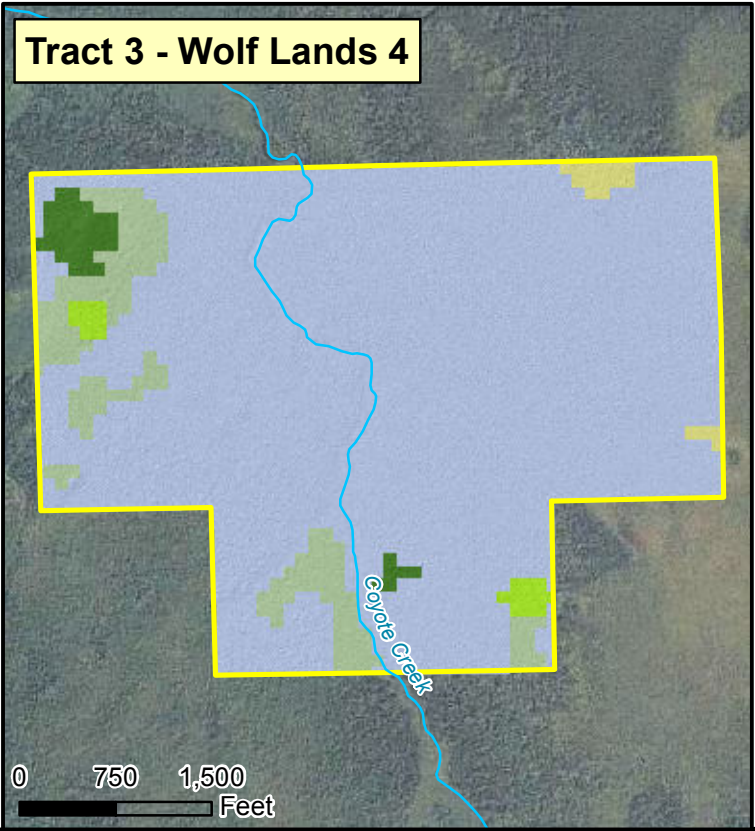
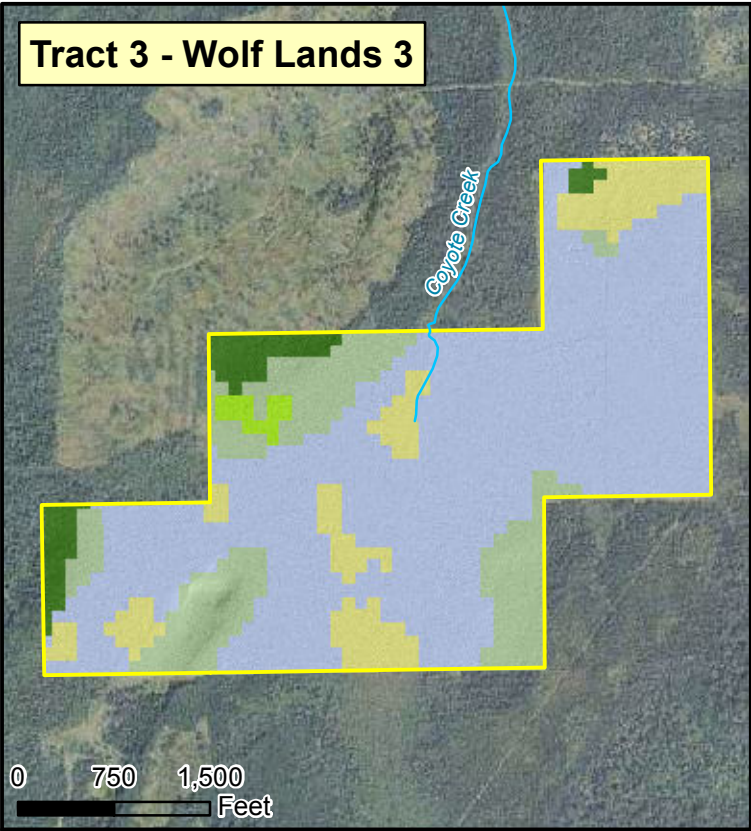
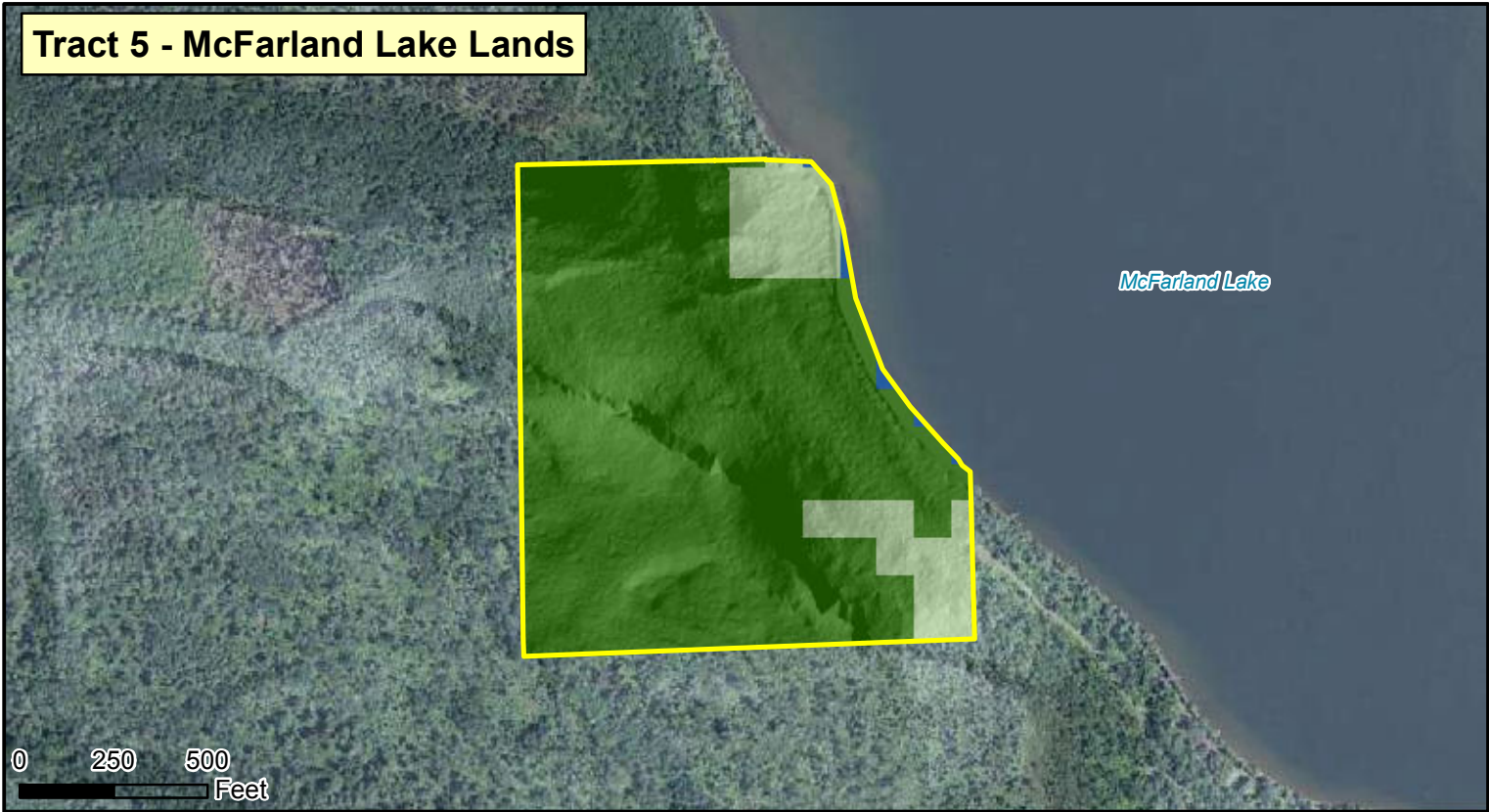
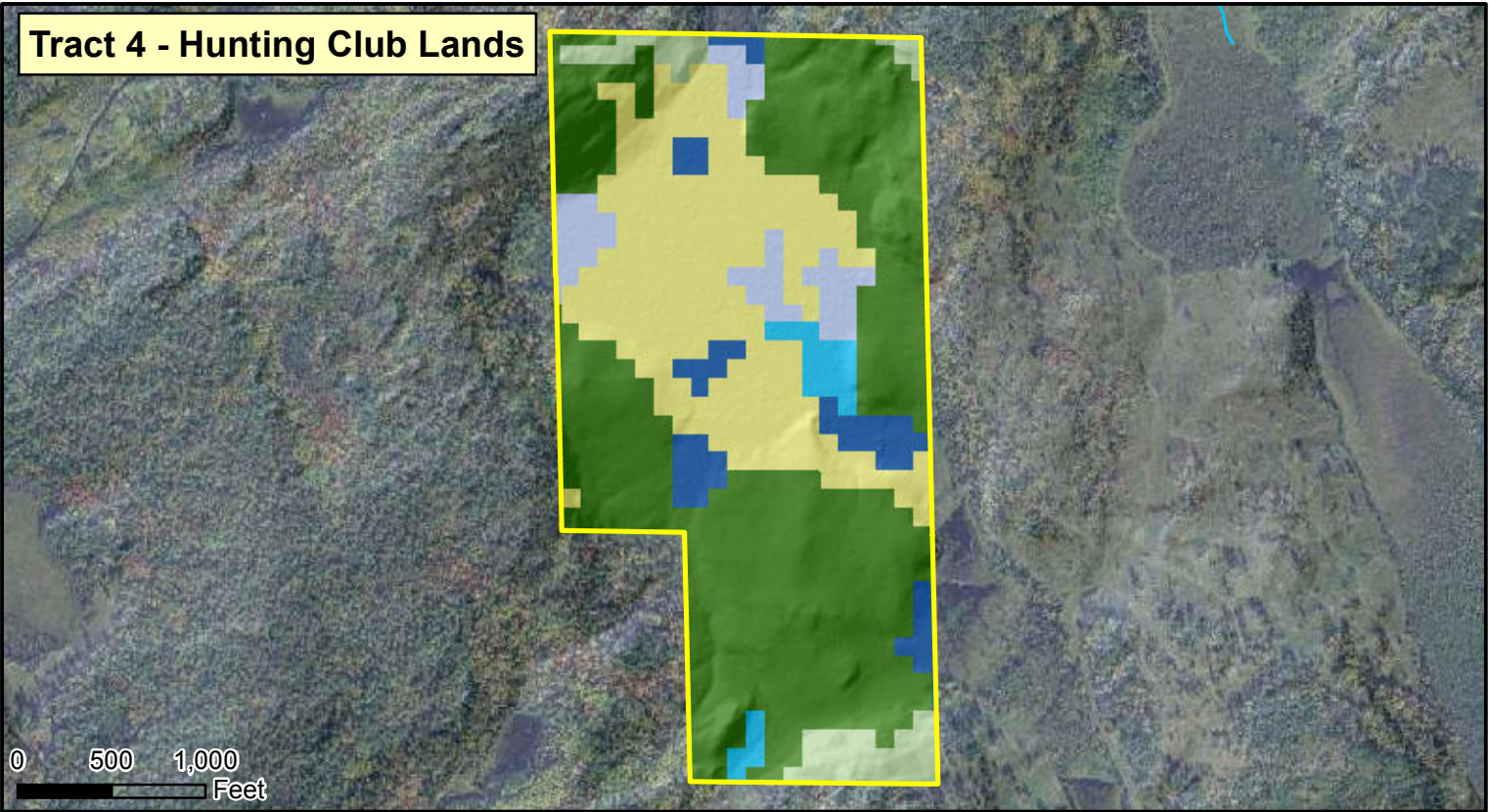


Figure 12
GAP Land Cover/Habitat Types - Hunting Club Lands, McFarland Lake Lands, and Wolf Lands 3 and 4
Biological Assessment for the NorthMet Project and Land Exchange
St. Louis County, Minnesota

4.3.3 Lake County Lands

Lake County Lands consist of Lake County Lands North and Lake County Lands South.

4.3.3.1 Lake County Lands North

Lake County Lands North is approximately 265 acres, of which about 209 acres are wetland (**Figure 11**). The lands have moderate topography, with the terrain generally sloping toward the southwest and Pine Lake. Lake County Lands North consists of two small areas to the north, and a single, small area to the south that is adjacent to Wolf Lands 1. The lands are comprised of mostly wetland habitat, except for areas of upland habitat on the northern portion of the northern area and on portions of the southern area. Portions of the lands have recently been logged. Wetland habitat consists mostly of immature coniferous forest, with lesser amounts of mature mixed coniferous/deciduous forest and shrubland. Upland habitat is dominated by mature deciduous and immature deciduous forests (AECOM 2011c).

Wetlands are comprised primarily of immature northern white cedar and black spruce with lesser amounts of tamarack, although several drainages also contain black ash. The midstory consists of balsam fir and black spruce, while speckled alder, leatherleaf, and bog Labrador-tea are found in the shrub layer. Club moss and sphagnum moss cover most of the ground.

Shrub swamp and emergent wetland habitats are also found on the lands. Shrub swamp habitat is associated with several drainages, a beaver pond, a bog area, and recently logged areas, while emergent wetland habitat was found near the beaver pond and on recently logged areas. Shrub swamp wetlands are dominated by speckled alder. Vegetation in the emergent wetlands consists of sedges and Canada bluejoint, with scattered black spruce, northern white cedar, tamarack, and speckled alder.

Upland habitats are comprised of immature and mature paper birch and black spruce, while recently logged areas supported young paper birch stands or shrub habitat. The midstory cover is comprised of balsam fir, black spruce, and beaked hazel. Young paper birch with scattered young trembling aspen and scattered immature paper birch are in areas that had been recently logged.

Older forests contain large amounts of downed woody material; this material is mostly absent in logged areas. Tree wind-throw is common in forest stands adjacent to the clearcuts, and walking in these forests is difficult due to downed trees and woody debris, and the dense stand of balsam fir, black spruce, and northern white cedar in the midstory.

4.3.3.2 Lake County Lands South

Lake County Lands South is approximately 117 acres, of which about 74 acres are wetland (**Figure 11**). The lands are relatively flat in the northwestern section, rise in elevation to the northeast, and fall in elevation to the southeast. Water flows from west to east. A series of beaver dams and ponds dominate the landscape. Several areas have been recently logged and shrubland is the dominant upland habitat (AECOM 2011c).

Forested wetlands dominate the western and southeastern portions of the lands and are comprised of immature and mature black spruce and northern white cedar, although immature tamarack is found in some forest stands and immature black ash is an important component of several drainages. The midstory consists of balsam fir and black spruce. Speckled alder, leatherleaf, bog Labrador-tea, and red-osier dogwood are common shrubs,

while sphagnum moss covers most of the ground. Forests in the northwestern section contain a dense mix of northern white cedar and black spruce with scattered black ash in the drainages. The northwestern portion of this section is dominated by mature northern white cedar.

Five beaver ponds were found on the lands. These ponds are comprised of open water with scattered dead spruce surrounded by emergent wetland dominated by sedges, narrow-leaved cattail, woolgrass, and Canada bluejoint, or by dense stands of speckled alder in more shallow areas. Shallower drainages, especially in areas that have been logged, are covered by speckled alder, sedges, and narrow-leaved cattail.

Most upland areas have been recently clearcut, with the exception of the southwestern portion of the lands. This area has been partially thinned, leaving areas where mature paper birch, black spruce, jack pine, eastern white pine, and northern white cedar trees remain, ranging from 12 to 24 inches dbh. Balsam fir and beaked hazel are found in the midstory, while forbs and grasses cover the ground layer. Because of recent logging activity, woody debris and large downed trees are abundant.

4.3.4 McFarland Lake Lands

McFarland Lake Lands are about 31 acres on a hillslope that rises from 1,483 feet above mean seal level at McFarland Lake to 1,778 feet above mean seal level on the western boundary of the lands. Rocky cliffs, about 150 feet in height, are found at the top of the hillslope and large boulders are found on the hillslope (AECOM 2011b).

McFarland Lake Lands are dominated by deciduous and mixed coniferous/deciduous forest habitats (**Figure 12**). Tree sizes and ages range from immature to mature. Some logging has occurred at the top of the hillslope along the western boundary of the lands.

4.3.5 Wolf Lands

Wolf Lands total 1,576 acres and consist of four parcels, Wolf Lands 1, 2, 3, and 4.

4.3.5.1 Wolf Lands 1

Wolf Lands 1 is approximately 126 acres, of which about 90 acres are wetland (**Figure 11**). Most upland habitat consists of mature coniferous and deciduous forest, while most wetland habitat consists of immature coniferous forest. The lands are relatively flat but slope gently downward toward the southwest. The lands are adjacent to Lake County Lands North (AECOM 2011c).

Wetland communities are comprised primarily of young and immature forests in nearly equal amounts. Young forests are comprised of black spruce, with scattered northern white cedar and tamarack. Young forests have characteristics of more open bogs, as tree cover is sparse, trees are short, and most of the ground is covered by bog Labrador-tea and leatherleaf, and sphagnum moss. In immature forests, the canopy is dominated by 6 to 10 inches dbh black spruce, with tamarack and northern white cedar also present. The midstory consists of balsam fir and black spruce, while speckled alder, leatherleaf, bog Labrador-tea, and red-osier dogwood dominate the shrub layer. Club moss and sphagnum moss cover most of the ground (AECOM 2011c).

Upland mixed coniferous/deciduous immature and mature forest is found in the southwestern portion of the lands. Paper birch and trembling aspen cover about half of the area, and the midstory consists of mostly balsam fir; beaked hazel, and red-osier dogwood.

4.3.5.2 Wolf Lands 2

Wolf Lands 2 is approximately 769 acres, of which about 706 acres are wetland (**Figure 11**). The lands consist of gently undulating terrain and slope toward the southwest. Water generally flows to the southwest and to Mary Ann Creek, Wenhoo Creek, and Greenwood Lake. The lands consist primarily of wetlands comprised of immature black spruce and northern white cedar forest, while shrub swamp comprised of speckled alder also is common. Black spruce is the dominant tree in wetlands in the northern and eastern portions of the lands, while northern white cedar is more prevalent in other portions of the lands (AECOM 2011c). Several drainages are dominated by speckled alder or have a black ash component, while emergent wetland habitat is associated with beaver ponds. Most upland habitat consists of immature mixed coniferous/deciduous forest.

Wetland immature forests are of three types: black spruce dominant, a mix of black spruce and northern white cedar, or northern white cedar dominant. Canopy trees range from 4 to 8 inches dbh. The midstory consists of young black spruce, northern white cedar, and balsam fir. Bog Labrador-tea comprises 10 to 30% of the low shrub cover, while sphagnum moss often covers more than 80% of the ground.

Several drainages are dominated by shrub swamp vegetation. These drainages generally have a sparse overstory of black spruce, northern white cedar, and tamarack. Speckled alder and young trees are in the midstory while low shrub cover consists of bog Labrador-tea.

Beaver dams and ponds are found in the southeastern portion of the lands. Typically, open water is adjacent to the dams, with emergent wetland surrounding the open water and shrub swamp wetland upstream of the dams.

Upland habitat in the northern portion of the lands consists of an overstory of young and immature mixed coniferous/deciduous forest over a shrub layer of beaked hazel. Some of the upland area on the northern portion of the lands has been logged. Upland habitat is also found in the southern portion of the lands and is comprised of paper birch, trembling aspen, and black spruce, over a midstory of balsam fir and shrub layer of beaked hazel.

4.3.5.3 Wolf Lands 3

Wolf Lands 3 is approximately 277 acres, of which about 233 acres are wetland (**Figure 12**). The lands are relatively flat and Coyote Creek begins its northward flow within the lands. Wetlands are dominated by shrub swamp and immature coniferous forest habitat, while uplands consist of mostly shrubland and immature deciduous forest (AECOM 2011c).

About half of the lands have been recently logged. Logged wetlands are dominated by grasses, forbs, and low growing shrubs, including red-osier dogwood and speckled alder. In shrub swamp wetlands, speckled alder dominates. Bog Labrador-tea is often thick in areas where there is a dense cover of speckled alder. Vegetation on logged uplands includes grasses, forbs, and beaked hazel.

In the unlogged areas, wetland forests are comprised of immature black spruce. In the northern portion of the lands, black spruce is co-dominant with tamarack; in the rest of the lands, tamarack is present in the canopy

but in much lower amounts. The midstory consists of balsam fir and black spruce, while the shrub layer is dominated by bog Labrador-tea, over a ground layer of nearly continuous sphagnum moss with scattered grasses and forbs. There are numerous downed trees and much woody debris associated with tree wind-throw in areas adjacent to the clearings.

Coyote Creek is bordered by emergent sedge meadow wetland comprised of sedges, narrow-leaved cattail, and Canada bluejoint. There are also scattered young tamarack and northern white cedar, as well as scattered patches of speckled alder and bog Labrador-tea. The emergent wetland is bordered by dense speckled alder. Water depth in the emergent and shrub swamp wetlands is about 18 to 24 inches.

Upland areas within the lands have been logged recently. Most of these areas have few trees remaining, though some areas still support paper birch up to 16 inches dbh and scattered balsam fir. The upland habitat along the boundary of the lands consists of both young and mature paper birch with scattered black spruce and northern white cedar, over an understory comprised of balsam fir.

4.3.5.4 Wolf Lands 4

Wolf Lands 4 is approximately 405 acres, of which about 363 acres are wetland (**Figure 12**). Coyote Creek bisects the lands, while the Stony River is found about 2,000 feet northwest of the lands. Timber harvests have recently occurred along the western border of the lands. Wetland habitats are dominated by immature coniferous forest and shrub swamp, while upland habitat consists primarily of mature deciduous forest (AECOM 2011c).

Coniferous forest dominates the wetland habitat. Black spruce forest dominates in the northern half of the lands, while northern white cedar is more prevalent in the southern half of the lands. Immature-size trees prevail over most of the lands, but patches of young black spruce are more common in the northeastern portion of the lands, and young northern white cedar and black spruce are more common in the southwestern portion of the lands. Emergent communities comprised of sedges and Canada bluejoint, and shrub swamp communities comprised primarily of speckled alder, are found in floodplains that border Coyote Creek.

Immature black spruce and black spruce/northern white cedar wetlands are dominated by trees ranging from 4 to 8 inches dbh. Scattered young and immature tamarack is also found in these wetlands. The low shrub layer is nearly continuous, and is comprised of leatherleaf, bog Labrador-tea, and other vegetation. Sphagnum and club mosses cover most of the ground.

Shrub swamp is dominated by speckled alder, with scattered black spruce, tamarack, and northern white cedar in the overstory. Leatherleaf and bog Labrador-tea cover comprise about 40 to 50% of the shrub layer.

Upland habitat consists of immature and mature paper birch and some black spruce. Trees are up to 18 inches dbh, although a 30 inches dbh jack pine and several large red pines to 24 inches dbh are found on the lands. Balsam fir is common in the midstory, while beaked hazel and raspberry are dominant in the shrub layer. In areas that have been logged recently, young paper birch is common over a shrub layer of beaked hazel, raspberry, and bog Labrador-tea.

4.4 Wetland Mitigation Lands

4.4.1 On-site Restoration

In accordance with the USACE *St. Paul District Policy for Wetland Compensatory Mitigation in Minnesota* and state guidelines, the potential for creating wetlands on-site was considered first. Approximately 102 acres of onsite wetland creation opportunities were identified that may occur at Project closure (Barr 2012, 2014d).

4.4.2 Off-site Mitigation

Three sites were identified to develop compensatory wetland mitigation for the Project. These are the 1,070-acre Aitkin Site, the 530-acre Hinckley Site, and the 569-acre Zim Site, which includes 481-acre Zim North (481 acres) and Zim South (88 acres) (**Figure 2**; Barr 2014a, 2014b, 2014c, 2014d). Of these 2,169 acres, about 1,603 acres would be restored to wetland habitat.

4.4.2.1 Aitkin Site

The Aitkin Site is a 1,070-acre planned mitigation area with about 876 acres of agricultural production, 46 acres of roads, buildings, and ditches, 48 acres are grassland, and 13 acres of forest (**Figure 13**). The types of habitats that would be restored on the site are discussed in Section 3.8.2.

4.4.2.2 Hinckley Site

The Hinckley Site is a 530-acre planned mitigation area. About 357 acres are in agricultural (sod) production; 95 acres are forestland, shrubland, and wet meadow/sedge wetland; 42 acres are upland forestland; 28 acres are comprised of roads, railroad tracks, buildings, and ditches; and 8 acres are grassland (**Figure 13**). The types of habitats that would be restored on the site are discussed in Section 3.8.2.

4.4.2.3 Zim North

The Zim North Site is approximately 481 acres, including about 393 acres of fields and open areas, 79 acres of woodlands, and 8 acres of buildings, roads, and borrow areas (**Figure 13**). This site primarily is used for sod production (Barr 2014c, 2014d). The types of habitats that would be restored on the site are discussed in Section 3.8.2.

4.4.2.4 Zim South

The Zim South Site is approximately 88 acres, including about 79 acres of fields and open areas, 8 acres of woodlands, and 2 acres of buildings, roads, and borrow areas (**Figure 13**). This site primarily is used for sod production (Barr 2014c, 2014d). The types of habitats that would be restored on the site are discussed in Section 3.8.2.

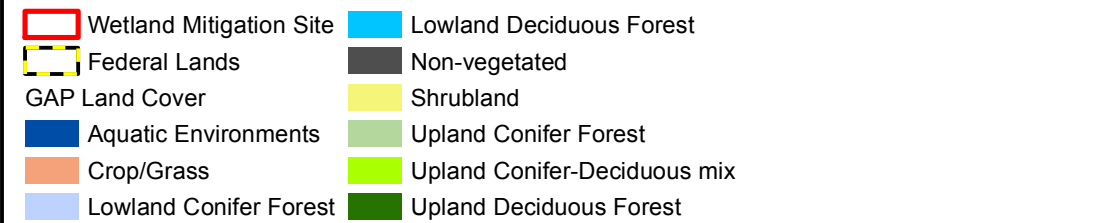
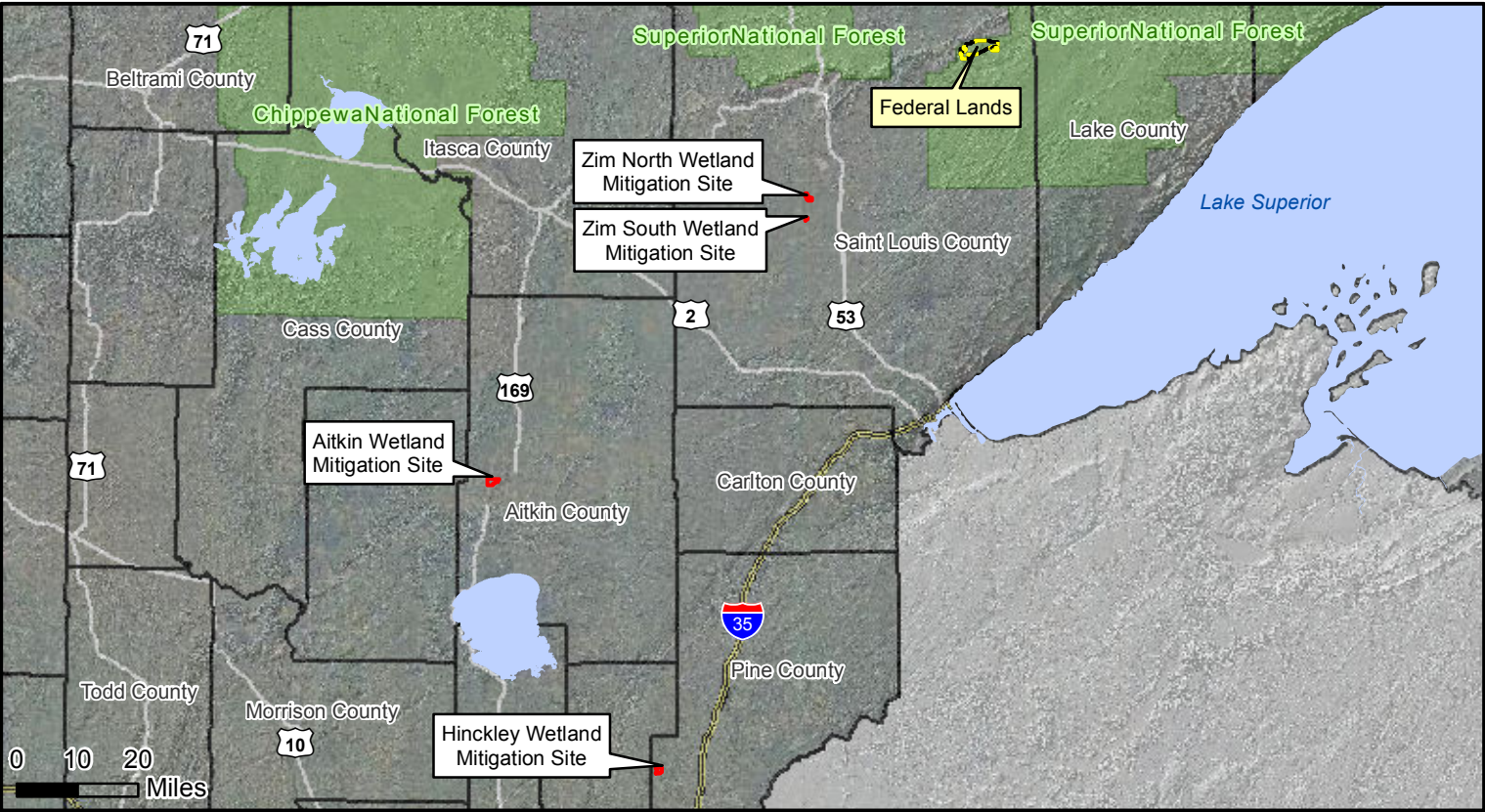
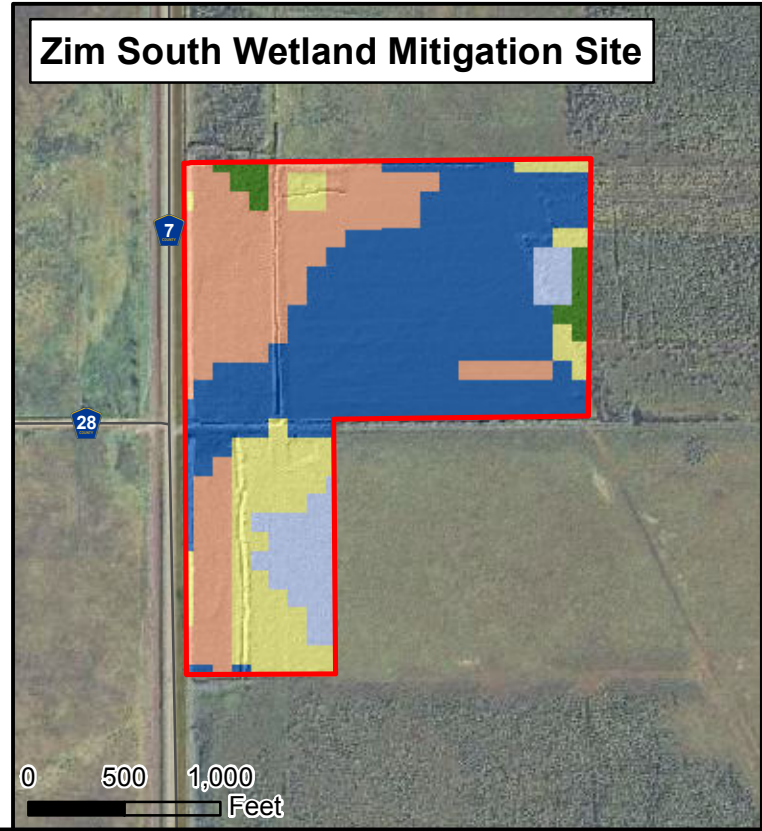
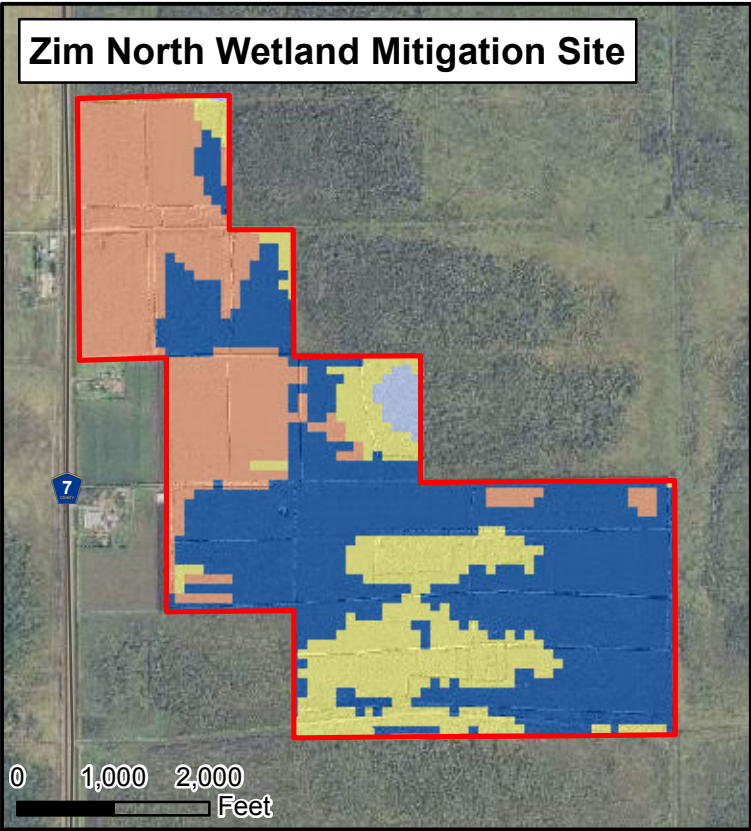
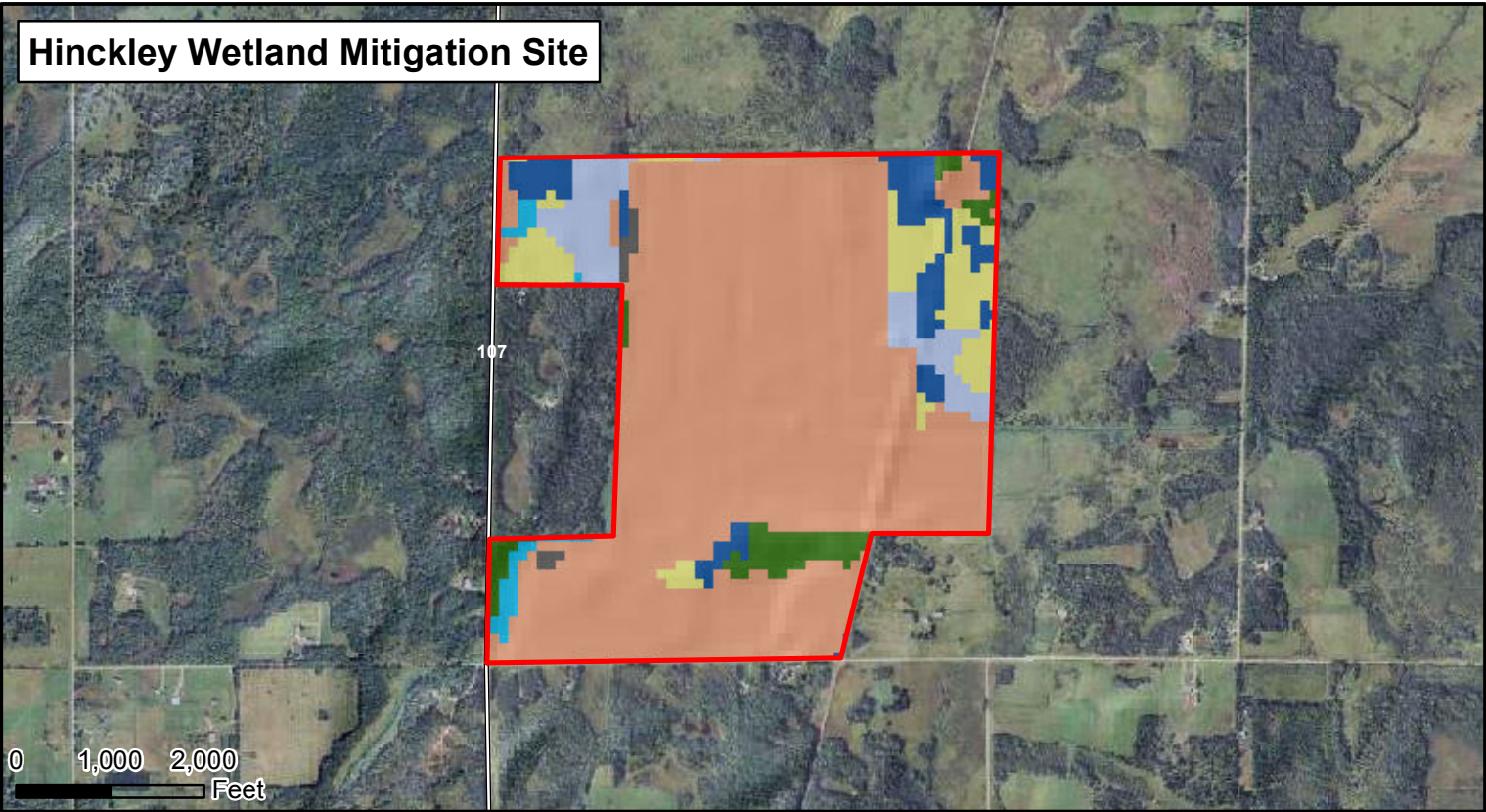
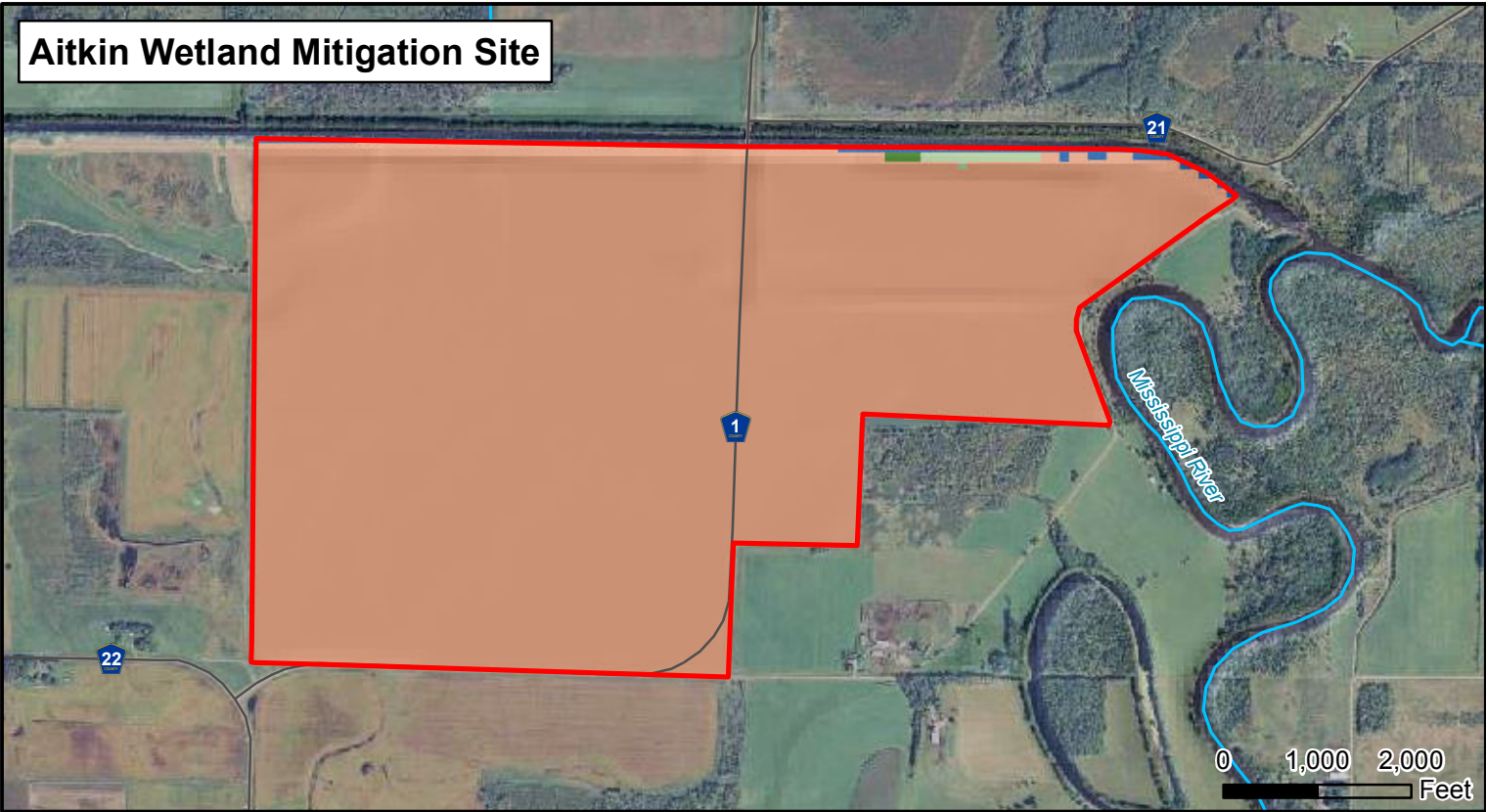


Figure 13
GAP Land Cover/Habitat Types - Wetland Mitigation Sites
Biological Assessment for the NorthMet Project and Land Exchange
St. Louis County, Minnesota

5.0 Biological Assessment Methodology

5.1 Literature Review

5.1.1 Biological Assessments and Biological Opinions

Several recent BAs and BOs have been prepared for proposed actions on or near the federal and non-federal lands and provided information that is used in this BA. These are:

- *Federally Listed Threatened and Endangered Species Programmatic Biological Assessment for the Revised Forest Plan Chippewa and Superior National Forests* (2004 Forest Plan BA; USDA Forest Service 2004b) – evaluated potential impacts to lynx and wolf and their critical habitats from proposed vegetation management activities in the Chippewa and Superior National Forests, including federal lands.
- *Biological Opinion for the Revised Land and Resource Management Plans (Forest Plans) for the Chippewa and Superior National Forests* (USDOJ USFWS 2004) – provided the USFWS evaluation of the potential effects to lynx and wolf and their critical habitats from proposed vegetation management activities in the Chippewa and Superior National Forests, including Project lands.
- *Whyte Project Biological Assessment* (USDA Forest Service 2006) – evaluated potential impacts to lynx and wolf and their critical habitats from proposed vegetation management activities in areas that include Wolf Lands 2, 3, and 4.
- *Final Biological Assessment for the Proposed Mesaba Energy Project* (AECOM 2009a) – evaluated potential impacts to lynx and wolf and their critical habitats for a proposed electric generating facility about 3 miles southwest of the Plant Site.
- *Tracks Forest Management Project Laurentian Ranger District, Superior National Forest, Biological Assessment* (Tracks Project BA; USDA Forest Service 2010) – evaluated potential effects to special status plants and animals from proposed forest management activities on the Tracks Forest Management Project (Tracks Project) area east of Hoyt Lakes and north of Brimson, Minnesota, in Lake and St. Louis Counties. The Track Project area encompasses about 152,000 acres of land of which approximately 78,000 acres are in the Superior National Forest.
- *Draft Biological Assessment for the Federal Hardrock Mineral Prospecting Permits Draft EIS* (2011 Hardrock Mining BA; USDA Forest Service 2011a) – evaluated potential impacts to lynx and wolf and their critical habitats from proposed hardrock mineral prospecting activities in the Superior National Forest, including the federal land.
- *Programmatic Biological Assessment for Federally-listed Species: Gray Wolf, Canada Lynx, and Their Critical Habitats for the Superior National Forest* (USDA Forest Service 2011b) – evaluated potential impacts to lynx and wolf and their critical habitats from proposed implementation of management direction for the Superior National Forest Plan, including the federal land.

- *Biological Opinion Mesabi Nugget Prevention of Significant Deterioration Permit* (USDOI USFWS 2009a) – evaluated potential impacts to lynx and wolf and their critical habitats from actions at the Mesabi Nugget facility immediately west of the Plant Site.
- *Biological Opinion Northshore Mine Eastern Progressions and CSAH 70 Relocation St. Louis County, Minnesota* (USDOI USFWS 2011a) – evaluated potential impacts to lynx and wolf and their critical habitats from actions east of the Northshore Mine and about 5 miles northeast of the Mine Site.

5.1.2 Other Sources of Information

This section is based on information (and references cited therein) in the following documents:

5.1.2.1 General

- *Consultation Handbook: Procedures for Conducting Consultation and Conference Activities under Section 7 of the Endangered Species Act* (USDOI USFWS and NMFS 1998).
- *Winter 2000 Wildlife Survey for the Proposed NorthMet Mine Site, St. Louis County, Minnesota* (ENSR 2000).
- *Land and Resource Management Plan for the Superior National Forest* (USDA Forest Service 2004a).
- *NorthMet Mine Summer Fish and Wildlife Study* (ENSR 2005).
- *2009 NorthMet Mine/Forest Additional Parcel Northern Goshawk and Owl Survey – Final Report* (AECOM 2009b).
- *2008 NorthMet Mine/Forest Service Additional Parcel Summer Wildlife and Wetland Assessment – Final Report* (AECOM 2011a).
- *2009 Hay Lakes Parcel and McFarland Lake Parcel Summer Wildlife and Wetland Assessment Final Report* (AECOM 2011b).
- *Hunting Club, Lake County, and Wolf Land Parcels Fall 2010 Wildlife and Wetland Assessment Final Report* (AECOM 2011c).

5.1.2.2 Canada Lynx

- *The Scientific Basis for Lynx Conservation* (Ruggiero et al. 2000a).
- *Canada Lynx Conservation Assessment and Strategy* (Ruediger et al. 2000).
- *Ecology and Conservation of Lynx in the United States* (Ruggiero et al. 2000b).
- *Canada Lynx Conservation Agreement* (USDA Forest Service and USDOI USFWS 2000).

- *Endangered and Threatened Wildlife and Plants: Determination of Threatened Status for the Contiguous U.S. Distinct Population Segment of the Canada Lynx and Related Rule; Final Rule* (USDOI USFWS 2000a).
- *Biological Opinion on the Effects of National Forest Land and Resource Management Plans and Bureau of Land Management Land Use Plans on Canada Lynx (Lynx canadensis) in the Contiguous United States* (USDOI USFWS 2000b).
- *Endangered and Threatened Wildlife and Plants: Notice of Remanded Determination of Status for the Contiguous U.S. Distinct Population Segment of the Canada Lynx; Clarification of Findings; Final Rule* (USDOI USFWS 2003a).
- *Endangered and Threatened Wildlife and Plants: Designation of Critical Habitat for the Contiguous United States Distinct Population Segment of the Canada Lynx* (USDOI USFWS 2006a).
- *Canada Lynx Assessment for the Proposed NorthMet Mine Project* (ENSR 2006).
- *Endangered and Threatened Wildlife and Plants; Revised Critical Habitat for the Contiguous United States Distinct Population Segment of the Canada Lynx (Lynx canadensis)*; USDOI USFWS 2008a).
- *Canada Lynx in the Great Lakes Region Final Report to USDA Forest Service and U.S. Geological Survey and Minnesota Department of Natural Resources* (Moen et al. 2008).
- *Canada Lynx in the Great Lakes Region 2008 and 2009 Annual Reports* (Moen 2008, 2009).
- *Endangered and Threatened Wildlife and Plants; Revised Critical Habitat for the Contiguous United States Distinct Population Segment of the Canada Lynx (Lynx canadensis); Final Rule* (USDOI USFWS 2009a).

5.1.2.3 Northern Long-eared Bat

- *Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition To List the Eastern Small-Footed Bat and the Northern Long-Eared Bat as Endangered or Threatened Species; Listing the Northern Long-Eared Bat as an Endangered Species; Proposed Rule* (USDOI USFWS 2013b).
- *Northern long-eared bat interim conference and planning guidance. January, 2014. USFWS Regions 2, 3, 4, 5, & 6* (USFWS 2014). *Summary of Acoustic and Emergence Surveys for Bats in the NorthMet Project Area* (USDA Forest Service 2014a).
- *Summary of the 2014 Minnesota Northern Long-eared Bat Summer Habitat Use in Minnesota Project (Preliminary Report)* (USDA Forest Service 2014b).
- *Endangered and Threatened Wildlife and Plants; Threatened Species Status for Northern Long-Eared Bat with 4(d) Rule; Interim and Final Rule* (USDOI USFWS 2015)

5.1.2.4 Gray Wolf

- *Recovery Plan for the Eastern Timber Wolf* (Wolf Recovery Plan; USDOJ USFWS 1992).
- *Minnesota Wolf Management Plan* (MDNR 2001).
- *Wolves: Behavior, Ecology, and Conservation* (Mech and Boitani 2003).
- *Endangered and Threatened Wildlife and Plants; Designating the Western Great Lakes Population of Gray Wolves as a Distinct Population Segment; Removing the Western Great Lakes Distinct Population Segment of the Gray Wolf From the List of Endangered and Threatened Wildlife* (USDOJ USFWS 2006b).
- *Final Rule Designating the Western Great Lakes Populations of Gray Wolves as a Distinct Population Segment; Removing the Western Great Lakes Distinct Population Segment of the Gray Wolf From the List of Endangered and Threatened Wildlife* (USDOJ USFWS 2007).
- *Endangered and Threatened Wildlife and Plants: Reinstatement of Protections for the Gray Wolf in the Western Great Lakes and Northern Rocky Mountains in Compliance with Court Orders* (USDOJ USFWS 2008b).
- *Endangered and Threatened Wildlife and Plants; Final Rule To Identify the Western Great Lakes Populations of Gray Wolves as a Distinct Population Segment and To Revise the List of Endangered and Threatened Wildlife* (USDOJ USFWS 2009b).
- *Endangered and Threatened Wildlife and Plants; Reinstatement of Protections for the Gray Wolf in the Western Great Lakes in Compliance With Settlement Agreement and Court Order* (USDOJ USFWS 2009c).
- *Endangered and Threatened Wildlife and Plants; Proposed Rule To Revise the List of Endangered and Threatened Wildlife for the Gray Wolf (Canis lupus) in the Eastern United States, Initiation of Status Reviews for the Gray Wolf and for the Eastern Wolf (Canis lycaon)* (USDOJ USFWS 2011b).

5.2 Database Inquiries

The MDNR Natural Heritage Information System Rare Features Database was queried for federally protected species documented within 1 mile of the federal and non-federal lands and Wetland Mitigation Sites (MDNR 2014a). The MDNR lynx database was also reviewed for lynx sightings that have occurred in the vicinity of these areas between 2000 and 2006 (MDNR 2007). The Natural Resources Research Institute (NRRI) lynx website was reviewed for records of radiomarked lynx within the study area (NRRI 2012). The Superior National Forest's lynx genetic reference database was also reviewed for records of lynx occurrence on or near the federal and non-federal lands and Wetland Mitigation sites.

5.3 Consultation with Biologists with Local Knowledge of the Species

Telephone and in-person interviews were conducted with agency and other personnel with knowledge of lynx in the region, including staff with the MDNR, Forest Service, USFWS, and University of Minnesota. The

information received from these contacts was used to gain information on lynx and wolf likely to be found in the areas of interest.

5.4 Field Studies

Canada lynx winter tracking surveys have been conducted in the vicinity of the Mine Site, including a 2006 survey at the Mine Site (ENSR 2006) and at sites about 6 miles east of the Mine Site (Barr 2011).

5.4.1 Project Lynx Survey

A survey was conducted for lynx within a radius of 6 miles of the Project during January through March of 2006. This area was identified by the USFWS as the minimum area that needed to be assessed to identify lynx that could be impacted by the Project (Burke 2006). The USFWS felt that lynx having territories further than 6 miles from the mine project would likely not be directly affected by the Project.

Six hundred sixteen miles of transect were surveyed in seven townships in and around the Project. Tracks and scat of four female lynx were identified during the survey, concentrated in areas approximately 5 miles south and east of the Mine Site. Lynx sign was most common in dense coniferous forests of balsam fir and jack pine. ENSR (2006) concluded that at least three lynx resided near the Mine Site.

5.4.2 Other Lynx Surveys near Project Area

A lynx survey was conducted for the Birch Lake Project and Maturi Project for Franconia Minerals Corporation, which is about 12 miles northeast of the Mine Site. Several lynx were found during the study, based on DNA analysis of scat samples and track locations. Open bog and stunted black spruce forest and jack pine and eastern white cedar cover provided habitat for snowshoe hare and lynx (Barr 2011).

5.4.3 Other Field Surveys

The Forest Service and other biologists with an interest in lynx and wolf have conducted informal track and scat surveys on or near the federal and non-federal lands and Wetland Mitigation Sites, and their data are included in this BA. These included radiotelemetry surveys of lynx conducted by the NRRI (2012) and surveys of wolf conducted by the International Wolf Center (2012).

General wildlife surveys were conducted for the federal lands in 2000, 2004 2008, and 2009 (ENSR 2000, 2005; AECOM 2009, 2011a); and for the non-federal lands in 2009 and 2010 (AECOM 2011b, c). These surveys included track surveys for Canada lynx and the results of these surveys are included in the BA.

Wildlife habitat features on the federal and non-federal lands, including plant species composition and structure and special features (snags, downed woody debris, rock outcrops, wetlands, and deer snow-intercept thermal cover) were recorded during field surveys. In particular, species composition, density, and size (dbh) of trees and shrubs near survey areas were noted, and the use of snags and other special habitat features by wildlife. The location of special features was recorded using Global Positioning System units. This information was recorded on aerial photographs, and, in conjunction with information on shrubs and herbaceous vegetation collected during surveys, was used to prepare habitat maps of the project lands.

The USFS Superior National Forest staff conducted surveys for the northern long-eared bat at three general locations in the Project area in July and August 2014 (USDA Forest Service 2014a). The three Project areas included the Mine Site, the Plant Site, and the Dunka Road and Utility Corridor. Survey methods utilized passive sonic (Anabat) detectors on the Mine Site and Dunka Road and Utility Corridor. At the Plant Site, the methods were primarily direct observation of bat species, supplemented by passive sonic detectors when feasible. The surveys found northern long-eared bats present at the Mine Site, Plant Site, and the Dunka Road and Utility Corridor.

Survey data confirmed that northern long-eared bats utilize the Mine Site and the Dunka Road and Utility Corridor for foraging and travel to and from foraging and roost sites. The Mine Site may also contain roost sites; however, the 2014 Forest Service surveys found no conclusive evidence of roost sites. The direct observations and passive sonic survey data suggested that northern long-eared bats used the Plant Site buildings for foraging, and that the Coarse Crusher and Concentrator Buildings “have potential for limited roost sites” (USDA Forest Service 2014a). No conclusive evidence of roost sites was found in the Plant Site buildings.

In addition, the 2014 USFS surveys and examination of the Mine Site, Plant Site buildings, and the Dunka Road and Utility Corridor found no evidence of northern long-eared bat hibernacula, or conditions suitable for hibernacula (USDA Forest Service 2014a).

In the spring of 2014, the Forest Service Superior National Forest staff and MDNR staff, with additional funding from USFWS, conducted a pilot project to describe summer habitat use by northern long-eared bats in Minnesota. Surveys were conducted at 12 sites, five of which were on the Superior National Forest. The survey captured six of the seven species of bats known to occur in Minnesota; tri-colored bat was the only species not captured. The most frequently captured bats were little brown bats (45%), and northern long-eared bats (22%) (Forest Service 2014b).

Acoustic surveys for bats were conducted as part of wildlife surveys for the federal and non-federal lands (AECOM 2011a, b, c). No effort was made to determine the species of bat making the echolocation. Seven bat species could occur in the Project area—northern long-eared bat, little brown myotis, big brown bat, tri-colored bat, silver-haired bat, eastern red bat, and hoary bat. Echolocations recorded during the surveys could have come from any of these seven bat species.

Echolocation surveys were conducted at five stations on the federal lands, although only four stations gave usable information due to rainfall during the survey at one station. Recordings indicated the presence of bats at all sites, with the greatest number of echolocations occurring at open water sites associated with the Partridge River and an unnamed creek, and the fewest echolocations at emergent wetlands covered with water and some aquatic vegetation.

Recordings on Hay Lake Lands showed that most echolocations occurred at an emergent wetland with open water (814 echolocations, mostly feeding activity). Moderate numbers of echolocations were recorded at the two sites along the Pike River (164 echolocations at the north Pike River site, 230 echolocations at the middle Pike River site; feeding activity was moderate), and at two small emergent wetland ponds with limited open water (64 and 181 echolocations; AECOM 2011b). An echolocation site to the south of Hay Lake Lands was located at a small patch of open water associated with an old beaver pond; 72 echolocations were recorded at this site. No echolocation surveys were made on Hunting Club Lands, Lake County Lands, and Wolf Lands as

surveys were conducted in November and bats would have already migrated from the area. Surveys were also not conducted at McFarland Lake Lands, although bats likely forage over McFarland Lake.

Acoustic surveys for bats have also recently been conducted on the federal lands by the Superior National Forest and the NRRI, but analysis has not been completed to determine the species making the calls.

Project effects on lynx, northern long-eared bat, and wolf habitat use were based on habitat classification systems developed by the MDNR and Forest Service. The primary GAP land cover types on the federal lands are lowland coniferous forest (46%), upland coniferous forest (25%), and upland deciduous forest (17%). On the non-federal lands, GAP land cover types include lowland coniferous forest (41%), shrubland (26%), and upland deciduous forest (17%).

The Forest Service designates and maintains data about Management Indicator Habitat (MIH) types on federal lands. The MIHs are based on forest type, including dominant species, stand age class, and stand condition. There are 14 MIHs, of which 13 MIHs pertain to forest habitats and 1 MIH pertains to aquatic habitats. A subset of these MIH types was used for the analysis of effects in the BE, including upland forest types (MIH 1; jack pine, red pine, white pine, balsam fir/trembling aspen-paper birch, black spruce-balsam fir, black spruce-jack pine, northern hardwoods, including oak and maple, trembling aspen, paper birch, and trembling aspen-black spruce-balsam fir); upland coniferous forest (MIH 5; all upland conifer and conifer-dominated mixed forest types); lowland black spruce-tamarack forest (MIH 9; all lowland conifer and lowland mixed conifer types dominated by black spruce or tamarack); and aquatic habitats (MIH 14; lakes, rivers, streams, pond, marshes or pools [permanent, intermittent, or seasonal]). A smaller subset of all MIH types were used for this analysis of effects to lynx, northern long-eared bat, and wolf, including upland forest (MIH 1), upland coniferous forest (MIH 5), lowland black spruce-tamarack forest (MIH 9), and aquatic habitats (MIH 14).

6.0 Baseline Analysis and Assessment of Effects

Section 6 includes background information and an analysis of the effects of the Project on lynx, northern long-eared bat, and wolf. The first part of each section provides background information on lynx and wolf abundance and distribution, habitat requirements, reproductive biology and life history, and current status and presence/absence of designated critical habitat. This is followed by a discussion of potential beneficial, direct, indirect, interdependent, and interrelated threats to lynx, northern long-eared bat, and wolf. Effects that are unrelated to the Project and that may result in cumulative effect as a result of the Project, are presented in Sections 6.1.4, 6.2.4, and 6.3.4, Analysis of Cumulative Effects. These effects are defined as follows:

- Beneficial – Effects of an action that are wholly positive, without any adverse effects, on a listed species or designated critical habitat. Determination that an action will have beneficial effects is a “may effect” situation.
- Direct – The direct or immediate effects of the project on the species or its habitat. Direct effects result from the proposed action including the effects of interrelated actions and interdependent actions.
- Indirect – Effects caused by or resulting from the proposed action that are later in time, and are reasonably certain to occur. Indirect effects may occur outside of the area directly affected by the action.
- Interdependent – Effects that result from an activity that has no independent utility apart from the action under consideration.
- Interrelated – Effects that result from an activity that is part of the proposed action and depends on the proposed action for its justification.
- Cumulative – Include the effects of future state, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this BA. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the ESA. Cumulative effects are discussed in Sections 6.1.4, 6.2.4, and 6.3.4.

For a more detailed discussion of types of effects, see USDOJ USFWS and NMFS (1998).

The effects assessment is based on the following factors:

- dependency of the species on specific habitat components,
- habitat abundance,
- population levels of the species,
- degree of habitat impact, and
- potential to mitigate for an adverse effect.

For the purposes of this assessment, the action area for direct and indirect effects includes those areas within 6 miles of Project, or approximately 250 mi². This area was identified by the USFWS as the minimum area that

needed to be assessed to identify lynx that could be impacted by the Project (Burke 2006). In addition, we have provided information on lynx and wolf found within about 6 miles of the federal lands, non-federal lands, and Wetland Mitigation Sites.

6.1 Canada Lynx

6.1.1 Environmental Baseline

6.1.1.1 Species Description and Status and Critical Habitat Status

The lynx is a medium-sized cat with long legs. Adult males average 22 pounds in weight and 33.5 inches in length (head to tail), and females average 19 pounds and 32 inches (Quinn and Parker 1987). The lynx's long legs and large feet make it highly adapted for hunting in deep snow.

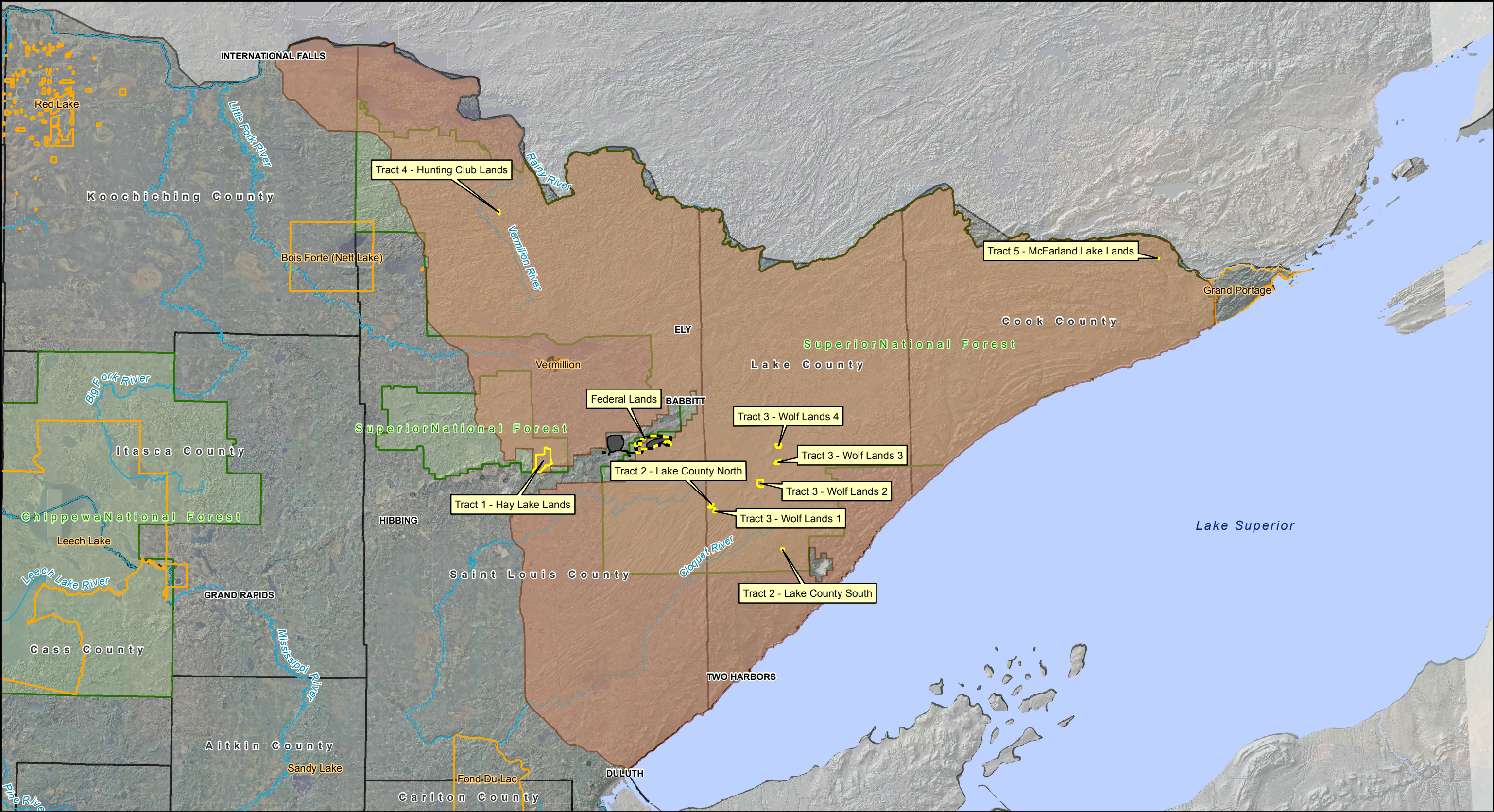
The bobcat is a North American relative of the lynx. Compared to the lynx, the bobcat has smaller paws, shorter ear tufts, and a more spotted pelage (coat), and only the top of the tip of the tail is black. The paws of the lynx have twice the surface area as those of the bobcat. The lynx also differs from the bobcat in its body proportions; lynx have longer legs, with hind legs that are longer than the front legs, giving the lynx a “stooped” appearance (Quinn and Parker 1987). Bobcats are largely restricted to habitats where deep snows do not accumulate (Koehler and Hornocker 1991). Hybridization (breeding) between lynx and bobcat was first documented in 2002 in Minnesota (Schwartz et al. 2004).




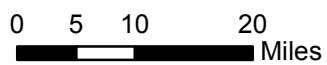
Classification of the lynx has been subject to revision. In accordance with Wilson and Reeder (1993), the USFWS currently recognizes the lynx in North America as *Lynx canadensis*. The USFWS previously used the scientific name *L. lynx canadensis* for the lynx (Jones et al. 1992). Other scientific names still in use include *Felis lynx* or *F. lynx canadensis* (Jones et al. 1986, Tumlison 1987).

On March 24, 2000, the lynx was federally listed as a threatened species in several states in the Northeast, Great Lakes Region (including Minnesota), and Southern Rockies (USDOI USFWS 2000a). On November 9, 2006, the USFWS designated 317 mi² as critical habitat in Voyageurs National Park (USDOI USFWS 2006a). On February 25, 2009, the USFWS re-designated lynx critical habitat to include portions of Cook, Koochiching, Lake, and St. Louis Counties, including portions of the federal lands, and all of the non-federal lands. A total of 8,065 mi² were designated as critical habitat in 2009 (USDOI USFWS 2009a). However, the designated critical habitat does not include lands immediately north of the Project which are part of the Iron Range and have been disturbed by past and ongoing mining activities (**Figure 14**). The Wetland Mitigation Sites also are not included within designated critical habitat. Lynx and/or their sign (scat, tracks) have been observed on or near the federal and non-federal lands, but not near the Wetland Mitigation Sites.

6.1.1.2 Distribution

The historical and present range of the lynx, north of the contiguous U.S., includes Alaska and the portion of Canada extending from the Yukon and Northwest Territories south to the U.S. border and east to New Brunswick and Nova Scotia. In the contiguous U.S., lynx historically occurred in the Cascades Range of Washington and Oregon; the Rocky Mountain Range in Montana, Wyoming, Idaho, eastern Washington,



<ul style="list-style-type: none">Critical Habitat - LynxFederal LandsNon-federal LandsProject AreasNational Forest BoundaryNative American Reservation	<ul style="list-style-type: none">County BoundaryMajor River	<div> US Army Corps of Engineers St. Paul District</div> <div></div>	<div> N W E S</div> <div> 0 5 10 20 Miles</div>	<p>Figure 14 Canada Lynx Critical Habitat Biological Assessment for the NorthMet Project and Land Exchange St. Louis County, Minnesota</p>
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eastern Oregon, northern Utah, and Colorado; the western Great Lakes Region; and the northeastern U.S. region from Maine southwest to New York (**Figure 15**; McCord and Cardoza 1982, Quinn and Parker 1987).

In the contiguous U.S., the distribution of the lynx is associated with the southern boreal forest, comprised primarily of subalpine coniferous forest in the West and mixed coniferous/deciduous forest in the East (Aubry et al. 2000). In Canada and Alaska, lynx inhabit the classic boreal forest ecosystem known as the taiga (McCord and Cardoza 1982, Quinn and Parker 1987, Agee 2000, McKelvey et al. 2000a). Within these general forest types, lynx are most likely to persist in areas that receive deep snow, for which the lynx is highly adapted (Ruggiero et al. 2000).

Lynx in the contiguous U.S. are part of a larger metapopulation whose core is located in the northern boreal forest of central Canada; lynx populations emanate from this area (Buskirk et al. 2000a, McKelvey et al. 2000a, b). The boreal forest extends south into the contiguous U.S. along the Cascade and Rocky Mountain Ranges in the West, the western Great Lakes Region, and the Appalachian Mountain Range of the northeastern U.S. At its southern margins, the boreal forest becomes naturally fragmented into patches of varying size as it transitions into other vegetation types. These southern boreal forest habitat patches are small relative to the extensive northern boreal forest of Canada and Alaska, which constitutes the majority of the lynx range. Lynx are considered “not at risk” in Canada (Committee on the Status of Endangered Wildlife in Canada 2006).

Many of these southern boreal forest habitat patches within the contiguous U.S. are able to support resident populations of lynx and their primary prey species. It is likely that some of the habitat patches act as sources of lynx (recruitment is greater than mortality) that are able to disperse and potentially colonize other patches (McKelvey et al. 2000b). Other habitat patches act as “sinks” in which lynx mortality is greater than recruitment and lynx are lost from the overall population. The ability of naturally dynamic habitat to support lynx populations may change as the habitat undergoes natural succession following natural or man-made disturbances (i.e., fire, clearcutting). In addition, fluctuations in the prey populations may cause some habitat patches to change from being sinks to sources and vice versa. The term “resident population” refers to a group of lynx that has exhibited long-term persistence in an area based on a variety of factors, such as evidence of reproduction, successful recruitment into the breeding cohort, and maintenance of home ranges. The word “transient” refers to a lynx moving from one place to another within suitable habitat. The word “dispersing” refers to lynx that have left suitable habitat for various reasons, such as competition or lack of food. When dispersing lynx leave suitable habitat and enter habitats that are unlikely to sustain them, these individuals are considered lost from the metapopulations unless they return to boreal forest.

6.1.1.3 Population Dynamics

Lynx numbers and snowshoe hare densities in the contiguous U.S. generally do not get as high as those in the center of their range in Canada, and there is no evidence they ever did so in the past (Hodges 2000a, b, McKelvey et al. 2000a). It appears that northern and southern snowshoe hare populations have similar cyclic dynamics, but that in southern areas both peak and low densities are lower than in the north (Hodges 2000b). However, it is unclear whether hare populations cycle everywhere in the contiguous U.S. Relatively low snowshoe hare densities at southern latitudes are likely a result of the naturally patchy, transitional boreal habitat at southern latitudes that prevents hare populations from achieving densities similar to those of the expansive northern boreal forest (Wolff 1980, Buehler and Keith 1982, Koehler 1990, Koehler and Aubry 1994). Additionally, the presence of more predators and competitors of hares at southern latitudes may inhibit the potential for high-density snowshoe hare populations with extreme cyclic fluctuations (Wolff 1980). As a result



- Resident Population
- Dispensers
- Resident/Dispensers



0 100 200 400
Miles

Figure 15
Contiguous United States Range of the Canada Lynx
Biological Assessment for the NorthMet Project and Land Exchange
St. Louis County, Minnesota

of naturally lower snowshoe hare densities, lynx densities at the southern part of the range rarely achieve the high densities that occur in the northern boreal forest (Aubry et al. 2000).

The density of lynx near the Project area was estimated to range from one lynx per 72 to 86 mi² based on lynx surveys conducted on or near the Project (ENSR 2006, Barr 2011). However, Moen (2009) noted that given the low densities of Canada lynx in Minnesota, it may be impossible to provide an accurate population estimate.

6.1.1.4 Lynx and Snowshoe Hare Relationships

The association between lynx and snowshoe hare is considered a classic predator-prey relationship (Saunders 1963, van Zyll de Jong 1966, Quinn and Parker 1987). In northern Canada and Alaska, lynx populations fluctuate on approximately 10-year cycles that follow the cycles of snowshoe hare populations (Elton and Nicholson 1942, Hodges 2000a, b, McKelvey et al. 2000a). Generally, researchers believe that when snowshoe hare populations are at their cyclic high, the interaction of predation and food supply causes the populations to decline drastically (Buehler and Keith 1982, Krebs et al. 1995, O'Donoghue et al. 1997). There is little evidence of regular snowshoe hare cycles in the Northeast, southern Quebec, and Minnesota (Hoving 2001, McCann 2006), but snowshoe hare populations can fluctuate widely in this region. Snowshoe hare fluctuations in this region may be more influenced by forest practices, weather, and other ecological factors.

Snowshoe hare provide the quality prey necessary to support high-density lynx populations (Brand and Keith 1979). Lynx also prey opportunistically on other small mammals and birds, particularly when hare populations decline (Nellis et al. 1972, Brand et al. 1976, McCord and Cardoza 1982, O'Donoghue et al. 1997, 1998a). Red squirrels are an important alternate prey (O'Donoghue et al. 1997, 1998a, Apps 2000, Aubry et al. 2000). However, a shift to alternate food sources may not sufficiently compensate for the decrease in snowshoe hares consumed to be adequate for lynx reproduction and kitten survival (Brand and Keith 1979, Koehler 1990, Koehler and Aubry 1994). When snowshoe hare densities decline, the lower quality diet causes sudden decreases in the productivity of adult female lynx and decreased survival of kittens, if any are born during this time. As a result, recruitment of young into the population nearly ceases during cyclic lows of snowshoe hare populations (Nellis et al. 1972, Brand et al. 1976, Brand and Keith 1979, Poole 1994, Slough and Mowat 1996, O'Donoghue et al. 1997, Mowat et al. 2000).

6.1.1.5 Home Range and Dispersal

Lynx require very large areas containing boreal forest habitat. The size of lynx home ranges varies by the animal's gender and age, abundance of prey, season, and the density of lynx populations (Hatler 1988, Koehler 1990, Poole 1994, Slough and Mowat 1996, Aubry et al. 2000, Mowat et al. 2000). Based on a limited number of studies in northeastern Minnesota, the average home range varied between 11 and 201 mi² for males, and 2 and 37 mi² for females (Burdett 2007). Male home ranges expanded during the breeding season, perhaps due to males searching for females, while female home ranges contracted (Moen et al. 2008).

Lynx are highly mobile and have a propensity to disperse. Long-distance movements (greater than 60 miles) are characteristic, and are more common among males (Mowat et al. 2000, Burdett 2007). Lynx disperse primarily when snowshoe hare populations decline (Ward and Krebs 1985, Koehler and Aubry 1994, O'Donoghue et al. 1997, Poole 1997). Subadult lynx also disperse even when prey is abundant (Poole 1997), presumably as an innate response to establish home ranges. Lynx also make exploratory movements outside their home ranges. Lynx are capable of moving extremely long distances (greater than 300 miles; Brainerd 1985, Washington Department of Wildlife 1993, Poole 1997, Mowat et al. 2000). While it is assumed lynx would prefer to travel

where there is forested cover, the literature contains many examples of lynx crossing large, unforested openings. The ability of both male and female lynx to disperse long distances, crossing unsuitable habitats, indicates they are capable of colonizing suitable habitats and finding potential mates in areas that are isolated from source lynx populations.

Moen et al. (2010) found that lynx in Minnesota disperse outside their home range and travel between Ontario, Canada, and Minnesota. About 40% of radiocollared male and female lynx made long-distance movements outside of their home range. Of those making long distance movements, females tended to move 62 to 124 miles and not return to their original home range, while males moved 31 to 49 miles and went back and forth between Ontario and Minnesota. Travel was generally linear, water was not avoided, and lynx walked around lakes while on long-distance movements. Movements were made across roaded areas, and also across the BWCAW, which has few linear features such as roads, trails, and logging roads that could guide movement by lynx. Observations suggested that geographically or topographically definable movement corridors do not exist for lynx in northeastern Minnesota, or between Minnesota and Ontario (Moen et al. 2010).

6.1.1.6 Mortality

Common causes of mortality for lynx include starvation of kittens (Quinn and Parker 1987, Koehler 1990), and trapping (Ward and Krebs 1985, Bailey et al. 1986). Lynx mortality due to starvation has been shown in cyclic populations of the northern taiga, during the first 2 years of snowshoe hare scarcity (Pool 1994, Slough and Mowat 1996). During periods of low snowshoe hare numbers, starvation can account for up to two-thirds of all natural lynx deaths. Trapping mortality may be additive rather than compensatory during the low period of the snowshoe hare cycle (Brand and Keith 1979). Hunger-related stress, which induces dispersal, may increase exposure of lynx to other forms of mortality such as trapping and vehicle collisions (Brand and Keith 1979, Carbyn and Patriquin 1983, Ward and Krebs 1985, Bailey et al. 1986).

Predation on lynx by mountain lion, coyote, wolverine, wolf, and other lynx has been observed (Berrie 1974, Koehler et al. 1979, Poole 1994, Slough and Mowat 1996, O'Donoghue et al. 1997, Apps 2000, Squires and Laurion 2000). Squires and Laurion (2000) reported two of six mortalities of radiocollared lynx in Montana were due to mountain lion predation.

An indirect effect of long-distance movements can be that some lynx are legally harvested in Ontario (USDA Forest Service 2011b). Although this harvest has little effect on the population of lynx in Ontario, it can affect the relatively small Minnesota population of lynx (Moen 2009, Moen et al. 2010).

There are few records of lynx being killed on highways, but direct mortality from vehicular collisions may be detrimental to small lynx populations in the lower 48 states. The MDNR lynx sighting records indicate that six lynx were killed by vehicle collisions in Minnesota between 2000 and 2006, and one lynx was killed by a train (MDNR 2007). Of those killed by vehicles, two occurred on Interstate 35, two on Highway 61, one on a county road, and one on the Gunflint Trail. No lynx-vehicle collisions have been reported on roads associated with mining projects, even though lynx have been observed using mine roads at the Northshore Mine and former Cliffs Erie mine site near the Project (ENSR 2006).

The USFWS Twin Cities Field Office has maintained an incidental take database since 2000. From 2000 to 2012, of 43 animals killed, 15 were from unknown causes, 13 were from trapping (4 due to legal trapping in Ontario, Canada), 7 were killed by vehicles, 6 were shot, and 2 were killed by trains (Rowse 2012). Between

2003 and 2009, the NRRI found that 15 of 19 radiocollared lynx deaths were directly or indirectly associated with human activities (Moen 2009, USDA Forest Service 2011b).

Many resident lynx that make movements into Ontario are harvested, particularly those that go long distances. Three radiocollared animals made 300 to 400 road mile movements to the same area in Ontario (USDA Forest Service 2011b). Lynx that conduct long-distance movements from Minnesota to Ontario are vulnerable to legal harvest in Canada whereas trapping mortality in Minnesota is incidental to trapping for other species because there is no legal trapping of lynx in the U.S. (Moen 2009). Moen et al. (2010) suggested that linear features such as roads benefit lynx from an energetic perspective, but may also be negative if they increase the chance of incidental mortality because of exposure to humans.

6.1.1.7 Recruitment

Lynx reproduction occurs in Minnesota. Based on 6 years of telemetry studies, an estimated 40 to 50 kittens were born to 33 radiocollared females. Only a few kittens survived past 2 years of age. Human factors have led to nearly all deaths, while starvation has been less important. These data suggest that lynx populations in Minnesota are influenced by lynx population dynamics in Ontario, Canada (Moen 2009).

6.1.1.8 Interspecific Relationships with other Carnivores

Buskirk et al. (2000b) described the two major competition impacts to lynx as exploitation (competition for food) and interference (avoidance). Of several predators examined (birds of prey, coyote, gray wolf, mountain lion, bobcat, and wolverine), it was deemed that coyotes were the most likely to pose local or regionally important exploitation impacts to lynx, and coyotes and bobcats were deemed to possibly impart important interference competition effects on lynx. Mountain lions were described as interference competitors, possibly impacting lynx during summer and in areas lacking deep snow in winter, or when high elevation snow packs develop crust in the spring.

In southern portions of snowshoe hare range, predators may limit snowshoe hare populations to lower densities than in the taiga (Dolbeer and Clark 1975, Wolff 1980, Koehler and Aubry 1994). Exploitation competition may contribute to lynx starvation and reduced recruitment. During periods of low snowshoe hare numbers, starvation accounted for up to two-thirds of all natural lynx deaths in the Northwest Territories of Canada (Poole 1994).

Parker et al. (1983) discussed anecdotal evidence of competition between bobcats and lynx. On Cape Breton Island, Nova Scotia, lynx were found to be common over much of the island prior to bobcat colonization. Concurrent with the colonization of the island by bobcats, lynx densities declined and their presence on the island became restricted to the highlands, the one area where bobcats did not become established.

Predation on adult lynx has rarely been observed and recorded in the literature. Predators of lynx include mountain lion, coyote, wolverine, wolf, and other lynx. The magnitude or importance of predation on lynx is unknown.

6.1.1.9 Behavioral Response to Humans

Staples (1995) described lynx as being generally tolerant of humans. Other anecdotal reports also suggest that lynx are not displaced by human presence, including moderate levels of snowmobile traffic (Mowat et al. 2000) and ski area activities (Roe et al. 1999).

In a lightly roaded study area in northcentral Washington, logging roads did not appear to affect habitat use by lynx (McKelvey et al. 2000c). In contrast, six lynx in the southern Canadian Rocky Mountains crossed highways within their home ranges less than would be expected (Apps 2000). The latter study area contained industrial road networks, twin-tracked railway, and 2 to 4-lane highways with average daily traffic volumes of about 1,000 to 8,000 vehicles per day.

6.1.1.10 Habitat Requirements

To understand habitat relationships of lynx one must first understand the habitat relationships of snowshoe hares. Generally, lynx hunt within habitats where snowshoe hare are common or abundant. An essential aspect of habitat is dense coniferous or mixed coniferous/deciduous forest cover that provides security for snowshoe hares. Snowshoe hares have evolved to survive in areas that have deep snow and use black spruce and balsam fir forests with dense understory vegetation that provide forage, cover to escape from predators, and protection during extreme weather (Wolfe et al. 1982, Monthey 1986, Hodges 2000a, b). Generally, earlier succession (younger) forest stages have greater understory structure than do mature forests and, therefore, support higher snowshoe hare densities (Fuller 1999, Hodges 2000a, b). The branches of trees in mature forests also capture more snow than younger forests, resulting in shallower snow in mature and younger forests (ENSR 2005).

Most lynx snowshoe hare kills occur in habitat where young or immature timber is prevalent and where a significant acreage of this habitat type is available. Lynx also hunt snowshoe hares in high stem density deciduous cover, such as speckled alder in riparian areas, and Canada bluejoint, willow, and bog birch in creek bottoms.

Communities used most often by lynx are young jack pine/balsam fir forests. Balsam fir often occurs as inclusions or “pockets” of regenerating trees within other cover types (e.g., in mature jack pine stands or in maturing black spruce/trembling aspen stands), and along forest edges. Lynx also use coniferous or mixed coniferous/deciduous forest patches in regenerating logged areas, including 10- to 25-year-old stands of jack pine or balsam fir/trembling aspen mixed coniferous/deciduous forest. Other important habitat types include black spruce/balsam fir and black spruce/tamarack forests.

Communities used by lynx often originate as a result of natural or “facilitated” regeneration after logging. However, fire and spruce budworm outbreaks also play a role in influencing forest stand composition and age in sites used by lynx. It generally takes 12 to 30 years after a forest thinning or fire before conditions become suitable for snowshoe hare, as forests mature from the young to the immature stage.

Lynx use coniferous forest plantations, especially where large stands of plantation forest occur in proximity to each other. Lynx use white spruce, jack pine, eastern white pine, red pine, and mixed coniferous/deciduous plantations, especially forests ranging from 10 to 30 years in age. Recent studies of snowshoe hare and red squirrel pellet density suggest that snowshoe hare and squirrel numbers are greatest in jack pine, red pine, black spruce, and mixed immature/mature and mature coniferous/deciduous forests; presumably, lynx would be more common in these habitats (Moen et al. 2004). Lynx in Minnesota have been observed hunting snowshoe hare in dense stands of young and mid-sized immature forest, especially balsam fir, black spruce, and jack pine forests. They have been reported avoiding lowland coniferous habitats, while favoring forest edges (Burdett 2007).

6.1.1.11 Diet

Snowshoe hares are the primary prey to lynx, comprising 35 to 97% of the diet throughout the range of the lynx (Koehler and Aubry 1994). Other prey species include red squirrel, several species of grouse, northern flying squirrel, ground squirrel, porcupine, beaver, mice, voles, shrews, fish, and ungulates as carrion or occasionally as prey (Saunders 1963, van Zyll de Jong 1966, Nellis et al. 1972, Brand et al. 1976, Brand and Keith 1979, Koehler 1990, Staples 1995, O'Donoghue et al. 1998b).

Several studies have shown that the importance of other prey species, especially red squirrel, increases in the diet during periods when snowshoe hares become scarce (Brand et al. 1976, O'Donoghue et al. 1998b, Apps 2000, Mowat et al. 2000). Recent research in northeastern Minnesota and northwestern Montana (Burdett 2007, Hanson and Moen 2008, Squires and Ruggerio 2007), however, concluded that red squirrel contributed little to the lynx diet and that lynx made little use of alternative prey species.

Hanson and Moen (2008) investigated the winter diet of lynx in northern Minnesota based on prey remains in lynx scat. Snowshoe hare remains were present in 76% of scats. Hair of white-tailed deer was found in scat, but white-tailed deer remains were used as bait to lure lynx to traps for a radiotelemetry study, and the authors felt that if scat with white-tailed deer hair were eliminated, snowshoe hare remains were found in 97% of scats. The study indicated that alternative prey are an insignificant component of Minnesota lynx diets in winter. No red squirrel remains were found in the analysis.

Most research has focused on the winter diet. Summer diets are poorly understood throughout the range of lynx. Mowat et al. (2000) reported that summer diets consist of less snowshoe hare and more alternate prey species than winter diets.

6.1.1.12 Den Site Selection

Lynx den sites are found where coarse woody debris, such as downed logs and wind-throw, provides denning sites with security and thermal cover for lynx kittens (McCord and Cardoza 1982, Koehler 1990, Koehler and Brittell 1990, Slough 1999, Squires and Laurion 2000). The integral component for all lynx den sites appears to be the amount of downed woody debris present rather than the age of the forest stand (Mowat et al. 2000, Moen and Burdett 2009). In Washington, lynx denned in immature lodgepole pine, black spruce, and subalpine fir forests older than 200 years with an abundance of downed woody debris (Koehler 1990). A den site in Wyoming was located in a mature subalpine fir/immature lodgepole pine forest with abundant downed logs and dense understory (Squires and Laurion 2000).

Based on radiotelemetry studies in Minnesota, most lynx dens are found in tree wind-throw areas with dense vertical and horizontal cover. Dens were often located in an area with foraging habitat and denning cover, and often in small patches of upland within a larger wetland. These are often areas where wind-throw occurs (Moen and Burdett 2009).

Female lynx appear to use a habitat mosaic that includes both foraging habitat and cover for denning. Den sites were often associated with wetland areas where dens were on small patches of upland surrounded by wetter low-lying areas (Moen et al. 2008). Moen and Burdett (2009) speculated that shallow soils in the low-lying areas may increase the chance that wind-throw would occur and provide suitable denning cover. Lynx appear to be adaptable in the selection of habitats to den in, but select specific types of areas based on the prevalence of wind-throw.

Moen et al. (2008) found that all den sites were associated with a downed tree, with disturbance area varying from about 50 square feet to greater than 2.5 acres. They also found that lynx den sites consistently had lower tree stem density than the surrounding area, with greater than 80% of tree stems being coniferous species. Lowland and upland coniferous forest cover types made up greater than 70% of the area within 330 feet of den sites and the percentage of those cover types decreased with greater distance from the den sites. These findings suggest that suitable denning habitat includes both upland and lowland forest 60 to 80 years old or greater depending on forest type (USDA Forest Service 2011b).

Moen et al. (2008), using denning habitat data, developed a model to estimate the spatial distribution of suitable denning habitat in northeastern Minnesota. This model has estimated that about 25% of the landscape in northeastern Minnesota consists of suitable lynx denning habitat. This suggests that lynx denning habitat is abundant and well-distributed in northeastern Minnesota and on the Superior National Forest.

6.1.1.13 Range of Lynx within the Contiguous United States

Within the contiguous U.S., the lynx's range coincides with that of the southern margins of the boreal forest along the Appalachian Mountains in the Northeast, the western Great Lakes, and the Rocky Mountains and Cascade Mountains in the West (**Figure 15**). In these areas, the boreal forest is at its southern limits, becoming naturally fragmented into patches of varying size as it transitions into subalpine forest in the West and deciduous temperate forest in the East (Agee 2000). Because the boreal forest transitions into other forest types to the south, scientists have difficulty mapping its exact boundaries (Elliot-Fisk 1988). Precisely identifying and describing the distribution of lynx habitat also is difficult because there are several vegetation and landform classifications and descriptions that have been published for various parts of North America (USDA Forest Service and Bureau of Land Management 1999). However, the term "boreal forest" broadly encompasses most of the vegetative descriptions of this transitional forest type that makes up lynx habitat in the contiguous U.S. (Agee 2000).

In addition to appropriate vegetation type, delineation of the range of the lynx within the contiguous U.S. must consider snow conditions. Lynx are at a competitive advantage over other carnivores (e.g., bobcats or coyote) in areas that have cold winters with deep snow because of their morphological adaptations for hunting and surviving in such environments. Therefore, lynx populations may not be able to successfully compete and persist in areas with insufficient snow even if suitable forest conditions otherwise appear to be present (Ruediger et al. 2000, Ruggiero et al. 2000b, Hoving 2001). A consistent winter presence of bobcats indicates an area that is not of high quality for lynx.

Lynx in the contiguous U.S. are part of a larger metapopulation whose center is located in the northern boreal forest of central Canada; lynx populations emanate from this area (Buskirk et al. 2000, McKelvey 2000a, b). When there is a high in the lynx population in central Canada, it acts like a wave radiating out to the margins of the lynx range. The magnitude of the lynx population high emanating from the central Canadian boreal forest varies for each cycle. This wave can be produced by local populations reacting to environmental conditions, dispersers, or a combination of these (McKelvey et al. 2000a, b).

An example of the cyclic population "wave" occurred in the 1960s and 1970s, when numerous lynx were reported in the contiguous U.S. far from source populations. These records of dispersing lynx correlate to unprecedented cyclic lynx highs in Canada (Adams 1963, Mech 1973, Gunderson 1978, Thiel 1987, McKelvey et al. 2000a, Mowat et al. 2000). These dispersers frequently were documented in areas, such as Wisconsin, that

are close to source populations of lynx in Canada or possibly northeastern Minnesota and that contain some boreal forest. But there also have been a number of occurrences of dispersers in unsuitable habitats far from source populations, such as the North Dakota prairie (Adams 1963, Gunderson 1978, Thiel 1987, McKelvey et al. 2000a).

Lynx populations in the northeastern U.S. and southeastern Canada are separated from those in northcentral Canada by the St. Lawrence River. There is little evidence of regular snowshoe hare or lynx population cycles in this area (Hoving 2001), but wide fluctuations in lynx and snowshoe hare populations do occur. On a smaller scale, fluctuating populations in the core of this area (Quebec's Gaspé Peninsula, western New Brunswick, and northern Maine) can potentially influence lynx distribution up to several hundred miles distant.

Lynx dispersing during periods of population highs will occupy many patches of boreal habitat at the periphery of their range. Some patches will be suitable to maintain a long-term population and some will not. Where the boreal forest habitat patches within the contiguous U.S. are large, with suitable habitat, prey, and snow conditions, resident populations of lynx are able to survive throughout the low period of the approximately 10-year cycle. Most likely the influx of lynx from populations in Canada at the high point of the cycle augments these resident populations. It is likely that some of these habitat patches within the contiguous U.S. are able to act as sources of lynx (where recruitment is greater than mortality) that are able to disperse and potentially colonize other patches (McKelvey et al. 2000b).

In other areas, few lynx may remain after a cyclic population high, or the habitat may be naturally marginal, so they are not able to persist or establish local populations, although some reproduction may occur. Such areas naturally act as population sinks (McKelvey et al. 2000b). Sink habitats are most likely those places on the periphery of the southern boreal forest where habitat naturally becomes patchier and more distant from larger lynx populations. Lynx found in these sink habitats are considered dispersers, but are usually included within the species range. Changes in the habitat conditions or cyclic fluctuations in the prey populations may cause some habitat patches to change from being sinks to sources and vice versa. Through this natural process, local lynx populations in the contiguous U.S. may "blink" in and out as the metapopulation goes through the 10-year cycle. Where habitat is of high enough quality and quantity, resident lynx populations are able to become established or existing populations are augmented, aiding in their long-term persistence.

Some maps (e.g., Hall and Kelson 1959) incorrectly portray the range of the lynx by encompassing peripheral records from areas that are not within boreal forest or do not have cold winters with deep snow, such as prairie or deciduous forest. Such maps have led to a misperception that the historic range of the lynx in the contiguous U.S. was once much more extensive than ecologically possible. Records of lynx outside of the southern boreal forest in peripheral habitats that are unable to support lynx represent long-distance dispersers that are lost from the metapopulation unless they return to the boreal forest and contribute to the persistence of a population. These unpredictable and temporary occurrences are not included within either the historic or current range of lynx because they are well outside of lynx habitat. This includes records from Connecticut, Indiana, Iowa, Massachusetts, Nebraska, Nevada, North Dakota, Ohio, Pennsylvania, South Dakota, and Virginia (Hall and Kelson 1959, Burt 1954 as cited in Brocke 1982, Gunderson 1978, McKelvey et al. 2000a). States that support some boreal forest and have frequent records of lynx are assumed to be the historic and current species range; these states include Colorado, Idaho, Maine, Michigan, Minnesota, Montana, New Hampshire, New York, Oregon, Utah, Vermont, Washington, Wisconsin, and Wyoming.

6.1.1.14 Range of Lynx within Great Lakes Geographic Region

Lynx are found within several geographic areas within the U.S.—the Cascade Mountains Geographic Area, Northern Rocky Mountains Geographic Area, Southern Rocky Mountains Geographic Area, Great Lakes Geographic Area, and Northeast Geographic Area. These geographic areas are separated from each other by expanses of unsuitable habitats that limit or preclude lynx movement, except the Northern Rockies and Cascades (USDOI USFWS 2000a).

Canada lynx in northern Minnesota are found within the Great Lakes Geographic Area. The Great Lakes Geographic Area encompasses northeastern and northcentral Minnesota, northern Wisconsin, Michigan's Upper Peninsula, and northern portions of Michigan. The majority of lynx occurrence records in the Great Lakes Geographic Area are associated with the mixed coniferous/deciduous habitat type (McKelvey et al. 2000a). Within this general forest type, the highest frequency of lynx occurrences have been in white spruce, balsam fir, jack pine, white pine, red pine, black spruce, and mixed black spruce/tamarack forest types. These forest types are found primarily in northern Minnesota, northern Wisconsin, and Michigan's Upper Peninsula.

About 4.5 million of the 6 million acres of Forest Service-administered lands in the Great Lakes Geographic Area are mapped as primary lynx habitat. These lands comprise about 19% of all lynx habitat within the Great Lakes Geographic Area. About 2 million acres are included within non-developmental land allocations where natural processes are expected to predominate. Private lands account for about 81% of the lynx habitat within the Great Lakes Geographic Area.

Although the mixed coniferous/deciduous forest covers an extensive area in the Great Lakes Region, much of this area may be marginal habitat for lynx because it is a transitional forest type at the edge of the snowshoe hare range. Habitat at the edge of hare range supports lower hare densities that may not be sufficient to support lynx reproduction (Buehler and Keith 1982). Furthermore, appropriate habitat with snow depths that allow lynx a competitive advantage over other carnivores (e.g., coyotes) occur only in limited areas in northeastern Minnesota, extreme northern Wisconsin, and Michigan's Upper Peninsula.

The historic status of lynx in the Great Lakes Region is uncertain. Minnesota has a substantial number of lynx reports (McKelvey et al. 2000a), which is expected because of the connectivity of the boreal forest with that of Ontario, Canada, where lynx occur. As noted earlier, lynx regularly travel between Minnesota and Ontario, Canada (Moen 2009, Moen et al. 2010). Wisconsin and Michigan have substantially fewer records of lynx. Researchers have debated whether lynx in this region are simply dispersing individuals emigrating from Canada, are members of a resident population, or are a combination of a resident population and dispersing individuals. Recent research efforts in Minnesota have confirmed a reproducing population of lynx. Reproduction has been documented in all years since 2001. However, there are a few records of lynx occurrence in Michigan and Wisconsin during this same period.

6.1.1.15 Range of Lynx in Minnesota

The majority of lynx occurrence records are from the northeastern portion of Minnesota; however, dispersing lynx have been found throughout Minnesota outside of typical lynx habitat (Gunderson 1978, Mech 1980, McKelvey et al. 2000a). In northeastern Minnesota, where deep snow accumulates, suitable lynx and snowshoe hare habitat is present. Much of this area is protected as designated wilderness, including the BWCAW. Furthermore, these habitats are contiguous with the boreal forest in southern Ontario. Until 1965, lynx had a bounty placed on them in Minnesota. In 1976, the lynx was classified as a game species, and harvest seasons

were established (DonCarlos 1994). Harvest and bounty records for Minnesota are available for 1930 to 1984. Approximate 10-year cycles are apparent in the data, with highs in the lynx cycle in 1940, 1952, 1962, and 1973 (Henderson 1978, McKelvey et al. 2000a). During a 47-year period (1930–1976), the Minnesota lynx harvest was substantial, up to 400 lynx in a year (Henderson 1978). These harvest returns for Minnesota are believed to be influenced by influxes of lynx from Canada, particularly in the 1960s and 1970s (Henderson 1978, Mech 1980, DonCarlos 1994, McKelvey et al. 2000a). When an anticipated lynx cyclic high for the early 1980s did not occur, the harvest season was closed in 1984 (DonCarlos 1994) and remains closed today.

Reproduction and maintenance of home ranges by lynx in Minnesota were documented in the early 1970s (Mech 1973, 1980), which may be evidence of a resident population (but see Section 6.1.1.7; Recruitment). The early 1970s were a period when the second highest lynx harvest returns in the 20th century occurred throughout Canada. The high numbers of lynx trapped in Minnesota during this period likely included immigrants from Canada (McKelvey et al. 2000b). Lynx were consistently trapped over 40 years during cyclic lows, which may indicate that a small resident population occurred historically.

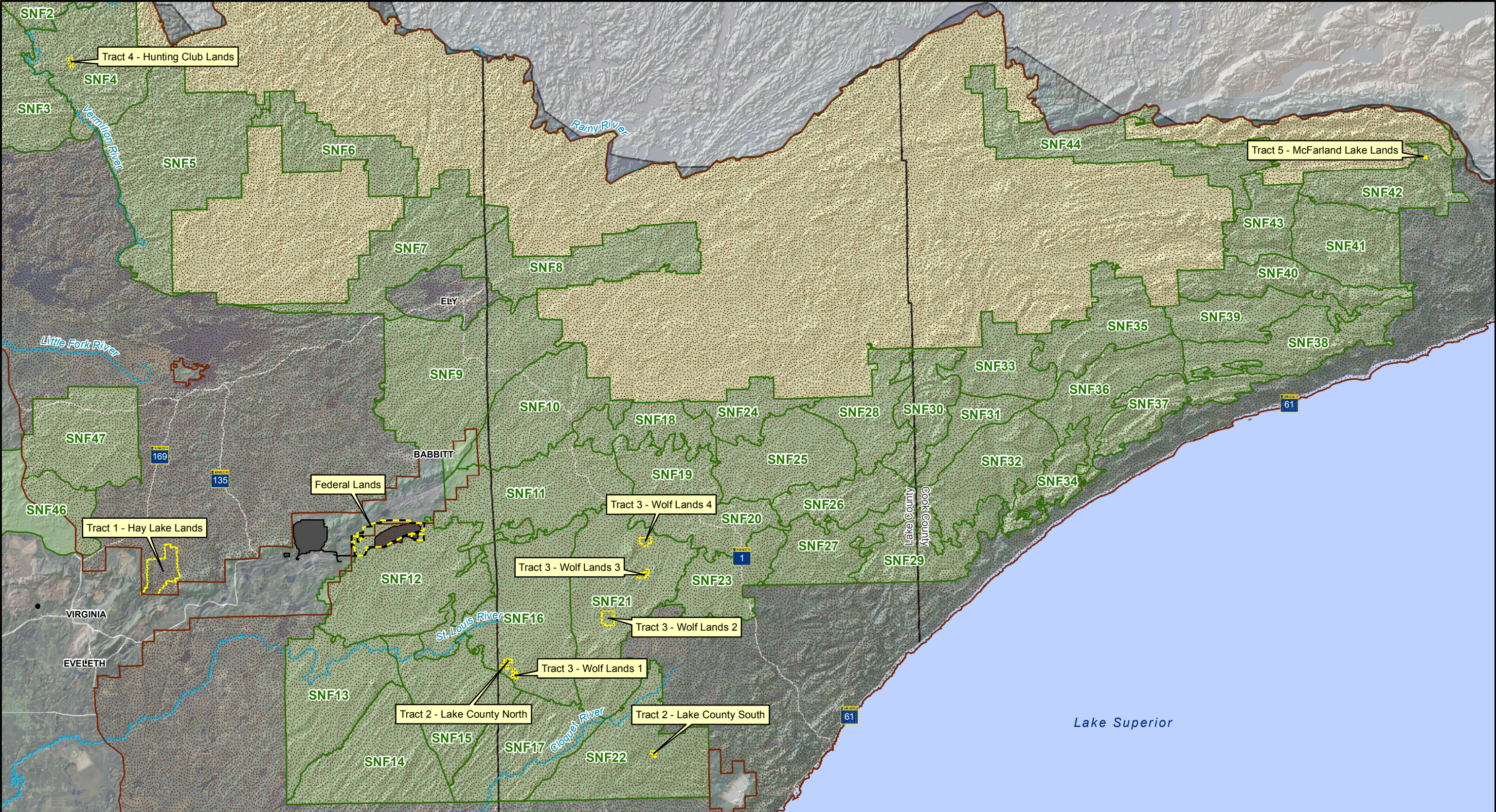
Lynx Analysis Units

The Superior National Forest first established Lynx Analysis Units (LAUs) in 2000 to map lynx habitats in the Superior National Forest using the criteria and procedures developed by the Lynx Science Team and Steering Committee (USDA Forest Service 2000b). Lynx Analysis Units are described in the Lynx Conservation Strategy and Assessment (Ruediger et al. 2000) as the smallest landscape-scale analysis units used to determine direct, indirect, and cumulative effects for lynx. Lynx Analysis Units may contain habitat that may or may not provide habitat or environmental conditions necessary to support lynx reproduction and survival. Lynx habitat outside LAUs exists because those areas did not contain sufficient habitat conditions to be viable LAUs (USDA Forest Service 2000b, 2004b).

In 2004, the LAUs were revised (USDA Forest Service 2004b, c, d) to add new LAUs, refine boundaries of some LAUs, and designate the BWCAW as a refugium for lynx.

The federal lands are in LAU Superior National Forest (SNF) 12. This LAU is 70,980 acres, of which 49,409 acres are on Forest Service-administered lands (Ryan 2013a). Under the proposed land exchange, there would be a loss of 6,495 acres under Forest Service administration within this LAU after transfer of the federal lands from the Forest Service to PolyMet, a 13% reduction in acreage administered by the Forest Service within LAU SNF 12. Under the land exchange, the non-federal lands, except Hay Lake Lands, would be incorporated into LAUs SNF 4, 16, 21, and 42, increasing the acreage of these LAUs administered by the Forest Service by approximately 2,149 acres (**Figure 16**). There is no LAU associated with Hay Lake Lands.

Table 5 shows the total acres of suitable and unsuitable lynx habitat in each LAU. After the land exchange, there would be a net decrease of about 1,719 acres of suitable lynx habitat within LAU SNF 12 due to the effects of the Project, or about a 2% decrease of suitable lynx habitat within the LAU. After reclamation, about 397 acres could provide suitable habitat for lynx in the future; however, due to the successional process, it could be 10 or more years after mining before revegetation results in much suitable habitat for lynx. Under the land exchange, there would be a loss of about 6,495 acres of suitable lynx habitat under Forest Service administration within LAU SNF 12, but a gain of 2,134 acres on other LAUs, for an overall loss of 4,361 acres under Forest Service administration within LAUs (MDNR et al. 2013, Ryan 2013a). However, the Forest Service would gain about 4,675 acres of suitable lynx habitat on Hay Lake Lands, although this acreage is not associated with an



Federal Lands

Non-federal Lands

Project Areas

Critical Habitat - Lynx

Major River

Lynx Analysis Unit (LAU)

Superior National Forest LAUs

Boundary Waters LAUs

Figure 16
Lynx Analysis Units
Biological Assessment for the NorthMet Project and Land Exchange
St. Louis County, Minnesota

Table 5
Suitable and Unsuitable Lynx Habitat within Lynx Analysis Units (for acreage under all ownerships within the LAU/for acreage administered by the Forest Service within the LAU) before and after the Project for the Federal and Non-federal Lands

Lynx Analysis Unit	Lands	Suitable Lynx Habitat before Land Exchange/Project	Unsuitable Lynx Habitat before Land Exchange/Project	Total Suitable Lynx Habitat after Land Exchange/Project¹
SNF 12	Federal Lands	69,131/47,908	2,737/31	67,412/41,413
SNF 4	Hunting Club	49,994/28,903	2,470/1,289	49,994/29,054
SNF 16	Lake County North and Wolf Lands 1	70,743/29,316	3,127/350	70,743/29,705
SNF 21	Wolf Lands 2, 3, and 4	69,632/32,984	2,931/272	69,632/34,434
SNF 22	Lake County South	57,107/40,217	913/344	57,107/40,330
SNF 42	McFarland Lake	27,775/19,609	534/13	27,775/19,640
NA	Hay Lake	NA	NA	4,675 ²
Net Gain (Loss) to Federal Estate within LAUs				(4,361) ³
Net Gain (Loss) to Federal Estate for all exchange lands				314

¹Acreage may differ slightly from acreage given in FEIS due to rounding.

²Gain in acreage in LAUs to Forest Service from land exchange; Hay Lake Lands are not within an LAU.

³Value differs from sum of acres due to rounding.

NA = Hay Lake Lands not within an LAU.

Total acreage within the LAU for all land ownerships —LAU SNF 4 = 55,071 acres, SNF 12 = 70,980 acres, SNF 16 = 76,108 acres, SNF 21 = 73,266 acres, SNF 22 = 58,154 acres, and SNF 42 = 32,305 acres; total acreage for lands administered by the Superior National Forest —LAU SNF 4 = 33,321 acres, SNF 12 = 49,409 acres, SNF 16 = 33,679 acres, SNF 21 = 36,082 acres, SNF 22 = 41,210 acres, and SNF 42 = 24,687 acres.

Sources: MDNR et al. (2013), Ryan (2013a).

LAU, resulting in an overall gain of 314 acres of suitable lynx habitat under Forest Service Administration after the land exchange.

Boundary Water Canoe Area Wilderness

The BWCAW serves as an important habitat refugium in northeastern Minnesota that connects with lynx habitat in Ontario, Canada. Moen et al. (2010) found that many lynx in the Superior National Forest portion of northern Minnesota travel through the BWCAW to and from Ontario, Canada. The quality, quantity, and distribution of lynx habitat in the BWCAW is primarily influenced by natural disturbance events and natural succession, although some prescribed fire management activities have occurred within the BWCAW (USDA Forest Service 2004b).

The BWCAW provides large amounts of lynx habitat, including about 755,000 acres of suitable lynx habitat, 667,000 acres of snowshoe hare habitat, and 481,000 acres of lynx denning habitat (USDA Forest Service 2011b:Table 15). The BWCAW is not managed using the LAU approach, and LAU management direction does not apply to the BWCAW. The 2004 Forest Plan BA concluded that the BWCAW refugium met the direction for minimum habitat conditions established for LAUs (USDA Forest Service 200b).

6.1.1.16 Observations of Lynx in the Vicinity of the Project

Minnesota Department of Natural Resources Lynx Database

Of 426 reports from March 2000 to November 2006 in the MDNR lynx sightings database, 323 (76%) of lynx sightings occurred in St. Louis (113 sightings), Cook (109 sightings), and Lake (101 sightings) Counties (**Figure 17**; MDNR 2007). Most sightings are incidental encounters, and as such, tend to be clustered along roads and other places frequented by observant and interested people. Thus, while these reports tell us something about where lynx are, they provide no information about where lynx do not occur. Similarly, we cannot know the relationship between the number of reports and the number of lynx in Minnesota at the time of the reports.

A review of the database revealed that a probable lynx sighting was made by a trained biologist in Section 13 of Township 59 North, Range 16 West, east of Hay Lake Lands, in October 2003. Another lynx sighting was made 1 mile to the west of Hay Lake Lands the same year. Unverified lynx sightings were made in December 2002 and January 2003 in Sections 22 and 27 of Township 64 North, Range 3 West, south of McFarland Lake Lands. There were no records of lynx within 6 miles of the other federal and non-federal lands or Wetland Mitigation Sites.

The relatively high proportion of lynx detected in northeastern Minnesota reflects, in part, the disproportionate survey effort that has occurred within this region as compared to other regions of the state that likely harbor lynx, and the number of lynx sightings may not be representative of the availability of suitable habitat or relative numbers of lynx.

Superior National Forest Genetic Reference Collection

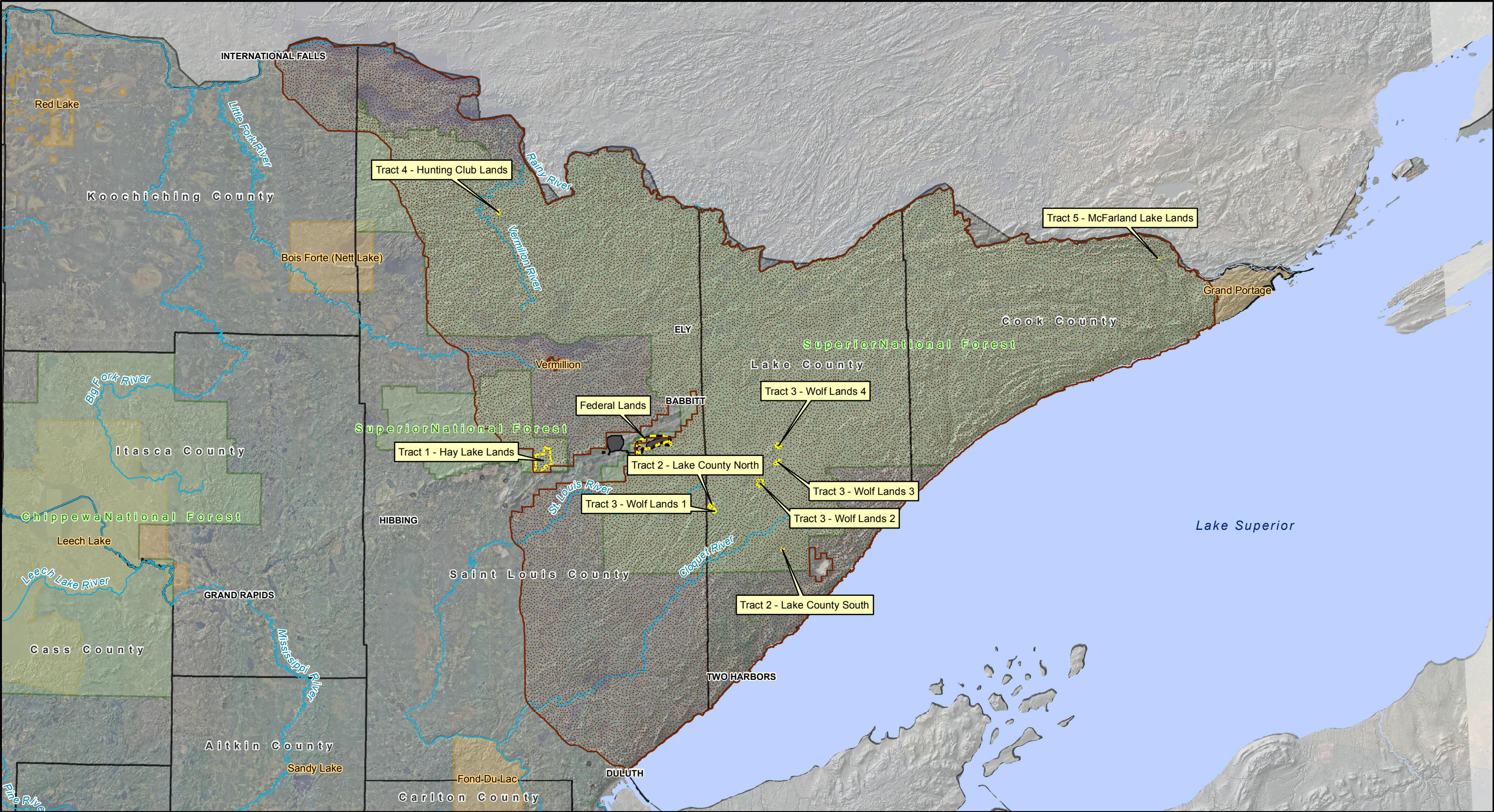
The Superior National Forest's genetic reference collection has 128 DNA sample collection points that have occurred within 6 miles of the Project since February 2004 (**Table 6**; Ryan 2013b). Lynx DNA have also been collected within 6 miles of the federal lands and all of the non-federal lands, except Hunting Club and McFarland Lake Lands; lynx DNA has been found within 10 miles of Hunting Club Lands and McFarland Lake Lands. Lynx DNA has been collected within 10 miles of the Hinckley Wetland Mitigation Site, but not within 10 miles of the other Wetland Mitigation Sites.

Natural Resources Research Institute Radio Telemetry Studies

Since 2003, the NRRI (2012) has captured and radiocollared and tracked 36 lynx in northeastern Minnesota. Four NRRI radiocollared study animals that were not identified in Superior National Forest's reference collection have been recorded within 6 miles of the Project.

Field Surveys

Several surveys have been conducted on and near the Project to determine lynx use based on tracks and scat. The Project lynx survey was conducted during January through March 2006 (ENSR 2006). Tracks and scat of three female lynx were identified during the survey within the study area, concentrated in areas approximately 5 miles east and south of the Mine Site; a fourth female was found adjacent to the study area (**Figure 18**). Lynx sign was most common in dense coniferous forests of balsam fir and jack pine. No evidence of lynx was found on the federal lands or Project areas.



- Lynx Sightings from Minnesota Lynx Database

 - Verified
 - Probable
 - Unverified
 - Evidence of Lynx Reproduction
 - Critical Habitat - Lynx
- Federal Lands
 - Non-federal Lands
 - Project Areas
 - National Forest Boundary
 - Native American Reservation
 - Major River

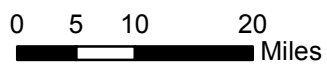
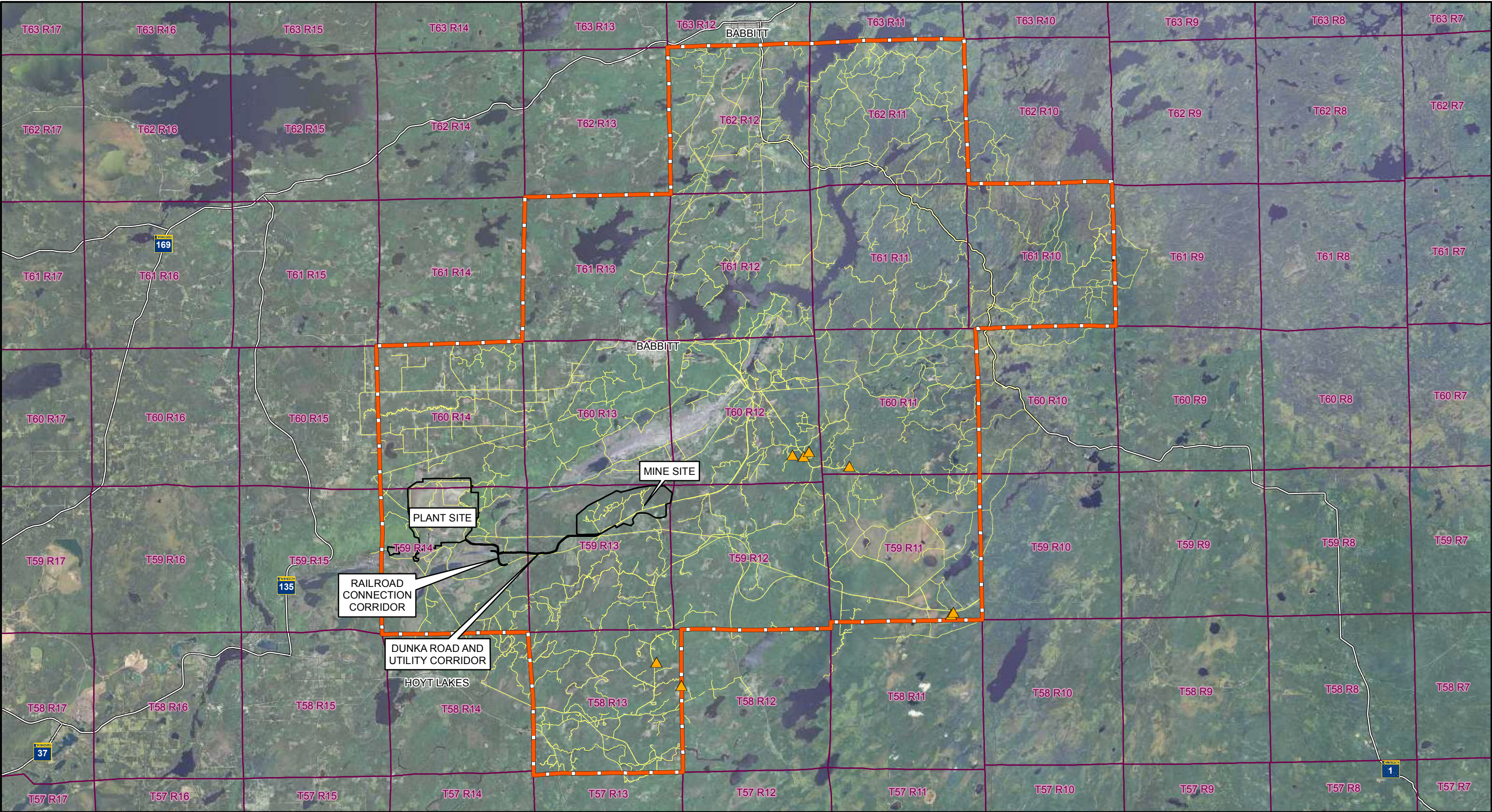


Figure 17
Canada Lynx Sightings in Northeastern Minnesota 2000 - 2006
Biological Assessment for the NorthMet Project and Land Exchange
St. Louis County, Minnesota



- ▲ Unique Individual Lynx
- Lynx Survey Routes
- ▭ Townships Surveyed For Lynx 2005-2008
- ▭ Project Areas
- ▭ Township Lines



0 1 2 4
Miles

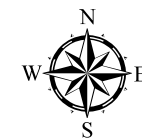


Figure 18
Lynx Survey Routes and Lynx Observations
Near Project Areas
Biological Assessment for the NorthMet Project and Land Exchange
St. Louis County, Minnesota

No lynx or their sign were seen on the federal and non-federal lands during wildlife surveys in 2000, 2004, 2008, 2009, and 2010 (ENSR 2000, 2005, AECOM 2009b, 2011a, b, c). However, Forest Service biologists did observe lynx tracks at the proposed Mine Site during a site visit in February 2010 (Ryan 2013c).

