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Forest Service

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Draft Environmental Impact Statement

Federal Hardrock Mineral Prospecting Permits

Superior National Forest
Cook, Lake, St. Louis, Koochiching Counties, Minnesota

Federal Hardrock Mineral Prospecting Permits
Draft Environmental Impact Statement
Cook, Lake, St. Louis, Koochiching Counties, Minnesota

Lead Agency:	**USDA Forest Service**
Cooperating Agencies:	**Bureau of Land Management**
Responsible Officials:	**James W. Sanders, Forest Supervisor** **8901 Grand Avenue Place** **Duluth, MN 55808** **Steven Wells, Deputy State Director** **626 East Wisconsin Avenue, Suite 200** **Milwaukee, WI**
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Abstract: The Superior National Forest (SNF) proposes to provide recommendations to the Bureau of Land Management (BLM) for the issuance of 33 federal hardrock mineral prospecting permits, (including the extension of one prospecting permit for four years), and 21 operating plans and the associated special use permits needed for access and road construction. This action is needed, because Federal law and mineral regulations state that when the BLM receives applications to explore for minerals on National Forest lands, they must coordinate with the Forest Service to complete the required environmental documentation prior to permit approval. The DEIS also includes analysis of predicted effects from future applications and operating plans forest-wide. This analysis may be tiered to, supplemented or adopted for future environmental documents and decisions for future prospecting permit applications and operating plans. The area affected by the proposal includes all federal owned lands over federally owned mineral rights within the boundary of the SNF excluding areas not open for mineral prospecting. One issue that drove analysis of alternatives was identified during scoping, the impact of noise from prospecting activities on recreationists and nearby residences. Three action alternatives were developed to address the noise issue. These were analyzed in detail along with the proposed action and the no action. The agency preferred alternative is Alternative 4.

It is important that reviewers provide their comments at such times and in such a way that they are useful to the Agency's preparation of the EIS. Therefore, comments should be provided prior to the close of the comment period and should clearly articulate the reviewer's concerns and contentions. The submission of timely and specific comments can affect a reviewer's ability to participate in subsequent administrative review or judicial review. Comments received in response to this solicitation, including names and addresses of those who comment, will be part of the public record for this proposed action. Comments submitted anonymously will be accepted and considered; however, anonymous comments will not provide the respondent with standing to participate in subsequent administrative or judicial reviews.

Send Comments to:	**James Sanders, Forest Supervisor** **re: Prospecting Permit DEIS** **8901 Grand Avenue Place** **Duluth MN 55808**
Date Comments Must Be Received:	**45 days from the date of publication in the Federal Register**

Summary

The presence and abundance of metal mineralization in northeastern Minnesota, primarily iron ores, has been known and mined for well over 120 years and has played a pivotal role in the development of local communities in the region. More recently, other base and precious metals have been targeted for exploration. Exploratory drilling, such as the proposed project, is done to determine if an ore body exists and if so, the extent and location of ores.

Purpose and Need for Action

The BLM has received applications to conduct mineral exploration drilling and geophysical activities on federally owned minerals on the Superior National Forest which would collect geologic information and drill core samples used to find, analyze, and map the presence and extent of minerals. These explorations would target metals such as copper, nickel, lead, zinc, cobalt, chromium, iron, titanium, platinum, palladium, silver, gold and other associated metals. The applications are approximately located across a northeast trending arc (Map 1) along the base of the Duluth Complex, a geologic formation in northeastern Minnesota.

According to Federal law and mineral policy, when the BLM receives applications to explore for minerals on National Forest System lands, they must evaluate the applications in conjunction with the Forest Service and coordinate the required environmental documentation prior to permit approval. As the lead agency, the Forest Service must complete an environmental analysis to decide whether to consent to issuing prospecting permits and operating plans; and if the agency consents, the stipulations under which those permits and plans may operate. The decision to consent will be based on two criteria:

- Whether the exploration of mineral resources can be conducted in an environmentally sound manner (Forest Plan D-MN-2, page 2-9) and in compliance with the stipulations on the permits and operating plans; and
- Whether the exploration of mineral resources is consistent with the goals and objectives and standards defined in the Forest Plan, and applicable law, regulation and policy.

See Table 2 for a list of current permit applications.

This project will analyze both the potential effects of applications currently under consideration, and the potential effects of mineral prospecting activity anticipated over the next twenty years. Future applications and operating plans would require some level of environmental documentation that would tier to, supplement or adopt this analysis.

Proposed Action

Based on the analysis in this (EIS), the Superior National Forest (SNF) proposes to provide consent to the Bureau of Land Management (BLM) for the issuance of 32 federal hardrock mineral prospecting permits (including the extension of one prospecting permit for four years) to DMC (USA) LLC (DMC), Twin Metals Minnesota LLC (Twin Metals), Lehmann Exploration Management Inc. (Lehmann Exploration), Encampment Resources LLC (Encampment), and Prime Meridian Resources Inc. (Prime Meridian), and 21 operating plans and the associated special use permits needed for access and road construction to DMC, Twin Metals, and Lehmann Exploration.

Decisions to be Made

The Forest Service is the lead agency for this EIS and the BLM is a cooperating agency. As a cooperating agency, the BLM will adopt the EIS to support their own Record of Decision (ROD). Federal laws and policies will be outlined in the EIS that will require the SNF, as the agency managing the surface, and the BLM, as the agency responsible for managing sub-surface minerals resources, to consider in the prospecting permit applications and operating plans. The responsible official for the BLM, the Eastern States Deputy State Director, will decide in a Record of Decision, whether to approve pending hardrock prospecting permits and associated operating plans based on the Forest Service consent with stipulations.

Based on the purpose and need, the Responsible Official for the Forest Service; who for this project is the Forest Supervisor of the Superior National Forest; reviews the proposed action, the other alternatives, and the environmental consequences in order to make the following decisions:

- What recommendations and resource protection stipulations will be provided to the Regional Forester so that he may advise the BLM whether the Forest Service will allow: (a) 32 federal hardrock mineral prospecting permits to be issued to Lehmann Exploration, Twin Metals, DMC, and Encampment Resources and their four-year permit extensions, and (b) one four-year prospecting permit extension to Lehmann Exploration. See Table 3 for a list of these permit applications and extension application.
- What direction will be provided to the BLM including resource protection stipulations required for 21 operating plans associated with prospecting permit applications and the extension application. See Table 5 and Table 6 for a listing of these operating plans.
- What resource protection measures will be required by the Forest Service for special use and occupancy authorizations for off-prospecting permit area activities associated with the 21 operating plans. See Table 5 - Table 6 for a listing of these operating plans.
- What resource protection stipulations will be required by the Forest Service for the BLM to issue future prospecting permits, permit extensions, and operating plans in the project area.
- What resource protection measures will be required by the Forest Service for the protection of surface resources under special use and occupancy authorizations for access, construction, or use and protection of existing roads for future operating plans.

No decision will be made on future prospecting permit applications, operating plans or special use authorizations until such a proposal is received. Decisions on future prospecting permit applications, operating plans and special use permits associated with operating plans would adopt, tier to, or supplement this EIS. Future prospecting permit applications, operating plans and special use permits associated with operating plans would be subject to notice, comment and appeal (except for projects where NEPA compliance may be completed with a Categorical Exclusion).

If a mineral lease application is proposed in the future as a result of exploration, additional environmental analysis and permitting would be required. Also, if a lease is issued and a mine is later proposed, another environmental analysis and permit would be required by the FS, BLM, and State of Minnesota. Therefore, these will not be included in this analysis since these actions may or may not be proposed in the future and are not ripe for a decision. Future mining is highly speculative and not reasonably foreseeable at the mineral exploration stage. The proposed activities are for exploration (rather than mine development) because there is not enough information at this time to reliably indicate where and how mining would occur, what would be mined or when it would take place. Therefore, effects to the human environment from mine development would not be meaningfully evaluated.

Scoping

The Notice of Intent (NOI) was published in the Federal Register on December 19, 2008. A scoping package was sent to interested individuals, agencies, Tribes, affiliations, organizations and federal, state and local government agencies on April1, 2009. The SNF received comments regarding the potential social impacts on local landowners, summer home visitors, Boundary Waters Canoe Area Wilderness (BWCAW) visitors and winter use enthusiasts. Other comments focused on potential impacts to the land, water resources, Tribal rights, social and economic impacts, vegetation, soils, wildlife and access. Commenters were also concerned about pollution, the processes used in exploration activities, and the potential for future mineral development. Other comments focused on the administrative side of permitting, such as appropriateness of current environmental laws and regulations and Forest Plan policies. Many highlighted the positive economic and social benefits of mineral exploration. Others were concerned about the adequacy of the analysis and the scope of the project.

Issues and Alternatives

The SNF identified noise as the sole issue that drove the formation of the alternatives, i.e., noise from drilling and exploration activities may degrade visitor experience and local landowner quality of life. The other issues, concerns and suggestions were considered in the analysis and addressed as necessary in the EIS, specialist reports or project file.

The issue of noise led the agency to develop the following alternatives to the no-action alternative and the proposed action:

- Alternative 3- Noise reduction in the entire project area regardless of season or location. Noise abatement methods would be developed by the permittees that would decrease noise at the source by 10 to 15 decibels.
- Alternative 4 –The intent of the alternative is to allow for drilling activities to occur across the project area but reduce noise levels emanating from drilling locations and provide for reduced target decibel levels at key receptors. Reduce sound levels reaching receptors to 30 dBA inside the BWCAW, 50 dBA for developed campgrounds, campsites, recreation residences and the Semi-Primitive Non Motorized MA, and 60 dBA for the Semi-Primitive Motorized MA.
- Alternative 5 - Drilling exploration and other project activities would be restricted to occur only from November 1 through April 30, to reduce impact to private residences and heavier summer recreation use periods. Alternative 5 also includes noise abatement measures such as baffles and exhaust extensions as described in Alternative 3.

Potential impacts by resource

Effects would be very similar under all action alternatives (2-5) for the following resources, except where noted otherwise.

Vegetation, soils, and water

Exploration activities would be well below one percent of the project area that could be potentially directly impacted. Implementation of stipulations, Forest Plan standards and guidelines and/or BMPs would result in minimal direct impacts to those acres.

The proposed drilling activity with the prescribed project design features described in section 2.4.3.9 is not anticipated to have a noticeable effect on the quality or quantity of the groundwater resource. The activity should not impact the potability of the groundwater or the production capacity of existing water supply wells.

Vegetation disturbed during prospecting activities is expected to naturally revegetate within one to two growing seasons. Direct and indirect effects to landtype ecosystem (LE) species composition and age class distribution would be very minimal if even measurable at the LE scale. There would be a slight risk of increasing NNIS infestations, but due to the small percentage of disturbance, the risk is minimal.

Air quality

The activities included in the project description are not expected to generate enough particulate matter to threaten the NAAQS or threaten sensitive receptors. Drilling activity only affects air quality over a short distance downwind and for only a few days or weeks depending on the phase of the drilling project. After the drilling is complete there is no longer any affect on air quality. Due to the short duration and minimal effects anticipated, no cumulative effects are expected.

Regional Forester's Sensitive species

For RFSS plants the determination in the BE is "May impact individuals but not likely to cause a trend to Federal listing or loss of viability". Ground disturbance associated with the project, including temporary road construction/reconstruction, drill pad construction, and drilling activities, could impact suitable habitat for RFSS plants. Resource stipulations specify that RFSS plant surveys would be conducted in suitable habitat before project activities take place, and that project operations would avoid known RFSS plant occurrences. These resource stipulations would help minimize impacts to RFSS plants.

The increase in temporary roads may increase human disturbance of terrestrial sensitive wildlife species. Surveys and protection of known locations would reduce impacts to individuals. The proposed actions *May impact individuals of sensitive species but not likely to cause a trend to Federal listing or loss of viability* of their populations. Change in habitat age can benefit some species or negatively impact other species but effects will be short-term, locally limited, and are not expected to cause population decreases across the Superior National Forest.

Threatened and Endangered Species

There are no threatened and endangered plants or habitat within the project area (see Hardrock BE, project record).

The increase in temporary roads may increase human disturbance of lynx and wolves and could lead to increased mortality. Alternatives 2-5 may affect, and are likely to adversely affect individual lynx and wolf because of the potential for increased human disturbance as a result of increased temporary road miles. Alternatives 2-5 are not likely to adversely affect lynx or wolf critical habitat. Habitat changes and seasonal variation between action alternatives are not likely to adversely affect lynx and wolves.

The aquatic species determination is *May impact individuals but not likely to cause a trend to Federal listing or loss of viability*.

Boundary Waters Canoe Area Wilderness (BWCAW)

Effects to the natural quality of wilderness character would be minor or negligible due to stipulations and the limited effects of minerals exploration. Alternative 5 would have the lowest negative effect to opportunity for solitude, followed by Alternative 4, Alternative 3 and Alternative 2. There would be no effect to the untrammeled and undeveloped qualities of wilderness character.

Heritage resources

There would be no direct impact. Heritage resources within and immediately adjacent to drill sites and temporary roads will be buffered to avoid impact.

Roadless areas

Effects would be very small and would not affect Forest Plan inventoried roadless areas or RACR areas from consideration as roadless areas. No permits or operating plans are currently proposed within roadless areas.

Scenery

Forest openings created for prospecting would generally re-vegetate within one to two years and would also be similar in size, shape and edge characteristics to natural openings in the landscape. If drilling occurred on Birch Lake, drilling equipment and barges and associated boat traffic would be visible but would not impact scenery along the shoreline. If drilling occurred along the shoreline, the effects would be similar to those along a travelway. Effects to scenery would be minimal.

Local economics

Under the action alternatives, anticipated exploration and associated activities would provide a minimum of 8 jobs (direct, indirect, and induced) and $358,000 in labor income (direct, indirect, and induced) and a maximum of 20 jobs and $917,000 in labor income on an average annual basis within the analysis area. While minority and low-income populations may exist in the area, the alternatives are not expected to have a disproportionately high and adverse human health or environmental effects on these communities

Minerals and geology

During the drilling process, the drill core or chips are collected for later mineral, chemical, and other technical identification and analysis. Over the 20 years of exploration, the maximum amount of rock that may be removed from the prospecting permit drilling operating is 38,131 cubic yards of rock. This is assuming a standard bore hole PQ size (134 mm or 5.3 inch) as the maximum hole diameter and 1920 holes to a depth of 3500 feet. These samples are taken from the earth and not replaced. Therefore, it can be considered an irreversible and irretrievable commitment of the resource. Considering the vast amount of bedrock under the Superior NF, this amount is extremely small and would have no effect on the rock and mineral resources.

Roads

A total of up to 922 acres or 384 miles of temp road construction over 20 years may be constructed to access drill pads for prospecting. An estimated annual average of 19.2 miles per year for 20 years could be possible. This is based on assumptions listed in section 2.2.2.4

Comparison of alternatives by response to issues

The degree of impacts under each alternative would depend on the distance from drill site to receptor, and required mitigation measures. Of the action alternatives, Alternative 2 would have the highest negative impact to recreation receptors since drilling operations would not include noise mitigation measures. Alternative 3 would have lower impacts than Alternative 2 since mitigation would reduce emitted decibel levels and area affected. Alternative 5 would further reduce impacts from Alternative 3 by avoiding operations during the summer season during which the large majority of recreation activity occurs. Alternative 4 would reduce impacts to the greatest degree of the alternatives in some locations by requiring maximum limits for decibel levels at key recreation locations. In other areas without required maximum limits, Alternative 4 may have impacts similar to Alternative 2. Alternative 1 would have no impact since no sound from drilling or associated project activities would occur. See Table 11 for a comparison of alternatives by issue indicators.

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3. Location of proposed prospecting activities from current permit applications and operating plans. This is a set of 17maps maps- including an index map showing locations of drill holes and roads proposed
4. Mineral interest level map
5. Roadless Area Conservation Rule Areas map
6. Cumulative actions map (since this map is very large, it is not printed in this EIS. It is available on the web CD and by request hard copy only)
7. Recreation sites, wilderness entry points, and scenic integrity objective map

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Chapter 1 Purpose of and Need for Action

1.1 Document Structure

The Superior National Forest (SNF) has prepared this Environmental Impact Statement in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This Environmental Impact Statement (EIS) discloses the direct, indirect, and cumulative impacts that would result from the proposed action and alternatives. The document is organized into four chapters:

- *Chapter 1. Purpose and Need for Action:* The chapter includes information on the history of the project proposal, the purpose of and need for the project, the agency's proposal for achieving that purpose and need and the decision framework. This section also details how the SNF informed the public of the proposal and how the public responded.
- *Chapter 2. Alternatives, including the Proposed Action:* This chapter provides a more detailed description of the agency's proposed action as well as alternative methods for achieving the stated purpose. These alternatives were developed based on issues raised by the public and other agencies. This discussion also includes mitigation measures. Finally, this section provides a summary table of the environmental consequences associated with each alternative.
- *Chapter 3. Affected Environment and Environmental Consequences*: This chapter describes the environmental effects of implementing the proposed action and other alternatives. This analysis is organized by issue and resource.
- *Chapter 4. Consultation and Coordination, Glossary and References:* This chapter provides a list of preparers and agencies consulted during the development of the environmental impact statement, a list of technical terms and their definitions and a list of references used in the EIS.
- *Appendices:* The appendices provide more detailed information to support the analyses presented in the environmental impact statement.

Additional supporting documentation may be found in the project planning record located at the Supervisor's Office, Duluth, MN.

1.2 Background

The presence and abundance of metal mineralization in northeastern Minnesota, primarily iron ores, has been known and mined for well over 120 years and has played a pivotal role in the development of local communities in the region. More recently with improved technology and increased metal prices, other base and precious metals have been targeted for exploration in northeastern Minnesota and one mine is currently in the permitting stage. Some of these targets are federal hardrock minerals located on the Superior National Forest.

The authority to manage the exploration and development of federal hardrock mineral resources within National Forest System (NFS) lands is jointly shared between the Forest Service and BLM. The BLM has sole authority under the mineral leasing acts to issue prospecting permits, operating plans, and leases associated with all phases of exploration, development and extraction of subsurface federal hardrock minerals. However, on NFS lands, they cannot authorize such activities without Forest Service consent. The Superior National Forest is responsible for managing National Forest System (NFS) lands and has the authority for off-permit uses, such as facilities and roads that require special use permits. Two interagency agreements (IA) between the USDI BLM and USDA Forest Service (completed in 1984 and 1987)

provide policy and procedures in processing, approval, and supervision of leasable mineral operations including federal hardrock minerals on NFS lands as authorized by licenses, permits, and leases.

The United States Department of Agriculture (USDA) Forest Service is the lead agency for this EIS and the United States Department of the Interior (USDI), Bureau of Land Management (BLM) is a cooperating agency. A memorandum of understanding for this project between the agencies was signed on March 27, 2008. As a cooperating agency, the BLM will adopt this EIS to support its' own Record of Decision (ROD). The BLM will authorize prospecting permits and operating plans based on Forest Service consent decisions that include stipulations in this EIS or reject the applications due to unacceptable resource impacts.

The Eastern States-Milwaukee Field Office-Bureau of Land Management (BLM) has received 46 federal hardrock mineral prospecting permit applications, including one prospecting permit extension application located within the Superior National Forest from DMC (USA) LLC (DMC), Twin Metals Minnesota LLC (Twin Metals), Lehmann Exploration Management Inc. (Lehmann Exploration), Encampment Resources LLC (Encampment Resources), Prime Meridian Resources Inc. (Prime Meridian), and Park Creek Management Company (Park Creek). The DMC and Twin Metals applications were originally submitted by Duluth Metals Corp. and the company has since gone through restructuring. See Table 2 for a listing of how many applications have been submitted and from which company. In order for applications to be considered complete, they must include an exploration plan. Thirty-three of the applications are complete, and therefore eligible for prospecting permits. Of the 33 complete applications, 21 also have operating plan proposals. In order for applications to be considered complete, they must include an exploration plan. Only 33 of the applications are complete enough for the agencies to issue prospecting permits. Of the 33 complete applications, 21 also have operating plan proposals.

A federal hardrock mineral prospecting permit gives the permittee the exclusive right to prospect on and explore for minerals within the permit area. The applications target copper, nickel, lead, zinc, cobalt, chromium, iron, titanium, platinum, palladium, silver, gold and other associated metals. The applications are located across an approximately northeast trending arc (Map 1) along the base of the Duluth Complex, a geologic formation in northeastern Minnesota (Figure 19).

Overall, operations would consist of drilling, geophysical surveys, geologic mapping, soil and rock chip geochemical surveys and access road reconstruction and construction.

The EIS includes analysis of predicted effects from future applications and operating plans forest-wide. Future environmental documents, decisions for future prospecting permit applications, and operating plans not covered by this decision may be tiered to, supplement or adopt it.

If a mineral lease[1] application is proposed in the future as a result of exploration, additional environmental analysis and permitting would be required. Also, if a lease is issued and a mine[2] is later proposed, another environmental analysis and permits would be required by the FS, BLM, and State of Minnesota. Therefore, these will not be included in this analysis since these actions may or may not be proposed in the future and are not ripe for a decision. Future mining is highly speculative and not reasonably foreseeable at the mineral exploration stage. The proposed activities are for exploration (rather than mine development) because there is not enough information at this time to reliably indicate where and how mining would occur, what would be mined or when it would take place. Therefore, effects to the human environment from mine development would not be meaningfully evaluated.

[1] A lease is issued to holders of prospecting permits who, during the term of the permit, demonstrate the discovery of a valuable deposit of the leasable mineral for which BLM issued the permit.
[2] A mine is an underground excavation or open-pit working for the extraction of mineral deposits.

The United States Department of Agriculture (USDA) Forest Service is the lead agency for this EIS and the United States Department of the Interior (USDI), Bureau of Land Management (BLM) is a cooperating agency. A memorandum of understanding for this project between the agencies was signed on March 27, 2008. The authority to manage the exploration and development of federal hardrock mineral resources within National Forest System (NFS) lands is jointly shared between the Forest Service and BLM. The administration of activities under the mineral leasing acts is primarily the responsibility of the BLM; but on NFS lands, they cannot approve such activities without Forest Service consent. As a cooperating agency, the BLM will adopt this EIS to support its' own Record of Decision (ROD). The BLM will authorize or reject prospecting permits and operating plans based on the Forest Service consent decision and stipulations in this EIS.

1.3 Project Area

The project area is comprised of all NFS lands with subsurface federal hardrock minerals within the boundary of the SNF excluding areas withdrawn from mineral entry by the Forest (Forest Plan p. 2-9, 3-19). Lands withdrawn from mineral entry are: the Boundary Waters Canoe Area Wilderness (BWCAW), Mining Protection Areas (MPAs) (Forest Plan p. 2-9), and Pigeon River Wild River Segments (WRS) (Forest Plan p. 3-19; also See Map 2). SNF lands with non-federal minerals such as private, county, and state are not included in the project area and not part of the proposed actions. The project area totals approximately 470,479 acres.

The project area is approximately 20 percent of the SNF managed lands minus the lands withdrawn from mineral entry. In addition, the project area is approximately 39 percent of the SNF managed lands within the forest boundary (see table below).

Table 1. Ownership and management status of lands within the project area

Land Descriptions	Area (acres)
SNF managed lands minus lands withdrawn from mineral entry	2,445,609
SNF managed lands within the forest boundary minus lands withdrawn from mineral entry	1,214,976
Non-federal lands within the boundary of the SNF minus lands withdrawn from mineral entry	1,230,633
SNF managed lands with federal minerals within the boundary of the SNF minus lands withdrawn from mineral entry	470,497
SNF managed lands with non-federal minerals within the boundary of the SNF minus lands withdrawn from mineral entry	744,479

Direct and indirect effects analysis on current and future prospecting permits and operating plans will apply only to SNF lands with subsurface federal hardrock minerals. However, cumulative effects analysis will take into consideration actions occurring on other ownerships such as state, country, and private lands.

There are known mineral deposits scattered along the base of the Duluth Complex from approximately ten miles south of the town of Hoyt Lakes to an area northeast of Birch Lake and the South Kawishiwi River (approximately ten miles southeast of the town of Ely). For this analysis, the term Duluth Complex will include other related rock units such as the Beaver Bay Complex. Areas outside of the Duluth Complex are expected to have a lower mineral interest (potential). See Map 4 depicting potential areas of mineral interest.

Of note, drilling activity from a barge or atop the ice on a lake or river is not considered in the direct and indirect effects analysis for this EIS. However, the cumulative effects analysis did take drilling atop water into consideration. This activity was not proposed in the current prospecting permit applications or operating plans and is uncommon. If such proposal is submitted it will be considered in a future analysis.

1.4 Purpose and Need for Action

The BLM has received applications to conduct federal hardrock mineral exploration drilling and geophysical activities on the Superior National Forest which would collect geologic information and drill core samples used to find, analyze, and map the presence and extent of minerals. According to Federal law and mineral policy, when the BLM receives applications to explore for federal hardrock minerals on National Forest System lands, they must evaluate the applications in conjunction with the Forest Service and coordinate the required environmental documentation prior to permit approval. As the lead agency, the Forest Service must complete an environmental analysis to decide whether to consent to issuing prospecting permits and operating plans; and if the agency consents, the stipulations under which those permits and plans may operate. The decision to consent will be based on two criteria:

- Whether the exploration of federal hardrock mineral resources can be conducted in an environmentally sound manner (Forest Plan D-MN-2, page 2-9) and in compliance with the stipulations on the permits and operating plans; and
- Whether the exploration of federal hardrock mineral resources is consistent with the goals and objectives and standards defined in the Forest Plan, and applicable law, regulation and policy.

See Table 2 for a list of current permit applications.

The Superior National Forest must conduct this environmental analysis in order to provide a timely response to the BLM on current and anticipated applications for federal hardrock mineral exploration. This project will analyze both the potential effects of applications currently under consideration, and the potential effects of mineral prospecting activity anticipated over the next twenty years. Future applications and operating plans would require some level of environmental documentation that would tier to, supplement or adopt this analysis.

1.4.1 Analysis of the effects to the environment from submitted federal hardrock prospecting permits and operating plans

Twenty one federal hardrock mineral operating plans have been submitted to the BLM (located in the project file at the SNF Headquarters Office in Duluth, MN and posted on the SNF website at www.fs.usda.gov/goto/superior/projects) provide detailed locations of proposed drill pads, drill holes, temporary roads needed for access and other details. For a summary of these plans see Table 4 and Table 5 and Map 3). In addition, 33 complete prospecting permit applications have been submitted.

Operating plan and prospecting permit application consideration includes:

- Analyzing the effects to the environment from implementation of operating plans as submitted.
- Determining whether the Forest Service proposed resource protection measures (stipulations) listed in Section 2.4 that apply to all action alternatives for federal hardrock prospecting permits and operating plans are adequate, or if any need to be added or changed based on site specific locations. These measures would be included in the Forest Service's consent to the BLM for approval of the prospecting permits and operating plans. Protection measures would also apply to special use permits.

1.4.2 Analysis of predicted federal hardrock prospecting permit applications and associated operating plans

This analysis includes:

- Analyzing the effects to the environment that may arise from anticipated future federal hardrock prospecting permit applications submitted over the next five years and issuance of future operating plan activities associated with those permit applications.
- Defining the stipulations that would be included in the Forest Service's consent to the BLM for approval of the federal hardrock prospecting permits and operating plans. The stipulations include terms and conditions for the protection of surface resources, and for access, construction, or use of existing roads.
- Analyze effects of related mineral special uses located outside of federal hardrock prospecting permit areas (off-permit areas) that may arise when permits and operating plans are approved and issued. These activities will be administered under Forest Service Special Use Permits. This includes the need to evaluate the effects from road construction and road reconstruction on off-permit areas. Although specific proposals have not been made, estimates will be made regarding access needs to sites based on previous experience.

Table 2. Federal hardrock mineral prospecting permit applications and operating plans submitted to the Bureau of Land Management as of September 2010, for this project

Company	Complete Prospecting Permit Applications Received (with exploration plans)	Incomplete Prospecting Permit Applications Received (without exploration plans)	Operating Plans Received
Encampment Resources	10	1	0
Lehmann Exploration	5 plus 1 extension	0	5 plus 1 extension
DMC	10	0	10
Twin Metals	5	0	5
Prime Meridian	2	0	0
Park Creek	0	12	0
Total	33(including 1 extension)	13	21 (including 1 extension)

1.5 Proposed Action

The Superior National Forest (SNF) proposes to allow the Bureau of Land Management (BLM) to issue 33 federal hardrock mineral prospecting permits, including the extension of one prospecting permit for four years, and 21 operating plans and the associated special use permits needed for access and road construction. This EIS will also analyze the predicted effects of future federal hardrock mineral permit applications and their potential four-year permit extensions and operating plans and the associated special use permits needed for access on a forest-wide basis for the next 20 years. See the description of the proposed action in chapter 2 for more specifics.

This EIS will also analyze the predicted effects of future permit applications and their potential four-year permit extensions and operating plans and the associated special use permits needed for access on a forest-wide basis for the next 20 years. See the description of the proposed action in chapter 2 for more specifics.

1.5.1 Federal Hardrock Mineral Prospecting Permits

The proposed action (as described in alternative 2) in chapter 2, section 2.2.2 would allow the BLM to issue permits for 33 federal hardrock mineral prospecting permit applications and one four-year permit extension as described in Table 2. Thirteen permit applications without exploration plans are incomplete and will be considered under future anticipated prospecting actions. The following table lists the 33 complete prospecting applications organized by company name, permit application numbers and acreage covered by each application.

Table 3. Federal hardrock mineral prospecting permit and permit extension application numbers and acres covered by permit

Company	Application Permit #	Acres
Lehmann Exploration	MNES 052446 (permit extension application)	774.18
	MNES 053731	596.23
	MNES 054387	1294.53
	MNES 055301	153.20
	MNES 055302	159.50
	MNES 055306	165.05
Encampment Resources	MNES 053462	2,423.96
	MNES 053463	2,060.95
	MNES 053464	2,345.04
	MNES 053465	2,305.11
	MNES 053466	1,675.28
	MNES 053564	2,117.24
	MNES 053565	1,640.00
	MNES 053566	1,898.76
	MNES 054209	1,176.81
	MNES 054233	480.00
DMC	MNES 053868	2,400.00
	MNES 054037	2,400.00
	MNES 054218	320.00
	MNES 054366	2,560.00
	MNES 054367	2,560.00
	MNES 054368	1,280.00
	MNES 054385	119.00
	MNES 055203	1,289.00
	MNES 055205	1,040.00
	MNES 055206	2,560.00
Twin Metals	MNES 054050	227.00
	MNES 054194	1,920.00
	MNES 054195	2,080.00
	MNES 054196	1,160.00
	MNES 055305	320.00
Prime Meridian	MNES 054045	360.00
	MNES 054217	360.00
Total acres, all permit application areas		44,220.84

1.5.2 Federal Hardrock Mineral Operating Plans

Three companies have submitted 21federal hardrock operating plans (including 1 operating plan for a prospecting permit extension application) described in Table 4 below. Overall, prospecting operations would consist of drilling, geophysical surveys, geologic mapping, soil and rock chip geochemical surveys

and access road reconstruction and construction. Site specific locations of drill pads and access roads have been identified in the operating plans. See Table 4 for a list of each operating plan and associated activity. Operating plans as submitted by the companies are located in the project file and are available for public review. These plans are also available on the SNF website at www.fs.usda.gov/goto/superior/projects, CD, and for hardcopies by request. These plans are quite lengthy and so are not included in the EIS. See section 2.1.1 for a description of typical minerals activities that may be included under these operating plans.

Table 4. Summary of federal hardrock mineral operating plans and associated activity by company

	DMC	Lehmann	Twin Metals	Totals
Maximum Size of Drill Pads (feet)	100'x100'	75"x75'	100'x100'	N/A
Number of Operating Plans	10	6	5	21
Number of Drill Pads	60	21	11	92
Total Acres of Disturbance	36.4	13.3	2.7	52.4
Miles of Temporary Roads Alt 2	9.47	3.5	1.33	14.3
Helicopter Operations	0	0	1	0
Number of Barge landings	0	8	0	8
Geophysical Surveying	Yes	Yes	Yes	N/A

1.5.3 Future Federal Hardrock Mineral Prospecting Permits and Operating Plans

A maximum exploration scenario for 20 years was described in the scoping package and has been modified slightly (section 2.2.2.4) based on further consideration by the BLM and SNF. This modification and additional details that apply to and further refine this alternative include BLM and Forest Service administrative stipulations (in section 2.4.1 and 2.4.2), resource stipulations, Forest Plan standard and guidelines (section 2.4.3), and operating assumptions (2.2.2.3); which can be found in their respective sections.

The BLM may grant permit extensions of 4 years for federal hardrock mineral prospecting permits (BLM regulations 43 CFR section 3505.61) if the permittee explored with reasonable diligence and was unable to determine the existence and workability of a valuable deposit covered by the permit (43 CFR section 3505.62).

1.6 Changes to the Proposed Action

Three alterations have been made to the proposed action described in the scoping package:

- James W. Sanders, Forest Supervisor, is dropping mineral bulk sampling from the proposed action and all associated potential alternatives based on further recommendations from the BLM. Any future bulk mineral sampling operating plan proposals will be considered under new and separate NEPA analyses.
- Mr. Sanders is adding one four-year prospecting permit extension for Lehmann Exploration because it was received from the company in time to be considered in the environmental analysis process for

this project; is consistent with the scope of the proposed action described in the project scoping letter; and fits within the decision framework.

- Mr. Sanders is also recognizing potential four-year permit extensions to existing 45 current permit applications and to future permit applications made within 5 years following the decision.

1.7 Decision Framework

The authority to grant prospecting permits and associated operating plans lies within the USDI BLM. However, the Forest Service must evaluate the project area for environmental impacts as described under the National Environmental Policy Act (NEPA). The Forest Service will utilize this EIS analysis to administratively determine whether prospecting is consistent with the purposes for which the land was acquired or is currently managed. The Forest Service will provide direction to the BLM regarding whether the prospecting should be permitted or denied and with what resource protection stipulations. The Forest Service will also provide direction to the BLM regarding what resource protection stipulations are required for operating plans associated with prospecting permits.

1.7.1 Forest Service Decisions

Based on the purpose and need, the Responsible Official for the Forest Service; who for this project is the Forest Supervisor of the Superior National Forest; reviews the proposed action, the other alternatives, and the environmental consequences in order to make the following decisions:

- What recommendations and resource protection stipulations will be provided to the Regional Forester so that he may advise the BLM whether the Forest Service will allow: (a) 32 federal hardrock mineral prospecting permits to be issued to Lehmann Exploration, Twin Metals, DMC, and Encampment Resources and their four-year permit extensions, and (b) one four-year prospecting permit extension to Lehmann Exploration. See Table 3 for a list of these permit applications and extension application.
- What direction will be provided to the BLM including resource protection stipulations required for 21 operating plans associated with prospecting permit applications and the extension application. See Table 5 and Table 6 for a listing of these operating plans.
- What resource protection measures will be required by the Forest Service for special use and occupancy authorizations for off-prospecting permit area activities associated with the 21 operating plans. See Table 5 - Table 6 for a listing of these operating plans.
- What resource protection stipulations will be required by the Forest Service for the BLM to issue future prospecting permits, permit extensions, and operating plans in the project area.
- What resource protection measures will be required by the Forest Service for the protection of surface resources under special use and occupancy authorizations for access, construction, or use and protection of existing roads for future operating plans.

No decision will be made on future prospecting permit applications, operating plans or special use authorizations until such a proposal is received. Decisions on future prospecting permit applications, operating plans and special use permits associated with operating plans would adopt, tier to, or supplement this EIS. Future prospecting permit applications, operating plans and special use permits associated with operating plans would be subject to notice, comment and appeal (except for projects where NEPA compliance may be completed with a Categorical Exclusion).

1.7.2 BLM Decisions

As a cooperating agency, the BLM will adopt the EIS to support their own Record of Decision. Federal laws and policies will be outlined in the EIS that will require the SNF, as the agency managing the surface, and the BLM, as the agency responsible for managing sub-surface minerals resources, to consider

the federal hardrock mineral prospecting permit applications and associated operating plans. The responsible official for the BLM, the Deputy State Director, will decide in a Record of Decision, whether to approve prospecting permit applications and associated operating plans based on the SNF recommendations.

See Figure 1 and Figure 2 for a diagram displaying the process by which a prospecting permit application and operating plans within a permit area are submitted and approved.

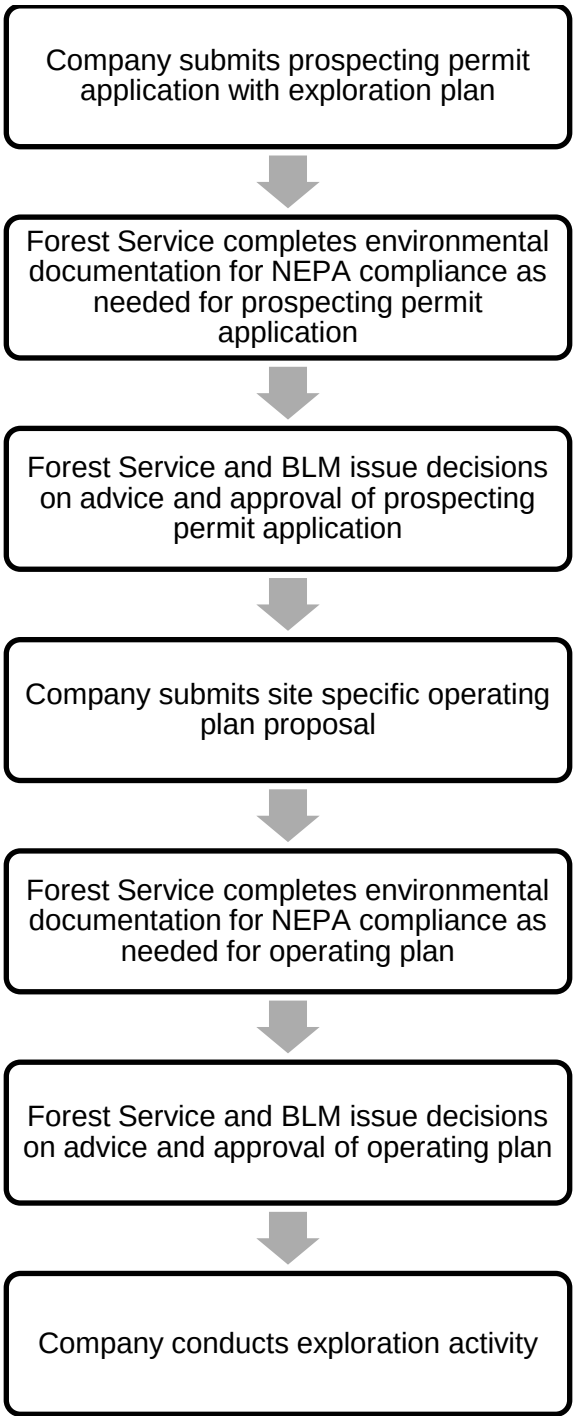


Figure 1. Overview of NEPA compliance process for federal hardrock mineral prospecting permits and operating plans

Note: NEPA compliance for prospecting permit applications and operating plans may be achieved concurrently if the exploration plan and the operating plan are submitted concurrently.

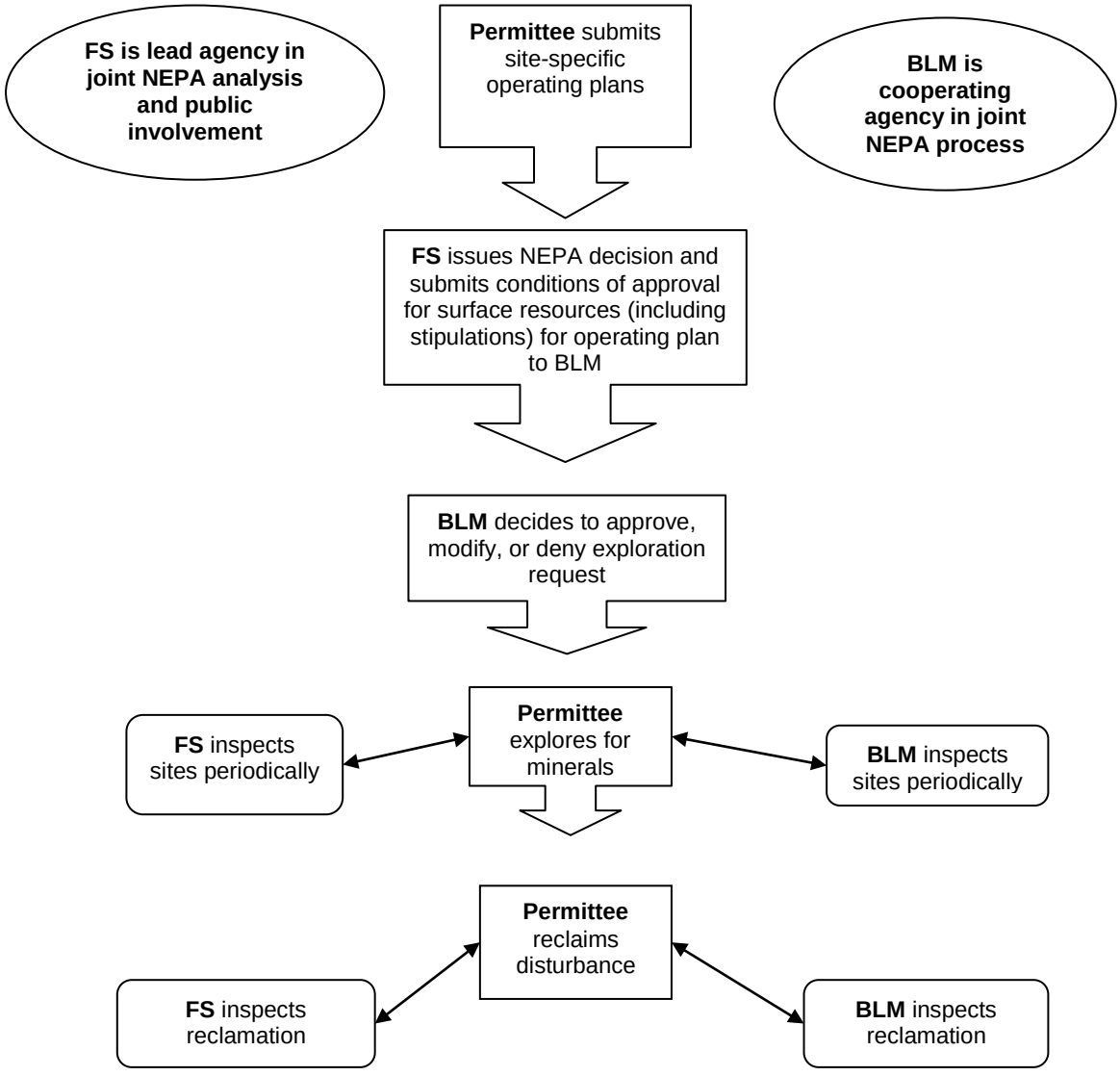


Figure 2. Flowchart showing process for approving an operating plan on a federal hardrock mineral prospecting permit

1.7.3 Authorities

The Federal Government's policy for minerals resource management is expressed in the Mining and Minerals Policy Act of 1970 Forest Service Manual (FSM 2800, page 6).

> Foster and encourage private enterprise in the development of economically sound and stable industries, and in the orderly and economic development of domestic resources to help assure satisfaction of industrial, security, and environmental needs.
>
> The mission of the Forest Service in minerals management is to encourage, facilitate, and administer the orderly exploration, development, and production of mineral and energy resources on National Forest System lands to help meet the present and future needs of the Nation (FSM 2800, page 3).

In Minnesota, on National Forest System lands reserved from the public domain, deposits of federal hardrock minerals are subject to disposal under the Act of June 30, 1950 (FSM 2822.13). This act authorizes the Secretary of the Interior to permit the prospecting, development and utilization of federal hardrock minerals only with the consent of the Secretary of Agriculture. Because the Act of June 30, 1950 authorizes leasing and development of conditions similar to those prescribed for like deposits covered by the President's Reorganization Plan of 1946, the Secretary of the Interior has prescribed the same regulations to the extent they are not inconsistent (43 CFR 3565). The regulations of the Secretary of the Interior for leasing mineral deposits in public lands and National Forest System lands are contained in title 43 of the Code of Federal Regulations, parts 3000 through 3568.6. The BLM exercises the authority of the Secretary of Interior for exploration and leasing of federally owned minerals.

FSM 2801 - The authority to manage the exploration and development of mineral and energy resources within National Forest System lands is jointly shared between the Secretary of Agriculture and the Secretary of the Interior. The administration of the general mining laws and the mineral leasing acts is primarily the responsibility of the USDI. Certain mineral leasing acts require the consent of the Secretary of Agriculture and are subject to conditions that ensure the adequate utilization of the lands for the purposes for which they were acquired or are being administered.

On a national level, the Forest Service has entered into interagency agreements with the BLM to cooperate and coordinate in managing federally owned minerals within National Forest System lands. The Superior National Forest and BLM-Eastern States Office has entered into a memorandum of understanding for this EIS. The BLM is responsible for issuing and administering the occupancy and use of the surface and subsurface under the prospecting permits and plan of operations, however, the Forest Service cooperatively works with the BLM to accomplish these tasks.

The authority to grant prospecting permits and associated operating plans lies within the USDI BLM. However, the Forest Service must evaluate the project area for environmental impacts as described under the National Environmental Policy Act (NEPA). The Forest Service will utilize this EIS analysis to administratively determine whether prospecting is consistent with the purposes for which the land was acquired or is currently managed. The Forest Service will provide direction to the BLM regarding whether the prospecting should be permitted or denied and with what resource protection stipulations. The Forest Service will also provide direction to the BLM regarding what resource protection stipulations are required for operating plans associated with prospecting permits.

Forest Supervisors approve and issue all special-use authorizations for which authority has been delegated by the Regional Forester, as stipulated in FSM 2704.32. Forest Supervisors may redelegate to District Rangers the authority to issue certain special-use authorizations, as provided in FSM 2704.34 (FSM 2704.33). A permit serves as a permissive license for uses of National Forest System lands that are of short duration, but usually greater than one year, and that do not involve permanent commitment of National Forest System resources (FSM 2711.2). The Forest Service may amend the permit at any time when it is in the public interest to do so. Forest officers shall discuss contemplated changes with the holder and shall attempt to obtain consent from the holder; however, the holder's concurrence is not required for implementation.

1.7.4 Laws, Regulations and Policies

The Forest Service has prepared this EIS in compliance with NEPA and its implementing regulations at 40 CFR Parts 1500-1508. NEPA at 40 CFR 1502.25(a) directs "to the fullest extent possible, agencies shall prepare environmental impact statements concurrently with and integrated with... other environmental review laws and executive orders." The following laws and executive orders were considered in the Federal Hardrock Minerals Prospecting Permits Project analysis.

The Forest Service manages National Forest System lands for multiple use and sustained yield of products and services and is authorized to govern their use and occupancy under the authority of the Organic Administration Act of 1897, the Multiple-Use Sustained Yield Act of 1960, the National Forest Management Act of 1976, and the Federal Land Policy and Management Act of 1976.

National Forest Management Act (NFMA) The NFMA requires that projects comply with the Forest Plan. This project has been designed according to direction in the 2004 Forest Plan. In order to eliminate repetitive discussion and documentation, this analysis tiers to the Forest Plan Final EIS. The Forest Plan identifies standards and guidelines that apply to management areas. These standards and guidelines have been incorporated into the resource protection stipulations.

The Federal Hardrock Minerals Prospecting Permits Project was developed in consideration of relevant scientific information and is consistent with the Superior National Forest Land and Resource Management Plan.

Weeks Act of 1911. The Weeks Act of March 1, 1911 authorized the federal government to purchase lands for stream-flow protection, and to maintain the acquired lands as national forests. The Act also provided for cooperation in fire control between federal and state authorities.

Pursuant to the Act of March 4, 1917, the Secretary of Agriculture is authorized to permit the prospecting, development, and utilization of the mineral resources of the lands acquired under the Act of March 11, 1911, known as the Weeks Law, upon such terms and for specified periods or otherwise, as he may deem to be for the best interests of the United States. The authority was then transferred to the Secretary of the Interior pursuant to the Reorganization Plan No. 3, of July 6, 1946. The Secretary of Interior shall allow mineral development of these lands “only when he is advised by the Secretary of Agriculture that such development will not interfere with the primary purposes for which the land was acquired (in most cases the regulation of the flow of navigable streams and production of timber) and only in accordance with such conditions as may be specified by the Secretary of Agriculture in order to protect such purposes.

In certain cases where mineral prospecting leads to a submittal of a lease application, the Forest Service would make a determination whether activities associated with the lease would be consistent with the purposes for which the lands were acquired under the Weeks Act. As an example, large open pit mines

may not meet the intent under the Act and consent to a lease application may not be given by the Forest Service to the BLM.

Endangered Species Act of 1973, as amended 1978, 1979, 1982, and 1988 (16 U.S. C. 1531). This Act provides direction to the Forest Service to establish objectives for habitat management and recovery through the Forest Plan for the conservation and protection of endangered and threatened species. This project is consistent with these guidelines. The project area has been reviewed to identify, manage, and protect essential and critical habitats to meet legal requirements and recovery objectives for federally listed species. Alternatives 2-5 may affect, and are likely to adversely affect lynx and wolf because of the potential for increased human disturbance as a result of increased temporary road miles. Alternatives 2-5 are not likely to adversely affect lynx or wolf critical habitat. Habitat changes and seasonal variation between action alternatives are not likely to adversely affect lynx and wolves.

National Historic Preservation Act (16 U.S.C. 470). This Act provides direction for Federal agencies to establish a program for preservation of historic properties. In compliance with this act, a review was conducted to determine if cultural resource surveys had been conducted within the project area, and if cultural resource sites had been recorded. Results of cultural surveys were shared with the State Historic Preservation Office for concurrence. In accord with 36 CFR 800, Protection of Historic Properties, it is the policy of the Forest Service to protect those sites determined eligible for the National Register of Historic Places (NRHP), as well as those sites not yet formally evaluated. Potential impacts to sites eligible for the NRHP, as well as for those not yet evaluated, were considered in this analysis.

There are no known sites within current operating plan areas. These undertaking have been reviewed by Forest Heritage staff and determined to be “No Effect” undertakings with regard to 36 CFR 800 of the NHPA. These “No Effect” projects will be reported in the Heritage Resource Office Annual Report, as directed by language in the heretofore mentioned Programmatic Agreement (PA) (2008). Should any heritage resources be discovered during implementation, all project activities within the site vicinity shall cease and the Forest Heritage Resource Program Manager shall be notified to assess the condition and implement protection measures.

Clean Water Act of 1972, as amended 1977. The Federal Water Pollution Control Act of 1972, as amended (commonly referred to as the Clean Water Act), was enacted to restore and maintain the chemical, physical, and biological integrity of the Nation’s waters. Section 319 for the 1977 amendment requires each state to develop and implement a program to control silviculture-related and other non-point sources of water pollution to the maximum extent practicable. Non-point sources of water pollution are controlled by the use of best management practices. Water quality in Minnesota is managed by the Minnesota Pollution Control Agency (MPCA) and administered as part of Minnesota Rules Part 7050 to be in compliance with the Clean Water Act.

The anticipated effects to water and aquatic resources is minimal based upon the analysis in Chapter 3 which considers the stipulations, Forest Plan standards and guidelines, existing State and federal regulations, design elements, anticipated operating conditions, and resource characteristics.

The proposed drilling activity with the prescribed project design features described in section 2.4.3.9 is not anticipated to have a noticeable effect on the quality or quantity of the groundwater resource. The activity should not impact the potability of the groundwater or the production capacity of existing water supply wells (See Water Resources Section for analysis, section 3.6).

Environmental Justice. Executive Order 12898 (1994) directs Federal agencies to avoid causing adverse human health and environmental effects that may disproportionately impact minority and low-

income populations. The disclosure of EO 12898 considerations are included in the Environmental Justice section 3.14.2.6 and 3.14.3.2.

Clean Air Act: The Boundary Waters Canoe Area Wilderness has special protection under the Clean Air Act as a Class I area. The activities included in the project description are not expected to generate enough particulate matter to threaten the NAAQS or threaten sensitive receptors, including any class I airsheds (see Air Quality Section 3.13).

Wild and Scenic Rivers Act: Impacts affecting the character of WSR segments are not anticipated with this project. No permit, lease, or other authorization will be issued for exploration or development of minerals owned by the United States within Wild Sections of Designated Wild & Scenic Rivers. These areas include a ¼ mile corridor on each side of a river (Forest Plan S-WSR-11). Surface disturbance or occupancy for development and extraction of federally owned minerals excluding sand and gravel are generally not permitted within Scenic or Recreational Sections of Designated Wild & Scenic Rivers. These areas include a ¼ mile corridor on each side of a river (Forest Plan S-WSR-12).

Wilderness Act: No permit, lease, or other authorization will be issued for exploration or development of minerals owned by the United States within BWCAW and in Mining Protection Areas (Forest Plan, S-MN-3; S-MN-4; S-MN-6; S-MN-7; D-MN-1). See Section 3.2 for effects to wilderness character.

Prime Farmland, Rangeland, and Forest Land. All alternatives are in keeping with the intent of the Secretary of Agriculture Memorandum 1827 for prime farmland. The project area does not contain any farmlands or rangelands.

Floodplains (Executive Order 11988) and Wetlands (Executive Order 11990). See Section 3.6 Water for discussion on floodplains and wetlands.

1.8 Tribal Involvement

The project area falls within the 1854 Ceded Territory for the Grand Portage, Bois Forte and Fond du Lac Bands and the Tribes of Lake Superior Chippewa (Collectively, the Bands). The Bands are sovereign nations and, as a result of the treaty with the United States, retain the usufructuary right to hunt, fish and gather in the ceded lands. The Superior National Forest has developed government to government consultation protocol agreements with the Bands to ensure that the exercise of treaty rights are considered and consulted upon during project planning and implementation.

For the Hardrock Federal Minerals Prospecting Project, consultation and coordination with Tribal Governments began through informal notice at regularly scheduled forest-wide meetings held with the Bands by the Forest Supervisor and Tribal Liaison Officer. The Bands were provided an overview of the proposed project starting in 2007, and were kept informed of the status of the project during meetings with the Forest Supervisor. Formal consultation began with a letter dated April 1, 2009. This letter notified the Bands of the proposed action and requested scoping comments. Letters were mailed to the 1854 Treaty Authority, an intertribal natural resource agency representing the Grand Portage and Bois Forte Bands, and to the Great Lakes Indian Fish and Wildlife Commission (GLIFWC) representing the Fond du Lac Band. One letter was received from Darren Vogt the Environmental Coordinator for the 1854 Treaty Authority. Concerns raised in Mr. Vogt's letter are summarized below. On February 11, 2011, the three Bands, 1854 Treaty Authority, GLIFWC and the Forest Supervisor and staff met to discuss the draft Federal Hardrock Mineral Prospecting Permits Environmental Impact Statement prior to public dissemination.

1.8.1 Tribal Issues and concerns

The primary concern raised by the Tribes was the potential effects of the project on the exercise of treaty rights and maintenance of tribal cultural practices. Specifically the following concerns were raised:

Potential change in access and harvest of traditional plants and animals.

There would be no decrease in access from implementing this project. No existing roads are being proposed for closure under this project. For each of the operating plan drilling proposals, up to 4.5 miles of temporary roads could be constructed for access (see section 2.2.2.4 for a description of potential road activities). These roads are only intended for mineral prospecting activities. These roads may or may not be blocked to vehicular traffic while drilling is active, typically a few days to six weeks. Even if roads are blocked to vehicular use, they would be open to foot traffic. Temporary roads would be closed at the completion of drilling activity and permanently reclaimed at the termination of the permit. Interim and final reclamation requirements are described in section 2.1.1.5. See section 2.1.1 for a description of drilling activities.

Although access for harvesting traditional plants would not decrease a small amount of habitat (less than ¼ acre in size, with access roads) for traditional plants and animals would be impacted by project activities. In the short term ground disturbance from activities such as drill pad construction and temporary road construction could disturb small patches of traditional plants such as blueberries, raspberries, birch and other species. Anticipated average annual ground disturbance is expected to average about 186 acres per year (see section Exploration Disturbance Descriptions on page 39). Over the duration of this project, about twenty years, approximately 3,725 acres could be disturbed. This represents approximately 0.34 percent of the project area (see section 3.7.3.2). In the long term, areas where project activities occurred would likely be re-colonized within one to two growing seasons by other nearby patches of the affected species. Impacts to traditional plants would likely be temporary and short-lived.

Potential effects to game species and associated habitat (moose is a priority).

Affected wildlife habitat changed to 0-9 years old could range from zero to about 770 acres in any year (Project File: Road-habitat analysis) but is not expected to exceed a total of 3,725 acres over the life of the project. Change in habitat age to 0-9 years old may temporarily benefit species favoring young trees or shrubs for forage, such as moose, deer and ruffed grouse (Wildlife Section 3.8.3.3). Temporary road mileage would remain within the parameters expected under the Forest Plan FEIS (see Figure 31) and may affect wildlife but is not expected to lead to a trend toward listing or limit population viability of sensitive species. Seasonal activities would not change from existing conditions in Alternatives 1-4 and are not expected to have negative impacts to sensitive species or game species. Seasonal activity increase during winter in Alternative 5 may add to species' stress during harsh winters and may force individuals to alter their activity patterns. However, effects would be very localized and the effects to populations of game species are not expected to lead to a trend toward listing or limit population viability of game species.

Potential impacts to wild rice.

Resource stipulations, especially those involving soil and water quality (section 2.2.3), would protect wild rice lakes from impacts related to mineral exploration. For example, a 50 foot setback from lakes is required for drill pad construction. Drilling on lakes was not proposed and will not be included under authorized activities in the decision for this project.

Potential impacts to water quality and fisheries.

The anticipated effects to water and aquatic resources is minimal based upon the analysis in Chapter 3 which considers the stipulations, Forest Plan standards and guidelines, existing State and federal regulations, design elements, anticipated operating conditions, and resource characteristics.

The proposed drilling activity with the prescribed project design features described in section 2.4.3.9 is not anticipated to have a noticeable effect on the quality or quantity of the groundwater resource. The activity should not impact the potability of the groundwater or the production capacity of existing water supply wells. Effects to water resources are discussed in Section 3.6.

Potential impacts to known cultural or heritage sites.

No direct impacts are expected to occur to heritage sites. A heritage resource inventory will be conducted for previously un-surveyed areas subject to ground disturbance within the permitted application areas. Identified heritage resources within and immediately adjacent to drill sites and temporary roads will be buffered to avoid impact. Post treatment monitoring, and maintenance of confidentiality with respect to heritage resource locations will effectively eliminate direct and indirect effects as they relate to the action alternatives of the Federal Hardrock Minerals Prospecting Permit undertaking. There will be no cumulative effects to heritage resources, as all potential direct and indirect effects would be mitigated. There are no known sites within the operating plans that have been submitted to date. Should any heritage resources be discovered during implementation, all project activities within the site vicinity shall cease and the Forest Heritage Resource Program Manager shall be notified to assess the condition and implement protection measures. Effects to heritage resources are discussed in section 3.11.

1.9 Public Involvement

The Notice of Intent (NOI) was published in the Federal Register on December 19, 2008. A scoping package was sent to interested individuals, organizations, and federal, state and local government agencies on April1, 2009. Using the comments from the public, other agencies, and organizations (see Issues section 1.9.1), the interdisciplinary team developed a list of issues to address. The other issues, concerns and suggestions (as described above) were considered in the analysis and addressed as necessary in the EIS, specialist reports or project file (See Section below Other Scoping Concerns, Questions and Suggestions 1.9.1.2).

1.9.1 Public Issues

The SNF separated the issues into two groups: issues that drive alternatives, and others issues that did not drive alternatives. Issues that do not drive alternatives were identified as those: 1) outside the scope of the proposed action; 2) already decided by law, regulation, Forest Plan, or other higher level decision; 3) irrelevant to the decision to be made; or 4) conjectural and not supported by scientific or factual evidence; 4) are limited in extent, duration, and intensity, 5) or are mitigated through proposed stipulations.

The Council on Environmental Quality (CEQ) NEPA regulations explain this delineation in Sec. 1501.7, "…identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec. 1506.3)…" The Forest Service identified one issue during scoping that drove the formation of the alternatives.

1.9.1.1 Issues that Drive Alternatives

The Forest Service identified one issue during scoping that drove the formation of the alternatives.

Issue statement: Noise from drilling and exploration activities may degrade visitor experience and local landowner quality of life.

During public scoping, concerns were raised that noise from the proposed core drilling activities would affect the quality of recreational experiences. Commenters are most concerned with potential effects to local landowners, summer home visitors, Boundary Waters Canoe Area Wilderness (BWCAW) visitors and winter use enthusiasts. Opportunities exist to design project activities with mitigations to reduce effects to the recreational experience.

Seven indicators were used to evaluate the effects of noise on local residents and the recreational experience. These indicators include an in-depth discussion on the duration, timing, area, and loudness of noise. However, while these indicators may estimate the physical characteristics of the noise, the evaluation of the impact of noise on the human experience addresses the issue.

1.9.1.2 Other issues, Other Scoping Concerns, Questions and Suggestions

During public scoping a number of suggestions, questions and resource concerns were raised that will not drive the formation of an alternative. A summary of these concerns and their disposition can be found in appendix A.

In general, commenters are concerned about the potential social impacts on local landowners, summer home visitors, Boundary Waters Canoe Area Wilderness (BWCAW) visitors and winter use enthusiasts. Other comments focus on potential impacts to the land, water resources, social and economic impacts, vegetation, soils, wildlife and access. Commenters are also concerned about pollution, the processes used in exploration activities, and the potential for future mineral development. Some commenters are concerned about the administrative side of permitting, such as appropriateness of current environmental laws and regulations and Forest Plan policies. Others are concerned about the adequacy of the analysis and the scope of the project. See appendix A for disposition of comments.

1.9.2 Project Record Documentation

This EIS incorporates by specific reference the project record (referenced file designation). The project record contains the technical reports prepared by the interdisciplinary team members, as well as other information including maps, field notes, and data used to support the analysis and conclusions that are disclosed in this EIS. It is considered an unpublished appendix to the EIS.

Its content is available upon request at the Supervisors Office during business hours. Relying upon the project record helps to implement the CEQ regulation provision that Federal agencies should reduce the paperwork related to NEPA (40 CFR 1500.4); that the EIS should be analytic, rather than encyclopedic; and that the EIS be kept as concise as possible, and no longer than absolutely necessary (40 CFR 1502.2).

The objective is to furnish the public and the Responsible Official with enough information to demonstrate a reasonable consideration of the environmental impacts of the alternatives and how these impacts may be mitigated, without repeating the detailed analysis and background information in the project record. The project record is updated over the course of the analysis and public involvement process.

Chapter 2 Alternatives

2.1 Introduction

This chapter describes and compares the alternatives considered for the Federal Hardrock Minerals Prospecting Permits Project. It includes a description of each alternative considered. This section also presents the alternatives in comparative form, sharply defining the differences between each alternative and providing a clear basis for choice among options by the decision maker and the public. Some of the information used to compare the alternatives is based upon the design of the alternative and some of the information is based upon the environmental, social and economic effects of implementing each alternative.

Following the descriptions of the alternatives below, section 2.4 describes in detail the specific requirements that would apply to all action alternatives. First is a list of administrative requirements from the BLM (section 2.4.1) and SNF (2.4.2) to be incorporated into all permits and operating plans. Secondly, section 2.4.3 lists the resource specific stipulations that would also be applied to both the permits and the operating plans. A list of assumptions that are the basis for the maximum disturbance scenario can be found in Section 2.2.2.4 under Alternative 2. Section 2.1.1 is an updated description of the activities associated with mineral exploration originally provided in the Scoping package. For this EIS, the maximum disturbance scenario and mineral exploration activities descriptions are incorporated into all action alternatives to provide an appropriate management framework for future mineral activity proposals.

2.1.1 Mineral Exploration Activities

This section includes a brief description of mineral exploration activities that may occur on the Superior National Forest authorized under a permit operating plan. It will be used to guide both the project specific and long-term analyses. However, it is a general explanation. Where operating plans with specific activities and locations have been submitted, those activities supersede any general descriptions. In general, operations may include geologic mapping; soil, vegetation, and rock geochemical surveys; geophysical surveys, access road reconstruction and construction, barge landings, helicopter access, drilling, and reclamation.

2.1.1.1 Geologic Mapping

Mapping of the bedrock geology is often conducted to advance understanding of the geologic framework and mineralization potential in the prospecting permit area. This activity involves casual use of the surface and would utilize existing roads, waterways, and trails. No surface disturbance is associated with this activity.

2.1.1.2 Soil, Vegetation, and Rock Geochemistry Surveys

These surveys are completed during geologic mapping or as independent surveys. Overall, very little to no ground disturbance is associated with these three types of surveys. However, sampling may require occasional small, localized brush cutting to allow the sampler to better fix his position using GPS. Four wheel drive pick-up trucks and ATVs may be used for access on existing roads and trails. Off road travel is generally by foot, however ATVs may be used off road and some vegetation cleared and authorized under a permit operating plan.

Soil Sampling

Typically, holes for soil sampling are dug with a mattock, shovel, or auger and a sample is taken and sieved to minus 80 mesh (0.08 inches). Generally less than 5 pounds is collected for analysis. The holes are generally 1 foot square by 2 feet deep; but can be deeper but narrower for auger holes. Soil surveys are generally made with the sample locations 650 to 1,600 feet apart in a watershed for early reconnaissance work and in more detailed follow-up surveys, sampling is completed in a grid pattern with sample locations 50 to 200 feet apart. The holes are back filled after sampling. The target is often the interface between the soil and bedrock. Linear paths may be cut through the forest to allow ATV access. However, soil sampling is often done without clearing vegetation or off-road ATV access.

Vegetation Sampling

Vegetation sampling is essentially a means of indirect soil and groundwater sampling for chemical analysis. Plants extract elements from depth and transmit them to foliage, but the degree to which plants accept or reject elements differs by species. Typically, samples of approximately 0.7 to 1.8 ounces are taken from the same organ in each target plant and sent to a laboratory. The samples are then often burned and the ashes analyzed for metals. Ideally, vegetation is sampled on a uniform grid but this is often compromised due to the limitations of natural irregular pattern of species occurrence.

Rock Sampling

Rock sampling is generally done by either rock chip or core sampling. Samples are taken within standardized areas or at standard intervals in a rock outcrop. A one pound sample is commonly taken in fine-grained rocks and up to five pounds are taken in very coarse grained rocks. In other applications, chips of mineralized fillings and coatings are collected from fractures or grab samples of rock on the surface may be collected.

2.1.1.3 Geophysical Surveys

The geophysical survey techniques proposed within the project area are usually magnetic, electro-magnetic, electro-conductivity/resistivity, and gravity. These surveys enable a geophysicist to look for magnetic, conductive or dense rocks (anomalies) 500 hundred feet (plus or minus) below the earth's surface without drilling exploratory holes. The magnetic or conductive rocks may represent mineralization. These surveys are usually completed in a grid type fashion where there is a base line that is up to two miles in length and several grid or wing lines that run perpendicular to the base line with varying lengths (usually an average of one mile) set on average 500 to 1000 feet apart. The grid could be up to 1-2 mile square. Electric generators may be used to induce an electrical current into the ground. A geophysicist and sometimes one or two assistants walk on and/or around these lines carrying hand held instruments laying and pulling small cables while taking readings at 50 to 1,320 foot intervals. Since the surveyors have to traverse these grid lines they may need to cut vegetation that is too dense to allow them and their equipment to get through. Normally the vegetation is thick shrubs and young trees. The grid line clearing usually does not exceed three to five feet in width and the vegetation usually grows back within two years. There is very little ground disturbance associated with these grid lines. Flags are attached to stakes, tree or shrubs to mark these lines. Access to the site may require overland travel during frozen ground conditions, and clearing of overgrown roads and trails. Other geophysical measurements may be made during or after drilling by lowering geophysical instruments down the drill hole and taking measurements at known locations. Surveys may also include airborne geophysical surveys using helicopter or planes. The Forest Service is usually notified when and where these types of surveys will take place for safety purposes and to avoid conflicts with other known aerial operations/projects. However, these airborne surveys do not require Forest Service permits or consent.

2.1.1.4 Access to the Drill Site

Motorized Access

A road surface approximately 10-12 feet in width is needed to transport the drill rig, fuel, equipment, water, and personnel to the site. Total disturbed width, including tree clearing and temporary storage of vegetation, would average 20 feet. Drainage structures and road reinforcement may be installed as necessary. Existing and pre-existing roads are used wherever possible. If these are overgrown with vegetation, they would be cleared to an approximate total of 16 feet in width. Additional drainage structures or road reinforcement may be installed as necessary. Roads are normally constructed to the lowest standard needed for access to protect resources. As site conditions allow, overland travel may be utilized with no blading or leveling of the soils, although some trees or brush may be cut. If access is needed through low or wet areas, operations usually occur during the winter months, at a time when the ground has sufficiently frozen to support vehicles. When the ground is not frozen, gravel, geosynthetic materials or corduroy may be used to cross low or wet areas. In general, activities that could occur in developing a temporary road include installing culverts, drivable dips and water crossings; clearing vegetation; cutting/removing trees and brush; using gravel; using geosynthetics; and installing drainage dips and water diversion structures. Overland travel using all terrain vehicles such as snowmobiles and four wheel ATVs may also be used.

Helicopter Access

Helicopter access and transport could be an alternative to accessing the drill sites by roads. Helicopters may be used to deliver/remove equipment, fuel and supplies to the drill sites using sling load and long line methods. These methods involve transporting and lowering equipment to the drill site using cables and slings to a cleared drill pad or opening. A staging area is a site where equipment, supplies, and personnel are transferred to and from ground transportation and helicopter. The staging areas may be located on the Superior National Forest in existing clearings as near to the drill sites as possible (not expected to exceed 8 miles from staging area to drill site). No additional clearing would be needed for the helicopter other than the clearing already expected for the drill pad sites. Lighter and smaller drill equipment would be utilized due to helicopter weight load limitations and would require less room to operate. Therefore, drill pad sites for helicopter operations could average 50 feet by 25 feet. Larger drill pad sites would be allowed as necessary up to a maximum of 100 feet by 100 feet. Personnel could be transported by helicopter if walking to the drill site is unreasonable or off-road vehicle travel (such as snowmobile or four wheeler) is prohibited or unreasonable.

The drill rig could get flown to the drill site by piece, in 6-10 trips depending on size. It would be assembled at the drill site. Other equipment to fly in such as drill rod steel, tanks, fuel, hose, pipe, etc. could involve 6-10 trips. The distance between the staging area and drill pad is expected not to exceed 8 miles. It could take an average of ½ day to transport the equipment and supplies into the site and set up. Flying out the equipment and supplies would require the same amount of trips and time as flying in. Flights with heavy loads are usually in the morning when the air is cooler and the helicopter can get more lift. Therefore, set-up and take-down of a drill site could involve up to 40 round trips over a total of one day.

During drilling operations, there could be one trip per day for delivering fuel and other items, one trip per day for removing drill core and other items, and 1-2 trips per day for personnel transport. Therefore, after the site is set up with equipment and supplies, there could be 3-4 helicopter round trips per day between the staging area and drill site. These trips would usually be split between the beginning and the end of a work shift.

Helicopter operations would normally occur during daylight hours. Night operations could occur if necessary and for emergency situations.

Water Access

There may be opportunities to reduce the amount of road construction by utilizing lakes and large rivers for access. Barges and motorized watercraft could be used to transport equipment, vehicles, personnel, and all other items necessary for drilling. The following assumptions will be used for this analysis:

- Since it is much cheaper and easier to cross a lake or wetland over ice, winter crossings are the preferred method. However, the ice on some lakes (such as Birch Lake) is not safe enough to drive across. Hence, there is a need to ferry across these lakes during open water. In general, it can be assumed that if it is safe, the drillers will drive across the lake in the winter, and only in selected cases will there be a need to ferry across the lake.
- Forty landings associated with water access would be needed over the 20 year analysis. The number of trips needed to bring in personnel (typically 12-hr shifts), equipment, fuel, and supplies would likely be a minimum of 3 to a maximum of 6 trips per day. For logistic efficiency and safety these trips are typically done during the day.
- The watercraft will have a shallow draft and may include pontoons, fishing boats, and likely a barge to transport dozer, trucks, ATVs, drill equipment, fuel and other associated materials. A small dozer or similar type of equipment will be used to bring in the drill rig and rod dray (skid that holds the drill rods and support equipment). Trucks will be needed to haul fuel, cuttings (ground up subsurface rock, a byproduct of drilling), and larger equipment. Typical fuel usage is about 100 gallons of diesel per day. Cuttings may need to be transported depending upon the ability of the drill hole site to accommodate a sump.
- The landing disturbance area would average 25 ft wide by 50 ft deep (perpendicular to the shoreline). Some clearing and grubbing may be required. However, the amount of needed clearing and grubbing will be minimized.
- There may be a temporary seasonal dock (akin to a cabin – owner's dock) that will be used to accept smaller boats. A permanent dock is not anticipated.
- Personnel and other smaller supplies will likely be transported from the landing to the drill site using ATVs.
- The site will be restored in accordance with stipulations and guidelines. Native seed and tree-planting will be accomplished as directed.
- It is anticipated the sites will need to be accessed several years after the original drilling activity in order to abandon the hole(s). In general, the driller will select a landing that requires the least amount of modification. This saves time, construction cost, rehabilitation cost, and minimizes environmental impact. The general location is selected based upon proximity to the proposed drill site. The specific location along the shoreline will be selected to minimize the ecological and social impact. Sites will be selected such that: no dredging will be required, no armoring below the water line will be required, no armoring above the water line will be required, the amount of merchantable timber that needs to be cut is minimized, the need to excavate or fill the landing area to accommodate vehicular traffic is minimized. Wild rice sites and spawning bed sites will be avoided.

2.1.1.5 Other activities related to prospecting operations

Drill Pad

A drill pad is an area where the drill rig and associated equipment is set up. It can vary in size but typically is 50 feet x 25 feet or less for a skid mounted drill and 50 feet x 50 feet or less for a truck

mounted drill. However, a drill pad site up to 100 feet x 100 feet may be necessary for operations needing additional space such as large capacity sumps when multiple holes are drilled from one location. For this environmental analysis, this maximum drill pad size will be used, however a smaller drill pad size is expected and pad size will be kept to a reasonable minimum during permitting. The area would be cleared of all vegetation that would obstruct setting up the drill rig or interfere with drilling operations. The ground at the site may be bladed level with a dozer. The entire depth of a drill hole would be drilled from this location. Multiple holes may be drilled from a single pad. Drilling from barges on lakes and large rivers is not included in this analysis since the State of Minnesota manages lakes. In this situation, the Forest Service would not be involved in any permits unless a special use access road is proposed.

Sump Pit

A sump pit is dug by heavy equipment and used to store and re-circulate water, drilling fluids, drilling clays, and other State approved additives for drilling. It is also the facility used to collect and store drill cuttings (ground up subsurface rock, a byproduct of drilling) and is the location where the cuttings are usually buried during reclamation for permanent disposal. The dimensions of a sump average 5 to 20 feet long by 5 to 20 feet wide by 5 to 10 feet deep.

Figure 3. Drill sump pit at the edge of a drill pad

For unusually deep holes, where ground water is expected, or when multiple hole are drilled using the same sump, the dimensions of a sump are larger and may average 60 feet long by 40 feet wide by 15 feet deep. The larger sumps would require a larger drill pad clearing up to 100 feet by 100 feet in size. For this environmental analysis, this maximum sump size will be used. However a smaller size is expected and it will be kept to a reasonable minimum during permitting.

The area disturbed for sumps is incorporated in the total disturbance of a drill pad. In cases when bedrock is too close to the surface to dig a sump, a tank may be used as a reservoir and settling point for core cutting as water circulates through the drill hole during drilling. In some situations, there may be an option to construct the sump a distance from the drill pad and utilize hose to transport the cuttings and water. If this is necessary, the drill pad area disturbance would be reduced to allow for the sump construction so that the total disturbance is kept within the assumed or maximum drill pad size. Sumps are typically reclaimed after the holes are completed and the rig moves off-site or at the end of the drilling program. The cuttings are either left in the sump and backfilled during reclamation to a depth of at least 4 feet or in some situations they may be removed and disposed of off-site in accordance with applicable rules and laws. If sumps are left open for a longer time, fencing may be installed to protect people and wildlife. Drill cuttings in tanks would be removed and disposed in an off-site non-wetland location and buried as described above for sumps or taken to a regional landfill.

Water for Drilling

Water is used during the drilling operation as a lubricant, coolant, and also to flush cuttings to the surface. A river, lake or stream close to the drill site would be a likely water source. If the water source is within pumping distance, the water is pumped directly to the drill site using small hoses laid over the ground. Otherwise, it is pumped into a water truck and delivered to the drill site. Approximately 1000 to 2000 gallons of water are used per day for each hole depending on subsurface conditions. (The state of Minnesota requires permits for water use equal to or greater than 10,000 gallons per day). If non-potable water is used, a minor amount of chlorine may be added to the water in accordance with Minnesota rules. To prevent water from escaping the drill hole, bentonite clay and rod casings are often used. Organic or bio-degradable synthetic drill "mud" additives may be added to the water to assist in drilling. State requirements for down hole additives are covered under Minnesota Department of Health Rules Chapter 4725.2950, Drilling Fluids and must be followed for all mineral exploration drilling.

Drilling Equipment and Operation

A standard truck-mounted drill rig or skid mounted diamond core or reverse circulation drill rig may be used. The skid mounted drill rig is pulled into place by a D-4 or larger dozer. Both drill rigs vary in size, but in general are about the size of a dump truck. When operating, mast heights range from about 20 feet in height to over 35 feet high, depending upon rig type and the size of drilling apparatus. The drill rig would normally operate 24 hours a day in two 12 hour shifts. More than one hole may be drilled at each site with different inclinations and directions depending on the geology. Multiple drill rigs may be operating at the same time but at different sites. Support equipment may include all terrain vehicles, snowmobiles, a skid-mounted rod dray, a D-4 or larger dozer, an excavator, a high lift and two or three axle trucks for transporting water, pipe, fuel, other equipment, and drill core. Four wheel drive pickups, sport utility vehicles (SUVs), all terrain vehicles, and snowmobiles are used to transport personnel, equipment, supplies, drill core boxes; and to service drill rigs. Vehicles and drills are equipped with the required fire-fighting equipment. Other materials often stored on the drill pad and used during drilling activities are drill core boxes, drilling additives, propane or welding tanks, and petroleum products such as fuels and lubricants. Spill abatement equipment and supplies also may be stored on the pad in the unlikely event that a spill occurs. Noise abatement such as enclosing the drill rig with panels and directing the noise upwards may be required.