Table 6
Superior National Forest Genetic Reference Collection Records

Lands	Lynx DNA Occurrences Distance from Site	
	6 Miles	10 Miles
Project Areas ¹	128	144
Federal Lands	130	142
Non-federal Lands		
Hay Lake	9	27
Lake County	83	673
Wolf Lands	523	852
Hunting Club	0	2
McFarland Lake	0	1
Wetland Mitigation Sites		
Aitkin	0	0
Hinckley	0	1
Zim	0	0

¹Some of the Project areas are within the federal lands.

Source: Ryan (2013b).

Tracking surveys for lynx were also conducted east of the federal lands. Several lynx were found during the study, based on DNA analysis of scat samples and track locations (Barr 2011). Open bog and stunted black spruce forest and jack pine and eastern white cedar cover provided habitat for snowshoe hare and lynx.

Habitat suitability for lynx and snowshoe hare was determined by the Forest Service for Superior National Forest lands within LAUs. This information is used in this BA to evaluate habitat suitability and impacts to lynx and snowshoe hare habitats from activities on the federal lands.

6.1.2 Analysis of Direct and Indirect Effects to Lynx and Its Critical Habitat

6.1.2.1 Effects to Canada Lynx within the Action Area

The USFWS concluded in the *Endangered and Threatened Wildlife and Plants: Determination of Threatened Status for the Contiguous U.S. Distinct Population Segment of the Canada Lynx and Related Rule; Final Rule* (USDOI USFWS 2000a) that the single biggest factor threatening the lynx in the contiguous U.S. is the inadequacy of existing regulatory mechanisms, specifically the lack of guidance for conservation of the lynx in National Forest and other resource management plans. In addition, the USFWS noted that timber harvest and fire suppression impact lynx in the Great Lakes Geographic Area.

Lands under federal management are necessary to lynx conservation regionally and nationally, as federal lands often provide large amounts of forested habitat needed by lynx and snowshoe hare. Large tracts of National Forest lands are found to the east of the Project. Most of the lands not associated with Mesabi Iron Range mining and related activities are forests. These forestlands could provide important habitat for lynx that use the Project area, and for movement of lynx between the Project area and areas with higher densities of lynx to the northeast.

The Project is within the Superior National Forest and the lynx critical habitat includes the Project area. These forestlands, as well as nearby private forestlands, provide important habitat for lynx that use the Project area, and for movement of lynx between the Project area and areas with higher lynx densities to the northeast of the Project area.

Other Lynx Risk Factors

The *Lynx Conservation Assessment and Strategy* (Ruediger et al. 2000) identified several other risk factors for lynx in the contiguous U.S., which could also apply to lynx in or near the Project area. These factors are considered in the following section on the effects of the Project, and the cumulative effects of the Project and other projects within or near the study area, on lynx. These include (**bolded items** considered important in the Project area).

1. Factors Affecting Lynx Productivity
 - a. **Timber management**
 - b. **Wildland fire management**
 - c. **Recreation**
 - d. **Forest/backcountry roads and trails**
 - e. Livestock grazing
 - f. **Other human developments (mining, power generation, etc.)**
2. Factors Affecting Lynx Mortality
 - a. **Trapping**
 - b. Predator control
 - c. **Incidental or illegal shooting**
 - d. **Competition and predation as influenced by human activities**
 - e. **Highways (vehicular collisions)**
3. Factors Affecting Lynx Movements
 - a. **Highways, roads, and rights-of-ways**
 - b. **Land ownership patterns**
 - c. Ski areas and large resorts
4. Other Large-scale Risk Factors
 - a. **Fragmentation and degradation of lynx refugia**
 - b. Lynx movement and dispersal across shrub-steppe habitats
 - c. Habitat degradation by non-native invasive plant species

The Project would result in both beneficial and adverse direct and indirect impacts to factors of importance to lynx. This section summarizes effects associated with the lynx risk factors 1 to 3 affected by the Project. The effects of past, present, and future activities on risks to lynx, and issues associated with lynx risk factor 4, are discussed in Section 6.1.4.

Factors Affecting Lynx Productivity

Timber, Wildland Fire, and other Habitat Management

Direct and Indirect Effects

Direct and indirect effects to lynx from timber and other habitat management, and wildland fire, were assessed based on information collected during lynx tracking and radiocollar studies and wildlife habitat surveys on and near the federal and non-federal lands, and from lynx and snowshoe hare habitat assessments conducted on LAUs.

Timber and other Habitat Management

Mine Site

The Forest Service manages the federal lands as a General Forest and General Forest – Longer Rotation Management Area. The General Forest - Longer Rotation Management Area emphasizes land and resource conditions that provide a wide variety of goods, uses, and services. These include wood products, other commercial products, scenic quality, developed and dispersed recreation opportunities, and habitat for a diversity of terrestrial and aquatic wildlife and fish species (USDA Forest Service 2004a). The characteristics and use of the General Forest Management Area are similar to the General Forest – Longer Rotation Management Area, except that harvests are more frequent, more uniform in age, and more extensive. The General Forest Management Area has the highest amount of young forest and the largest sized timber harvest units.

The Forest Service identified vegetative cover, denning habitat, and prey habitat as important habitat elements for lynx (USDA Forest Service 2004b). Open water, highly disturbed, and forested areas less than 4 years (upland) or 9 years (lowland) old were considered unsuitable habitat for lynx. These are general guidelines, as lynx have been seen crossing frozen lakes and highly disturbed areas. For example, a lynx tracked about 5 miles northeast of the Mine Site used mine disturbance areas where shrubs, jack pine, trembling aspen, and paper birch had partially revegetated the landscape, providing habitat for snowshoe hare and ruffed grouse, especially where waste rock talus provided escape cover for snowshoe hares.

Based on Forest Service criteria and wildlife assessments done at the Mine Site, all of the Mine Site could provide suitable habitat for lynx. Most forests consisted of immature/mature-size trees, with tree cover near 80% in younger forests, and 40 to 50% in immature and mature forests. These stands would be favored by lynx for foraging, bedding, and traveling. Small patches of mature forest are found in the central and western portions of the Mine Site that could provide foraging, bedding, traveling, and denning habitat.

Habitat of lesser suitability is primarily limited to roads, railways, clearings, and recent clearcuts near the Dunka Road, and at other scattered locations on the Mine Site. Shrublands and young forests are associated with areas that had been recently logged. Scattered trees (trembling aspen, paper birch, jack pine, and black spruce) are

occasionally found in these areas, but shrubs, including speckled alder, beaked hazel, blueberry, and raspberry may cover up to 80% or more of the landscape; percent vegetative cover is much less in more recently logged areas.

Denning habitat typically occurs in more mature forest stands, especially in areas with tree wind-throw, although lynx have been seen denning in immature forests (Moen et al. 2004, 2008, Moen et al. 2008)). There are about 5,393 acres of denning habitat on the federal lands; approximately 1,333 acres of denning habitat are found within the area that would be impacted by mining (MDNR et al. 2013). Most mature forest habitat was in the central and western portions of the Mine Site. The largest trees are up to about 16 inches dbh for both coniferous and deciduous trees. There is little wind-throw in these forests, but large snags (up to 16 inches dbh), stumps, and woody debris are common in mature forest stands and could provide denning habitat for lynx (ENSR 2000, 2005, AECOM 2011a).

About 397 acres of habitat lost to mining would be reclaimed after mine closure, but due to the successional process, it could be 10 or more years after mining before revegetation results in much suitable habitat for lynx. Based on the mine closure plan, most of the 397 acres of the habitat lost to mining that would be reclaimed would be reclaimed as grassland/herbaceous (54%), wetland and/or grassland/herbaceous (27%), and wetland (18%). The West Pit would not be reclaimed, but would remain as a 320-acre open pit lake (MDNR et al. 2013).

Studies of snowshoe hare and red squirrel pellet density suggest that snowshoe hare and red squirrel numbers are greatest in jack pine, red pine, black spruce, and mixed immature/mature forests; presumably, lynx would be more common in these habitats (Moen et al. 2004). Snowshoe hare were seen throughout the Mine Site, but were most common in young and immature coniferous forest dominated by jack pine. Although upland coniferous forests are dominated by jack pine, jack pine is especially abundant in the eastern portion of the Mine Site, as were snowshoe hare.

Three lynx were found within 6 miles of the Mine Site during lynx tracking surveys (ENSR 2006). Important habitat features used by lynx were identified during snow tracking. One lynx hunted snowshoe hares in mature jack pine where balsam fir inclusions in the understory were prevalent and provided dense cover, and in immature jack pine forest, often near lowland edges where balsam fir and other young and immature conifers provided relatively dense cover. This lynx also used lowland coniferous habitats. This lynx stalked three locations where white-tailed deer had bedded and investigated one site where grouse activity had occurred. It used an area where white-tailed deer activity was high, and also followed white-tailed deer trails and hunted snowshoe hare at this location. Two resting beds used by this lynx were found, one in mature jack pine and the other in a recent clearcut near a timbered edge.

A second lynx used mature black spruce swamp and hunted primarily in young and immature jack pine forest regenerating on sites that had been clearcut within 25 years. Snowshoe hare densities were abundant in a small stand of jack pine/balsam fir where the lynx hunted. Two resting beds, within 325 feet of each other, were found in this stand. The lynx pursued a white-tailed deer for a short distance and visited a site where humans had deposited venison trimmings. The lynx also investigated the empty snow roost of a grouse.

Federal Lands Surrounding the Mine Site

The federal lands surrounding the Mine Site would also be transferred to PolyMet under the Proposed Action. PolyMet could include some upland timber management that could enhance wildlife habitat.

Based on Forest Service criteria and wildlife assessments done for the federal lands, nearly all of this area could provide habitat for lynx and snowshoe hare. Forest vegetation dominates the federal lands (88%; **Figure 9; Table 7**). Most forest stands contain trees that are 12 inches dbh or less. Large stands of lowland black spruce with scattered northern white cedar and tamarack are found in low areas, while stands of immature and mature forest dominated by jack pine, and smaller patches of immature deciduous forest are found in upland areas.

The northern area of the federal lands includes a portion of One Hundred Mile Swamp. The swamp is comprised of some young, but mostly immature and mature black spruce, northern white cedar, and tamarack forests. Northern white cedar is prevalent in the northcentral portions of the northern area of the swamp, while black spruce and tamarack are more common in the remaining areas. Most of the forest stands are 90 years or older, with much of the remaining stands 70 to 90 years of age (USDA Forest Service 2000a). Because this area is very wet, it would probably provide little habitat for lynx and snowshoe hare, except perhaps during winter.

Approximately 3,161 acres of immature and mature forest habitat are found on the federal lands surrounding the Mine Site. Large downed woody material was seen in these areas that could provide denning habitat for lynx, but there was little tree wind-throw observed on these lands, except along old logging roads in mature white cedar forests.

Transportation and Utility Corridors

Because of prior use during the former LTVSMC taconite mining operation, the Transportation and Utility Corridors are now defined as having a “disturbed” cover type. The remaining MDNR GAP land cover types that are not disturbed include cropland/grassland (8%), shrubland (6%), and smaller acreages of the remaining types. The corridors could be used by lynx for travel between more suitable habitat types.

Plant Site

Of the 2,189 acres that would be disturbed at the Plant Site, approximately 50% (1,103 acres) of the Plant Site is disturbed and supports little vegetation. The remaining areas consist of aquatic environments (26%), upland deciduous forest (13%), shrubland (7%), upland coniferous forest (2%), and lowland coniferous forest (1%; **Figure 10; MDNR et al. 2013**). Development of the Plant Site would have little impact on lynx habitat, as about 75% of the site has been disturbed by LTVSMC taconite mining operations or is aquatic habitat. The remaining habitat may be used by snowshoe hare and provide foraging habitat for lynx. Lynx could also use portions of the site for travel and bedding. Given the amount of existing land disturbance, and noise and other human disturbance that would be associated with Plant Site activities, it is unlikely that the Plant Site would be used by lynx during Plant operations, although the Plant Site could be used by lynx after reclamation.

Non-federal Lands

Under the Proposed Action, approximately 7,075 acres of non-federal lands would be transferred to the Forest Service. The Forest Service and MDNR cover type mapping and field and wildlife habitat surveys were conducted for these lands and give an indication of the suitability of these lands for lynx. Portions of the non-federal lands have been harvested during the past 20 years, with much of the harvest occurring on Lake County Lands North, Lake County Lands South, and Wolf Lands 2 and 3, as indicated by acres of grassland and shrubland habitats shown in **Table 7**. Snowshoe hare and lynx could use these areas, especially if these areas are in proximity to coniferous stands. About 267 acres consists of aquatic habitat, which would not be used by snowshoe hare, red squirrel, or lynx, except perhaps during winter.

Table 7
GAP Cover Type and MIH Habitat (acres) on Federal and Non-federal Lands¹

Cover Type	Federal Lands	Non-federal Lands									Net Gain (Loss) to Forest Service after Land Exchange ¹
		Hay Lake	Hunting Club	Lake North	Lake South	McFarland Lake	Wolf Lands 1	Wolf Lands 2	Wolf Lands 3	Wolf Lands 4	
MDNR GAP Types											
Aquatic	60	251	10	2	4	0	0	0	0	0	207
Disturbed	64	0	0	0	0	0	0	0	0	0	(64)
Cropland/grassland	6	32	0	0	0	0	0	0	0	0	26
Shrubland	646	1,665	45	28	11	0	7	54	32	4	1,200
Lowland coniferous forest	2,979	1,524	9	133	53	0	75	586	184	357	(58)
Lowland deciduous forest	10	17	4	1	0	0	0	6	0	0	18
Upland coniferous forest	1,619	437	8	33	39	4	13	87	46	32	(920)
Upland deciduous forest	1,092	1,000	85	34	10	27	27	30	12	8	141
Upland mixed coniferous/deciduous forest	21	0	0	34	0	0	4	6	3	4	30
Management Indicator Habitat (MIH) and other Forest Service Habitat Types											
MIH 1	1,330	2,366	89	49	2	26	44	57	41	20	1,364
MIH 5	1,252	54	13	1	0	4	0	8	0	0	(1,172)
MIH 9	3,060	1,818	17	194	46	0	72	627	186	349	249
MIH 14	0	206	10	1	3	1	0	1	1	4	227
Lowland Shrub	492	113	27	21	6	0	10	76	49	31	(159)
Lowland Emergent	186	365	4	0	16	0	0	0	1	0	200
Upland Grass	0	0	0	0	43	0	0	0	0	0	43
MIH Age Class											
Young	271	534	27	24	43	0	2	8	130	10	507
Immature	1,539	3,260	33	75	1	0	76	69	22	5	2,001
Mature	3,854	460	60	145	48	30	38	615	75	354	(2,029)

¹ Acreages may differ slightly from acreages given in FEIS due to rounding.

The majority of habitat on the non-federal lands consists of immature and mature (age class) upland and lowland coniferous and deciduous forest totaling 5,365 acres (76%) that could be used by lynx and snowshoe hare (**Table 7**; MDNR et al. 2013). Mixed coniferous/deciduous forest and lowland shrub swamp and upland shrubland are also important habitat components that could be used by both snowshoe hare and lynx.

Wetland Mitigation Sites

Under the Proposed Action, approximately 2,169 acres of Wetland Mitigation Site lands would be purchased by PolyMet as compensatory mitigation for impacts to wetlands and other waters of the U.S. These lands are used for sod production, but under the Proposed Action would be restored to native wetland and upland vegetation. According to the Wetland Management Plan (Barr 2014d), approximately 1,603 acres (this includes the preservation of 29 acres of coniferous bog) of wetland and 197 acres of upland would be restored/created at the off-site Wetland Mitigation Sites. These sites could provide habitat for lynx and snowshoe hare, but there have been no recent records of lynx in the immediate vicinity of these lands.

Wildland Fire Management

Fire, wind, insects, and disease historically played an important role in maintaining the mosaic of forest successional stages that provide habitat for both snowshoe hare and lynx (Bailey et al. 1986, Quinn and Thompson 1987, Koehler and Brittell 1990, Slough and Mowat 1996, Ruediger et al. 2000). For the first few years after a burn, there appears to be a negative correlation between lynx use and the amount of area burned. This short-term effect is likely due to the reduction of snowshoe hare populations, removal of cover, and possibly also to increased competition from coyotes in open habitats (Koehler and Brittell 1990). The lag time until the peak of snowshoe hare population increase is generally about 15 to 30 years (this varies depending on tree species, habitat type, and severity of disturbance). Re-sprouting of deciduous trees occurs more quickly, in 3 to 12 years. Snowshoe hare populations again decrease as the forest canopy develops and shades out the understory. Forest gaps processes, such as large wind-throws, insect infestations, and outbreaks of disease, produce similar effects (Agee 2000).

The Superior National Forest lies within a boreal forest system where natural fire occurrence is common. The Forest also provides for a variety of recreational and management activities which sometimes result in unwanted human-caused fires.

Fire management is an integral part of land and resource management on the Superior National Forest. Fire plays a natural role in achieving long-term goals of ecosystem health. Wildland fire management decisions and resource management decisions go hand-in-hand and are based on approved Fire Management and Land and Resource Management Plans. Wildland fire, as a critical natural process, may be re-introduced into the ecosystem where human life, property, or resource values are not at risk.

In all cases, protection of human life is the first priority in wildland fire management. Property and resource values are the second priority, with management decisions based on values to be protected. Structural fire protection in the wildland/urban interface is the responsibility of tribal, state, and local governments.

Lynx and snowshoe hare favor early successional habitats that occur in the boreal forest about 10 or more years after disturbance. Thus, wildland fire can initiate plant succession to the benefit of lynx and snowshoe hare. Lynx denning habitat would not be available until at least 60 or more years after a wildland fire event (see Sections 6.1.1.10 and 6.1.1.12).

Under the Proposed Action, fire prevention would be a high priority at the Plant Site and on federal lands to protect human life and mine and plant infrastructure. After mine closure, wildland fire may again become part of the natural ecosystem on the federal lands, but would likely not be allowed at the Plant Site due to its close proximity to other mine infrastructure and other private properties.

Wildland fire could occur on the non-federal lands, but would likely be actively controlled to minimize loss of timber on the lands and to minimize the risk to nearby properties. Most habitat management on these lands would primarily be associated with timber management and harvests, and for Wetland Mitigation Sites, wetland and upland restoration under the Proposed Action.

Summary of Impacts to Lynx Habitat

Numerous habitat and human-disturbance factors influence lynx use of an area. Factors most important in the study area include timber management, mining activity, and habitat fragmentation. The mine project would remove forestlands, reduce the amount of available habitat for lynx, and increase habitat fragmentation; much of this habitat would be reclaimed after mine closure. However, large tracts of land associated with the Superior National Forest and adjacent to the Mine Site would be managed for lynx and other wildlife habitat. These lands have the potential to reduce the amount of habitat fragmentation within the region and help to maintain travel corridors between areas of suitable habitat.

Despite the presence of suitable habitat over most of the federal lands, sightings of lynx on the federal lands have been few. Based on tracking surveys on and near the federal lands, lynx density appears to be relatively low near the federal lands (approximately one lynx per 83 square miles) compared to other portions of northeastern Minnesota (ENSR 2006). Lynx sightings were more common a few miles east of the federal lands (Barr 2011). Thus, the loss of habitat due to the mining may have little impact on lynx.

None of the federal lands surrounding the Mine Site would be directly impacted by the Proposed Action. However, noise, light, and other disturbances at the mine site could limit use of the area by lynx, and perhaps to a lesser extent by snowshoe hare.

Lynx have not been recorded on the federal lands associated with the Mine Site, based on tracking surveys, NRRI field studies, Forest Service DNA data (collected from lynx scat), and MDNR lynx records databases. However, lynx tracks were seen on the Mine Site by a Forest Service biologist during February 2010 (Ryan 2013c). Although the lands contain much potential habitat for lynx, they also consist of much wetland habitat that is little used by snowshoe hare and could make lynx travel difficult outside of winter. Thus, the Project may have little direct impact on lynx use of these lands.

Lynx were not observed on the non-federal lands during wildlife studies, but lynx scat has been collected within 6 miles of all of the non-federal lands, except Hunting Club Lands and McFarland Lake Lands; lynx DNA has been found within 10 miles of Hunting Club Lands. The MDNR lynx database showed that lynx have been recorded within a mile of Hay Lake Lands and McFarland Lake Lands, but there were no records of lynx within 6 miles of the other non-federal lands.

The Forest Service would gain additional lands that would provide habitat for lynx and snowshoe hare under the Proposed Action. However, given that these lands would not be directly or indirectly impacted by the Project, would likely not be developed in the near future, and would remain mostly in timber production with

limited recreational use, there would likely be little or no adverse or beneficial effects to lynx using the non-federal lands with or without the proposed land exchange.

Although the Forest Service would administer additional habitat for lynx under the land exchange, there would still be a net loss of habitat to lynx and snowshoe hare due to habitat loss at the Mine Site. If the land exchange does not take place, and non-federal lands are not acquired by PolyMet and remain privately owned, non-federal lands would likely be managed primarily for timber production and some recreational use (hunting, fishing, and cabins). Most of the non-federal lands are wetland and lowland coniferous forest and not suitable for most types of recreational development. At this time, there also appears to be little interest in mining these lands or conducting other large scale surface disturbance. Thus, these lands would continue to provide similar acres of habitat for lynx and snowshoe hare with or without the land exchange.

No lynx tracking surveys have been conducted on or near the Wetland Mitigation Sites. Only one lynx scat has been collected within 10 miles of the Wetland Mitigation Sites, and there are no records in the MDNR lynx database of lynx within 6 miles of the Wetland Mitigation Sites. These sites are sod farms that would be restored to wetland and upland habitat. They could provide habitat for lynx in the future, but the beneficial effects to lynx from acquisition of these lands would be minor, if any, as there appears to be little or no use of these sites by lynx.

Recreation

Recreational activities are becoming increasingly widespread across the landscape, but their effects on lynx are little known. Very few studies have investigated the complex interactions between humans and wildlife. Some anecdotal information suggests that lynx are quite tolerant of humans (USDOI USFWS 1992, Staples 1995, Roe et al. 1999, Mowat et al. 2000).

Non-consumptive recreational activities are growing in popularity over the more traditional consumptive recreation uses of hunting and fishing (Duffus and Dearden 1990). Trends indicate that land-based activities occurring within developed recreation sites or near roads involve the greatest number of people.

Roads and trails used for recreation may present several risks to lynx, depending on their distribution over the landscape, their accessibility, the season of use, and the intensity and frequency of use. Management concerns include the potential for increased human use associated with roads and trails, which could increase disturbance at den sites, shooting or trapping of lynx, lynx-vehicle collisions, and compaction of snow that may increase inter-species competition. Dispersed recreation activities seldom result in a direct loss of habitat, but are more likely to impart indirect effects, such as increased competition resulting from snow compaction.

Recreational snowmobile use has expanded dramatically over the past 25 years, and is a common recreational activity in northern Minnesota. The growth of snowmobile use and an expanded trail system over the past 2 to 3 decades has increased human presence in lynx habitat in northern Minnesota and elsewhere in the U.S.

Direct and Indirect Effects

Federal Lands and Plant Site

Access to the Project and federal lands is controlled by a security gate near the Plant Site, and a locked gate prevents vehicle access to the Dunka Road at the Northshore Mine. The Dunka Road is a private road,

however, recreationalists could access the Mine Site by using all-terrain vehicles or snowmobiles, or on foot, from the east by traveling along the Dunka Road, and from the south on Forest Service Road 113. The Northshore Mine is north of the federal lands and recreationalists are not allowed to access the Northshore Mine property.

Recreational hunting and all-terrain vehicle/snowmobile use have been observed on or near the federal lands, but use of the site by recreationalists is limited as there is not easy access to the site. During mine operations, access to the Project area would be strictly controlled and recreational activities would not be allowed on the Project area.

Natural population growth, along with an influx of workers to support the Project, would further increase the growth of recreational activity in the Project area and could possibly impact lynx activities. Causes of lynx mortality varies, but Moen (2009) found that most known deaths of lynx were directly or indirectly associated with human activities, both in Minnesota and Ontario, Canada. Dispersed recreation activities seldom result in a direct loss of habitat. However, the road and trail network that is used by dispersed recreation has resulted in a loss of lynx habitat by displacing native vegetation.

Risks to lynx from recreationalists from the Project could increase during mine operations from current levels, as lynx that use the federal lands would be forced into areas surrounding these sites where hunting and other recreational activities are allowed. However, studies have shown that lynx use of the federal lands is uncommon, and thus this risk to lynx would be low. After mine closure, the Project area would remain privately owned and access to the Project area by the public would be prohibited.

If public access to the Project areas and federal lands was no longer restricted, it is likely that recreational use of these lands would increase, to the potential detriment of lynx. However, there is little evidence of lynx use of the Mine Site and Plant Site, with most lynx observations occurring east of the Mine Site. Thus, there should be little impact to lynx if the land exchange does not occur.

Non-federal Lands and Wetland Mitigation Sites

The non-federal lands are privately owned, but some hunting and off-road vehicle use occurs on these lands, except McFarland Lake Lands. Under the Proposed Action, the non-federal lands would be administered by the Forest Service and would be open to public recreation, including hunting and off-road travel. The Wetland Mitigation Sites would be privately owned and hunting and off-road vehicle would not be allowed. It is unlikely that new roads would be constructed to improve access to the non-federal lands and Wetland Mitigation Sites. Thus, risks to lynx from recreational activity would likely not change substantially under the Proposed Action.

If the land exchange does not occur and if the Project is not permitted, non-federal lands and Wetland Mitigation Sites would remain privately owned. Non-federal lands would likely be managed primarily for timber production, and some recreational use (hunting, fishing, and cabins), while the Wetland Mitigation Sites would be managed for agriculture. The level of recreation use and risks to lynx on these areas would not change substantially from current levels.

Forest and Backcountry Roads and Trails

There is a well-established forest and backcountry road and trail system along the Mesabi Iron Range, associated with mining activity, accessing federal, state, county, and privately owned forestlands, and serving recreational areas, private residences, and pasturelands. Roads and trails may present several risks to lynx based on the potential for increased human use in lynx habitat.

Construction of roads may reduce lynx habitat by removing forest cover and increasing the threat of illegal hunting and trapping. On the other hand, in some instances, along less-traveled roads where vegetation provides good snowshoe hare and white-tailed deer habitat, lynx may use the roadbed for travel and foraging (Koehler and Brittell 1990).

Forest backcountry roads and trails may facilitate snowmobile, cross-country skiing, and other human uses in the winter. As described later, snow compaction on roads or trails may allow competing carnivores, such as coyotes and mountain lions, access into lynx habitat (Buskirk et al. 2000). In the absence of roads and trails, snow depths and snow conditions normally limit the mobility of these other predators during midwinter.

Squires et al (2010) found no evidence that lynx are sensitive to forest roads, including roads used by snowmobiles in the winter. This study concluded that seasonal resource-selection patterns of lynx were little affected by forest roads with low vehicular or snowmobile traffic. In densely forested areas, vehicle use was concentrated on roads and trails and lynx were disturbed less than in other more open areas. Lynx were often seen crossing roads near the Mine Site and Northshore Mine during winter lynx surveys in 2006 and 2008 (ENSR 2006, Barr 2011).

Moen et al. (2010) showed that lynx will take advantage of roads when present and that a road and trail network increases habitat connectivity for lynx. In northeastern Minnesota, lynx on long-distance movements traveled within an average distance of less than 656 feet to a road. Lynx use of roads and other linear features is probably based on the energetic efficiency of moving along a road compared to moving through a forest. The northeastern Minnesota landscape is characterized by dense forests, bogs, and lakes of various sizes. Lynx may find that it is more energetically efficient to walk on or alongside of a road, whether within the home range or while on a long-distance movement.

Snowshoe hare densities may be higher along roads and trails due to the juxtaposition of land cover types and ages along these linear routes. The forest edges along forest roads provide preferred habitat for snowshoe hare. Regenerating and young forest is the cover type that has the highest density of snowshoe hares in Minnesota. Therefore, road and trails appear to provide productive snowshoe hare edge habitat that lynx opportunistically utilize (Moen et al. 2008).

Moen et al. (2010) indicated that the road and trail network may increase the connectivity of different parts of the Superior National Forest, and may enable lynx to move further than they would in the absence of a road and trail network. It is also possible that the existing road and trail network would make it easier for immigrating Canada lynx to find parts of the Superior National Forest with adequate snowshoe hare densities.

While linear features such as roads may benefit lynx from an energetic perspective, they may also be negative if they increase the chance of incidental mortality because of exposure to humans. It is unlikely that lynx behavior could be modified to prevent lynx from using linear features such as roads and trails (Moen et

al. 2010). Managing the road and trail network can minimize the potential for conflicts. But whether roads and trails are closed to motorized vehicle use or not, it may be impossible to totally eliminate human-lynx conflicts because human use would continue on non-motorized routes. The benefit of reducing mortality risk by managing road networks and densities has to be balanced against the cost of not being able to use linear features on long-distance movements.

Direct and Indirect Effects

Federal Lands, Transportation and Utility Corridors, and Plant Site

Impacts to lynx in and surrounding the Project area may include mortality from collisions with vehicles and trains. Construction and operation of the project, and the influx of workers to the area, would mean an increase in vehicular and rail traffic. The FEIS estimates that the Project would generate up to 1,316 miles per day of vehicle traffic near the Project site, including trips between the Mine Site and the Plant Site, and trips between the Plant Site and the Area 1 Shop. Vehicle traffic would consist primarily of light trucks and maintenance vehicles traveling between 30 and 45 miles per hour (mph), and a few large fuel, waste/supply, and haul trucks traveling between 25 and 40 mph. The Project would also generate 418 total miles per day of rail traffic between the Mine and Plant sites during mine operations. Trains would operate at 15 to 25 miles per hour (MDNR et al. 2013).

Harm or loss of lynx from collisions with vehicles or trains traveling within the Project boundaries cannot be discounted, but the risk would be very small as there is currently little use of the Project area by lynx, and use of the area by lynx would decrease substantially during project operations due to loss of habitat and noise and disturbance associated with Project activities.

In previous BOs for federal actions that are ongoing in Minnesota, including the *Mesaba Nugget Prevention of Significant Deterioration Permit U.S. Environmental Protection Agency* (USDOI USFWS 2009d), and *Northshore Mine Eastern Progression and CSAH 70 Relocation St. Louis County, Minnesota* (USDOI USFWS 2011a), the USFWS anticipated various levels of take, or loss of lynx to collisions with vehicles or other factors. Based on these opinions, the USFWS estimated that several lynx could be killed annually by current ongoing project-related activities in northern Minnesota, although actual take has been substantially less.

A Wisconsin study (Kohn et al. 2000 *cited in* USDOI USFWS 2009d) of wolf deaths by vehicles was used to estimate the number of lynx and wolf that could be killed by collisions with vehicles along the Dunka Road and Utility Corridor. In that study, an estimated 0.01 wolf were killed per mile of road for a traffic volume of 4,700 vehicles per day and a wolf density of 0.006 wolf per square kilometer. For the previous BOs, and this BA, it was assumed that the likelihood of a collision is the same for lynx and wolves, that trains and vehicles are equally likely to hit a lynx or a wolf, and that the collision frequency is related to the density of the species in the Project area and the vehicle/rail miles traveled per year. The USFWS noted that even intensive studies, such as the wolf mortality study in Wisconsin, may not document all road-related mortality within the study area (USDOI USFWS 2009d). Thus, the USFWS assumed that lynx and wolf mortalities due to automobile collision were actually twice the levels reported from the Wisconsin study (0.02 wolf killed per mile of road).

Based on the assumption that there is about 0.0048 lynx/square kilometer (km²; 1 lynx per 80 mi²; 1 lynx per 207 km²; see Section 6.1.1.3); that there would be about 1,316 vehicle and 418 rail miles traveled each day; that vehicle/rail collisions with lynx could occur during the Project ; and that vehicles and trains are equally likely to collide with lynx, it was estimated that approximately 0.006 lynx would be killed annually by vehicle/rail

traffic on the road/rail line between the Mine Site and Plant Site, or less than one (0.12) lynx during the estimated 20-year life of the Project (assuming that mortalities due to collisions with vehicles and trains were twice the estimated level). Thus, although risk of loss of lynx due to a collision with a vehicle or train is very small, it could occur during the life of the Project.

After mine operations cease, temporary roads would be closed and reclaimed except for a short road from the Dunka Road to the Waste Water Treatment Facility. The Dunka Road would be retained and would provide access to the Mine Site area after mine closure, but would be a private road and closed to public use. Although roads would be constructed to support mine and plant operations, it is expected that the miles of roads on the Mine and Plant sites would decrease from current levels after Mine Site and Plant Site reclamation, thus benefiting lynx (Pylka 2013b).

Temporary roads have been constructed on the federal lands to support timber harvest activities and within a ROW to support powerline maintenance. Except for recently constructed gravel roads to access timber harvest areas, temporary roads are now overgrown in places with vegetation and are generally only suitable for foot, all-terrain vehicle, and snowmobile travel. Vegetation within the ROW is maintained at a low height for safety purposes, and the ROW is accessible to all-terrain vehicles and snowmobiles. Temporary roads may be constructed to support future management, but roads would be likely closed after their intended use and allowed to revegetate; it is unlikely that permanent roads would be constructed. The miles of temporary roads would likely remain at or below current levels, to the benefit of lynx, and roads would be closed to the public (Pylka 2013b).

Non-federal Lands and Wetland Mitigation Sites

Access onto most of the non-federal lands is by secondary roads that branch off of Forest Service or county roads. Most secondary roads were constructed to support timber harvest activities. There is no road access onto Hunting Club Lands and Wolf Lands 4. Access to McFarland Lake Lands is controlled by a locked gate. If acquired by the Forest Service, the non-federal lands would be managed for General Forest, General Forest-Longer Rotation, Riparian Areas, and Candidate Research Natural Areas (MDNR et al. 2013). If new roads are constructed on the non-federal lands, they would likely be temporary and used to support timber management. There would likely be little change in the number of miles of backcountry roads and trails on the non-federal lands, and the number of miles may decrease if existing roads are closed and revegetated or allowed to revegetate naturally, benefiting lynx.

The Aitkin Wetland Mitigation Site is bisected by County Road 1. The Hinckley Wetland Mitigation Site is bordered on the south by Township Road 56, while the Zim Wetland Mitigation Sites are bordered on the west by County Road 7. Secondary access roads are also associated with the sites, but the sites are in rural areas. It is unlikely that new roads would be constructed within the sites, and some roads may be reclaimed in the future, to the benefit of lynx.

Other Human Developments (mining, power generation, etc.)

Other human developments that may alter lynx habitat near the federal and non-federal lands and Wetland Mitigation Sites include rural development, forestry, agriculture, and mine exploration, development, and operation. These activities affect lynx habitat by changing or eliminating vegetation, and may also contribute to habitat fragmentation. There may be an increased potential for human-caused mortality associated with the developments (Ruediger et al. 2000).

Direct and Indirect Effects

Federal Lands and Plant Site

The Northshore Mine is immediately north of the Mine Site and the Mesaba Nugget Mine Project is immediately west of the Plant Site. Sources of noise at these sites include trucks, bulldozers, rock drills, jack hammers, graders, backhoes, air compressors, and cranes. Noise from these facilities could impact lynx residing in or traveling through the Project area. The impacts of noise on lynx and other wildlife are largely unknown and the assessment of impacts remains subjective. Wildlife are receptive to different sound frequency spectrums, many of which may be inaudible to humans. Wildlife are also known to habituate to noise, especially noises that are steady or continuous, such as noises that would occur near the Project. For example, lynx have been seen within about a quarter mile of loud noise sources and other human disturbance at Northshore Mine facilities, and have been seen by drillers within a few hundred feet of operating exploration drill rigs to the east of the Project.

Disturbance associated with these facilities and associated transportation infrastructure includes lights, glare, and noise. Lynx traveling through the Project area may avoid areas that are active and well lit.

Non-federal Lands and Wetland Mitigation Sites

There are no large developments near the non-federal lands or Wetland Mitigation Sites. The non-federal lands are currently managed primarily for timber and recreation, similar to how these lands would be managed by the Forest Service. The Wetland Mitigation Sites would be restored to wetland and upland wildlife habitat. Lynx observations are rare near the Wetland Mitigation Sites and lynx use of the sites after restoration would be infrequent.

Factors Affecting Lynx Mortality

Trapping and Incidental or Illegal Shooting

Lynx mortality has been monitored in northeastern Minnesota since 2000. From 2000 to 2012, 43 incidents of lynx mortality occurred (Rowse 2012). Nineteen of 28 mortalities in which the cause of death was determined were due to illegal trapping or shooting. The 2004 Forest Plan BA reiterated findings from Ruediger et al. (2000) that incidental or illegal mortality may occur from trapping and hunting/poaching activities. The 2004 Forest Plan BA assumed and reported that mortality from trapping and shooting could and has occurred on lands managed by the Forest Service. Lynx mortality could indirectly or cumulatively occur on National Forest lands based on incidental trapping for other species such as fox, fisher, and gray wolf. This cause and effect relationship has not changed since 2004 (USDA Forest Service 2004b).

Since 2004, two lynx within the Superior National Forest, and four lynx outside the Superior National Forest, were killed due to incidental trapping or shooting. Three lynx were killed due to legal trapping in Canada. Five trapped lynx were released alive from traps during that same period in Minnesota (USDA Forest Service 2011b).

Access to the Project area would be carefully controlled and use of the site by workers would be monitored by security personnel. Workers would also be given training in how to avoid harming or killing lynx while working on the site.

Direct and Indirect Effects

Federal Lands and Plant Site

Hunting and trapping of lynx is illegal in Minnesota and would not be allowed on all lands affected by the Project. The Project area would be closed to all types of hunting and trapping during construction and operations. Project personnel would be trained to not harass lynx in the Project area, and to report dead or injured lynx seen on the property. The Project area would be privately owned and closed to the public after mine closure (Pylka 2013b).

Non-federal Lands and Wetland Mitigation Sites

Hunting and trapping are allowed on the non-federal lands and on nearby Forest Service lands. It is assumed that hunting and trapping would be allowed on the non-federal lands if acquired by the Forest Service. As noted above, two lynx have been illegally trapped or shot within Superior National Forest boundaries since 2004, and lynx could be illegally shot or trapped on the non-federal lands after transfer to the Forest Service. However, the risk of loss of lynx from hunting and trapping would be similar to these risks that now occur on the non-federal lands under private ownership.

Competition and Predation as Influenced by Human Activities

New roads and trails associated with Project activities and the influx of workers may facilitate snowmobile, cross-country skiing, and other human uses in the winter. Snow compaction on roads or trails may allow competing carnivores, such as coyotes and mountain lions, access into lynx habitat. In the absence of roads and trails, snow depths and snow conditions normally limit the mobility of these other predators during mid-winter. It is likely that lynx near the Project area would compete with these competitors and predators for primary lynx prey (Buskirk et al. 2000b).

Lynx and carnivore biologists (Bider 1962, Ozoga and Harger 1966, Murray and Boutin 1991, Koehler and Aubry 1994, Murray et al. 1995, Lewis and Wenger 1998, Buskirk et al. 2000b) have suggested that packed trails created by snowmobiles, all-terrain vehicles, and cross-country skiers may serve as travel routes for potential competitors and predators of lynx, especially coyotes. Buskirk et al. (2000b) hypothesized that the usual spatial segregation of lynx and coyotes may break down where human modifications to the environment increase access by coyotes to deep snow areas. Such modifications include expanded forest openings throughout the range of the lynx.

Fuller and Kittredge (1996) noted that the distribution and numbers of coyotes have dramatically expanded in recent decades. Geir (1975) and Nowak (1979) suggested that coyotes are thought to have originated in areas where snow cover was minimal, and it is only within the last century that they have colonized the boreal forests.

Buskirk et al. (2000b) hypothesized that coyotes may be locally or regionally important competitors for lynx food resources, possibly exerting interference competition pressures on lynx as well. O'Donoghue et al. (1998b) also suggested coyotes exert potentially important exploitation competition pressures on lynx. Predation rates by coyotes on snowshoe hares exceeded those of lynx in the Yukon Territories during periods when snowshoe hare population levels are high. Coyotes then shifted their prey preference from snowshoe hares to carrion because of intolerance to deep snow conditions (Todd et al. 1981). Coyotes have been shown to increase their use of open habitats between November and March due to the increase in packed snow conditions and the load-bearing

strength of snow in openings. It is this strong prey- and habitat-switching ability of the coyote that may contribute to its success as a competitor with lynx (Buskirk et al. 2000b).

Murray and Boutin (1991) reported that both lynx and coyotes used travel routes with shallow snow, but that coyotes traveled on harder snow more frequently. They also reported that the use of trails in the snow not only reduced the depth to which an animal sinks into the snow, but aided coyotes and lynx in obtaining additional food. Keith et al. (1977) suggested that during population peaks of snowshoe hares, the density of trails in snow facilitates coyote movement. Murray and Boutin (1991) reported similar results with their study where hare densities were high.

Dispersed recreation activities seldom result in a direct loss of habitat. However, the road and trail network that is used by dispersed recreation has resulted in a loss of lynx habitat by displacing native vegetation on the landscape. Snow compaction can result in increased access by competitors, and increased access for bobcat, thereby increasing the potential for hybridization.

Direct and Indirect Effects

Federal Lands and Plant Site

New roads would be constructed on the Project area. However, these roads would be well traveled and there would be much noise and activity associated with Mine Site and Plant Site activities. In addition, most of the vegetation within the disturbed areas of the Mine Site would be removed, and it may be 10 or more years after mine closure before the Mine Site is reclaimed to wetland, grassland, and shrubland habitat. Coyotes have been seen near the Plant Site, but would be unlikely to use the Project area during operation until after mine reclamation. There could be competition between lynx and coyotes for food resources and other habitat components, but given the low numbers of lynx and coyotes found near the Project area, these effects should be negligible. After mine closure, most roads would be reclaimed; only the Dunka Road and a short road from the Dunka Road to the Waste Water Treatment Facility would remain. These roads would be privately owned and closed to the public (Pylka 2013b).

Non-federal Lands and Wetland Mitigation Sites

As discussed earlier, the non-federal lands and Wetland Mitigation Sites would likely be managed for fish and wildlife habitat, forestry, and recreation with or without the Project. Road densities would remain near current levels. Thus, competition between lynx and coyotes associated with road density should remain near current levels.

Highways (vehicular collisions)

Direct and Indirect Effects

Federal Lands and Plant Site

Direct mortality from vehicular collisions may be detrimental to lynx populations in the lower 48 states (Ruediger et al. 2000). In their 2004 Forest Plan BA, the Forest Service assumed that mortality between high and low standard roads could differ, with potential mortality likely being higher on high standard (high-speed)

paved roads that are typically federally, state or county managed highways and lower on low standard (low-speed) non-paved roads that are typically managed by the Forest Service (USDA Forest Service 2004b).

An estimated 42 worker/supply vehicle round trips would be made daily between the Plant Site and Hoyt Lakes, Minnesota, and 156 worker/supply vehicle round trips would be made daily between U.S. Highway 135 and the Plant Site (Barr 2013a). For purposes of analysis, it was assumed that the average distance between Hoyt Lakes and the Plant Site main security gate is 6 miles, and that traffic accessing the Plant from Highway 135 comes from Babbitt to the Plant Site north gate, or about 33 miles on average. Average speed would be about 50 mph between the Plant Site and Hoyt Lakes, and Plant Site and Highway 135. In addition, about seven trains per month would carry supplies and materials to and from the Plant Site and Virginia, Minnesota, a distance of about 30 miles. These trains would continue on to Duluth or International Falls, Minnesota, but would likely be included with other rail traffic and thus not add to the potential for risk of collision with lynx (Barr 2013b).

The USFWS did not assess risks to lynx from off-site vehicle and train collisions for worker and mine/plant supply delivery traffic associated with other projects in northern Minnesota as discussed in earlier BOs (USDOI USFWS 2009d, 2011a); the USFWS requested that these risks be estimated for the Project.

Using the same assumptions and methodology used earlier to estimate lynx mortality on Project roads and railroads (see Forest and Backcountry Roads and Trails), approximately 0.037 lynx would be killed annually by vehicle/rail traffic on off-Project access roads/rail lines to the Plant Site, or about two (0.74) lynx during the estimated 20-year life of the Project (assuming that mortalities due to collisions with vehicles and trains were twice the estimated level).

Increased traffic to and from the Project area would increase the threat of lynx mortality from vehicle collisions in the vicinity of the Project. Harm or loss of lynx from collisions with vehicles within the vicinity of the Project cannot be discounted, but the risk would be very small as MDNR lynx observation records suggest there is little lynx use of areas associated with project access roads, and use of these road corridors would decrease substantially during project operations due to noise and disturbance associated with Project and other nearby mining activities, and activities in Hoyt Lakes. In addition, studies by the USFWS found that the estimated loss of lynx to vehicle traffic, based on the methodology used in this study, was substantially greater (3-fold) than the actual loss of lynx (USDOI USFWS 2009d).

After mine closure, nearly all access roads would be closed. The Dunka Road would remain privately owned and closed to the public. There would be little, if any, rail traffic between the Plant Site and Virginia, Minnesota.

Non-federal Lands and Wetland Mitigation Sites

Lynx have been observed on or near most of the non-federal lands. There are no rail lines on or adjacent to these lands, and limited vehicle access. The lands are primarily used for timber and recreation, and except for Hay Lake Lands, where vehicles travel along the Pike River Road on the eastern boundary of the lands, access to the lands is on logging roads that are primarily used during the hunting season. Access to the lands by vehicles is expected to remain near current levels, with or without the land exchange. No lynx deaths from vehicular collision have been reported on or near the non-federal lands (MDNR 2007). Thus, risks to lynx from vehicular collisions should be negligible.

Some of the Wetland Mitigation Sites are used for sod production. Trucks and other vehicles access the sites for sod production and removal. Under the Proposed Action, these sites would be restored to wetland and upland habitat and except during restoration and monitoring activities, few vehicles would be expected to access the sites. Thus, risks to lynx from vehicular collisions on the Wetland Mitigation Sites may be less under the Proposed Action than under current conditions. Given that lynx have not been reported within 6 miles of these sites, risk to lynx under both use scenarios is negligible.

Other

Hazardous Materials

The Project would use, or generate as waste, the following hazardous materials:

- Fuels, equipment maintenance products, and solvents – diesel fuel, gasoline, oils, grease, lubricants, anti-freeze, solvents, and lead-acid batteries used for equipment operation and maintenance.
- Plant reagents – sodium hydrosulfide, sodium hydroxide, acids, flocculants, and antiscalants used in processing plant applications.
- Mine Site Waste Water Treatment Facility chemicals – calcium hydroxide (hydrated lime), sodium metasilicate, ferric chloride, sodium hydroxide, polymer flocculent, carbon dioxide liquid, citric acid, and sodium hypochlorite.
- Plant Site Waste Water Treatment Plant chemicals – potassium permanganate, antiscalant, carbon dioxide liquid, and calcium hydroxide (hydrated lime).
- Blasting agents – ammonium nitrate/fuel oil (ANFO), emulsions, emulsion blends (a blend of ANFO and emulsion), blasting caps, initiators and fuses, and other high explosives used in blasting.
- Other materials – assay chemicals, and other by-products characterized as hazardous waste.

Mishandling of these materials or wastes could result in spills, accidental release, or discharge into the environment, which could pose risks to lynx. Sections 5.2.13 and 5.3.13 of the FEIS discuss the risks posed to the public and the environment from the transport, handling, storage, and use of hazardous materials. Mitigation measures to prevent releases in transportation, storage, and handling or use of these materials are described in several hazardous material management plans necessary to comply with various regulatory requirements for the Project and in the FEIS. Based on the FEIS analysis, and scarcity of lynx on the areas where these materials would be used, risks to lynx would be negligible and should not result in harm or death to lynx (MDNR et al. 2013).

Factors Affecting Lynx Movements

Highways, Roads, and Rights-of-ways

Moen et al. (2010) observed that lynx movements were made across roaded areas, and also across the BWCAW, which has few linear features such as roads, trails, and logging roads that could guide movement by

lynx, in northeastern Minnesota. Observations suggested that geographically or topographically definable movement corridors do not exist for lynx in northeastern Minnesota, nor between Minnesota and Ontario. Moen et al. (2010) suggested that linear features such as roads benefit lynx from an energetic perspective, but may also be negative if they increase the chance of incidental mortality because of exposure to humans.

Direct and Indirect Effects

Federal Lands and Plant Site

As discussed earlier, traffic associated with the Project would be on access roads leading to and from the Project area, along the Dunka Road and Utility Corridor, and on access roads to the Mine Site. Most traffic would travel on existing roads; new roads would be primarily limited to the Mine Site. After mine closure, many of the access roads would be closed to traffic and reclaimed. Traffic on the Dunka Road between the Mine Site and Plant Site during mine construction and operation should discourage use by lynx. However, most traffic within the corridor would likely occur during shift changes. Because lynx rarely use the Mine Site, Plant Site, or Transportation and Utility Corridors, and noise and disturbance associated with the Mine Site and Plant Site would discourage use of these areas by lynx, it would be unlikely that lynx would use these areas during mine construction and operations and effects of traffic on lynx movements would be negligible.

Non-federal Lands and Wetland Mitigation Sites

If lands are exchanged to the Forest Service, it is unlikely that the Forest Service would build new access roads to the lands. It is also unlikely that state or federal agencies would construct new roads near the lands, as these lands are in remote locations and little used by the public. Thus, activities on highways, roads, and ROWs near the non-federal lands, and their effects on lynx movements, would be little changed with or without the land exchange.

Access onto most of the non-federal lands is by secondary roads that branch off Forest Service or county roads. Most secondary roads were constructed to support timber harvest activities. There is no road access onto Hunting Club Lands and Wolf Lands 4. Access to McFarland Lake Lands is controlled by a locked gate. These roads are little used and traffic levels should change little under the land exchange. There would likely be little change in the number of miles of backcountry roads and trails on the non-federal lands, and the number of miles may decrease if existing roads are closed and revegetated or allowed to revegetate naturally, benefitting lynx.

The Aitkin Wetland Mitigation Site bisected by County Road 1. The Hinckley Wetland Mitigation Site is bordered along the south by Township Road 56, while the Zim Wetland Mitigation Sites are bordered on the west by County Highway 7. Because lynx are rarely observed near the wetland mitigation sites, highway and local traffic should have little effect on lynx.

Land Ownership Patterns

Lynx exemplify the need for landscape-level ecosystem management. Land and population management must cross international, federal, state, county, and private land boundaries. Coordination within and between agencies and other landowners has often been difficult. In situations where habitat connectivity is needed to maintain adequate populations, private land development may preclude use by lynx, and may interrupt the

connectivity of habitat and populations. In these situations, it will be important to provide conservation easements, land exchanges, or purchases to maintain adequate lynx habitat and populations.

Habitat fragmentation also may impede lynx movements. This could have negative effects by isolating lynx and/or prey populations, or by retarding movements to other areas (Ruediger 2000).

Contiguous tracts of land in public ownership (national and state forests, wilderness areas) provide an opportunity for management that can maintain lynx habitat connectivity. Throughout most of the lynx range in the lower 48 states, connectivity with habitats and source populations in Canada is critical to conservation of populations in the U.S. The size, amount, and spatial distribution of federal land vary considerably from west to east across the U.S.

The ability to provide connectivity between the two northern Minnesota National Forests is complicated by the lack of contiguous National Forest ownership and varied land use patterns. However, the eastern two thirds of the Superior National Forest is largely federally owned, and the BWCAW refugium remains intact and contiguous with Canada.

Ownership adjustments have occurred on the Superior National Forest since 2004. The largest land exchange, the South Kawishiwi Cabin Group, occurred in 2010. In that land exchange approximately 1,213 acres were acquired by the Forest Service and approximately 425 acres were disposed of, resulting in a net acquisition of 788 acres. All other individual land purchases, donations, and exchanges were less than 100 acres (USDA Forest Service 2011b). The land ownership changes contribute towards Forest-wide lynx habitat but the amounts that have occurred since 2004 have been relatively insignificant compared to the large area of the Superior National Forest (2,125,931 acres).

Direct and Indirect Effects

Federal Lands and Plant Site

The Project would involve the transfer of approximately 6,495 acres of Forest Service-administered lands to PolyMet, in exchange for 7,075 acres of privately owned lands. This land exchange would be the largest land exchange conducted by the Forest Service, and would result in a net acquisition of 580 acres by the Forest Service. The land exchange would help the Forest Service to consolidate ownerships by obtaining non-federal lands that are adjacent to Forest Service lands. However, the exchange would also increase the amount of land converted to mining and unavailable to lynx, at least until the Mine Site is reclaimed. Land reclaimed after mining could provide suitable lynx habitat, but it could be 10 or more years before revegetation, due to the successional process, results in much suitable habitat for lynx.

Although there is little documented use of the Mine Site by lynx, loss of habitat and noise and disturbance from the Project, could influence lynx movements on or near the Mine Site. It is possible that lynx could travel between forestlands to the south of the Mine Site and the Northshore Mine by traveling through the federal lands surrounding the Mine Site, or through forestlands further east of the Mine Site. Given the loss of habitat and increase in disturbance that would be associated with the Mine Site, it seems more likely that lynx would primarily use forestlands to the south and east of the Mine Site and Northshore Mine, and avoid the Mine Site and lands between the Mine Site and Plant Site. That said, lynx, including adults with kittens, have been seen using portions of the Northshore Mine, and could use the federal lands, even during mine construction and operations.

Non-federal Lands and Wetland Mitigation Sites

The transfer of the non-federal lands to the Forest Service should have negligible, if any, effect on lynx movements. Management of these lands would remain relatively unchanged, and lands would primarily be used for timber production and recreation.

Wetland Mitigation Sites would be converted from agricultural uses to wildlife habitat. Although lynx have not been reported on or near these sites, their value to lynx would increase once taken out of agricultural production, and lynx may move onto these sites in the future.

6.1.2.2 Effects to Lynx Critical Habitat

Overview

Primary Constituent Elements of Lynx Critical Habitat

Critical habitat is defined as “specific area within the geographical area occupied by the species...on which are found those physical and biological features (a) essential to the conservation of the species and (b) which may require special management considerations or protection” (USDOI USFWS and NMFS 1998).

On November 9, 2006, the USFWS designated 319 mi² as critical habitat in Voyageurs National Park, Minnesota. On February 25, 2009, the USFWS re-designated lynx critical habitat to include portions of Cook, Koochiching, Lake, and St. Louis Counties, Minnesota, including a portion of the federal lands, and all of the non-federal lands. A total of 8,065 mi² were designated as critical habitat in 2009 (USDOI USFWS 2009a). The Wetland Mitigation Sites are not included in the designated critical habitat area.

In its 2009 designation of critical habitat for lynx in northeastern Minnesota, including the Project area, the USFWS identified physical and biological features that are essential to the conservation of the species and that may require special management considerations or protections. The physical and biological features are primary constituent elements (PCEs) laid out in a specific quantity and spatial arrangement to be essential to the conservation of the species. The PCEs of critical habitat for lynx are found in boreal forest landscapes supporting a mosaic of differing successional forest stages and containing:

- a. Presence of snowshoe hares and their preferred habitat conditions, which include dense understories of young trees, shrubs, or overhanging boughs that protrude above the snow, and mature multistoried stands with coniferous boughs touching the snow surface.
- b. Winter snow conditions that are generally deep and fluffy for extended periods of time.
- c. Sites for denning that have abundant coarse woody debris, such as downed trees and root wads.
- d. Matrix habitat (e.g., hardwood forest, dry forest, non-forest, or other habitat types that do not support snowshoe hares) that occurs between patches of boreal forest in close juxtaposition (at the scale of a lynx home range) such that lynx are likely to travel through such habitat while accessing patches of boreal forest within a home range.

The Forest Service identified quantitative indicators in the 2004 Forest Plan BA to analyze the impacts of those risk factors that have the most substantive impacts on lynx habitat (USDA Forest Service 2004b). These indicators have been used to assess impacts to lynx critical habitat in this BA. These analysis indicators also serve as appropriate indicators for analysis of effects to critical habitat and its constituent elements. This is because the indicators address relevant PCEs of lynx critical habitat—those physical and biological features that are essential to the conservation of the species.

Table 8 compares the lynx risk analysis indicators to the PCEs and identifies the risk analysis indicators evaluated in this BA. For this analysis, risk analysis indicators are grouped as follows—habitat management, human activity (recreation and roads and trails), and cumulative. The cumulative effects risk analysis indicators are addressed in Section 6.1.4.

The following discussion provides an overview of the direct and potential indirect impacts to PCEs from the Project. It is followed by an analysis of impacts to PCEs based on lynx analysis indicators developed by the Forest Service.

Effects of NorthMet Project on Primary Constituent Elements

Presence of snowshoe hares and their preferred habitat conditions, which include dense understories of young trees, shrubs, or overhanging boughs that protrude above the snow, and mature multistoried stands with conifer boughs touching the snow surface.

The Forest Service has determined that there are about 6,365 acres of foraging habitat for snowshoe hare on the federal lands, or about 98% of the federal lands. Although snowshoe hare were seen throughout the federal lands, the largest concentrations of snowshoe hares were seen in the eastern portion of the federal lands in areas dominated by jack pine (ENSR 2000). Based on an assessment of existing conditions and conditions at the closure of the mine, there would be a loss of approximately 1,669 acres of snowshoe foraging habitat due to mining, or about 26% of the federal lands. Approximately 4,696 acres of federal lands owned by PolyMet adjacent to the Mine Site would still provide habitat for snowshoe hare.

In addition, basic foraging habitat, including forbs, grasses and small shrubs could be available to snowshoe hare about 10 years after mine closure due to succession within the disturbed areas, although it is uncertain if snowshoe hare would move from areas outside of the Mine Site to suitable habitat on the Mine Site. More mature snowshoe hare habitat, including young trees and boughs overhanging snow, could be available about 25-30 years after mine closure. Therefore, while about 397 acres of habitat lost to mining would be reclaimed after mine closure, it could be a minimum of 10 years before revegetation results in much suitable habitat for lynx. This is because of the estimated minimum 10-year period for basic snowshoe hare forage habitat (forbs, shrubs) to develop. Based on the mine closure plan, most of the 397 acres of the habitat lost to mining that would be reclaimed would be reclaimed as grassland/herbaceous (54%), wetland and/or grassland/herbaceous (27%), and wetland (18%). Areas reclaimed as wetland would not be suitable habitat for lynx. Snowshoe hare and lynx tracks were seen at the base of waste rock piles with scattered stands of young forest near the Dunka Pit. These rock piles are about 5 miles from undisturbed habitat used by snowshoe hares. Thus, snowshoe hare have shown the ability to re-colonize areas associated with mine development. The West Pit would not be reclaimed to the surface for revegetation, but would remain as a 320-acre open pit lake (MDNR et al. 2013).

Winter snow conditions that are generally deep and fluffy for extended periods of time.

Northeastern Minnesota generally receives approximately 70 inches of snow per year. Snow cover at least 1 inch deep is present between 85 days per year and 140 days per year depending on the part of the state. In general, snow can be found on the federal lands between October and April. Studies of lynx and other wildlife on the federal lands found that the snow is relatively dry, fluffy, and several feet deep during much of the winter (ENSR 2000, 2006). As discussed in Section 6.1.1.10, snowshoe hare favor areas that have deep snow and use black spruce and balsam fir forests with dense understory vegetation that provide forage, cover to escape from predators, and protection during extreme weather (Wolfe et al. 1982, Monthey 1986, Hodges 2000a, b). Generally, earlier succession (younger) forest stages have greater understory structure than do mature forests and, therefore, support higher snowshoe hare densities (Fuller 1999, Hodges 2000a, b). Generally, open areas and areas with earlier succession forest stages have deeper snow depths than areas with more mature forest, as the branches of trees in mature forests capture more snow than younger forests, resulting in shallower snow in mature than younger forests (ENSR 2005).

There are approximately 271 acres of young and 1,539 acres of immature forest on the federal lands. Of these, approximately 1,333 acres (73.6%) would be directly impacted by the mine project and lost to snowshoe hare and lynx during mine operation and closure. As discussed above, approximately 397 acres would be reclaimed, and as these lands change from grassland to shrubland and young/immature forestland, their value to snowshoe hare and lynx would increase.

Sites for denning that have abundant coarse woody debris, such as downed trees and root wads.

Based on radiotelemetry studies in Minnesota, most lynx dens are found in tree wind-throw areas with dense vertical and horizontal cover. Dens were often located in an area with foraging habitat and denning cover, and often in small patches of upland within a larger wetland. These are often areas where wind-throw occurs (Moen and Burdett 2009). Tree age is generally greater than 60 years.

About 5,393 acres of lynx suitable denning habitat are found on the federal lands, or 83% of federal lands. Snags and large woody debris were uncommon in disturbed areas, shrublands, and young and immature forests. Large snags (up to 16 inches dbh), stumps, and woody debris were common in more mature forest stands (ENSR 2005). Little blowdown was observed on the federal lands and generally occurred adjacent to recent forest harvest areas and near roads and transmission lines. Based on an assessment of existing conditions and conditions at closure of the mine, there would be a loss of approximately 1,333 acres of denning habitat due to mining. Thus, there would be a 20% reduction of denning habitat on the federal lands.

Matrix habitat (e.g., hardwood forest, dry forest, non-forest, or other habitat types that do not support snowshoe hares) that occurs between patches of boreal forest in close juxtaposition (at the scale of a lynx home range) such that lynx are likely to travel through such habitat while accessing patches of boreal forest within a home range.

Communities used most often by lynx are young jack pine/balsam fir forests. Balsam fir often occurs as inclusions or “pockets” of regenerating trees within other cover types (e.g., in mature jack pine stands or in maturing black spruce/trembling aspen stands), and along forest edges. Lynx also use coniferous or mixed coniferous/deciduous forest patches in regenerating logged areas, including 10- to 25-year-old stands of jack pine or balsam fir/trembling aspen mixed coniferous/deciduous forest. Other important habitat types include black spruce/balsam fir and black spruce/tamarack forests.

Communities used by lynx often originate as a result of natural or “facilitated” regeneration after logging. However, fire and spruce budworm outbreaks also play a role in influencing forest stand composition and age in sites used by lynx. It generally takes 12 to 30 years after a forest thinning or fire before conditions become suitable for snowshoe hare, as forests mature from the young to the immature stage.

Upland forest greater than 4 years of age, and lowland stands with forest greater than 9 years of age, provide suitable lynx cover to support habitat connectivity (USDA Forest Service 2004b). As shown on **Figure 9** and **Table 9**, the Mine Site consists of a mix of lowland and upland conifer and deciduous forest of various ages. Conifer forest habitat dominates the mine site, but other habitat types, including open grasslands and wetlands, deciduous forest, frozen lakes, roads, and utility corridors are found in close proximity to conifer forests and have been used by lynx on or near the Mine Site.

There are about 6,372 acres (98% of federal lands) of lynx habitat with adequate canopy cover on the federal lands. Based on an assessment of existing conditions and conditions at closure of the mine, there would be a loss of approximately 1,669 acres of lynx habitat with adequate canopy cover due to mining, or about 26% of lynx habitat with adequate canopy cover within the federal lands (MDNR et al. 2013).

Risk Analysis Indicators

Habitat Management

Direct and Indirect Effects

The Forest Service has identified five risk analysis indicators to measure loss of habitat that would apply to the Project (Ryan 2011). Parameters used by the Forest Service to identify suitable lynx habitat, and foraging habitat for snowshoe hare, were given in the Forest Plan BA (USDA Forest Service 2004b). In general, snowshoe hare foraging habitat was found in upland forest stands that were 3 to 15 years of age, or older than 60 years of age, while lowland stands are generally 10 years or older. Lynx denning habitat is typically found in forest stands that are 80 years or older and have large down woody material or areas of tree wind-throw. The existing condition of habitat-related indicators and impacts to lynx habitat from actions at the Mine Site and Plant Site for LAUs are provided in **Table 9**. All non-federal lands, except Hay Lake Lands, are within LAUs. Although the land exchange would not increase or decrease the amount of lynx habitat within these LAUs, it would contribute to the amount of lynx habitat administered by the Forest Service. Habitat gains and losses by LAU for lands under Forest Service administration for risk analysis indicators are summarized in **Table 9**.

Indicator 1a – Snowshoe Hare Foraging Habitat

The Mine Site is in LAU SNF 12. The Forest Service determined that there are about 6,365 acres of foraging habitat for snowshoe hare on the federal lands (**Figure 19**). Based on an assessment of existing conditions and conditions at closure of the mine, there would be a loss of approximately 1,669 acres of snowshoe hare foraging habitat due to mining, or about 6% of the snowshoe hare foraging habitat within LAU SNF 12 that is administered by the Forest Service (the Forest Service has not identified snowshoe foraging habitat on those portions of the LAU that are not administered by the Forest Service (MDNR et al. 2013).

The lands adjacent to the Mine Site would still provide habitat for snowshoe hare even though lands would be owned by PolyMet. In addition, foraging habitat could be available to snowshoe hare about 20 years after mine

closure due to restoration of disturbed areas, although it is uncertain if snowshoe hare would move from areas outside of the Mine Site to suitable habitat on the Mine Site. Snowshoe hare and lynx tracks were seen at the

Table 8
Lynx Analysis Indicators and Primary Constituent Elements

Lynx Analysis Indicator	Primary Constituent Element
Direct and Indirect Effects	
1a – Snowshoe Hare Foraging Habitat	<ul style="list-style-type: none"> • Presence of snowshoe hare and hare habitat.
1b – Unsuitable Habitat for Snowshoe Hare	<ul style="list-style-type: none"> • Presence of snowshoe hare and hare habitat. • Winter snow conditions deep and fluffy. • Sites for denning. • Matrix habitat and habitat connectivity.
2 – Red Squirrel Habitat	<ul style="list-style-type: none"> • Not analyzed; studies have shown that red squirrel are not important prey for lynx in Minnesota.
3 – Denning Habitat	<ul style="list-style-type: none"> • Sites for denning.
4 – Lynx Habitat with Adequate Canopy Cover	<ul style="list-style-type: none"> • Presence of snowshoe hare and hare habitat. • Sites for denning. • Matrix habitat and habitat connectivity.
5 – Miles of Designated All-terrain Vehicle Trails	<ul style="list-style-type: none"> • Not analyzed. There would be little change in miles of designated all-terrain vehicle trails under the Proposed Action.
6 – Miles of Designated Snowmobile Trails	<ul style="list-style-type: none"> • Not analyzed. There would be little change in miles of designated snowmobile trails under the Proposed Action.
7 – Miles of Temporary and Objective Maintenance Level (OML) 1 and 2 Roads	<ul style="list-style-type: none"> • Not analyzed. There would be little change in temporary and OML 1 and 2 roads under the Proposed Action.
8 – Policy of Cross-country Use of All-terrain Vehicles and Snowmobiles	<ul style="list-style-type: none"> • Not analyzed. There would be no change in policy under the Proposed Action.
9 – Policy on Cross-country Use of All-terrain Vehicles and Snowmobiles on OML 1 and 2 Roads	<ul style="list-style-type: none"> • Winter snow conditions deep and fluffy.
Cumulative Effects	
10 – Acres and Percent of Lynx Habitat Unsuitable on All Ownerships	<ul style="list-style-type: none"> • Presence of snowshoe hare and hare habitat. • Sites for denning. • Matrix habitat and habitat connectivity.
11 – Road and Compacted Trail Density	<ul style="list-style-type: none"> • Winter snow conditions deep and fluffy.

Table 9
Lynx Analysis Indicators for Lands Administered by the Forest Service
within the Lynx Analysis Units for Federal and Non-federal Lands for Existing Conditions and under the Proposed Action

Lynx Analysis Indicator	Lands	LAU	Existing Condition	Proposed Action	
			Acres	Acres	Net Gain (Loss) to Forest Service ¹
1a. Snowshoe hare foraging habitat	Federal Lands	SNF 12	30,133	23,768	(6,365)
	Non-federal Lands				
	Hunting Club	SNF 4	20,148	20,299	151
	Lake County North and Wolf Lands 1	SNF 16	19,080	19,469	389
	Wolf Lands 2, 3, and 4	SNF 21	21,968	23,418	1,450
	Lake County South	SNF 22	24,245	24,358	113
	McFarland Lake	SNF 42	12,983	13,014	31
	Hay Lake	NA	NA	4,643	4,643
Net Gain/(Loss)					412
1b. Unsuitable habitat for snowshoe hare	Federal Lands	SNF 12	130	0	(130)
	Non-federal Lands				
	Hunting Club	SNF 4	1,289	1,299	10
	Lake County North and Wolf Lands 1	SNF 16	350	352	2
	Wolf Lands 2, 3, and 4	SNF 21	272	272	0
	Lake County South	SNF 22	344	348	4
	McFarland Lake	SNF 42	13	13	0
	Hay Lake	NA	NA	251	251
Net Gain/(Loss)					137

Table 9 (Cont.)

**Lynx Analysis Indicators for Lands Administered by the Forest Service
within the Lynx Analysis Units for Federal and Non-federal Lands for Existing Conditions and under the Proposed Action**

Lynx Analysis Indicator	Lands	LAU	Existing Condition	Proposed Action	
			Acres	Acres	Net Gain (Loss) to Forest Service ¹
3. Denning habitat for lynx in 5 acre or larger blocks of habitat	Federal Lands	SNF 12	20,343	14,930	(5,393)
	Non-federal Lands				
	Hunting Club	SNF 4	13,994	14,986	92
	Lake County North and Wolf Lands 1	SNF 16	11,650	11,984	333
	Wolf Lands 2, 3, and 4	SNF 21	15,219	16,359	1,140
	Lake County South	SNF 22	18,773	18,821	48
	McFarland Lake	SNF 42	9,884	9,914	30
	Hay Lake	NA	NA	3,720	3,720
Net Gain/(Loss)					(30)
4. Lynx habitat with adequate canopy cover (suitable habitat)	Federal Lands	SNF 12	69,131/47,908 ²	62,758/41,537 ²	(6,372)
	Non-federal Lands				
	Hunting Club	SNF 4	49,994/28,903 ²	49,994/29,054 ²	151
	Lake County North and Wolf Lands 1	SNF 16	70,743/29,316 ²	70,743/29,705 ²	389
	Wolf Lands 2, 3, and 4	SNF 21	69,632/32,984 ²	69,632/34,434 ²	1,450
	Lake County South	SNF 22	57,107/40,217 ²	57,107/40,330 ²	113
	McFarland Lake	SNF 42	27,774/19,609 ²	27,774/19,640 ²	31
	Hay Lake	NA	NA	4,675	4,675
Net Gain/(Loss)					437

¹ Acreages may differ slightly from acreage given in FEIS due to rounding.

² Acres under all ownerships within the LAU/acres administered by the Forest Service within the LAU; acreage under all ownerships not available for indicators 1-3.

NA = Acreages do not include Hay Lake Lands, which is not within an LAU.

Total acreage within the LAU for all land ownerships —LAU SNF 4 = 55,071 acres, SNF 12 = 70,980 acres, SNF 16 = 76,108 acres, SNF 21 = 73,266 acres, SNF 22 = 58,154 acres, and SNF 42 = 32,305 acres; total acreage for lands administered by the Superior National Forest —LAU SNF 4 = 33,321 acres, SNF 12 = 49,409 acres, SNF 16 = 33,679 acres, SNF 21 = 36,082 acres, SNF 22 = 41,210 acres, and SNF 42 = 24,687 acres.

Sources: MDNR et al. (2013), Ryan (2013a).

base of waste rock piles with scattered stands of young forest near the Dunka Pit. These rock piles are about 5 miles from undisturbed habitat used by snowshoe hares. Thus, snowshoe hare have shown the ability to re-colonize areas associated with mine development.

Collectively, there about 6,777 acres (96% of available habitat) of snowshoe hare foraging habitat on the non-federal lands (**Figures 20 and 21**). This habitat, which is associated with several different LAUs, and Hay Lake Lands, would be administered by the Forest Service under the Proposed Action (**Table 9**). Based on habitat losses on the federal lands, and gains from the non-federal lands, there would be a net gain of 412 acres of snowshoe hare foraging habitat under Forest Service administration under the Proposed Action (MDNR et al. 2013).

Indicator 1b – Unsuitable Habitat

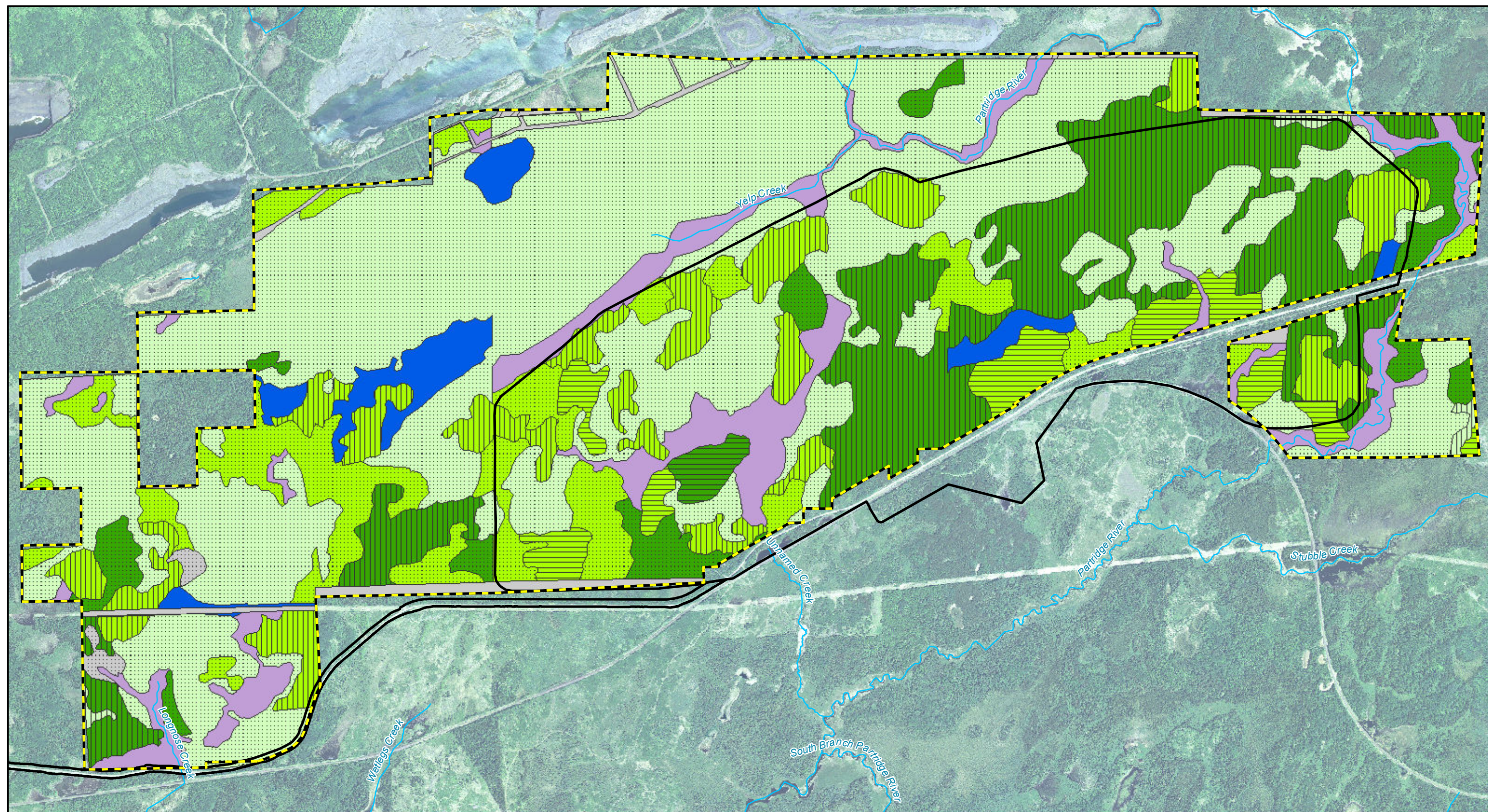
There are about 130 acres of unsuitable habitat for snowshoe hare on the federal lands (MDNR et al. 2013). Unsuitable habitat is defined as areas that are in the initial stages of forest growth where vegetation has not developed sufficiently to support snowshoe hare populations during all seasons (USDA Forest Service 2004b). For purposes of this BA, these are disturbed, cropland/grassland, and aquatic environments based on MDNR cover types (MDNR et al. 2013). Based on an assessment of existing conditions and conditions at mine closure, there would be a gain of approximately 1,669 acres of unsuitable habitat for snowshoe hare due to the Proposed Action, as about 50 acres of the disturbance area is already unsuitable for snowshoe hare. Some of this habitat may become suitable for snowshoe hare over time, as discussed above. There would be no change in the amount of unsuitable habitat on the federal lands surrounding the Mine Site due to the Project. However, because unsuitable habitat associated with the federal lands would be transferred from the Forest Service to PolyMet, there would be a reduction in unsuitable habitat for snowshoe hare administered by the Forest Service in LAU SNF 12 from current levels under the Proposed Action.

Collectively, there are about 267 acres of unsuitable habitat for snowshoe hare on the non-federal lands. This habitat, which is associated with several different LAUs and Hay Lake Lands, would be administered by the Forest Service under the Proposed Action (**Table 9**). There would be a gain of 137 acres of unsuitable habitat for snowshoe hare under Forest Service administration under the Proposed Action.

Indicator 3 – Denning Habitat

Based on an assessment of existing conditions and conditions at closure of the mine, there would be a loss of approximately 1,333 acres of denning habitat due to mining. There are about 5,393 acres of lynx suitable denning habitat on the federal lands. Thus, there would be a 7% reduction of denning habitat under in LAU SNF 12 from current levels (MDNR et al. 2013).

Collectively, the non-federal lands would provide about 5,363 acres of denning habitat (76% of all habitats within the non-federal lands). This habitat, which is associated with several LAUs and Hay Lake Lands, would be administered by the Forest Service under the Proposed Action (**Table 9**). Based on habitat losses on the federal lands, and gains from the non-federal lands, there would be a net loss of 30 acres of denning habitat under Forest Service administration under the Proposed Action.



- | | | |
|---|------------------------|---------------------|
| Federal Lands | Open Water | Age Class: Mature |
| Project Areas | Other Lowland Emergent | Age Class: Immature |
| Management Indicator Habitat: Upland Forest | Other Lowland Shrub | Age Class: Young |
| Upland Coniferous Forest | Other Upland Grass | Age Class: N/A |
| Lowland Black Spruce | N/A | |



0 1,000 2,000 4,000 Feet



Figure 19
Management Indicator Habitat Types and Age Classes -
Federal Lands
 Biological Assessment for the NorthMet Project and Land Exchange
 St. Louis County, Minnesota

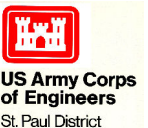
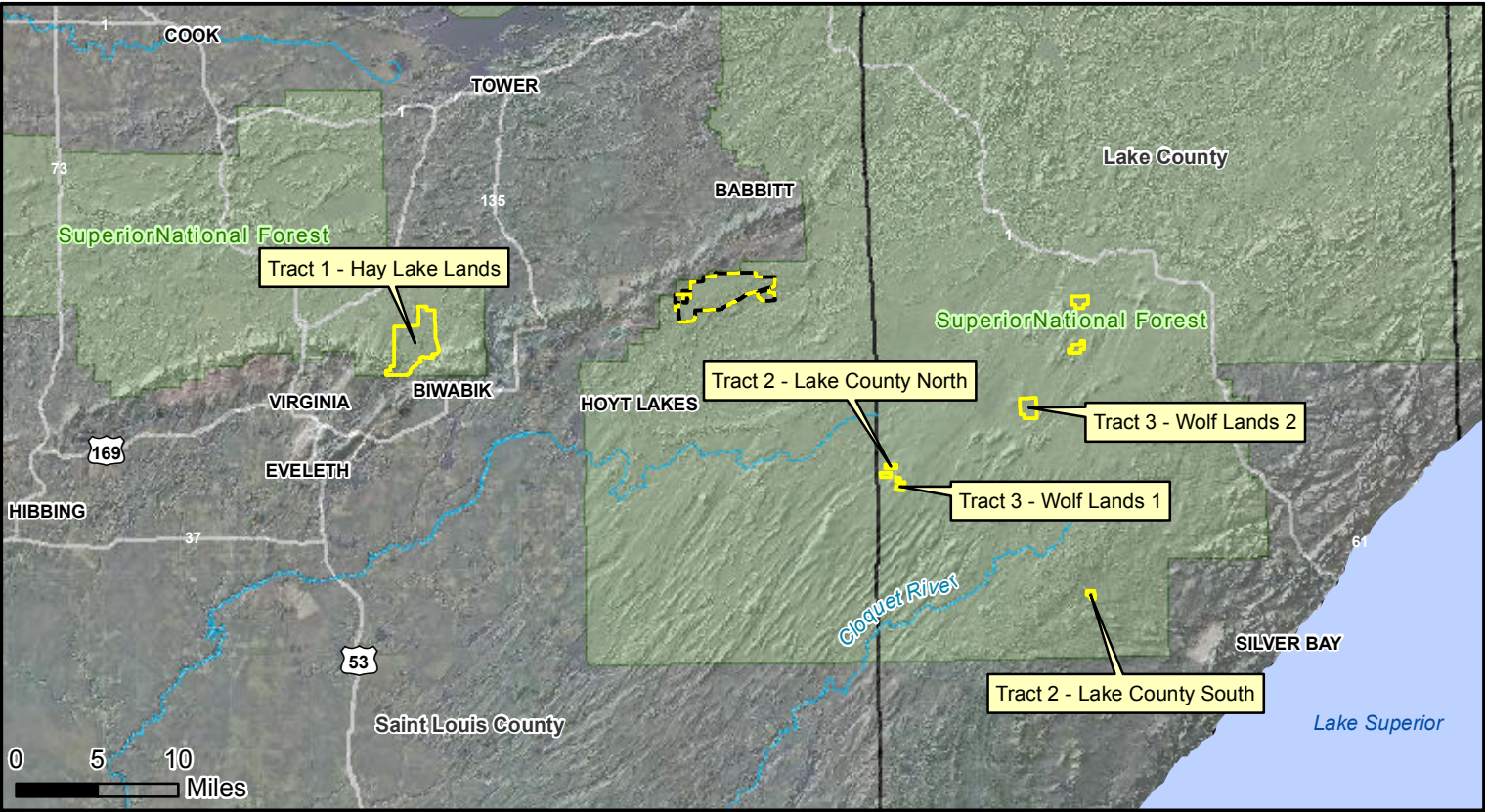
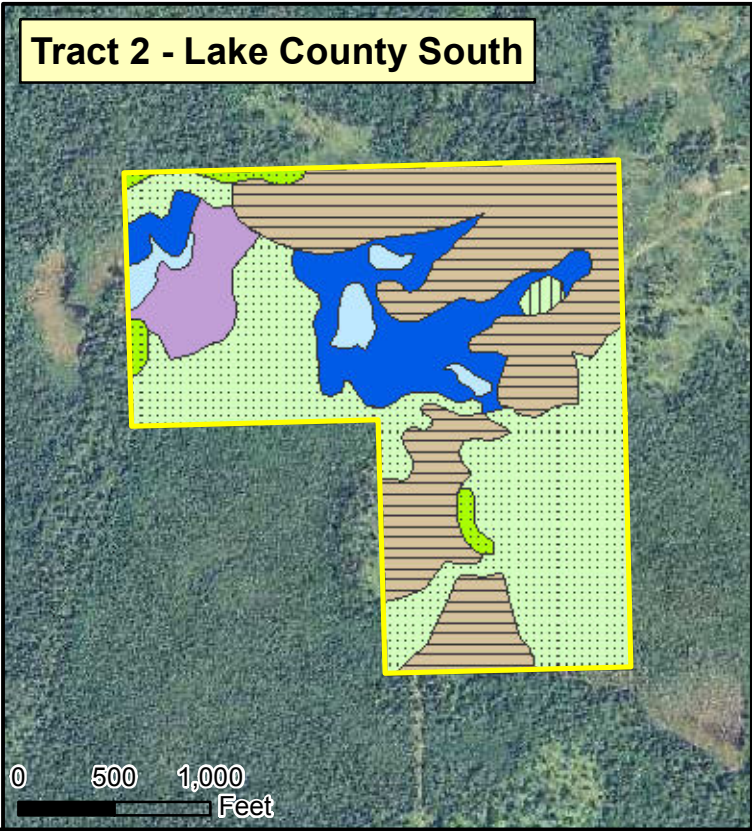
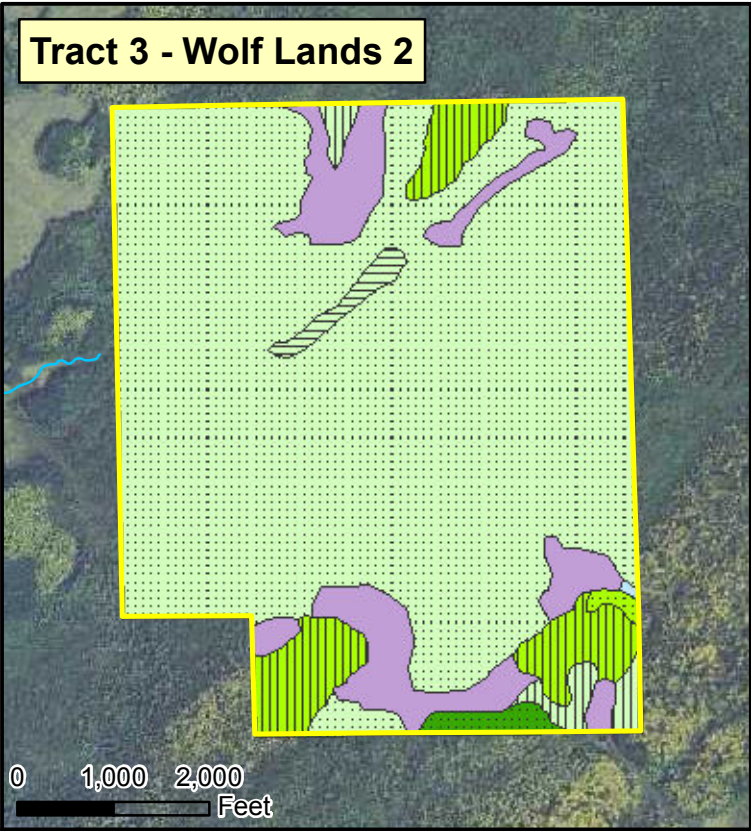
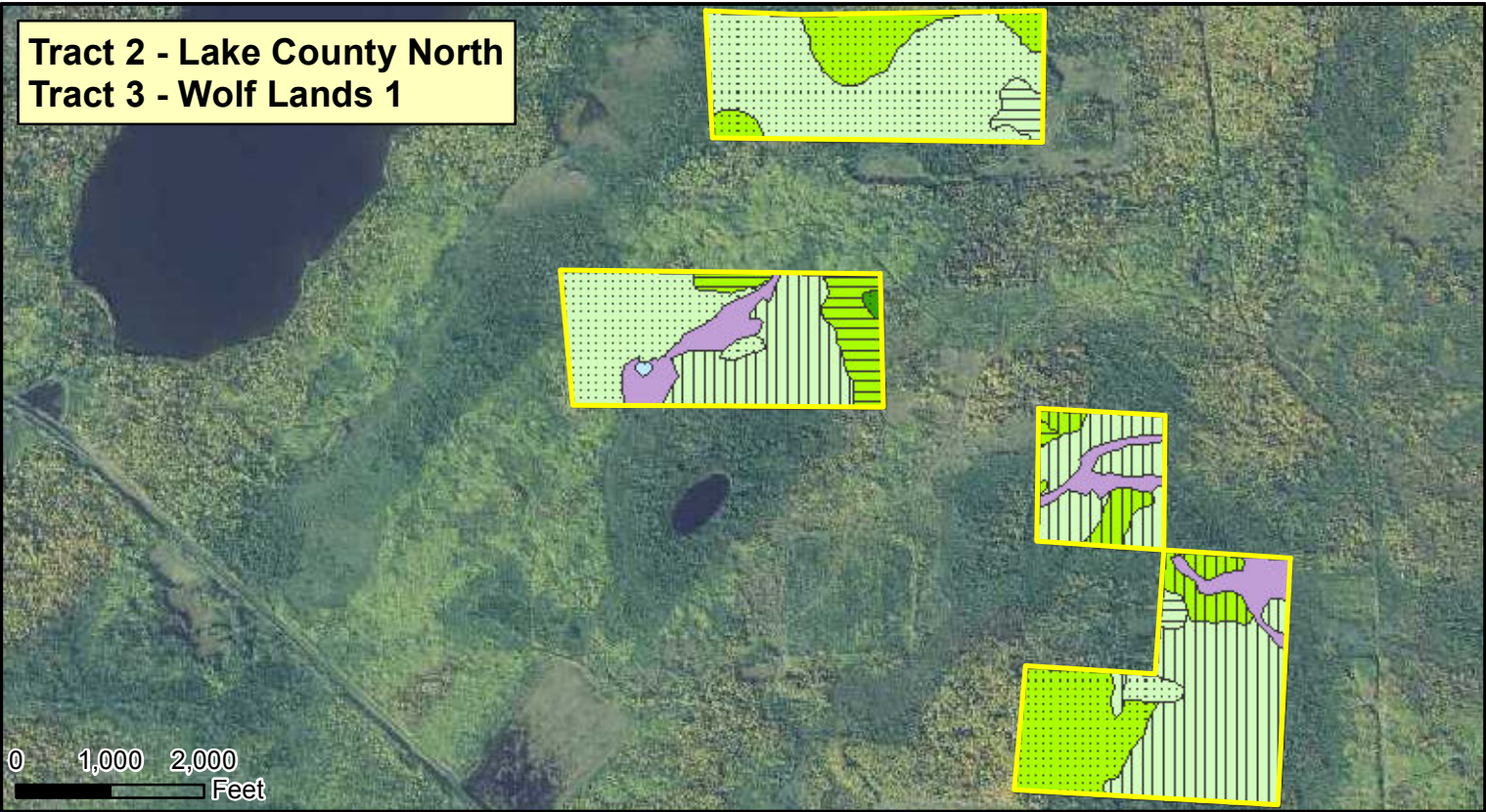
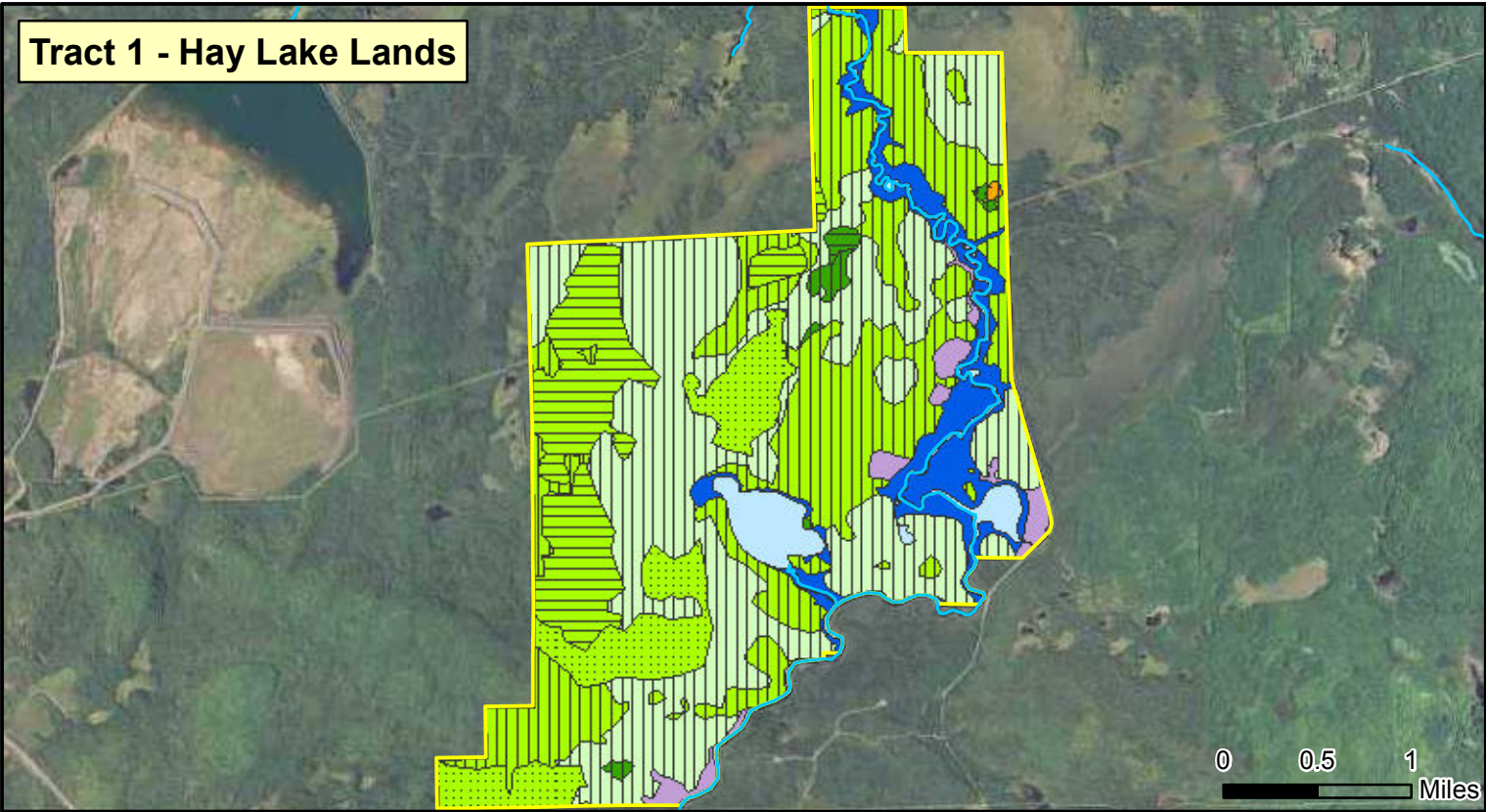


Figure 20
Management Indicator Habitat Types and Age Classes -
Hay Lake Lands, Lake County Lands, and Wolf Lands 1 and 2
 Biological Assessment for the NorthMet Project and Land Exchange
 St. Louis County, Minnesota

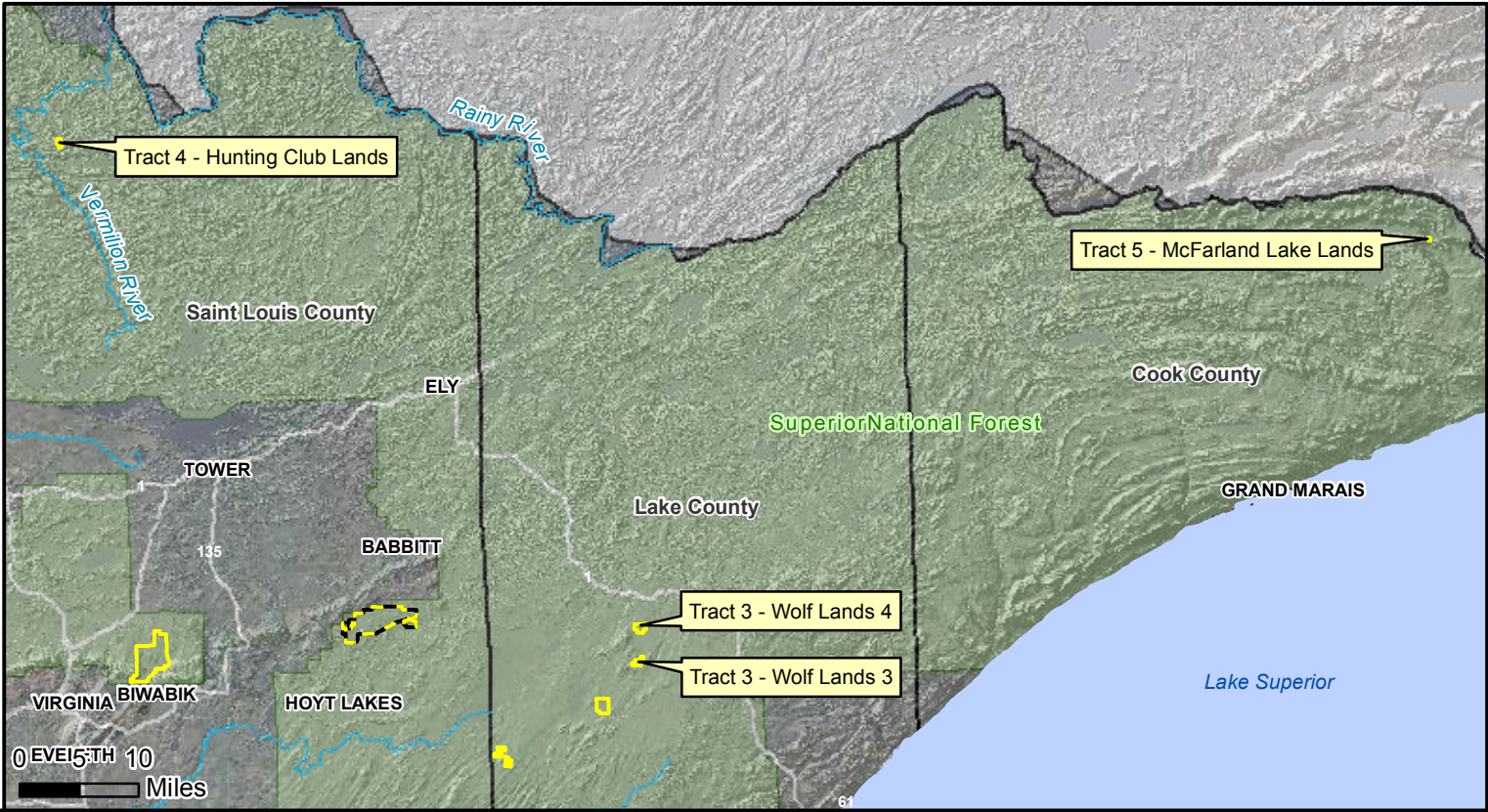
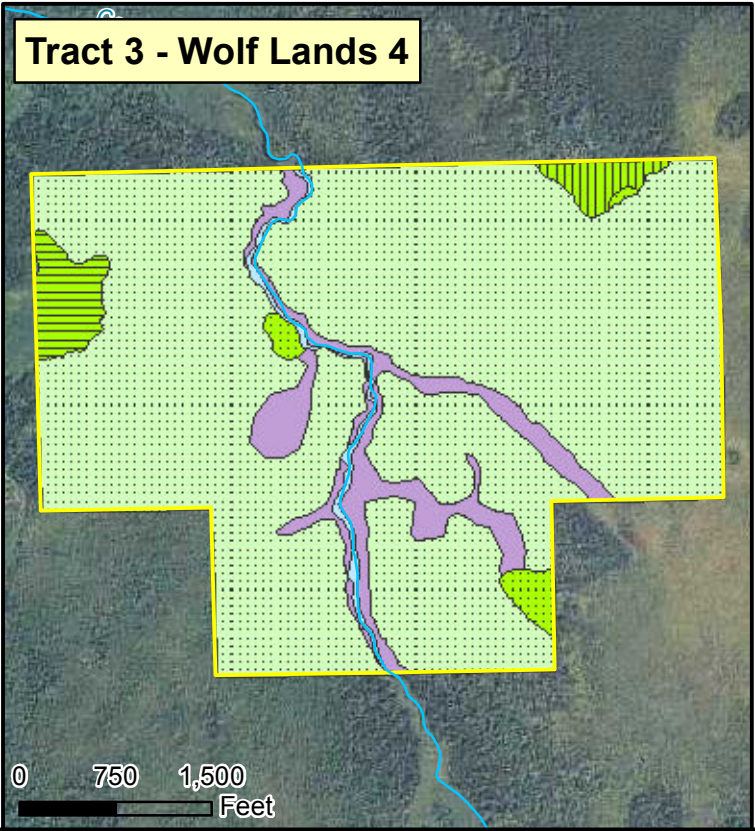
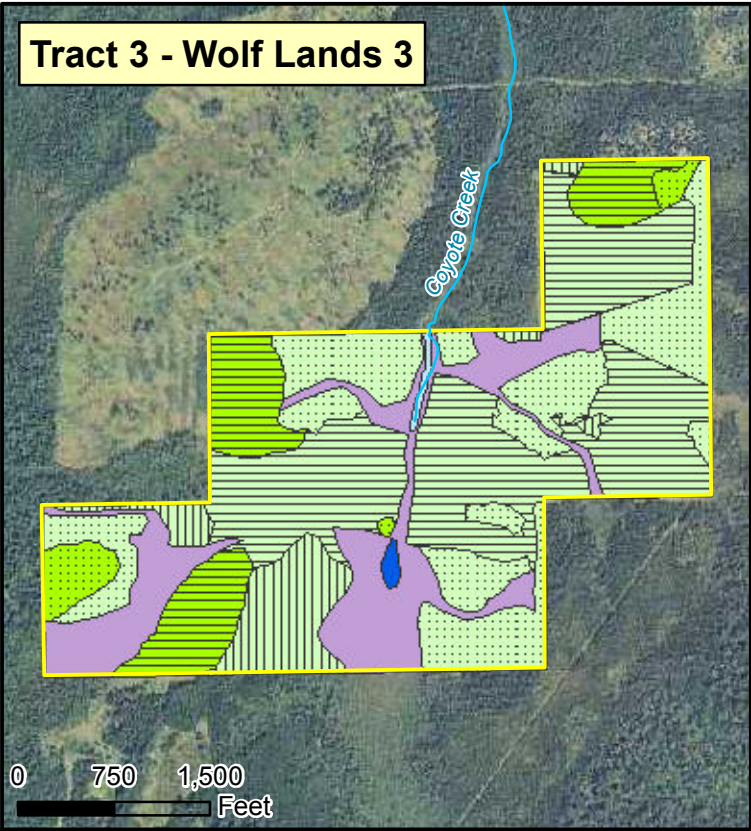
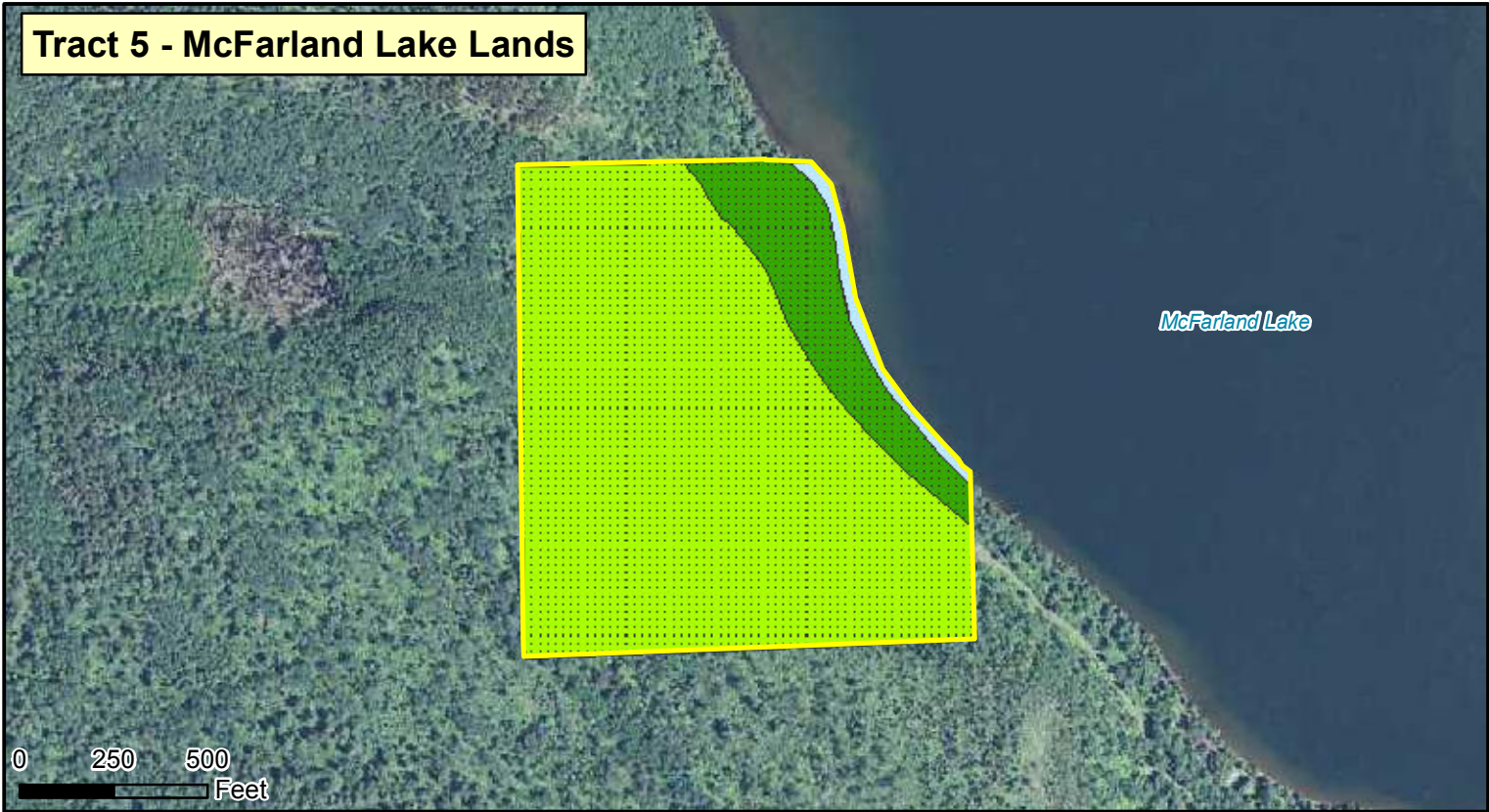
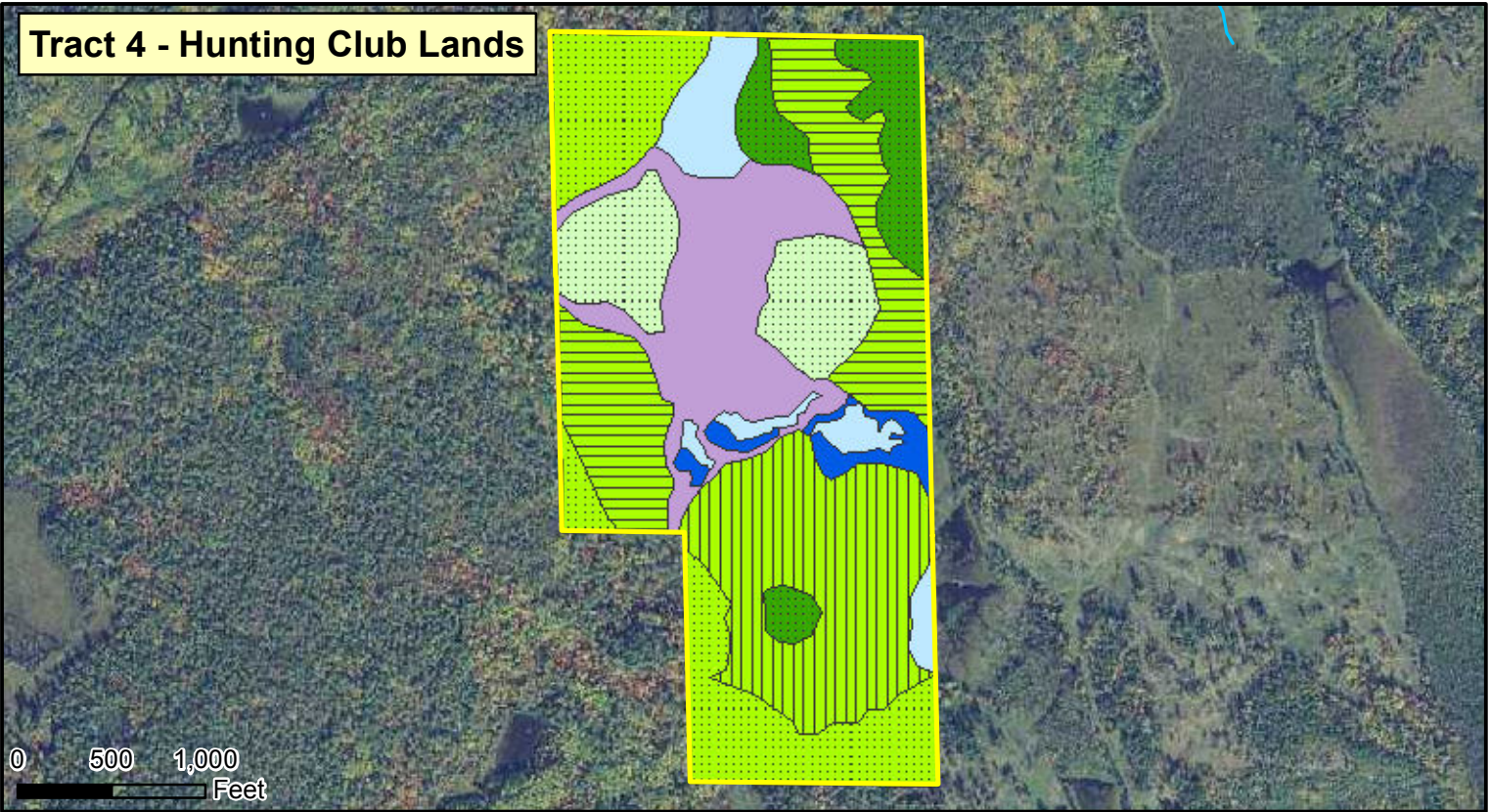


Figure 21
Management Indicator Habitat Types and Age Classes -
Hunting Club Lands, Mc Farland Lake Lands,
and Wolf Lands 3 and 4
 Biological Assessment for the NorthMet Project and Land Exchange
 St. Louis County, Minnesota

Indicator 4 – Lynx Habitat with Adequate Canopy Cover

Upland forest greater than 4 years of age, and lowland stands with forest greater than 9 years of age, provide suitable lynx cover to support habitat connectivity (USDA Forest Service 2004b).

There are about 6,372 acres of lynx habitat with adequate canopy cover on the federal lands. Based on an assessment of existing conditions and conditions at closure of the mine, there would be a loss of approximately 1,669 acres of lynx habitat with adequate canopy cover due to mining, or about 2% of lynx habitat with adequate canopy cover within LAU SNF 12 (MDNR et al. 2013). Under the land exchange, the Forest Service would no longer administer 6,372 acres of lynx habitat with adequate canopy within LAU SNF 12 (13% loss of suitable habitat administered by the Forest Service in LAU SNF 12), but would gain 2,134 acres of suitable habitat in other LAUs. The Forest Service would also gain an additional 4,675 acres of suitable habitat on Hay Lake Lands, or 6,809 acres in total, for a net gain of 437 acres of lynx habitat with adequate canopy cover under Forest Service administration (MDNR et al. 2013).

Human Disturbance

Recreation

Risk Analysis Indicators

The Forest Service identified four risk analysis indicators to measure risks to lynx from recreational activities.

Indicator 5 – Miles of Designated All-terrain Vehicle Trails

Indicator 6 – Miles of Designated Snowmobile Trails

As discussed in the 2004 Forest Plan BA, one of the key concerns associated with all-terrain vehicles and snowmobile trails is the potential for increased and deeper access for humans into lynx habitat (USDA Forest Service 2004b). Snowmobile and all-terrain vehicle use (or, on some trails, other means of access such as walking or driving other types of vehicles) for trapping, hunting, or other recreational activities may increase the chance for lynx disturbance, harm, or mortality throughout wider areas of the Superior National Forest and on privately owned lands. Because of the lynx's vulnerability to trapping, this potential impact is difficult, if not impossible, to avoid. Because Forest Service plans foster recreation and encourage recreational uses of the Forest, there is an increased potential for negative impacts to lynx on lands administered by the Forest Service.

The 2004 Forest Plan (USDA Forest Service 2004a) provides overall direction for road and trail density in lynx habitat, recommending upper limits for road and trail density of 2 miles/mi² and guidance to seek opportunities to reduce density. Direction for designated snow-compacted trails, on the other hand, guides the Forest Service to generally allow for no net increase of winter trails unless they serve to consolidate use.

Another concern with new construction of designated all-terrain vehicle trails and snowmobile trails is the potential for increased snow compaction and access for competitors to lynx habitat. This is not a major issue on Forest Service-administered lands as the 2004 Forest Plan allows no net increase in designated snow-compacting trails unless they effectively consolidate use. However, there may be a concern with new all-terrain vehicle trails because in most locations it is likely that these routes could appear inviting to snowmobiling, and thus may have an unintended result of increasing snow compaction where trails coincide with lynx habitat.

These two indicators were not analyzed in this BA. There are no designated all-terrain vehicle or snowmobile trails on the federal and non-federal lands and Wetland Mitigation sites, except for 0.03 miles of designated trail on Wolf Lands 3. The Forest Service would promote recreational use of the lands it acquires in the land exchange, but is not expected to develop new all-terrain vehicle or snowmobile trails, or improve existing non-designated trails. Thus, all-terrain vehicle and snowmobile use of the non-federal lands is expected to remain near current levels, without or without the land exchange.

Under the Proposed Action, PolyMet would gain control of the federal lands and Wetland Mitigation Sites. Access to the Project area would be strictly controlled during mine operations and PolyMet has no plans to construct designated all-terrain vehicle or snowmobile trails on the federal lands or Wetland Mitigation Sites. Thus, there would be no change in designated trails on federal and non-federal lands with or without the proposed land exchange.

Indicator 8 – Policy of Cross-country Use of All-terrain Vehicles and Snowmobiles

This indicator applies to lands administered by the Forest Service. Cross-country use by all-terrain vehicles and snowmobiles is allowed now and would also be allowed in the future in most management areas on the Superior National Forest. It is difficult to estimate the consequences of this policy. Ruediger et al. (2000) suggested that recent advances in snowmobile technology may allow snowmobiles to travel in deeper snow and to areas that were not accessible with older machines. However, most snowmobiles used on the Superior National Forest are getting larger and are designed for use on maintained system trails, and machines are difficult to take off trails or open areas because of the density of the forest. Places that can currently be traversed cross-country frequently are already used from year to year. For example, rivers or open non-forest lands that provide a long enough travel way can become *de facto* trails, because they are used in most winters and during most of the winter.

Under the Proposed Action, Superior National Forest policies would not apply on the federal lands. As noted above, public access to these areas would be restricted during and after mine operations.

Forest Service policies would apply to the non-federal lands under the Proposed Action. Some cross-country use of these lands occurs now, and would be expected to continue if these lands are administered by the Forest Service. Because there would be few changes under the Proposed Action, and because snowmobilers typically prefer established trails to cross-country travel through forested habitat, there should be little change in impacts to lynx with or without the land exchange. This indicator is not analyzed in this BA.

Indicator 9 – Policy on Cross-country Use of All-terrain Vehicles and Snowmobiles on OML 1 and 2 Roads

The Forest Service generally allows all-terrain vehicles and snowmobile use on all existing Objective Maintenance Level (OML) 1 and 2 roads and on unclassified roads (generally these are former temporary or low standard roads).

Objective Maintenance Level 1 designation is assigned to intermittent service roads when they are closed to street legal motorized vehicular traffic. The closure period must exceed 1 year. Roads receiving OML 1 maintenance would generally be managed at OML 2 during the time they are open for traffic. Basic custodial maintenance is performed to keep damage to adjacent resources to an acceptable level and to perpetuate the road to facilitate future management activities. Emphasis is normally given to maintaining drainage facilities and runoff patterns.

Objective Maintenance Level 2 designation is assigned to roads operated for use by high clearance vehicles. Passenger car traffic is not a consideration. Traffic is normally minor, usually consisting of one or a combination of administrative, permitted (such as log haul), dispersed recreation, or other specialized uses. Log haul may occur at this level. Temporary and newly constructed OML 1 and 2 roads would be effectively closed following their intended management use.

County and temporary or low standard roads are found on the non-federal lands and were constructed to facilitate timber management and recreational access. The effects of the Proposed Action on all-terrain vehicle and snowmobile use of temporary or low standard roads associated with the federal and non-federal lands would be similar to those described for Indicator 8. Thus, this indicator is not analyzed in this BA.

Roads and Trails

Risk Analysis Indicators

The Forest Service has identified one risk analysis indicator to measure impacts from forest and backcountry roads and trails.

Indicator 7 – Miles of Temporary and OML 1 and 2 Roads

Temporary roads are authorized by contract, permit, lease, other written authorization, or emergency operation. They are not intended to be a part of the forest transportation system, and are not necessary for long-term resource management. These roads are not included on the National Forest System road inventory and are decommissioned after use (USDA Forest Service 2004b). Objective Maintenance Level 1 and 2 roads are discussed above under Indicator 9. This indicator is not analyzed in this BA because there would be little or no change in the miles of temporary and OML 1 and 2 roads on federal and non-federal lands under the Proposed Action (Ryan 2013a).

Under the Proposed Action, PolyMet would gain control of the federal lands. There are approximately 5.9 miles of temporary and OML 1 and 2 roads on the federal lands. Temporary roads built to support historic timber management and mine exploration on the proposed Mine Site would be lost to mine development. Access to the Project area would be strictly controlled during mine operations.

These roads would likely have little impact on lynx, as lynx would be discouraged from using the roads due to noise and other disturbances. After mine closure, most access roads would be closed and the property would remain privately owned and closed to public access. Temporary roads may be constructed on the federal lands associated with the Mine Site to support forest management activities, but the number of miles of temporary backcountry roads and trails on the Project area should be similar to, or less than, existing miles of backcountry roads and trails on the federal lands. Roads would be privately owned and closed to public access. (Pylka 2013b).

The Forest Service would primarily manage the non-federal lands for timber production and recreation. If new roads are constructed on the lands, they would likely be temporary and used to support timber management. There would likely be little or no change in the number of miles of backcountry roads and trails on the non-federal lands, and the number of miles may decrease if existing roads are closed and revegetated or allowed to revegetate naturally, benefitting lynx.

6.1.3 Interrelated and Interdependent Effects

No known activities are interrelated or interdependent to the Project that would have the potential to affect Canada lynx. It is possible that future specific programs or projects may have relevant interrelated and interdependent actions (e.g., expansion of the Mine Site due to discovery of new ore bodies) and they would be considered in the context of consultations for those actions.

6.1.4 Cumulative Effects

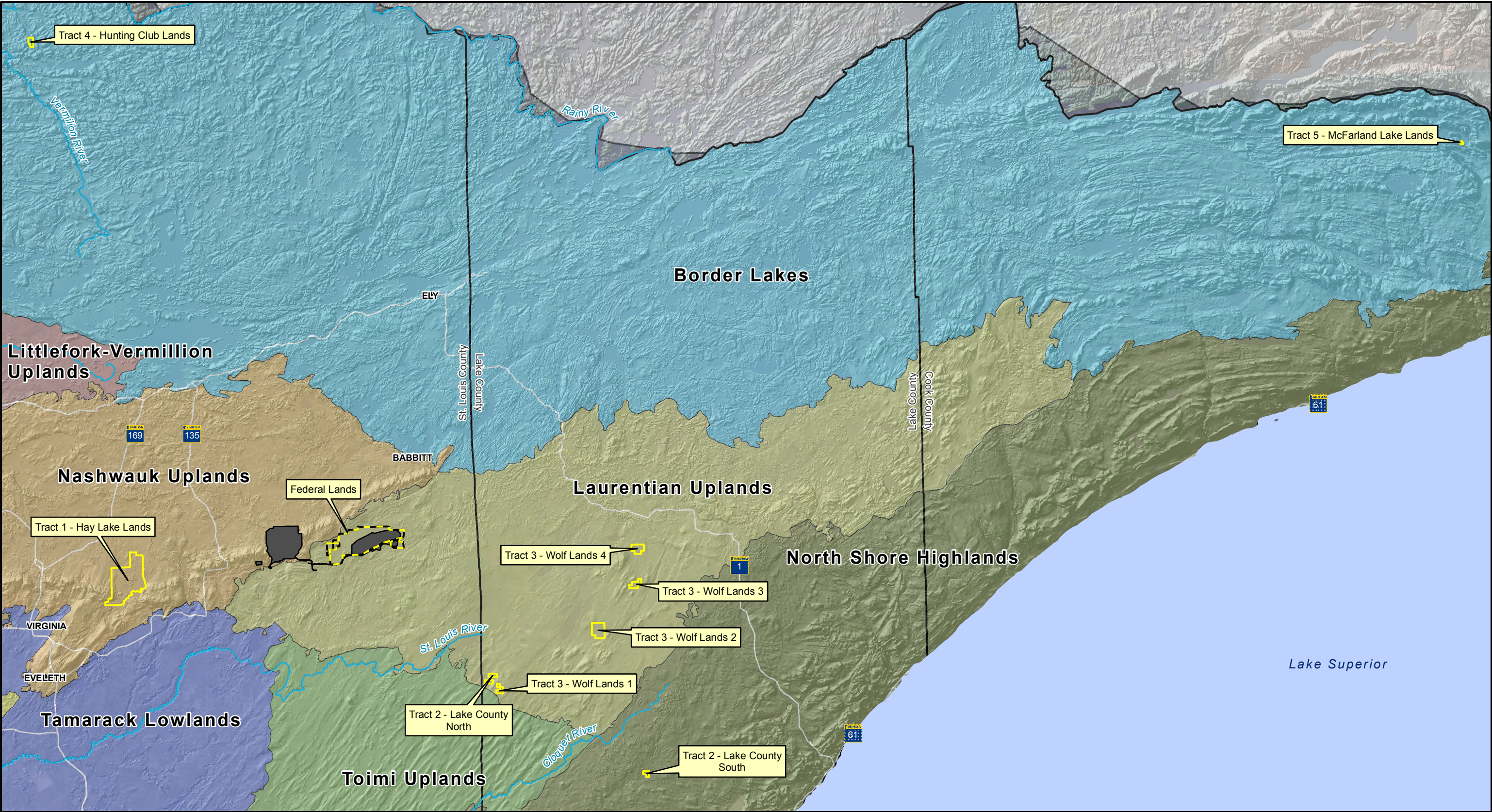
Cumulative effects include the effects of future state, tribal, local, or private actions that are reasonably certain to occur in the cumulative effects study area (CESA) considered in this BA. Future federal actions that are unrelated to the Proposed Action are not considered in this BA because they require separate consultation pursuant to Section 7 of the ESA.

The CESA includes the Nashwauk and Laurentian Uplands ecological subregions within the Arrowhead Region of Minnesota. This area totals approximately 1.38 million acres in the northeast corner of Minnesota (**Figure 22**; Emmons and Olivier Resources, Inc. 2006). The period for analysis of cumulative effects in this BA was from pre-settlement (approximately 1890) through closure and reclamation of Project facilities (approximately 40 years).

Cumulative effects to plants and animals are discussed in Chapter 6 of the FEIS (MDNR et al. 2013). The impacts discussed in that section were based on an analysis conducted for a 2006 MDNR report titled *Cumulative Effects Analysis on Wildlife Habitat and Travel Corridors in the Mesabi Iron Range and Arrowhead Regions of Minnesota* (Emmons and Olivier Resources, Inc. 2006), and a report titled *Cumulative Effects Analysis of Wildlife Habitat and Threatened and Endangered Wildlife Species* (Barr 2009).

In accordance with Council on Environmental Quality guidance on June 24, 2005 (Council on Environmental Quality 2005), past actions associated with the Project are addressed through their current aggregate effects and have not been provided as a list of individual projects in this BA. The FEIS identifies a number of projects that should be considered reasonably foreseeable future actions and that may contribute to cumulative effects to plants and animals. These include mining and other land development activities, and land management activities such as timber harvest, prescribed fire, and road construction that may be authorized or carried out on nearby federal, state, and private lands and that are likely to have both positive and negative effects to plants and animals.

Based on analysis conducted by Emmons and Olivier Resources, Inc. (2006), approximately 1,700 acres of wildlife habitat were lost from the Arrowhead Region between 1890 and the 1990s, with loss due to forestry and mining accounting for 88% of the loss. In much of the region, forest communities have transitioned from predominately pine- and tamarack-dominated forests to trembling aspen and other non-pine community-dominated forest species. Forest composition has changed, and the Minnesota Forest Resource Council (2003) concluded that forest fragmentation has increased, with decreased forest stand sizes and more miles of forest edge.



- | | | |
|-------------------|-------------------------------|-----------------------|
| Federal Lands | Ecological Subsections | North Shore Highlands |
| Non-federal Lands | Border Lakes | St. Louis Moraines |
| Project Areas | Laurentian Uplands | Tamarack Lowlands |
| Major River | Littlefork-Vermillion Uplands | Toimi Uplands |
| | Nashwauk Uplands | |

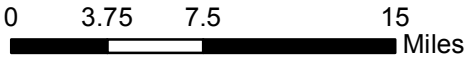


Figure 22
Arrowhead Region of Minnesota and
Ecological Subsections
Biological Assessment for the NorthMet Project and Land Exchange
St. Louis County, Minnesota

Barr (2009) estimated habitat loss due to mining at about 17,000 acres over the next 25 to 30 years. In the future, the rate of habitat losses due to mining would decrease as vegetation establishes on disturbed lands. Potential disturbances to habitat within the Laurentian Uplands ecological subsection would be primarily due to timber harvest and mining, and habitat types most likely to be affected include upland and lowland coniferous forest, upland deciduous forest, and upland shrub/woodland. Within the Nashwauk Uplands ecological subsection, mining activities and urban development would be more likely to affect habitat, with upland deciduous forests and upland shrub/woodland habitats most affected (Emmons and Olivier, Inc. 2006).

Although more land would be impacted by timber management than mining in the future, forestry management offers a greater range of options for lynx, northern long-eared bat, and wolf to co-exist with the practice, as it can mimic natural disturbances, whereas mining represents a complete land conversion that could affect long-term lynx habitat availability. Between 2005 and 2014 within the Laurentian Uplands ecological subregion, an average of approximately 1,034 forest acres were (or would be) harvested annually on state lands (0.2% of the subsection). Between 2010 and 2019 within the Nashwauk ecological subregion, an average of approximately 1,189 forest acres were (or would be) harvested annually on state lands (0.1% of the subsection). On average, 1% of timberland in the Superior National Forest is harvested annually (MDNR et al. 2013). Private timber harvest data are generally not available.

6.1.4.1 Factors Considered in the Cumulative Effects Analysis

The 2004 Forest Plan BA and 2011 Hardrock Mining BA identified several factors to consider when evaluating impacts to lynx in northeastern Minnesota at a landscape level of analysis. These are 1) habitat loss and fragmentation, including loss and fragmentation of lynx critical habitat, 2) human disturbance and access, and 3) habitat connectivity.

6.1.4.2 Cumulative Effects Assessment

Habitat Loss and Fragmentation, including Prey Habitat

The Project and other nearby proposed mine projects would increase the amount of habitat fragmentation in the area, changing wooded/forested and other vegetated habitats to disturbed/developed areas with limited habitat value. Development of iron mines along the Iron Range has made much of this area of limited value to lynx, especially areas with pits, tailings, and waste rock piles. Historic waste rock piles and tailings have begun to revegetate and provide some habitat for lynx and their prey, but their value is greatly reduced compared to habitat that existed in the area prior to mining.

Development of the Plant Site would have little impact on habitat fragmentation, as 61% of the site (2,756 of 4,515 acres) has been disturbed by LTVSMC taconite mining operations and the remaining habitat occurs in scattered tracts on the Plant Site. In addition, most of the land within several miles of the Plant Site have been disturbed by past and ongoing taconite operations, including lands within the Transportation and Utility Corridors.

Activities at the Plant Site would have little impact on lynx, as surveys suggest the Plant Site and nearby areas are avoided or rarely used by lynx, probably due to poor quality habitat and moderate level of human disturbance at or near the Plant Site. Development of the Mine Site would add to habitat fragmentation by converting much of the habitat on the Mine Site to an open water pit lake and waste rock stockpiles of limited value to lynx. Most lynx sightings on or near the Project area have been to the east of the Mine Site, but lynx

tracks have been seen on the Mine Site and it is likely that lynx move in an east-west direction between Forest Service and private forestlands in the vicinity of the Mine Site. Development of the Mine Site would force lynx to move further south to travel in an east-west direction to access these forests, and would also force lynx to travel south of the Mine Site, or north of the Mine Site through the federal lands surrounding the Mine Site. Use of the lands adjacent to the Mine Site by lynx may be limited during mine operations due to disturbance associated with the Mine Site and the Northshore Mine to the north. Impacts to lynx from habitat loss and fragmentation may not be great, however, as lynx studies in the area suggest that lynx primarily reside in an area east and southeast of the Mine Site on Superior National Forest lands and the BWCAW, and only occasionally use the Mine Site.

The Mine Site would account for about 1,719 acres, or 10% of the estimated 17,000 acres of habitat impacted by future mining activity within the next 25 to 30 years. It should be noted that while losses to forestry represent the bulk of habitat loss in the region, they are not as permanent or destructive as mining or economic development losses from the perspective of lynx and their prey. Forestry practices remove some or all trees from an area, reducing the value of that area as lynx habitat, but the natural process of succession ensures the regeneration of forest stands that can once again serve as high-quality habitat. Occasional timber harvest may actually promote the growth of dense coniferous stands that are favored by snowshoe hare, the primary prey species of the lynx.

Areas of mine disturbance would be reclaimed and available to lynx about 10 or more years after reclamation. Thus, habitat lost for use by lynx on the Mine Site would be only a small portion of the amount of habitat impacted by forestry and other mining activities. Although impacts to lynx would be expected at the individual level, they would not be expected at the population or species level.

Risk Analysis Indicators

The Forest Service has identified two risk analysis indicators to measure impacts to lynx from cumulative effects associated with habitat loss and fragmentation (**Table 10**).

Indicator 10 – Lynx Habitat Unsuitable on All Ownerships

Indicator 10 was developed by the Forest Service to identify the amount of habitat within a LAU that is unsuitable to lynx. If more than 30% of all lynx habitat within an LAU (all ownerships) is unsuitable,

Table 10
Unsuitable Habitat and Road/Trail Density within the Lynx Analysis Units Affected by the Project

Lynx Analysis Indicator	Lands	LAU	Existing Condition		Proposed Action ¹	
			Acres	Percent ²	Acres	Percent ²
10. Lynx Habitat Unsuitable on All Ownerships	Federal Lands	SNF 12	2,737	4.0	4,456	6.4
	Non-federal Lands					
	Hunting Club	SNF 4	2,470	4.9	2,470	4.9
	Lake County North and Wolf Lands 1	SNF 16	3,127	4.4	3,127	4.4
	Wolf Lands 2, 3, and 4	SNF 21	2,931	4.2	2,931	4.2
	Lake County South	SNF 22	913	1.6	913	1.6
	McFarland Lake	SNF 42	534	1.9	534	1.9

BASELINE ANALYSIS AND ASSESSMENT OF EFFECTS

	Hay Lake	NA			NA	
Lynx Analysis Indicator	Lands/Parcels	LAU	Existing Condition		Proposed Action ³	
			Miles within LAU ⁴	Density within LAU ³	Miles within LAU	Density within LAU ⁵
11. Road and Snow-Compacted Trail Density	Federal Lands	SNF 12	99	0.9	93	0.8
	Non-federal Lands					
	Hunting Club	SNF 4	185	2.2	185	2.2
	Lake County North and Wolf Lands 1	SNF 16	98	0.9	98	0.9
	Wolf Lands 2, 3, and 4	SNF 21	93	0.8	93	0.8
	Lake County South	SNF 22	105	1.2	105	1.2
	McFarland Lake	SNF 42	70	1.7	70	1.7
	Hay Lake	NA			NA	

¹ After Project closure. Some unsuitable habitat on the Mine Site would become suitable for lynx 10 or more years after reclamation of the Mine Site.

² Acres and percent of unsuitable habitat provided by USDA Forest Service (Ryan 2013a). Acres of suitable habitat are: SNF 4 – 49,994; SNF 12 – 69,131; SNF 16 – 70,743; SNF 21 – 69,632; SNF 22 – 57,107; and SNF 42 – 27,775.

³ After Project closure and reclamation.

⁴ Miles of roads and snow-compacted trail density provided by USDA Forest Service (Ryan 2013a).

⁵ Density = Miles of road per square mile.

Total acreage within the LAU for all land ownerships —LAU SNF 4 = 55,071 acres, SNF 12 = 70,980 acres, SNF 16 = 76,108 acres, SNF 21 = 73,266 acres, SNF 22 = 58,154 acres, and SNF 42 = 32,305 acres; total acreage for lands administered by the Superior National Forest —LAU SNF 4 = 33,321 acres, SNF 12 = 49,409 acres, SNF 16 = 33,679 acres, SNF 21 = 36,082 acres, SNF 22 = 41,210 acres, and SNF 42 = 24,687 acres.

then no further reduction in suitable condition should occur as a result of vegetation management activities by the Forest Service. **Table 10** shows the amount of unsuitable habitat within LAUs that would be affected by the Project. The amount of unsuitable habitat would increase in LAU SNF 12 to 6.4% from 4.0% due to Mine Site development, but would not exceed 30%. Because habitat management would be little changed due to the proposed transfer of the non-federal lands, the amount of area with unsuitable habitat within the other LAUs should not change with or without the proposed land exchange.

Indicator 11 – Road and Snow-compacted Trail Density

Indicator 11 provides a measure of the Forest Service goal to maintain road and snow-compacting trail densities below 2 miles/mi² within LAUs to maintain the natural competitive advantage of lynx in deep snow (**Table 10**). Where total road and regularly-used snow-compacting trail densities are greater than 2 miles/mi² and coincide with lynx habitat, effort should be made to prioritize roads for seasonal restrictions or reclamation in those areas, where practical or feasible. “Roads” include all ownerships of classified and unclassified roads and “regularly-used trails” are those that are used most years for most of the snow season. The 2004 Forest Plan allows no net increase in designated snow-compacting trails unless they effectively consolidate use (USDA Forest Service 2004a). However, there may be a concern with new all-terrain vehicle trails because in most locations it is likely that these routes could appear inviting to snowmobiling, and thus may have an unintended result of increasing snow compaction where trails coincide with lynx habitat.

Approximately 5.9 miles of OML 1 roads are on the federal lands, or about 0.6 miles/mi². After mine closure, these roads would be reclaimed, except for a short access road from the Dunka Road to the Waste Water Treatment Facility. Public access to the Mine and Plant sites is currently prohibited, and access to the Plant Site

and lands adjacent to the Mine Site would be strictly controlled during mine operations. The Project area would remain privately owned after mine closure and public access would be restricted (Pylka 2013b).

There are no designated all-terrain vehicle or snowmobile trails on the federal lands. It is unlikely that new designated trails would be constructed on the federal lands after mine closure.

There are designated and undesignated roads and trails on or bordering the non-federal lands, and recreational use of these roads and trails was evident on these sites. Road density exceeds 2.2 miles/mi² in LAU SNF 4. There are historic logging roads on Hunting Club Lands, and it is possible that new logging roads could be constructed in the future, but these would not be regularly used roads. Thus, regular use road density should not increase in LAU SNF 4 due to the land exchange. Road densities are below 2 miles/ mi² for the other lands. As noted for Indicator 7, there would be no immediate change in miles of designated and undesignated roads and designated all-terrain vehicle or snowmobile trails within the LAUs with or without the land exchange.

Human Access and Disturbance

Human Access and Traffic

The Project and other nearby proposed projects would increase the amount of human access and disturbance in the area. Increased human populations in the Project area may also lead to increased risk to lynx from collisions with vehicles and trains, increased levels of recreation activities and use of backcountry roads and trails, and increased mortality from illegal hunting and trapping.

There is a well-established road system along the Mesabi Iron Range, associated with mining activity, and to serve nearby towns, recreational areas, private residences, pasturelands, and forestlands. It is expected that the number of miles of roads within the Project area would show little increase during the life of the Project, and some roads could be taken out of service or reclaimed during the life of the Project. The Forest Service estimated that up to 157 miles of temporary roads could be constructed annually within the Superior National Forest from hardrock mining activities and that up to 761 miles could exist at any one time during the period of hardrock mining within the Superior National Forest (USDA Forest Service 2011a). Still, this would be less than the mileage gain estimated to occur under the 2004 Forest Plan, which was based on mileage limits to protect lynx (USDA Forest Service 2004a). Given that the number of miles of roads associated with the Mine Site, Dunka Road and Utility Corridor, Plant Site, and non-federal lands after mining is expected to be similar to or less than current levels, impacts associated with road mileage are not expected to accumulate from the Project.

Human activity associated with the Project, and other ongoing and proposed projects near the Project area, would increase the amount of vehicle and rail traffic in the region and the potential for collisions between lynx and vehicles and trains. Vehicle and rail traffic within and to/from the Project area could result in the loss of a lynx during the 20-year mine operation period, and accumulate with losses of lynx from collisions with trains and vehicles elsewhere in the CESA.

Trapping and Incidental or Illegal Shooting

There is evidence that lynx may be accidentally trapped during furbearer, including bobcat, fisher, gray wolf, and pine marten trapping seasons. Of the 435 records in the MDNR (2007) lynx database for 2000 to 2006, ten records list that the animal was caught in a trap, and of these, three were killed, six were released unharmed, and the

status of one is unknown. Based on records kept by the USFWS since from 2000 to 2012, 13 lynx died from trapping incidents (4 were legally trapped in Canada), and another 10 were trapped and released alive (Rowse 2012). It is likely that other lynx have been trapped, but not reported. The magnitude of accidental lynx trapping in the project area and in northern Minnesota is unknown.

Lynx could be shot mistakenly or intentionally by hunters or by poachers. Lynx and wolves may be shot by hunters during deer and other hunting seasons for fun, or lynx may be mistakenly identified as bobcat and shot during the bobcat season. The actual magnitude of lynx shooting in northern Minnesota is unknown. Of the 435 records in the MDNR (2007) lynx database for 2000 through 2006, only 1 record lists that the animal was intentionally shot, while another lynx was accidentally shot; the USFWS database lists six lynx shot since 2000 (Rowse 2012). However, it is likely that lynx shootings are generally not reported. It is unlikely that many lynx would be shot within the Project area due to limited numbers of lynx in the general vicinity of the Project, and because hunting would not be allowed on the Project area during mining, and most likely after mine closure.

The number of people, and potential for trapping and incidental or illegal shooting, would increase in the region due to the Project. Education of the public as to the importance of protecting lynx and other wildlife, however, has helped to reduce the accidental or intentional loss of lynx in recent years. Trapping and illegal or accidental shooting of lynx would be unlikely on the federal lands during mine construction and operation if conservation measures given in Chapter 7 of this BA are followed. Although the Project would cause an increase in the number of people in the region, the cumulative effects of the Project on trapping and illegal or accidental shooting of lynx on the non-federal lands and Wetland Mitigation Sites would be negligible.

Competition and Predation as Influenced by Human Activities

Lynx interact with other carnivores throughout their range. Competition with or predation by coyotes, gray wolves, mountain lions, bobcats, and birds of prey have been inferred or documented throughout the range of the lynx. Some human activities, particularly those related to timber harvest and over-the-snow access routes, have the potential to alter natural relationships between lynx and other predators.

Certain timber harvest practices increase edges and openings within forest stands, which may improve foraging conditions for generalist predators such as coyotes, bobcats, and great horned owls. This in turn increases the potential for both exploitation and interference competition with lynx to occur.

Snow compaction due to resource management or recreation activities may facilitate movement of coyotes and other potential competitors and predators into lynx habitat, making it likely that lynx in the study area would compete with these competitors and predators for primary lynx prey (Buskirk et al. 2000b).

The Forest Service recommends that road and snow-compacting trail densities be kept below 2 miles/mi². Where road and snow-compacting trail densities exceed 2 miles/mi², the Forest Service would prioritize roads for season restrictions or reclaim some roads. Of the 47 LAUs in northeastern Minnesota, 15 have road and snow-compacting trail densities exceeding 2 miles/mi², including LAU SNF 4. Based on road building activities between 2004 and 2010, the Forest Service estimates that about 77 miles of OML 1 and 123 miles of OML 2 roads would be constructed in the Superior National Forest each year. Another 532 to 860 miles of temporary roads could be constructed to support hardrock mining activities (USDA Forest Service 2011a). As noted earlier, however, most, if not all new roads constructed on the Mine Site and Plant Site would be removed or reclaimed after mining ceases, and there would be little or no new road construction on the lands adjacent to the Mine Site and non-federal lands. Thus, competition between lynx

and its predators due to an increase in road and snow-compacting trail densities would not accumulate due to the Project long term.

Habitat Connectivity

Much of the habitat for lynx along the Iron Range has been eliminated by mining, other industrial activities, and residential development, and remaining habitat is heavily fragmented. However, large patches of suitable lynx habitat exist on either side of the range, primarily within the Superior National Forest, Chippewa National Forest, and various state forests. To travel between habitat patches on either side of the Iron Range, lynx must find suitable corridors of habitat that traverse the range and allow safe movement. Emmons and Olivier Inc. (2006) identified 13 wildlife travel corridors, while Barr (2009) identified 18 travel corridors, which facilitate movement of wildlife across the Iron Range. Three wildlife travel corridors exist in the vicinity of the Project that could be impacted by the project and other projects in the area (**Figure 23**).

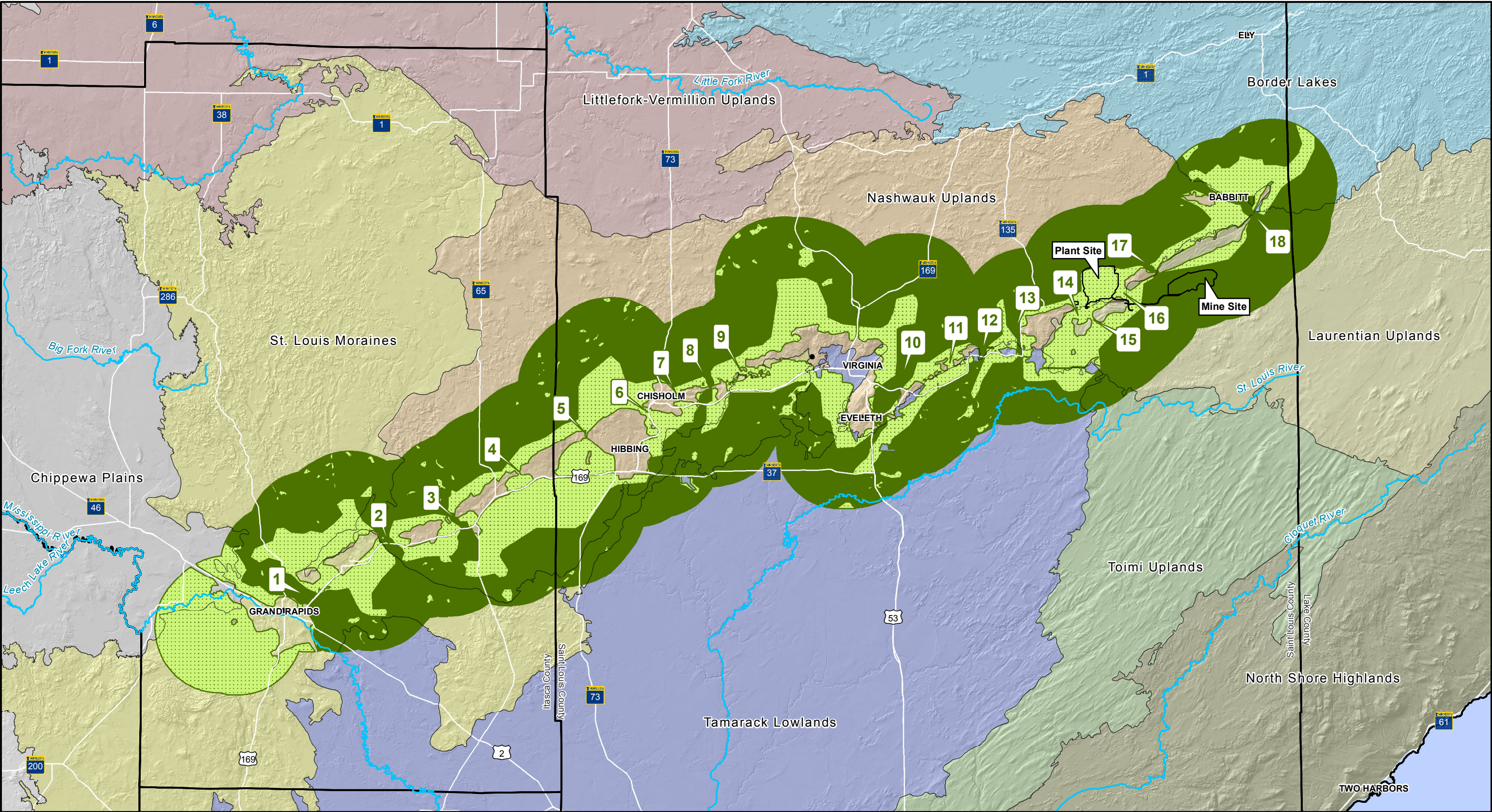
Corridor 16 is a small but important corridor, approximately 0.6 mile wide, which connects large habitat blocks to the east-southeast and north-northwest. The corridor is unlikely to be impacted by the Project because the Plant Site Tailings Basin area would be sited approximately 1 mile to the northwest on the existing LTVSMC Tailings Basin. The Emmons and Olivier, Inc. (2006) report also noted that an area to the southwest has high potential for future growth, which could impact the corridor, but estimated that the corridor would continue to serve as an important connection for wildlife in the future. Lynx have not been reported using this corridor.

Corridor 17 is a 1,200-foot wide strip that is between two open pits operated by the Northshore Mine and is approximately 0.5 mile northwest of the Mine Site. Operations at the Mine Site would indirectly impact the corridor by reducing the size of the large habitat block southeast of the corridor. Noise and mining activity could also discourage lynx use of this corridor. The corridor could be accessed from north of the Mine Site, and from the south and southwest of the corridor. Lynx have been observed using this corridor.

Corridor 18 is about 2,800 feet wide, located at the eastern boundary of the Northshore Mine, about 7 miles northwest of the Mine Site. The corridor follows a river, and several small roads cross this corridor. Recent expansion of the Northshore Mine easterly pit, and a relocation of County State Aid Highway 70 that is east of the pit, has reduced the width of the corridor to about 2,200 feet (USDOJ USFWS 2011a). Lynx have been observed using this corridor.

Research conducted by the NRRI indicates that lynx have varied home ranges, and disperse from them within the Superior National Forest, and to and from Canada (Burdett 2007, Moen et al. 2010). Movements were made across roaded areas, and also across the BWCAW, which has few or no linear features such as roads, trails, and logging roads that could guide movement by lynx. When lynx made long distance movements, they often crossed several LAU boundaries without changes in direction.

Moen et al. (2010) suggested that habitat connectivity does not appear to be a limiting factor for lynx in northeastern Minnesota. The combination of low topographic relief, the linear nature of movement paths, and the relative lack of differences in cover conditions indicate that geographically or topographically definable movement corridors do not exist for lynx either within in northeastern Minnesota, or between Minnesota and Ontario, Canada. Because northeastern Minnesota is the southern limit of boreal forest, no connectivity or linkage areas could be managed for lynx movement to the south and west because of unsuitable habitat in those directions.



- | | | |
|---------------------------------|------------------------|-------------------------------|
| Wildlife Travel Corridors | Project Areas | Littlefork-Vermillion Uplands |
| High Quality | Major River | Nashwauk Uplands |
| Moderate Quality | Ecological Subsections | North Shore Highlands |
| Wildlife Travel Corridor Number | Border Lakes | St. Louis Moraines |
| | Chippewa Plains | Tamarack Lowlands |
| | Laurentian Uplands | Toimi Uplands |

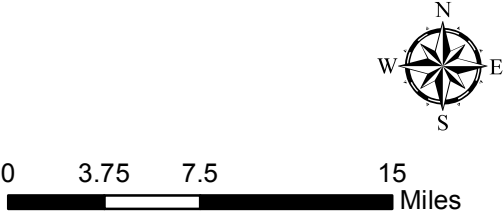


Figure 23
Wildlife Travel Corridors
Biological Assessment for the NorthMet Project and Land Exchange
St. Louis County, Minnesota

Dense forests occur in northeastern Minnesota, and while forest management activities alter patterns of vegetation community composition and structure at landscape and smaller scales, Ravenscroft et al. (2010) considered northeastern Minnesota forest landscape as largely unfragmented. In addition, Galatowitsch et al. (2009) stated that the BWCWA and the North Shore portion of the Superior National Forest are high quality protection areas.

Therefore, large portions of northeastern Minnesota provide excellent connectivity habitat. There is no indication that lynx use defined linkage areas, and they appear to move freely across the landscape throughout the Superior National Forest, and north into Canada. Although actions associated with the Project could impact Corridors 16 and 17, and these impacts would accumulate with impacts to nearby corridors from other projects in the region, there is good habitat connectivity within designated critical habitat and the Project area.

6.2 Northern Long-eared Bat

6.2.1 Environmental Baseline

The following baseline information is from *Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition To List the Eastern Small-Footed Bat and the Northern Long-Eared Bat as Endangered or Threatened Species; Listing the Northern Long-Eared Bat as an Endangered Species; Proposed Rule* (USDOI USFWS 2013b) and references cited therein. A full description of references cited in this rule is available at URL: <http://www.regulations.gov/#!documentDetail;D=FWS-R5-ES-2011-0024-0002>. Any additional information that is not from one of these sources is cited in the text.

6.2.1.1 Species Description and Status and Critical Habitat Status

The northern long-eared bat belongs to the order Chiroptera, suborder Microchiroptera, family Vespertilionidae, subfamily Vespertilioninae, genus *Myotis*, subgenus *Myotis*. The northern long-eared bat was considered a subspecies of Keen's long-eared myotis (*Myotis keenii*), but was recognized as a distinct species by van Zyll de Jong (1979).

A medium-sized bat species, the northern long-eared bat adult body weight averages 0.2 to 0.3 ounces, with females tending to be slightly larger than males. Average body length ranges from 3.0 to 3.7 inches. Fur colors include medium to dark brown on its back, dark brown, but not black, ears and wing membranes, and tawny to pale-brown fur on the ventral side. The northern long-eared bat is distinguished from other *Myotis* species by its long ears (average 0.7 inches), that, when laid forward, extend beyond the nose. Within its range, the northern long-eared bat can be confused with the little brown myotis or the western long-eared myotis. The northern long-eared bat can be distinguished from the little brown myotis by its longer ears, tragus, slightly longer tail, and less glossy pelage. The northern long-eared bat can be distinguished from the western long-eared myotis by its darker pelage and paler membranes (Caceres and Barclay 2000:1).

White-nose syndrome, a fungal disease known to affect bats, is currently the predominant threat to the northern long-eared bat, especially throughout the Northeast where the species has declined by up to 99% from pre-white-nose syndrome levels at many hibernation sites (hibernacula; USDOI USFWS 2013a). White-nose syndrome has spread rapidly throughout the East and is currently spreading through the Midwest. Although the disease, caused by the fungal species *Pseudogymnoascus destructans*, has not yet spread throughout the northern long-eared bat's entire range (white-nose syndrome is currently found in at least 22 of 39 states where the northern long-eared bat occurs), it continues to spread. Other threats to the species include wind energy

development, habitat destruction or disturbance (e.g., vandalism to hibernacula, roost tree removal), climate change, and contaminants. Although no significant population declines have been observed due to these threats, they may now be important factors affecting this bat's ability to persist while experiencing dramatic declines caused by white-nose syndrome.

The northern long-eared bat was proposed for listing as an endangered species by the USFWS on October 2, 2013. The USFWS also determined that critical habitat for the northern long-eared bat is not determinable at this time.

6.2.1.2 Distribution

The northern long-eared bat is found across much of the eastern and northcentral United States and all Canadian provinces from the Atlantic coast west to the southern Northwest Territories and eastern British Columbia (USDOI USFWS 2013a).

Historically, the species has been most frequently observed in the northeastern United States and in Canadian Provinces, Quebec and Ontario, with sightings increasing during swarming and hibernation. However, throughout the majority of the species' range it is patchily distributed, and historically was less common in the southern and western portions of the range than in the northern portion of the range.

Although they are typically found in low numbers in inconspicuous roosts, most records of northern long-eared bats are from winter hibernacula surveys. More than 780 hibernacula have been identified throughout the species' range in the United States, although many hibernacula contain only a few (1 to 3) individuals. Eleven hibernacula sites with one or more winter records are known from Minnesota.

The northern long-eared bat is commonly encountered in summer mist-net surveys throughout the majority of the Midwest and is considered fairly common throughout much of the region. However, the species is often found infrequently and in small numbers in hibernacula surveys throughout most of the Midwest. In northeastern Minnesota, this species has been detected in St. Louis, Lake, and Cook Counties based on records in the MDNR Natural Heritage Information System database of element occurrences (MDNR 2014a). In Minnesota, the Tower/Soudan Underground Mine State Park in St. Louis County contains a large number of individuals, possibly over 3,000; however, this is a very rough estimate because the majority of the mine cannot be safely accessed for surveys (Nordquist et al. 2006, USDOI USFWS 2013b). The mine is about 15 miles northwest of the Project area.

Additionally, northern long-eared bats have been detected in six caves along the North Shore of Lake Superior. These caves are within the Superior National Forest proclamation boundary but outside of federal surface ownership. Mist-net surveys conducted by Superior National Forest biologists confirmed the presence of northern long-eared bats at five of the eight sites surveyed in St. Louis and Lake Counties during the summer of 2013 (Grandmaison et al. 2013). While these data are far from providing an estimate of abundance on the Superior National Forest, they do suggest that northern long-eared bats can be detected, albeit at low numbers, across much of the forest where surveys are conducted.

6.2.1.3 Life History

Hibernation

The northern long-eared bat hibernates during the winter months to conserve energy from increased thermoregulatory demands and reduced food resources. In general, northern long-eared bats arrive at hibernacula in August or September, enter hibernation in October and November, and leave the hibernacula in March or April. Northern long-eared bats have shown a high degree of philopatry (using the same site multiple years) for a hibernaculum, although they may not return to the same hibernaculum in successive seasons.

Typically, northern long-eared bats are not abundant and compose a small proportion of the total number of bats hibernating in a hibernaculum. Although usually found in small numbers, the species typically inhabits the same hibernacula with large numbers of other bat species, and occasionally are found in clusters with these other bat species. Other species that commonly occupy the same habitat include little brown myotis, big brown bat, eastern small-footed bat, tri-colored bat, and Indiana bat.

Northern long-eared bats often move between hibernacula throughout the winter, which may further decrease population estimates. Though northern long-eared bats fly outside of the hibernacula during the winter, they do not feed; hence the function of this behavior is not well understood. However, it has been suggested that bat activity during winter could be due in part to disturbance by researchers. Northern long-eared bats exhibited significant weight loss during hibernation. Whitaker and Hamilton (1998:101) reported a weight loss of 41 to 43% over the hibernation period for northern long-eared bats in Indiana.

Migration and Homing

While the northern long-eared bat is not considered a long-distance migratory species, short migratory movements between summer roost and winter hibernacula between 35 to 55 miles have been documented. Several studies show a strong homing ability of northern long-eared bats in terms of return rates to a specific hibernaculum, although bats may not return to the same hibernaculum in successive winters.

Summer Roosts

During the summer, northern long-eared bats typically roost singly or in colonies underneath bark or in cavities or crevices of both live trees and snags. Northern long-eared bats switch roosts often. In Missouri, the longest time spent roosting in one tree was 3 nights; however, up to 11 nights spent roosting in a man-made structure has been documented. Bats switch roosts for a variety of reasons, including, temperature, precipitation, predation, parasitism, and ephemeral roost sites. Timpone et al. (2010:118) radiotracked 13 northern long-eared bats to 39 roosts and found the mean distance between the location where captured and roost tree was 1.1 miles.

Some studies have found tree roost selection to differ slightly between male and female northern long-eared bats. Male northern long-eared bats have been found to more readily use smaller diameter trees for roosting than females, suggesting males are more flexible in roost selection than females. In New Brunswick, Canada, Broder and Forbes (2004:606-607) found that there was spatial segregation between male and female roosts, with female maternity colonies typically occupying more mature, shade-tolerant deciduous tree stands and males occupying more conifer-dominated stands. In northeastern Kentucky, males do not use colony roosting

sites and are typically found occupying cavities in live hardwood trees, while females form colonies more often in both hardwood and softwood snags.

Reproduction

Breeding occurs from late July in northern regions to early October in southern regions and commences when males begin to swarm hibernacula and initiate copulation activity. Copulation occasionally occurs again in the spring. Hibernating females store sperm until spring, exhibiting a delayed fertilization strategy. Ovulation takes place at the time of emergence from the hibernaculum, followed by fertilization of a single egg, resulting in a single embryo. Gestation is approximately 60 days.

Maternity colonies, consisting of females and young, are generally small, numbering from about 30 to 60 individuals, although one group of 100 adult females was observed in Vermilion County, Indiana. Adult females give birth to a single pup. Birthing within the colony tends to be synchronous, with the majority of births occurring around the same time. Female roost site selection, in terms of canopy cover and tree height, changes depending on reproductive stage. Relative to pre- and post-lactation periods, lactating northern long-eared bats have been shown to roost higher in tall trees situated in areas of relatively less canopy cover and tree density.

Adult longevity is estimated to be up to 18.5 years, with the greatest recorded age of 19 years. Most mortality for northern long-eared and many other species of bats occurs during the juvenile stage.

Foraging Behavior and Home Range

The northern long-eared bat has a diverse diet including moths, flies, leafhoppers, caddisflies, and beetles. The most common insects found in the diets of northern long-eared bats are lepidopterans (moths) and coleopterans (beetles), with arachnids (spiders) also being a common prey item.

Foraging techniques include hawking (catching insects in flight) and gleaning in conjunction with passive acoustic cues. Northern long-eared bats have the highest frequency call of any bat species in the Great Lakes area. Gleaning allows this species to gain a foraging advantage for preying upon moths because moths are less able to detect these high frequency echolocation calls. Emerging at dusk, most hunting occurs above the understory, 3 to 10 feet above the ground, but under the canopy. This coincides with data indicating that mature forests are an important habitat type for foraging northern long-eared bats. Occasional foraging also takes place over forest clearings and water, and along roads. Foraging patterns indicate a peak activity period within 5 hours after sunset followed by a secondary peak within 8 hours after sunset.

Female home range size may range from 47 to 425 acres. Owen et al. (2003:353) estimated average maternal home range size to be 161 acres. Home range size of northern long-eared bats in this study site was small relative to other bat species, but this may be due to the study's timing (during the maternity period) and the small body size of northern long-eared bat.

6.2.1.4 Habitat

Winter Habitat

Northern long-eared bats predominantly overwinter in hibernacula that include caves and abandoned mines. Hibernacula used by northern long-eared bats are typically large, with large passages and entrances, relatively constant, cooler temperatures (32 to 48 degrees Fahrenheit), and with high humidity and no air currents. The sites favored by northern long-eared bats are often in very high humidity areas, to such a large degree that droplets of water are often observed on their fur. Caire et al. (1979:405) and Whitaker and Mumford (2009:208) commonly observed individuals exiting caves with mud and clay on their fur, also suggesting the bats were roosting in tighter recesses of hibernacula. They are also found hanging in the open, although not as frequently as in cracks and crevices.

To a lesser extent, northern long-eared bats have been found overwintering in other types of habitat that resemble cave or mine hibernacula, including abandoned railroad tunnels, more frequently in the northeast portion of the range. In 1952, three northern long-eared bats were found hibernating near the entrance of a storm sewer in central Minnesota (Goehring 1954:435).

Summer Habitat

During the summer, northern long-eared bats typically roost singly or in colonies underneath bark or in cavities or crevices of both live trees and snags. Males and non-reproductive females' summer roost sites may include cooler locations, including caves and mines. Northern long-eared bats have also been observed roosting in colonies in man-made structures, such as buildings, barns, a park pavilion, sheds, cabins, under eaves, behind window shutters, and in bat houses.

The northern long-eared bat appears to be somewhat opportunistic in tree roost selection, selecting varying roost tree species and types of roosts throughout its range, including tree species such as black oak, northern red oak, silver maple, black locust, American beech, sugar maple, sourwood, and shortleaf pine. Northern long-eared bats most likely are not dependent on a certain species of trees for roosts throughout their range; rather, certain tree species will form suitable cavities or retain bark and the bats will use them opportunistically.

Many studies have documented the northern long-eared bat's selection of live trees and snags, with a range of 10 to 53% selection of live roosts found. In tree roosts, northern long-eared bats are typically found beneath loose bark or within cavities and have been found to use both exfoliating bark and crevices to a similar degree for summer roosting habitat.

Canopy coverage at northern long-eared bat roosts has ranged from 56% in Missouri to greater than 84% in Kentucky. Studies in New Hampshire and British Columbia have found that canopy coverage around roosts is lower than in available stands. Females tend to roost in more open areas than males, likely due to the increased solar radiation, which aids pup development. Fewer trees surrounding maternity roosts may also benefit juvenile bats that are starting to learn to fly. However, in southern Illinois, northern long-eared bats were observed roosting in areas with greater canopy cover than in random plots. Roosts are also largely selected below the canopy, which could be due to the species' ability to exploit roosts in cluttered environments; their gleaning behavior suggests an ability to easily maneuver around obstacles.

Female northern long-eared bats typically roost in tall, large-diameter trees. Studies have found that the dbh and height of northern long-eared bat roost trees was greater than random trees. Lacki and Schwierjohann (2001:486) have also found that northern long-eared bats roost more often on upper and middle slopes than lower slopes, which suggests a preference for higher elevations due to increased solar heating.

6.2.1.5 Factors Affecting the Welfare of Northern Long-eared Bat

Several factors affect northern long-eared bats. These include: 1) modification to hibernacula, human disturbance during hibernation, loss of summer roosting habitat, and loss of habitat from other disturbance factors, including mining projects and prescribed burning; 2) loss of bats due to diseases such as rabies and encephalitis, and from contaminants; 3) predation from hawks, raccoons, skunks, and snakes; 4) lack of federal, state, and local regulations to address threats to northern long-eared bats, although the northern long-eared bat is a species of special concern in Minnesota; 5) wind energy development; and 6) climate change. However, these activities alone are not likely to have significant population-level effects (USDOI USFWS 2013b). PolyMet would follow the USFWS northern long-eared bat interim guidance for removal of marketable timber across the Project (USFWS 2014). Disturbance from noise and vibration is discussed in Section 6.2.2.1.

The most severe and immediate threat to the long-term persistence of this species is the infectious disease known as white-nose syndrome. White-nose syndrome is responsible for unprecedented mortality rates observed in the northeastern United States and poses an increasing threat to bat populations throughout North America. White-nose syndrome has spread rapidly throughout the northeast where an estimated 5.7 to 6.7 million bats have died, and is currently spreading through the Midwest. The causative fungal species for white-nose syndrome, *Pseudogymnoascus destructans*, is known to occur in Minnesota, including the Tower/Soudan Underground Mine State Park, which is 15 miles northwest of the Project area and serves as the largest known hibernaculum for Myotis bats in Minnesota.

White-Nose Syndrome

Since its first documented appearance in New York in 2006, white-nose syndrome has spread rapidly throughout the Northeast and is expanding through the Midwest. As of August 2013, white-nose syndrome has been confirmed in 22 States (Alabama, Connecticut, Delaware, Georgia, Illinois, Indiana, Kentucky, Maine, Maryland, Massachusetts, Missouri, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, Vermont, Virginia, and West Virginia) and 5 Canadian provinces (New Brunswick, Nova Scotia, Ontario, Prince Edward Island, and Quebec). Four additional States (Arkansas, Iowa, Minnesota, and Oklahoma) are considered suspect for white-nose syndrome based on the detection of the causative fungus on bats within those States, but with no associated disease to date. U.S. Fish and Wildlife Service biologists and partners estimate that at least 5.7 million to 6.7 million bats of several species have now died from white-nose syndrome.

The pattern of spread has generally followed predictable trajectories along recognized migratory pathways and overlapping summer ranges of hibernating bat species. Therefore, Kunz and Reichard (2010:12) assert that white-nose syndrome is spread mainly through bat-to-bat contact; however, evidence suggests that fungal spores can be transmitted by humans, and bats can also become infected by coming into contact with contaminated cave substrate. Six North American hibernating bat species (little brown myotis, Indiana bat, northern long-eared bat, eastern small-footed bat, big brown bat, and tri-colored bat), are known to be affected by white-nose syndrome.

White-nose syndrome is caused by the recently described psychrophilic (cold-loving) fungus, currently known as *Pseudogymnoascus destructans*. *Pseudogymnoascus destructans* may be non-native to North America, and only recently arrived on the continent. The fungus grows on and within exposed tissues of hibernating bats, and the diagnostic feature is the white fungal growth on muzzles, ears, or wing membranes of affected bats, along with epidermal (skin) erosions that are filled with fungal hyphae (branching, filamentous structures of fungi). Bats that are found in more humid regions of hibernacula may be more susceptible to white-nose syndrome.

In addition to the presence of the white fungus, initial observations showed that bats affected by white-nose syndrome were characterized by some or all of the following: 1) Depleted fat reserves by mid-winter; 2) a general unresponsiveness to human disturbance; 3) an apparent lack of immune response during hibernation; 4) ulcerated, necrotic, and scarred wing membranes; and 5) aberrant behaviors, including shifts of large numbers of bats in hibernacula to roosts near the entrances or unusually cold areas, large numbers of bats dispersing during the day from hibernacula during mid-winter, and large numbers of fatalities, either inside the hibernacula, near the entrance, or in the immediate vicinity of the entrance.

Although the exact process by which white-nose syndrome leads to death remains undetermined, it is likely that the immune function during torpor compromises the ability of hibernating bats to combat the infection. Other factors that could cause death include loss of fat stores during winter, alternation of normal arousal cycles in hibernating bats, and loss of wing-dependent physiological functions.

Due to white-nose syndrome, the northern long-eared bat has experienced a sharp decline in the northeastern part of its range, as evidenced in hibernacula surveys. The northeastern United States is very close to saturation (white-nose syndrome found in majority of hibernacula) for the disease, with the northern long-eared bat being one of the species most severely affected by the disease. In hibernacula surveys in New York, Vermont, Connecticut, and Massachusetts, hibernacula with larger populations of northern long-eared bats experienced greater declines, suggesting a density-dependent decline due to white-nose syndrome.

Long-term (including pre- and post- white-nose syndrome) summer data for the northern long-eared bat are somewhat limited; however, the available data parallel the population decline exhibited in hibernacula surveys. Summer data can corroborate and confirm the decline to the species seen in hibernacula data. Summer surveys from 2005 to 2011 near Surry Mountain Lake in New Hampshire showed a 99% decline in capture success of northern long-eared bats post- white-nose syndrome, which is similar to the hibernacula data for the State (a 95% decline).

Because white-nose syndrome has already had a substantial effect on northern long-eared bats in the core of its range and is likely to spread throughout the species' entire range within a short time, the USFWS considers white-nose syndrome to be the predominant threat to the species rangewide.

6.2.2 Analysis of Direct and Indirect Effects to Northern Long-eared Bat

6.2.2.1 Effects to Northern Long-eared Bat within the Action Area

As discussed in Section 6.2.1.5, the USFWS identified several factors affecting the welfare of northern long-eared bat. Of these, loss of habitat from the Project could be a direct effect to northern long-eared bats. Forest management activities, including timber harvest and prescribed burning, could occur on federal and non-federal lands in the reasonably foreseeable future under the Proposed Action and could result in cumulative effects to northern long-eared bats due to habitat modification.

In addition, the Forest Service (USDA Forest Service 2013b) has identified three analysis indicators for northern long-eared bat:

1. acres of upland forest (MIH 1),
2. presence of known hibernacula, and
3. presence of known summer roost sites.

Analysis indicators 2 and 3 are not evaluated in this BA because there are no known hibernacula or summer roost sites on the federal or non-federal lands. The 2014 Forest Service surveys indicated that summer roost sites may be present on the Mine Site; however, there have been no field surveys to identify roost trees in the Project area.

Federal Lands

Northern long-eared bats have been found in the winter in Minnesota in natural caves, sand mines, and deep iron mines, but these habitats are not found on the federal or non-federal lands. During warmer months of the year, northern long-eared bats primarily roost and forage in forests, especially more mature forests and forests near wetlands. There are approximately 233 acres of young, 540 acres of immature, and 557 acres of mature upland forest habitat (MIH 1), and 3,737 acres of wetlands, within the federal lands that could provide roosting, foraging, and drinking habitat for northern long-eared bat.

The 2014 Forest Service surveys confirmed that northern long-eared bats utilize the Mine Site for foraging and travel to and from foraging and roost sites. The 2014 Forest Service surveys also suggested that the Mine Site may contain roost sites; however, there have been no surveys specifically conducted for the identification of roost sites. Bats were also observed using wetlands in the vicinity of the Mine Site, although they were not identified to species (AECOM 2011a). The Project would result in the loss of about 532 acres of upland forest habitat (MIH 1) and 634 acres of wetlands due to mining. Based on the mine closure plan, about 397 acres of the habitat lost to mining would be reclaimed as grassland/herbaceous (54%), wetland and/or grassland/herbaceous (27%), and wetland (18%). Wetland habitat created would have lesser habitat value for northern long-eared bat. The West Pit would not be reclaimed, but would remain as a 321-acre open pit lake (MDNR et al. 2013). Young upland forest habitat could occur on reclaimed lands about 10 years after mine reclamation. As this forest habitat matures, it could be used by northern long-eared bats. Because northern long-eared bats can utilize trees with a minimum diameter of 3", the time to maturation of basic usable forest habitat would be approximately 10-15 years. Wetland and open water habitat on reclaimed lands could be used for foraging and drinking by northern long-eared bats; however, in general wetland habitats are less utilized by northern long-eared bats.

Transportation and Utility Corridors

The Dunka Road and Utility Corridor is approximately 108 acres and the Railroad Connection Corridor is approximately 12 acres. Because of prior use during the former LTVSMC taconite mining operation, the Dunka Road and Utility Corridor is now defined as having a "disturbed" cover type (94 acres). The remaining MDNR GAP land cover types that are not disturbed include cropland/grassland (10 acres), shrubland (8 acres), and smaller acreages of the remaining types, including 5 acres of upland forest and 3 acres of aquatic habitat

(MDNR et al. 2013). The 2014 Forest Service surveys confirmed that northern long-eared bats utilize the upland forest habitats for foraging.

Plant Site

Of the 4,515 acres at the Plant Site Area, 2,756 acres have been disturbed by LTVSMC taconite mining operations. Of the remaining 1,760 acres, approximately 648 acres are upland deciduous forest, 637 acres are aquatic habitat, 334 acres are shrubland, 100 acres are upland coniferous forest, and 42 acres are lowland coniferous forest (totals don't add because acreages are rounded). About 48% of the Plant Site would be impacted by plant construction and operations, with only about 422 acres of forest habitat remaining after construction. It is assumed that the majority of this forested habitat meets the minimum criteria for roosting and/or foraging value for northern long-eared bat. Construction of the processing facilities would have little impact on bat habitat, as over half of the site has been previously disturbed by LTVSMC taconite mining operations (MDNR et al. 2013). The 2014 Forest Service surveys confirmed that northern long-eared bats utilize the Plant Site for foraging. Driving transects identified the northern long-eared bat being present near the forest/open edge to the east of the Tailings Basin and southwest of the former LTVSMC processing buildings, but this species was not identified to be present within the Tailings Basin itself (Forest Service 2014a, Figure 4). The surveys found no evidence of roost sites at the Plant Site.

Non-federal Lands

Under the Proposed Action, approximately 7,075 acres of non-federal lands would be transferred to the Forest Service. The Forest Service has not determined the suitability of these lands to provide habitat for northern long-eared bat. However, wildlife habitat surveys conducted on these lands have shown that bats forage and drink on the non-federal lands, although bats were not identified to species during the surveys (AECOM 2011b, c). There are 591 acres of mature and 2,104 acres of young and immature upland forest habitat (MIH 1) on the non-federal lands that could provide habitat for northern long-eared bats. The non-federal lands would not be affected by the Project, but should benefit from Forest Service management that favors longer harvest rotations than typically occurs on private forestlands and from activities that promote development of snags. There are approximately 4,254 acres of wetlands on the non-federal lands that could provide habitat for northern long-eared bats.

Wetland Mitigation Sites

Under the Proposed Action approximately 2,169 acres of Wetland Mitigation Site lands would be purchased by PolyMet as compensatory mitigation for impacts to wetlands and other waters of the U.S.. These lands are used for sod production, but under the Proposed Action would be restored to native wetland and upland vegetation. After restoration, the combined total of wetland and upland acreage for these sites would be about 1,603 acres and 197 acres, respectively. These sites could provide habitat for northern long-eared bats and would be privately owned (Pylka 2013b).

Other

Noise and Vibration

Existing ambient steady equivalent noise levels for most of the Mine Site are in the range of 35 to 45 decibels (dBA), which is a range comparable to secluded woods or a quiet bedroom (MPCA 1999). The Peter Mitchell

Mine, north of the Mine Site, and traffic along Dunka Road and the existing railway, along the south edge of the Mine Site, also contribute brief, episodic noise impacts.

The primary sources of Project noise from the Mine Site would be blasting, haul trucks, and train horns, with noise levels ranging from 89-115 dBA. Equipment such as graders, bull dozers, and support trucks would be less dominant sources of noise, ranging from 75-95 dBA (Environmental Protection Agency 1971). Blasting at the Mine Site is expected to occur once every two to three days. Typically, rock blasting generates a single event noise level ranging from 111- 115 dBA at 50 feet from the blasting site (Table 5.5-7 of Madera County 2005). Within most of the Mine Site, the sound from the blast would be similar to a loud clap of thunder.

Noise associated with mining activities, including noise from vehicle and rail traffic, would likely have some effect on the behavior of northern long-eared bats. These effects would vary depending on the distance between the noise source and any roost trees in use at the time. Construction and routine operational noise would have a lesser impact on northern long-eared bats, because these noise sources would be more continuous and lower volume. Effects due to acute noise (such as blasting) are not well studied, but may cause northern long-eared bats to startle and may interrupt roosting activities; however, blasting would be more episodic and less continuous than other noise sources, and would therefore be a less-frequent impact. Noise and blasting effects may extend beyond the proposed Mine Site to nearby northern long-eared bat roost sites. However, noise and blasting effects on roosting would be ameliorated by the fact that northern long-eared bats typically utilize several spatially-distinct roosting tree areas (Kunz and Lumsden 2003). As a result, bats startled by noise from one roost area would likely move to another nearby known roost area (Kunz and Lumsden 2003). Section 6.3.2.1 provides further discussion on the noise levels for the NorthMet Project area. Though northern long-eared bats are likely to be sensitive to changes in noise levels, there are no local, national, or international standards or limits that are applicable to the NorthMet Project Proposed Action.

Hazardous Materials

Mishandling of hazardous materials or wastes could result in spills, accidental release, or discharge into the environment, which could pose risks to northern long-eared bats. Sections 5.2.13 and 5.3.13 of the FEIS discuss the risks posed to the public and the environment from the transport, handling, storage, and use of hazardous materials. Mitigation measures to prevent releases in transportation, storage, and handling or use of these materials are described in several hazardous material management plans necessary to comply with various regulatory requirements for the Project and in the FEIS. Based on this analysis, and limited use by northern long-eared bats of the areas where these materials would be used, risks to northern long-eared bats would be negligible and should not result in harm or death to northern long-eared bats (MDNR et al. 2013).

Potential Indirect Effects from Project Stormwater and Process Water Ponds

As previously mentioned, the northern long-eared bat primarily forages in forested areas on moths, flies, leafhoppers, caddisflies, and beetles. Occasional foraging in small forest canopy gaps, over forest clearings, riparian areas of waterways (with preference for streams protected by canopy closure), and along roads has also been observed. In a forest-agriculture landscape it was found that northern long-eared bats avoided the large agricultural openings (fields) and had preferential travel patterns that followed wooded streams and wooded edges including hedgerows (Henderson and Broders 2008). The same researchers found that foraging areas for the northern long-eared bat were typically within the forested parcels along creeks, providing a higher concentration of prey species and drinking areas than in upland open areas such as agricultural fields (Henderson and Broders 2008). Sources of drinking water for northern long-eared bat include open water areas

within forested areas such as woodland vernal pools (Franci 2005, 2008) and open water areas in wetlands (e.g., beaver ponds) (Taylor 2006).

A portion of the Mine Site would be cleared of vegetation to accommodate the mine pits and associated infrastructure (e.g., haul roads, stockpile, stormwater ponds, waste water ponds) and would become a large open area during operations. The existing Plant Site is primarily an open area dominated by the LTVSMC Tailings Basin and would continue as an open area during Project operations. As a forest specialist, the northern long-eared bat is unlikely to use large upland open areas (Henderson and Broders 2008; Jantzen 2012). Chapman et al. (2014) identify that the northern long-eared bat seldom forages outside the forest or over water bodies and Jantzen (2012) identified that most bat activity occurs within 40 meters of the forest edge, with a maximum distance from the forest edge of about 120 meters. Franci (2005, 2008) identifies the importance of palustrine habitats (bogs, fens, beaver ponds) for bat species usage and that woodland vernal pools are an important drinking water source for several species including the northern long-eared bat. Overall, the peer-reviewed literature identifies the northern long-eared as an obligate forest species (Ford et al. 2005; Buckman-Sewald et al. 2014) that has a strong preference to forage and roost and drink within the forest area (Henderson and Broders 2008; Franci 2008; Chapman et al. 2014) and that it is rare for this species to roost in man-made structures (Henderson and Broder 2008).

The 2014 Forest Service bat surveys indicated that northern long-eared bats were present and foraging at the Plant Site, with driving transect data identifying this species as being present at the forest/open edge area to the east of the Tailings Basin (within 50 meters of the road) and near the LTVSMC process buildings, but not within the Tailings Basin itself (USDA Forest Service 2014a, Figure 4). Currently, forest vegetation at the east side of the Tailings Basin is more than 300 meters from the existing pond. Emergence surveys indicated the northern long-eared bat was also present in areas adjacent to the existing LTVSMC process buildings, with forest vegetation being within about 140 to 150 meters on the west side of the concentrator building and within 30 to 50 meters southeast of the coarse crusher building (USDA Forest Service 2014a, Figure 5).

While other bat species may use open upland areas for foraging and ponds in open terrain for drinking (e.g., little brown bat), it seems unlikely for the northern long-eared bat to use these areas (Jantzen 2012; Chapman et al. 2014). Based on the 2014 Forest Service bat survey data (e.g., driving transects) and the weight of evidence in the peer-reviewed literature, it seems unlikely for the northern long-eared bat to use the open areas at the Tailings Basin or the cleared Mine Site, or the ponds within those open areas, to any great extent because they do not meet its habitat and foraging requirements. Therefore, the northern long-eared bat is likely to have a low potential exposure to water in mining-related ponds and minimal consumption of aquatic insects that may use the stormwater or process water ponds at the Mine Site or the Plant Site during operations, and no significant indirect effects to this species from the Project are likely to occur.

The Project's water management further limits the potential exposure of the northern long-eared bat to indirect effects from the various water features at the Plant Site or Mine Site and consumption of insects that may use these water features. Project water features include stormwater ponds, process water ponds, water in active mine pits, constructed wetlands, the Hydrometallurgical Facility pond (operations), the Flotation Tailings Basin Pond and wetland (reclamation and long-term closure), and the West Pit lake (long-term closure). Each water feature is qualitatively evaluated for potential indirect effects to northern long-eared bats.

1. Stormwater from precipitation and runoff would be directed to sedimentation ponds to remove total suspended solids (TSS) prior to being discharged off-site. Water in the ponds prior to

discharge is expected to reflect background concentrations of water quality parameters (including metals and mercury) and any aquatic insects inhabiting stormwater ponds should have metal and mercury concentrations that reflect background conditions, and therefore, similar to existing conditions. Therefore, any consumers of aquatic insects (including the northern long-eared bat) from Project stormwater ponds should not be exposed to metal or mercury concentrations in those insects above background levels.

2. Process water would be collected and stored in a number of ponds at the Mine Site (e.g., Overburden Storage and Laydown Area Pond) and the Flotation Tailings Basin Pond and Hydrometallurgical Residue Facility Pond at the Plant Site and be actively managed for re-use. The probability of insects inhabiting or using a process water pond as a source of drinking water is expected to be low because: 1) these ponds would tend to be turbid and limit the establishment and growth of plants and in turn limit organic materials and the establishment of macroinvertebrates (Nelms et al. 2012); 2) mining-related water is low in organic carbon (Berndt and Bavin 2012) and nutrients and would limit growth and reproduction of algae, macroinvertebrates, and other biota (Nelms et al. 2012; Seger et al. 2012) ; 3) the use of liners and/or compacted bottoms to maximize water retention would not likely provide a suitable substrate for the larval stages of most aquatic insects (Flake and Cieminski 1996); and 4) fine mineral sediments that have little silt or clay are poor media for plant establishment and growth (Nelms et al. 2012) and further limits the presence of aquatic insects that require organic materials for food (Seger et al. 2012). The above listed factors likely limit the aquatic life in process water ponds and insects from Project process water ponds would likely represent a very small percent of the diet of consumers of aquatic insects. Limited pond productivity and the preference of the northern long-eared bat for forest areas further reduces the potential effect of process water ponds on this bat species.

Similar to taconite processing, mercury in process water sent to the Flotation Tailings Basin Pond and the Hydrometallurgical Residue Facility Pond is expected to be associated with the solids and sequestered with those solids in the respective ponds and result in relatively low concentrations of mercury in the water column (Barr Eng. 2007b; PolyMet 2015). Mercury associated with solids such as tailings is sequestered within the basin and is typically not released from the basin (Berndt 2003) and not readily bioavailable. The continual deposition of solids in these ponds is likely to limit sediment-dwelling organisms (Nelms et al. 2012), as would the lack of organic material for food (Flake and Cieminski 1996; Nelms et al. 2012). Limited pond productivity, sequestration of mercury with solids, and the preference of the northern long-eared bat for forest areas also reduces the potential effect of process water ponds on this species.

3. Mine pit dewatering would occur during Mine Years 1 through 20 and this water would be routed to the Waste Water Treatment Facility for initial treatment and then pumped to the Flotation Tailing Basin Pond for use in ore processing (Poly Met 2014c). A minimal amount of water is expected to be present in an active mine pit, therefore the probability of aquatic insects inhabiting or using a sump area is low. The continual removal of water is likely to limit the presence of aquatic organisms (Nelms et al. 2012), as would the lack of organic material for food (Flake and Cieminski 1996; Nelms et al. 2012). Limited productivity and the preference of the northern long-eared bat for forest areas reduces the potential effect of mine pit watering on

this species.

4. As part of reclamation, some stormwater ponds and process water ponds would be filled and converted to terrestrial habitat (.e.g., Hydrometallurgical Residue Facility Pond) (Poly Met 2014b; 2014e; 2014f). Ponds filled and reclaimed to terrestrial vegetation would have the potential to produce runoff water that would be expected to reflect background conditions. Reclaiming ponds to terrestrial vegetation is not expected to produce runoff that would adversely affect aquatic insects.

A part of the East Pit (after backfilling is completed) and some stormwater and process water ponds would be converted to wetlands (Poly Met 2014b, 2014c, 2014d). These constructed wetlands are expected to receive precipitation and stormwater runoff. The accumulating water should reflect background concentrations for various parameters (including mercury). Any aquatic insects inhabiting a constructed wetland or using it as a source of drinking water should have metal or mercury concentrations that reflect background conditions. Therefore, any consumers of these aquatic insects (including the northern long-eared bat) should not be exposed to metal or mercury concentrations in those insects above background levels.

In regard to the backfilling of the East Pit, the water level would be maintained below the level of the fill material to facilitate truck hauling (Poly Met 2014b). No visible ponding of water is expected during backfilling. Therefore, backfilling of the East Pit would have no potential to affect aquatic organisms.

The Flotation Tailings Basin Pond would be present after Mine Year 20 and a wetland would be constructed around the perimeter of the pond. The pond and wetland are expected to be present into long-term closure. After Mine Year 20, the Beneficiation Plant and Mine Site would no longer contribute water and the largest source of water to the pond would be precipitation and runoff (PolyMet 2015). In long-term closure, the water in the pond would be primarily from precipitation and runoff (PolyMet 2015) and would be expected to reflect background conditions and parameter concentrations (including mercury). Any aquatic insects inhabiting the Flotation Tailings Basin Pond or using it as a source of drinking water during long-term closure should have metal or mercury concentrations that reflect background conditions. Therefore, any consumers of these aquatic insects (including the northern long-eared bat) should not be exposed to metal or mercury concentrations in those insects above background levels.

5. The depth of the West Pit at the end of mining will be more than 600 feet. Flooding of the pit would result in rapid water level increases that are predicted to average about 17 feet per year (PolyMet 2014g). Rapidly rising water levels likely limits the aquatic life that would inhabit the lake during the years of pit flooding (Nelms et al. 2007). In addition, the probability of the northern long-eared bat, an obligate forest species (Jantzen 2012; Chapman et al. 2014), to use a body of water more within a large open area is very low. Therefore, the potential exposure of the northern long-eared bat to any insects that might inhabit or use the West Pit lake during the early years of flooding is likely very low.

The majority of water used to flood the West Pit would be primarily from precipitation and stormwater runoff (Poly Met 2014g) and as the pit fills the parameter concentrations in the

upper portion of the water column (i.e., the epilimnion) should reflect background (including mercury). Flooding of the West Pit would produce a pit lake that is approximately 320 acres in size with a maximum depth of 630 feet (Poly Met 2014b). As an oligotrophic system with a small littoral area, aquatic insects diversity and numbers in the West Pit lake would be limited (Nelms et al. 2012; Gray et al. 2012). Data for pit lakes identifies they have low densities and diversity of invertebrates (MDNR 1989). In addition, pit lake waters are typically low in phosphorus, limiting primary production (MDNR 1989). For the above reasons, overall, the potential population of aquatic insects in the West Pit lake is expected to be small. In addition, these insects would likely represent only a small portion of the diet of consumers of aquatic insects. Therefore aquatic insects inhabiting the West Pit lake or using it as a source of drinking water would likely have no significant effect on insect consumers such as the northern long-eared bat.

With regard to mercury, the West Pit lake is estimated to have a total mercury concentration of 0.3 to 0.9 ng/L during flooding and in long-term closure (Poly Met, 2014g). Because precipitation would be the main input of water to the West Pit lake, metal concentrations in long-term closure would likely reflect background conditions. Therefore, any aquatic insects inhabiting the West Pit lake or drinking from the West Pit lake would be exposed to background concentrations. Any consumers of these aquatic insects (including the northern long-eared bat) should not be exposed to metal or mercury concentrations in those insects above background levels.

Because existing wetlands at the Plant Site (e.g., north of the tailings basin) and the Mine Site (e.g., 100 Mile Swamp) would be providing an abundant supply of insects, the northern long-eared bat and other consumers of insects would likely be focused in these areas and would not likely be relying on the Project water features for any significant portion of their food supply. Therefore, any insects inhabiting Project water features or using them as sources of drinking water are not expected to have a significant effect on the consumers of insects. Overall, no adverse indirect effects on the northern long-eared bat from the Project's water features are anticipated.

6.2.3 Effects of Interrelated and Interdependent Actions

No known activities are interrelated or interdependent to the Project that would have the potential to affect northern long-eared bat. It is possible that future specific programs or projects may have relevant interrelated and interdependent actions (e.g., expansion of the Mine Site due to discovery of new ore bodies) and they would be considered in the context of consultations for those actions.

6.2.4 Cumulative Effects

The methods used to analyze cumulative effects, and the temporal and spatial domains, are the same for northern long-eared bat as for lynx, as discussed in Section 6.1.4. Forest management and habitat fragmentation are reasonably foreseeable future actions that could affect northern long-eared bat.

6.2.4.1 Habitat Management and Fragmentation

Forest Management and Habitat Fragmentation

Forest management activities, such as timber harvest and road building, could occur on the federal and non-federal lands in the reasonably foreseeable future and these activities could result in habitat modification and fragmentation.

Northern long-eared bats roost predominantly in trees and to a lesser extent in man-made structures. Although there is still much to learn about the effects of forest removal on northern long-eared bats and their associated summer habitat, studies to date have found that the northern long-eared bat shows a varied degree of sensitivity to forest management practices. Several studies have found that the species uses a wide range of tree species for roosting, suggesting that forest succession may play a larger role in roost selection (than tree species). Studies have found that female bat roosts are more often located in areas with partial harvesting, which may be due to trees located in more open habitat receiving greater solar radiation and therefore speeding development of young. In the Appalachians of West Virginia, diameter-limit harvests (70 to 90 year-old stands, with 30 to 40% of the basal area removed in the past 10 years) rather than intact forest was the habitat type most selected by northern long-eared bats. Cryan et al. (2001:49) found several northern long-eared bat roost areas in recently harvested (less than 5 years) stands in the Black Hills of South Dakota, although the largest colony (n=41) was found in a mature forest stand that had not been harvested in over 50 years.

It is possible that this flexibility in roosting habits allows northern long-eared bats to be adaptable in managed forests. However, the northern long-eared bat has shown a preference for contiguous tracts of forest cover for foraging. Jung et al. (2004:333) found that it is important to retain snags and provide for recruitment of roost trees during selective harvesting in forest stands that harbor bats. If roost networks are disturbed through timber harvesting, there may be more dispersal and fewer shared roost trees, which may lead to less communication between bats in addition to less disease transmission. In the Appalachians, Ford et al. (2006:20) assessed that northern long-eared bats may be a suitable management indicator species for assessing mature forest ecosystem integrity, because they found male bats using roosts in mature forest stands of mostly second growth or regenerated forests.

Perry and Thill (2007:225) found that male northern long-eared bats seem to prefer more dense stands for summer roosting, with 67% of male roosts occurring in unharvested sites versus 45% of female roosts. The greater tendency of females to roost in more open forested areas than males may be due to greater solar radiation experienced in these openings, which could speed growth of young in maternity colonies. Lacki and Schwierjohann (2001:487) stated that silvicultural practices could meet both male and female roosting requirements by maintaining large-diameter snags, while allowing for regeneration of forests. However, Broders and Forbes (2004:608) found that timber harvest may have negative effects on female bats because they use forest interiors at small scales (less than 1.2 miles from roost sites). They also found that males are not as limited in roost selection and they do not have the energetic cost of raising young; therefore males may be less affected than females. Henderson et al. (2008:1,825) also found that forest fragmentation affects northern long-eared bats at different scales based on sex; females require a larger unfragmented area with a large number of suitable roost trees to support a colony, whereas males are able to use smaller areas (more fragmented).

The Project would result in habitat loss and fragmentation on about 1,166 acres at the Mine Site for about 20 years (until the Project is reclaimed). Impacts from habitat and fragmentation may continue beyond the onset of

reclamation, but these impacts would be expected to diminish as the target reclamation habitats develop along the expected successional trajectories. High-quality forested vegetation would begin to return to the site over the long-term successional trajectory (approximately 30 years), except in areas where trees and other deep-rooted vegetation would be excluded to protect stockpile liners.

Under the Proposed Action, PolyMet would acquire the federal lands from the Forest Service and would manage lands outside of the Mine Site for wildlife habitat, including some timber management. The non-federal lands would be managed for General Forest, General Forest-Longer Rotation, Riparian Areas, and Candidate Research Natural Areas (MDNR et al. 2013). If new roads are constructed on the federal or non-federal lands, they would likely be temporary and used to support timber management. Although these actions would result in some short-term loss of habitat for northern long-eared bats, long-term protection and management of forests would retain and promote high-quality forest habitat for northern long-eared bats that should result in a long-term cumulative benefit.

Prescribed Fire

Prescribed fire could be used on federal and non-federal lands to reduce hazardous fuels in the reasonably foreseeable future. Eastern forest-dwelling bat species, such as the northern long-eared bats, likely evolved with fire management of mixed-oak ecosystems. A recent review of prescribed fire and its effects on bats (U.S. Forest Service 2012:182) generally found that fire had beneficial effects on bat habitat. Fire may create snags for roosting and creates more open forests conducive to foraging on flying insects, although gleaners such as northern long-eared bats may readily use cluttered understories for foraging. Cavity and bark roosting bats, such as northern long-eared bat, use previously burned areas for both foraging and roosting. In Kentucky, the abundance of prey items for northern long-eared bats increased after burning, and more roosts were found in post-burn areas. Burning may create more suitable snags for roosting through exfoliation of bark, mimicking trees in the appropriate decay stage for roosting bats. Low-intensity burns may not kill taller trees directly but may create snags of smaller trees and larger trees may be injured, resulting in vulnerability of the tree to pathogens that cause hollowing of the trunk, which provides roosting habitat. Prescribed burning also opens the tree canopy, providing more canopy light penetration, which may facilitate faster development of juvenile bats.

Under the Proposed Action, prescribed fire would be used on a limited basis, primarily on non-federal lands administered by the Forest Service, and should have long-term benefit on forest health and habitat availability for northern long-eared bat.

6.3 Gray Wolf

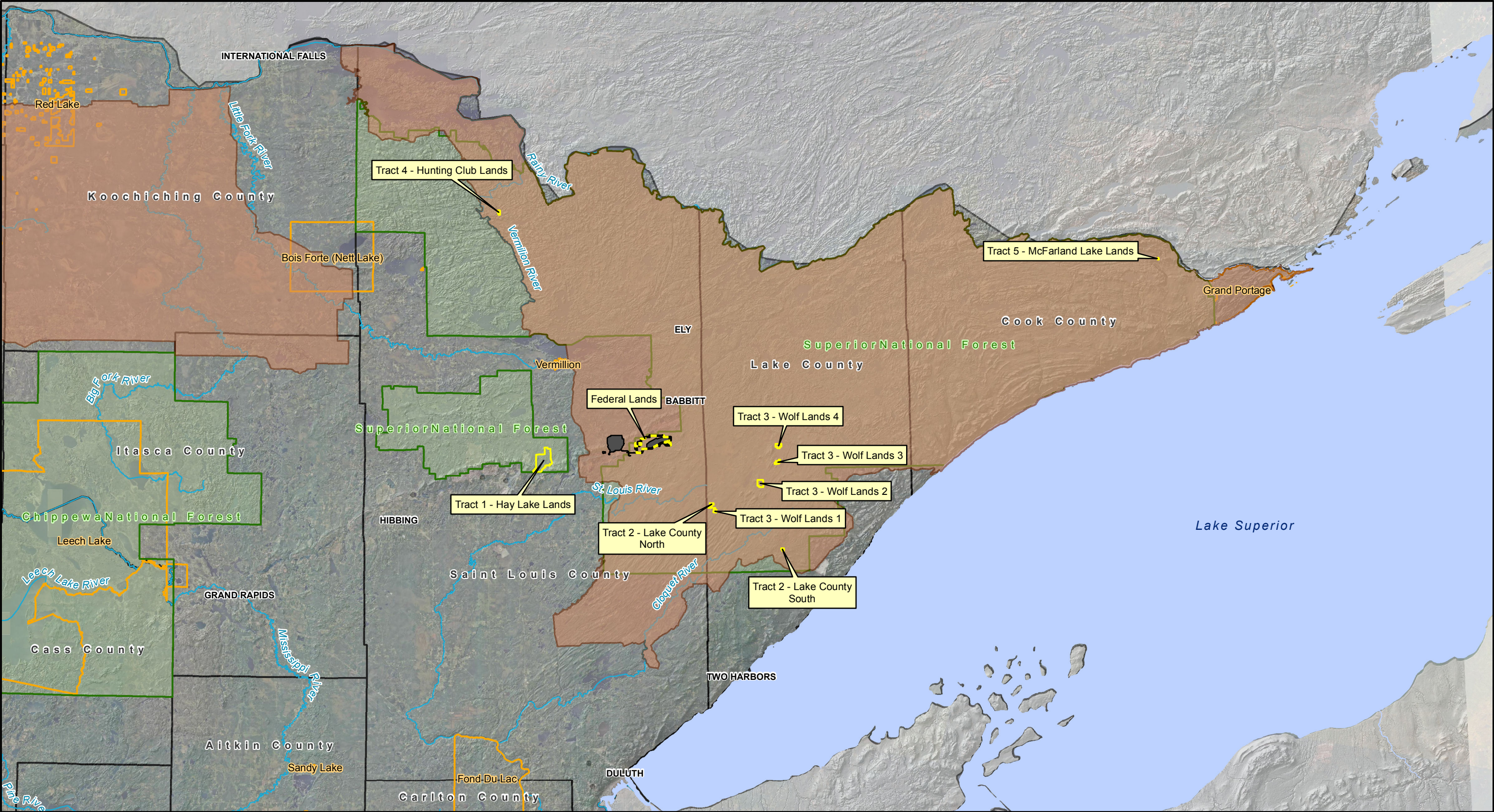
6.3.1 Environmental Baseline




6.3.1.1 Species Description and Status and Critical Habitat Status

Gray wolves are the largest wild members of the dog family (Canidae) with adults ranging from 40 to 175 pounds, depending on sex and subspecies (Mech 1974). Wolves have a gray fur coat that can vary from pure white to coal black. Wolves may look similar to coyotes and some domestic dogs, such as the Siberian husky (*C. familiaris*; USDOI USFWS 2003b). Currently, three wolf species are recognized with ranges in the conterminous U.S.—*Canis lupus*, *Canis lycaon*, and *Canis rufus*. *Canis lycaon* is primarily found in Canada and the western Great Lakes, and *C. rufus* in the southeastern U.S. *Canis lupus* is found in the western Great Lakes and western U.S. The ranges of *C. lupus* and *C. lycaon* overlap in the western Great Lakes region.

In response to their vastly declining numbers, the gray wolf was determined to be endangered in 1967 (USDOI USFWS 1967) under the Endangered Species Preservation Act of 1966. In 1974, the species was formally listed as endangered through the authority of the ESA (USDOI USFWS 1974), and the Minnesota population was reclassified to threatened in 1977 (USDOI USFWS 1977). In 1978, critical habitat was designated for the Eastern DPS of gray wolf (USDOI USFWS 1978). That rule (50 C.F.R. § 17.95[a]) identified critical habitat at Isle Royale National Park, Michigan, and Minnesota wolf management zones 1, 2, and 3, as delineated in 50 C.F.R. § 17.40(d)(1). Wolf management zones 1, 2, and 3 comprise approximately 9,800 mi² in northeastern and northcentral Minnesota and include all of the Superior National Forest and portions of the Chippewa National Forest. Hunting Club Lands and McFarland Lake Lands are in Zone 1, while the federal lands, and other non-federal lands are in Zone 2. The Wetland Mitigation Sites are outside the wolf zones (**Figure 24**).

In April 2003, gray wolf populations in the U.S. were separated into three DPS' (USDOI USFWS 2003b) to more effectively manage the species; the Minnesota population was a designated portion of the Eastern DPS. In March 2006, the USFWS proposed to designate gray wolves in the Western Great Lakes region as a DPS under the ESA and to remove wolves in Minnesota, Wisconsin, and Michigan from listing under the ESA. The Western Great Lakes DPS included Minnesota, Wisconsin, and Michigan as well as parts of North Dakota, South Dakota, Iowa, Illinois, Indiana, and Ohio (USDOI USFWS 2006b). In March 2007, the USFWS removed the gray wolf from the endangered species list (USDOI USFWS 2007).



<ul style="list-style-type: none">Critical Habitat - WolfFederal LandsNon-federal LandsProject AreasNational Forest BoundaryNative American Reservation	<ul style="list-style-type: none">County BoundaryMajor River	<div><p>US Army Corps of Engineers St. Paul District</p></div> <div><p>FOREST SERVICE U.S. DEPARTMENT OF AGRICULTURE</p></div>	<div><p>N W E S</p></div> <div><p>0 5 10 20 Miles</p></div>	<p>Figure 24 Wolf Critical Habitat Biological Assessment for the NorthMet Project and Land Exchange St. Louis County, Minnesota</p>
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In September 2008, the U.S. District Court for the District of Columbia overturned the USDOJ's decision to remove the Great Lakes DPS of the gray wolf from federal ESA protection; the USFWS issued a rule in December 2008 to comply with court orders reinstating regulatory protections for the gray wolf in the western Great Lakes and northern Rocky Mountains (USDOJ USFWS 2008b). In April 2009, the USFWS issued a rule to identify the Western Great Lakes DPS of the gray wolf, and to remove this DPS from the list of threatened and endangered species (USDOJ USFWS 2009b). In July 2009, the USFWS withdrew its request to delist the Western Great Lakes DPS and in September 2009 the USFWS reinstated protections for the Western Great Lakes DPS (United States District Court for the District of Columbia 2009, USDOJ USFWS 2009c). In May 2011, the USFWS again proposed to identify and remove the Western Great Lakes DPS of gray wolf from federal ESA protection. The USFWS also proposed to remove federal designation of critical habitat for the species in Minnesota and Michigan, and to remove the gray wolf special rule in Minnesota, which defined the circumstances when gray wolves can be taken in Minnesota (USDOJ USFWS 2011b).

On December 28, 2011, the USFWS revised the 1978 listing of the Minnesota population of gray wolf to conform to statutory and policy requirements. The USFWS renamed what was previously listed as the Minnesota population of the gray wolf as the Western Great Lakes DPS, and delineated the boundaries of the expanded Minnesota population segment to include all of Minnesota, Wisconsin, and Michigan and portions of the adjacent states. The USFWS removed the Western Great Lakes DPS from the list of endangered and threatened wildlife. The USFWS took this action because the best available scientific and commercial information indicated that the Western Great Lakes DPS does not meet the definitions of threatened or endangered under the ESA. This final rule also removed the designated critical habitat for the wolf in Minnesota and Michigan and the special regulations under Section 4(d) of the ESA for wolves in Minnesota. On December 19, 2014, a federal court reversed the USFWS decision to delist the gray wolf, restoring federal threatened status and critical habitat designation in Minnesota.

6.3.1.2 Distribution

The gray wolf historically occurred across most of North America, Europe, and Asia. The only areas of the conterminous U.S. that apparently lacked gray wolf populations since the last ice age are parts of California and portions of the eastern and southeastern U.S. (an area occupied by the red wolf; *Canis lupus rufus*). Wolf research and the expansion of wolf range over the last 3 decades have shown that wolves can successfully occupy a wide range of habitats, and they are not dependent on wilderness areas for their survival. In the past, for instance, wolf populations occupied nearly every type of habitat north of mid-Mexico that contained large ungulate prey species, including bison, elk, white-tailed deer, mule deer, moose, and woodland caribou. Inadequate prey density or high levels of human-caused mortality appear to be the only factors that limit wolf distribution (USDOJ USFWS 2011b).

Widespread persecution of wolves began following European settlement of North America (Boitani 1995). Poisons, trapping, and shooting spurred by federal, state, and local government bounties extirpated this once widespread species from more than 95% of its historic range. In the late 1960s, a diminished population (several hundred) of wolves was known to occur in northeastern Minnesota and on Isle Royale, Michigan; a few scattered wolves also may have occurred in Michigan's Upper Peninsula, Montana, and the southwest U.S. Today, wolves have expanded their range to include much of the U.S., including the Pacific Northwest, Northern Rockies, Upper Midwest, and eastern U.S. Wolves that comprised the Western Great Lakes DPS are found in Minnesota, Wisconsin, and Michigan.

6.3.1.3 Population Status in North America

Wolves once occupied all of North America, and today occupy only between 5 and 10% of this historic range. The wolves occupying Minnesota are part of a meta-population of 60,000 to 80,000 covering most of Canada, the Lake States of Minnesota, Wisconsin, and Michigan, portions of the northern Rocky Mountains, with smaller reintroduced populations in Wyoming (Yellowstone National Park), central Idaho, and Arizona/New Mexico (USDA Forest Service 2011b).

6.3.1.4 Life History

Wolves are carnivorous predators that prefer a diet of medium and large mammals. Wild prey species in Minnesota include white-tailed deer, moose, beaver, and snowshoe hare, with small mammals, birds, and large invertebrates sometimes being taken (Mech 1974, Wisconsin DNR 1999). Wolves are habitat generalists that do not depend on the type, age, or structure of vegetation, instead, they are indirectly influenced by vegetative condition through the distribution of their primary prey species.

Wolves are social animals, normally living in packs of 2 to 30 wolves, although about 15% of the population may be composed of loners and dispersers (Fuller 1989). In Minnesota, packs range in size from 4.9 to 5.6 (Erb and Benson 2004, Erb 2008). Packs are primarily family groups consisting of a breeding pair, their pups from the current year, offspring from the previous year, and occasionally an unrelated wolf. Packs typically occupy, and defend from other packs and individual wolves, territories of 42 to 100 mi² in the Great Lakes region and about 40 mi² in Minnesota (Fuller 1989, Erb and Benson 2004, Erb 2008).

Normally, only the top-ranking (alpha) male and female in each pack breed and produce pups. Litters are born from early April to May and range from 1 to 11 pups, but generally include 4 to 8 pups (Fuller 1989, Michigan DNR 1997, USDOJ USFWS 1992). Normally a pack has a single litter annually, but the production of two or three litters in 1 year has been documented in Yellowstone National Park (USDOJ USFWS et al. 2002).

Yearling wolves frequently disperse from their natal packs, although some remain with their natal pack. Yearlings may range over large areas as lone animals after leaving their natal pack or they may locate suitable unoccupied habitat, pair with a member of the opposite sex, and begin their own pack. Dispersal distances of over 500 miles have been documented (Fritts 1983); individual wolves have recently traveled from central Wisconsin to east-central Indiana (400 miles) and northern Illinois, from the Upper Peninsula of Michigan to northern Missouri (600 miles), and from the Minnesota-Wisconsin-Michigan population to east central Nebraska.

6.3.1.5 Wolf Habitat, including Prey Habitat

Potential and favorable wolf habitat is defined by several elements such as human population density, sufficient prey density, road density, vegetation cover, and special landscape patterns (Mladenoff et al. 1995). Gray wolves are generalists that can live in most any habitat that supports ungulate prey. Wolf densities are directly related to the densities of their primary ungulate prey (Fuller 1989), thus forested areas occupied by white-tailed deer and moose are critical. Additionally, the habitat should be suitable for smaller prey such as beaver and snowshoe hare which may be seasonally important (Mech 1970). Moose, deer, and snowshoe hare tend to forage in areas of regenerating upland forest, and coniferous forest is an important component of thermal cover for all. Riparian trembling aspen forest is important for beavers. Patch structure is only important in that it may alter prey densities or include areas of high road and human densities thereby indirectly altering wolf distribution (Fuller 1997).

Wolf density is heavily dependent on prey availability (Fuller 1989). Conservation of primary wolf prey, such as white-tailed deer, is clearly a high priority for the MDNR, which typically manages ungulates to ensure a harvestable surplus for hunters and non-consumptive users, and to minimize conflicts with humans. To ensure a harvestable surplus for hunters, the agency must account for all sources of natural mortality, including loss to wolves, and adjust hunter harvest levels when necessary.

White-tailed deer, moose, and beaver, the primary prey species for wolf, are closely associated with forage from young upland forest less than 10 years old. White-tailed deer and moose rely on upland immature (10 to 80 years old) and mature (80+ years old) conifer for thermal and hiding cover.

Moose Populations

Population estimates from aerial surveys in northeastern Minnesota, conducted since 1959, suggest that the moose population gradually began to increase in the 1970s and 1980s to a peak of 6,900 in 1988, then dropped to 3,700 by 1990, and then stabilized between 3,500 and 4,000 animals, or approximately 0.7 moose/mi², between 1996 and 2001. Due to a change in MDNR survey methods in 2004, population estimates from surveys conducted in 2005 and afterwards are not directly comparable to prior surveys. An estimated 8,106 moose occurred in northeastern Minnesota in 2005, 7,890 in 2008, 5,700 in 2010, but only 2,760 moose occurred in January 2013, a 52% decline between 2010 and 2013. Both the cow to calf ratio and the percent calves has exhibited a steady decline over the past 9 years (DelGiudice 2013). There is currently a moratorium on moose hunting in Minnesota due to low population numbers (MDNR 2013a).

There is no documentation expressing a correlation between the wolf and moose population fluctuations on the Superior National Forest, although as discussed below for white-tailed deer, there has been a decline in wolf populations concurrent with declines in white-tailed deer and moose populations in recent years.

White-tailed Deer Populations

Land management carried out by other public agencies and by private landowners in Minnesota's wolf range, including timber harvest and prescribed fire, improves habitat for white-tailed deer, the primary prey for wolves in the State. The success of these measures is apparent from the continuing high white-tailed deer densities in the Forest Zone of Minnesota, and with a white-tailed deer harvest averaging about 215,000 deer over the last 5 years. However, numbers of white-tailed deer harvested has declined slowly since a peak harvest of 290,000 deer in 2003 (MDNR 2012). Approximately one-half of the Minnesota deer harvest is in the Forest Zone, which encompasses most of the occupied wolf range in the State. The decline in white-tailed deer numbers may be depressing wolf abundance in Minnesota's core wolf range, as wolf numbers have declined statewide from 2,900 in 2009 to about 2,200 in 2012 (Erb and Samson 2013). Since 2007, Minnesota's Forest Zone white-tailed deer population is estimated to have declined by 25% (Grund and Walberg 2012). Erb and Samson (2013) believe that reduced prey density largely explains the 13% increase in wolf pack territory size they observed during the 2012-13 wolf survey, the first such increase in territory size since surveys began, and the decline in wolf populations in Minnesota. The harvest of wolves in Minnesota may also explain some of the decline in wolf populations. Nevertheless, current estimated density remains near the upper end of densities reported from other regions of North America where density of self-sustaining wolf populations has been estimated over a large area.

6.3.1.6 Human Access and Disturbance and Wolf Mortality

Human settlement and roads are considered to be major determinants in gray wolf distribution. These activities have multiple effects, including increased human presence causing an increase in illegal poaching and legal predator control, increased chance of introduced diseases and parasites via pets (e.g., canine parvovirus), and potential deterrence to colonization of otherwise suitable habitat (Mech 1995, Gogan et al. 1997).

Road Density

To a large extent, road density has been adopted as the best predictor of habitat suitability for wolves in the Midwest due to the connection between roads and human-related wolf mortality. Recent studies have used road density to predict probabilities of persistent wolf pack presence in an area. Areas with road densities less than 0.7 miles/mi² are estimated to have a greater than 50% probability of wolf pack colonization and persistent presence, and areas where road density exceeds 1 mile/mi² have less than a 10% probability of occupancy (Mladenoff et al. 1995, 1999).

Studies of wolf populations in Minnesota, Michigan, and Wisconsin indicate that wolf populations usually fail to sustain themselves in areas where rural roads open to the public have densities exceeding 0.93 linear miles of road/mi². The Wolf Recovery Plan recommends that density of higher standard roads remain below 1 mile/mi² in critical habitat to limit the extent of associated effects to wolves (USDOI USFWS 1992).

Roads lead to wolf-vehicle collisions and an increase in access by hunters and trappers, and can be barriers to movement (USDOI USFWS 1992). However, wolves may tolerate road densities as high as 1.2 miles/mi² if roaded areas are adjacent to large roadless areas, such as the Superior National Forest.

The Wolf Recovery Plan addresses the impact of low standard roads, but does not recommend a density threshold for such roads. Low standard roads may have a greater potential for human impact on wolves than high standard roads due to the potential for human access for trapping and shooting. These roads typically are accessed by recreational motor vehicles or on foot. Illegal killing of wolves may result from a variety of reasons. Some of these killings are accidental (e.g., wolves are hit by vehicles, mistaken for coyotes and shot, or caught in traps set for other animals) and may be reported to state, tribal, and federal authorities. Most illegal killings, however, likely are intentional and are never reported to authorities (Mech 1995). The MDNR receives approximately two to six reports of wolves killed by vehicle collision annually. While human habitation and the associated network of roads and vehicle traffic increase, wolf mortality from vehicle collisions is expected to continue both in actual numbers and as a percent of total diagnosed mortality in Minnesota.

As wolf populations have continued to expand, however, the road density threshold has been questioned. Wolves can be expected to expand their range into areas with more roads and humans, “as more tolerant attitudes toward wolves increase and depredations by wolves are controlled.” “Given the current status of wolves, reducing current levels of high standard road access is not necessary to increase either wolf density or distribution. However, in areas of sufficient size to sustain one or more wolf packs, land managers should be cautious about adding new road access that could exceed a density of 1 mile/mi² without considering the potential effect on wolves” (MDNR 2001 *in* USDA Forest Service 2011b). Thus, the focus of wolf protection is now on maintaining large blocks of habitat relatively free of human access even in areas where the road density exceeds 1 mile/mi².

Human-caused Mortality Factors

A study conducted in between 1980 to 1986 within northcentral Minnesota found human-caused mortality occurred at a rate of 29%, a figure which includes 2% mortality from legal depredation control actions (Fuller 1989). The MDNR conducted a radiotelemetry study of wolves and white-tailed deer, and of 32 wolves fitted with radio collars between 1993 and 2005, 11 of 16 documented mortalities were attributed to humans (USDA Forest Service 2011b). This includes one wolf accidentally snared, two vehicle collisions, and eight that were shot.

A smaller mortality dataset is available from a 1987 to 1991 study of wolves in and adjacent to Minnesota's Voyageurs National Park. Natural causes of mortality among radiomarked wolves included intraspecific strife ($n = 4$) and starvation (2). Confirmed human-induced causes of mortality among radiomarked wolves included shooting (2), trapping or snaring (2), and unknown method (2). Natural causes of mortality among non-radiomarked wolves included intraspecific strife (1) and starvation (1). Confirmed human-induced causes of mortality among non-radiomarked wolves included automobile collisions (3), shooting (3), and trapping or snaring (2). All mortalities within the boundaries of Voyageurs National Park were attributed to natural causes. Six of eight confirmed mortalities among instrumented wolves and eight deaths of non-instrumented wolves beyond the boundaries of Voyageurs National Park were human caused (Gogan et al. 2004).

The USDA Animal and Plant Health Inspection Service Wildlife Services found that from 1996 to 2009, an average of 146 wolves were taken annually for depredation control in Minnesota (USDA Forest Service 2011a).

Illegal mortality can often be estimated through radiotelemetry studies (Fuller 1989), however only a few radiotelemetry studies have taken place in Minnesota. Northcentral Minnesota data from 16 diagnosed mortalities of radiocollared wolves over a 12-year period (1994 to 2005) show that human-causes resulted in 69% of the diagnosed mortalities (USDA Forest Service 2011b).

Minnesota's wolves transitioned from federal protection under the ESA to state management by the Minnesota Department of Natural Resources on January 27, 2012. Minnesota's Wolf Management Plan will ensure the wolf's long-term survival. The plan gives owners of livestock and domestic pets more protection from wolf depredation. It splits the state into two management zones with more protective regulations in the northern third, considered the wolf's core range. The MDNR has not established a maximum population goal and wolves are allowed to naturally expand their range. A statewide winter population of 1,600 wolves is the minimum goal. If Minnesota's wolf population falls below this minimum, the MDNR will take immediate and appropriate management actions to reverse the decline and restore the population to its minimum level in the shortest possible time. The MDNR implemented a conservative and regulated hunting and trapping season in fall 2012. Hunters and trappers harvested 413 wolves in 2012 (MDNR 2013b). The MDNR expects the 2013 season to follow a similar framework with a harvest goal of 220 wolves (MDNR 2013c).

The MDNR (2001) and the Forest Service (2004b) use a variety of methods to encourage and support education of the public about the history and ecology of wolves in the state and the effects wolves on livestock, wild ungulate populations, and human activities. Public outreach efforts have been in effect for years in Minnesota, and while these efforts may not further reduce illegal take of wolves from existing levels, these measures may be crucial in ensuring that illegal mortality does not increase. Illegal take of wolves is likely

related to road and human population densities, but changing attitudes towards wolves may provide for their survival in areas where road and human densities were previously thought to be too high (Fuller et al. 2003). It is important to note that despite the difficulty in measuring the extent of illegal killing of wolves, all sources of wolf mortality, including legal (e.g., depredation control, hunting, trapping) and illegal human-caused mortality, have not been of sufficient magnitude to stop the growth of the wolf population in Minnesota, or for Minnesota to have a hunting season for wolves.

6.3.1.7 Disease

Disease such as canine distemper, canine parvovirus, Lyme's disease, mange, and blastomycosis have been observed in Minnesota wolves. However, the usual high annual replacement of dying wolves by a high number of pups produced (Mech 1977 *in* Mech 2002) may be attenuated by canine parvovirus mortality of young pups (Mech and Goyal 1995 *in* Mech 2002). On the Superior National Forest, wolf population density has been stable or increasing for many years probably indicating that the main effect of canine parvovirus is to reduce the number of dispersing wolves (Mech 2002).

Wolves in Minnesota may have been exposed to canine parvovirus as early as 1973 (Mech and Goyal 1993, 1995). The population impacts of canine parvovirus are believed to be via diarrhea-induced dehydration leading to abnormally high pup mortality (Wisconsin DNR 1999). Despite the presence of canine parvovirus, wolf abundance and range in Minnesota have stabilized above recovery goal levels and there is no evidence that canine parvovirus has caused a population decline in the Minnesota wolf population. In the Superior National Forest, Mech and Goyal (1995) found high canine parvovirus prevalence during the same years in which wolf pup numbers were low, however they concluded that these pup mortalities only replaced deaths that would have occurred from other causes, particularly starvation. They theorized that canine parvovirus prevalence would cause a wolf population decline when 76% of the adult wolves consistently test positive for canine parvovirus exposure. Their data indicate that canine parvovirus prevalence in adult wolves in their study area increased by an annual average of 4% during 1979 to 1993 and was at least 80% during the last 5 years of their study.

6.3.1.8 Population Numbers and Dynamics in Minnesota and Great Lakes Distinct Population Segment

In the western Great Lakes region, wolves in the densely forested northeastern corner of Minnesota have expanded into the more agricultural portions of central and northwestern Minnesota, northern and central Wisconsin, and the entire Upper Peninsula of Michigan. Habitats currently being used by wolves span the broad range from the mixed coniferous/deciduous forest wilderness area of northern Minnesota, through sparsely settled, but similar habitats in Michigan's Upper Peninsula and northern Wisconsin, and into more intensively cultivated and livestock-producing portions of central and northwestern Minnesota and central Wisconsin.

Five comparable surveys of wolf numbers and range in Minnesota have been carried out since 1979. These surveys estimated that in Minnesota there were 1,235 wolves in 1979; 1,500 to 1,750 in 1989; 2,440 in 1998; 3,020 in 2004; and 2,920 in 2008 (Berg and Kuehn 1982, Fuller et al. 1992, Erb 2008). The 1998 and later surveys revealed that the number of wolves in Minnesota was 2 times greater than the planning goal (1,400 wolves) as specified in the Recovery Plan for Minnesota. However, the 2012 survey showed that wolf numbers have declined statewide from 2,900 in 2008 to about 2,200 in 2012 (Erb and Samson 2013).

Based on analysis of 34 radiomarked wolves, average territory size was about 62 mi² in 2012, an increase from 54 mi² during the previous two surveys. Wolf observations were greatest in the vicinity of the Chippewa National Forest, in the Superior National Forest near Virginia, Minnesota, and in Voyageurs National Park (Erb 2008, Erb and Sampson 2013). The Superior National Forest's wolf population was estimated to be about 484 wolves, or about one wolf per 10 mi² (one wolf per 25.9 km²; 0.04 wolf per km²), based on radiotelemetry studies during 2003 to 2008 (Mech 2004, 2008, USDA Forest Service 2004b, 2011b). Both Forests are operated and managed through the 2004 Forest Plan in conformance with standards and guidelines that follow the 1992 Wolf Recovery Plan's recommendations for the wolf.

As wolves increased in numbers, they also expanded their range. In the early 1950s, the wolf range was approximately 12,000 mi², or 14% of the state. By the late 1990s, it was estimated at 34,000 mi², or about 40% of the state, with an occupied range of about 27,612 mi², but since then has shown little expansion (Erb 2008, Erb and Sampson 2013).

Wolves were considered to have been extirpated from Wisconsin by 1960, and no formal attempts were made to monitor that state's wolf population from 1960 until 1979. During that time, individual wolves and an occasional wolf pair were reported. There is no documentation, however, of any wolf reproduction occurring in Wisconsin, and the wolves that were reported may have been animals dispersing from Minnesota. Wolf population monitoring by the Wisconsin DNR began in 1979 and a statewide population of 25 wolves was estimated at that time. This population remained relatively stable for several years, and then declined to approximately 15 to 19 wolves in the mid-1980s. In the late 1980s, the Wisconsin wolf population began an increase that has continued to date. In 2002, wolf numbers in Wisconsin alone surpassed the planning goal as specified in the Wolf Recovery Plan for a second population near Minnesota (100 wolves for a minimum of 5 consecutive years; geographically isolated populations should have 200 wolves for a minimum of 5 years). Approximately 540 wolves were in Wisconsin in 2008 and 815 in 2012 (Wydeven and Wiedenhoeft 2008, Wisconsin DNR 2012).

Michigan wolves were extirpated as a reproducing population long before they were listed as endangered in 1974. Before 1991, and excluding Isle Royale, the last known breeding population of wild Michigan wolves occurred in the mid-1950s. As wolves began to reoccupy northern Wisconsin, the Michigan DNR began noting single wolves at various locations in the Upper Peninsula of Michigan. In the late 1980s, a wolf pair was verified in the central Upper Peninsula and was known to have produced pups in 1991. Since that time, wolf packs have spread throughout the Upper Peninsula, with immigration occurring from both Wisconsin to the west and Ontario to the east. They now are found in every county of the Upper Peninsula. When the wolf population estimates of Wisconsin and Michigan are combined, the total population has exceeded the second population recovery goal, as specified in the Wolf Recovery Plan, of 200 wolves for 5 consecutive years for a geographically isolated wolf population. The two state wolf population, excluding Isle Royale wolves, has exceeded 200 wolves since late winter 1995-1996. An estimated 510 wolves were in Michigan in 2007 and 687 in 2010 (Michigan Department of Natural Resources 2008, USDOJ USFWS 2013c).

6.3.1.9 Observations of Gray Wolf in the Vicinity of the Project

Gray wolf tracks, scat, and signs of wolf kills were seen during wildlife studies on the federal lands, Transportation and Utility Corridors, and Plant Site during 2000, 2004, 2008, and 2009 (ENSR 2000, 2005, AECOM 2009b, 2011a). Tracks were commonly seen on the Dunka Road, on mine exploration roads, along railroad grades and utility rights-of-ways, and north of the Mine Site on Northshore Mine roads

during all seasons. In addition, several wolves responded to calls from the Mine Site during 2004. The wolves were located to the south of the calling station, and likely south of the property boundary based on call intensity and direction.

Gray wolf tracks and scat were recorded on Hay Lake Lands, Wolf Lands 3 and 4, and Lake County Lands North during the surveys. Wolf scat was seen on several abandoned logging roads. No wolves or their sign were seen on the other non-federal lands, although conditions for surveys were not favorable for detecting tracks and scat at Hunting Club Lands.

Until 2012, International Wolf Center posted on their website a database summary of wolf radiotelemetry observations in northeastern Minnesota. Of the over 11,000 records in the monitoring database between 1994 and 2010, 10 records were for wolves recorded on the federal lands; however, there were no records for the Plant Site or Transportation and Utility Corridors (International Wolf Center 2012). Radiocollared wolves have been recorded on the townships of Hay Lake Lands. A wolf was observed in Section 6 of Township 58 North, Range 16 West in September 1994, just south of Hay Lake. Wolves were observed in Sections 1, 19, 22, and 23 of Township 59 North, Range 16 West, in and around Hay Lake Lands, between 1994 and 1997. Radiocollared wolves have been recorded in the vicinity of Wolf Lands 2 and 3. There are no recorded observations of wolves in the township of McFarland Lake Lands, although McFarland Lake Lands and other non-federal lands that would be involved in the land exchange or Wetland Mitigation Sites are within the current range of the wolf (Erb and Sampson 2013).

6.3.2 Analysis of Direct and Indirect Effects to Gray Wolf

6.3.2.1 Effects to Gray Wolf within the Action Area

The Wolf Recovery Plan (USDOI USFWS 1992) and the *Minnesota Wolf Management Plan* (MDNR 2001) identify habitat factors considered as essential for a recovering and recovered wolf population (including maintenance or improvement of critical habitat). Those that may be affected by the Project are prey habitat and human access and disturbance. In addition, disease can impact wolf populations. The Project would result in both beneficial and adverse direct and indirect impacts to factors of importance to wolves.

Factors Affecting Prey Habitat

Federal Lands

The primary impacts to gray wolf prey habitat from the Project would result from habitat loss and disturbance. The Forest Service manages the Mine Site as a General Forest and General Forest – Longer Rotation Management Area. The General Forest – Longer Rotation Management Area emphasizes land and resource conditions that provide a wide variety of goods, uses, and services. These include wood products, other commercial products, scenic quality, developed and dispersed recreation opportunities, and habitat for a diversity of terrestrial and aquatic wildlife and fish species (USDA Forest Service 2004a). The characteristics and use of the General Forest Management Area are similar to the General Forest – Longer Rotation Management Area, except that harvests are more frequent, more uniform in age, and more extensive. The General Forest Management Area has the highest amount of young forest and the largest sized timber harvest units.

The Forest Service identified young upland forest that is less than 10 years old as providing important foraging habitat for wolves (USDA Forest Service 2004b). Based on Forest Service and MDNR cover type mapping criteria and wildlife assessments done on the federal lands, only about 271 acres on the federal lands provide these habitats, although some suitable coniferous stands are found in mixed coniferous/deciduous forest habitats (**Table 11**; MDNR et al. 2013). Immature and mature coniferous forest habitat provides important cover habitat for wolves. There are about 5,393 acres of cover habitat on the federal lands (MDNR et al. 2013). The typical home range for gray wolf is approximately 161 square kilometers, or just under 40,000 acres (MDNR 2014b). The area of disturbance at the Mine Site is 1,719 acres, which is less than 10% of a gray wolf's home range. There is also abundant suitable habitat adjacent to the Mine Site.

Wolves used the federal lands, and wolf calls were heard to the south of the Mine Site during 2004 surveys (ENSR 2000, 2005). Wolf packs with radiocollared individuals have been observed several miles to the north and northeast of the Mine Site. It is likely that the federal lands include much of the territory of a wolf pack comprised of three or more individuals. Wolf tracks were seen along Dunka Road. Interestingly, wolf tracks were not observed on the study area during January 2000, when a drill rig was operating, but only during March 2000 and June 2004, when the rig was not in operation. Thus, noise and activity associated with drilling activities may have discouraged wolves from using the area in the immediate vicinity of the exploration area. Wolf tracks were seen along trails in the federal lands surrounding the Mine Site, and carcasses of two deer were found on these lands that appeared to be wolf kills (AECOM 2009b, 2011a).

White-tailed deer are common on the Mine Site. White-tailed deer tracks were primarily observed in the western and southern portions of the Mine Site during field studies in 2000 and 2004, especially in recently logged areas and shrublands near mixed coniferous/deciduous and coniferous immature/mature and mature forest habitats. White-tailed deer were common on the federal lands surrounding the Mine Site. White-tailed deer tracks and droppings were commonly found on the Project area in virtually all habitat types, and several white-tailed deer were seen along roads within the land. White-tailed deer tracks were primarily observed in the western portion of the federal lands surrounding the Mine Site during 2008 surveys.

Moose sightings were common in logged areas with abundant shrubs and near mature forest habitat, and in sedge and willow wetlands. Moose primarily used the western half of the federal lands (ENSR 2005, AECOM 2011a). Moose populations in the Superior National Forest have fluctuated considerably since the early 1900s and have shown their greatest increases during periods of intense timber harvest (Huempfer 1978). As noted above, however moose populations have declined by about 52% in Minnesota since 2010.

Beaver are common residents on the federal lands. Many large open water and emergent wetlands on the federal lands are the result of beavers damming streams on the site. Beavers also block culverts under road and railroad grades to create lake habitat. Beaver lodges and tree cuttings are common in areas used by beavers.

Based on a cover type mapping of the Mine Site, about 181 acres of wolf foraging habitat and 1,333 acres of wolf cover habitat would be lost on the Mine Site. Loss of this habitat would reduce the amount of prey and cover available to gray wolf traveling through the Project area. Loss of habitat would also make it less likely that a gray wolf pack would establish a territory within the Project area, especially areas directly impacted by the Project.

About 397 acres would be reclaimed after mine closure, but it would be 10 or more years before re-vegetation resulted in much suitable habitat for wolves.

Table 11
Gray Wolf Habitat on the Federal and Non-federal Lands

Lands	Foraging Habitat	Cover Habitat
Federal Lands	271	5,393
Non-federal Lands		
Hay Lake	534	3,720
Hunting Club	27	93
Lake County Lands North	24	220
Lake County Lands South	43	49
McFarland Lake	0	30
Wolf Lands 1	2	114
Wolf Lands 2	8	684
Wolf Lands 3	130	97
Wolf Lands 4	10	360
Net Gain (Loss) to Forest Service after Land Exchange	507	(26)

Source: MDNR et al. (2013).

Transportation and Utility Corridors

The Dunka Road and Utility Corridor is approximately 108 acres and the Railroad Connection Corridor is approximately 12 acres. Because of prior use during the former LTVSMC taconite mining operation, the Dunka Road and Utility Corridor is now defined as having a “disturbed” cover type (94 acres). The remaining MDNR GAP land cover types that are not disturbed include cropland/grassland (10 acres), shrubland (8 acres), and smaller acreages of the remaining types, including 5 acres of upland forest and 3 acres of aquatic habitat (MDNR et al. 2013).

Plant Site

Of the 4,515 acres at the Plant Site Area, 2,756 acres have been disturbed by LTVSMC taconite mining operations. Of the remaining 1,760 acres, approximately 648 acres are upland deciduous forest, 637 acres are aquatic habitat, 334 acres are shrubland, 100 acres are upland coniferous forest, and 42 acres are lowland coniferous forest (totals do not add because acreages are rounded). About 48% of the Plant Site would be impacted by plant construction and operations, with only about 422 acres of forest habitat remaining after construction. Construction of the processing facilities would have little impact on wolf habitat, as over half of the site has been previously disturbed by LTVSMC taconite mining operations (MDNR et al. 2013).

Non-federal Lands

Under the Proposed Action, approximately 7,075 acres of non-federal lands would be transferred to the Forest Service. The Forest Service has not determined the suitability of these lands to provide habitat for wolves or their prey. However, wildlife habitat surveys conducted on these lands give an indication of the suitability of these lands for wolves. Portions of the non-federal lands have been harvested for timber during the past 20 years, with much of the harvest occurring on Lake County Lands North, Lake County Lands South, and Wolf Lands 2 and 3; there are about 778 acres of wolf foraging habitat on the non-federal lands. In addition, the non-federal lands contain about 5,366 acres of upland immature and mature forest greater than 9 years old that can provide cover for wolf prey (**Table 7**; MDNR et al. 2013).

Wolf howling surveys were conducted at night on Hay Lake Lands and McFarland Lake Lands. No gray wolves were heard during howling surveys, but sign of gray wolf was seen on Hay Lake Lands. Wolf scat was seen on several abandoned logging roads. Radiocollared wolves have been recorded on Hay Lake Lands (AECOM 2011b).

Gray wolf tracks were seen on Wolf Lands 3 and 4 and Lake County Lands North during the surveys. A review of the International Wolf Center (2012) Minnesota Wolf Telemetry Database revealed that radiocollared wolves have been recorded in the vicinity of Wolf Lands 2 and 3 (AECOM 2011c).

Beaver dams or sign of beaver were found on or near all the lands. Several beaver dams were observed on Hunting Club Lands and Lake County Lands South. Open water bodies on the lands were created by beaver dams, and beaver lodges were also seen on large water bodies (AECOM 2011c).

Beaver dams were found in several ponds and wetlands, and along the Pike River, on Hay Lake Lands, with recent cuttings found at several locations. Several large open water bodies on the site were created by beaver dams, and beaver lodges were seen on large water bodies. Beaver cuttings were also seen on McFarland Lake Lands near McFarland Lake (AECOM 2011b).

White-tailed deer are common on the non-federal lands. White-tailed deer tracks and droppings were commonly found in the study areas in virtually all habitat types, and several white-tailed deer were seen along roads, in shrublands, and bedding along the Pike River on Hay Lake Lands. Deer were especially common in recently logged areas and shrublands near mixed coniferous/deciduous and coniferous immature and mature forest habitats (AECOM 2011b).

Moose sign (droppings, tracks, and evidence of browsing) were observed on Hay Lake Lands in areas with abundant shrubs and in shrub swamp speckled alder wetlands. Moose sign were also observed on Wolf Lands 3 and 4 and Lake County Lands South in areas with abundant upland shrubs and in shrub swamp speckled alder wetlands (AECOM 2011c).