Depth of drilling depends on the geological nature and geometry of the target to be drilled. In the past, exploration drill holes in northern Minnesota were typically 500 to 1,000 feet deep. However, recent drilling has mainly been within a range between 1,500 to 3,500 feet deep. In rare instances they may extend down to 4,500 feet. Holes may be vertical or inclined. In some cases, wedge off-sets may be drilled to acquire more material and information from a single drill site. Drill holes can take a few days to six weeks to complete. Cuttings settled out of the drill water in a sump pit or tank are later buried in the sump pit or disposed off-site in pre-approved areas either on or off the SNF. For initial closure, drill hole casings are temporarily capped in accordance with Minnesota standards. During final reclamation, drill holes are permanently abandoned by cutting off drill hole casings at least 18 inches below ground level and permanently sealing the bore hole with cement grouting. Minnesota Rules provide sealing requirements for exploratory drill bore holes. Minnesota allows 10 years before a bore hole would need to be permanently sealed. However, a company can request and be granted an extension to the 10 year sealing requirement.

Figure 4. Truck mounted drill rig

Reclamation Including Drill Hole Abandonment

Final reclamation will occur after drilling activities, other tests, and geophysical surveys are completed and the company permanently seals the exploration drill hole borings. The companies may propose to leave some drill hole borings temporarily abandoned (sealed) in accordance with Minnesota Rules for future work. In this situation, interim reclamation will occur after drilling operations have ceased and before the borings are permanently abandoned (sealed).

During interim reclamation, companies may be allowed to access sites for additional drilling, tests, sampling, and geophysical surveys. Interim reclamation typically includes removing all equipment, closing or fencing the sumps, stabilizing the sites, temporarily sealing the drill holes in accordance with State requirements, and closing the road and access routes as required by the Forest Service to restrict motorized access.

Final reclamation includes removing all improvements and equipment, recontouring the surface (drill pads, access roads and other disturbances), backfilling, grading, and spreading topsoil over sumps, ripping excessively compacted surfaces, removing culverts or other structures along the access routes, seeding with a native seed mix if necessary, scattering woody debris over the surfaces (from previously cut and cleared vegetation), permanently abandoning (sealing) the drill holes in accordance with Minnesota Rules, and closing road and access routes in accordance with Forest Service requirements.

Figure 5. Reclaimed drill pad soon after drilling

Minnesota Rules must be followed for exploration drill hole abandonment. For temporary abandonment, the drilling must be maintained to prevent the introduction of surface contaminants into the boring and to prevent the passage of water from one aquifer to another. It must also be covered and protected to prevent vandalism or entry of debris. Generally, the casing is protected by barriers or extending the casing at least four feet above the ground surface, grouted between the boring and casing with neat cement or concrete grout, and sealed with a metal cap (welded or screw top). For permanent abandonment (sealing) of exploration drill holes, the entire boring must be plugged with cement or bentonite clay. However in bedrock that does not contain water-bearing fractures or voids, only 250 feet below the top of the bedrock must to be sealed. This is accomplished by installing a plug or packer down the bore hole to the appropriate depth. The drill stem above the surface would be removed.

Permanent drill hole abandonment must be completed when the prospecting permit expires. This could be six to ten years. According to State rules, drill holes must be permanently abandoned within 10 years unless a variance is granted. The BLM may work with the State to assure a variance is not granted beyond when a prospecting permit expires. If final reclamation is delayed, some access routes may revegetate. In these cases, the access to the sites may be redisturbed to allow vehicular access to complete the reclamation. It may include removing obstacles placed on the access routes/roads and drill pads during reclamation such as berms, boulders, woody debris and vegetation (including trees depending on the length of time). Other access improvements may be needed such as culverts. This is completed with heavy construction equipment such as excavators and dozers. When the abandonment activities are completed, the access and drill sites would be reclaimed and monitored for additional years until they are stable and vegetated.

Figure 6. Drill site 2 years after reclamation

The Forest Service may require companies to secure a reclamation bond with the BLM before a specific prospecting permit or operating plan is approved. A bond estimate would be developed by the Forest Service or by the company and reviewed and accepted by the Forest Service for each exploration operating plan. These bonds may be greater than the bonds required by the BLM since the Forest Service includes all costs associated with the reclamation of surface resources including administrative costs. Bonds may be blanket statewide bonds that cover multiple permits and plans or individual bond instruments such as cash, certificate of deposit, Treasury note, and savings account.

2.2 Alternatives Considered in Detail

The SNF developed five alternatives, including the No Action and Proposed Action alternatives, in response to the noise issue raised by the public.

- Alternative 1 is No Action.
- Alternative 2 is the Proposed Action.
- Alternative 3 includes mitigation to reduce sound volume in the entire project area.
- Alternative 4 includes limits on sound volume reaching recreation receptors.
- Alternative 5 includes mitigation to reduce sound volume in the entire project area, and a seasonal restriction on drilling.

Note that all action alternatives include the stipulation to meet MPCA requirements for nighttime sound volume (50 dBA) at private and recreational residences.

2.2.1 Alternative 1 - No Action

Current management plans would continue to guide management of the project area. None of the 33 federal hardrock mineral prospecting permit applications and one four-year permit extension would be authorized and no prospecting activities associated with 21 proposed operating plans would occur. NEPA analysis for future prospecting permits, operating plans and associated special use permits would not occur. No changes in surface and subsurface resources would result from hardrock mineral prospecting. The analysis of the no action alternative provides a benchmark, enabling decision makers to compare the magnitude of environmental effects of the action alternatives.

2.2.2 Alternative 2 - Proposed Action

The proposed action includes 33 complete federal hardrock prospecting permit applications including one prospecting permit extension application, and 21 operating plans. Prospecting permit applications and operating plans can be viewed on the SNF project website at www.fs.usda.gov/goto/superior/projects, on CD, or by request for hard copies.

Mineral exploration activities that can be expected on prospecting permits for these and future applications are described in section 2.1.1. Section 2.2.2.4 provides information on the expected activities over 20 years.

Project stipulations have been developed to mitigate and guide project management and are included as part of the proposed action. These stipulations are listed in Section 2.4.

2.2.2.1 Prospecting Permit Applications

Alternative 2 includes 33 prospecting permit applications. Prospecting permits gives a permittee the exclusive right to access and explore for minerals within the permit area. These applications are complete with general exploration plans that describe the activities that could occur over the life of the permit. Prospecting permit applications can be viewed on the SNF project website at www.fs.usda.gov/goto/superior/projects, on CD, or by request for hard copies.

2.2.2.2 Operating Plans

Table 5 provides a general summary of the 21 proposed operating plans proposed by company. For more details, maps showing drill site and temporary access road locations, and information, the actual proposals may be found in the project file or viewed on the SNF project web site at www.fs.usda.gov/goto/superior/projects, on CD, or by request for hard copies. Additional details that apply to and further refine this alternative such as BLM and Forest Service administrative stipulations, resource stipulations, Forest Plan standard and guidelines can be found in detail in section 2.4.3. Typical mineral exploration activities and processes are further described in section 2.1.1.

Overall, operations would include drilling, geophysical surveys, geologic mapping, soil and rock chip geochemical surveys and access road reconstruction and construction.

Geophysical surveys are proposed for all operating plans. They include narrow (3-6 feet) vegetation clearing along lines laid out in a grid type fashion. There is no temporary road construction/reconstruction proposed for these surveys. See each operating plan for more details. Drill pads and access locations may be adjusted up to 500 feet if necessary. Unless specifically stated in the operating plan, no helicopters are planned to be used, but may be utilized if necessary.

All drill sites and access routes, and other proposed activities considered in this EIS would be submitted to the BLM and SNF in a site specific operating plan proposal, and approved by the BLM and SNF before operations commence. The water sources would be approved by the SNF and Minnesota DNR as needed. In most cases, a field review would be completed by the Forest Service prior to approval.

Table 5 is a general summary of the proposed operating plans. For more details and information, the actual operating plan proposals may be viewed on the SNF project web site at www.fs.usda.gov/goto/superior/projects, CD, or by request for hard copies.

Table 5. Summary of proposed operating plans

BLM MNES Application Number	Number of drill pads	Number of drill holes (preliminary)	Miles of new temp. road construction	Miles of temp. road reconstruction	Future definition drilling (speculative)[a]	Drill pad size	Sump size[b]	Maximum acres of disturbance for road access[c]	Maximum acres of disturbance for drill pads, landings, and other related areas[d]	Other
DMC										
053868	22	22	2.7	1.6	10/2.0 proposed. May need numerous holes.	50' X 25' (skid) or 50' X 50' (truck) or 100'x100' (maximum)	5-20' wide X 5-20' long X 5-10' deep	10.4	5.1	Drill pads and access locations may be adjusted up to 500 feet if necessary. Reserves the right to utilize helicopter access.
054037	7	7	0	0	8/0.5 proposed. May need minimum of 25 holes.	Same as above	Same as above	0	1.6	Same as above
054218	4	4	0.26	0	3/0.52 proposed. May need minimum 10-20 holes.	Same as above	Same as above	0.6	0.9	Same as above
054366	1	1	0	0	0 proposed. May need minimum 10-20 holes.	Same as above	Same as above	0	0.2	Same as above
054367	1	1	0	0	0 proposed. May need minimum 10-20 holes.	Same as above	Same as above	0	0.2	Same as above
054368	1	1	0.35	1.0	0 proposed. May need minimum 10-20 holes.	Same as above	Same as above	3.3	0.2	Same as above
054385	Application area covers two lakes only. Proposed activities are included under operating plans for permit application areas surrounding the lakes (MNES-053868 and MNES-054037).									

BLM MNES Application Number	Number of drill pads	Number of drill holes (preliminary)	Miles of new temp. road construction	Miles of temp. road reconstruction	Future definition drilling (speculative)[a]	Drill pad size	Sump size[b]	Maximum acres of disturbance for road access[c]	Maximum acres of disturbance for drill pads, landings, and other related areas[d]	Other
055203	1	1	0	0	0 proposed. May need minimum 20 holes.	Same as above	Same as above	0	0.2	Same as above
055205	1	1	0	0.46	0 proposed. May need minimum 10-20 holes.	Same as above	Same as above	1.1	0.2	Same as above.
055206	1	1	0	0.08	0 proposed. May need minimum 20 holes.	Same as above	Same as above	0.2	0.2	Same as above
		Note: For all drill holes above, there may be more holes than cited from the same drill pad location.								
Twin Metals										
054050	1	1	0	0	0/0 proposed. May need minimum 5-10 holes.	50’ X 25’ (skid) or 50’ X 50’ (truck) or 100’x100’ (maximum)	5-20’ wide X 5-20’ long X 5-10’deep	0	0.2	Drill pads and access locations may be adjusted up to 500 feet if necessary. Reserves the right to utilize helicopter access.
054194	1	1	0	0	0/0 proposed. May need minimum 10-20 holes.	Same as above	Same as above	0	0.2	Same as above

BLM MNES Application Number	Number of drill pads	Number of drill holes (preliminary)	Miles of new temp. road construction	Miles of temp. road reconstruction	Future definition drilling (speculative)[a]	Drill pad size	Sump size[b]	Maximum acres of disturbance for road access[c]	Maximum acres of disturbance for drill pads, landings, and other related areas[d]	Other
054195	1	1	0	0	0/0 proposed. No future number of holes estimated.	Same as above	Same as above	0	0.2	Same as above
054196	3	3	300 feet	0.6	0/0 proposed. May need minimum 10-20 holes.	Same as above	Same as above	1.6	0.7	Same as above
055305	2	2	0	0.28	3/0.4 proposed. May need minimum 10-20 holes.	Same as above	Same as above	0.7	0.5	Same as above except one drill site has helicopter access proposed.
		Note: For all drill holes above, there may be more holes than cited from the same drill pad location.								
Lehmann Exploration										
052446	8	18	1.26	0	None proposed at this time.	75’ X 75’ maximum	10’ wide X 15’ long X 10’ deep	3.1	1.9	4 holes use water access/3 landings. Landings cover approximately 25’x50’.

BLM MNES Application Number	Number of drill pads	Number of drill holes (preliminary)	Miles of new temp. road construction	Miles of temp. road reconstruction	Future definition drilling (speculative)[a]	Drill pad size	Sump size[b]	Maximum acres of disturbance for road access[c]	Maximum acres of disturbance for drill pads, landings, and other related areas[d]	Other
053731	2	2	0.38	0	None proposed at this time.	75' X 75' maximum	10' wide X 15' long X 10' deep	0.9	0.5	1 hole uses water access/1 landing. Landings cover approximately 25'x50'.
054387	2	3	0.18	0	None proposed at this time.	75' X 75' maximum	10' wide X 15' long X 10' deep	0.4	0.5	1 hole uses water access/1 landing. Landings cover approximately 25'x50'.
055301	3	3	0.63	0	None proposed at this time.	75' X 75' maximum	10' wide X 15' long X 10' deep	1.5	0.7	
055302	4	4	0.73	0	None proposed at this time.	75' X 75' maximum	10' wide X 15' long X 10' deep	1.8	1.0	3 holes use water access/3 landings. Landings cover approximately 25'x50'.
055306	2	2	0.35	0	None proposed at this time.	75' X 75' maximum	10' wide X 15' long X 10' deep	0.9	0.5	
Total Maximum Disturbance For All Operating Plans								**26.5**	**15.7**	**= 42.2 Acres**

a - Number of drill holes /miles of temp. roads (new and reconstruction)
b - this disturbance is incorporated into the disturbance area estimate for drill pads
c - using proposed 12 foot running surface and estimating 20 feet max. disturbance of surface and vegetation
d - using maximum drill pad 100'x100'
Note: Geophysical surveys are proposed for all operating plans. They may include narrow (3-6 feet) vegetation clearing along lines laid out in a grid type fashion. There is no temporary road construction/reconstruction proposed. See each operating plan for more details.

2.2.2.3 Future mineral prospecting permits and operating plans

A maximum exploration scenario for 20 years was described in the scoping package and has been modified slightly based on further consideration from the BLM and SNF. Assumptions were made regarding the number of potential prospecting permit applications and operating plans that would be submitted within the next five years. These assumptions were used to assess potential affects from future mineral exploration activities. See Minerals exploration scenario Section 2.2.2.4 for these assumptions.

2.2.2.4 Minerals exploration scenario

This mineral exploration scenario was developed to describe an estimated average exploration scenario for 20 years. Exploration under a permit and extension can occur for a six year timeframe. However, this timeframe could extend out up to 15 years (see “Length of Permit” section below). This scenario provides the basis for determining the potential effects in Chapter 3. Operating plans and prospecting permit applications that have been submitted were used to determine site specific effects analysis whereas the scenario is a set of assumptions used to determine effects from potential future mineral exploration activity.

These assumptions are based on typical mineral exploration in northern Minnesota in the past five years, current prospecting permit applications and associated operating plans, and professional experience and knowledge of the Superior National Forest Geologist and Bureau of Land Management Geologist.

Assumptions

This scenario only applies to federal hardrock mineral exploration. It does not include private mineral exploration notifications that may be received by the SNF.

New prospecting permits would be issued up to 5 years under this analysis. An average of 10 prospecting permits would be submitted each year for five years for a total of 50 prospecting permit applications. Currently, there are 45 existing prospecting permit applications and one permit extension application for a total of 46 applications. However, only 32 of the new prospecting permit applications and one permit extension application are complete with exploration plans for a total of 33 complete applications. This analysis will assume the remaining exploration plans will be submitted within a few years after the Final EIS and Record of Decision. Therefore, this analysis will assume there may be 96 prospecting permits approved within the 20 year scenario timeframe. Compliance with NEPA and other applicable law, regulation and policy will be reviewed at each permit application stage.

In accordance with BLM regulations, prospecting permits are initially issued for two years and may be extended for another 4 years for a total of six years or 72 months. This time does not have to be consecutive. As an example, there may be stipulations placed on permits that require limiting the timing (seasonality) of drilling operations. Another example is when the agency needs to complete an environmental analysis before the permittee may begin activities. Where these stipulations are applicable or there are other reasons the permittee is not allowed to operate, the BLM would place the permits in suspension during those restricted periods and then lift the suspension at the appropriate time. In all cases, the total amount of operating time would be capped at 72 months. The length of time it could take to acquire 72 months of total operating time could vary. A major limiting factor is soils. Across the forest, 20.4 percent has no restrictions for soils, 41.8 percent has frozen or dry soils restrictions, 35.9 percent has frozen soils restrictions, and 1.9 percent has no operations allowed. A frozen ground example is: if operations can only take place on frozen ground to protect soil resources, operations could be limited to 3 months a year during the coldest winter months. In this example, it could take up to 24 years (72 ÷ 3) to complete 72 months of operating time. In another example, there may be no seasonal restrictions. For the

purposes of this analysis and using the soils restrictions above, we will assume there will be an average of 5 months of exploration activities per year. Therefore, we will assume that a typical permit would be active for 15 years (72 months ÷ 5 months per year = 14.4 years = 15 years rounded up). For the permit extension, the four year extension equates to 10 years using these assumptions (48 months ÷ 5 months per year = 9.6 years = 10 years rounded up).

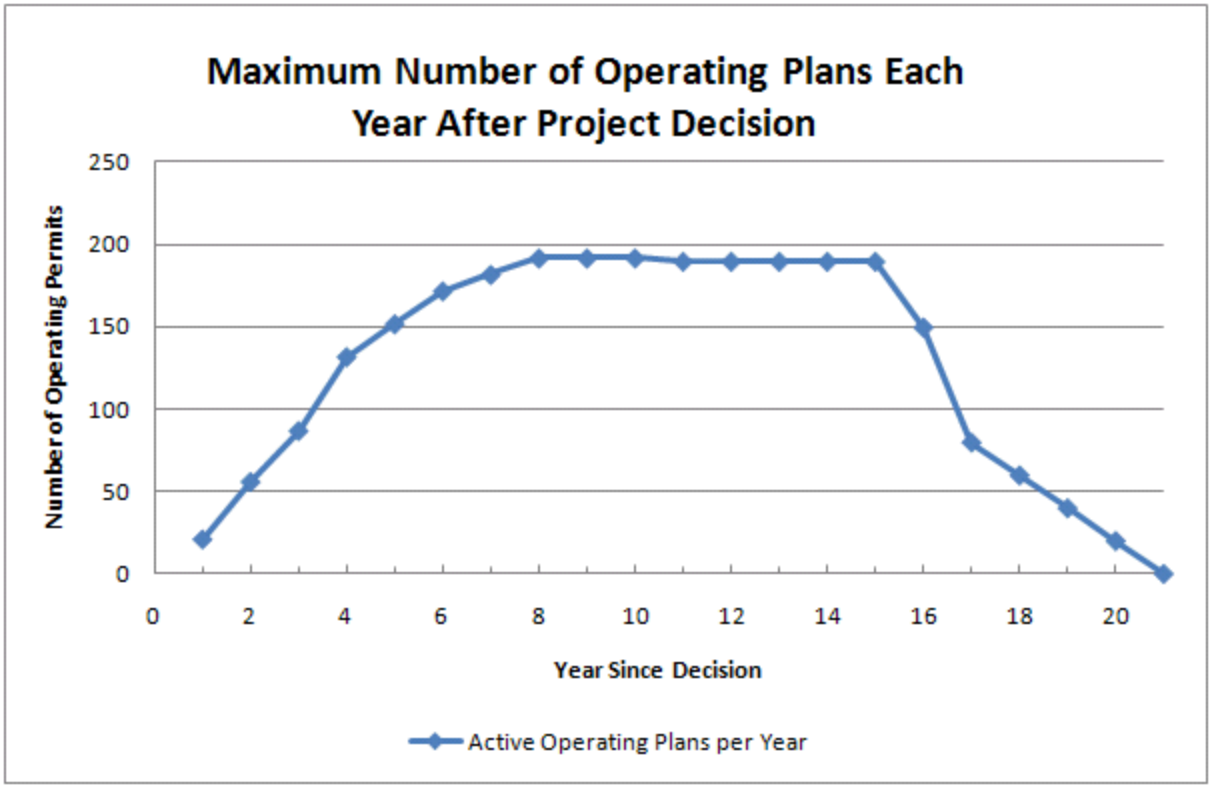


Figure 7. Maximum number of operating plans each year based on project assumptions

In general, a prospecting permit application includes an exploration plan that explains what activities would occur throughout the permit life. After the permit is issued, a site specific operating plan is submitted to the agencies for approval. Multiple operating plans may be permitted under each prospecting permit. For the purpose of this analysis, we will assume there may be an average of two operating plans submitted per prospecting permit.

Exploration activities can take place only after a prospecting permit has been issued and a specific exploration operating plan has been approved. Exploration operating plans can only be implemented during the life of a prospecting permit (total of 72 months of operating time) including all reclamation and permanent abandonment of drill holes. Operating plans can be active until the prospecting permit expires which under these assumptions is 15 years after the prospecting permit is issued. Therefore, this analysis will assume there would be 192 operating plans for the life of the project ((46 X 2 = 92) + (50 X 2 = 100)). Operating plans would normally need to be submitted several years prior to permit expiration to allow for analysis and completion of activities.

The following has been submitted to the BLM and FS to date:

Table 6. Applications for prospecting permits and exploration and operating plans

Company	Prospecting Permit Applications Received	Exploration Plans Received	Operating Plans Received
Encampment Resources	10 and 1 (incomplete)	10	0
Lehmann Exploration	5 plus 1 extension	5 plus 1 extension	5 plus 1 extension
DMC	10	10	10
Twin Metals	5	5	5
Prime Meridian	2	2	0
Park Creek	12 (incomplete)	0	0
Total	**33 complete 13 incomplete 46 Total**	**33 Total**	**21 Total**

Of the 33 complete prospecting permit applications, there are currently 21 operating plans proposed (DMC - 10, Twin Metals - 5, and Lehmann Exploration-5 plus 1 permit extension). This analysis will assume these 21 operating plan proposals would all be approved approximately 3 months after the Record of Decision (ROD) for this analysis with activities taking place in years 1-15 with the exception of the permit extension operating plan taking place in years 1-10. The additional 21 operating plans for these prospecting permits may be approved and active during years 3-15 with the exception of the permit extension operating plan taking place in years 3-10. Ground disturbing geophysical activities would likely take place in years 1-2, with drilling and related activities such as road access development taking place in years 1-15. Exploration activities may begin immediately after operating plan approval as stipulations allow.

Operating plans for the 12 remaining complete prospecting permit applications (Encampment Resources-10 and Prime Meridian-2) are expected to be submitted and potentially approved in years 1-2 with activities taking place in years 2-16. The additional 12 operating plans for these prospecting permits may be approved and active during years 4-16. Geophysical activities may likely take place in first two years (years 2-4), with drilling and related activities such as road access development taking place in years 4-16. Exploration activities may begin immediately after operating plan approval as stipulations allow.

The 13 incomplete prospecting permit applications (Park Creek-12 and Encampment Resources-1) are expected to be approved soon after the exploration plans are submitted and the appropriate analysis is completed. The operating plans for these 13 prospecting permit applications are expected to be submitted and approved within years 1-2 with activities taking place in years 2-16. The additional 13 operating plans for these prospecting permits may be approved and active during years 4-16.

The future 50 prospecting permit applications (10 each year for 5 years) may be approved in years 2-6. The associated operating plans may be approved in years 2-6 with activities potentially taking place in years 2-21. The additional 50 operating plans for these prospecting permits could be approved and active during years 4-21.

Ground disturbing geophysical activities are expected to occur within the first two years of prospecting permit issuance. Drilling and road work activities are expected to occur in years 1-20.

The total amount of surface disturbance analyzed would be spread over the 20 years. The rate of exploration over the 20 years varies depending on when operating plans are submitted and approved. Exploration activities would probably be highest during years eight through 10 where potentially all 192 operating plans may be active at the same time.

Each prospecting permit may have an average of 20 drill holes to demonstrate a valuable mineral deposit. This would average 10 drill holes per operating plan assuming 2 operating plans per prospecting permit. However, it's reasonable to assume that not all prospecting permits will have a valuable mineral deposit discovered and less drilling activity can be expected on those permit areas. Therefore, each exploration operating plan proposal may include an average of 7.4 holes. There may be one to two holes drilled from each drill pad. Taking the maximum disturbance of one hole per drill pad, this averages 7.4 drill pads per operating plan. Initial drill pad spacing may be 500 to 4,000 feet apart within a prospecting permit area. Drill pad spacing is generally not aligned along a grid but usually targets potential mineralized zones identified by geologic mapping, geophysical surveys, or other techniques. Ultimate definition drill pad spacing may be 300-600 feet within more focused prospecting permit target areas.

Using road access information from 20 operating plans submitted by Lehmann, DMC and Twin Metals, there is an estimated average of 0.33 miles (6.64 miles ÷ 20 OP) of new temp road construction and 0.23 miles (4.67 miles ÷ 20 OP) of reconstruction per operating plan (see Table 8 below). Only 20 plans are used for calculations because one application is entirely on lakes where roads would not be developed and drilling would be from permits surrounding the lakes. In addition, since a number of proposed holes have water access, one hole has helicopter access, there are many trails and existing roads in the proposal areas, and many of the current operating plan proposals have fewer holes proposed than normally is expected, these values were increased to cover a more intensive scenario to represent what may occur across the forest in the future. Therefore, the assumed new road construction per operating plan will be 2 miles of new construction and 2.5 miles of reconstruction that includes clearing vegetation from closed temporary roads. This gives an average of 19.2 miles of new temporary road construction and 24 miles of temporary road reconstruction per year over the 20 years of operations. Since most of an operating plan's activities occurs in the first 3 years after approval and downhole geophysics may occur anytime, the analysis will assume that for each operating plan, 100 percent of the miles will be open to vehicle use during year 1 for 5 months (the average operation activities in a year), 20 percent of the miles open to vehicle use during years 2 and 3 for 5 months, and then 10 percent of the miles open to vehicle use during years 4 through 20 for 5 months each year.

Up to one proposal per year may utilize a helicopter to transport equipment and supplies. The staging area could be on or off the Superior National Forest (SNF). If on the SNF, it would be located in an area with existing clearance necessary for staging and helicopter activities. Equipment would be flown in using a long line method and therefore no additional surface disturbance would be associated with their use other than what is cleared for the drill pad (up to 100 feet by 100 feet = 10,000 ft^2 = 0.23 acres). The helicopter would normally operate during daylight hours.

Barge access may be used and shore landings would be utilized where drill sites are located near bodies of water. There are currently eight landings proposed from four proposed operating plans on Birch Lake. Approximately forty landings associated with water access would be needed over the 20 year analysis. The landing disturbance area would average 25 ft wide by 50 ft deep (perpendicular to the shoreline). Some clearing and grubbing may be required. However, the amount of needed clearing and grubbing would be minimized. See Section 2.1.1, Mineral Exploration Activities, for more description of the assumptions.

The timeframe to complete drilling on each hole averages 3 weeks based on an average depth of 3500 feet. During a 5 month operations season per year, there may an average 7.4 holes per year per drill rig.

There may be an average of 10 drill rigs operating at the same time (based on 5 companies drilling with 2 drill rigs per year). Therefore, there may be an average of 74 holes drilled per year (assuming only one hole per drill pad and 5 months operating season per year). (192 operating plans X 7.4 holes per OP = 1420.8 drill holes over the 20 years of operations) (1420.8 drill holes ÷ 74 holes drilled per year = 19.2 years)

Prospecting activities may occur anywhere in the project area. However, exploration targets are expected to occur according to the known geology and mineralized areas within the project area. For this analysis, there are three mapped mineral interest areas; High (60-100 percent), Medium (0-30 percent), and Low (0-10 percent). A fourth area is unmapped called Very Low (0-1 percent). The percentages are the estimated amount of exploration activities that could occur within those areas. All of the prospecting permit applications will be considered as High. Of the 192 future exploration operating plans, we will assume that 115-192 would occur in the high, 0-58 would occur in the medium and 0-19 would occur in the low interest areas.

Table 7. Surface and mineral ownership, and mineral interest areas within the project area

Surface/Subsurface Mineral Ownership	Mineral Interest Areas (acres)		
	High	Moderate	Low
Federal/Federal	87,288	201,884	181,325
Federal/Non-federal	112,841	238,034	393,604
Private/Non-federal	127,293	248,749	854,591

The High (60-100 percent) mineral exploration interest area occurs mainly within the troctolitic series rocks of the Duluth Complex. Much of this zone is located along and near the base of the complex approximately located in the central part of the SNF. It could include parts of the footwall that may have been mineralized (older contact rocks situated below the Duluth Complex). The Medium (0-30 percent) mineral exploration interest area occurs in other portions of the Duluth Complex including the Beaver Bay Complex. The Low (0-10 percent) mineral exploration interest area is expected to mainly occur in the Archean age Superior Province, Wawa Subprovince volcanoplutonic rocks and greenstone belt rocks, Quetico Subprovince rocks, North Shore Volcanic Group, Iron deposits of the Mesabi Iron Range and Animikie Group of the Penokean Orogen, that make up the remaining parts of the project area. The Very Low (0-1 percent) mineral exploration interest is expected for potential kimberlite pipes and sediments originating from these pipes. However, these are unknown and unmapped and are not represented on the mineral interest area map. These mineral interest areas can be seen on Map 4.

Metal prices are cyclical. As advancement in metal extraction and mining technology progresses, options in developing mineral deposits would provide greater opportunities in mining and thus can spark interest in mineral exploration. In addition, price is not the sole factor driving mineral exploration. Discount rate, supply and demand, extraction and refinement technology, availability, location, political stability, confidence in the economy, rule-of-law, tax regimen, environmental sensitivity, and a number of other items are examples of some other factors taken into account by companies when planning mineral exploration.

Final reclamation of the roads and drill pads in a permit area would not be completed until the drill holes are permanently abandoned. Until that time, interim and/or concurrent reclamation would occur. For this analysis, it is assumed that final prospecting permit reclamation, including the last permanent drill hole abandonment would take place no later than 15 years from the prospecting permit issuance date. A stipulation will be included in all prospecting permits that states all reclamation, including permanent abandonment of drill holes, will be required at the end of a permit timeframe. However, final concurrent

reclamation in portions of the permit area would occur as opportunities arise and temporary access roads would be closed to motorized vehicles during interim/seasonal shut down of operations which for this analysis is five months after start-up of operations.

Exploration Disturbance Descriptions

Geophysical Exploration:
There could be a total of 96 ground disturbing geophysical surveys over the 20 years of operations (one per prospecting permit). Surveys would likely be completed in a grid fashion. Geophysical baselines could be up to 2 miles long with one mile long perpendicular cross wing or grid lines spaced along the baseline approximately every 500 to 1,000 feet. Each proposal may include up to 22 miles of cleared lines (of mostly brush and non-to-sub-merchantable trees) that are typically 3-6 feet wide for a maximum total of 16 acres. This equates to up to 1,536 acres of vegetation clearing over the 20 years and mainly between years one through seven. This averages 76.8 acres per year over the 20 years. Vegetation grows back into the cut lines very rapidly; usually within 2 years. The grid can vary from this spacing description but would not exceed the miles and acres to be cleared as described above.

Drilling:
Each operating plan proposal may include up to 7 drill pads that range between 50 X 25 feet to 100 X 100 feet in size (0.2 to 1.6 acres per operating plan). The sump disturbance would be incorporated into the drill pad disturbance estimation. If bedrock interferes with construction of the sump at the drill pad area, it may be located a short distance from the pad. If this is necessary, the drill pad area disturbance would be reduced to allow for the sump construction so that the total disturbance is maintained within the assumed or maximum drill pad size. Therefore, the sump disturbance, whether on or off the drill pad site, is included with the total pad estimated disturbance. The dimensions of a sump average 5 to 20 feet long by 5 to 20 feet wide by 5 to 10 feet deep. There may be larger sumps that could range up to 60 feet long by 40 feet wide by 15 feet deep in situations where multiple holes are drilled from the same pad and utilize the same sump. The total disturbance for 192 operating plans would approximately be between 38.4 to 307.2 acres over the 20 year timeframe. For this analysis, total disturbance associated with drill pads will have an assumed average of 1.9 to 15.4 acres per year for 20 years.

Roads and Landings:
Pre-Existing Road Reconstruction: For each of the operating plan drilling proposals, up to 2.5 miles of pre-existing roads could be utilized for access. This includes clearing of vegetation and reconstruction. If necessary, any regrowth of woody vegetation that interferes with driving ATVs and pickup trucks would be cut and/or bladed and cast to the side of the road. Additional drainage structures or road reinforcement may be installed as necessary. Total disturbed width would average 16 feet. This averages 5 acres of pre-existing road clearing and/or reconstruction per operating plan. The total disturbance for 192 operating plans would be approximately 960 acres or 480 miles. Annual disturbance associated with this activity will have an assumed average of 48 acres or 24 miles per year for 20 years.

New Temporary Access Road Construction:
For each of the operating plan drilling proposals, up to 2 miles of new temporary roads could be constructed for access. The road running surface would be an average of 12 feet wide. Total disturbed width, including tree clearing and temporary storage of vegetation, would likely average 20 feet. This averages 4.8 acres of temporary access road construction per operating plan. Drainage structures and road reinforcement would be installed as necessary. The total disturbance for 192 operating plans would be approximately 922 acres or 384 miles. Annual disturbance associated with this activity will have an assumed average of 46.1 acres or 19.2 miles per year for 20 years.

Landings:
Since landings are small features (25 feet X 50 feet) and are generally part of an access route, no additional acres will be calculated for landings.

Table 8. Estimates of disturbance from potential mineral prospecting activities anticipated over the next twenty years (as described above)

Activity type	Disturbance Per Year	Average Disturbance Over 20 Years
Expected ground disturbing geophysical proposals and associated activities	Up to 76 projects during years 1through 4, 20 during years 5 and 6	Up to 96 ground disturbing geophysical projects.
Expected drilling operating plan proposals and associated activities	Up to: 20 initiated in year one, 35 initiated in year two, 30 initiated in year three, 45 initiated in year four, 20 initiated in year five, 20 initiated in year six,10 initiated in year seven, and 10 initiated in year eight. All operating plan activities once initiated would take place during the 15 year prospecting permit term with the exception of the one prospecting permit extension that would be for 10 years.	Up to 192 operating plans.
Geophysics Line (vegetation clearing)	Average up to 76.8.	Up to 1,536 acres.
Helicopter Access	No additional ground disturbance.	No additional ground disturbance.
Drill Pad (includes surface grading)	Average of 1.9 to 15.4 acres.	Average of 38.4 to 307.2 acres.
Pre-existing Road Reconstruction	Average up to 48 acres or 24 miles.	Average up to 960 acres or 480 miles.
New Temporary Access Road Construction	Average up to 46.1 acres or 19.2 miles.	Average up to 922 acres or 384 miles.
Landings	No additional disturbance acres since road access incorporates the majority of the disturbance.	No additional disturbance acres since road access incorporates the majority of the disturbance.
Total Average Disturbance	Average up to 186 acres per year.	Average up to 3,725 acres over 20 years.

2.2.3 Alternative 3 – Noise Reduction for Entire Project Area

Alternative 3 applies noise abatement measures at all drilling exploration sites across the project area to reduce impact to private residences, businesses and recreation use within the project area. These measures would help disperse drilling noise upward rather than dispersing the noise generated laterally and reduce sound waves (Braslau 2007). The intent of the alternative is to reduce decibel levels caused by the drilling equipment which will reduce noise heard on the forest to typical ambient levels at a shorter distance from the drill site.

Noise levels at 20 feet from the drilling rig averages approximately 84 decibels without any noise abatement measures (Braslau 2007, Harrison 1980). Braslau (2007) showed that at ¼ mile from the drill rig, decibel level averages 37, which is near ambient noise level for a forested condition.

Detail of noise abatement measures

The permittees would be required to reduce decibel level at the source (20 feet from the drill rig) to 70 decibels. Typical methods for noise abatement at the drill rig sites that have been proven effective for noise abatement may include:

- Acoustical enclosure for the engine or drill rig (baffle): The enclosure would be build from absorbent synthetics, such as sheets of plywood with insulation that enclose the engine or drill rig and can be removed and re-assembled at each location. Baffles have been shown to reduce noise by 8-15 decibels and can reduce the decibel level to at or below the daytime ambient decibel level at one-quarter mile from the drill rig (Braslau 2007).
- Upward extension of the exhaust pipe and use of an engine muffler: The exhaust of the drilling engines would be extended and directed up into the air to help direct engine sound upward, rather than laterally.

The proposed assumptions regarding numbers of drill pads, drill holes, acres of disturbance, miles of temporary roads, etc. are the same as Alternative 2. Additional details that apply to and further refine the this alternative such as the maximum disturbance scenario, BLM permit stipulations, Forest Service standard stipulations, project design features, and resource stipulations are located in Section 2.4, and operating assumptions and can be found In Section 2.2.2.4 and 2.1.1.

2.2.4 Alternative 4 – Noise Reduction for Recreational Experience

Alternative 4 is the agency preferred alternative. The intent of the alternative is to allow for drilling activities to occur across the project area but provide for reduced target decibel levels at key receptors as described below. Alternative 4 requires decibels should not exceed more than 5 dBA above the target thresholds at the receptors identified in Table 9.

Table 9. Alternative 4 receptors, thresholds and rationale

Decibel (dBA) Level Threshold[a]	Common Noise Sources	Receptor	Rationale and Comments
60	Conversational Speech, Typical TV Volume	Semi-Primitive Motorized Management Area (MA)	The common noise sources exemplifying this decibel level are consistent with the descriptors for the Semi-Primitive Motorized Recreation Opportunity Spectrum applicable to the Semi-Primitive Motorized MA theme and setting descriptions in the Forest Plan (pg 3-25).
50	Library	Semi-Primitive Non-motorized MA, Developed Campgrounds, Campsites, & Dwellings	The common noise source exemplifying this decibel level are consistent with the descriptors for the Semi-Primitive Non-motorized ROS applicable to the Semi-Primitive Non-motorized MA theme and setting descriptions in the Forest Plan (pg 3-22). Developed campgrounds, campsites and existing dwellings are somewhat analogous to Residential locations discussed in the MPCA Guide to Noise Control (See page 5, Summary). Statute relating to noise for residential locations indicate need for no more than 50 dBA during the nighttime (10:00 PM – 7:00 AM). See also Minn. Rules § 7030 Noise pollution. (MPCA Noise controls guide, pages 15-19)
30	Secluded Woods	Wilderness MAs	Wilderness areas consist of remote forests, or “secluded woods”, and remote waterways.

Source – MPCA A Guide to Noise Control in Minnesota October 2008 (pg 5).
a- Decibels should not exceed more than 5 dBA above the target threshold since there is noticeable change in noise at ± 5 dBA. (MPCA A Guide to Noise Control in Minnesota, pgs 5 & 7).

The permittees would be required to meet these requirements. The proposed assumptions regarding numbers of drill pads, drill holes, acres of disturbance, miles of temporary roads, etc. are the same as Alternative 2. Further details that apply to and further refine the this alternative such as the maximum disturbance scenario, BLM permit stipulations (Section 2.4.1), Forest Service standard stipulations, project design features, resource stipulations and operating assumptions and can be found in detail on pp. 43 - 61.

2.2.5 Alternative 5 – Noise Reduction based on Season

To reduce potential impacts to people from noise from drilling operations, Alternative 5 provides for seasonal noise reduction within the project area by allowing drilling exploration and other project activities to occur only from November 1 through April 30. Limiting operations to this time frame would result in not impacting people with noise from drilling during the time frame when recreation use on and near the SNF is at its highest. In addition, this alternative further addresses potential noise impacts by requiring that drilling operations result in no more than about 70 dBA at 20 feet from the source (drill rig) throughout the exploration operations. This could be accomplished by utilizing noise abatement measures, such as baffles and exhaust extensions as described for Alternative 3.

The proposed assumptions regarding numbers of drill pads, drill holes, acres of disturbance, miles of temporary roads, etc. are the same as Alternative 2. Further details that apply to and further refine the this alternative such as the maximum disturbance scenario (Section , BLM permit stipulations (Section 2.4.1), Forest Service standard stipulations (Section 2.4.2), project specific resource stipulations (Section 2.4.3) and operating assumptions (Section 2.2.2.4)and can be found in their respective sections.

2.3 Alternatives Considered but Eliminated from Detailed Study

Federal agencies are required by NEPA to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14). Public comments received in response to the Proposed Action provided suggestions for alternative methods for achieving the purpose and need.

The Forest Supervisor has decided to no longer consider mineral bulk sampling as originally described in the April 2009 Proposed Action scoping package. If future mineral bulk sampling proposals are received by the SNF and BLM, additional NEPA analysis will be conducted at that time.

2.3.1 Alternative based on water quality or water quantity

Concerns were raised by the public regarding water quality and water quantity as a result of the proposed exploration activities. Best management practices / measures taken to protect or enhance water quality related to proposed exploration drilling activities were considered (See Project Record – hydrology specialist report) based upon their (1) proven effectiveness, and as a related item (2) the relative risk associated with their use. Based upon these considerations, the following evaluation of the effectiveness or of best management practices was completed for water quality and water quantity.

Water Quantity

The SNF is currently utilizing a mitigation measure in the Kawishiwi Minerals Exploration Project (Implemented in 2008) that limits the amount of water to be drafted from a streams, wetlands and lakes. It reads:

> Water cannot be withdrawn from streams that have less than 1 cubic feet per second flow rate. Withdrawal rates from streams shall be no more than 10 percent of the flow at the time of withdrawal. Withdrawal from wetlands, ponds,

> or lakes, shall not exceed 1 percent of the estimated volume of the basin at the time of withdrawal. Water intakes shall have appropriately sized screens to minimize impact to aquatic organisms.

This same mitigation measure will be applied to each action alternative in this project to reduce impacts to surface water quantity.

Groundwater withdrawal is regulated by the MN DNR from high capacity wells. The type of drilling that is to occur in this project is not considered to be high capacity drilling and therefore any regulations regarding high capacity wells do not apply to this project. If there is a concern regarding this interference with groundwater quantity, a complaint can be submitted to the MN DNR for their consideration and potential investigation. Based upon these considerations, additional mitigation measures or additional alternatives are not proposed.

Water Quality

The experience of the SNF and the Minnesota Department of Natural Resources on State of Minnesota lands has shown that the best management practices associated with mineral exploration drilling activities have effectively protected both groundwater and surface water resources (Rye 2010c). All wells must be completed by a licensed well driller and meet Minnesota Well Code requirements (Rye 2010b). These best management practices have been developed to meet State regulations and industry standards.

Mitigation measures currently being used on other similar exploration projects have proven effective, and therefore, an additional alternative utilizing additional measures was not developed further in the analysis.

2.3.2 Alternative based on time and season

This alternative would limit drilling operations to daytime hours (6 am to 10 pm) during the busy visitor season, May to October, and would not allow operations to continue during the night when typical ambient woodland noise levels are lower. Operations would be allowed 24-hours a day between November and April. The purpose for this alternative would be to reduce impacts to visitor recreation experience. Noise abatement measures could be applied to this alternative as described in Alternative 3. It was determined that Alternatives 3 and 4 and 5 include a number of noise reduction options that already address impacts to recreation visitor experience, and that this alternative would fall within the existing range of alternatives that address the issue of noise and therefore will not be carried forward in the analysis.

This alternative will not be carried through the analysis as limiting the timing for operations will lengthen the time that exploration may occur in an area if the operation must shut down and reopen daily versus allowing operations to occur over a 24-hour period. This alternative would be expected to result in greater impact to the land due to additional access daily in and out of the site by vehicles and equipment. The potential exists for additional site maintenance or access road maintenance due to increased access by the permittees. This alternative is also more costly to the permittees due to additional time needed on site, the cost of moving equipment on and off site and increased site and access road maintenance.

2.4 Prospecting Permit Stipulations

This section provides in detail the specific requirements that would apply to all action alternatives. A list of administrative requirements from the BLM and SNF would be incorporated into all permits and operating plans (sections 2.4.1 and 2.4.2). Section 2.4.3 lists the resource specific stipulations that would also be applied to both the permits and the operating plans.

2.4.1 Bureau of Land Management

The following are BLM requirements considered in this EIS that apply to all action alternatives.

1. Bond. The permittee shall file with the appropriate Bureau of Land Management office a permit bond prior to permit issuance in the amount of $1,000 for the use and benefit of the United States to ensure surface and sub-surface reclamation. An increase in the amount of the permit bond maybe required upon approval of a final exploration plan or at any other time during the life of the permit, to reflect changed conditions.
2. Extension. To qualify for an extension of the permit, the permittee must drill or excavate at least one exploration hole, trench or test pit, or perform other comparable exploration, e.g., substantial amounts of work described in stipulation No. 4. The requirements may be waived by the Authorized Officer if the permittee is unable to comply due to conditions beyond the permittee's control or for other reason provided by 43 CFR 3562.9-1.
3. Supervision. The Authorized Officer (Field Manager) located at the Bureau of Land Management - Eastern States, Milwaukee Field Office, 626 East Wisconsin Avenue, Suite 200, Milwaukee, Wisconsin 53202-4617, is responsible for the review and approval of exploration plans and modification thereof, inspection and enforcement of requirements, and is the recipient of quarterly reports.
4. Exploration Resulting in No Surface Disturbance. Prior to conducting activities on the permit area which do not disturb the surface or surface resources, e.g., geological mapping, geochemical surveys, ground and aerial geophysical surveys, and sampling of outcrops and old workings, the permittee shall notify the Authorized Officer, in writing, when such activities will commence, and thereafter furnish the Authorized Officer quarterly reports on the progress and results of such activities, including maps, narrative, and analyses as available on the date of the reports.
5. Exploration Resulting in Surface or Surface Resource Disturbance. Prior to conducting activities which disturb the surface and surface resources on the permit area, the permittee will submit to the Authorized Officer for review and approval two copies of a final exploration plan or of additional information which, when added to the exploration plan submitted prior to issuance of the permit, will provide the Bureau of Land Management with sufficient information to show in detail the proposed exploration, prospecting, or testing to be conducted. After the plan is approved, the permittee shall furnish the Authorized Officer a written notice of when the approved activities will commence, and thereafter furnish the Authorized Officer quarterly reports on the progress and results of the exploration. The quarterly reports shall include maps, logs, analyses, cross sections, or other graphic illustrations showing the geologic and physical mode of occurrence of the deposit as available on the date of the report period. Exploration plans may be changed by mutual consent of the Authorized Officer and the operator at any time to adjust to changed conditions or to correct an oversight. To obtain approval of a changed or supplemental plan, the operator shall submit a written statement of the proposed changes or supplement and the justification for the changes proposed. If circumstances warrant, or if development of an exploration plan for the entire operation is dependent upon unknown factors which cannot or will not be determined except during the progress of the exploration, a general plan may be approved and supplemented from time to time with site-specific information. The operator shall not, however, perform any exploration except under an approved plan.
6. Discovery Data. In the event permittee applies for a preference right lease, the said quarterly reports and supplementary data required by the Authorized Officer will be used to determine whether or not the permittee has discovered a valuable deposit. The supplementary data will indicate the extent of the deposit, the physical and geological mode of occurrence, the average grade as established prior to permit exploration, the anticipated mining and processing methods, the anticipated location, kind and

extent of necessary surface disturbance and measures to be taken to reclaim that disturbance. Valuable deposit is a deposit of character that further expenditure of labor means is justified with a reasonable expectation, not necessarily a demonstrated certainty, of success in developing a valuable mine.

2.4.2 Forest Service

The following are Forest Service requirements that apply to all action alternatives. These stipulations define and describe processes for permit administration and coordination.

1. All work and any operations authorized under this permit shall be done according to an approved operating plan on file with the Forest Supervisor at 8901 Grand Avenue Place, Duluth, MN 55808-1102. Plans generally require a minimum of 45 days for Forest Service review. The Bureau of Land Management must also review and approve the plan.
2. The Operating Plan will contain information the Forest Officer determines reasonable for assessment of (1) public safety, (2) environmental damage, and (3) protection for surface resources. The content of such plans will vary according to location and type of activity and may contain:
    a. Steps taken to provide public safety.
    b. Location and extent of areas to be occupied during operations.
    c. Operation methods including size and type of equipment.
    d. Capacity, character, standards of construction and size of all structures and facilities to be built. [No structures or facilities are proposed.]
    e. Location and size of areas where vegetation will be destroyed or soil laid bare.
    f. Steps taken to prevent and control soil erosion.
    g. Steps taken to prevent water pollution.
    h. Character, amount, and time of use of explosives or fire, including safety precautions during their use. [Explosives and fire are not proposed.]
    i. Program proposed for rehabilitation and revegetation of disturbed land.
3. Copies of all permits obtained from State or Federal agencies pertaining to work might be required. Archeological studies, if required, will accompany the plan.
4. The Forest Supervisor or his/her designated agent has authority to temporarily suspend or modify operations in whole or in part due to emergency forest conditions such as high fire danger or other unsafe situations. The permittee must keep the District Ranger informed about the progress of operations to the extent reasonably necessary for assuring public safety. This is especially important with geophysical inventory and testing activities because of their mobile nature. The District Ranger will alert the permittee to circumstances which may affect safe and efficient conduct of work activities.
5. The District Ranger shall be given advance notification of any activity that could involve hazards to public safety and suitable action will be taken to protect the public.
6. The District Ranger shall be notified at least 2 weeks in advance of the start up of all activities under the operating plan. This includes all activities in future years such as permanently sealing drill borings, geophysics, road work/closures, site maintenance, and final reclamation.
7. The District Ranger shall be notified yearly on the company's intent to permanently seal drill borings and when final reclamation will take place.

8. The permittee shall submit a report to the FS that describes the work completed each year the prospecting permit is active including methods/quantities/lengths of facilities constructed/reconstructed, maintenance, road closure techniques, borehole abandonment (temporary and final), reclamation, and maps.
9. The permittee shall coordinate with Forest Service Officials for surface disturbing activities including; location of road construction, location of drill sites and sumps, and location of water sources to be used for drafting. The Forest Service may provide additional guidelines that consider the need to protect resources such as soils, heritage sites, water quality and quantity, wetlands, riparian zones, NNIS, threatened, endangered, and sensitive wildlife species and safety.
10. Pursuant to the provisions of the act of March 4, 1917 (16 USC 520), Section 402 of the Re-organization Plan No. 3 of July 16, 1946 (60 Stat. 1097, 1099), the Act of August 7, 1947 (30 USC 352), and the National Environmental Policy Act of 1969 (42 USC 4321 et seq.) as said authorities have been or may hereafter be amended, no mineral development of any type is authorized hereby, and consent to the issuance of this prospecting permit as required by law and regulation (43 CFR 3507.11 (d)) and 43 CFR 3507.19(c)) is given subject to the express stipulation that no mineral lease may be issued for the land under permit without the prior consent of the Forest Service, USDA and the proper rendition of an environmental analysis in accordance with the National Environmental Policy Act of 1969, the findings of which shall determine whether and under what terms and conditions for the protection of the land involved the lease may be issued.
11. The licensee/permittee/lessee must comply with all the rules and regulations of the Secretary of Agriculture set forth at Title 36, Chapter II, of the Code of Federal Regulations governing the use and management of the National Forest System (NFS) when not inconsistent with the rights granted by the Secretary of the Interior in the prospecting permit. The Secretary of Agriculture's rules and regulations must be complied with for (1) all use and occupancy of the NFS prior to approval of a permit/operation plan by the Secretary of the Interior, (2) uses of all existing improvements, such as Forest development roads, within and outside the area permitted by the Secretary of the Interior, and (3) use and occupancy of the NFS not authorized by a permit/operating plan approved by the Secretary of the Interior. All matters related to this stipulation are to be addressed to Superior National Forest Supervisor at 8901 Grand Ave. Place, Duluth, MN 55808-1122, telephone number (218) 626-4300, who is the authorized representative of the Secretary of Agriculture.
12. The permittee shall file a report with the District Ranger upon the conclusion of all work, specifying the methods and materials used to properly plug and cap any drill holes and/or the types of material and methods used to restore any other excavations required to be restored by law, regulation, stipulation or permit provision. In addition, the permittee shall provide in the report the name and telephone number of the person to contact in order to arrange for an on-site inspection of the permitted area. A negative report is required and an inspection is required regardless of the amount and type of work performed.
13. Terms of the permit are considered violated if not done according to all stipulations.
14. Any modifications to the operating plan (OP), including timeframes for operations, must be submitted to the Forest Service for concurrence prior to implementation.
15. Forest Service concurrence of a permit or operating plan does not relieve the company of their responsibility to comply with other applicable state, federal or local laws, rules, or regulations or ordinances.
16. Modification of approved drill sites, access road locations and other surface disturbing activities in the operating plan may be modified only after Forest Service review and approval.

2.4.3 Resource Stipulations Common to All Alternatives

This section lists requirements that would be routinely employed during prospecting operations to ensure that the permits and operating plans meet Forest Plan direction regarding physical, social and biological resources and are noted with a citation to the Forest Plan location. However this is not an all inclusive list. This section also includes direction that is not found within the Forest Plan but will ensure for resource protection and safe operations during mineral exploration.

The following stipulations are applicable to all alternatives unless otherwise noted may include modifications or waivers after site specific proposals are submitted and analyzed, and as long as the objective is met. When a site specific operating plan is proposed the Forest Service will identify which stipulations apply and where no surface occupancy, timing restrictions or other protections would be required (project file). The location of proposed sites may be modified slightly in cooperation with the surface managers (SNF).

2.4.3.1 General Administration

Administration	
GA-1 Stipulation	The permittee will be responsible for the cost of certain monitoring activities as directed by the SNF. This may include but not be limited to water sampling and testing and NNIS, biological, and archeological surveys.
Objective	Shift the costs of project monitoring beyond normal monitoring activities to the permittees so that the cost to the agencies is limited and thereby reduces financial impacts to agency program management.
Source	SNF minerals program management
Best management practices	
GA-2 Stipulation	Additional mitigation and best management practices requirements may be added to any prospecting permit or operating plan by the agencies if an environmental analysis, permitting process, or permit/operating plan administration shows there is a need for improved resource management. No waivers or modifications. Best management practices shall be followed that include but are not limited to the following list: a. Surface disturbance from drilling shall be minimized to the extent possible. Drilling will involve some surface disturbances because of the need to prepare drill sites (including sumps for water re-circulation and settling out of drill cuttings) and the need to construct new access roads. b. In the construction of new access roads and drill pad sites, all effort shall be made to avoid cutting of timber. c. Removal or cutting of trees and vegetation shall be kept to a minimum. The permittee shall acquire a timber sale permit prior to any tree cutting. All woody vegetation must be cut parallel with the ground surface to prevent sharp points and as close to the ground as possible. Slash, brush, tree limbs, seedlings and saplings cut to clear temporary roadways, shall be disposed of or stored along the edges of the cleared temporary roadways such that the larger debris is easily accessible during reclamation. d. Any piled trees cut or pushed over along with slash shall be no higher than 3 feet high. This material shall be utilized in rehabilitating the temporary roads and drill pad sites once drilling operations are complete. For this reason, chipping of timber and slash shall not be utilized. e. Also, avoid felling trees into non-forested wetlands. f. No trees over 5 inches in diameter at breast height of 4 feet 5 inches above the surface (DBH) may be pushed over, they must be cut. Stumps shall be left no higher than 10 inches above ground. Any slash piles shall be no higher than 3 feet high. g. The top 12 inches of topsoil shall be stripped and stockpiled separately from the rest of the excavated material. This material shall be spread over the surface as the last step in re-contouring the sites and/or access routes during reclamation.
Objective	Permit activities in a way that protects forest resources and assists in project administration.
Source	SNF minerals program management.

Administration	
GA-3 Stipulation	No drilling will be allowed within Forest Service mineral material quarry areas unless the Forest Service and contractor both agree the activities will not interfere with the contract operations and will not damage the stone deposit.
Objective	Ensure that hardrock prospecting does not interfere with mineral material quarry contract permittee operations or other FS gravel quarries.
Source	SNF minerals program management.
GA-4 Stipulation	Permittees may perform activities that accelerate the ground to freeze when operations are limited to frozen ground conditions. If the permittee chooses to perform this work, a plan shall be submitted to both the BLM and FS that describes how the permittee plans to accomplish this work. The plan must be completed to the satisfaction of the BLM and FS prior to implementation.
Objective	Develop frozen ground conditions at the earliest time during the year to extend the winter drilling season.
Source	SNF minerals program management.
GA-5 Stipulation	Permittees and their contractors, subcontractors, operators, or assignees must comply with all general National Forest rules and regulations, any other rules and regulations applicable, all permit and operating plan stipulations, and any other requirement made by the Forest Service for the protection of the land and its' resources and users.
Objective	To assure compliance of all permits and operating plans.
Source	SNF minerals program management.
GA-6 Stipulation	For all exploration holes drilled on the SNF, the permittee shall submit a carbon copy of an exploratory boring sealing report at the same time it is submitted to the State of Minnesota in accordance with Minnesota Department of Health, Explorers and Exploratory Borings, rule 4727.0920. The report shall be sent to the SNF authorized officer.
Objective	To assure drill bore hole abandonment is completed in accordance with Minnesota state rules.
Source	SNF minerals program management.
Forest Plan guidance	
GA-7 Stipulation	All activities authorized on the permitted area are subject to the SNF Land and Resource Management Plan dated July 2004, as amended
Objective	Meet Forest Plan requirements
Source	SNF minerals program management
Health and Safety	
GA-8 Stipulation	Health and safety precautions should be followed, including, but not limited to the following list: a. Areas constructed as drill sites shall be open to state and federal officials, hired contractors and their employees and employees or consultants. In the interest of safety and to the extent practical, unauthorized personnel shall be discouraged from entering operations areas. The permittee shall discuss options for this with the Authorized Officer and implement the requirements. b. Road signs shall be installed for vehicle and public safety and shall be approved by the Authorized Officer prior to installation. c. Other appropriate signing may be required and permitted as long as first approved by a Forest Service Official. d. The District Ranger shall be given advance notification of any activity that could involve hazards to public safety and suitable action shall be taken to protect the public. e. Vehicles and drills shall be equipped with fire-fighting equipment. f. No explosives or firearms shall be permitted on the project by the permittee. g. During drilling operations, trash shall be stored in suitable containers and removed from the site for disposal h. Fires are permitted only in specific heating devices (salamanders, cook stoves, etc.) and all state and federal fire laws and regulations shall be observed to prevent and suppress fires in the areas of operation.
Objective	To protect health and safety of operators and publics.
Source	SNF minerals program management

2.4.3.2 Location and extent of areas to be occupied

Location and extent of areas to be occupied	
Minimizing impacts	
LOC-1 Stipulation	All roads, trails, drill pads and other disturbance features shall be staked or flagged on the ground for agency review during the permitting phase and prior to implementation.
Objective	Provide proposed and permitted disturbance features locations for agency administrative purposes.
Source	SNF minerals program management.
BWCAW and Mining Protection Areas	
LOC-2 Stipulation	No permit, lease, or other authorization will be issued for exploration or development of minerals owned by the United States within BWCAW and in Mining Protection Areas
Objective	To protect wilderness characteristics and sensitive resources
Source	Forest Plan S-MN-3; S-MN-4; S-MN-6; S-MN-7; D-MN-1
Research Natural Areas	
LOC-3 Stipulation	No Surface occupancy is allowed within Candidate Research Natural Areas and Research Natural Areas(locations are identified in Map 2)
Objective	Maintain the role of these Management Areas in ecological research and serve as baseline or reference areas for comparison to other similar ecosystems that are subject to a wider range of management activities.
Source	Forest Plan S-RNA-13
Unique Biological Areas	
LOC-4 Stipulation	No Surface occupancy is allowed within unique biological areas as defined by the Forest Plan (locations are identified in Map 2)
Objective	To protect unique biological resources
Source	Forest Plan S-UB-6
Wild and Scenic Rivers	
LOC-5 Stipulation	No permit, lease, or other authorization will be issued for exploration or development of minerals owned by the United States within wild sections of designated Wild & Scenic Rivers. These areas include a ¼ mile corridor on each side of a river (locations are identified in Map 2).
Objective	To protect the characteristics for which the river was designated wild.
Source	Forest Plan S-WSR-11
LOC-6 Stipulation	Surface disturbance or occupancy for development and extraction of federally owned minerals excluding sand and gravel are generally not permitted within scenic or recreational sections of designated Wild & Scenic Rivers. These areas include a ¼ mile corridor on each side of a river.
Objective	To protect the characteristics for which the river was designated scenic or recreational
Source	Forest Plan S-WSR-12
LOC-7 Stipulation	Where appropriate, sand and gravel may be removed by special permit issued by the Forest Supervisor. No sand and gravel may be removed from any area below the ordinary high water mark.
Objective	To protect the characteristics for which the river was designated scenic or recreational
Source	Forest Plan S-WSR-12

2.4.3.3 Heritage Resources

Heritage Resources	
Unknown locations	
HR-1 Stipulation	No earth-disturbing activities shall occur prior to completion of a survey in areas where heritage resource surveys have not been completed and the area proposed for ground disturbing activities is determined by the Forest Archaeologist to have a medium-high potential for historic properties.
Objective	Identify, evaluate, protect, monitor, and preserve heritage resources
Source	Forest Plan O-HR-1
HR-2 Stipulation	If the permittee decides to provide a heritage resource survey and report, the permittees archaeological contractor must contact the SNF Archaeologist and acquire all necessary permits. The permit must be obtained prior to the initiation of any heritage resource investigations on the SNF. The archaeological contractor will submit the report on the investigations to the SNF Archaeologist following the conditions of the permit, and the SNF will initiate and carry to completion all regulatory consultation with the Minnesota State Preservation Officer and Tribal Historic Preservation Officers within the ceded (1854) territory as required by the National Historic Preservations Act of 1966, as amended through 1992, and the accompanying regulations as found in 36 CFR 800. MN State Historic Preservation Office; 36 CFR 800
Objective	Identify, evaluate, protect, monitor, and preserve heritage resources
Source	Forest Plan O-HR-1
Sites found during implementation	
HR-3 Stipulation	If heritage resources are discovered during the implementation of exploration activities, the project must halt at that location and the Forest Archaeologist must be notified and the SNF Archaeologist must also notify the Tribal Historic Preservation Officer. MN State Historic Preservation Office36 CFR 800
Objective	Identify, evaluate, protect, monitor, and preserve heritage resources
Source	Forest Plan O-HR-1
Known locations	
HR-4 Stipulation	Historic properties shall be avoided include protected areas (buffers) beyond known site limits, determined on a case-by-case basis considering landform, vegetative cover, access, and planned project activities.
Objective	Identify, evaluate, protect, monitor, and preserve heritage resources
Source	Forest Plan S-HR-9
HR-5 Stipulation	Any heritage resource sites located prior to prospecting activities shall be avoided Protection measures shall be developed by the Forest Archaeologist, through collaboration with the State Historic Preservation Officer and Tribal Historic Preservation Officers within the ceded (1854) territory (SHPO/THPO), Expense and implementation of protection measures shall be the responsibility of the permittee. MN State Historic Preservation Office
Objective	Identify, evaluate, protect, monitor, and preserve heritage resources
Source	Forest Plan O-HR-1

2.4.3.4 Recreation and Visuals

Recreation and Visuals	
Noise Abatement	
RV-1 Stipulation	Under Alternatives 3 and 5, for all locations, reduce sound levels emitted from drilling rigs to 70 dBA at 20 feet from the drill rig. This may be accomplished with techniques such as installing baffling around the engine, directing exhaust pipes upward, or other measures that may be identified during implementation.
Objective	Reduce level of annoyance for Forest recreation users, and effects to solitude for wilderness users.
Source	Issue identified for the Federal Hardrock Minerals Prospecting Permit EIS
RV-2 Stipulation	Under Alternative 5, allow drilling only from November 1 to April 30 for any location.
Objective	Reduce level of annoyance for Forest recreation users, and effects to solitude for wilderness users.
Source	Issue identified for the Federal Hardrock Minerals Prospecting Permit EIS
RV-3 Stipulation	Under Alternative 4, reduce sound levels reaching receptors to 30 dBA inside the BWCAW, 50 dBA for developed campgrounds, campsites, recreation residences and the Semi-Primitive Non Motorized MA, and 60 dBA for the Semi-Primitive Motorized MA (see Map 7 for locations of receptors). This may be accomplished with measures such as installing baffling around the engine, directing exhaust pipes upward, adjusting the location of drilling, or other measures that may be identified during implementation.
Objective	Reduce level of annoyance for Forest recreation users, and effects to solitude for wilderness users.
Source	Issue identified for the Federal Hardrock Minerals Prospecting Permit EIS
RV-4 Stipulation	Under all action alternatives, sound levels reaching private and recreation residences must be no more than 50dBA.
Objective	Reduce level of annoyance for occupants of buildings.
Source	MPCA noise control rules for nighttime sound level limits.
Visual Integrity (see map 7)	
High Scenic Integrity Objective (SIO) areas	
RV-5 Stipulation	Staking, paint, flagging, equipment, maintenance, and staging areas should be minimized, removed or cleaned up within one month following project completion.
Objective	Minimize evidence of temporary activities and ensure cleanup is concurrent with project completion.
Source	Forest Plan G-SC-4, page 2-48 (map of SIO areas)
Moderate and High SIO areas	
RV-6 Stipulation	Schedule mechanized activities during periods of low recreation use if the mechanized activities can be viewed from travelways, recreation sites and bodies of water with access.
Objective	Minimize evidence of management activities
Source	Forest Plan G-SC-6
RV-7 Stipulation	Generally obliterate roads and trails that are decommissioned and reclaimed according to road stipulations under section 2.4.3.8.
Objective	Restore roads and trails to a natural appearance (See Appendix D for example drawing).
Source	Forest Plan G-TS-15
Developed Recreation Areas	
RV-8 Stipulation	No drilling operations inside developed recreation sites (for example, campgrounds, parking areas and trail heads).
Objective	To reduce conflicts to the recreation users and avoid damage to infrastructure.
Source	Forest Plan, G-Rec-2

2.4.3.5 Threatened and Endangered Wildlife Species

Threatened and Endangered Species	
Canada Lynx	
Critical Habitat-	
TES-1 Stipulation	Moderate the timing, intensity, and extent of management activities. Protective measures would be defined by a SNF wildlife biologist.
Objective	To maintain required habitat components in lynx habitat
Source	Forest Plan G-WL-1
Den Sites	
TES-2 Stipulation	Protect known active Canada lynx den sites during the denning season (generally May-July 31). Protective measures would be defined by a SNF journey-level wildlife biologist.
Objective	To limit disturbance during denning
Source	Forest Plan G-WL-2
Gray Wolf (also a Management Indicator Species)	
Den Sites	
TES-3 Stipulation	Provide for the protection of known active gray wolf den sites during the denning season (Generally April 1-May 15).This equates to No Surface Occupancy during the timeframe given. Protective measures would be defined by a SNF wildlife biologist. ***Seasonal restrictions** – for den sites consider pups usually born early to mid April and stay in the den 6-8 weeks (restrict activities April-May).
Objective	Limit disturbance during denning season
Source	Forest Plan G-WL-10.

2.4.3.6 Regional Forester's Sensitive Species (RFSS)

The following stipulations for the regional forester's sensitive species and other species are designed to meet the Forest Plan objective to maintain, protect, or improve habitat for sensitive species through site-level management strategies (O-WL-18): addressing species' needs by managing specifically for high quality habitat or known locations of sensitive species. The stipulations reflect management approaches and protective measures that are either Forest Plan standards or guidelines or methods that SNF biologists have applied and found to protect each particular species depending on the species' habitat requirements and distribution, individual site conditions, and expected management impacts (G-WL-12).

RFSS and other species of interest		
General requirements of known locations		
	RFSS-1 Stipulation	Avoid or minimize negative impacts to known occurrences of sensitive species.
	Objective	Maintain and protect sensitive species habitat and reduce adverse effects to species
	Source	Avoidance is a proven, standard SNF site-level management strategy used to meet Forest Plan G-WL-11.
	RFSS-2 Stipulation	Minimize negative impacts to known sensitive species from management activities that may disturb pairs in their breeding habitat during critical breeding season (varies by species).
	Objective	Maintain and protect sensitive species habitat and reduce adverse effects to species
	Source	Forest Plan G-WL-12
	Sites found during implementation	
	RFSS-3 Stipulation	If a new nest is found for bald eagle, osprey, goshawk, boreal owl, or great gray owl, during project implementation, activities would be temporarily halted in the area. The District Biologist would be consulted and appropriate mitigation measure would be designed and carried out prior to restarting operations.
	Objective	Reduce breeding season disturbance to RFSS. This is a SNF site-level management strategy routinely used to meet Forest Plan G-WL-12.
	Source	Forest Plan G-WL-12 b.
Survey Requirements for unknown locations		
	RFSS-4 Stipulation	Because all listed plant locations or nest and/or den sites are not known, survey needs shall be determined by a SNF biologist, using approved protocols in suitable habitat, to determine occupancy in the areas where exploration activities are planned. The suite of species in need of surveys may change as the sensitive species list is updated or new information on species or survey protocol warrants surveys.
	Objective	Contribute to the conservation of sensitive species and the habitats upon which these species depend and conserve the genetic variability of species.
	Source	Forest Plan D-WL-3d and D-WL-3i.This is a standard, SNF site-level management strategy used to meet Forest Plan G-WL-12 b
Bald Eagle (also a Forest Plan Management Indicator Species):		
Nests		
	RFSS-5 Stipulation	Maintain a buffer of 660 feet (200 meters) between the activities and the nest (including active and alternate nests) from January 15 – July 31. This equates to No Surface Occupancy in the timeframe and location given.
	Objective	To limit disturbance during breeding and nesting
	Source	National Bald Eagle Management Guidelines (2007)
	RFSS-6 Stipulation	Avoid cutting or removal of overstory trees within 330 of the nest at any time.
	Objective	To protect nesting habitat
	Source	National Bald Eagle Management Guidelines (2007)
	RFSS-7 Stipulation	Do not fly within 1000 feet (305 meters) of the nest, except where eagles have demonstrated tolerance for such activity. Tolerance will be determined by a SNF biologist.
	Objective	To avoid disturbing nesting bald eagles and their young
	Source	National Bald Eagle Management Guidelines (2007)
Wood Turtles		
Breeding locations		
	RFSS-8 Stipulation	No surface occupancy in high quality breeding habitat and protect nesting areas from negative human impacts. (Breeding habitat is generally found within 100 feet of the St. Louis and Cloquet Rivers and their tributaries.
	Objective	To minimize disturbance to breeding and nesting turtles
	Source	Forest Plan G-WL-19

RFSS and other species of interest		
Boreal Owl		
Nests and Breeding Habitat		
	RFSS-9 Stipulation	Prohibit management activities within 300 feet of known boreal owl nest sites. This equates to No Surface Occupancy in the location given.
	Objective	Minimize disturbance of nesting pairs
	Source	Forest Plan S-WL-6
	RFSS-10 Stipulation	Minimize activities that may disturb nesting pairs during the critical boreal owl nesting season (March 1-June 1). This equates to No Surface Occupancy in the timeframe given in a breeding area determined by a SNF biologist.
	Objective	Minimize disturbance during nesting season
	Source	Forest Plan G-WL-13
Great Gray Owl		
Nests and Breeding Habitat		
	RFSS-11 Stipulation	Allow, to the extent practical, only activities that protect, maintain or enhance site conditions within 660 feet of a known great gray owl nest site. This equates to No Surface Occupancy in the timeframe and location as determined by a SNF biologist.
	Objective	Limit disturbance to breeding and nesting birds
	Source	Forest Plan G-WL-14
	RFSS-12 Stipulation	Minimize activities during the critical great gray owl nesting season March 1-June 1. This equates to No Surface Occupancy in the timeframe and location given.
	Objective	Limit disturbance to breeding and nesting birds
	Source	Forest Plan G-WL-15
Three-toed Woodpecker		
Nests		
	RFSS-13 Stipulation	Protect known three-toed woodpecker nest sites within 200 foot radius until young have fledged (estimated to occur May 15-July 31). This equates to No Surface Occupancy in the timeframe given.
	Objective	Limit disturbance to breeding and nesting birds
	Source	Forest Plan G-WL-17
Sensitive Butterflies		
Breeding habitat		
	RFSS-14 Stipulation	Allow only those management activities that protect, maintain, or enhance known locations for: Jutta arctic, taiga alpine, Freija's grizzled skipper, and Nabokov's northern blue.
	Objective	Minimize disturbance to breeding habitat and individual butterflies
	Source	Forest Plan S-WL-7
Northern Goshawk (also a Management Indictor Species)		
Nests		
	RFSS-15 Stipulation	At northern goshawk nest sites with an existing nest structure, prohibit or minimize, to the extent practical, activities that may disturb nesting pairs in an area of 50 acres minimum (860 ft. radius) during critical nesting season (March 1 – August 30).
	Objective	Minimize disturbance of nesting pairs
	Source	Forest Plan S-WL-10
Breeding habitat		
	SRFSS-16 Stipulation	At northern goshawk nest sites in an area of 50 acres minimum (860 ft. radius), to the extent practical, allow only those activities that protect, maintain, or enhance high quality habitat conditions: 100% mature forest (>50 years old) with continuous forest canopy (>90% canopy closure) and large trees with large branches capable of supporting nests.
	Objective	Maintain high quality breeding habitat
	Source	Forest Plan S-WL-10

RFSS and other species of interest		
Post fledging areas		
	RFSS-17 Stipulation	Within northern goshawk post-fledging areas, as determined by a SNF biologist, minimize activities, to the extent practical, that may disturb nesting pairs during critical nesting season (March 1 – August 30) and, to the extent practical, within a 500 acre area encompassing all known nest areas within the territory.
	Objective	Limit disturbance during critical nesting season and fledging period
	Source	Forest Plan G-WL-22
Osprey		
Nests		
	RFSS-18 Stipulation	Minimize activities that may disturb nesting pairs of osprey within 330 feet of nest during the critical nesting season (April 1 – August 15). This equates to No Surface Occupancy in the timeframe and location given.
	Objective	Minimize activities that may disturb nesting pairs of osprey
	Source	Forest Plan G-WL-24
	RFSS-19 Stipulation	Osprey: From 330-660 feet from nest trees maintain, protect or enhance habitat. This equates to No Surface Occupancy in the location given.
	Objective	Limit disturbance to breeding and nesting birds
	Source	Forest Plan G-WL-25
Great Blue Heron		
Colonies		
	RFSS-20 Stipulation	Prohibit management activities within 330 feet from active great blue heron colonies. Prohibit management activities from 330 to 660 feet from March 1 through August 31. This equates to No Surface Occupancy in the timeframe and location given.
	Objective	Limit disturbance to breeding and nesting birds
	Source	Forest Plan G-WL-26
Common Loon		
Nests		
	RFSS-21 Stipulation	No Surface Occupancy within proximity to loon nest site, as determined by a SNF biologist, between May 15 and July 1.
	Objective	Limit disturbance to breeding and nesting birds
	Source	Forest Plan G-WL-28

2.4.3.7 Soils

Ecological Land Types (ELTs) associated with the proposed exploration activities are mapped and identified in the Project File. Table G-WS-8b in the Forest Plan provides a brief description of ELTs on the SNF identified in the measures below (Forest Plan, p. 2-18). Since equipment and techniques for drilling can vary, case by case exceptions or modifications can be granted for meeting the Forest Plan requirements in this table upon review of proposed equipment and activities by a SNF soil scientist or hydrologist for consistency with Forest Plan requirements.

Soils		
General Soils		
	SOIL-1 Stipulation	Salvage and reuse topsoil for site rehabilitation during construction projects or other land use activities. When topsoil is unsuitable for reuse, other methods or tools such as sodding, hydro-seeding, fertilization, or erosion-resistant matting may be used to help rehabilitate disturbed areas.
	Objective	To maintain site productivity and minimize erosion
	Source	Forest Plan S-WS-3
	Modification or waiver	None

Soils	
Ecological Land Type (ELT) Restrictions (mapping for locations is available in the project file, too large to include within the DEIS)	
On ELTs 1, 2, 3, 4, 5 and 6	
SOIL-2 Stipulation	Drilling and access are limited to frozen soil (frozen to a depth that will support equipment that is being used and no rutting and compaction occurs).
Objective	To maintain soil structure and prevent displacement
Source	Forest Plan Page 2-16 G-WS-8, p. 2-17 Table G-WS-8a
Modification or waiver	Since equipment and techniques for drilling can vary, case by case exceptions or modifications can be granted for meeting the Forest Plan requirements in this table upon review of proposed equipment and activities by a SNF soil scientist or hydrologist for consistency with Forest Plan requirements.
On ELTs 10, 14 15 and 16,17	
SOIL-3 Stipulation	Drilling and access are limited to frozen soil (frozen to a depth that will support equipment that is being used and no rutting and compaction occurs) or the normal dry period
Objective	To prevent rutting and compaction
Source	Forest Plan Page 2-16 Table G-WS-8 p. 2-17 Table G-WS-8a
Modification or Waiver	Activity could take place during non-frozen conditions or outside of the normal dry period if techniques and/or equipment designed to eliminate rutting and compaction are utilized.
On ELTs 9, 12, and 18	
SOIL-4 Stipulation	Drilling would not be allowed.
Objective	Maintain site productivity
Source	Forest Plan Page 2-16 Table G-WS-8 p. 2-17 Table G-WS-8a.
Modification or Waiver	Since equipment and techniques for drilling can vary, case by case exceptions or modifications can be granted for meeting the Forest Plan requirements in this table upon review of proposed equipment and activities by a SNF soil scientist or hydrologist for consistency with Forest Plan requirements.
On ELTs 12 and 18	
SOIL-5 Stipulation	New access roads would not be authorized.
Objective	Maintain site productivity
Source	Forest Plan Page 2-16 Table G-WS-8 p. 2-17 Table G-WS-8a.
Modification or Waiver	None
Wetland Soils	
SOIL-6 Stipulation	On access routes, appropriate water diversion structures (such as water bars) to reduce erosion shall be installed and so that surface water diverted from roads into filter strips or vegetative area, rather than directly into streams, lakes, open water wetlands, etc.
Objective	To minimize rutting and compaction
Source	As recommended in Part 2 of Sustaining Minnesota Forest Resources: Voluntary site-level Management Guidelines, Forest Soil Productivity section.
Modification or waiver	None
SOIL-7 Stipulation	Use of wetlands under frozen condition for temporary roads and skid trails will generally be permitted as long as no fill is placed in the wetland. These roads or trails will be blocked to discourage vehicle use under unfrozen conditions.
Objective	To maintain hydrologic function and minimize rutting and compaction
Source	Forest Plan Page. 2-15, G-WS-12
Modification or waiver	None

2.4.3.8 Roads

Roads	
Temporary roads construction and closure	
RDS-1 Stipulation	Locate temporary roads in areas where they minimize resource damage.
Objective	To minimize resource damage
Source	Forest Plan G-TS-13
RDS-2 Stipulation	Roads and trails designated for decommissioning and reclamation will generally be subject to the following: a. The road or trail will be rendered unusable by motorized vehicles by the placement of scattered large rocks (1 CY or greater) and boulders and the transplanting of small trees and brush to match the surrounding area to help the road disappear to passing motorists (See Appendix D). b. Stream crossing structures will be removed and the stream riparian buffer restored. c. Road and trail fills will be removed from flood prone and wetland areas to restore stream and wetland crossings to original contours. d. Removed fill will be used to recontour the "cut" section that it was removed from along the road. (i.e. recontour to pre-existing site conditions) e. Exposed soil will be revegetated.
Objective	To mitigate soil erosion and to protect water quality.
Source	Forest Plan G-TS-16
RDS-3 Stipulation	As soon as access use is completed, stabilize temporary roads and effectively close them to motorized traffic. Vegetation will be established within 10 years after the termination of the contract, lease, or permit.
Objective	To reduce human interaction with lynx and wolves; to allow areas to revegetate more quickly to prevent erosion, rutting; to reduce cross country ATV travel
Source	Forest Plan S-TS-3
RDS-4 Stipulation	Temporary roads, and landings adjacent to open roads, will be effectively closed to motorized vehicles when permit operations are not taking place
Objective	To limit the amount of human interaction with lynx and wolves
Source	Forest Plan S-TS-3
RDS-5 Stipulation	New roads built to access land for resource management will be temporary and not intended for public motorized use. Temporary roads will be decommissioned and reclaimed after their use is completed.
Objective	To limit the amount of human interaction with lynx and wolves
Source	Forest Plan FEIS p. 21, Forest Plan G-TS-14
RDS-6 Stipulation	On existing OML 1 roads, an effective barrier will generally be installed as needed to prevent use by highway-licensed vehicles or Off road vehicles (ORVs). All terrain vehicle (ATV) and Off highway motorcycle (OHM) use may continue to be allowed on some existing OML 1 roads.
Objective	To maintain required habitat components in wolf habitat and to limit the amount of human interaction with lynx and wolves
Source	Forest Plan S-TS-12
RDS-7 Stipulation	For newly constructed snow-compacting trails, effectively close or restrict to public access those trails and OML 1, OML 2, temporary, and unclassified roads that intersect the new trails unless these trails or roads are being used for other management purposes.
Objective	To limit the amount of human interaction with lynx and wolves
Source	Forest Plan G-WL-7
RDS-8 Stipulation	Slash, brush, tree limbs, seedlings and saplings cut to clear temporary roadways, shall be pushed a minimum distance for safe and efficient use of access. This slash material shall be utilized in rehabilitating the temporary roads and drill pad sites once drilling operations are complete or during final reclamation. For this reason, chipping of timber and slash shall not be utilized.
Objective	Limit disturbance outside of the road prism and utilize woody materials for reclamation.
Source	SNF mineral program management

Roads		
General Road use		
	RDS-9 Stipulation	Access roads shall be maintained commensurate with the permitted use. The permittee is responsible for maintenance during all project activities and up until Forest Service has accepted final reclamation and the reclamation bond is released. a. Maintenance activities may include, but are not limited to, grading, installing or replacing road closure and erosion control or sediment capturing devices. b. Access roads may be temporarily closed if conditions result in evidence of road damage as required by the Authorized Officer. c. Allow for aquatic organism passage in perennial streams. d. When rutting exceeds 6 inches in depth for continuous distances greater than 300 feet on any portion of roads, cease equipment operations on that portion of road. Resume operations only when conditions are adequate to support equipment or other mitigation has been approved by the Authorized Officer (MFRC guidelines) e. Fill in ruts and holes that develop during road use. Use a suitable material (such as gravel or compacted fill), and fill as soon as possible to reduce the potential for erosion. Any importation of fill must first be approved by the Authorized Officer. f. When applicable, specific areas shall be identified in the road maintenance plan for disposal of borrow or quarry sites, stockpiles, or other uses that are needed for the project.
	Objective	To mitigate against soil erosion and to protect water quality.
	Source	SNF Transportation Management and MFRC guidelines

2.4.3.9 Water

Water Quality		
Wetlands		
	WAT-1 Stipulation	No fuel storage within a wetland. Fuel storage containers should be kept on an upland site. Absorbent mats or other absorbent material shall remain under the drilling rig and extra mats shall remain on site at all times to clean up any small spills from refueling. Any spills or releases of oils, fuels, or other toxic or hazardous material must be reported and remediated per applicable State and Federal Laws.
	Objective	Reduce risk of fuel release near water resources
	Source	SNF hydrology program management.
	WAT-2 Stipulation	Avoid felling trees or depositing woody material from clearing operations into wetlands.
	Objective	Avoid changing the structure and functions of wetlands
	Source	Forest Plan G-WS-14
	WAT-3 Stipulation	Drilling, road use, and road construction shall occur within a wetland only after the surfaces have been frozen enough to provide access and use without breaking through the frozen layer.
	Objective	Prevent compaction and rutting in wetlands that could lead to water quality impairments
	Source	SNF hydrology program management.
Drilling		
	WAT-4 Stipulation	If a drill hole boring is to be temporarily sealed, State of Minnesota regulations shall be followed. They include that the casing and cap must extend at least five feet above the potential high water within the regional flood level. High water levels would be identified and established on a case by case basis and determined by on the ground evidence of past high water
	Objective	Prevent surface and ground water interaction within the bore hole.
	Source	State of Minnesota Rules Section 4727
	WAT-5 Stipulation	Drilling shall be accomplished by licensed well drillers in accordance with State regulations. The only additives to the drilling water shall be those permitted by the State of Minnesota. Each site shall be restored through surface grading, as needed.
	Objective	Ensure state and federal guidelines are understood and followed to ensure minimal effect of drilling activity
	Source	State of Minnesota Rules Section 4727, SNF minerals program management.

Water Quality		
Sumps and drafting		
WAT-6 Stipulation		Water cannot be withdrawn from streams that have less than 1 cubic feet per second flow rate. Cumulative withdrawal rates from streams shall be no more than 10% of the flow at the time of withdrawal. Cumulative withdrawal from wetlands, ponds, or lakes, shall not exceed 1% of the estimated volume of the basin at the time of withdrawal. Water intakes shall have appropriately sized screens to minimize impact to aquatic organisms
	Objective	Maintain natural seasonal flow and volume of water resources; prevent uptake of organisms
	Source	SNF hydrology program management.
WAT-7 Stipulation		Sumps to treat the water used in the drilling process shall be constructed (see Figure 3) as surface conditions allow. These sumps (as described on page 23) would contain and effectively treat the pump water. Drill cuttings and additives shall be allowed to sufficiently settle out of the drill water prior to backfilling the sump. No sump pits shall be allowed for drilling in wetlands and re-circulation tanks would be required. Recirculation tanks shall also be required where sumps cannot be constructed (such as in bedrock).
	Objective	Reduce the risk of untreated drill water from interacting with wetlands or water resources
	Source	State of Minnesota Rules Section 4727, SNF hydrology program management.
WAT-8 Stipulation		Streams shall not be dammed or dredged or otherwise modified for drafting purposes.
	Objective	Maintain water flow and avoid in-stream erosion and sedimentation
	Source	SNF hydrology program management
Road construction and use		
WAT-9 Stipulation		Log mats placed for the crossing of wetlands (if used) shall be removed once they are no longer needed. A setback of at least 100 ft shall be maintained for drill pad disturbance from all lakes, open water wetlands, and perennial streams and rivers.
	Objective	Prevent erosion, compaction, and rutting in wetlands that could lead to water quality impairments
	Source	SNF hydrology program management.
WAT-10 Stipulation		Culvert crossings would be designed and installed in accordance with geomorphic principles and accommodate aquatic organism passage. All temporary culverts and floodplain fill shall be completely removed and the temporary access roadway completely decommissioned and reclaimed when drilling is completed and the holes have been abandoned. Temporary access obliteration shall include brushing in, lop and scattering as well as barriers and signs.
	Objective	Assure that organisms, water, sediment, and debris freely and naturally move through a stream crossing during and after operations
	Source	SNF hydrology program management.
WAT-11 Stipulation		All sites located in low or wet areas would only have overland access during winter months once the ground has sufficiently frozen.
	Objective	Prevent erosion, compaction, and rutting in wetlands that could lead to water quality impairments
	Source	SNF hydrology program management.
Brackish water		
WAT-12 Stipulation		Drilling within 3 miles of the Lake Superior shoreline will be considered the “potential brackish water intrusion area”. A Brackish Water Management Plan will be required to be part of the Operating Plan for approval by the USFS prior to drilling in this area.
	Objective	Avoid introduction of high saline waters to surface or ground water
	Source	SNF hydrology program management

2.4.3.10 Aquatic Species

Aquatic Species	
Non-native invasive species	
AQS-1 Stipulation	The following measures to control or prevent the spread of non native invasive species shall be followed: a. There shall be no back-flushing water from the draft tank back into water source to avoid cross-contamination of aquatic invasive species. If there is a need to empty the draft tank, it may be permitted in an upland area, where these invasives would not persist. b. Do not dump water from one stream or lake into another. c. Avoid sucking organic and bottom material into water intakes when pumping from streams or ponds d. Minimize driving equipment through or wading across water bodies whenever possible e. If a water source is known to have NNIS present, that water source shall be avoided. Water sources need to be approved by the SNF prior to use to avoid spread of NNIS
Objective	Prevent or slow the spread of aquatic invasive species to non-infested water
Source	SNF fisheries program management.
AQS-2 Stipulation	Disinfect all pump and water tank equipment prior to entry on the SNF as well as before moving to a new site on the SNF. a. Sanitation will consist of a 5 percent solution of quaternary ammonium compounds (6.4 oz per gallon of water) or its equivalent will destroy most if not all target invasive organisms. b. Quaternary ammonium compounds are safe for gear and remain effective for at least a day if not overly diluted or muddied. c. Use sprayers or similar cleaning devises to clean all water tanks and sump liners. The quaternary ammonium solution must be in contact with the surface being sanitized for at least 10 minutes and then rinsed. d. For water pumps circulate through a 5 percent solution of quaternary ammonium compounds from a disinfected tank for 10 minutes.
Objective	Eliminate aquatic invasive species that linger on or in equipment
Source	SNF fisheries program management.

2.4.3.11 Non-native Invasive Species

Non-native invasive species	
Disturbance	
NNIS-1 Stipulation	Where possible, sites shall be confined to areas of previous disturbance. Retain shade and native vegetation in and around prospecting activity to the maximum extent possible to suppress non-native invasive plants and prevent their establishment and growth.
Objective	During project implementation, reduce the spread of non-native invasive species.
Source	Forest Plan G WL-23
NNIS-2 Stipulation	Gravel sources shall be approved by the SNF prior to use to avoid spread of NNIS.
Objective	To reduce the introduction and spread of NNIS
Source	Forest Plan O-WL-37

Non-native invasive species		
Equipment cleaning requirements		
NNIS-3 Stipulation		For external equipment surfaces: a. Prior to movement onto the SNF, all equipment and vehicles shall be cleaned such that the equipment is free of non-native invasive species, soil, seeds, vegetative matter, non-native invasive species or their propagation structures (spores, eggs, etc.) b. Prior to moving equipment from a drill site known to be infested with NNIS to a new drill site, equipment shall be cleaned as described above. c. The companies shall contact the SNF to verify this has been completed and give them the opportunity to complete an inspection of heavy equipment before they are transported onto National Forest System lands. d. For internal equipment surfaces: e. Sweep vehicle cabs and deposit refuse in waste receptacles prior to movement onto the SNF.
	Objective	To minimize the introduction of NNIS
	Source	Forest Plan O-WL-37
Revegetation		
NNIS-4 Stipulation		If seeding for revegetation is required, only native or desired non-native species that are certified noxious weed free seed shall be planted.
	Objective	To minimize the introduction of NNIS
	Source	Forest Plan G-WS-1, G-WL-23
Monitoring		
NNIS-5 Stipulation		The SNF shall monitor a sample of current and recently closed exploration sites for noxious weeds. If weeds are found, the permittee is responsible for treating the weed infestation in accordance with SNF requirements or may choose to fund the SNF to treat the weeds.
	Objective	To reduce the introduction and spread of NNIS
	Source	Forest Plan Table MON-4 and O-WL-37

2.4.3.12 Reclamation Requirements

Reclamation		
General		
RECL-1 Stipulation		The companies will be required to secure a reclamation bond with the BLM before the operating plans are approved. The Forest Service will make recommendation for reclamation and bonds.
	Objective	To secure adequate funding to assure the completion of reclamation by the agencies if necessary.
	Source	SNF mineral program management
RECL-2 Stipulation		All final reclamation, including permanent abandonment of drill holes and final reclamation and closure of access routes and drill pads, must be completed by the end of the prospecting permit's six year total timeframe and not extended into the lease application phase.
	Objective	To assure reclamation is completed during the life of a permit's timeframe of a total of 6 years and doesn't exceed the EIS's 20 year environmental effects analysis.
	Source	SNF mineral program management
	Modification or waiver	The agencies may extend final reclamation if a lease application is submitted which would also trigger additional NEPA analysis.

Reclamation		
Interim Reclamation		
	RECL-3 Stipulation	This reclamation is completed at the end of the yearly drilling season or when the work is completed and the sites are no longer needed, whichever comes first. a. Remove all equipment, trash, and other materials; b. Temporarily seal the exploratory borings in accordance with state regulations. c. Collect all drill cuttings and place them in the sump pits before they are backfilled. d. Backfill sump pits (no recirculation tank was used), with stockpiled soil. e. The topsoil, typically the upper six inches of soil, must be removed and stockpiled separately when constructing the sump pits. The reserved topsoil must be replaced over the disturbed area as the final step in returning the surface to its original contours. Stockpile topsoil where leveling temporary roads deeper than six inches. Use proper erosion control methods as needed for the stockpiles. BMP. f. Re-contour the disturbed sites to blend in with the natural topography and to stabilize the soils; and apply stockpiled topsoil as required. g. Pull back brush and slash and spread it over all disturbed sites. h. Seed disturbed areas, if deemed necessary by the Authorizing Officer, with a native plant seed mix made up of grasses, shrubs, and forbs. i. Maintain access routes and other disturbed sites to assure the soils are stabilized and erosion will not occur during interim closure. j. Close temporary road entrances with methods that restrict access by motorized vehicles (examples: gates and boulders, berms of soil material are not allowed for access closures). All other site access, including snowmobile and ATV access and vegetation clearing for geophysics or other mineral investigation, shall follow Forest Plan direction on temporary roads and road decommissioning (Forest Plan, page 2-50) and as illustrated in Appendix D as much as possible so the access is not open to other potential users and motorized vehicles.
	Objective	To protect forest resources
	Source	SNF mineral program management.
Final Reclamation		
	RECL-4 Stipulation	Final reclamation This reclamation is completed when the sites are no longer needed and before the prospecting permit expires. a. Remove all equipment, trash, and other materials; b. All stakes and flagging used to mark gridlines or other locations must be removed after they are no longer needed. c. Permanently seal borings as per Minnesota Department of Health Rules. d. Collect all drill cuttings and placing them in the sump pits before they are backfilled; e. The topsoil, typically the upper six inches of soil, must be removed and stockpiled separately when constructing the sump pits. The reserved topsoil must be replaced over the disturbed area as the final step in returning the surface to its original contours. Stockpile topsoil where leveling temporary roads deeper than six inches. Use proper erosion control methods as needed for the stockpiles. BMP f. Backfill sump pits (if no recirculation tank was used) with stockpiled soil; g. Re-contour the disturbed sites to blend in with the natural topography and to stabilize the soils; h. Pull back brush and slash and spread it over all disturbed sites; i. Seed disturbed areas, if deemed necessary by the Authorizing Officer, with a native plant seed mix made up of grasses, shrubs, and forbs; j. As soon as access use is no longer needed, reclaim temporary roads with methods that effectively eliminates access by motorized vehicles, stabilizes soils, re-establishes drainages, and follows Forest Plan direction (Forest Plan, page 2-50) and as illustrated in Appendix D. Effective closures should blend in and not stand out with the surroundings. At a minimum, the sight distance of the road shall be obliterated and woody vegetation plantings should be included. Berms of soil material are not allowed for access closures. The best closures should be effective and aesthetic. All other site access, including snowmobile and ATV access and vegetation clearing for geophysics or other mineral investigation, shall follow this direction as much as possible including eliminating motorized access.
	Objective	To protect and restore forest resources
	Source	SNF mineral program management.

2.5 Comparison of Alternatives

This section provides a summary of the effects of implementing each alternative. Information in the table is focused on activities and effects where different levels of effects or outputs can be distinguished quantitatively or qualitatively among alternatives.

2.5.1 Comparison of Alternatives by Resource Impacts

Table 10 below summarizes impacts to resources by alternative. Chapter 3 provides detailed analysis of potential impacts to resources by alternative.

Table 10. Comparison of effects by resource

Resource	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Soils	No effect	With an estimated maximum of 3,725 acres of disturbance in 20 years, exploration activities would be well below one percent of the permit area that could be potentially directly impacted. Implementation of stipulations, Forest Plan standards and guidelines and/or BMPs would result in minimal direct impacts to those acres. Alternative 5 would have less impact than the other action alternatives due to the seasonal restriction applying to all drilling.			
Hydrology	No effect	The anticipated effects to water and aquatic resources is minimal based upon the analysis in Chapter 3 which considers the stipulations, Forest Plan standards and guidelines, existing State and federal regulations, design elements, anticipated operating conditions, and resource characteristics. The proposed drilling activity with the prescribed project design features described in section 2.4.3.9 is not anticipated to have a noticeable effect on the quality or quantity of the groundwater resource. The activity should not impact the potability of the groundwater or the production capacity of existing water supply wells.			
Vegetation	No effect	Considering the relatively small area of land disturbed by exploration activities each year and for the life of the project, these figures represent 0.01% and 0.34% of the Project area respectively. As a result of this small proportion of vegetation disturbed, direct and indirect effects to LE species composition and age class distribution would be very minimal if even measurable at the LE scale.			
NNIS	No risk	Alternative 2, 3, and 4 have a slightly higher risk of non-native invasive plant spread and negative impacts,			Alternative 5 has a lower risk of NNIP spread due to seasonal restriction.
Threatened Endangered and RFSS-Plants	No effect	There are no threatened and endangered plants or habitat within the project area (see Hardrock BE, project record). For RFSS plants the determination in the BE is “May impact individuals but not likely to cause a trend to Federal listing or loss of viability”. Ground disturbance associated with the project, including temporary road construction/reconstruction, drill pad construction, and drilling activities, could impact suitable habitat for RFSS plants. Resource stipulations specify that RFSS plant surveys would be conducted in suitable habitat before project activities take place, and that project operations would avoid known RFSS plant occurrences. These resource stipulations would help minimize impacts to RFSS plants.			

Resource	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Threatened and Endangered – Wildlife	No effect	The increase in temporary roads may increase human disturbance of lynx and wolves and could lead to increased mortality. Alternatives 2-5 may affect, and are likely to adversely affect individual lynx and wolf because of the potential for increased human disturbance as a result of increased temporary road miles. Alternatives 2-5 are not likely to adversely affect lynx or wolf critical habitat. Habitat changes and seasonal variation between action alternatives are not likely to adversely affect lynx and wolves.			
Sensitive Species-Terrestrial Wildlife	No Effect	The increase in temporary roads may increase human disturbance of terrestrial sensitive wildlife species. Surveys and protection of known locations would reduce impacts to individuals. The proposed actions *May impact individuals of sensitive species but not likely to cause a trend to Federal listing or loss of viability* of their populations. Change in habitat age can benefit some species or negatively impact other species but effects will be short-term, locally limited, and are not expected to cause population decreases across the Superior National Forest.			
Transportation	No effect	Total of up to 922 acres or 384 miles of temp road construction over 20 years (see Section 2.2.2.4). Annual average of 19.2 miles per year for 20 years.			
TES Aquatics	No effect	"May impact individuals but not likely to cause a trend to Federal listing or loss of viability".			
Minerals & Geology	No Effect	During the drilling process, the drill core or chips are collected for later mineral, chemical, and other technical identification and analysis. Over the 20 years of exploration, the maximum amount of rock that may be removed from the prospecting permit drilling operating is 38,131 cubic yards of rock. This is assuming a standard bore hole PQ size (134 mm or 5.3 inch) as the maximum hole diameter and 1920 holes to a depth of 3500 feet. These samples are taken from the earth and not replaced. Therefore, it can be considered an irreversible and irretrievable commitment of the resource. Considering the vast amount of bedrock under the Superior NF, this amount is extremely small and would have no effect on the rock and mineral resources.			
Air Quality	No Effect	The activities included in the project description are not expected to generate enough particulate matter to threaten the NAAQS or threaten sensitive receptors. Drilling activity only affects air quality over a short distance downwind and for only a few days or weeks depending on the phase of the drilling project. After the drilling is complete there is no longer any affect on air quality. Due to the short duration and minimal effects anticipated, no cumulative effects are expected.			
Socio-Economics	No jobs or income would be generated	Under the action alternatives, anticipated exploration and associated activities would provide a minimum of 8 jobs (direct, indirect, and induced) and $358,000 in labor income (direct, indirect, and induced) and a maximum of 20 jobs and $917,000 in labor income on an average annual basis within the analysis area. While minority and low-income populations may exist in the area, the alternatives are not expected to have a disproportionately high and adverse human health or environmental effects on these communities			
Recreation (impacts other than noise)	No effect	minor impact to recreation receptors	minor impact to recreation receptors	minor impact to recreation receptors	negative effects would be lower than Alternatives 2-4 due to seasonal restriction to recreation receptors

Resource	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Scenery	No effect	Forest openings created for prospecting would generally re-vegetate within one to two years and would also be similar in size, shape and edge characteristics to natural openings in the landscape. If drilling occurred on Birch Lake, drilling equipment and barges and associated boat traffic would be visible but would not impact scenery along the shoreline. If drilling occurred along the shoreline, the effects would be similar to those along a travelway. Effects to scenery would be minimal.			
BWCAW	No Effect	Effects to the natural quality of wilderness character would be minor or negligible due to stipulations and the limited effects of minerals exploration. Alternative 5 would have the lowest negative effect to opportunity for solitude, followed by Alternative 4, Alternative 3 and Alternative 2. There would be no effect to the untrammeled and undeveloped qualities of wilderness character.			
Roadless	No Effect	Effects would be very small and would not affect Forest Plan inventoried roadless areas or RACR areas from consideration as roadless areas.			
Heritage	No effect	There would be no direct impact. Heritage resources within and immediately adjacent to drill sites and temporary roads will be buffered to avoid impact.			

2.5.2 Comparison of Alternatives by Response to Issues

The degree of impacts under each alternative would depend on the distance from drill site to receptor, and required mitigation measures. Of the action alternatives, Alternative 2 would have the highest negative impact to recreation receptors since drilling operations would not include noise mitigation measures. Alternative 3 would have lower impacts than Alternative 2 since mitigation would reduce emitted decibel levels and area affected. Alternative 5 would further reduce impacts from Alternative 3 by avoiding operations during the summer season during which the large majority of recreation activity occurs. Alternative 4 would reduce impacts to the greatest degree of the alternatives in some locations by requiring maximum limits for decibel levels at key recreation locations. In other areas without required maximum limits, Alternative 4 may have impacts similar to Alternative 2. Alternative 1 would have no impact since no sound from drilling or associated project activities would occur. See Table 11 for a comparison of alternatives by issue indicators.

Table 11. Comparison of alternatives by receptor

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Recreational Residences	No impact from project	Limited to 50 dBA, reducing impact	50 dBA or less; reduces impact due to mitigation	Limited to 50 dBA, reducing impact	Limited to 50 dBA, reducing impact. Avoids most impacts since most use occurs in summer
Private Residences	No impact from project	Limited to 50 dBA, reducing impact	50 dBA or less; reduces impact due to mitigation	Limited to 50 dBA, reducing impact	50 dBA or less due to mitigation. Avoids impact to summer users.
Developed Campgrounds	No impact from project	Largest negative impact of action alternatives	Reduces impact due to mitigation	Limited to 50 dBA, reducing impact	Avoids most impacts since most use occurs in summer
BWCAW	No impact from project	Largest negative impact of action alternatives	Reduces impact due to mitigation	Minor to negligible impact due to requirement for sound volume to be 30 dBA (and less deeper in the wilderness)	Lowest impact due to mitigation and seasonal restriction
Winter Recreationalists	No impact from project	Largest negative impact of action alternatives	Reduces impact due to mitigation	Depends on location. Reduces impact for recreation areas.	May increase negative impacts above Alternative 3 since drilling would only occur in winter
Semi Primitive Non Motorized Areas (outside Wilderness)	No impact from project	Largest negative impact of action alternatives	Reduces impact due to mitigation	Limited to 50 dBA, reducing impact	Lowest impact due to mitigation and seasonal restriction
Semi Primitive Motorized Areas	No impact from project	Largest negative impact of action alternatives	Reduces impact due to mitigation	Limited to 60 dBA, reducing impact	Lowest impact due to mitigation and seasonal restriction

Chapter 3 Affected Environment and Environmental Consequences

This chapter is organized by issues first (noise), and the resources most affected by that issue (BWCAW, Recreation, etc). After the effects by the three issues are disclosed, other resources considered in the analysis are listed.

3.1 Noise

3.1.1 Introduction

During public scoping, concerns were raised that noise production from the proposed core drilling activities would affect the quality of recreational experiences. The following analysis of this project's effects on recreation focuses on the effects of noise on recreation opportunities for receptors within the project area identified as:

- local landowners and recreation residences
- developed recreation site and trail visitors
- designated dispersed recreational campsites and trails, and Semi-Primitive Non Motorized areas outside the BWCAW
- Boundary Waters Canoe Area Wilderness (BWCAW) visitors
- winter use enthusiasts[3]

3.1.1.1 Analysis Methods

There are several activities associated with this project that generate sound which may impact recreational experiences. These include drilling, helicopter use, watercraft use, and support vehicle use (motor vehicles, ATVs and snowmobiles). The analysis focuses on drilling since this has a greater potential to affect recreational experience due to the constant nature of this sound (drilling occurs 24 hours a day, 7 days a week) and has been a focus of public concern on noise for this project. Sounds from helicopters, watercraft and support vehicles are also evaluated.

In order to evaluate sound from minerals exploration that may affect key receptors, it is necessary to review some definitions and standards for measuring noise.

- Sound – A physical phenomenon; a vibration that can be measured and recorded (Predicting Impact of Noise on Recreationists, USFS Publication #67).
- Noise – Any sound that is undesired or that interferes with something to which one is listening (Webster's Third New College Dictionary, page 1533).
- A-Weighted Decibel (dBA) – The commonly used unit for measuring sound pressure levels (MPCA Guide to Noise Control in Minnesota, page 17). The A-weighted decibel scale is used since the 'A weighting' most closely approximates sounds heard by the human ear.
- Ambient level – The loudest decibel level of combined background sounds. This may be human made or natural sounds, depending on timing and location.

[3] Snowmobile trails and ATV trails are not considered key receptor sites since sound from these machines would generally render drilling noise less noticeable to users of these trails.

- Natural Ambient level – The loudest sound level if all human made noises were removed from the environment.

Indicators

The effects of sound from the project on receptors may occur because of a change in the type of sound, sound volume, duration, or area of effect. However, while these physical changes may be estimated, the effect of these changes on an individual's recreation experience is the most relevant factor in addressing the issue. Seven indicators evaluating these factors are described below. Calculations used for evaluation of the indicators are contained in the project file.

Indicator 1: Type of Sound

Ambient background noise is comprised of a variety of sounds. This include natural sounds such as wind, leaves rustling, birdsong, insect noise or running water depending on the location on the Forest and time of year. In addition, the soundscape of the Forest includes human-made sounds such as from engines in motor vehicles, off-highway vehicles (OHVs), snowmobiles, motorboats, aircraft, logging equipment and minerals drilling equipment, which also depend on location and time of year.

This indicator looks at whether each alternative introduces a new type of sound that is not already present in the ambient soundscape. This involves evaluating whether activities identified in the project alternatives (drilling and associated activities) are already present on the Forest. The introduction of a new type of sound into the soundscape may be noticeable and affect the recreational experience for receptors.

Indicator 2: Duration and Timing of Sound

The duration and timing of sound may affect a receptor's experience. For example, the degree of annoyance from a human-made sound may vary depending on whether it is heard during the night or the day. In addition, the degree of annoyance may also vary depending on whether it is heard for short or long periods of time, or continually versus temporarily.

This will be evaluated by comparing whether each alternative imposes restrictions on duration and timing of sound and the likely duration and timing of project activities. This indicator will also be evaluated using proposal information from the proponents and Forest staff knowledge about typical minerals exploration practices.

For the purpose of this analysis, the following durations of noise impact are defined (MPCA Guide to Noise Control 1999).

- Short-term equals 1-60 days
- Medium-term equals 61-90 days
- Long-term equals 91 days or more

Indicator 3: Area of Audibility

Sound from project activities may be audible[4] even if the sound level is softer than the background ambient level. This is because motorized sound generated from drilling and associated activities may be of a different quality (i.e. a motor versus a bird call) than natural ambient sound. While sound generated by project activities that is softer than the ambient sound level may not be as annoying as sound that dominates the soundscape, it may still affect the recreational experience for some visitors.

This indicator evaluates the area of audibility by using monitoring data taken on the Forest under typical summer conditions. Field monitoring has indicated that drilling from two adjacent drilling rigs with sound

[4] Audible is defined as 'capable of being heard; loud enough to be heard; actually heard.'

mitigation (i.e. baffles that blocked sound transmission) would be barely audible at about 7150 feet or 1.3 miles. Under calm conditions (no wind), sounds may be audible for greater distances, while under windy conditions, sounds may be audible for shorter distances (see monitoring data in Appendix E). However, the measurement of 7150 feet was considered representative of more common conditions on the Forest since wind is usually present. Extrapolating this distance to other areas of the Forest with different topography or vegetation types introduces some error into the evaluation. However, Harrison (1980) found that differences between vegetation types do not result in substantial differences in sound decay (also called sound attenuation), and the evaluation site where the 7150 feet was measured was fairly flat ground (near Highway 1 south of the South Kawishiwi River). Areas with greater topographical barriers between the sound source and receptor would generally result in greater sound decay (less than 7150 feet). Taking these limitations into account, 7150 feet was considered acceptable for the purpose of comparing alternatives with sound mitigation. Accounting for the absence of sound mitigation, 8580 feet or about 1.6 miles is assumed to be the distance that two adjacent unbaffled drilling rigs may be audible. These figures were input into a GIS to create the maps displaying area of audibility (see Figure 12 and Figure 14).

An alternative method for evaluating audibility is a spectrum analysis. Spectrum analysis evaluates the composition of sound by one third octave frequency to better characterize the soundscape and degree of audibility of an introduced sound. Braslau (2007) indicates that sound generally becomes inaudible when it decreases a few dBA below ambient level. 7150 feet would be below 20 dBA according to the model output displayed in Table 12. This is noticeably lower than nighttime ambient dBA in remote areas (25 dBA), rendering the distances a conservative estimate of audibility under most conditions. Therefore, while adding more precision, it was not considered necessary to perform a spectrum analysis. However, a spectrum analysis was part of the corroborating analysis performed using the SPreAD-GIS tool (see Appendix B).

Indicator 4: Area where Sound Above Natural Ambient Level May be Heard

Sound from project activities may dominate the soundscape (be louder than the existing ambient sounds) in a more limited area than the area of audibility. In this area, sound from project activities may have a greater impact than in the area in which it is only audible. The area of sound greater than natural ambient will be estimated using a simple model (Braslau 2007). See Indicator 5 for discussion on the model and modeling assumptions.

Indicator 5: A-Weighted Decibel Level at Key Receptors

To estimate the decibel level at key receptor locations from sound generated by drilling, a model was used to estimate sound volume. The distance and area associated with benchmark dBA levels was then calculated using model results.[5] A sound decay curve represented by the 26 log D decay curve was used since this conservatively assumes a typical forested area during the summer season, but with deciduous leaves not on trees (Braslau 2007). The 26 Log D decay curve accounts for loss due to geometric spreading, atmospheric absorption and forest cover. The 26 Log D decay curve is represented by the following equation, where D refers to distance:

$$dBA_2 = dBA_1 - 26*\log(D_2/D_1)$$

A summer forested area with leaves on trees, would have more rapid sound decay (Braslau 2007). In other words, the sound decay curve used in this analysis conservatively overestimates the volume of sound at key receptor locations for leaf-on conditions. The type of forest present is variable depending on site conditions and can include aspen, maple, spruce, fir, pine and others. Tree cover reduces sound propagation by acting as a barrier to sound waves. The difference in effect of different tree species on

[5] Calculations made using the model are in the project file.

sound propagation is relatively minor (Harrison 1980 p. 14). Therefore, the sound decay rate is not differentiated by forest type. Table 12 below displays the dBA levels at various distances from a CS-4000 type drill rig which is representative of the type of drill rigs that may be used in project activities. Table 13 is based on the 26 Log D decay curve. Outputs of the 26 Log D decay curve were input into a GIS to create the maps displaying sound contours (see Figure 13 and Figure 15).

Table 12. Decibel (dBA) levels for CS-4000 drill rig using 26 Log D decay curve (Braslau 2007)

Distance (feet)	Front	Rear	Left	Right	Average
20	78.5	85.1	86.8	87	84.4
40	70.7	77.3	79.0	79.2	76.5
80	62.8	69.4	71.1	71.3	68.7
160	55.0	61.6	63.3	63.5	60.9
320	47.2	53.8	55.5	55.7	53.0
640	39.4	46.0	47.7	47.9	45.2
1280	31.5	38.1	39.8	40	37.4
2560	23.7	30.3	32.0	32.2	29.6
5120	15.9	22.5	24.2	24.4	21.7
8000	10.8	17.4	19.1	19.3	16.7
10240	8.1	14.7	16.4	16.6	13.9
20480	0.2	6.8	8.5	8.7	6.1
40960	0.0	0.0	0.7	0.9	0.4

Sound propagation may also be affected by topography. The Superior National Forest includes minor to moderate topographic variations, but does not include many dramatic features such as high mountains, tall cliffs, or canyons. Hills and topographic features may present barriers to sound propagation, while on hilltops sound transmission may depend more on atmospheric absorption and geometric spreading (Reed 2008). This analysis does not account for topographic features. However, in the majority of cases topography would likely reduce, rather than increase sound levels at receptors due to the presence of barriers. Therefore, this assumption conservatively overestimates sound levels at most receptors. Further, exact drilling locations may be adjusted up to 500 feet during implementation (see Chapter 2, section 2.2.2.2) that include or exclude a hilltop or barrier between a source and receptor, rendering such an analysis moot.

For sound generated by watercraft, it is assumed that the watercraft engine is 82 dBA at 50 feet (MPCA 1999).A decay curve of 24 Log D which removes the sound reducing effects of vegetation (Braslau 2007) is used for watercraft.

For sound generated by helicopters, data from Braslau (2007) was used to estimate sound levels along helicopter flight paths, and the effects of mitigation measures which include varying the flight path and the flight elevation.

Adding Sound Sources

In some cases, multiple adjacent sound sources may add to the total dBA level. Methods for estimating sound levels created by multiple sources are discussed below. According to the Minnesota Pollution Control Agency's A Guide to Noise Control in Minnesota, (page 7), adding sources of sound of equal value increases the decibel level by 3 decibels as shown in Table 14.

Table 13. Example of addition of decibel levels

Source	Decibel Level
1	50 dBA
2	53 dBA
4	56 dBA
8	59 dBA

Adding sources of sound only holds true if the sources are located in the same location. None of the companies propose using more than one drill rig at a site. Since no more than one drill rig would be in operation at any given proposed site, the effect of adding sources of decibel levels would be less than suggested in Table 13. A more accurate way to calculate addition of decibels with differing levels is found in Table 14 (retrieved from www.acousticalsurfaces.com, November, 2007).

Table 14. Adding differing decibels levels

When Two Decibel Levels Differ By:	Add the Following Number to the Higher Value:
0-1 dB	3 dB
2-3 dB	2 dB
4-9 dB	1 dB
10 db or More	0 dB

SPreAD-GIS Analysis

An alternative analysis using the SPreaAD-GIS model for the area of audibility, and decibel levels affecting receptors (Indicators 3-5), was conducted to corroborate this analysis. The SPreAD-GIS model is designed to assess impacts of motorized noise on receptors in outdoor and remote settings. The model accounts for effects to noise propagation from spherical spreading, atmospheric absorption, foliage and ground cover, weather, topography and the ambient soundscape. See Appendix B for the analysis methods, model inputs and results of the model. The results of the SPreAD-GIS model along with the methods discussed above are used in evaluating noise impacts to receptors.

Indicator 6: Level of Annoyance and Indicator 7: Level of Effects to Opportunities for Solitude
In this analysis, 'level of annoyance' refers to effects outside the BWCAW, while 'opportunities for solitude' refers to effects inside the BWCAW since 'opportunities for solitude' is specifically identified in the Wilderness Act as a component of wilderness character. See Sections 3.1 and 3.2 for further information on analysis methods and disclosure of effects to opportunities for solitude.

While Indicators 1-5 provide a comparison of the alternatives for the type, duration, timing, area and loudness of sound, this does not by itself answer the question of how the sound is experienced by people. Sound is experienced differently depending on the person and the expectations of that person. Thus, Indicators 6 and 7 have a qualitative component and may not capture the feelings or expectations of every person. Research done by Miller (2007) on the effect of sound on visitor experience in National Parks shows that people have differing reactions to whether a sound is annoying. However, the more noticeable a sound is, the more people that find it annoying as displayed in Figure 8.

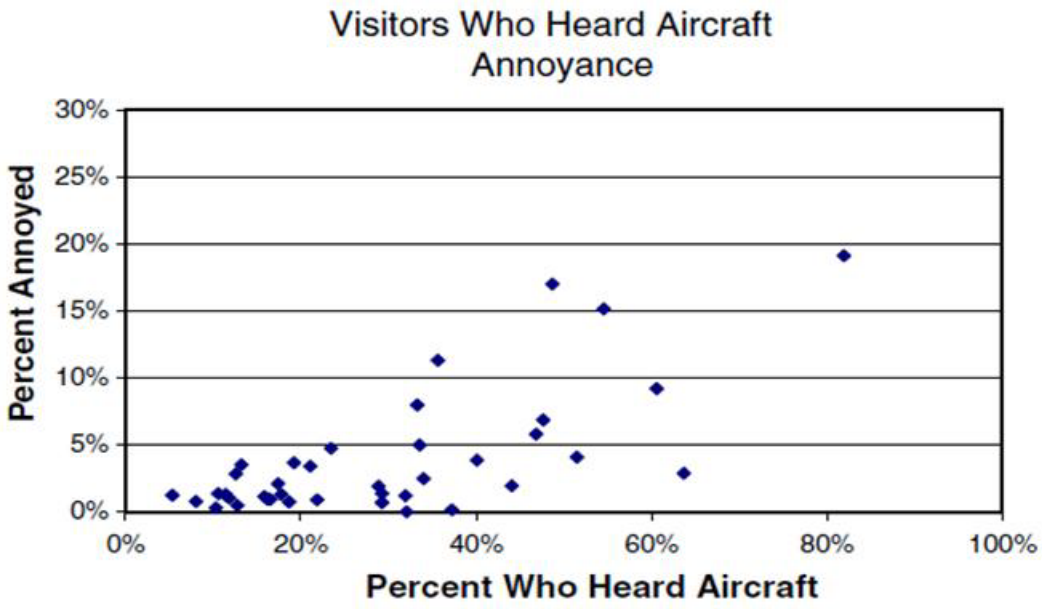


Figure 8. Correlation between percent who heard sound and percent annoyed (Miller 2007)

Expectations for the recreation experience provided by Forest Plan Recreational Opportunity Spectrum (ROS) class, Forest Plan Management Areas (MAs), and research on the effects of sound on outdoor recreation is used to provide further context. See the Forest Plan for a description of ROS classes and Forest Plan MAs.

Effect of Change in Sound Level and Total Sound Level on Human Experience

The effect of a change in dBA level due to project activities needs to be evaluated according to how such a change would affect the human listener. The following information provides a qualitative description of how these changes may affect a human listener. Further information on what a listener may expect, depending on the recreation setting, is presented in the Affected Environment section.

Table 15. Perceived change in decibel level (from MPCA Guide to Noise Control in Minnesota, page 9)

Change in Sound Level	Perceived Change to the Human Ear
± 1 dB	Not Perceptible
± 3 dB	Threshold of Perception
±5 dB	Clearly Noticeable
±10 dB	Twice (or half) as Loud
±20 dB	Fourfold (4x) Change

Figure 9 provides descriptions of common noises at various decibel levels which can help equate a dBA level to the resulting human experience. In addition, MPCA (1999) provides the following context:

- Small in scope equals 30-60 decibels (example: a secluded woods is 30 decibels and a library is 50 decibels)
- Moderate in scope equals 61-90 decibels (example: heavy truck traffic is 80 decibels)
- Wide in scope equals 90 decibels or louder (example: a jointer/planer is 100 decibels, a chainsaw is at the high end of moderate or the low end of wide in scope at 90 decibels).

The degree of effects evaluated by Indicators 1-5, the human experience of decibel levels displayed in Table 15 and Figure 9, and user expectations described by Forest Plan MAs and ROS class, are considered in evaluating the degree of annoyance and effects to opportunities for solitude. This analysis refers to levels of annoyance and effects to opportunity for solitude from higher to lower as 'substantial', 'moderate', 'minor', 'negligible' or nonexistent. Since there is no single variable that can allow for a conclusion, it is based on a professional judgment call by Forest Service staff. However, the greater the degree of effect displayed in Indicators 1-5, along with higher expectations for a quiet environment according to MA and ROS class, leads towards estimating a higher level of annoyance or effect to opportunity for solitude for a receptor in Indicators 6 and 7.

Figure 9. Human experience of dBA levels

Analysis Parameters

Current Operating Plans

The analysis area for direct, indirect and cumulative effects from the 21 operating plans includes the area on all ownerships within 1.6 miles of the operating plan areas (1.6 miles is assumed to be the average audible distance for drilling rigs without sound mitigation; see Analysis Methods). This includes cumulative effects because this area covers any intersection where sound from operating plan activities may overlap with the sound generated from other activities. This includes the area of wilderness within 1.6 miles of the operating plan areas. See Figure 12 which shows the area of audibility from proposed drill sites.

The analysis timeframe is six years (although these six years are not necessarily consecutive; see Section 2.2.2.4 for details on timeframes) it is anticipated that activities from the 21 operating plans would be complete within this timeframe and sound does not last beyond the time that activities occur.

Current Prospecting Permits

The analysis area for direct, indirect and cumulative effects for the 33 prospecting permit applications and one prospecting permit extension includes the area on all ownerships within 1.6 miles of the prospecting permit areas since this covers the area where sound from activities in the prospecting permit areas may potentially be heard (1.6 miles is assumed to be the average audible distance; see Analysis Methods). This includes cumulative effects because this area covers any intersection where sound from prospecting permit activities may overlap with the sound generated from other activities. This includes the area of wilderness within 1.6 miles of the prospecting permit areas. The analysis timeframe is 20 years since this is when activities associated with these permits are anticipated to occur and sound does not last beyond the time that activities occur.

Future Prospecting Permits and associated operating plans

The analysis area for direct, indirect and cumulative effects for the future prospecting permits includes the area on all ownerships within 1.6 miles of and including the Project Area since this covers the area where sound from activities in the prospecting permit areas may potentially be heard (1.6 miles is assumed to be the average audible distance; see Analysis Methods). See Map 2 for the Project Area of the Forest that

may receive a prospecting permit application covered under this analysis which is about 424,431 acres. This includes cumulative effects because this area covers any intersection where sound from prospecting permit activities may overlap with the sound generated from other activities. This includes areas of wilderness within 1.6 miles of the project area.

The analysis timeframe is 20 years since this is when activities associated with future permits are anticipated to occur and sound does not last beyond the time that activities occur.

3.1.2 Affected Environment

3.1.2.1 Recreational Activities

The Project Area contains numerous opportunities to users identified as local landowners, recreation residences, Boundary Waters Canoe Area Wilderness (BWCAW) visitors, winter use enthusiasts, developed recreation site and trail visitors, and designated dispersed recreational campsite visitors outside the BWCAW. State Highway and County Roads are located throughout this area and are heavily traveled by local residents and visitors. Dispersed recreation activities occur on most lakes, roads, and trails. Popular dispersed recreation activities in the Project Area include fishing, camping, boating, hunting, scenic driving, hiking, canoeing, berry picking, all terrain vehicle use, skiing, dog sledding, and snowmobiling. The BWCAW boundary in located in proximity to the project area, therefore, visitors traveling to and from their wilderness trip experience pass through the Project Area.

See Section 3.3 Recreation of this DEIS and the Recreation section of the Forest Plan FEIS for further information.

3.1.2.2 Management Area (MA) and Recreation Opportunity Spectrum (ROS)

Current Operating Plans

The general forest MA covers the majority of the operating plan areas. The recreation use in a scenic landscape MA surrounds parts of Birch Lake and the South Kawishiwi River and includes several operating plan areas. There is a research natural area and a unique biological area that include operating plan areas. Adjacent to the operating plan areas in the wilderness is the semi-primitive non motorized MA. See Map 7 displaying management areas. See Chapter 3 of the Forest Plan for a description of MAs.

Within the operating plan areas, there are ROS classes of semi primitive motorized and roaded natural. The adjacent wilderness is semi-primitive nonmotorized. See Map 7 displaying ROS classes. See Forest Plan for a description of ROS classes and their recreational setting.

Current Prospecting Permit Applications

The prospecting permits applications are located inside several MAs, including general forest, recreation use in a scenic landscape surrounding Birch Lake and South Kawishiwi River, research natural area, unique biological area, eligible wild, scenic and recreational river, and semi primitive motorized. Inside the wilderness near the prospecting permit application areas there is semi-primitive non motorized wilderness and some primitive wilderness next to Snake River entry point.

Within this area, the ROS class is semi primitive motorized and roaded natural, and some area of semi-primitive non motorized for the permits located to the southwest near the Saint Louis River.

Future Prospecting Permit Applications and associated Operating Plans

The affected environment includes all of the MAs and ROS present on the Forest outside the wilderness. In addition, the affected environment includes MAs and ROS inside wilderness near the border of the

wilderness where drilling might occur and project sound into the wilderness. These include semi primitive non motorized wilderness, semi primitive motorized wilderness, and primitive wilderness.

3.1.2.3 Existing Soundscape

Average Ambient Decibel Levels

In general forest areas, daytime decibel levels on the Forest may be as low as 30 to 35 dBA, while nighttime levels may be as low as 20 to 25 dBA without wind or insects (Braslau 2007). Winter forests may be as low as 25 dBA when there is snow cover (Harrison and Clark 1980, p. 19). However, monitoring has shown that higher dBA levels may be present, particularly in areas with more human use (see Table 16).

For the purposes of this analysis, the average natural ambient level is assumed to be 34 dBA during the day and 25 dBA at night. The average ambient dBA level which includes human-generated sound for key receptors is displayed in Table 16. This is based on monitoring data for continuous week long periods using a Larson-Davis sound measurement device at ambient sound levels at representative recreation receptor locations on the Forest along with Braslau (2007) and Harrison (1980). See Appendix B for monitoring data.

Table 16. Average ambient decibel levels

Site	Summer Average Daytime dBA	Summer Average Nighttime dBA	Winter Average Daytime dBA	Winter Average Nighttime dBA
Developed Recreation sites and motorized trails	46	44	45	30
Recreation Residences and Local Landowners	40	36	40	30
Dispersed designated campsites	44	43	34	25
BWCAW	35	30	34	25
Semi-Primitive Non-motorized MA and non motorized trails	40	35	34	25
Semi-Primitive Motorized MA	50	45	40	30

While these averages are assumed, dBA level would fluctuate based on time and location and could be louder or softer if factors such as wind speed changes, wave action on lakes is present or human made sound enters the area.

Composition of the Soundscape

The composition of ambient sound at these receptor locations includes natural and human generated sounds. Natural sounds include wind, leaves rustling, wave action on lakeshores, bird song and other animal calls. Less noticeable human-generated sounds include sounds from skiing, walking, and talking. More noticeable human-generated sounds are generally from motorized sources and include sounds from motor vehicles, ATVs, snowmobiles, logging equipment, airplanes, prescribed fire, minerals exploration drilling, minerals extraction at gravel pits and quarries, and uses at buildings such as stationary generators, music, lawnmowers, leaf blowers and snow blowers. Some of these sound sources are seasonal (e.g. snowmobiles operate in the winter and ATVs operate in the summer). Roads and trails in

the analysis area include some of these human-generated sounds such as motor vehicles on roads leading to wilderness entry points (e.g. the Gabbro Lake entry point), or snowmobile sound from a snowmobile trail (e.g. the Tomahawk snowmobile trail). See Map 7, Forest Recreation Sites, for these locations.

Minerals Exploration

Minerals exploration has been a historic activity on the Forest, focused on the Duluth Complex geological formation. The Duluth Complex is also identified as a high interest exploration area for this project on Map 4. From 1948 to 2002, over 1,700 core holes totaling over 1.4 million feet of core have been drilling in the basal zones of the complex (Miller 2002). The majority of the historic activity took place between 1950 and 1980, although recent years have seen an increase in activity. For the past several years, there has been drilling on federal, state and private lands in the vicinity of the operating plan and current prospecting permit application areas. See Map 6 for historic drilling in the project area. Drilling has also occurred on the surface of Birch Lake via a barge, which is permitted by the State of Minnesota. As indicated in scoping comments on this project, drilling over the past several years has impacted the recreation experience of recreation users such as some dog sledders while others have not been bothered or support it.

It is assumed that recent levels of drilling would increase into the future on state and private land, and on federal land for reserved and outstanding minerals based on increasing interest in minerals exploration on federal lands. Much of this drilling has occurred during the winter when the ground is frozen to allow access for equipment, and the considerable majority of future drilling is anticipated to occur during frozen conditions from about November through April in the future (Forest Geologist, personal communication). Drilling generally occurs on a continuous basis (24 hours a day/seven days a week), and each drill hole takes an average of 3 weeks (it could take a few days up to 6 weeks) to complete. Sound from this drilling is part of the affected environment for recreation receptors. A particular receptor may or may not hear drilling sound depending on location and timing. See Map 3 for possible future drilling areas on existing leases.

3.1.2.4 Recreation Receptors

Recreation receptors are present in a variety of settings that contain different soundscapes, and people have expectations for the soundscape based on the recreation setting along with personal preference. People located in Primitive or Pristine Wilderness Management Areas may expect a soundscape with minimal human-generated sound, while people located outside the wilderness in a developed campsite next to a lake where motorboat use is common may expect to hear noticeable human-generated sounds on a regular basis. People at dispersed recreation sites or trails outside the wilderness may expect to hear a soundscape intermediate between these two settings. As discussed above, ROS and MA designations provide context for expectations of the recreational experience.

A large majority of recreation use occurs in the summer, yet there are still important recreational uses that occur in the winter. This applies to both the BWCAW and the rest of the Forest. In the winter, developed recreation sites are closed (e.g. Birch Lake Campground and permitted recreation residences).

Current Prospecting Permit Applications and Operating Plans

See Figure 12 and Figure 13 for the locations of several recreation receptors in the vicinity of current operating plans and prospecting permit application areas.

There are a number of recreation residences in the area, primarily on the shores of the South Kawishiwi River and Birch Lake. The South Kawishiwi Cabin Group includes about 30 cabins, and there are additional cabins on Birch Lake. Other buildings or recreational residences in the vicinity of current

prospecting permit application areas include those near Slate Lake, Grouse Lake, and Mitiwan Lake. There are public developed campgrounds at Birch Lake and the South Kawishiwi River.

There are several trails in the vicinity of drill sites. The Tomahawk Snowmobile Trail is located east and north of the proposed drill sites (although snowmobile traffic is proposed to be relocated onto FR 179 in the Trail Corridor Project for a portion of the Tomahawk Trail and become a non-motorized trail). The Cobalt Creek dogsled trail enters the BWCAW northeast of the proposed drill sites. Further southwest are the St. Louis River Hunter Walker trails near permit application areas. The Big Pine dogsled trail crosses through a prospecting permit application area just north of the South Kawishiwi River.

The Little Gabbro Lake, South Kawishiwi River, and Snake River wilderness entry points are the closest to the operating plan proposed drill locations. The closest campsites inside the BWCAW are located at the South Kawishiwi River, Little Gabbro Lake, Gabbro Lake, Bald Eagle Lake and Bog Lake.

In the winter a portion of the Big Pine dogsled trail is inside a prospecting permit application area. Dog sledding, snowshoeing and cross country skiing may also occur at the Cobalt Creek winter trail in the wilderness.

Future Prospecting Permit Applications and Operating Plans

There are numerous recreation receptors in the analysis area. Map 7 shows important recreation sites across the Forest. See section 3.8 of the Forest Plan FEIS for a description of recreation activities on the Forest. See also the Recreation section of this Draft EIS for further information. Prospecting permit applications and subsequent minerals exploration activity that generates noise that could affect the recreational experience are most likely in the areas of the Forest that contain moderate or high potential for minerals exploration activity (see Map 4).

3.1.3 Direct and Indirect Effects of Current Prospecting Permit Applications

Current prospecting permit applications include the operating plans discussed in section 2.2.2.2. As explained in section 2.2.2.4, additional operating plans may be submitted in these permit application areas in the future. Potential receptors are displayed in Figure 14 and include the receptors described in the Affected Environment section. The area of possible effect, and the effect of sound upon receptors on a per drill site basis is evaluated. When operating plans are submitted, the BLM and Forest Service may, if needed, require additional mitigation for specific receptors to reduce effects.

3.1.3.1 Alternative 1

Under this alternative, none of the 33 prospecting permit applications or one permit extension would be approved and there would be no activities generating sound from the project. Therefore, there would be no direct or indirect effects under this alternative.

3.1.3.2 Effects Common to Action Alternatives

Support Vehicles

Motor vehicles, ATVs and snowmobiles may be used during geophysical investigations and to support drilling operations. These vehicles are present in the project area and would not represent a new type of sound. The majority of activity would occur during the winter months when recreation use is low on the Forest. The sound would be primarily during daylight hours, occur for a portion of the day, and last for an average of 3 weeks on access routes to drill pads during drilling operations. Temporary roads would be closed for public use, so receptors would be unlikely to get very close to access routes from which sound would be emitted.

Almost all of the current prospecting permit application areas have an ROS class of roaded natural and semi-primitive motorized. In these ROS areas, negative impacts would be unlikely for most recreation users since these activities are expected or are being done by users themselves. There are some areas with an ROS class of semi-primitive non motorized that are adjacent to the current prospecting permit application areas. In these areas, particularly adjacent areas of the BWCAW, impacts would be more noticeable, but would be minor due to the commonality, intermittent nature, short-term duration, shifting location, and seasonality of sound generated by support vehicles.

Watercraft

As discussed in Chapter 2, additional water crossings may be proposed in prospecting permit applications. These are expected to primarily be on Birch Lake, but other lakes may be used. Three to six trips per day may occur during drilling operations lasting about 3 weeks, and trips would generally occur during daylight hours. Sound from watercraft engines would affect users of the lake and recreational residences on the lakeshore. Sound would travel further across the lake than in the forest since vegetation would not provide a barrier. Motorized watercraft are allowed and are common on Birch Lake, so this activity would not introduce a new type of sound (some other lakes have less motorized use and the watercraft would be more noticeable).

There would likely be an increase in the frequency of sound near the travel routes of watercraft used for project activities. See Table 17 for sound levels as distance from the watercraft increases. A decibel level of 82 dBA at 50 feet is assumed based on MPCA noise control limits for motorboats (MPCA 1999).

Table 17. Sound volume of watercraft engines with increasing distance across open water

dBA	Distance (feet)
82	50
65	255
50	1076
34	5000
25	11857

Overall, impacts to receptors on Birch Lake would be minor due to the common presence of motorboats, and may be slightly higher for receptors on lakes with infrequent motorboat use.

Helicopters

For transportation to drill pads, helicopters flying at about 1000 feet would generate about 81 dBA for any receptors (outside the BWCAW) directly under the flight path (Braslau 2007). This would be temporary noise. During the setup and breakdown day for the drill site, there would be 6-10 trips per day, while operating days would have about 2 trips per day. Flights would last an average of 3 weeks per drilling site. Figure 10 displays dBA levels as a helicopter increases in elevation and distance from a receptor.

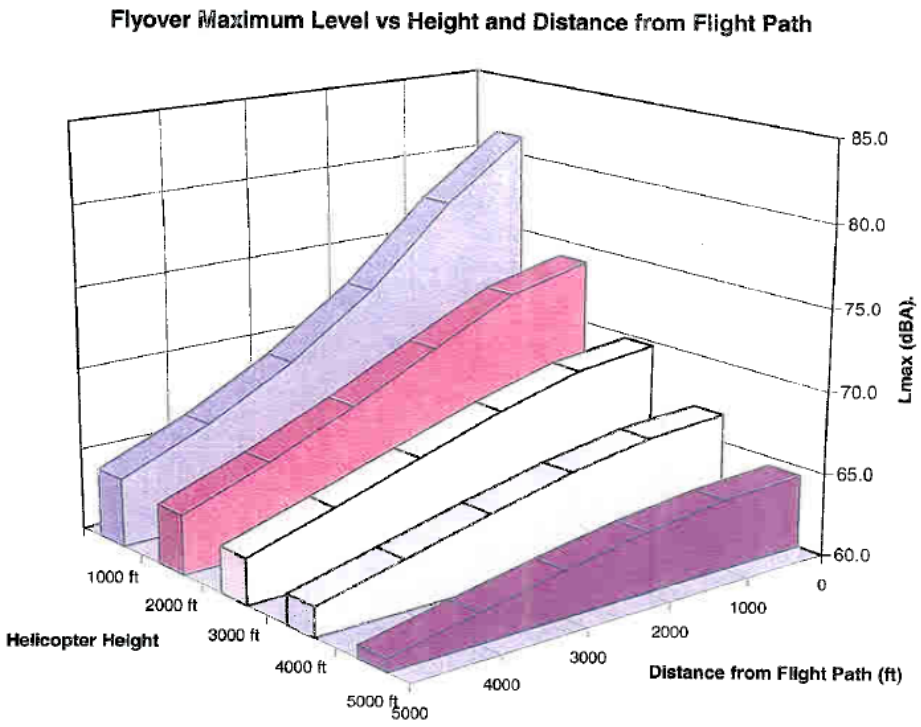


Figure 10. Helicopter sound decay with elevation and distance (Braslau 2007)

For some recreationalists, the helicopter would be heard once or twice if they were traveling on a trail and left the flight path of the helicopter. Other recreationalists may be more affected such as those staying at a campground or campsite for a week. Receptors that are likely to be in the flight path on repeated occasions would be identified in operating plans and alternate flight paths or elevations would be identified as needed to minimize effects to the extent possible while maintaining the safety and efficiency of helicopter operations.

Indicator 1: Type of Sound

As displayed on Figure 15, minerals exploration activities have occurred on multiple occasions in the vicinity of the current prospecting permit application areas. In addition, motorized noise associated with future drilling is similar to motorized noise associated with other engines such as logging equipment that is also a part of the human-made soundscape. Therefore, noise associated with drilling and associated activities are not considered a new type of sound.

3.1.3.3 Differences among Action Alternatives

Indicators 2-5 (see Analysis Methods for Indicator descriptions)

Potential key receptors are displayed below in Figure 11. Sound from project activities may be located inside or adjacent to the permit application areas, depending on where drill sites are located. The area of audible sound, and sound above ambient levels on a per drill site basis is displayed in Table 18. Alternative 2 has the greatest impact on a per drill site basis due to lack of mitigation, while Alternative 3 reduces impacts with mitigation measures, and Alternative 5 further reduces impact with seasonal restrictions.

Table 18. Impacts per drill site for alternatives 1 - 5

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Duration of Drilling (Indicator 2)	0 days	24 hours a day, 7 days a week for an average of 3 weeks			
Timing of Drilling (Indicator 2)	No drilling	Mostly winter, some summer	Mostly winter, some summer	Mostly winter, some summer	Only winter (November 1 to April 30)
Area/Distance of Audibility (Indicator 3)	0 acres	5307 acres	3685 acres	Depends on location[a]	3685 acres
	0 feet	8580 feet	7150 feet	Depends on location	7150 feet
Area/Distance of Sound Louder than nighttime residential standard (50 dBA or more) (Indicator 4)	0 acres	13 acres	1 acre	Depends on location	1 acre
	0 feet	0 to 418 feet	0 to 117 feet	Depends on location	0 to 117 feet
Area/Distance of Sound Louder than daytime natural ambient (34 dBA to 50 dBA) (Indicator 4)	0 acres	204 acres	16 acres	Depends on location	16 acres
	0 feet	418 to 1734 feet	117 to 480 feet	Depends on location	117 to 480 feet
Area/Distance of Sound Louder than nighttime natural ambient (25 to 34 dBA) (Indicator 4)	0 acres	830 acres	66 acres	Depends on location	66 acres
	0 feet	1734 to 3811 feet	480 to 1074 feet	Depends on location	480 to 1074 feet
Sound Level in BWCAW (Indicator 5)	0 dBA	84 dBA to inaudible, depending on location	70 dBA to inaudible, depending on location	30 dBA to inaudible, depending on location	70 dBA to inaudible, depending on location
Sound Level in Semi Primitive Motorized MA (Indicator 5)	0 dBA	84 dBA to inaudible, depending on location	70 dBA to inaudible, depending on location	60 dBA to inaudible, depending on location	70 dBA to inaudible, depending on location
Sound Level in Semi-Primitive Non-Motorized MA, Developed Campgrounds, Campsites, & Dwellings (Indicator 5)	0 dBA	84 dBA to inaudible, depending on location	70 dBA to inaudible, depending on location	50 dBA to inaudible, depending on location	70 dBA to inaudible, depending on location

a - Effects per drill site depend on location because mitigation would need to be implemented depending on whether a receptor close enough to the receptors to exceed limits specified in Table 19.

Alternative 4 would require mitigation when drilling is close enough to the receptors to exceed limits specified in Table 19. If receptors are distant enough to comply with these limits, mitigation would not be required. Therefore, the area of audibility and sound volume would depend on the mitigation measures selected at each drill pad to comply with the limits.

Table 19.Threshold dBA levels required under Alternative 4

Receptor	Threshold (average dBA)	Variance (Upper Limit)
Semi Primitive Motorized MA	60	+ 5 (65)
Semi Primitive Non Motorized MA, Developed Campgrounds, Campsites and Recreational Residences[a]	50	+ 5 (55)
Wilderness MAs	30	+ 5 (35)

a - The 50 dBA threshold at residential buildings meets MPCA noise control rules for nighttime sound level limits.

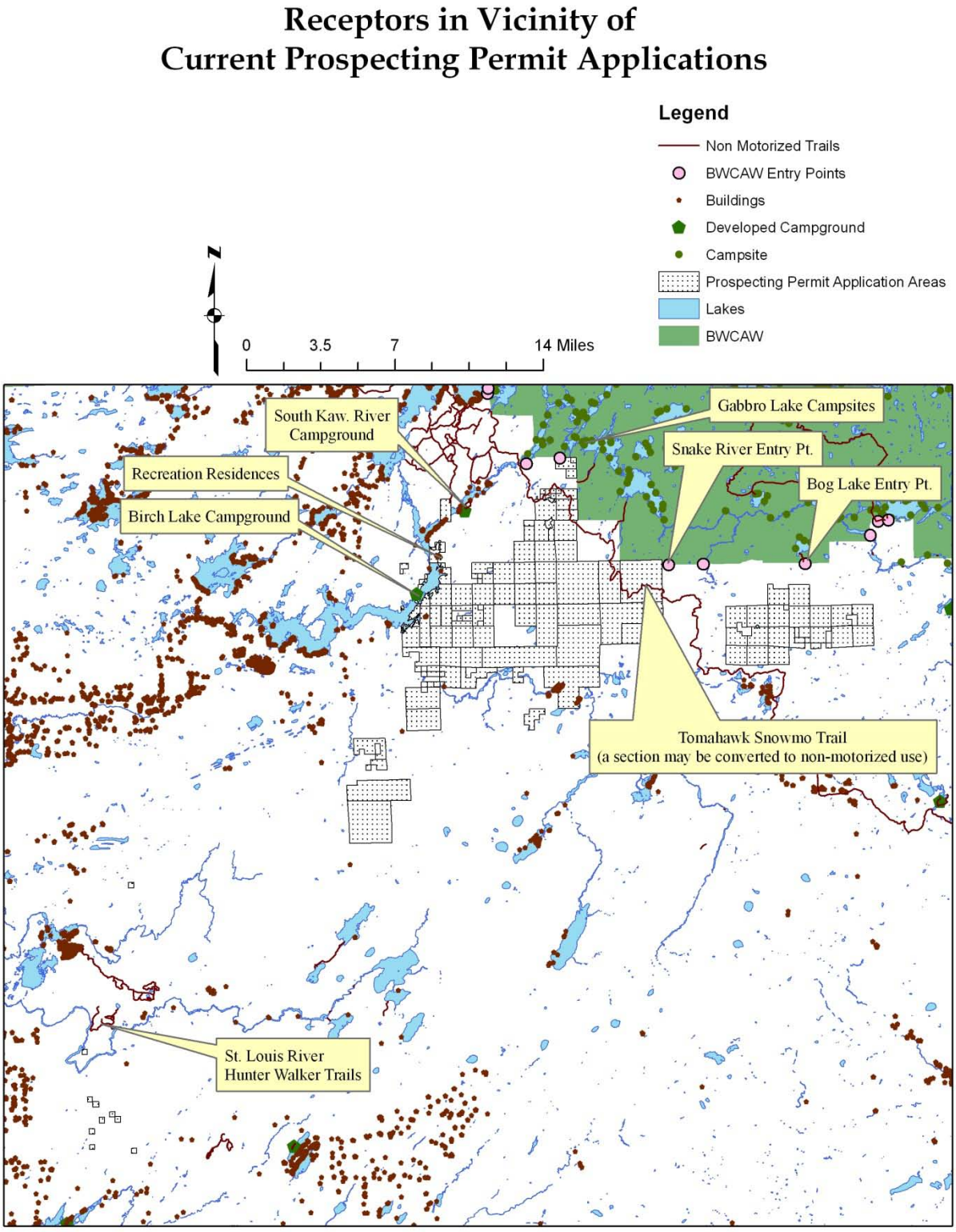


Figure 11. Receptors in range of current prospecting permit applications

Indicator 6: Level of Annoyance

Recreation Setting

The recreation setting would affect level of annoyance since people expecting a more natural soundscape would be annoyed more by drilling sound. Developed campgrounds and recreation residences would expect occasional motorized sound in the background while receptors at dispersed campsites, trails, and non-motorized winter use enthusiasts would expect to hear less frequent motorized sound.

The recreation setting in semi-primitive non motorized ROS class areas include an expectation for less motorized sound than in semi-primitive motorized or roaded natural ROS class areas. The recreation use in a scenic landscape MA generally includes noticeable signs of human activity, including motorized noise. However, the constant nature of drilling sound could be perceived as out of place compared to other motorized sounds in this MA. The eligible wild, scenic and recreational river MA has a more remote setting and receptors may be more annoyed at drilling noise. The research natural area and unique biological area MAs have settings that would include only infrequent human disturbance (such as motorized sound). However, these MAs do not allow surface occupancy for federal minerals exploration, minimizing effects. The general forest and general forest-longer rotation MAs include some motorized use as a part of the setting and include expectations for encountering human activities (such as motorized sound).

Distance from Drill Site

The level of annoyance for receptors outside the wilderness depends on the location of drill sites in prospecting permit areas and the location of receptors. Annoyance would decrease with increasing distance from the drill site since sound levels would decrease as would the degree to which people would notice the sound. See Table 18 for distances for each Alternative. The following impacts apply to campers or recreation residences; traveling people would experience less impact since they would generally move away from the drill site and experience the noise for a shorter duration.

Alternatives 2, 3 and 5

- If receptors are located close to drill sites and receive 50 dBA or more on a 24 hours a day, 7 days a week basis(see Table 18; within a 13 acre area of drill sites for Alternative 2, or a 1 acre area of drill sites for Alternatives 3 and 5), there would be a substantial level of annoyance.. It is unlikely that receptors would camp this close to a drill site, so this level of effect is unlikely to occur.
- Receptors hearing 34 to 50 dBA would be likely to sometimes hear sound above ambient levels, especially in less developed areas of the Forest such as dispersed campsites. This would be moderately annoying for people engaged in non-motorized activities or during less active moments such as dawn and dusk, and in the winter when ambient decibel levels are lower. Receptors in developed campgrounds and recreation residences may find this sound level less annoying than in more remote settings.
- Receptors receiving between 25 and 34 dBA may not perceive any sound from drilling during the day. Some people may perceive the sound on calm nights and in the winter in more remote settings and experience minor annoyance during these time periods.
- Below 25 dBA, fewer people would perceive the sound and for most people, effects would be negligible.
- Receptors located outside of the area of audibility would not be affected.

Alternative 4

Alternative 4 would limit sound levels to receptors in semi-primitive motorized MAs to 60 dBA or less. Alternative 4 also limits sound levels to receptors in semi-primitive non-motorized MAs, campgrounds, campsites, and recreation residences to 50 dBA or less.

- In semi primitive motorized MAs, the limit may be above the ambient sound level, although only occasionally since other motorized sounds tend to be present. Motorized recreationalists in this MA would be unlikely to be annoyed by drilling noise since the motorized use would generate similar, and likely louder sound (e.g. a recreationalist driving an ATV).
- For recreation residences, the limit may be above the ambient sound level for some of the day. This sound would be small in scope (e.g. the sound level in a library), although still generate some annoyance due to the constant nature of the drilling sound. MPCA rules for sound levels reaching residential buildings to be limited to 50 dBA at night would be met. US EPA (1973) indicates that buildings with closed windows may reduce sound levels by 27 dBA, reducing sound levels to 23 dBA (less than nighttime ambient dBA). Thus, the building would provide an additional barrier to render the level of annoyance negligible. However, people may keep windows open at recreation residences in the summer or be outside during quiet times at dawn or dusk in which case annoyance would increase.
- In developed campgrounds, the 50 dBA limit may be above ambient sound level for some of the day and would be small in scope. Campers would not sleep in buildings, although those in RVs may experience lower decibel levels. Campers in tents may find the sound moderately annoying when nighttime ambient sound levels are lower.
- A sound level of 50 dBA may be moderately annoying for people staying at dispersed campsites, particularly at night and in the winter when ambient sound levels are lower. This is compounded by the expectation for a more remote experience at these areas than in developed campgrounds.

Time of Year
Alternative 5 would reduce impacts compared to the other action alternatives by avoiding activity during the summer months. This would avoid impacts to a substantial majority of Forest recreationalists, and avoid impacts at developed campgrounds and recreation residences which are closed or unused in winter months.

Indicator 7: Level of effects to opportunity for solitude

Recreation Setting
Wilderness visitors generally have a higher expectation of a natural soundscape and solitude than visitors in the rest of the Forest. Receptors located in semi-primitive motorized wilderness MAs would be less likely to be impacted due to more common motorized sound emitted from motors inside and outside the wilderness. Receptors in the wilderness in the semi primitive non motorized or primitive MAs would find the sound more noticeable than in the semi primitive motorized MA.

Although expectations for a natural soundscape are higher than for outside the wilderness, the BWCAW soundscape near the wilderness boundary contains motorized sound from existing sources outside the wilderness (see Affected Environment section). This includes drilling sound entering the wilderness from drilling on reserved and outstanding minerals, and state and private lands, under all alternatives (including no action).

Distance from Drill Site
As for level of annoyance outside the wilderness, effects to solitude inside the wilderness depends on the location of drill sites in prospecting permit areas and the location of receptors. The following impacts

apply to campers; traveling people would experience less impact since they would generally move away from the drill site and experience the noise for a shorter duration.

Alternatives 2, 3 and 5

- If campers are located close to drill sites (e.g. close to the wilderness border) and receive 50 dBA or more on a 24 hours a day, 7 days a week basis (e.g. within a 13 acre area of drill sites for Alternative 2, or a 1 acre area of drill sites for Alternatives 3 and 5), there would be a substantial impact to solitude. It is unlikely that this impact would occur for more than a fraction of a wilderness trip while visitors walk into the wilderness since campsites are mostly located deeper in the wilderness, even if the drill site is located very close to the wilderness border. Due to the short duration, the impact would not be substantial. Receptors hearing 34 to 50 dBA would be likely to hear sound above ambient levels. While this sound level is considered small in scope, it would occur continuously and thus may have a moderate impact to solitude for receptors at campsites. Receptors receiving between 25 and 34 dBA may not perceive any sound from drilling during the day. Some people may perceive the sound on calm nights and experience a minor impact to solitude during these time periods.
- Below 25 dBA, some people would not ever perceive the sound. For other people in the wilderness, perceiving a faint motorized sound would generally have a minor impact on their experience of solitude.
- Receptors located outside of the area of audibility would not be affected.

Alternative 4

Alternative 4 would limit effects to the wilderness by reducing sound level to 30 dBA or less. This would be below average daytime ambient sound level of 34 dBA in the wilderness, would be small in scope (e.g. a quiet woods), and would not be noticeable to most wilderness users. In general, sound a few decibels below ambient level is not audible to most people (Braslau 2007). The sound may be more noticeable for some people at night when natural sound levels may occasionally get closer to 25 dBA during very calm periods. However, given that sound levels would be 30 dBA at the wilderness boundary, most campsites are located deeper in the wilderness and would receive less than 25 dBA due to sound decay with distance.

Time of Year
Alternative 5 would reduce impacts compared to the other action alternatives by avoiding activity during the summer months. This would avoid impacts to a substantial majority of BWCAW visitors.

3.1.4 Cumulative Effects for Current Prospecting Permit Applications

3.1.4.1 Alternative 1

Since there would be no direct or indirect effects from Alternative 1, there would be no cumulative effects.

3.1.4.2 Alternatives 2-4

As discussed in the Affected Environment section, there are a variety of human-made and natural sounds that comprise the soundscape in the analysis area. These sounds result in the cumulative soundscape when added to sound from project activities. It is likely that sounds from drilling on reserved and private minerals on federal land, and drilling on state and private land, may occasionally overlap with sounds from drilling on federal minerals on federal land. When drilling sites are close together, up to 3 to 4 dBA may be added to the total volume of sound. Since changes in sound volume of 5 dBA or more is generally

noticeable (MPCA 1999), drilling from other projects is unlikely to result in a substantial change in cumulative sound volume.

However, drilling from this and other projects may increase the total duration of drilling sound that may be heard over a period of time. For example, drilling for three weeks on federal land, followed by an additional three weeks of drilling on adjacent state land, could result in a longer cumulative duration that drilling sound may be heard. Known future drilling may occur on leases shown in Map 7. This shows that cumulative additions in duration may occur for some receptors on or adjacent to Birch Lake, and on or adjacent to the Saint Louis River. Drilling activities are still temporary in nature and do not represent a noise source that lasts indefinitely (such as a high standard road carrying vehicles).

See Map 6 in the project file. This map is too large to include in the document, but will be posted on the SNF website and included on a CD with the hardcopy or electronic version of the DEIS.

Other reasonably foreseeable activities in the analysis area include timber harvest as a part of the Glacier, Birch, Dunka, Tomahawk and Inga South Projects, and some harvest on state land. This may also add about up to 3 to 4 dBA to total volume of sound if timber harvest and drilling occur in adjacent areas, which would be a minor difference (MCPA 1999). Cumulative additions in duration of sound are unlikely since sound from timber harvest activities is temporary instead of constant in nature like that of drilling.

Sound generated by motor vehicles, ATVs, snowmobiles, motorboats, chainsaws and aircraft would occur in the future as the result of activity by federal, state and private entities as they have in the past and present. Overall, project activities utilizing these machines would represent a level of activity within the scope of what is anticipated to occur from other entities and projects. Access roads to drill sites and travel routes for barges and helicopters used in project activities would experience an increase in sound levels in these locations. Minimal cumulative effects are anticipated in these areas since temporary roads used for access would be closed to public use, and other aircraft or watercraft would not travel close to the travel routes of helicopters and barges used in project activities.

3.1.4.3 Alternative 5

Alternative 5 would have the same cumulative effects as Alternatives 2-4, except cumulative effects in the summer would be avoided due to the seasonal restriction. There may be some concentration of effects in the winter compared to Alternatives 2-4, although this would not be substantial since the majority of drilling is anticipated to occur during frozen ground conditions in all action alternatives.

3.1.5 Conclusion

The degree of impacts under each alternative would depend on the distance from drill site to receptor, and required mitigation measures. Of the action alternatives, Alternative 2 would have the highest negative impact to recreation receptors since drilling operations would not include noise mitigation measures. Alternative 3 would have lower negative impacts than Alternative 2 since mitigation would reduce emitted decibel levels. Alternative 5 would further reduce negative impacts from Alternative 3 by avoiding operations during the summer season during which the large majority of recreation activity occurs. Alternative 4 would reduce impacts to the greatest degree of the action alternatives for some drill sites by requiring maximum limits for decibel levels at key recreation locations. For drill sites which do not have receptors that may exceed prescribed limits, Alternative 4 may have impacts similar to Alternative 2. Alternative 1 would have no impact since no drilling or associated project activities would occur.

3.1.6 Direct and Indirect Effects for Current Operating Plans

3.1.6.1 Alternative 1

Under this alternative, none of the 21 operating plans would be approved and there would be no activities generating sound from the project. Therefore, there would be no direct or indirect effects.

3.1.6.2 Effects Common to Action Alternatives

Support Vehicles

Motor vehicles, ATVs and snowmobiles may be used during geophysical investigations and to support drilling operations. These vehicles are present in the project area and would not represent a new type of sound. The majority of activity would occur during the winter months when recreation use is low on the Forest (under Alternative 5, all activity would be in the winter months). For each drill hole, the sound would be primarily during daylight hours, occur for a portion of the day, and an average of 3 weeks on access routes to drill pads during drilling operations. Almost all of the current operating plan areas have an ROS class of roaded natural and semi-primitive motorized. In these ROS areas, negative impacts would be minor for most recreation users since these activities are expected in this setting or are being done by users themselves. Temporary roads would be closed for public use, so receptors would be unlikely to get very close to access routes from which sound would be emitted.

There are some areas with an ROS class of semi-primitive non motorized that are adjacent to the current operating plan areas. In these areas, particularly adjacent areas of the BWCAW, impacts would be more noticeable, but would be minor due to the intermittent nature, short-term duration, shifting location, and seasonality of sound generated by support vehicles.

Watercraft

Several operating plans include proposals to transport equipment across Birch Lake on a barge (MNES 052446, 053731, 054387, 055301, and 055302). For each drill hole, three to six trips per day may occur during drilling operations lasting an average of 3 weeks, and trips would generally occur during daylight hours. Sound from watercraft engines would affect users of the lake and recreational residences on the lakeshore. Sound would travel further across the lake than in the forest since vegetation would not provide a barrier. Motorized watercraft are allowed and are common on Birch Lake, so this activity would not introduce a new type of sound. Motorized use associated with minerals exploration (including drilling) has occurred in the past on Birch Lake as permitted by the State of Minnesota.