Wetland Mitigation Sites

Under the Proposed Action approximately 2,169 acres of Wetland Mitigation Site lands would be purchased by PolyMet as compensatory mitigation for impacts to wetlands and other waters of the U.S. These lands are used for sod production, but under the Proposed Action would be restored to native wetland and upland vegetation. After restoration, the combined total of wetland and upland acreage for these sites would be about 1,603 acres and 197 acres, respectively. These sites could provide habitat for wolves and would be privately owned (Pylka 2013b).

Summary of Prey Habitat Impacts to Wolves

Numerous habitat and human-disturbance factors influence wolf and wolf prey use of an area. Factors most important in the study area include timber management, mining activity, and habitat fragmentation. The mine project would remove forestlands, reduce the amount of available habitat for wolves and their prey, and increase habitat fragmentation; some of this habitat would be reclaimed after mine closure. However, large tracts of land associated with the Superior National Forest and adjacent to the mine project would be managed to provide wolf habitat. These lands would also help to maintain wolf travel corridors between areas of suitable habitat.

Despite the presence of wolf tracks on the Mine Site, there is little suitable foraging habitat for wolves, and it appears that only a few wolves use the Mine Site at any one time. Thus, the loss of habitat on the Mine Site may have little impact on wolves. To conserve wolves in the area, PolyMet would reclaim the Mine Site, maintain vegetated buffers around the Project area, close the Project area to public access, minimize the number of roads constructed in the Project area and reclaim roads after mine closure, and educate workers on the need to observe speed limits and take measures to protect wolves and other wildlife.

The land adjacent to the Mine Site would not be directly impacted by the Proposed Action. However, noise, light, and other disturbances at the Mine Site could limit use of the area by wolves and their prey. Wolves have been recorded using this area, and appeared to have preyed upon white-tailed deer in the western portion of the federal lands. Still, based on number of tracks observed during field studies, few wolves appear to use the land at any one time (AECOM 2009b, 2011a). Thus, the Project may have little direct impact on wolf use of this area.

Wolves have been recorded on most of the non-federal lands based on radiotelemetry and wildlife studies. The Forest Service would gain additional lands that would provide habitat for wolves under the Proposed Action. However, given that these lands would not be directly or indirectly impacted by the Project, would likely not be developed, and would remain mostly in timber production with limited recreational use, there would likely be little or no adverse or beneficial effects to wolves using the non-federal lands with or without the Proposed Action.

Although the Forest Service would administer additional habitat for wolves under the Proposed Action, there would still be a net loss of habitat to wolves and their prey from the Project. If the land exchange does not take place, and non-federal lands are not acquired by PolyMet and remain privately owned, non-federal lands would likely be managed primarily for timber production, and some recreational use (hunting, fishing, and cabins). Much of the habitat on the non-federal lands is wetland and is not suitable for most types of development. At this time, there also appears to be little interest in mining these lands or conducting other large scale surface disturbance. Thus, these lands would continue to provide similar acres of habitat for wolves and their prey with or without the land exchange.

No wolf surveys were conducted on or near the Wetland Mitigation Sites. These sites are agricultural farms that would be restored to wetland and upland habitat. They could provide habitat for wolves in the future, but the beneficial effects to wolves from acquisition of these lands would be minor.

Human Access and Disturbance

Federal Lands and Plant Site

Human-related Disturbance

The Project would generate as many as 500 full-time workers over an 18-month during peak construction period, and about 360 full-time workers during operation. It is estimated that about 80% of construction workers, but only about 25% of operations workers, would commute from population centers such as Duluth, Hibbing, and Virginia to the Project area on a daily or weekly basis, while remaining workers would be local hires. The Project would employ about 360 full-time workers during operation. When accounting for family members, the total population influx from direct, indirect, and induced employment would be about 400 people. A small number of workers would be needed during mine closure (MDNR et al. 2013). New housing

and other infrastructure would be required to support many of these new workers and could indirectly affect wolves through loss of habitat and human disturbance. However, new housing for workers may be constructed in nearby municipalities, such as Hoyt Lakes, Aurora, and Babbitt. It is not anticipated that new housing centers would be constructed that would result in additional townships exceeding a human density of more than four humans per square kilometer (2.5 humans per square mile). The MDNR criteria for a wolf-occupied township is a human density of fewer than four humans per square kilometer and a road density of fewer than 0.7 kilometers per square kilometer (0.4 miles per square mile). The Mine Site and Federal Lands are located within Township 59 North (35 square miles) and there are 3.3 miles of Forest Road 113 and 77.5 miles of other Forest Service roads and trails within the township. The road density for Township 59 North is 0.1 mile per square mile, considering only Forest Road 113, and 2.2 miles per square mile considering all roads and trails.

Disturbance associated with the facility and associated transportation corridors would include lights, glare, and noise. The Project is expected to operate 24 hours a day, 365 days a year, for a minimum of 20 years. Lights and glare would primarily be associated with the Mine Site, Plant Site, and Transportation and Utility Corridors. Wolves traveling through the study area would likely avoid areas that are active and well lit.

Noise

Sources of noise during the construction phase include trucks, bulldozers, rock drills, jack hammers, graders, backhoes, air compressors, and cranes. The loudest noise sources during the operational phase of the project include blasting, haul trucks, and train horns at the Mine Site, and crushers at the Plant Site. Estimated noise levels from blasting at receptors located 50 feet from the noise source are estimated to range from 111 to 115 a-weighted decibels (dBA; MDNR et al. 2013), while noise levels for drill rigs, excavators, and crushers range from 109 to 121 dBA near the noise source. Noise from the Mine Site and Plant Site could impact wolves residing in or traveling through the Project area. The impacts of noise on wolves and other wildlife are largely unknown and the assessment of impacts remains subjective. Wildlife are receptive to different sound frequency spectrums, many of which may be inaudible to humans. Wildlife are also known to habituate to noise, especially noises that are steady or continuous, such as noises that would occur at the Project. For example, wolves have been seen within about a quarter mile of loud noise sources and other human disturbance at Northshore Mine facilities north of the Mine Site.

Under the Proposed Action, the areas not disturbed by the Project on the lands adjacent to the Mine Site would be managed for wildlife habitat, including timber management. During mine operations, few, if any wolves would use this area due to noise and other disturbance associated with the adjacent Mine Site. After mine closure, wolf use of this area could return to the current level of use. But with a large area of new mine disturbance between much of this area and areas to the east where wolves are more common, it is unlikely that wolf use of this area would increase from current levels.

Roads

Impacts to wolves on and surrounding the Project may include mortality from vehicle collisions and trains. Construction and operation of the project, and the influx of workers to the area, would mean an increase in the number of roads and rail lines, as well as an increase in vehicular traffic volume along transportation corridors. The FEIS estimates that the Project would generate a total of up to 1,316 miles per day of vehicle traffic near the Project site, including trips between the Mine Site and the Plant Site, and trips between the Plant Site and the Area 1 Shop. Vehicle traffic would consist primarily of light trucks and maintenance vehicles traveling

between 30 and 45 miles per hour (mph), and a few large fuel, waste/supply, and haul trucks traveling between 25 and 40 mph. The Project would also generate 418 total miles of train traffic each day during mine operations. Trains would operate at 15 to 25 mph (MDNR et al. 2013).

Harm or loss of wolves from collisions with vehicles or trains traveling within the Project boundaries cannot be discounted, but the risk would be very small as there is currently little use of the Project area by wolves, and use of the site by wolves would decrease substantially during project operations due to loss of habitat and noise and disturbance associated with Project activities.

The potential for wolves to be killed from vehicle/rail collisions was estimated using the methodology described in Section 6.1.2.1 for lynx. Assuming that there is about 0.04 wolf/km² (see Section 6.2.1.8), that vehicle/rail collisions could occur along the 8-mile Transportation and Utility Corridors and railroad, and that vehicles and rail traffic have equal potential for collisions with wolves, it was estimated that approximately 0.05 wolf could be killed annually by vehicle/train traffic between the Mine Site and Plant Site, or about one wolf during the estimated 20-year life of the Project (assuming that mortalities due to collisions with vehicles and trains were twice the estimated level).

Using the same assumptions and methodology used to estimate wolf mortality on Project roads and railroads, approximately 0.3 wolf could be killed annually by vehicle/train traffic on off-Project access roads/rail lines to the Plant Site, or about six wolves during the estimated 20-year life of the Project (assuming that mortalities due to collisions with vehicles and trains were twice the estimated level).

These losses are probably overestimated, however, based on wolf mortality estimates done for other projects in northern Minnesota by the USFWS. Thus, although risk of loss of wolves due to a collision with a Project-related vehicle or train traffic is very small, it could occur during the life of the Project.

In addition to potential harm from vehicle/train/wolf collisions, road density influences wolf use of habitat. The Wolf Recovery Plan recommends that density of higher standard roads remain below 1 mile/mi² in critical habitat to limit the extent of associated effects to gray wolves (USDOI USFWS 1992, 2011a). However, wolves may tolerate road densities as high as 1.2 miles/mi² if roaded areas are adjacent to large roadless areas, such as the Superior National Forest. Current road density is 0.5 miles of road/mi² for the Mine Site. After mine operations cease, temporary roads would be closed and reclaimed and would remain closed to the public.

Temporary roads have been constructed on the federal lands to support timber harvest activities and within a ROW to support powerline maintenance. Except for recently constructed roads, temporary roads are now overgrown in places with vegetation and are generally only suitable for foot, all-terrain vehicle, and snowmobile travel. Vegetation within the ROW is maintained at a low height for safety purposes, and the ROW is accessible to all-terrain vehicles and snowmobiles. Temporary roads may be constructed to support future management, but roads would be likely closed after their intended use and allowed to revegetate; it is unlikely that permanent roads would be constructed. The number of miles of temporary roads would likely remain at or below current levels, to the benefit of wolves. These roads would be privately owned and closed to the public after mine closure.

Non-federal Lands and Wetland Mitigation Sites

The non-federal lands would be transferred to the Forest Service. The non-federal lands are currently managed primarily for timber and recreation, similar to how these lands would be managed by the Forest Service. The

Wetland Mitigation Sites would be restored to wetland and upland wildlife habitat. Wolf observations are rare near the Wetland Mitigation Sites and wolf use of the sites after restoration would be infrequent. Thus, there would be few beneficial effects to wolves from the land exchange and wetland mitigation.

Access onto most of the non-federal lands is by secondary roads that branch off Forest Service or county roads. Most secondary roads were constructed to support timber harvest activities, and wolves were observed using these roads on several lands. There is no road access onto Hunting Club Lands and Wolf Lands 4. Access to McFarland Lake Lands is controlled by a locked gate. If acquired by the Forest Service, the lands would be managed for General Forest, General Forest-Longer Rotation, Riparian Areas, and Candidate Research Natural Areas. If new roads are constructed on the lands, they would likely be temporary and used to support timber management. There would likely be little change in the number of miles of backcountry roads and trails on the non-federal lands, and the number of miles may decrease if existing roads are closed and re-vegetated or allowed to re-vegetate naturally, benefitting wolves.

Other

Hazardous Materials

Mishandling of hazardous materials or wastes could result in spills, accidental release, or discharge into the environment, which could pose risks to wolves. Sections 5.2.13 and 5.3.13 of the FEIS discuss the risks posed to the public and the environment from the transport, handling, storage, and use of hazardous materials. Mitigation measures to prevent releases in transportation, storage, and handling or use of these materials are described in several hazardous material management plans necessary to comply with various regulatory requirements for the Project and in the FEIS. Based on this analysis, and limited use by wolves of the areas where there materials would be used, risks to wolves would be negligible and should not result in harm or death to wolves (MDNR et al. 2013).

6.3.2.2 Effects to Wolf Critical Habitat

Overview

Primary Constituent Elements of Wolf Critical Habitat

No specific primary constituent elements (PCE) have been formalized for the gray wolf. However, in general, primary constituent elements for gray wolf may include the following:

1. space for population growth;
2. normal behavior, nutritional or physiological requirements;
3. shelter and breeding habitats, and
4. habitats representing appropriate species distribution.

In addition, the USFWS (1992) has identified five main factors critical to the long-term survival of gray wolf:

1. large tracts of wild land with low human densities and minimal accessibility by humans
2. ecologically sound management
3. availability of adequate wild prey;
4. adequate understanding of wolf ecology and management, and
5. maintenance of populations that are either free of, or resistant to, parasites and diseases new to wolves or are large enough to successfully contend with their adverse effects.

Additional detail on the presence of general PCEs and factors critical to the long-term survival of gray wolf is provided in Section 6.3.1, Gray Wolf Environmental Baseline. Potential impacts to the general PCEs and to factors critical to the long-term survival of gray wolf are described in Section 6.3.2, Analysis of Direct and Indirect Effects to Gray Wolf. Further detail on impacts to gray wolf prey habitat is provided below.

The Forest Service identified quantitative indicators in the 2004 Forest Plan BA, and in the *Programmatic Biological Assessment: Gray Wolf, Canada Lynx, and Their Critical Habitats for the Superior National Forest* (USDA Forest Service 2011b), to analyze the impacts of those risk factors that have the most substantive impacts on wolf habitat. These indicators have been used to assess impacts to wolf critical habitat, if it was implemented in Minnesota in the future, in this BA. **Table 12** lists risk indicators and identifies those that apply to the Project.

Risk Analysis Indicators

Prey Habitat

The Forest Service has identified two risk analysis indicators to measure the effects to prey habitat that would apply to the Project. Parameters used by the Forest Service to identify suitable wolf prey habitat were given in the *Federally Listed Threatened and Endangered Species for the Revised Forest Plans: Chippewa and Superior National Forests* (USDA Forest Service 2004b) and *Programmatic Biological Assessment: Gray Wolf, Canada Lynx, and Their Critical Habitats for the Superior National Forest* (USDA Forest Service 2011a).

Indicator 1 – Acres and Percent of Young Upland Forest < 10 Years Old

This indicator represents potential habitat for moose, white-tailed deer, and beaver, important prey items for wolves, by acres of young upland forest. Acreage dedicated to coniferous plantations, clearcuts, areas of prescribed burns, and shelterwood harvests all provide significant forage biomass. Lowland conifer is not included. Even though the correlation between habitat and populations appears to be weak, this indicator provides an overall analysis of potential prey forage habitat.

There are about 271 acres of young upland forest on the federal lands (**Figure 9, Table 7**). Based on Management Indicator Habitat mapping done by the Forest Service, about 181 acres of young upland forest would be lost to mining. Although young upland forest vegetation would be lost on the Mine Site, the lands adjacent to the Mine Site would still provide young upland forest for wolf prey even though lands would be owned by PolyMet, as these lands would be managed to provide wildlife habitat and would not be developed. About 10 or more years after mine reclamation, approximately 397 acres of young upland forest could be available to wolf prey, although it is uncertain if wolf prey would move from areas outside of the Mine Site to suitable habitat on the Mine Site.

Collectively, the non-federal lands have about 778 acres (11% of available habitat) of young upland forest. Under the Proposed Action, this habitat would be administered by the Forest Service. Wetland Mitigation Sites would provide additional young upland forest. Based on young upland forest losses at the federal lands, and gains from the non-federal lands, there would be a net gain of 507 acres of young upland forest under Forest Service administration under the Proposed Action (MDNR et al. 2013).

Table 12
Wolf Risk Analysis Indicators

Risk Analysis Indicators¹	Analyzed	Rationale for Exclusion
1. Acres and Percent of Young Upland Forest <10 years Old (MIH 1, Young)	Yes	
2. Acres and Percent of Upland Conifer (Spruce and Pine) > 9 years Old on All Uplands (MIH 5, All but Young)	Yes	
3. Miles of High Standard Roads (OML 3, 4, and 5)	No	Miles of high standard roads would not change under the Proposed Action.
4. Cross-country Use Policy for Designated All-terrain Vehicle and Snowmobile Trails	No	Policy would not change under the Proposed Action. There are 0 miles of designated trails on the federal lands, and 0.3 miles on the non-federal lands.
5. Miles of Temporary and OML 1 and 2 Roads	No	There would be little or no change in the miles of Temporary and OML 1 and 2 roads on federal and non-federal lands under the Proposed Action (Ryan 2013a).

Source: USDA Forest Service (2004b).

Indicator 2 – Acres and Percent of Upland Forest > 9 Years Old on all Uplands

This indicator represents potential winter thermal and hiding cover for white-tailed deer and moose provided by relatively dense occurrence of immature and mature coniferous forest in planted/seeded stands. Coniferous forest also provides important summer thermal cover (from heat) for moose.

There are about 5,393 acres of immature and mature upland coniferous forest on the federal lands (**Figure 19, Table 7**). About 1,333 acres of immature and mature upland coniferous forest would be lost to mining based on Management Indicator Habitat mapping done by the Forest Service. Although forest vegetation would be lost on the Mine Site, the federal lands would still provide immature and mature upland coniferous forest for wolf prey even though lands would be owned by PolyMet, as these lands would be managed to provide wildlife habitat and would not be developed. About 20 or more years after mine reclamation, approximately 397 acres of immature and mature upland coniferous forest could be available to wolf prey for cover, although it is uncertain if wolf prey would move from areas outside of the Mine Site to suitable habitat on the Mine Site.

Collectively, the non-federal lands have about 5,366 acres (76% of available habitat) of immature and mature upland coniferous forest. Under the Proposed Action, this habitat would be administered by the Forest Service. Wetland Mitigation Sites would provide additional immature and mature upland coniferous forest. Based on immature and mature upland coniferous forest losses at the federal lands, and gains from the non-federal lands, there would be a net loss of 26 acres of immature and mature upland coniferous forest under Forest Service administration under the Proposed Action.

Human Access and Disturbance

The Forest Service identified three indicators that apply to human access and disturbance. These are:

Indicator 3 – Miles of High Standard Roads (OML 3, 4, and 5)

Indicator 4 – Cross-country Use Policy for Designated All-terrain Vehicle and Snowmobile Trails

Indicator 5 – Miles of Temporary and OML 1 and 2 Roads

Indicators 4 and 5 were not analyzed for reasons given for Indicators 7 and 9 for lynx. Indicator 3 was not analyzed because there are no High Standard Roads (OML 3, 4, and 5) on the federal and non-federal lands, and none are proposed to be built under the Proposed Action. Objective Maintenance Level 3 roads are those roads open and maintained for travel by a prudent driver in a passenger car. User comfort and convenience are not considered priorities. Roads are typically low speed, single lane with turnouts and have only spot surfacing. Objective Maintenance Level 4 roads provide a moderate degree of user comfort and convenience at moderate travel speeds. Most roads are double lane and aggregate surfaced. Objective Maintenance Level 5 roads provide a high degree of user comfort and convenience. The roads are normally double lane, paved facilities (USDA Forest Service 2004a).

Under the Proposed Action, PolyMet would gain control of the federal lands. There are approximately 5.9 miles of temporary and OML 1 and 2 roads on the federal lands. Most temporary roads were built to support historic timber management and mine exploration on the proposed Mine Site and would be lost to mine development. Access to the federal lands would be strictly controlled during mine operations.

These roads would likely have little impact on wolves as wolves would not likely use the federal lands during mining due to noise and other disturbances. After mine closure, roads would be reclaimed (except for a short road from the Dunka Road to the Waste Water Treatment Facility; Pylka 2013b) and closed to vehicle access. Temporary roads may be constructed on the lands adjacent to the Mine Site to support forest management activities, but number of miles of temporary backcountry roads and trails on the lands should be similar to, or less than, existing miles of backcountry roads and trail on the lands. After mine closure, the federal lands would remain in private ownership and the public would not be allowed to use the roads to access the lands (Pylka 2013b).

The Forest Service would manage the non-federal lands for timber production and recreation. If new roads are constructed on the lands, they would likely be temporary and used to support timber management. There would likely be little or no change in the number of miles of backcountry roads and trails on the non-federal lands, and the number of miles may decrease if existing roads are closed and re-vegetated or allowed to re-vegetate naturally, benefitting wolves.

6.3.3 Effects of Interrelated and Interdependent Actions

No known activities are interrelated or interdependent to the Project that would have the potential to affect gray wolves. It is possible that future specific programs or projects may have relevant interrelated and interdependent actions (e.g., expansion of the Mine Site due to discovery of new ore bodies) and they would be considered in the context of consultations for those actions.

6.3.4 Cumulative Effects

The methods used to analyze cumulative effects, and the temporal and spatial domains, are the same for wolves as for lynx, as discussed in Section 6.1.4.

6.3.4.1 Prey Habitat

The types of cumulative effects to wolf prey habitat and habitat fragmentation, and to wolf travel corridors, would be similar to those effects to lynx as discussed in Section 6.1.4. However, given that more wolves are found in the CESA, more wolves could be impacted than lynx. Although the Project would result in habitat loss and fragmentation on about 1,719 acres at the Mine Site for about 20 years (until the Project is reclaimed), in the context of available habitat, and habitat that would be available to wolves in the reasonably foreseeable future, cumulative effects of the Project on habitat loss and fragmentation would be minor.

6.3.4.2 Human Access and Disturbance

Human Access and Traffic

The Project and other nearby proposed projects would increase the amount of human access and disturbance in the area. Effects from loss of habitat and disturbance associated with human activities from the Project are discussed above. However, increased human populations in the Project area may also lead to increased risk to wolves from collisions with vehicles and trains, increased levels of recreation activities and use of backcountry roads and trails, and increased mortality from illegal hunting and trapping.

See Section 6.1.4.2, Human Access and Traffic, for a discussion of the road system in the area. Given that the number of miles of roads associated with the federal and non-federal lands after mining is expected to be similar to or less than current levels, impacts associated with road mileage are not expected to accumulate from the Project.

Trapping and Legal and Illegal Taking

An influx of worker and their families into the region to support the Project and other development would increase the potential for illegal harvest of wolves. The USDA Animal and Plant Health Inspection Service Wildlife Services maintains records on the legal taking of wolves in Minnesota. From 1996 to 2009, an average of 146 wolves was taken annually as a result of depredation control in Minnesota (USDA Forest Service 2011b).

Hunting and trapping of wolves would not be allowed on lands administered by PolyMet. Thus, there should be no illegal or accidental take due to the Project. Loss of wolves to illegal trapping and hunting should remain near current levels on the non-federal lands, while the number of wolves harvested on non-federal lands during legal hunting and trapping seasons will vary based on wolf population levels. Thus, there should be negligible or no cumulative effect to legal, illegal, and accidental take of wolves from the Project and land exchange.

7.0 Conservation Measures

Seven conservation measures are recommended to reduce potential impacts to lynx, northern long-eared bat, and wolf from the Project. These measures are based, in part, on conservation measures identified by the Forest Service during its review of the Project, measures in the *Lynx Conservation Assessment and Strategy* (Ruediger et al. 2000) that are applicable to lynx populations throughout the contiguous U.S. and could therefore apply to lynx in and around the Project area; measures identified in the *Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition To List the Eastern Small-Footed Bat and the Northern Long-Eared Bat as Endangered or Threatened Species; Listing the Northern Long-Eared Bat as an Endangered Species; Proposed Rule* (USDOJ USFWS 2013b); and measures identified in the *Minnesota Wolf Management Plan* (MDNR 2001) that can benefit wolves in Minnesota.

7.1 Reclaim Project Area

PolyMet would reclaim about 397 acres to wetland and upland habitat at the Mine Site, including the Waste Rock Stockpiles, the Overburden Storage and Laydown Area, and the Ore Surge Pile. The stockpiles would be revegetated using a mixture of native grasses and forbs. Areas revegetated with grasses and forbs would initially provide little habitat value for lynx, northern long-eared bat, and wolf and their prey, primarily due to lack of hiding cover. Over time, reclaimed areas may be used by lynx, northern long-eared bats, and wolves and their prey as coniferous and deciduous forests establish on the sites through plant succession. Lynx tracking surveys at waste rock stockpiles east of the Project found that lynx hunt for snowshoe hare that reside in early successional shrubland and forestland habitats that have established on waste rock stockpiles. As disturbed areas are reclaimed, they would also improve habitat connectivity with forestlands in the vicinity of the Project.

When feasible, PolyMet should progressively reclaim disturbance areas to allow reclaimed areas to revegetate sooner than if the areas were not reclaimed until after mine operations cease.

7.2 Maintain Vegetated Buffers

The facility should be designed to reduce impacts to lynx, northern long-eared bats, and wolves by minimizing the disturbance area and new road construction, and reclaiming any areas where Project activities cease. Where feasible, a vegetative buffer should be retained around the perimeter of the facility to reduce light and noise effects on lynx, northern long-eared bat, and wolf. In addition, existing and newly constructed roads (built to access the Project area) should be reclaimed or obliterated after facility closure, where feasible.

7.3 Limit Public Access to Project Area

Public access to the Project area should be limited to the extent possible during development, operation, and reclamation. Users of any snowmobile or all-terrain vehicle trails on public lands near the Project area should be encouraged to stay on the trail and avoid travel into other areas. After closure and reclamation, activities that compact snow should be minimized.

7.4 Minimize Road Construction and Reclaim Unused Roads

Where feasible and appropriate, dirt and gravel roads traversing lynx and wolf habitat within the Project area should not be paved or otherwise upgraded (e.g., straightening of curves, widening of roadway, etc.) in a

CONSERVATION MEASURES

manner that is likely to lead to significant increases in traffic speeds or increased width of the cleared ROW, or would foreseeably contribute to development or increases in human activity in lynx and wolf habitat within the Project area.

Plowed roads and groomed over-the-snow routes may allow competing carnivores such as coyotes to access lynx and wolf habitat in the winter, increasing competition for prey (Buskirk et al. 2000). However, plowed or created snow roads would be necessary to access the facility during construction and operation, and are necessary to access other lands within the vicinity of the Project.

Several studies suggest that lynx may not avoid roads, except at high traffic volumes. Therefore, at this time, there is no compelling evidence to recommend management of road density to conserve lynx. There is evidence, however, that road density can impact wolf use of an area. Thus, the number of new roads constructed in support of the Project should be minimized and roads reclaimed/obliterated where feasible and appropriate.

7.5 Educate Workers and Public

Direct mortality from vehicular collisions has been detrimental to lynx and wolf in northern Minnesota. It is unlikely that lynx and wolves would travel close to the Project area due to disturbance and lack of habitat. Still, to benefit lynx, wolf, and other wildlife, speed limits should be enforced along access roads to reduce the risk of wildlife-vehicle collisions. Workers should be given training to make them aware of the importance of the area to wildlife, to request that employees report sick or dying wildlife along roads or at facilities, to ensure that employees do not dump wastes or other harmful materials off the site, and to make employees aware of other actions that could be harmful to wildlife or their habitats.

Lynx and wolf may be mistakenly trapped or shot outside the legal wolf hunting season by legal predator hunters seeking bobcats or other furbearers. Prey species, such as snowshoe hares, may also be affected by legal and illegal trapping and shooting. To reduce or eliminate the incidence of illegal trapping and shooting of lynx and wolf, PolyMet could work with the MDNR and local conservation groups to initiate information and education efforts to protect the lynx and wolf and to ensure that trappers check their traps at frequent intervals and release lynx and wolf that are still alive. Trailhead posters, magazine articles, and news releases could be used to inform the public of the possible presence of lynx and wolf within or near the Project area.

7.6 Lynx Monitoring

Because limited research has been conducted on lynx in the contiguous U.S., PolyMet would continue to follow studies of lynx conducted by the Forest Service, NRRI, MDNR, and other conservation agencies and groups to better understand lynx use of the study area during the Project's construction and operation, and to identify specific reclamation measures that could be implemented to restore lynx habitat to the area after facility closure.

7.7 Preserve and Protect Habitat

Lynx, northern long-eared bat, and wolf would benefit from habitat protection on lands adjacent to the Mine Site. These lands would be managed by PolyMet and provide habitat for use by lynx, northern long-eared bat, wolf, and other wildlife.

Forestlands in this area would likely be harvested periodically, but could be managed to provide early successional habitat favored by snowshoe hare, while wetlands could be left relatively untouched. Wetlands and forestlands could be used by lynx and wolf as a travel corridor between lands to the east and west of the Mine Site, and for foraging and roosting habitat by northern long-eared bat. Based on observations of lynx and wolf on and near disturbance areas at the Northshore Mine, lynx and wolf could use this area as a travel corridor during mine operations, and would likely use this area as a travel corridor after mine operations cease.

8.0 Determination of Effects

Lynx and wolf have been observed on and near the federal lands, and at several of the non-federal lands. The northern long-eared bat has been observed on the federal lands. Bats have been observed on the non-federal lands, although they were not identified to species. The primary effects to lynx and their critical habitat, and to wolf, would be from loss and fragmentation of habitat, to habitat connectivity, and from fatalities associated with vehicle and rail traffic on the Mine Site, Transportation and Utility Corridors, Plant Site, and access roads and railroads to the Project area. The primary effect to northern long-eared bat would be loss of habitat.

Collision with vehicles and trains is a documented cause of lynx and wolf mortality in Minnesota. Vehicle and rail traffic would include road and rail access to and within the Project area. Increased traffic is expected in the vicinity of the Project area. Although there is little likelihood that lynx or wolf would be killed by vehicle and rail traffic associated with the Project, based on studies at several other mine sites, this risk of the loss of lynx and wolf cannot be discounted.

Critical habitat for the lynx has been designated in the Project area. The Mine Site and a portion of the Dunka Road and Utility Corridor are within lynx critical habitat. Not all areas within the mapped boundaries of designated habitat are considered critical habitat. Only areas that contain the primary constituent elements required by the species are considered critical habitat. Primary constituent elements are the physical and biological features of a landscape that a species needs to survive and reproduce (USDOI USFWS and NMFS 1998). The Mine Site contains habitat elements that facilitate lynx survival and reproduction.

Habitat loss and fragmentation would be unavoidable effects to lynx, northern long-eared bat, and wolf from the Project, and additional impacts from other proposed projects in the area are expected. In addition, Project noise and other disturbances could disrupt lynx and wolf use of travel corridors near the Project area. The types of habitat that provide suitable habitat for lynx and their prey and would be lost to the Project are common in northeastern Minnesota, however, and lands along the Iron Range are already highly fragmented.

The Project would affect about 0.03% of lynx critical habitat in Minnesota, including Primary Constituent Elements (PCEs) of lynx critical habitat. Less than 0.03% of wolf critical habitat, including PCEs for wolf, would be directly affected by mining. In addition, of the 1,719 acres that would be directly affected by mining, about 397 acres (23%) would be reclaimed to habitats that could be used by lynx and wolf about 10 or more years after reclamation. It is unlikely that habitat loss and fragmentation resulting from the Project would represent a significant impact to lynx and wolf habitat from a regional perspective.

Based on the analysis in this BA, the Project would affect lynx, and those effects would not be insignificant or discountable. Thus, the Project **is likely to adversely affect** Canada lynx. As noted above, the Project would directly impact only about 0.03% of lynx critical habitat, including PCEs of lynx habitat. Some of this habitat would be reclaimed and available for use by lynx and their prey about 10 or more years after reclamation. However, not all of the reclaimed areas would restore the lost PCEs nor would they likely return to the quality of the habitat removed from the site. Thus, the Project **is likely to adversely affect** Canada lynx critical habitat.

Based on analysis in this BA, the Project is **likely to adversely affect** the continued existence of northern long-eared bat. This is because of the loss of available summer roost habitat. Impacts on northern long-eared bats from the Project would not preclude both the survival and recovery of the population as a whole.

CONSERVATION MEASURES

Based on the analysis in the BA, the Project would affect gray wolves, and those effects would not be insignificant or discountable. Thus the Project **is likely to adversely affect gray wolves**. The Project would directly impact only 0.03% of wolf critical habitat, including PCEs, in Minnesota. Some of this habitat would be reclaimed and available for use by gray wolves and their prey about 10 or more years after reclamation. Thus, the Project **is likely to adversely affect** gray wolf critical habitat.

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APPENDIX A

Common and Scientific Names of Plants and Animals Given in this Biological Assessment

Common Name	Scientific Name
Plants	
American Beech	<i>Fagus grandifolia</i>
Balsam Fir	<i>Abies balsamea</i>
Beaked Hazel	<i>Corylus cornuta</i>
Black Ash	<i>Fraxinus nigra</i>
Black Locust	<i>Robinia pseudoacacia</i>
Black Oak	<i>Quercus velutina</i>
Black Spruce	<i>Picea mariana</i>
Blueberry	<i>Vaccinium angustifolium</i>
Bog Birch	<i>Betula pumila</i>
Bog Labrador-tea	<i>Ledum groenlandicum</i>
Canada Bluejoint	<i>Calamagrostis canadensis</i>
Cattail	<i>Typha</i> spp.
Club Moss	<i>Lycopodium</i> spp.
Eastern White Pine	<i>Pinus strobus</i>
Jack Pine	<i>Pinus banksiana</i>
Leatherleaf	<i>Chamaedaphne calyculata</i>
Lodgepole Pine	<i>Pinus contorta</i>
Narrow-leaved Cattail	<i>Typha latifolia</i>
Northern Red Oak	<i>Quercus rubra</i>
Northern White Cedar	<i>Thuja occidentalis</i>
Paper Birch	<i>Betula papyrifera</i>
Pussywillow	<i>Salix discolor</i>
Raspberry	<i>Rubus</i> spp.
Red-osier Dogwood	<i>Cornus stolonifera</i>
Red Pine	<i>Pinus resinosa</i>
Sedge	<i>Carex</i> spp.
Shining Club Moss	<i>Lycopodium lucidulum</i>
Shortleaf Pine	<i>Pinus echinata</i>
Silver Maple	<i>Acer saccharinum</i>
Small-fruited Bog Cranberry	<i>Vaccinium oxycoccus</i>
Sourwood	<i>Oxydendrum arboreum</i>
Speckled Alder	<i>Alnus rugosa</i>
Sphagnum Moss	<i>Sphagnum</i> spp.
Subalpine Fir	<i>Abies lasiocarpa</i>
Sugar Maple	<i>Acer saccharum</i>
Tamarack	<i>Larix laricina</i>

APPENDIX A (Cont.)**Common and Scientific Names of Plants and Animals Given in the Report**

Common Name	Scientific Name
Plants (Cont.)	
Trembling Aspen	<i>Populus tremuloides</i>
White Pine	<i>Pinus strobus</i>
White Spruce	<i>Picea glauca</i>
Willow	<i>Salix</i> spp.
Woolgrass	<i>Scirpus cyperinus</i>
Animals	
Beaver	<i>Castor canadensis</i>
Big Brown Bat	<i>Eptesicus fuscus</i>
Bison	<i>Bison bison</i>
Bobcat	<i>Lynx rufus</i>
Canada Lynx	<i>Lynx canadensis</i>
Coyote	<i>Canis latrans</i>
Eastern Red Bat	<i>Lasiurus borealis</i>
Eastern Small-footed Myotis	<i>Myotis leibii</i>
Elk	<i>Cervus canadensis</i>
Fisher	<i>Martes pennanti</i>
Gray Wolf	<i>Canis lupus</i>
Hoary Bat	<i>Lasiurus cinereus</i>
Indiana Bat	<i>Myotis sodalis</i>
Keen's Long-eared Myotis	<i>Myotis keenii</i>
Little Brown Myotis	<i>Myotis lucifugus</i>
Moose	<i>Alces alces</i>
Mountain Lion	<i>Puma concolor</i>
Mule Deer	<i>Odocoileus hemionus</i>
Northern Flying Squirrel	<i>Glaucomys sabrinus</i>
Northern Long-Eared Bat	<i>Myotis septentrionalis</i>
Pine Marten	<i>Martes americana</i>
Porcupine	<i>Erethizon dorsatum</i>
Red Squirrel	<i>Tamiasciurus hudsonicus</i>
Ruffed Grouse	<i>Bonasa umbellus</i>
Siberian Husky	<i>Canis familiaris</i>
Silver-haired Bat	<i>Lasionycteris noctivagans</i>
Snowshoe Hare	<i>Lepus canadensis</i>
Spruce Budworm	<i>Choristoneura fumiferana</i>
Tri-colored Bat	<i>Perimyotis subflavus</i>
Western Long-eared Myotis	<i>Myotis evotis</i>

APPENDIX A (Cont.)**Common and Scientific Names of Plants and Animals Given in the Report**

Common Name	Scientific Name
Animals (Cont.)	
White-tailed Deer	<i>Odocoileus virginianus</i>
Wolverine	<i>Gulo gulo</i>
Woodland Caribou	<i>Rangifer tarandus</i>

Biological Evaluation

U.S. Department of Agriculture Forest Service

**Laurentian Ranger District
Superior National Forest
Aurora, Minnesota**



Biological Evaluation for the Proposed NorthMet Project and Land Exchange

April 2015

NorthMet Project and Land Exchange

U.S. Department of Agriculture Forest Service

Laurentian Ranger District
Superior National Forest
Aurora, Minnesota

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Biological Evaluation

U.S. Department of Agriculture Forest Service
Laurentian Ranger District
Superior National Forest
Aurora, Minnesota

April 2015

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Executive Summary

Poly Met Mining Inc. (PolyMet) proposes to construct an open pit mine in northern Minnesota to extract low- to medium-quality copper-nickel-PGE minerals with low sulfide content. This project, called the NorthMet Project (Project), is located in St. Louis County on the eastern end of the Mesabi Iron Range, about 60 miles north of the City of Duluth, and 6 miles south of the City of Babbitt, Minnesota. The Project areas include the Mine Site (3,015 acres), Plant Site (4,515 acres), and Transportation and Utility Corridors (120 acres) that connect the Mine Site to the Plant Site.¹

PolyMet plans to mine and process polymetallic ore from the northwestern portion of the Duluth Complex, a rock formation that forms much of the bedrock of northeastern Minnesota. The ore contains copper, nickel, gold, platinum, palladium, and cobalt. The Project would mine ore for approximately 20 years, using open pit mining methods similar to those currently in use at ferrous metallic mining operations on the Iron Range. The Plant Site was previously used as a taconite processing facility by the LTV Steel Mining Company (LTVSMC). PolyMet would upgrade existing facilities and construct new facilities to produce copper concentrates, nickel concentrates, and base and precious metal precipitates for off-site shipment and treatment. Tailings from ore processing would be placed in a tailings basin built atop the existing LTVSMC taconite tailings basin.

About 1,719 acres of the Mine Site would be directly disturbed by mining activities. Of these, 1,667 acres are administered by the Forest Service and 52 acres are privately owned. Habitats on the federally administered lands that would potentially be affected by the project include upland coniferous forest (including black spruce², jack pine, and balsam fir), upland deciduous forest (including trembling aspen and paper birch), upland mixed coniferous/deciduous forest, coniferous bogs (including black spruce and tamarack), open bogs (including leatherleaf and Labrador tea), coniferous swamps (including black spruce, tamarack, and northern white cedar), hardwood swamps (including black ash), shrub swamps (including speckled alder, willows, and dogwoods), marshes (including cattails), and sedge and wet meadows (including sedges and grasses). A variety of plants and animals, including several species of concern, have been observed on or near the Mine Site. A 2014 Forest Service study confirmed that northern long-eared bats and little brown bats utilize the Mine Site and adjacent Project areas (USDA Forest Service 2014a).

Of the approximately 3,015 acres on the Mine Site, approximately 2,719 acres are owned by the United States (U.S.) Government (Government) and administered by the U.S. Department of Agriculture (USDA) Forest Service (Forest Service). In addition, about 3,776 acres adjacent to the Mine Site are owned by the Government and administered by the Forest Service.

The Forest Service is considering transferring these approximately 6,495 acres (federal lands) to PolyMet in exchange for lands (non-federal lands) of similar value that have been offered for consideration by PolyMet. All

¹ Acreages given in this report are based on Geographic Information System (GIS) analysis. Acreages associated with the legal descriptions of the lands are based on original surveys performed by the Bureau of Land Management, Government Land Office (GLO) surveyors between 1858 and 1907. As such, GLO acreages are used as part of the project description for the Final Environmental Impact Statement (FEIS) being prepared for the Project and would also be used to define the real estate transaction if the Land Exchange Proposed Action was approved. The analysis of effects presented in this Biological Evaluation (BE) is based upon GIS data. GIS values indicate the actual size of the parcels discussed in this BE, which may be different than the GLO legal acreage.

² Common and scientific names of plants and animals given in this report are provided in **Appendix A**.

EXECUTIVE SUMMARY

lands potentially involved in the land exchange would be independently appraised according to the Uniform Appraisal Standards for Federal Land Acquisitions. The appraisals would determine the market value of the properties. Information collected during wildlife and wetland functions and values studies would be used by the Forest Service in the land exchange appraisal, and would be used to evaluate impacts to wetlands, and wildlife and their habitats, for a Final Environmental Impact Statement (FEIS) for the Project and land exchange.

Assuming a land exchange occurs, the portions of the Mine Site, Dunka Road and Utility Corridor, and lands adjacent to the Mine Site that are administered by the Forest Service would no longer be part of the National Forest and therefore would not be subject to Forest Service management plans and policies. A land exchange for land adjustment is consistent with the 2004 *Land and Resource Management Plan for the Superior National Forest* (2004 Forest Plan).

To fulfill land exchange requirements, PolyMet is proposing to purchase and transfer all or a portion of 7,075 acres of non-federal lands to the Forest Service. The non-federal lands consist of the Hay Lake Lands (4,926 acres), Hunting Club Lands (160 acres), Lake County Lands (382 acres), McFarland Lake Lands (31 acres), and Wolf Lands (1,576 acres). All lands are dominated by second-growth deciduous and coniferous forest habitats and a variety of plants and animals, including several species of concern, have been observed on or near the non-federal lands.

Assuming a land exchange occurs, the non-federal lands would be administered by the Forest Service. The non-federal lands are associated with four Forest Plan Management Areas, as designated by the Forest Service, which include General Forest, General Forest – Longer Rotation, Riparian Emphasis Area, and Candidate Research Natural Areas. If all or portions of the non-federal lands are acquired by the Forest Service, they would be administered by the Forest Service to meet the goals of these management areas.

The Project could adversely impact plant and animal species of concern found on or near the federal lands. The 2004 *Forest Plan Revision Final Environmental Impact Statement for Chippewa and Superior National Forests* (2004 Forest Plan EIS) assessed plant and animal species identified by the Regional Forester for which population viability was a concern as evidenced by:

- Significant current or predicted downward trends in population numbers or density.
- Significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution (Forest Service Manual 2670.5).

Based on the 2004 Forest Plan EIS and subsequent updates, the Regional Forester identified 12 non-vascular plants, 46 vascular plants, 2 aquatic invertebrates, 6 insects, 4 fish, 1 reptile, 8 birds, and 5 mammals as Regional Forester Sensitive Species (RFSS). Of these, eight vascular plants, and six (and possibly nine as unidentified bat species have been reported on the federal lands) animals have been reported on the federal exchange lands, while two vascular plants and two (and possibly up to five as unidentified bat species have been found on the non-federal exchange lands) animals have been reported on the non-federal lands.

This Biological Evaluation (BE) was prepared to document RFSS populations and habitat use on or near the federal and non-federal lands, and potential direct, indirect, and cumulative impacts to these species from the Project. This BE complies with Forest Service Manual Directives 2671.1 through 2672.43 and the National

Forest Management Act of 1976. The Forest Service Manual Directive 2672.42 objectives for completing BEs for proposed Forest Service programs and activities are to:

- ensure that Forest Service actions do not contribute to loss of viability of any native or desired non-native plant or animal species,
- ensure that Forest Service activities do not cause any species to move toward federal listing, and
- incorporate concerns for sensitive species throughout the planning process, reducing negative impacts to species and enhancing opportunities for mitigation.

In addition to addressing impacts to RFSS from the Proposed Action, which includes the Project and land exchange, this BE also addresses impacts to RFSS from two alternatives also considered in the FEIS:

- Land Exchange Alternative B (Alternative B) - under Alternative B, the Forest Service would transfer 4,753 acres of federal lands, which comprise 2,719 acres at the Mine Site and a smaller amount of federal land surrounding the Mine Site, to PolyMet in exchange for the 4,926-acre Hay Lake Lands. This land exchange would involve the transfer of a similar acreage, would provide wetlands to the Forest Service, and Hay Lake Lands would have a higher-per-acre value than the federal lands.
- Land Exchange No Action Alternative (No Action Alternative) - under the No Action Alternative, mine construction, development, and operation would not occur and no lands would be exchanged. The Government would not convey federal lands to PolyMet, and the Forest Service would continue managing these federal lands.

Based on the analyses for this BE, the Forest Service has determined that the Proposed Action and Alternative B would have **no impact** to the following RFSS:

Plants

Alpine milkvetch	Lanceleaf grapefern	Scotch false asphodel
<i>Arctoparmelia centrifuga</i>	Largeleaf sandwort	Short sedge
<i>Arctoparmelia subcentrifuga</i>	Little goblin moonwort	Smooth woodsia
Braun's holly fern	Long-leaved arnica	Sticky locoweed
Creeping rush	Maidenhair spleenwort	Triangle grapefern
Chilean sweet-cicely	Moschatel	Wain's cup lichen
Douglas' hawthorn	Nodding saxifrage	
Encrusted saxifrage	Oakes' pondweed	

Animals

Lake sturgeon	Nipigon cisco	Shortjaw cisco
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EXECUTIVE SUMMARY

The Forest Service determined that the Proposed Action and Alternative B **may impact individuals but are not likely to cause a trend to federal listing or loss of viability** for the following RFSS:

Plants

American shoreweed	<i>Cetraria aurescens</i>	New England sedge
American waterawlwort	Cloudberry	Pale moonwort
Appalachian clubmoss	Common moonwort	Peppered moon lichen
Auricled twayblade	Fairy slipper	Quill spikerush
Barren strawberry	Fan lichen	Ram's head lady slipper
Beard lichen	Floating marsh marigold	Roughfruit fairybells
Bog muhly	Honeycombed lichen	Selwyn's scalewort
Bog white violet	Least moonwort	Small beggerticks
<i>Caloplaca parvula</i>	Leiberg's waterlily	Snowline wintergreen
Canada ricegrass	Linear-leaved sundew	Ternate grapefern
Canada yew	Michigan moonwort	Western Jacob's-ladder
Cartilage lichen	Moor rush	Yellow specklebelly

Animals

Bald eagle	Freija's grizzled skipper	Northern long-eared bat
Bay-breasted warbler	Gray wolf	Olive-sided flycatcher
Black sandshell	Great gray owl	Quebec emerald dragonfly
Boreal owl	Headwaters chilostigman caddisfly	Taiga alpine
Connecticut warbler	Little brown myotis	Three-toed woodpecker
Creek heelsplitter	Northern brook lamprey	Tri-colored bat
Eastern heather vole	Northern goshawk	Wood turtle
Ebony boghaunter		

EXECUTIVE SUMMARY

The Forest Service determined that the Proposed Action and Alternative B would have **no beneficial impact**, and **would not likely impact individuals or result in a trend to federal listing or loss of viability**, for any RFSS discussed in this BE.

Finally, the Forest Service determined that the No Action Alternative would have **no impact** on RFSS discussed in this BE.

A separate Biological Assessment (BA) was prepared to evaluate project effects to Canada lynx, a federally listed threatened species, and its critical habitat; northern long-eared bat, a RFSS species that was recently federally listed as threatened; and gray wolf, a RFSS species that was previously federally listed as threatened in 1977, delisted in 2011, and relisted December 19, 2014, following a federal court reversal of the USFWS decision to delist the gray wolf.

Contents

1.0 Introduction	1-1
1.1 Overview	1-1
2.0 Description of the Proposed Action and Alternatives.....	2-1
2.1 Proposed Action (Alternative A).....	2-1
2.1.1 Overview	2-1
2.1.2 Mine Site	2-1
2.1.3 Plant Site.....	2-8
2.1.4 Transportation and Utility Corridors	2-12
2.1.5 Traffic.....	2-15
2.1.6 Project Reclamation	2-16
2.1.7 Federal and Non-federal Lands	2-23
2.2 Land Exchange Alternative B (Alternative B).....	2-25
2.3 Land Exchange No Action Alternative (No Action Alternative).....	2-26
3.0 Description of the Lands Affected by the Project.....	3-1
3.1 Federal Lands.....	3-1
3.1.1 Mine Site	3-1
3.1.2 Federal Lands Surrounding the Mine Site.....	3-15
3.2 Plant Site and Transportation and Utility Corridors	3-17
3.3 Non-federal Lands	3-17
3.3.1 Hay Lake Lands	3-17
3.3.2 Hunting Club Lands	3-18
3.3.3 Lake County Lands	3-18
3.3.4 McFarland Lake Lands	3-20
3.3.5 Wolf Lands.....	3-20
4.0 Biological Evaluation Methodology	4-1
4.1 Literature Review.....	4-1
4.1.1 Biological Evaluations	4-1
4.1.2 Other Sources of Information	4-1
4.2 Database Inquiries.....	4-2
4.3 Consultation with Biologists with Local Knowledge of the Species	4-2
4.4 Field Studies.....	4-2

TABLE OF CONTENTS

4.4.1	Federal Lands	4-2
4.4.2	Non-federal Lands.....	4-4
4.5	Determination of Effects.....	4-4
4.5.1	Types of Effects and Assessment Factors	4-4
4.5.2	Cumulative Effects.....	4-5
5.0	Analysis and Determination of Effects	5-1
5.1	Vascular and Non-vascular Plants	5-1
5.1.1	Plants Not Evaluated in the Biological Evaluation	5-1
5.1.2	Plants of Non-forested Wetlands, Shallow Water, and Riparian Areas (Habitat Group 1).....	5-1
5.1.3	Cliff, Talus Slope, and Exposed Rock Habitat (Habitat Group 2)	5-10
5.1.4	Upland Disturbed, Barrens, or Early Successional Forest Habitat (Habitat Group 3).....	5-14
5.1.5	Forested Wetland – Black Spruce, Tamarack, and Mixed Conifer Forest Habitat (Habitat Group 4).....	5-20
5.1.6	Mesic Hardwood Forest Dominated Habitat (Habitat Group 5).....	5-28
5.1.7	Dry-mesic Upland Forest: Deciduous, Coniferous, or Mixed Forest Habitat (Habitat Group 6)	5-32
5.2	Animals	5-37
5.2.1	Animals Not Evaluated in the Biological Evaluation	5-37
5.2.2	Mussels	5-37
5.2.3	Insects	5-40
5.2.4	Fish	5-48
5.2.5	Reptiles	5-50
5.2.6	Birds.....	5-53
5.2.7	Mammals	5-78
6.0	References.....	6-1

Appendixes

Appendix A	Common and Scientific Names of Plants and Animals Given in this Biological Evaluation
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List of Figures

1	Project Location.....	1-2
2	Federal and Non-federal Lands	1-4
3	Land Exchange – Proposed Action and Alternative B	1-5
4	Mine Site Plan.....	2-2
5	Plant Site Layout.....	2-8
6	Transportation and Utility Corridors.....	2-13
7	Mine Site Plan Long-term Closure	2-17
8	Plant Site Layout Long-term Closure	2-20
9	Management Indicator Habitat Types and Age Classes - Federal Lands	3-2
10	Management Indicator Habitat Types and Age Classes - Hay Lake Lands, Lake County Lands, and Wolf Lands 1 and 2	3-3
11	Management Indicator Habitat Types and Age Classes - Hunting Club Lands, McFarland Lake Lands, and Wolf Lands 3 and 4.....	3-4
12	GAP Land Cover/Habitat Types - Federal Lands.....	3-5
13	GAP Land Cover/Habitat Types - Hay Lake Lands, Lake County Lands, and Wolf Lands 1 and 2	3-6
14	GAP Land Cover/Habitat Types - Hunting Club Lands, McFarland Lake Lands, and Wolf Lands 3 and 4.....	3-7
15	Wetlands - Federal Lands.....	3-8
16	Wetlands - Hay Lake Lands, Lake County Lands, and Wolf Lands 1 and 2.....	3-9
17	Wetlands - Hunting Club Lands, McFarland Lake Lands, and Wolf Lands 3 and 4	3-10
18	Arrowhead Region of Minnesota and Ecological Subsections	4-7

List of Tables

1	Regional Forester Sensitive Species Occurrence and Habitat Availability on the Federal and Non-federal Lands.....	1-7
2	Maximum Pit Dimensions.....	2-4
3	Waste Rock Properties.....	2-5
4	Maximum Stockpile Dimensions - Approximate	2-5
5	GAP Cover Type and Management Indicator Habitat on Federal and Non-federal Lands.....	3-11
6	Management Indicator Habitat and Age Classes on Federal and Non-federal Lands	3-12
7	GAP Cover Types on Federal and Non-federal Lands	3-13
8	Wetland Types on Federal and Non-federal Lands	3-14
9	GAP Cover Types Affected by the Project at the Mine Site	3-16

List of Acronyms

BA	Biological Assessment
Barr	Barr Engineering, Incorporated
BE	Biological Evaluation
BWCAW	Boundary Waters Canoe Area Wilderness
CESA	Cumulative Effects Study Area
dbh	Diameter-at-breast-height
DDT	Dichlorodiphenyltrichloroethane
DPS	Distinct Population Segment
e.g.	For example
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FEIS	Final Environmental Impact Statement
Forest Service	U.S. Forest Service
GAP	Gap Analysis Program
GIS	Geographic Information System
GLO	Government Land Office
Government	United States Government
GPS	Global Positioning System
i.e.	In otherwords
kV	kilovolts
LTVSMC	LTV Steel Mining Company
MDNR	Minnesota Department of Natural Resources
mg/L	milligrams per liter
mi ²	square miles
MIH	Management Indicator Habitat
MPCA	Minnesota Pollution Control Agency
N/A	Not Applicable
NHIS	Natural Heritage Information System
NRRI	Natural Resources Research Institute
PolyMet	Poly Met Mining Inc.
Project	NorthMet Project
RFSS	Regional Forester Sensitive Species
ROW	Rights-of-way
SCUBA	Self-contained Underwater Breathing Apparatus
SEIS	Supplemental Environmental Impact Statement
SUV	Sport Utility Vehicle
Tracks Project	Tracks Forest Management Project
USDOI	U.S. Department of the Interior
U.S.	United States
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service

1.0 Introduction

1.1 Overview

Poly Met Mining Inc. (PolyMet) proposes to construct an open pit mine in northern Minnesota to extract low- to medium-quality copper-nickel-PGE minerals with low sulfide content. This project, called the NorthMet Mining Project (Project), is located in St. Louis County on the eastern end of the Mesabi Iron Range, about 60 miles north of the City of Duluth, and 6 miles south of the City of Babbitt, Minnesota. The Project areas include the Mine Site (3,015 acres), Plant Site (4,515 acres), and Transportation and Utility Corridors (120 acres) that connect the Mine Site to the Plant Site³ (**Figure 1**).

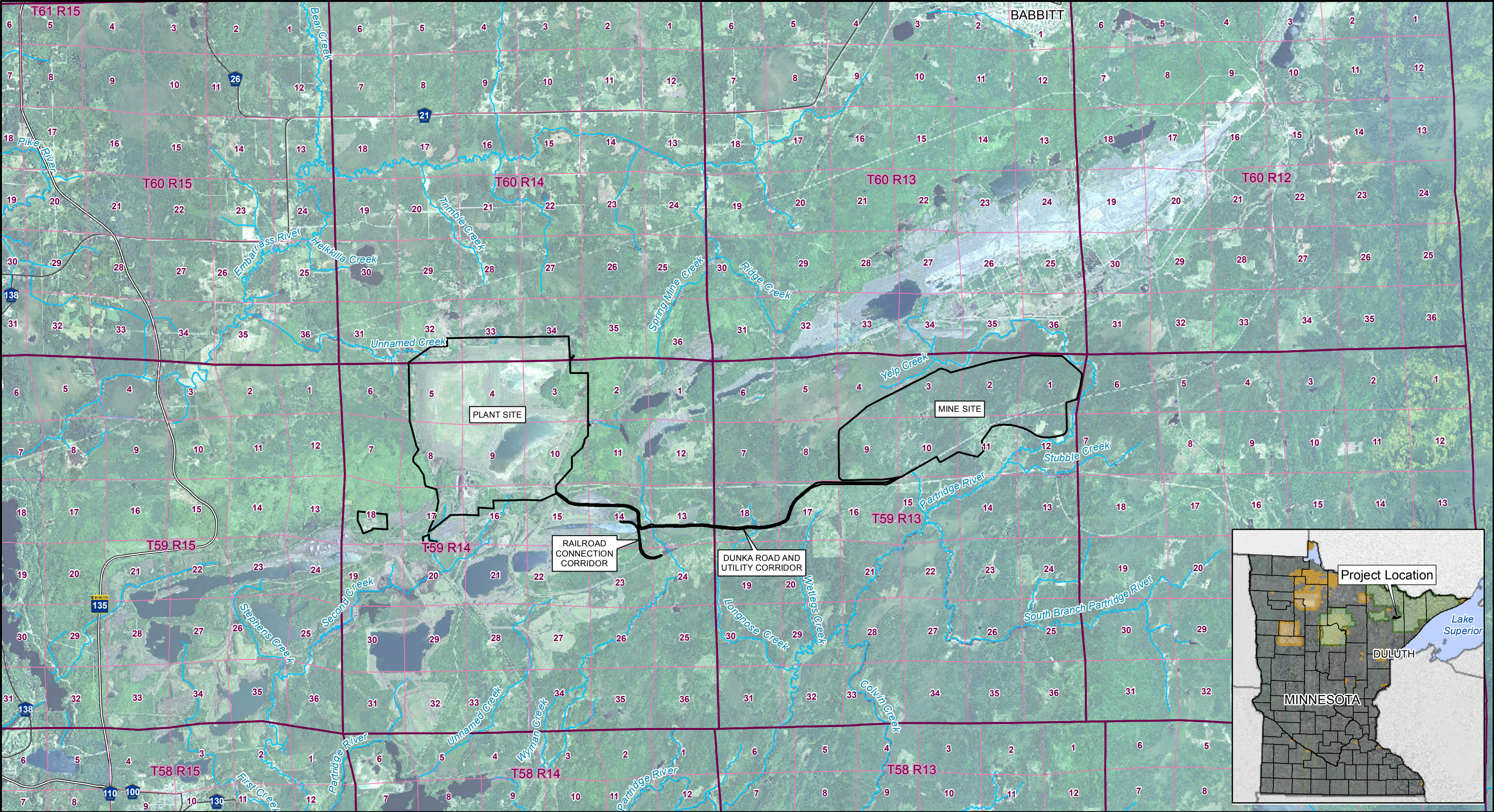
PolyMet plans to mine and process polymetallic ore from the northwestern portion of the Duluth Complex. The Duluth Complex is an ore complex that forms much of the bedrock of northeastern Minnesota. The ore contains copper, nickel, gold, platinum, palladium, and cobalt. The Plant Site was previously used as a taconite processing facility by the LTV Steel Mining Company (LTVSMC). PolyMet would upgrade existing facilities and construct new facilities to produce copper concentrates, nickel concentrates, and base and precious metal precipitates for off-site shipment and treatment. Because the Plant Site has been operated as an industrial facility for decades, the Project would not have significant new effects on wildlife habitat at the Plant Site.

About 1,719 acres of the Mine Site would be directly disturbed by mining activities. Of these, 1,667 acres are administered by the Forest Service and 52 acres are privately owned. Habitats on the federally administered lands that would potentially be affected by the project include upland coniferous forest (including black spruce⁴, jack pine, and balsam fir), upland deciduous forest (including trembling aspen and paper birch), upland mixed coniferous/deciduous forest, coniferous bogs (including black spruce and tamarack), open bogs (including leatherleaf and Labrador tea), coniferous swamps (including black spruce, tamarack, and northern white cedar), hardwood swamps (including black ash), shrub swamps (including speckled alder, willows, and dogwoods), marshes (including cattails), and sedge and wet meadows (including sedges and grasses). A variety of plants and animals, including several species of concern, have been observed on or near the Mine Site.

Of the approximately 3,015 acres on the Mine Site, approximately 2,719 acres are owned by the United States (U.S.) Government (Government) and administered by the U.S. Department of Agriculture (USDA) Forest Service (Forest Service). In addition, about 3,776 acres adjacent to the Mine Site are owned by the Government and administered by the Forest Service.

³ Acreages given in this report are based on Geographic Information System (GIS) analysis. Acreages associated with the legal descriptions of the Lands are based on original surveys performed by the Bureau of Land Management, Government Land Office (GLO) surveyors between 1858 and 1907. As such, GLO acreages are used as part of the project description for the Final Environmental Impact Statement (FEIS) being prepared for the Project and would also be used to define the real estate transaction if the land exchange was approved. The analysis of effects presented in this Biological Evaluation (BE) is based upon GIS data. The GIS values indicate the actual size of the Lands discussed in this BE, which may be different than the GLO legal acreage.

⁴ Common and scientific names of plants and animals given in this report are provided in **Appendix A**.



- Project Areas
- Township Lines
- Section Lines
- Rivers & Streams



0 0.5 1 2 Miles

Figure 1
Project Location
Biological Evaluation for the NorthMet Project and Land Exchange
St. Louis County, Minnesota

INTRODUCTION

The Forest Service is considering transferring these approximately 6,495 acres (federal lands) to PolyMet in exchange for lands (non-federal lands) of similar value that have been offered for consideration by PolyMet (**Figures 2 and 3**). Assuming a land exchange occurs, the portions of the Mine Site, Dunka Road and Utility Corridor, and lands adjacent to the Mine Site that are administered by the Forest Service would no longer be part of the National Forest and therefore would not be subject to Forest Service management plans and policies. A land exchange for land adjustment is consistent with the 2004 *Land and Resource Management Plan for the Superior National Forest* (2004 Forest Plan; USDA Forest Service 2004a).

To fulfill land exchange requirements, PolyMet is proposing to purchase and transfer all or a portion of 7,075 acres of non-federal lands to the Forest Service under the Proposed Action (**Figure 2**). The non-federal lands consist of the Hay Lake Lands (4,926 acres), Hunting Club Lands (160 acres), Lake County Lands (382 acres), McFarland Lake Lands (31 acres), and Wolf Lands (1,576 acres). All lands are dominated by second-growth deciduous and coniferous forest habitats and a variety of plants and animals, including species of concern, have been observed on or near the non-federal lands.

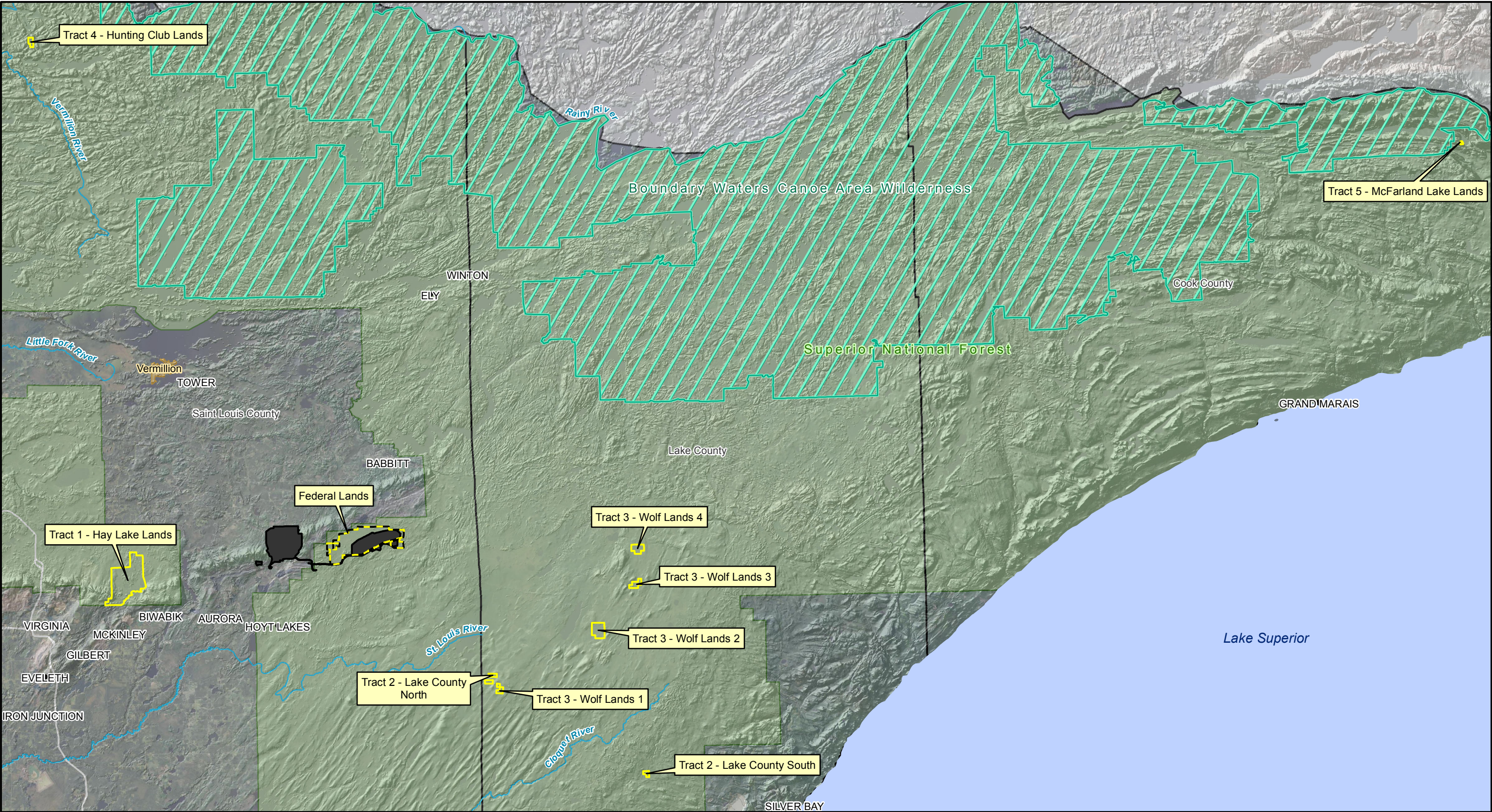
Assuming a land exchange occurs, the non-federal lands would be administered by the Forest Service. The non-federal lands are associated with four Forest Plan Management Areas, as designated by the Forest Service, which include: General Forest, General Forest – Longer Rotation, Riparian Emphasis Area, and Candidate Research Natural Areas. If all or a portion of the non-federal lands are acquired by the Forest Service, they would be administered by the Forest Service to meet the goals of these management areas (USDA Forest Service 2004a).

The Regional Forester or other authorized officer must decide if the proposed land exchange complies with the 2004 Forest Plan (USDA Forest Service 2004a), is a fair value exchange, and is in the public interest. All lands potentially involved in the land exchange would be independently appraised according to the Uniform Appraisal Standards for Federal Land Acquisitions. The appraisals would determine the market value of the properties. Information collected during wildlife and wetland functions and values studies would be used by the Forest Service in the land exchange appraisal, and would be used to evaluate impacts to wetlands, and wildlife and their habitats, for a *NorthMet Mining Project and Land Exchange Final Environmental Impact Statement* (FEIS) for the Project and land exchange (Minnesota Department of Natural Resources [MDNR] et al. 2015).

The Project could adversely impact plant and animal species of concern found on or near the federal lands. The 2004 *Forest Plan Revision Final Environmental Impact Statement for Chippewa and Superior National Forests* (2004 Forest Plan EIS; USDA Forest Service 2004b) assessed plant and animal species identified by the Regional Forester for which population viability was a concern as evidenced by:

- Significant current or predicted downward trends in population numbers or density.
- Significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution (Forest Service Manual Directive 2670.5; USDA Forest Service 2000a).

Table 1 provides information on species occurrence and habitat availability for the Regional Forester Sensitive Species (RFSS) on the federal and non-federal lands. Based on the 2004 Forest Plan EIS and



<ul style="list-style-type: none"> Project Areas Federal Lands Non-federal Lands Boundary Waters Canoe Area Wilderness National Forest Boundary Native American Reservation Major River 				<p>Figure 2 Federal and Non-federal Lands Biological Evaluation for the NorthMet Project and Land Exchange St. Louis County, Minnesota</p>
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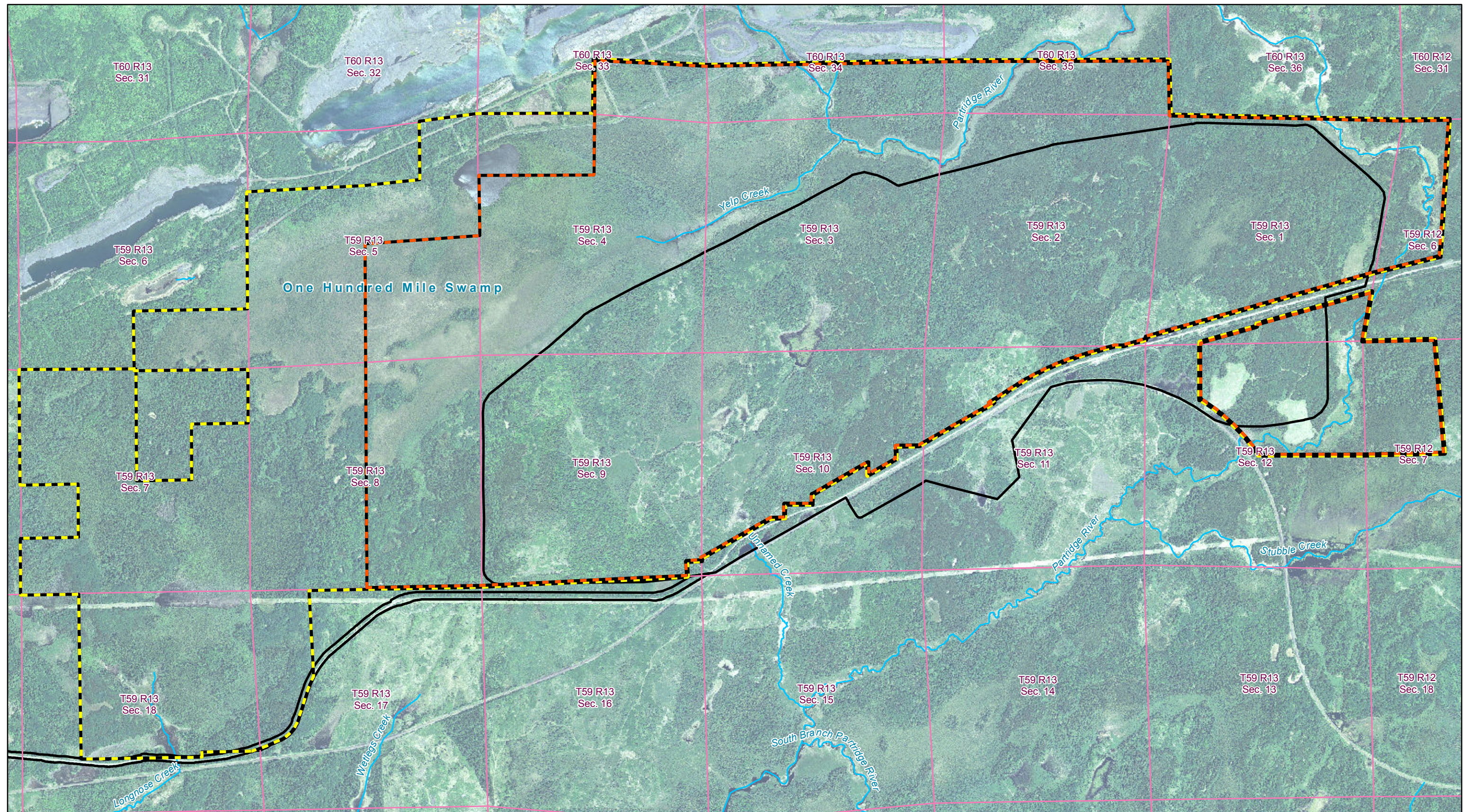


Figure 3
Land Exchange - Proposed Action and Alternative B
 Biological Evaluation for the NorthMet Project and Land Exchange
 St. Louis County, Minnesota

subsequent updates, the Regional Forester identified 12 non-vascular plants, 46 vascular plants, 2 aquatic invertebrates, 6 insects, 4 fish, 1 reptile, 8 birds, and 5 mammals as RFSS (Ryan 2011). Of these, eight vascular plants, and six (and possibly nine as unidentified bat species have been found on the federal exchange lands) animals have been reported on the federal lands, while two vascular plants and two (and possibly up to five as unidentified bat species have been found on the non-federal lands) animals have been reported on the non-federal exchange lands (**Table 1**). If the known and potential habitat and species occurrences are listed as “No” for a RFSS in **Table 1**, the RFSS was not analyzed in this Biological Evaluation (BE).

In accordance with Forest Service Manual Directives 2671.1 through 2672.43 (USDA Forest Service 2000a) and the National Forest Management Act of 1976, the Forest Service is required to prepare a BE to:

- ensure that Forest Service actions do not contribute to loss of viability of any native or desired non-native plant or animal species,
- ensure that Forest Service activities do not cause any species to move toward federal listing, and
- incorporate concerns for RFSS throughout the planning process, reducing negative impacts to species and enhancing opportunities for mitigation.

In addition to addressing impacts to RFSS from the Proposed Action, which includes the Project and land exchange, this BE also addresses impacts to RFSS from two alternatives also considered in the FEIS:

- Land Exchange Alternative B (Alternative B) - under Alternative B, the Forest Service would transfer 4,753 acres of federal lands, which comprise 2,719 acres at the Mine Site and a smaller amount of federal land surrounding the Mine Site, to PolyMet in exchange for the 4,926-acre Hay Lake Lands (**Figure 3**). This land exchange would involve the transfer of a similar acreage, would provide wetlands to the Forest Service, and Hay Lake Lands would have a higher-per-acre value than the federal lands.
- Land Exchange No Action Alternative (No Action Alternative) - under the No Action Alternative, mine construction, development, and operation would not occur and no lands would be exchanged. The Government would not convey federal lands to PolyMet, and the Forest Service would continue managing these federal lands.

This BE was prepared to document RFSS populations and habitats on or near the federal and non-federal lands, and likely direct, indirect, and cumulative impacts to these species from the Project. A separate Biological Assessment (BA) was prepared to evaluate project effects to Canada lynx, a federally listed threatened species, and its critical habitat; northern long-eared bat, a RFSS species that was recently federally listed as threatened; and gray wolf, a RFSS species that was recently re-listed as federally threatened, and its critical habitat (U.S. Army Corps of Engineers [USACE] and USDA Forest Service 2013). While the Canada lynx, northern long-eared bat, and gray wolf are discussed in this BE, the *NorthMet Mining Project and Land Exchange Biological Assessment Draft* provides additional details on these species (USACE and USDA Forest Service 2013).

Table 1

Regional Forester Sensitive Species Occurrence and Habitat Availability on the Federal and Non-Federal Lands

RFSS Species		Species and Habitat Occurrence				Habitat Characteristics
Scientific Name	Common Name	Known Species Occurrence on/near Federal Lands	Potential Habitat Present on/near Federal Lands	Known Species Occurrence on/near Non-federal Lands	Potential Habitat Present on/near Non-federal Lands	
Non-vascular Plants						
<i>Arctoparmelia centrifuga</i>	Arctoparmelia Lichen	No	No	No	No	Sunny rocks and open talus slopes.
<i>Arctoparmelia subcentrifuga</i>	Arctoparmelia Lichen	No	No	No	No	Sunny rocks and open talus slopes.
<i>Caloplaca parvula</i>	Unnamed Lichen	No	No	No	Yes	Smooth bark of young black ash in moist, humid old-growth black ash stands.
<i>Cetraria</i> (=Ahtiana) <i>aurescens</i>	Unnamed Lichen	No	Yes	No	Yes	Conifer bark in lowland conifer swamps (old cedar/black spruce).
<i>Cladonia wainioi</i>	Wain’s Cup Lichen	No	No	No	No	On rock outcrops and thin soil and exposed sites with lots of light.
<i>Frullania selwyniana</i>	Selwyn’s Scalewort	No	Yes	No	Yes	Lowland cedar swamps on bark of northern white cedar.
<i>Menegazzia terebrata</i>	Honeycombed Lichen	No	Yes	No	Yes	Cedar swamps, especially old growth, often at base of cedar trees.
<i>Peltigera venosa</i>	Fan Lichen	No	Yes	No	Yes	Soil and moist cliffs and on exposed root wads.
<i>Pseudocyphellaria crocata</i>	Yellow Specklebelly	No	Yes	No	Yes	Mossy rocks and trees in partially shaded, moist, frequently foggy habitats.
<i>Ramalina thrausta</i>	Cartilage Lichen	No	Yes	No	Yes	Cedar swamps, and especially old growth forest.
<i>Sticta fuliginosa</i>	Peppered Moon Lichen	No	Yes	No	Yes	On hardwoods in humid, old growth cedar or ash bogs.
<i>Usnea longissima</i>	Beard Lichen	No	Yes	No	Yes	On old conifers in moist situations, often in or near a conifer or hardwood swamps.

Table 1 (Cont.)
Regional Forester Sensitive Species Occurrence and Habitat Availability on the Federal and Non-Federal Lands

RFSS Species		Species and Habitat Occurrence				Habitat Characteristics
Scientific Name	Common Name	Known Species Occurrence on/near Federal Lands	Potential Habitat Present on/near Federal Lands	Known Species Occurrence on/near Non-federal Lands	Potential Habitat Present on/near Non-federal Lands	
Vascular Plants						
<i>Adoxa moschatellina</i>	Moschatel	No	No	No	Yes	Shaded damp cliffs and slopes in upland mature northern hardwood forests on North Shore of Lake Superior.
<i>Arnica lonchophylla</i>	Long-leaved Arnica	No	No	No	No	Cool and moist cliffs and ledges along North Shore of Lake Superior.
<i>Asplenium trichomanes</i>	Maidenhair Spleenwort	No	No	No	Yes	In crevices of moist, mostly east-facing cliffs, ledges, and talus; Rove formation.
<i>Astragalus alpinus</i>	Alpine Milkvetch	No	No	No	No	Found on rocky, gravelly margins of shallow groundwater-fed ponds; herbaceous cover is typically sparse.
<i>Bidens discoidea</i>	Small Beggarticks	No	Yes	No	Yes	Wet habitats. Silty shores and hummocks in floating mats and swamps; also partly submerged logs.
<i>Botrychium lanceolatum</i>	Triangle Grapefern	No	Yes	Yes	Yes	Northern hardwood forest, old fields, old logging roads, and trails.
<i>Botrychium lanceolatum</i> var. <i>angustisegmentum</i>	Lanceleaf Grapefern	No	Yes	No	Yes	Prefers moist, shady, mature northern hardwood forests, particularly in low areas.

Table 1 (Cont.)

Regional Forester Sensitive Species Occurrence and Habitat Availability on the Federal and Non-Federal Lands

RFSS Species		Species and Habitat Occurrence				Habitat Characteristics
Scientific Name	Common Name	Known Species Occurrence on/near Federal Lands	Potential Habitat Present on/near Federal Lands	Known Species Occurrence on/near Non-federal Lands	Potential Habitat Present on/near Non-federal Lands	
<i>Botrychium lunaria</i>	Common Moonwort	No	Yes	No	Yes	Prefers open habitats such as gravelly banks, rocky ledges, and talus. It has also been found in open, sparsely vegetated habitats with grasses and scattered shrubs, and open habitats such as old log landings, sawmill sites, and building sites.
<i>Botrychium michiganense</i> (<i>hesperium</i>)	Michigan Moonwort	Yes	Yes	No	Yes	Open habitats such as old log landings, old dirt roads, gravel pits, powerline corridors, borrow pits, beach ridges, old fields, trails, and dredge spoil dumps.
<i>Botrychium mormo</i>	Little Goblin Moonwort	No	No	No	No	Occurs in mature mesic hardwood forests where the dominant trees are sugar maple with lesser amounts of northern white cedar; canopy must be intact to maintain shaded and moist conditions.
<i>Botrychium pallidum</i>	Pale Moonwort	Yes	Yes	No	Yes	Full to shady exposure and edge of alder thickets.
<i>Botrychium rugulosum</i>	Ternate (St. Lawrence) Grapefern	Yes	Yes	No	Yes	Disturbed habitats, fields, open woods, and forests.
<i>Botrychium simplex</i>	Least Moonwort	Yes	Yes	No	Yes	Full to shady exposure at edge of alder thickets and along forest roads.
<i>Caltha natans</i>	Floating Marsh Marigold	Yes	Yes	No	Yes	Shallow water in ditches and streams, alder swamps, shallow marshes, and beaver ponds

Table 1 (Cont.)
Regional Forester Sensitive Species Occurrence and Habitat Availability on the Federal and Non-Federal Lands

RFSS Species		Species and Habitat Occurrence				Habitat Characteristics
Scientific Name	Common Name	Known Species Occurrence on/near Federal Lands	Potential Habitat Present on/near Federal Lands	Known Species Occurrence on/near Non-federal Lands	Potential Habitat Present on/near Non-federal Lands	
<i>Calypso bulbosa</i>	Fairy Slipper	No	Yes	No	Yes	Hummocks in northern white cedar swamps, moist to wet lowland coniferous swamps, and to lesser extent in upland coniferous forests.
<i>Carex novae-angliae</i>	New England Sedge	No	Yes	No	Yes	Moist woods with sugar maple, also with yellow birch, trembling aspen, white spruce dominated forest, and tall shrubs.
<i>Carex rossii</i>	Short Sedge	No	No	No	No	Rocky summits, dry exposed cliff faces, and rocky slopes, in east Border Lakes subsection.
<i>Crataegus douglasii</i>	Douglas' Hawthorn	No	No	No	No	North Shore of Lake Superior rocky and gravelly streambeds/banks and open areas, and rocky borders of woods.
<i>Cypripedium arietinum</i>	Ram's head Lady Slipper	No	Yes	No	Yes	Wide variety of forests, both upland and lowland, but in Minnesota predominantly in northern white cedar swamps; also in forests dominated by jack pine, red pine, or white pine.
<i>Drosera linearis</i>	Linear-leaved Sundew	No	Yes	No	Yes	One of a small group of rare plant species that are restricted to high-quality, undisturbed examples of a peatland type called patterned fens.
<i>Eleocharis nitida</i>	Quill Spikerush	Yes	Yes	No	Yes	Full exposure and moist ditches.
<i>Huperzia appalachiana</i>	Appalachian Clubmoss	No	No	No	Yes	Shelves and crevices on cliff/talus/rock outcrops, and shrub-dominated talus piles.

Table 1 (Cont.)

Regional Forester Sensitive Species Occurrence and Habitat Availability on the Federal and Non-Federal Lands

RFSS Species		Species and Habitat Occurrence				Habitat Characteristics
Scientific Name	Common Name	Known Species Occurrence on/near Federal Lands	Potential Habitat Present on/near Federal Lands	Known Species Occurrence on/near Non-federal Lands	Potential Habitat Present on/near Non-federal Lands	
<i>Juncus stygius</i>	Moor Rush	Yes	Yes	No	Yes	Open-patterned peatlands, rich and poor fens, and northern black spruce bogs.
<i>Juncus subtilis</i>	Creeping Rush	No	No	No	No	Sandy lakeshore; only known occurrence is in the Boundary Waters Canoe Area Wilderness (BWCAW).
<i>Listera auriculata</i>	Auricled Twayblade	No	Yes	No	Yes	On alluvial or lake-deposited sands or gravels, with occasional seasonal flooding; associated with riparian alder or black spruce/balsam fir forest.
<i>Littorella uniflora</i> (= <i>L. americana</i>)	American Shoreweed	No	Yes	No	Yes	Shallow margins of nutrient-poor lakes and seepage lakes; sandy substrates and may have fine gravel/organic soil; fluctuating water level up to about 3 feet.
<i>Moehringia macrophylla</i>	Largeleaf Sandwort	No	No	No	Yes	Cliffs/rock outcrops, talus, and conifer sites on shallow soils; pine plantation with rocky outcrops; usually semi-open shrub or tree canopy.
<i>Muhlenbergia uniflora</i>	Bog Muhly	No	Yes	No	Yes	Wet sandy beaches and floating peat mats.
<i>Nymphaea leibergii</i>	Leiberg's Water-lily	No	Yes	No	Yes	Slow moving streams, rivers, and beaver impoundments 3 to 6 feet deep; occurs at outer margin of emergent vegetation.
<i>Osmorhiza berteroi</i>	Chilean Sweet-cicely	No	No	No	No	Northern hardwood forest dominated by sugar maple on North Shore of Lake Superior.

Table 1 (Cont.)
Regional Forester Sensitive Species Occurrence and Habitat Availability on the Federal and Non-Federal Lands

RFSS Species		Species and Habitat Occurrence				Habitat Characteristics
Scientific Name	Common Name	Known Species Occurrence on/near Federal Lands	Potential Habitat Present on/near Federal Lands	Known Species Occurrence on/near Non-federal Lands	Potential Habitat Present on/near Non-federal Lands	
<i>Oxytropis borealis</i> var. <i>viscida</i>	Sticky Locoweed	No	No	No	Yes	Slate cliffs and talus slopes in east Border Lakes subsection; arctic/alpine disjunct.
<i>Piptatherum</i> (= <i>Oryzopsis</i>) <i>canadense</i>	Canada Ricegrass	No	Yes	No	Yes	Sandy/gravelly soil; red pine and jack pine plantations; borders, edges, trailsides, and openings.
<i>Polemonium occidentale</i> ssp. <i>lacustre</i>	Western Jacob's-ladder	No	Yes	No	Yes	Primarily northern white cedar swamps, but also mixed conifer swamps; thrives in openings.
<i>Polystichum braunii</i>	Braun's Holly Fern	No	No	No	Yes	Cool, shady cliffs and slopes in northern hardwoods in North Shore Highlands subsection.
<i>Potamogeton oakesianus</i>	Oakes' Pondweed	No	No	No	No	Quiet, acidic waters of bogs, ponds, and lakes.
<i>Prosartes trachycarpa</i> (synonym = <i>Disporum trachycarpum</i>)	Roughfruit Fairybells	No	No	No	Yes	Semi-open jack pine forest with trembling aspen, paper birch, and shallow rocky soils in east Border Lakes subsection.
<i>Pyrola minor</i>	Snowline Wintergreen	Yes	Yes	No	Yes	Black spruce swamps and ecotone between uplands and lowland speckled alder/coniferous swamp; prefers closed canopy.
<i>Rubus chamaemorus</i>	Cloudberry	No	Yes	No	Yes	Black spruce/sphagnum forest with acidic water; Superior National Forest at southern edge of species range.
<i>Saxifraga cernua</i>	Nodding Saxifrage	No	No	No	No	Cliffs, ledges, and diabase cliffs (calcium based feldspars); arctic/alpine disjunct.

Table 1 (Cont.)

Regional Forester Sensitive Species Occurrence and Habitat Availability on the Federal and Non-Federal Lands

RFSS Species		Species and Habitat Occurrence				Habitat Characteristics
Scientific Name	Common Name	Known Species Occurrence on/near Federal Lands	Potential Habitat Present on/near Federal Lands	Known Species Occurrence on/near Non-federal Lands	Potential Habitat Present on/near Non-federal Lands	
<i>Saxifraga paniculata</i>	Encrusted Saxifrage	No	No	Yes	Yes	Cliffs, sheltered crevices, and ledges of north-facing cliffs; arctic/alpine disjunct.
<i>Subularia aquatica</i>	American Waterawlwort	No	Yes	No	Yes	Beach zone of sandy nutrient-poor lakes and shallow lake margins; submerged, emerged, or stranded; water depth of 6 to 24 inches, but can occur in deeper water.
<i>Taxus canadensis</i>	Canada Yew	No	Yes	No	Yes	Wide variety of uplands and lowlands, including northern white cedar/black ash swamps, talus and cliffs, northern hardwoods, and trembling aspen/paper birch forest.
<i>Tofieldia pusilla</i>	Scotch False Asphodel	No	No	No	No	Sedge mats at edges of shoreline rock pools along Lake Superior; arctic disjunct.
<i>Viola lanceolata</i>	Bog White Violet	No	Yes	No	Yes	Sandy to peaty lakeshores; borders of marshes and bogs and damp sand ditches.
<i>Waldsteinia fragarioides</i>	Barren Strawberry	No	Yes	No	Yes	Upland coniferous and deciduous forests, in recently harvested areas, established plantations, and areas with no recent harvest.
<i>Woodsia glabella</i>	Smooth Woodsia	No	No	No	No	Moist, north-facing cliffs along Lake Superior; arctic disjunct.

Table 1 (Cont.)
Regional Forester Sensitive Species Occurrence and Habitat Availability on the Federal and Non-Federal Lands

RFSS Species		Species and Habitat Occurrence				Habitat Characteristics
Scientific Name	Common Name	Known Species Occurrence on/near Federal Lands	Potential Habitat Present on/near Federal Lands	Known Species Occurrence on/near Non-federal Lands	Potential Habitat Present on/near Non-federal Lands	
Invertebrates – Bivalves						
<i>Lasmigona compressa</i>	Creek Heelsplitter	No	Yes	No	Yes	Headwaters of larger rivers. St. Louis river and tributaries and Lake of the Woods tributaries.
<i>Ligumia recta</i>	Black Sandshell	No	Yes	No	Yes	Medium to large rivers.
Invertebrates - Insects						
<i>Chilostigma itascae</i>	Headwaters Chilostigman Caddisfly	No	Yes	No	Yes	Predominantly bogs, fens, and heaths.
<i>Erebia mancinus</i>	Taiga Alpine	No	Yes	No	Yes	Shady black spruce swamp.
<i>Plebejus idas nabokovi</i>	Nabokov’s Blue	No	Yes	No	Yes	Dwarf bilberry host in open sandy jack pine areas.
<i>Pyrgus centaureae freija</i>	Freija’s Grizzled Skipper	No	Yes	No	Yes	Upland acidic meadow.
<i>Somatochlora brevicincta</i>	Quebec Emerald Dragonfly	No	Yes	No	Yes	Predominantly bogs, fens, and heaths.
<i>Williamsonia fletcheri</i>	Ebony Boghaunter	No	Yes	No	Yes	Predominantly bogs, fens, and heaths.
Fish						
<i>Acipenser fulvescens</i>	Lake Sturgeon	No	No	No	No	Large lakes and rivers in the Hudson Bay drainage of Superior National Forest.
<i>Coregonus nipigon</i>	Nipigon Cisco	No	No	No	No	Known distribution restricted to Saganaga Lake in northeastern Minnesota and southern Ontario.
<i>Coregonus zenithicus</i>	Shortjaw Cisco	No	No	No	No	Lake Superior, Saganaga, and Gunflint Lakes, possibly others.

Table 1 (Cont.)

Regional Forester Sensitive Species Occurrence and Habitat Availability on the Federal and Non-Federal Lands

RFSS Species		Species and Habitat Occurrence				Habitat Characteristics
Scientific Name	Common Name	Known Species Occurrence on/near Federal Lands	Potential Habitat Present on/near Federal Lands	Known Species Occurrence on/near Non-federal Lands	Potential Habitat Present on/near Non-federal Lands	
<i>Ichthyomyzon fossor</i>	Northern Brook Lamprey	No	Yes	No	Yes	Warm, medium-sized, low-gradient streams with sections of higher gradient reaches suitable for spawning; requires organically enriched and sandy substrate until metamorphosis.
Reptiles						
<i>Glyptemys insculpta</i>	Wood Turtle	No	Yes	No	Yes	Upland and lowland habitats with suitable shade and insects for forage; riparian habitats with open sandy areas for nesting.
Birds						
<i>Accipiter gentilis</i>	Northern Goshawk	Yes	Yes	Yes	Yes	Large patch of older trees with closed canopy and open understory.
<i>Aegolius funereus</i>	Boreal Owl	Yes	Yes	No	Yes	Secondary cavity nester; old boreal forest (including trembling aspen) next to lowland conifer foraging areas.
<i>Contopus cooperi</i>	Olive-sided Flycatcher	No	Yes	No	Yes	Snags, low density conifer lowlands, and riverine/riparian areas.
<i>Dendroica castanea</i>	Bay-breasted Warbler	No	Yes	No	Yes	Mature upland and lowland black spruce and balsam fir forests.
<i>Haliaeetus leucocephalus</i>	Bald Eagle	Yes	Yes	No	Yes	Large lakes and rivers with large trees for nesting and roosting.
<i>Oporornis agilis</i>	Connecticut Warbler	No	Yes	No	Yes	Jack pine or lowland conifer with a thick ericaceous understory.
<i>Picoides tridactylus</i>	Three-toed Woodpecker	Yes	Yes	No	Yes	Coniferous forests with snags.

Table 1 (Cont.)
Regional Forester Sensitive Species Occurrence and Habitat Availability on the Federal and Non-Federal Lands

RFSS Species		Species and Habitat Occurrence				Habitat Characteristics
Scientific Name	Common Name	Known Species Occurrence on/near Federal Lands	Potential Habitat Present on/near Federal Lands	Known Species Occurrence on/near Non-federal Lands	Potential Habitat Present on/near Non-federal Lands	
<i>Strix nebulosa</i>	Great Gray Owl	Yes	Yes	No	Yes	Nesting habitat of mature trees on wet soil with greater than 60% canopy cover near open foraging areas.
Mammals						
<i>Canis lupus</i>	Gray Wolf	Yes	Yes	Yes	Yes	Variety of open and wooded habitats.
<i>Myotis lucifugus</i>	Little Brown Myotis	Yes	Yes	Potential	Yes	Forest habitats and buildings, attics, and other man-made structures.
<i>Myotis septentrionalis</i>	Northern long-eared Bat	Yes	Yes	Potential	Yes	Found in most caves and mines surveyed in Minnesota, although typically in low numbers.
<i>Perimyotis subflavus</i>	Tri-colored Bat	No	Yes	Potential	Yes`	Hibernate in caves, mines, and tunnels during winter, roost in trees during summer. Maternity colonies found in trees, rock crevices, and barns or other buildings.
<i>Phenacomys ungava</i>	Eastern Heather Vole	No	Yes	No	Yes	Forest, brushland, or clearcuts with bilberry and rocks.

2.0 Description of the Proposed Action and Alternatives

2.1 Proposed Action (Alternative A)

2.1.1 Overview

The USACE and the USFS have separate proposed actions on which consultation is occurring. The USACE has an application under the Clean Water Act to impact wetlands and other waters of the U.S. associated with the construction and operation of the NorthMet mine. The USFS is evaluating a land exchange of federal and non-federal lands. For convenience, the impacts are described in terms of the Project and its associated activities.

PolyMet proposes to construct an open pit mine in northern Minnesota to extract low- to medium-quality copper-nickel-PGE minerals with low sulfide content. This Project is located in Sections 5, 6, 8, 9, 13, 14, 15, 16, 17, 23, and 24, Township 58 North, Range 14 West; Sections 1, 2, 3, 4, 9, 10, 11, 12, 15, 16, 17, and 18, Township 59 North, Range 13 West; Sections 3, 4, 5, 8, 9, 10, 11, 13, 14, 15, 16, 17, 20, 23, 24, 29, and 32, Township 59 North, Range 14 West; and Sections 32, 33, and 34, Township 60 North, Range 14 West, in St. Louis County on the eastern end of the Mesabi Iron Range, about 60 miles north of the City of Duluth, and 6 miles south of the City of Babbitt, Minnesota (**Figure 1**).

This section describes specific Project features that could have potential effects on RFSS and their habitats. Additional Project features that are not relevant to potential effects on RFSS and their habitats are listed in this section, but are not described in detail. Full Project details are available in the FEIS (MDNR et. al. 2015).

Ore would be excavated at the Mine Site and hauled by railroad approximately 8 miles west to the Plant Site for processing. Corridors for roads, railroad, utilities, and water pipelines would connect the Mine Site and the Plant Site. The four Project areas are shown on **Figure 1** and include:

- Mine Site
- Plant Site
- Dunka Road and Utility Corridor
- Railroad Connection Corridor

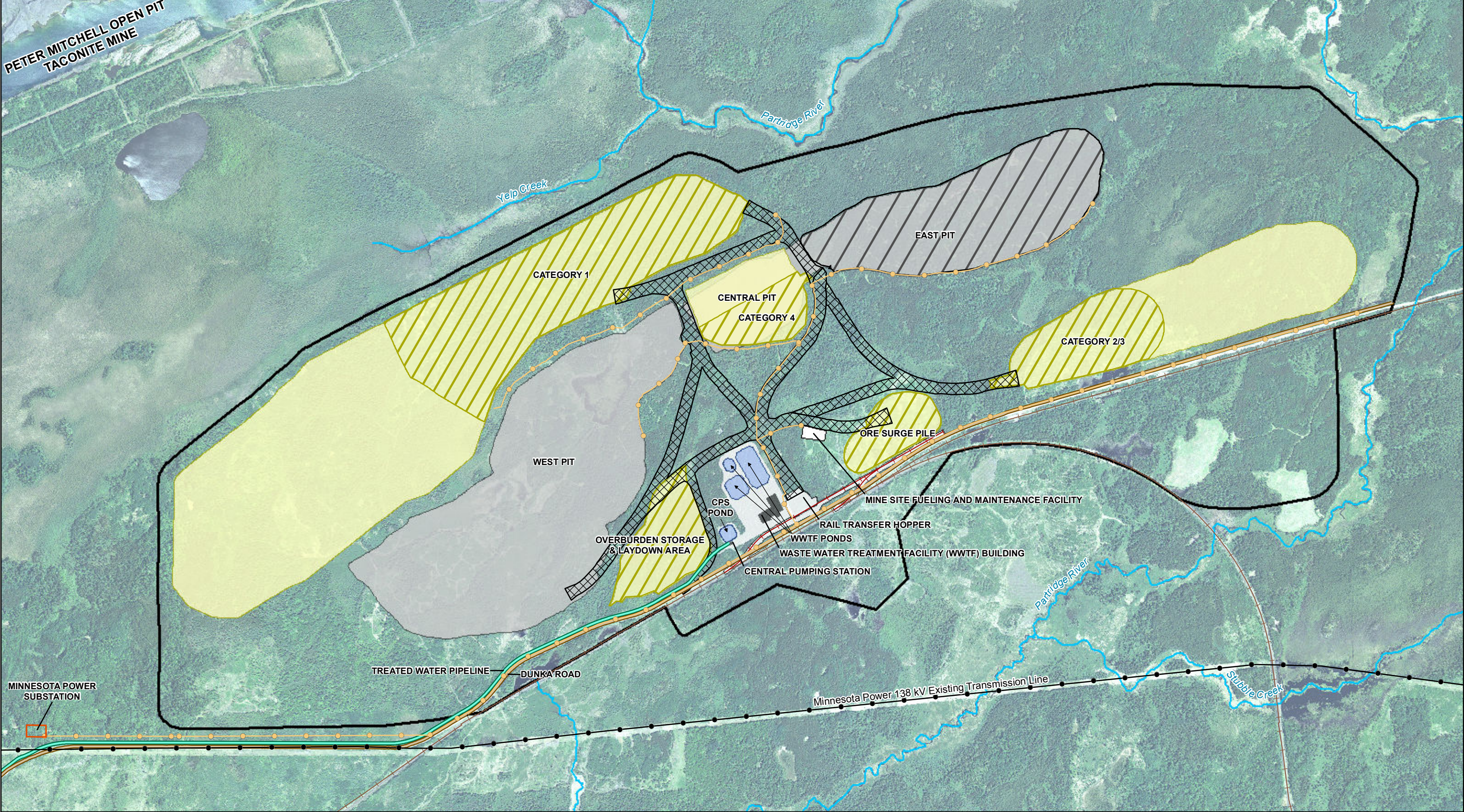
2.1.2 Mine Site

The Mine Site, approximately 3,015 acres, would be developed at a greenfield site that has previous disturbance from logging and mining exploration activities. The Project would develop open mine pits (up to 528 acres), stockpiles (up to 794 acres), and supporting infrastructure (up to 397 acres). The location and dimensions of Mine Site features are shown on **Figure 4**. The Project features at the Mine Site would include:

- mine pits;
- ore storage and handling facilities, including an Ore Surge Pile and a Rail Transfer Hopper;

DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

- stockpiles for overburden and waste rock with engineered systems to manage potential water resource impacts (such as liners, covers, and the Category 1 Waste Rock Stockpile Groundwater Containment System);



Mine Site	Haul Roads
Year 1 Mine Pits	Treated Water Pipeline
Year 11 Mine Pits	Dunka Road
Year 1 Stockpiles	Existing Private Railroad
Year 11 Stockpiles	Proposed Railroad Track

Figure 4
Mine Site Plan
Biological Evaluation for the NorthMet Project and Land Exchange
St. Louis County, Minnesota

DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

- a Waste Water Treatment Facility and process water collection systems to collect and treat water from the mine pits, waste rock stockpiles, ore handling facilities, and haul roads;
- a Central Pumping Station and Treated Water Pipeline to transport water from the Mine Site to the Plant Site; and
- supporting infrastructure (such as roads, electrical supply, rail connections, and fueling and maintenance facilities).

2.1.2.1 Pre-production Mine Development

Mine Site infrastructure would be constructed during the estimated 12 to 18 months of pre-production mine development. Pre-production mine development would be followed by a gradual ramp-up of ore output over 6 to 12 months. The following Project features would be constructed during pre-production mine development:

- Roads - site access roads, haul roads, and Dunka Road upgrades.
- Railroad infrastructure - the Rail Transfer Hopper, the rail spur connecting the Rail Transfer Hopper with Cliffs Erie railroad track, and the rail spur between the Cliffs Erie railroad track and PolyMet railroad track that serves the Coarse Crusher Building.
- Surface water management features - dikes ditches, water collection ponds, and sumps.
- Overburden Storage and Laydown Area.
- Stockpile liners and containment systems.
- Waste Water Treatment Facility, Treated Water Pipeline, and Central Pumping Station.
- Substation drop from the 138 kilovolt (kV) Minnesota Power transmission line and a 13.8 kV Mine Site power distribution system.
- Mine Site Fueling and Maintenance Facility.

2.1.2.2 Mining Activities

PolyMet expects to mine a total of 533 million tons of waste rock and ore over 20 years, which would include 225 million tons of ore and 308 million tons of waste rock. Mining activities include overburden removal, open pit mining, drilling and blasting, excavation and haulage, ore storage and loading for transport to the Process Plant, waste rock stockpiling, and mine site water management.

Overburden Removal

The marketable timber would be cleared and the overburden removed from the footprints of the mine pits, the Ore Surge Pile, and the waste rock stockpiles, as necessary. Overburden has been defined for this Project as the material that lies on top of the underlying bedrock.

Overburden would be stripped incrementally as needed for mine development in order to minimize the amount of bedrock exposed at any one time. After removal of overburden from the initial mining area, additional overburden stripping could take place concurrently with the mining of ore and waste rock. Approximately 32% of the required overburden stripping for the pit development would be done in the first 2 years of mine operation. All of the overburden that needs to be stripped from the pits would be removed by the end of Mine Year 11.

Open Pit Mining

The Project would use open pit mining methods similar to those used at ferrous metallic mining operations on the Iron Range. The mine would consist of three separate open pits known as the East, Central, and West pits. For approximately the first 10 years of operations, mining would take place in the East and West pits simultaneously, with the East Pit mining ending in Mine Year 11. The Central Pit mining would occur between Mine Years 11 and 16. During Central Pit mining, the East and Central pits would converge into one pit which would then be referred to as the East Pit.

At its maximum size, each pit is projected to have the approximate maximum area and depth shown in **Table 2**.

Table 2
Maximum Pit Dimensions

Mine Pit	Area (acres)	Maximum Depth (feet below ground surface)
East	155	696
Central	52	356
West	321	630

Drilling and blasting would be conducted to remove waste rock and extract ore. Two conventional electric or diesel powered rotary drilling rigs would be used. Blasting of ore and waste rock is anticipated to take place approximately every 2 to 3 days.

After being drilled and blasted, the ore would be loaded by excavators into haul trucks that would haul the ore to the Rail Transfer Hopper or to the Ore Surge Pile for temporary storage, and haul the waste rock to the stockpiles or the East Pit. Up to nine haul trucks would be in service with a maximum speed of 34 miles per hour loaded, however their speed would typically be lower.

Mining operations would be supported by mine auxiliary vehicles (in other words [e.g.], water trucks, dozers, graders) traveling on access and haul roads within the Mine Site.

Ore Storage and Loading

Ore would be loaded for transport to the Plant Site at the Rail Transfer Hopper. The Rail Transfer Hopper would consist of a raised platform from which haul trucks dump into a hopper over a pan feeder into rail cars. The Rail Transfer Hopper would be located to the south of the mine pits and would be connected to the existing Cliffs Erie main line track by a new spur line (**Figure 4**).

An Ore Surge Pile would be constructed adjacent to the Rail Transfer Hopper to allow for temporary storage of ore until it could fit into the processing schedule or as required by operational delays. Drainage from the Ore

DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

Surge Pile would be collected on a liner and routed to a sump for pumping to the Waste Water Treatment Facility.

Stockpiling

Waste rock and overburden would be managed according to its geochemical properties as determined using a sampling and analysis program approved by the MDNR. PolyMet has categorized waste rock into four categories defined according to its sulfur content, in ascending order of reactivity. These waste rock categories are summarized in **Table 3**.

The Category 1 Waste Rock Stockpile would be the only permanent stockpile for the Project. During Mine Years 1 through 11, Category 2, 3 and 4 waste rock would be placed on the temporary Category 2/3 or Category 4 Waste Rock Stockpiles (**Figure 4**). When at its maximum size, each stockpile is projected to have the approximate area, height, and elevation shown in **Table 4**.

Table 3
Waste Rock Properties

Waste Rock Categorization	Sulfur Content (percent)¹	Approximate Percent of Total Waste Rock Produced during Mining (percent)
Category 1	≤ 0.12	70
Category 2	> 0.12 to ≤ 0.31	24
Category 3	> 0.31 to ≤ 0.60	3
Category 4	> 0.6	3

¹In general, the higher the rock's sulfur content, the higher it's potential for generating acid rock drainage or leaching heavy metals.

Table 4
Maximum Stockpile Dimensions - Approximate

Stockpile	Mine Year of Maximum Footprint	Maximum Footprint (acres)	Maximum Height (feet)	Maximum Elevation (feet above sea level)
Category 1 waste rock	6/21 ¹	508/526 ¹	280	1,880
Category 2/3 waste rock	6	180	200	1,770
Category 4 waste rock	3	57	180	1,790
Ore Surge Pile	NA ²	31	120	1,690

¹The Category 1 Waste Rock Stockpile has a maximum footprint of 508 acres while active. It would reach this size by Mine Year 6. The stockpile would be re-graded as part of the reclamation with a final footprint of 526 acres.

²The Ore Surge Pile would have ore moving in and out as needed to meet mine and plant operations.

All waste rock stockpiles would be engineered to manage water resource impacts. The temporary Category 2/3 and Category 4 Waste Rock Stockpiles, which have the potential to generate acid rock drainage, would have liner systems to capture water passing through the stockpile. The permanent Category 1 Waste Rock Stockpile, which does not have the potential to generate acid rock drainage, would be constructed with a groundwater containment system to collect stockpile drainage from around the entire stockpile.

Progressive Reclamation

Reclamation of the East Pit and the temporary waste rock stockpiles would begin during operations. The temporary Category 2/3 and Category 4 Waste Rock Stockpiles would be relocated to the East Pit starting in Mine Year 11. The infrastructure associated with the temporary stockpiles (pipes, pumps, liners, etc.) would be removed and the footprint of each area would be reclaimed.

After the temporary stockpiles are reclaimed, all future Category 2, 3, and 4 waste rock would be placed in the East Pit. Most of the Category 1 waste rock mined after Mine Year 12 would also be placed in the East Pit. Ultimately, approximately 45% of the total waste rock mined would be backfilled to the East Pit.

The East Pit would be flooded to keep the waste rock in a subaqueous environment to reduce the environmental impact associated with further oxidation and dissolution of sulfide minerals. If natural inflow of water into the East Pit is insufficient to keep the waste rock submerged, water could be pumped from the Waste Water Treatment Facility. During periods of high precipitation or during spring snowmelt, dewatering (to the Waste Water Treatment Facility and ultimately to the Flotation Tailings Basin) may be required to allow safe placement of the waste rock.

Reclamation of the Category 1 Waste Rock Stockpile would also begin during operations. A cover system would be added incrementally after Mine Year 13 to limit infiltration through the stockpile. The stockpile would be sloped and graded, an engineered geomembrane system would be installed, soil would be placed on top of the cover, and vegetation would be planted to meet the requirements of Minnesota Rules, part 6132.2200, subpart 2, item B. The cover system would be designed to promote runoff with minimal erosion.

Mine Site Water Management

This section summarizes information from the Water Management Plan - Mine, which would become part of the MDNR Permit to Mine and Water Appropriations permits and Minnesota Pollution Control Agency (MPCA) National Pollutant Discharge Elimination System/State Disposal System permit. These plans include water management system designs, operating and maintenance plans, water quality monitoring plans, reporting requirements, and adaptive management approach.

In addition to the stockpile liners, the stockpile cover, and the groundwater containment system, water management at the Mine Site would include pit dewatering, stormwater dikes and ditches, and the Waste Water Treatment Facility that would treat water that comes in contact with mining features. During operations, there would be no direct discharge of treated waste water to public waters.

It would be necessary to dewater the pits during mining to remove groundwater flow and precipitation runoff. These waters would be directed to low areas in the pits where it would be collected in sumps and pumped to the Waste Water Treatment Facility.

Non-contact stormwater, the result of precipitation that falls on natural or reclaimed vegetated surfaces, would be routed through sedimentation ponds prior to discharge to a small watercourse that flows to the Partridge River. A system of dikes and ditches constructed at the Mine Site perimeter would minimize the amount of surface water flowing onto the site and into the mine pits, manage the amount of water that comes into contact with mining features, and control non-contact stormwater flowing off the site.

During operations, the Waste Water Treatment Facility would treat water that comes into contact with the waste rock stockpiles, haul roads, Ore Surge Pile, and mine pits. For the first approximately 10 years, all Waste Water Treatment Facility effluent would be pumped to the Plant Site Flotation Tailings Basin Pond for reuse in the beneficiation process. Reuse of the Mine Site process water at the Plant Site would eliminate the need to discharge any process water to surface waters during operations. Starting in Mine Year 11, some Waste Water Treatment Facility effluent would be sent to the East Pit to augment flooding as the pit is backfilled, with the remainder of the effluent continuing to go to the Flotation Tailings Basin. The purpose of the Waste Water Treatment Facility is to maintain water quality in the Flotation Tailings Basin pond at concentrations that do not have an adverse impact on Beneficiation Plant operations or future reclamation of the Flotation Tailings Basin.

Mine Site water would be managed in accordance with a future MPCA National Pollutant Discharge Elimination System/State Disposal System permit, which would include a Stormwater Pollution Prevention Plan. The Stormwater Pollution Prevention Plan would identify and describe Best Management Practices for the Mine Site to minimize the discharge of potential pollutants in stormwater runoff.

2.1.2.3 Fueling and Maintenance Facilities

The Mine Site Fueling and Maintenance Facility would consist of two buildings, one for fueling mobile equipment, and one for minor service and repair of mobile equipment. Major scheduled maintenance and repair work lasting several days on most mobile equipment would be done in the refurbished and reactivated former LTVSMC Area 1 Shop. Stationary or slow-moving equipment such as excavators, dozers, drill rigs, and light plants would be fueled in the field using mobile fuel tankers.

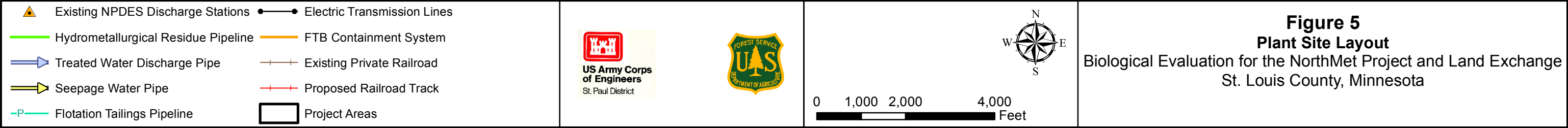
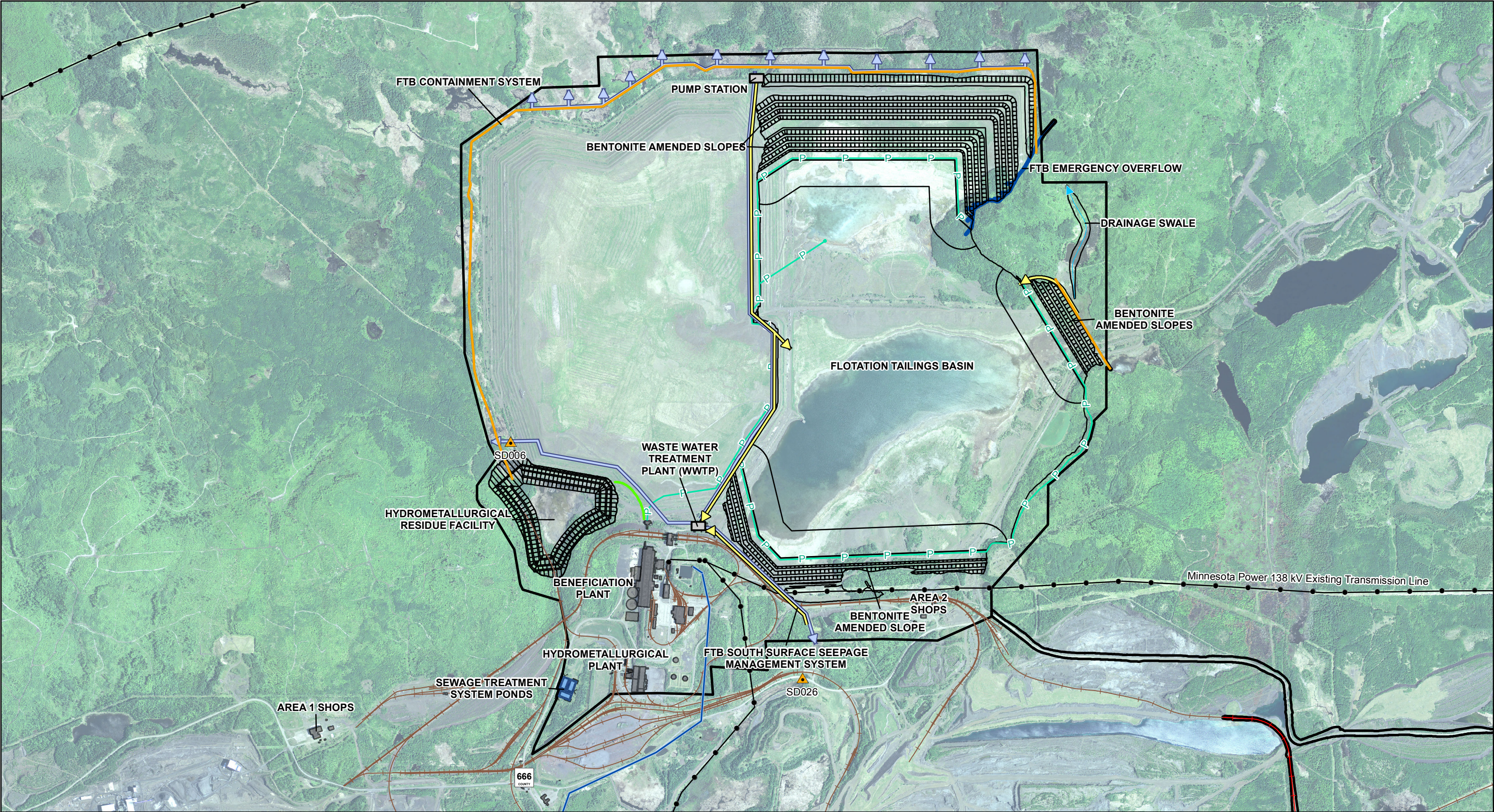
The former LTVSMC Area 2 Shop, about 1 mile east of the Process Plant, would be reactivated to provide office space for mining and railroad operations supervision and management, as well as clothes changing facilities, toilets, lunch rooms, first aid facility, emergency response center, and training and meeting rooms for mining and railroad crews. The Area 2 Shop facilities would include a Locomotive Fueling Station, Locomotive Service Building, and Mine Reporting Building.

2.1.3 Plant Site

The Plant Site was previously used as a taconite processing facility by the LTVSMC. The location and dimensions of Plant Site features are shown on **Figure 5**.

At the Plant Site, the Project would upgrade existing facilities (Beneficiation Plant, Tailings Basin, Area 1 Shop, sewage collection system, rail connections, access roads) and construct new facilities (Hydrometallurgical Plant, Hydrometallurgical Residue Facility, Concentrate Dewatering/Storage Building, Sewage Treatment System Ponds, and Waste Water Treatment Plant) within an existing brownfield facility. The Flotation Tailings would be stored atop the existing LTVSMC Tailings Basin by staged construction of new dams. The Plant Site also includes supporting infrastructure (e.g., roads, electrical supply, rail connections, Area 1 Shop, and Area 2 Shop).

Plant Site environmental controls would include: cover systems to limit infiltration of oxygen and water through the Flotation Tailings Basin dams, beaches, and pond bottom, and seepage capture systems to collect seepage from the Flotation Tailings Basin. Most water used in processing would be recycled for use. A Waste Water Treatment Plant would be constructed, including reverse osmosis or similar membrane separation technology, to treat any water that could not be recycled prior to discharge to the environment. If makeup water is needed for



processing, it may be provided via the Colby Lake Water Pipeline. No new construction is required for the Colby Lake Water Pipeline.

2.1.3.1 Ore Processing

A Beneficiation Plant and Hydrometallurgical Plant would process the ore at the Plant Site to recover base metals, gold, and platinum group metals. The purpose of the beneficiation process would be to produce final separate concentrates. One of the separate concentrates would be a copper concentrate. The other separate concentrates would be differing grades of nickel concentrate. The concentrates could be shipped to customers, used as a feedstock to the hydrometallurgical process, or divided for both uses. PolyMet expects that the Beneficiation Plant would be operational several years before the Hydrometallurgical Plant and during that period all concentrates would be shipped to customers. Once the Hydrometallurgical Plant becomes operational, some or all of the nickel concentrates would be feedstock to the hydrometallurgical process. The decision to ship or process concentrates would be based on equipment maintenance schedules, customer requirements, and overall Project economics.