There would be an increase in the frequency of sound near the travel routes of watercraft used for project activities that could cause some annoyance to nearby receptors. Table 17 displays estimated dBA levels with increasing distance across open water from an engine that generates 82 dBA at 50 feet.[6] Overall, impacts to receptors on Birch Lake would be minor due to the common presence of motorboats.

Helicopters

The Operating Plan MNES-055305 includes helicopter flight to access a drill site in the southeastern portion of the permit area. During the setup and breakdown day for the drill site, there would be 6-10 trips per day, while operating days would have about 2 trips per day. Flights could last about 3 weeks. The expected flight path for MNES-055305 does not cross over or near known recreation receptors. Therefore this helicopter use would have negligible impacts, although there may be a few people traveling cross

[6] 82 dBA at 50 feet is identified as a limit for sound generated by motorized watercraft built after January 1, 1982 (MPCA 1999).

country in the area that would experience an occasional impact if they were under the flight path. This would be temporary noise that recedes as the helicopter moves away. Flights would generally occur during the daytime, reducing the possibility of disrupting of any sleeping campers traveling cross country.

Indicator 1: Type of Sound

As displayed on Map 6, minerals exploration activities have occurred on multiple occasions in the vicinity of the operating plan areas and future drilling in the area is anticipated on state and private land, and for outstanding and reserved minerals on federal lands. Therefore, noise associated with drilling and associated activities are not considered a new type of sound in the vicinity of the operating plan areas under any action alternative.

3.1.6.3 Alternative 2

This alternative does not require mitigation of drilling sound and sound level may be an average of 84 dBA at 20 feet from the drill rig.

Indicator 2: Duration and Timing of Sound

Drilling would occur on a continual basis (24 hours a day, 7 days a week) until complete. Each drill hole would take an average of 3 weeks to complete. While this alternative does not include seasonal restrictions based on noise mitigation, a substantial majority of drilling would still occur under frozen conditions in the winter to protect soils and since this is what has historically occurred. Although there are 92 drill sites identified in the operating plans, and additional definition drill sites may be identified during implementation, these would not all occur at the same time. Drilling would be complete in about 4 years. Drilling activities are temporary in nature and do not represent a noise source that lasts indefinitely (such as a high standard road carrying vehicles).

Indicator 3: Area of Audibility

The area of audibility would be about 64,260 acres (see Figure 12 for the area of audibility). If additional definition drill sites are identified during implementation, this would add about 5307 acres per drill site, assuming the areas of audibility do not overlap. Only a portion of drill sites would be active at any one time (about 10); therefore only a portion of the acreage identified in Figure 13 would contain audible drilling sound at a given time (about 53,070 acres). As discussed in the Affected Environment section, motorized sound from drilling and other sources has been and is present in the vicinity of the operating plan areas. Therefore, the area of audibility created by drilling identified in the operating plans would not represent a new expansion in the area of audible motorized sound. However, at a given time, project activities may create an audible motorized sound that would not otherwise be present.

Drilling sound would be audible to receptors at the Little Gabbro and Snake River entry points to the wilderness, some campsites on Little Gabbro and Gabbro lakes, and Cobalt Creek winter trail. Sound would also be audible at the Birch Lake campground, recreation residences on the shore of Birch Lake and the South Kawishiwi River, and users of much of Birch Lake.

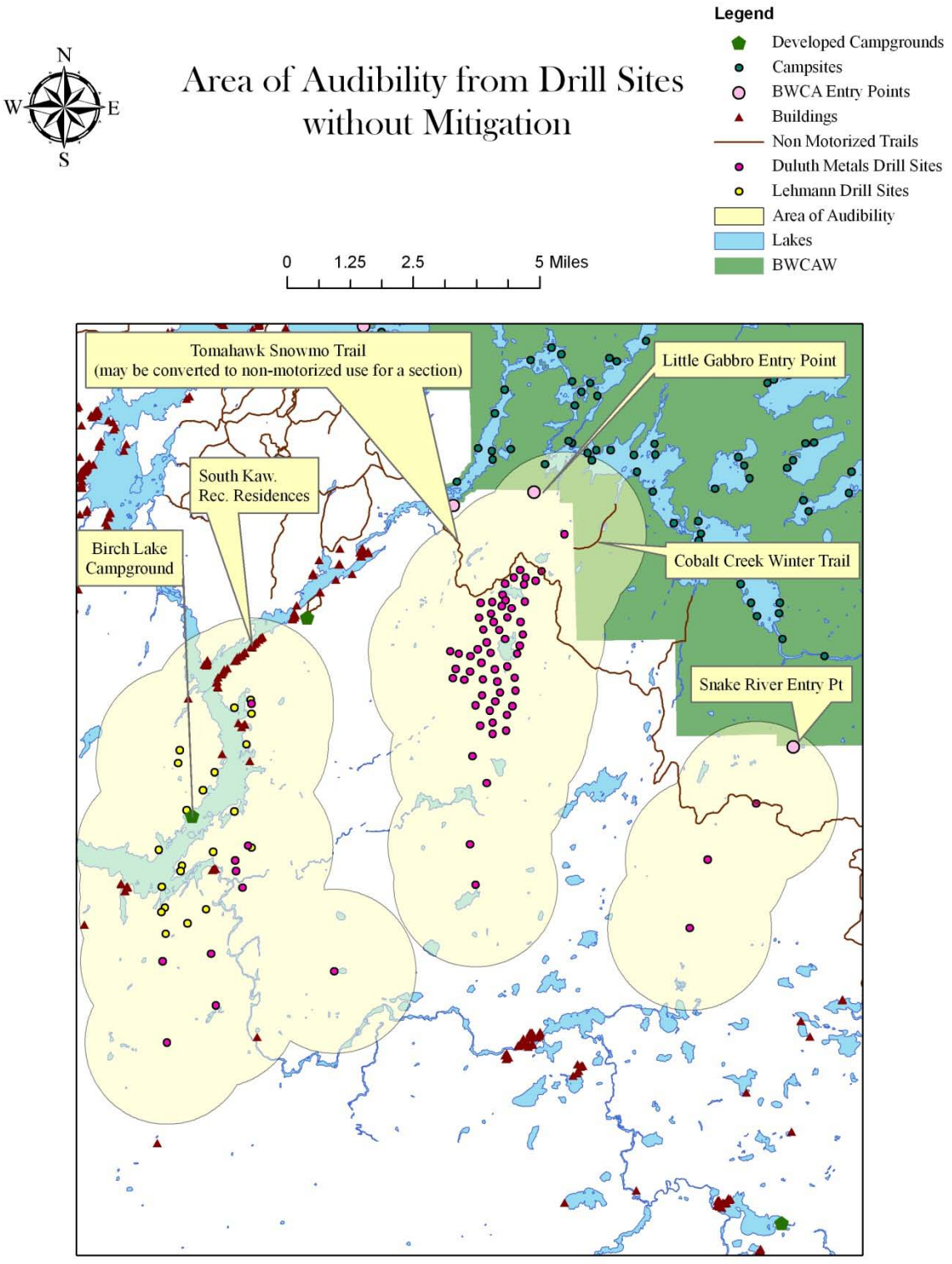


Figure 12. Area of audibility for operating plans under Alternative 2

Indicator 4: Area where Sound Above Natural Ambient May be Heard

The area where sound above average natural ambient daytime levels may be heard is displayed on Figure 13 at the 34 dBA contour line. The area where sound above calm nighttime ambient levels may be heard is displayed on Figure 13 at the 25 dBA contour line. Only a portion of drill sites would be active at any one time (about 10 drill rigs) therefore about 8,430 acres would contain drilling sound above ambient levels at a given time. If two or more drill sites located next to each other are drilled at the same time, it would add 3-4 dBA to the sound level (Braslau 2007 and MPCA 1999). If additional definition drill sites are identified during implementation, this would add area where sound above ambient may be heard, assuming the areas do not overlap. Table 20 displays the acreage affected by sound louder than ambient levels from current operating plans, and additional area if more definition drill sites are implemented.

Table 20. Areas affected by sound above ambient for operating plans under Alternative 2

Operating Plans-Area with Sound Above Ambient	
Decibel Range	Area (acres)
50-84	1140
34-50	9193
25-34	15907
Sound Above Ambient Per Additional Drill Site	
Decibel Range	Area (acres)
50-84	13
34-50	204
25-34	830

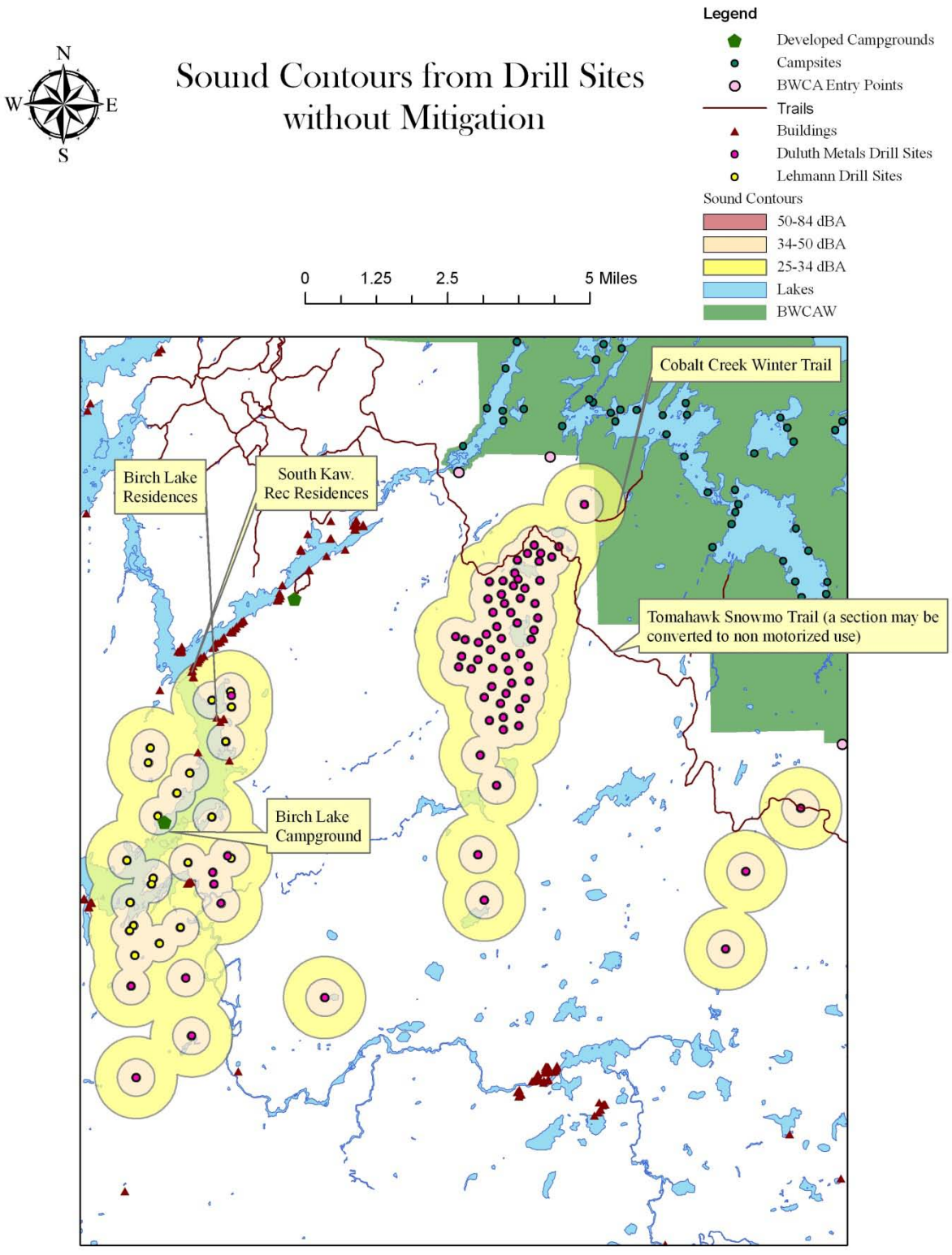


Figure 13. Sound contours for operating plans under Alternative 2

Indicator 5: A-Weighted Decibel Level at Key Receptors

As displayed in Figure 13, the receptor with the greatest exposure to sound from drilling would be the Birch Lake Campground since it is very close to a drill site. Decibel levels from 34 to 50, or higher, may be experienced by recreationalists depending on how far away they are located from the drill site. This may also be the case for several recreation residences located on Birch Lake. Table 21 displays distances from a drill rig for several sound volume benchmarks.

Table 21. Noise levels without mitigation under Alternative 2

Distance from Drill Rig (feet)	dBA Level	Sound Benchmark
20	84	Sound level of a drill rig at 20 feet
418 feet (about 140 yards)	50	Maximum Volume to meet MPCA rules for nighttime sound levels at residential buildings
1734 (about 1/3 of a mile)	34	Average Daytime Natural Ambient Sound Level on Forest
3811 (about 0.7 miles)	25	Nighttime Natural Ambient Sound Level on Forest under calm conditions

Additional receptors that would be exposed to sound levels higher than nighttime natural ambient include several South Kawishiwi Cabin Group residences (between 25 and 34 dBA) and the Cobalt Creek Winter Trail in the BWCAW (between 25 and 34 dBA).

Indicator 6: Level of Annoyance

Drilling would cause a greater degree of annoyance than other motorized sounds due to the continual duration (24 hours a day, 7 days a week for an average of 3 weeks). This annoyance may be moderated depending on the volume of the sound at the receptor and the expectations of the receptor.

In the vicinity of the operating plans, the receptor that is most likely to experience substantial annoyance is recreationalists at the Birch Lake Campground and possibly some recreation residences on Birch Lake. This is due to the proximity to drilling as discussed above. If drilling occurs in the summer at sites that are very close to the campground or residences, there would likely be substantial disruption to the recreation experience for the time needed to complete drilling. Sound levels would be above daytime natural ambient in most or all of the Birch Lake Campground, and for recreationalists within 418 feet of the drill site, the sound may highly annoying. This annoyance may be avoided by conducting drilling in the winter since these facilities would be closed.

Sound reaching several of the South Kawishiwi Recreation Residences would be above nighttime ambient level (25-34 dBA). This is below MPCA standards for sound reaching nighttime residences (50 dBA). Building walls would further reduce sound levels to render it unnoticeable inside (US EPA 1973). However, the recreation experience may be affected for people keeping windows open at night in the summer, or recreating outside in the late evening. For some people, this faint sound would not be annoying, while others may find it annoying.

Overall, given the location of the operating plan drill sites, drilling sound would to result minor or no annoyance to key receptors and be small in scope. The exception is camping areas and recreation residences located immediately adjacent to drilling sites around Birch Lake which may be moderate in scope. Recreationalists may experience substantial annoyance if located within 418 feet of the drilling sites, or moderate to minor annoyance at further distances. If additional definition drill sites are

implemented, effects would range from substantial to nonexistent as the distance between the drill site and receptor increases (see Table 21).

Indicator 7: Level of effects to Opportunities for Solitude

Sound reaching the Cobalt Creek Winter Trail would be below daytime ambient levels (25 to 34 dBA), and it is unlikely that dogsledders or other recreationalists would spend the night on the portion of the trail affected (see Figure 13). Thus, there would be minor to no effects to opportunity for solitude of recreationalists on this trail from sound below daytime ambient levels. However, some recreationalists may still find that audible motorized sound impacts the wilderness experience. In addition, receptors at campsites on Little Gabbro and Gabbro Lakes may find that audible motorized noise results in minor impacts to their sense of solitude during quiet moments such as dawn or dusk. This would occur for about three weeks during one year.

If additional definition drill sites are implemented, effects would range from substantial to nonexistent as the distance between the drill site and receptor increases. See Table 21 for estimated dBA levels at several distances. Substantial effects are unlikely since BWCAW visitors are unlikely to linger for long periods in locations within 418 feet of the wilderness boundary.

3.1.6.4 Alternative 3-Noise Reduction for Entire Project Area

This alternative requires that all drilling rigs use mitigation measures that would reduce the sound level to 70 dBA at 20 feet.

Indicator 2: Duration and Timing of Sound

The duration and timing of sound would be the same as in Alternative 2.

Indicator 3: Area of Audibility

Due to mitigation measures, Alternative 3 has a smaller area of audibility than Alternative 2. The area of audibility would be about 52,370 acres (see Figure 14 for the area of audibility). If additional definition drill sites are identified during implementation, this would add about 3685 acres per drill site, assuming the areas of audibility do not overlap. About 10 drill sites would be active at any one time; therefore about 36,850 acres would contain audible drilling sound at a given time. As discussed in the Affected Environment section, motorized sound from drilling and other sources has been and is present in the vicinity of the operating plan areas. Therefore, the area of audibility created by drilling identified in the operating plans would not represent a new expansion in the area of audible motorized sound.

Drilling sound would be audible to receptors at the Little Gabbro entry point to the wilderness, and the Cobalt Creek winter trail. Sound would also be audible at the Birch Lake campground, recreation residences on the shore of Birch Lake, and users of much of Birch Lake (Figure 14).

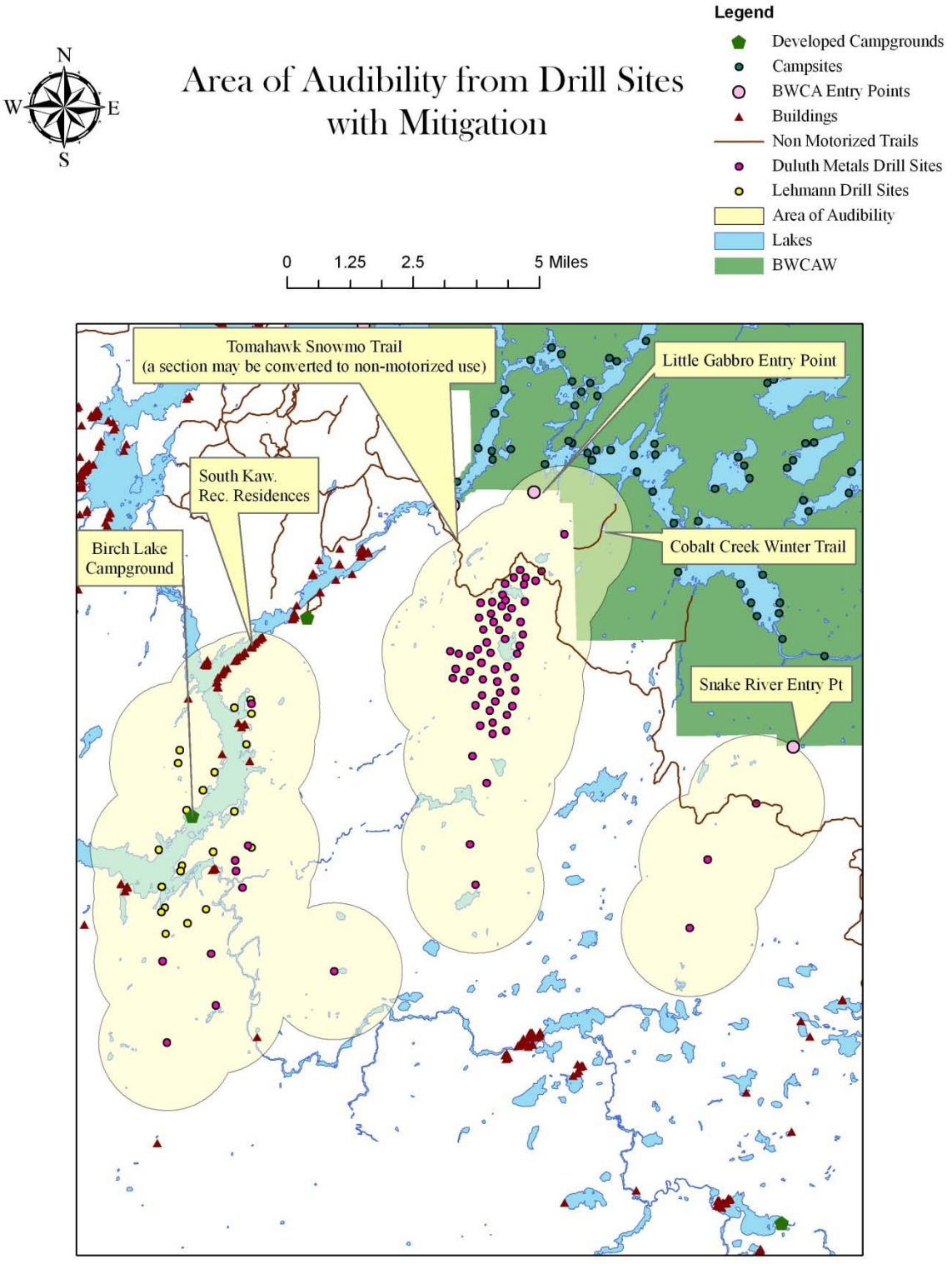


Figure 14. Area of audibility for operating plans under Alternatives 3 and 5

Indicator 4: Area where Sound Above Natural Ambient May be Heard

The area where sound above average natural ambient daytime levels may be heard is displayed on Figure 15 at the 34 dBA contour line. The area where sound above calm nighttime ambient levels may be heard is displayed on Figure 15 at the 25 dBA contour line. About10 drill sites would be active at any one time; therefore about 660 acres would contain drilling sound above ambient levels at a given time. If two or more drill sites located next to each other are drilled at the same time, it would add 3-4 dBA to the sound level (Braslau 2007 and MPCA 1999).

If additional definition drill sites are identified during implementation, this would add area where sound above ambient may be heard, assuming the areas do not overlap. Table 22 displays the acreage affected by sound louder than ambient levels from current operating plans, and additional area if more definition drill pads are implemented. The area affected by operating plans, and the incremental area per additional drill site are smaller in Alternative 3 than Alternative 2 due to sound mitigation (see Chapter 2, section 2.2.3).

Table 22. Area affected by sound above ambient for operating plans in Alternatives 3 and 5

Operating Plans-Area with Sound Above Ambient	
Decibel Range	**Area (acres)**
50-84	90
34-50	1403
25-34	4062
Sound Above Ambient Per Additional Drill Site	
Decibel Range	**Area (acres)**
50-84	1
34-50	16
25-34	66

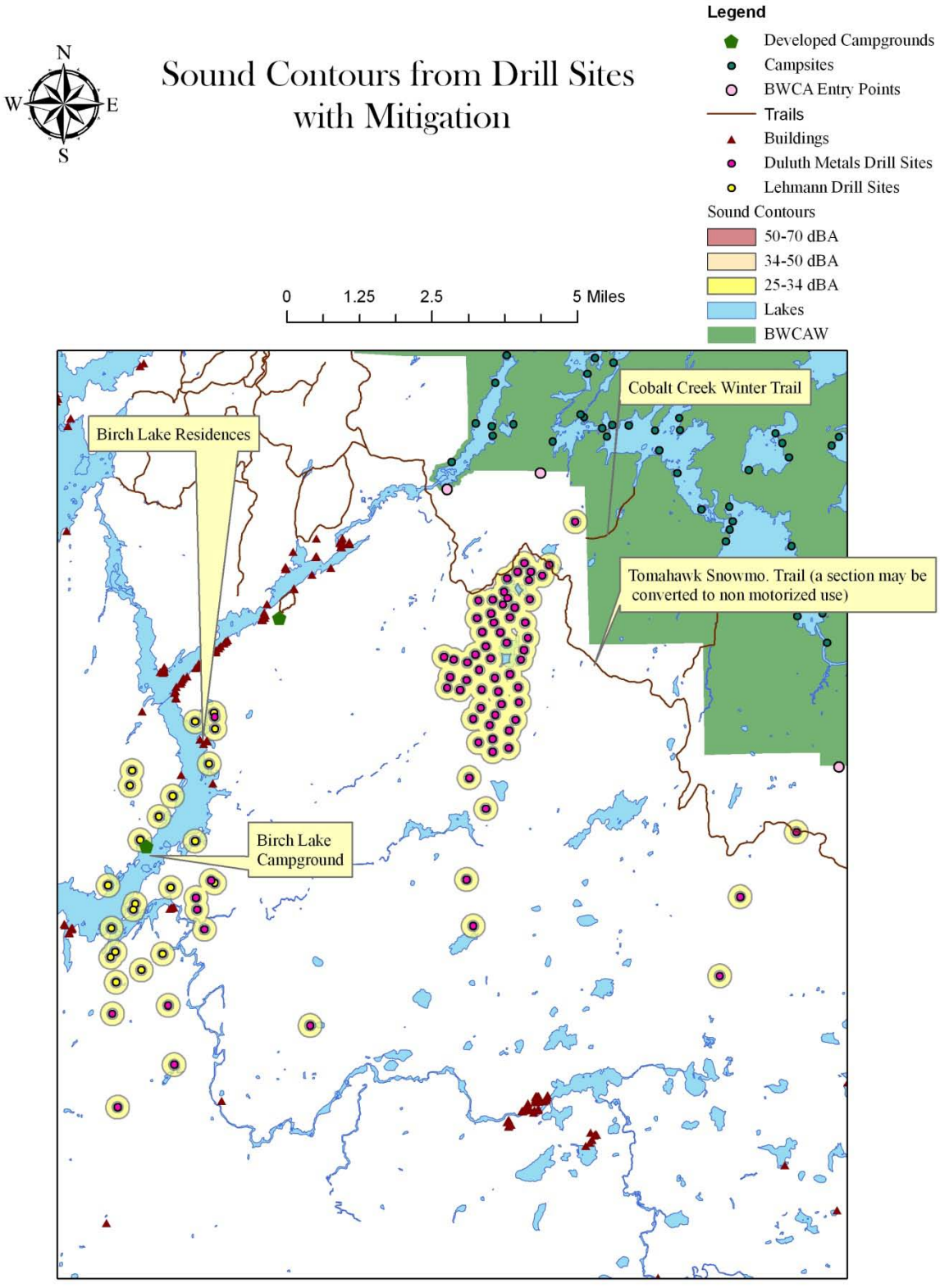


Figure 15. Sound contours for operating plans under Alternatives 3 and 5

Indicator 5: A-Weighted Decibel Level at Key Receptors

As displayed in Figure 15, the receptor with the greatest exposure to sound from drilling would be the Birch Lake Campground since it is very close to a drill site. Decibel levels from 34 to 50, or higher, may be experienced by recreationalists depending on how far away they are located from the drill site. Table 23 displays distances from a drill rig for several sound volume benchmarks. The affected area and decibel levels would be less than experienced in Alternative 2. Recreation residences on Birch Lake would also experience less sound than Alternative 2 and may not experience any sound above nighttime ambient level. In Alternative 3, the Cobalt Creek Winter Trail in the BWCAW would not experience sound above nighttime ambient level.

Table 23. Sound levels with mitigation in Alternatives 3 and 5

Distance from Drill Rig (feet)	dBA Level	Sound Benchmark
20	70	Sound level of a drill rig at 20 feet
117 (about 40 yards)	50	Maximum volume to meet MPCA rules for nighttime sound levels at residential buildings
480 (about 160 yards)	34	Average daytime natural ambient sound level on Forest
1074 (about 0.2 miles)	25	Nighttime natural ambient sound level on Forest under calm conditions

Indicator 6: Level of Annoyance

In the vicinity of the operating plans, the receptor that is most likely to experience substantial annoyance is recreationalists at the Birch Lake Campground. This is due to the proximity to drilling as discussed above. If drilling occurs in the summer at this site, there would be moderate to substantial disruption to the recreation experience for the several weeks needed to complete drilling. Sound levels would sometimes be above daytime ambient in some of the campground, and for recreationalists within about 117 feet of the drill site, the sound may highly annoying. This annoyance may be avoided by conducting drilling in the winter.

This alternative does not include sound above nighttime ambient levels reaching recreation residences, and annoyance would be less than in Alternative 2 and possibly not present. Overall, given the location of the operating plan drill sites, drilling sound would to result minor or no annoyance to key receptors with the exception of camping areas and recreation residences located immediately adjacent to drilling sites around Birch Lake. Recreationalists may experience substantial annoyance if located within about 117 feet of the drilling sites, or moderate to minor annoyance at further distances. These effects could be eliminated by drilling in the winter at these locations.

If additional definition drilling sites are implemented, the level of annoyance would depend on the distance between the drill site and receptor as discussed above.

Indicator 7: Level of effect to Opportunity for Solitude

This alternative does not include sound above nighttime ambient levels reaching the Cobalt Creek Trail. For some wilderness visitors, sound near the wilderness border may be audible. Visitors would be unlikely to linger in these areas and there would be minor to negligible effects to opportunities for solitude.

3.1.6.5 Alternative 4-Noise Reduction for Recreational Experience

This alternative does not require that mitigation measures be implemented for all drill sites. Instead, mitigation must be implemented to meet thresholds for average dBA levels at key receptor locations listed in Table 24. For those drill sites that would not exceed these thresholds, no sound mitigation would be required. Other drill sites that exceed the thresholds would require mitigation such as baffling devices, changing the orientation of the drill rig to place the quieter side of the rig towards the receptor, and moving the drill site.

Table 24.Threshold dBA levels required under Alternative 4

Receptor	Threshold (average dBA)	Variance (Upper Limit)
Semi Primitive Motorized MA	60	+ 5 (65)
Semi Primitive Non Motorized MA, Developed Campgrounds, Campsites and Recreational Residences[a]	50	+ 5 (55)
Wilderness MAs	30	+ 5 (35)

a - The 50 dBA threshold at residential buildings meets MPCA noise control rules for nighttime sound level limits.

Indicator 2: Duration and Timing of Sound

The duration and timing of sound would be the same as in Alternative 2.

Indicator 3: Area of Audibility

The area of audibility would depend on whether mitigation was implemented on a particular drill site. Estimated areas of audibility for drilling without mitigation are discussed under Alternative 2 and with mitigation under Alternative 3. To meet limits listed in Table 24, additional mitigation beyond that required in Alternative 3 may in some cases be implemented. This would further reduce the area of audibility.

Indicator 4: Area where Sound Above Natural Ambient May be Heard

The area of sound above ambient level would depend on whether mitigation was implemented on a particular drill site. Estimated areas of sound above natural ambient level for drilling without mitigation are discussed under Alternative 2 and with mitigation under Alternative 3. To meet limits listed in Table 24, additional mitigation beyond that required in Alternative 3 may in some cases be implemented. This would further reduce the area where sound above ambient may be heard.

Indicator 5: A-Weighted Decibel Level at Key Receptors

Under this alternative, sound levels would be required to meet thresholds at key receptors as shown in Table 24. The threshold is an average top allowable dBA, and at any given time the dBA could not be more than 5 dBA above the threshold.

Indicator 6: Level of Annoyance

Under this alternative, the level of annoyance experienced by receptors would be limited due to the requirement to meet the thresholds identified in Table 24. For the operating plans, this would limit the dBA level in Birch Lake Campground to 50 dBA or less. During the daytime, the 50 dBA may not be very noticeable due to higher ambient dBA levels in the developed campground area created by motor vehicle and motorboat traffic. 50 dBA would become more noticeable and annoying at night.

If additional definition drill sites are added, these would result in effects to receptors up to the threshold levels identified in Table 24. These impacts would result in less annoyance than Alternative 2 at these receptors. In some cases, impacts would result in greater annoyance than Alternative 3 when the threshold is higher than what required mitigation would produce. For example, mitigation on a drill site under Alternative 3 may result in a dBA of less than 50 dBA at a developed campground, while under Alternative 4 the dBA could be up to 50 dBA at that campground. Impacts could be smaller if additional mitigations beyond what is required under Alternative 3 must be implemented under Alternative 4 to meet the threshold.

Indicator 7: Level of effects to Opportunity for Solitude

There would not be much difference between Alternative 4 and Alternative 3 for the BWCAW since Alternative 3 already avoids projecting sound louder than ambient levels into the wilderness. Alternative 4 would result in less sound in the wilderness than Alternative 2 (30 instead of 34 dBA), but less than a 5 dBA change would not be clearly noticeable (MPCA 1999).

3.1.6.6 Alternative 5-Noise Reduction Based on Season

This alternative includes mitigation required in Alternative 3 to reduce sound at drilling sites to 70 dBA 20 feet from the drill rig, and a seasonal restriction to allow drilling only from November 1 through April 30.

Indicator 2: Duration and Timing of Sound

Drilling would occur on a continual basis (24 hours a day, 7 days a week) until complete. Each drill hole would take an average of 3 weeks to complete. This alternative includes restrictions on the time of year drilling would occur, and would only be allowed between November 1 and April 30. This would completely avoid generating sound from project activities when the majority of recreational activity occurs since far more use occurs in the summer than in the winter. In particular, effects to recreation residences and developed campgrounds would be avoided since these are either closed or generally unused in the winter. Drilling activities are temporary in nature and do not represent a noise source that lasts indefinitely (such as a high standard road carrying vehicles).

Indicator 3: Area of Audibility

This alternative includes the mitigation identified in Alternative 3. Therefore, the area of audibility is the same as discussed in Alternative 3 and is displayed in Figure 14 and would be about 52,370 acres. Additional drill sites would add about 3685 acres per site.

Indicator 4: Area where Sound Above Natural Ambient May be Heard

This alternative includes the mitigation identified in Alternative 3. Therefore, the area of sound above natural ambient is the same as discussed in Alternative 3 and is displayed in Figure 15 and Table 22.

Indicator 5: A-Weighted Decibel Level at Key Receptors

This alternative includes the mitigation identified in Alternative 3. Therefore, dBA levels at key receptors are the same as what is disclosed for Alternative 3. However, there is a difference in that recreationalists would not be present at several key receptor locations, including recreational residences and developed campgrounds. Impacts would therefore be avoided at Birch Lake Campground and recreational residences on Birch Lake and the South Kawishiwi River. In addition, overall recreational use of the Forest is far lower in the winter than the summer, and impacts to users in the summer would be avoided under this Alternative.

Indicator 6: Level of Annoyance

As discussed above, effects from noise would be avoided in the summer months, and completely avoided at sites that do not have use in the winter (e.g. recreation residences on Birch Lake and the South Kawishiwi River, and Birch Lake Campground). In addition, sound levels would be reduced as in Alternative 3 due to the requirement that all drill sites include sound mitigation measures. The combination of seasonal restriction and sound mitigation would result in Alternative 5 having the lowest level of annoyance to receptors of all the action alternatives.

Indicator 7: Level of effects to Opportunity for Solitude

The effects to opportunity for solitude would be the same as Alternative 3 except that impacts from audible sound in the wilderness would be avoided for summer visitors. This would avoid the vast majority of wilderness users since most use occurs in the summer (see Affected Environment section). The combination of seasonal restriction and sound mitigation would result in Alternative 5 having the lowest negative effect to opportunity for wilderness solitude of all the action alternatives.

3.1.7 Cumulative Effects for Current Operating Plans

3.1.7.1 Alternative 1

Since there would be no direct or indirect effects from Alternative 1, there would be no cumulative effects.

3.1.7.2 Alternatives 2-4

As discussed in the Affected Environment section, there are a variety of human-made and natural sounds that comprise the soundscape in the analysis area. These sounds result in the cumulative soundscape when added to sound from project activities. It is likely that sounds from drilling on reserved and private minerals on federal land, and drilling on state and private land, may occasionally overlap with sounds from drilling on federal minerals on federal land. When drilling sites are very close together, 3 to 4 dBA may be added to the total volume of sound. Since changes in sound volume of 5 dBA or more are clearly noticeable (MPCA 1999), drilling from other projects would not result in a substantial change in cumulative sound volume.

However, drilling from this and other projects may increase the total duration of drilling sound that may be heard over a period of time. For example, drilling for three weeks on federal land, followed by an additional three weeks of drilling on adjacent state land, could result in a longer cumulative duration that drilling sound may be heard. Known future drilling may occur on leases and prospecting permits shown in Map 6. This shows that cumulative additions in duration may occur for some receptors on or adjacent to Birch Lake.

Other reasonably foreseeable activities in the analysis area include timber harvest as a part of the Glacier, Birch, Dunka, and Tomahawk Projects, and some harvest on state land. This may also add about 3 to 4 dBA to total volume of sound if timber harvest and drilling occur in adjacent areas, which would be a minor difference (MCPA 1999). Cumulative additions in duration of sound are unlikely since sound from timber harvest activities is temporary instead of constant in nature like that of drilling.

The Trail Corridor Project would reroute a portion of the Tomahawk snowmobile trail, and this would become a non-motorized trail for cross country skiing and snowshoeing. If this designation is made, impacts to the trail would be greater because drilling noise in the area would be more noticeable to non-motorized recreationalists. There may be several winter seasons where this effect would occur, although it would not be long term since operating plans are anticipated to be completed over six years (which may

not be consecutive). As displayed on Figure 13 and Figure 15, receptors may receive 50 dBA or more down to ambient levels depending on their location on the trail and the location of the drill site. Alternatives 2 and 4 would have a higher impact than Alternatives 3 and 5. This would annoy some recreationalists while they were skiing or snowshoeing near the drilling rigs, and be moderately annoying if close enough for sound received to be above 50 dBA until they left the drilling area.

Sound generated by motor vehicles, ATVs, snowmobiles, motorboats, and aircraft would occur in the future as the result of activity by federal, state and private entities as they have in the past and present. Project activities utilizing these machines would represent a level of activity within the scope of what is anticipated to occur from other entities and projects. Access roads to drill sites and travel routes for barges and helicopters used in project activities would experience an increase in sound levels in these locations. Minimal cumulative effects are anticipated in these areas since temporary roads used for access would be closed to public use, and other aircraft or watercraft would not travel close to the travel routes of helicopters and barges used in project activities.

3.1.7.3 Alternative 5

Alternative 5 would have the same cumulative effects as Alternatives 2-4, except cumulative effects in the summer would be avoided due to the seasonal restriction. There may be some concentration of effects in the winter compared to Alternatives 2 through 4, although this would not be substantial since the majority of drilling is anticipated to occur during frozen ground conditions in all action alternatives.

3.1.8 Conclusion

Alternative 1 would have no impact since no sound from drilling or associated project activities would occur.

Recreation receptors in the analysis area outside the wilderness with the greatest potential for negative effects include the Birch Lake Campground, Birch Lake users and recreation residences on the shore of Birch Lake under Alternative 2. These impacts would be reduced in Alternative 3. Alternative 4 would result in less negative effects than Alternative 2, but may have greater or less negative effects than Alternative 3 and 5 depending on drill location. Alternative 5 would have the lowest impact of the action alternatives for these receptors since most would not be present during the winter months.

Inside the wilderness, there would be minor impacts to users of the Cobalt Creek Winter trail under Alternative 2 from sound above natural ambient levels. These would be avoided under Alternatives 3, 4 and 5. Audible sound projected into the wilderness under Alternative 2 may produce minor impacts for some wilderness visitors, particularly at the Gabbro Lakes campsites. These impacts would affect a smaller area and avoid wilderness campsites under Alternatives 3 and 5. Alternative 4 would have similar impacts to Alternative 3. Alternative 5 would have the lowest negative impact of the action alternatives on the wilderness.

Finally, as explained in Appendix B, the analysis completed with the SPreAD-GIS model generally estimates a smaller volume and area of noise impacts than what is displayed in this section of the DEIS. Thus, this analysis should be considered a conservative overestimate of negative impacts.

3.1.9 Direct and Indirect Effects of Future Prospecting Permit Applications

Potential receptors are displayed in Map 7 (Forest Recreation Map) and include the receptors described in the Affected Environment section. The effect of sound upon receptors in the range of recreation settings on a per drill site basis is evaluated. When operating plans are submitted, the BLM and Forest Service may, if needed, require additional mitigation for drilling affecting specific receptors.

Ninety percent of applications are likely to be located in the high and moderate minerals interest areas displayed on Map 4. As discussed in the Scenario in Chapter 2, it is estimated that there would be an average of 74 holes drilled per year for 19 years, and each hole would take an average of 3 weeks to complete.

3.1.9.1 Alternative 1-No Action

Under this alternative, there would be no activities generating sound from the project. Therefore, there would be no direct or indirect effects under this alternative.

3.1.9.2 Effects Common to Action Alternatives

Support Vehicles, Watercraft and Helicopters

See Section 3.1.3.2 for effects from support vehicles, watercraft and helicopters. As noted in Section 2.2.2.4, there would be up to 40 water crossings proposed over 20 years, and an average of one helicopter operation per year.

Indicator 1: Type of Sound

As displayed on Map 6, minerals exploration activities have occurred on multiple occasions in the vicinity of much of project area. However, portions of the project area with low potential for minerals exploration (see Map 3) have experienced less or no historic exploration. These areas may experience a new type of sound if future prospecting permit applications are approved in these areas. Motorized noise associated with drilling is similar to motorized noise associated with other engines such as logging equipment that is also a part of the soundscape. Thus, the type of motorized sound from drilling and associated activities would be unlikely to be experienced as an entirely novel addition to the soundscape. The new aspect of the motorized sound would be the continual duration of drilling as compared to sporadic sound generated by other motorized sources.

3.1.9.3 Differences among Action Alternatives

Indicators 2-5

Since the methods for drilling are anticipated to be similar in the future, the analysis that identifies effects per drill site may be used for future prospecting permit applications. Differences between action alternatives per drill site are discussed in Section 3.1.3.3 and summarized in Table 18.

Indicators 6 and 7: Level of Annoyance and Effect to Opportunity for Solitude

See section 3.1.3 for effects to level of annoyance outside the wilderness and opportunity for solitude in the wilderness. The analysis for current prospecting permit applications may be applied to future prospecting permit applications since the range of recreation settings, types of recreation receptors, and potential impacts per drill site are similar.

3.1.10 Cumulative Effects for Future Prospecting Permit Applications

3.1.10.1 Alternative 1

Since there would be no direct or indirect effects from Alternative 1, there would be no cumulative effects.

3.1.10.2 Action Alternatives

Cumulative actions across the entire project area are displayed in Appendix C. These include timber harvest, minerals exploration, travel management, and others. Relevant types of cumulative actions are analyzed in Section 3.1.4. This analysis also applies for future prospecting permit applications since the type of cumulative actions that are relevant for cumulative effects for future prospecting permits is the same and effects are considered on a per drill site basis.

3.1.11 Conclusion

The degree of impacts under each alternative would depend on the distance from drill site to receptor, and required mitigation measures. Of the action alternatives, Alternative 2 would have the highest negative impact to recreation receptors since drilling operations would not include noise mitigation measures. Alternative 3 would have lower impacts than Alternative 2 since mitigation would reduce emitted decibel levels and area affected. Alternative 5 would further reduce impacts from Alternative 3 by avoiding operations during the summer season during which the large majority of recreation activity occurs. Alternative 4 would reduce impacts to the greatest degree of the alternatives in some locations by requiring maximum limits for decibel levels at key recreation locations. In other areas without required maximum limits, Alternative 4 may have impacts similar to Alternative 2. Alternative 1 would have no impact since no sound from drilling or associated project activities would occur.

3.2 Boundary Waters Canoe Area Wilderness

3.2.1 Introduction

During project scoping, the public expressed concern that the effect of noise from the proposed drilling and exploration activities may impact a visitor's year-round experience related to their opportunities for solitude in the Boundary Waters Canoe Area Wilderness (BWCAW). Since at least the end of World War II, there has been explicit expression of public interest in preserving the opportunity for experiencing "natural quiet" or the sounds of nature, unencumbered by the sounds of human activities (Miller 2008). Since people visit natural areas and can make noise, however, providing both opportunities to visit the natural areas and to experience an abundance of natural sounds both inside and out leads directly to conflicting interests.

3.2.1.1 Methodology

The Forest Service has the responsibility to protect the wilderness character of the Boundary Waters Canoe Area Wilderness (BWCAW). Much of the Project Area is adjacent to the BWCAW. No project activities are proposed inside the wilderness. This analysis considers how any of the actions proposed outside the wilderness would affect the wilderness.

The analysis for the wilderness resource utilizes the analysis for resource sections in Chapter 3 and then considers how these effects impact Wilderness Character.

Wilderness Character

Wilderness character may be described as the combination of biophysical, experiential, and symbolic ideals that distinguishes wilderness from other lands. These ideals combine to form a complex and sometimes subtle set of relationships among the land, its management, and the meanings people associate with wilderness. Wilderness character monitoring is needed to improve stewardship and accountability; and improve communication among managers, decision-makers, policymakers, and the public (USDA FS 2005).

The USDA Forest Service has developed guidelines and methods for wilderness monitoring. The purpose of monitoring is to provide managers with a tool they can use to answer key questions about wilderness character and stewardship, such as: what is the current state of wilderness character, how is it changing over time, and how do stewardship actions affect and best preserve wilderness character? The guidelines and methods are documented in the General Technical Report "Monitoring Selected Conditions Related to Wilderness Character": a National Framework (USDA Forest Service 2005). The framework defines the four qualities of wilderness as:

- **Untrammeled** - The Wilderness Act states that wilderness "[is] an area where the earth and its community of life are untrammeled by man," and "generally appears to have been affected primarily by the forces of nature." This quality monitors human activities that directly control or manipulate the components or processes of ecological systems inside wilderness. In summary, wilderness is essentially unhindered and free from modern human control or manipulation.

- **Undeveloped** - The Wilderness Act states that wilderness is "an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation," "where man himself is a visitor who does not remain" and "with the imprint of man's work substantially unnoticeable." This quality monitors the presence of structures, construction, habitations, and other evidence of modern human presence or occupation. In summary, wilderness is essentially without permanent improvements or modern human occupation.

- **Natural** - The Wilderness Act states that wilderness is "protected and managed so as to preserve its natural conditions." This quality monitors both intended and unintended effects of modern people on ecological systems inside a wilderness since the area was designated. In summary, wilderness ecological ecosystems are substantially free from the effects of modern civilization.

The "untrammeled" and "undeveloped" qualities of wilderness listed above will not be addressed in this analysis because none of the proposed activities occur within the wilderness or would impact the "untrammeled" and "undeveloped" qualities of wilderness. The "natural" quality, or effects to the ecological integrity of the wilderness, will be addressed in other resource sections in the EIS.

- **Solitude or a Primitive and Unconfined Type of Recreation** - The Wilderness Act states that wilderness has "outstanding opportunities for solitude or a primitive and unconfined type of recreation." This quality monitors conditions that affect the opportunity for people to experience solitude or primitive, unconfined recreation in a wilderness setting; it does not monitor visitor experiences per se. In summary, wilderness provides outstanding opportunities for people to experience solitude or primitive and unconfined recreation, including the values of inspiration and physical and mental challenge.

The Solitude or Primitive and Unconfined Type of Recreation quality directly relates to how minerals exploration noise impacts could affect opportunities for solitude provided by and expected in a wilderness setting. Minerals exploration activity may affect visitors' sense of solitude. However, solitude in the context of wilderness does not mean complete isolation, nor is solitude at the other end of a continuum

from crowded (Dawson 2004). Rather, it has been construed to mean separation from others and the influences of others, which in this analysis the "others" means noise production from drilling activities. The conditions necessary for solitude often refer to some degree of separation in sight, sound, and distance …from within the wilderness and from outside the wilderness (Dawson 2004).

Research on wilderness visitors supports the importance of solitude as a condition or characteristic of wilderness and as an experience achieved, to some degree, by visitors (Dawson 2004). In a 2007 study asking BWCAW visitors the importance of solitude and remoteness, 56 percent of them said it was very important. Different people have different definitions and expectations for opportunities for solitude and those can vary based on many different factors or constraints. The perceptions reported by visitors in surveys and interviews are not easy to interpret for monitoring wilderness conditions as these are considered visitor experiences and not necessarily wilderness conditions; visitor experiences are influenced by a wide variety of intervening psychological, social, experience use history, and environmental factors (Dawson 2004).

3.2.1.2 Indicators

Effects to the natural quality of wilderness character are evaluated in the wildlife, vegetation, NNIS, soils, water resources and air sections of the EIS and are summarized below. In addition, this Wilderness section evaluates the effects of potential illegal motorized intrusion into the wilderness since this may affect the natural aspect of wilderness character.

Effects to the outstanding opportunities for solitude or a primitive and unconfined type of recreation quality are evaluated in the noise and scenery sections of the EIS and are summarized below. In addition, this Wilderness section evaluates the effects of potential illegal motorized intrusion into the wilderness since this may affect sights and sounds in the wilderness.

An indicator for outstanding opportunities for solitude inside wilderness is remoteness from occupied and modified areas outside the wilderness. Remoteness, meaning distance from the sights and sounds of civilization, is important for achieving a sense of solitude (Dawson 2004). In addition, research shows that most wilderness visitors stay on developed trails and that a large proportion of use is concentrated within a few miles of trailheads or access points, especially where day use makes up much of the visitation (USDA FS 2009), and the proposed drilling sites are near areas such as this. Since remoteness is often measured by number of wilderness acres away from access and travel routes and the BWCAW has a very dense and brushy forest-type where most people stick to the established travel routes especially in a canoe, finding more opportunities for solitude (escaping noise from the outside) by merely "going off trail" as research suggests isn't likely for most visitors.

A measure for this indicator is the extent and magnitude of intrusions on the natural soundscape. For this analysis, the effects of sound production to the natural soundscape are evaluated by type of sound, duration and timing of sound, area of audibility, sounds above natural ambient levels, and decibel levels at key receptor sites and the meaning of these effects on opportunity for solitude in the BWCAW. Noise is analyzed in section 3.1.

For effects from potential illegal motorized intrusion, miles of temporary road construction within ½ mile of the BWCAW Boundary is used because the project proposes construction of temporary roads that may serve as a jumping off point for illegal motorized intrusion into the wilderness. The greater the mileage of temporary roads near the wilderness, the greater the degree to which there may be the potential for illegal motorized intrusion. This is evaluated using a Geographic Information Systems (GIS) analysis to identify permit application areas and temporary roads in proposed operating plans within ½ mile of the BWCAW boundary.

3.2.2 Affected Environment

See the Affected Environment sections of the other resource sections in Chapter 3 for more resource-specific information (e.g. the Noise section 3.1 has information on the soundscape inside the BWCAW).

The BWCAW is a natural area located in the northern third of the Superior National Forest in northeastern Minnesota with a contiguous border along Canada's Quetico Provincial Park, also managed as a wilderness area.

Glaciers left behind lakes and streams interspersed with islands that are surrounded by rugged cliffs and crags, gentle hills, canyon walls, rocky shores, and sandy beaches. The total acreage within the BWCAW is 1,098,057. Approximately 1175 lakes varying in size from 10 acres to 10,000 acres and several hundred miles of streams comprise about 190,000 acres (20 percent) of the BWCAW surface area and provide for the opportunity for long distance travel by watercraft. The BWCAW has approximately 80 entry points with access to 1200 miles of canoe routes, 12 hiking trails, and over 2,000 designated campsites. It offers freedom to those who wish to pursue the expansive opportunities for solitude and personal challenges. In the winter months visitors also enjoy opportunities for skiing, dog-sledding, snowshoeing, camping and ice- fishing. This type of experience is rare within the continental United States and the BWCAW is the only lake land wilderness of its kind and size in the National Wilderness Preservation System allowing visitors to canoe, hike, portage and camp.

The BWCAW is one of the most heavily used wilderness areas in the Forest Service with an average of 34,000 reserved permits annually, and over 250,000 visitors a year. Due to that use, a sense of being in a primitive and unconfined wilderness area is constrained by mandatory permits, regulations, restrictions, designated campsites and naturally confining travel routes due to the thick vegetation funneling users into main travel corridors, which many were most likely used for thousands of years.

In a recent study (Schneider 2010) on constraints to visiting the BWCAW, visitors described constraints of time and access causing shortened experiences, base-camping, and reduced opportunities for solitude. Because the periphery of the BWCAW is quite busy in the summer months, often a visitor must move into the interior to find better opportunities for solitude and since time is often a constraint, visitors linger near the periphery which not only allows them to encounter more people, but it increases their chances of hearing human caused sounds from outside the wilderness diminishing their sense of remoteness.

3.2.2.1 Wilderness near Operating Plan and Prospecting Permit Areas

The Little Gabbro Lake (semi-primitive non-motorized management area), South Kawishiwi River (semi-primitive non-motorized management area), and Snake River entry points (straddles the semi-primitive non-motorized and primitive management areas) are the closest BWCAW access points to the current operating plan proposed drill locations. The Bog Lake (near the Weasel primitive management area) entry point is also located near prospecting permit application areas although no specific drill locations are identified for these areas yet. The closest campsites inside the BWCAW are located at the South Kawishiwi River, Little Gabbro Lake, Gabbro Lake, Bald Eagle Lake (semi-primitive non-motorized management area) and Bog Lake. Also, the Cobalt Creek dogsled trail (semi-primitive non-motorized management area) enters the BWCAW northeast of proposed drill sites. Table 25 shows visitor use for these areas.

Table 25. Overnight and self-issue visitor use of the BWCAW entry points nearest the proposed drill sites

Entry Point	Overnight Use Permits 2009		Self-Issue Day Use Permits 2009	
Little Gabbro Lake (also Cobalt Creek area)	204 permits	1080 visitors	165 permits	454 visitors
South Kawishiwi River	201	993	125	463
Snake River	83	364	14	42
Bog Lake	22	63	21	34
Weasel Primitive MA	4			

3.2.2.2 Management Areas

The SNF Forest Plan (page 3-66) states that the desired future conditions of both the physical and social aspects of the wilderness resource differ slightly between management areas that helped describe the receptors above. This establishes a framework, along with the wilderness character framework, for managers allowing them to provide a range of wilderness opportunities for the public while maintaining the overall goals of preservation. The wilderness has been divided into four different management areas:

- **Pristine wilderness**. Areas of pristine wilderness provide outstanding opportunities for isolation and solitude, relatively free from the evidence of contemporary human activities.
- **Primitive wilderness**. This area provides an excellent opportunity for isolation and solitude, relatively free from the sights and sounds of humans. The frequency of encountering others is low.
- **Semi-primitive non-motorized wilderness**. Opportunities for experiencing isolation and solitude are moderate to low. The frequency of encountering others in the area is moderate.
- **Semi-primitive motorized wilderness**. Opportunities for experiencing solitude and isolation are low. Motorized watercrafts are permitted and will be noticeable along major travel routes and portages and near major entry points. The frequency of encountering others is moderate to high.

The majority of the project is adjacent to semi-primitive non-motorized MA. Semi-primitive non-motorized management areas are generally located along the main travel routes, where a visitor expects to encounter others more frequently, and solitude is not one of their highest priorities. A visitor may experience more human caused noises from outside the wilderness in an area like this compared to a pristine or primitive management area.

3.2.2.3 Analysis Areas

See the other resource sections of Chapter 3 for the portion of the analysis area particular to each resource that includes the BWCAW. In general, project activities near the wilderness may have the potential to affect areas inside the wilderness near the boundary.

3.2.3 Direct and Indirect Effects

3.2.3.1 Alternative 1

No new prospecting activities would be approved, so no direct or indirect effects are expected to wilderness character qualities.

3.2.3.2 Alternatives 2-5

Untrammeled and undeveloped wilderness character qualities

These qualities of wilderness listed above will not be addressed in this analysis because none of the proposed activities occur within the wilderness or would impact the "untrammeled" and "undeveloped" qualities of wilderness.

Natural wilderness character quality

Effects to the ecological integrity of the wilderness are addressed in the relevant resource sections in this EIS and are summarized below.

Soils

Potential direct effects to the soil resource are logically confined to the soil directly beneath where the activity takes place; therefore no direct impacts are anticipated to soils in the BWCAW. Because no direct or in direct effects are expected to soils in the Mining Protection Area, BWCAW or Voyageurs National Park, no cumulative effects are expected to the same areas (See Soils Section 3.5.4).

Water

The proposed activity associated with the proposed exploratory drilling is not anticipated to have an effect on the water and aquatic resources at the HUC6 watershed level. In addition, there is not expected to be a local impact due to temporary road construction.

The anticipated effects to water and aquatic resources is minimal based upon the water resources analysis (See Water Resources Section) which considers the stipulations, Forest Plan standards and guidelines, existing State and federal regulations, design elements, anticipated operating conditions, and resource characteristics.

There would be few, if any anticipated negative effects to ground water, surface water or aquatic habitat in the analysis area, including relevant portions of the BWCAW, from proposed new temporary road stream crossings because they would be designed, constructed, and used following appropriate protection measures.

Wildlife

The Boundary Waters Canoe Area Wilderness Area would continue to provide abundant, well distributed wildlife habitat, especially in the northern portion of the Superior National Forest (See Section 3.8.3).

NNIS

Some mineral exploration activities could occur near the edge of the BWCAW. There is a risk that project activities could cause non-native invasive plants to spread to ground that is directly disturbed by project activities (see Section 3.9.3). There is a much lower risk that these infestations would lead to new infestations in the BWCAW. For project activities to indirectly increase invasive plant infestations in the BWCAW, first the new non-native invasive plant infestation (for example, at a drill pad) would have to disperse (most likely via wind or wildlife) to the BWCAW, where no project activities or ground disturbance are proposed. Then invasive plants would have to establish in competition with undisturbed native vegetation, which is unlikely. A recent study of non-native plants on BWCAW portages found that non-natives were restricted to portages or within one meter of a portage (Dickens et al. 2005); they did not establish well when competing with native trees, shrubs, and forbs. Similarly, in recent monitoring of unclassified roads, no spread was observed from weed infestations along unclassified roads into adjacent

undisturbed forest vegetation (USDA Forest Service 2008). For these reasons, the risk of non-native invasive plants spreading to the BWCAW as an indirect result of project activities is very low.

Cumulative: Spatially, nearly all of the cumulative non-native invasive plant impacts (both negative and positive) in the analysis area would occur outside of the BWCAW. All of the timber harvest, road, minerals, and Travel Management projects (described in Section 3.9.4) would occur outside the BWCAW, and the small levels of cumulative impacts of these activities on non-native invasive plant spread would be seen outside the BWCAW. In contrast, one of the beneficial cumulative impacts (invasive plant management) would also occur inside the BWCAW (non-native invasives are hand-pulled in the BWCAW not sprayed). Non-native invasive plants would need to establish in proximity to the BWCAW, disperse to the BWCAW, and then establish in the BWCAW where no ground disturbance would be occurring in order for there to be cumulative non-native invasive plant impacts on the BWCAW. The likelihood of this chain of events happening is low (See Section 3.9.3 for analysis).

Vegetation

No vegetation would be disturbed in the BWCAW therefore there would be no direct, indirect or cumulative effects to the BWCAW (See Vegetation Section 3.7.3 for analysis).

Air

The Boundary Waters Canoe Area Wilderness has special protection under the Clean Air Act as a Class I area and is considered a sensitive receptor.

The activities included in the project description are not expected to generate enough particulate matter to threaten the NAAQS or threaten sensitive receptors. Dust that is generated by this project would be almost entirely from truck traffic, since the drilling would involve the use of water to transport the cuttings. Dust from truck traffic would tend to be larger in size. This would mean that whatever small amount of dust is generated would settle out quickly and not travel far from the drilling site. Therefore sensitive receptors would not be affected by dust unless the drilling sites were immediately adjacent to them. The small amount of additional, intermittent diesel engine usage is not expected to affect air quality over and above the existing level of diesel emissions from truck traffic on the Forest. The existing level of truck traffic on the Forest is reflected in the background measured air quality, which is very good (See Section 3.13.3.1).

Solitude Wilderness Character Quality

Sights

Section 3.12.3 under Scenery in the EIS evaluates impacts to sights inside the wilderness. It is unlikely drilling would occur directly adjacent to the wilderness boundary, and vegetation would screen most drilling activities from view within the wilderness. There would be minimal, or no impacts to opportunity for solitude in the wilderness from effects to sights.

Noise

It is not possible for the wilderness soundscape to be entirely free of motorized sound due to ongoing activity outside the wilderness, as well as legal administrative use of motors inside wilderness. Some wilderness area managers document actual sounds heard from within the wilderness area and consider these ambient or background. These sounds include natural and recently approved, traditional, accepted or long standing human caused sounds that can be heard in the wilderness.

Natural sounds include wind, leaves rustling, trees creaking, wave action on lakeshores, insects, bird song and other animal calls. Less noticeable human-generated sounds include sounds from skiing, walking, dog sledding, talking, and campsite activities. More noticeable human-generated sounds are generally from

motorized sources (some conducted outside and some inside wilderness) and include sounds from motor vehicles, ATVs, motorboats, snowmobiles, logging equipment, airplanes, prescribed fire activities (planes, boats, generators, etc.), and minerals exploration activities. All in all, the wilderness setting should provide for a more natural soundscape than what exists outside the wilderness and this is a common expectation among users.

The following effects apply to receptors at campsites. If receptors are traveling, effects would be less since the duration would occur for less time and mostly occur during the day when ambient noise levels are higher.

Current Prospecting permit applications

Alternatives 2 and 3

- If receptors are located close to drill sites and receive 50 dBA or more on a 24 hours a day, 7 days a week basis (e.g. within a 13 acre area of drill sites for Alternative 2, or a 1 acre area of drill sites for Alternatives 3 and 5), there would be a substantial impact to opportunity for solitude. It is unlikely that this impact would occur for more than a fraction of a wilderness trip while visitors access the wilderness since campsites are mostly located deeper in the wilderness, even if the drill site is located very close to the wilderness border. Due to the short duration, the impact would not be substantial.
- Receptors hearing 34 to 50 dBA would be likely to hear sound above ambient levels. While this sound level is considered small in scope, it would occur continuously and thus may have a moderate impact to opportunities for solitude.
- Receptors receiving between 25 and 34 dBA may not perceive any sound from drilling during the day. Some people may perceive the sound on calm nights and experience a minor impact to opportunities for solitude during these time periods. These impacts might occur if a drill site is located adjacent to the wilderness border, and receptors are located close by (such as a portage near the border).
- Below 25 dBA, some people would not perceive the sound. For other people in the wilderness, perceiving a faint motorized sound would generally have a minor impact on their opportunities for solitude.
- Receptors located outside of the area of audibility would not be affected.

Alternative 4

Alternative 4 would limit effects to the wilderness by reducing sound level to 30 dBA or less. This would be below average daytime ambient sound level of 34 dBA in the wilderness, would be small in scope (e.g. a quiet woods), and would not be noticeable to most wilderness users. In general, sound a few decibels below ambient level is not audible to most people (Braslau 2007). The sound may be more noticeable for some people at night when natural sound levels may occasionally get closer to 25 dBA during very calm periods. However, given that sound levels would be 30 dBA at the wilderness boundary, most campsites are located deeper inside the wilderness and would receive less than 25 dBA due to sound decay with distance. Impacts to opportunities for solitude would be minor or negligible under this alternative.

Alternative 5

Alternative 5 would reduce impacts compared to the other action alternatives by avoiding activity during the summer months. This would avoid impacts to opportunities for solitude for a substantial majority of BWCAW visitors.

Current operating plans

Alternative 2

Sound reaching the Cobalt Creek Winter Trail would be below daytime ambient levels (25 to 34 dBA), and it is unlikely that dogsledders or other recreationalists would spend the night on the portion of the trail affected (see Figure 9). Thus, there would be minor to no effects to solitude of recreationalists on this trail from sound below daytime ambient levels. However, some recreationalists may still find that audible motorized sound impacts their opportunities for solitude. In addition, receptors at campsites on Little Gabbro and Gabbro Lakes may find that audible motorized noise results in minor impacts to their sense of solitude during quiet moments such as dawn or dusk.

If additional definition drill sites are implemented, effects would range from substantial to nonexistent as the distance between the drill site and receptor increases (see Table 18 for estimated dBA levels at several distances). Substantial impacts are unlikely since BWCAW visitors are unlikely to linger for long periods in locations within 418 feet of the wilderness boundary. Travel generally occurs to and from destinations near the boundary.

Alternative 3

This alternative does not include sound above nighttime ambient levels reaching the Cobalt Creek Trail. For some wilderness visitors, sound near the wilderness border may be audible. Visitors would be unlikely to linger in these areas and there would be minor to negligible effects to opportunity for solitude.

Alternative 4

There would not be much difference between Alternative 4 and Alternative 3 for the BWCAW since Alternative 3 already avoids projecting sound louder than ambient levels into the wilderness. Alternative 4 would result in less sound in the wilderness than Alternative 2 (30 instead of 34 dBA), but less than a 5 dBA change would not be clearly noticeable (MPCA 1999).

Alternative 5

The effects to solitude would be the same as Alternative 3 except that impacts from audible sound in the wilderness would be avoided for summer visitors. This would avoid the vast majority of wilderness users since most use occurs in the summer. The combination of seasonal restriction and sound mitigation would result in Alternative 5 having the lowest negative effect to wilderness solitude of all the action alternatives.

Table 26. Wilderness campsites affected by audible noise from operating plans

Alternatives	Lake	# of Campsites
1	N/A	0
2	Little Gabbro/Gabbro	3
3	Little Gabbro	1
4	Little Gabbro	1
5	Little Gabbro	1

Future Prospecting Permits

The analysis for current prospecting permit applications may be applied to future prospecting permit applications since the range of recreation settings, types of recreation receptors, and potential impacts per drill site are similar.

3.2.4 Cumulative Effects

3.2.4.1 Alternative 1

There would be no cumulative impacts because no project activities would create direct or indirect effects.

3.2.4.2 Alternatives 2-4

The untrammeled and undeveloped qualities of wilderness character will not sustain cumulative effects by the proposed activities because none of the proposed activities occur within the wilderness. The natural qualities, or effects to the ecological integrity of the wilderness, were addressed in other resource sections in the EIS and cumulative effects are also summarized above.

Past, on-going and future projects and activities will continue to impact a visitor's opportunity for solitude in the wilderness. Activities that may contribute impacts to the wilderness character of solitude include:

- Drilling on state and private land, and reserved and outstanding minerals on federal land
- Federal, state and private vegetation management projects near the boundary
- Prescribed burning and wildfire suppression with aircraft, motorboats, generators, etc.
- Fire patrols with aircraft
- Search and rescue missions with aircraft
- Law Enforcement with motorboats and aircraft
- Approved Department of natural Resources activities with motorboats and aircraft
- Department of Homeland Security border security activities with motorboats and aircraft
- Forest-wide Travel Management Project (this would reduce negative effects to opportunity for solitude by reducing roads and OHV travel routes near the wilderness)
- Recreation activities on state, county, and private land
- Vehicle traffic on roads and entry points near the wilderness
- Recreational motorized use inside wilderness (watercraft, OHV, snowmobiles)
- Illegal motorized use in the BWCAW

As discussed in the cumulative effects Noise Sections of this EIS, the most noticeable cumulative impacts would occur from cumulative additions in the duration of drilling sound. This may occur if drilling for federal minerals on federal lands is followed by drilling on adjacent lands.

For sights, cumulative effects would be unlikely since vegetation would screen sights of drilling equipment from the wilderness, drilling is unlikely to occur directly adjacent to the wilderness boundary, and additional disturbance to sights in the immediate vicinity of the drilling operations would not occur since timber harvest or recreational use would not be allowed in the immediate vicinity of drilling equipment and personnel.

3.2.4.3 Alternative 5

Alternative 5 would have the same cumulative effects as Alternatives 2-4, except cumulative effects in the summer would be avoided due to the seasonal restriction. There may be some concentration of effects in the winter compared to Alternatives 2-4, although this would not be substantial since the majority of drilling is anticipated to occur during frozen ground conditions in all action alternatives.

3.2.5 Impacts from Potential for Illegal Motorized Intrusion

3.2.5.1 Direct and Indirect Effects

Indicator 1-Miles of Temporary Road within ½ mile of the wilderness boundary

Alternative 1
There would be no direct or indirect effects since no project activities would occur.

Alternatives 2-5
The current prospecting permit applications and operating plans do include areas that are within ½ mile of the wilderness boundary. Current operating plans include about 0.25 miles of temporary roads within ½ mile of the wilderness. Of the current prospecting permit applications, 9 permit application areas are within ½ mile of the wilderness.

All temporary roads constructed in the action alternatives would be decommissioned once they are no longer needed for vegetation management. Road decommissioning activities result in the stabilization and restoration of unneeded roads to a more natural state (36 CFR 212.1), (FSM 7703). Road decommissioning includes closure (blocking) methods used to eliminate motorized access and to meet environmental considerations for the future such as restoring cross-drainages and wetlands, reshaping and re-contouring, and tree planting, seeding and mulching. The intended outcome of decommissioning roads is to, "make the road disappear to the casual viewer and to render it not drivable from the beginning of a road to the furthest point seen from a Forest system road or other public road" (Forest Plan Appendix F).

Temporary roads within one-half mile of the wilderness boundary would be unlikely to lead to illegal OHV intrusions into the wilderness due to effective decommissioning of temporary roads upon completion of management activities. In addition, temporary roads would not be open for public use while minerals exploration activities were occurring. Furthermore, monitoring efforts to date have found that all road spurs or user created/maintained trails found inside the BWCAW originated from established roads associated with timber sales that pre-dated the 2004 Revised Forest Plan (2007 Monitoring of Motorized Use and Effects). Finally, self-policing and law enforcement of motorized recreation would also reduce the potential for illegal entry (2009 Revised Supplement to the Environmental Assessment for the Forest-wide Travel Management Project).

Future prospecting permit applications and operating plans may include areas within ½ mile of the wilderness boundary. As for the current prospecting permit applications and operating plans, protective stipulations, effective road closures and decommissioning, self-policing, law enforcement and monitoring would reduce and mitigate effects.

3.2.5.2 Cumulative Effects

Alternative 1

There would be no cumulative effects since no project activities would occur.

Alternatives 2-5

It is unlikely that temporary roads built for minerals exploration would be extended in length closer to the wilderness by federal, state, or private entities for other purposes. It is possible this may occur on an infrequent basis for a purpose such as timber harvest, although no such proposal currently exists. Therefore, few or no additional access routes added onto temporary roads built by this project would contribute to cumulative opportunities for illegal motorized entry into the wilderness. If such a dual use occurred, Forest Plan standards and guidelines for closing and decommissioning temporary roads would

apply, reducing the possibility for negative effects. There would be minimal or no cumulative effects to wilderness character from the potential for illegal motorized entry into the wilderness created by current and future prospecting permits and operating plans.

3.2.6 Overall Conclusion for Wilderness Character

Alternative 1 would have no effects since no project activities would occur. Effects to the natural quality of wilderness character would be the same among action alternatives, and would be minor due to protective stipulations identified in Chapter 2 of this EIS along with Forest Plan standards and guidelines. Effects to the solitude quality of wilderness character would vary by action alternative. Alternative 2 would have the highest impacts due to a lack of mitigation and areas near the wilderness boundary could experience moderate to negligible negative impacts. Alternative 3 would reduce effects with sound mitigation and more limited impacts would be experienced near the boundary. Alternative 5 would avoid impacts to most wilderness users by limiting drilling season. Alternative 4 would limit sound reaching the wilderness to 30 dBA, which would result in minor or negligible impacts since sound would attenuate to less than 30 dBA inside the wilderness, which would be inaudible much of the time.

3.2.7 Monitoring Recommendations

Monitoring recommendations for all resources can be found in appendix E.

3.3 Recreation Use Patterns

3.3.1 Introduction

The primary effect of the proposed activities on recreationists is likely to be the effect of the noise generated during drilling. The effects of noise are addressed in the noise issue section.

3.3.1.1 Methodology

Recreation use patterns may be impacted by the proposed activities because if drill sites and use of temporary roads is near developed or dispersed recreation facilities it may impact the recreational experience of visitors causing some people to recreate elsewhere.

Indicators for Measuring Impacts

The indicators used for recreation are the location of drill sites and construction and use of temporary roads.

Spatial and Temporal Context for Effects Analysis

The project boundaries for direct and indirect effects encompass the entire Superior National Forest excluding the BWCAW. This is an appropriate boundary because the effects of the current and future prospecting permits would occur at various developed and dispersed recreation sites across the entire forest and no mineral exploration activities would occur in the BWCAW. The effects of the project on aspects of the BWCAW will be disclosed in the wilderness section.

The timeframe for direct and indirect effects is 20 years because this is the extent of the time considered for prospecting permits. This is an appropriate timeframe because effects are not expected to last longer than prospecting activities and would generally exist only while prospecting activities were occurring. Temporary roads would be closed and decommissioned upon completion of drilling and while some evidence of a temporary road may linger, the road would not be open of use.

3.3.2 Affected Environment

The project area contains numerous recreation opportunities for residents and visitors. State Highway and County roads are located throughout this area and are heavily travelled by local residents and visitors to access developed and dispersed recreation opportunities. Developed recreation sites include campgrounds, boat landings, trails, wilderness entry points, and backcountry campsites. Dispersed recreation activities are those occurring in general forest areas including lakes, roads and trails. Recreation activities include fishing, camping, boating, hunting, scenic driving, hiking, canoeing, berry picking, gathering, all terrain vehicle riding, skiing, dog sledding and snowmobiling.

3.3.3 Direct and Indirect Effects

3.3.3.1 Alternative 1 – No Action

Because no new activities would occur in this alternative, there would be no additional direct or indirect effects on the recreation resource. The effects resulting from currently approved operating plans and prospecting permits would continue.

3.3.3.2 Alternatives 2, 3, 4, and 5

Current operating plans and prospecting permits

The primary effect of the proposed activities on recreationists is likely to be the effect of the noise generated during drilling. The effects of noise are addressed in the noise issue section.

The primary effect of proposed activities on recreationist use patterns addressed in this section involves the location of drill sites and increase in temporary roads that would be constructed to access mineral exploration sites. There would generally be no direct effects on developed recreation sites because mineral exploration would not be permitted within campgrounds, parking areas, or boat launches during the managed use season. Dispersed areas such as trail corridors or general forest areas may be directly impacted depending on the location of drilling sites because there will be no seasonal restrictions. Effects would include short term traffic from drilling operations and seeing the drilling operations. The entire national forest is open to dispersed recreation and it is likely some drill sites would be located in areas where some dispersed recreation use has occurred.

The construction of temporary roads may affect some recreation sites and users due to dual use and seasonal impacts. For example, a plowed temporary road may cross a snowmobile trail which would result in loss of snow and the need for snowmobilers to stop and check for traffic. This situation can be mitigated by posting the plowed road on the trail and avoiding blind corners both in the trail and along the road.

All of the action alternatives would result in a similar number of temporary roads so the effects of the temporary roads on recreational use would be similar. Alternative 5 would result in fewer impacts to the recreation resource because there would be no drilling during the summer season, when most of the recreation use occurs.. Recreationists may notice temporary roads leading off the main roads. There are already temporary roads leading off most of the forest roads therefore, adding new temporary roads would not result in a new type of effect on recreation users. Actual drill rigs may also be located directly adjacent to existing roads and dispersed recreation areas. Effects would generally be short-term because people would be driving past the temporary roads or drill rigs. If a drill rig were next to a dispersed recreation user, the effects would last as long as the recreationist was at or near the drill pad. There would be other areas of the forest where the recreationist could go to get away from the drilling if they did not want to be around the drilling. Recreation use patterns on Birch Lake are not expected to noticeably

change because drilling equipment flotation devices will be similar to current flotation equipment utilized for recreation purposes.

No noticeable changes in recreation use patterns in developed recreation facilities are expected, including South Kawishiwi River Campground and Birch Lake Campground. Noticeable effects are tied to noise and these effects are disclosed in section 3.1 Noise.

Future prospecting permits

The estimated impacts from future prospecting permits to recreation users would be similar to those described above. The total miles of temporary road construction per year is estimated to be 19.2 miles. The total acres disturbed per year would be 186 acres. The total maximum disturbance for over 20 years is less than 4,000 acres. This figure represents less than one percent of the project area and would result in minimal effects.

Summary of Effects

The effects to the recreation resource would be very minor because no drilling would occur in developed recreation sites and temporary roads would not be open for public use and would be closed to motorized access during temporary drill hole abandonment, decommissioned, and reclaimed after permanent drill hole abandonment. Short-term effects may impact trails and trail users if temporary roads cross trails or use portions of trails such as possible dual use or a change in snow and trail tread. Effects to recreationalists may be limited by posting speed limit signs, and limiting where and when temporary roads could cross trails.

Mineral exploration associated with this project is expected to disturb a maximum of 161 acres per year and up to 4,000 acres for the 20 year span of the project. Considering the relatively small area of land disturbed by exploration activities each year and for the life of the project, those figures represent less than one percent of the Project area. As a result of this small proportion of disturbance, direct and indirect effects to recreation would be minimal if even noticeable on a management scale.

3.3.4 Cumulative Effects

The project boundaries for cumulative effects encompass the entire Superior National Forest excluding the BWCAW, WSRs and Mining Protection Areas. Cumulative effects will also consider the effects of other projects occurring within the boundaries of the Forest. This is an appropriate boundary because the effects of the current and future prospecting permits would occur at various locations across the forest but no drilling would occur in the BWCAW or Mining Protection Area.

The timeframe for cumulative effects is 20 years because this is the extent of the time considered for prospecting permits. This is an appropriate timeframe because effects are not expected to last longer than prospecting activities and would generally exist only while prospecting activities were occurring.

Alternative 2, 3, 4, and 5 – Potential cumulative effects include logging, mineral exploration and mining activities, other recreation uses, private developments, and any other activities occurring within the national forest boundaries

There would be an increase in the amount of large truck traffic and equipment utilizing state highways, county roads and forest roads if logging and drilling operations are occurring at the same time. Logging has been and is occurring across the forest. It is estimated that future harvest levels would remain similar to current and past levels. Additional mineral exploration resulting from this project would result in a slight increase in the number and length of temporary roads. Again, because temporary roads needed for vegetation management and mineral exploration are generally not open for public use and are

decommissioned and reclaimed upon completion of activities, effects would be similar to the existing condition and are not expected to last longer than the duration of the exploration activities. These other projects and actions would have even less of a cumulative effect under Alternative 5 since recreation decreases dramatically between the months of November through April.

The infrequent operating times and the short duration of operating time would have little to no impact on the recreation resource within the analysis area.

3.4 Minerals

3.4.1 Introduction

The following information and maps are mainly from a Minnesota Department of Natural Resources publication Mineral Potential and Geology of Minnesota by Mark Jirsa and David Southwick. The source is from the Minnesota Department of Natural Resource (DNR) website: www.geo.umn.edu/mgs/mnpot/MnpotGlg.html. The original publication covers the entire State of Minnesota. Sections not applicable to the Superior National Forest (SNF) and this EIS were excluded.

3.4.2 Affected Environment

3.4.2.1 Mineral Interest Areas

Based on the above referenced DNR publication, other publications, where recently and historically there has been exploration and mining, and where mineral deposits have already been identified, the following mineral exploration interest levels will be used in the analysis. This information is intended to provide guidance for the EIS analysis on where mineral exploration targets may be located and/or concentrated across the Forest. However, since this is very basic and there is much geologic information yet to be discovered, it is not intended to exclude any part of the Forest that may in the future have mineral exploration activities. See Map 4.

The SNF has included notes in italics that describe the assumptions that will be used in this environmental analysis for mineral exploration interest. For this analysis, mineral exploration interest areas relate to the mineral potential of a particular formation(s). A summary is listed below.

Mineral Exploration Interest Areas

High (60-100%):

- Troctolitic series rocks of the Duluth Complex. Much of this zone is located along and near the base of the complex approximately located in the central part of the SNF.
- May include parts of the footwall that may have been mineralized (older contact rocks situated below the Duluth Complex).
- Prospecting permit application areas will be included in this area.

Moderate (0-30%):

- Other portions of the Duluth Complex, including the Beaver Bay Complex, not described in the “High” level above.

Low (0-10%):

- Archean age Superior Province; Wawa Subprovince volcanoplutonic rocks and greenstone belt rocks, and Quetico Subprovince rocks.
- North Shore Volcanic Group.

- Penokean rocks: Iron deposits of the Mesabi Iron Range and Animikie Group.

Very Low (0-1%):

- Kimberlite pipes and sediments originating from these pipes (unmapped).

3.4.2.2 Geology of Northern Minnesota

Bedrock Geology of Minnesota

Minnesota's geologic framework is moderately well known from a combination of outcrop mapping, where exposure permits, and interpretation of high resolution geophysical data and drilling where it does not. The state is underlain by rocks of Precambrian age that are covered in part by veneers of Paleozoic and Mesozoic (Phanerozoic) marine strata and rather extensively by Quaternary glacial deposits. The Late Archean rocks of the Superior Province and the Early Proterozoic rocks of the Penokean orogen are southwestern extensions of counterparts in southern Ontario that are noteworthy for their abundance of metallic mineral deposits. The mafic igneous rocks within the Middle Proterozoic Midcontinent Rift System trend obliquely across the regional east-northeast strike of the older rocks and separate the Minnesota segments of some lithotectonic belts from their equivalents to the east and northeast in Wisconsin, Upper Michigan, and Ontario. Nevertheless, the geological continuity of Late Archean and Early Proterozoic belts from Ontario into Minnesota is well established.

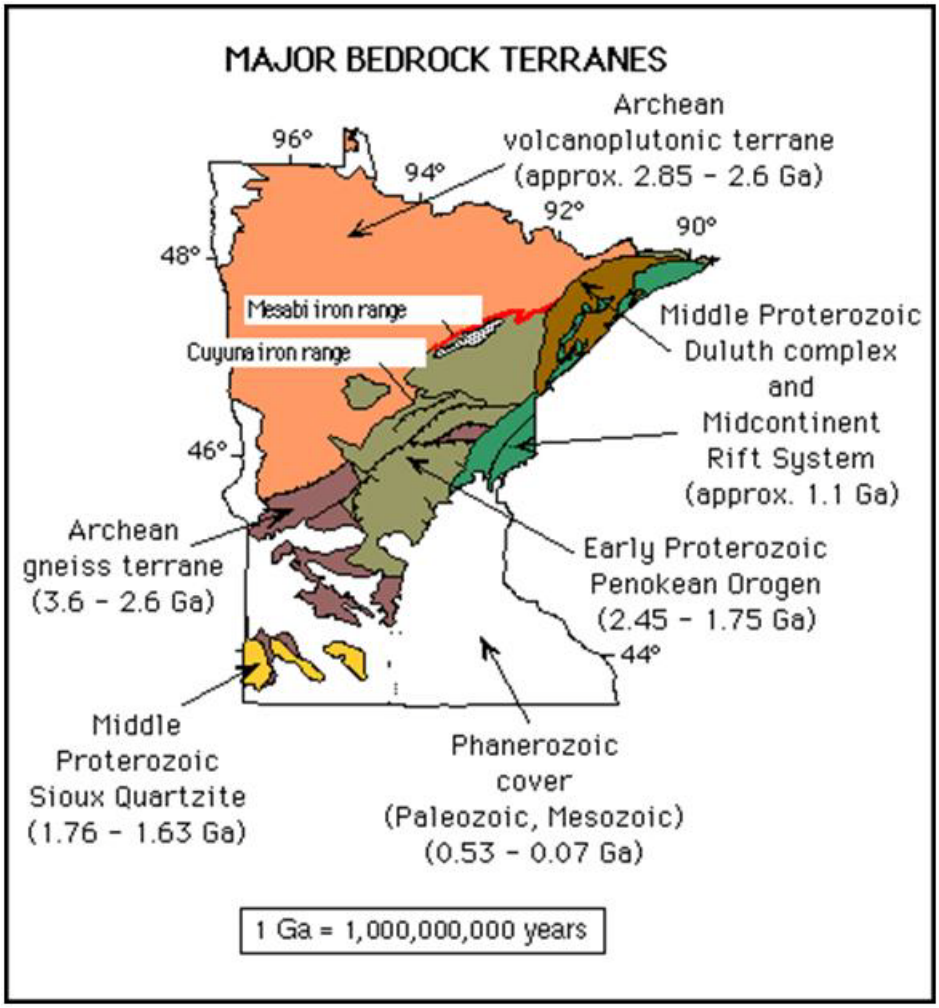


Figure 16. Bedrock geology of Minnesota

Mineral Potential and Geology of the Archean in Minnesota

The Superior Province in Minnesota consists of three subprovinces defined and named in Canada (from north to south, the Wabigoon, the Quetico, and the Wawa); and a fourth, the Minnesota River Valley (MRV) subprovince, which lies south of the Wawa subprovince. Only two of these subprovinces lie within the Superior National Forest; the Wawa and the Quetico, both in the northwest portion of the Forest. The age of these rocks is approximately 2.85 to 2.6 billion years.

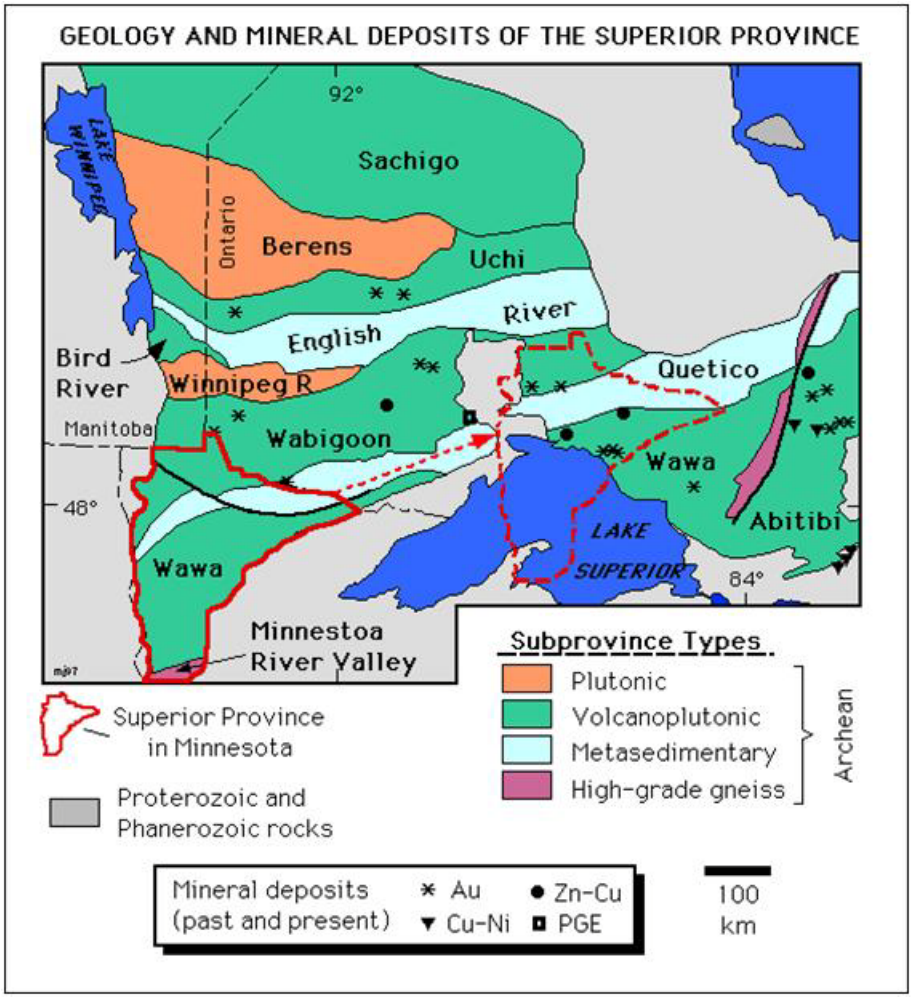


Figure 17. Mineral deposits of the Superior Province

The Wabigoon and Wawa subprovinces are volcanoplutonic belts that consist of deformed, relatively low-grade metavolcanic and metasedimentary rock sequences (often referred to as greenstone rocks due to the abundance of green minerals that formed during metamorphism) intruded by granitoid plutons. The volcanic-rich portions of both subprovinces possess lithologic and structural attributes broadly similar to those in mineralized greenstone belts in Ontario.

This complex is similar to the granite-greenstone complexes in Canada, where mines have produced billions of dollars worth of ore, and to the greenstone belts in Wisconsin, where several major ore bodies have recently been discovered. Several types of ore deposits occur in these complexes, but the high grade copper-lead-zinc-silver deposits that occur in the volcanic sequences are most important here in the United States, and the volcanic greenstone belts of northern Minnesota are being explored for them.

The Quetico subprovince consists chiefly of metasedimentary schist, various migmatitic rocks derived primarily from sedimentary protoliths, and granitoid intrusions.

To date, the only commodity successfully mined from Archean rocks in Minnesota has been iron. Successful exploration in Canada has tended to focus on major faults and shear zones that are both marginal to and within the volcanoplutonic subprovinces (Wabigoon and Wawa). Similar fault structures have been identified through geologic and geophysical mapping in Minnesota, but relatively little systematic mineral exploration has been done along them.

For this analysis, the Superior National Forest assumes the Archean age Superior Province, Wawa Subprovince volcanoplutonic rocks and greenstone belt rocks and the Quetico Subprovince rocks, in the northwest part of the forest, will have low (0-10 percent) mineral exploration interest even though some geologists may believe the mineral potential of these greenstone belts may be higher in some areas.

Mineral Potential and Geology of the Penokean Orogen

The Penokean orogen records an extended history of continental extension and convergence that affected the southern margin of the Superior craton in the time interval between 2.45 and 1.75 billion years ago. Several tectonic episodes took place, with the earliest activity in the Huronian belt of southern Ontario and the youngest in east-central Minnesota. The strongest collisional pulse apparently occurred at about 1.85 billion years ago, when intense deformation, metamorphism, and plutonism occurred along the entire strike length of the orogen. In Minnesota, the principal features of the Penokean belt are (1) an arcuate, northwest-verging fold and thrust terrane that involves supracrustal volcanic and sedimentary rocks as well as Archean basement; (2) a succession of tectonic foredeeps, the youngest, largest, and best-preserved of which is the Animikie basin; and (3) abundant syntectonic to post-tectonic granitoid plutons that range in age from about 1.85 to 1.77 billion years ago. The world-class iron deposits of the Mesabi iron range are localized in sedimentary iron-formation along the north, or cratonic, margin of the Animikie foredeep.

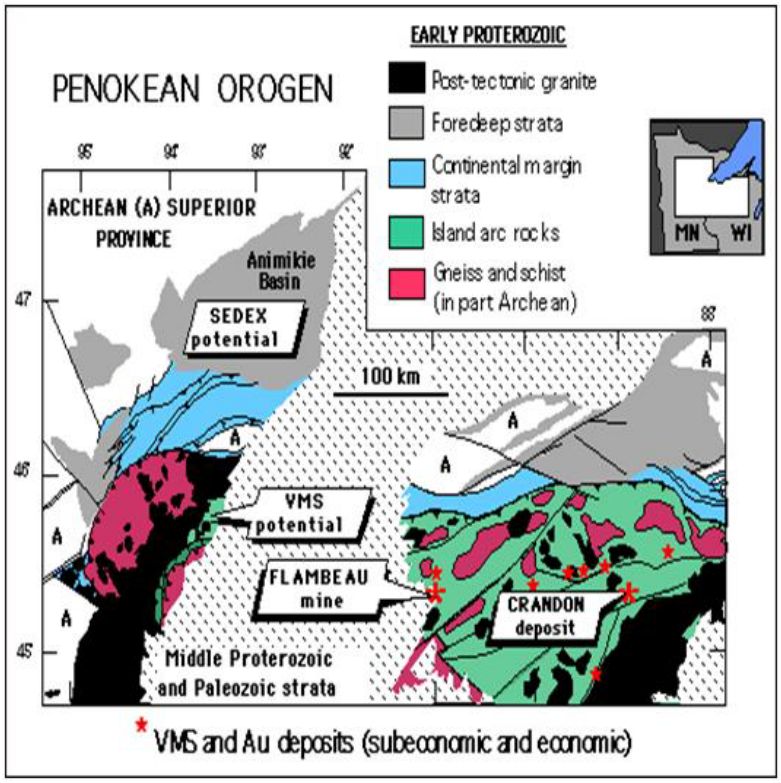


Figure 18. Mineral potential of the Penokean Orogen

The iron deposits of the Mesabi Iron Range borders the SNF and mineralization slightly overlaps the SNF near Virginia and Babbitt, Minnesota. For this EIS analysis, due to the large amount of iron deposits located on private land already, the SNF assumes these areas will have low (0-10 percent) mineral exploration interest. The iron deposits have been mined for over 100 years on private land and to date, no

iron mining has been proposed on the SNF. The Animikie Group will also have low (0-10 percent) mineral exploration interest.

Kimberlites in Minnesota
The ancient cratonic terranes of the MRV subprovince and its reworked equivalent in the Penokean orogen are peppered by small, subcircular aeromagnetic anomalies that are known from scattered drilling to reflect small mafic and ultramafic intrusions. The possibility that kimberlite pipes (possibly diamond-bearing) may lurk among the several hundred potential anomalies remains open to future investigation.

For this analysis, the SNF assumes there is limited potential for diamond deposits on the Forest *and mineral exploration interest for diamonds will be very low (0-1 percent). However, it is difficult to predict where diamond exploration targets may be located and therefore will not be reflected in the EIS mineral exploration interest map.*

Mineral Potential and Geology of the Duluth Complex and North Shore Volcanic Group

The Midcontinent Rift System developed in response to crustal-scale tectonic extension in the Middle Proterozoic, approximately 1.1 billion years ago. The western arm of the rift extends southwestward from Lake Superior - where rift-fill rocks are moderately well exposed - to the subsurface of the Twin Cities metropolitan area, and from there to the subsurface of northeastern Kansas. The fill associated with the active stages of rift development consists mainly of tholeiitic basalt that was erupted under subaerial conditions, together with petrologically related sills, dikes, and large layered intrusions that cooled beneath or within the cogenetic volcanic pile. The largest and most important of the layered intrusions is the Duluth Complex, a composite intrusion of troctolite and gabbro derived from periodic tapping of an evolving magma source. In the waning stages of rifting, the principal rock types deposited in the rift shifted gradually from magmatic to sedimentary; among the sedimentary sequences are those for which alluvial-fan, fluvial braid-plain, aeolian, and lacustrine depositional environments may be inferred.

Duluth Complex
The Duluth Complex hosts four distinct types of magmatic mineral deposits. The deposit types include (1) large, low-grade, disseminated Ni-Cu concentrations, some of which contain local zones enriched in platinum-group elements (PGEs); (2) localized high-grade zones of massive nickel-copper (Ni-Cu) sulfides, some of which are moderately enriched in PGEs; (3) stratabound PGE-enriched "reefs" associated with specific types of phase-layer transitions; and (4) oxide-rich ultramafic plugs that in some instances are potential sources of titanium (Ti) and vanadium (V). Deposit types (1) and (2) occur only at or very near the basal contact of the Complex, whereas types (3) and (4) occur in the basal zone and also at higher levels.

More recent information on the economics of select Duluth Complex mineral deposits has shown that mining proposals may be submitted in the future and in fact one is currently being reviewed for permitting. The Duluth Complex covers portions of the eastern, middle and northeastern areas of the Forest. The Duluth Complex is known to have high mineral potential. At least 19 localities of mineral deposits have been mapped by industry and the Minnesota DNR near the base of the Complex. There is active mineral exploration in the Duluth Complex on the SNF and adjacent lands. Most is near the base of the Complex. PolyMet Mining Inc. is currently in the permitting and environmental analysis stages for a proposed copper, nickel, platinum group metals (PGM) open pit mine at one of these deposits located between the towns of Babbitt and Hoyt Lakes. Other mineral deposits have been discovered recently near Birch Lake and the Kawishiwi River areas. However, to date, mining has not been proposed for these new deposits. Exploration has been very active in the recent past in the Duluth Complex and expected to continue.

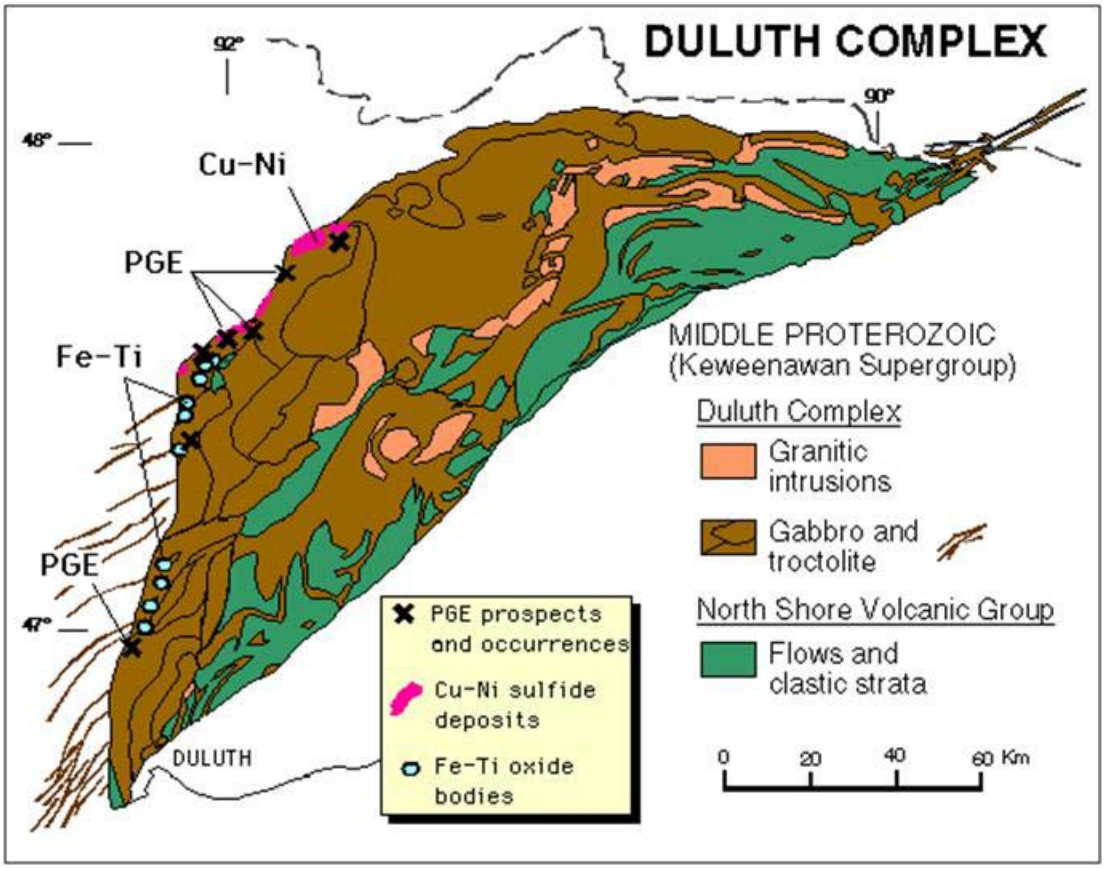


Figure 19. Mineral potential of the Duluth Complex

For this analysis, the SNF assumes the base of the Duluth Complex and rock higher (and often younger) in the formation that are approximately within 15 surface miles from the base will have high mineral exploration interest (65-100 percent). Mineralization may also be located in the footwall rocks adjacent to the deposits. Other parts of the Duluth Complex, including the Beaver Bay Complex, are identified as having moderate mineral exploration interest (0-30 percent).

North Shore Volcanic Group

Significant quantities of native copper, native silver, bornite, and other copper minerals were mined earlier this century from hydrothermal vein and stockwork deposits in basalts and interflow sediments of the Midcontinent Rift System on the Keweenaw Peninsula of Michigan. In addition, large amounts of finely dispersed native copper and other copper minerals were mined from a "kupferschiefer" type of deposit in lacustrine siltstone and shale at White Pine, Michigan. Although trace occurrences of native copper, native silver, and various other copper minerals have been found in basaltic rocks along the North Shore of Lake Superior in Minnesota, no mineable deposit of the Keweenaw or White Pine type has been discovered in Minnesota. However, even though these rocks are not currently being explored, they may see limited exploration in the future.

For this analysis, the SNF assumes the North Shore Volcanic Group in the eastern portion of the Forest *will have low mineral exploration interest (0-10 percent).*

Glacial Cover in Minnesota

Much of the Precambrian rock in Minnesota is covered rather continuously by glacial deposits. Due to this, there is limited exposed bedrock on the SNF. The deposits generally are made up of an assortment of boulders, cobbles, gravel, sand, silt, and clay. The deposits are oriented according to the direction of ice sheet flow direction from the north, northwest, or northeast. Many different ice sheet lobes overrode the area over many thousands of years. Thickness generally ranges from zero to under 100 feet in northeast Minnesota. To date, no mineral exploration has occurred in these deposits. However, they are quarried for other uses such as road construction and cement mixing.

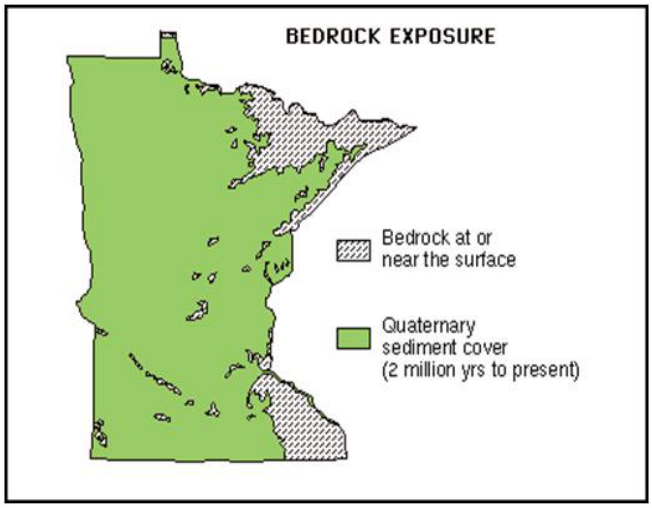


Figure 20. Bedrock exposure in Minnesota

Glacial cover will not be considered a mineral exploration target for this analysis.

3.4.3 Direct and Indirect Effects

3.4.3.1 Alternative 1

There would be no effect to rock and mineral resources.

3.4.3.2 Alternatives 2-5

During the drilling process, the drill core or chips are collected for later mineral, chemical, and other technical identification and analysis. These samples are taken from the earth and not replaced. Therefore, it can be considered an irreversible commitment of the resource. Over the 20 years of exploration, the maximum amount of rock that may be removed from the prospecting permit drilling operating is 38,131 cubic yards of rock. This is assuming a standard bore hole PQ size (134 mm or 5.3 inch) as the average maximum hole diameter and 1,920 holes to a depth of 3,500 feet. Considering the vast amount of bedrock under the Superior NF, this amount is extremely small and would have no effect on the rock and mineral resources. In addition, the State of Minnesota requires that a split or portion of the core be submitted to them for long term storage so that the rock can be reviewed and studied by others in the future. Therefore, the knowledge that can be gained by the removal of this rock is not lost, in fact it is enhanced. Since the effect of rock removal is extremely minor, this topic will not be carried further in this analysis.

3.4.4 Cumulative Effects

Since the direct and indirect effects are minor no cumulative effects are anticipated.

3.5 Soil

3.5.1 Introduction

3.5.1.1 Methodology

The analysis area used to examine the direct, indirect and cumulative effects of each alternative includes the mapped soil units (ecological landtypes: ELTs) on National Forest System land outside the Boundary

Waters Canoe Area Wilderness (BWCAW) and Mining Protection Areas (MPA). Ecological landtypes are mapped terrestrial ecological units whose natural boundaries best define site-specific soil resource information for the Superior National Forest. Potential effects to the soil resource are logically confined to the soil directly beneath where the activity takes place. An example would be a piece of heavy equipment causing soil compaction that reduces pore space for air, water and roots within a section of a treatment area does not impact pore space on adjacent areas. Additionally, this area was chosen because no mineral exploration would take place on federally owned minerals within the BWCAW or MPA. While access roads could potentially be constructed within the MPA to gain access to sites outside the MPA it is very unlikely and therefore is not considered in the analysis.

The time period for direct and indirect effects is fifteen years after exploration activities have taken place. The time period for cumulative effects is fifteen years prior to and after proposed management activities. These time frames were selected because the effects of the resource management activities to the soil would diminish over time and would not be measurable fifteen years from the time the management activity has occurred.

The data used for analyzing the potential impacts is the ELT mapping for the Superior National Forest.

3.5.1.2 Indicators for Measuring Impacts

The indicator for the soil resource is acres proposed for prospecting activities (drill sites and associated access roads). This indicator analyzes the differences between alternatives related to the influence prospecting activities have on erosion, compaction and displacement.

3.5.2 Affected Environment

The ecological classification system used for the Superior National Forest is discussed in the National Hierarchical Framework of Ecological Units in Ecosystem Management by Cleland and others (1997). This system classifies and maps ecological units based on associations of climate, topography, soils, water, and potential natural communities.

Within this hierarchical system, mapping units range from provinces that are thousands of square miles in size, to landtype associations (LTAs) that are broad geographic areas, to ecological landtypes (ELTs) which are more site-specific. The province is the largest unit representing the climate zones of North America. The Superior National Forest falls into the Laurentian Mixed Forest Province with short, warm summers and long, cold winters. Accordingly, within the province there are increasingly smaller ecological units called sections, subsections, landtype associations, and ecological landtypes.

Ecological Landtypes (ELTs) on the SNF were mapped from 1969 to 2003. Mapping was compiled through a combination of field inventories and aerial photo interpretation and is now available as a SNF GIS layer. ELT descriptions are available on page 2-18 of the Forest Plan (2004). For much of the area, mapping was compiled regardless of ownership. The ELTs within the project area are listed in the table below.

Table 27. Ecological landtype (ELT) distribution

ELT	Acres	% of Project Area
1	49,289	4%
2	106,302	10%
3	13,810	1%
4	15,855	1%
5	11,605	1%
6	199,038	18%
7	568	< 1%
8	834	< 1%
9	3,839	< 1%
10	31,923	3%
11	104,417	9%
12	1,600	< 1%
13	119,687	10%
14	215,869	20%
15	24,502	2%
16	139,953	12%
17	48,851	4%
18	15,984	1%
Total	**1,103,928**	**100%**

3.5.3 Direct and Indirect Effects

3.5.3.1 Alternative 1

Because no activities would occur in this alternative, no direct or indirect effects would occur.

3.5.3.2 Alternatives 2, 3, 4

Prospecting permit applications current and future

Potential direct effects to the soil resource are logically confined to the soil directly beneath where the activity takes place; therefore no direct impacts are anticipated to soils in the WSR, MPAs, BWCAW or Voyageurs National Park.

There is minimal difference in the amount of land impacted by mineral exploration activity between action alternatives. The direct impact to the soil within prospecting areas is associated with the drilling operations, including access road, helicopter and barge operations, drill pad and sump construction, and support activity. Support activity could include, but is not limited to: vehicle traffic to shuttle crews and drill core samples, and maintenance vehicle traffic for drill rig repair and fuel delivery. Drilling operation direct impacts to soil include soil compaction and, as a result of compaction, indirect effects include reduced water infiltration and an increased potential for erosion. Additionally, soil compaction resulting from vehicle traffic usually results in reduced vegetation growth and regeneration. Areas scheduled for summer operations would have the greatest potential for compaction. Frost action and floral and faunal activity tend to reduce compaction within three to eleven years after activity (Mace 1971; Thorud and Frissell 1976; Zenner et. al 2007; Puettmann et. al. 2008).

Following the stipulations outlined in Chapter 2 will minimize the impacts to the soil resource. In order to protect the soil resource design features tailored to specific ELTs would be implemented. Exploration

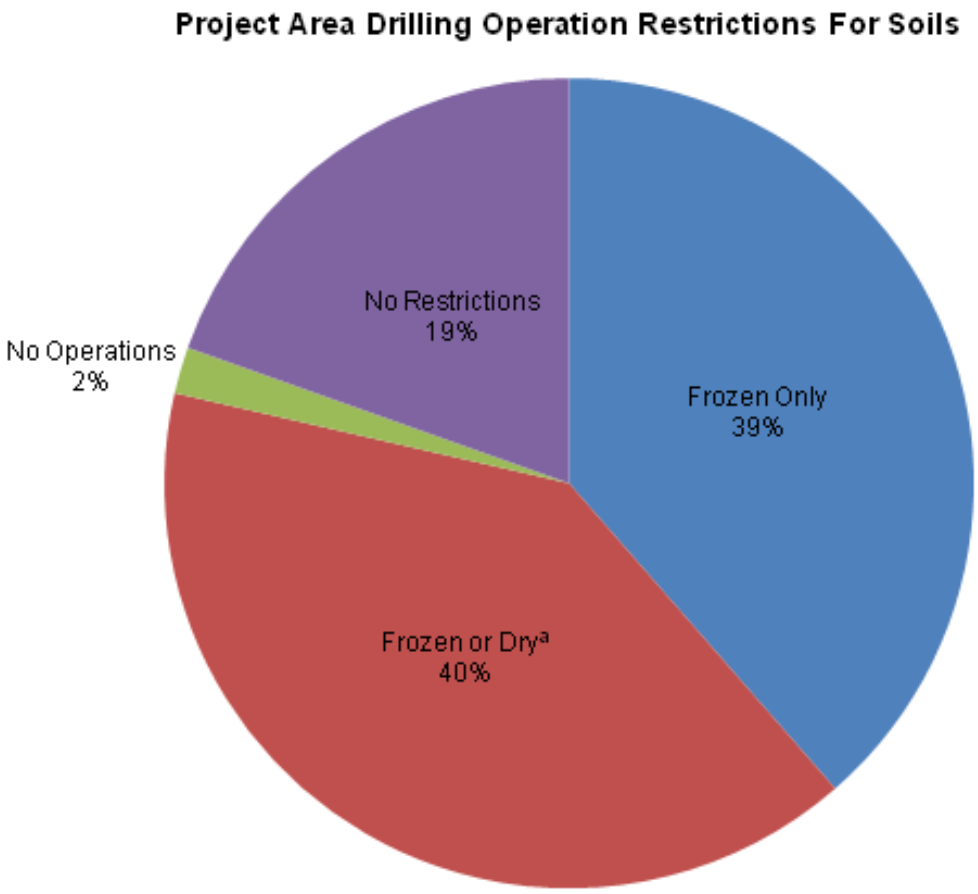
activity on lowland ELTs (ELTs 1, 2, 3, 4, 5 and 6) will be limited to soil that is frozen to a depth that will support equipment that is being used so no rutting or compaction would occur. These ELTs represent 39 percent of the project area. On fine textured ELTs (ELT 10, 14, 15) and shallow soil ELTs (ELT 16 and 17), exploration would be restricted to frozen soil or the normal dry period to prevent rutting and compaction or exploration activities will need to employ techniques and/or equipment designed to eliminate impacts to the soil. These could include, but are not limited to, commercially available products such as Mud Mats, high flotation tires or tracks, or temporary structures that would prevent soil resource damage. Compaction and/or rutting would be prevented by distributing the weight of vehicles and/or equipment across a larger surface area. An example of measures taken to eliminate impacts to the soil is shown in Figure 21. ELTs 10, 14, 15, 16 and 17 represent 40 percent of the project area.

Figure 21. Planking utilized during spring thaw to prevent rutting and compaction

Exploration on ELTs 9, 12 and 18 is prohibited. ELT 9 is comprised of droughty sand and gravel deposits with a thin surface organic layer. Removal of the thin organic layer would reduce site productivity on an already low-nutrient ecological unit. ELT 12 is a boulder field where site conditions would likely inhibit exploration activities. A typical ELT 12 is shown in Figure 22.

ELT 18 is an ecological unit characterized by an extremely shallow soil (0 - 8 inches over bedrock). Site productivity in these areas is more susceptible to the impacts of compaction and loss of the surface organic layer. ELTs 9, 12 and 18 make up about 2 percent of the project area. The area discussed in this section represents Federal lands within in the project area and are depicted in Figure 23.

Figure 22. Example of ELT 12



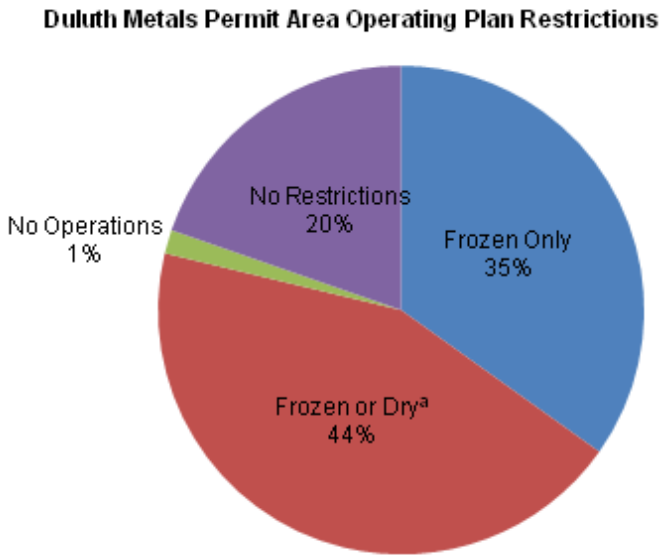
a - Activities would occur during frozen soil or the normal dry period to prevent rutting and compaction or exploration activities would need to employ techniques and equipment designed to eliminate impacts to the soil.

Figure 23. Project area configuration by operating restrictions

Direct impacts of temporary access road construction include compaction and displacement of soil and potential sediment delivery to nearby wetlands and waterways. However, the impacts would be minimized by using existing corridors where possible. Impacts would also be greatly reduced through the use of BMPs along with Forest Plan standards and guidelines (S-TS-3, G-TS-13). Most of these impacts would be short-term (less than fifteen years). Once exploration activities were completed, the road would be closed, reclaimed and revegetated.

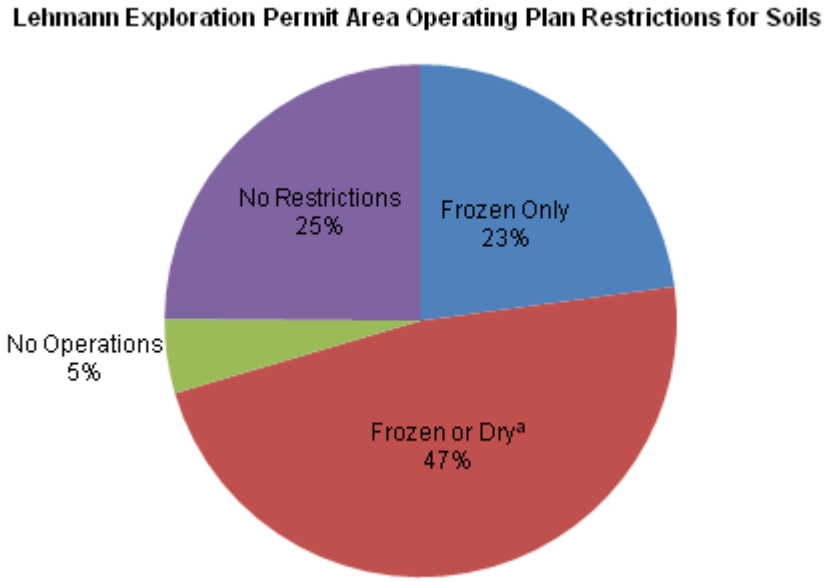
Current Operating Plans

Three companies, DMC, Twin Metals, and Lehmann Exploration, have submitted operating plans for site specific exploration activities. Impacts to soils from the site specific proposed activities included in these operating plans would be the same as previously discussed. Figure 24 through Figure 26 depict the operating restriction configuration for the permit areas covered by Duluth Metals, Lehmann Exploration, and Twin Metals respectively.



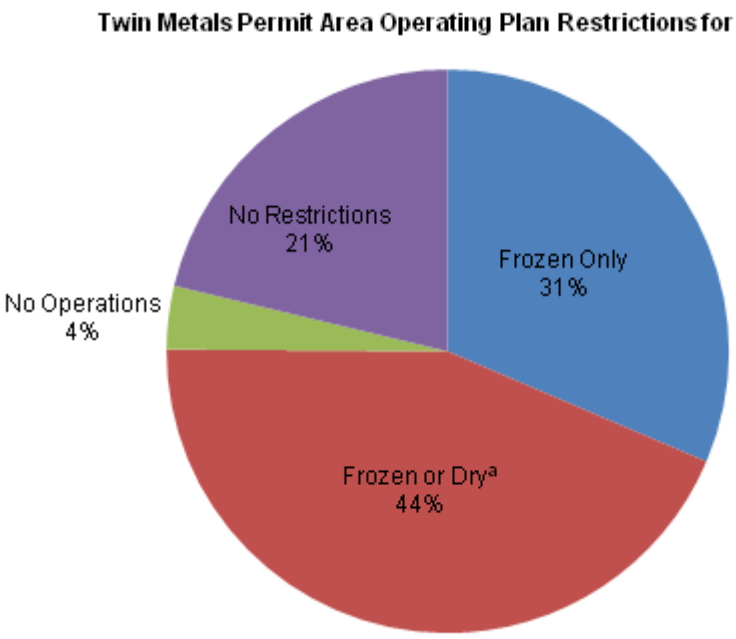
a - Activities would occur during frozen soil or the normal dry period to prevent rutting and compaction or exploration activities would need to employ techniques and equipment designed to eliminate impacts to the soil.

Figure 24. DMC permit area configuration by operating restrictions



a - Activities would occur during frozen soil or the normal dry period to prevent rutting and compaction or exploration activities would need to employ techniques and equipment designed to eliminate impacts to the soil.

Figure 25. Lehmann Exploration permit area configuration by operating restrictions



a - Activities would occur during frozen soil or the normal dry period to prevent rutting and compaction or exploration activities would need to employ techniques and equipment designed to eliminate impacts to the soil.

Figure 26. Twin Metals permit area configuration by operating restrictions

3.5.3.3 Alternative 5

Alternative 5, which proposes to limit exploration activity to the time period from November 1 through April 30, would result in lower potential for impacts to the soil resource. During a majority of that time frame, soils would likely be frozen resulting in a reduced potential for compaction, rutting and displacement.

3.5.4 Cumulative Effects

Alternative 1

Because no direct or indirect effects would occur, no cumulative effects would occur.

Alternatives 2, 3, 4 and 5

Because no direct or indirect effects are expected to soils in the WSR, MPA's, BWCAW or Voyageurs National Park, no cumulative effects are expected to the same areas.

Mineral exploration activities on non-federal lands in the project area are expected to have minimal impacts to the soil. Minimal cumulative effects from other resources management activities, such as timber harvest and recreational development, are anticipated through the use of stipulations, Forest Plan standards and guidelines and the use of Best Management Practices (BMPs). See Appendix C for discussion on cumulative actions considered.

Traffic from various types of machinery has occurred for decades on portions of the Superior National Forest. While not as prevalent as timber harvest, mineral exploration has accounted for some of that activity within the Forest. Mechanical equipment used for both activities in earlier years caused some rutting, compaction and soil displacement. More recent advancements in equipment and improved project

mitigation measures have resulted in substantial reductions in the impacts associated with mechanical activities.

Modifications in drilling operations, such as adjustments in season of operation, and various technological advancements, such as Mud Mats, have also resulted in substantial reductions in the impacts associated with mineral exploration activities in recent years.

Soils on the Superior National Forest have typically recovered from management activities within a few years. Vegetation is usually re-established within the first growing season after ground disturbing activities and becomes more prevalent after a few freeze-thaw cycles have restored any soil functions that may have been altered by the effects of equipment operations. Forest Plan standards and guidelines specify procedures for operations on National Forest System Land to minimize if not eliminate impacts from exploration activities. Publications such as Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development (USDOI 2007) along with various Best Management Practices (BMPs) on all lands provide direction and guidance for conducting exploration and associated activities in a manner to minimize impacts.

No discernable impacts to long-term soil productivity have been identified as a result of past mineral exploration activities within the Forest. Past resource management activity has had minimal effects to the soil. Reasonably foreseeable future management actions that would occur on land impacted by proposed management activities, as identified in Appendix C, are expected to have minimal cumulative impacts to the soil resource through the implementation of BMPs and Forest Plan standards and guidelines.

3.6 Water Resources

3.6.1 Introduction

The water resources in the area are a part of a functioning ecosystem and are used for recreation and potable water supply. Since water tends to spend time both on the surface and within the soil / bedrock matrix throughout the hydrologic cycle, the distinction between surface water and groundwater is essentially a human-derived classification based upon its present setting. The efficiency or ease of water to transcend between being on the surface and within the ground varies greatly. In some instances there is little resistance and there is a relatively easy and frequent transition between groundwater and surface water. In other instances there is little opportunity for water to interact and surface water does not enter the bedrock and water within the bedrock can remain there for many thousands of years.

This discussion will retain the distinction between groundwater and surface water as separate entities with the understanding that at different times and places within the forest, the distinction may blur as discussed above.

3.6.1.1 Indicators for measuring impacts

These indicators help to measure the potential direct, indirect, and cumulative effects to the quality of water resources at the site specific scale including potential downstream effects to water quality within the BWCAW.

Table 28. Indicators for potential effects on water resources

Constituent	Indicator	Threshold	Spatial Scale	Temporal Scale
Groundwater Quality	Potability of groundwater as determined by MN Department of Health Drinking Water Standards	Exceeds potability standards	The effects of exploratory drilling on groundwater quality should be relatively local to the activity. Hence, the analysis area is considered the same as the project area.	25 years – While the transmissitivity rates can vary significantly, it is assumed that impacts will occur within 5 years of the drilling activity.
Groundwater Quantity	Production capacity of existing wells	Interference with existing well production		25 years – It is assumed that the impacts well production would occur shortly after drilling
Surface Water Quality	Clean Water Act standards	Exceeds Clean Water Act	The analysis area consists of all HUC 6 watersheds that intersect the entire project area. These will be all of the HUC 6 watersheds on the Forest except those watersheds where there is no drilling allowed (such as the watersheds that are entirely within the BWCAW). However, the effects analysis is directed toward each lake or stream	20 years – It is assumed that the impacts to surface water quality would occur during the drilling process
Surface Water Quantity	Divergence from existing water levels	Reduction of flow in a stream by 10% or drop in water levels in a basin by more than 1 ft.		20 years – The impacts to surface water quantity would occur during the drilling process.
Aquatic Habitat and Biota-Landings	Percentage of disturbed littoral area	Dwelling density exceeds MnDNR lake classification threshold	The analysis area is for the entire project area. However, the effects analysis is directed toward each lake or stream. A specific analysis was performed for the Operating Plan associated with Birch Lake.	25 years – The impacts to the aquatic habitat would occur during the drilling process and it is assumed that the littoral area would revert to pre-disturbance conditions within 5 years
Riparian Habitat – Landings	Percentage of disturbed riparian area measured as the dwelling density along the shoreline	Dwelling density exceeds MnDNR lake classification threshold		25 years – The impacts to the riparian habitat would be prior to well abandonment. The riparian area would be restored and resume much of its pre-disturbance function within 5 years of the disturbance.

Groundwater Quality

Potential impacts to groundwater quality related to the proposed activity relate to the potential drilling fluid contamination of the groundwater resource, reduction of groundwater quality by the introduction of surface or upper aquifer contaminants into to deeper groundwater resource, and the introduction of salty or brackish water into the groundwater resource. Water quality in Minnesota is managed by the Minnesota Pollution Control Agency (MPCA) and administered as part of Minnesota Rules Part 7050 to be in compliance with the Clean Water Act.

Indicator: Potability or ability to meet drinking water standards will be considered the indicator for this potential impact.

Groundwater Quantity

Potential impacts to the groundwater quantity relate to potential interference or reduction in local well capacity due to the introduction of grout into the existing fractured system that is used by others for domestic water supply. These existing uses of groundwater by other private and public entities are considered the 'receptors' of potential impacts.

A specific procedure for resolving well interference is defined by Minnesota Rules 6115.0730. Minnesota Statutes 103G.261 establishes domestic water use as the highest priority of the state's water when supplies are limited.

Indicator: The production capacity of existing wells. It is reasonable to assume that these 'receptors' are representative of the impacts on the production potential of groundwater resources.

Surface Water Quality

Potential impacts to surface water quality include the potential for cuttings to migrate off-site and enter local surface water features. 'Cuttings' are very small pieces of rock that break away due to the action of the bit teeth during the drilling process. Additionally, surface water can be impacted by accidental spilling of diesel fuel or other materials used in the drilling process.

In addition, sediment can enter the water column from roadways and proposed landings along the shoreline as described in the Aquatic Habitat and Biota section below.

The federal Clean Water Act (CWA) requires states to adopt water-quality standards to protect waters from pollution. These standards define how much of a pollutant can be in the water and still allow it to meet designated uses, such as drinking water, fishing and swimming. The potential change in the level of impairment or identification of a source of pollution would identify a possible effect associated with the proposed exploratory drilling.

Indicator: The ability of water resources to meet Clean Water Act water quality standards set by the Minnesota Pollution Control Agency for different beneficial uses under the federal Clean Water Act. Surface Water Quantity

Surface Water Quantity

Water needed for drilling operations would be withdrawn from surface waters. If too much water is withdrawn it could impact the ecological function of the pond, lake, wetland, or stream. In addition, there is potential for an exploratory hole to be drilled through a confining layer of a surface water and the subsurface material had a high capacity for storage and transmissivity (rate which water can flow through a medium), then the surface water feature could be drained.

An analysis of the impact of clearing of drill sites on snowmelt volume and timing and ensuing effect on downstream water resources was not performed for the EIS. This analysis is performed at the watershed scale to ensure consistency with Forest Plan standard and guideline S-WS-1 (USDA 2004). If the young and open upland coverage exceeds 60 percent of the total watershed there is considered to be a potential impact on the watershed (per Forest Plan). However, there are no areas that are presently in excess of the 60 percent threshold. The area of disturbance is so small that the analysis was not considered of value because the 60 percent threshold would not be exceeded as a result of the relatively nominal area of disturbance.

Indicator: The water levels within ponds, wetlands and lakes, and the flow in streams are a good indicator of impacts to aquatic biota.

Divergence of these levels from anticipated levels associated with hydrologic conditions would identify an effect associated with the proposed exploratory drilling.

Aquatic Habitat and Aquatic Biota

Landings
In addition to effects of the installation of roadways, drilling pads, and drilling activity described above, there are potentially additional effects to aquatic resources related to the construction of landings along rivers and lakes. Landings would be needed to cross a lake or river. Hence, **t**he landings considered herein are for *access to* drilling activities that are on Federal Lands (i.e. not on a lake or river).

The potential effects of landing construction activities on water resources include:

- The introduction of sediment into the lake or river as a result of landing construction and use
- Physical modification of the riparian vegetation and shoreline
- The introduction or export of non-native invasive species
- Physical modification of the littoral area (shallow water zone near the shore) that may include impacts to submerged and emergent aquatic vegetation. This can be the result of direct limited dredging needed to get the needed depth accommodate landing of the watercraft. In addition, unconsolidated lake/river bed that does not consist of rock, gravel, or coarse sand can be disturbed by the 'prop-wash'. In other words, the action of the boats or barges accelerating away from the landing export bed material and inhibit plant growth.

Shoreline development along lakes can impact riparian vegetation (Elias 2003), aesthetics (Stedman 2006), shallow water (littoral) vegetation (Radomski, 2001), fish nesting (Reed 2009), water quality and other characteristics (Engel and Pederson 1998). This has an effect on multiple organisms including fishery species richness / composition / abundance (Bryan 1991), green frogs (Woodford and Meyer 2003), birds including loons (Lindsay et al. 2002), and other species.

Indicators for aquatic habitat and biota
The percentage of near shore littoral area disturbance and riparian disturbance are good indicators of the health of the aquatic habitat and aquatic species. Near shore littoral and riparian disturbance is generally associated with the development of the shoreline. Near shore littoral disturbance is commonly associated with the removal of aquatic vegetation, limited dredging, placement of docks, and importing of beach sand that is often part of a residential lakeshore development. In addition, residential lakeshore development often includes the removal or thinning of native riparian vegetation. This type of activity is similar to the proposed activity to install landings to accommodate exploratory drilling. Hence, it can be considered that the disturbance associated with the exploratory drilling landings is similar to a lakeshore residence and the percentage of near shore littoral and riparian disturbed can be estimated by the shoreland development intensity. These are considered analogous even though the disturbance associated with lakeshore development is typically permanent while the disturbance associated with the landing access is temporary.

A measure of the intensity of existing shoreline development and incremental impact of the proposed activity is the density of development along the shoreline. This has been used as a management parameter for lakes by the Minnesota Department of Natural Resources in the development of its statewide shoreland regulations (MnDNR 1970), (Barstad 1987). In addition, it has been used estimate effects of a

proposed land exchange on the Superior National Forest in the Rifle Lake Land Exchange Environmental Assessment (USFS 2010).

Indicator: Percentage of disturbed riparian area measured as the dwelling density along the shoreline and percentage of near shore littoral area disturbance.

Wetland Functions
There may be impacts associated with roadway and landing construction that cross wetlands for access to upland drill sites or for drill sites in wetlands. These impacts will be avoided or mitigated as discussed in Section 3.5.3 of this EIS.

The construction of roadways across streams can create physical or velocity barriers to aquatic organism passage through the inappropriate installation of culverts. The crossing of streams without the installation of culverts can destabilize embankments and cause in-stream damages. With the appropriate design, installation, and eventual removal and site restoration crossings would allow aquatic organism passage and the crossings would have minimal effect on the aquatic resources.

There is no proposed filling (installation of soil material) associated with the drill sites. Some material may be installed as part of the maintenance of existing roads. A roadbed would not be installed as part of the temporary road construction (see Section 3.5). However, some material may be installed at stream crossings as part of a culvert installation needed to minimize the impact to the streambed. The culvert and fill would be removed after the drill holes have been abandoned. Any proposed wetland fill would likely require a USACE Section 404 permit and possibly a MN/DNR Protected Waters Permit and/or a Wetland Conservation Act Permit that would require the avoidance, minimization, and mitigation for wetland fill. It would also be a part of the Forest Service Special Use Permit. Based these measures, the physical effects to the water resources should be minimal. Additional discussion is provided in Section 3.5

3.6.1.2 Area of analysis

See Table 28 for the spatial and temporal scale of analysis for each indicator.

The analysis area for the groundwater and surface water is considered the same. It is recognized that the groundwater influence can be different. However, given the scale of the analysis area and the general proclivity of groundwater divides to generally follow surface water divides, it is considered reasonable to use the same analysis area for the groundwater and surface water resources.

The analysis area for the landing area impact is considered to be the basin or river reach that the proposed disturbance would occur. A river reach would generally be defined as having fluvial geomorphic similarities. The breadth of these similarities can vary however, for this analysis is assumed to be 1 mile long. The fluvial geomorphic similarities are generally expressed as similar river slope, type of valley, substrate, and flow. These physical similarities indicate a similar ecological function and can be used as an analysis unit for this EIS.

3.6.2 Affected Environment

The water resources in the area are a part of a functioning ecosystem and are used for recreation and potable water supply. Since water tends to spend time both on the surface and within the soil / bedrock matrix throughout the hydrologic cycle, the distinction between surface water and groundwater is essentially a human-derived classification based upon its present setting. The efficiency or ease of water to transcend between being on the surface and within the ground varies greatly. In some instances there is little resistance and there is a relatively easy and frequent transition between groundwater and surface water. In other instances there is little opportunity for water to interact and surface water does not enter the bedrock and water within the bedrock can remain there for many thousands of years.

This discussion will retain the distinction between groundwater and surface water as separate entities with the understanding that at different times and places within the forest, the distinction may blur as discussed above.

The geology of northeastern Minnesota is described in "Minnesota's Geology" (Ojakangas and Matsch 1982):

> For the most part, this segment of Minnesota lies far enough north to have been involved in a more complicated glacial history than the areas downstate. Also, it was generally beneath ice that was in a mode of glacial erosion in contrast to one of deposition. Therefore, drift is relatively thin or even absent over wide areas, being concentrated mainly in belts of moraine…
>
> ….northeastern Minnesota [bedrock]includes: (1) the Vermillion district, which is….[a] Lower Precambrian volcanic-sedimentary (greenstone) (2)… Lower Precambrian batholiths….; (3) part of the Middle Precambrian basin in which the world-famous Biwabik Iron Formation was deposited; (4) …..Upper Precambrian continental lava flows that poured out of North America's largest rift structure; and (5) the Duluth complex, which is one of the world' largest mafic intrusions as well as a major reservoir of copper and nickel.

These bedrock types are have a relatively low transmissitivity (rate which water can flow through a medium) with a lower water yield than in other parts of the state where there is limestone or sandstone bedrock. The water that is within the bedrock of northeastern Minnesota is trapped in fractures. The volume and ability to extract water from these bedrock fractures is highly variable depending upon the fractures' density, size, orientation, extent, and connection with surface water features.

3.6.3 Direct and Indirect Effects

3.6.3.1 Alternative 1 – No Action

There would be no impacts to water resources associated with the No-Action alternative because no activity would take place.

3.6.3.2 Alternatives 2-4 Current and Future Prospecting Permits and Operating Plans

The following analysis applies to both current and future prospecting permits and operating plans because activities from both current and future exploration would have similar methods, and have potential effects on similar types of water resources.

Quality and Quantity of the Groundwater Resource

The action alternatives (2-5) use the same drilling and abandonment procedures. Therefore many of the effects on the hydrogeology and water quality caused by installing an exploratory hole would be similar for all action alternatives.

The drilling would be completed by a contractor that is licensed by the Minnesota Department of Health (Rye 2010b). The downhole activity (drilling, drilling fluid, abandonment, etc.) is essentially the same as if a residential well were being constructed or abandoned. The only difference is that a core would be extracted from the hole for analysis.

Potability of Groundwater
Drilling fluids are used to cool the drill bit and help transport the cuttings out of the drill hole. The drilling fluid used for the exploration process is the same as used for water supply wells and does not pose a threat to human health (Rye 2010a).

It is possible that an accident could occur during the drilling process that would introduce hydraulic fluids or other fluids from the drill rig into the groundwater. However, this type of accident is unlikely, has not happened on the Forest to date, would be of relatively small magnitude, and there are stipulations and regulatory controls to address this type of incident.

The exploratory drill holes would be cased through the non-bedrock overburden / till. The hole may be kept open for a time to collect additional information (such as water levels). It is possible that surface water (that would not be potable) could enter the aquifer. However, the rules developed by the Minnesota Department of Health (MDH) were developed to minimize this possibility. Since holes must be drilled by a licensed well driller and the MDH rules must be followed the likelihood of this occurring is minimized. If the well is not permanently abandoned after completion as described below, it is temporarily capped using a solid cap.

In some isolated locations within the Forest boundaries, there have been some instances of saline water in drill holes (Rye 2010d). This is generally on the east side of the Forest and occurs with more frequency closer to Lake Superior. The origin of this saline water is not well understood. It may be a reflection of the characteristics of a portion of the bedrock or it may be trapped marine water from many millions of years ago. Neither the aerial boundaries nor depth of these saline water are well defined. Well drillers occasionally experience the saline waters when drilling wells for domestic and other uses. The local drillers have historically tested the water for salinity through the drilling process in areas of known salinity risks and reacted accordingly to abandon saline wells.

Groundwater Quantity
During the abandonment process, grout is injected into the hole to seal it so that surface water cannot enter the aquifer. The injected grout does not expand far beyond the hole within the overburden. The effect of the grout in the overburden is very local. However, the injected grout can spread into the fractures of the bedrock aquifer. If there are enough abandoned exploration holes and they happen to fill in enough of the right upgradient fracture(s) it could reduce the yield for other wells including domestic wells. However, it is unlikely that the widely spaced proposed exploratory holes would fulfill all of these requisites to produce a noticeable effect on the yield potential of the other wells since the fractures are generally very tight and the bedrock is highly impervious..

Conclusion: From 1948 to 2002, over 1,700 core holes totaling over 1.4 million feet of core have been drilled in the basal zones of the Duluth complex (Miller 2002) (see Map 7). These have occurred on State, Federal, County, and private lands. The drilling methods and abandonment techniques are very similar to the proposed exploratory drilling. There have been no reported problems to the Minnesota Department of Health (MDH) related to groundwater quality or production rates related to these previously established holes. Based upon this, the proposed drilling activity with the prescribed project design features described in section 2.4.3 is not anticipated to have a noticeable effect on the quality or quantity of the groundwater resource. Based upon these considerations and mitigation measures the results of the proposed action alternatives should not exceed the potability standards of groundwater. The activity should not impact the potability of the groundwater or the production capacity of existing wells.

Quality and Quantity of the Surface Water Resource

Surface Water Quantity
The withdrawal of water to use in the drilling process could have an effect on the surface water resources. Surface water removal can affect aquatic biota by simple desiccation, or cause stress and mortality to fish and other aquatic organisms by changes in the thermal and chemical properties of water. Excess rate of water removal can affect the stream biota. A typical water tank for drilling operations has a capacity of 2,000 gallons. The rate of pumping to fill the tank varies with equipment; however, typical values can range from 50 to 200 gallons per minute (gpm) (0.1 to 0.4 cubic feet per second(cfs)). Both the rate and volume of removal is managed by the project design features described in Section 2.4.3.9. Implementation of these protection measures would protect the aquatic biota.

Based upon these mitigation measures, the divergence of water levels will not exceed natural variation and will have little impact aquatic biota.

Surface Water Quality
The introduction of eroded material associated with construction of landings, roadways, and from the drilling sites can reduce the water quality within the receiving waters and impact the aquatic biota.

Runoff from the drill sites that comes in contact with cuttings or disturbed ground could have negative impacts on the water quality runoff (MN Exploration Assn 2004). The drill site disturbance is small and the volume of soil or suspended solids runoff from these disturbed drill sites would be small. The drill sites would also be disbursed so the runoff volume, rate, and quality to the receiving waterbodies would be within the natural buffering capacity of these systems. Sumps are constructed to control drill cuttings from moving off the drill site (see Figure 3 and Section 2.1.1.5) For these reasons, the level of impairment should not change for the existing surface water resources that are not listed, there should be no impact on surface waters, and the project should not noticeably increase the mercury concentration or cause them to be considered impaired by any other constituent.

While effects would be minor, the degree of effects from new temporary roads to water quality and water quantity is similar for all action alternatives. Future, site specific routes not proposed in this EIS, but associated access to mineral exploration, would be permitted under future prospecting permit operating plans and special use permits and reviewed by resource management staff for feasibility and to assure that stream and wetland crossings are avoided, minimized, or mitigated according to the same guidelines as this EIS. As described above, new temporary roadways in the operating plans within this EIS and future proposed roadways for drilling activity would require a permit from the U.S. Army Corps of Engineers for impacts to navigable waters and jurisdictional wetlands.

In some areas of the Forest there is not sufficient access to the drilling sites via roadways and access must be obtained by crossing lakes, rivers, and wetlands. Specific conditions are needed to require a landing including:

- Insufficient existing road access and
- A waterbody that is either
    - deep enough to accept barge / boat traffic or
    - capable of producing sufficient ice thickness to accommodate winter travel crossing

Winter crossing is considered preferable to open water season crossing due to the anticipated expense and potential social and environmental effects associated with open water crossings. Hence, winter use of the landings would be the preferred condition. However, on sites where there is insufficient ice thickness to support drilling equipment, use of the landings during the open water season is required. One example of

this condition occurs in Birch Lake where there is presently a drilling operation on a barge and there is a proposed use of landings during the open water season.

The number of landings is difficult to estimate. In addition to the above-mentioned considerations, the geologic characteristics and economic conditions influence the number of landings that would be needed.

The number of landings used for access that are known are summarized as:

- Historically, there has only been a single landing developed for access to coring locations on Federal Lands. This occurred on Birch Lake in 2000.
- The State of Minnesota has not had request for the development and use of a landing in the area to cross a lake or stream.
- The existing Lehmann Exploration prospecting permit application includes 8 landings.

Based upon the above described considerations, it would appear to be reasonable to assume an additional 20 open water landings and an additional 20 winter landings over the ice (for at total of 40). These would not be evenly distributed over time and space. Birch Lake is an area that fits the criteria for needing a landing described above and may therefore have more future open-water landings than other areas. It is generally assumed that an existing boat launch would be used to get the equipment and materials onto the lake or stream. Hence, most of the subject boat landings would be used as an egress to the drilling site. Economics may concentrate the activity at the beginning, middle, or end of the 20-yr analysis. Criteria for landings are located in Section 2.2.2.4 under the Water Access Section.

Figure 27. Left-location of previous landing (2000 – 2004); right-access route of previous landing (2000–2004)

Figure 28. Photos of previous landing site on Birch Lake (photos taken 8/12/2010)

The potential effects of these activities on water resources include:

- the introduction of sediment into the lake or river as a result of landing construction and use
- physical modification of the riparian vegetation and shoreline

- the introduction or export of non-native invasive species
- physical modification of the littoral area (shallow water zone near the shore) that may include impacts to submerged and emergent aquatic vegetation. This can be the result of direct limited dredging needed to get the needed depth accommodate landing of the watercraft. In addition, unconsolidated lake/river bed that does not consist of rock, gravel, or coarse sand can be disturbed by the 'prop-wash'. In other words, the action of the boats or barges accelerating away from the landing export bed material and inhibit plant growth.

The proposed 8 landing sites were visited in 2010 by the USFS (Butcher 2010). One of these landings is at the same location as a landing used between 2000 and 2004. Photos of this site are provided below in Figure 27.

A brief summary of this site visit is provided below:

- Site conditions were variable but most were located in bays or inlets away from the main channel.
- Substrates varied from muck to ledge rock, but most had stable substrates on the nearshore/washzone (cobble and gravel) and softer substrate (sand or muck) offshore in the littoral zone.
- Most sites had sufficient depths to facilitate shallow draft watercraft such as pontoons, barges, and outboards.
- All the sites that may present a concern or have potential undesirable effects from a water resource or aquatic biological perspective have alternative access or mitigations that would minimize resource impacts. For example, several sites could be moved to the left or right shoreline to avoid shallow depths, wild rice or other aquatic vegetation, or avoid landing on shoreline wetlands.
- The rehabilitated site showed little, if any, sign of impact. The path of overland travel to the drill site was overgrown except for a small foot path and occasional signs of 2-track paths. The drill pad area was overgrown with herbaceous vegetation and alder and the sump pit remained as a small pool similar to an open water wetland or ephemeral pond about 12ft in diameter and 2-3 ft. deep. The landing area showed no sign of impact; however, this landing site was very conducive to barge landing since it was on a site with a "natural bedrock ramp" located on a point surrounded by water of sufficient depth for boat traffic.

Based upon the site conditions, experience with a prior landing, stipulations listed in Chapter 2 of this EIS that require the minimization of disturbance and subsequent stabilization, the impact to water quality is anticipated to be minimal, local, and temporary.

Percentage of disturbed littoral area measured as the dwelling density along the shoreline
The processes that form the littoral zone (wave action, ice, and local deposition) would not be modified by the activities associated with the landing creation and use. Hence, the disturbance would be temporary and the impacted littoral area would revert to its pre-disturbance condition once the use has ended. The length of time it would take to revert would vary with the intensity of the forming processes and the characteristics of the sediment and vegetation at each site. As a result of the process and site variability, time to revert to pre-disturbance conditions may vary from as little as a year to within 5 years. It should also be noted that ecological functions would be different, but not necessarily lost, during the interim between the end of the disturbance and the reversion to pre-disturbance condition.

Accidents that introduce substances used in drilling operations such as oil, diesel fuel, anti-freeze, engine grease, and rod grease can have an effect on water quality. These substances can cause stress or mortality of aquatic resources. They are not used in large amounts at the drilling site, hence, the volume of any spills can be contained. The practices for activities such as refueling and the protocol to be followed if there is an accidental spill are outlined in the project design features described in Section 2.4.3.9.

Based upon these considerations, the proposed drill pad construction, drilling activity, and access construction, and landings should not cause an impairment of surface waters (exceeding Clean Water Act standards).

Conclusion
There would be few, if any anticipated negative effects to surface water quantity or water quality in the analysis area, including relevant portions of the BWCAW and Voyageur's National Park from proposed activities including new temporary road stream crossings. Any new crossings would be designed, constructed, and used following appropriate design criteria and mitigation measures.

Aquatic and Riparian Habitat

Landings
The primary impact to aquatic and riparian habitat would come from landing construction and use. The processes that form the littoral zone (wave action, ice, and local deposition) would not be modified by the activities associated with the landing creation and use. Hence, the disturbance would be temporary and the impacted littoral area would revert to its pre-disturbance condition once the use has ended. The length of time it would take to revert would vary with the intensity of the forming processes and the characteristics of the sediment and vegetation at each site. As a result of the process and site variability, time to revert to pre-disturbance conditions may vary from as little as a year to within 5 years. It should also be noted that ecological functions would be different, but not necessarily lost, during the interim between the end of the disturbance and the reversion to pre-disturbance condition.

Percentage of disturbed riparian area measured as the dwelling density along the shoreline
Different receptors (such as frogs, fish, etc.) are respondent to different levels of activity in the littoral zone. A study on birds indicates an approximate threshold of 5 homes per mile of shoreline has an effect on bird guilds (Lindsay et al. 2002). Green frogs may become extirpated due to habitat manipulation at a density of approximately 42 houses / shoreline mile (Woodford and Meyer 2003).

Birch Lake is designated as a "Recreational Development" in the Lake County ordinance. This designation was established by the Minnesota Department of Natural Resources based upon lake characteristics (size, crowding potential, existing natural characteristics / physical characteristics – such as soil type, vegetative cover, land/lakebed slope, etc.), public waters needs, and existing development patterns at the time of designation. A Recreational Development designation is "intended for those waters which are capable of absorbing additional development and recreational use. They are usually lightly to moderately developed at present. They would be assigned an intermediate set of development standards" (MnDNR 1976). The development density for the classification of lakes is summarized below in Table 29.

Table 29. Lake classification development density limits

Lake Classification	Development Density (dwellings / mile of shoreline)
Natural Environment	Less than 3
Recreational Development	3 to 25
General Development	Greater than 25

The development density for Birch Lake remains well within the recommended density (less than 4 dwellings per mile of shoreline) for Recreational Development Lakes as a result of Alternatives 2-4.

Wetlands

Temporary road construction within wetlands for exploratory drilling is subject to the CWA standards. The U.S. Corps of Engineers regulates the discharge of dredged or fill material into waters of the U.S. including jurisdictional wetlands. This includes the mechanized land clearing (grading, dozing, etc.) within jurisdictional wetlands.

The drilling companies would be required to obtain needed permits for any proposed activities for the landings or temporary road construction in wetlands. Sequencing (avoid, minimize, and finally mitigate) would be required as part of the permit process.

Wetland resources are identified by their Ecological Land Type (ELT). Wetland soils are either required to be crossed / occupied during frozen / winter conditions or must be avoided. Impacts to wetlands (based upon their soil type) are described in 3.5.3.

There are three main potential effects to wetlands are associated with roads. These include:

- The physical filling of a wetland,
- Interruption of natural riverine or wetland processes (such as becoming a barrier to aquatic organism passage, and
- Becoming a source for sediment to enter the stream or wetland

Hence, if roads are not properly designed and constructed, they may affect watershed, riparian, stream, and wetland hydrologic and biological functions such as reduced soil water infiltration, increased surface runoff, removal of streamside vegetation and riparian habitat, disruption of natural wetland flow, and reduce or eliminate aquatic organism passage. A thorough description of potential geomorphic, hydrologic, aquatic habitat, and soil displacement effects from roads and trails is contained in the Superior National Forest Land and Resource Management Plan Final EIS, pages 3.6-11-12 (USDA Forest Service 2004d).

Temporary roads for the mineral prospecting activities are similar in use, design, and management to temporary roads used for timber harvest. The effects of stream and wetland crossing largely depend on the season of use and type of crossing. When possible, avoiding wetland and stream crossings by using existing roads or using alternative routes would eliminate the need for many crossings and reduce potential effects of the overall project. . Crossing design and installation are managed by stipulations and Forest Plan standards and guidelines to minimize effects on aquatic resources and water quality (see Section 2.4.3.9).

Potential effects of winter crossings are usually less than the potential effects of all-season crossing construction and use. There would be few, if any anticipated negative effects to water quality and watershed health within the analysis area from proposed winter roads because they would be designed, constructed, and used following appropriate design criteria and mitigation measures. These roads are specifically designed to reduce impacts to soils, streams, and wetlands by providing over-the-snow or ice travel for equipment during frozen conditions. The use of winter roads provides for greater protection to water quality and watershed health than roads that allow use outside of “frozen” conditions since travel over ice or snow has far less chance to create erosion or contribute sediment to receiving water bodies.

Under all alternatives, temporary roads and associated stream crossings would be decommissioned and reclaimed after all use is completed (Forest Plan FEIS. F-9). There may be some short-term negative effects to both local and downstream reaches from minor sediment input and stream flow manipulation. However, stream crossings would be designed and constructed properly following required guidelines, project design features, and mitigation measures and effects would be minimal, if any. Possible effects

after mitigation measures are applied include minor contributions of sediment to streams during initial site preparation or final crossing removal.

In summary, there would be very little if any impact to aquatic habitat, surface water quantity, or surface water quality resources due to the construction of temporary roads because:

- wetland filling is regulated by the U.S. Army Corps of Engineers and Forest Plan to avoid, minimize, and mitigate impacts to the waters of the Unites States or jurisdictional wetlands,
- riverine processes, including aquatic organism passage, water transport, and sediment transport, would be maintained through the proper design and installation of roadways and crossings as required by the Forest Plan and stipulations, and
- the roadways are not expected to be source of additional sediment because of proper design features and mitigation measures in addition to being temporary or frozen (winter) use roads.

Conclusion

There would be few, if any anticipated negative effects to aquatic and riparian habitat surface in the analysis area, including relevant portions of the BWCAW and Voyageur's National Park from proposed activities.

3.6.3.3 Alternative 5

As described above, stipulations and permit restrictions would adequately protect surface and groundwater resources from impact. There would be less localized impact due to timing restriction of November to April 30.

Conclusion

There would be few, if any anticipated negative effects to groundwater quality or quantity, surface water quantity or quality, or aquatic and riparian habitat in the analysis area, including relevant portions of the BWCAW and Voyageur's National Park from proposed activities.

Summary of Effects

The anticipated effects to water and aquatic resources is minimal based upon the above analysis which considers the stipulations, Forest Plan standards and guidelines, existing State and federal regulations, design elements, anticipated operating conditions, and resource characteristics.

3.6.4 Cumulative Effects

The spatial and temporal scale of the cumulative effects analysis is the same as the direct and indirect effects analysis.

The scope for the cumulative effects analysis includes all water resources in the analysis area. Past activities that have affected water resources include timber harvest, road construction, and prior drilling activities (see Appendix C for description of past, present, and reasonably foreseeable actions).

Specifically, all of the projects listed in Appendix C may impact the water resources. A summary of selected projects and the assumptions and descriptions of the elements as they relate to the water resources in the analysis area is provided below in Table 30. These activities have or are estimated to potentially have minimal effects on water resources. Implementation of mitigating measures would protect the water resources and biota from impacts such as compaction, rutting, chemical contamination, and changes in water flow.

Based upon the stated assumptions and project elements the cumulative effects should not impair the potable use of groundwater due to reduced yield or impacts to water quality.

Based upon the stated assumptions and project elements the cumulative effects, there should be no change in the impairment classification of the surface water resources. The impacts to flow, pond levels, and physical impacts to the water resources and aquatic biota would also be nominal due to the nature of activities and the mitigation measures to be employed.

Table 30. Summary of selected cumulative effects related to water resources

Action	Assumptions / Description of Elements
Past Actions	
Historic Drill Holes – known drilling that has occurred in the vicinity of the proposed operating plans.	Drilling has occurred in compliance with state drill code and mitigation measures / best management practices have been employed. The MDH has not recorded any problems with nearby wells.
Bulk Sampling Shaft - Maturi Site	The collection was performed and closed in a manner consistent with state and federal permit requirements so that it is not considered a source and adjacent water resources are not impaired.
Bulk Sampling - Spruce Road Site	The bulk sample collection was performed in 1974. Subsequent monitoring indicated a concern about the restoration of the site. Additional site restoration activity occurred in 1975/1976. The sampling and testing was performed and the site was reclaimed/closed in a manner consistent with state and federal permit requirements so that it is not presently considered a source and adjacent water resources are not considered impaired. Additional information on this site (Butcher 2011) is available in the project file.
Present Actions	
Drilling on State and private Mineral Rights – Franconia's drilling in Bob's Bay area and on Birch lake. Also, Encampment has 3 drilling proposals.	Drilling has occurred in compliance with state drill code and mitigation measures / best management practices have been employed. The MDH has not recorded any problems with nearby wells.
Kawishiwi Minerals Exploration Project	This project was approved with stipulations to protect water and aquatic resources.
Logging on USFS Land	Logging is performed consistent with standards and guidelines as established by the Forest Plan to protect water and aquatic resources. Subsequent monitoring has confirmed the adequacy of these standards and guidelines to protect water and aquatic resources.
Logging on Private and Non-Forest Service Public Land	It is assumed the voluntary best management practices are being employed to minimize the impacts to ground and surface water resources(Project File, Water References).
Reasonably Foreseeable Actions	
Drilling on State and Private Mineral Rights –sites not yet drilled.	Drilling will continue on state, county, and private lands. This activity will continue to be regulated by existing state regulations on drilling activity.
Polymet – proposed mining/drilling.	The proposed activity is undergoing an extensive environmental review and would be subject to multiple state and federal permits. The environmental review would also require impacts to local and regional systems to be evaluated within the context of other activities including the proposed exploratory drilling. These permit and environmental review process would require measures to be developed to ensure the groundwater and surface water systems are not impaired.

3.6.5 Monitoring Recommendations

Monitoring recommendations for all resources can be found in appendix E.

3.7 Vegetation

3.7.1 Introduction

The analysis area used to examine the direct and indirect effects of each alternative is National Forest System land outside the Boundary Waters Canoe Area Wilderness (BWCAW) and Mining Protection Areas (MPAs), and Wild, Scenic and Recreational Rivers (WRS), approximately 1,184,760 acres. This analysis area was selected because it demonstrates how the actions on federal lands influence LE composition and age class distribution within those LEs. Additionally, this area was chosen because no mineral exploration would take place on federally owned minerals within the BWCAW, MPA or WRS. While access roads could potentially be constructed within the MPA to gain access to sites outside the MPA or likewise for Scenic and Recreational River Areas, it is very unlikely and therefore is not considered in the analysis for direct and indirect effects.

The analysis area for cumulative effects is all lands within the Northern Superior Uplands (NSU) Section. This analysis area was selected because it demonstrates how mineral exploration activities will influence LE composition and age class distribution across all ownerships within the ecological classification unit (section).

The time period for direct, indirect and cumulative effects is twenty years because this is the time frame in which the total estimated disturbance would take place. Past management activities' impacts on LE species composition and age class distribution are considered when looking at the existing condition. For example, a stand that had been harvested and converted would reflect the effects of past management activities on the vegetation through the current condition of its forest type and age class.

3.7.1.1 Indicators

The indicator used for vegetation for the project area is acres of vegetation disturbed (cut). This indicator analyzes the differences between alternatives related to the influence prospecting activities have on landscape ecosystem dynamics.

3.7.2 Affected Environment

Relatively minor portions of the Forest are within the Northern Minnesota and Ontario Peatlands and the Northern Minnesota Drift and Lake Plans Sections. Because the Forest accounts for such small parts of these sections, landscape ecosystem objectives within these sections are not considered in the Forest Plan and therefore will not be discussed in this document.

The vast majority of the Forest is in the Northern Superior Uplands (NSU) Section. Within this section, and within the Forest, there are six Landscape Ecosystems (LE) which include Forest Plan objectives. The LEs are:

- Jack Pine/Black Spruce
- Dry-mesic Red and White Pine
- Mesic Red and White Pine
- Mesic Birch/Aspen/Spruce-Fir
- Sugar Maple
- Lowland Conifers

Vegetation objectives for the LEs are the basis for identifying opportunities to move vegetation from the existing condition toward long-term desired conditions. Existing conditions, at the time of Forest Plan

Revision, and desired future conditions for the LE's are described in detail on pages 2-59 through 2-78 of the Forest Plan (USDA 2004). Current existing conditions for LE species composition and age class distribution are listed in the Forest Monitoring Report.

3.7.3 Direct and Indirect Effects

3.7.3.1 Alternative 1

No activities are proposed and therefore no effects are expected.

3.7.3.2 Alternatives 2, 3, 4, 5

Current prospecting permits and operating plans

Three companies, DMC, Twin Metals and Lehmann Exploration, have submitted plans of operation for site specific exploration activities. Plans include number of drill pads and proposed access roads. For analysis purposes it is assumed that for drill pad construction an area of 100 feet by 100 feet, slightly less than a quarter acre, would be cleared. Also, it is assumed roads would be constructed to a width of 16 feet. The potential area of land impacted by activities proposed in the plans of operation submitted by the three companies is shown in Table 31.

Table 31. Acres impacted by exploration activities described in plans of operations submitted by DMC, Twin Metals and Lehmann Exploration

Company	# of Drill Pads Proposed	Total Disturbance Acres Associated with Activities
DMC	60	36.4
Twin Metals	11	2.7
Lehmann Exploration	21	13.3

Twin Metals operating plans were originally submitted under DMC and were split out at a later date.

Considering the potential impacts from the figures listed in Table 31 there would be no substantial impacts to LE composition and age class distribution because of the relatively small amount of vegetation impacted by exploration activities.

Future prospecting permits and operating plans

Mineral exploration associated with this project is expected to disturb a maximum of 186 acres per year and approximately 3,725 acres for the 20-year span of the project. Considering the relatively small area of land disturbed by exploration activities each year and for the life of the project, these figures represent 0.01 percent and 0.34 percent of the Project area respectively. As a result of this small proportion of vegetation disturbed, direct and indirect effects to LE species composition and age class distribution would be very minimal if even measurable at the LE scale.

Figure 29. Example of a typical drill pad site two growing seasons after activity has been completed
Note the relatively small area impacted (less than one acre) and minimal overstory vegetation disturbance. A capped drill pipe is visible slightly to the right of the center of the picture.

The direction provided by the stipulations outlined in Section 2.4.3 provides guidance to minimize the impacts of mineral exploration and associated activities on LE composition and age class distribution. The following stipulation best addresses measures taken to further minimize the effects:

- In the construction of new access roads and drill pad sites, all effort shall be made to avoid cutting of timber.
- Removal or cutting of trees and vegetation shall be kept to a minimum.

There is minimal difference in the amount of land impacted by mineral exploration activity between action alternatives. The area of land impacted by exploration and associated access routes is the same and therefore would result in the same amount of disturbance within stands. The amount of disturbance for all action alternatives would still be relatively small to the point of having no influence on LE composition and age class distribution.