Beneficiation Plant

The Beneficiation Plant processes would include ore crushing, grinding, flotation, dewatering, storage, and shipping. Crushing and grinding would occur in the existing Coarse Crusher Building, Fine Crusher Building, and Concentrator Building. Flotation would occur in a new Flotation Building located on previously disturbed ground immediately to the west of the Concentrator Building. Dewatering, storage, and shipping would occur in a new Concentrate Dewatering/Storage Building located on previously disturbed ground.

Hydrometallurgical Plant

Hydrometallurgical processing technology would be used for the treatment of nickel concentrates. This process would involve high pressure and temperature autoclave leaching followed by solution purification steps to extract and isolate platinum group metals, precious metals, and base metals. All equipment used in the hydrometallurgical process would be located in a new Hydrometallurgical Plant Building. Should spillage of process fluids occur, it would remain within the Hydrometallurgical Plant Building and be returned to the appropriate process streams.

Plant Site Infrastructure

Plant Site infrastructure that exists at this site includes:

- County Road 666 ends at the Main Gate for the industrial area that includes the Process Plant, Area 1 Shop, and Area 2 Shop.
- The Canadian National Railroad serves the industrial area that would include the Process Plant. The PolyMet railroad would connect to the Area 1 Shop and the Area 2 Shop.
- Three Minnesota Power Company 138 kV transmission lines serve the Project substation.

- The existing mechanical Sewage Treatment Plant would be replaced with new Sewage Treatment System Ponds, and the existing sewage collection system would be upgraded to meet current construction and performance standards and sized as appropriate.
- The Process Plant potable water treatment plant located near the Plant Reservoir would be refurbished and reactivated. The potable water distribution system extends to the Area 1 Shop and Area 2 Shop. This water would be used for showers and sinks and would be treated (chlorinated) to be drinkable. However, bottled water would be brought in for drinking as well.
- Area 1 Shop and Area 2 Shop.

2.1.3.2 Flotation Tailings Basin

Flotation Tailings from the flotation process at the Beneficiation Plant would be pumped to the Flotation Tailings Basin, which would be constructed on top of cells 1E and 2E of the existing LTVSMC Tailings Basin. Treated water from the Waste Water Treatment Facility would also be pumped to the Flotation Tailings Basin, enabling it to serve as the primary collection and distribution point for water used in the beneficiation process.

The existing LTVSMC Tailings Basin is unlined and was constructed in stages beginning in the 1950s. It has been inactive since January 2001, except for reclamation activities consistent with a MDNR-approved Closure Plan currently managed by Cliffs Erie.

The future Flotation Tailings Basin perimeter dams would be raised using upstream construction methods. The dams would be constructed using compacted LTVSMC tailings borrowed from the existing Tailings Basin. Once the LTVSMC tailings supply has been completely used for dam construction, offsite borrow from MDNR-approved sources would be utilized. Material from LTVSMC Area 5 would be a likely source, but other sources could also be considered.

Emergency overflow channels would be provided to protect the dams in the unlikely event that freeboard within the Flotation Tailings Basin is not sufficient to contain all water from an extreme storm event. Even though there is a low likelihood of overflow, it is standard practice in dam design to accommodate overflows in a manner that protects the integrity of the dams.

Seepage from the Flotation Tailings Basin would be collected by the Flotation Tailings Basin Containment System located around the northern, western, and portions of the eastern sides of the Tailings Basin and the Flotation Tailings Basin South Surface Seepage Management System located south of Tailings Basin Cell 1E. These two systems are collectively referred to as the Flotation Tailings Basin Seepage Capture Systems. The Flotation Tailings Basin Containment System would include a low permeability cutoff wall so that it can collect seepage (from up-gradient), but avoid drawing in water from down-gradient wetlands.

2.1.3.3 Hydrometallurgical Residue Facility

The Hydrometallurgical Residue Facility would be constructed to manage residues generated by the hydrometallurgical process. The Hydrometallurgical Residue Facility would consist of a one-lined cell located adjacent to the southwest corner of Tailings Basin, on previously disturbed ground (**Figure 5**).

The Hydrometallurgical Residue Facility liner system would be a double liner system consisting of two barrier layers separated by a leakage collection layer. This system would substantially remove all hydraulic head from the lower liner, virtually eliminating leakage from the Hydrometallurgical Residue Facility.

Residue from the Hydrometallurgical Plant would be pumped to the Hydrometallurgical Residue Facility as slurry. A pond would be maintained within the Hydrometallurgical Residue Facility so that the solids in the slurry would settle out. Most of the liquid would be recovered by a pump system and returned to the plant for reuse.

2.1.3.4 Plant Site Water Management

This section summarizes information from the Water Management Plan - Plant, which is a support document for the MDNR Permit to Mine and Water Appropriations permits and MPCA National Pollutant Discharge Elimination System/State Disposal System permit. These plans include water management system designs, operating and maintenance plans, preliminary water quality monitoring plans, preliminary reporting requirements, and adaptive management approach. Final water quality monitoring and reporting requirements would be determined in the permits.

Water management features at the Plant Site would include the Flotation Tailings Basin and seepage capture systems, Hydrometallurgical Residue Facility, stormwater dikes and ditches, drainage swale, Waste Water Treatment Plant, and stream augmentation. With the exception of the Flotation Tailings Basin seepage containment system, all Plant Site water management features would be located on previously disturbed areas.

Waste Water Treatment Plant

The Waste Water Treatment Plant would treat any water collected by the Flotation Tailings Basin seepage capture systems that cannot be reused as process water. It would include a reverse osmosis unit or similar membrane separation technology designed to achieve an effluent sulfate concentration that meets the sulfate standard for waters used for the production of wild rice (10 milligrams per liter (mg/L)). Water would be treated to meet appropriate discharge limits, then discharged along the west, northwest, and north perimeter of the Flotation Tailings Basin, beyond the Flotation Tailings Basin Containment System, and to Second Creek at the south end of the Flotation Tailings Basin to replenish the flow to the surrounding wetlands and streams. This discharge strategy would limit the potential for indirect wetland impacts due to reduced seepage from the Tailings Basin to the wetlands.

Stream Augmentation

Construction of the Flotation Tailings Basin Containment System would reduce the amount of seepage that is currently leaving the existing Tailings Basin. Consequently, the stream flow in the four tributaries around the Tailings Basin (Unnamed Creek, Second Creek, Trimble Creek, and Mud Lake Creek) would be reduced from current levels. Flow to Unnamed Creek, Second Creek, and Trimble Creek would be augmented by treated water from the Waste Water Treatment Plant. Flow to Mud Lake Creek would be augmented by construction of a drainage swale east of the Flotation Tailings Basin.

2.1.4 Transportation and Utility Corridors

The remaining Project components are linear corridor features, including the following:

- Dunka Road and Utility Corridor
- Railroad Connection Corridor
-

This section describes Project features in the Transportation and Utility Corridors and presents information on the types of traffic that would result from the Project.

2.1.4.1 Dunka Road and Utility Corridor

Dunka Road is an existing, compacted-gravel, private road that extends from near the LTVSMC Plant Site to the Mine Site, then continues roughly northeast toward Babbitt, Minnesota (**Figure 6**). The portion of Dunka Road that connects the Plant Site to the Mine Site would be widened. The Treated Water Pipeline would be constructed parallel and adjacent to the Dunka Road in the Utility Corridor to transport treated water from the Mine Site to the Plant Site. The distance along Dunka Road from the Plant Site gate to the Mine Site gate is approximately 6.4 miles. Including the road segments located within the Plant Site and the Mine Site, the total distance from the ore processing area at the Plant Site to the ore loading area at the Mine Site is approximately 8.5 miles.

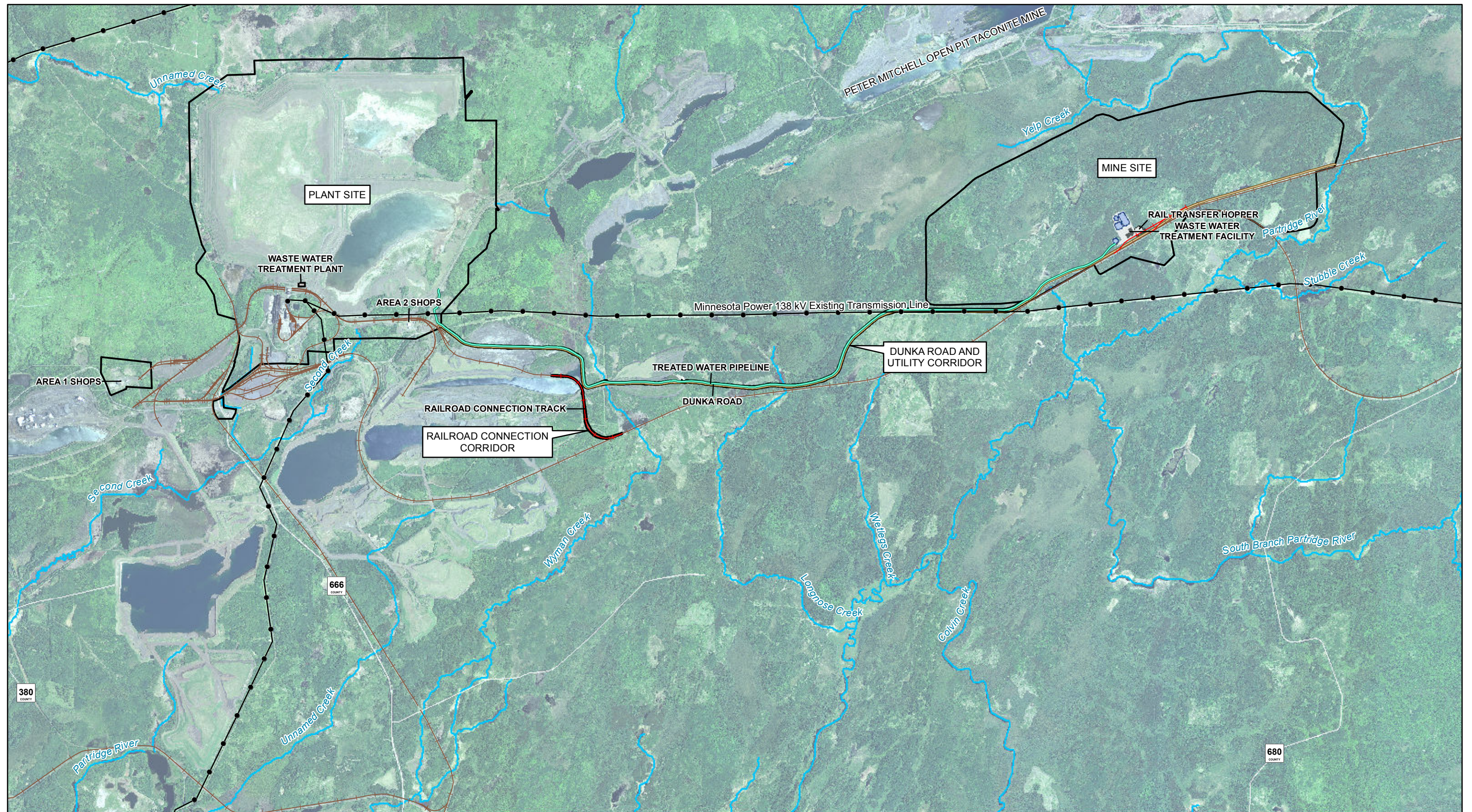
Traffic on Dunka Road would include light trucks and automobiles, sport utility vehicles (SUVs), fuel trucks, supply and waste trucks, and haul trucks needing maintenance.

- Automobiles, light trucks, or SUVs transporting employees would travel between the Area Two Shops and the Mine Site each day, at speeds of 30 to 45 miles per hour.
- Trucks carrying fuel and blasting agents would travel to the Mine Site every day, at speeds of 25 to 40 miles per hour. These trucks would travel from County Highway 666 to Dunka Road.
- Trucks transporting supplies and waste to and from the Waste Water Treatment Plant and the Waste Water Treatment facility would travel between the Plant Site and the Mine Site each day, at speeds of 25 to 40 miles per hour.
- Haul trucks would travel from the Mine Site to the Area 1 Shop for maintenance occasionally, at a maximum speed of 35 miles per hour.

2.1.4.2 Railroad Connection Corridor

The railroad route from the Mine Site to the Plant Site would be from a new spur at the Rail Transfer Hopper, to the existing track on the Cliffs Erie private railroad, to a new approximately 1.1 mile connecting railroad track between the Cliffs Erie railroad track and existing PolyMet track railroad that serves the Coarse Crusher Building at the Process Plant (**Figure 6**).

Each ore train would consist of 16 to 20 100-ton side dumping ore cars and one diesel-electric “Gen-Set” or “Multi-Engine” locomotive. Ore trains would make approximately 22 roundtrips per day delivering ore from the Mine Site to the Plant Site, traveling between 15 to 25 miles per hour.



- Dunka Road
- +— Existing Private Railroad
- +— Proposed Railroad Track
- Treated Water Pipeline
- Electric Transmission Lines
- Project Areas



0 2,250 4,500 9,000
Feet

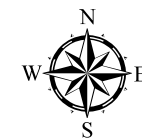


Figure 6
Transportation and Utility Corridor
 Biological Evaluation for the NorthMet Project and Land Exchange
 St. Louis County, Minnesota

To minimize the amount of ore that escapes from rail cars, ore would be loaded into the center of the car so that fines would be located at the center of the car and the larger ore pieces would be at the edge. The result would be that fines would be kept from reaching the edge of the car where they would be subject to spillage through the hinge gaps. Large pieces that extend over the edge of the rail car would be pushed into the center of the car using a rubber-tired dozer or a front-end loader. In the event that a large ore piece would fall over the top edge of the cars during transit, it would be recovered during routine track maintenance.

In order to guard against possible adverse impacts from spilled ore, monitoring and mitigation activities can be developed. It is expected that the surface water quality sampling in the two streams traversed by the rail line would be included in permit monitoring. Mitigation measures could include alterations to the stream crossings (bridges or culverts) to collect any spilled material or the physical collection of spilled ore from the top of the rail ballast.

2.1.5 Traffic

Transportation of Project consumables and products would result in traffic on public roads and commercial railroads. Public roads would also have additional traffic from employees and service providers.

2.1.5.1 Transport of Consumables and Products

Process consumables and products would be transported to and from the Plant Site by truck and by rail. This section describes the traffic on public roads and commercial railroad lines that would result from the Project.

Trucks transporting raw materials needed for the beneficiation process and the hydrometallurgical process would make approximately 80 round trips per month, entering the Plant Site from Highway 135. Trucks transporting copper and nickel concentrates would make up to approximately four round trips per day, also entering the Plant Site from Highway 135.

A locomotive, similar to the locomotives that would be hauling ore from the Mine Site to the Plant Site, would transfer loaded and empty cars carrying process consumables and concentrates to and from the interchange location with the Canadian National Railroad. Cars carrying process consumables and concentrate would meet railroad common carrier requirements.

Product shipment would require an approximately 100-car train once per month and a 30-car train 4 times per month, year-round. Process consumables would require an approximately 100-car train once per week, April through October. It is expected that outgoing PolyMet products would go by rail from the Plant Site to Virginia, Minnesota, with about half going south to Duluth, Minnesota, and the other half going north to International Falls, Minnesota. Product transport beyond Virginia is likely to be a part of the existing commercial rail traffic, with limited potential to generate additional commercial train trips. Process consumables would arrive at the Plant Site from the south from Duluth through Virginia. This movement is likely to be a part of the existing commercial rail traffic, with limited potential to generate additional commercial train trips.

2.1.5.2 Traffic from Employees and Service Providers

The Project would employ as many as 500 full-time workers over an 18-month period during peak construction period, and about 360 full-time workers during operation. There would be approximately 38 employee vehicles per day and 4 service vehicles per day entering the Main Gate (from County Road 666). In

addition, there would be approximately 113 employee vehicles per day and 36 service vehicles per day entering the North Gate (from Highway 135).

2.1.6 Project Reclamation

Mining is expected to be completed approximately 20 years after operations begin. This section summarizes information from the Reclamation Plan, which is a support document for the MDNR Permit to Mine, and focuses on those aspects of Project Reclamation that have potential effects on RFSS. Additional information on Project reclamation is available in the FEIS (MDNR et al. 2015).

In general, Project facilities have been designed and would be operated to allow for progressive reclamation, or “mining in a manner that creates areas that can be reclaimed as soon after initiation of the operation as practical and as continuously as practical throughout the life of operation” (Minnesota Rules, part 6132.0100). This would leave a smaller portion of the Project area needing to be reclaimed after closure. Project features that would be progressively reclaimed include the Waste Rock Stockpiles, the East Pit, exterior slopes of the Flotation Tailings Basin, and the Hydrometallurgical Residue Facility. The Waste Water Treatment Facility and the Waste Water Treatment Plant would remain operative during reclamation and long-term closure⁵.

2.1.6.1 Building and Structure Demolition and Equipment Removal

The buildings and structures would be removed and foundations razed. All mining, dewatering, and electrical equipment would be removed from the mine pit and scrapped, decommissioned, or sold. Debris and equipment would be removed from the Mine Site and Plant Site. Most roads, parking areas, or storage pads built to access these facilities would be demolished. Utility tunnels would be sealed and reclaimed in place. After demolition, these areas would be reclaimed and vegetated according to Minnesota Rules, part 6132.2700. All areas would be stabilized as required for stormwater management.

Demolition waste from structure removal would be disposed of in the existing on-site demolition landfill located northwest of the Area 1 Shop. Most concrete from demolition would be crushed and used for structural fill, placed in the basements of the Plant Site buildings, or placed in the existing on-site industrial landfill. Asphalt from paved surfaces would be removed and recycled or properly disposed of. Railroad track and ties that were not used by common carriers would be removed and recycled. All disturbed areas would be reclaimed and vegetated.

Any roads, including Mine Site access roads that may develop into unofficial off-road vehicle trails, would require a variance from MDNR reclamation rules to allow a 15-foot-wide unpaved, unvegetated track down the centerline of the road. Such approvals would also be coordinated with the St. Louis County Mine Inspector’s Office.

Special materials would be disposed of appropriately during reclamation:

- Any ore remaining in the Rail Transfer Hopper, the Ore Surge Pile, or anywhere else in the

⁵ “Long-term closure” is defined as being the time period when the West Pit has filled with water and the Waste Water Treatment Facility is discharging water to the outlet channel to the Upper Partridge River. This will likely occur during the post-closure maintenance period of reclamation.

vicinity of the Rail Transfer Hopper, as well as sediment removed from ditches and process water ponds, would be placed in the East Pit.

- Asbestos-containing materials would be removed intact, properly packaged, and disposed of in the on-site demolition landfill. The locations of asbestos-containing materials in the landfill would be noted on the property deed. Any asbestos-containing materials found in utility tunnels would be sealed before the utility tunnel is sealed.
- Fluorescent and sodium halide bulbs, nuclear sources, oil-stained concrete, and partially used paint, chemical, and petroleum products would be removed and recycled or properly disposed of.
- Any materials remaining in storage tanks would be sent to appropriate recycling or waste disposal facility. All storage tanks would be cleaned, disassembled, and recycled or disposed of appropriately. Tank foundations would be removed and all disturbed areas would be vegetated.
- Material remaining in the equipment and process piping would be properly disposed of in the Hydrometallurgical Residue Facility or other MPCA-approved locations.
- On-site sewer and water systems, powerlines, pipelines, and culverts would be closed according to regulatory requirements.

2.1.6.2 Reclamation of Mine Site

Mine Site reclamation would include building and structure demolition and equipment removal, mine pit reclamation, stockpile reclamation and watershed restoration. Mine Site reclamation would begin as soon as practical throughout operations, with reclamation of the East Pit and Waste Rock Stockpiles commencing before mining activities cease.

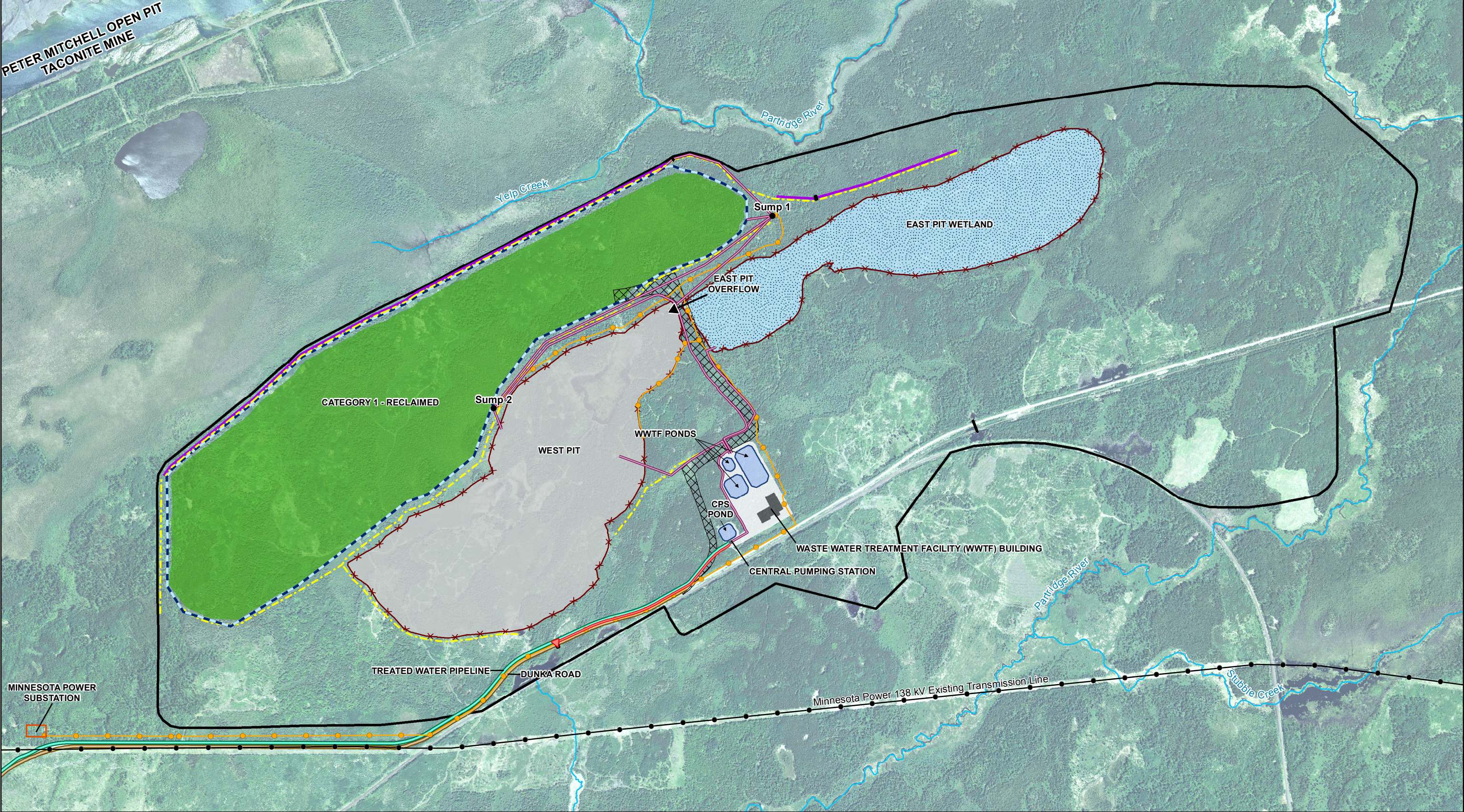
Mine Pit Reclamation

Mine pit reclamation would include pit flooding, construction of overflows and outlet control structures, sloping and vegetation of pit walls, and fencing to control access to the pits. East Pit reclamation would begin during operations, while West Pit reclamation would commence when mining activity ceases.

Mine pit dewatering systems would be removed from the pits and the pits would be allowed to flood with water. All areas disturbed during pipe removal would be graded and revegetated. Some temporary pumps may remain in the pits for dewatering that would be performed during pit flooding.

East Pit flooding would start in Mine Year 11 and be completed by Mine Year 20. Overflow from the East Pit would flow to the West Pit through a new ditch. An East Pit outlet structure would be built, which would establish the steady-state water level in the East Pit. The East Pit would be revegetated with wetland vegetation, resulting in approximately 207 acres of wetland (**Figure 7**).

Upon completion of mining operations, the West Pit would begin to flood naturally with groundwater, precipitation, and surface runoff from the tributary watershed. West Pit flooding would be accelerated with treated and untreated water from the Plant Site. With the addition of water pumped from the Plant Site to the



Mine Site	Groundwater Containment System	Culverts
Covered Stockpile	Process Water Pipe	Fence
West Pit	Stormwater Collection Ditch	
East Pit Wetland	Perimeter Dike	
Haul Roads	Discharge Pipe	

Figure 7
Mine Site Plan Long-term Closure
Biological Evaluation for the NorthMet Project and Land Exchange
St. Louis County, Minnesota

West Pit, West Pit flooding is projected to be completed between Mine Years 40 and 45. The West Pit would remain an open pit lake (MDNR et al. 2013).

When the West Pit is full, discharge would be prevented by pumping West Pit water to the Waste Water Treatment Facility for treatment. The Waste Water Treatment Facility would be upgraded to include reverse osmosis or similar membrane separation technology to achieve an effluent concentration that meets the sulfate standard for waters used for the production of wild rice (10 mg/l). After the upgrade, effluent would be discharged through Dunka Road into an existing wetland and eventually into the Partridge River through an existing tributary channel.

The overburden portions of the pit walls would be sloped, graded, and vegetated in accordance with Minnesota Rules, part 6132.2300. Lift heights would be selected based on the need to protect public safety, the location of the pit wall in relation to the surrounding land uses, the soil types and their erosion characteristics, the variability of overburden thickness, and the potential use of the pit following mining.

A pit perimeter fencing system would be installed consisting of fences, rock barricades, ditches, stockpiles, and berms. The barrier system plan would be submitted to the St. Louis County mine inspector for review and approval before installation. Safe access would be provided to the bottom of each mine pit via selected haul roads built during pit development. The access road would be selected such that, as pit water level rises, there would always be a clear path to the water surface. A gated entrance would be placed at each pit access location.

Stockpile Reclamation

Stockpile reclamation would begin during operations. Upon full reclamation of the Category 1 Waste Rock Stockpile, runoff from the top and sides of the stockpile would be classified as non-contact stormwater and discharged into the natural drainage system. The Category 1 Waste Rock Stockpile Groundwater Containment System would continue to collect drainage from the stockpile during reclamation, with drainage treated at the Waste Water Treatment Facility.

Watershed Restoration

During mining operations, stormwater runoff from reclaimed stockpile areas and natural (undisturbed) areas would be routed via dikes and ditches to stormwater sedimentation ponds. During reclamation, dikes and ditches that were no longer needed would be removed or filled and ponds would be filled. The reclaimed surfaces would then be scarified, topsoil placed on the surface, and the area revegetated with native species.

Surface runoff inflows would be routed to the mine pits using a combination of existing and new ditches. Some portions of the pit rim dikes may be left in place, if needed, to prevent an uncontrolled flow to or from the pits and potential erosion (head cutting) of the pits walls.

All stormwater ponds, the Overburden Storage and Laydown Area process water pond, haul road process water ponds, and all stockpile sumps and overflow ponds would be filled with overburden and peat (that was removed from the site during construction and stored in the Overburden Storage Area), and covered with topsoil and revegetated or converted into wetlands. If the process water ponds were converted into wetlands, any sedimentation that occurred within the pond would be evaluated to determine if removal of sediment or covering of the pond would be necessary prior to restoration. Stormwater pond outlet control structures would remain in place as necessary to manage water flows.

2.1.6.3 Reclamation of Plant Site

Plant Site reclamation would include building and structure demolition and equipment removal, Flotation Tailings Basin reclamation, and Hydrometallurgical Residue Facility reclamation. Similar to the Mine Site,

Plant Site facilities have been designed and would be operated to allow for progressive reclamation. Features that would remain at the Plant Site are shown on **Figure 8**.

The Waste Water Treatment Plant, Flotation Tailings Basin Seepage Management Systems, and Hydrometallurgical Residue Facility Leakage Collection System would continue to operate during reclamation, although seepage rates would be progressively reduced. Seepage would be recycled back into the Flotation Tailings Basin Pond or treated at the Waste Water Treatment Plant and pumped to the Mine Site to aid in West Pit flooding, or discharged.

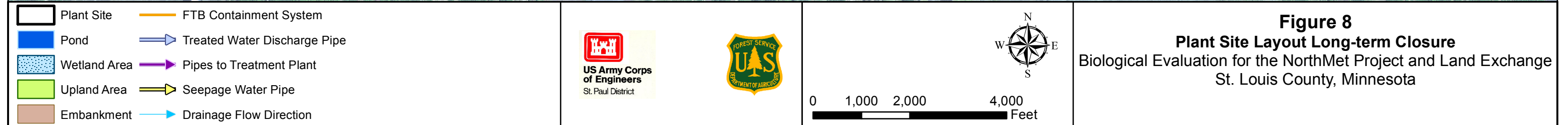
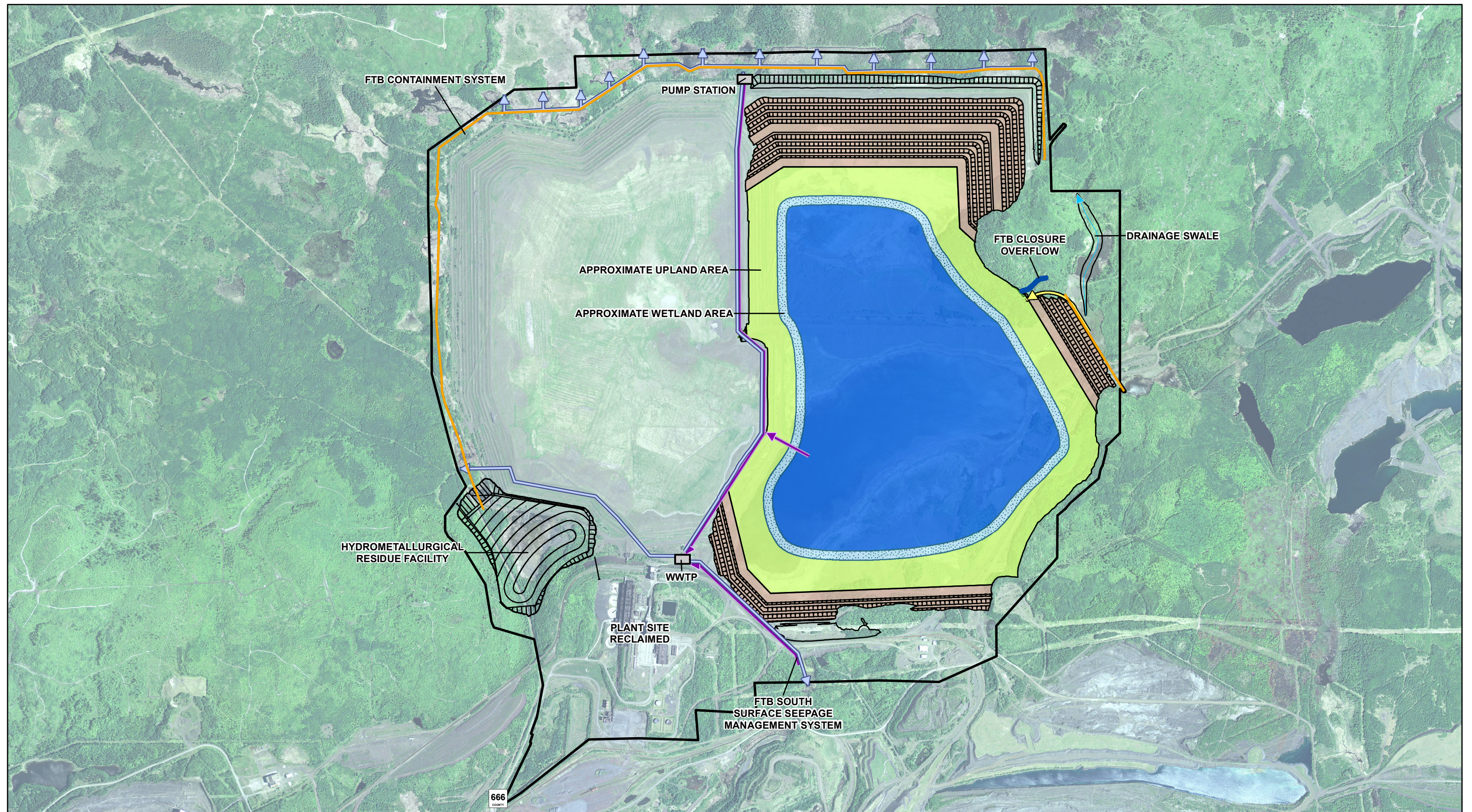
Flotation Tailings Basin Reclamation

Permanent vegetation would be established on the Flotation Tailings Basin to control fugitive dust. Flotation Tailings Basin exterior dam surfaces would be reclaimed progressively, while interior areas would be seeded and mulched after closure.

Infiltration would be reduced through the dam faces, beaches, and pond bottom of the Flotation Tailings Basin by bentonite amendment. The exterior faces of the dams would be reclaimed progressively, with a bentonite layer added as they are constructed to limit oxygen diffusion. The exposed beaches and dam tops would be amended with a bentonite layer to limit oxygen diffusion. The pond bottom would be covered with a bentonite layer to maintain a permanent pond that would limit oxygen diffusion.

During reclamation, several sources of water from the Flotation Tailings Basin would require management. The sources and a summary of the type of management needed are described as follows:

- Ponded water within the Flotation Tailings Basin – a pond and wetland would remain in the Flotation Tailings Basin. The pond and wetland would receive surface water runoff from the crest and beaches of the basin and natural terrain adjacent to the Flotation Tailings Basin. The pond and wetland would continue to lose water via seepage, but at a reduced rate as compared to during operations as a result of the bentonite augmentation of the Flotation Tailings Basin pond bottom. Excess water would be pumped from the Flotation Tailings Basin pond to the Waste Water Treatment Plant for treatment prior to discharge.
- Stormwater management would include grading to provide a gently sloping surface that effectively routes surface water runoff to the interior of the Flotation Tailings Basin, and to accommodate future differential settlement of the underlying Flotation Tailings.
- An emergency overflow channel would be constructed to carry stormwater from the pond to the adjacent wetland in case of an extreme storm or snowmelt event after reclamation. The conceptual location of the emergency overflow channel is from the combined Cell 1/2E to the adjoining land.



Hydrometallurgical Residue Facility Reclamation

Hydrometallurgical Residue Facility reclamation would include removal of ponded water from the Hydrometallurgical Residue Facility cell surface, removal of pore water from the residue, construction of the cell cover system, establishment of vegetation, and surface water runoff controls.

Ponded water remaining in the cell would be removed and treated at the Waste Water Treatment Plant. Drainage would be collected from the base of the cell at the geocomposite drainage system and managed as described for ponded water. The rate of drainage would decrease over time as the pore water within the Hydrometallurgical Residue Facility was collected and removed.

The hydrometallurgical cell area would be graded into a gently sloping surface, and an engineered cover system would be installed to limit infiltration. Permanent vegetation would be established over the cover system. The turf and final cover would be inspected, mowed once per year or as needed, fertilized if vegetation growth is poor, and repaired as needed.

The cover would slope gently toward the site perimeter to accommodate natural drainage of the runoff. Final cover slopes on the cell interior would be relatively shallow to minimize surface water runoff flow velocity and the associated erosion. Runoff channeled along the cell perimeter would be routed downslope via rip-rapped drainage swales or plug-resistant inlet structures and piping systems. Once runoff was conveyed down the cell exterior dam slope, it would be routed to the surrounding natural drainage system. All runoff would be from reclaimed cover or dam exterior slopes, which would be constructed of MDNR-approved material.

2.1.6.4 Long-Term Closure Activities

Mechanical water treatment systems (the Waste Water Treatment Facility and the Waste Water Treatment Plant) would continue to operate during long-term closure. The water collected by the Category 1 Waste Rock Stockpile Groundwater Containment System and the West Pit water would be treated using the Waste Water Treatment Facility (upgraded to reverse osmosis or similar membrane separation technology) to ensure that the discharge meets applicable water quality discharge limits. The Waste Water Treatment Plant would treat water collected by the Flotation Tailings Basin seepage capture systems, Hydrometallurgical Residue Facility Leakage Collection System, and excess Flotation Tailings Basin pond water, to meet applicable water quality discharge limits. Inspection, water treatment maintenance, and reporting activities would continue while the mechanical treatment systems operated during long-term closure.

Surface water and groundwater quality would be monitored. These long-term closure activities would be expected to be ongoing until such time as the various facility features are deemed environmentally acceptable, in a self-sustaining and stable condition.

Other long-term closure activities would include repair of stockpile and Flotation Tailings Basin dam slope erosion, up-keep of constructed wetlands and outflow structures, removal of shrubs and trees from the Hydrometallurgical Residue Facility and Category 1 Waste Rock Stockpile cover systems, and on-going operation/maintenance and inspection of the seepage capture systems at the Category 1 Waste Rock Stockpile and Flotation Tailings Basin.

When PolyMet has completed all reclamation and long-term closure activities required under the Permit to Mine, a Request for Release per Minnesota Rules, part 6132.1400 would be submitted to the MDNR. This

request would provide the Commissioner of the MDNR with detailed information on the final closure status of the Project.

2.1.7 Federal and Non-federal Lands

2.1.7.1 Land Exchange Process

As part of the Project, the Forest Service is considering transferring approximately 6,495 acres of federal lands to PolyMet in exchange for non-federal lands of similar value that have been offered for consideration by PolyMet (**Figures 2 and 3**).

The federal lands are in St. Louis County, approximately 60 miles north of the City of Duluth, 20 miles south of the Boundary Waters Canoe Area Wilderness (BWCAW), and 6 miles south of the City of Babbitt, Minnesota. The federal lands are bounded on the north by the Northshore taconite mine and on the south by the Dunka Road and Utility Corridor.

The proposed land exchange between the Government, acting through the Forest Service, and PolyMet is an assembled land exchange. The land exchange is proposed under the authority of the Weeks Act of March 1, 1911 as amended; General Exchange Act of March 20, 1922; Federal Land Exchange Facilitation Act of 1988; and the Federal Land, Policy and Management Act of October 21, 1976.

The proposed land exchange complies with the 2004 Forest Plan (USDA Forest Service 2004a). The federal lands are located within the General Forest and General Forest - Longer Rotation Management Area. The theme of the General Forest – Longer Rotation Management Area emphasizes land and resource conditions that provide a wide variety of goods, uses and services. The characteristics and use of the General Forest Management Area are similar to the General Forest – Longer Rotation Management Area, except that harvests are more frequent, more uniform in age, and more extensive. The General Forest Management Area has the highest amount of young forest and the largest-sized timber harvest units. Forested habitats on the federal lands can be categorized using the Forest Service’s Management Indicator Habitat (MIH), which describes dominant species, stand age class (young, immature, and mature), and stand condition (USDA Forest Service 2010a).

Land ownership adjustment direction for the General Forest and General Forest - Longer Rotation Management Area allows for the exchange of federal lands, with the desired condition described as “Land ownership patterns (federal, state, county, corporation and private) are consolidated, promote efficient administration and reduce the costs of managing resources.”

2.1.7.2 Federal Lands

The federal lands include approximately 2,719 acres of the 3,015-acre Mine Site and 3,776 acres of lands surrounding the Mine Site that are owned by the Government and administered by the Forest Service (**Figure 3**). The federal lands are located in Township 59 North, Range 12 West, Sections 6 and 7; Township 59 North, Range 13 West, Sections 1-12, 17, and 18; and Township 60 North, Range 13 West, Sections 33, 34, and 35 (**Figure 1**). Most of the federal lands are part of the General Forest – Longer Rotation Management Area, while the remainder is within the General Forest Management Area.

DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

The federal lands include a portion of One Hundred Mile Swamp, a large black spruce, tamarack, and northern white cedar wetland, and Mud Lake. Yelp Creek and the Partridge River flow through the federal lands on the north, east, and southeast. Management of the 3,776 acres of federal lands surrounding the Mine Site may include some upland timber management to enhance wildlife habitat, however, wetland areas would be maintained in their natural state for the foreseeable future.

2.1.7.3 Non-federal Lands

PolyMet has acquired non-federal lands for transfer to the Government that encourage efficient land ownership patterns, with the desired condition of consolidating federal, state, county, corporate and private ownership to promote efficient administration and reduce the cost of managing resources to the Forest Service. The non-federal lands would be incorporated with adjacent federal ownership and managed in accordance with 2004 Forest Plan direction for that particular area (USDA Forest Service 2004a). Lands with obvious recreational values would be managed to enhance those public recreation opportunities. The non-federal lands assembled include five different lands totaling approximately 7,075 acres that are comprised primarily of forest and wetland habitat (**Figure 2**).

Hay Lake Lands

Hay Lake Lands are in central St. Louis County, Minnesota, and are approximately 3 miles west of Biwabik, Minnesota. The lands, located at the eastern end of the Mesabi Iron Range, include approximately 4,926 acres in all or portions of Sections 9, 16, 19, 20, 21, 27, 28, 29, 30, 31, and 32 in Township 59 North, Range 16 West. The lands are moderately hilly and consist predominantly of second- or third-growth deciduous and coniferous forest uplands and emergent, shrub swamp, and forested wetlands. Approximately 59% (2,931 acres) of the Hay Lake Lands consists of wetlands. The lands include Hay Lake, identified as a Wild Rice Water by the MDNR, and Little Rice Lake, and are bordered on the east by the Pike River. The Superior National Forest borders the lands to the north, east, and west. Forest Service lands adjacent to Hay Lake Lands are managed as General Forest and Candidate Research Natural Areas. Research Natural Areas are areas that the Forest Service has designated to be permanently protected and maintained in natural condition. These protected natural areas include unique ecosystems or ecological features; rare or sensitive species of plants and animals and their habitat; and/or high-quality examples of widespread ecosystems. Candidate Research Natural Areas are those areas which are in various stages of review for possible establishment as a Research Natural Area.

Hunting Club Lands

Hunting Club Lands are in northern St. Louis County, Minnesota, and include approximately 160 acres in Section 17, Township 66 North, Range 17 West. The lands are nearly level and consist predominantly of second- or third-growth deciduous and mixed coniferous/deciduous forest uplands and emergent, shrub swamp, and forested wetlands. Approximately 40% (64 acres) of Hunting Club Lands consists of wetlands. The lands are bordered by Forest Service and county lands. Nearby Forest Service lands are managed as General Forest – Longer Rotation.

Lake County Lands

Lake County Lands consist of approximately 382 acres, with 265 acres in Sections 5 and 6, Township 57 North, Range 11 West (Lake County Lands North), and 117 acres in Section 17, Township 56 North, Range 9 West (Lake County Lands South) in Lake County, Minnesota. The lands are administered by Lake County. The lands

are nearly level and consist predominantly of second- or third-growth mixed coniferous/deciduous forest uplands and bog, emergent, shrub swamp, and forested wetlands. Much of Lake County Lands South was recently logged. Approximately 74% (283 acres) of Lake County Lands consists of wetlands. The lands are bordered by the Superior National Forest. Forest Service lands near Lake County Lands North are managed as Riparian Emphasis Area and General Forest – Longer Rotation. Forest Service lands near Lake County Lands South are managed as General Forest – Longer Rotation. In Riparian Emphasis Areas, riparian ecological functions are actively restored, protected, and enhanced in areas where ecosystem processes are sensitive to degradation. This includes maintaining and restoring native vegetation communities; maintaining and restoring riparian/hydrologic functions such as shoreline stability, wildlife habitat, coarse woody debris recruitment to aquatic and riparian ecosystems, and temperature regulation; and controlling non-native invasive species. Restoration focuses on components of the ecosystem that are not functioning at or within the range of desired conditions. Those components that are functioning properly are protected. These areas are also managed for recreational opportunities and visual quality adjacent to bodies of water.

McFarland Lake Lands

McFarland Lake Lands are approximately 31 acres in Section 9, Township 64 North, Range 3 East, in Cook County, Minnesota. The lands are approximately 3 miles west of the U.S. - Canada border and 10 miles north of Hovland, Minnesota. The lands are mostly on a hillslope and consist of second- or third-growth deciduous and coniferous upland forest. McFarland Lake is an entry point to the BWCAW. There are no wetlands on the lands. The lands are bordered by Forest Service lands, which are managed as General Forest – Longer Rotation.

Wolf Lands

Wolf Lands total 1,576 acres and are comprised of 126 acres in Section 8, Township 57 North, Range 11 West (Wolf Lands 1); 769 acres in Sections 15 and 22, Township 58 North, Range 10 West (Wolf Lands 2); 277 acres in Sections 30 and 31, Township 59 North, Range 9 West (Wolf Lands 3); and 405 acres in Sections 7, 8, 15, 17, and 18, Township 59 North, Range 9 West (Wolf Lands 4) in Lake County, Minnesota. The lands are nearly level and consist predominantly of second- or third-growth mixed coniferous/deciduous forest uplands and bog, emergent, shrub swamp, and forested wetlands. Much of Wolf Lands 3 has been recently logged. Approximately 88% (1,393 acres) of Wolf Lands consists of wetlands. Forest Service lands border portions of all of Wolf Lands and are managed as General Forest (Wolf Lands 2, 3, and 4) and General Forest – Longer Rotation (Wolf Lands 1). Wolf Lands would supplement National Forest ownership by reducing federal exterior boundaries and would eliminate several private in-holdings.

2.2 Land Exchange Alternative B (Alternative B)

Alternative B was derived from the Mine Site Exchange-Only Alternative Proposed Action (refer to Sections 3.3.3.2 and 3.3.3.3.4 of the FEIS) that was developed to address concerns raised during scoping. This alternative would convey fewer acres of federal lands to the Government for fewer acres of non-federal land from PolyMet.

Land exchanges are based on equal value. Because there would be fewer federal acres available to be conveyed by the Government, there would be fewer acres of private land that would be acquired by the Government. The Government would convey approximately 4,753 acres of federal lands to PolyMet, and the Forest Service would no longer administer these lands. The Government would acquire approximately 4,926 acres of Hay Lake Lands (identified as Tract 1 – Hay Lake Lands in the FEIS). Hay Lake Lands were selected for this alternative for the following reasons:

- they would be almost equal in size to the smaller federal lands,
- they would provide wetlands, and
- it is likely that Hay Lake Lands would have a higher per-acre value than the federal lands because of their access to a county road and its potential for riparian lots.

The configuration of the smaller federal lands is the smallest acreage that would meet the Purpose and Need for the Land Exchange (**Figure 2**). Under Alternative B, approximately 1,742 acres to the west of the Mine Site would remain under federal ownership. These remaining federal lands would become an isolated piece of federal land with limited or difficult access through private property. As with the Land Exchange Proposed Action, the Forest Service would reserve ownership of 181 acres of mineral rights scattered across the federal lands. These minerals are located outside of the mine pits.

2.3 Land Exchange No Action Alternative (No Action Alternative)

Under the No Action Alternative, the Project would not occur and no lands would be exchanged. The Government would not convey federal lands to PolyMet and the Forest Service would continue administering these lands as has been done in the past. The level of development and acceptable activities would continue to be regulated by Forest Service and Superior National Forest policies. Management would include vegetation management, mineral exploration, recreation, wildlife, watershed, and other uses identified in the 2004 Forest Plan. These lands are in General Forest – Longer Rotation and the General Forest Management Areas. Furthermore, under the No Action Alternative, the Government would not acquire the five tracts of non-federal lands and the non-federal lands would remain as private lands.

At the Mine Site, PolyMet would be required under exploration approvals to reclaim surface disturbance associated with exploratory and development drilling activities. Other existing surface uses would be allowed to continue consistent with 2004 Forest Plan.

No further upgrades or new segments would be constructed along the existing power transmission line, railroad, or Dunka Road, which would continue to be used by their private owners.

At the brownfield Plant Site, Cliffs Erie would be required to complete closure and reclamation activities required under an existing MDNR- and MPCA-approved reclamation program. This would include completing activities for the localized affected areas under the Minnesota Voluntary Investigation and Cleanup Program, removal of the former Plant Site building, and management of seepage at the Flotation Tailings Basin embankment.

3.0 Description of the Lands Affected by the Project

3.1 Federal Lands

Federal lands under the Proposed Action include approximately 2,719 acres at the 3,015-acre Mine Site and 3,776 acres surrounding the Mine Site that are owned by the Government and administered by the Forest Service (**Figure 3**). For Alternative B, the federal lands would include the 2,719 acres at the Mine Site and 2,034 acres surrounding the Mine Site.

The Forest Service designates and maintains data regarding MIH types on federal lands (USDA Forest Service 2004a: Appendix C, 2010a). The MIHs are based on forest type, including dominant species, stand age class, and stand condition. There are 14 MIHs, of which 13 MIHs pertain to forest habitats and 1 MIH pertains to aquatic habitats. A subset of these MIH types was used for the analysis of effects in the BE, including upland forest types (MIH 1; jack pine, red pine, white pine, balsam fir/trembling aspen-paper birch, black spruce-balsam fir, black spruce-jack pine, northern hardwoods, including oak and maple, trembling aspen, paper birch, and trembling aspen-black spruce-balsam fir); upland coniferous forest (MIH 5; all upland conifer and conifer-dominated mixed forest types); lowland black spruce-tamarack forest (MIH 9; all lowland conifer and lowland mixed conifer types dominated by black spruce or tamarack); and aquatic habitats (MIH 14; lakes, rivers, streams, pond, marshes or pools [permanent, intermittent, or seasonal]). The MIH types for the federal lands are shown on **Figure 9**, and for the non-federal lands are shown on **Figures 10 and 11**. **Tables 5 and 6** provide a summary of MIH type acreage on the federal and non-federal lands and gains and losses of MIH type acreage that would be administered by the Forest Service under the Proposed Action and Alternative B.

The MDNR developed the Gap Analysis Program (GAP) to identify land cover types (MDNR et al. 2013). The GAP land cover system is a hierarchical land classification system that organizes vegetation communities into 1-acre blocks. The GAP land cover types for the federal lands are shown on **Figure 12**, and for the non-federal lands on **Figures 13 and 14**. **Tables 5 and 7** provide a summary of GAP cover type acreage on the federal and non-federal lands and gains and losses of GAP cover type acreage that would be administered by the Forest Service under the Proposed Action and Alternative B.

Wetlands on the federal and non-federal lands were identified using the Eggers and Reed (1997) community types. Forest wetland types include coniferous bog, coniferous swamp, and hardwood swamp. Non-forested wetlands types include deep marsh, open bog, open water (includes shallow, open water and lakes), sedge/wet meadow, shallow marsh, and speckled alder thicket and shrub-carr. Wetland community types for the federal lands are shown on **Figure 15**, and for the non-federal lands on **Figures 16 and 17**. **Table 8** provides a summary of wetland community type acreage on the federal and non-federal lands and gains and losses of wetland cover type acreage that would be administered by the Forest Service under the Proposed Action and Alternative B.

3.1.1 Mine Site

The Mine Site encompasses 3,015 acres; 2,719 acres are Government owned while 296 acres are privately owned (**Figure 3**). The Mine Site has little topographic relief. The site consists of a mosaic of slightly elevated upland areas surrounded by wetlands, with the northern portion of the site sloping toward the east-northeast and the remainder of the site sloping to the south-southwest, in the direction of the Partridge River. About 57% of the Mine Site is upland habitat, and 43% is wetland habitat (PolyMet 2014a).

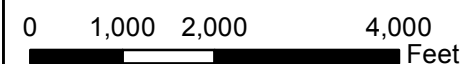
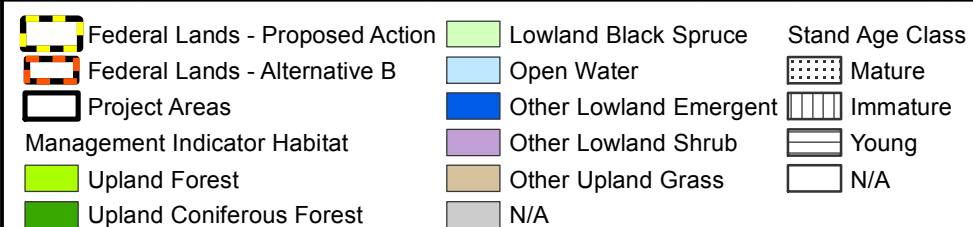
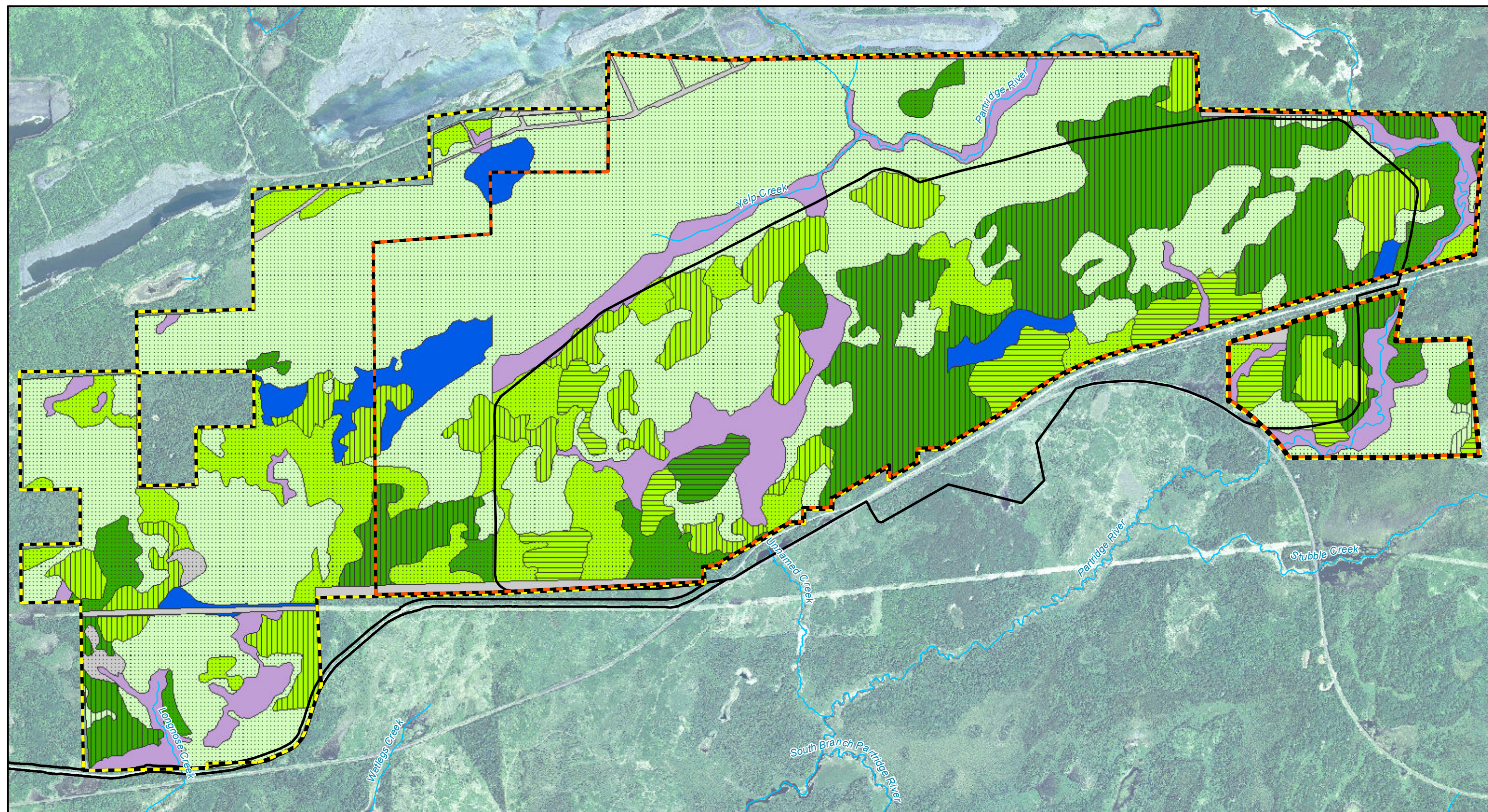
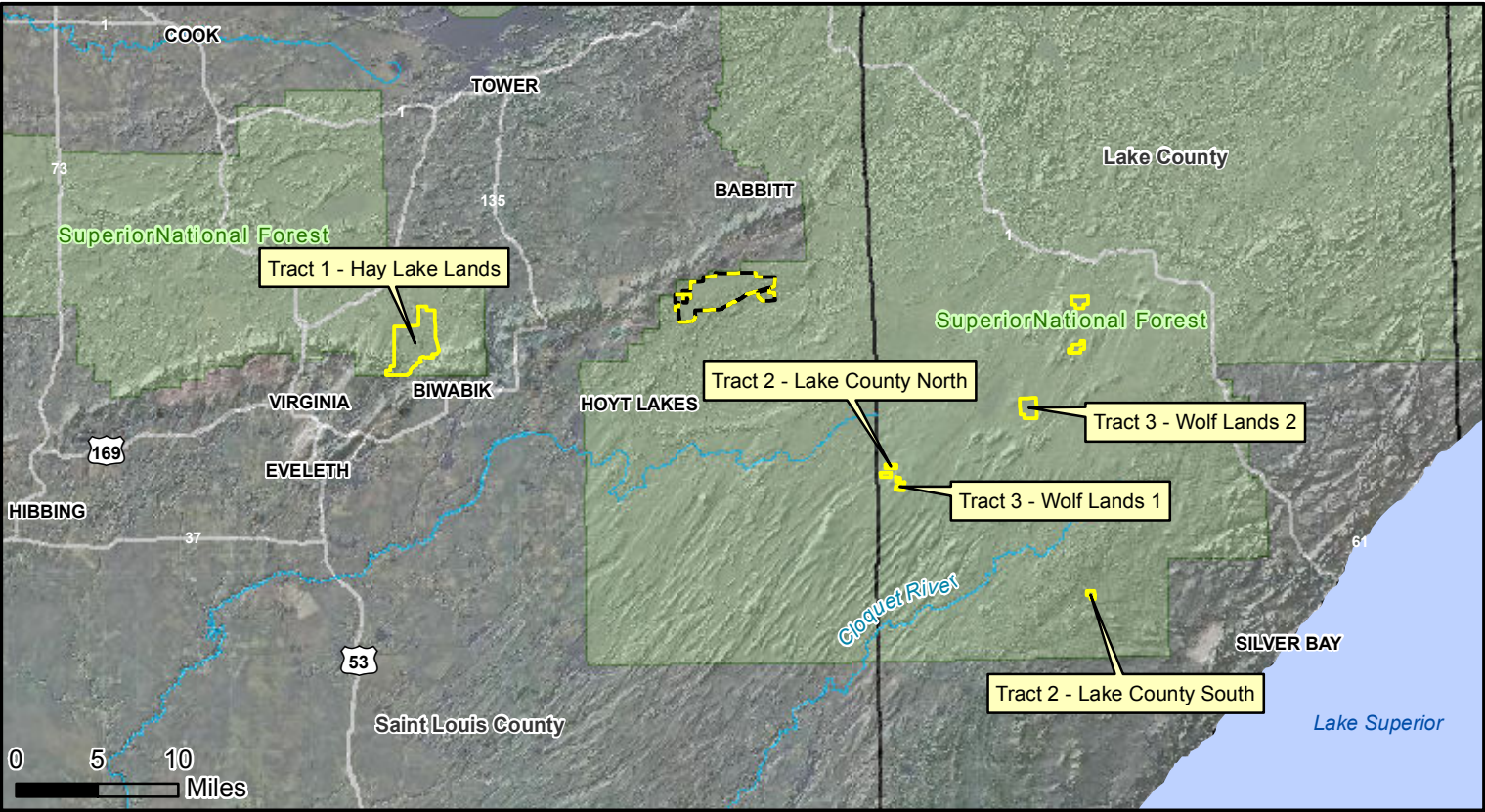
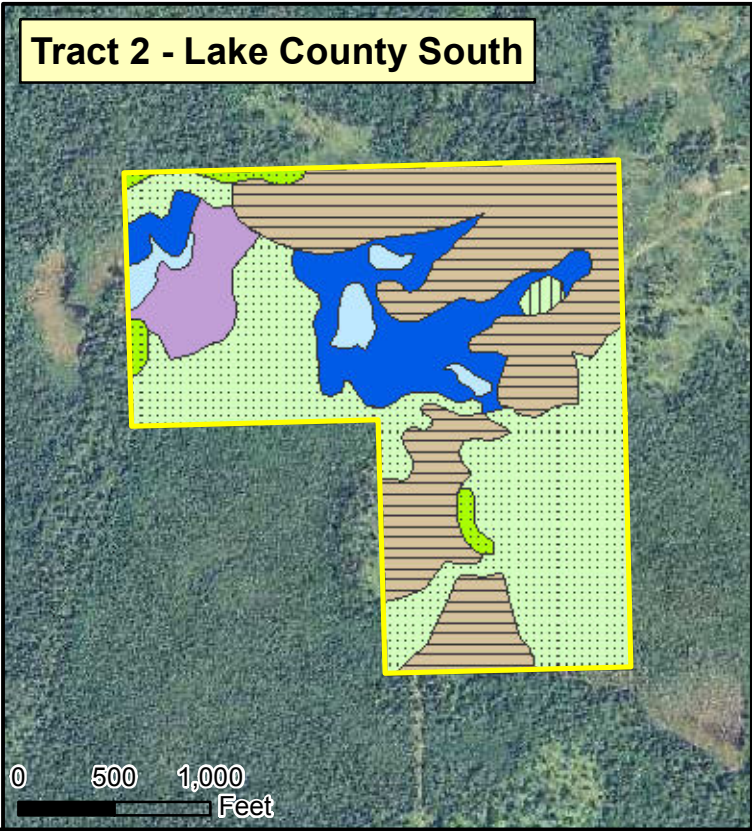
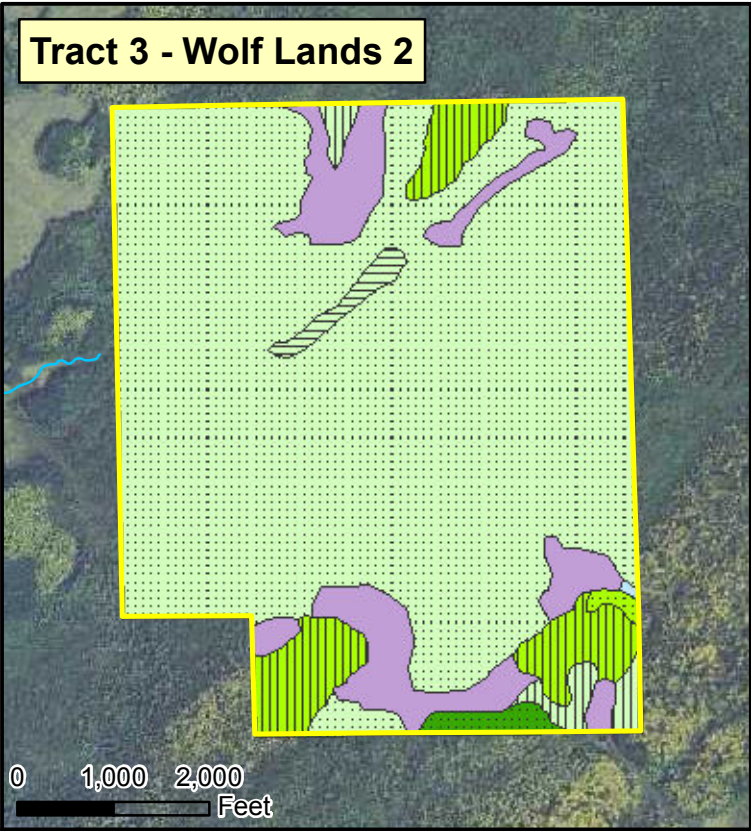
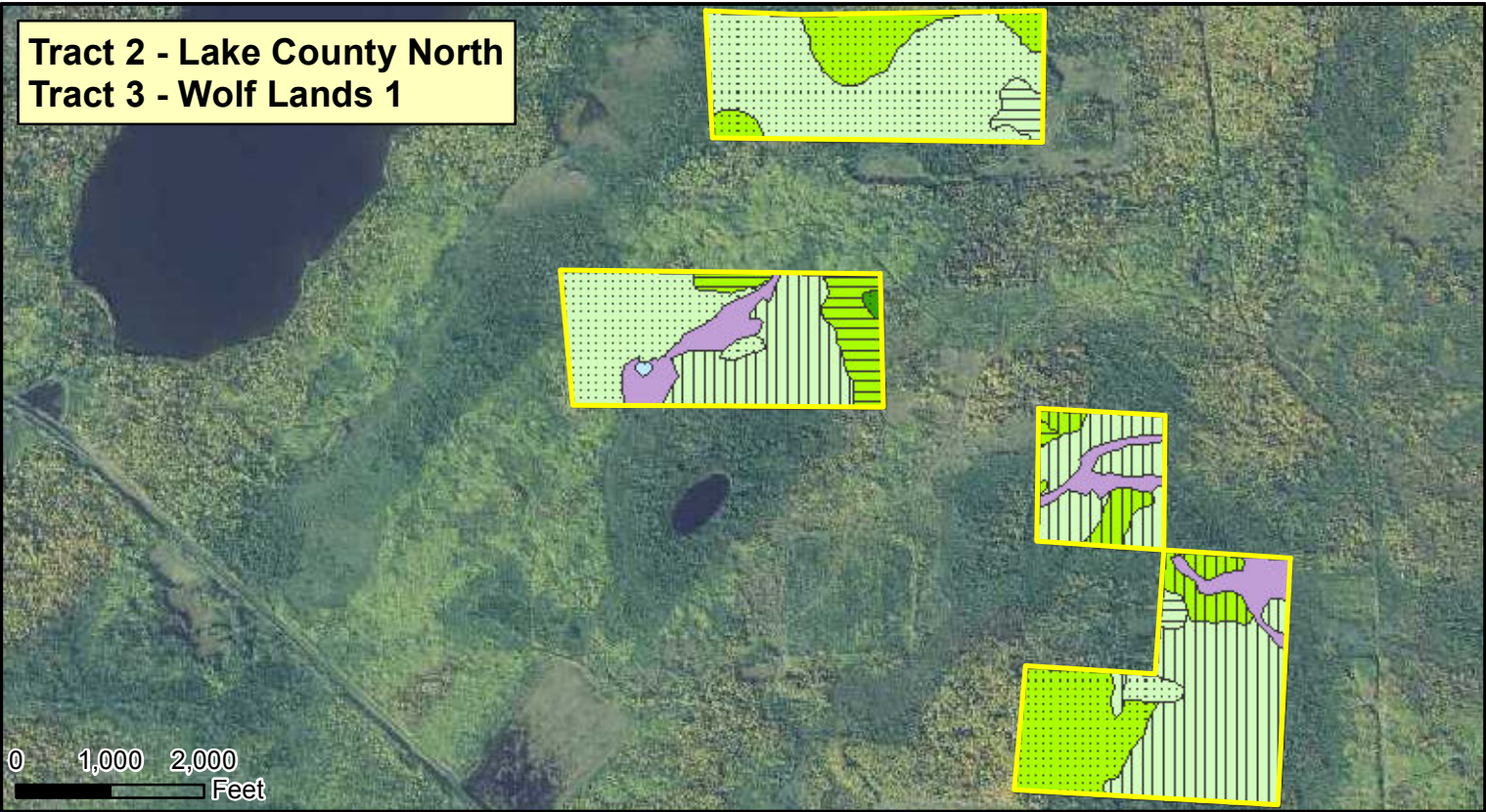
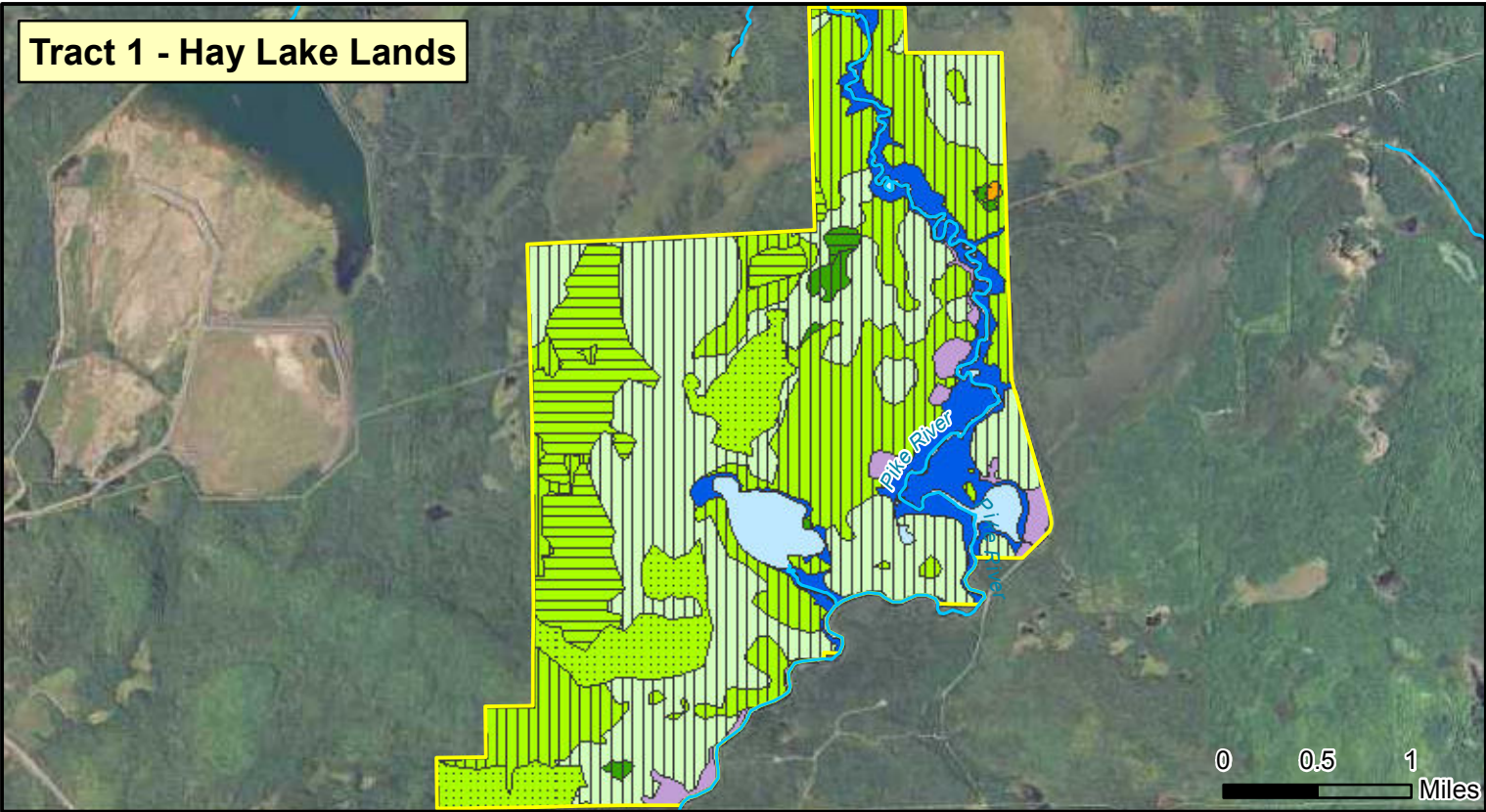


Figure 9
Management Indicator Habitat Types
and Age Classes - Federal Lands
 Biological Evaluation for the NorthMet Project and Land Exchange
 St. Louis County, Minnesota



Federal Lands	Open Water	Mature
Non-federal Lands	Other Lowland Emergent	Immature
Management Indicator Habitat	Other Lowland Shrub	Young
Upland Forest	Other Upland Grass	N/A
Upland Coniferous Forest	N/A	
Lowland Black Spruce		

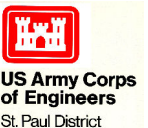


Figure 10
Management Indicator Habitat Types and Age Classes -
Hay Lake Lands, Lake County Lands, and Wolf Lands 1 and 2
 Biological Evaluation for the NorthMet Project and Land Exchange
 St. Louis County, Minnesota

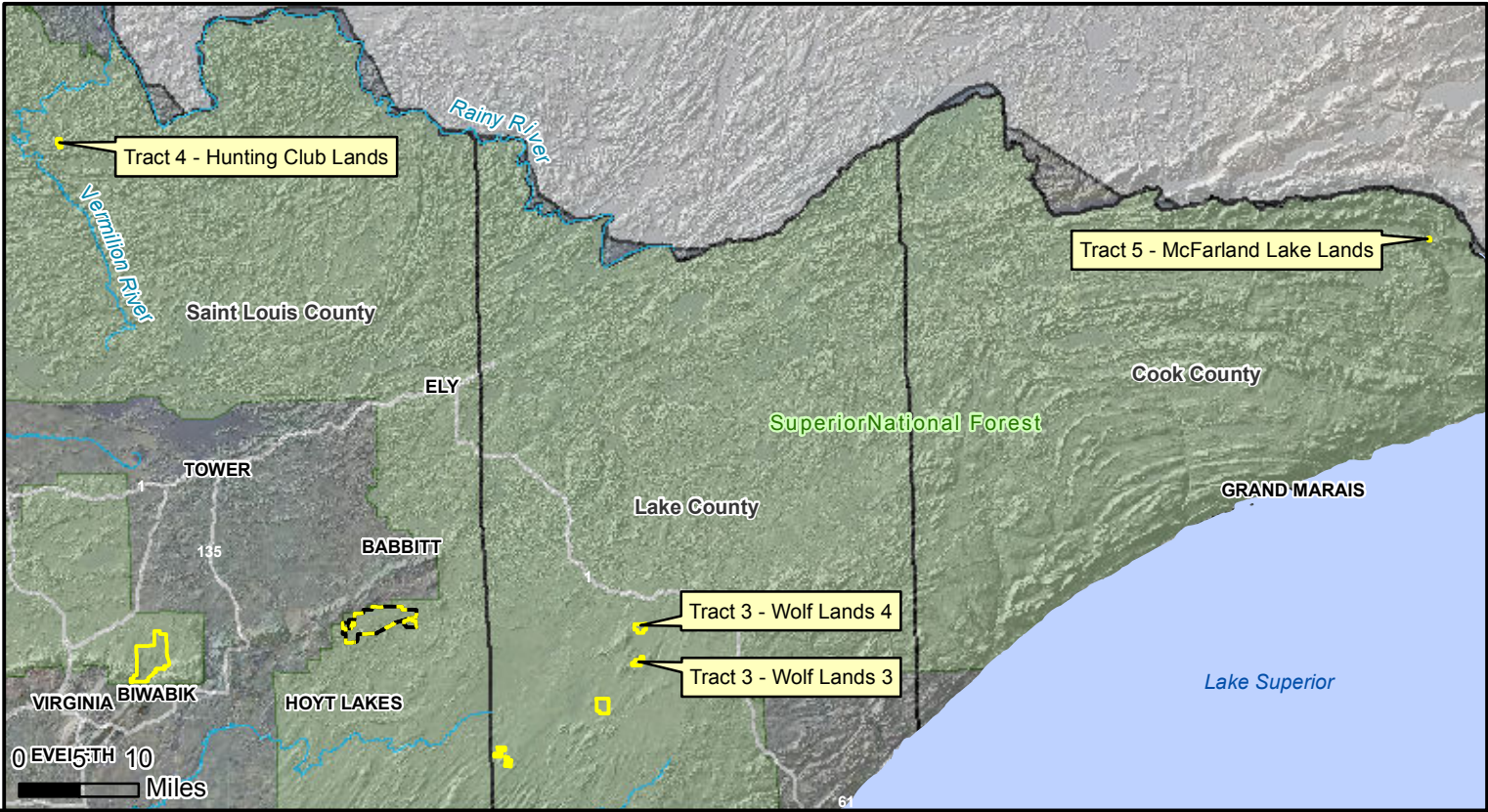
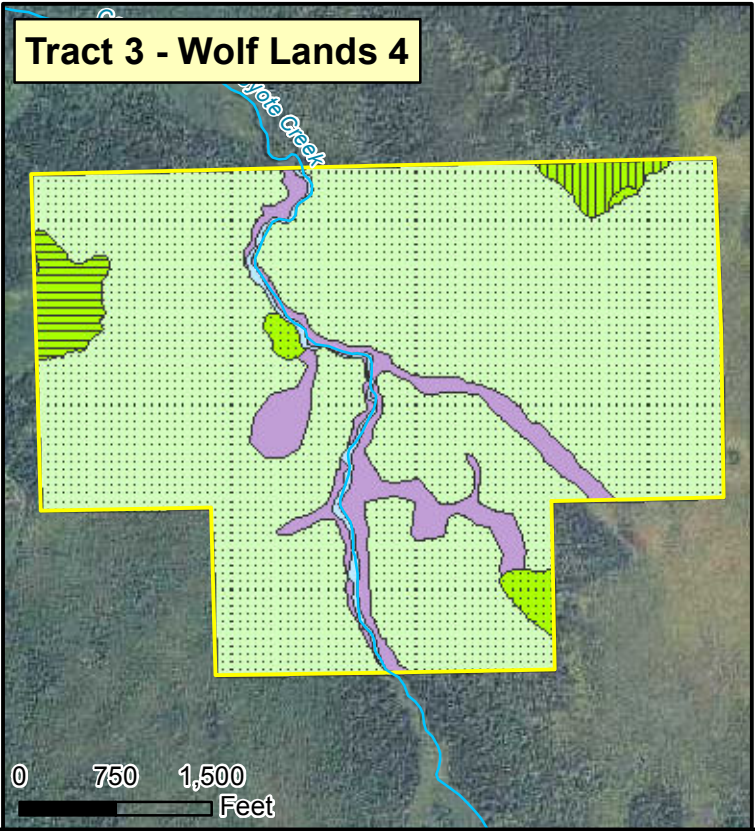
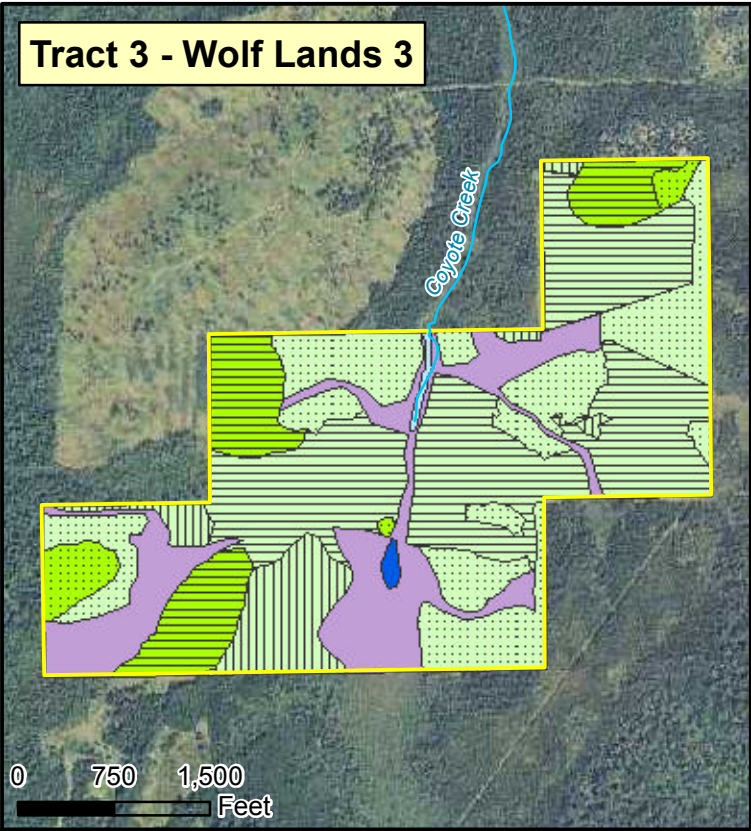
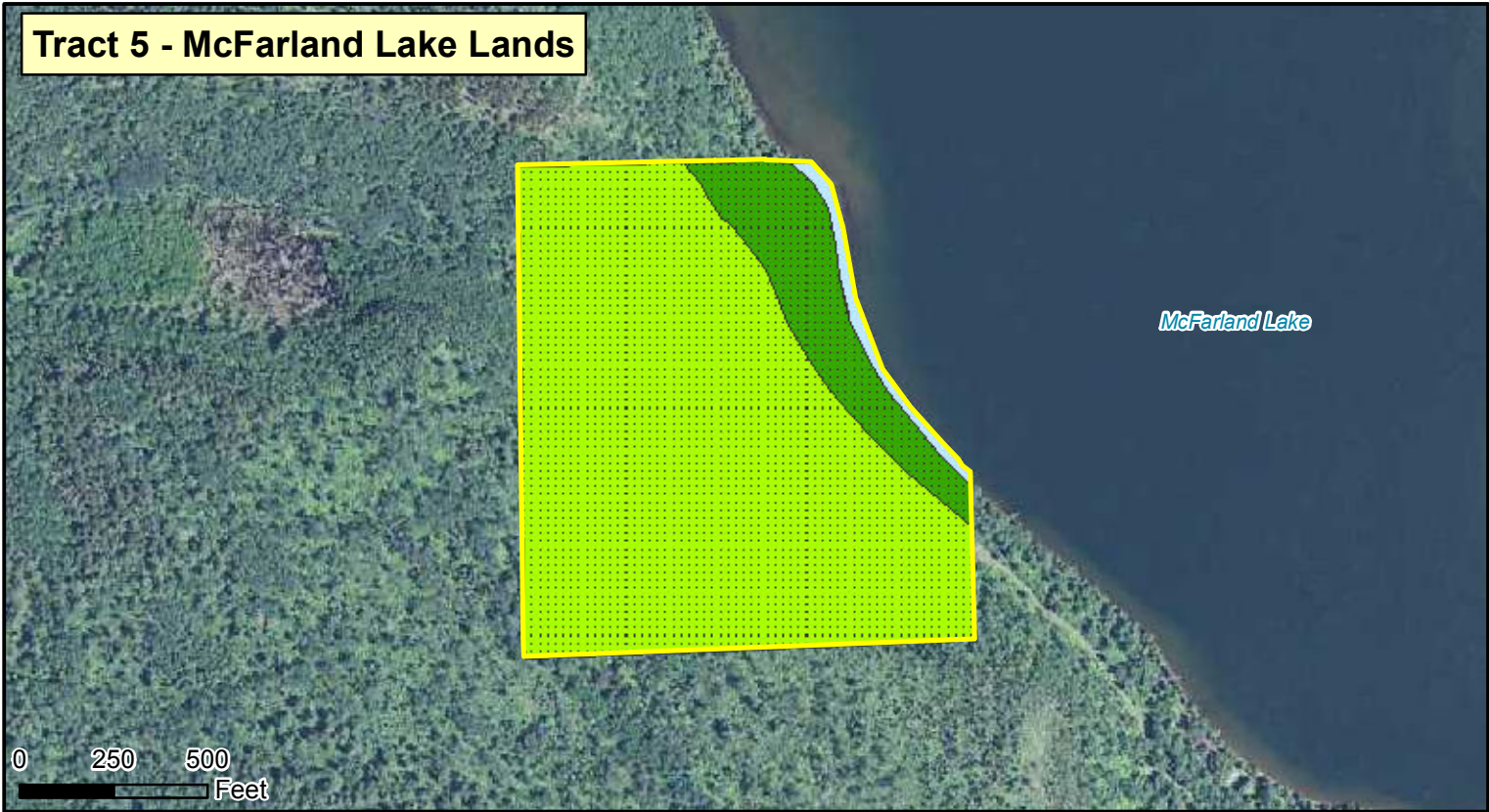
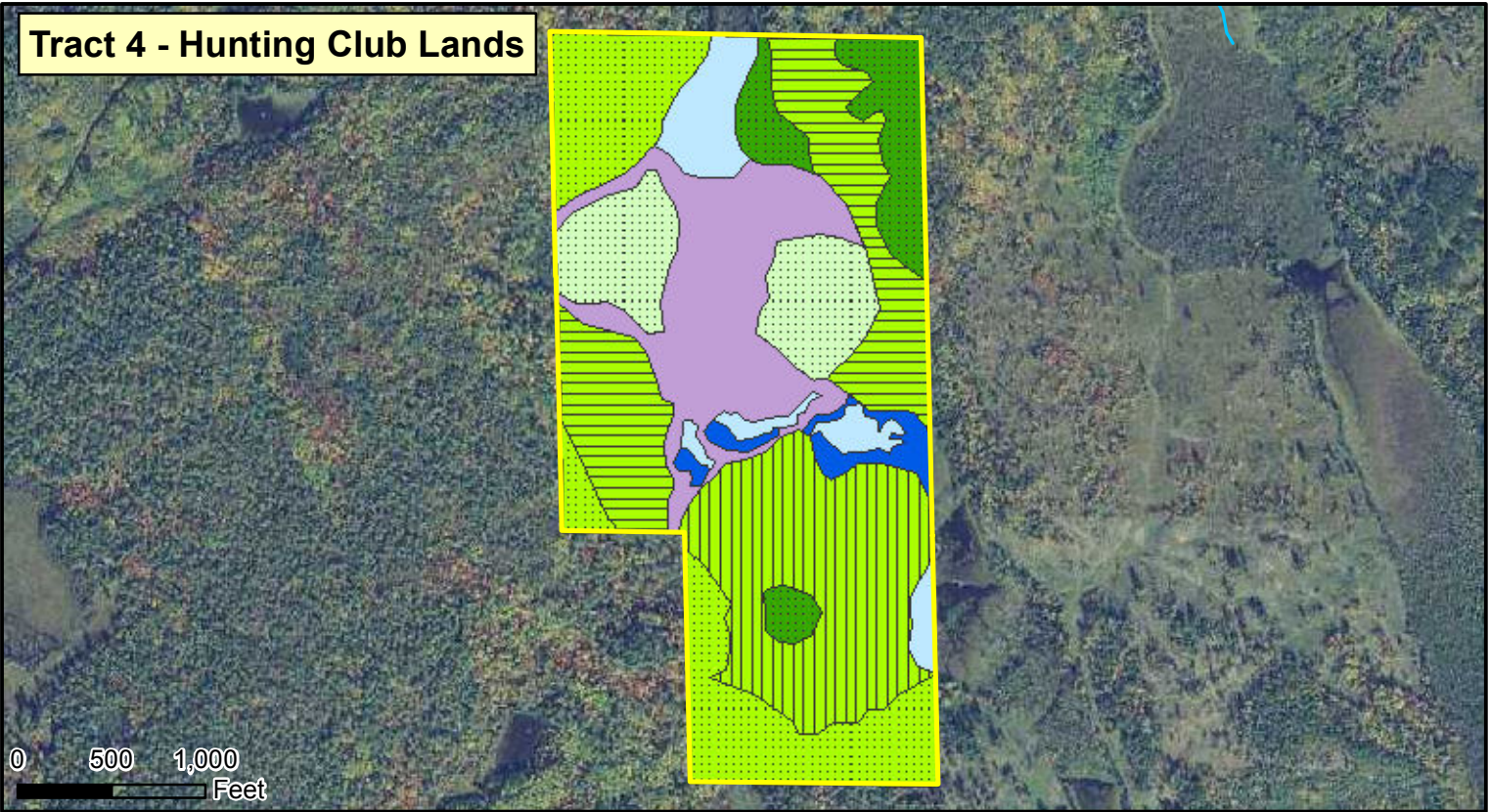
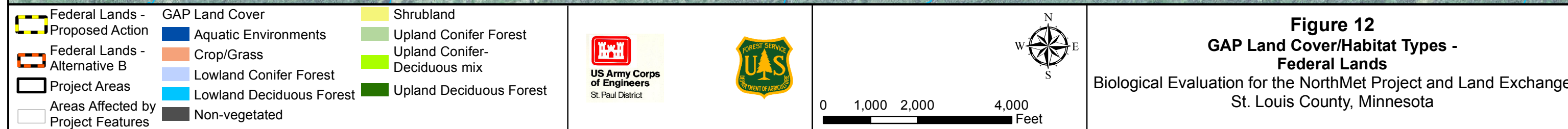
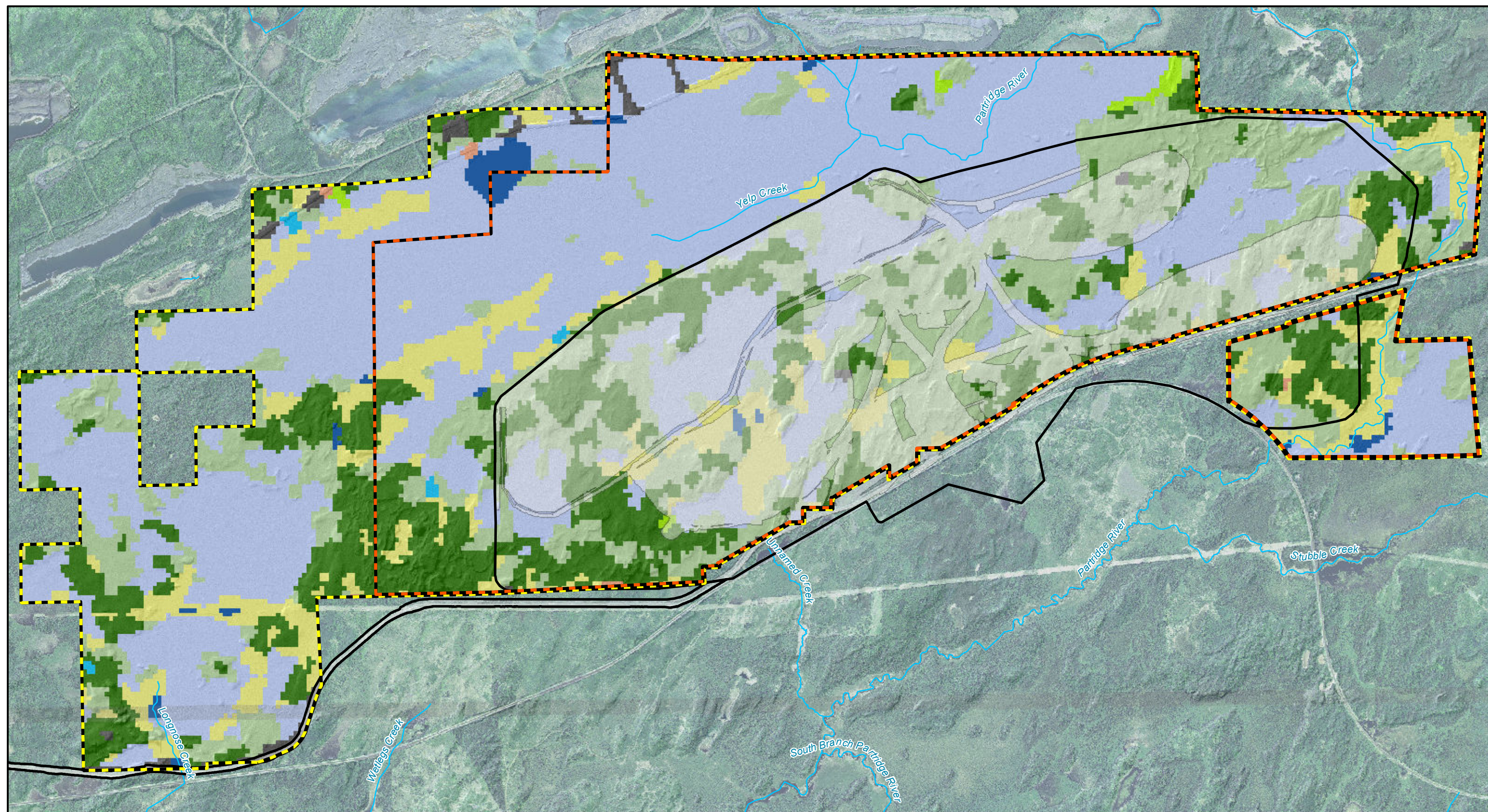


Figure 11
Management Indicator Habitat Types and Age Classes -
Hunting Club Lands, Mc Farland Lake Lands,
and Wolf Lands 3 and 4
 Biological Evaluation for the NorthMet Project and Land Exchange
 St. Louis County, Minnesota



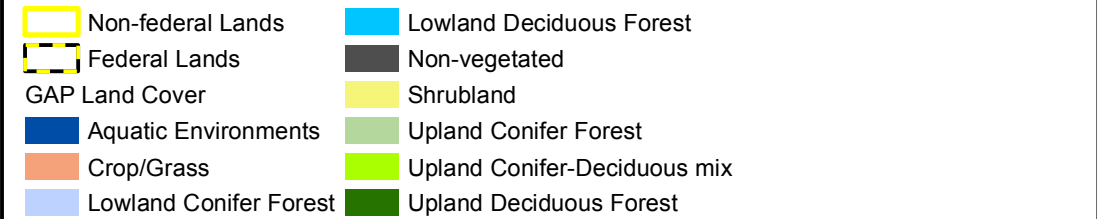
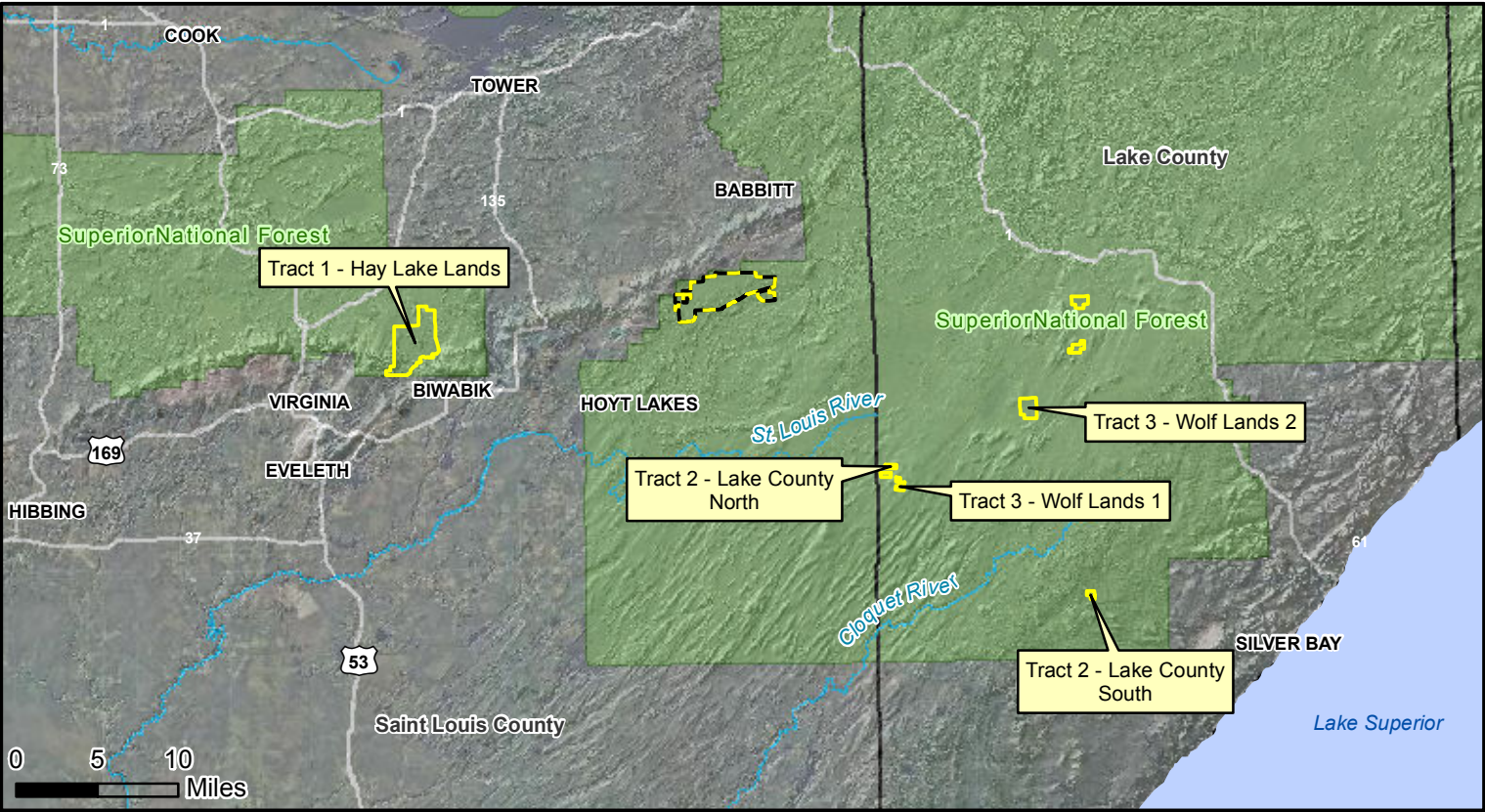
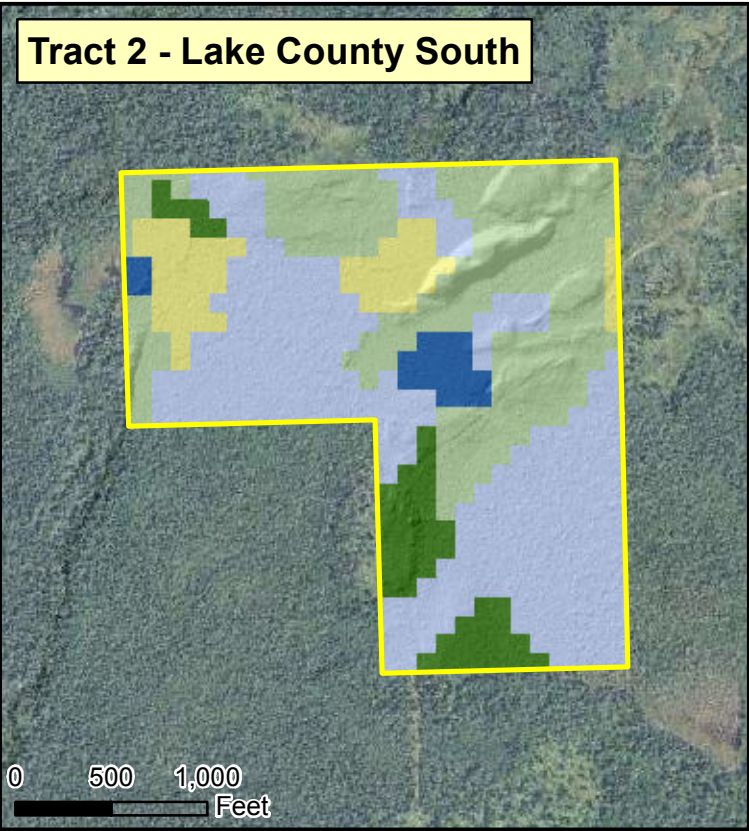
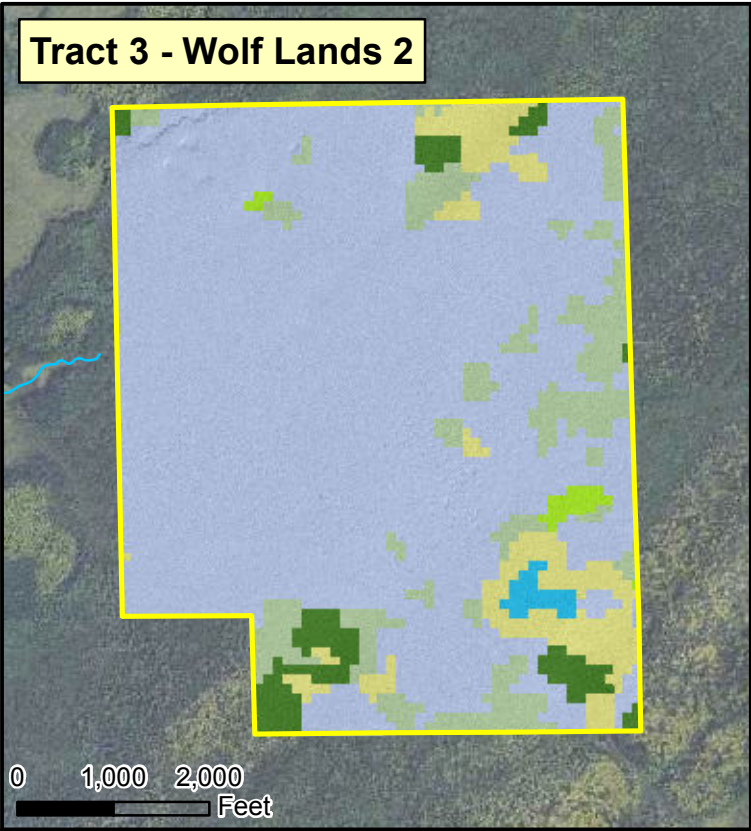
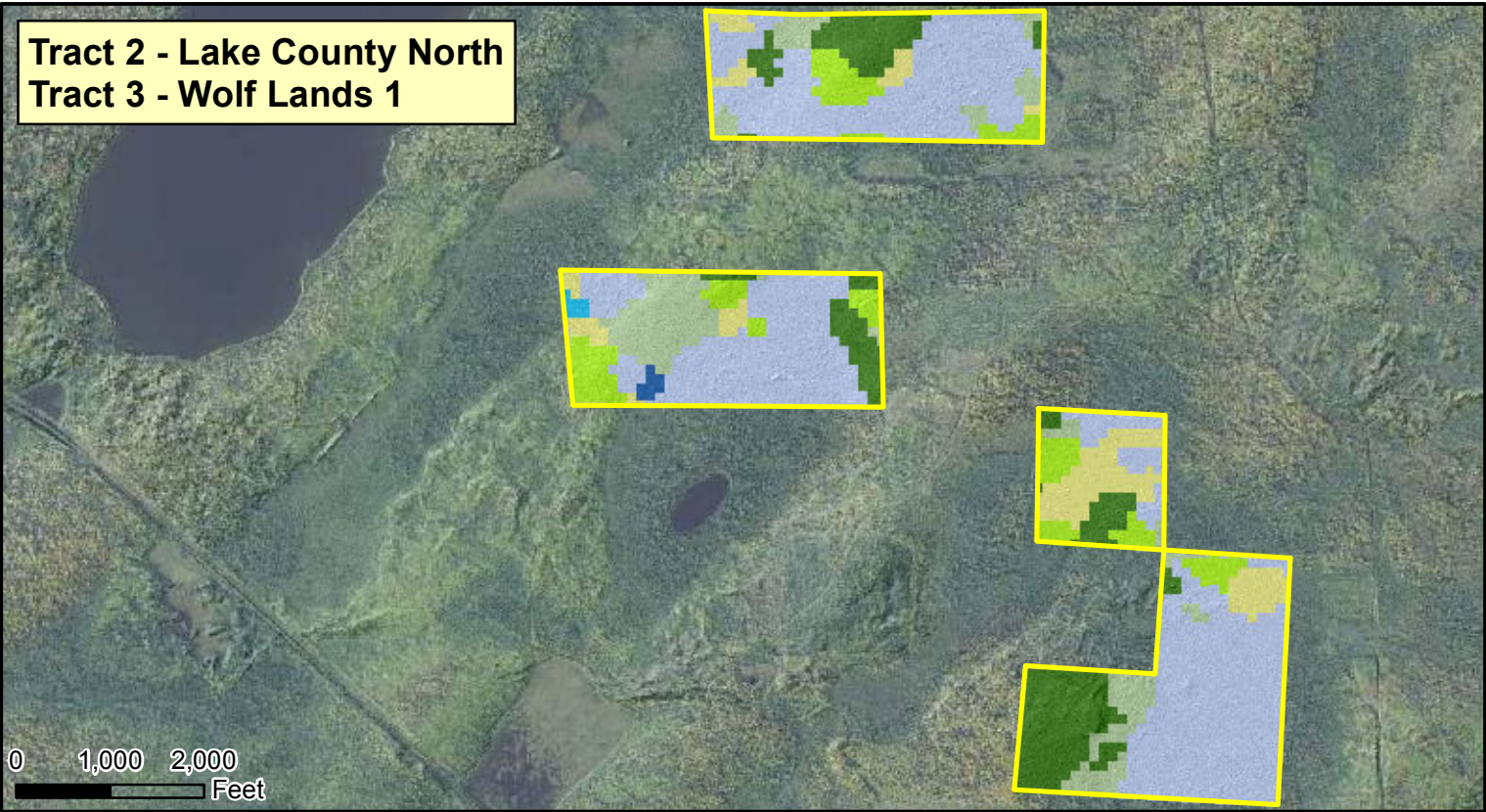
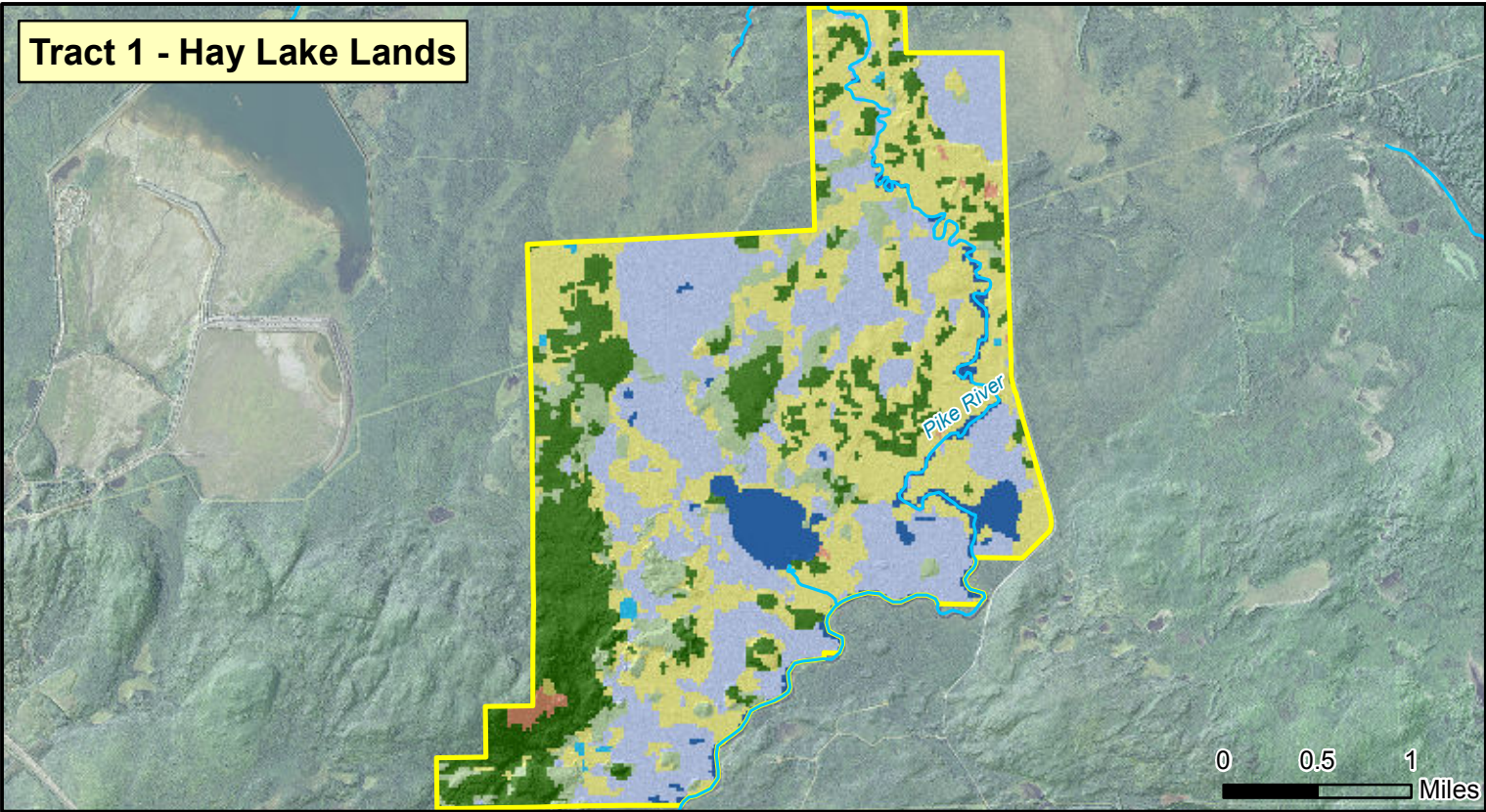


Figure 13
GAP Land Cover/Habitat Types -
Hay Lake Lands, Lake County Lands, and Wolf Lands 1 and 2
Biological Evaluation for the NorthMet Project and Land Exchange
St. Louis County, Minnesota