3.7.4 Cumulative Effects

Mineral exploration is typically conducted in the same manner regardless of surface ownership and/or mineral rights. Mineral exploration on reserved and outstanding private mineral rights within National Forest System Lands would not have substantial effects on LE species composition and age class distribution. Mineral exploration activities on non-federal lands would not likely have substantial impacts on LE composition and age class distribution. These activities would impact only a very small proportion of total forest area.

The Minnesota Department of Natural Resources (MnDNR) has developed forest resource management plans for three of the five subsections, Border Lakes, North Shore Highlands and Nashwauk Uplands, within the NSU Section. (Minnesota Department of Natural Resources 2010) The MnDNR's management

plans have similar goals to those in the Forest Plan in moving towards desired conditions for forest composition and age class distribution.

Management activities on county and industrial forest land are not likely to have substantial effects on LE configuration. Although industrial forest land and some county land are typically managed more actively for timber production the relatively small amount of each within the project area (3.5 percent and 7.7 percent respectively) would not account for a substantial influence on species composition and age class distribution within the LEs.

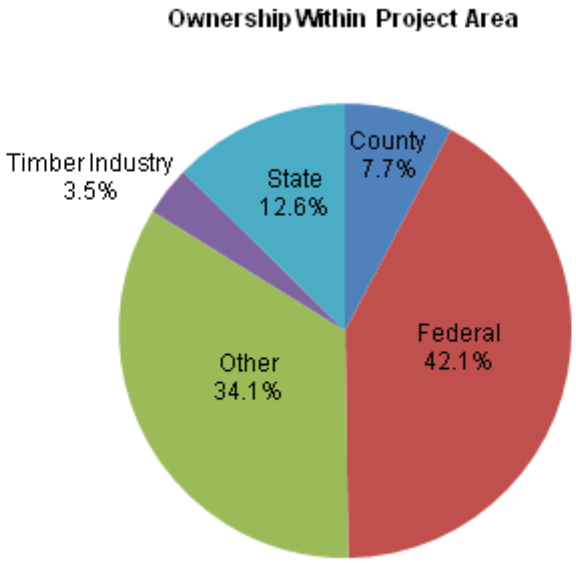


Figure 30. Pie chart showing land ownership within the project area

The ownership pattern within the NSU section including all lands inside and outside the project area would be similar. The BWCAW is entirely within the NSU section. This area of land, regardless of surface ownership, is not managed for timber and would account for a relatively large portion of land that would not see any manipulation of LE composition or age class distribution other than from natural disturbance and succession. Management activities on county and industrial forest land within the NSU section would reflect minimal changes overall within the section. These relatively minor changes would not result in substantial impacts to LEs.

Forest management on private forest land would not have substantial effects on LE composition. Private landowners typically have not utilized their lands for timber production. Timber production accounted for only one percent of primary reasons for owning forest land among 2,000 private landowners that participated in a survey across the United States (Baughman et. al. 2001). Considering this, private land within the project area would not have a noticeable influence on LE structure throughout the project area or NSU section.

No discernable impacts on LE composition and age class distribution have been identified as a result of past mineral exploration activities within the Forest. Vegetation management on NFS land would continue to move LE composition and age class distribution towards Forest Plan objectives. Known past and reasonably foreseeable future management actions that would occur on land impacted by proposed management activities would have minimal cumulative impacts to LEs.

Minimal cumulative effects to the vegetation resource as a result of exploration activities in conjunction with other resource management activities are anticipated.

3.8 Wildlife

3.8.1 Introduction

This section reviews the effects of the project to terrestrial endangered, threatened, proposed, or sensitive species and any designated critical habitat and summarizes the analyses in the Draft Biological Assessment(USFS 2010a) and Draft Biological Evaluation (USFS 2010b). Animals included in this analysis are the federally threatened Canada lynx and gray wolf (USDI Fish and Wildlife Service 2011) including critical habitat, 21 terrestrial Regional Forester Sensitive Species (USDA Forest Service 2006), and game species. Changes in season of operations, temporary road mileage, and habitat continuity are discussed. Other issues that are discussed are habitat and fragmentation, corridors, unauthorized motor use, road hunting from ATVs, protection of sensitive areas, public use, and potential drilling fluid affects to wildlife.

3.8.1.1 Methodology

Methods used to evaluate effects include analyses of the changes from existing conditions in miles of temporary roads, and miles of road used during winter (November 1 – April 30), and fragmentation and degradation of refugia. All analyzed wildlife species have key habitat indicators related to habitat, whether management indicator habitats, non-forest habitat, age, forest type, or spatial orientation of habitat and habitat continuity (Project File).

Minnesota Natural Heritage Program Biotics database (MN DNR 2010) and USFS data are among the data sets used for planning and wildlife analysis. The most up-to-date regional information is used in the analysis. Analysis of the potential for taking of a federally threatened or endangered species is located in the Biological Assessment.

Acres of habitat changed to 0-9 years old

The small percent of forest changed to 0-9 years old would be a discountable change in wildlife habitat. Clearing drill pads will change habitat by 0.5 percent in any LAU. This habitat change will be temporary and few canopy trees will be removed. This is a discountable amount habitat change and will not be analyzed further. Habitat analysis may be found in the project file (Roads –habitat analysis.xls and the Draft Biological Assessment (USDA Forest Service 2010a)).

Miles of temporary roads open for drilling activities

The estimate of temporary road-related permitted activities is an activity-over-time formula (Project file: Road-habitat analysis) based on predicted activity levels in section 2.2.2.4. In order to calculate effects numerically we attached a percent use by year and assumed that activities would be most likely at the beginning of the permit and taper off over the life of the permit. This scenario assumes 100 percent of temporary roads are open the first year of an operating plan, 20 percent are open in years 2 and 3 and 10 percent of the roads are open in the remaining years of the operating plan. Figure 31 compares the number of active permits expected to be active in each year and the miles of temporary roads used in each year using the activity-over-time formula.

Use of 10 percent of the roads per year after year 3 tries to capture the road use variability over the life of the operating permit based on the fact that we do not know which specific years any operating plan may have operations on the ground. Road closure would take place after operations are completed for the year, road decommissioning and reclamation would take place after completion of all operations on the road,

and either may occur in any year of the permit depending on operational needs. The assumption of 10 percent also reflects that some permits would be completed well before 15 years and no road use would occur after permit completion. For the purposes of this analysis we assume there will be 5 months of exploration activities per year because of potential seasonal restrictions in any action alternative.

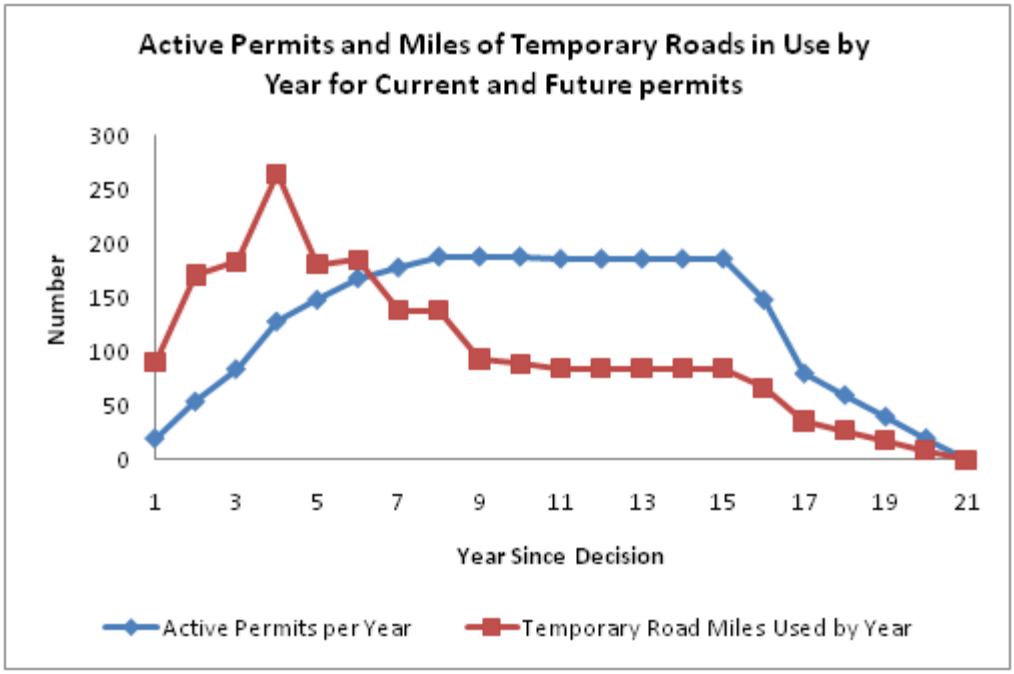


Figure 31. Active prospecting permits and miles of temporary roads in use by year for current and future permits

The SNF Forest Plan FEIS analysis did not assume prospecting permits in roads analyses but this analysis compares the mileage expected in the FEIS with that expected forest-wide for all resources including hardrock minerals prospecting. The Forest Plan assumed most temporary roads are built for timber sale access (Forest Plan FEIS Appendix F-9) and the estimated temporary road miles needed for any decade are base upon this assumption. Timber harvest funding in 2009 was 59 percent of the Allowable Sale Quantity (the basis for the FEIS analysis roads estimate) (USDA Forest Service 2010c, timber section). Therefore the FEIS estimate of temporary road miles needed for each decade (754 miles for Decade 1; 764 miles for Decade 2; and 761 miles for Decade 3) were multiplied by 59 percent to attain mileage proportionate to the current timber harvest level.

Decommissioning of roads is figured into the roads analysis. The Forest Plan FEIS objective to decommission approximately 80 miles of road included many unclassified roads, often similar to temporary roads that had remained open or grown in. Since 2004 approximately 34 miles of road have been decommissioned. In addition, approximately 109 miles of roads approved for decommissioning but not yet accomplished, were identified in eight NEPA decisions between 2004 and 2009. When these planned projects are fully implemented, a total of 143 miles of roads will have been decommissioned (Transportation Section, 2009 Monitoring and Evaluation Report, 8/2/2010). This analysis does not extrapolate beyond 2009 figures. The analysis includes special use roads on federal lands.

Seasonal road use

Season of operations would vary by alternative, Alternatives 2-4 allowing operations all year and Alternative 5 allowing only winter operations. About 39 percent of the soils in the project area are

operable only during frozen conditions and 40 percent are operable only in frozen or dry conditions (Soils Section). It is expected that ground disturbing activities such as drill pad and road creation and use would be completed more often in the winter, under frozen conditions, to avoid adverse impacts to soils and the resulting seasonal restrictions. Since any road may cross many soil types this wildlife analysis estimates that 40 percent of the roads would have seasonal road restrictions and be operable only during frozen conditions and half of the frozen or dry conditions would cause winter operations, for a total of about 60 percent of operations occurring during winter (Nov. 1-April 30).

Habitat continuity

Fragmentation will be analyzed by evaluating continuity of habitat on the landscape. Continuity is the opposite of fragmentation (Haila 1999, page 241) and more appropriate for analysis on the Superior National Forest because the majority of the landscape is forested or in natural vegetation types typical to northeastern Minnesota. Effects of this project would be to change forested vegetation to a young age; impacts would not result in permanent forest or habitat loss, but instead would create small, young-aged forest patches which would naturally revegetate or may be planted with native seeds to prevent erosion. Potential effects to the Boundary Waters Canoe Area Wilderness will be addressed in this section.

Canopy openings and percent of the forest affected will be compared to guidelines in the Forest Plan which are based on the range of natural variation for this landscape as discussed in the Forest Plan EIS. Spatial distribution of habitat changes were evaluated using the acres of forest changed to 0-9 years old in each lynx analysis unit (USDA Forest Service 2010a). LAUs are categorized according to mineral exploration interest of high, moderate, or low-very low (Section 3.4.2.1).

Incomplete and Unavailable Information

Forest Type: There may be temporary, localized changes in tree composition as drill pads and temporary roads revegetate but the forest type is expected to remain the same over time at any drill pad or road site in all alternatives. Operating plans provide best location estimates of operations but exact locations of temporary roads and drill pads are not known at this time because geophysical surveys, soils, or topography may cause roads and drill pad placement to change during implementation. Affected areas are expected to retain their pre-disturbance forest type since natural regeneration will be used, no planting would take place, and hydrological regimes would remain intact through the use of appropriate stipulations to protect soils and streams. For these reasons, it is not reasonable to analyze changes in age by forest type.

The number and location of drill pads and drill holes is known for permit applications with operating plans, but not all operating plans have been received from applicants. Because we have incomplete information on drill pads and drill hole locations for permits without operating plans, miles of temporary roads, acres of habitat, and habitat continuity are used to represent drill pad and drill hole disturbance to wildlife.

Spatial and Temporal Context for Effects Analysis

The time period for direct and indirect effects is from the time project activities begin to ten years after project activities cease. The time period used for analyzing cumulative effects for all permits and plans is from the 2004 to 10 years after exploration activities have been completed. Ten years in the future was selected because wildlife habitat would move out of the 0-9 year old condition 10 years of the cessation of activities at any particular site. The Forest Plan documented environmental baselines for sensitive species as of 2004 and this represents a comprehensive look at species' status against which to judge changes beyond 2004.

Analysis Area for Current operating plans prospecting permits
Ten lynx analysis units overlapping the current operating plans and current prospecting permits area (lynx analysis areas SNF9-13, SNF16, SNF18, SNF19, SNF24, and SNF25) are used to consider effects to lynx and wolf and other wildlife. Lynx analysis unit boundaries remain the same over time, making it possible to detect changes in habitat and disturbance factors over short-term and long-term timeframes. Cumulative effects analysis will take into consideration actions occurring on other ownerships and next to the Boundary Waters Canoe Area Wilderness, Mining Protection Areas, and eligible Wild River Segments.

Analysis Area for Future prospecting permits and operating plans
The wildlife analysis area for future prospecting permits includes all NFS lands managed by the SNF except for lands within the Boundary Waters Canoe Area Wilderness Area, Mining Protection Areas, and eligible Wild River Segments. This analysis is divided into analysis of areas of low mineral exploration interest and moderate to high mineral exploration interest (See Project Mineral Exploration Interest Levels – Map 4) and includes all lynx analysis units in the analysis area which overlap moderate and high mineral exploration interest levels (lynx analysis units SNF9-SNF43). Cumulative effects analysis will take into consideration actions occurring on other ownerships and next to the Boundary Waters Canoe Area Wilderness, Mining Protection Areas, and eligible Wild River Segments.

3.8.1.2 Indicators for Measuring Impacts

Indicators vary by species and are included in the Biological Assessment (USFS 2010a) for federally endangered, threatened, proposed, or candidate species and the Biological Evaluation (USFS 2010b) for Regional Forester Sensitive Species. Species' analyses are grouped by indicator (Project file: Road and habitat analysis).

Miles of temporary roads open for drilling activities

This indicator considers both all-season use and winter-only use. This indicator does a good job of highlighting the difference between the alternatives because it allows a comparison of disturbance to breeding animals. Miles of temporary roads also serves as a surrogate for the level of activity associated with all activities because it averages the miles of temporary road needed by operating plan to access drill sites and complete geophysical exploration along with the assumption that activities will take place while the temporary road is open. Species analyzed for effects from temporary roads are gray wolf, Canada lynx, bald eagle, Le Conte's sparrow, wood turtle, and Laurentian tiger beetle.

Seasonal road use

Seasonal road use is a good indicator because it reflects disturbance to wildlife whether during the breeding season or during critical hunting periods. Species analyzed for effects from potential effects of seasonal road use are Canada Lynx, gray wolf, and bald eagle.

Habitat continuity

Habitat continuity is a good indicator because it evaluates changes to habitat at scales either Forest-wide, by lynx analysis unit, or at the local level which can be used to evaluate effects whether populations of native, threatened and sensitive species are viable. Forest disturbance such as wind storms and fire frequently create small patches of young forest within both same-age or mixed-age forest canopy on the Superior National Forest. Although the openings created by this project would not have all the features of natural disturbances, for example, they will not include tip-up mounds from uprooted trees; canopy closure will be used for evaluating impacts to forest vegetation since it is the most obvious change to forest structure.

3.8.2 Affected Environment

The Project Area contains a wide diversity of habitat types, including young to mature/old aged upland and lowland forest types including conifer and deciduous tree species, upland and lowland non-forested openings, and upland and lowland brush. The project area includes habitat to support all native and desired non-native wildlife species including game species such as moose, grouse and white-tailed deer. Each habitat type is widely distributed across the Superior National Forest. See Forest Plan FEIS for a full description of wildlife habitat (USDA Forest Service 2004, Section 3.3). Drill sites and access roads may be located in any of these habitat types as long as stipulations are followed and applied to protect resources.

3.8.3 Direct and Indirect Effects to Wildlife

3.8.3.1 Design Features and Mitigation Measures

In all action alternatives stipulations in Chapter 2 Section 2.4.3.6 would protect known locations of sensitive species and maintain suitable distances and activity periods outside critical breeding seasons according to species' needs. Protective boundaries are either listed in the stipulations or will be defined by a Superior National Forest biologist on a case-by-case basis depending on site-specific conditions. Pre-operational surveys for large raptors and their nests would provide protection of new nesting areas as they are located.

Clearing overgrowth on existing temporary or closed roads for drill rig passage may be required. Stipulations are in place to reduce the number of trees removed for access roads and drill sites.

All proposed temporary roads would be stabilized after geophysical and drilling operations, and permanently decommissioned and reclaimed after the holes are plugged and the drill sites are reclaimed. These temporary roads are not included on the National Forest System road inventory. All proposed temporary roads would be closed to public use after drilling operations and public use would be discouraged during drilling operations. The temporary and permanent closures, decommissioning, and reclamation would be monitored for effectiveness (see Appendix E). The Superior NF has monitored road decommissioning and has found decommissioning to be effective.

3.8.3.2 Alternative 1

Current prospecting permits and operating plans

Miles of temporary road:
No temporary roads would be created for prospecting under this decision. Temporary road construction and mileage is estimated to range from 523 to 628 miles open in any year for the next 20 years. This range is 58percent to 67 percent of the miles analyzed in the Forest Plan FEIS.

Season of activities:
About 50 percent of the current ground-disturbing activities for other resources may be restricted to frozen soil conditions to comply with seasonal soil stipulations. Activities that alter habitat such as timber harvest may be seasonally restricted to protect soil or to meet the objectives of the treatment. For example, some aspen stands are harvested in summer to deplete root reserves and reduce aspen's competitive advantage, while lowland spruce may be harvested in winter under frozen soil conditions to reduce soil compaction.

Habitat continuity:
Habitat continuity would not change and would fall within the Forest-wide range listed below.

Future prospecting permits and operating plans

Miles of temporary road:
Forest-wide temporary road construction and mileage is estimated to range from 523 to 628 miles open in any year for the next 20 years. This range is 58 percent to 67 percent of the miles analyzed in the Forest Plan FEIS helping to limit the effect on wildlife, especially lynx and wolves from human disturbance facilitated by roads.

Season of activities:
Effects from season of activities would be the same as those in Current operating plans, above.

Habitat continuity:
Habitat continuity, the opposite of fragmentation, in LAUs outside the BWCAW ranges from 75 percent to 96 percent on SNF land (US Forest Service 2010a).

3.8.3.3 Alternatives 2-4

Current prospecting permits and operating plans

Large raptor breeding habitat would be protected around known breeding sights in current permit areas through avoidance as required by resource stipulations. There is currently one known goshawk territory in the current permit and operating plans area.

Miles of temporary road:
Additional temporary road mileage created under the current applications is estimated to range from no miles to 157 miles depending on the year since the decision. This would be a range of 58 percent to 80 percent of the Forest Plan FEIS estimated mileage over the life of the project (See Figure 33). The intersections of new, closed temporary roads and roads open to the public are likely to become available as parking areas for 1-4 cars (Figure 32). This may lead to an indirect increase in public access to the lands around drill pads and may increase hunting or human disturbance of wildlife in the area.

Some use by the public is expected even though roads will be closed to motorized use and road use would increase because of prospecting activities. Legal access on foot may increase, especially during the hunting season. Game species would be subject to current hunting regulations, protecting their population status. Lynx and wolf individuals, family groups, and wolf packs are known to use the current application areas, would be more likely to encounter humans in the current prospecting areas, and may be subject to more human disturbance or human caused mortality because of additional roads.

Some use by the public is expected even though roads will be closed to motorized use and road use would increase because of prospecting activities. Legal access on foot may increase, especially during the hunting season. Game species would be subject to current hunting regulations, protecting their population status. Lynx and wolf individuals, family groups, and wolf packs are known to use the current application areas, would be more likely to encounter humans in the current prospecting areas, and may be subject to more human disturbance or human caused mortality because of additional roads.

Figure 32. Temporary road closure on Highway 1 showing boulders and room to park four vehicles.

Season of activities:
Activities would take place year round, but about about 60 percent of the ground-disturbing activities in Alternatives 2-4 may be restricted to frozen or dry soil conditions to comply with seasonal soil stipulations. The effects would be similar to those assumed in the Forest Plan, creating compacted snow conditions that may give Canada lynx competitors an advantage during the winter on 60 percent of the roads.

Habitat continuity:
Habitat continuity will not be reduced by the small openings created for drill pads. Drill pad and temporary road openings are similar to fine-scale forest canopy gaps created by either an individual tree or a few neighboring trees falling within the forest matrix. Canopy gap creation because of tree disease, insect mortality, and wind is a vegetation dynamic common to the Superior National Forest. Habitat continuity would continue to be provided in the Boundary Waters Canoe Area Wilderness.

Stand openings may allow increased solar penetration, rapid drying of fuels and increase air movement (Heinselman 1973). At higher latitudes, such as in the Superior National Forest, the forest floor of the smallest canopy gaps is often shaded by surrounding trees, limiting regeneration to shade tolerant plant species such as spruce and fir. Larger openings of where sunlight reaches the forest floor would favor regeneration of shade-intolerant tree species such as aspen, paper birch, or red pine.

The majority of canopy gaps are of small size in all but the oldest forests (Kneeshaw and Bergeron 1998). Gap creation rates range from 0.2 percent to 2.0 percent of a stand per year, which are similar to drill pad and temporary road disturbance rates for this project. Canopy gaps can create opportunities such as black-throated blue warbler nesting sites, increased berry production for wildlife food, and young trees and shrubs which provide higher nutrient winter browse for deer and moose. Raspberries may increase in the openings and provide food for bears, wolves and other animals.

Future prospecting permits and operating plans

Miles of temporary roads:
Additional temporary road miles created by future prospecting permits are estimated to range from no miles to 135 miles depending on the year since the decision. This would be a range of 58 percent to 80 percent of the Forest Plan FEIS estimated mileage over the life of the project.

Effects of an increase in temporary roads would be similar to that described under Current operating plans but may occur on many more acres throughout the project area, most likely in the high and moderate mineral interest areas.

Season of activities:
Activity by season would be the same as in Current operating plans.

Habitat continuity:
The effects would be the same as in Alternatives 2-4.

Summary of Effects

Temporary road mileage would remain within the parameters expected under the Forest Plan FEIS and may affect wildlife but is not expected to lead to a trend toward listing or limit population viability of sensitive species. Seasonal activities would not change from existing condition and are not expected to have negative impacts to sensitive species or game species.

The increase in temporary road miles may increase human disturbance of lynx and wolves and could lead to increased mortality, but those mileage increases are within the expected amounts in the Forest Plan Final Environmental Impact Statement (USDA Forest Service 2004). Implementation of current and future operating plans in Alternative 2, 3, or 4 **may affect, and is likely to adversely affect individual lynx and wolves** because of the potential for increased human disturbance as a result of increased temporary road miles. Some individuals may be impacted near activity areas in this project area, but effects to the population will be discountable or insignificant. Implementation of Alternatives 2-4 is **not likely to adversely affect lynx or wolf critical habitat**. Alternatives 2-4 habitat and seasonal activities are **not likely to adversely affect lynx and wolves**. Current and future permits would have no effect on wolf, lynx, and respective critical habitat because no on the ground actions are allowed under a permit until an operating plan has been approved. Alternative 5

3.8.3.4 Alternative 5

Current and future prospecting permits and operating plans

Miles of temporary road:
One difference in Alternative 5 is that there would be no summertime access using barges and the use restrictions would mean that there would be likely be more winter or frozen road use than summer road use than in Alternatives 2-4.

Season of activities:
Activities would take place from November 1 through April 30 in Alternative 5. All operations would be active during the snow season in order to complete the full suite of permitted activities and may take more years to complete, impacting wildlife populations for more winters than Alternatives 2-4. Limiting operations to November 1 through April 30 would result in a decrease in the competitive advantage of Canada lynx due to the increase in snow compaction in the project area. It would, however, be beneficial to lynx and other wildlife species by reducing disturbance during breeding seasons. Increased public foot-

travel access on winter roads during hunting and trapping seasons could negatively impact wolves and lynx by potentially increasing mortality.

Habitat continuity:
The effects would be the same as in Alternatives 2-4.

Future prospecting permits and operating plans

Miles of temporary road:
The effects would be the same as in current prospecting permits and operating plans.

Season of activities:
The effects would be the same as in current prospecting permits and operating plans.

Habitat continuity:
The effects would be the same as in Alternatives 2-4.

Summary of Effects

Temporary road mileage would remain within the parameters expected under the Forest Plan FEIS and **may affect wildlife but is not expected to lead to a trend toward listing or limit population viability of sensitive species**. The increase in temporary roads may increase human disturbance of individual lynx and wolves and could lead to increased mortality. Implementation of Alternative 5 **may affect, and is likely to adversely affect individual lynx and wolves** because of the potential for increased human disturbance as a result of increased temporary road miles, but effects to populations are expected to discountable. Implementation of Alternative 5 is **not likely to adversely modify lynx or wolf critical habitat**.

3.8.4 Cumulative Effects

3.8.4.1 Area of Analysis

The wildlife analysis area for cumulative effects includes all lands within the boundary of the Superior National Forest including the Boundary Waters Canoe Area Wilderness, Mining Protection Areas, and eligible Wild River Segments. This area was selected because it provides a large enough area to encompass wildlife that rely on landscape-scale habitat factors such as distribution, distributed and for wildlife population distribution and habitat components in northeastern Minnesota.

Alternative 1

There would be no cumulative effects in Alternative 1 because there would be no activities under this alternative.

Alternatives 2-4

Miles of temporary road:
Temporary road mileage created by current and future applications as well as mileage already on the ground or proposed in other SNF projects is estimated to range from 523 miles to 860 miles depending on the year since the decision. Since 2004 approximately 34 miles of road have been decommissioned. In addition, approximately 109 miles of roads approved for decommissioning but not yet accomplished, were identified in eight NEPA decisions between 2004 and 2009. When these planned projects are fully implemented, a total of 143 miles of roads will have been decommissioned. The total for all decommissioned road closure mileage, the estimated mileage for this project, and the estimated mileage for temporary road mileage under special use permits would be a range of 58 percent to 95 percent of the

Forest Plan FEIS estimated mileage over the life of the project (Figure 33). Temporary road creation on other ownerships may increase as human population levels and resource demands increase but any mileage that the Superior National Forest would be responsible for is included in the special uses mileage.

Road closure effectiveness for similar prospecting activities on the SNF has been monitored and found to be effective. Various approved hardrock and mineral material operating/management plans were monitored for compliance at 53 sites in 2008, according to the latest data (USFS 2010c). Overall, monitoring of mineral activities on the SNF showed compliance for the various activities except for a few issues that were quickly resolved once they were identified. Monitoring showed that closures were effective at preventing motor vehicle use by the public on all roads that were visited.

Clearing of grown-in OML 1 and 2 roads may allow a temporary increase in legal public use but, if not used frequently, roads close with vegetation that restricts motorized use. It is anticipated that the impacts of opening an OML 1 road for prospecting will be no different than opening it for other activities such as timber harvest. Most of these roads are spurs that do not invite ATV riders because the roads are short, do not provide a loop trail, and do not go to scenic destinations. Many of the OML 1 and 2 roads that will be used for prospecting begin at roads that are not legal for ATV use, lowering the chance of legal use. Illegal hunting may be reduced by the presence of other people, such as prospecting equipment operators, being in the area (S. Duffy, Pers. Comm. 8/31/2010).

Season of activities:
Activities would take place year round, but about 60 percent of the activities in Alternatives 2-4 may be restricted to frozen or dry soil conditions to comply with seasonal soil stipulations. The effects would be similar to those assumed in the Forest Plan, creating compacted snow conditions that may give Canada lynx competitors an advantage during the winter on 60 percent of the roads. Seasonal actions on other ownerships are expected to remain the same as current conditions.

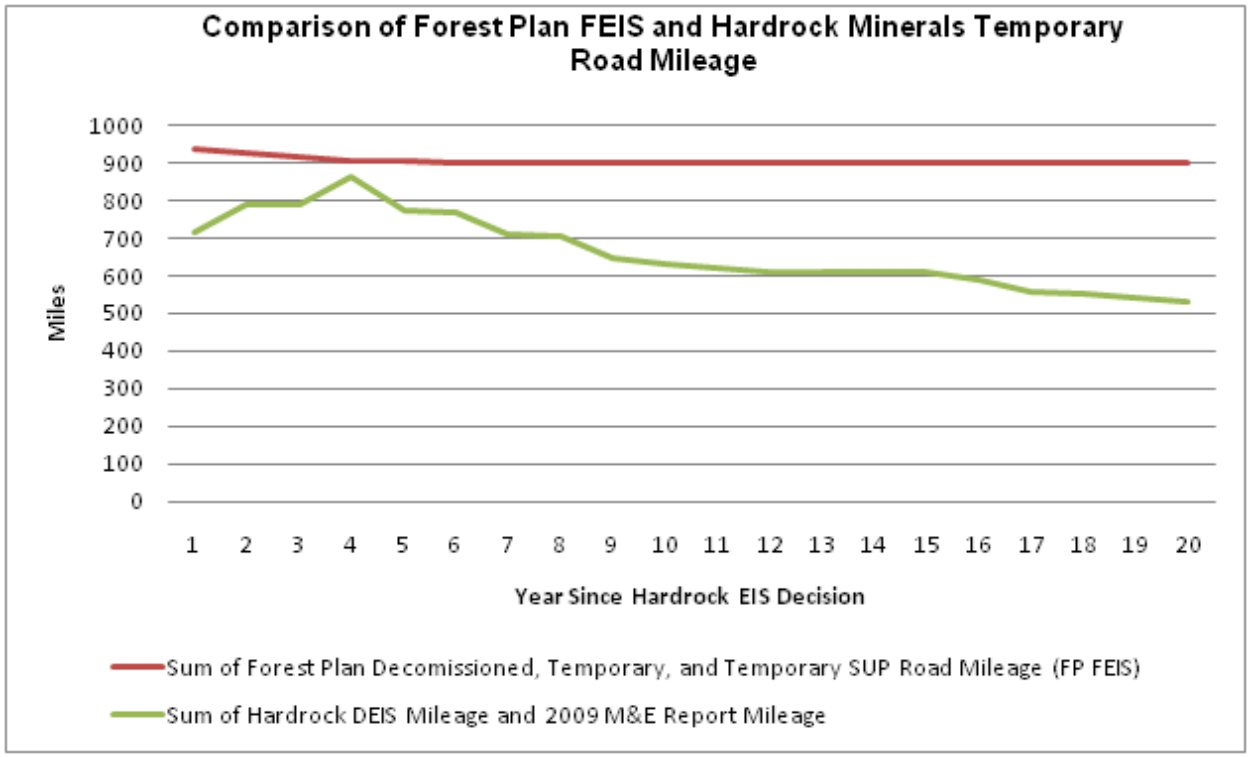


Figure 33. Comparison of Forest Plan FEIS and Hardrock Minerals temporary road mileage

Habitat Continuity:
The effects would be the same as in Alternatives 2-4.

Other Issues:
Sediment from drilling fluids will be buried at the site and unavailable to wildlife when activities are completed. During drilling operations wildlife are unlikely to use the sight because of the presence of the equipment operators. Planning and stipulations protect rare and sensitive species (Project File, BE).

The Boundary Waters Canoe Area Wilderness, Mining Protection Areas, and eligible Wild River Segments will continue to contribute to wildlife habitat. Edge effects may occur where activities that clear vegetation are next to the boundaries of these areas but effects are considered minor because only small portions of the boundary may be affected temporarily. The only sensitive species affected by edges are heather vole and olive-sided flycatcher. Olive sided flycatchers may benefit from edge-induced effects near lowlands and heather voles may be temporarily displaced, but population viability of wildlife species would not change on the Forest because of activities next to these areas. Known locations of these species would be protected with buffers.

Alternative 5

Miles of temporary road:
One difference in Alternative 5 is that there would be no summertime access using barges and the use restrictions would mean that there would be likely be more winter or frozen road use than summer road use than in Alternatives 2-4.

Season of activities:
Activities would take place from November 1 through April 30 in Alternative 5. It is likely that all operations would be active during the snow season in order to complete the full suite of permitted activities. Limiting operations to November 1 through April 30 would have a decrease in the competitive advantage of Canada lynx due to the increase in snow compaction in the project area. It would, however, be beneficial to lynx and other wildlife species by reducing disturbance during breeding seasons. Increased access on winter roads during hunting and trapping seasons could negatively impact wolves and lynx and lead to mortality. Seasonal actions on other ownerships are expected to remain the same as current conditions.

Other issues:
Wildlife habitat affected in Alternative 5 would be the same as in Alternatives 2-4.

Habitat Continuity:
The effects would be the same as in Alternatives 2-4

3.8.5 Monitoring Recommendations

Monitoring recommendations for all resources can be found in appendix E.

3.9 Non-Native Invasive Plants

3.9.1 Introduction

During project scoping, the public expressed a concern that mineral prospecting and associated activities have the potential to increase the risk of spread of non-native invasive plants, in particular into the Boundary Waters Canoe Area Wilderness (BWCAW). Ground disturbance associated with the prospecting activities could create conditions favorable to the introduction or spread of non-native invasive plants.

This potential effect is analyzed in this section, which describes the non-native invasive plants that are currently known to exist in the project area, as well as the effects of the alternatives on non-native invasive plants. This analysis considers 46 permit application areas, 21 site specific operating plans, and future permit applications received for mineral exploration in the project area.

Non-native invasive plants are generally defined by two characteristics: 1) they were not historically (i.e., pre-European settlement) present in a region's ecosystems, and 2) they have the ecological ability to invade and persist in native plant and animal communities, and often become dominant species at the expense of native species.

3.9.1.1 Methodology

The following assumptions cover this analysis. Although only federal minerals are covered by the analysis, all National Forest System lands within the analysis area boundary are included in the direct and indirect effects analysis because access roads and drill pads could be placed on any federal surface lands in order to access federal minerals. For similar reasons, all non-Forest Service surface lands in the analysis area boundary are included in the cumulative effects analysis. Also, although mineral exploration could occur anywhere within this analysis area, the majority of mineral exploration and subsequent effects would be in the Duluth Complex (see DEIS Chapter 2 – Assumptions for the Proposed Action and All Action Alternatives).

3.9.1.2 Indicators for Measuring Impacts

Two indicators are used to analyze the effects of the alternatives on non-native invasive plants; their values are displayed in Table 33.

Indicator 1: Acres of non-native invasive plants known from the 46 permit application areas and one permit extension.

This indicator describes the acreage of known infestations within the 46 permit application areas. This indicator is useful for the analysis because it helps describe the abundance of invasives at the locations where mineral exploration has been proposed.

Indicator 2: Total estimated maximum ground disturbance over twenty years.

This indicator describes an upper limit of ground disturbance over the lifetime of this project. Because of the correlation between ground disturbance and spread of invasives, this indicator is useful because it describes the maximum area where some weed spread could occur. This indicator does not describe the maximum amount of non-native invasive plant infestation, which is likely to be much less.

3.9.1.3 Spatial and Temporal Context for Effects Analysis

The area covered by the analysis of direct and indirect effects includes all lands administered by the Superior National Forest outside of the BWCAW and the Mining Protection Area, as well as a one-mile band of National Forest lands within the adjacent area of the BWCAW. This analysis area was selected because 1) it includes all possible National Forest lands where drilling or temporary road construction could occur, and these are the primary project activities that could cause the direct and indirect effects to non-native invasive plants, and 2) because it includes adjacent BWCAW lands where concerns have been raised about weed spread and where indirect effects of project activities on non-native invasive plants could occur. Although no project activities are proposed within the BWCAW, the one-mile band of BWCAW lands represents a conservative analysis area boundary for non-native invasive plant effects; wind and wildlife would be the main vectors for weed spread into the BWCAW, and these vectors would be unlikely to actually disperse non-native invasive plants that far.

The area covered by the cumulative effects analysis includes lands of all ownerships within the same geographic area as described above. This cumulative effects analysis area was selected because non-federal lands within the project area boundaries share a number of physical characteristics (e.g. soils, landforms, etc.) with adjacent National Forest lands. These characteristics influence land uses, which in turn influence invasive plant distribution throughout the area, so this boundary makes a logical analysis unit for cumulative effects.

The time period for direct and indirect effects is from the time project activities begin to ten years after project activities cease. No effects of project activities will occur until project implementation begins, and project impacts should diminish within ten years of when project ground disturbance ends. This ten year lag period is due to invasive plants that may start growing at the end of exploration activities, but are then either gradually shaded out as succession progresses or diminish because they have been treated. The time period covered by the cumulative effects analysis is from the 1920s to ten years after project activities cease. The 1920s were chosen because that was when some of the first documented populations of NNIP were being introduced at horse logging camps in the Superior NF (G. Kuyava pers. comm. 2005). The ten year lag period was chosen for the same reason as stated above for direct and indirect effects.

3.9.2 Affected Environment

Table 32 displays the non-native invasive plants that are known to occur in the analysis area. This list was developed based on results from non-native invasive plant inventory data collected on the Superior National Forest since 2002. Additional non-native plant species can be found in the analysis area but they do not appear in Table 32 because they are not considered invasive under most conditions.

Non-native invasive plants are typically spread in several ways such as vehicle wheels or bodies, livestock, wildlife, boat traffic, or human foot traffic. Non-native invasive plants typically enter an area along a corridor of ground disturbance such as a road or trail, and depending on numerous factors such as shade tolerance, degree of invasiveness, dispersal mechanisms, and habitat availability, may or may not spread into adjacent forested or non-forested ecosystems. Typical areas that have some invasive plant infestation in the analysis area are roadsides, trails, portages, gravel pits, parking areas, campgrounds, helispots, and administrative sites. The majority of non-native invasive plant infestations on the Superior National Forest are small patches (less than 0.01 acres) that are scattered along travel corridors.

Mesic forested sites with shady understories on the Superior National Forest are fairly resistant to invasion by most of the non-native invasive plants found on the Forest. Invasive plants that disperse into such plant communities tend to quickly lose in competition with native shrubs, forbs, and trees. However, some non-native invasive plants are exceptions to this general observation. For example, goutweed, Tatarian honeysuckle, and Siberian peabush can thrive in the understory of mesic native plant communities. These species are relatively uncommon in the analysis area; there are only approximately 2 acres of these species in the analysis area.

Conversely, there are a number of native plant communities typical of droughty, shallow-soiled sites that are susceptible to invasion by non-native invasive plants. These sites have less abundant shrub and forb layers, and as a result are more likely to be invaded by invasives, especially if some ground disturbance occurs. These types of sites correspond to Ecological Landtypes (ELTs) 7, 9, 11, 16, 17, and 18. Most susceptible among these are rock outcrops, which correspond to ELT 18 (ELT 18 is defined as zero to eight inches of soil over bedrock.). Approximately 1 percent of the analysis area is mapped as ELT 18.

Table 32. Non-native invasive plants known in the project area

Species	MN Status[a]	Life History/Habitat Summary	Acres[b]	Ecological Risk[c]
Goutweed *Aegopodium podagraria*	No status	Perennial herb, spread by rhizome primarily. Escaped ornamental. (Czarapata 2005)	0.001	High
Plumeless thistle *Carduus acanthoides*	P	Annual or biennial herb, spread by seed, primarily found in disturbed uplands (Czarapata 2005)	0.002	Moderate
Siberian peabush *Caragana arborescens*	No status	Perennial shrub, can spread by seed or vegetatively, used as reclamation species (Saskatchewan Purple Loosestrife and Invasive Species Project 2005)	1.7	High
Spotted knapweed *Centaurea maculosa*	S	Short lived perennial, spread entirely by seeds, invades disturbed areas, & droughty, shallow soils (Wilson and Randall 2002)	63.3	High
Canada thistle *Cirsium arvense*	P	Perennial, spread by seed and rhizome, invades disturbed sites, and areas around wetlands where the water level fluctuates (Lym and Christianson 1996)	72.1	High
Bull thistle *Cirsium vulgare*	P	Biennial, spread by seed, occupies disturbed sites (Lym and Christianson 1996)	3.7	Low
Leafy spurge *Euphorbia esula*	P	Aggressive perennial, spread by seed and rhizome, dry to mesic uplands (Lym and Zollinger 1995)	1.2	High
Cypress spurge *Euphorbia cyparissias*	No status	Moderately aggressive perennial spread by rhizome and seed (Czarapata 2005)	1.8	Moderate
Orange hawkweed *Hieracium auranticum*	S	Perennial, spread by seed and rhizome, widespread in disturbed upland sites (Callihan et al. 1982)	550	Moderate
Yellow hawkweeds *Hieracium* sp.	No status	Several similar non-native invasive yellow hawkweeds occur in Project Area; perennial, spread by seed and rhizome, widespread in disturbed upland sites (Czarapata 2005)	550	Moderate
St. Johnswort *Hypericum perforatum*	No status	Perennial, spread by seed and rhizome, dry to mesic uplands (Fitzsimmons and Burrill 1993)	7.4	Moderate
Oxeye daisy *Leucanthemum vulgare*	S	Perennial, spread by seed and rhizome, widespread in disturbed upland sites (Czarapata 2005)	550	Moderate
Lupine *Lupinus polyphyllus*	No status	Perennial herb spread mainly by seed; primarily found in roadsides and open areas (Czarapata 2005)	1.2	Low
Purple loosestrife *Lythrum salicaria*	P	Aggressive perennial; spread by seed and rhizome; wetlands and road ditches (MNDNR 2006)	15.5	High
Common tansy *Tanacetum vulgare*	S	Perennial; spread by seed and rhizome; invades disturbed uplands, & droughty shallow soils (Voss 1996)	114.7	Moderate
Tatarian honeysuckle *Lonicera tatarica*	No status	Perennial shrub spread primarily by bird dispersed berries, can colonize in forest areas (Czarapata 2005)	0.2	High

a - P = Prohibited noxious weed (Minnesota Rules 1505.0730). Prohibited noxious weeds must be controlled or eradicated as required in Minnesota statutes. S = Secondary noxious weed. These species may be added to the county prohibited or restricted list at the discretion of counties (Minnesota Rules 1505.0640).
b - Estimated acres based on miles of Objective Maintenance Level 1-5 roads outside of Mining Protection Area.
c - Species represents either a low, moderate, or high threat to natural communities (USDA Forest Service 2005e).
Risk given in table represents risk in most susceptible habitat.

In general, the analysis area has a relatively low level of non-native invasive plant infestation (Table 32). The total known infestation acreage is approximately 1,933 acres, or about 0.2 percent of Forest Service ownership in the analysis area. Orange hawkweed, yellow hawkweeds, and oxeye daisy are the most abundant non-native invasive plants. They are found along nearly every road in the analysis area and pose a moderate ecological risk to native plant species. The next most abundant species are tansy, Canada thistle, and spotted knapweed. Typically infestations of these species are small and widely scattered along roads, but many roads have at least one of the three species present. The remaining invasive plants are much less abundant. The low risk species, bull thistle and lupine, do not pose enough of a threat to native plant communities to warrant consideration in the analysis (USDA Forest Service 2005e).

3.9.3 Direct and Indirect Effects

The following table summarizes effects for all alternatives. The following sections provide the detailed analysis.

Table 33. Indicators for non-native invasive plant analysis

Indicator	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
1. Acres of non-native invasive plants known from the 46 permit application areas and one permit extension	0	6.6	6.6	6.6	6.6
2. Total estimated maximum ground disturbance over 20 years	0	3,725 ac	3,725 ac	3,725 ac	3,725 ac

3.9.3.1 Alternative 1 – No Action

Although all the indicators are zero for Alternative 1 and no ground disturbance would occur, this alternative would still have direct effects on non-native invasive plants. Any non-native invasive plant in the analysis area would continue to exist and would probably be spread in the analysis area along typical corridors for weed dispersal such as roads, trails, gravel pits, and parking lots. Any public or administrative vehicle use in the analysis area (e.g., passenger vehicles, trucks, road maintenance equipment, ATVs) would have the potential to spread non-native invasive plants. Wildlife and human foot traffic in the analysis area would also have the potential to spread non-native invasive plants, but the likelihood of spread by these means would be lower than from vehicle use. Overall, this alternative would have the least amount of ground disturbance and, therefore, the least risk of weed spread.

3.9.3.2 Alternative 2

Current and future prospecting permits and operating plans

Indicator 1: Acres of non-native invasive plants known from the 46 permit application areas. There are approximately 6.6 acres of inventoried non-native invasive plants that occur within the permit application/extension areas (Table 33); of these, 0.005 acres of infestations occur on access roads proposed for use by the 21 site specific operating plans. Ground disturbance associated with project activities, such as temporary road construction/reconstruction, drill pad construction, and sump excavation, would likely cause known infestations to spread where ground disturbance occurs. However, for these permit application/extension areas, the amount of non-native invasive plant spread would be limited by the resource stipulations. For the 46 permit applications, 21 site specific operating plans, and for future permit applications, the project impacts to non-native invasive plants are described below.

Some species, like oxeye daisy and orange and yellow hawkweed, are already widespread along roads in the project area, and would probably quickly colonize the sides of new upland temporary roads. However, the ecological consequences of the spread of these species would be minor, since they primarily stay on roadsides and do not compete well with native upland vegetation.

Other species, such as Canada thistle and spotted knapweed, are not as common in the analysis area, but have a high ecological risk (Table 32). These species can outcompete native vegetation and degrade wildlife habitat. Project activities will probably cause some of these species to spread, and most new infestations would be confined to the disturbed areas. There is a risk that these species could spread to nearby undisturbed susceptible habitat (like rock outcrops or wetland edges) and degrade native plant communities.

Five other high risk species, goutweed, purple loosestrife, Siberian peabush, leafy spurge, and Tatarian honeysuckle, also occur in the analysis area. They too can cause severe ecological consequences when they spread away from roads into adjacent intact habitat. However, these species are much less abundant than Canada thistle and spotted knapweed, so resource stipulations that specify avoiding these species should limit the spread of these species to a very minor amount.

Tansy, St. Johnswort, plumeless thistle, and cypress spurge have a moderate risk of ecological consequences. Tansy is the most widespread of these invasive plants, and project activities would probably cause new infestations of tansy in disturbed areas like access roads and drill pads. The other species are much less abundant than tansy and thus have a lower chance of being spread by project activities. The ecological consequences of the spread of these species would be minor, since they primarily stay on roadsides and do not compete as well with native upland vegetation. Furthermore, roadside infestations are easier to find and manage than infestations in forested communities.

Some mineral exploration activities could occur near the edge of the BWCAW. As described above, there is a risk that project activities could cause non-native invasive plants to spread to ground that is directly disturbed by project activities. There is a much lower risk that these infestations would lead to new infestations in the BWCAW. For project activities to indirectly increase invasive plant infestations in the BWCAW, first the new non-native invasive plant infestation (for example, at a drill pad) would have to disperse (most likely via wind or wildlife) to the BWCAW, where no project activities or ground disturbance are proposed. Then invasive plants would have to establish in competition with undisturbed native vegetation, which is unlikely. A recent study of non-native plants on BWCAW portages found that non-natives were restricted to portages or within one meter of a portage (Dickens et al. 2005); they did not establish well when competing with native trees, shrubs, and forbs. Similarly, in recent monitoring of unclassified roads, no spread was observed from weed infestations along unclassified roads into adjacent undisturbed forest vegetation (USDA Forest Service 2008). For these reasons, the risk of non-native invasive plants spreading to the BWCAW as an indirect result of project activities is very low.

Indicator 2: Total estimated maximum ground disturbance over twenty years.
Over the time frame of the analysis, approximately 3,725 acres would be affected by ground disturbance associated with the project (Table 33). These activities would cause the same types of effects on invasive plants as described above. Because the project activities potentially could affect up to 3,725 acres, the scale of effects is larger for indicator 2 compared to indicator 1. Despite the larger scale, non-native invasive plants are not likely to infest every acre of disturbed ground. In a worst-case scenario, even if every one of these acres became infested, it would still only represent 0.3 percent of Forest Service ownership in the analysis area.

Current prospecting permits and operating plans

Three companies, DMC, Twin Metals, and Lehmann Exploration have submitted plans of operation for site specific exploration activities. Plans include number of drill pads and proposed access roads. For analysis purposes, it is assumed that for drill pad construction an area of 100 feet by 100 feet (slightly less than 0.25 acre) would be cleared. Also, it is assumed that roads would be 16 feet wide. The potential area of land impacted by activities proposed in the plans of operation submitted by the three companies is shown in Table 34.

Table 34. Acres impacted by exploration activities described in plans of operations submitted by DMC, Twin Metals, and Lehmann Exploration

Company	# of Drill Pads Proposed	Total Disturbance Acres Associated with Activities
DMC	60	36.4
Twin Metals	11	2.7
Lehmann Exploration	21	13.3

Ground disturbance associated with the 21 operating plans submitted by the three companies would impact approximately 52.4 total acres. These activities would cause the same types of effects on invasive plants as described further under future prospecting permit and operating plans under Indicator 1.

Several factors would reduce the potential impacts of non-native invasive plants on other resources. First, the resource stipulations include avoidance, equipment cleaning, and treatment measures that would reduce the potential for spread of non-native invasives. Second, any new roads would be temporary roads. After road use is complete, the temporary roads would be decommissioned and reclaimed. Non-native invasive plant species that occur on such a road, if not treated, would decline in abundance as native trees and shrubs begin to colonize the road and shade out the invasives. Lastly, ongoing non-native invasive plant management on the Superior National Forest would continue to reduce existing invasive plant infestations. Some of the potential effects of invasive plants in the analysis area would be offset by the 92 and 172 acres of non-native invasive plants that were treated by herbicide and handpulling in 2008 and 2009, respectively. Ongoing non-native invasive plant treatments would help reduce the risk of future non-native invasive plant spread.

3.9.3.3 Alternatives 3 and 4

Because Alternatives 3 and 4 only affects potential noise levels but not any assumptions about acres of disturbance, number of drill pads, etc., the indicators as well as the direct and indirect effects of Alternatives 3 and 4 would be the same as Alternative 2. As with Alternative 2, the potential effects of weed spread under Alternatives 3 and 4 would be minimized by the same factors.

3.9.3.4 Alternative 5

There would be less risk of non-native invasive plant spread under Alternative 5 than under Alternatives 2, 3, or 4. Although the indicators for Alternative 5 are the same as for Alternatives 2, 3, and 4, Alternative 5 would only permit exploration activities from November 1 through April 30. Although the assumptions about acres of disturbance, number of drill pads, etc., would be the same, the majority of exploration activity would occur under frozen ground conditions with snow on the ground because of the seasonal restriction. For this reason, there would be less soil disturbance and hence less opportunity for non-native invasive plant spread. The risk for spread of invasives would still be higher for Alternative 5 than Alternative 1 – No Action because more ground disturbance would occur under Alternative 5 than

Alternative 1. The potential effects of weed spread under Alternative 5 would be minimized by the same factors as described for Alternatives 2, 3, and 4.

3.9.4 Cumulative Effects

See DEIS Appendix C (past, present, and reasonably foreseeable future actions) that lists the projects considered for the cumulative effects analysis.

The cumulative effects from the prospecting activities associated with this project on non-native invasive plants would be negligible and would not differ much between Alternatives 1, 2, 3, 4, and 5. Some would be negative effects and others would be beneficial effects. Past actions influenced the composition and distribution of non-native invasive plants in the cumulative effects analysis area. For example, development of a transportation system (i.e. roads and railroads) provided corridors for the introduction and spread of these species. Mixed land ownership patterns in the analysis area have also contributed to development of the transportation system and invasive plant spread. Most non-native invasive plant species, like spotted knapweed, were introduced unintentionally. Cumulatively, these past actions influenced the present composition and distribution of these species in the analysis area.

Non-native invasive plants would continue to spread in the analysis area under all alternatives as a result of past, present and reasonably foreseeable actions on National Forest and non-National Forest System lands. Past fuels and vegetation management projects in the analysis area (see Table C-58) have resulted in small amounts of non-native invasive plant spread. The effects of non-native invasive plants would continue to be concentrated in developed areas (e.g. roadsides, gravel pits) and not undeveloped forestlands. For example, in 2007 monitoring of harvested stands treated under the Virginia EIS (Laurentian Ranger District) found only 0.1 acres of new infestations on skid trails in harvest units, but no infestations within the regenerating stands themselves (USDA Forest Service 2008). It is likely that the past and present vegetation management projects listed in Table C-58 would have similar patterns of invasive plant spread. Past, present, and reasonably foreseeable vegetation management on state, county, and private lands in the analysis area probably resulted in small amounts of non-native invasive plant spread similar to that documented by monitoring described above. Cumulatively these actions would probably contribute a small amount to invasive plant spread for each alternative.

Another past, present, and future action in the analysis area that would result in increased levels of infestations is road building. Temporary and permanent road construction, whether associated with vegetation management, exploratory mineral drilling, or mineral extraction projects (Table C-58), would lead to increases in non-native invasive plants. The pattern of invasive plant spread would likely be similar to the existing pattern described above in the Affected Environment – numerous small weed patches scattered along roadsides. Cumulatively, road building would probably contribute a small amount to invasive plant spread for each alternative.

In contrast, road decommissioning completed as part of past, present, or future projects in the analysis area would help decrease levels of non-native invasive plant infestations. Road decommissioning associated with different vegetation management projects and the Forest-wide Travel Management Project (Table C-59) would allow wildflowers, shrubs, and trees to eventually colonize and reduce levels of invasive plants that may exist on road corridors. Road decommissioning would probably contribute to a small decrease in invasive plant infestations for each alternative.

Minerals projects, whether ongoing exploratory drilling, gravel pit development, or possible mineral extraction (Table C-58) in the analysis area could also lead to a small amount of non-native invasive plant spread associated with each project. The pattern of invasive plant spread would likely be similar to the existing pattern described above in the Existing Condition – numerous small weed patches scattered along

roadsides. Cumulatively, minerals projects would probably contribute a small amount to invasive plant spread for each alternative.

The Travel Management Project (Table C-58) could also contribute to non-native invasive plant spread in the analysis area through designation of some off-highway vehicle routes, and reduce NNIP plant spread through road decommissioning. The pattern of invasive plant spread would likely be similar to the existing pattern described above in the Existing Condition – numerous small weed patches scattered along roadsides. Cumulatively, the Travel Management Project would probably contribute a small amount to invasive plant spread for the selected alternative.

Herbicide spraying of non-native invasive plants occurred on 92 acres of infestations spread over 1,500 sites in the analysis area in 2008, and on 172 acres of infestations spread over 3,200 sites in 2009. This is a beneficial effect with respect to non-native invasive plant spread. Herbicide spraying was authorized on April 27, 2006, by Forest Supervisor Jim Sanders, who signed a decision to implement a Forest-wide NNIP management EA (USDA Forest Service 2006). Similar treatments would continue in the future. Such treatments would minimize impacts from non-native invasive plant spread directly, indirectly, and cumulatively caused by project activities.

Spatially, nearly all of the cumulative non-native invasive plant impacts (both negative and positive) in the analysis area would occur outside of the BWCAW. All of the timber harvest, road, minerals, and Travel Management projects described above would be outside the BWCAW, and the small levels of cumulative impacts of these activities on non-native invasive plant spread would be seen outside the BWCAW. In contrast, one of the beneficial cumulative impacts (invasive plant management) would also occur inside the BWCAW (non-native invasives are hand-pulled in the BWCAW not sprayed). As described above (in Direct and Indirect Effects, Alternative 2), non-native invasive plants would need to establish in proximity to the BWCAW, disperse to the BWCAW, and then establish in the BWCAW where no ground disturbance would be occurring in order for there to be cumulative non-native invasive plant impacts on the BWCAW. As discussed in Direct and Indirect Effects-Alternative 2, the likelihood of this chain of events happening is low.

It is difficult to quantify a threshold for cumulative effects of non-native invasive plants. One way to approach this is to consider the total amount of higher susceptibility habitat (i.e. ELT 7, 9, 11, 16, 17, 18) in the analysis area relative to how much is occupied by invasive plants. There are 378,549 acres of higher susceptibility habitat in the analysis area, and of that, 807 acres (0.2 percent) are occupied by non-native invasive plants. There is nothing to suggest that the pattern of non-native invasive plant spread resulting from the Federal Hardrock Mineral Prospecting Permits project would be different than what it is currently (i.e., numerous small weed patches scattered along roadsides). Given this, and that the percentage is so low to start with, it is very unlikely that enough non-native invasive plant spread would take place to raise the percentage some substantial amount, say to 10 percent. The cumulative spread of weeds caused by the Federal Hardrock Mineral Prospecting Permits project and other projects would not likely reach any threshold that could cause large environmental impacts.

Summary of Effects

It is not possible to quantify the amount of future non-native invasive plant spread by alternative because we cannot predict the location or extent of new infestations. However, we can describe the general risk of non-native invasive plant spread by alternative. When direct, indirect, and cumulative effects (both negative and beneficial cumulative effects) are considered together, Alternative 1 emerges as the alternative with the lowest risk of non-native invasive plant spread and subsequent negative impacts, mainly because no ground disturbance is proposed. Alternative 5 has a low risk of non-native invasive

plant spread and impacts. Alternative 2, 3, and 4 have a slightly higher risk of non-native invasive plant spread and negative impacts, and the risk is identical for each of these alternatives.

3.9.5 Monitoring Recommendations

Monitoring recommendations for all resources can be found in appendix E.

3.10 Roadless

3.10.1 Introduction

This section includes information on past roadless inventories and current direction for effects analysis for inventoried roadless areas. It gives background information relating to the various inventoried roadless area identification and management direction history.

3.10.1.1 RARE II

Roadless Area Review and Evaluation II (RARE II) was a comprehensive process, instituted in June 1977, to identify roadless and undeveloped land areas in the National Forest System and to determine their general uses for both wilderness and other resource management and development.

3.10.1.2 2001 Roadless Area Conservation Rule

The 2001 Roadless Area Conservation Rule (RACR) Final EIS was published in November 2000, and the Final Rule was published in the Federal Register on January 12, 2001. The thirteen areas on the Superior National Forest that were included in the RACR FEIS were the roadless areas analyzed during the 1986 Forest Plan analysis. See Appendix C of the 2004 Forest Plan Revision FEIS for detailed information on the RACR. On the SNF RACR areas are the same areas and acres identified under RARE II.

Table 35. Roadless Area Conservation Rule areas management area allocations on the Superior National Forest

SNF RACR Areas	NFS Acres	Management Area Allocation in Modified Alternative E
Little Indian Sioux	995	General Forest - Longer Rotation
Baldpate Lake	485	General Forest - Longer Rotation
Moose Portage III	81	General Forest - Longer Rotation
Hegman Lakes	673	General Forest - Longer Rotation
Mississippi Creek	5,712	General Forest - Longer Rotation
Cabin Creek	6,068	Candidate Research Natural Area, Semi-Primitive Motorized Recreation, General Forest
Tait Lake	6,272	General Forest - Longer Rotation
Phantom Lake	6,516	General Forest
Wood Lake	568	Recreation Use in a Scenic Landscape
South Kawishiwi River	135	Recreation Use in a Scenic Landscape
Brule Lake-Eagle Mountain	12,302	General Forest, General Forest - Longer Rotation
Kawishiwi Lake to Sawbill	14,942	General Forest
Baker-Homer-Brule	6,707	Semi-primitive Motorized Recreation, General Forest - Longer Rotation
Total	**61,456**	

Table 37 shows values or features often characterize inventoried roadless areas considered in the Forest Service Roadless Area Conservation FEIS (Vol. 1, 3–3 to 3–7).

3.10.1.3 2005 State Petitioning Rule

In May 2005, the US Department of Agriculture announced the Special Areas; State Petitions for Inventoried Roadless Area Management; Roadless Area Conservation National Advisory Committee; Final Rule and Notice. This 2005 State Petitioning Rule replaced the 2001 Roadless Area Conservation Rule described above. The 2005 State Petitioning Rule applied to 30 areas on the Superior National Forest which were inventoried as roadless areas during the Forest Plan revision. Minnesota Governor Pawlenty did not file a petition under this rule which means that the Secretary of Agriculture is not re-evaluating the Management Area (MA) designations assigned to Forest Plan inventoried roadless areas as a result of the 2004 Forest Plan Revision (FPR) FEIS and Record of Decision.

In October 2006, a court ruling in California overturned the 2005 State Petitioning Rule and re-instated the 2001 Roadless Area Conservation Rule. This court ruling only applies to the Ninth Circuit and New Mexico. The state of Minnesota is in the Eighth Circuit.

In August 2008, the Federal District Court for the District of Wyoming held that the 2001 Roadless Area Conservation Rule was unlawfully promulgated in violation of the National Environmental Policy Act and the Wilderness Act. The Wyoming court rejected the Forest Service' request for narrowly tailored relief and instead declared that "the roadless rule must be set aside" and that ‘[t]herefore, the Court ORDERS that the Roadless Rule, 36 CFR §§ 294.10 to 294.14, be permanently enjoined, for the second time". As a result, in Minnesota, there is no Roadless Rule, the State Petitioning Rule still applies, and it is the current (only applicable) rule.

Although the California ruling was clarified to be in effect in the Ninth Circuit and New Mexico, understanding of roadless court rulings and roadless area issues remain unsettled and prone to change.

On May 28, 2009, Secretary of Agriculture Thomas J. Vilsack reserved final decision authority over certain forest management and road construction projects in inventoried roadless areas designated by the 2001 Roadless Area Conservation Rule. The Secretary’s Memorandum 1042-154 is intended to assure the careful evaluation of actions in these roadless areas while long term roadless policy is developed and relevant court cases move forward.

On May 28, 2010, Secretary Vilsack renewed his reservation of final decision authority over certain forest management and road construction projects in inventoried roadless areas designated by the 2001 Roadless Area Conservation Rule. It does not alter or prescribe any substantive standards for the management of such areas. Any project authorized through the process established by this Secretary's Memorandum must comply with all applicable laws, including, but not limited to, the National Environmental Policy Act.

3.10.1.4 Forest Plan Inventoried Roadless Areas

Forest Plan Inventoried Roadless Areas are lands in a National Forest that met specific criteria identified in Table 39 These criteria used in the Forest Plan Revision FEIS directly relate to those listed in FSH (Forest Service Handbook) 1909.12, 71.12 that qualify areas for inventory as lands that may have potential for wilderness recommendation. This section of the FSH states: “National Forest lands in the eastern United States (east of the 100th meridian) have been acquired over time from private ownership. Criteria for inventorying those lands that may have potential for wilderness recommendation recognize that much, if not all the land, shows some signs of human activity and modification even though they have shown high recuperative capabilities.”

Table 36. Modified Alternative E – forest roadless area inventory management area allocations

SNF Forest Plan Revision Roadless Area Inventory	NFS Acres	Management Area Allocation
Seven Beavers	5,174	Riparian Area, Candidate Research Natural Area
Picket Lake	4,097	Semi-primitive Motorized Recreation
Wolf Lake	2,661	General Forest - Longer Rotation
Echo River	1,900	General Forest - Longer Rotation, Recreation Use in a Scenic Landscape
Beaver Stream	1,277	General Forest - Longer Rotation
Lake Jeanette	1,793	General Forest - Longer Rotation
Meander Lake	753	General Forest - Longer Rotation
Urho Creek	3,573	General Forest - Longer Rotation
Little Indian Sioux[a]	995	General Forest - Longer Rotation E
Agassa Lake	2,641	General Forest - Longer Rotation, Semi-primitive Motorized Recreation
Baldpate Lake[a]	485	Longer Rotation
North Arm Burntside Lake	2,285	Semi-primitive Motorized Recreation
Greenstone Lake East	1,476	Semi-primitive Motorized Recreation
Greenstone Lake West	1,353	Semi-primitive Motorized Recreation
Big Lake	1,079	Semi-primitive Non-motorized Recreation
Wood Lake[a]	544	Recreation Use in a Scenic Landscape
South Kawishiwi River[a]	211	Recreation Use in a Scenic Landscape
Hog Lake	7,035	General Forest, Semi-primitive Motorized Recreation
Brule Lake Eagle Mountain K1[a]	589	General Forest - Longer Rotation
Brule Lake Eagle Mountain K2[a]	1,035	General Forest - Longer Rotation
Kawishiwi Lake to Sawbill[a]	1,486	General Forest and General Forest - Longer Rotation
Baker-Homer-Brule[a]	4,963	Semi-primitive Motorized Recreation, General Forest - Longer Rotation
Mit Lake	961	General Forest - Longer Rotation
Mississippi Creek[a]	5,152	General Forest - Longer Rotation
Magnetic Lake	1,119	Recreation Use in a Scenic Landscape
Gunflint Lake SE	1,003	Recreation Use in a Scenic Landscape
Brule Lake Eagle Mountain K3[a]	1,071	General Forest - Longer Rotation
Cucumber Lake	1,801	Semi-primitive Non-motorized Recreation
Mine Lake	1,129	Recreation Use in a Scenic Landscape
East Otter Lake	522	Recreation Use in a Scenic Landscape
Total	60,163	

a - Areas that are part or all of a RARE II/RACR area. See FPR FEIS Appendix C, Table C-4. RACR/RARE II Areas Not Meeting Plan Revision Roadless Inventory Criteria, page C-7.

The Forest Plan revision process, completed in 2004, required an up-to-date inventory to address roadless area management issues. At the time of the Superior National Forest plan revision, all national forests were required to evaluate those previously inventoried roadless areas (Roadless Area Conservation Rule), and other lands, which remain essentially roadless and undeveloped, and had not been designated for wilderness. Areas that met the FSH inventory criteria were evaluated and considered for wilderness study recommendation (FSH 1909.12). The Forest Plan Revision Record of Decision (pages 17 and 18)

described why the areas were not recommended for wilderness study and consequently all the inventoried areas were allocated to other MAs.

Since the ROD for the Forest Plan was signed in July 2004, any proposed site-specific project within a Forest Plan inventoried roadless area requires an environmental analysis that considers effects of the project proposal on the roadless characteristics in the area. While no mineral exploration within a Forest Plan inventoried roadless area has been proposed in the current permit applications and operating plans, it is possible that future explorations envisioned in the 20 Year Mineral Exploration Scenario (section 2.2.2.4) could be proposed within inventoried roadless areas on the SNF.

As described in Chapter 1, section 1.9.1, the interdisciplinary team did not identify potential effects to inventoried roadless areas as an issue that drives alternatives considered in detail. Roadless areas were mentioned once in one letter. The comment was about protecting special areas on the SNF including roadless areas.

This analysis of inventoried roadless areas is important because of the relatively high level of interest historically expressed by the public about potential effects to roadless areas from proposed minerals exploration activities, temporary road and drill pad development.

Table 36 lists all Forest Plan inventoried roadless areas in the SNF. Table 35 specifically lists the SNF RACR areas. The roadless areas and their corresponding MA allocation are also shown on these tables. The Forest Plan Revision FEIS analysis is in the section 3.7 Special Designations, pages 3.7-1 – 3.7-13. Appendix C of the Forest Plan Revision FEIS displays the Forest Roadless Area Inventory and Evaluation for the Forest Plan Revision and includes maps of the Forest Plan inventoried roadless areas. Map 5 shows all of the Roadless Area Conservation Rule areas on the SNF.

3.10.1.5 Analysis Methods

Indicators

Indicators considered for this inventoried roadless area analysis relate to the roadless inventory criteria used in the FPR FEIS that are based on Forest Service Manual criteria (FSM 1925). The FPR analysis used these indicators to discuss general effects to vegetation, setting/solitude, ownership, roads, and shape. Table 37 and Table 38 show how and why the inventoried roadless area analysis for this project considered these criteria as potential effects indicators.

Table 37. Roadless Area Conservation FEIS roadless characteristics

Roadless Characteristic Description	Substantial Effects from this Project[a]	Sections of the DEIS Showing the Limited Scope of Effects to the Resource
High quality or undisturbed soil, water, and air	None	3.5 Soils, 3.6 Water Resources, and 3.13 Air
Sources of public drinking water	None	3.6 Water Resources
Diversity of plant and animal communities	None	3.8 Wildlife, 3.7 Vegetation, and 3.9 Invasive
Habitat for threatened, endangered, proposed, candidate, and sensitive species and for those species dependent on large, undisturbed areas of land	None	Project File – BA and BE
Primitive, Semi-Primitive Non-Motorized, and Semi-Primitive Motorized classes of dispersed recreation	None	3.3 Recreation and 3.1 Noise
Natural appearing landscapes with high scenic quality	None	3.3 Scenery
Traditional cultural properties and sacred sites	None	3.11 Heritage Resources
Other locally identified unique characteristics	None	Section 3.2 Wilderness and 3.1 Noise

a - No permit applications include any RACR areas. Disturbance from exploration envisioned in Section 2.2.2.4 activities would be limited in scope and duration.

Table 38. Forest Plan inventoried roadless area indicators

Criteria Focus	Criteria Description	Used in this Analysis	Rationale
Criteria for Roadless Areas (Used in Forest Plan Revision FEIS and based on FSH and FSM direction)			
Vegetation	No more than 20 percent of the area harvested in the past 10 years.	No	No timber harvest is proposed nor would be included in future prospecting permit applications. Timber cut in establishing temporary roads or drill pad would be incidental to prospecting activities and would create forest canopy gaps within forest stands. Harvest areas would not be created for the proposed prospecting activities. (See Section 3.7.3 Vegetation.)
Setting/ Solitude	At least about 2,500[a] acres of semi-primitive area if not adjacent to existing wilderness (regional guideline). No acre limit adjacent to existing wilderness.	No	No actions are proposed that would change the size of the inventoried roadless areas. Sound from drilling operations would affect the setting and sense of solitude for the duration of operations two to three weeks per drilled hole. At the end of operations the prior sense solitude would return and remote setting would be restored. (See Section 3.1 Noise)
Ownership	At least 70 percent federal ownership. No future non-federal land access needs.	No	No land ownership changes are a part of this project.
Roads	No more than ½ mile of improved roads per 1,000 acres. No roads not under Forest Service jurisdiction.	No	No improved roads are proposed to be constructed or decommissioned in the inventoried roadless areas. This project would not affect the amount of improved roads in the inventoried roadless areas.
Shape	A manageable area without narrow, elongated, or gerrymandered boundaries.	No	No actions are proposed that would change the shape of inventoried roadless areas.
Indicators for Federal Hardrock Minerals Exploration Project's Activities			
Forest Canopy Gaps	Acres (%) projected for temporary roads and drill pads within the Forest Plan Revision and RACR/RARE II inventoried roadless areas.	Yes	Displays potential extent of effects of prospecting activities on vegetation within inventoried roadless areas.

a - This acreage, 2,500 acres, is a guideline in the evaluation process rather than strict criteria.

No permit applications include any inventoried roadless areas. Disturbance from exploration described in section 2.2.2.4 activities would be limited in scope and duration. A drill hole would take about 2 to 3 weeks complete, drill pads would be no more than 100 X 100 feet, access roads would be temporary. Drill sites and temporary roads would be reclaimed as described Section 2.2.2.4 and as required in the stipulations identified in Chapter 2, Section 2.4.3.12.

Although none of the attributes of roadless areas would be substantially affected by the proposed prospecting activities, prospecting activities such as temporary road and drill pad construction could affect forest canopy within inventoried roadless areas in the SNF. The estimated amount of forest canopy gaps created in inventoried roadless areas relates to the inventoried roadless area criteria and characteristics that consider wildlife habitat, scenic quality, and timber harvest. The estimated potential

forest canopy gaps provide a sense of the potential intensity of effects from temporary roads and drill pads created in the inventoried roadless areas.

All of the Forest Plan inventoried roadless areas and areas included in RACR were allocated to MAs that would allow temporary road and drill pad construction for minerals exploration.

Effects from prospecting in RACR/RARE II areas are possible since the Wyoming court ruling enjoining RACR currently governs the situation in Minnesota. Through Forest Plan revision RACR/RARE II areas were allocated to MAs that would allow constructing temporary roads and drill pad sites. An exception is the approximately 115 acres allocated as a Candidate Research Natural Area MA within the Cabin Creek RACR/RARE II area.

Forest Canopy Gaps

Acres and percentage of inventoried roadless areas will demonstrate the extent of potential effects to inventoried roadless areas. It will display the intensity of effects of prospecting activities on vegetation within inventoried roadless areas.

No timber harvest is proposed nor would be included in future prospecting permit applications. Timber cut in establishing temporary roads or drill pad would be incidental to prospecting activities and would create a canopy gap within a forest stand. Harvest areas would not be created for the proposed prospecting activities (Section 3.7.3, Vegetation).

Effects of vegetation disturbance from canopy gaps created from temporary roads and drill pads envisioned by the 20 Year Mineral Exploration Scenario (described in section 2.2.2.4) will be estimated by extrapolating what could potentially occur in the SNF inventoried roadless areas from the amount of temporary roads and drill pads envisioned to occur on the SNF in the 20 Year Maximum Mineral Exploration Scenario.

Roads

The Forest Plan, Appendix C, page C-6, defines improved roads as: “Any constructed or existing feature or facility created on the land for the purpose of travel by passenger vehicles (four wheeled, two wheel drive) which are legally allowed to operate on forest roads or public roads and highways, and vehicles are greater than 50 inches in width. Said facility will have an area for vehicles to travel on and will incorporate some manner for the disposal of surface runoff.”

The Forest Plan Glossary, page Glossary-27 defines temporary roads as: “Roads authorized by contract, permit, lease, other written authorization, or emergency operation that are not intended to be a part of the forest transportation system, and not necessary for long-term resource management. These roads are not included on the National Forest System road inventory and are decommissioned after use.”

Temporary roads that would be developed for accessing drill pads would not be improved roads and they would not affect inventoried roadless area roads criteria shown in Table 37. The temporary roads would not be created for the purpose of travel by passenger vehicles, they are developed to allow trucks and heavy equip to access a drill pad as well as allow access for supplies, other equipment and personnel. See Section 2.1.1 for a description of temporary roads and drilling equipment.

Temporary road construction for access to drill pads would occur in all of the action alternatives. These roads would not provide permanent motorized access to the inventoried roadless areas, since their use would only be for the duration of the proposed management activities.

Since this project does not propose any activities to build or decommission improved roads in the inventoried roadless areas, there would be no change to the amount of improved roads in any of the alternatives from the Federal Hardrock Minerals Exploration Project.

All temporary roads developed for this project would be decommissioned and reclaimed following the proposed management activities. All of the action alternatives would have the same amount of temporary roads and would not substantially affect the criteria qualifying inventoried roadless areas.

Analysis Area

The geographic areas for this effects analysis are the inventoried roadless areas within the SNF that are not within the Mining Protection Area (MPA). See map 5. These are the analysis boundaries for inventoried roadless areas because they are consistent with the FPR FEIS analysis for inventoried roadless areas and their potential to be studied for wilderness designation (Forest Plan Revision FEIS, Appendix C, page C-13). Prospecting activities would be on the national forest system acres with federally owned mineral rights that are outside of the MPA and other areas described in Chapter 1, Project Area, page 8.

Although not all of the RACR/RARE II areas were included in the Forest Plan inventoried roadless evaluation, they are included in this analysis area to accommodate potential concerns relating to court rulings affecting resource management in RACR areas.

The FPR FEIS states that any proposed site-specific projects within an inventoried area will require an environmental analysis that considers effects of the project proposal on the roadless characteristics in the area. Although no current prospecting permit applications or extensions of existing permits include any inventoried roadless areas on the SNF, it is possible that future permit applications and prospecting envisioned in the 20 Year SNF Minerals Exploration Scenario (section 2.2.2.4) could include inventoried roadless areas. Table 35 and Table 36 identify the inventoried roadless areas considered in this analysis. Maps on the SNF web site for this project show the location of the inventoried roadless areas across the SNF. Maps of all the inventoried roadless areas on the Superior National Forest are also in the Forest Plan Revision FEIS, Appendix C, pages C-95 – C-110.

Mineral prospecting effects for this analysis include timber cut on the SNF inventoried roadless areas to accommodate temporary roads and drill pads.

3.10.2 Affected Environment

The Forest Plan Revision FEIS, (Appendix C. Forest Roadless Area Inventory and Evaluation, pages C-24 – C-90) describes the inventoried roadless areas listed in Table 36 in extensive detail. Descriptions include information on each area in terms of acreage, location and access, geography and topography, vegetation, current uses of the area, appearance and surroundings, and key attractions. The FEIS also describes the areas in terms of Wilderness capability, availability for Wilderness, Wilderness evaluation, and environmental consequences. These roadless areas have had extensive timber harvest in the early to mid-1900s. They also contain improved, unimproved, and unclassified roads. Although extensive harvest occurred in these areas, they met roadless criteria for the Forest Plan revision.

Federal mineral rights within the inventoried roadless areas is dispersed and in irregular blocks across the landscape. The amount of federal mineral rights from one inventoried roadless area to the next is also inconsistent. Some areas have a fairly high concentration of federal mineral rights (Kawishiwi Lake to Sawbill and Cucumber Lake) and others may have none at all (Gunflint Lake SE and Wood Lake).

Table 39 shows that 14 of the 28 Forest Plan inventoried roadless areas do not have lands with federally owned mineral rights outside of the MPA. They would not be affected by this project. Two more areas

would have extremely small acreage available for explorations to be considered, about 0.6 acres in the 1,318 acre Beaver Stream area and about 4 acres in the North Arm-Burnside Lake area. It is highly unlikely that prospecting activities would be proposed in these very small areas, especially since they are also located in the "low" mineral potential zone.

Table 39. Forest Plan inventoried roadless areas acres of federal mineral rights and acres of mining protection area (MPA)

Name	Total Acres	NFS Acres	Acres of Federal Mineral Rights	Acres in the Mining Protection Area	Federal Mineral Rights Outside of MPA
Agassa Lake	2872.89	2,641	62.08	2872.89	0.00
Baker-Home-Brule Lake	5634.03	4,963	1900.78	7.76	1895.36
Baldpate Lake	485.45	485	121.50	485.45	0.00
Beaver Stream	1317.74	1,277	1121.12	1315.85	0.55
Big Lake	1194.89	1,079	1068.26	1194.89	0.00
Brule Lake-Eagle Mountain	2823.55	2,695	1636.35	0.00	1636.35
Cucumber Lake	1895.93	1801	1847.00	646.52	1200.48
East Otter Lake	556.30	522	290.40	556.30	0.00
Echo River	1899.95	1,900	911.28	0.17	911.28
Greenstone Lake East	1628.58	1,476	287.62	1628.58	0.00
Greenstone Lake West	1903.77	1,353	73.48	1903.77	0.00
Gunflint Lake SE	1002.96	1,003	0.00	1002.96	0.00
Hog Lake	7209.47	7,035	3854.90	0.00	3854.90
Kawishiwi Lake to Sawbill	1565.13	1,486	1472.35	0.04	1472.31
Lake Jeanette	1792.62	1,793	1792.52	1792.62	0.00
Little Indian Sioux	995.16	995	995.16	995.16	0.00
Magnetic Lake	1133.34	1,119	1062.65	1133.34	0.00
Meander Lake	753.32	753	79.01	753.32	0.00
Mine Lake	1207.88	1,129	346.80	1207.88	0.00
Mississippi Creek	5710.39	5,152	2207.82	0.00	2207.82
Mit Lake	972.93	961	244.88	0.16	244.75
North Arm-Burntside Lake	2747.36	2,285	1261.54	2715.29	4.31
Picket Lake	4482.98	4,097	2856.80	115.08	2797.02
Seven Beaver Lake	6908.04	5,174	548.67	0.00	548.67
South Kawishiwi River	212.03	211	209.40	0.01	209.39
Urho Creek	3616.43	3,573	3600.60	3616.43	0.00
Wolf Lake	2840.54	2,661	163.76	0.00	163.76
Wood Lake	623.51	544	0.00	623.51	0.00
	65,987.18	60,163	30,016.73	24,567.98	17,146.94

Table 40 shows that 5 of the 13 areas designated as roadless under the RACR do not have lands with federally owned mineral rights outside of the MPA. They would not be affected by this project.

Table 40. RACR acres of federal mineral rights and acres of mining protection area (MPA)

Name	Total Acres	NFS Acres	Acres of Federal Mineral Ownership	Acres in the Mining Protection Area	Acres Fed Minerals outside MPA
Baker-Homer-Brule Lakes	8578.37	6,707	3385.34	0.01	3385.33
Baldpate Lake	485.46	485	121.51	485.46	0.00
Brule Lake-Eagle Mountain	15157.60	12,302	5449.65	0.00	5449.65
Cabin Creek	7421.68	6,068	596.34	0.00	596.34
Hegman Lakes	834.87	673	345.43	834.87	0.00
Kawishiwi Lake to Sawbill	15785.30	14,942	12858.27	0.00	12858.27
Little Indian Sioux	995.16	995	995.16	995.16	0.00
Mississippi Creek	7425.03	5,712	2284.92	0.00	2284.92
Moose Portage III	81.97	81	81.97	81.97	0.00
Phantom Lake	8556.66	6,516	271.06	0.00	271.06
South Kawishiwi River	135.86	135	135.80	0.01	135.79
Tait Lake	7759.50	6,272	5521.18	0.00	5521.18
Wood Lake	623.51	568	0.00	623.51	0.00
	73840.97	61,456	32046.62	3020.99	30502.54

3.10.3 Direct and Indirect Effects

3.10.3.1 Alternatives 1

No Forest Service management activities affecting the vegetation, setting/solitude, ownership, roads or shape of the inventoried roadless areas would occur. No effects to the roadless character would occur to the inventoried roadless areas under the No Action alternative. No forest canopy gaps would be created within any of the inventoried roadless areas listed in Table 34 or Table 35.

3.10.3.2 Alternatives 2-5

Current Prospecting Permits and Operating Plans

There are no effects to inventoried roadless areas from current prospecting permit applications, extensions, and their corresponding operating plans. None of the permit applications, extension, and operating plans are proposed on any SNF inventoried roadless areas including those designated by RACR. No forest canopy gaps would be created in inventoried roadless areas under current prospecting permit application proposals.

Future prospecting permits and operating plans

Since the same amount of prospecting activities (temporary road and drill pad construction) would occur under all of the action alternatives, the potential for effects to roadless qualities of inventoried roadless areas would be the same under all the action alternatives.

Forest Canopy Gaps

Forest Plan Inventoried Roadless Areas

Of the Forest Plan inventoried roadless areas, Kawishiwi Lake to Sawbill would have the greatest potential of forest canopy gaps from prospecting representing the greatest potential impact any Forest Plan inventoried roadless areas. All other areas would have less potential impact. In the Kawishiwi Lake

to Sawbill roadless area, of the approximately 1,486 NFS lands, about 1,472 acres (99 percent) are federal mineral ownership, outside of the MPA, and within the Moderate to High mineral potential zone.

Table 41. Forest Plan inventoried roadless areas and mineral potential interest levels

Name	NFS Acres	Mineral Potential Interest Levels	Mineral Potential Interest Level Acres	NFS Federal Mineral acres outside of MPA
Baker-Home-Brule Lake	4,963	High/Moderate	3637.88	1122.40
		Low	1987.808	772.37
Beaver Stream	1,277	Low	1.893	0.55
Brule Lake-Eagle Mountain	2,695	High/Moderate	1448.508	746.16
		Low	1375.044	890.20
Cucumber Lake	1801	High/Moderate	1172.469	1123.54
		Low	76.943	76.94
Echo River	1,900	Low	1899.788	911.28
Hog Lake	7,035	High/Moderate	7209.473	3854.90
Kawishiwi Lake to Sawbill	1,486	High/Moderate	1565.091	1472.31
Mississippi Creek	5,152	High/Moderate	349.475	215.88
		Low	5360.914	1991.94
Mit Lake	961	High/Moderate	972.768	244.75
North Arm-Burntside Lake	2,285	Low	32.065	4.31
Picket Lake	4,097	Low	4367.895	2797.02
Seven Beaver Lake	5,174	High/Moderate	6908.044	548.67
South Kawishiwi River	211	Low	212.02	209.39
Wolf Lake	2,661	Low	2840.538	163.76

As shown in section 2.2.2.4, about 3,725 acres of the 424,431 acres of SNF federal minerals ownership lands would be disturbed from temporary roads and drill pads, about 0.5 percent of those lands. In the Kawishiwi Lake to Sawbill Forest Plan inventoried roadless area, 0.5 percent of the lands of federal mineral ownership, outside of the MPA, and within the Moderate to High mineral potential zone would be about 7 acres of forest canopy gaps dispersed across the area. Since 99 percent of the NFS lands in the Kawishiwi Lake to Sawbill would be available to prospecting activities, this is about 0.5 percent of this inventoried roadless area. All of the other Forest Plan inventoried roadless areas would have less than 0.5 percent of the lands disturbed.

RACR Areas

Of the RACR inventoried roadless areas, Kawishiwi Lake to Sawbill would have the greatest potential of forest canopy gaps from prospecting representing the greatest potential impact any Forest Plan inventoried roadless areas. All other areas would have less potential impact. In the Kawishiwi Lake to Sawbill RACR area, of the approximately 14,942 acres of NFS lands, about 12,851 acres (86 percent) have federal mineral ownership, outside of the MPA, and within the Moderate to High mineral potential interest zone. See Map 4 Potential Mineral Interest Zones.

As shown in section 2.2.2.4, about 3,725 acres of the 424,431 acres of SNF federal minerals ownership lands would be disturbed from temporary roads and drill pads, about 0.5 percent of those lands. In the Kawishiwi Lake to Sawbill Forest Plan inventoried roadless area, 0.5 percent of the lands of federal mineral ownership, outside of the MPA, and within the Moderate to High mineral potential zone would be

about 64 acres of forest canopy gaps dispersed across the area. Since 86 percent of the NFS lands in the Kawishiwi Lake to Sawbill would be available to prospecting activities, this is about 0.4 percent of this RACR area. All of the other RACR areas would have less than 0.4 percent of the lands disturbed.

Table 42. RACR/RARE II areas and mineral potential interest levels

Name	NFS Acres	Mineral Potential Interest Levels	Mineral Potential Interest Level Acres	NFS Federal Mineral acres outside of MPA
Baker-Homer-Brule Lakes	6,707	High/Moderate	3929.30	1207.50
		Low	4648.36	2177.13
Brule Lake-Eagle Mountain	12,302	High/Moderate	9342.36	2902.85
		Low	5815.23	2546.80
Cabin Creek	6,068	High/Moderate	6490.65	321.66
		Low	931.03	274.68
Kawishiwi Lake to Sawbill	14,942	High/Moderate	15778.49	12851.47
Mississippi Creek	5,712	High/Moderate	358.61	220.04
		Low	7066.42	2064.87
Phantom Lake	6,516	High/Moderate	6842.73	244.68
		Low	1713.93	26.38
South Kawishiwi River	135	Low	135.85	135.79
Tait Lake	6,272	High/Moderate	3010.56	2337.43
		Low	4748.94	3183.76

3.10.3.3 Conclusion

The extent of the effects of prospecting activities envisioned in the 20 Year Mineral Exploration Scenario (section 2.2.2.4) would be very small and would not affect Forest Plan inventoried roadless areas or RACR areas from consideration as roadless areas. The forest canopy gaps that could be created would be few and dispersed across the landscape of the inventoried roadless areas. Factors contributing to the negligible effect of the prospecting activities within inventoried roadless areas include:

A maximum of about 0.5 percent of any one inventoried roadless area (or all combined) would consist of forest canopy gaps as a result of the proposal.

- Intermittent spacing of federal mineral rights across the landscape.
- Variability of the mineral potential from area to area.
- Dilution effect of other land ownerships (Table 43).

Table 43. Overview of potential extent of forest canopy gaps from proposed prospecting within roadless areas on the SNF

Factor	Forest Plan Revision Inventoried Roadless Area acres	Estimated Forest Canopy Gaps in FPR Inventoried Roadless		RACR/ RARE II acres	Estimated Forest Canopy Gaps in RACR/RARE II Areas	
		Acres	%		Acres	%
Roadless Area Acres – All Ownerships	65,987	86	0.1%	73,841	153	0.2%
SNF Acres of Roadless in Mining Protection Area	24,568	0	0%	3,021	0	0%
SNF Acres of Roadless with Federal Minerals Ownership	30,017	86	0.3%	32,047	153	0.5%
SNF Federal Minerals Ownership acres in Roadless Outside of MPA	17,147	86	0.5%	30,503	153	0.5%

3.10.4 Cumulative Effects

The proposed prospecting would not contribute any cumulative effects that would disqualify any SNF inventoried roadless areas from continued consideration as roadless areas. As shown in Table 37 proposed temporary roads and drill pads would not affect roadless criteria. The extent of the vegetation disturbance from canopy gaps that would be created by the proposed temporary road and drill pad construction is very small, an aggregated total of canopy gaps with a maximum of up to 0.5 percent of any one inventoried roadless area or of inventoried roadless areas combined.

3.11 Heritage

3.11.1 Introduction

Historic properties are discrete locations on the landscape which display evidence of past human activities. Traditional Cultural Properties (TCPs) are districts, sites, buildings, structures or objects that are valued by a living community for the role they play in sustaining the community's cultural integrity (King 2004: 362). An example of a historic property would be an early 20th century logging camp and its associated artifacts and building remains. An example of a Traditional Cultural Property would be a wild rice stand which has been annually harvested by a distinct, living community for the past 100 years. For the purposes of this analysis, the term heritage resources, or heritage resource site, will refer to both of these aforementioned property types. Heritage resources are fragile and can be adversely affected by a variety of factors, including erosion, fire, and numerous human activities. Heritage resources are especially vulnerable to surface disturbances.

Over the last thirty years, the Forest has conducted archaeological field surveys throughout the lands administered by the Superior National Forest within the project area. The Forest Service fully intends to avoid impacts to all heritage resources which are currently unevaluated or eligible to the National Register of Historic Places (NRHP).

The analysis area for heritage resources encompasses all forest service lands outside the Boundary Waters Canoe Area Wilderness, Mining Protection Areas, and eligible Wild River Segments, with a focus on the current prospecting permit application locations. Those areas that have the potential to create ground disturbance and/or alter the nature or character of a heritage resource within the project boundary will be

analyzed, with specific information provided for the current known permit application locations (33 permit applications) and operating plans (21). Because heritage resources are a static, non-renewable resource, a buffer placed around each resource ensures adequate protection from ground disturbance. There are a total of 34 known heritage resources on Forest Service lands located within the permit application boundaries. Of these, all have the potential to be adversely affected by project activities.

3.11.1.1 Methodology

The effects analysis for heritage resources considers potential impacts to known heritage resources and those areas that have a high potential for previously unknown heritage resources to occur. The analysis area was identified by the purpose and need and proposed project description. Forest site atlases and survey coverage atlases were consulted to identify location and intensity of survey coverage and location of known heritage sites. Site types were then identified and historical documents and publications of the history and prehistory of the area were consulted to identify probable location and site types throughout the project area.

Heritage methodology revolves around probability models. Given the inter-connected nature of the streams and lakes on the landscape of the Superior National Forest, areas considered high probability for archaeological sites include navigable lakes and streams as well as connecting trails overland (i.e., portages). Areas considered high probability for Fur Trade era sites revolve around and along the Border route between the United States and Canada from Lake Superior westward to Lake of the Woods. High probability areas for historical sites include known ore ranges, historical logging company properties, and historical homesteads.

Compliance with relevant direction

Forest Plan direction for heritage resources is to identify, evaluate, monitor, and preserve heritage resources for “the qualities for which they have been deemed significant”; to promote heritage values in public education and outreach; and to contribute relevant historical and cultural perspectives to natural resource management. This project is managed for heritage resources as outlined in the Heritage Resources Standards & Guidelines in the 2004 Superior National Forest Plan (pp. 2-38 and 2-39) and in accordance with Section 106 of the National Historic Preservation Act of 1966 (NHPA), as amended (36 CFR Part 800) and the Programmatic Agreement Among the Advisory Council on Historic Preservation; The United States Department of Agriculture, Forest Service Superior National Forest; The Minnesota State Historic Preservation Officer; The Bois Forte Band of Chippewa; The Grand Portage Band of Chippewa and The Fond Du Lac Band of Lake Superior Chippewa Regarding the Process for Compliance with Section 106 of the National Historic Preservation Act for Undertakings on the Superior National Forest of the U.S. Forest Service, signed 2007/2008 (PA).

To satisfy the Forest’s responsibilities for undertakings under Section 106 of the NHPA, the Forest Plan (2004) and the PA (2008), a heritage resource inventory will be conducted for previously un-surveyed areas subject to ground disturbance within the permitted application areas. The goal of this inventory is to identify historic properties in order to protect them from project activities. Results of this inventory will be documented in project specific Cultural Resource Reconnaissance Reports and reported to the Minnesota State Historic Preservation Officer (MN SHPO) in that year’s Superior National Forest Heritage Annual Report.

As outlined in 36 CFR Part 800 Protection of Historic Properties, federal agencies are responsible for the management of historic properties. Historic properties are defined as “any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places maintained by the Secretary of the Interior” (36 CFR 800.16 (l)(1) Historic property: 15). This also includes properties of traditional religious or cultural importance to Indian tribes that meet eligibility

requirements for the National Register of Historic Places. For purposes of this analysis, historic properties will be termed heritage resources. Heritage resource management on the Superior National Forest includes evaluation of heritage resources to determine eligibility for listing on the NRHP. Unevaluated resources are treated as eligible until such time as they can be formally evaluated. Therefore, eligible and unevaluated resources are typically excluded from project activities, pursuant to S-HR-9 of the Forest Plan, which places a buffer around heritage resources to ensure their protection and avoidance from project activities.

Spatial and Temporal Context for Effects Analysis

The time scale used for the analysis of direct and indirect effects is 20 years. This time scale is chosen because it is reasonable to assume that all proposed projects would be implemented by the time and expected effects have occurred. The time scale for cumulative effects is 30 years, looking back 10 years into the past, and 20 years forward to the maximum mineral exploration deadline. This is also an appropriate time scale for cumulative effects because it allows for the most realistic prediction of reasonably foreseeable future projects.

3.11.2 Affected Environment

Existing conditions include the known historic properties within the project area, as well as any remaining known surveyed and non-surveyed areas. While a large part of the permit application areas have been covered by block survey, only a small portion has been covered by more intensive survey, with approximately 1300 acres having never been surveyed. Block survey consists of aerial survey (i.e., identifying locations via aerial photographs or locations identified during helicopter flights and conducting subsequent ground survey). Very little of the project area has received more intensive survey, which involves walkover pedestrian transects spaced no more than 50 meters apart and/or intensive shovel testing of high probability locations such as shorelines on navigable lakes and rivers and points or peninsulas on lake and rivers, with shovel tests spaced 5-15 meters apart.

Prospecting Permit Application Areas

There are over 3,500 known historic properties on National Forest System lands, with approximately 2/3 of these located on Forest lands outside the Boundary Waters Canoe Area Wilderness. There are a total of 46 known historic properties on National Forest System lands within the prospecting permit application boundaries. Of these, 11 have been determined to be not eligible for inclusion in the NRHP and therefore require no further management consideration. Of the remaining 35 historic properties, 5 of the known sites are pre-contact subsurface sites consisting of artifacts related to settlement, subsistence activities and the production and use of stone tools. One of these sites has been dated to the Initial Woodland Period, characterized by Laurel pottery (2100bp – 900bp), one dates to the Late Archaic/Initial Woodland periods (6,000bp – 3,000bp) and the rest are undetermined. There are 29 known historic sites including a post-1938 trapper's shack, a 1920s – 1930s granite quarry, early to mid 1900s logging/lumber camps, a dike, and a dam, as well as late 1880s homesteads/farmsteads, 1940s/1950s portable sawmill sites, and a 1930s Forest Service ranger station and lookout. Most of these sites should exhibit some above-surface features such as refuse dumps and/or earth-berm foundations. One site is multi-component, including Initial Woodland period ceramics and a 1930 National Industrial Recovery Act (NIRA) camp. A review of the site types found within the proposed prospecting permit application areas is summarized in Table 44.

Table 44. Number of sites by type within the proposed prospecting permit areas

Site Type	No. of Sites
Pre-contact	5
Historic	29
Multi-component	1
Total Heritage Sites	35

Current Operating Plans

These undertakings have been reviewed by Forest Heritage staff. There are no known heritage sites associated with proposed temporary roads or drill pads within current operating plan areas. During the review process, three locations (totaling 12 acres) on Birch Lake associated with amended Lehmann Plan of Operations (MNES #055302; MNES #052446; and #055301) were identified as needing heritage survey coverage prior to implementation. These areas will be surveyed prior to implementation. If heritage resources are identified, avoidance measures will be implemented. A "No Effect" determination has been made for the remaining Operating Plans (n=18) with regard to 36 CFR 800 of NHPA (as amended). These projects will be reported in the FY2010 Heritage Resource Office Annual Report, as directed by language in the heretofore mentioned PA (2008). Heritage compliance and previous survey coverage is documented in Superior National Forest Cultural Resource Management Report #1005015 Hardrock EA Operating Plans. Should any heritage resources be discovered during implementation, all project activities within the site vicinity shall cease and the Forest Heritage Resource Program Manager shall be notified to assess the condition and implement protection measures.

3.11.3 Direct and Indirect Effects

3.11.3.1 Alternative 1 – No Action

There would be no direct, indirect, or cumulative effects under Alternative 1 because there would not be any new ground disturbing activities.

3.11.3.2 Alternatives 2 – 5

Design Features and Mitigation Measures

In accordance with 36 CFR 800 of the NHPA (as amended), an office review of heritage site location and heritage survey data will be conducted for each operating plan. If determined necessary, additional field survey will be completed prior to project implementation. If heritage resource sites are identified within areas to be subjected to ground disturbance, then site protection measures will be developed for all operating plans prior to project implementation. Companies are encouraged to submit their operating plans at the earliest date so surveys, recordation and site protection measures can be completed within the company's timeframe needs. This is because in Northeastern Minnesota, heritage field season is limited to periods when the ground is not frozen and there no snow is on the ground.

If heritage resource sites require avoidance mitigation during project implementation, a FS project administrator will visit the project a number of times to insure compliance with the operating plan. This will ensure compliance with, and effectiveness of, mitigation measures.

Current Prospecting Permit Applications

Current prospecting permit applications areas contain known heritage resources. Ground disturbing activities associated with drilling operations, including temporary road construction, drill pad preparation,

sump hole excavation, and/or road decommissioning, have the potential to adversely affect heritage resources through surface and subsurface artifact and feature displacement. Indirect effects from drilling and road construction activities could occur as a result of increased access to and visibility of heritage resources, increasing the likelihood of artifact looting.

Implementation of mitigation measures (i.e., flag and avoid), post treatment monitoring, and maintenance of confidentiality with respect to heritage resource locations will effectively eliminate direct and indirect effects as they relate to the action alternatives of the Federal Hardrock Minerals Prospecting Permit undertaking. There will be no cumulative effects to heritage resources, as all potential direct and indirect effects would be mitigated. Should any heritage resources be discovered during implementation, all project activities within the site vicinity shall cease and the Forest Heritage Resource Program Manager shall be notified to assess the condition and implement protection measures.

Current Operating Plans

There are no known sites within current operating plan areas. These undertaking have been reviewed by Forest Heritage staff and determined to be "No Effect" undertakings with regard to 36 CFR 800 of the NHPA. These "No Effect" projects will be reported in the Heritage Resource Office Annual Report, as directed by language in the heretofore mentioned PA (2008). Should any heritage resources be discovered during implementation, all project activities within the site vicinity shall cease and the Forest Heritage Resource Program Manager shall be notified to assess the condition and implement protection measures.

Future Prospecting Permits and Operating Plans

Effects are similar to those described under current prospecting permits applications and operating plans. In accordance with Section 36 CFR 800 of the NHPA (as amended), an office review of heritage resource site and survey data will be conducted for each operating plan. If determined necessary, additional field survey will be completed prior to project implementation. If heritage resource sites are identified within areas to be subjected to ground disturbance, then protection measures will be developed for all operating plans prior to project implementation. Companies are encouraged to submit their operating plans at the earliest date so surveys, recordation and site protection measures can be completed within the company's timeframe needs. This is because in Northeastern Minnesota, heritage field season is limited to periods when the ground is not frozen and there no snow is on the ground. Ground disturbing activities associated with drilling operations, including temporary road construction activities, have the potential to adversely affect heritage resources through surface and subsurface artifact and feature displacement. Indirect effects from drilling and road construction activities could occur as a result of increased access to and visibility of heritage resources, increasing the likelihood of artifact looting.

No effects to heritage resources are expected as all known sites would be buffered. If heritage resource sites are located within, or immediately adjacent to areas of proposed surface disturbance (such as drill sites and temporary roads), they will be buffered to avoid impact. Implementation of mitigation measures (i.e., flag and avoid), post treatment monitoring, and maintenance of confidentiality with respect to heritage resource locations will effectively eliminate direct and indirect effects. Should any heritage resources be discovered during implementation, all project activities within the site vicinity shall cease and the Forest Heritage Resource Program Manager shall be notified to assess the condition and implement protection measures.

3.11.4 Cumulative Effects

Implementation of mitigation measures (i.e., flag and avoid), post treatment monitoring, and maintenance of confidentiality with respect to heritage resource locations will effectively eliminate direct and indirect

effects as they relate to the action alternatives of the Federal Hardrock Mineral Prospecting Permit undertaking. Therefore, there will be no cumulative effects from the action alternatives.

3.12 Scenery

3.12.1 Introduction

3.12.1.1 Methodology

The data used for analyzing potential impacts is based on Agricultural Handbook (AH) 701 Landscape Aesthetics, A Handbook for Scenery Management. This Handbook defines scenic integrity as the degree of direct human caused deviation in the landscape, such as road construction, timber harvesting or activity debris. Scenic integrity is used to describe an existing situation, standard for management, or desired future condition.

Scenic Integrity Objectives (SIO) are derived by considering areas that are important for scenery such as travel routes and use areas and their levels of concern, the various aspects of landscape visibility from them, and the distance zones they can be seen from.

Page 2-46 of the Forest Plan identifies the SIO's that the Superior National Forest manages to, and their percent of land (outside the BWCAW). They are as follows:

- High SIO = 27 percent
- Moderate SIO=61 percent
- Low SIO=12 percent

Page 2-48 of the Forest Plan contains a map of the SIOs on the Forest. The Forest Plan states: High SIO areas on the Superior National Forest are generally areas ¼ mile wide on either side of certain roads and trails. Most campgrounds are in High SIO areas.

Indicators

The indicator for scenic quality is the location of drill sites in relation to the Forest Plan Scenic Integrity Objectives. Drill sites located in high scenic integrity areas would generally be more noticeable to the public than sites located in moderate or low scenic areas.

Spatial and Temporal Context for Effects Analysis

The boundary for direct and indirect effects encompasses the entire Superior National Forest excluding the BWCAW, MPAs and WSR segments and all no surface occupancy areas. This is an appropriate boundary because the effects of the current and future prospecting permits would occur at various locations across the forest but no drilling would occur in the BWCAW, MPAs, WSRs and all no surface occupancy areas, and it is unlikely that drilling would occur directly adjacent to the wilderness and therefore would not be seen from within the wilderness.

If drilling were to occur near the BWCAW boundary, vegetation would screen the drilling from site within the wilderness. In addition, a wilderness visitor would need to be on or adjacent to the boundary to see a drilling operation that was adjacent to the boundary. There are no developed campsites or trails on or adjacent to the wilderness except for entry points so this is unlikely to occur. Therefore drilling is highly unlikely to be visible from within the wilderness.

The timeframe for direct and indirect effects is 20 years because this is the extent of the time considered for prospecting permits. This is an appropriate timeframe because effects are not expected to last longer

than prospecting activities and would generally exist only while prospecting activities were occurring and when operations were complete, sites would revegetate naturally. Drill sites would be rehabilitated according to operating plans.

3.12.2 Affected Environment

Currently, Forest visitors have opportunities to enjoy views of natural and undisturbed forested settings throughout the Project area. The project has the potential to impact scenery and modify the vegetation along travelways. The Forest Plan states that "Management activities will maintain the Forest's scenic resources by meeting as a minimum the Scenic Integrity Objectives. In terms of scenery resources, stands of timber appear natural and are valued by the viewing public."

3.12.3 Direct and Indirect Effects

3.12.3.1 Alternative 1

Because no new or additional activities would occur in this alternative, no direct or indirect effects would occur. Existing leases would continue to operate under approved operating plans.

3.12.3.2 Alternatives 2, 3, 4, and 5

Current and Future Prospecting Permits and Operating Plans

The effects of the project on scenery would be the same for all of the action alternatives. The seasonal restrictions associated with Alternative 5 are not expected to result in different effects on the scenic resource.

Approximately 30 percent of the existing leases and prospecting permit areas are partially within High SIO areas and approximately 66 percent of the existing leases are in Moderate SIO areas.

Approximately 75 percent of the prospecting permit application areas are outside of High SIO areas with some areas overlapping High and Moderate areas.

Some drill sites may be located within the High SIO areas along main travelways or on lakes and the drilling activity and machinery would be visible for the duration of the operation. Forest openings created for prospecting would generally re-vegetate within one to two years and would also be similar in size, shape and edge characteristics to natural openings in the landscape.

There are currently eight landings proposed from four proposed operating plans on Birch Lake. Approximately forty landings associated with water access would be needed over the 20 year analysis. The landing disturbance area would average 25 ft wide by 50 ft deep (perpendicular to the shoreline). Some clearing and grubbing may be required. However, the amount of needed clearing and grubbing would be minimized. See section 2.1.1 for further details. Landings, drilling equipment and barges and associated boat traffic would be visible but would minimally impact scenery along the shoreline. If drilling occurs along the shoreline under future prospecting permits and operating plans, the effects would be similar to those along a travelway. The effects would be noticeable while drilling was occurring and for a short period after completion of drilling, until the site revegetated. Reclamation includes pulling back and spreading woody debris over the disturbed areas, recontouring to blend in with the surrounding area, and if required by the FS seeding the disturbed areas.

Forest Plan standards and guidelines would be followed, including G-SC-2, 3, 4, and 5. G-SC-6 states "in Moderate and High SIO areas, schedule mechanized activities during periods of low recreation use if the mechanized activities can be viewed from travel ways, recreation sites, and bodies of water with access."

It may not be practical to conduct all drilling in the winter during periods of low recreation use and this may impact more recreation users but would have minimal effect on scenery.

3.12.4 Cumulative Effects

The project boundaries for cumulative effects encompass the entire Superior National Forest excluding the BWCAW, MPAs and WSR segments and all no surface occupancy areas. Cumulative effects will also consider the effects of other projects occurring within the boundaries of the Forest. This is an appropriate boundary because the effects of the current and future prospecting permits would occur at various locations across the Forest but no drilling would occur in the BWCAW, MPAs, WSRs and all no surface occupancy areas, and it is unlikely that drilling would occur directly adjacent to the wilderness and therefore would not be seen from within the wilderness.

The timeframe for cumulative effects is 20 years because this is the extent of the time considered for prospecting permits. This is an appropriate timeframe because effects are not expected to last longer than prospecting activities and would generally exist only while prospecting activities were occurring. Reclamation would accelerate improving the scenic integrity after project implementation and includes pulling back and spreading woody debris over the disturbed areas, recontouring to blend in with the surrounding area, and if required by the FS seeding the disturbed areas.

Potential cumulative effects to scenery include vegetation management activities, mineral exploration, drilling and potential mine developments on other ownership, gravel pits, road construction and reconstruction, private developments, and natural disturbances such as wildfire and wind storms. Based on all of the possible changes that could occur across the Forest, there is a potential for cumulative effects to the scenery resource. However, there is no known method to accurately estimate or quantify the changes or the effects of those changes on members of the public across the entire superior National Forest. The short-term effects resulting from this project would be unlikely to lead to or result in measurable cumulative effects on a Forest-wide scale because of the small area of impact resulting from the drill sites and because the drill sites would re-vegetate upon completion of drilling activities. In addition, the temporary roads would be decommissioned and revegetated upon completion of the exploration activities.

3.13 Air Quality

3.13.1 Introduction

Air quality differs from other resources in that it is not stationary. Air masses are constantly moving across the landscape, gathering pollution in one area and transporting it to another. Another difference between air quality and other resources is that the time scale of air quality effects can be both short (instantaneous to 24-hour) and longer term such as an annual basis. Typically the time and spatial scale of air quality effects from Forest projects such as this one are not large enough to be a concern except possibly at the small scales. As is discussed in more detail in Section 3.13.3.2, drilling activity only affects air quality over a short distance downwind and for only a few days or weeks depending on the phase of the drilling project. After the drilling is complete there is no longer any effect on air quality.

3.13.2 Affected Environment

3.13.2.1 Existing Condition

The existing condition of the air in the area is very good. Air quality on the Forest is mainly affected by regional transport of air pollution from industrial/populations centers to the south such as

Minneapolis/Milwaukee/Chicago and beyond (Minnesota Pollution Control Agency 2009). Sensitive air quality receptors on the Forest are generally sites of concentrated human occupation such as Hoyt Lakes and Ely. Another sensitive receptor is the Boundary Waters Canoe Area Wilderness which has special protection under the Clean Air Act as a Class I area.

The most important air pollutant for this Project is particulate matter. Fine particulate matter is the size fraction of particulate matter that is the focus of air quality regulation since it is most responsible for adverse health effects. The threshold of concern for fine particulate matter is defined by US Environmental Protection Agency and is called the National Ambient Air Quality Standard (NAAQS), which is currently 15 micrograms per cubic meter (ug/m3), on an annual average (averaged over 3 years). Air monitoring done in the state shows that air quality near the Forest (represented by the Virginia site) is well below the annual fine particulate matter NAAQS (Figure 34).

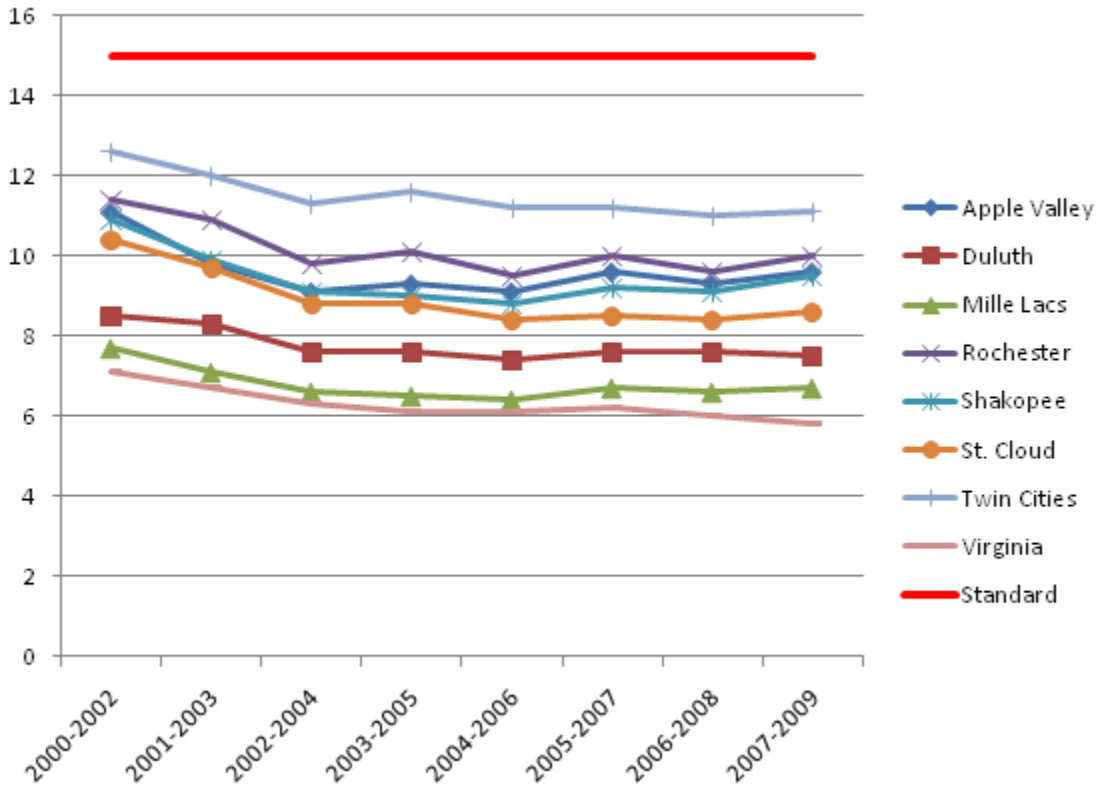


Figure 34. Fine particulate matter monitoring results for Minnesota (MPCA 2010)

3.13.3 Direct and Indirect Effects

3.13.3.1 Alternative 1

No effects would occur to air quality under Alternative 1

3.13.3.2 Alternatives 2-5

Each of the drilling projects can be divided into three phases. The first phase involves road building and site preparation. This phase would generate particulate matter (dust) for a few days, which would be very similar to that already occurring in the area due to unpaved road usage and maintenance. Dust generated

by unpaved road traffic does not travel far from the road's edge - 90 percent settles within 50 meters of the roadside (AWMA 2000). In addition to dust, diesel engines would have emissions which would be similar to those already occurring in the area from diesel trucks. During the second phase of operation the drilling would occur. This activity could go for 24-hours per day and could run intermittently for 2 to 3 weeks for each drill hole. This is a wet process so no air emissions would be generated other than from the diesel engine the drives the drill. Those emissions, while potentially more continuous over the drilling periods, have similar natural resource impacts to existing diesel trucks. The last phase would be the site reclamation which would generate emissions similar to the first phase of operations.

The activities included in the project description are not expected to generate enough particulate matter to threaten the NAAQS or threaten sensitive receptors. Dust that is generated by this project would be almost entirely from truck traffic, since the drilling would involve the use of water to transport the cuttings. Dust from truck traffic would tend to be larger in size. This would mean that whatever small amount of dust is generated would settle out quickly and not travel far from the drilling site. Therefore sensitive receptors would not be affected by dust unless the drilling sites were immediately adjacent to them. The small amount of additional, intermittent diesel engine usage is not expected to affect air quality over and above the existing level of diesel emissions from truck traffic on the Forest. The existing level of truck traffic on the Forest is reflected in the background measured air quality, which is very good.

3.13.4 Cumulative Effects

Due to the short duration and minimal effects anticipated, no cumulative effects are expected to the Forest, including the BWCAW.

3.14 Economics and Environmental Justice

3.14.1 Introduction

Economic and environmental justice concerns were identified as part of the scoping effort specific to this project. Multiple statutes, regulations, and executive orders identify the general requirement for applying economic and social evaluation in support of Forest Service planning and decision making. These include, but are not limited to, the Multiple -Use Sustained Yield Act of 1960 (74 Stat. 215; 16 USC 528–531), National Environmental Policy Act (NEPA) of 1969 (83 Stat. 852; 42 USC 4321, 4331–4335, 4341–4347), and the Forest and Rangeland Renewable Resources Planning Act of 1974.

The economic impacts to the local economy affected by exploration and associated activities are measured by estimating the employment (full- and part-time jobs) and labor income generated by geophysical activities and exploratory drilling activities. This analysis offers a consistent measure for comparison of alternatives. Changes in final demand for goods and services, as a result of actions under this EIS, can contribute to employment and income in the area. If demand exists for these products, employment and income would likely be supported in other areas if these goods and services are provided by other means. Effects from potential minerals development are not included since these activities are not covered under this EIS. Direction provided in 40 CFR 1502.23 and Forest Service Handbook 1909.15 and 22.35 (September, 2010) provides for qualitative analysis to evaluate the effects of nonmarket values. Therefore, the alternatives' nonmarket aspects are discussed qualitatively where appropriate and are described in other resource sections of the DEIS.

In addition, Executive Order (EO) 12898, issued in 1994, requires that Federal agencies "identify and address the disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low -income populations." EO 12898 also directs

agencies to consider patterns of subsistence hunting and fishing when an agency action may affect fish or wildlife.

3.14.1.1 Analysis area

In order to accurately portray the effects of the alternatives, the geographic scope of analysis must be defined. The economic effects from issuance of prospecting permits and associated activities feasibly extend beyond the immediate vicinity of the activity. Thus, the effects within the larger region must be addressed while not masking potential change within counties in the area. In this manner, area economic characteristics and effects on the economic environment are dependent on the extent of the area examined, thus area information is presented for both the northeastern Minnesota region and counties within that region.

At the broad scale, economic areas from the Bureau of Economic Analysis (BEA) are used. These economic areas represent the relevant regional markets for labor, products, and information and are also determined by commuting patterns. This delineates local labor markets and also serves as a proxy for local markets where businesses in the areas sell their products (US Department of Commerce 2004). The BEA's Duluth, MN-WI economic area contains a large portion of the Superior National Forest (SNF) however analysis at only this scale would likely mask relationships with the Forest in smaller areas. While Carlton County and Douglas County, WI are included in the BEA's economic area, they contain no national forest land. In addition inclusion of these counties would dilute important economic relationships and are consequently not included in the analysis area. Thus, characteristics of the five county region are presented alongside those for the individual counties of Cook, Itasca, Koochiching, Lake and St. Louis counties. In addition, Environmental Justice is examined at both the regional and county level.

3.14.2 Affected Environment

3.14.2.1 Demographic Overview

Between 1970 and 2007 population change in Itasca, Lake, Koochiching and St. Louis counties was 24, - 20, - 22 and - 11 percent, respectively. Growth in these counties was outpaced by growth in the nation and the state of Minnesota which increased by 48 and 36 percent, respectively. In contrast Cook County population growth outpaced the state and the nation increasing by 61 percent over this period (Figure 35). The decreases in population occurred over a decade in the 1980s and occurred in part due to a downturn in the national steel industry affecting the local taconite industry (US Department of Energy 2007, University of Montana 2007).

The SNF overlaps some of Minnesota's least dense counties (3.7 and 5.2 persons per square mile in Lake and Cook counties) and St. Louis County which contains a moderate population density at 31 persons per square mile compared to the state median of 27 (US Department of Commerce 2007).

The population within the region has aged since 1990 from a median age of 35.9 to 39.7 in 2000. In the year 2000, for individual counties the largest age categories were 45 to 49 years. Between 1990 and 2000 the fastest growing age groups were 45 to 49 in Lake, Itasca, Koochiching and St. Louis counties while the older 50 to 54 category in Cook County. In all counties the largest decreases in population occurred for those aged 30 to 34 years old which occurred alongside smaller decreases in other age groups between the ages of 25 to 39 (US Census 2000). Thus all analysis area counties show similar trends of an aging population occurring alongside decreases in the younger generation.

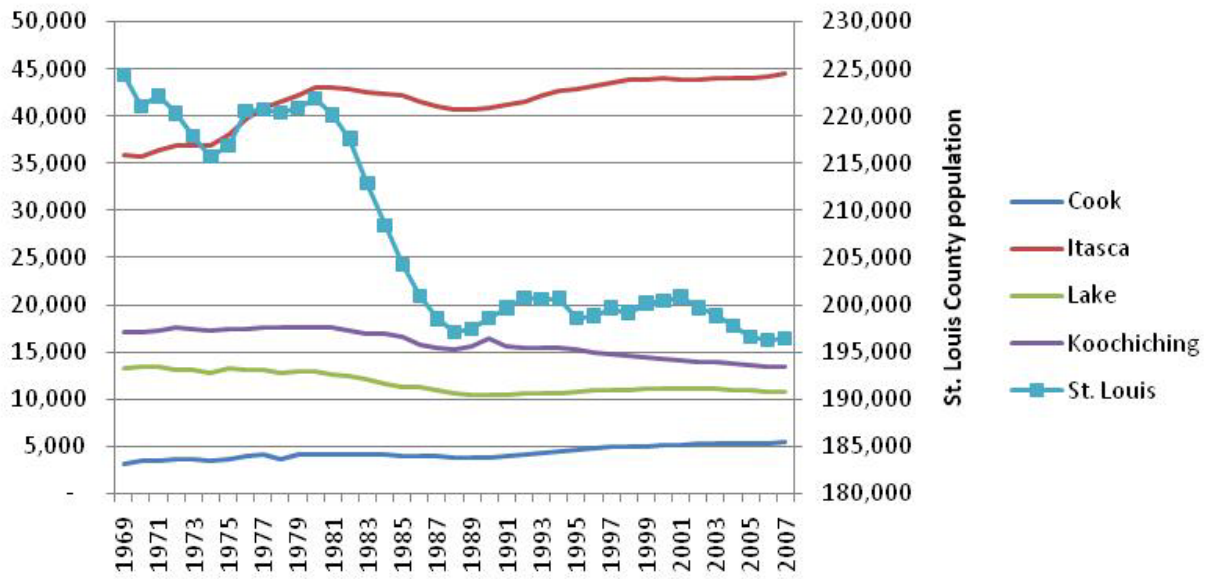


Figure 35. Population change in counties in the analysis area (US Department of Commerce 2007)

Race and Ethnicity are broken out separately since Hispanics can be of any race. For individual counties within the analysis area the share of the American Indian population was greater than the analysis area and the state in Cook and Itasca counties. In addition the share of those identifying as African American and Asian were greater in St. Louis County than their shares in the analysis area while the share of those identifying themselves as Hispanic was greater in Cook County than in the analysis area (Table 45).

Table 45. Population by race (2007)

	White	Black or African American	American Indian and Alaska Native	Asian	Native Hawaiian or Other Pacific Islander	Two or more races	Hispanic
Minnesota	89.2%	4.5%	1.2%	3.5%	0.1%	1.5%	4.0%
Analysis area	94.4%	0.9%	2.5%	0.6%	0.03%	1.5%	1.0%
Cook	88.5%	0.3%	8.4%	0.4%	0.04%	2.4%	1.6%
Itasca	94.2%	0.3%	3.7%	0.3%	0.02%	1.5%	0.9%
Koochiching	95.5%	0.5%	2.5%	0.2%	0.07%	1.2%	0.8%
Lake	97.8%	0.1%	0.9%	0.2%	0.01%	1.0%	0.7%
St. Louis	**94.4%**	**1.2%**	**2.2%**	**0.7%**	**0.03%**	**1.5%**	**1.0%**

Source: US Census Bureau 2007

3.14.2.2 Economic Specialization and Employment

Employment within the analysis area is distributed amongst industry sectors and displayed below in Figure 36 (IMPLAN 2007). The Interior Columbia Basin Ecosystem Management Project identified communities that were specialized with respect to employment. Their method used the ratio of the percent employment in each industry in the region of interest (counties within the analysis area) to the percent of employment in that industry for a larger area (the reference region; the BEA's Economic Area). For a given industry, when the percent employment in the analysis region is greater than in the reference region, local employment specialization exists in that industry (USDA Forest Service 1998).

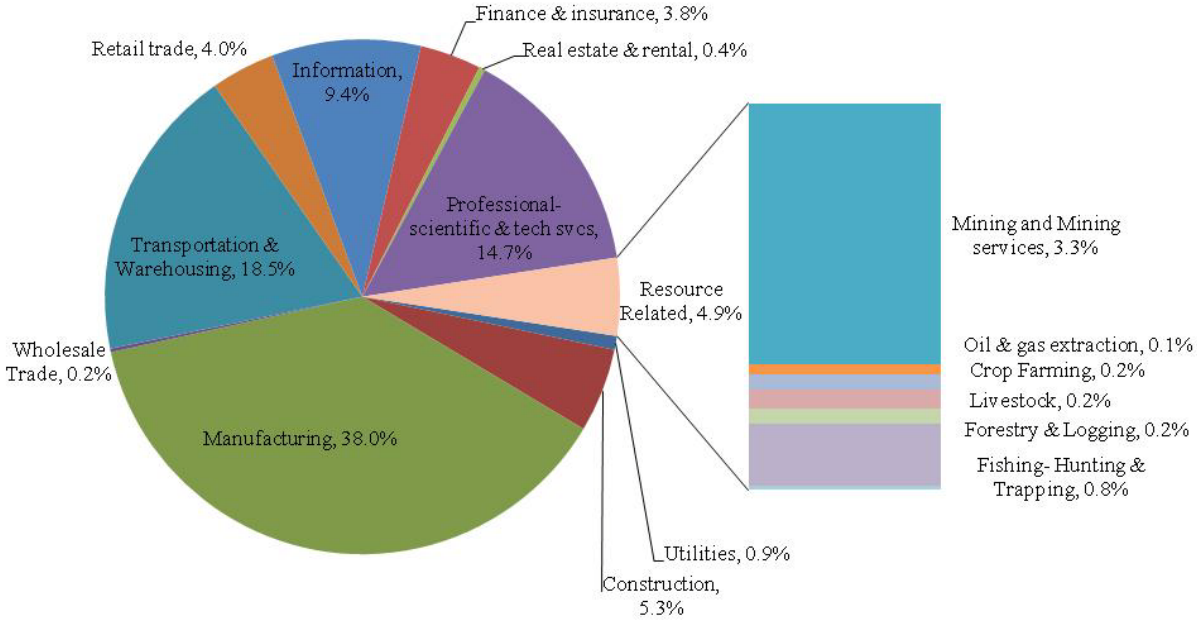


Figure 36. Analysis area industry employment distribution (Source: IMPLAN 2007)

Using this criterion applied with 2007 data, Lake and St. Louis counties can be characterized as specialized with respect to employment in the mining and mining services sectors. Over time economic specialization has changed. The degree of change is reflected in Figure 37, where total employment in the five county analysis area is disaggregated into four industry sectors where data was available (US Department of Commerce 2000)[7].

From 1970 to 2006, total employment in the analysis area increased by 48.5 percent (from 112,592 to 167,226 jobs classified as full and part-time employment)[8] (US Department of Commerce 2006). The state of Minnesota saw an increase in total employment of 106 percent over this time period. The employment growth seen in these counties is largely due to increases between 1970 and 2000 in Service and Retail trade related employment. The share of total employment attributable to the Service related sector increased from 18.4 percent to 32.5 percent while Retail trade related employment increased from 15.3 to 18.6 percent. While actual employment in the Government sector increased over this period (Figure 37), its share of total employment decreased by 4 percent (from 21 to 17 percent). Employment in the Construction sector has increased in absolute terms and as a share of total employment (from 4.5 percent to 5.2 percent). Between 1970 and 1997[9] manufacturing employment decreased in absolute terms and as a share of total employment (from 13.6 to 8.2 percent) while the Farm and Agricultural Services sector saw slight increases in number and their portions of total employment, increasing from 1.4 to 1.8 percent (US Department of Commerce 2000).

[7] The numbers in Figure 37 are not directly comparable to the IMPLAN numbers in Figure 36 since IMPLAN data include farm and proprietor employment in addition to wage and salary employment. Similarly the IMPLAN data also includes estimates for non-disclosures that similarly include farm and proprietor employment in addition to wage and salary employment.

[8] Changes in employment for sectors below are discussed over the period from 1970 to 2000 since the US Census Bureau changed its industry classification convention in 2000.

[9] Data for several sectors are not available for the period discussed above due to disclosure restrictions to protect proprietary information of individual firms at the county level thus, employment in the manufacturing, farm and agricultural services sector is presented for the period from 1970 to 1997.

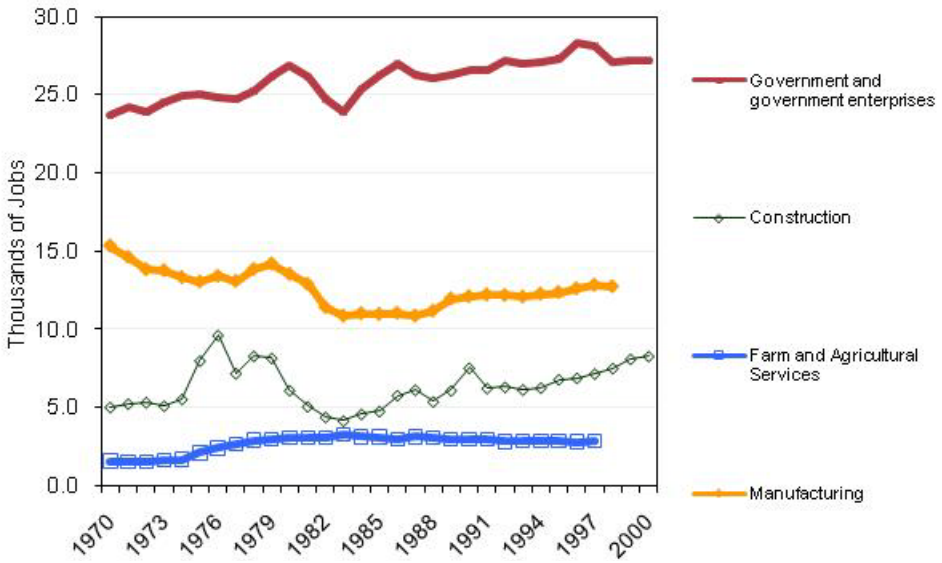


Figure 37. Employment history of the analysis area (US Department of Commerce 2000)

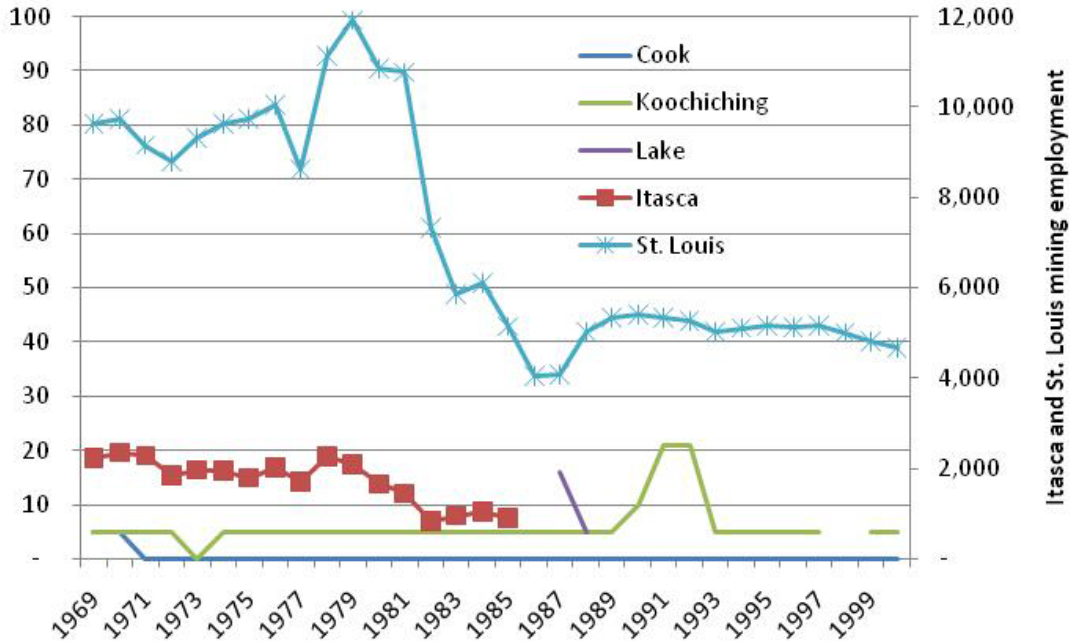


Figure 38. Employment history for the mining industry within counties in the analysis area (US Department of Commerce 2000)

For individual counties in the analysis area, mining and mining services employment has decreased over the period from 1970 to 2000 (Figure 38). Gaps in data in Figure 38 below indicate information is not disclosed from the US Census Bureau in order to protect proprietary data specific to individual firms. Figure 38 shows St. Louis and Itasca counties historically had higher shares of employment in this sector which decreased in the 1980s following the downturn in the national steel industry affecting the local taconite industry (University of Montana 2007). Between 2001 and 2006 mining employment has continued to drop in St. Louis and Itasca counties decreasing by 20 and 8 percent, respectively (from 3,546 to 2,872 and from 362 to 359, respectively). In 2006 mining employment made up less than one percent of total employment in Cook and Koochiching counties and 2 percent in St. Louis County (US

Department of Commerce 2006). This information demonstrates mining has provided a decreasing portion of total area employment while the Service and Professional sector has maintained a steady increase.

3.14.2.3 Economic Well-Being and Poverty

As noted above, the Service and Professional sectors increased in their share of total employment while the Farm and Agriculture Services, Manufacturing and Mining sectors remained relatively steady or decreased. However, the Service and Professional sector jobs may not pay as much, which could decrease area economic well being. Within the analysis area the private sectors examined can be lumped into Goods- Producing sectors (Natural Resources, Construction, and Manufacturing) and Service-Providing sectors (Trade, Transportation, Utilities, Finance, Education, Health, etc.). In 2006 the Goods-Producing and Service-Providing sectors paid average annual wages of $47,697 and $29,640, respectively (US Department of Labor 2006). From these statistics it is apparent that while the service sector accounts for an increasing share of total employment, these jobs do not pay as much. The welfare implications of these changes are not so clear. The changes in population in some counties noted above suggests some people may be moving away instead of taking lower paying jobs in the service sector. Other people might move to the area to take a service sector job but exchange the lower wage they may receive for the unique natural and cultural amenities. In this manner some may benefit from a “secondary income” not provided by their place of employment but by the benefits they gain from living in the area.

Total personal income (TPI) and per capita personal income (PCPI) are useful measures of economic well-being. From 1970 to 2006, annual TPI in the economic analysis area increased by $5.1 billion to $8.6 billion, and annual PCPI increased from $17,661 to $31,880 (all measures adjusted for inflation to 2006 dollars). This translates to an TPI increase of 69 percent (roughly 2 percent annually) and a PCPI increase of 81 percent (roughly 2 percent annually) over this time period. Average PCPI in the economic analysis area was lower than the state ($38,859) and the nation ($36,714) in 2006 which can be explained by differences in cost of living in metropolitan verses the predominantly non-metropolitan economic analysis area. Differences in non-metropolitan and combined metropolitan/non-metropolitan PCPI levels for the state and the nation explain the lower levels seen in the economic analysis area (non-metropolitan for the state was $29,249 and for the nation was $27,239 in 2006; while metropolitan/non-metropolitan combined was $38,859 for the state and $36,714 the nation) (US Department of Commerce 2006b).

While PCPI is a useful measure of economic well-being it should be examined alongside changes in real earnings per job. Since PCPI includes income from 401(k) plans as well as other non-labor income sources like transfer payments, dividends, and rent, it is possible for per capita income to rise, even if the average wage per job declines over time. While PCPI rose between 1970 and 2006, average earnings per job fell from $37,978 to $36,983 (values adjusted for inflation to 2006 dollars) (US Department of Commerce 2006c). So while PCPI bounced back after job loss in the iron industry, real earnings per job decreased. Alongside observed increases in non-labor income associated with the aging population discussed above, the changes in PCPI make sense. Regardless real earnings per job fell indicating a possible decrease in economic well-being.

From 1992 to 2000, average annual unemployment rates in the analysis area fell with national and state levels from 8.4 to 4.6 percent (Figure 39). Since 2000, unemployment has continued to follow state and national trends and rose to 6.8 percent in 2008 (US Department of Labor 2008). New jobs created in an area are filled from two principal sources; local unemployment and in-migration. If unemployment remains high, new jobs are likely to be filled by local area residents, however if unemployment falls, new jobs could be filled more often by new area residents. A report on the Minnesota Mining Economy prepared by the University of Montana cited a shortage of skilled workers across the Iron Range region

for the Minnesota Steel Project in Itasca County. The report noted that mining companies were recruiting workers from areas outside of the Range (University of Montana 2007).

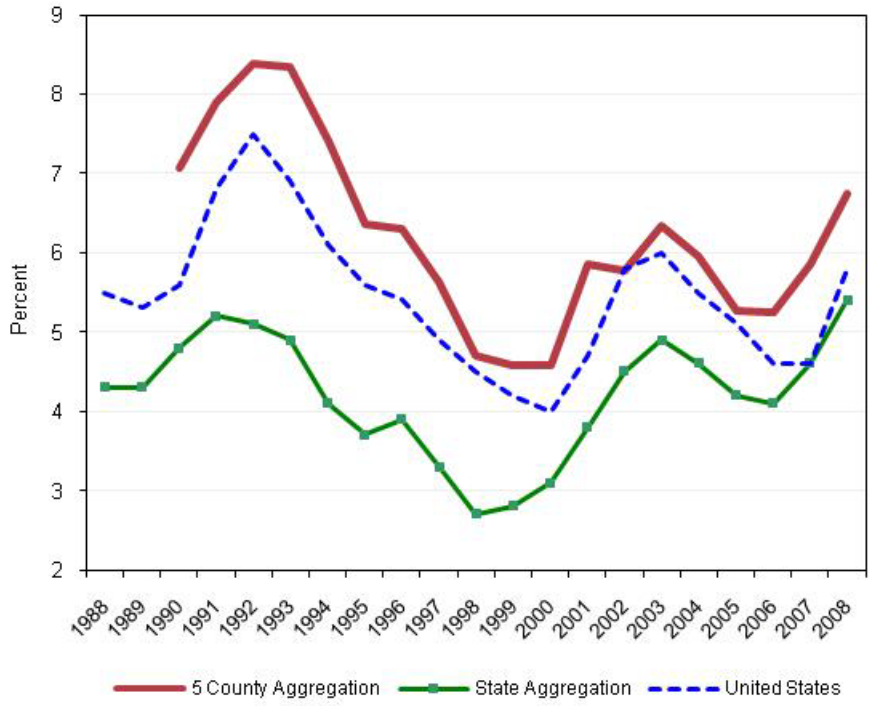


Figure 39. Average annual unemployment rate of the analysis area (source: US Department of Labor 2008)

The number of people living below the poverty level in all counties decreased between 1989 and 1999 expect in Cook County where a slight increase occurred. Despite this increase the share of those persons, from the number of persons for whom poverty status was assessed, decreased in all analysis area counties (Table 46). The largest decreases occurred in Itasca County where the share fell by 5.3 percent. This decrease was greater than the reduction seen for the state however, all other counties saw smaller changes than the state over this period. In 1999 the entire analysis area and all counties except Lake County maintained levels of poverty greater than the state (US Census Bureau 2000).

Table 46. Share of population living below poverty level and change between 1989 and 1999 (US Census Bureau 2000)

	1989	1999	net change	change in share
Minnesota	**10%**	**8%**	**-54,855**	**-2.3%**
Analysis area	**14%**	**12%**	**-6,220**	**-2.5%**
Cook	**11%**	**10%**	**103**	**-0.7%**
Itasca	**16%**	**11%**	**-1,786**	**-5.3%**
Koochiching	**13%**	**12%**	**-373**	**-0.8%**
Lake	**9%**	**7%**	**-174**	**-2.1%**
St. Louis	14%	12%	-3,990	-2.1%

3.14.2.4 Components of Personal Income

Further examining trends within personal income provides insight to the area economy and its connection to potential activities proposed under this EIS. There are three major sources of personal income: (1) labor earnings or income from the workplace, (2) investment income, or income received by individuals in the form of rent, dividends, or interest earnings, and (3) transfer payment income or income received as Social Security, retirement and disability income or Medicare and Medicaid payments.

Labor earnings were the largest source of income in the analysis area accounting for 61 percent of all income in 2006. The Manufacturing sector was the largest components of labor income in 2007 for the economic analysis area (Figure 40). While mining made up only 3.3 percent of analysis area employment it makes up 7.8 percent of labor income.

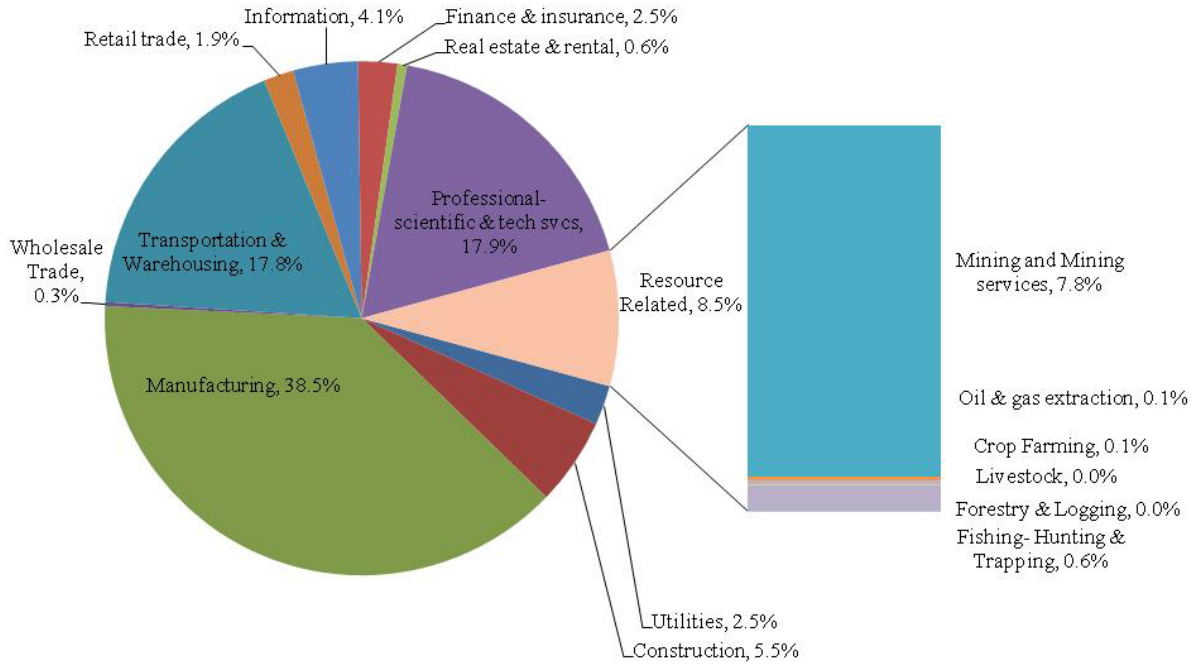


Figure 40. Economic analysis area labor income distribution (IMPLAN 2007)

While labor earning's share of TPI has decreased from 1970 to 2006 (from 74 to 61 percent), the share of non-labor income has risen (from 25 to 39 percent). As a share of TPI, investment income and transfer payments rose from 13 to 17 and 12 to 19 percent, respectively, over this 36-year time period. The increase in transfer payments are not due to increases in welfare or unemployment related payments. Data shows the share of transfer payments from unemployment payments decreased from 5 to 2 percent while the share from income maintenance benefit payments, or "welfare" also decreased from 10 to 7 percent. In 2006 the largest component of transfer payments were the age related payments (classified as Retirement and Disability Insurance and Medicare Benefits) accounting for 55 percent of total transfer payments.

These patterns reflect the importance of the aging population noted above, whom are more likely to have investment earnings than younger adults. As the population of the area continues to age, the share of income from these non-labor sources should continue to rise as long as residents continue to stay in the area after retirement or new retirees move in. Rural county population change, the development of rural recreation and retirement-destination areas are all related to natural amenities (Knapp and Graves 1989, Clark and Hunter 1992; Treyz et al. 1993, Mueser and Graves 1995, McGranahan 1999, Lewis et al.

2002). Such amenity-supported economic vitality is a powerful force in many areas of the nation including St. Louis, Itasca, and Lake Counties (University of Montana 2007). Many of the natural amenities in the area are managed by the Superior National Forest and thus, indirectly contribute to area labor and non-labor income.

3.14.2.5 Mining

In 2008, Minnesota was one of 11 states that produced more than $2 billion worth of nonfuel mineral commodities producing $3.2 billion in total value of production which was 4.5 percent of the total U.S. nonfuel mineral production value (US Department of the Interior 2009). In terms of value, the top five types of mineral commodities removed are iron ore, sand and gravel (construction), stone (crushed), sand and gravel (industrial), and stone (dimension). Prospecting under the33 permit applications in this EIS would target copper, nickel, lead, zinc, cobalt, chromium, iron, titanium, platinum, palladium, silver, gold and other associated metals.

In 2008, mines in Michigan and Minnesota shipped 98 percent of the usable iron ore produced in the U.S. (US Department of the Interior 2009). Copper, nickel, and titanium have been discovered in the state in minable quantities, and production may occur with changing market conditions (State of Minnesota 2009). The United States did not mine or refine cobalt in 2008; however, negligible amounts of byproduct cobalt were produced as intermediate products from some mining operations. Minnesota contains almost all of the one million tons of identified cobalt resources within the U.S. (US Department of the Interior 2009). Exploration for additional resources, such as chromium, gold, platinum, palladium, silver, zinc, and lead, continues today in Minnesota.

Mining employment within the analysis area as a share of total employment dropped from 10.8 percent in 1970 to 2.9 in the 2000. In Itasca County mining employment dropped from 20.6 to less than one percent of total employment over this period and fell from 11.3 to 3.9 percent in St. Louis County (US Department of Commerce 2000). Given the small number of firms in the area within the industry, complete data is not available for other counties from the US Department of Commerce however, similar data depicted in Figure 36 and Figure 40 show that mining made up 3.3 percent of analysis area employment and 7.8 percent of labor income in 2007 (IMPLAN 2007). In 2006 average annual wages in the mining sector were $72,669 which was 20 percent more than wages in all other sectors (US Department of Labor 2006).

3.14.2.6 Environmental Justice

Environmental justice refers to the fair treatment and meaningful involvement of people of all races, cultures and incomes with respect to the development, implementation and enforcement of environmental laws, regulations, programs, and policies. Executive Order 12898 requires Federal agencies to “identify and address the disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations.”

According to the Council on Environmental Quality’s (CEQ) Environmental Justice Guidelines for NEPA (1997) “minority populations should be identified where either: (a) the minority population of the affected area exceeds 50 percent or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis.” Table 45 shows that Cook and Itasca counties contained populations of those identifying as American Indian and Alaska Native which were greater than the state and the analysis area during 2000. Cook and St. Louis counties also contained populations of those identifying as African American and Hispanic which were greater than the analysis area. Thus, the US Census data suggest minority populations within the economic analysis area likely meet the CEQ’s Environmental Justice criterion.

CEQ guidance on identifying low-income populations states “agencies may consider as a community either a group of individuals living in geographic proximity to one another, or a set of individuals (such as migrant workers or Native Americans), where either type of group experiences common conditions of environmental exposure or effect.” The discussion above on poverty noted the share of those living below the poverty level decreased between 1989 and 1999 however, county levels remained above the state and the analysis area in Itasca County (Table 46). Thus, the Census data indicate low income populations exist within the economic analysis area.

3.14.3 Direct and Indirect Effects

The analysis of economic effects considers job and labor income in an economic impact analysis. Non-market values, such as the value of recreation experiences and effects on ecological services, by their nature are difficult to quantify. Direction provided in 40 CFR 1502.23 and Forest Service Handbook 1909.15, (7/6/04) and 22.35 (01/14/05) provides for the use of qualitative analysis to evaluate the effects of these non-market values. As discussed above under Issues, the efficiency and non-market aspects of each proposed activity will be described in other resource sections of the EIS and specialist reports.

Employment and labor income impacts are used to evaluate potential direct, indirect, and induced effects on the economy. The analytical technique used by the Forest Service to estimate these impacts is "input-output" analysis using the IMPLAN Pro software system (IMPLAN 2007). Input-output analysis (Miernyk 1965) is a means of examining relationships within an economy between businesses and between businesses and final consumers. The direct employment and labor income resulting from exploration and associated activities first benefit employees and their families, and therefore directly affect the local economy. Additional indirect and induced multiplier effects (ripple effects) are generated by the direct activities. A portion of the effect occurs outside the analysis area, and can be classified as leakage, and is thus not included in the direct or indirect effect. Together, the direct and multiplier effects comprise the total economic impacts to the local economy. In this manner, input-output analysis captures all monetary market transactions for consumption in a given time period. Potential limitations of these estimates are the time lag in IMPLAN data and the data intensive nature of the input-output model.

The economic impacts to the local economy affected by exploration and associated activities are measured by estimating the employment (full- and part-time jobs) and labor income generated by geophysical activities and exploratory drilling activities (Table 47) for the 20 year analysis period. Effects from potential minerals development are not included since these activities are not covered under this EIS. Table 47 below provides the list of activities and assumptions used in the economic analysis.

Table 47. Geophysical and exploratory drilling activities and assumptions used in analysis of economic effects

Activities	Assumptions for Economic Analysis
Geophysical Activities	
Ground and aerial survey	Sixteen acres of ground disturbing and eight acres of non ground disturbing per proposal. One aerial survey per 6,400 acres of ground survey.
Exploratory Drilling Activities	
Site prep and restoration	Includes dozer work, road work, and water hauling
Drilling	7.4 holes per operating plan proposal (average depth of 3,500 ft). One proposal per year may utilize helicopter support.

Employment and labor income response coefficients (employment and labor income per proposal) were estimated for the activities in Table 47. The response coefficients indicate the number of full and part time jobs and dollars of labor income generated per proposal from geophysical and exploratory drilling activities. They are useful for understanding the economic contributions tied to current activities and for understanding employment and labor income effects of anticipated activities under the alternatives. The response coefficients are unique to the 5-county analysis area discussed above. Using information on activity cost obtained from area operators, minimum and maximum response coefficients were estimated for each activity since actual cost depends on a variety of unanticipated factors (Table 48).

Table 48. Employment and labor income response coefficients (direct, indirect and induced effects per proposal)

Activities	Employment (Jobs per Proposal)		Labor Income (2010 Dollars) ($ per Proposal)	
	Minimum	Maximum	Minimum	Maximum
Geophysical Activities				
Ground and aerial survey	0.1	0.2	$2,682	$5,603
Drilling Activities				
Site prep and restoration	0.1	0.2	$3,440	$5,161
Drilling	0.9	2.4	$42,925	$111,662

It is important to note that while response coefficients may be greater for certain activity types, the economic effects to the analysis area also depend on the level of activity or number of proposals under which activities would occur. In addition, these response coefficients reflect an economic structure that is a snapshot in time and, therefore, are not applicable to exploration activity that are dramatically different from levels examined. If levels of exploration and associated activities were to change radically, there would be a structural shift in the economy as spending patterns changed and these response coefficients would no longer reflect underlying economic processes.

Since activities will occur at different times throughout the 20 year analysis period (for example, geophysical activities are assumed to take place in the first two years of permit approval, while drilling and related activities are assumed to occur over a twenty year period), employment and income are examined on an annual basis. The response coefficients were multiplied by the number of anticipated annual proposals during the 20 year analysis period as depicted in Figure 7. This portrayal of an annual range of effects provides insight on the importance of potential employment and income for any year over the 20 year analysis period (Figure 41).

This analysis offers a consistent measure for comparison of alternatives however, it should not be viewed as a complete answer. The discussion of potential jobs and income impacts should occur alongside consideration of other values and resource effects not included here. Changes in final demand for goods and services, as a result of actions under this EIS, can contribute to employment and income in the area. However, if demand exists for these products, employment and income would likely be supported in other areas if these goods and services are provided by other means. Therefore it is important to consider the efficiency of using these resources alongside potential job and income generation from their use. Consideration of these impacts alongside additional social, ecological or other resource considerations provide a complete comparison of the EIS alternatives.

Environmental Justice

Environmental justice effects will report what, if any, effects might occur to minority and low-income populations, as defined by the CEQ and presented in the discussion of the affected environment above.

Spatial and Temporal Context for Effects Analysis

The timeframe over which activities may occur as a result of implementing proposals is 20 years. The economic effects feasibly extend beyond the immediate vicinity of the activity. Thus, the effects within the larger region must be addressed while not masking potential change within counties in the area. As discussed above, the analysis area used to assess employment and income effects includes Cook, Itasca, Koochiching, Lake and St. Louis counties.

3.14.3.1 Alternative 1 – No Action

Current operating plans

Under the No Action alternative, no prospecting permits and operating plans would not be approved. Consequently employment and income levels associated with exploratory drilling activities would not change from the current conditions described above.

3.14.3.2 Alternatives 2 - 5

Current operating plans

Under the action alternatives the current 21 proposed operating plans (and extension) would be approved. Consequently geophysical and exploratory drilling activities would occur as anticipated in Figure 7. The response coefficients shown in Table 48 and levels of use anticipated as described in Section 2.2.2.4 were used to estimate the economic effects from exploration and associated activities of the proposed action in the analysis area (Table 49).

Table 49. Annual average economic effects of current operating plans under the action alternatives

Activities	Employment (Jobs per Proposal)		Labor Income (2010 Dollars) ($ per Proposal)	
	Minimum	Maximum	Minimum	Maximum
Geophysical Activities				
Ground and aerial survey	0.1	0.2	$2,816	$5,883
Drilling Activities				
Site Prep and restoration	0.2	0.3	$6,307	$9,461
Drilling	1.6	4.3	$74,408	$198,281
Total	1.9	4.8	$86,169	$220,418

Over the 20 year analysis period, anticipated exploration and associated activities would provide a minimum of 2 jobs (direct, indirect, and induced) and $86,000 in labor income (direct, indirect, and induced) and a maximum of 5 jobs and $220,000 in labor income on an average annual basis within the analysis area. It is important to note that these are not new jobs or income, but rather jobs and income that can be attributed to activities associated with current operating plans under the action alternatives.

Current prospecting permits

Under the action alternatives the current 46 prospecting permits would include the current 21 operating plans discussed above plus an additional 25 permits could be approved. Therefore, there would be a total

of 92 operating plans potentially approved contingent upon environmental review. Consequently geophysical and exploratory drilling activities would occur as anticipated in Figure 7. The response coefficients shown in Table 48 and levels of use described in Section 2.2.2.4 were used to estimate the economic effects from exploration and associated activities of the proposed action in the analysis area (Table 50).

Table 50. Annual average economic effects of current prospecting permits under the action alternatives

Activities	Employment (Jobs per Proposal)		Labor Income (2010 Dollars) ($ per Proposal)	
	Minimum	Maximum	Minimum	Maximum
Geophysical Activities				
Ground and aerial survey	0.2	0.4	$6,035	$12,607
Drilling Activities				
Site Prep and restoration	0.4	0.6	$14,220	$21,330
Drilling	3.5	9.4	$167,605	$446,807
Total	4.2	10.5	$187,860	$480,744

With these additional operating plans, anticipated exploration and associated activities would provide a minimum of 4 jobs (direct, indirect, and induced) and $188,000 in labor income (direct, indirect, and induced) and a maximum of11 jobs and $481,000 in labor income on an average annual basis within the analysis area. It is important to note that these are not new jobs or income, but rather jobs and income that can be attributed to activities associated with current prospecting permits under the action alternatives.

Future prospecting permits

Under the action alternatives it is anticipated that10 permits will be received each year for 5 years for a total of 50 permits and 100 operating plans. Consequently geophysical and exploratory drilling activities would occur for these 50 additional permits as anticipated in Figure 7. The response coefficients shown in Table 48 and levels of use levels of use described in Section 2.2.2.4 were used to estimate the economic effects from exploration and associated activities of the proposed action in the analysis area (Table 51).

Table 51. Annual average economic effects of current plus future prospecting permits under the action alternatives

Activities	Employment (Jobs per Proposal)		Labor Income (2010 Dollars) ($ per Proposal)	
	Minimum	Maximum	Minimum	Maximum
Geophysical Activities				
Ground and aerial survey	0.3	0.6	$8,270	$17,276
Drilling Activities				
Site Prep and restoration	0.8	1.2	$26,895	$40,343
Drilling	6.7	17.8	$316,891	$844,903
Total	7.8	19.6	$352,056	$902,522

With the additional operating plans authorized under these anticipated permits, exploration and associated activities would provide a minimum of 8 jobs (direct, indirect, and induced) and $358,000 in labor income (direct, indirect, and induced) and a maximum of 20 jobs and $917,000in labor income on an average annual basis within the analysis area. It is important to note that these are not new jobs or income,

but rather jobs and income that can be attributed to activities associated with current prospecting permits under the action alternatives.

Examination of effects on an annual basis provides insight on the range of potential employment and labor income from anticipated differences in the timeframe of exploration activities (Figure 41).