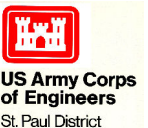
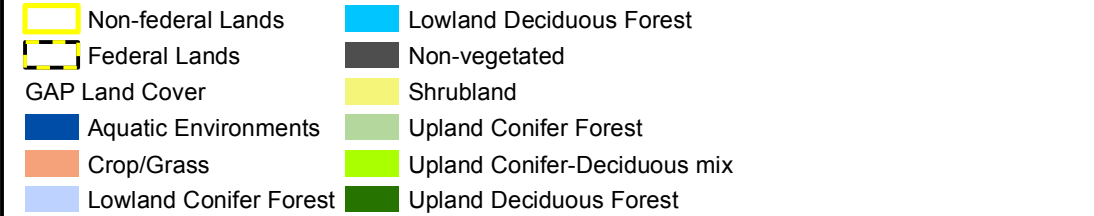
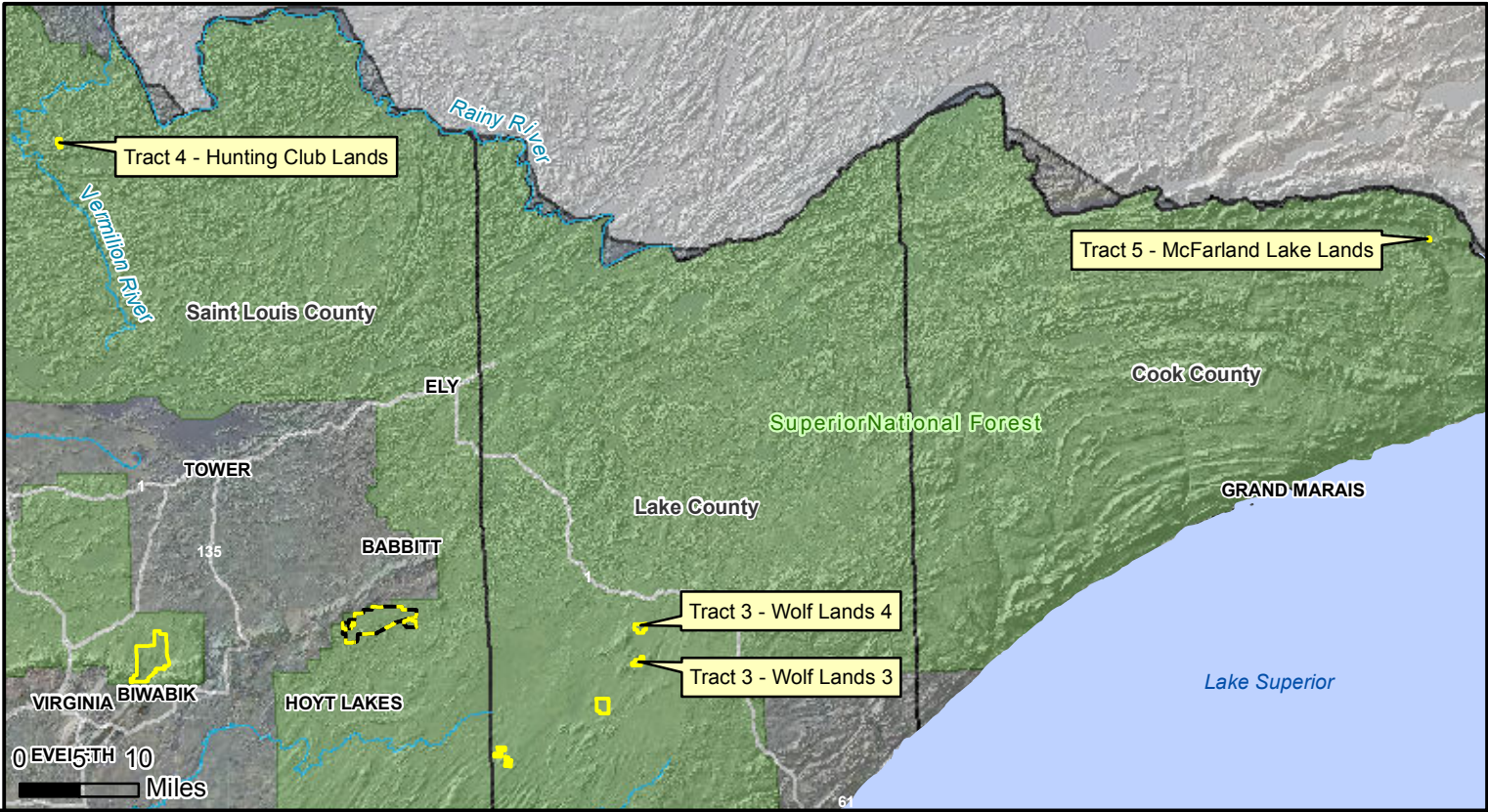
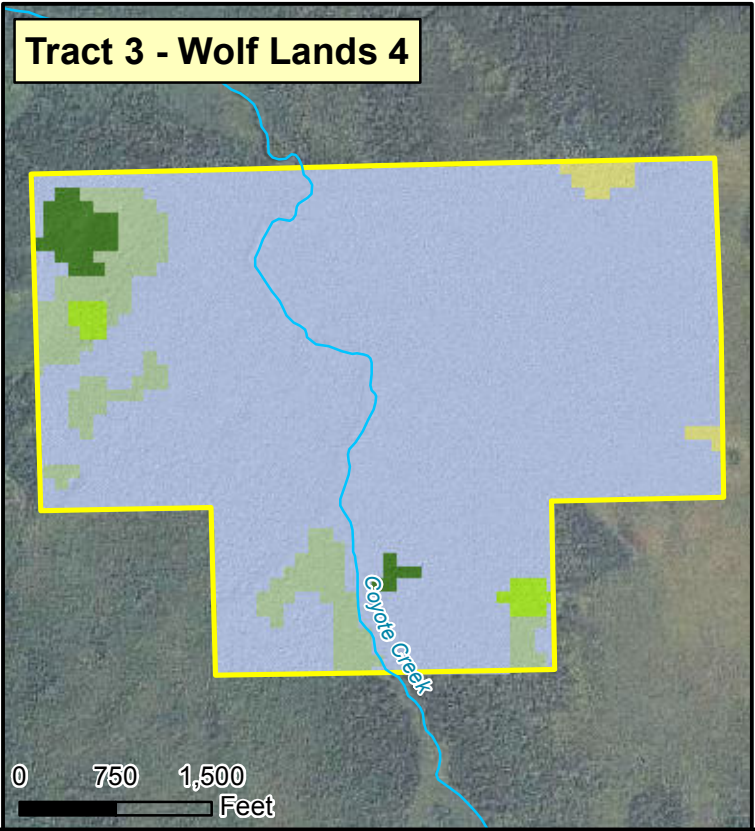
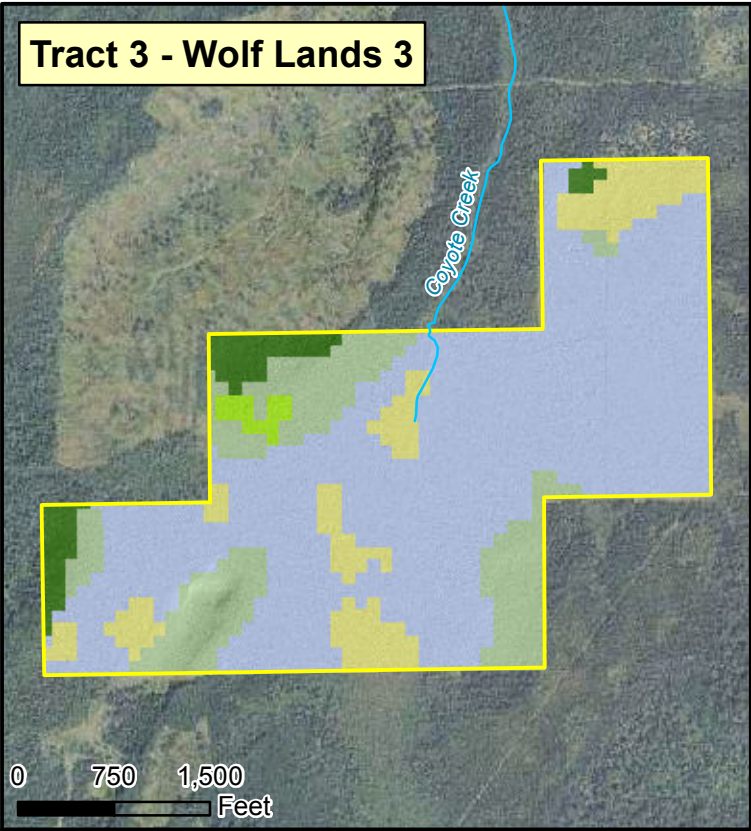
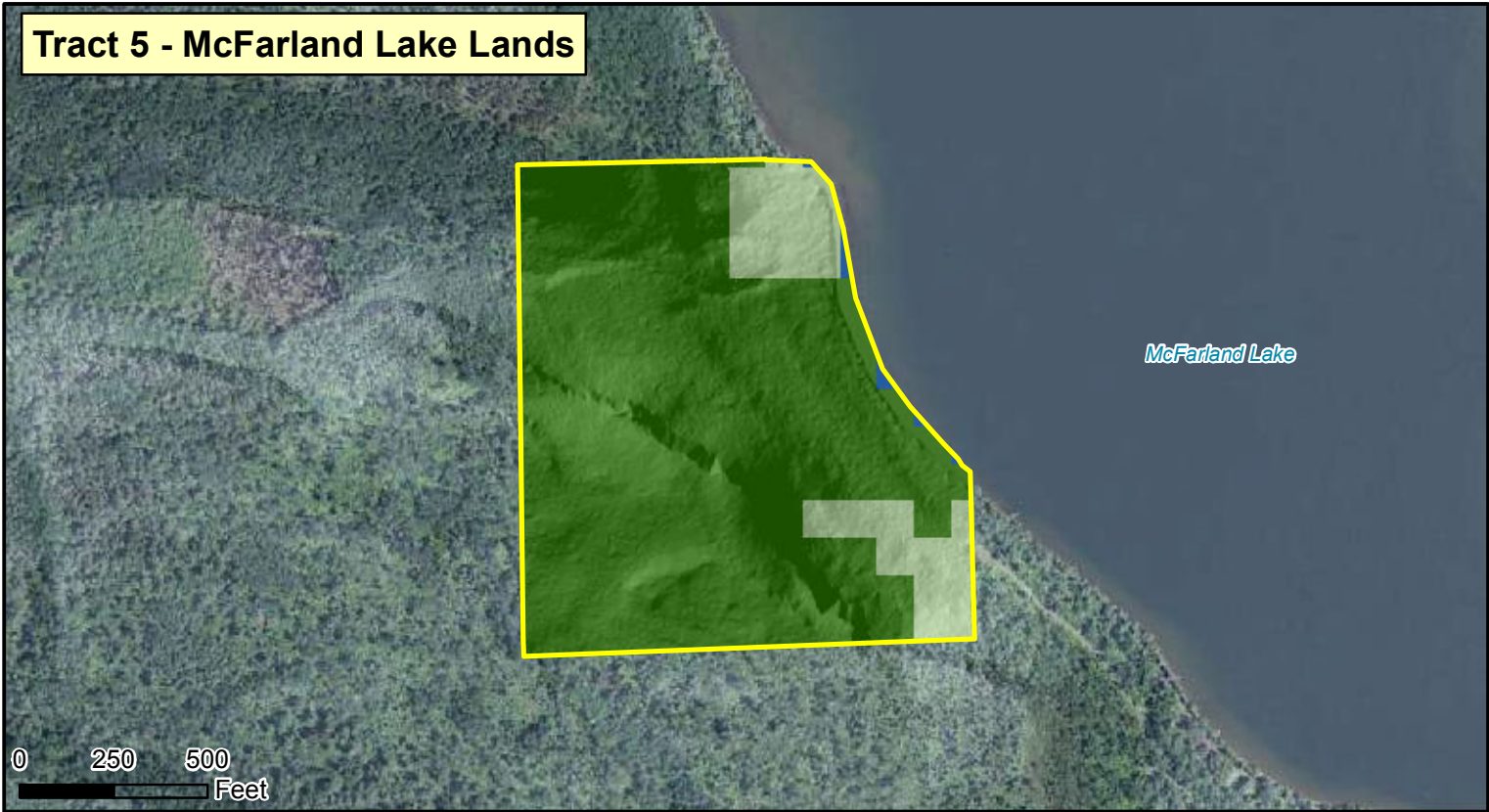
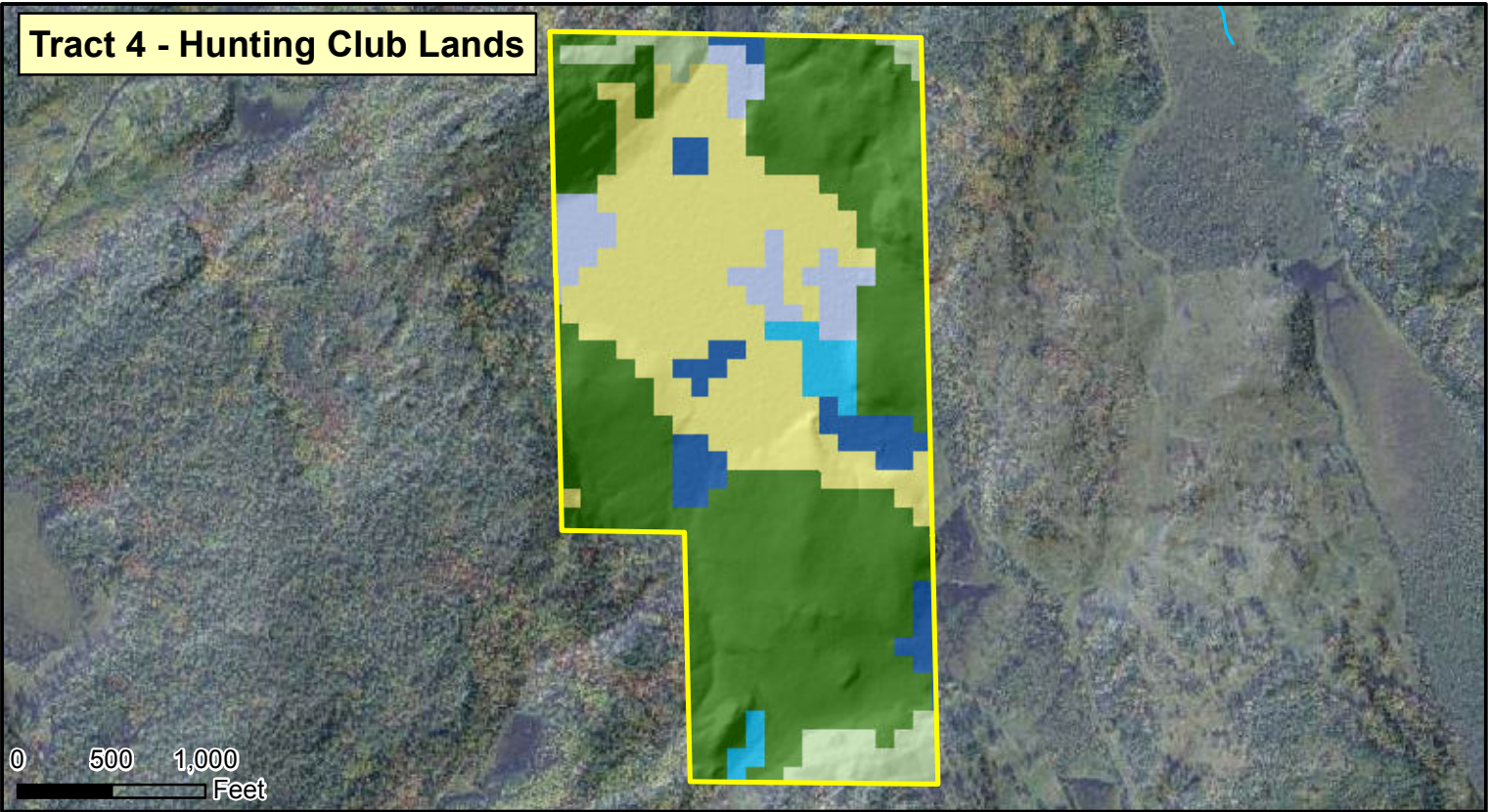
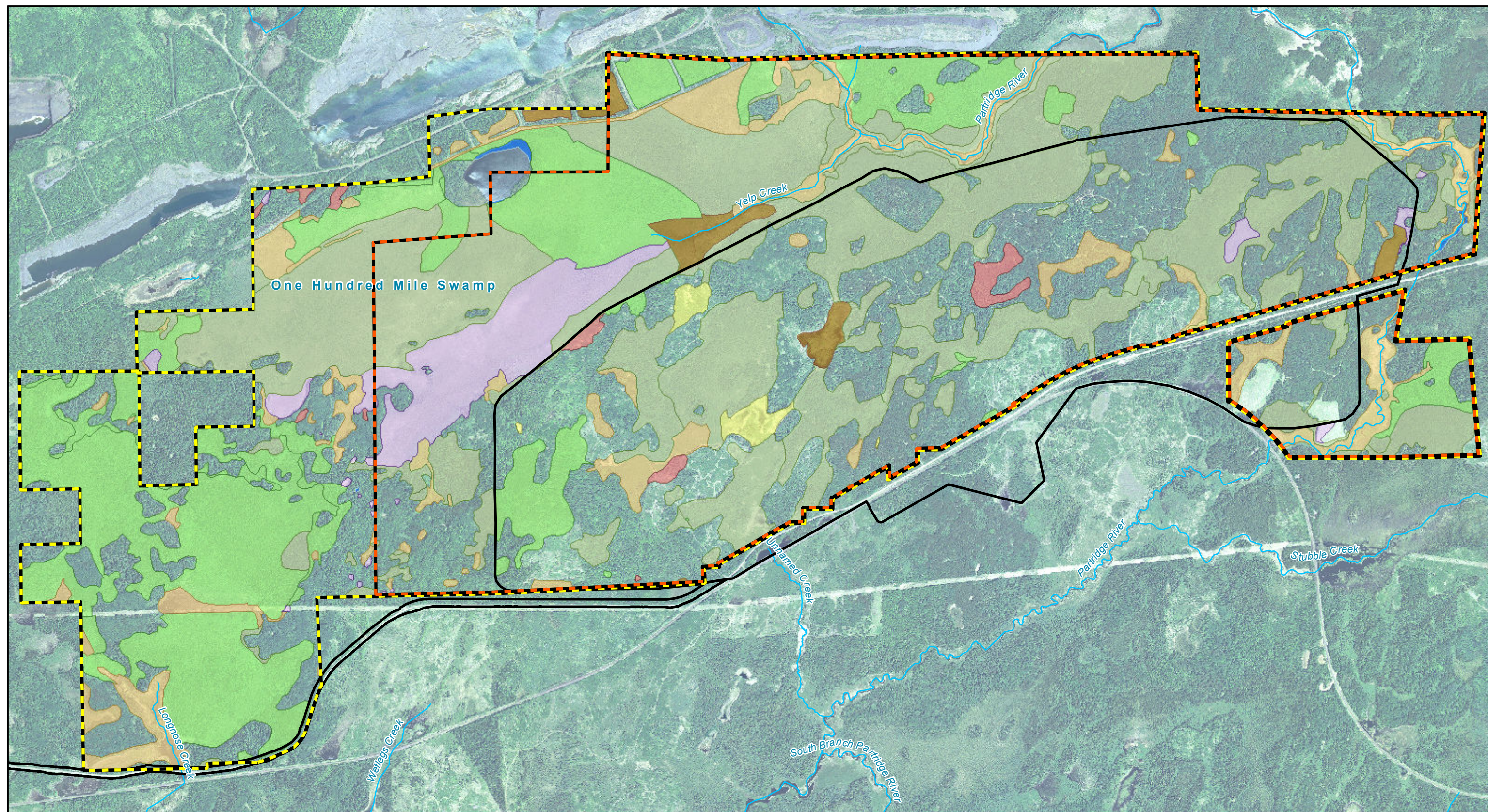


Figure 14
GAP Land Cover/Habitat Types - Hunting Club Lands, McFarland Lake Lands, and Wolf Lands 3 and 4
 Biological Evaluation for the NorthMet Project and Land Exchange
 St. Louis County, Minnesota



- | | | |
|---|---------------------------|--|
| Federal Lands - Proposed Action | Coniferous bog | Open water (Shallow, open water & lakes) |
| Federal Lands - Alternative B | Coniferous swamp | |
| Project Areas | Deep marsh; Shallow marsh | Open bog |
| Eggers & Reed Wetland Types | Hardwood swamp | Sedge meadow; Wet meadow |
| Shrub Swamps (Alder thickets & Shrub-carrs) | | |



0 1,000 2,000 4,000 Feet



Figure 15
Wetlands - Federal Lands
 Biological Evaluation for the NorthMet Project and Land Exchange
 St. Louis County, Minnesota

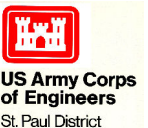
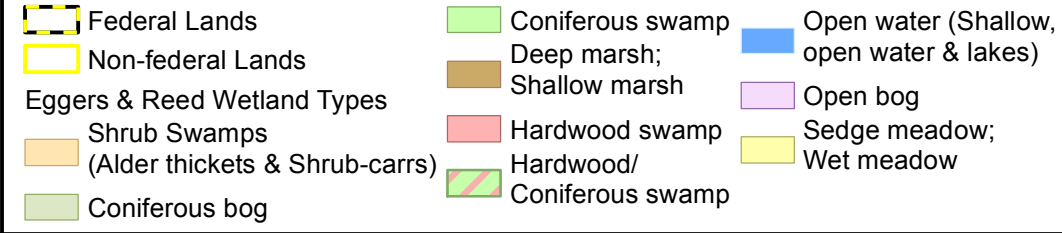
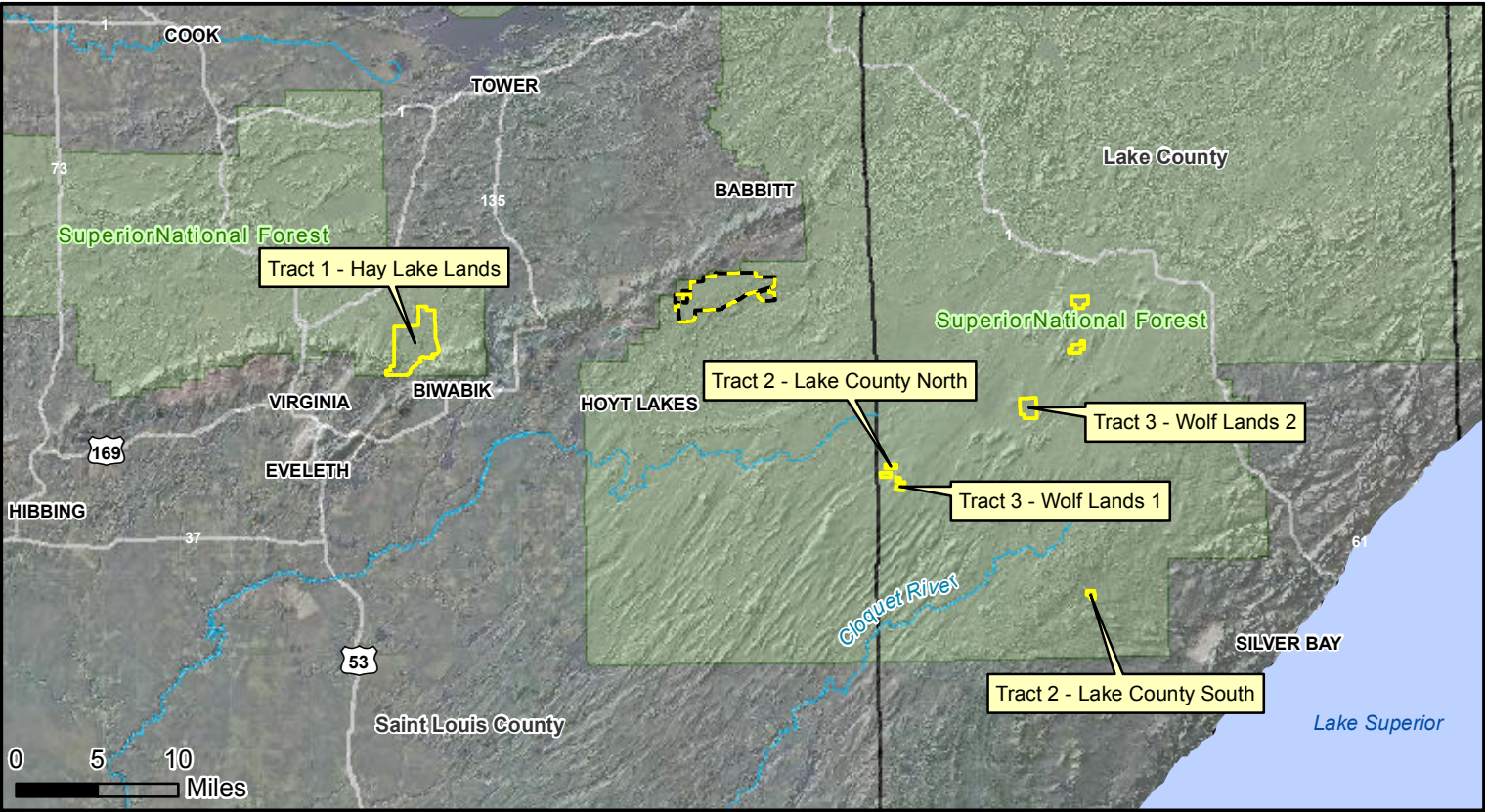
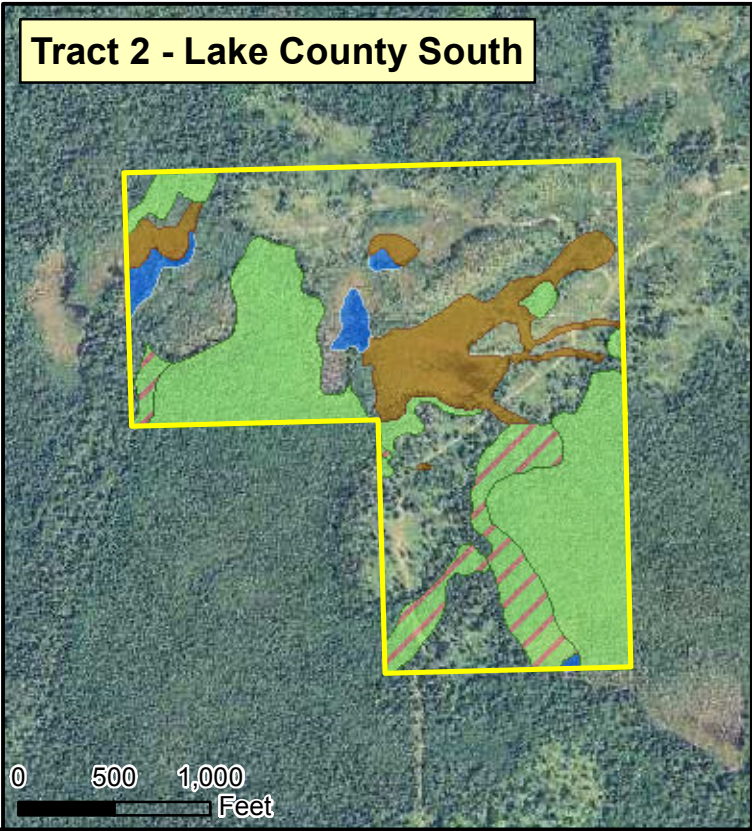
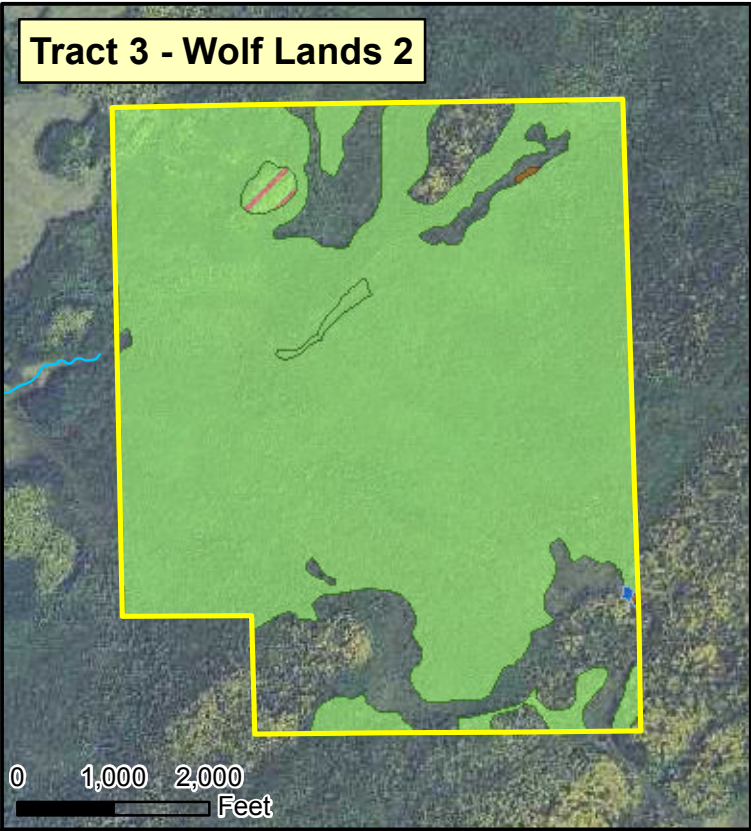
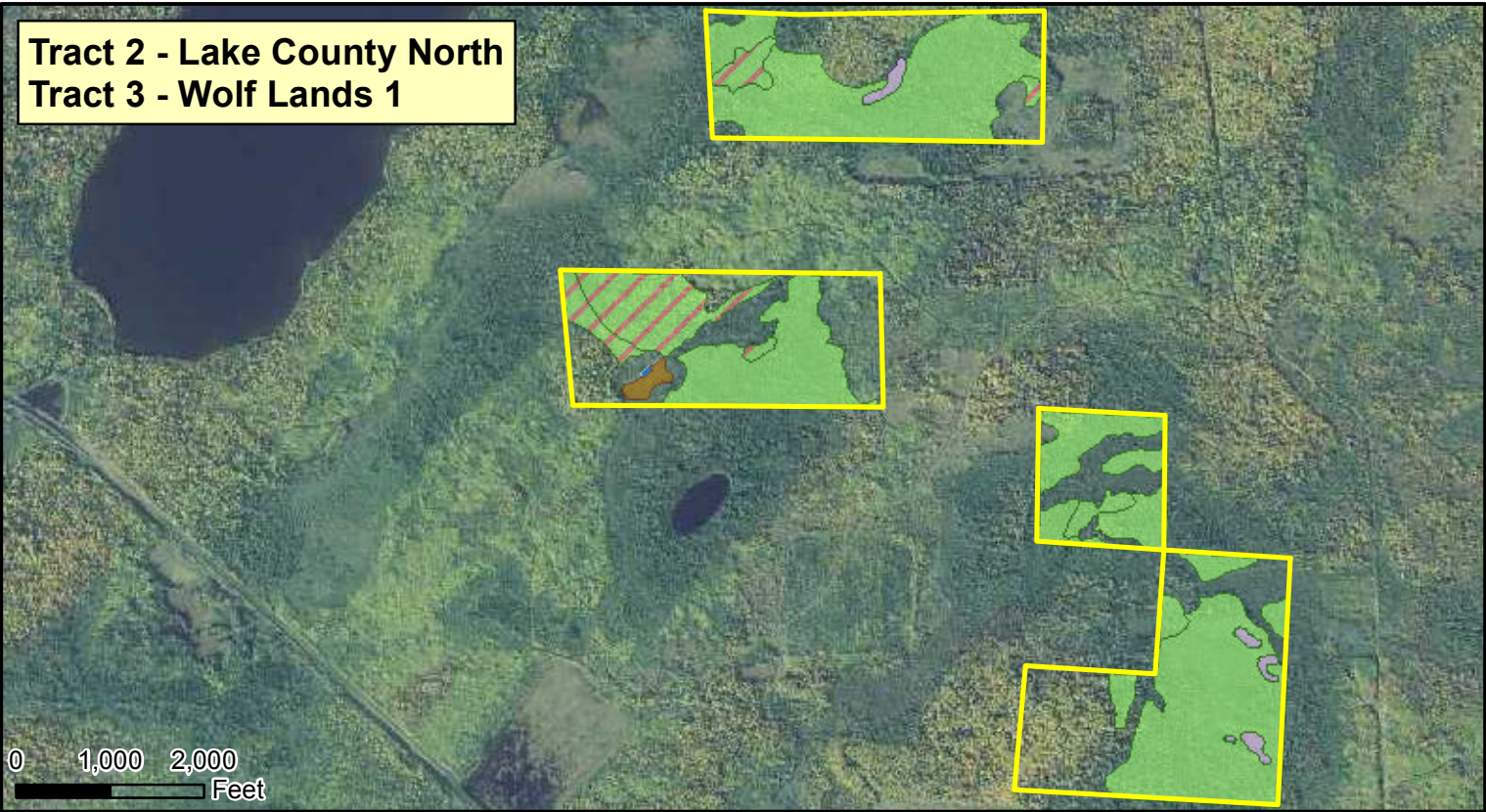
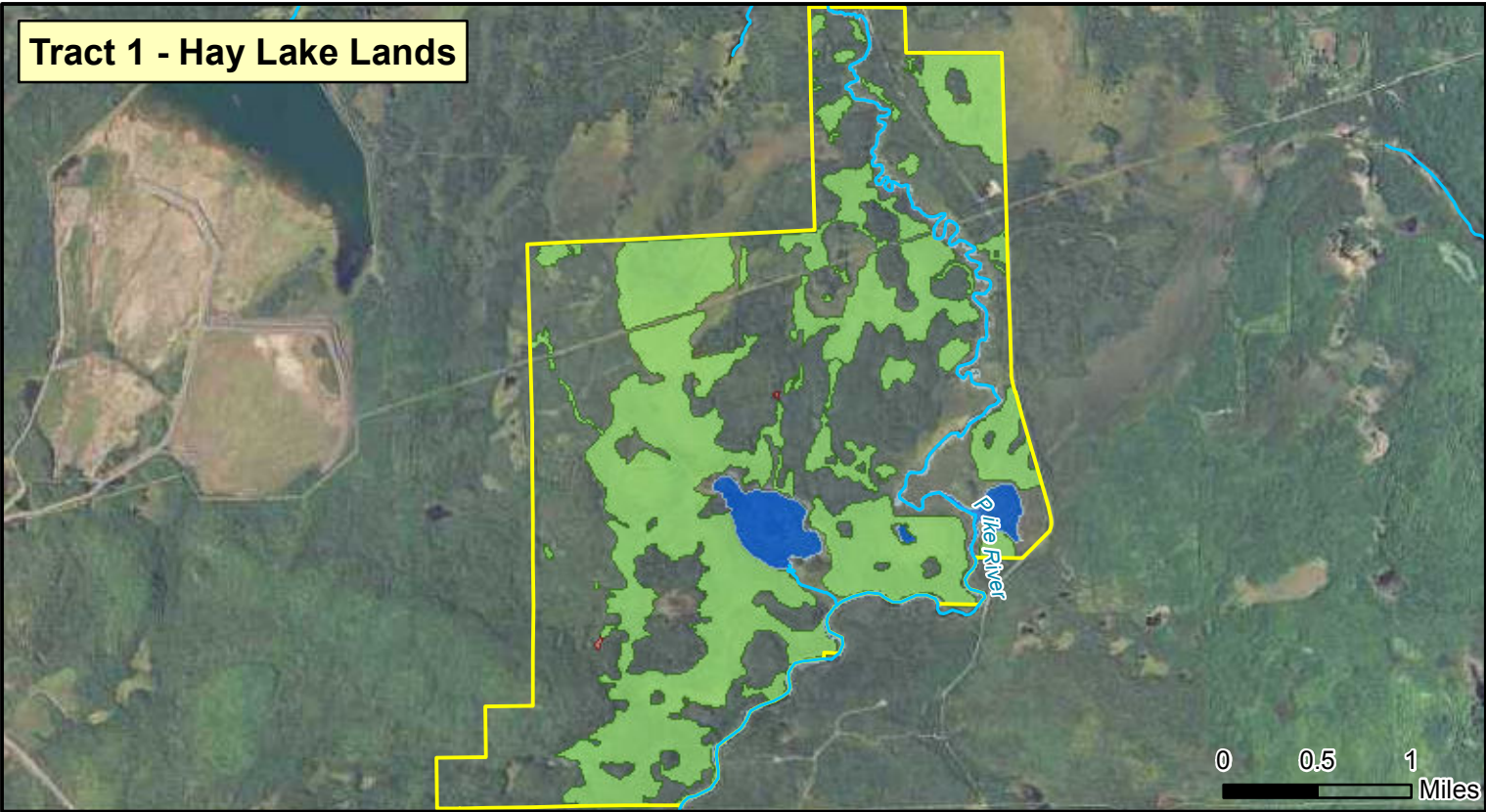
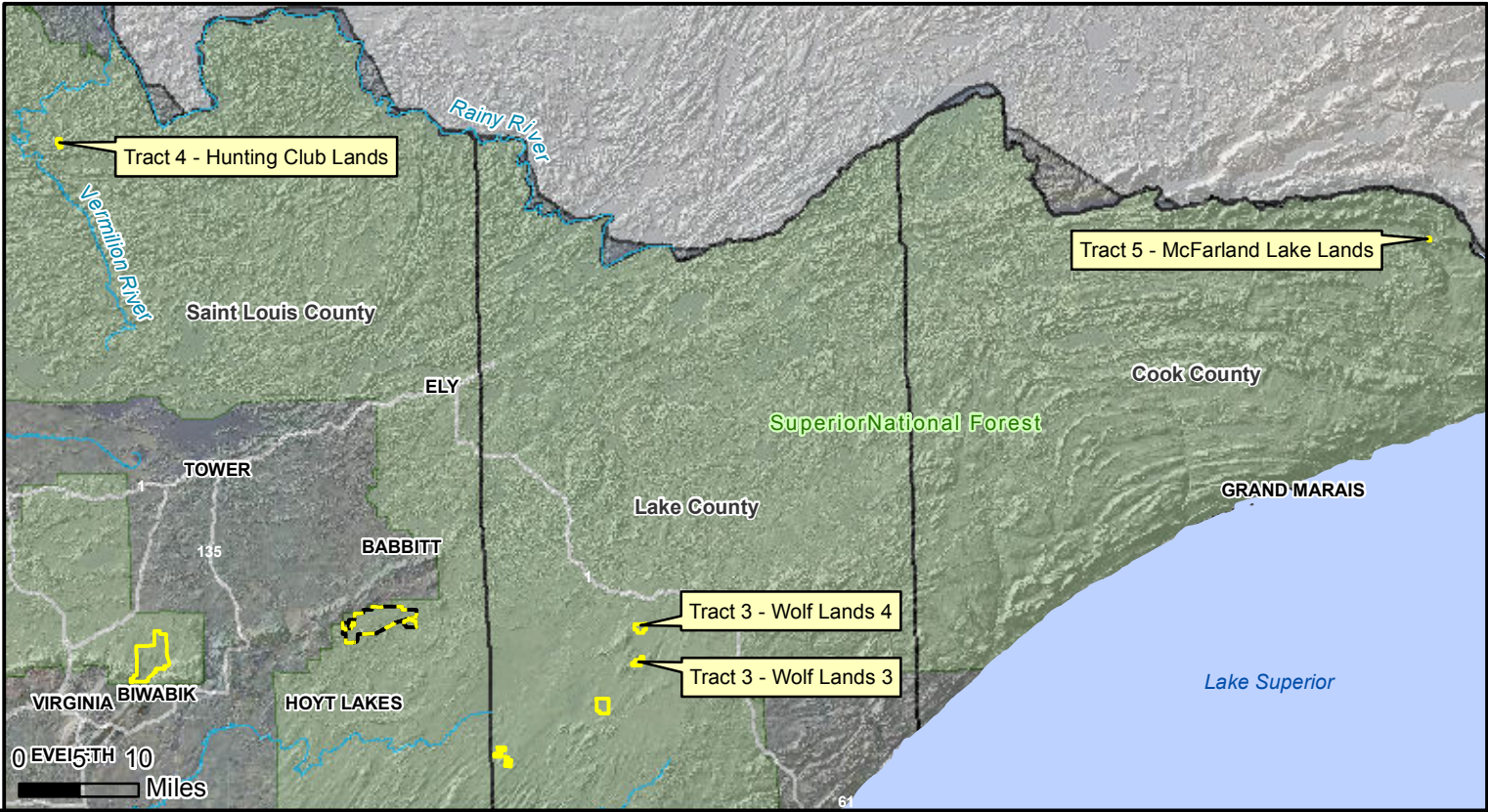
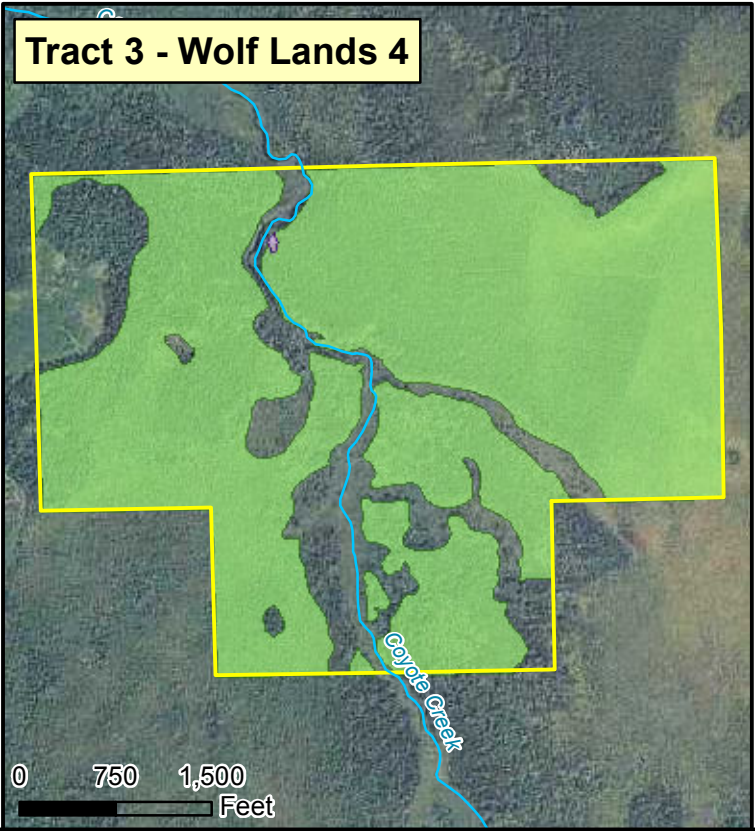
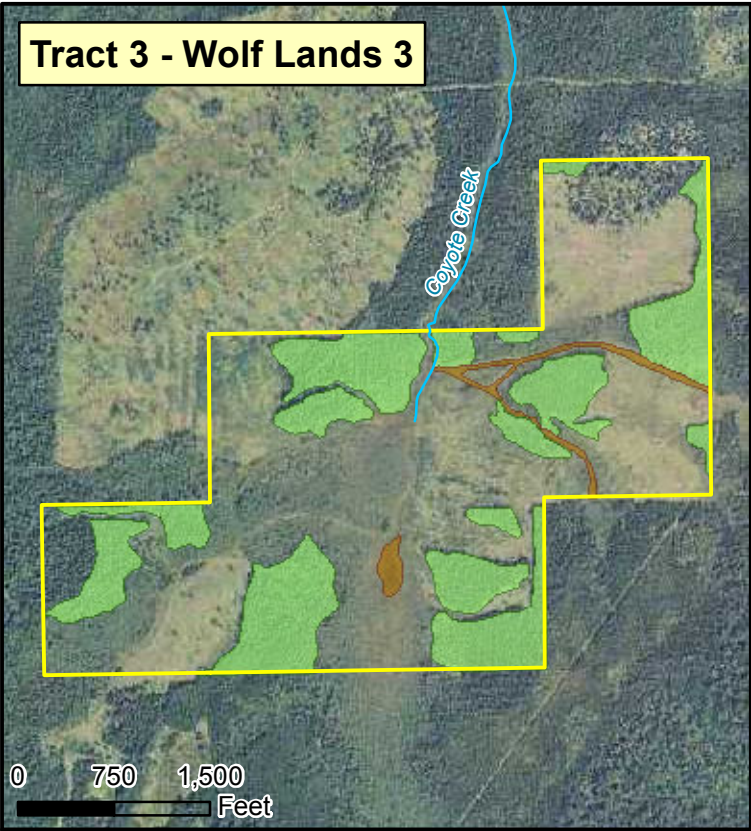
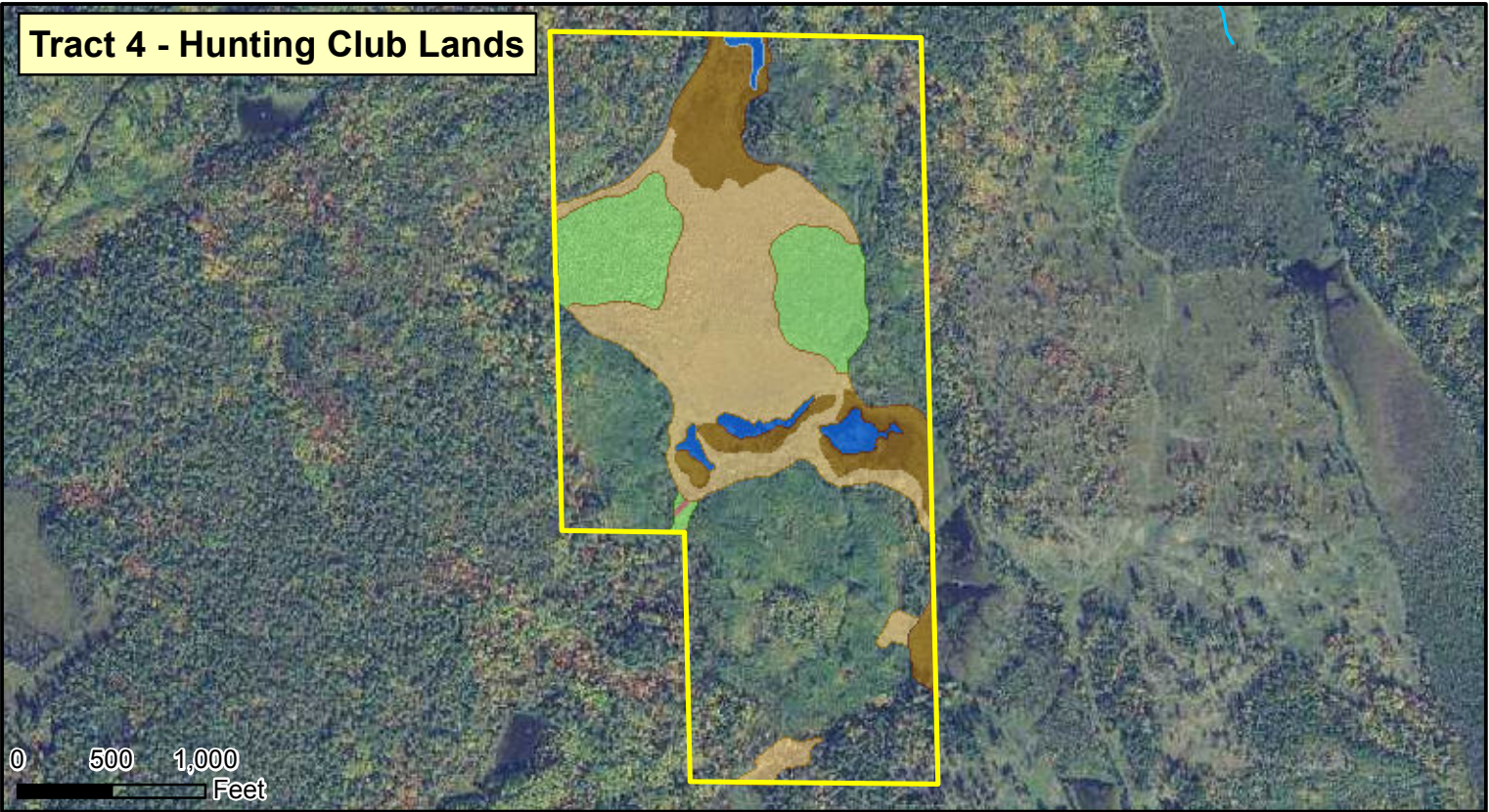


Figure 16
Wetlands - Hay Lake Lands, Lake County Lands, and Wolf Lands 1 and 2
Biological Evaluation for the NorthMet Project and Land Exchange
St. Louis County, Minnesota



- | | | |
|--------------------------------|------------------|--|
| Federal Lands | Coniferous swamp | Open water (Shallow, open water & lakes) |
| Non-federal Lands | Deep marsh; | Open bog |
| Eggers & Reed Wetland Types | | |
| Shrub Swamps | Hardwood swamp | Sedge meadow; |
| (Alder thickets & Shrub-carrs) | Hardwood/ | Wet meadow |
| Coniferous bog | Coniferous swamp | |



Figure 17
Wetlands - Hunting Club Lands, McFarland Lake Lands, and Wolf Lands 3 and 4
 Biological Evaluation for the NorthMet Project and Land Exchange
 St. Louis County, Minnesota

Table 5
GAP Cover Type and Management Indicator Habitat on Federal and Non-federal Lands

Cover Type	Federal Lands	Non-federal Lands									Net Gain (Loss) to Forest Service after Land Exchange ¹
		Hay Lake	Hunting Club	Lake North	Lake South	McFarland Lake	Wolf Lands 1	Wolf Lands 2	Wolf Lands 3	Wolf Lands 4	
MDNR GAP Types											
Aquatic	60	251	10	2	4	0	0	0	0	0	207
Disturbed	64	0	0	0	0	0	0	0	0	0	(64)
Cropland/grassland	6	32	0	0	0	0	0	0	0	0	26
Shrubland	646	1,665	45	28	11	0	7	54	32	4	1,200
Lowland coniferous forest	2,979	1,524	9	133	53	0	75	586	184	357	(57)
Lowland deciduous forest	10	17	4	1	0	0	0	6	0	0	18
Upland coniferous forest	1,619	437	8	33	39	4	13	87	46	32	(920)
Upland deciduous forest	1,092	1,000	85	34	10	27	27	30	12	8	141
Upland mixed coniferous/deciduous forest	21	0	0	34	0	0	4	6	3	4	31
Management Indicator Habitat and other Forest Service Habitat Types											
MIH 1	1,330	2,366	89	49	2	26	44	57	41	20	1,364
MIH 5	1,252	54	13	1	0	4	0	8	0	0	(1,172)
MIH 9	3,060	1,818	17	194	46	0	72	627	186	349	249
MIH 14	0	206	10	1	3	1	0	1	1	4	227
Lowland Shrub	492	113	27	21	6	0	10	76	49	31	(160)
Lowland Emergent	186	365	4	0	16	0	0	0	1	0	201
Upland Grass	0	0	0	0	43	0	0	0	0	0	43
Management Indicator Habitat Age Class											
Young	271	534	27	24	43	0	2	8	130	10	507
Immature	1,539	3,260	33	75	1	0	76	69	22	5	2,001
Mature	3,854	460	60	145	48	30	38	615	75	354	(2,029)

¹ Totals may differ from actual sums due to rounding.
 Sources: MDNR (2006), USDA Forest Service (2010a).

Table 6
Management Indicator Habitat and Age Classes on Federal and Non-federal Lands

Management Indicator Habitat and Age Class	Federal Lands - Existing Conditions (acres)		Direct Project Impacts – Federal Lands (acres) ¹	Non-federal Lands - Existing Conditions (acres)		Net Gain (Loss) to Forest Service after Land Exchange	
	Proposed Action	Alternative B		Proposed Action (All Lands)	Alternative B (Hay Lake Lands only)	Proposed Action ²	Alternative B ³
MIH 1	1,330	954	532	2,695	2,366	1,365	1,412
Young	233	233	144	607	519	374	286
Immature	540	395	231	1,497	1,387	957	992
Mature	557	326	158	591	460	34	134
MIH 5	1,252	1,139	505	80	54	(1,173)	(1,085)
Young	38	38	38	15	15	(23)	(23)
Immature	979	915	443	40	40	(940)	(876)
Mature	235	186	24	26	0	(210)	(186)
MIH 9	3,060	2,079	482	3,309	1,818	249	(261)
Young	0	0	0	113	0	113	0
Immature	20	16	0	1,988	1,818	1,968	1,802
Mature	3,040	2,063	482	1,208	0	(1,832)	(2,063)
MIH 14	0	0	0	227	206	227	206
N/A ⁴	175	80	2	4	4	(171)	(76)
Other Lowland Emergent ⁴	185	115	11	386	365	200	250
Other Lowland Shrub ⁴	492	385	141	332	113	(160)	(272)
Other Upland Grass ⁴	0	0	0	43	0	43	0
Totals⁵	6,495	4,753	1,673	7,075	4,926	580	173
MIH by age class						0	0
Young	271	271	181	778	534	507	263
Immature	1,539	1,326	673	3,540	3,260	2,001	1,934
Mature	3,854	2,575	665	1,825	460	(2,029)	(2,115)

¹ Acres of direct impacts from the Project are the same for the Proposed Action and Alternative B. The area of direct impacts on the federal lands includes portions of the Mine Site and the Dunka Road and Utility Corridor.

² The Proposed Action includes a land exchange of federal lands (6,495 acres) and non-federal lands (7,705 acres).

³ Alternative B includes a land exchange of federal lands (4,753 acres) and non-federal lands (Hay Lake Lands; 4,926 acres).

⁴ MIH type was not provided (N/A) or age class was not defined.

⁵ Totals may differ from actual sums due to rounding.

Source: USDA Forest Service (2010a).

Table 7
GAP Cover Types on Federal and Non-federal Lands

GAP Cover Types	Federal Lands - Existing Conditions (acres)		Direct Project Impacts – Federal Lands (acres) ¹	Non-federal Lands - Existing Conditions (acres)		Net Gain (Loss) to Forest Service after Land Exchange	
	Proposed Action	Alternative B		Proposed Action (All Lands)	Alternative B (Hay Lake Lands only)	Proposed Action ²	Alternative B ³
Aquatic	60	26	4	267	251	207	225
Disturbed	64	29	16	0	0	(64)	(29)
Cropland/grassland	6	2	0	32	32	26	30
Shrubland	646	437	127	1,846	1,665	1,200	1,228
Lowland coniferous forest	2,979	2,065	437	2,921	1,524	(58)	(541)
Lowland deciduous forest	10	5	0	28	17	18	12
Upland coniferous forest	1,619	1,366	738	699	437	(920)	(929)
Upland deciduous forest	1,092	805	349	1,233	1,000	141	195
Upland mixed coniferous/deciduous forest	21	18	2	51	0	30	(18)
Totals⁴	6,495	4,753	1,673	7,075	4,926	580	173

^{1,2,3} See Table 6.

⁴ Totals may differ from actual sums due to rounding.

Source: MDNR (2006).

Table 8
Wetland Types on Federal and Non-federal Lands

Wetland Types ¹	Federal Lands - Existing Conditions (acres)		Direct Project Impacts – Federal Lands (acres) ²	Non-federal Lands - Existing Conditions (acres)		Net Gain (Loss) to Forest Service after Land Exchange (acres)	
	Proposed Action	Alternative B		Proposed Action (All Lands)	Alternative B (Hay Lake Lands only)	Proposed Action ³	Alternative B ⁴
	Total Land Acres	6,495	4,753	1,673	7,075	4,926	580
Coniferous bog	1,961	1,677	505	0	0	(1,961)	(1,677)
Coniferous swamp	1,288	476	71	3,242	1,954	1,955	1,478
Hardwood swamp	21	14	13	58	8	37	(6)
Open bog	210	175	7	7	2	(202)	(173)
Deep marsh	0	0	0	0	0	0	0
Shallow marsh	97	81	23	117	84	20	3
Open water (includes shallow, open water, and lakes)	31	9	0	183	177	152	168
Shrub swamp (includes alder thicket and shrub-carr)	521	395	94	1,062	706	541	311
Sedge/wet meadow	36	35	35	0	0	(36)	(35)
Total Wetlands ⁵	4,164	2,861	747	4,670	2,931	505	70

¹ Wetland classification system based on Eggers and Reed (1997).

² Acres of direct impacts from the Project are the same for the Proposed Action and Alternative B. The area of direct impacts on the federal lands includes portions of the Mine Site and the Dunka Road and Utility Corridor.

³ The Proposed Action includes a land exchange of federal lands (6,495 acres) and non-federal lands (7,705 acres).

⁴ Alternative B includes a land exchange of federal lands (4,753 acres) and non-federal lands (Hay Lake Lands; 4,926 acres).

⁵ Totals may differ from actual sums due to rounding.

Sources: MDNR et al. (2013), PolyMet (2013, 2014).

Most upland habitat is associated with the central portion of the Mine Site. One Hundred Mile Swamp, which borders much of the Mine Site, is the dominant feature on the landscape. The Partridge River flows along and outside the northeastern and eastern boundary of the Mine Site (**Figure 3**).

Habitat observed on the Mine Site is typical of habitats associated with much of the Iron Range. Forest vegetation dominates the Mine Site (**Figures 9 and 12**). Most forest stands contain trees that are 12 inch diameter-at-breast-height (dbh) or less.

The site can be divided into three general areas. The northwestern area is dominated by lowland black spruce, with scattered stands of trembling aspen and balsam fir/trembling aspen; tamarack is also scattered throughout these stands (ENSR 2000, 2005). Most trees are estimated to be 60 years or older (USDA Forest Service 2000b). Interspersed within forest stands are brush/young tree stands in areas that were recently logged and that provide habitat for deer and moose. Several wetlands are found in the northwest area, with One Hundred Mile Swamp comprising most of the western and northern portions of this area, including the federal lands surrounding the Mine Site.

The northeastern area is dominated by nearly equal amounts of jack pine and black spruce, with scattered trembling aspen stands and speckled alder swamps (ENSR 2000, 2005). Although there are scattered black spruce stands containing trees greater than 60 years in age, most trees, especially jack pine, are 30 to 70 years in age (USDA Forest Service 2000b). There are a few recently logged areas within this area. Several large wetlands are found in this area. Most shrub/young tree habitat is associated with these wetlands and drainages.

The southern area contains a nearly equal mix of lowland and upland black spruce, jack pine, and trembling aspen, with some balsam fir and paper birch (ENSR 2000, 2005). Most tree stands are from 40 to 80+ years of age, although jack pine tree stands along Dunka Road are from 20 to 40 years of age.

Vegetation in the recently logged areas consists of grasses and ferns with trembling aspen saplings and speckled alder (ENSR 2000, 2005). The areas of more mature upland forests consist of jack pine, balsam fir, and trembling aspen, with lesser amounts of paper birch, red pine, and white pine. The mature lowland areas consist mainly of black spruce and tamarack growing on a bed of sphagnum moss and club moss with speckled alder, bog Labrador-tea, and leatherleaf. The open wetland areas consist of grasses, sedges, cattails, speckled alder, and pussywillow.

Approximately 1,719 acres of the Mine Site would be affected by the Project. **Table 9** shows the cover types that would be affected by the Project.

3.1.2 Federal Lands Surrounding the Mine Site

Federal lands surrounding the Mine Site encompass about 3,776 acres surrounding the Mine Site to the west, north, and east. This area has little topographic relief. The lands consist of a mosaic of slightly elevated upland areas surrounded by wetlands, and slope toward the east-northeast, in the direction of the Partridge River. Most (76%) of the area is wetland habitat, including a portion of One Hundred Mile Swamp, although upland habitat (24%) is an important component in the western portions of the area (**Figures 12 and 15, Table 6**). Yelp Creek flows from One Hundred Mile Swamp, joining the Partridge River, which flows around the northern, eastern, and southeastern edges of the federal lands, outside of the Mine Site (AECOM 2011a).

DESCRIPTION OF LANDS AFFECTED BY PROJECT

Forest vegetation dominates the federal lands. Most forest stands contain trees that are 12 inches dbh or less. The area can be divided into three general parts (AECOM 2011a). The eastern portion is dominated by the Partridge River. Large stands of lowland black spruce with scattered northern white cedar and tamarack are found in low areas associated with the river. Emergent and speckled alder wetland is adjacent to most of the river. Stands of immature (trees from 5 to 11 inches dbh, and from about 10 to 80 years of age) and mature (trees greater than 11 inches dbh and over 80 years of age) mixed coniferous/deciduous forest, coniferous forest dominated by jack pine, and smaller patches of immature deciduous forest, are found at higher elevations (USDA Forest Service 2000b).

The northern portion of the federal lands surrounding the Mine Site includes a portion of One Hundred Mile Swamp. The swamp is comprised of some young (trees less than 5 inches dbh and less than 10 years of age), but mostly immature and mature black spruce, northern white cedar, and tamarack forests (AECOM 2011a). Northern white cedar is prevalent in the northcentral portion of the northern area, while black spruce and tamarack are more common in the remaining areas. Scattered stands of speckled alder are associated with the swamp, as are bog and emergent wetlands, especially along the Partridge River. There are scattered “islands” of mature deciduous and mixed coniferous/deciduous forest. Most of the forest stands are 90 years or older, with many of the remaining stands 70 to 90 years of age (USDA Forest Service 2000b).

The western portion of the federal lands surrounding the Mine Site are dominated by lowland immature black spruce forest in its center, bordered by bog wetlands and wetlands dominated by speckled alder and red-osier dogwood (AECOM 2011a). A large area dominated by cattail is associated with the transmission line rights-of-way (ROW). Upland immature and mature deciduous and mixed coniferous/deciduous forest, with scattered stands of coniferous forest, surrounds the centrally located black spruce forest. Clearings comprised of grasses, forbs, and shrubs are associated with the transmission line ROW, while scattered low areas, dominated by emergent and shrub swamp wetland vegetation, are interspersed within upland forest habitats.

Table 9
GAP Cover Types Affected by the Project at the Mine Site

Cover Type	Affected Acres	Non-affected Acres	Total Cover Type Acres	Percent of Cover Type Affected
Upland coniferous forest	742	454	1,196	62
Lowland coniferous forest	437	344	781	56
Upland deciduous forest	355	293	648	55
Shrubland	133	109	242	55
Disturbed	44	84	128	34
Aquatic environments	6	7	12	50
Upland coniferous-deciduous forest	2	1	3	67
Cropland/grassland	<1	5	5	4
Lowland deciduous forest	0	<1	<1	0
Total	1,719	1,296	3,015	57

Source: MDNR et al. (2013).

3.2 Plant Site and Transportation and Utility Corridors

The Plant Site encompasses about 4,515 acres, which include the former LTVSMC processing plant, existing LTVSMC Tailings Basin, Area 1 Shop, Hydrometallurgical Residue Facility, and administration buildings. There is no federal land at the Plant Site.

The southwestern corner of the Plant Site, the former LTVSMC processing plant, has almost entirely been disturbed by past mining activities. No wetlands are present within this portion of the Plant Site, although there is a plant reservoir east of the concentrator that is not regulated as a wetland (PolyMet 2014a). The regulated wetlands within the Plant Site include a total of 52 wetlands covering approximately 245 acres. Using the MDNR GAP land cover types, approximately 61% (2,756 acres) of the Plant Site is disturbed and supports little vegetation. The remaining areas consist of trembling aspen and trembling aspen-paper birch forest (14%), aquatic habitat (14%), grass/brushland (7%), upland coniferous forest (2%), and lowland coniferous forest (1%; MDNR et al. 2013).

The Dunka Road and Utility Corridor is approximately 108 acres and the Railroad Connection Corridor is approximately 12 acres. There is no federal land in the Railroad Connection Corridor; however there is some federal land in the Dunka Road and Utility Corridor (**Figure 3**). Because of prior use during the former LTVSMC taconite mining operation, the Dunka Road and Utility Corridor is now defined as having a “disturbed” cover type. The remaining MDNR GAP land cover types that are not disturbed include cropland/grassland (8%), shrubland (6%), and smaller acreages of the remaining types. A total of 25 wetlands, encompassing approximately 7 acres, have been identified within the Dunka Road and Utility Corridor (MDNR et al. 2013).

3.3 Non-federal Lands

3.3.1 Hay Lake Lands

Hay Lake Lands are approximately 4,926 acres and have moderate topographic relief. The lands consist of a mosaic of slightly elevated upland areas surrounded by wetlands, and slope toward the east-northeast, in the direction of the Pike River (AECOM 2011b).

Most (59%) of Hay Lake Lands is wetland habitat, although upland habitat (41%) is an important component in the central and western portions of the lands (**Figure 16**). The Pike River, Hay Lake, and Little Rice Lake are dominant features of the landscape. The Pike River flows along the eastern boundary of the lands.

Forest vegetation dominates Hay Lake Lands. Nearly all forest stands contain trees that are 12 inches dbh or less, and most of the upland trees are 8 inches dbh or less. The lands can be divided into four general habitats. The eastern portion is dominated by the Pike River. Floodplain associated with river is dominated by emergent wetland with sedge and grass habitat, and shrub swamp wetland with speckled alder habitat. Wetland areas to the west of the river are dominated by lowland black spruce forest, with scattered northern white cedar and tamarack, and shrub swamp wetlands, especially in areas with evidence of past disturbance by logging activities.

Higher elevations in the northern, central, and western portions of the lands are dominated by upland deciduous and mixed coniferous/deciduous forest. Upland forest stands in the northern, central, and southwestern portions of the lands are immature to mature in size and age, while stands in the western portion of the lands are young to immature in size and age, having been harvested in recent years. Most trees are estimated to be 60 years or

younger. Two transmission line ROWs are found on the lands. Emergent wetland and upland grassland/shrubland vegetation dominates the ROWs. Abandoned logging roads are also found on the lands. Low areas along roads are dominated by emergent wetland vegetation consisting of sedges and grasses, while upland portions of roads are dominated by grasses and forbs.

3.3.2 Hunting Club Lands

Hunting Club Lands are approximately 160 acres, of which about 64 acres are wetland (**Figure 17, Table 5**). The lands drain to the north and then northeast via an unnamed creek. Several beaver dams are found along the creek. From this low area, the lands slope upward to the east and west. The lands consist primarily of shrub swamp wetland, with lesser amounts of emergent wetland, and upland immature and mature deciduous forests (AECOM 2011c).

Beaver ponds and dams are the dominant wetland features on the lands. Open water habitat is typical near the dams. Emergent vegetation, consisting of Canada bluejoint, narrow-leaved cattail, and sedges, is found in water from 12 to 24 inches deep, while shrub swamp is found near ponds at water depths from 6 to 18 inches. Speckled alder makes up to 80% of the cover in the shrub swamp wetlands. A large immature black spruce forest is found in the middle of Hunting Club Lands. The midstory consists of speckled alder, while leatherleaf, bog Labrador-tea, and sphagnum moss are found below the speckled alder. Immature black ash is found in a drainage leading to wetlands on the lands.

Habitat in the northwestern and northeastern portions and near the southern boundary of the lands is comprised of upland mature mixed coniferous/deciduous forest, dominated by eastern white pine to 24 inches dbh, and paper birch and trembling aspen to 12 inches dbh. The midstory consists primarily of balsam fir, while beaked hazel is found in the shrub layer.

The eastern and southern portions of the lands consist of patches of upland young and immature trembling aspen. The midstory consists of beaked hazel, with scattered black spruce and balsam fir. There is little ground cover. An “island” of trembling aspen-eastern white pine forest is found within the young and immature trembling aspen forest. It consists of young mature forest comprised of trembling aspen and eastern white pine to 16 inches dbh and black spruce to 12 inches dbh. There are many downed trees and much woody debris on the ground.

3.3.3 Lake County Lands

Lake County Lands consist of Lake County Lands North and Lake County Lands South.

3.3.3.1 Lake County Lands North

Lake County Lands North is approximately 265 acres, of which about 209 acres are wetland (**Figure 16, Table 5**). The lands have moderate topography, with the terrain generally sloping toward the southwest and Pine Lake. Lake County Lands North consists of two small areas to the north, and a single, small area to the south that is adjacent to Wolf Lands 1. The lands are comprised of mostly wetland habitat, except for areas of upland habitat on the northern portion of the northern area and on portions of the southern area. Portions of the lands have recently been logged. Wetland habitat consists mostly of immature coniferous forest, with lesser amounts of mature mixed coniferous/deciduous forest and shrubland. Upland habitat is dominated by mature deciduous and immature deciduous forests (AECOM 2011c).

Wetlands are comprised primarily of immature northern white cedar and black spruce with lesser amounts of tamarack, although several drainages also contain black ash. The midstory consists of balsam fir and black spruce, while speckled alder, leatherleaf, and bog Labrador-tea are found in the shrub layer. Club moss and sphagnum moss cover most of the ground.

Shrub swamp and emergent wetland habitats are also found on the lands. Shrub swamp habitat is associated with several drainages, a beaver pond, a bog area, and recently logged areas, while emergent wetland habitat was found near the beaver pond and on recently logged areas. Shrub swamp wetlands are dominated by speckled alder. Vegetation in the emergent wetlands consists of sedges and Canada bluejoint, with scattered black spruce, northern white cedar, tamarack, and speckled alder.

Upland habitats are comprised of immature and mature paper birch and black spruce, while recently logged areas supported young paper birch stands or shrub habitat. The midstory cover is comprised of balsam fir, black spruce, and beaked hazel. Young paper birch with scattered young trembling aspen and scattered immature paper birch are in areas that had been recently logged.

Older forests contain large amounts of downed woody material; this material is mostly absent in logged areas. Tree wind-throw is common in forest stands adjacent to the clearcuts, and walking in these forests is difficult due to downed trees and woody debris, and the dense stand of balsam fir, black spruce, and northern white cedar in the midstory.

3.3.3.2 Lake County Lands South

Lake County Lands South is approximately 117 acres, of which about 74 acres are wetland (**Figure 16, Table 5**). The lands are relatively flat in the northwest, rise in elevation to the northeast, and fall in elevation to the southeast. Water flows from west to east. A series of beaver dams and ponds dominate the landscape. Several areas have been recently logged and the dominant upland habitat is shrubland (AECOM 2011c).

Forested wetlands dominate the western and southeastern portions of the lands and are comprised of immature and mature black spruce and northern white cedar, although immature tamarack is found in some forest stands and immature black ash is an important component of several drainages. The midstory consists of balsam fir and black spruce. Speckled alder, leatherleaf, bog Labrador-tea, and red-osier dogwood are common shrubs, while sphagnum moss covered most of the ground. Forests in the northwestern portion contain a dense mix of northern white cedar and black spruce with scattered black ash in the drainages. The northwestern area of the northwestern portion is dominated by immature and mature northern white cedar.

Five beaver ponds were found on the lands. These ponds are comprised of open water with scattered dead spruce surrounded by emergent wetland dominated by sedges, narrow-leaved cattail, woolgrass, and Canada bluejoint, or by dense stands of speckled alder in shallow-water areas. Shallower-water drainages, especially in areas that have been logged, are covered by speckled alder, sedges, and narrow-leaved cattail.

Most upland areas have been recently clear-cut, with the exception of the southwestern section of the lands. This area has been partially thinned, leaving areas where mature paper birch, black spruce, jack pine, eastern white pine, and northern white cedar trees remain, ranging from 12 to 24 inches dbh. Balsam fir and beaked hazel are found in the midstory, while forbs and grasses cover the ground layer. Because of recent logging activity, woody debris and large downed trees are abundant.

3.3.4 McFarland Lake Lands

McFarland Lake Lands are about 31 acres on a hillslope that rises from 1,483 feet above mean sea level at McFarland Lake to 1,778 feet above mean sea level on the western boundary of the lands. Rocky cliffs, about 150 feet in height, are found at the top of the hillslope and large boulders are found on the hillslope (AECOM 2011c).

McFarland Lake Lands are dominated by deciduous and mixed coniferous/deciduous forest habitats (**Figure 17, Table 5**). Tree sizes and ages range from immature to mature. Some logging has occurred at the top of the hillslope along the western boundary of the lands.

3.3.5 Wolf Lands

Wolf Lands total 1,576 acres and consist of four parcels, Wolf Lands 1, 2, 3, and 4.

3.3.5.1 Wolf Lands 1

Wolf Lands 1 is approximately 126 acres, of which about 90 acres are wetland (**Figure 16, Table 5**). Most upland habitat consists of mature coniferous and deciduous forest, while most wetland habitat consists of immature coniferous forest. The lands are relatively flat but slope gently downward toward the southwest. The lands are adjacent to Lake County Lands North (AECOM 2011c).

Wetland communities are comprised primarily of young and immature forests in nearly equal amounts. Young forests are comprised of black spruce, with scattered northern white cedar and tamarack. Young forests have characteristics of more open bogs, as tree cover is sparse, trees are short, and most of the ground is covered by bog Labrador-tea and leatherleaf, and sphagnum moss. In immature forests, the canopy is dominated by 6 to 10 inches dbh black spruce, with tamarack and northern white cedar also present. The midstory consists of balsam fir and black spruce, while speckled alder, leatherleaf, bog Labrador-tea, and red-osier dogwood dominate the shrub layer. Club moss and sphagnum moss cover most of the ground (AECOM 2011c).

Upland mixed coniferous/deciduous immature and mature forest is found in the southwestern portion of the lands. Paper birch and trembling aspen cover about half of the area, and the midstory consists of mostly balsam fir; beaked hazel, and red-osier dogwood.

3.3.5.2 Wolf Lands 2

Wolf Lands 2 is approximately 769 acres, of which about 706 acres are wetland (**Figure 16, Table 5**). The lands consist of gently undulating terrain and slope toward the southwest. Water generally flows to the southwest and to Mary Ann Creek, Wenhoo Creek, and Greenwood Lake. The lands consist primarily of wetlands comprised of immature black spruce and northern white cedar forest, while shrub swamp comprised of speckled alder also is common. Black spruce is the dominant tree in wetlands in the northern and eastern portions of the lands, while northern white cedar is more prevalent in other portions of the lands (AECOM 2011c). Several drainages are dominated by speckled alder or have a black ash component, while emergent wetland habitat is associated with beaver ponds. Most upland habitat consists of immature mixed coniferous/deciduous forest.

Wetland immature forests are of three types: black spruce dominant, a mix of black spruce and northern white cedar, or northern white cedar dominant. Canopy trees range from 4 to 8 inches dbh. The midstory consists of

young black spruce, northern white cedar, and balsam fir. Bog Labrador-tea comprises 10 to 30% of the low shrub cover, while sphagnum moss often covers more than 80% of the ground.

Several drainages are dominated by shrub swamp vegetation. These drainages generally have a sparse overstory of black spruce, northern white cedar, and tamarack. Speckled alder and young trees are in the midstory while low shrub cover consists of bog Labrador-tea.

Beaver dams and ponds are found in the southeastern portion of the lands. Typically, open water is adjacent to the dams, with emergent wetland surrounding the open water and shrub swamp wetland upstream of the dams.

Upland habitat in the northern portion of the lands consists of an overstory of young and immature mixed coniferous/deciduous forest over a shrub layer of beaked hazel. Some of the upland area on the northern portion of the lands has been logged. Upland habitat is also found in the southern portion of the lands and is comprised of paper birch, trembling aspen, and black spruce, over a midstory of balsam fir and shrub layer of beaked hazel.

3.3.5.3 Wolf Lands 3

Wolf Lands 3 is approximately 277 acres, of which about 233 acres are wetland (**Figure 17, Table 5**). The lands are relatively flat and Coyote Creek begins its northward flow within the lands. Wetlands are dominated by shrub swamp and immature coniferous forest habitat, while uplands consist of mostly shrubland and immature deciduous forest (AECOM 2011c).

About half of the lands have been recently logged. Logged wetlands are dominated by grasses, forbs, and low growing shrubs, including red-osier dogwood and speckled alder. In shrub swamp wetlands, speckled alder dominates. Bog Labrador-tea is often thick in areas where there is a dense cover of speckled alder. Vegetation on logged uplands includes grasses, forbs, and beaked hazel.

In the unlogged areas, wetland forests are comprised of immature black spruce. In the northern portion of the lands, black spruce is co-dominant with tamarack; in the rest of the lands, tamarack is present in the canopy but in much lower amounts. The midstory consists of balsam fir and black spruce, while the shrub layer is dominated by bog Labrador-tea, over a ground layer of nearly continuous sphagnum moss with scattered grasses and forbs. There are numerous downed trees and much woody debris associated with tree wind-throw in areas adjacent to the clearings.

Coyote Creek is bordered by emergent sedge meadow wetland comprised of sedges, narrow-leaved cattail, and Canada bluejoint. There are also scattered young tamarack and northern white cedar, as well as scattered patches of speckled alder and bog Labrador-tea. The emergent wetland is bordered by dense speckled alder. Water depth in the emergent and shrub swamp wetlands is about 18 to 24 inches.

Upland areas within the lands have been logged recently. Most of these areas have few trees remaining, though some areas still support paper birch up to 16 inches dbh and scattered balsam fir. The upland habitat along the boundary of the lands consists of both young and mature paper birch with scattered black spruce and northern white cedar, over an understory comprised of balsam fir.

3.3.5.4 Wolf Lands 4

Wolf Lands 4 is approximately 405 acres, of which about 363 acres are wetland (**Figure 17, Table 5**). Coyote Creek bisects the lands, while the Stony River is found about 2,000 feet northwest of the lands. Timber harvests have recently occurred along the western border of the lands. Wetland habitats are dominated by immature coniferous forest and shrub swamp, while upland habitat consists primarily of mature deciduous forest (AECOM 2011c).

Coniferous forest dominates the wetland habitat. Black spruce forest dominates in the northern half of the lands, while northern white cedar is more prevalent in the southern half of the lands. Immature-size trees prevail over most of the lands, but patches of young black spruce are more common in the northeastern portion of the lands, and young northern white cedar and black spruce are more common in the southwestern portion of the lands. Emergent communities comprised of sedges and Canada bluejoint, and shrub swamp communities comprised primarily of speckled alder, are found in floodplains that border Coyote Creek.

Immature black spruce and black spruce/northern white cedar wetlands are dominated by trees ranging from 4 to 8 inches dbh. Scattered young and immature tamarack is also found in these wetlands. The low shrub layer is nearly continuous, and is comprised of leatherleaf, bog Labrador-tea, and other vegetation. Sphagnum and club mosses cover most of the ground.

Shrub swamp is dominated by speckled alder, with scattered black spruce, tamarack, and northern white cedar in the overstory. Leatherleaf and bog Labrador-tea cover comprise about 40 to 50% of the shrub layer.

Upland habitat consists of immature and mature paper birch and some black spruce. Trees are up to 18 inches dbh, although a 30 inches dbh jack pine and several large red pines to 24 inches dbh are found on the lands. Balsam fir is common in the midstory, while beaked hazel and raspberry are dominant in the shrub layer. In areas that have been logged recently, young paper birch is common over a shrub layer of beaked hazel, raspberry, and bog Labrador-tea.

4.0 Biological Evaluation Methodology

This section discusses the methods and references used for the literature review, database inquiries, consultations, field studies, and effects determination for the BE. This information is used in Section 5.0 for the analysis and determination of effects for all RFSS plants and animals.

4.1 Literature Review

4.1.1 Biological Evaluations

Several recent BEs have been prepared for proposed actions on or near the federal and non-federal lands and provided information that is used in this BE and include:

- *Forest Plan Revision Chippewa and Superior National Forests Regional Forester Sensitive Plants Biological Evaluation* (USDA Forest Service 2004c) and *Forest Plan Revision Chippewa and Superior National Forests Regional Forester Sensitive Animals Biological Evaluation* (USDA Forest Service 2004d; collectively 2004 Forest Service BEs) – evaluated potential effects to RFSS plants and animals from proposed vegetation management activities in the Chippewa and Superior National Forests, including federal lands.
- *Whyte Forest Management Project Laurentian Ranger District, Superior National Forest Biological Evaluation Region 9 Regional Forester Sensitive Species* (USDA Forest Service 2006) – evaluated potential effects to RFSS plants and animals from proposed forest management activities in Lake County.
- *Tracks Forest Management Project Laurentian Ranger District, Superior National Forest Biological Evaluation Region 9 Regional Forester Sensitive Species* (Tracks Project BE; USDA Forest Service 2010b) – evaluated potential effects to RFSS plants and animals from proposed forest management activities on the Tracks Forest Management Project (Tracks Project) area east of Hoyt Lakes and north of Brimson, Minnesota, in Lake and St. Louis Counties, and near the Project area. The Track Project area encompasses about 152,000 acres of land of which approximately 78,000 acres are in the Superior National Forest.
- *Regional Forester Sensitive Species Biological Evaluation for the Federal Hardrock Mineral Prospecting Permits Final EIS Appendix I Superior National Forest* (USDA Forest Service 2012) – evaluated potential effects to RFSS plants and animals from proposed hardrock mineral prospecting activities in the Superior National Forest, including the federal lands.

4.1.2 Other Sources of Information

- *Winter 2000 Wildlife Survey for the Proposed NorthMet Mine Site, St. Louis County, Minnesota* (ENSR 2000).
- *Land and Resource Management Plan for the Superior National Forest* (USDA Forest Service 2004a).
- *NorthMet Mine Summer Fish and Wildlife Study* (ENSR 2005).
- *2009 NorthMet Mine/Forest Additional Parcel Northern Goshawk and Owl Survey – Final Report* (AECOM 2009).

- *2008 NorthMet Mine/Forest Service Additional Parcel Summer Wildlife and Wetland Assessment – Final Report* (AECOM 2011a).
- *2009 Hay Lakes Parcel and McFarland Lake Parcel Summer Wildlife and Wetland Assessment Final Report* (AECOM 2011b).
- *Hunting Club, Lake County, and Wolf Land Parcels Fall 2010 Wildlife and Wetland Assessment Final Report* (AECOM 2011c).
- *NorthMet Mining Project and Land Exchange Draft Supplemental EIS* (MDNR et al. 2013).
- *Superior National Forest Bat Monitoring: Summary of 2013 Survey Effort* (Grandmaison et al. 2013).
- *Summary of Acoustic and Emergence Surveys for Bats in the NorthMet Project Area* (USDA Forest Service 2014a).
- *Summary of the 2014 Minnesota Northern Long-eared Bat Summer Habitat Use in Minnesota Project (Preliminary Report)* (USDA Forest Service 2014b).

4.2 Database Inquiries

The MDNR Natural Heritage Information System (NHIS) Rare Features database was queried for sightings of RFSS within the federal and non-federal lands (MDNR 2014a).

4.3 Consultation with Biologists with Local Knowledge of the Species

Telephone and in-person interviews were conducted with agency and other personnel with knowledge of RFSS in the region, including staff with the MDNR, Forest Service, and University of Minnesota.

4.4 Field Studies

4.4.1 Federal Lands

Several studies have been conducted for RFSS plants and animals on the federal lands. Three rare plant surveys were conducted on the proposed Mine Site during July 2004 (Johnson-Groh 2004, Pomroy and Barnes 2004, Walton 2004). A variety of habitats were surveyed and Global Positioning System (GPS) was used to record the locations of rare plant occurrences. Photographs were taken of specimens in their habitats, and representative specimens were collected, pressed, dried, and analyzed in the laboratory. Characteristics of the habitat were recorded at each location where RFSS plants were observed.

Surveys for moonworts, which are rare ferns, were conducted in July 2004 on the Mine Site using protocol developed by Johnson-Groh (2004) for the Forest Service. Areas with high potential for having moonworts were searched on hands and knees using the timed meander search approach.

Barr Engineering Company (Barr; 2007a) conducted surveys for ternate grapefern in late August and early September 2007. Surveys were conducted along the Dunka Road and other roads for the Project. The majority

of vegetation cover types on the Project area do not provide suitable habitat for St. Lawrence grapefern. Characteristics of the habitat were recorded at each location where RFSS plants were observed.

ENSR conducted studies of wildlife use of the proposed Mine Site in 2000 (winter study) and 2004 (summer study; ENSR 2000, 2005). In addition to determining general wildlife use of the area during January and March 2000 and June 2004, the study also determined the presence of RFSS wildlife species and important habitats used by RFSS and other wildlife species. These studies involved: 1) reviewing federal and state agency and conservation group databases for known and historic occurrences of RFSS species in the proposed Mine Site area; 2) reviewing previous plant and animal surveys conducted on or near the proposed Mine Site; 3) consultation with agency and conservation group biologists; 4) field surveys to record wildlife and their habitats on the site; and 5) calling surveys for wolf, raptors, and several species of woodpeckers, including RFSS species. In addition, a vegetation cover type map was prepared showing the habitat types on the site, including disturbed, wetland, and upland habitats. Within the wetland and upland habitat types, open water, emergent and bog wetland, grassland, shrubland, and deciduous, mixed deciduous/coniferous, and coniferous forest habitat types were recorded.

In October 2004, David Heath conducted studies of the freshwater mussel fauna in two reaches of the Partridge River, one reach of the Embarrass River, and one reach of Trimble Creek (Heath 2004). Mussels were collected by hand using Self-contained Underwater Breathing Apparatus (SCUBA) and snorkeling equipment.

In February 2005, Dan Breneman conducted a stream and wetland biological survey in the Project area (Breneman 2005). The survey was conducted on four stream sites and two wetland sites. Fish and macroinvertebrate community composition, habitat characteristics, and water chemistry parameters were examined to establish biological condition at these sites. Fish were sampled by electrofishing in streams, and with 24-hour trap net sets in wetlands. Macroinvertebrates were collected with D-frame kick nets and Hess, Ekman, or Petite Ponar dredge sampling gear. Total number of fish and total length per species were determined within each stream reach to estimate catch-per-unit effort. Macroinvertebrates were identified and enumerated, and the relative abundance and taxa richness per site were determined. Stream habitat characteristics and water quality parameters at each site were summarized by point estimates along randomly spaced transects.

Wetlands on the Mine Site were initially mapped in June 2004 by ENSR based on a general field survey of the area for wetland and upland habitats (ENSR 2005). The location and boundaries of wetlands were determined based primarily on vegetative and hydrologic characteristics of the sites (wetland boundaries were not mapped using GPS).

Between 2004 and 2012, Barr evaluated wetlands across the federal lands, including the Mine Site. Barr conducted wetland delineations across several Project areas between 2004 and 2006 (PolyMet 2013, 2014). In 2007, Barr evaluated wetlands on approximately 2,420 acres of the federal lands surrounding the Mine Site that were not evaluated as part of the 2004 to 2006 studies (Barr 2007b). Wetlands in this area were identified from field studies and aerial interpretation. Along the Dunka Road and other possible transportation routes, Barr conducted field studies to determine wetland boundaries, vegetation cover types, and plant species composition of wetlands identified in this area. For areas outside of the Dunka Road and possible transportation routes, wetlands were mapped primarily based on the presence of photographic signatures with limited field-truthing and GPS-locating. Barr also assessed wetland functions and values for these wetlands.

In September 2007 and August 2008, Barr assessed plant species of concern on portions of the federal lands surrounding the Mine Site (Barr 2007a, 2009a, 2011).

In August 2008, AECOM conducted studies of wildlife use of lands surrounding the Mine Site (AECOM 2011a). The study also determined the presence of RFSS wildlife species and important habitats used by RFSS and other wildlife species, and followed protocols used during 2000 and 2004 surveys of the Mine Site. In April 2009, AECOM conducted calling surveys for northern goshawk and owls, and made observations of other wildlife, on the federal lands surrounding the Mine Site (AECOM 2009).

The USFS Superior National Forest staff conducted surveys for the northern long-eared bat and little brown bat at three general locations in the Project area in July and August 2014 (Smith et al. 2014). The three Project locations included the Mine Site, the Plant Site, and the Dunka Road and Utility Corridor. Survey methods utilized passive sonic (Anabat) detectors on the Mine Site and Dunka Road and Utility Corridor. At the Plant Site, the methods were primarily direct observation of bat species, supplemented by passive sonic detectors when feasible.

4.4.2 Non-federal Lands

In June 2009, AECOM evaluated wildlife and their habitats and conducted northern goshawk, owl, bat, and gray wolf surveys on about 4,760 acres of non-federal lands on Hay Lake Lands and McFarland Lake Lands (AECOM 2011b). In November 2010, wildlife and their habitats, and wetland functions and values, were evaluated on the Lake County Lands, Hunting Club Lands, and Wolf Lands (AECOM 2011c). During both wildlife surveys, AECOM also mapped upland and wetland habitats on the lands and evaluated wetlands for their functions and values. Survey protocols were similar to those used by ENSR and AECOM for the federal lands.

An assessment of RFSS plant species was not conducted for the non-federal lands as these lands would not be disturbed by the Project. Information on RFSS occurrence on or near the lands was obtained from the MDNR (2014) NHIS database and from Forest Service observations on and near the lands. However, these sources do not provide the same level of detail as the plant surveys conducted on the federal lands, so lack of occurrence data does not conclusively indicate that an RFSS plant species is not present on the non-federal lands. Should these lands be acquired by the Forest Service under the land exchange, the Forest Service would conduct RFSS surveys prior to conducting ground-disturbing activities, such as road building and timber harvesting.

4.5 Determination of Effects

4.5.1 Types of Effects and Assessment Factors

Section 5.0 includes background information and an analysis of the effects of the Project on the RFSS listed in **Table 1**, which are species that have occurred or are likely to occur, and/or have habitat or are likely to have potential habitat, on the federal and/or non-federal lands. For each RFSS, background information on species abundance and distribution and habitat requirements is presented. Potential beneficial and adverse direct and indirect effects to the species that are related to the proposed action and alternatives, and that may result from the Proposed Action or alternatives, are presented. Effects of future actions on RFSS, and that are reasonably likely to occur in the areas considered in this BE, or cumulative effects, are also discussed. These effects are defined as follows:

- Beneficial – Effects of an action that are wholly positive, without any adverse effects, on a RFSS or designated habitat. Determination that an action will have beneficial effects is a “may impact” situation.
- Direct – The direct or immediate effects of the Project on a RFSS or its habitat. Direct effects result from the proposed action including the effects of interrelated actions and interdependent actions.
- Indirect – Effects caused by or resulting from the proposed action, which are later in time, and are reasonably certain to occur. Indirect effects may occur outside of the area directly affected by the action.
- Cumulative – Include the effects of future state, tribal, local, or private actions that are reasonably certain to occur in the cumulative effects study area (CESA) and are considered in this BE.

The effects assessment is based on the following factors:

- the dependency of the species on specific habitat components,
- habitat abundance,
- population levels of the species,
- the degree of habitat impact, and
- the potential to mitigate for an adverse effect.

4.5.2 Cumulative Effects

Cumulative effects include the effects of future state, tribal, local, or private actions that are reasonably certain to occur in the CESA considered in this BE.

The CESA includes the Nashwauk and Laurentian Uplands ecological subregions within the Arrowhead Region of Minnesota. This area totals approximately 1.38 million acres in the northeast corner of Minnesota (**Figure 18**; Emmons and Olivier Resources, Inc. 2006). The period for analysis of cumulative effects in this BE was from pre-settlement (approximately 1890) through closure and reclamation of Project facilities (approximately 40 years).

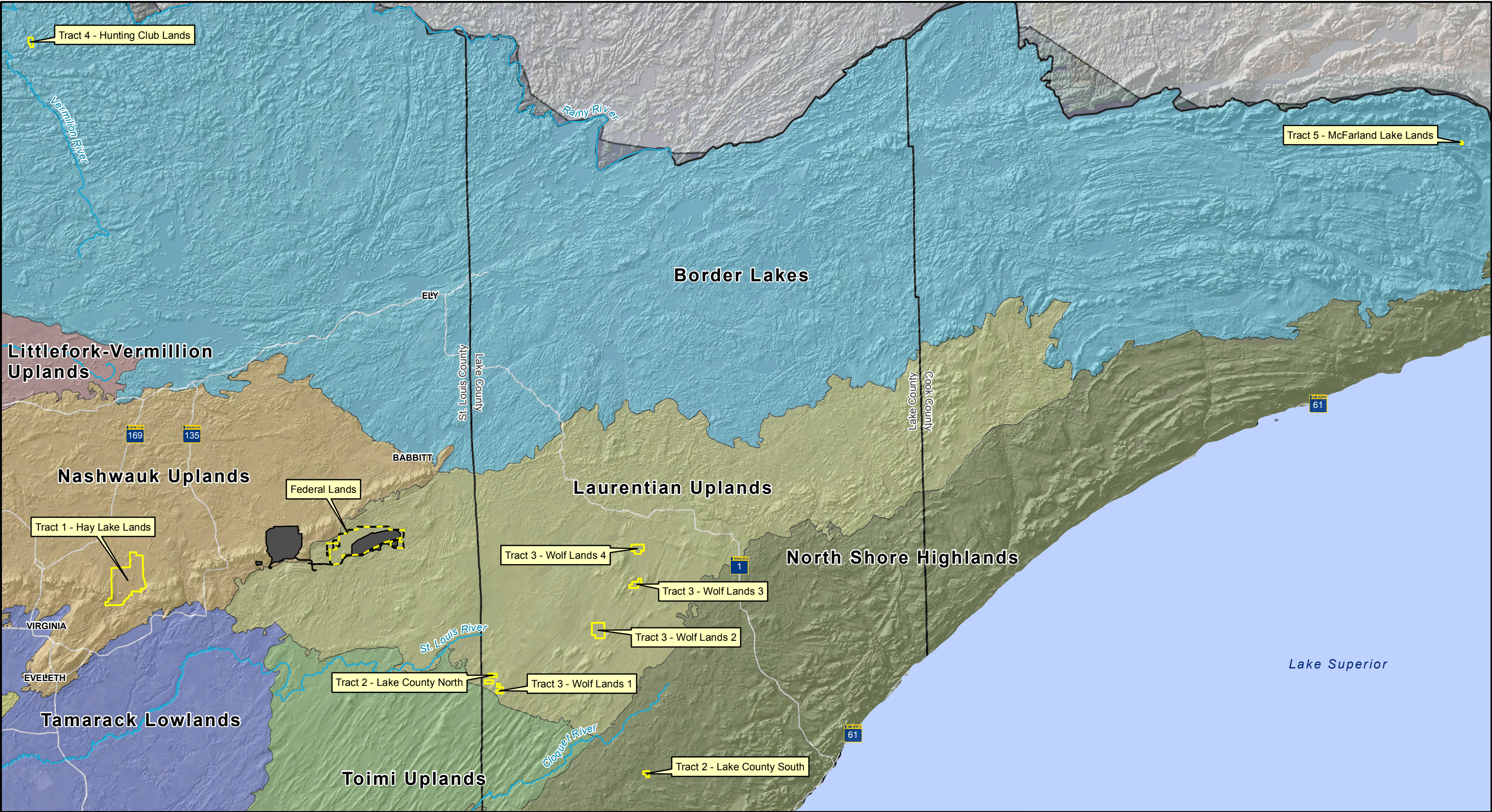
Cumulative effects to plants and animals are discussed in Chapter 6 of the FEIS (MDNR et al. 2015). The effects discussed in that section were based on an analysis conducted for a 2006 MDNR report titled *Cumulative Effects Analysis on Wildlife Habitat and Travel Corridors in the Mesabi Iron Range and Arrowhead Regions of Minnesota* (Emmons and Olivier Resources, Inc. 2006), and a report titled *Cumulative Effects Analysis of Wildlife Habitat and Threatened and Endangered Wildlife Species* (Barr 2009b).

In accordance with Council on Environmental Quality guidance on June 24, 2005 (Council on Environmental Quality 2005), past actions associated with the Project are addressed through their current aggregate effects and have not been provided as a list of individual projects in this BE. The FEIS identifies a number of proposed projects that should be considered reasonably foreseeable future actions and that may contribute to cumulative effects to plants and animals. These include mining and other land development activities, and land management activities such as timber harvest, prescribed fire, and road construction that may be authorized or carried out on nearby federal, state, and private lands and that are likely to have both positive and negative effects to RFSS.

Based on analysis conducted by Emmons and Olivier Resources, Inc. (2006:30, 38), approximately 1,700 acres of wildlife habitat were lost from the Nashwauk and Laurentian Uplands ecological subregions between 1890 and the 1990s, with loss due to forestry and mining accounting for 89% of the loss. In most of the region, forest communities have transitioned from predominately pine- and tamarack-dominated forests to trembling aspen and other non-pine community-dominated forest species. Forest composition has changed, and the Minnesota Forest Resource Council (2003) concluded that forest fragmentation has increased, with decreased forest stand sizes and more miles of forest edge.

Barr (2009b) estimated habitat loss due to mining at about 17,000 acres over the next 25 to 30 years. In the future, the rate of habitat loss due to mining would decrease as vegetation establishes on disturbed lands. Potential disturbances to habitat within the Laurentian Uplands ecological subsection would be primarily due to timber harvest and mining, and habitat types most likely to be affected include upland and lowland coniferous forest, upland deciduous forest, and upland shrub/woodland. Within the Nashwauk Uplands ecological subsection, mining activities and urban development would be more likely to affect habitat, with upland deciduous forests and upland shrub/woodland habitats most affected (Emmons and Olivier, Inc. 2006).

Although more land would be impacted by timber management than mining in the future, forestry management offers a greater range of options for RFSS to co-exist with the practice, as it can mimic natural disturbances, whereas mining represents a complete land conversion that could affect long-term RFSS habitat availability. Between 2005 and 2014, within the Laurentian Uplands ecological subregion, an average of approximately 1,034 forest acres were (or would be) harvested annually on state lands (0.2% of the subregion). Between 2010 and 2019 within the Nashwauk Uplands ecological subregion, an average of approximately 1,189 forest acres were (or would be) harvested annually on state lands (0.1% of the subregion). On average, 1% of timber land in the Superior National Forest is harvested annually (MDNR et al. 2013). Private timber harvest data are generally not available.



- | | | |
|-------------------|-------------------------------|-----------------------|
| Federal Lands | Ecological Subsections | North Shore Highlands |
| Non-federal Lands | Border Lakes | St. Louis Moraines |
| Project Areas | Laurentian Uplands | Tamarack Lowlands |
| Major River | Littlefork-Vermillion Uplands | Toimi Uplands |
| | Nashwauk Uplands | |

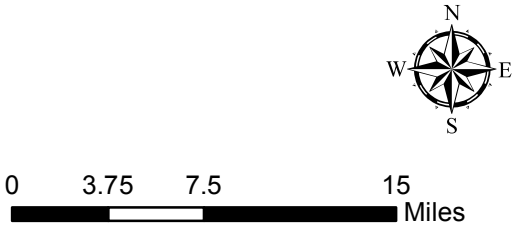


Figure 18
Arrowhead Region of Minnesota and
Ecological Subsections
Biological Evaluation for the NorthMet Project and Land Exchange
St. Louis County, Minnesota

5.0 Analysis and Determination of Effects

This section discusses all RFSS plants and animals that are known or suspected to occur on the federal and/or non-federal lands, or that may have habitat on the lands, as identified in **Table 1**. Primary sources of information used to describe the environmental baseline condition are the *NorthMet Mining Project and Land Exchange Draft SEIS* (MDNR et al. 2013 and references cited therein), *Tracks Project BE* (USDA Forest Service 2010b and references cited therein), MDNR Rare Species Guide (MDNR 2008 and references cited therein), MDNR NHIS Rare Features Database (MDNR 2014a), and Bell Museum of Natural History (2013) Scientific Collections database.

Plant habitat cover types and acreages used in the description of habitat conditions and for Project effects analysis are based on MDNR (2006) for GAP cover types, USDA Forest Service (2010a) for MIH cover types, and MDNR et al. (2013) and PolyMet (2013,2014) for wetland habitat cover types.

Plant population numbers correspond to the MDNR Element Occurrence within the NHIS database (MDNR 2014a). According to the 2014 MDNR NHIS training notes, Element Occurrences may have multiple observations in a given area, but are considered one population if they are “within close enough proximity to one another to allow for gene flow and there are no known barriers to movement.” These clusters of observations are described here as colonies for given populations. An individual is defined as a single plant of a species. A colony is a group of individual plants of one species in a distinct geographic location. A population is a group of individuals or colonies of one species that may be separated geographically, but are close enough to interbreed and persist over time.

Other sources of information for the BE are provided in Section 4.0. Information in Section 5.0 may be assumed to be from one of these sources. Any additional information that is not from one of these sources is cited in the text.

5.1 Vascular and Non-vascular Plants

5.1.1 Plants Not Evaluated in the Biological Evaluation

As shown in **Table 1**, there is no suitable habitat on the federal or non-federal lands for alpine milkvetch, *Arctoparmelia centrifuga*, *Arctoparmelia subcentrifuga*, creeping rush, Chilean sweet-cicely, Douglas’ hawthorn, little goblin moonwort, long-leaved arnica, nodding saxifrage, Oakes’ pondweed, Scotch false asphodel, short sedge, smooth woodsia, and Wain’s cup lichen. The Proposed Action, Alternative B, and No Action Alternative would have **no impact** to individuals of these species, and they will not be addressed further in this BE.

5.1.2 Plants of Non-forested Wetlands, Shallow Water, and Riparian Areas (Habitat Group 1)

5.1.2.1 Environmental Baseline

Habitat Group 1 RFSS favor non-forested wetland habitat, shallow water, and riparian areas. The following Habitat Group 1 RFSS either occur on, and/or have suitable habitat on, the federal and/or non-federal lands—small beggarticks, floating marsh marigold, linear-leaved sundew, quill spikerush, moor rush, auricled twayblade, American shoreweed, bog muhly, Leiberg’s waterlily, American waterawlwort, and bog white violet.

ANALYSIS AND DETERMINATION OF EFFECTS

Of these species, floating marsh marigold, quill spikerush, and moor rush are found on the federal lands. No Habitat Group 1 RFSS have been reported on the non-federal lands.

Species Conditions

Small Beggarticks (*Bidens discordea*)

In Minnesota, small beggarticks is restricted to a relatively few lakes in the northeast counties, including St. Louis and Cook Counties, where it is found along boggy shorelines and floating mats in partial to full sunlight (Minnesota Wildflowers 2013).

Small beggarticks has not been reported on the federal or non-federal lands, or on the Tracks Project area. As discussed in Section 4.1.1, the Tracks Project area is east of Hoyt Lakes and north of Brimson, Minnesota, in Lake and St. Louis Counties, and near the Project area. The Tracks Project area encompasses about 152,000 acres of land of which approximately 78,000 acres are administered by the Forest Service.

Floating Marsh Marigold (*Caltha natans*)

Floating marsh marigold was first collected in Minnesota in 1889 from Vermilion Lake in St. Louis County. All subsequent collections have been from St. Louis County, including the federal lands and Tracks Project area. Very few populations are known in Minnesota. Habitat loss is the primary reason behind recent local extirpations of this species in Minnesota.

Floating marsh marigold is a perennial aquatic forb and occurs within shallow open water or on moist mud within northern ponds, lakes, slow-moving rivers, streams, ditches, and wet meadows. Floating marsh marigold is found in relatively stable aquatic systems and may be sensitive to disturbances, including alteration of hydrology or hydro-period, water quality, water chemistry, and non-native species invasion, although a few populations are found on disturbed habitats.

Of the 12 known populations statewide, 3 populations, totaling 22 individuals, occur on the federal lands north of the Mine Site along the Partridge River. The populations would not be disturbed by mining. Nine additional populations of floating marsh marigold occur on privately owned lands south of the Mine Site, and along Dunka Road. One of these populations would be directly affected by a Waste Rock Stockpile.

Floating marsh marigold has not been reported on the non-federal lands.

Linear-leaved Sundew (*Drosera linearis*)

In Minnesota, linear-leaved sundew has been found in Lake County, but not in St. Louis or Cook Counties. It is one of a small group of rare plant species that are restricted to a high-quality, undisturbed, type of peatland called patterned fens. These fens tend to develop at the core of large peatland complexes in northern Minnesota. Like all sundews, linear-leaved sundew is a small, inconspicuous plant with one outstanding feature; the leaves are covered with mucilage-tipped tentacle-hairs that are adapted to trap insects. Protection of fen habitat is essential to the survival of this species.

Linear-leaved sundew has not been reported on the federal or non-federal lands, or on the Tracks Project area.

Quill Spikerush (*Eleocharis nitida*)

Quill spikerush distribution in Minnesota is limited to the northeastern counties of the Arrowhead region and west to Itasca County. Quill spikerush was first collected in Minnesota in 1946 from various wetland habitats in Cook and St. Louis Counties. Despite the long collection record for this species in Minnesota, relatively few populations have been documented and little is known about the overall distribution of the species throughout the state.

Quill spikerush occurs within various wetland habitats of northern Minnesota, including acid bog pools, small streams, areas of seasonal water drawdown (mucky/peaty flats), disturbed wetland edges, and along roads and trails. This rooted perennial species may be intolerant of hydrologic fluctuations and alterations to water quality and chemistry associated with landscape and wetland alteration and development. However, roadside distributions suggest the species may be semi-tolerant to disturbance and at least mild alterations in water quality in the short term.

Of the 49 known populations in the state, 1 population occurs within the federal lands, on the Mine Site, and would be affected by the Project. There are an additional 13 locations of this species on private lands located along Dunka Road and the railroad tracks south of the Mine Site. Project activities would directly affect four of these populations.

Quill spikerush has not been reported on the non-federal lands. It has been reported on the Tracks Project area.

Moor Rush (*Juncus stygius* var. *americanus*)

Moor rush is distributed across the northern and northeastern Arrowhead counties in large patterned peatlands and calcareous fens. It was first documented in St. Louis County in 1886. In 2003, it was reported in Carlton County (one occurrence), Koochiching County (five occurrences), and Lake County (four occurrences; USDA Forest Service 2004e). It is generally not a dominant species. Even in ideal, large-patterned peatland settings, it occurs in isolated colonies with scattered individuals.

Moor rush is a perennial graminoid species that occurs in full sun, and generally, it is restricted to narrow wet zones of the margin of a bog pond. Moor rush has very specific hydrology requirements and the principal threats are large-scale disturbances to its peatland habitat and surrounding watersheds. These threats include mineral exploration, peat mining, pollution of watershed waters, alterations of hydrologic regime, and acid rain (USDA Forest Service 2004e and references cited therein).

Of the 30 known populations in Minnesota, 1 population consisting of 67 individuals scattered within a 450-foot radius was found on the federal lands within One Hundred Mile Swamp in bog habitat with scattered black spruce (PolyMet 2013).

Moor rush has not been reported on the non-federal lands. It has been reported on the Tracks Project area.

Auricled Twayblade (*Listera auriculata*)

Auricled twayblade ecology is poorly understood and the species has a very limited distribution. It is found in St. Louis, Lake, and Cook Counties, including along the North Shore of Lake Superior, and at Isle Royale National Park. It is rarely encountered and, until recently, little was known about its distribution and habitat

ANALYSIS AND DETERMINATION OF EFFECTS

requirements. The species is very rare in Minnesota, prompting its listing as a state endangered species in 1996. Its persistence is precarious because there are so few populations and most populations have few individuals.

In Minnesota, it is characteristically found along streams or pond margins in low, moist hardwood forests, mixed coniferous/deciduous forest, and shrub swamps (Hoy 2001). Habitat destruction related to high water levels and vegetation succession, either by human alteration or by natural processes is a potential threat.

Auricled twayblade has not been reported on the federal or non-federal lands, or on the Tracks Project area.

American Shoreweed (*Littorella americana*)

American shoreweed occurs in the northeastern U.S. and adjacent Canada, and is considered vulnerable or imperiled across much of its range due to its rarity and threats to its habitat. It currently reaches the westernmost extent of its distribution in the Laurentian Uplands ecological subregion of northeastern Minnesota. The species was first collected in 1886 from Basswood Lake in Lake County. Since that time, 60 additional occurrences have been documented in the state, including in St. Louis, Lake, and Cook Counties, primarily in the BWCAW.

American shoreweed is an aquatic plant primarily occurring in lakes having a sandy, gravel/cobble substrate. In some lakes, plants may become partially or wholly buried in fine organics or silts. Plants are most often observed when they become stranded along the lakeshore.

American shoreweed has not been reported on the federal or non-federal lands. It has been reported on the Tracks Project area.

Bog Muhly (*Muhlenbergia uniflora*)

Bog muhly is a small, fine grass primarily distributed in northeastern North America and ranging as far west as Minnesota. It is found in Lake and Cook Counties, primarily in the BWCAW. The species was first reported in Minnesota from St. Louis County in 1956 and from Lake County the following year. The St. Louis County occurrence near Gilbert has never been located again. It is also questionable whether Lake County location has been located again, in part due to a disputed herbarium label data. Bog muhly subsequently went undocumented in the state until 1987, when it was discovered on the sandy beaches of a lake in the BWCAW. As of 2009, approximately 25 occurrences have been reported, many of which are within 5 miles of each other.

In Minnesota, bog muhly occurs in wetlands and is considered to be a wetland obligate species. It occurs along sandy-gravel shores or cobbly organic shores, in seasonal basins, in peaty depressions, and on low hummocks in rich sedge fens. It is also known to occur in bogs, wet meadows, and lake shores in sandy or peaty, often acidic, soils.

Bog muhly has not been reported on the federal or non-federal lands, or on the Tracks Project area.

Leiberg's waterlily (*Nymphaea leibergii*)

Leiberg's waterlily has a rather limited geographic range and is rare within its geographic range. It has been reported in Cook and Lake Counties and the BWCAW. This aquatic species was first discovered in Minnesota at Bald Eagle Lake (Lake County) in 1914. It was subsequently found at Mulligan Lake (Beltrami County) in 1949, Botany Bog (Itasca County) in 1977, and Stony Creek (Lake of the Woods County) in 1980. The species

was ultimately found in several rivers and streams in two major drainages within the sandy region of the Glacial Lake Agassiz basin, including the western branches of the Rapid River, which drains the Red Lake peatland.

The documented occurrences of Leiberg's waterlily in Minnesota are in shallow, protected bays in lakes and in slow-moving streams, especially streams impounded by beaver dams. One site is in a narrow outlet of a small pond surrounded by a graminoid poor fen. The plants are usually rooted in soft sediments beneath 3 to 7 feet of water, although the water is sometimes deeper. They prefer the outer margin of emergent vegetation, which typically consists of wild rice, arrowhead, bulrush, and cattail. The species frequently occurs with yellow pond-lily.

Leiberg's waterlily has not been reported on the federal or non-federal lands, or on the Tracks Project area.

American Waterarrowwort (*Subularia aquatica* spp. *americana*)

American waterarrowwort is a small, aquatic species that inhabits shallow water margins (typically 6 to 18 inches, sometimes as deep as 35 inches). It has a wide distribution in North America, although it is uncommon over most of its range. In Minnesota, it has been found primarily in the littoral zone of large, sandy, oligotrophic lakes in the northeast; there are a few occurrences from silty substrata in non-oligotrophic lakes in north-central Minnesota. When originally listed as state endangered in 1984, American waterarrowwort was known from only six sites. Between 1984 and 2008, 11 additional populations were discovered. The majority of sites are in the Superior National Forest and the BWCAW, including in St. Louis, Lake, and Cook Counties.

American waterarrowwort has not been reported on the federal or non-federal lands, or the Tracks Project area.

Bog White Violet (*Viola lanceolata* var. *lanceolata*)

Bog white violet (synonym: lance-leaved violet) occurs in low, moist meadows with a sandy substrate, moist swales in sand dunes and savannas, and occasionally on sandy lakeshores. One recent population was found on dry mud in an old beaver lodge. The majority of the original Minnesota populations probably occurred on the Anoka Sandplain in Sherburne, Isanti, and Anoka Counties. Recently, there have been discoveries of bog white violet in northeastern Minnesota in St. Louis and Lake Counties, including the BWCAW, where it appears to occur sporadically over a relatively large area (Milburn and Husveth 2004).

Bog white violet is typically found in habitats that have experienced some sort of disturbance event, which benefits this species due to its inability to compete with larger species. As competition for light and nutrients increases within the community, the size of the population decreases, and the population waits for the next disturbance event. Following a disturbance event, the species is adapted to quickly germinate from the seed bank or colonize an open area. The greatest threat to bog white violet is loss of habitat due to development, but fire suppression, altered hydrology, and invasive species can also negatively affect this species.

Bog white violet has not been reported on the federal or non-federal lands, or on the Tracks Project area.

Habitat Conditions

There are approximately 4,164 acres of wetlands on the federal lands (**Table 8**). Although coniferous bog and coniferous swamp are the dominant wetland types, there are about 343 acres of non-forested wetland habitat (open bog, sedge/wet meadow, and shallow marsh) and 31 acres of open water associated with the federal lands,

or 6% of the federal lands, that could provide habitat for Habitat Group 1 RFSS. Nearly all of these wetlands are rated high for wetland quality (MDNR et al. 2013).

Mud Lake, the dominant open water feature on the federal lands, is within the One Hundred Mile Swamp. It is approximately 30.5 acres and has approximately 4,550 feet of shoreline. Yelp Creek flows out of One Hundred Mile Swamp to the Partridge River. The Partridge River flows through the northern, eastern, and southeastern portions of the federal lands. Collectively, Yelp Creek and the Partridge River are approximately 5.3 miles in length on the federal lands.

There are approximately 4,670 acres of wetlands on the non-federal lands (**Table 8**). Coniferous swamp and alder thicket or shrub-carr are the dominant wetland types, but there are also 124 acres of non-forested wetland habitat (open bog, sedge/wet meadow, and shallow marsh) and 182 acres of shallow, open water habitat on the non-federal lands, or 4% of the non-federal lands, that could provide habitat for Habitat Group 1 plant species. All wetlands on the non-federal lands are rated high for most wetland functions and values and wetlands on the non-federal lands share similar characteristics to those on the federal lands.

Several lakes and streams with associated riparian zone habitat are found on the non-federal lands. Hay Lake is on Hay Lake Lands and is approximately 96 acres with approximately 9,894 feet of shoreline. Little Rice Lake is also on Hay Lake Lands and is approximately 29 acres with approximately 4,830 feet of shoreline. An unnamed lake between Hay Lake and Little Rice Lake is approximately 4 acres with approximately 1,700 feet of shoreline. McFarland Lake Lands border McFarland Lake, with approximately 990 feet of shoreline along McFarland Lake. There are no other major lakes on the other non-federal lands.

Within Hay Lake Lands, the Pike River flows approximately 8 miles from the southern boundary to the northern boundary of the lands. Riparian habitat is found on both sides of the river for 5.7 miles and is found along one side of the river for 2.4 miles where the Pike River forms the boundary of Hay Lake Lands.

Coyote Creek begins on Wolf Lands 3, then flows north onto Wolf Lands 4 and beyond. The creek is approximately 0.1 mile long on Wolf Lands 3, and 0.9 mile long on Wolf Lands 4. Riparian habitat is found on both sides of the creek.

5.1.2.2 Direct and Indirect Effects

Proposed Action

Species Conditions

Federal Lands

Based on plant surveys of the federal lands, floating marsh marigold and quill spikerush would be directly affected by the Project. Moor rush has been found on the federal lands, but would not be affected by the Project. The remainder of Habitat Group 1 RFSS has not been reported on the federal lands.

Nine floating marsh marigold populations are near, but outside, the Mine Site and federal lands; five of these populations are found along the Partridge River. One population of floating marsh marigold would be directly affected by a Waste Rock Stockpile. The known statewide population for this species is rather small, the Project would affect about 8% of the known population in Minnesota.

Quill spikerush is primarily found in ditches along Dunka Road with gravel or sandy substrates. Of the 49 known populations in the state, 1 population would be affected by the Project (2% affected). An additional 13 populations are found along Dunka Road and the railroad tracks, but they are not on federal lands. The Project would have a direct effect on four of these populations. This species seems to be semi-tolerant of disturbance because it inhabits roadside ditches.

Moor rush has 30 known populations in the state, none of which occur on the Project area. One population, however, is found on the federal lands north of the Mine Site and within One Hundred Mile Swamp. This population would not be affected by the Project.

Non-federal Lands

No Habitat Group 1 RFSS have been reported on the non-federal lands. Under the Proposed Action, the non-federal lands would be transferred to the Forest Service, who would manage the lands for timber production, recreation, nature study, and other values. There would be no direct or indirect effects to Habitat Group 1 RFSS on the non-federal lands from the Project.

Habitat Conditions

Federal Lands

Direct effects to habitat for Habitat Group 1 RFSS on the federal lands would occur from habitat removal or destruction primarily from mining-related activities, including construction of the mine pits, Waste Rock Stockpiles, access roads, and mine facilities.

There are about 343 acres of non-forested wetland and 31 acres of open water within the federal lands that could provide habitat for Habitat Group 1 RFSS (**Table 8**). The Project would affect about 65 acres of non-forested wetland, but 0 acres of open water, or about 17% of the available habitat. The Project would not affect Mud Lake, the large open water area found within One Hundred Mile Swamp, or riparian zone habitat associated with Yelp Creek and the Partridge River.

Habitat for these species could be indirectly affected by dust from mining activities and vehicles, ore spillage, changes in surface and groundwater hydrology from groundwater drawdown, and from changes in water quality related to leakage from stockpiles/mine features and seepage from mine pits. These risks to Habitat Group 1 RFSS, however, should be negligible.

Non-federal Lands

There are about 124 acres of non-forested wetland (open bog, sedge/wet meadow, and shallow marsh) and 183 acres of open water within non-federal lands that could provide habitat for Habitat Group 1 RFSS (**Table 8**). Most of these habitats are found on Hay Lake Lands (263 acres; 86%). Smaller acreages of these habitats are found on Hunting Club Lands (16 acres) and Lake County Lands South (15 acres), with the remainder as scattered, small acreages on the other non-federal lands (**Table 8**). Under the Proposed Action, the Forest Service would survey for Habitat Group 1 RFSS prior to conducting land-disturbing activities and areas of known or potential habitat would be avoided when feasible.

Alternative B

Federal Lands

Effects to Habitat Group 1 RFSS and their habitats under Alternative B would be similar to those under the Proposed Action. Under Alternative B, there are about 291 acres of non-forested wetland (open bog, open water, sedge/wet meadow, and shallow marsh) and 9 acres of open water on the federal lands that could provide habitat for Habitat Group 1 RFSS (**Table 8**). About 74 fewer acres of open bog, open water, sedge/wet meadow, and shallow marsh habitats would be transferred to PolyMet under this alternative than under the Proposed Action, but direct and indirect effects to Habitat Group 1 RFSS species and habitats from the Project activities would remain the same as under the Proposed Action.

Non-federal Lands

Under Alternative B, only Hay Lake Lands would be transferred to the Forest Service. As discussed under the Proposed Action, no Habitat Group 1 RFSS have been reported on Hay Lake Lands. The Forest Service would acquire about 86 acres of non-forested wetland (open bog, open water, sedge/wet meadow, and shallow marsh) and 177 acres of open water habitats that are favored by Habitat Group 1 RFSS, or about 86% of the acreage the Forest Service would have obtained under the Proposed Action (**Table 8**). Effects on these species and their habitats from Forest Service and public use of Hay Lake Lands would be similar to those under the Proposed Action.

No Action Alternative

There would be no direct or indirect effects to Habitat Group 1 RFSS under the No Action Alternative.

5.1.2.3 Cumulative Effects

Timber harvesting, road building, and recreational activities are reasonably foreseeable future actions that could continue to occur on the federal lands and non-federal lands. In addition, there is the potential for homes and cabins to be built on the non-federal lands, including on small portions of wetlands, should the FEIS Record of Decision select the No Action Alternative and the non-federal lands remain under private ownership. These activities could affect the Habitat Group 1 RFSS within the CESA.

Forest management activities could result in Habitat Group 1 RFSS and their habitats being driven over and crushed by timber harvest and road construction/maintenance equipment, and harmed from sedimentation of streams and lakes due to ground disturbance. Timber harvest activities would be conducted during winter in wetlands, however, to reduce the risks of ground disturbance and sedimentation. Prior to implementing ground-disturbing activities, the Forest Service would conduct RFSS surveys to determine if RFSS would be affected by proposed activities. These surveys should help to ensure that RFSS species on non-federal lands are avoided, where feasible.

Lowland road construction and use and wetland draining are the two actions that probably have the largest effect on Habitat Group 1 RFSS within the CESA. Construction and use of roads in lowlands in the CESA, including construction of lowland roads for county, state, and private timber harvest, and for access to mineral exploration and production sites, recreation sites, and homesites, would continue to affect Habitat Group 1 RFSS habitat. However, the amount of suitable habitat affected by these activities should be small. In addition, timber harvest

on Forest Service and other ownerships would not affect this habitat appreciably because it is typically not forested with merchantable trees. The Forest Service would survey proposed timber harvest treatment areas for RFSS and would avoid areas with known or potential habitat for RFSS, where feasible.

Project activities on the federal lands would affect one population of quill spikerush. Project activities on adjacent private lands on the Mine Site would affect an additional four populations of quill spikerush and one population of floating marsh marigold. Approximately 65 acres of habitat could be directly affected on the federal lands that could be used by Habitat Group 1 RFSS. Despite the cumulative effects of the Project, habitat used by Habitat Group 1 RFSS that would be affected by the Project occurs elsewhere in the Superior National Forest, including the Tracks Project area, and would not be affected by the Project or other reasonably foreseeable future activities in the CESA. In addition, there are approximately 67,000 acres of open wetland and water habitat that could be used by Habitat Group 1 RFSS elsewhere in the CESA (Emmons and Olivier Resources, Inc. 2006:30, 38).

5.1.2.4 Summary

Project activities associated with the Proposed Action or Alternative B would have direct, indirect, and cumulative adverse effects on Habitat Group 1 RFSS and their habitat. Other activities in the CESA would contribute to cumulative effects for Habitat Group 1 RFSS. The Proposed Action and Alternative B would have similar effects on Habitat Group 1 RFSS, while there would be no effects to Habitat Group 1 RFSS from the No Action Alternative.

5.1.2.5 Determination

The Proposed Action and Alternative B **may impact individuals but are not likely to cause a trend to federal listing or loss of viability** for floating marsh marigold, quill spikerush, moor rush, small beggarticks, linear-leaved sundew, auricled twayblade, bog muhly, American shoreweed, Leiberg's waterlily, American waterawlwort, or bog white violet. The No Action Alternative would have **no impact** on individuals of Habitat Group 1 RFSS.

5.1.2.6 Mitigation and Recommendations

Mitigation measures for Habitat Group 1 RFSS could include the following:

- Reseed Mine Site and Plant Site impact areas with native species, provided they can perform as effectively as the non-native species. In some areas where erosion control would be critical to prevent slope failures, non-native species may be needed. Temporary stabilization efforts using non-native species should use non-invasive plant species to minimize the long-term risk to surrounding plant communities.
- In the event invasive non-native species are introduced, an additional mitigation measure would be to implement a monitoring and control program for invasive species (including noxious weeds) to ensure these species do not overtake surrounding native communities.
- Additionally, the purchase of an unprotected site with a population of the RFSS species *Caltha natans* should be assessed as mitigation.

5.1.3 Cliff, Talus Slope, and Exposed Rock Habitat (Habitat Group 2)

5.1.3.1 Environmental Baseline

Habitat Group 2 RFSS favor cliffs, talus slopes, and exposed rock habitat. The following Habitat Group 2 RFSS either occur on, and/or have suitable habitat on, the federal and/or non-federal lands —maidenhair spleenwort, largeleaf sandwort, sticky locoweed, and encrusted saxifrage. Habitat Group RFSS 2 habitats are very rare on the federal and non-federal lands. No Habitat Group 2 RFSS have been reported on the federal lands. Encrusted saxifrage has been found on McFarland Lake Lands.

Species Conditions

Maidenhair Spleenwort (*Asplenium trichomanes*)

Maidenhair spleenwort has been found in Cook and Lake Counties, primarily near the North Shore of Lake Superior, and on the BWCAW. Most populations of maidenhair spleenwort occur on moist, north- to east-facing cliffs, particularly on ledges and in crevices. It also occurs in talus at the base of cliffs. Some of the cliffs are associated with large lakes that may provide a needed, climate-modifying effect. At least two populations are known to occur in association with open, exposed southeast-facing cliffs where conditions are warmer, drier, and sunnier. Populations in these more exposed habitats grow in sheltered crannies of cobbly talus.

Maidenhair spleenwort has not been reported on the federal or non-federal lands, or on the Tracks Project area.

Appalachian Clubmoss (*Huperzia appalachiana*)

Appalachian clubmoss may be locally common in moist, sheltered habitats on sandstone ledges. However, the species seems to be rare even where suitable habitat exists. Historic populations documented by herbarium specimens collected in Blue Earth County (1883), in Hennepin County (1902), in Lake County (1943), and in St. Louis County (1949) have presumably been destroyed by human activities. There are very few populations known to currently exist in Minnesota.

Prior to 2000, all Minnesota specimens had been collected from sandstone bluffs and ledges in southeastern Minnesota. Beginning in 2000, the species was found at a number of sites in northeastern Minnesota on diabase cliffs. Sites in the northeast are typically northerly facing, wooded habitats that are moist and well-shaded. Appalachian clubmoss has been found in St. Louis, Lake, and Cook Counties, primarily along the North Shore of Lake Superior, and on the BWCAW. Appalachian clubmoss is found on shelves and crevices on cliff/talus/rock outcrops, and shrub dominated talus piles.

Appalachian clubmoss has not been reported on the federal or non-federal lands, or on the Tracks Project area.

Largeleaf Sandwort (*Moehringia macrophylla*)

In Minnesota, populations of largeleaf sandwort are found in Cook and Lake Counties. Only a few of the historic populations have been relocated, despite considerable effort. All evidence indicates that this is a very rare species with limited distribution and restrictive environmental needs. Furthermore, all known populations are small and occur in fragile habitats. Most of the documented sites of largeleaf sandwort in Minnesota occur on sheltered cliffs of slate and diabase in the Rove Formation. In these habitats, the plants grow in small rock

crevices where organic debris accumulates or where moss mats provide a suitable substrate. Populations are typically associated with cliffs having a northerly aspect, where they are often found near the cliff base on small shelves, cracks, and chutes.

Largeleaf sandwort has not been reported on the federal or non-federal lands, or on the Tracks Project area.

Sticky Locoweed (*Oxytropis borealis* var. *viscida*)

In Minnesota, sticky locoweed (synonym: viscid locoweed) is restricted to a single cliff in Cook County. The population was originally discovered in 1938 and still persists. Such a small, isolated population is vulnerable to a variety of stochastic processes attributable to natural events and human-caused effects. For this reason, sticky locoweed was listed as an endangered species in Minnesota in 1996.

The Minnesota sticky locoweed population occurs on a single, north- to northwest-facing cliff face and at the top of the associated talus slope. Plants occur in both sunny and partially shaded conditions where there is little competition from typical forest species; this is similar to the habitat occupied by the species in the Rocky Mountains. This population is apparently a relic of a wider, preglacial distribution.

Sticky locoweed has not been reported on the federal or non-federal lands, or on the Tracks Project area.

Encrusted Saxifrage (*Saxifraga paniculata*)

Encrusted saxifrage was first documented in Cook County, Minnesota in 1932, and has since only been reported in Cook County, including on the McFarland Lake Lands. Encrusted saxifrage is an arctic-alpine species that reaches the southern end of its range in Minnesota. It typically occurs in rock crevices and on ledges of shaded north-facing cliffs with bedrock of diabase, gabbro/diorite, basalt, or Rove Formation rocks. There is very little suitable cliff habitat for encrusted saxifrage in Minnesota, and threats to the species could include climate change, changes in the biotic community, and recreational exploration of vulnerable cliff faces.

Encrusted saxifrage was found on McFarland Lake Lands, presumably associated with rock outcrops along the western edge of the lands. It has not been reported on the federal lands, other non-federal lands, or the Tracks Project area.

Habitat Conditions

There is very little suitable habitat for Habitat Group 2 RFSS on most of the federal and non-federal lands. There are scattered rock outcrops on the federal lands, and on Hay Lake Lands, Hunting Club Lands, Lake County Lands North, and Lake County Lands South, but no cliffs or talus slopes. Thus, it is unlikely that Habitat Group 2 RFSS would be found on these lands. Cliffs with exposed rock that are about 100 feet high are found in the central portion of McFarland Lake Lands and encrusted saxifrage was reported to occur on the McFarland Lake Lands (MDNR 2006).

5.1.3.2 Direct and Indirect Effects

Proposed Action

Species Conditions

Federal Lands

No Habitat Group 2 RFSS have been reported on the federal lands, and there is very little suitable habitat on the federal lands. Thus, it is unlikely that Habitat Group 2 RFSS would be affected by the Project.

Non-federal Lands

The Forest Service would monitor encrusted saxifrage on McFarland Lake Lands, and seek to protect high quality habitat for this plant species. Under the Proposed Action, the non-federal lands would be transferred to the Forest Service, who would manage the lands for timber production, recreation, nature study, and other values. The Forest Service would monitor Habitat Group 2 RFSS use of these lands, and seek to protect high quality habitat for these species.

Habitat Conditions

Federal Lands

There are no cliffs or talus slopes, and only a few areas with exposed rock, on the federal lands (ENSR 2005, AECOM 2011a). At most, only a few acres of exposed rock would be affected by the Project on the federal lands. Suitable habitat for maidenhair spleenwort, largeleaf sandwort, and encrusted saxifrage could occur on exposed rock outcrops, but it is unlikely that these species would be found on the exposed outcrops. Mining would result in development of a mine pit and associated rock walls and overburden storage piles that would have some exposed rock. These areas could provide habitat for Habitat Group 2 RFSS in the future.

Non-federal Lands

There are scattered rock outcrops on Hay Lake Lands, Hunting Club Lands, Lake County Lands North, and Lake County Lands South, but no cliffs or talus slopes (AECOM 2011b, c). Cliffs with rock outcrops are found on McFarland Lake Lands and total about an acre. Encrusted saxifrage is found on McFarland Lake Lands. Under the Proposed Action, the Forest Service would survey for Habitat Group 2 RFSS and associated habitat prior to conducting land-disturbing activities and areas of known or potential habitat would be avoided when feasible.

Alternative B

Federal Lands

Direct effects to Habitat Group 2 RFSS and their habitats under Alternative B would be similar to those under the Proposed Action. Although exposed rock habitat has not been specifically identified on the federal lands, it likely comprises only a few acres, and is more common in the upland areas on the eastern portion of the federal lands surrounding with the Mine Site (AECOM 2011a).

Non-federal Lands

As discussed under the Proposed Action, no Habitat Group 2 RFSS have been reported on Hay Lake Lands. There are scattered rock outcrops on the lands that could be used by Habitat Group 2 RFSS, but no cliffs or talus slopes (AECOM 2011b). Effects on Habitat Group 2 RFSS and their habitats from Forest Service and public use of Hay Lake Lands would be similar to those under the Proposed Action.

No Action Alternative

There would be no direct or indirect effects to Habitat Group 2 RFSS under the No Action Alternative.

5.1.3.3 Cumulative Effects

As discussed in Section 4.5.2, there has been a cumulative loss of habitat for RFSS from mining, road construction, housing and commercial development, and other land development activities, and from forestry and other land management activities. It is possible that Habitat Group 2 RFSS and/or their habitat have been lost from past and ongoing activities in the CESA, and would be lost in the future from similar reasonably foreseeable future activities.

Although Habitat Group 2 RFSS are rare in Minnesota, populations have been found elsewhere in the Superior National Forest, and on McFarland Lake Lands, and typically occupy areas that are not susceptible to timber harvesting or road building or other development. Given that Habitat Group 2 RFSS have not been reported on the federal lands, and potential habitat for these species on the federal lands is limited to only a few acres, adverse cumulative effects associated with Project actions on federal lands should be negligible.

Under the Proposed Action, the non-federal lands would be transferred to the Forest Service, who would manage the lands for timber production, recreation, nature study, and other values. Prior to implementing ground-disturbing activities, the Forest Service would conduct RFSS surveys to determine if RFSS would be affected by proposed activities. These surveys should help to ensure that RFSS species found on non-federal lands are avoided, where feasible. Due to its proximity to McFarland Lake and several cabins, it is unlikely that the Forest Service would harvest timber or construct roads on McFarland Lake Lands. The steep terrain also makes the lands unsuitable for snowmobile and most recreational uses. Thus, risks to encrusted saxifrage from Forest Service and recreational uses would be negligible, although the plant could be harmed by plant collectors.

5.1.3.4 Summary

Project activities associated with the Proposed Action, Alternative B, or the No Action Alternative should have no direct and indirect adverse effects on individuals of Habitat Group 2 RFSS, and any adverse effects to potential habitat for these species would be limited to a few acres. Other activities in the CESA would also contribute to cumulative effects toward the RFSS plants of this habitat group. The Proposed Action and Alternative B would have similar effects on Habitat Group 2 RFSS, while there would be no effects on Habitat Group 2 RFSS from the No Action Alternative.

5.1.3.5 Determination

The Proposed Action, Alternative B, and the No Action Alternative would have **no impact** to individuals of maidenhair spleenwort, largeleaf sandwort, sticky locoweed, and encrusted saxifrage.

5.1.3.6 Mitigation and Recommendations

No mitigation measures are proposed for Habitat Group 2 RFSS.

5.1.4 Upland Disturbed, Barrens, or Early Successional Forest Habitat (Habitat Group 3)

5.1.4.1 Environmental Baseline

Habitat Group 3 RFSS favor upland disturbed, barrens, or early successional forest habitat. The following Habitat Group 3 RFSS either occur on, and/or have suitable habitat on, the federal and/or non-federal lands—common moonwort, Michigan moonwort, pale moonwort, ternate grapefern, least moonwort, Appalachian clubmoss, and roughfruit fairybells. Michigan moonwort, pale moonwort, ternate grapefern, and least moonwort have been found on the federal lands, and pale moonwort, ternate grapefern, and least moonwort would be directly affected by mining activities. No Habitat Group 3 RFSS have been reported on the non-federal lands.

Species Conditions

Common Moonwort (*Botrychium lunaria*)

Common moonwort is the most widespread of the moonworts and has been found in St. Louis and Cook Counties and several other counties in northern Minnesota, including on the Tracks Project area. Common moonwort appears to prefer open habitats such as gravelly banks, rocky ledges, and talus. It has also been found on open, sparsely vegetated habitats with grasses and scattered shrubs. Along the shore of Lake Superior, common moonwort has been found in fire-dependent forests among mosses and lichens. A Forest Service database reported the habitat for common moonwort as cool/moist conditions, along forest roads and trails, in open areas, lakeshores (sand dunes), and occasionally in forests. Common moonwort has also been reported on sandy soils of old log landings in jack and red pine woods (Chadde and Kudray 2001a and references cited therein).

Common moonwort has not been reported on the federal or non-federal lands.

Michigan Moonwort (*Botrychium michiganense* [*hesperium*])

Across its range, Michigan moonwort (synonym: western moonwort) generally prefers an open habitat and often is found on open early successional habitats that have been disturbed in the past, such as roadside ditches, tailings ponds, gravel pits, log landings, sandy gravel pits, and mine tailings within the Mesabi Iron Range of northeastern Minnesota, including on the federal lands and on the Tracks Project area. Plants have also been found on sand dunes. Soils are often sandy or gravelly. In Minnesota, Michigan moonwort appears to prefer open disturbed habitats. Element occurrence records in St. Louis, Lake, and Cook Counties list habitats as tailings ponds, gravel pits, ditches, an old log landing, and along a weedy roadside (Chadde and Kudray 2001b and references cited therein).

Plant surveys conducted in 2004 identified nine locations of Michigan moonwort within the federal lands. Three of the locations were found on the federal lands within the Mine Site, all of which would be affected by the Project. Six locations of Michigan moonwort were found on private lands within or near the Dunka Road and Utility Corridor (Johnson-Groh 2004); one of these populations would be affected by Project activities.

Michigan moonwort has also been found on the Tracks Project area. Michigan moonwort is sometimes found with other *Botrychium* species in Minnesota including matricary grapefern and pale moonwort.

Michigan moonwort has not been reported on the non-federal lands.

Pale Moonwort (*Botrychium pallidum*)

Pale moonwort (synonym: pale botrychium) was first identified in Minnesota in 1992 and new populations are documented each year in a variety of habitats across northern Minnesota. It occurs in open early successional habitats, log landings, roadsides, sandy gravel pits, and mine tailings within the Mesabi Iron Range of northeastern Minnesota, including on the federal lands and on the Tracks Project area.

This diminutive perennial fern emerges in the late spring, produces spores, and matures within 3 to 4 weeks. Like many of the moonworts, pale moonwort may be sensitive to changes in soil mycorrhizae, herbivory from introduced earthworms, vegetative cover (in other words [i.e.], increased vegetative competition and shading), soil moisture, or other environmental factors affecting suitable microhabitats (Chadde and Kudray 2013a and references cited therein).

Of the 101 known populations statewide, 5 populations totaling 12 individuals were found on the federal lands surrounding the Mine Site; all of these populations would be directly affected by the Project. One of these populations is located south of the West Pit, along the Dunka Road and Utility Corridor. The other four populations are located adjacent to Dunka Road. An additional six locations of pale moonwort were found on private lands immediately adjacent to the federal lands; three of these populations would be affected by Project activities.

Pale moonwort has not been reported on the non-federal lands.

Ternate Grapefern (*Botrychium rugulosum*)

Ternate grapefern (synonym: St. Lawrence grapefern) is a perennial semi-evergreen fern that occurs in the northern and southcentral portions of Minnesota. Relatively little is known about the overall distribution, genetics, and life history requirements of ternate grapefern. In northern Minnesota, ternate grapefern prefers partially shaded mine tailings, sandy coniferous forests and plantations, and shaded vernal pool margins in rich deciduous hardwood forests. It also occurs in wetland areas within habitats subject to past clearing or cultivation. Ternate grapefern is often found in small stands of five to ten individuals, though larger populations can also occur. Disturbance also likely plays an important long-term role in the proliferation of this species (Chadde and Kudray 2013b and references cited therein).

Of the 72 known extant populations in Minnesota, 7 populations totaling 39 individuals occur on the federal lands. One of the seven populations occurring on federal lands would be directly affected by the Project (1% affected). Two additional populations occur on private lands immediately adjacent to the federal lands, neither of which would be affected by Project activities.

Ternate grapefern has not been reported on the non-federal lands, but has been reported on the Tracks Project area.

Least Moonwort (*Botrychium simplex*)

Least moonwort (synonym: little grapefern) occurs throughout northern and central Minnesota. Least moonwort occurs in a variety of natural and disturbed habitats, including brushy fields (often with other species of *Botrychium*), moist or dry woods, edges of forested vernal pools and swamps, mine tailings, and edges of sand/gravel/exposed forest roads. Like the other *Botrychium* species, disturbance likely plays an important role in the proliferation of this species (Chadde and Kudray 2013c and references cited therein).

Of the 213 known populations statewide, 16 populations consisting of at least 354 individuals occur on federal lands within the Mine Site; all but one of these populations would be affected by the Project. There are an additional 19 populations on private lands along the Dunka Road, the railroad, and the transmission line ROW near the Mine Site; 7 of these populations would be affected by Project activities.

Least moonwort has not been reported on the non-federal lands, but has been reported on the Tracks Project area.

Roughfruit Fairybells (*Prosartes trachycarpa* (synonym = *Disporum trachycarpum*))

Roughfruit fairybells has been found near Pigeon River Cliffs in Cook County. The species favors semi-open jack pine forest with aspen, birch, and shallow rocky soils.

Roughfruit fairybells has not been reported on the federal or non-federal lands, or on the Tracks Project area.

Habitat Conditions

Habitat Group 3 RFSS favor upland disturbed, barrens, or early successional ('young' in MIH) forest habitat. There are approximately 64 acres of disturbed habitat and 652 acres of grassland/shrubland on the federal lands, primarily associated with roads and mine exploration sites (**Table 7**). In addition, there are about 271 acres of early successional (young) upland forest habitat (MIH 1 and 5) on the federal lands (**Table 6**).

There are no disturbed areas and approximately 1,878 acres of grassland/shrubland on the non-federal lands (**Table 7**). In addition, there are about 622 acres of early successional upland forest (**Table 6**) that could provide habitat for Habitat Group 3 RFSS on the non-federal lands. Grassland/shrubland habitat is primarily found on Hay Lake Lands and Lake County Lands South, while early successional upland forest is found on Hay Lake Lands, Hunting Club Lands, Lake County Lands North, and Wolf Lands 3.

5.1.4.2 Direct and Indirect Effects

Proposed Action

Species Conditions

Federal Lands

Based on plant surveys of the federal lands, four Habitat Group 3 RFSS would be directly affected by the Project: Michigan moonwort, pale moonwort, ternate grapefern, and least moonwort. All four species have also been found on adjacent private lands along the Dunka Road and Utility Corridor.

Of the 35 populations of Michigan moonwort documented in Minnesota, 3 populations totaling 11 individuals have been found on the federal lands within the Mine Site. Six additional populations totaling 255 individuals have been found on adjacent private lands along the Dunka Road and/or near the railroad tracks. The three populations on federal lands would all be directly affected (9% of statewide populations affected), with one population each being removed by pit excavation, haul road construction, and water pipeline construction. One of the six populations on private lands would be directly affected by Project activities.

Of the 101 known populations of pale moonwort in Minnesota, 5 populations totaling 12 individuals were found on federal lands surrounding the Mine Site. All five populations would be directly affected by the Project, including four locations along Dunka Road (5% of statewide populations affected). Six additional populations totaling 88 individuals were found on adjacent private lands along Dunka Road. Project activities would directly affect three of the six populations. This species, however, appears to be semi-tolerant of disturbance. Therefore, colonies may actually expand into newly disturbed areas along Dunka Road and at the Mine Site (MDNR et al. 2013).

Of the 72 known extant populations of ternate grapefern in Minnesota, 1 population with 19 individuals would be directly affected by construction of the East Pit (1% of statewide populations affected). Six additional populations of ternate grapefern were found within the federal lands, but would not be affected by the Project. Two populations of ternate grapefern, totaling six individuals, were found on private lands along Dunka Road south of the Ore Surge Stockpile and Category 2/3 Stockpile. The Project would have no effect on these two populations.

Of the 213 known populations of least moonwort in Minnesota, 16 populations with at least 356 individuals occur on the Mine site and all but one would be directly affected by mining activities. These include seven populations from stockpiles and mine pits, five populations from haul roads, two populations from water pipelines, and one population from other Project features (7% of statewide population affected). The populations affected by stockpiles, mine pits, and haul roads would be removed, while the populations affected by construction of pipelines or ditches may be reduced in numbers in the short term. Another 19 populations of least moonwort, totaling at least 1,424 individuals, are on adjacent private lands along Dunka Road and the railroad tracks in the vicinity of the Mine Site. The Project would have a direct effect on 7 of the 19 populations on adjacent private lands. Depending on proximity to construction activities, most of these populations of least moonwort would likely recover by growing along the Dunka Road and at the Mine Site post-closure, as this species appears to be semi-tolerant of disturbance (MDNR et al. 2013).

Non-federal Lands

No Habitat Group 3 RFSS have been reported on the non-federal lands, although many of these species were found on the Tracks Project area, which is near Lake County Lands and Wolf Lands. Under the Proposed Action, the non-federal lands would be transferred to the Forest Service, who would manage the lands for timber production, recreation, nature study, and other values. The Forest Service would monitor Habitat Group 3 RFSS use of these lands, and seek to protect high quality habitat for these species.

Habitat Conditions

Federal Lands

Direct effects to Habitat Group 3 RFSS habitat on the federal lands would occur from habitat removal or destruction primarily from mining-related activities, including construction of the mine pits, Waste Rock Stockpiles, access roads, or other mine facilities.

There are 64 acres of disturbed areas and 652 acres of grasslands and shrublands on the federal lands that could provide habitat for Habitat Group 3 RFSS (**Table 7**). The Project would affect about 14 acres of disturbed areas and 204 acres of grasslands and shrublands. In addition, about 260 acres of young upland forest habitat (MIH 1 and 5) would also be lost to mining (**Table 6**).

Habitat for these species could be indirectly affected by dust from mining activities and vehicles, ore spillage, changes in surface and groundwater hydrology from groundwater drawdown, and from changes in water quality related to leakage from stockpiles/mine features and seepage from the mine pits. These risks to Habitat Group 3 RFSS, however, should be negligible.

About 614 acres of grassland/shrubland habitat would be restored during mine reclamation (MDNR et al. 2013). Any remaining individuals in affected portions of the Project area could colonize this habitat. Although the biology of these *Botrychium* species is poorly understood, past mine development activities similar to those proposed by the Project have resulted in creation of habitat conditions favorable to the establishment of several *Botrychium* species, including several RFSS *Botrychium* species. These favorable habitat conditions may perpetuate any populations of these species that may have been missed during Project inventories (USDA Forest Service 2010b).

Non-federal Lands

There are no acres of disturbed habitat and about 1,878 acres of grassland/shrubland that that could provide habitat for Habitat Group 3 RFSS on the non-federal lands (**Table 7**). In addition, there are about 622 acres of early successional upland forest (MIH 1 and 5) that could provide habitat for Habitat Group 3 RFSS on the non-federal lands (**Table 6**). Much of this Habitat Group 3 RFSS habitat is found on Hay Lake Lands. There is no suitable Habitat Group 3 RFSS habitat on the other non-federal lands, although Appalachian clubmoss is found on shelves and crevices on cliff/talus/rock outcrops, which occurs on McFarland Lake Lands. Under the Proposed Action, the Forest Service would survey for Habitat Group 3 RFSS and associated habitat prior to conducting land-disturbing activities and areas of known or potential habitat would be avoided when feasible. Most recreational activity would be confined to trails and roads and could affect Habitat Group 3 RFSS that favor open, disturbed habitats.

Alternative B

Federal Lands

Direct effects to Habitat Group 3 RFSS under Alternative B would be similar to those under the Proposed Action. Based on plant surveys of the federal lands, the four Habitat Group 3 RFSS that could be directly affected by the Project under Alternative B are Michigan moonwort, pale moonwort, ternate grapefern, and least moonwort.

Direct effects to upland disturbed, barrens, or early successional forest habitat from mining and related activities would be similar for the Proposed Action and Alternative B. Under Alternative B, there are 29 acres of disturbed habitat and 439 acres of grassland/shrubland that could provide habitat for Habitat Group 3 RFSS (**Table 7**). In addition, there are about 271 acres of early successional upland forest (MIH 1 and 5) that could provide habitat for Habitat Group 3 RFSS on the non-federal lands (**Table 6**). About 35 fewer acres of disturbed habitat, 213 fewer acres of grassland/shrubland habitat, and the same number of acres of early successional upland forest habitat would be transferred to PolyMet from the Forest Service under Alternative B than under the Proposed Action.

Non-federal Lands

No Habitat Group 3 RFSS have been reported on Hay Lake Lands. There are no acres of disturbed habitat and 1,697 acres of grassland/shrubland that could provide habitat for Habitat Group 3 RFSS on Hay Lake Lands (**Table 7**). In addition, there are about 534 acres of early successional upland forest (MIH 1 and 5) that could provide habitat for Habitat Group 3 RFSS on Hay Lake Lands (**Table 6**). About 86% of early successional upland forest habitat that occurs on the non-federal lands is found on Hay Lake Lands. Thus, the Forest Service would receive much of the land that could provide habitat for Habitat Group 3 RFSS on the non-federal lands under both the Proposed Action and Alternative B.

No Action Alternative

There would be no direct or indirect effects to Habitat Group 3 RFSS under the No Action Alternative.

5.1.4.3 Cumulative Effects

As discussed in Section 4.5.2, it is possible that Habitat Group 3 RFSS and/or their habitat have been lost from past and ongoing activities in the CESA, and would be lost in the future from similar reasonably foreseeable future activities.

The Project could directly affect 35 Habitat Group 3 RFSS populations and about 478 acres of habitat used by Habitat Group 3 RFSS, on the federal lands. Despite the cumulative effects of the Mine Site, Habitat Group 3 RFSS species that would be affected by the Project occur elsewhere in the Superior National Forest, including the Tracks Project area, and in Minnesota, and would not be affected by the Project or other ground-disturbing activities in the CESA. In addition, there are about 33,000 acres of grassland habitat in the CESA (Emmons and Oliver Resources, Inc. 2006:30, 38). About 7% of Forest Service-administered lands are young forest (USDA Forest Service 2011:42), while the percentage of forestlands that are young forest is likely greater for privately owned lands. However, based on a conservative assumption that about 5% of upland forest in the CESA is young forest, about 31,000 acres of early successional upland forest would be available Habitat Group 3 RFSS. In addition, there are about 100,000 acres of disturbed mining areas, some of which could provide habitat for Habitat Group 3 RFSS in the CESA (Emmons and Oliver Resources, Inc. 2006:30, 38).

After mining, about 397 acres would be reclaimed and the federal lands would be privately owned and closed to public access (MDNR et al. 2013). Habitat Group 3 RFSS favor disturbed areas and early successional habitats, the types of habitat associated with recent logging and road-building activity. There is potential for mining activities and mine reclamation to create disturbed areas and early successional habitats that could be colonized by Habitat Group 3 RFSS in the future.

Timber harvesting, road building, and recreational activities could occur on the federal and non-federal lands. Forest management activities could result in Habitat Group 3 RFSS and their habitats being driven over and crushed by timber harvest and road construction/maintenance equipment. No Habitat Group 3 RFSS have been reported on the non-federal lands, but there are about 622 acres of suitable habitat (young age class; **Table 6**) on the lands. The Forest Service would survey for RFSS prior to conducting land-disturbing activities, and would avoid areas with known or potential habitat for RFSS when feasible. Should disturbance activities occur on the non-federal lands, it would result in soil disturbance and creation of early successional habitat that could be colonized by Habitat Group 3 RFSS.

5.1.4.4 Summary

Project activities associated with the Proposed Action and Alternative B would have direct, indirect, and cumulative effects on Habitat Group 3 RFSS, and cause adverse effects on up to 478 acres of known or potential habitat for Habitat Group 3 RFSS on the federal lands. Other activities in the CESA would also contribute to cumulative effects toward the RFSS plants of this habitat group. The Proposed Action and Alternative B would have similar effects on Habitat Group 3 RFSS, while there would be no effects to Habitat Group 3 RFSS from the No Action Alternative.

5.1.4.5 Determination

The Proposed Action and Alternative B **may impact individuals but are not likely to cause a trend to federal listing or loss of viability** for Michigan moonwort, pale moonwort, ternate grapefern, least moonwort, common moonwort, Appalachian clubmoss, and roughfruit fairybells. The No Action Alternative would have **no impact** to individuals of Habitat Group 3 RFSS.

5.1.4.6 Mitigation and Recommendations

No mitigation measures are proposed for Habitat Group 3 RFSS.

5.1.5 Forested Wetland – Black Spruce, Tamarack, and Mixed Conifer Forest Habitat (Habitat Group 4)

5.1.5.1 Environmental Baseline

Habitat Group 4 RFSS favor forested wetlands comprised of coniferous trees such as black spruce, tamarack, and northern white cedar, and deciduous trees such as black ash and yellow birch. The following Habitat Group 4 RFSS either occur on, and/or have suitable habitat on, the federal and/or non-federal lands—fairy slipper, ram's head lady slipper, Selwyn's scalewort, yellow specklebelly, cartilage lichen, cloudberry, peppered moon lichen, honeycombed lichen, western Jacob's-ladder, snowline wintergreen, beard lichen, and two unnamed lichens, *Caloplaca parvula*, and *Cetraria aurescens*. Snowline wintergreen has been found on the federal lands. No Habitat Group 4 RFSS have been reported on the non-federal lands.

Species Conditions

Fairy Slipper (*Calypso bulbosa* var. *occidentalis*)

Fairy slipper is palearctic in distribution, and occurs in 20 of the 48 contiguous states and all of the Canadian provinces. It occurs across the northern third of Minnesota, including St. Louis, Lake, and Cook Counties. It is principally associated with northern white cedar, growing in the shaded duff with little or no herbaceous competition over a metamorphic and igneous bedrock parent material, with calcium accumulated from ground springs (Schmidt 2003a and references cited therein). In bogs, it can occur on stumps, logs, hummocks of drier soil, or slopes, but does not occur in soggy soils. Fairy slipper is also found in closed canopy forest with at least 60% cover and cool soils, and is intolerant of soil temperatures higher than 60 degrees Fahrenheit.

Fairy slipper requires older, closed-canopy cedar stands, so any loss of a viable cedar type affects this species. Limited regeneration due to high deer populations is the primary threat to the cedar community and associated species. Other threats to the community include beaver activity and forest harvesting.

Fairy slipper has not been reported on the federal or non-federal lands, or on the Tracks Project area.

Ram's head Lady Slipper (*Cypripedium arietinum*)

Ram's head lady slipper ranges from Quebec and Saskatchewan south to Maine, New Hampshire, Vermont, Connecticut, and New York, and west to Michigan, Wisconsin, and Minnesota. Ram's head lady slipper has always been considered biologically rare in Minnesota, and the reasons for its rarity are not entirely known. It is known from St. Louis, Lake, and Cook Counties, and elsewhere in central and northern Minnesota. Recently, however, it has suffered a general decline in Minnesota largely as a result of habitat loss from changes in land use, including clear-cutting of jack pine forests.

In Minnesota, populations of Ram's head lady slipper occur in a variety of coniferous forest habitats. Several populations occur in swamps, bogs, or lowland forests dominated by northern white cedar, tamarack, balsam fir, or black spruce. Cool soils seem to define its range; in its southernmost reaches the orchid is found in cold bogs or north-facing cool bluffs near the Great Lakes where cool air drains down ravines. The species also occurs in the drier upland coniferous forests that may be dominated by white pine, red pine, or jack pine (Brzeskiewicz 2000 and references cited therein).

Ram's head lady slipper has not been reported on the federal or non-federal lands, or on the Tracks Project area.

Selwyn's Scalewort (*Frullania selwyniana*)

Selwyn's scalewort is found on lowland northern white cedar swamps on the bark of northern white cedar.

Selwyn's scalewort has not been reported on the federal or non-federal lands, but has been found on the Tracks Project area.

Honeycombed Lichen (*Menegazzia terebrata*)

In the Great Lakes Region, honeycombed lichen has a scattered distribution, mainly associated with bog and cedar swamps, perhaps revealing its oceanic (moist oceanic forests) origin (USDA Forest Service 2002 and references cited therein). In the Great Lakes Region, honeycombed lichen survives in the oldest and wettest

ANALYSIS AND DETERMINATION OF EFFECTS

northern white cedar bogs as a few scattered individuals on cedar trunks (estimated 200+ years) in relatively open areas with 50 to 60% canopy cover. In Minnesota, five sites were found on the Superior National Forest within interior portions of old growth northern white cedar bogs. The main short term threat in northern white cedar bogs/swamps is hydrological change from road building and logging.

Honey-combed lichen has not been reported on the federal or non-federal lands, or on the Tracks Project area.

Western Jacob's-ladder (*Polemonium occidentale* spp. *lacustre*)

Western Jacob's-ladder was first documented in St. Louis County, Minnesota in 1944. Prior to that discovery, this subspecies was unknown to science. A total of only five sites in Itasca and St. Louis Counties, Minnesota, have been located since 1944, even after extensive survey efforts.

Habitat requirements for western Jacob's-ladder include open forested wetland communities with associated northern white cedar, tamarack, black spruce, and generally a ground cover of sphagnum moss. Common associated shrub species include speckled alder and bog birch. Within suitable forests, western Jacob's-ladder is found on open and sparsely forested portions of the swamps, as well as in moderately deep shade, usually on hummocks of sphagnum moss. The saturated conditions usually originate from groundwater seepage.

Likely threats would include increased canopy closure, any activity that directly alters the habitat and destroys plants (e.g. slash piles, peat mining, and flooding by beaver dams), or anything that alters groundwater flow. All known locations of this species have a history of logging, ranging from disturbance in the early 1900s to as recent as the 1990s. In all five known populations, western Jacob's ladder blooms most in natural or logging-related openings. In contrast to other species associated with northern white cedar communities, logging appears to be less of a threat (Schmidt 2003b and references cited therein).

Western Jacob's ladder has not been reported on the federal or non-federal lands, or on the Tracks Project area.

Snowline Wintergreen (*Pyrola minor*)

Snowline wintergreen (synonym: small shinleaf) is listed as a species of special concern in Minnesota. The species was first reported in Lake County in 1914 near the North Kawishiwi River. It has since only been documented in Cook, St. Louis, Lake, and Carlton Counties.

Snowline wintergreen is a circumpolar species occurring across Canada and the western U.S. in boreal and alpine habitats. It usually occurs in conifer swamps, including black spruce and northern white cedar swamps, and black spruce-balsam fir forests. Snowline wintergreen can also be found along moist ecotones between wetlands and uplands or between streams and slopes. It may be semi-tolerant of disturbance, because healthy populations exist along well-traveled portage routes and at sites that have experienced timber harvesting around 20 years prior.

Snowline wintergreen has been reported southwest of Mud Lake on the federal lands, within One Hundred Mile Swamp, and approximately 0.7 mile northwest of the Mine Site. Snowline wintergreen has also been found on the Tracks Project area.

Snowline wintergreen has not been reported on the non-federal lands.

Yellow Specklebelly (*Pseudocyphellaria crocata*)

Yellow specklebelly has always been rare in northern Minnesota. It was collected between 1897 and 1902 in St. Louis, Koochiching, Lake, and Cook Counties. In the last 34 years, it has been found only once in St. Louis County, approximately 65 miles northwest of the federal lands. The extensive removal of mature, moist forests across Minnesota's forested landscape has seriously reduced the occurrence of this lichen in the state.

Yellow specklebelly is found in habitats that are moist, shady, and often foggy. Substrates for this lichen are varied, including mossy rocks and a variety of trees, especially northern white cedar in mature hardwood and coniferous forests. When found on trees, this lichen usually occurs 3 to 4 feet above the ground and is at least partially shaded by the tree on which it is growing. All known Minnesota populations of this lichen are near water, and many are on offshore islands.

Yellow specklebelly has not been reported on the federal or non-federal lands, or on the Tracks Project area.

Cartilage Lichen (*Ramalina thrausta*)

Cartilage lichen is found in old growth and other northern white cedar swamps.

Cartilage lichen has not been reported on the federal or non-federal lands, or on the Tracks Project area.

Cloudberry (*Rubus chamaemorus*)

Cloudberry is an arctic and boreal species that is typical of circumpolar bog habitats in North America, Europe, and Asia. The southern limit of its range in North America is poorly defined and is represented by local and discontinuous populations in northern New England and disjunctive sites at Montauk Point, Long Island, and northeastern Minnesota. This species was unknown in Minnesota until 1954 when it was discovered near a research facility on Basswood Lake in the Superior National Forest in Lake County. Since that time, only a few colonies have been located despite targeted surveys. It has been found in St. Louis, Lake, and Cook Counties.

In Minnesota, cloudberry has been found in sphagnum bogs dominated by black spruce or mixed forests of black spruce speckled alder, bog birch, and sometimes northern white cedar. It is often found on deep sphagnum moss hummocks associated with bluejoint, three-seeded bog sedge, creeping snowberry, Labrador tea, and three-leaved false Solomon's seal.

Cloudberry has not been reported on the federal or non-federal lands, or on the Tracks Project area.

Peppered Moon Lichen (*Sticta fuliginosa*)

Peppered moon lichen (synonym: spotted felt lichen) was formerly quite common in Minnesota along the Lake Superior shoreline and around inland lakes and bogs. Today, there are only a few extant populations known in Cook, Lake, and St. Louis Counties; none of these sites are near the federal or non-federal lands. Where it exists, it is found on conifer and hardwood trees in mature, moist forests and bogs. Yellow birch and northern white cedar are preferred substrates. This lichen prefers partial shade in areas that tend to retain moisture, such as northern white cedar swamps, and is often growing on the lower trunks of trees, 3 to 5 feet above the ground (Whitmore 2002a and references cited therein).

Peppered moon lichen has not been reported on the federal or non-federal lands, or on the Tracks Project area.

Beard Lichen (*Usnea longissima*)

Beard lichen is known in Michigan, Wisconsin, and Minnesota. In Minnesota, it has been found in St. Louis, Lake, and Cook Counties, primarily near Lake Superior and in the BWCAW.

Beard lichen is usually found in forests near streams, lakes, or in bogs. The forests are balsam fir, black spruce, or northern white cedar over 100 years old that may be open or quite shady. High humidity and habitat continuity are important for growth, but this species grows better on the upper branches of trees where there is more available light. The recent localities in Superior National Forest are undisturbed balsam fir or northern white cedar stands near water. In one locality (Mark Creek), it apparently began growth in a mature balsam fir forest that has since been killed by insects but the thallus persisted on a dead balsam fir. The extensive logging in the past has eliminated many potential habitats (Wetmore 2002b and references cited therein).

Beard lichen has not been reported on the federal or non-federal lands, or on the Tracks Project area.

Lichen spp. (*Caloplaca parvula*)

Caloplaca parvula was unknown to science when this species was first collected in Minnesota in 1978 near Kettle Falls in St. Louis County. Only two additional specimens have been found in the state since then, both in St. Louis County on Little Long Lake and Echo Lake on the Superior National Forest (Wetmore 2002c and references cited therein). This lichen species occurs in old-age, deciduous-tree swamps, specifically black ash bogs, near open water. In Minnesota, all sites were open black ash bogs with some standing water and without tall grasses, sedges, or brush. These swamps typically have 12 to 14 inches dbh trees, but this lichen species is not found on these trees. Instead, the preferred substrate is 3 to 4 inches dbh young re-growth, near the tree base, within 1 foot of the ground. The forest canopy is fairly open, allowing for lots of sunlight. Humidity in these habitats is high. Groundcover is minimal, typically comprised of just a few sedges.

Caloplaca parvula does not occur on sites with abundant shrubs and groundcover. It is found on sites with some amount of standing water, but has never been found other on a site without standing water. Water is in depressions in the swamp. The young trees or regrowth on which this species is found may themselves be in standing water. All Minnesota sites could be potentially threatened by permanent lake level changes caused by addition or removal of dams (Wetmore 2002c and references cited therein).

Caloplaca parvula has not been reported on the federal or non-federal lands, or on the Tracks Project area.

Lichen spp. (*Cetraria aurescens*)

Cetraria aurescens occurs in old-growth temperate forests and usually grows on pine, on cedar, and occasionally on hardwoods in the southern Appalachians. It has been found in St. Louis, Lake, and Cook Counties, including about 6 miles south of Hoyt Lakes and 5 miles east of Babbitt, Minnesota.

In northern Minnesota, it is restricted to moist habitats near bogs or water in areas of old-growth forest without disturbance, especially within northern white cedar swamps over 100 years old. In the Great Lakes Region, this species seems to require old-growth, moist habitats. In a habitat study in Superior National Forest, this species was found in forest stands with an overstory ranging from 10 to 80% and on trees ranging in age from 118 to

266 years. These localities were usually northern white cedar swamps or black spruce bogs (Wetmore 2002d and references cited therein).

Cetraria aurescens has not been reported on the federal or non-federal lands, or on the Tracks Project area.

Habitat Conditions

Habitat Group 4 RFSS favor forested wetlands comprised of coniferous trees such as black spruce, tamarack, northern white cedar, and deciduous trees such as black ash and yellow birch. Several species, including bearded lichen, fairy slipper, and *Cetraria aurescens* prefer mature wetland forest habitat. Although forested wetland habitat is the most common habitat on the federal and non-federal lands, only one species, snowline wintergreen, was found on the federal lands, and only two species, snowline wintergreen and Selwyn's scalewort, were found on the Tracks Project area; none of the Habitat Group 4 RFSS were reported on the non-federal lands.

There are about 3,270 acres of forested wetland on the federal lands, which represents 79% of all wetland habitat and 50% of all habitat on these lands (**Table 8**). Snowline wintergreen was found within One Hundred Mile Swamp, which is dominated by black spruce, northern white cedar, and tamarack forest, with small patches of open bogs and shrublands. Sphagnum and club mosses cover nearly 100% of the ground, while forest and shrub cover is about 40 to 70%. ENSR (2005) found that about 1% of wetland forest is comprised of young trees, 93% is comprised of immature trees, while about 5% is comprised of mature trees. Of this acreage, only 1% is comprised of deciduous or mixed coniferous-deciduous forest, the remainder was black spruce, northern white cedar, or tamarack forest.

There are about 3,300 acres of forested wetland on the non-federal lands, which represents 71% of all wetland habitat and 47% of all habitat on these lands (**Table 8**). Wetland forest is dominated by black spruce and tamarack, with scattered northern white cedar. Forest and shrub cover ranges from 30 to 60%, while ground cover is 50 to 90% (AECOM 2011b, c). AECOM (2011b, c) found that less than 1% of wetland forest is comprised of mature trees, 4% is comprised of young trees, while 95% is comprised of immature trees. Of this acreage, only 3% is comprised of deciduous or mixed coniferous-deciduous forest, the remainder was black spruce, northern white cedar, and tamarack forest. Black ash is found in small patches on Lake County Lands South, Hunting Club Lands, and Wolf Lands 2, while northern white cedar is most common on Lake County Lands North, Lake County Lands South, Wolf Lands 2, and Wolf Lands 4.

5.1.5.2 Direct and Indirect Effects

Proposed Action

Species Conditions

Federal Lands

Based on plant surveys of the federal lands, one population of snowline wintergreen, consisting of ten individuals, was found northwest of the Mine Site within One Hundred Mile Swamp. The remainder of Habitat Group 4 RFSS have not been reported on the federal lands. The Project would have no direct or indirect effect on the snowline wintergreen population in One Hundred Mile Swamp.

Non-federal Lands

No Habitat Group 4 RFSS have been reported on the non-federal lands. Under the Proposed Action, the non-federal lands would be transferred to the Forest Service, who would manage the lands for timber production, recreation, nature study, and other values. The Forest Service would monitor Habitat Group 4 RFSS use of these lands, and seek to protect high quality habitat for these species.

Habitat Conditions

Federal Lands

Direct effects to Habitat Group 4 RFSS on the federal lands could occur from mining-related activities, including construction of the mine pits, Waste Rock Stockpiles, access roads, and mine facilities. Although no Habitat Group 4 RFSS were found during plant surveys for the federal lands, about 589 acres of forested wetland would be directly affected by mining on the federal lands (**Table 8**).

Habitat for snowline wintergreen, which is found northwest of the Mine Site, and other Habitat Group 4 RFSS, could potentially be indirectly affected by dust from mining activities and vehicles, changes in surface and groundwater hydrology from groundwater drawdown, and from changes in water quality related to leakage from stockpiles/mine features and seepage from mine pits (MDNR et al. 2013). These risks, however, should be negligible.

About 516 acres of wetland habitat would be restored during mine reclamation (MDNR et al. 2013). However, it is unlikely that any Habitat Group 4 RFSS would colonize these areas because nearly all Habitat Group 4 RFSS prefer immature and mature forests and it would likely be 20 or more years before the restored habitat would reach this stage of maturity.

Non-federal Lands

There are about 3,300 acres of forested wetland, or 71% of all wetland habitat and 47% of all habitat, on the non-federal lands (**Table 8**). Under the Proposed Action, the Forest Service would survey for Habitat Group 4 RFSS and associated habitat prior to conducting land-disturbing activities; areas of known or potential habitat would be avoided when feasible. Most recreational activity would be confined to trails and roads and could affect Habitat Group 4 RFSS that favor open, disturbed habitats.

Alternative B

Federal Lands

Direct and indirect effects to Habitat Group 4 RFSS under Alternative B would be similar to those under the Proposed Action. Based on plant surveys for the federal lands, no Habitat Group 4 RFSS would be directly affected by the Project under Alternative B.

Direct and indirect effects to forested wetlands from mining and related activities would be similar for the Proposed Action and Alternative B. Under Alternative B, there are about 2,167 acres of forested wetland (**Table 8**). About 1,103 fewer acres (34%) of forested wetland would be transferred to PolyMet from the Forest Service than under the Proposed Action.

Non-federal Lands

No Habitat Group 4 RFSS have been reported on Hay Lake Lands. There are about 1,962 acres of forested wetland on Hay Lake Lands, which is about 59% of the forested wetland habitat that occurs on the non-federal lands (**Table 8**). Thus, the Forest Service would receive lands that could provide habitat for Habitat Group 4 RFSS on the non-federal lands under Alternative B.

No Action Alternative

There would be no direct or indirect effects to Habitat Group 4 RFSS under the No Action Alternative.

5.1.5.3 Cumulative Effects

As discussed in Section 4.5.2, it is possible that Habitat Group 4 RFSS and/or their habitat have been lost from past and ongoing activities in the CESA, and would be lost in the future from similar reasonably foreseeable future activities.

Because European settlement, timber harvest, wetland drainage, and road construction have affected forested wetlands and reduced the amount and distribution of this habitat within the CESA. More recently, timber sales on federal, state, county, and private lands have changed the age class distribution of lowland black spruce habitats, but have not altered the overall suitability of the habitat for species in this habitat group.

Forest management activities could result in Habitat Group 4 RFSS and their habitats being driven over and crushed by timber harvest and road construction/maintenance equipment, and harmed from sedimentation of streams and lakes due to ground disturbance. Timber harvest activities would be conducted during winter in wetlands, however, to reduce the risks of ground disturbance and sedimentation.

Construction and use of roads in lowlands under the Proposed Action, Alternative B, and No Action Alternative and elsewhere in the CESA would continue to affect suitable habitat. However, the proportion of total suitable habitat affected by these activities would be very small. Timber sales affecting lowlands on state or county lands could change the age class of lowland black spruce forests in the Project area, temporarily making some stands less suitable for Habitat Group 4 RFSS. However, the proportion of total suitable habitat affected by these activities would be very small.

The Project could potentially indirectly affect the habitat of one Habitat Group 4 RFSS population, and directly affect about 589 acres of potential habitat on the federal lands for Habitat Group 4 RFSS (**Table 7**). Despite the potential cumulative effects, RFSS that could be affected by the Project also occur elsewhere in the Superior National Forest, including the Tracks Project area, and elsewhere in Minnesota, which would not be affected by the Project or other ground-disturbing activities in the CESA. In addition, there about 370,000 acres of habitat for Habitat Group 4 RFSS remaining in the CESA (Emmons and Olivier Resources, Inc. 2006:30, 38).

PolyMet would acquire about 2,266 acres of forested wetland on the federal lands surrounding the Mine Site under the proposed land exchange (**Table 8**). Although these lands would remain privately owned, it is likely that some or all of these lands would be managed for timber production and harvested in the reasonably foreseeable future. Timber harvest and associated road construction could directly or indirectly affect Habitat Group 4 RFSS, including snowline wintergreen, unless efforts are taken to avoid Habitat Group 4 RFSS. Effects

from timber management would be mitigated by voluntary adherence to Minnesota Forest Resources Council best management practices (Minnesota Forest Resources Council 1999).

Timber harvesting, road building, and recreational activities could occur on non-federal lands. No Habitat Group 4 RFSS have been reported on the non-federal lands, but there are about 3,300 acres of suitable habitat on the non-federal lands (**Table 8**). The Forest Service would survey for RFSS prior to conducting land-disturbing activities, and would avoid areas with known or potential habitat for RFSS when feasible. Should disturbance activities occur on the non-federal lands, it would take 20 or more years before disturbed lands would be suitable for Habitat Group 4 RFSS.

5.1.5.4 Summary

Project activities associated with the Proposed Action and Alternative B could have indirect effects on individual Habitat Group 4 RFSS, and indirect and cumulative effects on their habitat. Other activities in the CESA would also contribute to cumulative effects toward the RFSS plants of this habitat group. The Proposed Action and Alternative B would have similar effects on Habitat Group 4 RFSS, while there would be no effects to Habitat Group 4 RFSS from the No Action Alternative.

5.1.5.5 Determination

The Proposed Action and Alternative B **may impact individuals but are not likely to cause a trend to federal listing or loss of viability** for snowline wintergreen, fairy slipper, ram's head lady slipper, Selwyn's scalewort, yellow specklebelly, cartilage lichen, cloudberry, peppered moon lichen, honeycombed lichen, western Jacob's-ladder, beard lichen, and two unnamed lichens, *Caloplaca parvula*, and *Cetraria aurescens*. The No Action Alternative would have **no impact** to individuals of Habitat Group 4 RFSS.

5.1.5.6 Mitigation and Recommendations

No mitigation measures are proposed for Habitat Group 4 RFSS.

5.1.6 Mesic Hardwood Forest Dominated Habitat (Habitat Group 5)

5.1.6.1 Environmental Baseline

Habitat Group 5 RFSS favor upland mesic (moderately moist) deciduous forests comprised of sugar maple, basswood, paper birch, and yellow birch. The following Habitat Group 5 RFSS either occur on, and/or have suitable habitat on, the federal and/or non-federal lands—moshatel, Braun's holly fern, triangle grapefern, and lanceleaf grapefern. Triangle grapefern has been found on Hay Lake Lands, but not on the other non-federal lands or federal lands. Moshatel, Braun's holly-fern, and lanceleaf grapefern have not been found on the federal or non-federal lands.

Species Conditions

Moshatel (*Adoxa moschatellina*)

The number of known occurrences of moshatel in Minnesota exceeds 120 populations, including records from St. Louis, Lake, and Cook Counties. The habitat of moshatel in Minnesota is primarily mesic hardwood forests. These are typically mature or old growth communities dominated by sugar maple and basswood. There may also

be significant amounts of paper birch and yellow birch. In the northern part of the state there may be conifers present, particularly northern white cedar and balsam fir.

The narrow geographical and ecological range of those occurrences may be a cause for concern. It appears that the mature mesic hardwood forests where this species occurs are often selectively targeted for intensive forest management in northern Minnesota. In addition to the pressures of the timber industry, mesic forests in southeastern Minnesota tend to be more vulnerable to invasion by non-native species.

Moshatel not been reported on the federal or non-federal lands, or on the Tracks Project area.

Triangle Grapefern (*Botrychium lanceolatum*) and Lanceleaf Grapefern (*Botrychium lanceolatum* var. *angustisegmentum*)

Lanceleaf grapefern is a variety of triangle grapefern and the two are analyzed together in this section. These are small ferns that range across much of the northeastern U.S. and Canada. They are uncommon in Minnesota, but more common in Wisconsin and Michigan, and especially common on the Ottawa National Forest in Michigan's western Upper Peninsula. They are found in St. Louis, Lake, and Cook Counties and several other counties in Minnesota, including on the Tracks Project area. They prefer moist, shady, mature northern hardwood forests, particularly in low areas. They usually occur with sugar maple, yellow birch, green ash, black ash, red oak, basswood, and sometimes northern white cedar. The understory can be rather open.

These ferns probably appear or disappear in accordance with mycorrhizal health due to their obligate relationship with the fungi. Environmental factors that may affect mycorrhizae, like reduction in water availability, are likely to have effects on these ferns, whereas the repeated removal of leaf tissue may have little effect (Chadde and Kudray 2001c and references cited therein).

Triangle grapefern not been reported on the federal lands, but one population was been found near the southwestern portion of Hay Lake Lands (MDNR 2014a). It was not reported on the Tracks Project area.

Lanceleaf grapefern has not been reported on the federal or non-federal lands, but was found on the Tracks Project area.

Goblin Fern (*Botrychium mormo*)

The geographic range of *Botrychium mormo* is confined to forests in portions of three contiguous states: Minnesota, Wisconsin, and Michigan. Most of the records are from north-central Minnesota, particularly Cass County. However, the species is scarce even within its stronghold, and it is becoming increasingly rare. The species requires an intact tree canopy in order to have consistently shaded, moist conditions and the accelerating rate of habitat degradation is the reason for its decline. Concerns over habitat loss and degradation from timber management activities and land clearing prompted the listing of *B. mormo* as a Minnesota special concern species in 1984.

B. mormo occurs in mature mesic hardwood forests where the dominant trees are *Acer saccharum* (sugar maple) with lesser amounts of *Thuja occidentalis* (northern white cedar). The canopy must be intact to maintain shaded, moist conditions. The soils are loamy with large amounts of humus, or organic matter, on the surface.

There is a documented occurrence of goblin fern within a mile of the Hay Lake parcel, where suitable habitat for goblin fern may be present.

Braun's Holly Fern (*Polystichum braunii*)

The geographic range of Braun's holly fern is quite limited and it is generally considered to be rare or local wherever it occurs. It was first found in Minnesota in 1966 during a geological survey of Cook County, and it has since been discovered in adjacent Lake County. Surveys of suitable habitats in northeastern Minnesota have located this species in only a few locations, and it typically occurs in rather localized, small populations.

Most occurrence records place the species in rocky environments, including in soil pockets and fissures in rock outcrops, at the bases of cliffs, among talus, along boulder-strewn water courses, or in rocky woods. But others have found it in environments that may be relatively rock-free, such as floodplain forests and woods with deep loamy soil. Microhabitat seems to be crucial in providing the cooler temperatures needed by this northern species. It is often found in erosion channels where the banks are steeply cut and cool air drains and settles, providing cool and moist conditions throughout the day. Shade, either of steep-sided ravines and gorges, north-facing slopes, or provided by a mature forest canopy or at least a shrub thicket, seems to be a constant. (Brzeskiewicz and Fields 2003 and references cited therein). In Minnesota, Braun's holly fern has been found on small ledges and cracks on the steep walls of river gorges, at the base of cliffs, on shaded rockslides, and in a cobbly, seepy drainage of lowland black ash and northern white cedar. However, most of the populations occur along moist, often rocky draws and ephemeral rocky streams in rich hardwood forests dominated by sugar maple and yellow birch.

Braun's holly fern has not been reported on the federal or non-federal lands, or the Tracks Project area.

5.1.6.2 Habitat Conditions

Habitat Group 5 RFSS favor upland mesic (moderately moist) deciduous forests comprised of sugar maple, basswood, paper birch, and yellow birch. Upland mesic deciduous forest is a component of MIH 1. However, the Forest Service MIH mapping system is too broad to accurately identify acres of this particular forest type. There are about 1,330 acres of upland forest (MIH 1), which includes aspen/aspen-white birch, maple/basswood, and oak forest cover types, on the federal lands and 2,695 acres of upland forest on the non-federal lands (**Table 6**). However, based on plant habitat surveys for the federal lands, mesic deciduous forest comprises only a small portion of upland deciduous forest on the federal and non-federal lands (MDNR et al. 2013).

5.1.6.3 Direct and Indirect Effects

Proposed Action

Species Conditions

Federal Lands

There should be no direct or indirect effects to moshatel, Braun's holly fern, triangle grapefern, or lanceleaf grapefern on federal lands from the Project as they have not been found on the federal lands and there is very little suitable habitat for these species on the federal lands.

Non-federal Lands

The Forest Service would monitor for triangle grapefern near Hay Lake Lands, and seek to protect high quality habitat for this plant species. Under the Proposed Action, the non-federal lands would be transferred to the Forest Service, who would manage the lands for timber production, recreation, nature study, and other values. The Forest Service would monitor Habitat Group 5 RFSS use of these lands, and seek to protect high quality habitat for these species.

Habitat Conditions

Federal Lands

There is very little suitable mesic upland forest habitat for Habitat Group 5 RFSS on the federal lands.

Non-federal Lands

Very little upland mesic upland forest habitat is found on the non-federal lands. Under the Proposed Action, the Forest Service would survey for Habitat Group 5 RFSS and associated habitat prior to conducting land-disturbing activities; areas of known or potential habitat would be avoided when feasible. Most recreational activity would be confined to existing trails and roads and would not likely affect Habitat Group 5 RFSS that favor upland mesic deciduous forests.

Alternative B

Federal Lands

There should be no direct or indirect effects to moshatel, Braun's holly fern, triangle grapefern, or lanceleaf grapefern on federal lands from the Project under Alternative B as these species have not been reported on the federal lands and there is little suitable mesic upland forest habitat for these species on the federal lands.

Non-federal Lands

Triangle grapefern has been found near Hay Lake Lands. Risks to this population and other Habitat Group 5 RFSS populations that could be found on the non-federal lands, and their habitat, would be similar to those under the Proposed Action.

No Action Alternative

There would be no direct or indirect effects to Habitat Group 5 RFSS under the No Action Alternative.

5.1.6.4 Cumulative Effects

As discussed in Section 4.5.2, it is possible that Habitat Group 5 RFSS and/or their habitat have been lost from past and ongoing activities in the CESA, and would be lost in the future from similar reasonably foreseeable future activities.

Forest management activities could result in Habitat Group 5 RFSS and their habitats being driven over and crushed by timber harvest and road construction/maintenance equipment, and from ground disturbance

associated with these activities. Timber harvest and road construction have affected upland forests and reduced the amount and distribution of this habitat within the CESA. Construction and use of roads under the Proposed Action, Alternative B, and the No Action Alternative, and elsewhere in the CESA, would continue to affect suitable habitat. There are about 460,000 acres of upland deciduous forest in the CESA (Emmons and Olivier Resources, Inc. 2006:30, 38), and a portion of this habitat would be mesic hardwood forest and would be available to Habitat Group 5 RFSS.

There should be no effects to Habitat Group 5 RFSS or their habitat from mining, and little upland mesic hardwood forest would be transferred to PolyMet under the land exchange (MDNR et al. 2013). Timber harvesting, road building, and recreational activities could occur on the federal and non-federal lands, depending upon whether the Proposed Action, Alternative B, or No Action Alternative is selected in the Record of Decision. In addition, there is the potential for homes and cabins to be built on the non-federal lands should the FEIS Record of Decision select the No Action Alternative and non-federal lands remain under private ownership. Only one population of triangle grapefern has been found on or near the non-federal lands (Hay Lake Lands) and little suitable habitat is found on the non-federal lands for Habitat Group 5 RFSS. The Forest Service would survey for RFSS prior to conducting land-disturbing activities, and would avoid areas with known or potential habitat for RFSS when feasible.

5.1.6.5 Summary

Project activities associated with the Proposed Action and Alternative B should have no direct or indirect adverse effects on Habitat Group 5 RFSS or their habitat, and would have a negligible contribution toward cumulative effects for Habitat Group 5 RFSS. Other activities in the CESA could also contribute to cumulative effects toward the RFSS plants of this habitat group. The Proposed Action and Alternative B would have similar effects on Habitat Group 5 RFSS, while there should be no effects to Habitat Group 5 RFSS from the No Action Alternative.

5.1.6.6 Determination

There would be **no impacts** to individuals of moshatel, Braun's holly fern, triangle grapefern, or lanceleaf grapefern under the Proposed Action, Alternative B, or No Action Alternative.

5.1.6.7 Mitigation and Recommendations

No mitigation measures are proposed for Habitat Group 5 RFSS.

5.1.7 Dry-mesic Upland Forest: Deciduous, Coniferous, or Mixed Forest Habitat (Habitat Group 6)

5.1.7.1 Environmental Baseline

Habitat Group 6 RFSS favor dry to mesic upland forests. The following Habitat Group 6 RFSS either occur on and/or have suitable habitat on, the federal and/or non-federal lands—New England sedge, fan lichen, Canada yew, Canada ricegrass, and barren strawberry. Fan lichen, although not included as part of any habitat group in the Forest Plan BE, is analyzed with this habitat group in this BE because of its affinity for bare soil habitats such as root wads (USDA Forest Service 2004c). None of these species have been reported on the federal or non-federal lands.

Species Conditions

New England Sedge (*Carex novae-angliae*)

New England sedge has been found at several locations in the Superior National Forest in St. Louis, Lake, and Cook Counties, including on the Tracks Project area. It is found in moist woods with sugar maple, paper birch, trembling aspen, yellow birch, and white spruce dominated forest (Shackleford 2004).

New England sedge has not been reported on the federal or non-federal lands. It has been found on the Tracks Project area.

Fan Lichen (*Peltigera venosa*)

In Minnesota, fan lichen has only been found in Cook County, where it grows on soil and on moist cliffs at a few locations near Lake Superior (Wetmore 2002e and references cited therein). In 1897, Bruce Fink found the species at two localities, while the most recent collections are from 2010. Thorough searches at many localities have yielded no additional records, but some potential habitat remains to be searched. The preferred substrate for fan lichen is rich, not-recently-disturbed soil and mossy rocks. It prefers cool, shady, moist locations, but only where there is little competition from other plants.

Fan lichen has not been reported on the federal or non-federal lands, or on the Tracks Project area.

Canadian Ricegrass (*Piptatherum [=Oryzopsis] canadense*)

Canadian ricegrass is found in St. Louis, Lake, and Cook Counties. This species is known from only eight documented locations in Minnesota. It prefers gravelly/sandy soil associated with red and jack pine plantations.

Canada ricegrass has not been reported on the federal or non-federal lands, but has been found on the Tracks Project area.

Canada Yew (*Taxus canadensis*)

Canada yew is found in northern Minnesota, including St. Louis, Lake, and Cook Counties. Canada yew is a shrub found as an understory species in a wide variety of uplands and lowlands, including northern white cedar/black ash swamps, talus and cliffs, northern hardwoods, and trembling aspen/paper birch forest.

Canada yew has not been reported on the federal or non-federal lands, but has been found on the Tracks Project area.

Barren Strawberry (*Waldsteinia fragarioides*)

In Minnesota, barren strawberry is restricted to forested sites in the northeastern part of the state. The earliest collection of the species is from 1893 in Lake County. It was later collected by Olga Lake at several locations in St. Louis and Lake Counties between 1938 and 1956. Relatively few records were reported in the 1980s but since that time, over 30 observations have been documented, including on the Tracks Project area. Some of these observations are clustered, with sites within a few miles of each other. Separate observations may actually be part of one larger population. Taking this into consideration, there are probably just over 20 populations that have been observed in the state since 1990.

In Minnesota, barren strawberry grows both in fire-dependent forests and in dry mesic hardwood forests. It is often found in forests dominated by pine, including red pine, white pine, and jack pine. It is also found in mixed pine and hardwood forests, often with trembling aspen, as well as in hardwood forests dominated by sugar maple. It is sometimes observed growing in deep shade, but perhaps most often in woodlands with small openings or relatively open tree or shrub canopies. It is also found growing in full sun along roadsides (Hill 2003 and references cited therein).

Barren strawberry has not been reported on the federal or non-federal lands.

Habitat Conditions

Upland forest (MIH 1 and 5) is common on the federal and non-federal lands. There are about 2,582 acres of upland forest on the federal lands, and 2,774 acres of upland forest on the non-federal lands, that could provide habitat for Habitat Group 6 RFSS (**Table 6**). Coniferous forest (MIH 5) makes up about 49% of the upland forest habitat on the federal lands, but only 3% of upland forest on the non-federal lands (**Table 6**). Jack pine, trembling aspen, paper birch, black spruce, and balsam fir are the dominant upland forest species on the federal lands; there are also scattered stands of red and white pine (ENSR 2005, AECOM 2011a). These species are also common on the non-federal lands, although there is less jack pine and more eastern white pine on the non-federal lands than on the federal lands (AECOM 2011b, c). This may be due to higher levels of timber harvesting on non-federal than federal lands, specifically harvesting of coniferous species. Portions of several non-federal lands have been recently logged (Lake County Lands South and Wolf Lands 3, in particular).

5.1.7.2 Direct and Indirect Effects

Proposed Action

Species Conditions

Federal Lands

No Habitat Group 6 RFSS were found during plant surveys on the federal lands, despite the fact that upland forest habitat comprised almost 40% of the federal lands (**Table 6**). Thus, there should be no direct or indirect effects to Habitat Group 6 RFSS from the Project on federal lands.

Non-federal Lands

No Habitat Group 6 RFSS were found during plant surveys on the non-federal lands, despite the fact that upland forest habitat comprised about 39% of the habitat on non-federal lands (**Table 6**). Under the land exchange, the Forest Service would administer the non-federal lands. The Forest Service would monitor Habitat Group 6 RFSS use of these lands, and seek to protect high quality habitat for these species. Some species, such as barren strawberry and Canada ricegrass, seem to tolerate disturbance on opening-up of timber stands.

Habitat Conditions

Federal Lands

There are 2,582 acres of upland forest on the federal lands that can provide habitat for these RFSS (**Table 6**). Upland forest is more prevalent on the portion of the federal lands within the Mine Site, making up 62% (1,694 acres) of the habitat. About 30% of the upland forest on the federal lands is immature or mature forest. The Project would affect about 1,037 acres of upland forest habitat and affected areas would not provide habitat for Habitat Group 6 RFSS for at least 20 years after mining and reclamation, and much longer for Habitat Group 6 RFSS that favor more mature forest habitat.

Non-federal Lands

There are 2,774 acres of upland forest habitat that could be used by Habitat Group 6 RFSS on the non-federal lands (**Table 6**). There is less upland forest habitat (39%), on a percentage basis, on the non-federal lands than on the federal lands. Timber harvest, and road building and recreational activities, could alter or destroy habitat for these species if these lands are transferred to the Forest Service. Under the Proposed Action, the Forest Service would survey for Habitat Group 6 RFSS and associated habitat prior to conducting land-disturbing activities; areas of known or potential habitat would be avoided when feasible. Most recreational activity would be confined to existing trails and roads and would not likely affect Habitat Group 6 RFSS that favor upland forests.

Alternative B

Federal Lands

There should be no direct effects to New England sedge, fan lichen, Canada yew, Canada ricegrass, and barren strawberry on federal lands from the Project as these species have not been reported on the federal lands. Under Alternative B, there are 2,093 acres of upland forest on the federal lands (**Table 6**). About 489 fewer acres of upland forest habitat would be transferred to PolyMet from the Forest Service than would occur under the Proposed Action, but direct and indirect effects to Habitat Group 6 RFSS species and their habitats from the Project activities would remain the same.

Non-federal Lands

There would be no direct effects to New England sedge, fan lichen, Canada yew, Canada ricegrass, and barren strawberry under Alternative B. There are about 2,420 acres of suitable habitat (MIH 1 and 5) on Hay Lake Lands, which is about 87% of the upland forest found on the non-federal lands (**Table 6**). Prior to implementing ground-disturbing activities, the Forest Service would conduct RFSS surveys of Hay Lake Lands to determine if RFSS would be affected by proposed activities. These surveys should help to ensure that RFSS found on the lands are avoided, where feasible. Under Alternative B, however, about 354 acres of upland forest habitat that is found on the other non-federal lands would remain under private ownership (**Table 6**).

No Action Alternative

There would be no direct or indirect effects to Habitat Group 6 RFSS under the No Action Alternative.

5.1.7.3 Cumulative Effects

As discussed in Section 4.5.2, it is possible that Habitat Group 6 RFSS and/or their habitat have been lost from past and ongoing activities in the CESA, and would be lost in the future from similar reasonably foreseeable future activities.

Timber harvest and road construction have affected upland forests and reduced the amount and distribution of this habitat within the CESA. Construction and use of roads in upland forests under the Proposed Action, Alternative B, and No Action Alternative and elsewhere in the CESA would continue to affect suitable habitat. For Canada ricegrass and barren strawberry, however, timber harvest should not have any long-term cumulative effects to habitat for these species because they appear to be able to tolerate some levels of disturbance. Suitable habitat for fan lichen (in the form of tip-ups) would continue to be created by future timber harvests.

There should be no direct or indirect effects to individuals of Habitat Group 6 RFSS from mining. About 1,037 acres of upland forest on the federal lands would be lost to mining and would be an adverse cumulative effect (**Table 6**).

Timber harvesting, road building, and recreational activities could occur in the future on the federal and non-federal lands, depending upon the whether the Proposed Action, Alternative B, or the No Action Alternative is selected in the Record of Decision. In addition, there is the potential for homes and cabins to be built on the non-federal lands, should the FEIS Record of Decision select the No Action Alternative and non-federal lands remain under private ownership. These activities could harm Habitat Group 6 RFSS and their habitats. There are about 31,000 acres of upland deciduous hardwood forest, and about 161,000 acres of upland conifer forest, in the CESA (Emmons and Olivier, Inc. 2006:30, 38), and Habitat Group 6 RFSS are found throughout the Superior National Forest, including on the Tracks Project area. The Forest Service would survey for RFSS prior to conducting land-disturbing activities, and would avoid areas with known or potential habitat for RFSS when feasible on lands they administer.

5.1.7.4 Summary

Project activities associated with the Proposed Action and Alternative B should have no direct or indirect adverse effects on individual Habitat Group 6 RFSS or their habitats because these species have not been found on the Mine Site. The Project would result in the cumulative loss of about 1,037 acres of potential habitat for these species on the federal lands (**Table 6**). Other activities in the CESA would also contribute to cumulative effects toward the RFSS plants of this habitat group. The Proposed Action and Alternative B would have similar effects on Habitat Group 6 RFSS. There should be no effects to Habitat Group 6 RFSS or their habitats from the No Action Alternative.

5.1.7.5 Determination

The Proposed Action and Alternative B **may impact individuals but are not likely to cause a trend to federal listing or loss of viability** for New England sedge, fan lichen, Canada yew, Canada ricegrass, and barren strawberry. The No Action Alternative would have **no impact** to individuals of Habitat Group 6 RFSS.

5.1.7.6 Mitigation and Recommendations

No mitigation measures are recommended for Habitat Group 6 RFSS.

5.2 Animals

5.2.1 Animals Not Evaluated in the Biological Evaluation

As shown in **Table 1**, there is no suitable habitat on the federal and non-federal lands for lake sturgeon, Nipigon cisco, and Shortjaw cisco. The Proposed Action, Alternative B, and No Action Alternative would have **no impact** to individuals of these species, and they will not be addressed further in this BE.

5.2.2 Mussels

Unionid mussels (*Unionidae*) constitute one of the most imperiled major taxa in the U.S. (Master et al. 2000), and 33 unionid species within Minnesota are state-endangered (13 species), threatened (11 species), or species of special concern (9 species). Two of these species, creek heelsplitter and black sandshell, both RFSS, are known to occur in the St. Louis River Watershed. No listed freshwater mussel species were observed on federal during mussel surveys for the Project (Heath 2004, 2011). No listed freshwater mussel species are known to occur on the non-federal lands.

5.2.2.1 Environmental Baseline

Creek Heelsplitter (*Lasmigona compresssa*)

The creek heelsplitter typically occurs in small headwater streams and requires riverine habitat conditions to survive and proliferate. It has also been documented at or near river inlets on lakes on the Superior National Forest. Although the creek heelsplitter is capable of self-fertilization, it relies extensively on host fish species for its parasite life stage (glochidia larvae) and dispersal. Because of its habitat and host fish requirements, the creek heelsplitter may be affected by vegetative management and road construction activities that could potentially increase sedimentation and streamflow, as well as create potential host fish migration barriers at road crossings.

The creek heelsplitter has not been reported on the federal or non-federals lands. It is not known to occur on the Partridge River in the vicinity of the Project area. On Hunting Club Lands, the creek heelsplitter is unlikely to be found as the creek that flows through the lands because the creek does not have a sandy substrate. There are no streams or rivers associated with Wolf Lands 1 and 2, Lake County Lands, or McFarland Lake Lands (AECOM 2011a, b).

There is potential habitat for the species on Hay Lake Lands and Wolf Lands 3 and 4. It has not been reported on Hay Lake Lands, but suitable habitat may exist in the Pike River. This species has been documented 2.3 miles downstream of the Hay Lake Lands at the Sand and Pike Rivers confluence, where the Pike River becomes a fourth-order stream. On the Hay Lake Lands, third-order segments of the Pike River may offer adequate sand substrate and flow to provide habitat for this species.

While the creek heelsplitter is not known to occur within or in the immediate vicinity of Wolf Lands 3 or 4, it has been documented near the eastern and western confluence of the northernmost lake in the chain of McDougal Lakes and in the third-order stretch of the Stony River. Therefore, it could occur in Coyote Creek, which flows from Wolf Lands 3 and 4 into McDougal Lakes, and is near the Stony River. The habitat in Coyote Creek within Wolf Lands 3 and 4 is unknown, but it could display first-order headwater stream characteristics.

The creek heelsplitter is known to occur on the Track Project area in the Cloquet River, and may occur in larger tributaries of the Cloquet River.

Black Sandshell Mussel (*Ligumia recta*)

The black sandshell mussel is primarily a riverine species that requires deep run or glide habitat in wide rivers with moderate current.

The black sandshell mussel is known to occur on the Superior National Forest, although near the edge of this species range. It has been documented in several locations in the St. Louis River system. The black sandshell mussel is not known to occur on the federal or non-federal lands, or within the Tracks Project area. The nearest documented occurrences of this species to the Project area are four locations in the St. Louis River, approximately 9 to 11 miles south to southwest of the federal lands. There is suitable habitat in the Pike River (Hay Lake Lands) and possibly Coyote Creek (Wolf Lands 3 and 4) for the black sandshell mussel. The Langley or Cloquet Rivers (Tracks Project area) may also support individuals or populations and provide habitat for the black sandshell mussel.

5.2.2.2 Direct and Indirect Effects

Proposed Action

There should be no direct effects to creek heelsplitter and black sandshell mussels from the Project as they have not been reported on the federal lands. Because the Project should not result in any measurable changes in habitat quality and flow regimes in the Partridge River, and no change in water quality (for any of the Class B water quality standards), no effects to the habitat for these species are expected within the Partridge River Watershed. Section 5.2.6 of the FEIS provides additional information on anticipated changes to flow regimes.

No creek heelsplitter or black sandshell mussels have been reported on the non-federal lands, although the creek heelsplitter has been documented in the Pike River, about 2.3 miles downstream of Hay Lake Lands, and in the Stony River near Wolf Lands 3 and 4. Under the Proposed Action, the Forest Service would survey for creek heelsplitter and black sandshell mussels and associated habitat prior to conducting land-disturbing activities; areas of known or potential habitat would be avoided when feasible.

Alternative B

Potential effects to creek heelsplitter and black sandshell mussel from Project activities would be similar to those under the Proposed Action. Under Alternative B, PolyMet would administer lands on which the Partridge River flows.

The Forest Service would acquire Hay Lake Lands under Alternative B. The Pike River flows along the eastern boundary of these lands. As noted above, suitable habitat for the creek heelsplitter could be found in the third-order segments of the Pike River, and this species has been found about 2.3 miles downstream of Hay Lake Lands. Creek heelsplitter habitat may occur on Coyote Creek within Wolf Lands 3 and 4 that would remain privately owned.

No Action Alternative

There would be no direct or indirect effects to creek heelsplitter or black sandshell mussel under the No Action Alternative.

5.2.2.3 Cumulative Effects

Substrate quality, channel stability, and host fish migration opportunities are key habitat components for maintaining individuals, populations, and habitat of creek heelsplitter and black sandshell mussel. It is likely that timber harvest, road and trail construction, and poorly designed stream crossings may have affected RFSS mussels and their habitat by altering stream channels and flow, contributing sediment into local streams, increasing stream temperatures, and restricting host fish migration within the CESA (USDA Forest Service 2004a).

Undeveloped federal and non-federal lands could be managed for timber production, and the developed portions of the Mine Site could be managed for timber after reclamation. Use of unclassified roads on federal and non-federal lands may contribute sediment into local streams and potentially threaten RFSS mussels and their habitat, although this input should be minimal if existing roads are used or reclaimed and no new roads are constructed near streams. Road construction and timber management activities could affect individuals, populations, and/or habitat of creek heelsplitter and black sandshell mussel on the Partridge River, Pike River, and Coyote Creek. These activities could potentially increase the inputs of fine sediment into local streams, increase or reroute stream flows, increase stream temperatures, and disrupt existing and/or future habitat unless properly mitigated. These effects could be mitigated by following design criteria to minimize effects to riparian zone habitat, including prohibiting the harvest of trees would occur within certain distances of different types of streams except for the purpose of maintaining or restoring riparian ecological function.

Standards and guidelines in the Forest Plan and best management practices would help to ensure that land management activities would not contribute to cumulative effects (USDA Forest Service 2004a). Provided that best management practices are implemented by landowners and managers, there should be no long-term cumulative effects to creek heelsplitter and black sandshell mussels and habitat from reasonably foreseeable future activities.

There should be no cumulative effects to creek heelsplitter and black sandshell mussel or their habitats from the Project as they have not been reported on or near the federal lands and the Project is not predicted to result in any measurable changes in water flows or water quality within the Partridge River Watershed. Creek heelsplitter has been found near Hay Lake Lands, and would be afforded protection by the Forest Service under both the Proposed Action and Alternative B.

5.2.2.4 Summary

The Proposed Action, Alternative B, and No Action Alternative should have no direct, indirect, or cumulative effects to individuals or habitat of creek heelsplitter or black sandshell mussel.

5.2.2.5 Determination

The Proposed Action and Alternative B **may impact individuals but are not likely to cause a trend to federal listing or loss of viability** creek heelsplitter or black sandshell mussels. The No Action Alternative would have **no impact** to creek heelsplitter or black sandshell mussel individuals.

5.2.2.6 Mitigation and Recommendations

No mitigation measures are recommended for creek heelsplitter or black sandshell mussel.

5.2.3 Insects

Although no RFFS insects have been reported on the federal or non-federal lands, there are six RFFS insects that could have suitable habitat on the federal and/or non-federal lands—headwaters chilostigman caddisfly, ebony boghaunter, Quebec emerald dragonfly, taiga alpine, Nabokov's blue butterfly, and Freija's grizzled skipper.

5.2.3.1 Headwaters Chilostigman Caddisfly (*Chilostigma itasca*), Ebony Boghaunter (*Williamsonia fletcheri*), and Quebec Emerald Dragonfly (*Somatochlora brevicincta*)

Environmental Baseline

Headwaters Chilostigman Caddisfly (*Chilostigma itasca*)

Little is known about the headwaters chilostigman caddisfly. It has only been discovered in two locations within Minnesota. In 1994, it was documented in a slow-moving, silt-dominated headwater stream in Itasca State Park and in 2005, in a rich swamp to poor fen habitat at Finland State Forest, which is about 4 miles north of Lake County Lands South.

Observations at Finland State Forest were within a large, acid to minerotrophic peatland complex. These peatlands have a loose to moderately dense canopy of black spruce and tamarack, with some northern white cedar, and a shrub layer of speckled alder and bog birch. Sphagnum mosses, sedges, and several heath species dominate the ground layer. Shallow pools among the hummocks and narrow streamlets are a characteristic feature where adults were observed crawling around on the snow. Adults were also observed in an aspen-mixed coniferous forest on a ridge adjacent to this peatland complex. Presumably these adults wandered from the peatland where larval development took place.

Habitats similar to those at Finland State Forest occur within the One Hundred Mile Swamp on the federal lands. However, because the distribution of this caddisfly appears to be very limited, it is unlikely that this species occurs on the federal or non-federal lands.

Headwaters chilostigman caddisfly has not been reported on the federal or non-federal lands, or the Tracks Project area.

Ebony Boghaunter (*Williamsonia fletcheri*)

The ebony boghaunter uses low elevation sphagnum bogs adjacent to coniferous or mixed coniferous/deciduous forest. It is usually absent from bogs that lack sphagnum. Larvae may develop in shallow pools (6 to 12 inches) in sedge fens or among sphagnum mats that have open pools and are not choked with

heaths. The adult male territorial arenas and adult perching sites are often in small, sun-lit clearings in the forest surrounding the laying habitat, not in completely open upland habitat. The ebony boghaunter has not been identified from benthic macroinvertebrate surveys conducted on and near the federal lands, and it has not been reported on the non-federal lands or Tracks Project area. Habitat likely exists for the ebony boghaunter on the federal and non-federal lands in bogs.

Quebec Emerald Dragonfly (*Somatochlora brevicincta*),

The Quebec emerald dragonfly occurs in lentic habitats typically associated with bogs, fens, and heaths near water-saturated or water-suspended sphagnum moss. The microhabitat is water-suspended or water-saturated sphagnum moss, whether or not associated with open water, and typically having grass-like emergent plants indicating weak minerotrophism. Eggs are laid outside plant tissues on the moss or adjacent water surface, with the larvae likely living within the saturated moss rather than on the water interface. The species has not been observed on open-water peatland ponds. Landforms in which the habitat can develop will generally consist of bedrock or surficial deposits with little mineralizing potential. Habitat may also form adjacent to or within peat bogs or heaths in low relief areas.

The Minnesota Odonata Survey Project found an individual in northern Lake County approximately 30 miles northeast of the Project area in 2006. This RFSS' habitat requirements are not well-understood in Minnesota. Suitable habitat could be present within the federal lands near the bogs associated with the headwater stream, Yelp Creek. It could inhabit poor fens and wet meadow/sedge meadow habitat found on the federal and non-federal lands. However, the likelihood of observing Quebec emerald dragonfly individuals or populations in the vicinity of the federal or non-federal lands is low.

Quebec emerald dragonfly was not found during benthic macroinvertebrate surveys of the federal lands (Breneman 2005, Barr 2011), and has not been reported on the non-federal lands, or the Tracks Project area.

Direct and Indirect Effects

Proposed Action

There should be no direct or indirect effects to headwaters chilostigman caddisfly, ebony boghaunter, or Quebec emerald dragonfly as they have not been reported on the federal lands and sightings have been 30 miles or more from the federal lands. These species favor slow-moving streams, bogs, and fens, which are similar to sedge/wet meadow habitat. There are 2,207 acres of habitat that could be used by these RFSS insects on the federal lands (210 acres of open bog, 1,961 acres of coniferous bog, and 36 acres of sedge/wet meadow; **Table 8**). A total of 547 acres of these habitats (512 acres of open and coniferous bog and 35 acres of sedge/wet meadow) would be disrupted by mining activities.

Because the Proposed Action should not result in any measurable changes in flows or water quality (for any of the Class B water quality standards) in the Partridge River, negligible effects to the headwaters chilostigman caddisfly, ebony boghaunter, or Quebec emerald dragonfly are expected within the Partridge River Watershed from the Project.

The headwaters chilostigman caddisfly, ebony boghaunter, and Quebec emerald dragonfly have not been reported on the non-federal lands, although the headwaters chilostigman caddisfly has been found at Finland State Forest, which is about 4 miles north of Lake County Lands South. There are 7 acres of open bog habitat

that could be used by these RFSS insects on the non-federal lands (**Table 8**). Under the Proposed Action, the Forest Service would survey for chilostigman caddisfly, ebony boghaunter, and Quebec emerald dragonfly and associated habitat prior to conducting land-disturbing activities; areas of known or potential habitat would be avoided when feasible.

Alternative B

Potential effects to headwaters chilostigman caddisfly, ebony boghaunter, or Quebec emerald dragonfly from Project activities would be the same as under the Proposed Action. Under Alternative B, there would be 1,887 acres of habitat that could be used by these RFSS insects on the federal lands (175 acres of open bog, 1,677 acres of coniferous bog, and 35 acres of sedge/wet meadow; **Table 8**). About 320 fewer acres of habitat would be transferred to PolyMet from the Forest Service than under the Proposed Action. Habitat loss to mining activities would be the same under Alternative B as under the Proposed Action.

Under Alternative B, the Forest Service would acquire Hay Lake Lands. No headwaters chilostigman caddisfly, ebony boghaunter, or Quebec emerald dragonfly have been reported on or near Hay Lake Lands. Based on a habitat assessment, there are only 2 acres of open bog habitat on Hay Lake Lands that could provide habitat for these species. About 30% of the available habitat that occurs on the non-federal lands is found on Hay Lake Lands (AECOM 2011b).

No Action Alternative

There would be no direct or indirect effects to headwaters chilostigman caddisfly, ebony boghaunter, or Quebec emerald dragonfly under the No Action Alternative.

Cumulative Effects

Past, present, and reasonably foreseeable future actions from land management and development include federal, state, county, and private road construction and timber management projects, private development, and routine road maintenance and transportation activities. The CESA has mixed ownership with roads crossing from one landowner to the next, and includes multiple jurisdictions. Standards and guidelines in the 2004 Forest Plan help to ensure that Forest Service activities do not contribute to cumulative effects (USDA Forest Service 2004a). In addition to federal standards and guidelines, state, private and local land owners and managers follow established best management practices that should help to minimize cumulative effects.

There should be no cumulative effects to headwaters chilostigman caddisfly, ebony boghaunter, or Quebec emerald dragonfly from the Project as they have not been reported on or near the federal lands. About 547 acres of habitat that could be used by these species on the federal lands would be directly affected by the Project, but given that there are about 368,000 acres of bog, sedge/wet meadow, and lowland conifer habitat within the CESA, habitat loss from the Project would have a negligible cumulative effect (Emmons and Olivier Resources, Inc. 2006:30, 38).

Summary

Project activities associated with the Proposed Action and Alternative B should have no adverse direct or indirect effects on individual headwaters chilostigman caddisfly, ebony boghaunter, or Quebec emerald dragonfly or their habitats, but the Project could cause cumulative effects to these species through loss of

potential habitat for these species on the federal lands. Other activities in the CESA would also contribute to cumulative effects toward this species. There would be no effects to headwaters chilostigman caddisfly, ebony boghaunter, or Quebec emerald dragonfly or their habitats from the No Action Alternative.

Determination

The Proposed Action and Alternative B **may impact individuals but are not likely to cause a trend to federal listing or loss of viability** for headwaters chilostigman caddisfly, ebony boghaunter, or Quebec emerald dragonfly. The No Action Alternative would have **no impact** on individuals of these species.

Mitigation and Recommendations

No mitigation measures are recommended for headwaters chilostigman caddisfly, ebony boghaunter, or Quebec emerald.

5.2.3.2 Taiga Alpine (*Erebia disa mancinus*)

Environmental Baseline

The taiga alpine occurs across northern North America. The taiga alpine's only occurrence in the contiguous U.S. is in Minnesota, where it is known from only a handful of localities in a small area in the northeast part of the state. These locations include the Sand Lake Peatland Scientific and Natural Area, which is about 8 miles north of Lake County Lands North and Wolf Lands 1, 5 miles west of Wolf Lands 2, and 8 miles west of Wolf Lands 3; and the McNair Management Area near Lake County Lands South. Recent surveys in the Glacial Lake Agassiz peatlands have not discovered any occurrences there, suggesting that taiga alpine has highly specialized habitat requirements. Because of the small number of known locations, the taiga alpine is likely vulnerable to habitat destruction and catastrophic events.

In Minnesota, the taiga alpine appears to favor black spruce bogs and swamps where immature black spruce trees form a park-like environment, with small bushy trees dotting the understory. This type of habitat is abundant in northern Minnesota, making the very restricted distribution of the butterfly an enigma. In Canada, where it is more common and widespread, it occurs in a broader range of habitats, most commonly in open black spruce-sphagnum bogs.

The taiga alpine was not searched for during field surveys for the Project and the MDNR NHIS database has no records of taiga alpine occurring on or in the vicinity of the federal or non-federal lands. Taiga alpine was found during surveys of the Tracks Project area.

Direct and Indirect Effects

Proposed Action

Taiga alpine has not been observed on or near the federal lands. There are 3,060 acres of lowland coniferous forest (MIH 9) within the federal lands that could provide habitat for this butterfly (**Table 6**). The Project would affect about 482 acres of lowland coniferous forest.

Taiga alpine has not been reported on the non-federal lands, although it has been found within 8 miles of Lake County Lands North, and Wolf Lands 2 and 3. There are about 3,309 acres of lowland coniferous forest habitat

on the non-federal lands that could provide habitat for taiga alpine (**Table 6**). Under the Proposed Action, the Forest Service would survey for taiga alpine and associated habitat prior to conducting land-disturbing activities; areas of known or potential habitat would be avoided when feasible.

Alternative B

Potential direct and indirect effects to taiga alpine and its habitat from Project activities would be similar to those under the Proposed Action. Under Alternative B, there would be about 2,079 acres of lowland coniferous forest on the federal lands that would be transferred to PolyMet (**Table 6**), or about 982 fewer acres of lowland coniferous forest that be transferred to PolyMet from the Forest Service than under the Proposed Action. In particular, portions of One Hundred Mile Swamp would remain under Forest Service management. Habitat loss due to mining activities would be the same under Alternative B as under the Proposed Action.

Under Alternative B, the Forest Service would acquire Hay Lake Lands. There are about 1,818 acres of lowland coniferous forest on Hay Lake Lands (**Table 6**). About 55% of lowland coniferous forest that occurs on the non-federal lands is found on Hay Lake Lands.

No Action Alternative

There would be no direct or indirect effects to taiga alpine under the No Action Alternative.

Cumulative Effects

As discussed in Section 4.5.2, mature black spruce and tamarack lowland forest has been lost from past and ongoing activities in the CESA, and would be lost in the future from similar reasonably foreseeable future activities.

Because European settlement, timber harvest, mining, wetland drainage, and road construction have affected forested wetlands and reduced the amount and distribution of this habitat within the CESA. More recently, timber sales on federal, state, county, and private lands have changed the age class distribution of lowland black spruce habitats, but have not altered the overall suitability of the habitat for taiga alpine.

Construction and use of roads in lowland forests under the Proposed Action, Alternative B, and No Action Alternative, and elsewhere in the CESA would continue to affect suitable habitat. Timber sales affecting lowland forests on state or county lands could change the age class of lowland black spruce forests in the Project area, temporarily making some stands less suitable for taiga alpine. However, the proportion of total suitable habitat affected by these activities would be very small in relation to habitat availability within the CESA.

The Project should not directly affect taiga alpine. About 482 acres of lowland coniferous forest habitat that could be used by this species on the federal lands would be directly affected by the Project (**Table 6**). Despite the potential cumulative effects of the Project, taiga alpine habitat is common in the CESA and about 356,000 acres of lowland coniferous forest/shrubland would remain in the CESA after the Project (Emmons and Olivier Resources, Inc. 2006:30, 38).

PolyMet would acquire lowland coniferous forest on the federal lands surrounding the Mine Site under the proposed land exchange. Although these lands would remain privately owned, it is likely that some or all of these lands would be managed for timber production and harvested in the reasonably foreseeable future. Timber

harvest and associated road construction could directly or indirectly affect taiga alpine habitat. Effects from timber management would be mitigated by voluntary adherence to best management practices (Minnesota Forest Resources Council 1999).

Under the Proposed Action and Alternative B, all or portions of the non-federal lands would be transferred to the Forest Service, who would manage the lands for timber production, recreation, nature study, and other values. Taiga alpine has not been reported on the non-federal lands, but has been observed within 8 miles of several non-federal lands, and there are about 3,309 acres of lowland coniferous forest on the non-federal lands.

Forest management activities could result in ground disturbance that adversely affects taiga alpine habitat, and possibly even individual butterflies. However, timber harvest activities would be conducted during winter in lowland coniferous forest to reduce the risks of ground disturbance and sedimentation. Should disturbance activities occur on the non-federal lands, it could take 80 or more years before disturbed lands would be suitable for taiga alpine. Prior to implementing ground-disturbing activities, the Forest Service would conduct RFSS surveys to determine if RFSS would be affected by proposed activities. These surveys should help to ensure that RFSS species found on non-federal lands are avoided, where feasible.

Summary

Project activities associated with the Proposed Action and Alternative B should have no adverse direct or indirect effects on individual taiga alpine or their habitat, but the Project could cause cumulative effects to potential habitat for taiga alpine on the federal lands. Other activities in the CESA would also contribute to cumulative effects toward this species. The Proposed Action and Alternative B would have similar effects on taiga alpine, while there would be no effects to this species from the No Action Alternative.

Determination

The Proposed Action and Alternative B **may impact individuals but are not likely to cause a trend to federal listing or loss of viability** for taiga alpine. The No Action Alternative would have **no impact** on individuals of this species.

Mitigation and Recommendations

No mitigation measures are recommended for taiga alpine.

5.2.3.3 Nabokov's Blue (*Lycaeides idas nabokovi*) and Freija's Grizzled Skipper (*Pyrgus centaureae freija*)

Environmental Baseline

Nabokov's Blue (*Plebejus idas nabokovi*)

Populations of Nabokov's blue tend to occur in geographic clusters, or metapopulations, linked by distances of 1 to 2 miles. Fewer than five metapopulations are known to occur in each of the Great Lake States (Michigan, Minnesota, and Wisconsin); several of the most important sites occur on U.S. Forest Service lands (Wolf 2002 and references cited therein). Recent Minnesota records for Nabokov's blue are confined to the three northeastern most counties (St. Louis, Lake, and Cook), including the McNair Butterfly Management Area, which is approximately 23 miles southeast of the federal lands and 9 to 13 miles from Wolf Lands 1 and 2,

respectively (BAMONA 2013). Focused searches in the past few years have discovered several new occurrences of Nabokov's blue, although most appear to be small colonies.

In Minnesota, all known colonies of this butterfly occur at sandy sites, including those with jack pine, but it is recorded on rock outcrops in Michigan. Because the species' preferred habitat is open woodland where the larval host plant, dwarf bilberry, is abundant, forest fires were probably important in creating and maintaining habitat for the species.

Active forest management can play a major role in conservation of these rare species. Encroachment of dense vegetation and woody plants is a major threat to existing populations, especially in the southern part of their geographic range. Fire suppression has likely been responsible for loss of habitat for dwarf bilberry during the past 50 years or longer (Wolf 2002).

Freija's Grizzled Skipper (*Pyrgus centaureae freija*)

The Freija's grizzled skipper has only been observed at a single locality in Minnesota, on the McNair Butterfly Management Area. It could occur at other locations in Minnesota, and the absence of additional records may be explained by its spring flight period, when weather is often unsuitable for butterfly activity, and by the poor understanding of its habitat preferences. At the one known location on the McNair Butterfly Management Area, Freija's grizzled skipper occurs in a large, old clearing on sandy soils dominated by grasses, with some willow, speckled alder, dwarf bilberry, and blueberries. Black spruce and tamarack swamps border the clearing in places.

Direct and Indirect Effects

Proposed Action

No butterfly surveys were conducted on the federal and non-federal lands. Based on observations of Nabokov's blue and Freija's grizzled skipper in Minnesota, however, it is unlikely that they are found on or near the federal lands, and thus there should be no direct or indirect adverse effects to these species from the Proposed Action. These butterflies favor sandy and rocky sites associated with jack pine and other upland coniferous forest, which are rare on the federal lands.

There are 1,252 acres of upland coniferous forest habitat (MIH 5) on the federal lands that could provide habitat for Nabokov's blue and Freija's grizzled skipper (**Table 6**). The Project would affect about 505 acres of upland coniferous forest habitat.

Nabokov's blue and Freija's grizzled skipper have not been reported on the non-federal lands, although they have been found within 23 miles of the federal lands and 9 miles of the non-federal lands. There are about 80 acres of upland coniferous forest on the non-federal lands that could provide habitat for Nabokov's blue and Freija's grizzled skipper (**Table 6**). These lands would not be affected by the Project. Under the Proposed Action, the Forest Service would survey for Nabokov's blue and Freija's grizzled skipper and associated habitat prior to conducting land-disturbing activities; areas of known or potential habitat would be avoided when feasible.

Alternative B

Potential direct and indirect effects to Nabokov's blue and Freija's grizzled skipper and their habitat from Project activities would be similar to those under the Proposed Action. Direct effects to upland coniferous forests from the Project would be similar for both the Proposed Action and Alternative B. Under Alternative B, there are 1,139 acres of upland coniferous forest habitat on the federal lands (**Table 6**). About 114 fewer acres of upland coniferous forest would be transferred to PolyMet from the Forest Service than under the Proposed Action. Habitat loss to mining activities would be the same under Alternative B as under the Proposed Action.

Under Alternative B, the Forest Service would acquire Hay Lake Lands. There are 55 acres of upland coniferous forest habitat on Hay Lake Lands (**Table 6**). About 68% of the upland coniferous forest on the non-federal lands is found on Hay Lake Lands.

No Action Alternative

There would be no direct or indirect effects to Nabokov's blue and Freija's grizzled skipper under the No Action Alternative.

Cumulative Effects

As discussed in Section 4.5.2, upland coniferous forest has been lost from past and ongoing activities in the CESA, and would be lost in the future from reasonably foreseeable future activities. Timber management activities have led to the creation of young upland forest habitat in areas that are suitable habitat for Nabokov's blue and Freija's grizzled skipper over much of the Arrowhead region, especially on private lands that tend to have shorter harvest rotations than federal lands. On the Superior National Forest, projections show decreasing young forest habitat (upland forest younger than 9 years) and greatly increasing immature and mature (upland conifer older than 10 years) forest habitat (USDA Forest Service 2010b). Timber harvest and associated road construction could help to promote habitat for Nabokov's blue and Freija's grizzled skipper.

The Project should not directly affect individual Nabokov's blue and Freija's grizzled skipper or their habitat, but could cumulatively affect these species through loss of potential habitat. About 505 acres of upland coniferous forest habitat that could be used by these species on the federal lands would be directly affected by the Project. Although there are few populations of Nabokov's blue and Freija's grizzled skipper in Minnesota, they are more common outside of Minnesota. There are also about 161,000 acres of upland coniferous forest within the CESA that could provide habitat for Nabokov's blue and Freija's grizzled skipper (Emmons and Olivier Resources, Inc. 2006:30, 38).

Under the Proposed Action and Alternative B, all or portions of the non-federal lands would be transferred to the Forest Service, who would manage the lands for timber production, recreation, and other activities. Forest management activities could result in ground disturbances that adversely affect Nabokov's blue and Freija's grizzled skipper and their habitat. The Forest Service would survey for Nabokov's blue and Freija's grizzled skipper prior to conducting land-disturbing activities, and would avoid areas with known or potential habitat for Nabokov's blue and Freija's grizzled skipper when feasible. Should disturbance activities occur on the non-federal lands, it would take 10 or more years before disturbed lands would be suitable for Nabokov's blue and Freija's grizzled skipper. The Forest Service would conduct RFSS surveys to determine if Nabokov's blue and Freija's grizzled skipper would be affected by any proposed land-disturbance activities. These surveys should help to ensure that these RFSS, if found on Hay Lake Lands, are avoided, where feasible.

Summary

Project activities associated with the Proposed Action and Alternative B should have no adverse direct or indirect effects on Nabokov's blue and Freija's grizzled skipper, but the Project could cause cumulative adverse effects to these species through loss of potential habitat. Other activities in the CESA would also contribute to cumulative effects toward these species. The Proposed Action and Alternative B would have similar effects on Nabokov's blue and Freija's grizzled skipper, while there would be no effects to these species from the No Action Alternative.

Determination

The Proposed Action and Alternative B **may impact individuals but are not likely to cause a trend to federal listing or loss of viability** for Nabokov's blue and Freija's grizzled skipper. The No Action Alternative would have **no impact** to individuals of these species.

Mitigation and Recommendations

No mitigation measures are recommended for Nabokov's blue and Freija's grizzled skipper.

5.2.4 Fish

The only RFSS fish for which there is habitat near the Project area is northern brook lamprey, although they have not been reported on or near the federal lands or non-federal lands. There could be potential habitat for northern brook lamprey within the Partridge River, and within several streams on the non-federal lands.

5.2.4.1 Northern Brook Lamprey (*Ichthyomyzon fossor*)

Environmental Baseline

The northern brook lamprey is a non-parasitic lamprey that is uncommon and has relatively restricted range in Minnesota. They require moderately warm, low-gradient streams with sections of higher gradient (riffle) reaches suitable for spawning. They are most common in streams of medium size, averaging 60-feet wide and 3-feet deep; but can occur in smaller (3- to 10-feet wide) and larger rivers (100- to 325-feet wide). Spawning occurs in May to June in gravel areas near riffles with water depths of about 1 foot. Larval forms (ammocoetes) require soft substrate (approximately 80% sand and silt) for burrowing, often among vegetation at depths of 6 to 20 inches. The diet of ammocoetes consists of diatoms and unicellular algae. Growth is rapid and larvae require organically enriched, sandy substrate until metamorphosis. After a 3- to 6-year growth period, metamorphosis occurs and adults spawn about 3 to 4 months afterwards. As adults, they do not feed and are believed to die a few days after spawning. Northern brook lamprey occurs in medium-size streams in several watersheds on the Superior National Forest.

There are no known occurrences of this species on or near the federal lands. Northern brook lampreys were found at a site south of Cloquet, Minnesota, approximately 75 miles south of the Project area. Since 1986, it has been collected from six other sites in the Lake Superior drainage. Potential habitat near the Project area includes sections of the St. Louis, Cloquet, and Partridge Rivers.

Northern brook lamprey has not been reported on or near non-federal lands, although suitable habitat for the species likely occurs on Hay Lake Lands and Wolf Lands. This species has not been documented on the Tracks Project area.

Direct and Indirect Effects

Proposed Action

There would be no direct or indirect effects to northern brook lamprey from the Project as this species has not been observed on or near the Project area, although suitable habitat for the species could occur in the Partridge River. Because the Project should not contribute sediment, increase stream temperatures, or substantially alter stream flow in the Partridge River, no effects to habitat for this species are expected.

Northern brook lampreys have not been reported on or near non-federal lands, although suitable habitat for the species could occur in the Pike River on Hay Lake Lands and in Coyote Creek on Wolf Lands 4. Under the Proposed Action, the Forest Service would survey for northern brook lamprey and associated habitat prior to conducting land-disturbing activities; areas of known or potential habitat would be avoided when feasible.

Alternative B

There would be no direct or indirect effects to northern brook lamprey from the Project under Alternative B. Under Alternative B, the Forest Service would acquire Hay Lake Lands. The Pike River flows along the eastern boundary of the lands and could provide habitat for northern brook lamprey.

No Action Alternative

There would be no direct or indirect effects to northern brook lamprey under the No Action Alternative.

Cumulative Effects

Historical events, including overfishing, construction of dams, and resource management activities have affected individuals and populations of northern brook lamprey within the CESA. It is possible that historic timber harvest, road and trail construction, and poorly designed stream crossings may have affected northern brook lamprey habitat and ammocoete survival by contributing sediment, increasing stream temperatures, and altering stream flow (USDA Forest Service 2004b).

Use of unclassified roads on federal and non-federal lands may contribute sediment into local streams and potentially threaten RFSS fish and their habitat, although this input should be minimal if existing roads are used and no new roads are constructed near streams. Standards and guidelines in the Forest Plan would help to ensure that Forest Service activities would not contribute to cumulative effects (USDA Forest Service 2004a). In addition to federal standards and guidelines, state, private, and local land owners and managers follow established best management practices that should also contribute to reducing cumulative effects.

There should be no cumulative effects to northern brook lamprey and their habitat from the Project as northern brook lamprey have not been reported on or near the federal lands. The small decrease in the Partridge River flow that is predicted to occur during the Project is not likely to adversely affect the northern brook lamprey.

ANALYSIS AND DETERMINATION OF EFFECTS

Under the Proposed Action and Alternative B, most Project roads would be reclaimed after mining. There could be timber management and road construction on the undeveloped portions of the federal and non-federal lands. Because Hay Lake Lands and Wolf Lands 4 could have northern brook lamprey habitat, there could be cumulative effects to potential habitat for northern brook lamprey.

Summary

Project activities associated with the Proposed Action and Alternative B should have no adverse direct, indirect, or cumulative effects on northern brook lamprey or their habitat. The Proposed Action and Alternative B would have similar effects on this species. Under the Proposed Action and Alternative B, the Partridge River (federal lands) and Pike River (non-federal lands) would be exchanged, but Coyote Creek, another stream that could have northern brook lamprey habitat, would not be exchanged under Alternative B. There would be no effects to northern brook lamprey or their habitats from the No Action Alternative.

Determination

The Proposed Action and Alternative B **may impact individuals but are not likely to cause a trend to federal listing or loss of viability** for northern brook lamprey. The No Action Alternative would have **no impact** to individuals of northern brook lamprey.

5.2.4.2 Mitigation and Recommendations

No mitigation measures are recommended for northern brook lamprey.

5.2.5 Reptiles

One RFSS reptile, the wood turtle, has been observed near the federal lands and there could be potential habitat for wood turtles along the Partridge River within the federal lands, and along several streams on the non-federal lands.

5.2.5.1 Wood Turtle (*Glyptemys insculpta*)

Environmental Baseline

The wood turtle's range extends from Virginia to Nova Scotia and westward to Minnesota and northeast Iowa. The Project area is at the western edge of its range in Minnesota. The wood turtle is largely aquatic, preferring small- to medium-sized, fast-moving rivers and streams with adjacent deciduous and coniferous forests. The substrates of wood turtle streams typically consist of sand or gravel. Wood turtles will occupy adjacent alder thickets, forest, and grassland habitat for basking and foraging, typically staying within ¼ mile of the river or stream. Sandy, sparsely vegetated areas that are not prone to flooding and have ample exposure to direct sunlight provide important nesting sites.

The wood turtle occurs just south and west of the Superior National Forest along the St. Louis River and in the south end of the Superior National Forest along the Cloquet River; wood turtles were also found on the Tracks Project area. In the Cloquet River, all known populations use artificial sites such as gravel pits, road shoulders, and a turtle nesting island created in the late 1990s. Populations are isolated and the wood turtles may travel 3 miles along a stream to find nesting sites.

The MDNR NHIS database records indicate the northernmost population of wood turtles in the state occurs immediately south of the federal lands on the Partridge River. However, wood turtles are unlikely to be found on the federal lands because that the portion of the Partridge River within the federal lands does not have the sandy-gravelly morphology and sand bars that wood turtles prefer for hibernating, mating, and nesting.

The MDNR NHIS database did not identify sightings of wood turtles on or within a mile of the non-federal lands. There may be suitable habitat along the Pike River on Hay Lake Lands.

Direct and Indirect Effects

Proposed Action

There would be no direct effects to wood turtles from the Project as this species has not been observed on the federal lands. The small decrease in the Partridge River flow that is predicted to occur during the Project is not likely to affect the river morphology and should not adversely indirectly affect wood turtle habitat.

Should wood turtles occur in the vicinity of the Project area, the potential for indirect effects from contaminants, such as mercury, in ponds or discharge water, is not likely. Because the wood turtle inhabits woodland streams and adjacent habitat (alder thickets, forest, and grassland habitat) within about one-quarter mile of a stream, it is not likely to be found within the large open areas of the Plant Site or Mine Site during operations or near mining-related features such as stormwater and process water ponds associated with the Project. For example, the Tailings Basin Pond and Hydrometallurgical Residue Facility Pond would not have outlets and would be more than a quarter mile from a woodland stream. Similarly, process water ponds at the Mine Site (e.g., Overburden and Storage Laydown Area Pond) would not have outlets and would be more than one-quarter mile from a woodland stream.

The Plant Site and immediately adjacent lands provide no habitat or poor quality habitat for a wood turtle (e.g., lack of forest canopy over streams; slower flow in streams with numerous beaver ponds). During operations, water released from the Plant Site would include stormwater and treated waste water. Stormwater is expected to meet water quality standards after sedimentation ponds remove total suspended solids prior to being released off-site. Water discharged from the Waste Water Treatment Plant would be directed to Unnamed Creek (PM11), Trimble Creek, and Second Creek (at SD026) and would be required to meet water quality standards, including the mercury water quality standard of 1.3 ng/L. During reclamation, some ponds may be converted to wetlands that would receive precipitation and runoff water and this water would meet water quality standards. Other ponds, including the Hydrometallurgical Residue Facility Pond, would be filled and converted to terrestrial vegetation during reclamation and would have no potential to affect the wood turtle.

There could be potential wood turtle habitat along the Partridge River. During operations (Mine Years 1 through 20), there would be no permitted discharges of water from the Mine Site as process water and water accumulating in the mine pits would be pumped to the Plant Site. Stormwater released from the Mine Site is expected to meet water quality standards after sedimentation ponds remove total suspended solids prior to being released off-site. During reclamation, some ponds may be converted to wetlands that would receive precipitation and runoff water and would meet water quality standards. Other ponds, including the Overburden Storage and Laydown Area Pond, would be filled and converted to terrestrial vegetation during reclamation and would have no effect on the wood turtle. In long-term closure the West Pit Lake discharge would be treated at the Waste Water Treatment Facility (or by non-mechanical treatment after it is proven to meet water quality objectives), then discharged to the Upper Partridge River. This discharge channel would provide a riparian habitat that could

ANALYSIS AND DETERMINATION OF EFFECTS

be occupied by a wood turtle. Treated water discharged from the West Pit lake would comply with water quality standards, including mercury.

Overall, the potential for indirect effects to a wood turtle inhabiting a woodland stream near the Plant Site or Mine Site would be low and no adverse effects would be expected to occur to a wood turtle inhabiting a stream reach that receives stormwater or treated waste water.

Wood turtles have not been reported on or near the non-federal lands, although suitable habitat for the species could occur in the Pike River on Hay Lake Lands or in Coyote Creek on Wolf Lands 4. Under the Proposed Action, the Forest Service would survey for wood turtles and associated habitat prior to conducting land-disturbing activities and areas of known or potential habitat would be avoided when feasible.

Alternative B

Potential direct and indirect effects to wood turtles from the Project would be similar to those under the Proposed Action. Under Alternative B, the Forest Service would acquire Hay Lake Lands. The Pike River flows along the eastern boundary of the lands and could provide habitat for wood turtles.

No Action Alternative

There should be no direct or indirect effects to wood turtle under the No Action Alternative.

Cumulative Effects

Because of its dependence on forested riverine systems and well-drained soils, the wood turtle was probably never been uniformly distributed in the Upper Great Lakes Region, but was locally abundant in areas with optimal habitat. Throughout its range, many populations have become affected or extirpated by human activities. In Minnesota, factors contributing to its decline include the loss or fragmentation of riverine forests related to agriculture, timber harvest, road construction, and development; siltation of streams caused by excessive runoff; and flooding of nesting areas. Prime wood turtle habitat is attractive to recreationists, leading to increased collection and road kills. In addition, human activity attracts predators into areas because of trash left behind. An increase in predators can in turn affect wood turtle populations, with predators digging up nests or eating young turtles. All of these problems are compounded by the wood turtle's low reproductive potential, resulting in few juveniles recruited into the population (Bowen and Gillingham 2004, MDNR 2008).

Preservation of high-quality wood turtle habitat is dependent upon reasonable floodplain conservation techniques and zoning restrictions, including: maintaining water quality; controlling sedimentation; restricting pesticide use near waterways; enforcing minimum set-back requirements and stream-side buffer zones; and use of best management practices for timber harvest, livestock grazing, and agriculture. Limiting recreational use of streams in prime wood turtle habitat may be necessary to protect the habitat.

There should be no cumulative effects to wood turtles and their habitat from the Project as they have not been reported on the federal lands and mining activities would have no direct effects on the Partridge River, and indirect effects, such as changes in water flow and quality due to mining, should be negligible.

Both PolyMet and the Forest Service could conduct timber management activities on acquired lands. Cumulative effects from timber management should also be minor if the Forest Service follows guidance in its

2004 Forest Management Plan, and PolyMet and/or private landowners follow Minnesota Forest Resource Council (2003) forest management guidelines to protect riparian zones and streambanks.

Summary

Project activities associated with the Proposed Action and Alternative B should have no adverse direct or indirect effects on wood turtles. PolyMet, the Forest Service, and other landowners in the CESA could conduct timber management and other land-use activities in the reasonably foreseeable future that could have adverse cumulative effects on wood turtle habitat within the CESA, but this risk should be negligible if best management practices are followed to protect wood turtle habitat. There would be no direct or indirect effects to wood turtles or their habitats under the No Action Alternative.

5.2.5.2 Determination

The Proposed Action and Alternative B **may impact individuals but are not likely to cause a trend to federal listing or loss of viability** for wood turtle. The No Action Alternative would have **no impact** to individuals of wood turtle.

5.2.5.3 Mitigation and Recommendations

No mitigation measures are recommended for the wood turtle.

5.2.6 Birds

Five RFSS birds have been observed on or near federal and/or non-federal lands and have suitable habitat on or near these lands —bald eagle, northern goshawk, boreal owl, great gray owl and three-toed woodpecker. In addition, these birds have not been observed, but there is suitable habitat for the following three RFSS birds on the federal and/or non-federal lands—olive-sided flycatcher, bay-breasted warbler, and Connecticut warbler.

5.2.6.1 Bald Eagle (*Haliaeetus leucocephalus*)

Environmental Baseline

The bald eagle was removed from the federal threatened species Endangered Species Act (ESA) list on June 28, 2007. After a period of decline due to hunting and widespread use of dichlorodiphenyltrichloroethane (DDT), bald eagle populations in the lower 48 states rose dramatically beginning in 1972. The bald eagle is federally protected by the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act.

Forest stands used for nesting (and perching) are typically mature trees within stands with uneven age structure. Second growth forest with 5% to 10% remnant old growth component provides breeding habitat in Minnesota. Nest trees are almost always taller than the surrounding vegetation, probably because it is difficult for such a large bird (especially inexperienced fledglings) to maneuver and take off in dense understories. However, nests are often built below the topmost branches, probably for protection from rain and sun. Bald eagles prefer old growth pine taller than the surrounding forest canopy, and on the Superior National Forest, nearly all nests are in eastern white pine or red pine.

Bald eagles typically use large trees within 500 feet of rivers or large lakes as nest sites and perches to search for fish and other prey. The MDNR NHIS database contains records of 18 nesting areas, some with multiple nests,

within 12 miles of the Project area. Some of these nests were in close proximity and were assumed to be used by a single pair. The five closest bald eagle nesting territories were 6 to 7.5 miles from the Project area and averaged 6 miles apart. No large lakes or large nesting trees are found on or near the Mine Site and it is unlikely that bald eagles would use the Mine Site.

The primary foraging habitats of bald eagles are the shorelines of lakes and rivers. The smallest body of water on which bald eagles were reported to nest was 20 acres on the Chippewa National Forest in Minnesota. Bald eagles nesting on smaller bodies of water may require additional foraging areas nearby. Nesting near small lakes usually means there is a larger lake or several smaller lakes nearby.

Bald eagles generally winter near open water where prey or carrion are available. There are no large open-water lakes on the federal lands. Mud Lake (30.5 acres) is the only open-water area on the federal lands, but it is shallow lake and freezes over during winter. Animal-vehicle collisions on Dunka Road and/or natural white-tailed deer or other wildlife mortality do not appear to produce sufficient carrion to sustain bald eagles on the federal lands (ENSR 2005), although the amount of carrion available to bald eagles during mine operations could increase due to increased levels of vehicle and rail traffic.

Wildlife surveys were conducted during the spring and summer on the federal lands in 2004, 2008, and 2009 (ENSR 2005, AECOM 2009, 2011a). No bald eagle nests were found on the federal lands, although a bald eagle was seen flying over the federal lands. Bald eagles or their nests were not observed on the non-federal lands (AECOM 2011b, c).

Direct and Indirect Effects

Proposed Action

There should be no direct or indirect effects to bald eagles from the Project on the federal lands. There are no large lakes or rivers on the Mine Site that would provide optimal nesting/foraging habitat, although the Partridge River (approximately 0.5 mile south of the federal lands), Mud Lake, and the ponds at the Tailings Basin associated with the Plant Site could provide some, though less-than-optimal, habitat.

The nearest known bald eagle nests to the federal lands are approximately 6 miles from the Project area. The U.S. Department of the Interior (USDOI) U.S. Fish and Wildlife Service (USFWS) *National Bald Eagle Management Guidelines* (USDOI USFWS 2007) suggest that human activity within 2 miles can be seen or heard by eagles and, depending on the level of screening and habituation of individual eagles, may cause them to abandon a nest.

Project noise would potentially have an impact on eagle utilization of habitat in the vicinity of the Mine Site. Existing ambient steady equivalent noise levels for most of the Mine Site are in the range of 35 to 45 decibels (dBA), which is a range comparable to secluded woods or a quiet bedroom (MPCA 1999). The Peter Mitchell Mine, north of the Mine Site, and traffic along Dunka Road and the existing railway, along the south edge of the Mine Site, also contribute brief, episodic noise impacts.

The primary sources of Project noise from the Mine Site would be blasting, haul trucks, and train horns, with noise levels ranging from 89-115 dBA. Equipment such as graders, bull dozers, and support trucks would be less dominant sources of noise, ranging from 75-95 dBA (Environmental Protection Agency 1971). Blasting at the Mine Site is expected to occur once every two to three days. Typically, rock blasting generates a single event

noise level ranging from 111- 115 dBA at 50 feet from the blasting site (Table 5.5-7 of Madera County 2005). Within most of the Mine Site, the sound from the blast would be similar to a loud clap of thunder.

The impacts of noise on bald eagle utilization of habitat near the Mine Site are largely unknown and the assessment of impacts remains subjective. Impacts may also vary between individual eagles. Some eagles may adapt to predictable human activities, so if the activity generally occurs at predictable time periods at the same places or along the same routes, animals may become habituated to the activity (ENSR/AECOM 2006).

Bald eagle nesting territories in Minnesota are, on average, about 10 miles apart. Bald eagle nests near the Project area average about 6 miles apart. This suggests that the area near the Project provides high quality habitat for bald eagles, but there is low likelihood that the area would support many more territories. As eagles become more numerous, any eagles seeking to establish new territories in the area would need to select lower quality habitat and/or move into closer proximity to human activity.

The Forest Service considers MIH 7, which is primarily red and white pine forest, indicative of bald eagle habitat. No stands of MIH 7 were observed on the federal lands or proposed Mine Site, although there are scattered pines on the federal lands.

Surface water contaminants (e.g., mercury) that are absorbed by prey species such as waterfowl could lead to ingestion of contamination by eagles (Marr 2008). However, bald eagles are relatively insensitive to the toxic effect of mercury exposure through their food (Judd 2013). In addition, the potential incremental change in fish mercury concentrations in lakes (e.g., Heikilla, Colby, Sabin, Whitewater, Wynne) potentially associated with the Project's air emissions is estimated to be small (ranges from 0.0006 to about 0.016 parts per million, about 0.2% to 1.6% of background; Barr 2013; Section 10). This potential change in fish mercury concentration would be within the variability of background fish mercury concentrations for the Hoyt Lakes area (Barr 2013: Section 10 and Attachment F). Because the potential change in fish mercury concentrations is estimated to be small and not likely statistically measurable (i.e., no measurable change from existing background conditions), the potential effect of Project-related mercury on the bald eagle would not likely be measurable. Overall, no adverse indirect effects to the bald eagle would be expected from the Project.

Under the land exchange, the Forest Service would acquire potential bald eagle habitat, but no areas with known bald eagle nests. The nearest bald eagle nest to Hay Lake Lands is about 4 miles to the southeast on Cedar Island Lake. Eagle nests have been observed at John Lake and at North Fowl Lake (two nests), about 2 to 3 miles from McFarland Lake Lands. It is likely that eagles use habitat associated with Pine Lake, which is near Wolf Lands 1 and Lake County Lands North; Greenwood Lake, which is near Wolf Lands 2; and the Stony River, which is near Wolf Lands 3 and 4.

Lakes and rivers that could be associated with eagle habitat are present on or near several of the non-federal lands. Hay Lake Lands include the Pike River, Hay Lake (96 acres), and Little Rice Lake (29 acres). Lake County Lands and Wolf Lands are near large lakes such as Pine and Greenwood. McFarland Lake Lands border McFarland Lake, which is connected to other lakes within the BWCAW, and bald eagles have been seen foraging on McFarland Lake (Russ 2010).

There are 2,582 acres of upland forest (MIH 1 and 5), which comprises about 40% of all habitat on the federal lands; 792 acres are mature forest habitat (**Table 6**). There are 2,775 acres of upland forest, which comprises about 39% of all habitat on the non-federal lands; 617 acres are mature forest habitat (**Table 6**). Jack pine, trembling aspen, paper birch, black spruce, and balsam fir are the dominant upland forest species on the federal

lands. These species are also common on the non-federal lands, although there was less jack pine and more eastern white pine on the non-federal lands than on the federal lands.

The Project would affect about 1,037 acres of upland coniferous forest habitat, of which about 182 acres are mature upland forest habitat (**Table 6**). Only about 20% of upland forest stands on the non-federal lands consist of mature forest, which might include trees that could support bald eagle nests. Under the Proposed Action, the Forest Service would survey for bald eagles and associated habitat prior to conducting land-disturbing activities; areas of known or potential habitat would be avoided when feasible.

Alternative B

Potential direct and indirect effects to bald eagles from the Project would be similar to those under the Proposed Action. Under Alternative B, there are 2,093 acres of upland forest on the federal lands (**Table 6**). About 490 fewer acres of upland forest habitat would be transferred to PolyMet from the Forest Service under Alternative B than under the Proposed Action. Habitat loss from mining activities would be the same under Alternative B as under the Proposed Action.

The Forest Service would acquire Hay Lake Lands under Alternative B. There are no bald eagle nests and no known mature coniferous forest habitat on the lands. There are about 2,420 acres of upland forest habitat on Hay Lake Lands, however, only about 2% of this habitat is coniferous (MIH 5) and none of it is mature forest (**Table 6**). About 87% of the upland forest habitat that occurs on the non-federal lands is found on Hay Lake Lands. Thus, the Forest Service would receive most of the land that could provide habitat for bald eagles on the non-federal lands under the Proposed Action and Alternative B. Hay Lake, Little Rice Lake, and the Pike River are on Hay Lake Lands and may provide foraging habitat for bald eagles.

No Action Alternative

There should be no direct or indirect effects to bald eagle under the No Action Alternative.

Cumulative Effects

Human activity is the biggest threat to the bald eagle. Although DDT is no longer a risk factor in the U.S., organophosphates, heavy metals, and other pollutants continue to cause sickness or death in bald eagles. Lead poisoning is also a significant cause of mortality, and oil spills threaten eagles in coastal areas. Bald eagles are occasionally still shot or intentionally poisoned. Additionally, collisions with vehicles and power lines are a growing threat as more land is developed. Vehicle collisions have become more frequent as the bald eagle population has increased in Minnesota, due to the bald eagles habit of feeding on deer carcasses along roads. Land development in wilderness areas and along shorelines destroys breeding habitat and winter roost sites, and increased human activity may cause bald eagles to abandon nesting or winter roosting sites. However, the fact that bald eagles are now successfully nesting in proximity to humans, even in the Twin Cities metropolitan area, indicates that some bald eagles may become habituated to humans if they are not persecuted (USDA Forest Service 2004b).

Modeling to predict future vegetation management activities in Minnesota projected, under all scenarios modeled, that bald eagle nesting, roosting, and perching habitat will increase statewide. Red and eastern white pine forest acres, and the amount of old forests in both these forest types, are expected to increase. Cumulative

effects of forest management on all ownerships should benefit eagles by increasing preferred nesting, roosting, and perching habitat over the next several decades on both public and private lands (Jaakko Poyry 1994).

Adverse effects to bald eagles could occur on lands outside of Forest Service administration. Increases in the potential for human access near bald eagle territories would occur as people buy, subdivide, and develop private lands. New road construction would be needed to access this property. Some of these roads may be developed near to current or future nesting habitat. Development of cabins and second homes next to lakeshores could also decrease high quality eagle habitat through destruction of potential nesting habitat or indirectly through increases in disturbance associated with motorized recreation such as all-terrain vehicles and motorboats. Populations of fish, one of the primary types of prey species for eagle, may decrease on lakes with increased fishing pressure. Increasing fish populations through MDNR stocking would mitigate fish declines in some lakes (USDA Forest Service 2004b).

Relatively high deer populations across the landscape also are likely to pose potential adverse indirect cumulative effect on eagle. High deer populations are a result of factors (warm winters that increase survival, MDNR population management through hunting permits) that are outside the control of the Forest Service, and are the result of factors over which Forest Service has control (forest vegetation management for suitable deer habitat). With increasing deer populations and increasing numbers of road-killed deer, and forest management that promotes increasing deer habitat, this could result in greater potential for eagles to be killed or harmed along highways.

The Project could have minor cumulative effects, as there is mature forest habitat on the Mine Site that could be used by bald eagles. Bald eagles, however, were not observed using this habitat during wildlife surveys on the Mine Site. Both PolyMet and the Forest Service could conduct timber and other land management activities on their acquired lands. Cumulative effects from timber and other land management should be negligible if the Forest Service follows guidance in its 2004 Forest Plan (USDA Forest Service 2004a), and PolyMet and/or private landowners follow national bald eagle management guidelines developed by the USDO I USFWS (2007).

Summary

Project activities associated with the Proposed Action and Alternative B should have no adverse direct or indirect effects on individual bald eagles or their habitat. There could be minor cumulative effects to bald eagle habitat, primarily from loss of mature forest habitat due to mining, but it is unlikely that these trees would be used by eagles in the near future. There would also be a cumulative loss of bald eagle habitat elsewhere in the CESA due to timber management, lakeside and other development, and other land use activities. Timber management and road construction could occur on the federal and non-federal lands in the reasonably foreseeable future, but only a small acreage of federal and non-federal lands would be affected.

Determination

The Proposed Action and Alternative B **may impact individuals but are not likely to cause a trend to federal listing or loss of viability** for bald eagle. The No Action Alternative would have **no impact** to individuals of bald eagle.

Mitigation and Recommendations

No mitigation measures are recommended for the bald eagle.

5.2.6.2 Northern Goshawk (*Accipiter gentilis*)

Environmental Baseline

Northern goshawk is a large forest raptor that is found on boreal and temperate forests throughout the holarctic. Squires and Reynolds (1997) state that *Accipiter gentilis atricapillus*, the subspecies occurring in Minnesota, is widely distributed across the northern half of eastern North America and in many parts of western North America. Northern goshawks are generally uncommon throughout their range. Population productivity and nesting densities coincide with populations of snowshoe hare and grouse. Populations in the Great Lakes Region may have declined in the past due to early logging and settlement and extermination of passenger pigeons, a prey species for northern goshawk. In Wisconsin, the reintroduced fisher is blamed for increased nest failure and adult female mortality. Northern goshawk populations may be increasing with the recovery and maturing of forests in recent times in some parts of the U.S.

Northern goshawk is a forest dwelling raptor whose habitat preferences are mature deciduous or mixed coniferous/deciduous forest in fairly contiguous blocks intermixed with younger forests and openings for prey species habitat. Goshawks are adapted to flying beneath the forest canopy and use primarily mature forest with sufficient open space between the bottom live tree branches and understory for the birds to fly easily. Some understory (e.g., forbs) and downed logs are needed for prey species habitat. Adults and fledglings use large downed logs as feeding and plucking perches. Goshawks may use forest edge if large-bodied prey is more common there.

Boal et al. (2001 in USDA Forest Service 2010b) studied habitat use by nesting goshawks in northern Minnesota. Eighty-one percent of 46 nests were built in aspen trees, 11% in paper birch trees, 4% in white pine trees, and 2% each in red oak and red pine trees. On the Laurentian District, red pine plantations were the most common nest stands (four nests), followed by trembling aspen-black spruce-balsam fir (two nests), trembling aspen (one nest), jack pine (one nest), paper birch (one nest), and maple (one nest).

While goshawks do not always use the same nest for more than a year, they typically have two and up to nine alternate nest sites that are usually within a mile of the present nest. It is important to also protect these alternate nest sites that may be used in subsequent years.

Boal et al. (2001 in USDA Forest Service 2010b) found that foraging stands, regardless of stand type, were consistent in having high stand densities of tall, large canopy trees, with horizontal open spaces of 3 to 12 feet between the bottom of the overstory and top of the understory trees, and up to 3 feet between the bottom of the understory canopy and top of the shrub layer. They suggested that these relatively unobstructed spaces between vegetation layers may serve as important flight paths through forest stands, and the heights in which they occurred was consistent among stand types.

Calling surveys were conducted for northern goshawks on the federal lands (ENSR 2000, 2005, AECOM 2009, 2011a) and on Hay Lake Lands and McFarland Lake Lands (AECOM 2010b). One nest was found within the federal lands within the Mine Site in March 2000 (One Hundred Mile Swamp Territory; Ryan 2013a). The northern goshawk pair observed on the Mine Site used a large, 14 inches dbh trembling aspen tree as a nest, and

the midstory was mostly open in the vicinity of the nest. The surrounding forest stand was a mixture of deciduous and coniferous trees, and was near a recent clear-cut stand and a shrub swamp wetland. No goshawks were detected at the site during a 2004 survey (ENSR 2005). The territory was actively used by northern goshawks in 2005, but they did not nest. In 2006, the site was occupied by a great gray owl and there was a possible nest attempt by great gray owls in 2010 (Ryan 2013b).

In April 2009, a goshawk nest with a pair of goshawks at the nest was found near the boundary of the Mine Site (Wetlegs Creek Territory; AECOM 2009, Ryan 2013b). The occupied nest was located in the fork of a 12 inches dbh trembling aspen tree. The nest site area was characterized as a mixed coniferous/deciduous forest habitat, with numerous mature trembling aspen trees found in the forest stand. The nest site was in close proximity to a large bog wetland. In 2010, a barred owl used the nest at this location. In 2011, the nest was again used by northern goshawks. The nest was not occupied by goshawks during 2012, but in 2013 was again used by northern goshawks, although the nest attempt failed. A second nest was also found near the boundary of the Mine Site in 2009, but the nest was unoccupied and may have been an alternate goshawk nest or nest of another raptor or common raven.

A northern goshawk territory (Pike Mountain 2 Territory) is found near the southwestern boundary of Hay Lake Lands, and are probably used by the same pair (Ryan 2013b). The pair produced young in 2010, 2011, and 2013. No other northern goshawk nests have been found on or within a mile of the other non-federal lands, although northern goshawks have been seen within 3 miles of Lake County Lands South.

Direct and Indirect Effects

Proposed Action

There could be direct and indirect effects to northern goshawk from the Project. Two northern goshawk territories have been found on the federal lands, and northern goshawks nested on the federal lands in 2000, 2009, 2011, and 2013. Under the Proposed Action, the northern goshawk nest tree within the One Hundred Mile Swamp Territory on the Mine Site would no longer be available to northern goshawks, although the tree has not been used by northern goshawks since at least 2005.

Project noise would potentially have an impact on northern goshawk utilization of habitat in the vicinity of the Mine Site. Existing ambient steady equivalent noise levels for most of the Mine Site are in the range of 35 to 45 decibels (dBA), which is a range comparable to secluded woods or a quiet bedroom (MPCA 1999). The Peter Mitchell Mine, north of the Mine Site, and traffic along Dunka Road and the existing railway, along the south edge of the Mine Site, also contribute brief, episodic noise impacts.

The primary sources of Project noise from the Mine Site would be blasting, haul trucks, and train horns, with noise levels ranging from 89-115 dBA. Equipment such as graders, bull dozers, and support trucks would be less dominant sources of noise, ranging from 75-95 dBA (EPA 1971). Blasting at the Mine Site is expected to occur once every two to three days. Typically, rock blasting generates a single event noise level ranging from 111- 115 dBA at 50 feet from the blasting site (Table 5.5-7 of Madera County 2005). Within most of the Mine Site, the sound from the blast would be similar to a loud clap of thunder.

Noise and other disturbances on the Mine Site and Dunka Road and Utility Corridor could disturb northern goshawks nesting just off the Mine Site and on federal lands (Wetlegs Creek Territory), and possible cause them to abandon the territory. The Wetlegs Creek Territory nest site is about 0.75 miles from the Mine Site and

Dunka Road, and is buffered by forestland, which should help to minimize disturbance to the pair. Both territories are about 0.75 miles from the Northshore Mine property, where there is active mining, suggesting that northern goshawks nesting on the federal lands have habituated to disturbance from that mining operation.

Northern goshawks favor mature upland forest habitat (MIH 1). There are 557 acres of mature upland forest habitat within the federal lands that could provide habitat for the northern goshawks (**Table 6**). In addition, there are about 773 acres of young and immature upland forest habitat that could be used by northern goshawks in the future. The Project would affect about 158 acres of mature upland forest habitat, including mature trembling aspen habitat used by northern goshawks. In addition, about 375 acres of young and immature upland forest habitat would be lost to mining.

There are 591 acres of mature and 2,104 acres of young and immature upland forest habitat on the non-federal lands (**Table 6**). The non-federal lands would not be directly affected by the Project, but should benefit from Forest Service management that favors longer harvest rotations than typically occurs on private forestlands. Under the Proposed Action, the Forest Service would survey for northern goshawks and associated habitat prior to conducting land-disturbing activities; areas of known or potential habitat would be avoided when feasible.

Alternative B

Potential direct and indirect effects to northern goshawk from the Project under Alternative B would be similar to those under the Proposed Action. Under Alternative B, there are about 326 acres of mature and 628 acres of young and immature upland forest habitat on the federal lands (**Table 6**). About 230 fewer acres of mature and 145 acres of young and immature upland forest habitat on the federal lands would be transferred to PolyMet from the Forest Service under Alternative B than under the Proposed Action. Habitat loss to mining activities under Alternative B would be the same as under the Proposed Action.

The Forest Service would acquire Hay Lake Lands under Alternative B. There is a northern goshawk territory on Hay Lake Lands (Ryan 2013a). There are about 460 acres of mature and 1,906 acres of young and immature upland forest on Hay Lake Lands that could provide habitat for northern goshawk (**Table 6**). About 78% of mature, and 91% of young and immature, upland forest habitat that occurs on the non-federal lands is found on Hay Lake Lands. Thus, the Forest Service would receive most of the land that could provide habitat for northern goshawk on the non-federal lands under both the Proposed Action and Alternative B.

No Action Alternative

There would be no direct or indirect effects to northern goshawk under the No Action Alternative.

Cumulative Effects

Destruction or modification of habitat, habitat fragmentation, changes in vegetative structure and composition, and effects of activities associated with habitat modification are considered the primary threats to breeding northern goshawks (USDA Forest Service 2010b). Niemi and Hanowski (1992 in Jaakko Poyry Consulting, Inc. 1994)) suggested that northern goshawk prefer larger tracts of forest for foraging and are affected by fragmentation of forested areas. The species seldom uses recently cut areas for foraging, presumably because prey is hard to detect and capture in the dense understory. Another threat to northern goshawk is creation of landscape patterns (e.g., large openings from clear-cutting or increased edge habitat) that favor predators such as

red-tailed hawk, great-horned owl, fisher, or raccoon. In one study, stands larger than 50 acres were used more consistently by northern goshawk rather than stands smaller than 25 acres (Estabrook 2000).

State, county, and private forest management will likely reduce the present level of large blocks of mature upland forest found in the CESA. A 2008 Geographic Information System analysis shows a slight increase in mature upland forest on the Superior National Forest in recent decades, but the amount of mature/old upland forest is expected to decrease over the next several decades (USDA Forest Service 2010b). Fragmentation of larger blocks of habitat would make northern goshawks more vulnerable to predators and affect species distribution. Boal et al. (2001 *cited in* USDA Forest Service 2010b) documented up to 30% nest predation in northern Minnesota. Wide ranging pairs of northern goshawks may not successfully breed if they are forced to expand their home ranges to compensate for further loss of high quality foraging habitat.

There would be cumulative effects to northern goshawk habitat from the Project. About 158 acres of mature upland forest habitat that could be used by northern goshawk on the federal lands would be directly affected by the Project, including mature and other upland forest associated with the One Hundred Mile Swamp Territory, which was last used by northern goshawks in 2005 (**Table 6**). However, there are about 625,000 acres of upland forest within the CESA that could now, or in the reasonably foreseeable future, provide habitat for northern goshawk (Emmons and Olivier, Inc. 2006:30, 38). Thus, habitat loss from the Project would have a negligible cumulative effect on northern goshawks in the CESA.

Summary

Project activities associated with the Proposed Action and Alternative B would have no direct effects, but could have adverse indirect and cumulative effects to individual northern goshawks and their habitat. In particular, mining activities could disturb northern goshawks nesting on the Wetlegs Creek Territory, and remove habitat and prey and cause disturbance in areas where these birds may forage. Upland forest habitat used by northern goshawks is abundant in the CESA, and northern goshawks, although uncommon in the region, seem to have increased in numbers over the past several decades.

Timber management and road construction could occur on the federal and non-federal lands in the reasonably foreseeable future, but only a small acreage of federal and non-federal lands would be affected. It is more likely that production of mature upland forest habitat on the non-federal lands would occur if these lands are federally administered rather than under private ownership.

Determination

The Proposed Action and Alternative B **may impact individuals but are not likely to cause a trend to federal listing or loss of viability** for northern goshawk. The No Action Alternative would have **no impact** to individuals of northern goshawk.

Mitigation and Recommendations

No mitigation measures are recommended for the northern goshawk.

5.2.6.3 Boreal Owl (*Aegolius funereus*)

Environmental Baseline

Hayward (1994) states that boreal owls occupy boreal forests throughout the northern hemisphere. East of the Rocky Mountains, breeding by boreal owls has only been confirmed in Minnesota and primarily in northeastern Minnesota. Nesting boreal owls are uncommon west of Highway 53 or the Vermillion River, or within 8 miles of Lake Superior. The prime area for boreal owls appears to be the eastern portion of the Forest Service Laurentian Ranger District, southern portion of the Kawishiwi Ranger District, and the middle portion of the Tofte Ranger District.

Boreal owls are rarely seen in Minnesota. The first one reported nesting in Minnesota was in 1978. Boreal owls have been documented as breeding in the Superior National Forest (USDA Forest Service 1999, Green 2003, Catton 2007), including a failed boreal owl nest in 2013 that was about 8 miles east/southeast of Wolf Lands 2 and 3 in Township 58 North, Range 9 West, Lake County, Minnesota (Ryan 2013c).

While attempts have been made to monitor boreal owl populations, present survey techniques are not sufficiently precise to detect population trends for northern Minnesota. Boreal owl populations fluctuate with winter snow depth and prey availability, and winter population irruptions occur periodically. There appears to be an influx of boreal owls into northern Minnesota every 4 years, perhaps due to a decline in their prey (vole) populations further north in Canada. The latest influx was in winter 2013, with several boreal owls sighted near Duluth. The population on the Superior National Forest is part of a larger Canadian population and may not be viable by itself at present.

Boreal owls prefer forests dominated by black spruce, white spruce, balsam fir, balsam poplar, trembling aspen, and paper birch. They favor mature forest during winter because snow conditions (un-crusted snow) facilitate access to prey. In summer, mature forest sites have less herbaceous cover than open sites, allowing greater access to prey. Following spring thaw, before herbaceous vegetation becomes dense, owls shift to openings where densities of voles exceed densities in forested stands.

Nesting habitat is mixed coniferous/deciduous upland forest usually older than 70 years. Nest trees are typically trembling aspen and paper birch with an average 16 to 18 inches dbh. Cavities excavated by pileated woodpeckers are often used for nesting by the boreal owl. Within 8 acres centered on each nest site, another important habitat component is six or more dominant or co-dominant conifers that are used as calling perches. Nest sites are usually within 200 yards of large areas of productive mature lowland conifers, primarily black spruce, which are preferred for foraging and roosting. Nests that are further than 200 yards from lowland conifer forest typically have a mature forest corridor to that lowland coniferous forest. Populations are limited by availability of cavities for nesting and food supply. Limiting factors may be the right combination of nesting and foraging/roosting habitat, and possibly the distribution of these habitats and cavity trees. Fragmentation has been a primary factor causing the isolation of lowland coniferous forests. Other limiting factors include automobile collisions and low prey density.

Night calling surveys for boreal owls were conducted on the federal lands during winter and early spring 2000, summer 2004, summer 2008, and spring 2009 by broadcasting pre-recorded boreal owl calls; no boreal owls were heard during the surveys (ENSR 2000, 2005, AECOM 2009, 2011a). A boreal owl was heard along the Dunka Road during surveys in 1988 to 1989 (ENSR 2000). Surveys were also conducted on the non-federal

lands, but no boreal owls were heard (AECOM 2011b, c), although a boreal owl nest was found by the Forest Service in 2013 about 8 miles east/southeast of Wolf Lands 2 and 3 (Ryan 2013c).

Direct and Indirect Effects

Proposed Action

There should be no direct effects to boreal owls on the federal lands from the Project as no boreal owls are known to use the federal lands. Boreal owls could use the federal lands, however, and mining activities could disturb boreal owls on or near the Mine Site and Dunka Road and Utility Corridor and indirectly affect their habitat use.

The Project would cause the loss of potential boreal owl foraging habitat (lowland black spruce and mixed swamp coniferous stands greater than 50 years old) and nesting habitat (upland deciduous forest habitat greater than 70 years old; USDA Forest Service 2010b). There are about 3,040 acres of mature lowland coniferous forest (MIH 9) and about 557 acres of mature upland forest habitat (MIH 1) on the federal lands that could provide habitat for boreal owls (**Table 6**). In addition, there are about 773 acres of young and immature upland forest habitat that could be used by boreal owls in the future. The Project would affect about 482 acres of mature lowland coniferous forest, 158 acres of mature upland forest, and 375 acres of young and immature upland forest habitat (**Table 6**). No young or immature lowland coniferous forest habitat would be affected by the Project.

Boreal owls have not been recorded on the non-federal lands in recent years, but a boreal owl nest was found by the Forest Service in 2013 about 8 miles east/southeast of Wolf Lands 2 and 3 (Ryan 2013c). There are about 1,208 acres of mature and 2,101 acres of young and immature lowland coniferous forest habitat, and about 591 acres of mature and 2,104 acres of young and immature upland forest habitat, on the non-federal lands (**Table 6**). Thus, there could be suitable boreal owl foraging habitat (mature lowland coniferous forest) and nesting habitat (mature upland forest) on the non-federal lands. These lands would not be directly affected by the Project. This habitat could be maintained through the retention of mature patches greater than 300 acres, limited black spruce harvest, riparian management, and by leaving large trembling aspen/paper birch as reserve trees and positioning reserve areas along the wetland/upland interface. Under the Proposed Action, the Forest Service would survey for boreal owls and associated habitat prior to conducting land-disturbing activities and areas of known or potential habitat would be avoided when feasible. The Forest Service would also monitor boreal owl use of these lands and seek to protect larger patches of high quality habitat for boreal owls.

Alternative B

Effects to boreal owl under Alternative B should be similar to those under the Proposed Action. Under Alternative B, there are about 2,063 acres of mature and 16 acres of young and immature lowland coniferous forest habitat and 326 acres of mature and 628 acres of young and immature upland forest on the federal lands (**Table 6**). About 977 fewer acres of mature lowland coniferous forest and 231 fewer acres of mature upland forest would be transferred to PolyMet from the Forest Service than under the Proposed Action. Habitat loss to mining activities would be the same under Alternative B as under the Proposed Action.

The Forest Service would acquire Hay Lake Lands under Alternative B. No boreal owls have been observed in recent years on these lands. There are 0 acres of mature and 1,818 acres of young and immature lowland coniferous forest habitat, and 460 acres of mature and 1,906 acres of young and immature upland deciduous

ANALYSIS AND DETERMINATION OF EFFECTS

forest habitat on Hay Lake Lands. About 87% of the lowland coniferous forest habitat and 78% of the mature upland forest habitat that occurs on the non-federal lands are found on Hay Lake Lands.

No Action Alternative

There would be no direct or indirect effects to boreal owl under the No Action Alternative.

Cumulative Effects

The Final Generic Environmental Impact Statement Study on Timber Harvesting and Forest Management in Minnesota (Jaakko Poyry Consulting Inc. 1994) projected a decrease in the Minnesota boreal owl population if statewide timber harvest increased over 1 million cords overall or about 25% higher than at present. On federal lands, there is anticipated to be a reduction in mature upland patches (less than 300 acres) and a reduction in interior forest, but also an increase in mature lowland patches greater than 300 acres. Harvest by other landowners has the potential to further reduce boreal owl nesting, and to a lesser extent, foraging habitat.

The 2008 Superior National Forest-wide monitoring showed a slight increase in mature upland deciduous and coniferous habitat, and a slight decrease in mature lowland coniferous forest for the Superior National Forest (USDA Forest Service 2010b). Monitoring also showed a slight increase in mature upland forest on the Superior National Forest in recent decades, but the amount of mature upland forest is expected to decrease over the next several decades. State, county, and private forest management will probably reduce the present level of large blocks of mature upland forest found on the CESA.

There should be no cumulative effects to individual boreal owls from the Project, but there would be a cumulative loss of potential boreal owl habitat. About 640 acres of mature lowland coniferous forest and upland deciduous forest habitat that could be used by this species on the federal lands would be directly affected by the Project. However, there are about 820,000 acres of upland deciduous and lowland coniferous forest within the CESA that could now, or in the reasonably foreseeable future, provide habitat for boreal owls (Emmons and Olivier, Inc. 2006; 30, 38). Thus, habitat loss from the Project would have a negligible cumulative effect on boreal owls in the CESA.

Summary

Project activities associated with the Proposed Action and Alternative B should have no adverse direct or cumulative effects on individual boreal owls, but could have direct, indirect, or cumulative effects on their habitat. Mining activities could disturb boreal owls on or near the Mine Site and Dunka Road and Utility Corridor and indirectly affect their habitat use. Timber management and road construction could occur on lands within the CESA in the reasonably foreseeable future, but only a small acreage of federal and non-federal lands would be affected. It is more likely that production of mature lowland and upland forest habitat on the non-federal lands would occur if these lands are federally administered rather than under private ownership.

Determination

The Proposed Action and Alternative B **may impact individuals but are not likely to cause a trend to federal listing or loss of viability** for boreal owl. The No Action Alternative would have **no impact** to individuals of boreal owl.

Mitigation and Recommendations

No mitigation measures are recommended for boreal owl.

5.2.6.4 Great Gray Owl (*Strix nebulosa*)

Environmental Baseline

The great gray owl has a holarctic distribution and breeds in the western U.S. and in the northern Great Lakes Region. Great gray owls forage anywhere meadow voles are abundant and available. Meadow vole abundance is influenced by season (more numerous in late summer and fall), a 3- to 5-year cycle in Minnesota, and habitat capacity. The great gray owl prefers moist soils and relatively open areas with high primary production of prey. Nesting commonly occurs in mature trembling aspen adjacent to muskegs. Minimum nest stand size was 10 acres in Manitoba and 27 acres in Alberta. Foraging occurs in open habitat, including bogs, selective and clear-cut logged areas with residual perches, natural meadows, and open forests within 1.5 miles of the nest. Perches need not be tall and can be high stumps, broken-off trees, and the short black spruce found in peatland bogs. Meadow voles that are 50 feet or more from a perch or forest edge are usually not available to great gray owls. Great gray owls avoid jack pine, taller black spruce, dense forest cover, large open treeless areas without perches, and habitats with a dense shrub layer. They also avoid concentrations of predators such as great horned owls. Average home range size for breeding adults was 1.7 square miles (mi²) in Oregon. A Minnesota study found eight nests in 20 mi².

Kozie (1999) recommended the following forestry practices to maintain or enhance great gray owl habitat: 1) restriction of harvest unit size to less than 25 acres with a mosaic of multi-sized units, 2) retention of forest stands within 900 feet of known or potential nest trees or sites, 3) provision of hunting perches in clearcuts, 4) ensuring irregularly shaped harvest units with a maximum distance across the cut of less than 300 feet, and 5) maintenance of forested travel corridors, 150 to 300 feet wide, between cut areas. In the Pacific Northwest, the Forest Service recommended providing a no-harvest buffer of about 300 feet around meadows and natural openings and establishment of a 1,320-foot protection zone (125 acres) around nest trees. Kozie (1999) also recommended placing priority on maintaining nesting habitat within 0.5 to 1.5 miles of natural openings rather than clear-cuts.

Night calling surveys did not identify great gray owls on the federal lands (ENSR 2000, 2005, AECOM 2009, 2011a). During 2009 surveys, however, a great gray owl was observed hunting along Dunka Road south of the Mine Site. Based on Forest Service observations, a great gray owl pair was seen using a nest site on the Mine Site in 2006, and possibly in 2010. The nesting effort(s) were unsuccessful. This was the same nest site used by northern goshawks in 2000 (ENSR 2000; Ryan 2013b). In 2011, a great gray owl was seen using a nest site on the federal lands surrounding the Mine Site and near a nest used by northern goshawks (Wetlegs Creek Territory).

Calling surveys did not identify great gray owls on the non-federal lands (AECOM 2011b, c). Great gray owls were surveyed on the Tracks Project area in 2007 and 2008 using both call playback and listening stops. Five survey routes were run and consisted of 50 survey points along roads. These routes were run two to four times in the spring both years. No great gray owls were detected within the Tracks Project area.

Direct and Indirect Effects

Proposed Action

Great gray owls were seen nesting on the Mine Site in 2006, and foraging along the Dunka Road in 2009. If the Mine Site is part of the territory of a great gray owl, mining activities could directly affect great gray owls by disrupting their use of this area, and indirectly affect owls through removal of a tree that has provided a nest site for great gray owls in the past, removal of foraging habitat and prey, and from Mine Site and Dunka Road and Utility Corridor disturbances. Great gray owls have been seen perching near the Plant Site entrance on light poles, and foraging and perching on trees within 100 feet of the Dunka Road. Thus, great gray owls seem tolerant of some human disturbance (AECOM 2009).

Project noise would potentially have an impact on eagle utilization of habitat in the vicinity of the Mine Site. Existing ambient steady equivalent noise levels for most of the Mine Site are in the range of 35 to 45 decibels (dBA), which is a range comparable to secluded woods or a quiet bedroom (MPCA 1999). The Peter Mitchell Mine, north of the Mine Site, and traffic along Dunka Road and the existing railway, along the south edge of the Mine Site, also contribute brief, episodic noise impacts.

The primary sources of Project noise from the Mine Site would be blasting, haul trucks, and train horns, with noise levels ranging from 89-115 dBA. Equipment such as graders, bull dozers, and support trucks would be less dominant sources of noise, ranging from 75-95 dBA (EPA 1971). Blasting at the Mine Site is expected to occur once every two to three days. Typically, rock blasting generates a single event noise level ranging from 111- 115 dBA at 50 feet from the blasting site (Table 5.5-7 of Madera County 2005). Within most of the Mine Site, the sound from the blast would be similar to a loud clap of thunder.

The impacts of noise on great gray owl utilization of habitat near the Mine Site are largely unknown and the assessment of impacts remains subjective, although as noted above, great gray owls appear to be tolerant of human disturbance. Impacts may also vary between individual owls. Some may adapt to predictable human activities, so if the activity generally occurs at predictable time periods at the same places or along the same routes, individual great gray owls may become habituated to the activity (ENSR/AECOM 2006).

Mature upland forest (MIH 1) is indicative of nesting habitat, while foraging habitat consists of young upland forest and lowland coniferous forest (MIH 9). Non-forest (upland and lowland) also provides foraging habitat. There are about 233 acres of young and 557 acres of mature upland forest habitat, 3,060 acres of lowland coniferous habitat, and 492 acres of lowland shrubland (MIH – other lowland shrub) on the federal lands that could provide habitat for great gray owls (**Table 6**). The Project would affect about 144 acres of young and 158 acres of mature upland forest habitat. In addition, about 482 acres of lowland coniferous forest habitat and 141 acres of shrubland would be lost to mining (**Table 6**).

There are about 607 acres of young and 591 acres of mature upland forest habitat, 3,309 acres of lowland coniferous forest habitat, and 332 acres of lowland shrubland habitat on the non-federal lands (**Table 6**).

There is abundant great gray owl foraging habitat and nesting habitat on the non-federal lands. These lands would not be directly affected by the Project. This habitat would be maintained through the retention of mature patches greater than 300 acres, limited black spruce harvest, riparian management, and in harvest units by leaving large trembling aspen/paper birch as reserve trees and positioning reserve areas along the wetland/upland interface. Under the Proposed Action, the Forest Service would survey for great gray owls and

associated habitat prior to conducting land-disturbing activities and areas of known or potential habitat would be avoided when feasible.

Alternative B

Potential direct and indirect effects to great gray owl from the Project would be similar to those under the Proposed Action. Under Alternative B, there are about 233 acres of young and 326 acres of mature upland forest, 2,079 acres of lowland coniferous forest, and 385 acres of lowland shrubland on the federal lands (**Table 6**). About 230 fewer acres of upland forest, 982 fewer acres of lowland coniferous forest, and 107 fewer acres of lowland shrubland would be transferred to PolyMet from the Forest Service under Alternative B than under the Proposed Action. This area would provide habitat for great gray owls, although noise and other disturbance associated with mining may discourage use of the area by great gray owls.

The Forest Service would acquire Hay Lake Lands under Alternative B. No great gray owls have been reported on these lands. There are about 519 acres of young and 460 acres of mature upland forest, 1,818 acres of lowland coniferous forest, and 113 acres of lowland shrubland habitat on Hay Lake Lands (**Table 6**). About 85% of young and 78% of mature upland forest, 55% of lowland coniferous forest habitat, and 34% of lowland shrubland habitat that occurs on the non-federal lands are found on Hay Lake Lands. A portion of Hay Lake Lands could be administered as a Candidate Research Natural Area, to the potential benefit of great gray owls. As noted in Section 5.2.6.2, a northern goshawk territory is found in the southwestern portion of Hay Lake Lands. Great gray owls show a propensity to use northern goshawk nests, and could use the nest sites on Hay Lake Lands in the future.

No Action Alternative

There would be no direct or indirect effects to great gray owl under the No Action Alternative.

Cumulative Effects

As discussed for boreal owls, reasonably foreseeable future land and timber management activities in the CESA could result in a loss of some habitat for owls in Minnesota. Logging in nesting habitat could affect the great gray owl under the Proposed Action, Alternative B, and No Action Alternative by removing suitable nesting structure. Despite the fact that timber harvest can remove nesting habitat, harvest can create more temporary foraging habitat in some coniferous forest types. Maintaining large mature patches of upland forest would help to ensure suitable interior nesting habitat would be available across the landscape. Implementation of Minnesota Forest Resources Council's (1999) Voluntary Site-Level Forest Management Guidelines would help to ensure that snags, reserve trees, and downed wood are provided in all harvested stands.

Roads and recreation projects should have a minimal effect on great gray owls. Owls readily forage along roadsides. Many of the proposed roads use existing road corridors which are not owl nesting habitat. Wetlands would be avoided whenever possible. Prescribed burning should not have an effect on great gray owls unless there was a nest present in the stand.

About 925 acres of young and mature upland forest, lowland coniferous forest, and shrubland that could be used as nesting and foraging habitat for this species on the federal lands would be directly affected by the Project (**Table 6**). However, there are about 980,000 acres of upland forest, and lowland coniferous forest and shrubland, within the CESA that could now, or in the reasonably foreseeable future, provide habitat for great

gray owls (Emmons and Olivier, Inc. 2006:30, 38). Thus, habitat loss from the Project would have a negligible cumulative effect on great gray owls in the CESA.

Summary

Project activities associated with the Proposed Action and Alternative B should have no adverse direct, indirect, or cumulative effects on individual great gray owls, but could have direct, indirect, or cumulative effects on their habitat. Timber management and road construction could occur on the lands within the CESA in the reasonably foreseeable future, but only a small acreage of federal and non-federal lands would be affected. It is more likely that production of mature lowland and upland forest habitat on the non-federal lands would occur if these lands are federally administered rather than under private ownership.

Determination

The Proposed Action and Alternative B **may impact individuals but are not likely to cause a trend to federal listing or loss of viability** for great gray owl. The No Action Alternative would have **no impact** to individuals of great gray owl.

Mitigation and Recommendations

No mitigation measures are recommended for great gray owl.

5.2.6.5 Three-toed Woodpecker (*Picoides tridactylus*)

Environmental Baseline

Three-toed woodpecker is a species of boreal and montane coniferous forests and is primarily a resident species throughout its range (Burdett 2002 and references cited therein). It usually inhabits mature or old-growth lowland coniferous stands with abundant insect-infected dead and dying trees. Even in predominately living forests, three-toed woodpeckers forage mainly on dead and dying timber. Three-toed woodpeckers breed throughout lowland coniferous forests in Canada and the western U.S., and in northern Minnesota and Wisconsin. Population trends are unknown. In the Superior National Forest, they seem to nest mainly in black spruce and balsam fir snags and mature trees. This dependence on insect-infected dead and dying timber frequently results in populations showing an association with forest disturbances such as fire, wind-throw, floods, insect outbreaks, and disease. In particular, three-toed woodpecker populations often show an increased abundance in early post-fire successional areas (Burdett 2002). Black spruce and tamarack stands are the vegetation community most likely to contain three-toed woodpeckers in Minnesota.

Habitat for the three-toed woodpecker is conifers killed by fire, beetles, partial wind-throw, or flooding. The bird keys in on beetles that feed on dead trees 1 to 5 years after trees are killed. A limiting factor for the three-toed woodpecker is foraging habitat where sufficient insects can be found to feed its young during the breeding season. This species can be nomadic and shift over large portions of the landscape depending on habitat conditions. Promotion of conifers and retaining residual trees (preferably long-lived, wind-firm conifers) in large openings may maintain or enhance habitat conditions for three-toed woodpeckers. Studies have also found that they are more likely to occur in larger areas of virgin forest versus smaller patches, suggesting forest fragmentation may adversely affect the three-toed woodpecker population.

ENSR (2000, 2005) and AECOM (2011a) conducted visual and calling surveys for woodpeckers on the federal lands. One three-toed woodpecker was observed foraging on black spruce snags during winter field surveys on the Mine Site in 2000 (ENSR 2000). A three-toed woodpecker was also seen on the Mine Site by Forest Service personnel in 2007. AECOM (2011b, c) conducted calling and visual surveys for three-toed woodpeckers on the non-federal lands, but no three-toed woodpeckers were seen or heard.

The Natural Resources Research Institute's (NRRI) Breeding Bird Monitoring effort surveys 169 forest stands on the Superior National Forest. The Institute did not detect three-toed woodpeckers on the Superior National Forest; however, timing and location of survey routes are such that this species is not adequately surveyed (USDA Forest Service 2010b). No three-toed woodpeckers were observed on the Tracks Project area.

Direct and Indirect Effects

Proposed Action

A three-toed woodpecker was identified on the federal lands during surveys in 2000 and was observed on the lands again in 2007. Though not surveyed, the Transportation and Utility Corridors and Plant Site lack the old-growth forest or recent burn habitat preferred by the three-toed woodpecker. This species is sensitive to disturbance and would not be expected to use the Mine Site, Transportation and Utility Corridors, or the Plant Site, although observations of three-toed woodpecker in 2000 were made within one-half mile of an active exploration drill rig (ENSR 2005).

Project noise would potentially have an impact on eagle utilization of habitat in the vicinity of the Mine Site. Existing ambient steady equivalent noise levels for most of the Mine Site are in the range of 35 to 45 decibels (dBA), which is a range comparable to secluded woods or a quiet bedroom (MPCA 1999). The Peter Mitchell Mine, north of the Mine Site, and traffic along Dunka Road and the existing railway, along the south edge of the Mine Site, also contribute brief, episodic noise impacts.

The primary sources of Project noise from the Mine Site would be blasting, haul trucks, and train horns, with noise levels ranging from 89-115 dBA. Equipment such as graders, bull dozers, and support trucks would be less dominant sources of noise, ranging from 75-95 dBA (EPA 1971). Blasting at the Mine Site is expected to occur once every two to three days. Typically, rock blasting generates a single event noise level ranging from 111- 115 dBA at 50 feet from the blasting site (Table 5.5-7 of Madera County 2005). Within most of the Mine Site, the sound from the blast would be similar to a loud clap of thunder.

The impacts of noise on three-toed woodpecker utilization of habitat near the Mine Site are largely unknown and the assessment of impacts remains subjective, although as noted above, three-toed woodpeckers appear to be sensitive to human disturbance. Impacts may also vary between individual three-toed woodpeckers.

Three-toed woodpeckers favor lowland black spruce forest and areas with snags. There are about 3,040 acres of mature lowland coniferous habitat (MIH 9) on the federal lands that could provide habitat for three-toed woodpeckers (**Table 6**). AECOM (2005) found about 80 acres associated with the Partridge River that had been flooded, killing spruce trees and creating snag habitat. The Project would affect about 482 acres of mature lowland coniferous habitat. This includes pockets of snag habitat within wetlands.

There are about 1,208 acres of mature lowland coniferous forest habitat on the non-federal lands (**Table 6**). AECOM found about 45 acres of black spruce snags associated with forests that had been flooded by beavers,

which kills trees (AECOM 2011b, c). These lands would not be directly affected by the Project. Under the Proposed Action, the Forest Service would survey for three-toed woodpeckers and associated habitat prior to conducting land-disturbing activities and areas of known or potential habitat would be avoided when feasible.

Alternative B

Potential direct and indirect effects to three-toed woodpeckers from the Project would be similar to those under the Proposed Action. Under Alternative B, there are about 2,063 acres of mature lowland forest on the federal lands (**Table 6**). About 977 fewer acres of mature lowland coniferous forest would be transferred to PolyMet from the Forest Service under Alternative B than under the Proposed Action. This area could provide habitat for three-toed woodpeckers, although noise and other disturbance associated with mining could discourage use of the area by three-toed woodpeckers.

The Forest Service would acquire Hay Lake Lands under Alternative B. No three-toed woodpeckers were seen on these lands during wildlife surveys. There are about 1,818 acres of lowland coniferous forest habitat on Hay Lake Lands, although none of this habitat contains mature forest (**Table 6**). About 55% of the lowland coniferous forest that occurs on the non-federal lands is found on Hay Lake Lands. There are about 45 acres of black spruce snag habitat on Hay Lake Lands (AECOM 2011b). Thus, there would be limited foraging and nesting habitat for three-toed woodpeckers on Hay Lake Lands.

No Action Alternative

There would be no direct or indirect effects to three-toed woodpecker under the No Action Alternative.

Cumulative Effects

Threats facing the three-toed woodpecker include habitat loss and fragmentation, fire suppression, salvage logging, conifer conversion to aspen, beaver control, and poor snag retention policies. Historically, natural fire regimes in mature conifer and large amounts of old-growth forest would have created abundant foraging habitat for three-toed woodpeckers prior to European settlement. Clearing of the forests and fire suppression after settlement would have started to reduce habitat for this species.

Forest management that removes conifers that have the potential to have high populations of insects, especially wood-boring beetles, is detrimental to the three-toed woodpecker. Practices that increase the amount of mature lowland coniferous forest would benefit this species.

Other ownerships (especially the State of Minnesota) have started converting some trembling aspen stands to coniferous stands, which should help increase habitat. Beaver populations may increase and thereby increase three-toed woodpecker habitat (flood-killed trees). Recent large fires on the Superior National Forest in the past few years have produced good habitat. Prescribed burning may be beneficial to this species if it leads to some mortality of overstory trees.

About 482 acres of mature lowland coniferous forest that could be used by this species on the federal lands would be directly affected by the Project (**Table 6**). However, there are about 356,000 acres of lowland coniferous forest/shrubland within the CESA that could now, or in the reasonably foreseeable future, provide habitat for three-toed woodpeckers (Emmons and Olivier, Inc. 2006:30, 38). Thus, habitat loss from the Project would have a negligible cumulative effect on three-toed woodpeckers in the CESA.

Summary

Project activities associated with the Proposed Action and Alternative B could have adverse direct, indirect, or cumulative effects on three-toed woodpeckers and their habitat. Few three-toed woodpeckers use the federal lands. Timber management and road construction could occur on the lands in the reasonably foreseeable future, but only a small acreage of federal and non-federal lands would be affected. It is more likely that production of mature lowland habitat on the non-federal lands would occur if these lands are federally administered rather than under private ownership.

Determination

The Proposed Action and Alternative B **may impact individuals but are not likely to cause a trend to federal listing or loss of viability** for three-toed woodpecker. The No Action Alternative would have **no impact** to individuals of three-toed woodpecker.

Mitigation and Recommendations

No mitigation measures are recommended for three-toed woodpecker.

5.2.6.6 Olive-sided flycatcher (*Contopus cooperi*)

Environmental Baseline

The olive-sided flycatcher has a large breeding range that includes the wooded areas of Canada, Alaska, and the western and northeastern U.S. While secure in some places, the Breeding Bird Survey data for North America shows the species declined 5% per year between 1986 and 1998 nationally, and more than 1.5% per year in northern Minnesota between 1966 and 1996 (USDA Forest Service 2010b, Sauer et al. 2012).

No olive-sided flycatchers were seen during surveys of the federal and non-federal lands, although surveys were conducted on the Hunting Club, Lake County, and Wolf Lands during late fall after flycatchers had migrated south for the winter (ENSR 2000, 2005, AECOM 2011a, b, c). A few individuals are detected each year on songbird monitoring plots in the Superior National Forest, but numbers are not large enough to estimate population trends. An average of 1.7 and 0.2 olive-sided flycatchers have been recorded on the Jordan and Hart Lake Breeding Bird Survey routes, respectively, each year since 1966. The Jordan route is about 20 miles southeast of the federal lands and the Hart Lake route is about 20 miles south of the federal lands; these routes are the closest survey routes to the federal lands. Two olive-sided flycatchers were recorded during the Tracks Project area Breeding Bird Surveys in 2008.

The NRRI's Breeding Bird Monitoring effort surveys 169 forest stands on the Superior National Forest. Olive-sided flycatchers have been detected in 37 forest stands on the Superior National Forest. However, detections are rare and irregular, with only 1 detection in 20 forest stands during the period between 1991 and 2005. A nesting olive-sided flycatcher was reported on the Gunflint Ranger District in 2005.

Olive-sided flycatchers nest most frequently in larger black spruce-tamarack bogs or in large openings with scattered trees. MacLean (1999) found olive-sided flycatchers using burned or cleared areas with standing trees, primarily conifers. Beaver ponds provide important habitat with flood-killed trees. Timber harvest does not provide habitat if it results in an even-aged stand with little variation in canopy height, or few dead standing

trees. At least 50 acres of habitat may be needed to support a single territorial pair of olive-sided flycatchers. The primary threat to the species, however, appears to be destruction of wintering habitats in the Andes of South America.

Direct and Indirect Effects

Proposed Action

Olive-sided flycatchers favor lowland black spruce/tamarack bogs, but also use upland coniferous forest. There are 3,060 acres of lowland coniferous forest (MIH 9) and 1,252 acres of upland coniferous habitat (MIH 5) on the federal lands that could provide habitat for the olive-sided flycatchers (**Table 6**). The Project would affect about 482 acres of lowland coniferous and 505 acres of upland coniferous habitat. After mining, about 397 acres would be reclaimed to wetland/grassland/shrubland habitat that, over time, would become upland and lowland coniferous and deciduous habitat that could be used by olive-sided flycatchers (MDNR et al. 2013).

There are about 3,309 acres of lowland coniferous forest, but only 80 acres of upland coniferous forest habitat on the non-federal lands (**Table 6**). These lands would not be directly affected by the Project. Under the Proposed Action, the Forest Service would survey for olive-sided flycatchers and associated habitat prior to conducting land-disturbing activities and areas of known or potential habitat would be avoided when feasible.

Alternative B

Potential direct and indirect effects to olive-sided flycatchers from the Project would be similar to those under the Proposed Action. Under Alternative B, there are 2,079 acres of lowland coniferous forest and 1,139 acres of upland coniferous habitat on the federal lands (**Table 6**). About 981 fewer acres of lowland coniferous forest and 113 fewer acres of upland coniferous forest on the federal lands would be transferred to PolyMet under Alternative B. This area could provide habitat for olive-sided flycatchers, although noise and other disturbance associated with mining may discourage use of the area by olive-sided flycatchers.

The Forest Service would acquire Hay Lake Lands under Alternative B. There are about 1,818 acres of lowland coniferous forest and 54 acres of upland coniferous forest habitat on Hay Lake Lands (**Table 6**). About 55% of the lowland coniferous forest and 68% of the upland coniferous forest that occurs on the non-federal lands is found on Hay Lake Lands. No olive-sided flycatchers were seen on these lands during wildlife surveys, although olive-sided flycatchers were seen on the nearby Tracks Project area and Breeding Bird Survey routes.

No Action Alternative

There would be no direct or indirect effects to olive-sided flycatcher under the No Action Alternative.

Cumulative Effects

Threats facing this species are similar to those for species, such as the three-toed woodpecker and boreal owl, that use lowland black spruce/tamarack bog habitat, including habitat loss and fragmentation, fire suppression, salvage logging of fire-killed trees, conifer conversion to aspen, beaver control, and clear-cutting that leaves few residual trees or little variety in canopy structure. Historically, natural fire regimes in mature coniferous forest and large amounts of old-growth forest would have created abundant foraging habitat for olive-sided

flycatchers prior to European settlement. Clearing of the forests and fire suppression after settlement would have started to reduce habitat for this species.

Other ownerships (especially the State) have started converting some trembling aspen stands to coniferous stands, which should help increase habitat. Beaver populations may increase and thereby increase olive-sided flycatchers' habitat (flood-killed trees). Recent large fires on the Superior National Forest in the past few years have produced good habitat. Prescribed burning may be beneficial to this species if it leads to some mortality of overstory trees.

About 482 acres of lowland coniferous forest (MIH 9) and 505 acres of upland coniferous forest habitat (MIH 5) that could be used by this species on the federal lands would be lost due to the Project (**Table 6**). However, there are about 356,000 acres of lowland coniferous forest and about 161,000 acres of upland coniferous forest within the CESA that could now, or in the reasonably foreseeable future, provide habitat for olive-sided flycatchers (Emmons and Olivier, Inc. 2006:30, 38). Thus, habitat loss from the Project would have a negligible cumulative effect on olive-sided flycatchers in the CESA.

Summary

Project activities associated with the Proposed Action and Alternative B should have no adverse direct, indirect, or cumulative effects on individual olive-sided flycatchers, but could have direct, indirect, or cumulative effects on their habitat. Timber management and road construction could occur on the lands in the reasonably foreseeable future, but only a small acreage of federal and non-federal lands would be affected. It is more likely that production of immature and mature lowland habitat, prescribed burnings that leave standing dead trees, and partial cuts, on the non-federal lands could occur if these lands are federally administered rather than under private ownership.

Determination

The Proposed Action and Alternative B **may impact individuals but are not likely to cause a trend to federal listing or loss of viability** for olive-sided flycatcher. The No Action Alternative would have **no impact** to individuals of olive-sided flycatcher.

Mitigation and Recommendations

No mitigation measures are recommended for olive-sided flycatcher.

5.2.6.7 Bay-breasted Warbler (*Dendroica castanea*)

Environmental Baseline

Bay-breasted warbler is a neotropical migrant that breeds throughout the black spruce-balsam fir forest of Canada and the northernmost parts of the U.S., following the range of spruce budworm (*Choristoneura fumiferana*). The Project area is at the very edge of its range in Minnesota, although vegetation data from the time of European settlement shows that most of the area was black spruce/balsam fir forest. Bay-breasted warbler populations are closely tied to outbreaks and declines in spruce budworm (Mayasich and Niemie 2002 and references cited therein), and have been decreasing range-wide (4.5% per year in North America between 1986 and 1998). An average of 0.2 bay-breasted warblers have been recorded on the Hart Lake Breeding Bird

Survey route each year since 1966, but none have been recorded on the Jordan Breeding Bird Survey route (Sauer et al. 2012). No bay-breasted warblers were observed on the nearby Tracks Project area. The NRRI's Breeding Bird Monitoring effort has detected bay-breasted warblers in 21 of 169 forest stands, but sightings have been rare. Loss of habitat, change in vegetation composition, management to control spruce budworm, fire suppression, and deforestation in wintering habitat all contribute to the population decline of the bay-breasted warbler.

Bay-breasted warbler breeds primarily in old spruce-fir forests, sometimes pine, and also in spruce bogs and coniferous riparian areas (Maxson 1999). They breed in forests where the conifers are dominant or co-dominant trees. There is little information about their use of black spruce lowlands in Minnesota. They need patches of spruce budworm outbreak over a large area. Birds often move to such an area in large groups. It is possible that maintenance of a viable and well-distributed population may require patches of relatively un-fragmented old spruce-fir forest of more than 3,000 acres capable of hosting a large enough spruce budworm outbreak. Robbins et al. (1989) suggested that some warblers may require extensive areas of interior forest habitat, but research has not been done to find out to determine its applicability to bay-breasted warbler in northeastern Minnesota.

No bay-breasted warblers were seen during wildlife surveys on the federal and non-federal lands, although surveys on Hunting Club Lands, Lake County Lands, and Wolf Lands occurred during late fall after bay-breasted warblers had migrated south for the winter (ENSR 2000, 2005, AECOM 2011a, b, c).

Direct and Indirect Effects

Proposed Action

Bay-breasted warblers favor lowland and upland mature spruce forest. There are about 3,040 acres of mature lowland (MIH 9) and 235 acres of mature upland coniferous forest habitat (MIH 5) on the federal lands that could provide habitat for the bay-breasted warblers. The Project would affect about 482 acres of mature lowland and 24 acres of mature upland coniferous forest habitat (**Table 6**).

There are 1,208 acres of mature lowland coniferous forest and 26 acres of mature upland coniferous forest habitat on the non-federal lands (**Table 6**). These lands would not be directly affected by the Project. Under the Proposed Action, the Forest Service would survey for bay-breasted warblers and associated habitat prior to conducting land-disturbing activities and areas of known or potential habitat would be avoided when feasible.

Alternative B

Potential direct and indirect effects to bay-breasted warblers from the Project under Alternative B would be similar to those under the Proposed Action. Under Alternative B, there are about 2,063 acres of mature lowland and 186 acres of mature upland coniferous forest habitat on the federal lands (**Table 6**). About 977 fewer acres of mature lowland coniferous forest and 49 fewer acres of mature upland coniferous forest on the federal lands would be transferred to PolyMet from the Forest Service under Alternative B than under the Proposed Action. This area could provide habitat for bay-breasted warblers, although noise and other disturbance associated with mining and use of the Dunka Road and Utility Corridor may discourage use of the area by bay-breasted warblers.

The Forest Service would acquire Hay Lake Lands under Alternative B. No bay-breasted warblers were seen on these lands during wildlife surveys, and observations of bay-breasted warblers are extremely rare in the vicinity

of Hay Lake Lands. There is no mature lowland or upland coniferous forest habitat on Hay Lake Lands (**Table 6**). Thus, there would be limited foraging and nesting habitat for bay-breasted warblers on Hay Lake Lands.

No Action Alternative

There would be no direct or indirect effects to bay-breasted warbler under the No Action Alternative.

Cumulative Effects

The greatest threat to the breeding range of the bay-breasted warbler is the reduction in the area of old-growth black spruce and balsam fir of the boreal forest. Both nesting habitat and food supply (spruce budworm) are at risk when reductions or alterations of these forest types occur. Spraying insecticides to control spruce budworm can have direct toxic effect on this warbler (inhibition of brain acetylcholinesterase activity). Winter habitat degradation and loss is also a threat, as commercial and residential development activity continues to reduce the forested habitats in the tropics (Mayasich and Niemie 2002). Green (1995) stated that coniferous forest-dominated stands have decreased and been replaced by trembling aspen over the past 100 years, indicating that less habitat is available at present compared to 100 years ago. Black spruce-balsam fir forest is currently below 2004 Forest Plan objectives and the Minnesota Forest Resources Council Landscape Committee set a goal to increase black spruce-balsam fir forest in Minnesota (USDA Forest Service 2004a). Forest Service data show that spruce budworm defoliation in the eastern U.S. dropped substantially in 1986 from 5 to 8 million acres per year prior to that to less than 1 million acres per year after 1985. In Minnesota, there were about 70,000 of spruce-budworm defoliation in 1999 compared to a million acres in 1958.

About 482 acres of mature lowland coniferous forest and 24 acres of mature upland coniferous forest habitat that could be used by this species on the federal lands would be directly affected by the Project (**Table 6**). However, there are about 356,000 acres of lowland coniferous forest and about 161,000 acres of upland coniferous forest within the CESA that could now, or in the reasonably foreseeable future, provide habitat for bay-breasted warblers (Emmons and Olivier, Inc. 2006:30, 38). Thus, habitat loss from the Project would have a negligible cumulative effect on bay-breasted warblers in the CESA.

Summary

Project activities associated with the Proposed Action and Alternative B should have no adverse direct, indirect, or cumulative effects on individual bay-breasted warblers, but could have direct, indirect, or cumulative effects on their habitat. Bay-breasted warblers were not seen on the federal lands during wildlife surveys for the FEIS, and are rare in the Superior National Forest, although habitat is present. Timber management and road construction could occur on the federal and non-federal lands in the reasonably foreseeable future, but only a small acreage of federal and non-federal lands would be affected. It is more likely that production of immature and mature lowland habitat, prescribed burnings that leave standing dead trees, and partial cuts on the non-federal lands could occur if these lands are federally administered rather than under private ownership.

Determination

The Proposed Action and Alternative B **may impact individuals but are not likely to cause a trend to federal listing or loss of viability** for bay-breasted warbler. The No Action Alternative would have **no impact** to individuals of bay-breasted warbler.

Mitigation and Recommendations

No mitigation measures are recommended for bay-breasted warbler.

5.2.6.8 Connecticut Warbler (*Oporornis agilis*)

Environmental Baseline

The Connecticut warbler has the most restricted breeding distribution of any northern warbler, aside from the Kirtland's warbler, ranging from eastern British Columbia east across south-central Canada to Quebec and south to northern Minnesota, Wisconsin, and the Upper Peninsula and northern Lower Peninsula of Michigan. Eighty-five percent of the North American breeding range of the Connecticut warbler is in Canada (Kudell-Ekstrum 2002 and references cited therein).

The bird is very secretive and difficult to detect. Breeding Bird Survey data showed a 5% per year population decline between 1986 and 1998 in North America. The NRRI's Breeding Bird Monitoring effort detected Connecticut warblers in 41 of 169 forest stands on the Superior National Forest during 1991 through 2005. An average of 0.3 Connecticut warblers have been recorded on the Hart Lake, and two Connecticut warblers on the Jordan Breeding Bird Survey routes each year since 1966 (Sauer et al. 2012). Two Connecticut warblers were seen on the nearby Tracks Project area.

Typical habitat consists of wet areas with black spruce, tamarack, mosses, speckled alder, dogwood, Labrador tea, bog rosemary, bog laurel, and leatherleaf. Breeding habitat consists of black spruce-tamarack bogs, muskeg, poplar woodlands and moist deciduous forests, and jack pine. The Connecticut warbler has been found in 15 forest types in the U.S. consisting of jack pine, red pine, black spruce, mixed swamp conifer, northern white cedar, sugar maple/basswood, tamarack, paper birch, and trembling aspen, and wetland bog and wetland sedge meadow. They may also be found in jack pine with a dense blueberry understory. They forage on the ground and in low shrubs. Boreal bogs that are 100 acres or larger are typical habitat in northeastern Minnesota. Territories of a breeding pair of birds are about 1.2 acres. Connecticut warblers nest on the ground in a small hollow, on moss mound in a bog, or in grasses or weeds, or at the base of a shrub and sometimes forming loose "colonies."

No Connecticut warblers were seen during wildlife surveys of the federal and non-federal lands, although surveys on the Hunting Club, Lake County, and Wolf Lands occurred during late fall after Connecticut warblers had migrated south for the winter (ENSR 2000, 2005, AECOM 2011a, b, c).

Direct and Indirect Effects

Proposed Action

Connecticut warblers favor lowland spruce forest and upland jack pine forest. There are about 3,060 acres of lowland (MIH 9) and 1,252 acres of upland coniferous (MIH 5) forest on the federal lands that could provide habitat for the Connecticut warbler. Approximately 482 acres of lowland coniferous forest and 505 acres of upland coniferous forest habitat would be lost due to mining (**Table 6**). Forest Service MIH mapping did not specifically identify jack pine forest (MIH 8) on the Mine Site, but it is present on the eastern portion of the Mine Site in association with black spruce and trembling aspen.

There are about 3,309 acres of lowland coniferous and 80 acres of upland coniferous forest habitat on the non-federal lands (**Table 6**). These lands would not be directly affected by the Project. Under the Proposed Action, the Forest Service would survey for Connecticut and associated habitat prior to conducting land-disturbing activities and areas of known or potential habitat would be avoided when feasible.

Alternative B

Potential direct and indirect effects to Connecticut warblers from the Project would be similar to those under the Proposed Action. Under Alternative B, there are about 2,079 acres of lowland and 1,139 acres of upland coniferous forest on the federal lands (**Table 6**). About 981 fewer acres of lowland coniferous forest and 113 fewer acres of upland coniferous forest would be transferred to PolyMet from the Forest Service than under the Proposed Action. This area could provide habitat for Connecticut warblers, although noise and other disturbance associated with mining may discourage use of the area by Connecticut warblers.

The Forest Service would acquire Hay Lake Lands under Alternative B. No Connecticut warblers were seen on these lands during wildlife surveys (AECOM 2011b, c), although two Connecticut warblers were observed on the nearby Tracks Project area. There are about 1,818 acres of lowland and 54 acres of upland coniferous forest habitat on Hay Lake Lands (**Table 6**). About 55% of the lowland coniferous forest and 68% of upland coniferous forest that occurs on the non-federal is found on Hay Lake Lands. There would be suitable foraging and nesting habitat for Connecticut warblers on Hay Lake Lands. This habitat should benefit from Forest Service management that favors longer harvest rotations than typically occurs on private forestlands.

No Action Alternative

There would be no direct or indirect effects to Connecticut warbler under the No Action Alternative.

Cumulative Effects

The Connecticut warbler may be sensitive to habitat fragmentation due to increases in nest predation and parasitism that may accompany decreases in forest interior habitat. Loss and fragmentation of jack pine forests was identified as the biggest threat to Connecticut warbler. However Connecticut warblers have been found in association with open forest habitats. Cowbird parasitism may also be a threat.

Peat mining may pose a threat to Connecticut warbler habitat. Peat mining is a large industry in Canada and has started in the U.S. at Pine Island in Koochiching County, Minnesota. Towers and structures have been reported as specific threats. Three hundred Connecticut warblers were killed in one season from collision with towers in Eau Claire, Wisconsin (Kudell-Ekstrum 2002 and references cited therein). Rieck (1999) stated that wintering habitat in northern South America is declining and breeding habitat may also be in decline range-wide.

About 482 acres of lowland coniferous forest and 505 acres of upland coniferous forest habitat that could be used by this species on the federal lands would be directly affected by the Project (**Table 6**). However, there are about 356,000 acres of lowland coniferous forest and 161,000 acres of upland coniferous forest within the CESA that could now, or in the reasonably foreseeable future, provide habitat for Connecticut warblers (Emmons and Olivier, Inc. 2006:30, 38). Thus, habitat loss from the Project would have a negligible cumulative effect on Connecticut warblers in the CESA. Noise and other disturbance from the Project could also cumulatively affect Connecticut warblers, although Connecticut warbler use of the Project area is likely very rare.

Summary

Project activities associated with the Proposed Action and Alternative B should have no adverse direct, indirect, or cumulative effects on individual Connecticut warblers, but could have direct, indirect, or cumulative effects on their habitat. Connecticut warblers have not been seen on the federal lands, and are rare in the Superior National Forest. Timber management and road construction could occur on the federal and non-federal lands in the reasonably foreseeable future, but only a small acreage of federal and non-federal lands would be affected. It is more likely that production of immature and mature lowland habitat and partial cuts that benefit Connecticut warbler would occur on the non-federal lands if these lands are federally administered rather than under private ownership.

Determination

The Proposed Action and Alternative B **may impact individuals but are not likely to cause a trend to federal listing or loss of viability** for Connecticut warbler. The No Action Alternative would have **no impact** to individuals of Connecticut warbler.

Mitigation and Recommendations

No mitigation measures are recommended for Connecticut warbler.

5.2.7 Mammals

5.2.7.1 Eastern Heather Vole (*Phenacomys ungava*)

Environmental Baseline

In eastern North America, the range of the eastern heather vole reaches its southernmost point in the Upper Midwest on the Superior National Forest. A long-term (1995-2006) study of small mammal populations documented 64 eastern heather voles on the Superior National Forest (Jannett 2006 *cited* in USDA Forest Service 2010b).

Eastern heather voles are found in a wide variety of habitats, including coniferous forests and forest borders, heath shrublands, willow thickets, rocky hillsides, and moist meadows (Coffin and Pfannmuller 1988, McAllister and Hofmann 1988). *Vaccinium* species (ericaceous shrubs) are often present where eastern heather voles are found. Naylor et al. (1985) found high densities of eastern heather voles in Ontario in jack pine monocultures with a dense, relatively continuous understory of ericaceous shrubs. Eastern heather voles' preferred habitat appears to be upland forests and openings with ericaceous ground cover not far from water. Anything that encourages grasses encourages meadow voles, which are detrimental to the eastern heather vole.

No eastern heather voles were seen during wildlife surveys of the federal and non-federal lands (ENSR 2000, 2005, AECOM 2011a, b, c). The MDNR NHIS database documents the nearest known eastern heather vole location as 24 miles north of the Project area off of the Tomahawk Road. No eastern heather voles were found on the nearby Tracks Project area.

Direct and Indirect Effects

Proposed Action

Forest Service MIH 8, which is primarily mature jack pine forest, is considered indicative of eastern heather vole habitat. Forest Service MIH mapping did not specifically identify jack pine forest on the federal lands, but jack pine forest is on present across the Mine Site, especially on the eastern portions of the site, and often in association with black spruce and trembling aspen (ENSR 2000, 2005, AECOM 2011a). However, there is no mature jack pine habitat on the Mine Site. There are about 1,252 acres of upland coniferous forest (MIH 5) on the federal lands, including about 235 acres of mature upland coniferous forest that could be used as habitat by the eastern heather vole (**Table 6**). The Project would affect about 505 acres of upland coniferous forest habitat.

The eastern heather vole was not identified on the non-federal lands during wildlife surveys or in the MDNR NHIS database (MDNR 2006, AECOM 2011b, c). There are about 80 acres of upland coniferous forest habitat on the non-federal lands, and jack pine is a component in these forests (**Table 6**). There are only 26 acres of mature coniferous forest habitat found on the non-federal lands. The majority of mature coniferous forest habitat, which consists primarily of eastern white pine, is found on Hunting Club Lands. These lands would not be directly affected by the Project. Under the Proposed Action, the Forest Service would survey for eastern heather vole and associated habitat prior to conducting land-disturbing activities and areas of known or potential habitat would be avoided when feasible.

Alternative B

Potential direct and indirect effects to eastern heather voles from the Project would be similar to those under the Proposed Action. Under Alternative B, there are about 1,252 acres of upland coniferous forest on the federal lands (**Table 6**). About 113 fewer acres of upland coniferous forest on the federal lands would be transferred to PolyMet from the Forest Service under Alternative B than under the Proposed Action. This area could provide habitat for eastern heather vole.

The Forest Service would acquire Hay Lake Lands under Alternative B. No eastern heather voles were seen on these lands during wildlife surveys (AECOM 2011b). Coniferous forest is rare on Hay Lake Lands. There are about 54 acres of upland coniferous forest habitat on Hay Lake Lands, although none of this habitat contains mature forest (**Table 6**). About 68% of the upland coniferous forest that occurs on the non-federal lands is found on Hay Lake Lands. Forest cover was 60 to 70% and was comprised of red pine and jack pine (AECOM 2011b). There would be little suitable habitat for eastern heather vole on Hay Lake Lands, but upland coniferous forest habitat should benefit from Forest Service management that favors longer harvest rotations than typically occurs on private forestlands.

No Action Alternative

There would be no direct or indirect effects to eastern heather vole under the No Action Alternative.

Cumulative Effects

The biggest negative effect to eastern heather vole habitat has likely come from fire suppression. Timber harvest potentially perpetuates habitat for this species, however, an increase of trembling aspen and a decrease of jack pine has likely reduced the amount of suitable habitat for the species. Based on analysis done for the Tracks

Project, the amount of mature jack pine forest should increase in the Superior National Forest during the next 10 years and would benefit eastern heather vole. The Superior National Forest goals are to increase the amount of jack pine forest over time. The cumulative effects analysis for the 2004 Forest Plan BE concluded that habitat conditions in the future are predicted to continue to provide a patchy distribution for eastern heather vole (USDA Forest Service 2004d).

About 505 acres of upland coniferous forest habitat that could be used by this species on the federal lands would be directly affected by the Project, but none of this habitat consists of mature coniferous trees (**Table 6**). There are about 161,000 acres of upland coniferous forest within the CESA that could now, or in the reasonably foreseeable future, provide habitat for eastern heather vole (Emmons and Olivier, Inc. 2006:30, 38). Thus, habitat loss from the Project would have a negligible cumulative effect on eastern heather vole in the CESA. In addition, about 397 acres of the 1,719-acre mine disturbance area would be reclaimed and could become upland coniferous forest habitat 20 years or more after reclamation (MDNR et al. 2013).

Summary

Project activities associated with the Proposed Action and Alternative B should have no adverse direct, indirect, or cumulative effects on individual eastern heather vole, but could have cumulative effects on their habitat. Eastern heather vole has not been seen on the federal lands, and is rare in the Superior National Forest, although habitat is present. Timber management and road construction could occur on the lands in the reasonably foreseeable future, but only a small acreage of federal and non-federal lands would be affected.

Determination

The Proposed Action and Alternative B **may impact individuals but are not likely to cause a trend to federal listing or loss of viability** for eastern heather vole. The No Action Alternative would have **no impact** to individuals of eastern heather vole.

Mitigation and Recommendations

No mitigation measures are recommended for eastern heather vole.

5.2.7.2 Northern Long-eared Bat (*Myotis septentrionalis*), Tri-colored Bat (*Perimyotis subflavus*), and Little Brown Myotis (*Myotis lucifugus*)

Environmental Baseline

The northern long-eared bat, tri-colored bat (synonym: eastern pipistrelle), and little brown myotis bat species were added to the 2011 RFSS list due to the spread of white-nose syndrome, which is a fungal disease affecting bats. In addition, the northern long-eared bat was recently listed by the USFWS as threatened species under the ESA (USDOI USFWS 2013, USACE, and USDA Forest Service 2013). The disease carries a high mortality rate for all bat species, and the Superior National Forest is closely watching the RFSS bat species to identify signs of white-nose syndrome. White-nosed syndrome has been reported at the Tower/Soudan Underground Mine State Park in St. Louis County, 15 miles northwest of the Project area, and in Fillmore County in southeastern Minnesota (USDOI USFWS 2013, U.S. Geological Survey National Wildlife Health Center 2013).

The northern long-eared bat prefers forests and riparian areas. It may hibernate in caves, mines, overhangs, crevices, drill holes, and similar sites. As noted in Section 1.1, the *NorthMet Mining Project and Land Exchange Biological Assessment Draft* was prepared to evaluate project effects to northern long-eared bat, a RFSS species that was recently listed as a federally threatened species (USACE and USDA Forest Service 2013). Additional information on the northern long-eared bat is available in the BA.

The tri-colored bat prefers open areas with large trees and woodland edges. It avoids open fields and deep woods. It may hibernate in caves and mines and roosts in trees and man-made structures. The little brown myotis is the most abundant bat in Minnesota. It is a habitat generalist and its preferred habitat includes boreal forests, bogs and fens, open fields, shrublands, and urban areas. It may hibernate in caves, tunnels, and abandoned mines and roosts in trees and man-made structures. Both the tri-colored bat and the little brown bat generally avoid large open areas, but do forage over or near water and prefer aquatic, soft-bodied insects (e.g., moths, flies, beetles, gnats, mosquitos).

Between 2008 and 2010, acoustic surveys for bats were conducted as part of wildlife surveys for the federal and non-federal lands (AECOM 2011a, b, c). No effort was made to determine the species of bat making the echolocation. Along with the three RFSS bats, four other bat species could occur in the Project area: the big brown bat, the silver-haired bat, the eastern red bat, and the hoary bat. Echolocations recorded during the surveys could have come from any of these seven bat species.

Echolocation surveys were conducted at five stations on the federal lands, although only four stations gave usable information due to rainfall during the survey at one station. Recordings indicated the presence of bats at all sites, with the greatest number of echolocations occurring at open water sites associated with the Partridge River and an unnamed creek, and the fewest echolocations at emergent wetlands covered with water and some aquatic vegetation.

Recordings on Hay Lake Lands showed that most echolocations occurred at an emergent wetland with open water (814 echolocations, mostly feeding activity). Moderate numbers of echolocations were recorded at the two sites along the Pike River (164 echolocations at the north Pike River site, 230 echolocations at the middle Pike River site; feeding activity was moderate), and at two small emergent wetland ponds with limited open water (64 and 181 echolocations; AECOM 2011b). An echolocation site to the south of Hay Lake Lands was located at a small patch of open water associated with an old beaver pond; 72 echolocations were recorded at this site. No echolocation surveys were made on Hunting Club Lands, Lake County Lands, and Wolf Lands as surveys were conducted in November and bats would have already migrated from the area. Surveys were also not conducted at McFarland Lake Lands, although bats likely forage over McFarland Lake.

In the summer of 2013, Superior National Forest staff initiated a pilot project to document forest bat occupancy and collect demographic and habitat data (Grandmaison et al. 2013). Across eight locations on the Kawishiwi District, 34 bats were collected over nine nights. Northern long-eared bats comprised 38% of the captured bats, while little brown bats comprised 62% of the captured bats. No tri-colored bats were documented in the survey (Grandmaison et al. 2013).

In the spring of 2014, the Superior National Forest staff and MDNR staff, with additional funding from USFWS, conducted a pilot project to describe summer habitat use by northern long-eared bats in Minnesota. Surveys were conducted at 12 sites, five of which were on the Superior National Forest. The survey captured six of the seven species of bats known to occur in Minnesota; tri-colored bat was the only species not captured. The most

frequently captured bats were little brown bats (45%) and northern long-eared bats (22%) (USDA Forest Service 2014b).

Superior National Forest staff conducted surveys for the northern long-eared bat and the little brown bat at three general locations in the Project area in July and August 2014 (USDA Forest Service 2014a; Personal Communication, Dan Ryan, USDA Forest Service, January 9, 2015). The three Project locations included the Mine Site, the Plant Site, and the Dunka Road and Utility Corridor. Survey methods utilized passive sonic (Anabat) detectors on the Mine Site and transportation corridor. At the Plant Site, the methods were primarily direct observation of bat species, supplemented by passive sonic detectors when feasible. The surveys found northern long-eared bats, little brown bats, silver-haired bats, big brown bats, hoary bats and eastern red bats present at the Mine Site with little brown bat accounting for 78% of all calls and northern long-eared bat accounting for 14% of all calls (USDA Forest Service 2014a). The eastern red bat was the only species whose calls were not identified during the driving surveys. Emergence surveys at the Plant Site in conjunction with the sonic detectors identified the presence of little brown bat, northern long-eared bat, silver-haired bat and big brown bat. The tri-color bat was not detected in any of the surveys (USDA Forest Service 2014a). The 2014 surveys suggested that the Mine Site may contain roost sites, however, there have been no surveys specifically targeted for identification of roost sites.

Bats were seen during wildlife surveys of the federal and non-federal lands, but were not identified to species. As noted above, bats foraged and drank water on wetlands and other aquatic habitats with some open water. There are no caves or mine shafts that could be used for hibernation on the federal lands, but bats could also roost in tree hollows and under tree bark, or under railroad trestles near the Mine Site. Bats have occasionally been observed in Plant Site buildings, but do not hibernate or roost in great numbers at the Plant Site.

Direct and Indirect Effects

Proposed Action

There are about 210 acres of open bog, 31 acres of open water, 36 acres of sedge/wet meadow, and 97 acres of shallow marsh habitat that could be used by bats for feeding and drinking on the federal lands (**Table 8**). There are about 4,312 acres of lowland and upland coniferous forest habitat (MIH 5 and 9) that could be used by bats for roosting on the federal lands (**Table 6**). The Project would directly affect 65 acres of open bog, open water, sedge/wet meadow, and shallow marsh habitat and 987 acres of lowland and upland coniferous forest habitat (**Tables 6 and 8**).

Potential indirect affects to the tri-color and little brown bat from drinking water from Project ponds and from the consumption of insects that may inhabit or drink from the ponds is qualitatively assessed. MnDNR (2015) identifies that the tri-color bat is typically found in the southeast corner of the state and the occurrence in the northeast portion of the state is considered rare. Even though the tri-color bat was not detected in the 2014 Forest Service surveys, it is assumed to have the potential to be present in the Project area. A qualitative assessment of potential affects to the northern long-eared bat is provided in the Biological Assessment Report.

The tri-color bat and the little brown bat are considered habitat generalists by some researchers (Ford et al. 2005). Studies have identified the little brown bat to have a preference for foraging along the forest edge (Broders et al. 2006; Jantzen 2012). Both the tri-color and little brown bat have an affinity for water and feed above open water (Fenton and Barclay 1980; Broders et al. 2006; Lookingbill et al. 2010), and using water sources within the forest for drinking (woodland seasonal pools and beaver ponds) (Francel 2008). Other studies identify that the little brown bat has some affinity for open upland areas (meadow, prairie, and savanna) (Buckman-Sewald et al. 2014). Jantzen (2012) found bat activity (little brown bat, northern long-eared bat) to be concentrated within about 40 meters of the forest/open edge and Fulton et al. (2014) found that bats were more active in hydric habitats (riparian areas and wetlands) than in the surrounding forest. Lookingbill et al. (2010) identified a foraging radius of 500 meters for the little brown bat and 100 meters for the tri-color bat. Tri-colored bats tend to avoid deep woods or open fields (Ford et al. 2005). The Wisconsin DNR (2013) identified that little brown bats would preferentially follow a forest edge rather than fly across a large open area such as a field. Common summer roosting habitat is in older forest stands that provide more opportunities for roosting in cavities, but because they are common to a wide range of areas they also roost in human-made structures (Wisconsin DNR 2013).

In comparison, the northern long-eared bat is a forest specialist (Henderson and Broders 2008; Chapman et al. 2014). As a forest specialist, the weight of evidence in the literature (Henderson and Broders 2008; Jantzen 2012; Chapman et al. 2014) indicates it would be highly unlikely for the northern long-eared bat to be present in the large open area at the future Mine Site or near the ponds within the Plant Site.

About 57% of the 3,015 acre Mine Site would be affected by the Project. Much of this affected area would be cleared of vegetation to accommodate the mine pits and associated infrastructure (e.g., haul roads, stockpile, stormwater ponds, waste water ponds) and would become a large open area during operations. The existing Plant Site is primarily an open area dominated by the LTVSMC Tailings Basin and would continue as an open area during Project operations. Overall, the peer-reviewed literature identifies that bats will forage at those locations where insect density is highest (Jantzen 2012; Lookingbill et al. 2010) and the large area of existing wetlands around the Tailings Basin and the future Mine Site would likely attract a large portion of the

local population of bats. Further, Francl (2008) has identified the little brown bat's predominance at woodland seasonal pools. Based on the peer-reviewed literature and the existing wetland and riparian areas immediately adjacent to the Mine Site, there is a low probability that either species would use the operational Mine Site to any great extent. However, because both species of bat are known to feed over open water and because the 2014 Forest Service bat surveys identified the little brown bat presence within the existing Tailings Basin (Forest Service 2014a: Figure 4), it is possible that some number of bats may be present within the active Flotation Tailings Basin during mining operations although it is uncertain if bats would use an active tailings basin in the same manner or frequency that they currently use the reclaimed LTVSMC Tailings Basin.

The Project's water management is expected to limit the potential exposure of bats to indirect effects from the various water features at the Plant Site or Mine Site and consumption of insects that may use these water features. Project water features include stormwater ponds, process water ponds, water in active mine pits, constructed wetlands, the Hydrometallurgical Facility pond (operations), the Flotation Tailings Basin Pond and wetland (reclamation and long-term closure), and the West Pit lake (long-term closure). Each water feature is qualitatively evaluated for potential indirect effects to bats.

1. Stormwater from precipitation and runoff would be directed to sedimentation ponds to remove total suspended solids prior to being discharged off-site. Water in the ponds prior to discharge is expected to reflect background concentrations of water quality parameters (including metals and mercury) and any aquatic insects inhabiting stormwater ponds should have metal and mercury concentrations that reflect background conditions, and therefore, similar to existing conditions. Therefore, any consumers of aquatic insects (including bats) from Project stormwater ponds should not be exposed to metal or mercury concentrations in those insects above background levels.
2. Process water would be collected and stored in a number of ponds at the Mine Site (e.g., Overburden Storage and Laydown Area Pond) and the Flotation Tailings Basin Pond and Hydrometallurgical Residue Facility Pond at the Plant Site and be actively managed for re-use. The probability of insects inhabiting or using a process water pond as a source of drinking water is expected to be low because: 1) these ponds would tend to be turbid and limit the establishment and growth of plants and in turn limit organic materials and the establishment of macroinvertebrates (Nelms et al. 2012); 2) mining-related water is low in organic carbon (Berndt and Bavin 2012) and nutrients and would limit growth and reproduction of algae, macroinvertebrates, and other biota (Nelms et al. 2012; Seger et al. 2012) ; 3) the use of liners and/or compacted bottoms to maximize water retention would not likely provide a suitable substrate for the larval stages of most aquatic insects (Flake and Cieminski 1996); and 4) fine mineral sediments that have little silt or clay are poor media for plant establishment and growth (Nelms et al. 2012) and further limits the presence of aquatic insects that require organic materials for food (Seger et al. 2012). The above listed factors likely limit the aquatic life in process water ponds. Insects from Project process water ponds would likely represent a very small percent of the diet of consumers of aquatic insects when compared to the large acreage of existing wetlands around the Plant Site and Mine Site that currently provide the forage base for bats and other consumers. Overall, limited pond productivity likely reduces the potential effect of process water ponds on insects and consumers of those insects such as bat species.

Similar to taconite processing, mercury in process water sent to the Flotation Tailings Basin Pond

and the Hydrometallurgical Residue Facility Pond is expected to be associated with the solids and sequestered with those solids in the respective ponds and result in relatively low concentrations of mercury in the water column (Barr 2007b; PolyMet 2015). Mercury associated with solids such as tailings is sequestered within the basin and is typically not released from the basin (Berndt 2003) and not readily bioavailable. The continual deposition of solids in these ponds is likely to limit sediment-dwelling organisms (Nelms et al. 2012), as would the lack of organic material for food (Flake and Cieminski 1996; Nelms et al. 2012). Limited pond productivity and sequestration of mercury with solids likely reduces the potential effect of process water ponds on bat species.

3. Mine pit dewatering would occur during Mine Years 1 through 20 and this process water would be routed to the Waste Water Treatment Facility for initial treatment and then pumped to the Flotation Tailing Basin Pond for use in ore processing (Poly Met 2014c). A minimal amount of water is expected to be present in an active mine pit, therefore the probability of aquatic insects inhabiting or using a sump area is low. The continual removal of water is likely to limit the presence of aquatic organisms (Nelms et al. 2012), as would the lack of organic material for food (Flake and Cieminski 1996; Nelms et al. 2012). Limited productivity reduces the potential effect of mine pit watering on bat species, including the northern long-eared bat which is a forest specialist (Henderson and Broders 2008; Jantzen 2012; Chapman et al. 2014) and not expected to be present within the mine pits.
4. As part of reclamation, some stormwater ponds and process water ponds would be filled and converted to terrestrial habitat (.e.g., Hydrometallurgical Residue Facility Pond) (Poly Met 2014b; 2014e; 2014f). Ponds filled and reclaimed to terrestrial vegetation would have the potential to produce runoff water that would be expected to reflect background conditions. Reclaiming ponds to terrestrial vegetation is not expected to produce runoff that would adversely affect aquatic insects.

A part of the East Pit (after backfilling is completed) and some stormwater and process water ponds would be converted to wetlands (Poly Met 2014b, 2014c, 2014d). These constructed wetlands are expected to receive precipitation and stormwater runoff. The accumulating water should reflect background concentrations for various parameters (including mercury). Any aquatic insects inhabiting a constructed wetland or using it as a source of drinking water should have metal or mercury concentrations that reflect background conditions. Therefore, any consumers of these aquatic insects (including bats) should not be exposed to metal or mercury concentrations in those insects above background levels.

In regard to the backfilling of the East Pit, the water level would be maintained below the level of the fill material to facilitate truck hauling (Poly Met 2014b). No visible ponding of water is expected during backfilling. Therefore, backfilling of the East Pit would have no potential to affect aquatic organisms.

5. The Flotation Tailings Basin Pond would be present after Mine Year 20 and a wetland would be constructed around the perimeter of the pond. The pond and wetland are expected to be present into long-term closure. After Mine Year 20, the Beneficiation Plant and Mine Site would no longer contribute water and the largest source of water to the pond would be precipitation and

runoff (Poly Met 2015). In long-term closure, the water in the pond would be primarily from precipitation and runoff (Poly Met 2015) and would be expected to reflect background conditions and parameter concentrations (including mercury). Any aquatic insects inhabiting the Flotation Tailings Basin Pond or using it as a source of drinking water during long-term closure should have metal or mercury concentrations that reflect background conditions. Therefore, any consumers of these aquatic insects (including bats) should not be exposed to metal or mercury concentrations in those insects above background levels.

6. The depth of the West Pit at the end of mining will be more than 600 feet. Flooding of the pit would result in rapid water level increases that are predicted to average about 17 feet per year (Poly Met 2014g). Rapidly rising water levels likely limits the aquatic life that would inhabit the lake during the years of pit flooding (Nelms et al. 2007). Therefore, the potential exposure of bats to any insects that might inhabit or use the West Pit lake during the early years of flooding is likely low.

The majority of water used to flood the West Pit would be primarily from precipitation and stormwater runoff (Poly Met 2014g) and as the pit fills the parameter concentrations in the upper portion of the water column (i.e., the epilimnion) should reflect background (including mercury). Flooding of the West Pit would produce a pit lake that is approximately 320 acres in size with a maximum depth of 630 feet (Poly Met 2014b). As an oligotrophic system with a small littoral area, aquatic insect diversity and numbers in the West Pit lake would be limited (Nelms et al. 2012; Gray et al. 2012). Data for pit lakes identifies they have low densities and diversity of invertebrates (MDNR 1989). In addition, pit lake waters are typically low in phosphorus, limiting primary production (MDNR 1989). For the above reasons, overall, the potential population of aquatic insects in the West Pit lake is expected to be small. In addition, these insects would likely represent only a small portion of the diet of consumers of aquatic insects. Therefore aquatic insects inhabiting the West Pit lake or using it as a source of drinking water would likely have no significant effect on insect consumers such as bats.

With regard to mercury, the West Pit lake is estimated to have a total mercury concentration of 0.3 to 0.9 ng/L during flooding and in long-term closure (Poly Met, 2014g). Because precipitation would be the main input of water to the West Pit lake, metal concentrations in long-term closure would likely reflect background conditions. Therefore, any aquatic insects inhabiting the West Pit lake or drinking from the West Pit lake would be exposed to background concentrations. Any consumers of these aquatic insects (including bats) should not be exposed to mercury concentrations in those insects above background levels.

Because existing wetlands at the Plant Site (e.g., north of the tailings basin) and the Mine Site (e.g., 100 Mile Swamp) would be providing an abundant supply of insects, the majority of bats and other consumers of insects would likely be focused in these areas and would not likely be relying solely on the Project water features for their food supply. Therefore, any insects inhabiting Project water features or using them as sources of drinking water are not expected to have a significant effect on the consumers of insects. Overall, the Project's water features are not expected to have adverse indirect effects on bats. Project noise would potentially have an impact on bat utilization of maternity and roosting habitat in the vicinity of the Mine Site. Existing ambient steady equivalent noise levels for most of the Mine Site are in the range of 35 to 45 decibels (dBA), which is a range comparable to secluded woods or a quiet bedroom (MPCA 1999). The Peter Mitchell Mine, north of the Mine

Site, and traffic along Dunka Road and the existing railway, along the south edge of the Mine Site, also contribute brief, episodic noise impacts.

The primary sources of Project noise from the Mine Site would be blasting, haul trucks, and train horns, with noise levels ranging from 89-115 dBA. Equipment such as graders, bull dozers, and support trucks would be less dominant sources of noise, ranging from 75-95 dBA (EPA 1971). Blasting at the Mine Site is expected to occur once every two to three days. Typically, rock blasting generates a single event noise level ranging from 111- 115 dBA at 50 feet from the blasting site (Table 5.5-7 of Madera County 2005). Within most of the Mine Site, the sound from the blast would be similar to a loud clap of thunder.

Bats were seen on the non-federal lands during wildlife surveys (AECOM 2011b, c). There are about 7 acres of open bog, 183 acres of open water, 0 acres of sedge/wet meadow, and 117 acres of shallow marsh on the non-federal lands (**Table 8**). There are about 3,389 acres of lowland and upland coniferous forest habitat (MIH 5 and 9) that could be used by bats for roosting on the non-federal lands (**Table 6**). These lands would not be directly affected by the Project. Under the Proposed Action, the Forest Service would survey for bats and associated habitat prior to conducting land-disturbing activities and areas of known or potential habitat would be avoided when feasible.

Alternative B

Potential direct and indirect effects to bats from the Project would be similar to those under the Proposed Action. Under Alternative B, there are 175 acres of open bog, 9 acres of open water, 35 acres of sedge/wet meadow, 81 acres of shallow marsh, and 3,218 acres of lowland and upland coniferous forest on the federal lands (**Tables 6 and 8**). About 74 fewer acres of open bog, open water, sedge/wet meadow, and shallow marsh habitat and 1,094 fewer acres of lowland and upland coniferous forest habitat on the federal lands would be transferred to PolyMet from the Forest Service under Alternative B than under the Proposed Action. This habitat could be used by bats. Habitat loss to mining activities would be the same as under the Proposed Action.

The Forest Service would acquire Hay Lake Lands under Alternative B. Bats were seen at several locations on the lands during wildlife surveys (AECOM 2011b). There are 2 acres of open bog, 177 acres of open water, 0 acres of sedge/wet meadow, 84 acres of shallow marsh, and 1,872 acres of lowland and upland coniferous forest (MIH 5 and 9) on Hay Lake Lands (AECOM 2011b). About 86% of the open bog, open water, sedge/wet meadow, and shallow marsh and 55% of the lowland and upland coniferous forest (MIH 5 and 9) that occurs on the non-federal lands is found on Hay Lake Lands (**Tables 6 and 8**). This habitat would benefit from Forest Service management that favors longer protection of wetlands and other aquatic resources.

No Action Alternative

There would be no direct or indirect effects to northern long-eared bat, tri-colored bat, or little brown myotis bat under the No Action Alternative.

Cumulative Effects

Bats are facing loss of habitat from fewer old houses, buildings, old open mines, and snags (dead and decaying trees). Loggers cut down snags because they can be a danger, and people target snags for firewood. However, protecting old open mines that provide habitat for bats, limiting human intrusion into these mines with bat gates,

and managing forests to protect snags has helped to slow the loss of bat hibernacula (hibernation) and roosting habitat.

As noted above, the Forest Service has added the northern long-eared bat, tri-colored bat, and little brown myotis to the RFSS list due to concerns about white-nosed syndrome. White-nose syndrome has killed more than a million bats in the northeastern U.S. A fungus that thrives in the same cold temperature range as hibernating bats causes a white fuzzy growth on their noses and wings. Scientists speculate the fungus interrupts sleep patterns and causes the hibernating bats to awaken, depleting their fat reserves and causing starvation.

Bats also have been found dead near wind energy towers. Most collision mortality involves migrating or dispersing bats, not resident, breeding bats (MDNR 2008). Future research should concentrate on determining the cause of bat collisions with wind turbines and methods to reduce and mitigate the mortality.

About 65 acres of wetland/aquatic habitat and 987 acres of lowland and upland coniferous habitat that could be used by bats on the federal lands would be directly affected by the Project (**Tables 6 and 8**). However, there are about 67,000 acres of open wetland and open wetland, and about 517,000 acres of lowland and upland coniferous forest habitat within the CESA that could now, or in the reasonably foreseeable future, provide habitat for northern long-eared bat, tri-colored bat, and little brown myotis (Emmons and Olivier, Inc. 2006:30, 38). Thus, habitat loss from the Project would have a negligible cumulative effect on northern long-eared bat, tri-colored bat, and little brown myotis in the CESA. In addition, about 516 acres that would be affected by mining would be reclaimed to wetland and open water habitat (MDNR et al. 2013). Reclaimed areas would likely provide feeding and drinking habitat for bats soon after reclamation, and could provide roosting habitat about 80 or more years after trees establish on the reclamation areas (USDA Forest Service 2004a). In addition, about 614 acres of mining disturbance would be reclaimed to grassland/herbaceous habitat and could provide roosting habitat about 80 or more years after trees establish on these reclamation sites (MDNR et al. 2013).

Summary

Project activities associated with the Proposed Action and Alternative B could have adverse direct, indirect, or cumulative effects on individual northern long-eared bat, tri-colored bat, and little brown myotis and their habitats. Bats are common on the federal and non-federal lands. About 65 acres of open bog, open water, sedge/wet meadow, and shallow marsh habitat that could be used by bats for foraging and drinking would be lost due to mining (**Table 8**). In addition, about 987 acres of lowland and upland coniferous forest habitat that could be used by bats for roosting would be lost due to mining (**Table 6**).

Timber management and road construction could occur on the federal and non-federal lands in the reasonably foreseeable future and could destroy bat habitat, but only a small acreage of federal and non-federal lands would be affected. It is more likely that production of immature and mature upland coniferous habitat that benefits roosting bats would occur on the non-federal lands if these lands are federally administered rather than under private ownership. PolyMet would follow the April 2015 interim 4(d) rules for the federally-threatened northern long-eared bat regarding tree removal (USFWS 2015), or would consult with the USFWS if tree removal activities do not meet the criteria of the exempted activities presented in the interim 4(d) rules. Wetland and other aquatic habitat would be about equally protected under Forest Service or private ownership because of federal and state laws.

Determination

The Proposed Action and Alternative B **may impact individuals but are not likely to cause a trend to federal listing or loss of viability** for northern long-eared bat, tri-colored bat, and little brown myotis. The No Action Alternative would have **no impact** to individuals of northern long-eared bat, tri-colored bat, and little brown myotis.

Mitigation and Recommendations

No mitigation measures are recommended for northern long-eared bat, tri-colored bat, and little brown myotis.

5.2.7.3 Gray Wolf

As noted in Section 1.1, the *NorthMet Mining Project and Land Exchange Biological Assessment Draft* was prepared to evaluate project effects to gray wolf, a RFSS species that has been federally listed as threatened in the past, delisted in 2011, and relisted December 19, 2014, following a federal court reversal of the USFWS decision to delist the gray wolf. The following summarizes the results of the BA.

Environmental Baseline

The gray wolf is the largest wild member of the dog family (*Canidae*) and is common on and near the federal and non-federal lands. In 1967, the gray wolf was determined to be endangered under the Endangered Species Preservation Act of 1966, in response to their vastly declining numbers range wide. In 1974, the species was formally listed as endangered through the authority of the ESA, and the Minnesota population was reclassified to threatened in 1977. In April 2003, gray wolf populations in the U.S. were separated into three Distinct Population Segments (DPS) to more effectively manage the species; the Minnesota population was a designated portion of the Eastern DPS. In 1978, critical habitat was designated for the Eastern DPS of gray wolf. That rule identified critical habitat at Isle Royale National Park, Michigan, and Minnesota wolf management zones 1, 2, and 3. Wolf management zones 1, 2, and 3 comprised approximately 9,800 mi² in northeastern and north central Minnesota and included all of the Superior National Forest and portions of the Chippewa National Forest. Hunting Club Lands and McFarland Lake Lands were in Zone 1, while the federal lands, and other non-federal lands were in Zone 2.

On December 28, 2011, the USFWS revised the 1978 listing of the Minnesota population of gray wolf to conform to statutory and policy requirements. The USFWS renamed what was previously listed as the Minnesota population of the gray wolf as the Western Great Lakes DPS, and delineated the boundaries of the expanded Minnesota population segment to include all of Minnesota, Wisconsin, and Michigan and portions of the adjacent states. The USFWS removed the Western Great Lakes DPS from the list of endangered and threatened wildlife. The USFWS took this action because the best available scientific and commercial information indicated that the Western Great Lakes DPS does not meet the definitions of threatened or endangered under the ESA. This final rule also removed the designated critical habitat for the gray wolf in Minnesota and Michigan and the special regulations under Section 4(d) of the ESA for gray wolves in Minnesota. In 2012, the MDNR established a regulated hunting and trapping season for wolves in Minnesota. On December 19, 2014, a federal court reversed the USFWS decision to delist the gray wolf, restoring federal threatened status and critical habitat designation in Minnesota.

Six comparable surveys of gray wolf numbers and range in Minnesota have been carried out since 1979. Gray wolf populations in Minnesota were estimated at 1,235 in 1979; 1,500 to 1,750 in 1989; 2,440 in 1998; 3,020 in 2004, and 2,920 in 2008 (Berg and Kuehn 1982, Fuller et al. 1992, Berg and Benson 1999, Erb 2008). The 1998 and later surveys revealed that the number of gray wolves in Minnesota was two times greater than the planning goal (1,400 gray wolves) as specified in the Recovery Plan for Minnesota. However, the 2012 survey showed that gray wolf numbers have declined statewide from 2,920 in 2008 to about 2,200 in 2012 (Erb and Samson 2013).

Gray wolves are carnivorous predators that prefer a diet of medium and large mammals. Prey species in Minnesota include white-tailed deer, moose, beaver, and snowshoe hare, with small mammals, birds, and large invertebrates sometimes being taken (Mech 1974, Wisconsin DNR 1999). Gray wolves are habitat generalists that do not depend on the type, age, or structure of vegetation. Instead, they are indirectly influenced by vegetative condition through the distribution of their primary prey species.

Potential and favorable gray wolf habitat is defined by several elements such as low human population density, sufficient prey density, low road density, vegetation cover, and special landscape patterns (Mladenoff et al. 1995). Gray wolves can live in most any habitat that supports ungulate prey. Gray wolf densities are directly related to the densities of their primary ungulate prey (Fuller 1989). Thus, forested areas occupied by white-tailed deer and moose are important habitat. Additionally, the habitat should be suitable for smaller prey such as beaver and snowshoe hare that may be seasonally important (Mech 1970). Moose, deer, and snowshoe hare tend to forage in areas of regenerating upland forest, and coniferous forest is an important component of thermal cover for all. Riparian trembling aspen forest is important for beavers. Patch structure is only important in that it may alter prey densities or include areas of high road and human densities thereby indirectly altering gray wolf distribution (Fuller 1997).

The Forest Service identified young forest (MIH by age class - young) that is less than 10 years old as providing important foraging habitat for wolves (USDA Forest Service 2004b). Immature and mature forest habitat provides important cover habitat for wolves (MIH by age class - immature and mature).

Gray wolf tracks, scat, and signs of gray wolf kills were seen during wildlife studies on the federal lands, Dunka Road and Utility Corridor, and Plant Site during 2000, 2004, 2008, and 2009 (ENSR 2000, 2005, AECOM 2009, 2011a). Tracks were commonly seen on the Dunka Road, on mine exploration roads, along railroad grades and utility ROW, and north of the Mine Site on Northshore Mine roads during all seasons. In addition, several wolves responded to calls from the Mine Site during 2004. The wolves were located to the south of the calling station, and likely south of the property boundary based on call intensity and direction.

Gray wolf tracks and scat were recorded on the Hay Lake Lands, Wolf Lands 3 and 4, and Lake County Lands North during the survey. Gray wolf scat was seen on several abandoned logging roads. No wolves or their sign were seen on the other non-federal lands, although conditions for surveys were not favorable for detecting tracks and scat at the Hunting Club Lands.

Until 2012, International Wolf Center posted on their website a database summary of gray wolf radiotelemetry observations in northeastern Minnesota. Of the over 11,000 records in the monitoring database between 1994 and 2010, 10 records were for wolves recorded on the federal lands; however, there were no records for the Plant Site or Transportation and Utility Corridors (International Wolf Center 2012). Radiocollared wolves have been recorded on the townships of the Hay Lake Lands. A gray wolf was observed in Section 6 of Township 58

North, Range 16 West in September 1994, just south of Hay Lake. Wolves were observed in Sections 1, 19, 22, and 23 of Township 59 North, Range 16 West, in and around the Hay Lake Lands, between 1994 and 1997. Radiocollared wolves have been recorded in the vicinity of Wolf Lands 2 and 3. There are no recorded observations of wolves in the township of the McFarland Lake Lands, although the McFarland Lake Lands and other non-federal lands that would be involved in the land exchange are within the current range of the gray wolf (Erb and Sampson 2013).

Direct and Indirect Effects

Proposed Action

There are 271 acres of gray wolf foraging habitat and 5,393 acres of gray wolf cover habitat on the federal lands that could be used as habitat by the gray wolf (**Table 6**). The Project would affect about 181 acres of gray wolf foraging habitat and 1,333 acres of gray wolf cover habitat (**Table 6**). Loss of this habitat would reduce the availability of prey and cover for gray wolf traveling through the Project area. Loss of habitat would also make it less likely that a gray wolf pack would establish a territory within the Project area, especially areas directly affected by the Project. The primary effects to gray wolf prey habitat from the Project would result from habitat loss and disturbance.

Project noise would potentially have an impact on gray wolf utilization of habitat in the vicinity of the Mine Site. Existing ambient steady equivalent noise levels for most of the Mine Site are in the range of 35 to 45 decibels (dBA), which is a range comparable to secluded woods or a quiet bedroom (MPCA 1999). The Peter Mitchell Mine, north of the Mine Site, and traffic along Dunka Road and the existing railway, along the south edge of the Mine Site, also contribute brief, episodic noise impacts.

The primary sources of Project noise from the Mine Site would be blasting, haul trucks, and train horns, with noise levels ranging from 89-115 dBA. Equipment such as graders, bull dozers, and support trucks would be less dominant sources of noise, ranging from 75-95 dBA (EPA 1971). Blasting at the Mine Site is expected to occur once every two to three days. Typically, rock blasting generates a single event noise level ranging from 111- 115 dBA at 50 feet from the blasting site (Table 5.5-7 of Madera County 2005). Within most of the Mine Site, the sound from the blast would be similar to a loud clap of thunder.

The impacts of noise on gray wolf utilization of habitat near the Mine Site are largely unknown and the assessment of impacts remains subjective. Impacts may also vary between individual gray wolves. Some may adapt to predictable human activities, so if the activity generally occurs at predictable time periods at the same places or along the same routes, individual gray wolves may become habituated to the activity (ENSR/AECOM 2006).

There are 778 acres of gray wolf foraging habitat and 5,365 acres of gray wolf cover habitat on the non-federal lands (**Table 6**). The Forest Service has not determined the suitability of these lands to provide habitat for wolves or their prey. However, wildlife habitat surveys conducted on these lands give an indication of the suitability of these lands for these species. Portions of the non-federal lands have been harvested for timber during the past 20 years, with much of the harvest occurring on Lake County Lands and Wolf Lands 2 and 3. Under the Proposed Action, the Forest Service would survey for gray wolves and associated habitat prior to conducting land-disturbing activities and areas of known or potential habitat would be avoided when feasible.

Alternative B

Potential direct and indirect effects to wolves from the Project would be similar to those under the Proposed Action. Under Alternative B, there are 271 acres of gray wolf foraging habitat and 3,901 acres of gray wolf cover habitat on the federal lands. The same acreage of gray wolf foraging habitat and 1,492 fewer acres of gray wolf cover habitat would be transferred to PolyMet from the Forest Service under Alternative B than under the Proposed Action.

The Forest Service would acquire Hay Lake Lands under Alternative B. Gray wolf howling surveys were conducted at night on Hay Lake Lands. No gray wolves were heard during howling surveys, but sign of gray wolf was seen on Hay Lake Lands. Gray wolf scat was seen on several abandoned logging roads (AECOM 2011b). There are about 534 acres of gray wolf foraging habitat and 3,720 acres of gray wolf cover habitat on Hay Lake Lands (**Table 6**). About 69% of the gray wolf forage habitat and 69% of the gray wolf cover habitat that occurs on the non-federal lands is found on Hay Lake Lands. Lowland and upland coniferous forest habitat would benefit from Forest Service management that favors longer harvest rotations than typically occurs on private forestlands.

No Action Alternative

There should be no direct or indirect effects to gray wolf under the No Action Alternative.

Cumulative Effects

The Project and other nearby proposed mine projects would increase the amount of habitat fragmentation in the area, changing wooded/forested and other vegetated habitats to disturbed/developed areas with limited habitat value. Development of iron mines along the Iron Range has made portions of this area of limited value to the gray wolf, especially areas with pits, tailings, and waste rock piles. Historic waste rock piles and tailings have begun to revegetate and provide some habitat for gray wolf and their prey.

The Project would increase the amount of human access and disturbance in the area. Increased human populations in the Project area may also lead to increased risk to wolves from collisions with vehicles and trains, increased levels of recreation activities and use of backcountry roads and trails, and increased mortality from illegal hunting and trapping.

Minnesota's Wolf Management Plan will ensure the gray wolf's long-term survival. The plan gives owners of livestock and domestic pets more protection from gray wolf depredation. It splits the state into two management zones with more protective regulations in the northern third, considered the gray wolf's core range. The MDNR has not established a maximum population goal and wolves are allowed to naturally expand their range. A statewide winter population of 1,600 wolves is the minimum goal. If Minnesota's gray wolf population falls below this minimum, the MDNR will take immediate and appropriate management actions to reverse the decline and restore the population to its minimum level in the shortest possible time. The MDNR implemented a conservative and regulated hunting and trapping season in fall 2012. Hunters and trappers harvested 413 wolves in 2012 (MDNR 2013a). The MDNR expects the 2013 season to follow a similar framework with a harvest goal of 220 wolves (MDNR 2013b).

Given that the number of miles of roads associated with the federal and non-federal lands after mining is expected to be similar to or less than current levels, effects associated with road mileage are not expected to accumulate from the Project. The potential for wolves to be killed from vehicle/rail collisions was estimated using the methodology described in Section 6.1.2.1 of the BA (USACE and USDA Forest Service 2013). Assuming that there is about 0.04 gray wolf/km², that vehicle/rail collisions could occur along the 8-mile Transportation and Utility Corridors and railroad, and that vehicles and rail traffic have equal potential for collisions with wolves, it was estimated that approximately 0.05 gray wolf could be killed annually by vehicle/train traffic between the Mine Site and Plant Site, or about one gray wolf during the estimated 20-year life of the Project (assuming that mortalities due to collisions with vehicles and trains were twice the estimated level).

ANALYSIS AND DETERMINATION OF EFFECTS

Using the same assumptions and methodology used to estimate gray wolf mortality on Project roads and railroads (see Section 6.1.2.1 of the BA), approximately 0.3 gray wolf could be killed annually by vehicle/train traffic on off-Project access roads/rail lines to the Plant Site, or about six wolves during the estimated 20-year life of the Project (assuming that mortalities due to collisions with vehicles and trains were twice the estimated level).

Hunting and trapping of wolves would not be allowed on lands administered by PolyMet. Thus, there should be no illegal or accidental take due to the Project. Loss of wolves to illegal trapping and hunting should remain near current levels on the non-federal lands, while the number of wolves harvested on non-federal lands during legal hunting seasons will vary based on gray wolf population levels. Thus, there should be negligible or no cumulative effect to legal, illegal, and accidental take of wolves from the Project and land exchange.

About 181 acres of gray wolf foraging habitat and 1,333 acres of gray wolf cover habitat would be lost due to mining (**Table 6**). Development of the Mine Site would add to habitat fragmentation by eventually converting habitat on the Mine Site to an open water pit lake (321 acres) and waste rock stockpiles (526 acres) of limited value to wolves. The Mine Site would account for about 0.4% of habitat affected by future mining activity within the next 30 years (Barr 2009b).

Although the Project would result in habitat loss and fragmentation on about 1,719 acres for about 20 years (until the Project is reclaimed), in the context of available habitat, and habitat that would be available to wolves in the reasonably foreseeable future, cumulative effects of the Project on habitat loss and fragmentation would be minor.

Summary

Project activities associated with the Proposed Action and Alternative B would have adverse direct, indirect, and cumulative effects on wolves and their habitat. Wolves have been seen on or near the federal and non-federal lands. Timber management and road construction could occur on the federal and non-federal lands in the reasonably foreseeable future and could destroy gray wolf habitat, but only a small acreage of federal and non-federal lands would be affected. It is more likely that production of immature and mature lowland and upland coniferous habitat that benefits gray wolf cover would occur on the non-federal lands if these lands are federally administered rather than under private ownership, although more gray wolf foraging habitat could be created on the non-federal lands under private ownership.

Determination

The Proposed Action and Alternative B **may impact individuals but are not likely to cause a trend to federal listing or loss of viability** for gray wolves. The No Action Alternative would have **no impact** to individual gray wolves.

Mitigation and Recommendations

Mitigation measures recommended for gray wolf would be primarily designed to reduce the likelihood of vehicle collisions with wolves by increasing visibility and improving wolf identification by employees. These include:

1. Reduce speed limits on Dunka Road and on haul roads.

2. Clear trees and shrubs along the inside of curves in Dunka Road to increase sight distance.
3. Promptly remove (within 48 hours of their discovery) any deer or moose killed by vehicles on Dunka Road and the haul roads to limit the likelihood of wolves feeding on carrion on or near the road. Carcasses should be taken at least one-quarter mile away from Dunka Road or the haul roads.
4. Provide site safety training on identification of gray wolves to contractors and employee who would drive on the haul road.
5. Report any vehicle collisions with gray wolves to the local Superior National Forest office. These reports shall include all known information regarding the incident, including the species involved, date of incident, fate of the animal (e.g., dead, injured), location of the carcass, geographic coordinates of the accident location, sex of the animal, and approximate age (i.e., adult, juvenile).

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APPENDIX A

Common and Scientific Names of Plants and Animals Given in this Biological Evaluation

Common Name	Scientific Name
Plants	
A Lichen	<i>Caloplaca parvula</i>
A Lichen	<i>Cetraria aurescens</i>
American Shoreweed	<i>Littorella uniflora</i>
American Waterawlwort	<i>Subularia aquatica</i>
Alpine Milkvetch	<i>Astragalus alpinus</i>
Appalachian Clubmoss	<i>Huperzia appalachiana</i>
Arctoparmelia Lichen	<i>Arctoparmelia centrifuga</i>
Arctoparmelia Lichen	<i>Arctoparmelia subcentrifuga</i>
Arrowhead	<i>Sagittaria latifolia</i>
Auricled Twayblade	<i>Listera auriculata</i>
Balsam Fir	<i>Abies balsamea</i>
Barren Strawberry	<i>Waldsteinia fragariodes</i>
Basswood	<i>Tilia americana</i>
Beaked Hazel	<i>Corylus cornuta</i>
Beard Lichen	<i>Usnea longissima</i>
Black Ash	<i>Fraxinus nigra</i>
Black Spruce	<i>Picea mariana</i>
Blueberry	<i>Vaccinium angustifolium</i>
Bog Birch	<i>Betula pumila</i>
Bog Labrador-tea	<i>Ledum groenlandicum</i>
Bog Muhly	<i>Muhlenberia uniflora</i>
Bog Rosemary	<i>Andromedia polifolia</i>
Bog White Violet	<i>Viola lanceolata</i>
Braun's Holly Fern	<i>Polystichum braunii</i>
Bullrush	<i>Scirpus</i> sp.
Canada Bluejoint	<i>Calamagrostis canadensis</i>
Canada Ricegrass	<i>Piptatherum canadense</i>
Canada Yew	<i>Taxus canadensis</i>
Cartilage Lichen	<i>Ramalina thrausta</i>
Cattail	<i>Typha</i> spp.
Chilean Sweet-cicely	<i>Osmorhiza berteroi</i>
Cloudberry	<i>Rubus chamaemorus</i>
Clubmoss	<i>Lycopodium</i> spp.
Common Moonwort	<i>Botrychium lunaria</i>
Creeping Rush	<i>Juncus subtilis</i>
Creeping Snowberry	<i>Gaultheria hispidula</i>
Douglas' Hawthorn	<i>Crataegus douglasii</i>

APPENDIX A (Cont.)

Common and Scientific Names of Plants and Animals Given in the Report

Common Name	Scientific Name
Plants (Cont.)	
Dwarf Bilberry	<i>Vaccinium cespitosum</i>
Eastern White Pine	<i>Pinus strobus</i>
Encrusted Saxifrage	<i>Saxifraga paniculata</i>
Fairy Slipper	<i>Calypso bulbosa</i>
Fan Lichen	<i>Peltigera venosa</i>
Floating Marsh Marigold	<i>Caltha natans</i>
Honeycombed Lichen	<i>Menegazzia terebrata</i>
Jack Pine	<i>Pinus banksiana</i>
Lanceleaf Grapefern	<i>Botrychium lanceolatum</i> var. <i>angustisegmentum</i>
Largeleaf Sandwort	<i>Moehringia macrophylla</i>
Least Moonwort	<i>Botrychium simplex</i>
Leatherleaf	<i>Chamaedaphne calyculata</i>
Leiberg's Waterlily	<i>Nymphaea leibergii</i>
Linear-leaved Sundew	<i>Drosera linearis</i>
Little Goblin Moonwort	<i>Botrychium mormo</i>
Long-leaved Arnica	<i>Arnica lonchophylla</i>
Maidenhair Spleenwort	<i>Asplenium trichomanes</i>
Michigan Moonwort	<i>Botrychium michiganense</i>
Moor Rush	<i>Juncus stygius</i>
Moschatel	<i>Adoxa moschatellina</i>
Narrow-leaved Cattail	<i>Typha latifolia</i>
New England Sedge	<i>Carex novae-angliae</i>
Nodding Saxifrage	<i>Saxifraga cernua</i>
Northern White Cedar	<i>Thuja occidentalis</i>
Oakes' Pondweed	<i>Potamogeton oakesianus</i>
Pale Moonwort	<i>Botrychium pallidum</i>
Paper Birch	<i>Betula papyrifera</i>
Peppered Moon Lichen	<i>Sticta fuliginosa</i>
Pussywillow	<i>Salix discolor</i>
Quill Spikerush	<i>Eleocharis nitida</i>
Ram's Head Lady Slipper	<i>Cypripedium arietinum</i>
Raspberry	<i>Rubus</i> spp.
Red Oak	<i>Quercus rubra</i>
Red-osier Dogwood	<i>Cornus stolonifera</i>
Red Pine	<i>Pinus resinosa</i>
Roughfruit Fairybells	<i>Prosartes trachycarpa</i>
Scotch False Asphodel	<i>Tofieldia pusilla</i>

APPENDIX A (Cont.)

Common and Scientific Names of Plants and Animals Given in the Report

Common Name	Scientific Name
Plants (Cont.)	
Sedge	<i>Carex</i> spp.
Selwyn's Scalewort	<i>Frullania selwyniana</i>
Shining Clubmoss	<i>Lycopodium lucidulum</i>
Short Sedge	<i>Carex rossii</i>
Small Beggarticks	<i>Bidens discoidea</i>
Small-fruited Bog Cranberry	<i>Vaccinium oxycoccus</i>
Smooth Woodsia	<i>Woodsia glabella</i>
Snowline Wintergreen	<i>Pyrola minor</i>
Sphagnum Moss	<i>Sphagnum</i> spp.
Speckled Alder	<i>Alnus rugosa</i>
Sticky Locoweed	<i>Oxytropis borealis</i> var. <i>viscida</i>
Sugar Maple	<i>Acer saccharum</i>
Tamarack	<i>Larix laricina</i>
Ternate Grapefern	<i>Botrychium rugulosum</i>
Three-seeded Bog Sedge	<i>Carex trisperma</i>
Three-leaved False Solomon's Seal	<i>Smilacia trifolia</i>
Trembling Aspen	<i>Populus tremuloides</i>
Triangle Grapefern	<i>Botrychium lanceolatum</i>
Wain's Cup Lichen	<i>Cladonia wainioi</i>
Western Jacob's-ladder	<i>Polemonium occidentale</i> ssp. <i>lacustre</i>
White Pine	<i>Pinus strobus</i>
White Spruce	<i>Picea glauca</i>
Wild Rice	<i>Zizania</i> spp.
Willow	<i>Salix</i> spp.
Woolgrass	<i>Scirpus cyperinus</i>
Yellow Specklebelly	<i>Pseudocyphellaria crocata</i>
Animals	
Bald Eagle	<i>Haliaeetus leucocephalus</i>
Bay-breasted Warbler	<i>Dendroica castanea</i>
Beaver	<i>Castor canadensis</i>
Big Brown Bat	<i>Eptesicus fuscus</i>
Black Sandshell	<i>Ligumia recta</i>
Boreal Owl	<i>Aegolius funereus</i>
Brown-headed Cowbird	<i>Molothrus ater</i>
Canada Lynx	<i>Lynx canadensis</i>
Common Raven	<i>Corvus corax</i>
Connecticut Warbler	<i>Oporornis agilis</i>

APPENDIX A (Cont.)

Common and Scientific Names of Plants and Animals Given in the Report

Common Name	Scientific Name
Animals (Cont.)	
Creek Heelsplitter	<i>Lasmigona compressa</i>
Eastern Heather Vole	<i>Phenacomys ungava</i>
Eastern Red Bat	<i>Lasiurus borealis</i>
Ebony Boghaunter	<i>Williamsonia fletcheri</i>
Fisher	<i>Martes pennanti</i>
Freija' Grizzled Skipper	<i>Pyrgus centaureae freija</i>
Gray Wolf	<i>Canis lupus</i>
Great Gray Owl	<i>Strix nebulosa</i>
Great Horned Owl	<i>Bubo virginianus</i>
Headwaters Chilostigman Caddisfly	<i>Chilostigma itasca</i>
Hoary Bat	<i>Lasiurus cinereus</i>
Moose	<i>Alces alces</i>
Lake Sturgeon	<i>Acipenser fulvescens</i>
Little Brown Myotis	<i>Myotis lucifugus</i>
Nabokov's Blue	<i>Plebejus idas nabokovi</i>
Nipigon Cisco	<i>Coregonus nipigon</i>
Northern Brook Lamprey	<i>Ichthyomyzon fossor</i>
Northern Goshawk	<i>Accipiter gentilis</i>
Northern Long-eared Bat	<i>Myotis septentrionalis</i>
Olive-sided Flycatcher	<i>Contopus cooperi</i>
Passenger Pigeon	<i>Ectopistes migratorius</i>
Quebec Emerald	<i>Somatochlora brevicincta</i>
Raccoon	<i>Procyon lotor</i>
Red-tailed Hawk	<i>Buteo jamaicensis</i>
Ruffed Grouse	<i>Bonasa umbellus</i>
Shortjaw Cisco	<i>Coregonus zenithicus</i>
Silver-haired Bat	<i>Lasionycteris noctivagans</i>
Snowshoe Hare	<i>Lepus canadensis</i>
Spruce Budworm	<i>Choristoneura fumiferana</i>
Taiga Alpine	<i>Erebia mancinus</i>
Three-toed Woodpecker	<i>Picoides tridactylus</i>
Tri-colored Bat	<i>Perimyotis subflavus</i>
White-tailed Deer	<i>Odocoileus virginianus</i>
Wood Turtle	<i>Glyptemys insculpta</i>