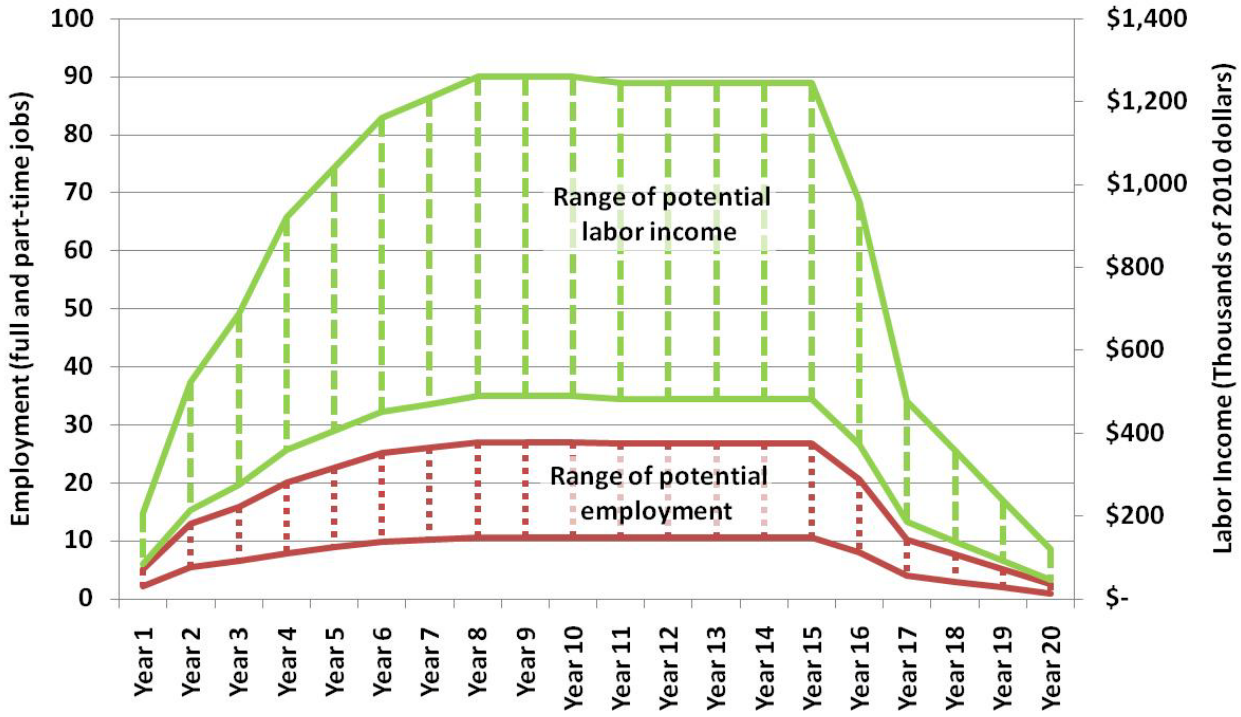


Figure 41. Annual estimates of employment and income under the action alternatives

Between years 8 and 10 the maximum potential employment and labor income contribution is possible (Figure 41). Over this period exploration and associated activities would provide a minimum of 11 jobs (direct, indirect, and induced) and 501,000 in labor income (direct, indirect, and induced) and a maximum of 28 jobs and $1.29 million in labor income on an average annual basis within the analysis area.

While minority and low-income populations may exist in the area, the alternatives are not expected to have a disproportionately high and adverse human health or environmental effects on these communities. Impacts to local communities are expected to be negligible, and there is no reason to suspect that any impacts will disproportionately affect minority and low income populations. In fact, employment and income supported by Alternatives 2- 5 could benefit area minority and low-income individuals.

Summary of Effects

Under the action alternatives, anticipated exploration and associated activities would provide a minimum of 8 jobs (direct, indirect, and induced) and $352,000 in labor income (direct, indirect, and induced) and a maximum of20 jobs and $903,000 in labor income on an average annual basis within the analysis area. While minority and low-income populations may exist in the area, the alternatives are not expected to have a disproportionately high and adverse human health or environmental effects on these communities.

3.14.4 Cumulative Effects

3.14.4.1 Area of Analysis

The economic effects from issuance of prospecting permits and associated activities feasibly extend beyond the immediate vicinity of the activity. Thus, the effects within the larger region must be addressed while not masking potential change within counties in the area. At the broad scale, economic areas from the BEA are used. These economic areas represent the relevant regional markets for labor, products, and information and are also determined by commuting patterns (US Department of Commerce 2004). While Carlton County and Douglas County, WI are included in the BEA's economic area, they contain no portion of the forest and inclusion of these counties would dilute important economic relationships at the local level. Thus the analysis area includes Cook, Itasca, Koochiching, Lake and St. Louis counties.

3.14.4.2 Alternative 1

The No Action alternative contributes no jobs or income because there are no additional prospecting permits and associated activities under this alternative. Consequently there are no cumulative economic effects to the analysis area economy.

3.14.4.3 Alternatives 2-5

Employment and labor income associated with exploratory activities would contribute directly as a result of labor required, and indirectly as purchases are made between industry sectors and households spend resulting income. These contributions would accrue to the analysis area alongside impacts from other projects occurring on public and private land in the area. Direct effects to the mining and mining services sector from activities under current and future prospecting permits would account for less than a fifth of a percent in employment and labor income annually in any given year of 20 year analysis scenario. Total employment supported in all sectors of the analysis area economy would not exceed a tenth of a percent in any given year. The economy can be affected by a variety of factors including population growth, changes in interest rates, recession, growth of new sectors, tax policy, state economic policy, etc. When compared to these factors, the proposed actions have a negligible cumulative effect on the analysis area economy. Because any changes in economic activity from the proposed action would be unnoticeable at these levels, there should be no cumulative economic effects.

3.15 Required Disclosures

NEPA at 40 CFR 1502.25(a) directs "to the fullest extent possible, agencies shall prepare draft environmental impact statements concurrently with and integrated with …other environmental review laws and executive orders."

3.15.1 Short-term Uses and Long-term Productivity

NEPA requires consideration of "the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" (40 CFR 1502.16). As declared by the Congress, this includes using all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans (NEPA Section 101).

Clearing of vegetation for drill pads, geophysics lines and temporary roads may have short-term effects on vegetation however; any gaps created are expected to re-vegetate naturally within two growing seasons. There are no expected impacts to long term productivity under this project. No discernable impacts on landtype ecosystem composition and age class distribution have been identified as a result of

past mineral exploration activities within the Forest. Vegetation management on NFS land would continue to move LE composition and age class distribution towards Forest Plan objectives (see Section 3.7.4).

3.15.2 Unavoidable Adverse Effects

3.15.2.1 Effects to lynx and wolves

Implementation of current and future operating plans in Alternatives 2-5 may affect, and is likely to adversely affect lynx and wolf because of the potential for increased human disturbance as a result of increased temporary road miles (see Wildlife Section 3.8.3.3). The increase in temporary roads may increase human disturbance of lynx and wolves and could lead to increased mortality. Some individuals may be impacted near activity areas in this project area, but effects to the population will be discountable or insignificant. Under Alternative 5, limiting operations to November 1 through April 30 would have a decrease in the competitive advantage of Canada lynx due to the increase in snow compaction in the project area. It would, however, be beneficial to lynx and other wildlife species by reducing disturbance during breeding seasons. Increased access on winter roads during hunting and trapping seasons could negatively impact wolves and lynx and lead to mortality. Seasonal actions on other ownerships are expected to remain the same as current conditions.

3.15.3 Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources are those that cannot be regained, such as the extinction of a species or the removal of mined ore. Irretrievable commitments are those that are lost for a period of time such as the temporary loss of timber productivity in forested areas that are kept clear for use as a power line rights-of-way or road.

All resources were evaluated to determine if there would be irreversible or irretrievable commitment of resources. Except for the resources described below, no irreversible or irretrievable commitments of resources were found in any action alternative (2-5):

3.15.3.1 Effects to surficial and bedrock materials

During the drilling process, the drill core or chips are collected for later mineral, chemical, and other technical identification and analysis. These samples are taken from the earth and not replaced. Therefore, it can be considered an irreversible commitment of the resource. Over the 20 years of exploration, the estimated maximum amount of rock that may be removed from the prospecting permit drilling operating would be 38,131 cubic yards of rock. This is assuming a standard bore hole PQ size (134 mm or 5.3 inch) as the average maximum hole diameter and 1,920 holes to a depth of 3,500 feet. Considering the vast amount of bedrock under the Superior NF, this amount is minute and would have virtually no effect on the rock and mineral resources. The State of Minnesota requires that a split or portion of the core be submitted to them for long term storage so that the rock can be reviewed and studied by others in the future. The knowledge that can be gained by the removal of this rock is not lost, in fact it is enhanced. Since the effect of rock removal is extremely minor, this topic will not be carried further in this analysis.

3.15.4 Other Disclosures

3.15.4.1 Possible conflicts between the proposed action and Federal, regional, State, and local land use plans, policies, and controls for the area concerned.

This project has been scoped with federal, tribal, regional, State and local government and any comments or concerns have been considered in developing the proposed action and alternatives. There are no known conflicts with land use plans, policies and controls in the project area.

3.15.4.2 Energy requirements and conservation potential of the various alternatives and mitigation measures.

The energy consumption from this project is not expected to vary by action alternative. Stipulations in Chapter 2 of this EIS encourage the most efficient use of resources possible.

3.15.4.3 Natural or depletable resource requirements and conservation potential of alternatives and mitigation measures.

See Section 3.15.3.1 for discussion on the potential for depletion of natural resources.

3.15.4.4 Urban quality, historic and cultural resources, and the design of the built environment, including the reuse and conservation potential of alternatives and mitigation measures.

This project would not include activities in urban areas would not affect urban quality or the design of the built environment. See Section 3.11 for effects to historical and cultural resources. Effects would be avoided through following Forest Plan direction and project stipulations listed in Chapter 2.

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Chapter 4 Consultation and Coordination

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The following individuals, Federal, State, and local agencies, tribes and non-Forest Service persons contributed in the development of this environmental impact statement.

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4.1.1.2 Federal, State, and Local Agencies

The following federal, state and local agencies were involved in the initial public scoping efforts in 2009.

Bureau of Land Management –Milwaukee Field Office
US Army Corps of Engineers - St. Paul District
John Engesser- Assistant Director of Lands and Minerals, MN DNR
Minnesota Department of Natural Resources-Division of Ecological Resources
Lake County Highway Dept
Ely City Council
City of Hoyt Lakes
City of Babbitt
Iron Range Resources and Rehabilitation;
Minnesota House of Representatives
Hibbing Area Chamber of Commerce
Cook County Board of Commissioners
EPA
Lake County Board of Commissioners
Lake County Highway Department
Lake County Wetland Technical Committee
St. Louis County Board of Commissioners
Town of Morse

4.1.1.3 Tribes

The following organizations representing affected tribes were consulted during the public scoping in 2009:

Great Lakes Indian Fish & Wildlife Commission
1854 Treaty Authority
Bois Forte Reservation
Fond Du Lac Tribal Office
Nett Lake (Bois Forte) Tribal Office

4.1.1.4 Others

The following organizations and individuals were involved in the initial public scoping efforts in 2009:

Organizations:

All Terrain Vehicle Assoc. of MN
American Lands Alliance
Arrowhead Coalition for Multiple Use
Bear Track Outfitters
Blandin Forestry
Boise Fort Heritage Center
Camp Buckskin
Conservationists With Common Sense (CWCS)
Defenders Of Wildlife
Duluth Metals
Ely Echo
Encampment Resources LLC
Franconia Minerals
Friends of the Boundary Waters
Friends of the Boundary Waters Canoe Area
Friends of the Boundary Waters Wilderness
FSEEE
Global Minerals Engineering LLC
Golden Eagle Lodge Inc.
Grand Portage Reservation
Great Lakes School of Log Bldg
Hungry Jack Lodge
Izaak Walton League Of America
Jule Foster Logging
Kakabeka Falls Provincial Park
Kawishiwi Water Concerned Residents
Lehmann Exploration
Mining Minnesota
Minnesota Center for Environmental Advocacy
Minnesota Forest Resources Council
Minnesota Historical Society
Minnesota Outward Bound
Minnesota Power
Minnesota Power/land And Water
Minnesota Trout Unlimited
MN Center for Environmental Advocacy (MCEA)
MN Forest Ind./MN Timber Producers Assoc.
MN. Center for Environmental Advocacy
Mundt & Associates
North Country Trail Assoc
Northeastern Minnesotans for Wilderness
Northern MN Jeepers
P&H Mining Equipment
Prime Meridian Enterprises
RGGS Lands and Minerals
River Point Resort & Outfitting Co.
Sierra Club
Sierra Club North Star Chapter
Spirit Of The Wilderness
Stora Enso North America
The Ski Hut
TriTech Inc
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Robert and Kay Olson
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Marilyn Dalfonso
Tina Foster
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Alan Mosher
Darwin Olson
Cyrus Quam
Mark Ridlon
Wayne Saline
Wesley Saline
John Sipple
Robert Vose
Mark Zupec

Glossary

Abandonment	The process of permanently abandoning and rehabilitating a bore hole. Process must be completed according to State regulations that are designed to protect ground water.
Access	The opportunity to approach, enter, and make use of public or private land.
Ambient Level (sound) (see also natural ambient level)	The ambient level of sound is the loudest decibel level of combined background sounds. This may be human made or natural sounds, depending on timing and location.
Aquifer	A geologic formation, group of formations, or part of a formation that contains sufficient saturated, permeable material to be able to yield significant quantities of water to wells and springs.
Best Management Practices (BMPs)	Practices (individual or in combination) that prevent non-point source of pollution or ensure that the amount is kept to a level compatible with state water quality and wetland protection goals.
Buffer	An area that is designated to block or absorb unwanted impacts to the area beyond the buffer. Buffer strips along a trail could block views that may be unwanted. Buffers may be set aside wildlife habitat to reduce abrupt change to the habitat.
Cap	A fitting usually threaded onto the end of the core hole casing sticking out of the ground.
Cased	A hole that has casing installed.
Casing	Casing means a pipe or curbing placed in a well or boring to: A. prevent the walls from caving; B. seal off surface drainage; or C. prevent gas, water, or other fluids from entering the well or boring except through the screen, open hole, or perforated casing. [Minnesota Department of Health Rules (MDH) 4725.0100 Definitions, subpart 22]
Categorical exclusion	A category of actions that do not individually or cumulatively have a significant effect on the human environment. Neither an environmental assessment nor an environmental impact statement is required.
C.F.R.	Code of Federal Regulations
Classified Road	Roads wholly or partially within or adjacent to National Forest System lands that are determined to be needed for long-term motor vehicle access, including Forest system roads, state roads, county and township roads, and other roads authorized by the Forest Service.
Cuttings	Ground up subsurface rock and a byproduct of drilling.

Decibel ‘A’ Weighted Decibel (dBA)	Decibel is a numerical expression of the relative loudness of a sound: the difference in decibels between two sounds is ten times the common logarithm of the ratio of their power levels. The ‘A’ Weighted Decibel (dBA) is the commonly used unit for measuring sound pressure levels (MPCA Guide to Noise Control in Minnesota, page 17). The A-weighted decibel scale is used since the 'A weighting' most closely approximates sounds heard by the human ear.
Drill water/fluid	Water used for drilling to lubricate and flush the drill hole, typically brought to the drilling site from another source.
Ecological Landtype (ELT)	An ecological map unit which is a subdivision of landtype associations or groupings of landtype phases that are areas of land with a distinct combination of natural, physical, chemical and biological properties that cause it to respond in a predictable and relatively uniform manner to the application of given management practices. In a relatively undisturbed state and/or a given stage of plant succession, an ELT is usually occupied by a predictable and relatively uniform plant community.
Entry Point	The area designated as a drop-off point for entrance into the BWCAW.
Erosion	The wearing away of the land’s surface by running water, wind, ice, and other geological agents. It includes detachment and movement of soil or rock fragments by water, wind, ice, or gravity. Rills, gullies, pedestals and soil deposition are indicators of accelerated surface soil erosion, which are considered detrimental erosion.
Exploration Plan	An exploration plan must be submitted after the BLM initially reviews the prospecting permit applications but before the issuance of the permit. It shows and describes how a permittee intends to determine the existence and workability of a valuable deposit.
Federal mineral lease (hardrock)	BLM authorization that grants the lessee exclusive rights to explore for, develop, and produce valuable metals within the constraints of laws, regulations, and policies at the time the lease/claim was established or authorized. The BLM must obtain the consent of the surface management agency before they issue a lease or prospecting permit.
Federal minerals	Mineral rights owned by the United States government.
Floodplain	Lowland and relatively flat areas joining inland waters, including flood-prone areas of islands. The minimum area included is that subject to a one percent (100-year recurrence) or greater chance of flooding in any given year.
Geographic Information System (GIS)	Electronic mapping system used for analysis
Grout	A material used to fill the annular space around a casing, or to seal a well or boring. Grout is either neat cement grout, concrete grout, bentonite grout, or high solids bentonite grout. (MDH Rules 4725.0100, subpart 30)

Hardrock Minerals	The term, hardrock minerals, includes mineral deposits that are found in sedimentary and other rocks. Hardrock minerals include base metals, precious metals, industrial minerals, and precious or semi-precious gemstones. Hardrock minerals do not include coal, oil shale, phosphate, sodium, potassium, or gilsonite deposits. Also, hardrock minerals do not include commodities the government sells such as common varieties of sand, gravel, stone, pumice or cinder.
Hydrogeology	The science that deals with subsurface waters and related geologic aspects of surface waters (Gary 1974)
Hydrologic Characteristics	Features of a watershed relating to the flow of water, such as infiltration, evapotranspiration, runoff, water yield, peak flows, and normal annual peak flow.
Interim Reclamation	Interim reclamation is site stabilization after drilling operations have ceased yet before the hole is permanently plugged and abandoned.
Landtype Association (LTA)	An ecological unit based on similar geologic landform, soils, climate, and vegetation that is part of the "National Hierarchical Framework of Ecological Units". Landtype associations are smaller than subsections and larger than landtypes.
Lease	A lease is issued to holders of prospecting permits who, during the term of the permit, demonstrate the discovery of a valuable deposit of the leasable mineral for which BLM issued the permit.
Lynx Analysis Unit (LAU)	Lynx Analysis Units (LAUs) are the smallest landscape scale analysis units upon which direct, indirect, and cumulative effects analyses for lynx will be performed. LAUs encompass lynx habitat (on all ownerships) within the administrative unit that has been mapped (in coordination with adjacent management agencies and Fish and Wildlife Service) using specific criteria to identify appropriate vegetation and environmental conditions. In addition, LAUs are intended to provide the fundamental scale with which to begin monitoring and evaluation of effects of management actions on lynx habitat.
Management Area (MA)	A portion of a landscape with similar management objectives and a common management prescription. An area of common direction that differs from neighboring areas. The entire Forest is divided into management areas. Specific direction for each management area is described through desired conditions, objectives, standards, and guidelines.
Mine	A mine is an underground excavation or open-pit working for the extraction of mineral deposits.
Mineralization	The process or processes by which a mineral or minerals are introduced into a rock and can result in an economically valuable or potentially valuable deposit. This is a general term, incorporating various types and modes of mineralization.

Mining Protection Areas

The BWCAW Act of 1978 (PL 95-495) and the Forest Plan standards and guidelines set direction for management of mineral resources within the Wilderness and the adjacent Mining Protection Area.

• Federal minerals: basically no permit, lease, or other authorization will be issued for the exploration or mining of minerals owned by the United States within the Wilderness. Peat and marl deposits are managed similarly. Sand and gravel deposits are to be used for administrative purposes only.

• Non-federal minerals: exploration and development of non-federal minerals is allowed, but occupancy and use of federal property is limited to activities, which do not preclude protection of wilderness values and navigable waters.

National Environmental Policy Act (NEPA)

Public law that outlines specific procedures for integrating environmental considerations into agency planning. Congress passed NEPA in 1969 to encourage productive and enjoyable harmony between people and their environment. One of the major tenets of NEPA is its emphasis on public disclosure of possible environmental effects of any major action on public land. The Act requires a statement of possible environmental effects to be released to the public and other agencies for review and comment.

Natural Ambient Level

The natural ambient level is the loudest sound level if all human made noises were removed from the environment.

Noise

Noise is any sound that is undesired or that interferes with something to which one is listening (Webster's Third New College Dictionary, page 1533).

Non-point Source (NPS) Water Pollutants

Pollutants contributed to runoff and seepage from land areas, often resulting from multiple, difficult to define, points of origin. Agricultural and urban runoff, runoff from construction activities and runoff from forestry practices are example sources of non-point pollutants. The following forest management activities are potential nonpoint sources of pollution: prescribed burning, pest and fire control, surface drainage, and road construction and maintenance from which there is natural runoff. Best Management Practices (BMPs) are recognized as control mechanisms for nonpoint source pollution.

Operating Plan

An operating plan is a site specific proposal that describes all exploration activities, equipment, access, road, drill pad, and other construction, and reclamation and includes maps showing where activities will occur. A reclamation bond may be required prior to approval. It can be submitted concurrently with a prospecting permit application or after a permit is authorized. It is reviewed by the BLM and FS and authorized by the BLM with FS consent. It may be active during through the course of the prospecting permit.

Overburden

The loose soil, silt, sand, gravel, or other unconsolidated material overlying bedrock, either transported or formed in place (Gary 1974)

Permanent sealing

The process of preparing an exploratory boring to be filled with grout and filling the exploratory boring with grout.

Plan of Operations	An exploration plan submitted to the BLM and Forest Service that shows how the company intends to determine the existence and workability of a valuable deposit. The plan includes who the operator will be, a brief description of the affected environment, a narrative describing the method of exploration, equipment, measures to prevent or control fire, soil erosion, pollution of surface and ground water and air, damage to fish and wildlife or their habitat, damage to other natural resources, public health and safety hazards, actions necessary to meet all applicable laws and regulations, method for plugging drill holes, measures to reclaim the land, estimated timetable for each phase of the work, maps showing the proposed location of drill holes, roads, trenches and other disturbances, and any other data the BLM may require.
Potable water	Water which is safe for human consumption in that it is free from impurities in amounts sufficient to cause disease or harmful physiological effects. (MDH Rules 4725.0100 Definitions, subpart 35)
Prospecting	To search for or explore (a region) for mineral deposits or oil.
Prospecting Permit	A permit issued by the Bureau of Land Management, Department of Interior, who has jurisdiction over federally owned mineral rights, which grants the permittee the exclusive right to prospect on and explore the lands involved to determine the existence of, workability of, and/or commercial value of the mineral deposits therein. (From Forest Service Manual 2820)
Receptor (sound)	A sound receptor is a site or area from which sound sources are heard and measured; for example a wilderness area or campground.
Reclamation (plan)	Plan listing and describing steps taken to reclaim and stabilize drill sites once drilling activities have ceased.
Recreation Opportunity Spectrum (ROS)	A formal Forest Service process designed to delineate, define, and integrate outdoor recreation opportunities in land and resource management planning. ROS classes are used to describe all recreation opportunity areas; from natural, undisturbed, and undeveloped to heavily used, modified and developed. ROS designations attempt to describe the kind of recreation experience one may have in a given part of the National Forest.
Recreation Residence	Cabins on National Forest System land that normally were established in tracts and built for recreation purposes, with agency approval and supervision. These cabins are authorized by special-use permit and are not the primary residences of the owners.
Resistivity	Geophysical survey technique where electrical current is introduced into the ground and the potential difference is measured.
Return water	Water returned to surface from the bore hole. Used to lubricate drill bit and transport cuttings to the surface and into the sump.
Riparian Areas	Riparian areas include aquatic ecosystems, riparian ecosystems, and wetlands. They are three-dimensional: Longitudinal (extending up and down streams and along the shores); lateral (to the estimated boundary of land with direct land-water interactions); and vertical (from below the water table to above the canopy.
Sediment	Solid material, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by air, water, gravity, or ice and has come to rest on the earth's surface.

Semi-primitive Motorized ROS Class Part of the Recreation Opportunity Spectrum. Area is characterized by a predominantly natural or natural-appearing environment of moderate to large size. Concentration of users is low, but there is often evidence of other users. The area is managed in such a way that minimum on-site controls and restrictions may be present, but would be subtle. Use of local, primitive, or collector roads with predominantly natural surfaces and trails suitable for motorbikes is permitted.

Semi-primitive Non-motorized ROS Class Part of the Recreation Opportunity Spectrum. Area is characterized by a predominantly natural or natural-appearing environment of moderate to large size. Interaction between users is low, but there is often evidence of other users. The area is managed in such a way that minimum on-site controls and restrictions may be present, but would be subtle. Motorized recreation use is not permitted, but local roads used for other resource management may be present on a limited basis. Use of such roads is restricted to minimize impacts on recreational experience opportunities.

Sound (see also noise) Sound is a physical phenomenon; a vibration that can be measured and recorded (Predicting Impact of Noise on Recreationists, USFS Publication #67).

Soundscape A soundscape is an atmosphere or environment created by or with sound; for example ‘the raucous soundscape of a city street’.

Stipulation A modification of the terms and conditions on a standard lease or permit form at the time of the permitting or lease. Often is associated with special measures to protect/mitigate resources. Stipulations are both general and site-specific resource protection measures required as part of an operating plan.

Surface inspection Inspection by Forest Service personnel in order to ensure plan of operations and/or reclamation plan has been followed.

Temporary Roads Roads authorized by contract, permit, lease, other written authorization, or emergency operation that are not intended to be a part of the forest transportation system, and not necessary for long-term resource management. These roads are not included on the National Forest System road inventory and are decommissioned after use.

Temporary sealing Protecting an exploratory boring by following the construction and operation practices under Minnesota Rule 4727.0950 to 4727.0985 until the boring is permanently sealed.

Treaty Rights Rights related to hunting, gathering, and fishing retained by Native American Tribal members.

Winter Road Roads only used during frozen roadbed conditions and closed in other seasons. They usually are constructed to reduce ground disturbance, often without removal of existing topsoil and utilizing snow and ice as part of the road surface. They are typically OML 1 roads when not maintained for winter use, and move up to an OML 2 road when used.

References Cited

General References

USDA Forest Service. 1993. Boundary Waters Canoe Area Wilderness Management Plan and Implementation Schedule. On file with: Forest Supervisor, Superior National Forest, 8901 Grand Avenue Place, Duluth, MN 55808-1102.

USDA Forest Service. 1993. Final Environmental Impact Statement for the Boundary Waters Canoe Area Wilderness Management Plan and Implementation Schedule. On file with: Forest Supervisor, Superior National Forest, 8901 Grand Avenue Place, Duluth, MN 55808-1102.

USDA Forest Service. 2004. Land and Resource Management Plan – Superior National Forest, July 2004, as amended. On file with: Forest Supervisor, Superior National Forest, 8901 Grand Avenue Place, Duluth, MN 55808-1102.

USDA Forest Service. 2004. Final Environmental Impact Statement for the Land and Resource Management Plan – Superior National Forest, July 2004, as amended. On file with: Forest Supervisor, Superior National Forest, 8901 Grand Avenue Place, Duluth, MN 55808-1102

USDI Bureau of Land Management. 2010. USDI BLM Northeastern States Field Office website. http://www.blm.gov/es/st/en/fo/milwaukeefo_html/milwaukee_field_office5.html Accessed 02/15/11.

USDI Bureau of Land Management and USDA, Forest Service. 2007. Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development. BLM/WO/ST-06/021+3071/REV 07. Bureau of Land Management. Denver, Colorado. 84 pp.

Noise

Braslau, D. 2007. Kawishiwi Minerals Exploration Project: Noise Impacts from Encampment Resources, LLC Proposed Drilling and Helicopter Operations. Prepared for Encampment Resources, LLC by David Braslau Associates, Inc.

Duluth Metals. 2010. Plans of Operations for Minerals Exploration.

Landres et al. 2005. Monitoring Selected Conditions Related to Wilderness Character: A National Framework. General Technical Report RMRS-GTR-151 USDA Forest Service

Harrison, R.T. and Clark, R.N. 1980. Predicting Impact of Noise on Recreationalists. USDA Forest Service San Dimas Equipment Development Center.

Miller, J.D., Jr., Green, J.C., Severson, M.J., Chandler, V.W., Hauck, S.A., Peterson, D.M., and Wahl, T.E. 2002. Geology and mineral potential of the Duluth Complex and related rocks of northeastern Minnesota: Minnesota Geological Survey Report of Investigations 58, 207 p.

Miller, N.P. 2008. US National Parks and management of park soundscapes: A review. Applied Acoustics. Volume 69: 77-92.

Minnesota Pollution Control Agency. 1999. A Guide to Noise Control in Minnesota.

Reed, S.E., J.L. Boggs, and J.P. Mann. 2010. SPreAD-GIS: an ArcGIS toolbox for modeling the propagation of engine noise in a wildland setting. Version 2.0. The Wilderness Society, San Francisco, CA.

US Environmental Protection Agency, Office of Noise Abatement and Control. 1973. Public Health and Welfare Criteria for Noise. July 27, 1973

Boundary Waters Canoe Area Wilderness

GTR-WO-80. 2009. Technical Guide for Monitoring Wilderness Conditions Related to Wilderness Character

GTR-212. 2008. “Keeping It Wild” - Interagency Strategy

Miller R. 1996. Federal regulations and other activities in noise control. Noise Control Engineering Journal 44(3):149–152

Pilcher, J. J., Band, D., Odle-Dusseau, H. N., & Muth, E. R. 2007. Human performance under sustained operations and sleep deprivation conditions: toward a model of controlled attention. Aviation, Space and Environment Medicine 78(5, Suppl.), B15-24.

Sheikh P, Uhl, C. 2004. Airplane noise: a pervasive disturbance in Pennsylvania Parks, USA. Journal of Sound and Vibration 274(1–2):411–420

Schwer R, Gazel R, Daneshvary R. 2000. Air-tour impacts—the Grand Canyon case. Annals of Tourism Research 27(3):611–623

USDA Forest Service. ND. Manual 2300 – Wilderness Management

USDA Forest Service. 2004. SNF Land and Resource Management Plan. BWCAW Management Direction

USDA Forest Service Wilderness Advisory Group. 2005. 10 Year Wilderness Challenge Guidebook

USDI National Park Service. 1994. Report to congress. Report on Effects of Aircraft Overflights on the National Park System.

Minerals

Behling, Stuart J. 1979. Economic Geology of the Superior National Forest. Superior National Forest.

Chandler, V.W. 2007. Aeromagnetic Map of Minnesota Micro-Leveled Data Color Shaded Relief Format. Minnesota Geological Survey-MCC.

Chandler, V.W., Green, J.C., Miller, J.D., Jr., Peterson, D.M., Severson, M.J. 2001. Geologic Map of the Duluth Complex and Related Rocks in Northeastern Minnesota. Misc. Maps Series, Map – 119. Minnesota Geologic Survey, University of Minnesota, St. Paul.

Chandler, V.W., Green, J.C., Hauck, S.A., Miller, J.D., Jr., Peterson, D.M., Severson, M.J., Wahl, T.E.. 2002. Geology and Mineral Potential of the Duluth Complex and Related Rocks in Northeastern Minnesota. Report of Investigations 58. Minnesota Geologic Survey, University of Minnesota, St. Paul.

Jirsa, Mark A., Miller, James D., Jr., Morey, G.B. 2007. Geology of the Biwabik Iron Formation and Duluth Complex. University of Minnesota, Minnesota Geological Survey, St. Paul, MN. McSwiggen and Associates, St. Anthony, MN, www source 2007.

Jirsa, Mark, Southwick, David. Mineral Potential and Geology of Minnesota. www.geo.umn.edu/mgs/mnpotMnpotGlg.html

Meints, Joyce, Morey, G.B. 2000. Geologic Map of Minnesota Bedrock Geology. State Map Series, S-20. Minnesota Geologic Survey, University of Minnesota, St. Paul.

Peterson, Dean M. 2002. Shaded Relief Map of the Basal Contact Surface of the South Kawishiwi Intrusion Duluth Complex, Northeastern Minnesota. NRRI/MAP-2002/01. University of Minnesota, Natural Resources Research Institute, Duluth.

Peterson, Dean M. 2008. Bedrock Geologic Map of the Duluth Complex in the Northern South Kawishiwi Intrusion and Surrounding Area, Lake and St. Louis Counties, Minnesota. Economic Geology Group Map Series, NRRI/MAP-2008-01, University of Minnesota, Natural Resources Research Institute, Duluth.

Peterson, Dean M. 2009. Nokomis Cu-Ni-PGE Deposit, Minnesota. www.duluthmetals.com, Duluth Metals Limited.

Soil

Cleland, D.T., P.E. Avers, W.H. McNab, M.E. Jensen, R.G. Bailey, T. King and W.E.Russell. 1997. National hierarchical frame work of ecological units. In: Ecosystem management applications for sustainable forest and wildlife resources. Ed. Boyce, M.S. and A. Haney. Yale University Press, New Haven, Conn. Pp. 181-200.

Mace, A.C., Jr. 1971. Recovery of forest soils from compaction by rubber-tired skidders. Minnesota Forestry Notes No. 226. University of Minnesota, St. Paul, MN.

Puettmann, K. J., A.W. D'Amato, M. Arikian and J.C. Zasada. 2008. Spatial impacts of Soil disturbance and residual oversotry on density and growth of regenerating aspen. Forest Ecology and Management, 256: 2110 - 2120.

Thorud, D.B., and S.S. Firssell Jr. 1976. Time changes in soil density following ompaction under an oak forest. Minnesota Forestry Notes No. 257. University of Minnesota, St. Paul, MN.

USDI Bureau of Land Management. 2007. Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development, Forth Edition - Revised 2007.

Zenner, E. K., J.T. Fauskee, A. L. Berger and K. J. Puettmann. 2007. Impacts of Skidding Traffic Intensity on Soil Disturbance, Soil Recovery, and Aspen Regeneration in North Central Minnesota. Northern Journal of Applied Forestry, 24(3): 177 - 183.

Water

Barstad, Wayne and Deborah Karasov. 1987. "Lake Development How Much is Too Much?" Minnesota Department of Natural Resources Division of Waters. St. Paul, MN.

Bryan, Michael D. and Dennis L. Scarnecchia. 1992 “Species richness, composition, and abundance of fish larvae and juveniles inhabiting natural and developed shorelines of a glacial Iowa lake” Environmental Biology of Fishes (35): pgs 239-341.

Butcher, Jason. 2010. Technical Memorandum No. 5 – Site Review of Proposed Landing Sites on Birch Lake. Superior National Forest. Federal Hardrock Mineral Prospecting Permit EIS Project File.

Elias, Joan E. and Michael W. Meyer. 2003. “Comparisons of Undeveloped and Developed Shorelands, Northern Wisconsin, and Recommendations for Restoration”. Wetlands (23) No. 4 pgs 800-816.

Engel, Sandy and Jerry L. Pederson Jr. 1998. “The Construction, Aesthetics, and Effects of Lakeshore Development: A Literature Review”. Wisconsin Department of Natural Resources Research Report 177. Madison, WI.

Lindsay, Alec R., S. Gillum, and M. Meyer. 2002. “Influence of lakeshore development on breeding bird communities in a mixed northern forest”. Biological Conservation (107), pgs 1-11.

Minnesota Department of Natural Resources (MnDNR), 1970. “Minnesota’s Lakeshore – Part 2 Statistical Summary; Summary Report of the Minnesota Lakeshore Development Study”. St. Paul, MN.

Minnesota Department of Natural Resources (MnDNR), January 1976(rev). “Shoreland Management Classification System for Public Waters – Supplementary Report No. 1 (Second Edition)”. St. Paul, MN.

Minnesota Exploration Association. January 29, 2004. “Information Memorandum on Drill Hole Cuttings”. MN Exploration Association, Minneapolis, MN.

Ojakangas, Richard W. and Charles L. Matsch. 1982. “Minnesota’s Geology”. University of Minnesota Press, Minneapolis, MN.

Radomski, Paul. 2006. “Historical Changes in Abundance of Floating-Leaf and Emergent Vegetation in Minnesota Lakes”. North American Journal of Fisheries Management; (26), pgs 932-940.

Reed, Jeffrey R., and Donald L. Pereira, 2009. “Relationship Between Shoreline Development and Nest Site Selection by Black Crappie and Largemouth Bass”. North American Journal of Fisheries Management vol 29, pgs 943-948.

Rye, Marty. 2010a. Technical Memorandum No. 1 – Drilling Fluid Impact on Water Quality. Superior National Forest. Federal Hardrock Mineral Prospecting Permit EIS Project File.

Rye, Marty. 2010b. Technical Memorandum No. 2 – Existing State Controls. Superior National Forest. Federal Hardrock Mineral Prospecting Permit EIS Project File.

Rye, Marty. 2010c. Technical Memorandum No. 3 – Results of SNF Exploratory Drilling Monitoring for Impacts to Water Resources. Superior National Forest. Federal Hardrock Mineral Prospecting Permit EIS Project File.

Rye, Marty. 2010d. Technical Memorandum No. 4 – Brackish Water Intrusion into Aquifers. Superior National Forest. Federal Hardrock Mineral Prospecting Permit EIS Project File.

Seaber, P.R. F.P. Kapinos and J. L. Knapp. 1987. “Hydrologic unit maps, Water Supply Paper 2294”, Corvallis, OR, US Department of Interior, Geological Survey.

Stedman, Richard C. and Roger B. Hammer. 2006. “Environmental Perception in a Rapidly Growing, Amenity-Rich Region: The Effects of Lakeshore Development on Perceived Water Quality in Vilas County, Wisconsin”. Society and Natural Resources (19), pgs 137-151.

USDA Forest Service. February 2010. “Environmental Assessment Rifle Lake Land Exchange” Superior National Forest Supervisor’s Office. Duluth, MN.Verry, Elon S., James W. Hornbeck, and C. Andrew Dolloff. 2000. “Riparian Management in Forests of the Continental Eastern United States” Lewis Publishers, New York.

Woodford, James E. and Michael W. Meyer. 2003. “Impact of lakeshore development on green frog abundance”. Biological Conservation (110), pgs 277-284.

Vegetation

Baughman, M.J., K. Updegraff and J.C. Cervantes. 2001. Motivating forest landowners in the North Central United States. St. Paul, Minnesota: University of Minnesota, College of Natural Resources.

Minnesota Department of Natural Resources, (2010, January 21). Subsection forest resource management planning. Retrieved January 21, 2010 from the Minnesota Department of Natural Resources, Division of Forestry website: http://www.dnr.state.mn.us/forestry/subsection/index.html

USDA Forest Service. 2004. Superior National Forest Land and Resource Management Plan.

Wildlife

Duffy, Susan. 2010. Personal communication. Discussion of temporary road creation and public use. Project file.

Haila, Y. 1999. Islands and fragments. Chapter 7, pages 234-264, In Maintaining biodiversity in forest ecosystems, M. L. Hunter Jr., editor. Cambridge University Press, Cambridge, UK.

Heinselman, M.L. 1973. Fire in virgin forests of the Boundary Waters Canoe Area, Minnesota. Quaternary Research 3, pp. 329-382

Kneeshaw, D.D. and Y. Bergeron. 1998. Canopy characteristics and tree replacement in the southeastern boreal forest. Ecology 79(3) pp. 783-794

Leonard, Jr., David L. 2001. American three-toed woodpecker (Picoides dorsalis). The Birds of North America Online (A. Pole, Ed.). Ithaca: Cornell Lab of Ornithology. Accessed February 16, 2011 at http://bna.birds.cornell.edu/bna/species/588

Minnesota Department of Natural Resources - Natural Heritage and Non-Game Research Program. 2010. Biotics Rare Features Database: rare animal occurrences on the Superior National Forest. St. Paul, Minnesota.

USDA Forest Service. 2004. Forest Plan Revision Final Environmental Impact Statement. On file with Forest Supervisor, Superior National Forest, 8901 Grand Ave. Place, Duluth, Minnesota 55808.

USDA Forest Service. 2006. Regional Forester Sensitive Animals, updated January 10, 2007. Accessed August 24, 2010 at: http://www.fs.fed.us/r9/wildlife/tes/docs/rfss_animals.pdf

USDA Forest Service. 2010a. Draft Biological Assessment for the Federal Hardrock Mineral Prospecting Permits. On file with Forest Supervisor, Superior National Forest, 8901 Grand Ave. Place, Duluth, Minnesota 55808.

USDA Forest Service. 2010b. Draft Biological Evaluation for the Federal Hardrock Mineral Prospecting Permits. On file with Forest Supervisor, Superior National Forest, 8901 Grand Ave. Place, Duluth, Minnesota 55808.

USDI Fish and Wildlife Service. 2011. Letter providing a list of all endangered, threatened, proposed, and candidate species, and designated and proposed critical habitat that occurs within the Superior National Forest. Tony Sullins, January 3, 2011.

Wirz, Eric. 2010. Personal communication. Discussion of temporary road creation, closure, and public use. Project file.

NNIS

Callihan, R.H., D.C. Thill, and D.W. Wattenbarger. 1982. Hawkweeds. University of Idaho Cooperative Extension Service, Moscow, Idaho. Publication 633. 4 p.

Czarapata, E.J. 2005. Invasive Plants of the Upper Midwest. University of Wisconsin Press, Madison, Wisconsin. Pp. 32-35, 99-103, 105, 108-110, 138.

Dickens, S.M., F. Gerhardt, S.K. Collinge. 2005. Recreational portage trails as corridors facilitating non-native plant invasions of the Boundary Waters Canoe Area Wilderness. Conservation Biology 19: 1653-1657

Fitzsimmons, J.P., and L.C. Burrill. 1993. St. Johnswort (*Hypericum perforatum*). Pacific Northwest Extension Service. Publication PNW 442. 2 p.

Kuyava, G. 2005. Email to Jack Greenlee from Gary Kuyava, St. Louis County agricultural inspector dated January 19, 2005. 1 p.

Lym, R.G., and K. M. Christianson. 1996. The thistles of North Dakota. North Dakota State University Extension Service, Publication W-1120, 25 pp.

Lym, R.G., and R.K. Zollinger. 1995. Integrated management of leafy spurge. North Dakota State University Extension Service, Fargo, North Dakota. Publication W-866. 4 p.

Minnesota Department of Natural Resources – Invasive Species Program. 2006. Purple loosestrife (*Lythrum salicaria*). Available online: http://www.dnr.state.mn.us/invasives/aquaticplants/index.html.

Saskatchewan Purple Loosestrife and Invasive Species Project. 2005. *Caragana* or Siberian peashrub. 2 p. Available internet: http://www.sfn.saskatoon.sk.ca/science/splep/caragana.html

USDA Forest Service. 2005. Superior National Forest Non-native invasive plant species – ecological risk assessment factors and rating. Unpublished report, Duluth, Minnesota. 5 p.

USDA Forest Service. 2006. Environmental Assessment, Superior National Forest non-native invasive plant management project. 92 p. On file with Forest Supervisor, Superior National Forest, 8901 Grand Ave. Place, Duluth, MN. 55808.

USDA Forest Service. 2008. Fiscal Year 2007 Monitoring and Evaluation Report. P. 38-42. On file with Forest Supervisor, Superior National Forest, 8901 Grand Ave. Place, Duluth, MN. 55808

USDA Forest Service. 2008. Field notes summary from 2008 weed inventory along unclassified roads. 1 p. On file with Forest Supervisor, Superior National Forest, 8901 Grand Ave. Place, Duluth, MN. 55808.

Voss, E.G. 1996. Michigan flora, part III. Cranbrook Institute of Science Bulletin 61, Ann Arbor, Michigan. P. 400.

Wilson, L.M., and C.B. Randall. 2002. Biology and biological control of knapweed. Forest Health Technology Enterprise Team, Morgantown, West Virginia. FHTET-2001-07, p. 8.

Roadless

Roadless Area Review and Evaluation II (RARE II)
http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5116928.pdf

USDA Forest Service. 2004. Forest Plan Revision Final Environmental Impact Statement. On file with Forest Supervisor, Superior National Forest, 8901 Grand Ave. Place, Duluth, Minnesota 55808.

2001 Roadless Area Conservation Rule (RACR) Final EIS -
http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5050459.pdf

2010 Secretary of Agriculture Thomas J. Vilsack Reserved Final Decision Authority
http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5167211.pdf

Heritage

Gilman, Carolyn. 1982. Where Two Worlds Meet: the Great Lakes Fur Trade. Minnesota Historical Society Press. St. Paul, Minnesota.

King, Thomas F. 2004. Cultural Resource Laws and Practices. Altimira Press. Walnut Creek, California.

Mulholland, Susan C. 2000. The Arrowhead Since the Glaciers: The Prehistory of Northeastern Minnesota. The Minnesota Archaeologist 59: 1-10.

Okstad, Walter. 1983. Logging Industry Thematic Study. In Cultural Resource Management on the Superior National Forest: 1982 Annual Report. USDA Forest Service, Superior National Forest, Duluth, Minnesota, pp. 144-192.

Ray, Arthur J. 1974. Indians in the Fur Trade. University of Toronto Press. Toronto, Canada.

Woolworth, Nancy L. and Alan R. Woolworth. 1977. A Cultural Resources Survey of the Superior National Forest Located in Cook, Lake, and St. Louis Counties, Minnesota. Report submitted to Superior National Forest, Contract Number 1451 R9-76 T. Duluth, Minnesota.

Air Quality

AWMA, 2000. Air Pollution Engineering Manual, 2nd Edition. Air and Waste Management Association, Wiley-Interscience Publication, 886 pp.

Minnesota Pollution Control Agency, 2009. Regional Haze State Implementation Plan http://www.pca.state.mn.us/index.php/view-document.html?gid=2181

Minnesota Pollution Control Agency, 2009b. Air quality in Minnesota: Emerging Trends- 2009 Report to the Legislature, January 2009. http://www.pca.state.mn.us/index.php/about-mpca/legislative-issues/legislative-reports/air-quality-in-minnesota-emerging-trends-2009-legislative-report.html

Economic References

Clark, D.E., and W.J. Hunter. 1992. The Impact of Economic Opportunity, Amenities and Fiscal Factors on Age-Specific Migration Rates." Journal of Regional Science 32(3): 349-65.

IMPLAN. 2007. Minnesota IMPLAN group 2007.

Knapp, T.A., and P.E. Graves. 1989. On the Role of Amenities in Models of Migration and Regional Development. Journal of Regional Science 29(1): 71-87.

Lewis, D.J., G.L. Hunt, and A.J. Plantinga. 2002. Public Conservation Land and Employment Growth in the Northern Forest Region." Land Economics, 78(2): 245-259.

McGranahan, D.A. 1999. Natural Amenities Drive Rural Population Change. Food and Rural Economics Division, Economic Research Service, U.S. Department of Agriculture. Agricultural Economic Report No. 781.

Miernyk, William H. 1965. The elements of input-output analysis. New York: Random House.

Mueser, P.R., and P.E. Graves. 1995. Examining the Role of Economic Opportunity and Amenities in Explaining Population Redistribution." Journal of Urban Economics 37(2): 176-200.

State of Minnesota. 2009. Minnesota Department of Natural Resources. Accessed on December 22, 2009 at http://www.dnr.state.mn.us/education/geology/digging/mining.html

Treyz, G.I., D.S. Rickman, G.L. Hunt, and M.J. Greenwood. 1993. The Dynamics of U.S. Internal Migration." The Review of Economics and Statistics 75(2): 209-14.

University of Montana. 2007. The Economic Role of Metal Mining in Minnesota: Past, Present, and Future. A report prepared for Minnesota Center for Environmental Advocacy and the Sierra Club. By Thomas Michael Power, Economics Department, University of Montana, Missoula, Montana 59812. October 2007

US Census Bureau. 2000. USA Counties. Accessed on December 22, 2009 at http://censtats.census.gov/usa/usa.shtml

US Census Bureau. 2007. Population estimates. County estimates by demographic characteristics. Annual Estimates of the Resident Population by Sex, Race Alone, and Hispanic Origin for Counties. Accessed on December 18, 2009 http://www.census.gov/popest/counties/asrh/CC-EST2008-RACE6.html

USDA Forest Service. 1998. Economic and Social Conditions of Communities: Economic and Social Characteristics of Interior Columbia Basin Communities and an Estimation of Effects on Communities from the Alternatives of the Eastside and Upper Columbia River basin DEIS.

US Department of Commerce. 2000. Bureau of Economic Analysis. Table CA25 Total full-time and part-time employment by SIC industry. Accessed on December 18, 2009 http://www.bea.gov/regional/reis/

US Department of Commerce. 2004. Bureau of Economic Analysis, Survey of Current Business article, "2004 Redefinition of the BEA Economic Areas" http://www.bea.gov/SCB/PDF/2004/11November/1104Econ-Areas.pdf

US Department of Commerce. 2006. Bureau of Economic Analysis. Table CA25N Total full-time and part-time employment by SIC industry. Accessed on December 18, 2009 http://www.bea.gov/regional/reis/

US Department of Commerce. 2006b. Bureau of Economic Analysis. Table CA1-3 Personal income, population, per capita personal income. Accessed on December 17, 2009 http://www.bea.gov/regional/reis/

US Department of Commerce. 2006c. Table CA30 Earnings per job. Accessed on December 22, 2009 http://www.bea.gov/regional/reis/

US Department of Commerce. 2007. Bureau of Economic Analysis. Table CA1-3 Personal income, population, per capita personal income. Accessed on December 17, 2009 http://www.bea.gov/regional/reis/

US Department of Energy. 2007. U.S. Department of Energy in cooperation with Minnesota Department of Commerce. Mesaba Energy Project Draft Environmental Impact Statement DOE/EIS-0382d Mn PUC Docket # E6472/GS-06-668 Can be accessed at http://gc.energy.gov/NEPA/nepa_documents/docs/deis/eis0382D/

US Department of Labor. 2006. Bureau of Labor Statistics Quarterly Census of Employment and Wages. Accessed on December 22, 2009 at http://www.bls.gov/cew/#databases

US Department of Labor. 2008. Bureau of Labor Statistics Local Area Unemployment Statistics . Accessed on December 22, 2009 at http://www.bls.gov/Lau/

USDI Geological Survey. 2009. US Geological Survey Minerals Commodity Summaries 2009. Accessed on December 22, 2009 at http://minerals.usgs.gov/minerals/pubs/mcs/2009/mcs2009.pdf

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Appendix A - Issue disposition

Issues in this project that do not drive analysis of alternatives considered in detail refer to those that can be resolved through application of design protocol which may take the form of a stipulation, term and condition, best management practice, Forest Plan standard, etc, or it could be resolved through analysis by the resource specialists. Sources of design protocol include but are not limited to: MN Voluntary Forest Best Management Practices, appropriate Gold Book standards (a joint publication between the BLM and USFS regarding oil and gas development but has pertinent information on road building standards), stipulations used in the South Kawishiwi EA or other new resource considerations that are developed specifically for this EIS.

The following is a summary of the issues that did not drive analysis of alternatives considered in detail as a result of the IDT review and grouping exercise. These are issues that can be resolved therefore are briefly discussed in the EIS or in Table 52 below. Please note that comments that resulted in the same disposition statement were grouped together.

Table 52. Issue disposition

Comment	Disposition	Location of Discussion in DEIS
To the extent that diesel-operated and gasoline-operated vehicles and machinery are used, local air emissions may also be a significant adverse impact of prospecting activities.	Effects to air quality are disclosed in the EIS.	Air (Section 3.13)
Non-Native Invasive Species ("NNIS"): Road construction and clearing adjacent to the Boundary Waters Wilderness could lead to NNIS establishment in disturbed areas. Furthermore, clearing and road construction along the wilderness boundary creates the potential for illegal trespasses into the Boundary Waters Wilderness, with concomitant risks of spread of NNIS, Water Quality and Watershed Health: The direct and indirect effects of the Project's water quality and watershed health impacts on the Boundary Waters Wilderness ecosystem should receive major consideration. In reviewing map 4 illustrating "Areas of Moderate to High Mineral Exploration Interest Areas," it appears that a high degree of the exploration will occur adjacent to the Boundary Waters Canoe Area Wilderness (BWCAW). We are concerned about the potential for negative impacts from these 32 current permits as well as future explorations within an area so close to the Wilderness. We are concerned about impacts that may cross into the Wilderness (e.g. water pollution, noise intrusion) as well as impacts outside the Wilderness resulting from concentrating exploration in a relatively small area of forest.	A Forest-wide NNIS control plan is in place. Effects to spread of NNIS are covered in the EIS. All new access to drill sites would be Temp roads and must be closed after operations are complete per Forest Plan (Section 2.4.3.12). Impacts to water quality are disclosed in the EIS. Impacts to the BWCAW are disclosed in the EIS (section 3.2).	NNIS (Section 3.9) BWCAW (Section 3.2 Noise (Section 3.1) Recreation (Section 3.3) Water (Section 3.6)
The loss of carbon sequestration and the degradation of water resources related to mining and mining exploration could pose significant future problems.	The effects of mining are not addressed in this EIS, those effects would be addressed in future NEPA documents if proposed. This EIS only deals with mineral exploration. Effects to water resources are analyzed in the EIS. Minerals exploration would result in only very minor amounts of timber cutting as discussed in the Vegetation Section of this EIS. Based on past analysis of potential carbon release from vegetation management projects on the Superior NF, this would be a very minor amount of carbon release. Also, carbon would be re-sequestered as the land revegetates and trees grow.	Water (Section 3.6) Vegetation (Section 3.7)

Comment	Disposition	Location of Discussion in DEIS
Mineral Bulk Sampling PI, Para 2 Any sulfide-bearing mineralized rock and/or waste rock that is not removed from the site must immediately be overlaid with impervious cover and at least 4 feet of soil on it. This keeps a green house effect from starting under an exposed cover that causes condensation and leaching. A good percentage of material removed will not fit back in the hole. What will be done with the rest? This material placed back into the hole and the remaining material must be sealed in such a way that oxygen and water cannot get to the material. See the problems caused at MinnAmax from unpermitted exposed bulk samples and leachate from mineralized sulfide waste rock at the LTV Dunka pit, near Babbitt circa 1976).	Bulk sampling was dropped from this project and is no longer part of the proposed action and therefore not included in this analysis (Section 1.6). Drill core will be removed from the site. The drill cuttings are either disposed off site when tanks are used (wetlands and where sumps cannot be constructed due to surface conditions) or disposed by subsurface burial in sumps. The cuttings are a blend of all rock types drilled and the majority of the rock is not mineralized. The cuttings are covered with soil and contained so that they are not exposed to erosion. Therefore, the probability of impacting surface waters is very low.	Minerals 3.4
The EIS should also evaluate other types of prospecting likely to conflict with the SNF forest management plan and materially impair environmental resources.	The EIS analysis includes an assumed exploration scenario that is based on past exploration activities and present proposals. In addition, it includes site specific exploration operating plan proposals. If in the future, other types of activities are proposed, additional environmental analysis would be completed as needed.	Minerals 3.4
Two hundred miles of new roads and continued use of 800 miles of existing "temporary" roads will compact the habitat of the Federally protected lynx and encourage transport of NNIS into the area.	A Forest-wide NNIS control plan is in place. Effects to spread of NNIS are covered in the EIS. Impacts to listed species are evaluated in the BAE and summarized in the EIS (Section 3.8). All new access to drill sites would be Temp roads and must be closed after operations are complete (Forest plan requirement).	NNIS (3.9) Wildlife (3.8) See section 2.4.3.8 for stipulations pertaining to roads and section 2.4.3.12 for stipulations pertaining to reclamation.
Access to the Drill site PI, Para 1 Ingress and egress of drill sites can be problematic from the standpoint of once a road is in place will more than likely become another "rogue" ATV impact to the forest. It also means additional ATV hunting of wildlife (the new version of what use to be called "road hunting" in the past). This further depletes the wildlife resources in the SNF. I have observed no method that is effective in limiting A TV access once a type of road/trail/path is constructed. Lacking independent studies to the contrary, the USFS should assume that others would use these drilling trail ways for perpetuity. In developing permits USFS should be restricted in or near sensitive or potentially sensitive areas (wildlife or natural). Conversely if an ATV trail is planned in the exploration area the exploration company should develop their road/trail/path 'on the future location of the proposed trail. Thus saving the taxpayer some future construction costs.	No temp roads will be left open per Forest Plan direction. Effectiveness of road closures is addressed in section 3.8.4.	Wildlife (3.8.3.3, 3.8.3.4 and 3.8.4)

Comment	Disposition	Location of Discussion in DEIS
Eighth, the drilling and exploratory activities you have described have the potential to cause environmental impacts beyond the footprint of the disturbed areas. Construction of roads has the potential to interrupt and alter surface water hydrology, including ponding, channelization, and interruption of flow. Drilling can result in the inadvertent release of drilling fluids into wetlands and waterbodies, some drilling fluid additives are toxic or harmful to flora and fauna, and drilling spoils can contain heavy metals that become bioavailable when brought up from depth. Drilling and other equipment and vehicles require fuel, and this gasoline or diesel can be accidentally released/spilled into the environment in remote locations. Equipment and vehicles release pollutants into the air, particularly if high sulfur diesel fuel is used, which is inappropriate when it can be detected within the BWCA. In total, the proposed action has the potential to result in vegetation removal from a total of over 8 square miles, which is not a trivial area. This vegetation removal can result in erosion and soil instability, reduction in forage for herbivores, alteration of wildlife habitat, such as nesting sites for woodland birds, and loss of forest sensitive flora or other rare and protected plant species. In short, the EIS should be comprehensive in identifying potential impact producing factors, and then comprehensive in assessing how these impacts affect all forest resources and other forest uses, particularly with your multiple use mandate.	Impacts from roads, and to water, to soils, vegetation, wildlife, etc. are addressed in the EIS. Design protocols, including stipulations to address potential impacts have been developed (Section 2.4). Expected acres of disturbance are disclosed in 2.2.2.2. Estimated total disturbance over a twenty year period is expected to be less than 4000 acres (Table 8). Considering the relatively small area of land disturbed by exploration activities each year and for the life of the project, these figures represent .01% and .34% of the Project area respectively (Section 3.7.3).	Water (3.6) Wildlife (3.8), Soils (3.5), Vegetation (3.7) Air Quality (3.13)
Vegetation Composition: The Forest Service should consider any direct or indirect effects of the Project's vegetation composition changes on the Boundary Waters Wilderness ecosystem. Vegetation composition changes created by the Project and all other anticipated mining activities along the edge of the Boundary Waters Wilderness should receive significant scrutiny in the EIS.	Impacts to vegetation are discussed in the EIS (Management Indicator Habitat)	Vegetation (3.7)
New road construction can result in habitat fragmentation, increased solar penetration into adjacent woodlands, greater potential for blowdown along forest edges, and barriers to small animal foraging and breeding travel.	Effects from temporary road construction on wildlife are disclosed in the wildlife section. Habitat continuity would remain high under all alternatives.	Wildlife (3.7)
Purpose and Need/or the Project P2, Para 1 The BWCAW is the only pristine area in the SNF. It is one of a few protected pristine areas in the State. The BWCA W's major resource is its pristine waters. Minnesota is a state where precipitation exceeds evaporation. Other than the Tower-Sudan mine near Tower, Minnesota, all other mines discharge water while operating and become inundated (to one degree or another) after closure. The water can be a result of precipitation or the interception of ground water, or both. Scientific studies and publications document that' even low concentrations of sulfide mineral bearing waste rock as well as mine sidewalls can produce heavy metal leachates. These leachates have been demonstrated to have significant toxicity (ceriodaphnia and other aquatic invertebrates). To date no mitigation methods have been developed to economically and environmentally seal these exposed mineralized rocks for perpetuity.	These comments pertain to the effects from mining. The effects of mining are not addressed in this EIS, those effects would be addressed in future NEPA documents if proposed. This EIS only deals with mineral exploration. Effects to water resources are analyzed in the EIS. Design protocol, including stipulations and terms and conditions have been developed as appropriate to address potential impacts (Section 2.4).	Water (3.6)
Water required for drilling will negatively affect streams, rivers and lakes, especially with the recent historic droughts.	Effects to water are discussed in the Water Section of the EIS. Design protocols, including stipulations and terms and conditions have been developed to address potential impacts (Section 2.4.3.9, 2.4.3.12).	Water (3.6)

Comment	Disposition	Location of Discussion in DEIS
Although not specifically discussed in the materials on the SNF web site pertaining to the SNF Prospecting Permits EIS; Water Legacy members have been made aware of existing and potential future drilling sites underneath waters of the state, including lakes, rivers and streams. The potential for contamination of waters, the difficulty in monitoring or detecting spills and the challenges of reclamation of aquatic habitat raise significant environmental concerns The Attachments also note that the state of Minnesota requires water use permits for use equal to 10,000 gallons per day, while approximately 1,000 to 2,000 gallons of water are used per day for each hole for a drill site, depending on subsurface conditions. It is clear from this discussion that cumulative impacts of multiple independent drill sites could impact hydrology without even triggering water use permit requirements.	From 1948 to 2002, over 1,700 core holes totaling over 1.4 million feet of core have been drilled in the basal zones of the Duluth complex (Miller 2002) (see Map 7). These have occurred on State, Federal, County, and private lands. The drilling methods and abandonment techniques are very similar to the proposed exploratory drilling. There have been no reported problems to the Minnesota Department of Health (MDH) related to groundwater quality or production rates related to these previously established holes. Based upon this, the proposed drilling activity with the prescribed project design features described in section 2.4.3 is not anticipated to have a noticeable effect on the quality or quantity of the groundwater resource. Based upon these considerations and mitigation measures it is not anticipated the proposed action alternatives will result in an exceedance of potability standards of groundwater. The activity should not impact the potability of the groundwater or the production capacity of existing wells (see effects to water resources section 3.6.3.2) The withdrawal of water to use in the drilling process could have an effect on the surface water resources. Surface water removal can affect aquatic biota by simple desiccation, or cause stress and mortality to fish and other aquatic organisms by changes in the thermal and chemical properties of water. Excess rate of water removal can affect the stream biota. A typical water tank for drilling operations has a capacity of 2,000 gallons. The rate of pumping to fill the tank varies with equipment; however, typical values can range from 50 to 200 gallons per minute (gpm) (0.1 to 0.4 cubic feet per second(cfs)). Both the rate and volume of removal is managed by the project design features described in Section 2.4.3.9. Implementation of these protection measures would protect the aquatic biota (see effects to water resources section 3.6.3.2).	Water (3.6)

Comment	Disposition	Location of Discussion in DEIS
	Based upon these mitigation measures, the divergence of water levels will not exceed natural variation and will have little impact aquatic biota. Impacts due to past, present and reasonably foreseeable actions are part of the cumulative effects analysis required by NEPA and were analyzed in the Water Section of the EIS.	
The building of roads has a major impact on wildlife habitat and corridors. Impacts from additional road building on Canada lynx and other wildlife that require unfragmented, unroaded habitat;	Impacts to wildlife due to roads are discussed in the EIS.	Wildlife (3.8)
The Sierra Club is concerned with the locations of prospecting permit applications that are near the boundary to the BWCAW; including ones located in the Kawishiwi Ranger District near Bogberry Lake and Omaday Lake (northeast of Birch Lake) (see map 08 kawishiwi area b). Also of concern are prospecting permit applications located next to Birch Lake (see map 08 kawishiwi area b). Birch Lake, the Kawishiwi River and the BWCAW have already been affected by acid drainage from mining activities in the past. The Sierra Club is very concerned that if exploration and mining is allowed next to Birch Lake, pollutants will find their way into the water, and into the BWCAW.	Display the effects to surface water by considering the following indicators: Identify "Water Body Class" for BWCAW waters and identify standards and thresholds related and defining any special needs beyond protections provided by Forest Plan, BMPs, Kawishiwi Minerals Project design features and stipulations (see Appendix B of the Kawishiwi Project decision notices), Identify any thresholds re: total max daily limits of suspended particles, season of drilling operations, number of temp rd crossings near the BWCAW.	Water (3.6)
Sump Pit, P2 It is well known that pockets of salt water can be contained in the deep rock formations of northeast Minnesota (private water wells, and Minn. Amax encounters). Saline water chlorides are quite mobile in the environment. Such water could go unnoticed by drillers or their mud men (as it was by MinnAmax circa 1976). If a drilling encountered such water near a trout stream, the chlorides could adversely impact the stream. All drill pits near streams or lakes should be lined with impervious membranes and have no discharges. After the cessation of drilling the remaining fluids should be chemically tested before they are released to the environment to check for unacceptable chlorides, sulfides, pH, dissolved metals and other possible conditions. I own property on White Iron Lake and am concerned about any hydrologic effect on the Kawishiwi River, including water quality. I would like to see all mining, including prospecting, be located far from where it could impact waters associated with the Kawishiwi River, surface or groundwater. For that matter, it shouldn't impact any river or lake. Potential effects of sulfuric acid leaching resulting from exploration or mining operations. She said that past exploration at the "Dunka River Exploration site" has resulted in leaching into the river and that it has been given a recent "variance" by the state that she strongly disapproves of. Mineral Bulk Sampling PI, Para 2 Some may state that closed underground mines once totally inundated will not leach heavy metals since the ground water is anoxic. The sulfide mineralogy and associated heavy metals in ground water at the inundated Tri-State Mining District (Southeast Kansas, Southeast Missouri,	These comments pertain to the effects from mining. The effects of mining are not addressed in this EIS. Those effects would be addressed in future NEPA documents if proposed. This EIS only deals with mineral exploration. This EIS discloses risk of impact to water resources - groundwater, surface water and water levels. Saline deposits occur along the north shore. Stipulations addressing brackish water is located in Section 2.4.3.9. State regulations will guide capping and mitigation (Section 2.4.3.9 and 2.4.3.12) Shaft bulk sampling has been dropped from this project (Section 1.6) More detail in the EIS describes water usage and recycling from sumps that conserves water usage.	Water Resources (3.6)

Comment	Disposition	Location of Discussion in DEIS
Northeast Oklahoma) (zinc and lead) would indicate this assumption might be not accurate (substantial USEPA investigations of this area has been performed on this toxic water). She also expressed concerns that potential mining would adversely affect water quality due to sulfuric acid. She shared that she has a chemistry background and that she knows of no sulfide mining that has not polluted water. potential water pollution from petroleum leaks and acid runoff; It is also of concern that mining operations in both Minnesota and Wisconsin have resulted in contamination of waters resulting in the need for remedial action. This is never as good as having no contamination in the beginning. It also appears that nearly every mining activity results in pollution. With the population on the rise in Cook County and pollution of some of our major waters all ready a problem (Poplar River) it is important that the health of the aquifers be of prime consideration. The attachment raises many questions esp. regarding aquifers. The amount of water required for the drilling seems to be a huge amount relative to the size of our small creeks and rivers. There was no explanation of what might be in the cuttings or drilling additives. It would appear that there is sufficient opportunity for contamination of aquifers currently in use by County residents. The thought of a 15x15 opening to 1.000 . . . might be . . . way to quickly contaminate all aquifers in the area. Again, since Cook County is experiencing rapid growth, these new users will need potable water from those aquifers that probably be used or crossed by the mineral exploration bulk sampling shafts, the EIS should probably include evaluation of these aquifers.		

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Appendix B - Noise Analysis with the SPreAD-GIS Model and Noise Monitoring Data

Introduction

An alternative analysis, using the SPreaAD-GIS model for the area of audibility, and decibel levels affecting receptors (Indicators 3-5 listed in section 3.1 of this EIS), was conducted to corroborate the analysis in section 3.1 of the EIS. The SPreAD-GIS model is designed to assess impacts of motorized noise on receptors in outdoor and remote settings. The results of the SPreAD-GIS model along with the analysis in section 3.1 of this EIS are used in evaluating noise impacts to receptors.

The SPreAD-GIS model was developed by Sarah E. Reed, Ph.D., Jennifer Boggs and Jacob P. Mann and was sponsored by The Wilderness Society. It is based on the research report "Predicting Impact of Noise on Recreationists" by Harrison, Clark and Stankey (1980). This research report describes methods to predict the impact of noise on recreationists while accounting for effects to noise propagation from the following environmental variables: spherical spreading, atmospheric absorption, vegetation and ground cover, weather (wind, temperature, relative humidity and cloud cover), topography, and the ambient soundscape. The SPreAD-GIS model essentially completes calculations used in the Harrison, Clark and Stankey report in a Geographic Information Systems (GIS) program environment. The Harrison, Clark and Stankey report cautions that the model output is not the final answer in evaluating noise impacts since there are limitations in the model (or any model), and effects need to be interpreted according to the context of the situation, recreationist expectations, and resource manager knowledge. These factors are addressed in the analysis in section 3.1 of the EIS (e.g. the Affected Environment section, and the discussion for Indicators 6 and 7).

For a full description of the SPreAD-GIS model and instructions on running the model, the instructions (and the model itself) are available on the internet at http://warnercnr.colostate.edu/~sereed/research/SPreAD-GIS.html and are in the project file.

SPreAD-GIS Model Parameters

The SPreAD-GIS model requires several parameters to be input with data. These were prepared according to the SPreAD-GIS instructions.

Model Runs

Several model runs were completed to estimate potential noise volume and area created by the proposed drill sites in the current operating plans. The input parameters used are shown in Table B-54. The topography, landcover and sound source data was the same for all model runs. The ambient soundscape, season and weather vary by model run since these variables may change over time, changing the sound propagation and impacts to receptors.

The sound impact areas displayed from the SPreAD-GIS model are measured in decibels at the 1000 hertz frequency, whereas the sound impact areas displayed from the analysis in section 3.1 of the EIS are measured in A-weighted decibels. While this does not allow for a direct comparison between the model ouputs for impact to the human experience, it allows for a validation of the analysis in section 3.1 of the EIS. The two models were compared to evaluate whether the analysis in section 3.1 of the EIS represents a conservative estimate of negative effects. In other words, does the analysis in section 3.1 adequately estimate the extent of impacts from noise that may generally occur from drilling? A comparison with the

SPreAD-GIS analysis is useful because the SPreAD-GIS model accounts for more factors that may affect noise propagation than the analysis in section 3.1 of the EIS does.

Table B-53. Description of SPreAD-GIS Input Parameters

Parameter	Data Source
Topography	A topography layer was prepared from a Digital Elevation Model covering the Superior National Forest.
Landcover	For the landcover/vegetation layer, a National Land Cover Dataset was used and reclassified according to the landcover classes listed in the SPreAD-GIS instructions.
Sound Source (minerals exploration drilling noise)	The data input for the sound source came from measurements taken with a Larson-Davis 831 sound pressure measurement device. This measurement was taken from an unbaffled drill rig located near the intersection of Highway 1 and Forest Road 1902, which is in the vicinity of proposed drilling areas in the Federal Hardrock Minerals Prospecting Permit Project. These measurements are listed in Table B-56. The drill rig was measured at 47 decibels at the 1000 hertz frequency, 450 feet from the drill rig.
Ambient Soundscape	Sound monitoring conducted with a Larson-Davis 831 sound pressure measurement device was used (see Table B-55). In addition, the table from p. 11 of the SPreAD-GIS instruction manual was used.
Weather	Data from the RAWS weather station located in Ely, MN (near proposed drill sites) was used to generate average temperature, relative humidity, wind speed, and wind direction for the winter and summer. See Table B-57. Windroses for Ely, MN are displayed in Figure B-50 through Figure B-53.
Model Run Frequency	The SPreAD-GIS model may be run for a range of sound frequencies (hertz). As per Harrison, Clark and Stankey (1980), the 1000 hertz frequency was run because this is generally the most noticeable frequency to the human ear.

Maps showing the model run results are displayed in Figure B-42 through Figure B-49. The SPreAD-GIS model may be run to display 'baseline noise propagation'[10], which evaluates noise propagation from drilling as affected by all environmental variables (e.g. topography, vegetation, landcover, weather, and factors such as atmospheric absorption) except the ambient soundscape. The SPreAD-GIS model may also be run to display 'excess noise propagation'[11] which takes into account of all the environmental variables accounted for by the baseline noise propagation model, and also accounts for the ambient soundscape. The excess noise propagation analysis displays less noise impacts than the baseline propagation analysis since the ambient soundscape reduces the ability of a person to hear an introduced sound. Both the baseline noise propagation and excess noise propagation model runs are displayed in Figure B-42 through Figure B-49.

The contour lines on the maps represent 3 decibel increments which decrease with increasing distance from the drill site. Beyond the final contour, there is no impact estimated by the model. The contour lines generated from the SPreAD-GIS model are overlaid on the area of audibility and sound contours produced from the analysis in section 3.1 of the EIS. This allows for a comparison of the results between the two analyses.

[10] The SPreAD-GIS model describes the baseline noise propagation model run as "the predicted pattern of noise propagation around the source, accounting for attenuation due to spherical spreading loss, atmospheric absorption, foliage and ground cover loss, upwind and downwind loss, and terrain effects." (SPreAD-GIS Users Guide V 2.0, p. 16)

[11] The SPreAD-GIS model describes the baseline noise propagation model run as "calculates the difference between introduced noise and background sound levels. The excess noise calculation can be used to identify areas where introduced noise is likely to be audible, or where it may impact species of concern." (SPreAD-GIS Users Guide V 2.0, p. 16)

Table B-54. Parameters used for SPreAD-GIS model runs

	Run # 1	Run # 2	Run # 3	Run # 4
Evaluated Frequency (Hz)	**1000**	**1000**	**1000**	**1000**
Ambient Soundscape Decibels				
Ambient Coniferous Forest	26	16	26	11
Ambient Grassland	20	16	20	14
Ambient Hardwood Forest	24	16	24	14
Ambient Shrubland	22	16	22	14
Ambient Urban	30	30	30	30
Ambient Water	28	16	20	4
Ambient Barren	20	8	20	4
Run Parameters				
Sound Source Locations	Operating Plan Drill Sites	Operating Plan Drill Sites	Operating Plan Drill Sites	Operating Plan Drill Sites
Model Extent	5 mile extent around all drill sites	5 mile extent around all drill sites	5 mile extent around all drill sites	5 mile extent around all drill sites
Sound Level of Source (DB)	47	47	47	47
Distance Measured	450 feet	450 feet	450 feet	450 feet
Elevation Dataset	Digital Elevation Model	Digital Elevation Model	Digital Elevation Model	Digital Elevation Model
Landcover Dataset	National Landcover Dataset	National Landcover Dataset	National Landcover Dataset	National Landcover Dataset
air temp (F)	62	62	14	14
Relative Humidity (%)	74	74	79	79
wind direction (degrees)	225	225	242	242
wind speed (mph)	7	0	6	0
seasonal conditions	clear, summer, windy day	clear, summer, calm day	clear, winter, windy day	clear, winter, calm day
ambient sound conditions	generated from ambient soundscape data above	generated from ambient soundscape data above	generated from ambient soundscape data above	generated from ambient soundscape data above

Results

Model Run #1

This model run evaluates noise propagation during the summer with average wind conditions. As may be seen in Figure B-42, baseline noise propagation is almost completely within the area of impact predicted in section 3.1 of the EIS. As shown in Figure B-43, excess noise propagation predicted by SPreAD-GIS is far less than what is predicted in section 3.1 of the EIS as displayed by the ‘area of audibility’ and sound contours shown on Figure B-43. Part of this difference may be due to the difference in model output (A-weighted decibels versus 1000 hertz decibels). However, this also is likely due to the attenuating effect of variables accounted for in the SPreAD-GIS model that are not accounted for in the analysis in section 3.1 of the EIS. In other words, the analysis in section 3.1 of the EIS generally overestimates impacts because

it does not account for some environmental factors such as topography that may reduce sound propagation.

Model Run #2

In order to account for situations when wind is calm, a model run was completed that was the same as Run #1, except wind was set for zero miles per hour. As in Model Run #1, effects are within the scope of effects disclosed in section 3.1 of the EIS. See Figure B-44 and Figure B-45.

Model Run #3

This model run evaluates noise propagation during the winter with average wind conditions. This allows for a comparison between summer and winter conditions. As shown when comparing Figure B-42 and Figure B-43 to Figure B-46 and Figure B-47, there are some differences between the summer and winter analysis runs, but these are minor. The amount of audible noise in the winter is a little greater than in the summer, which is likely due to the quieter soundscape which is present in a winter forest than a summer forest.

Model Run #4

This model run evaluates noise propagation during the winter with calm wind conditions. As in Model Run #3, effects are within the scope of effects disclosed in section 3.1 of the EIS. See Figure B-48 and Figure B-49.

Conclusion

The model runs display noise propagation that generally shows a similar or smaller impact area than what is displayed in section 3.1 of the EIS. This outcome is reasonable because the SPreAD-GIS model accounts for more environmental variables that may reduce sound propagation than does the model used in section 3.1 of the EIS. Therefore, the analysis in section 3.1 of the EIS generally represents a conservative overestimate of sound impacts that would occur from drilling.

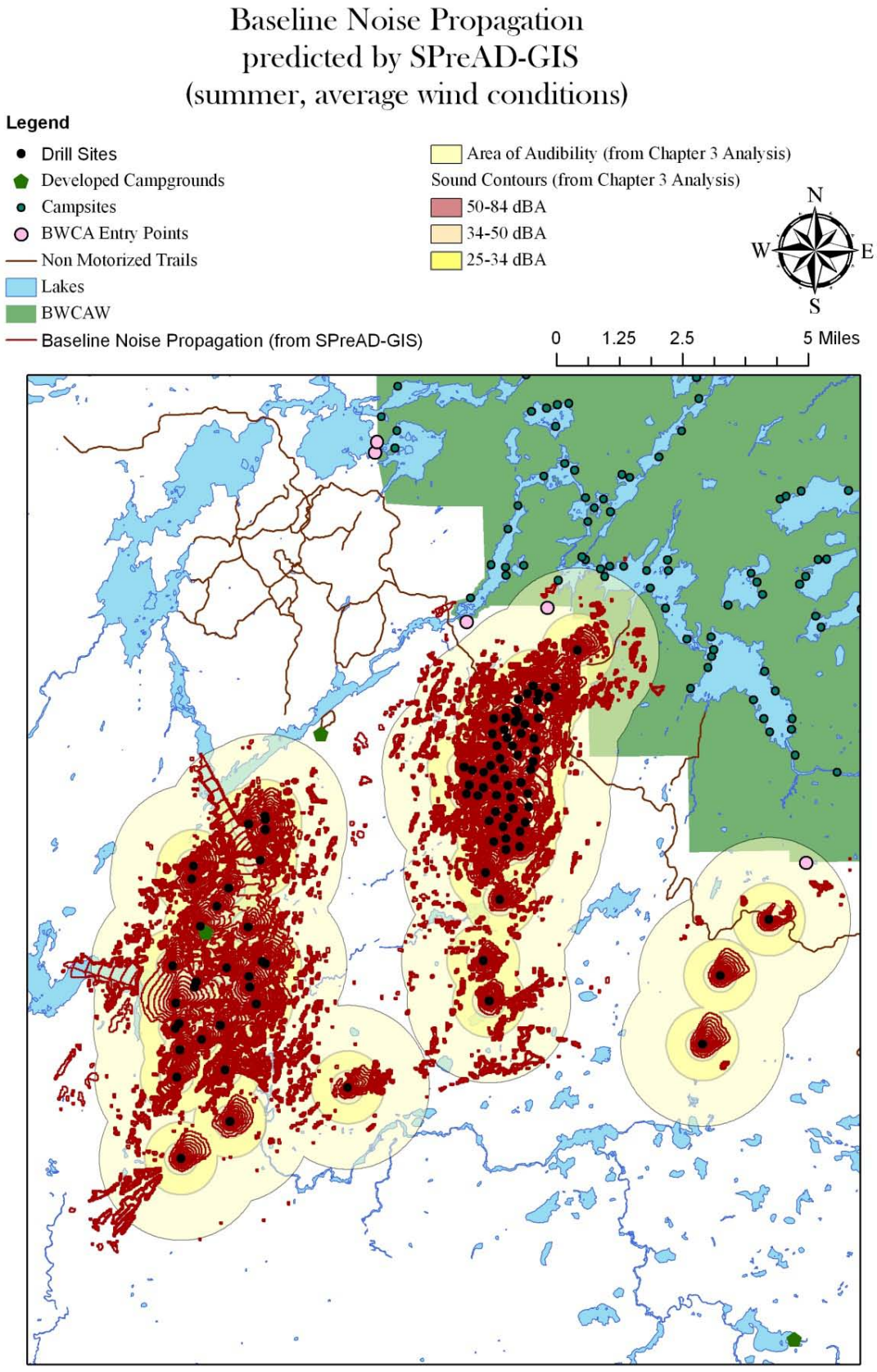

Figure B-42. Baseline noise propagation from run #1

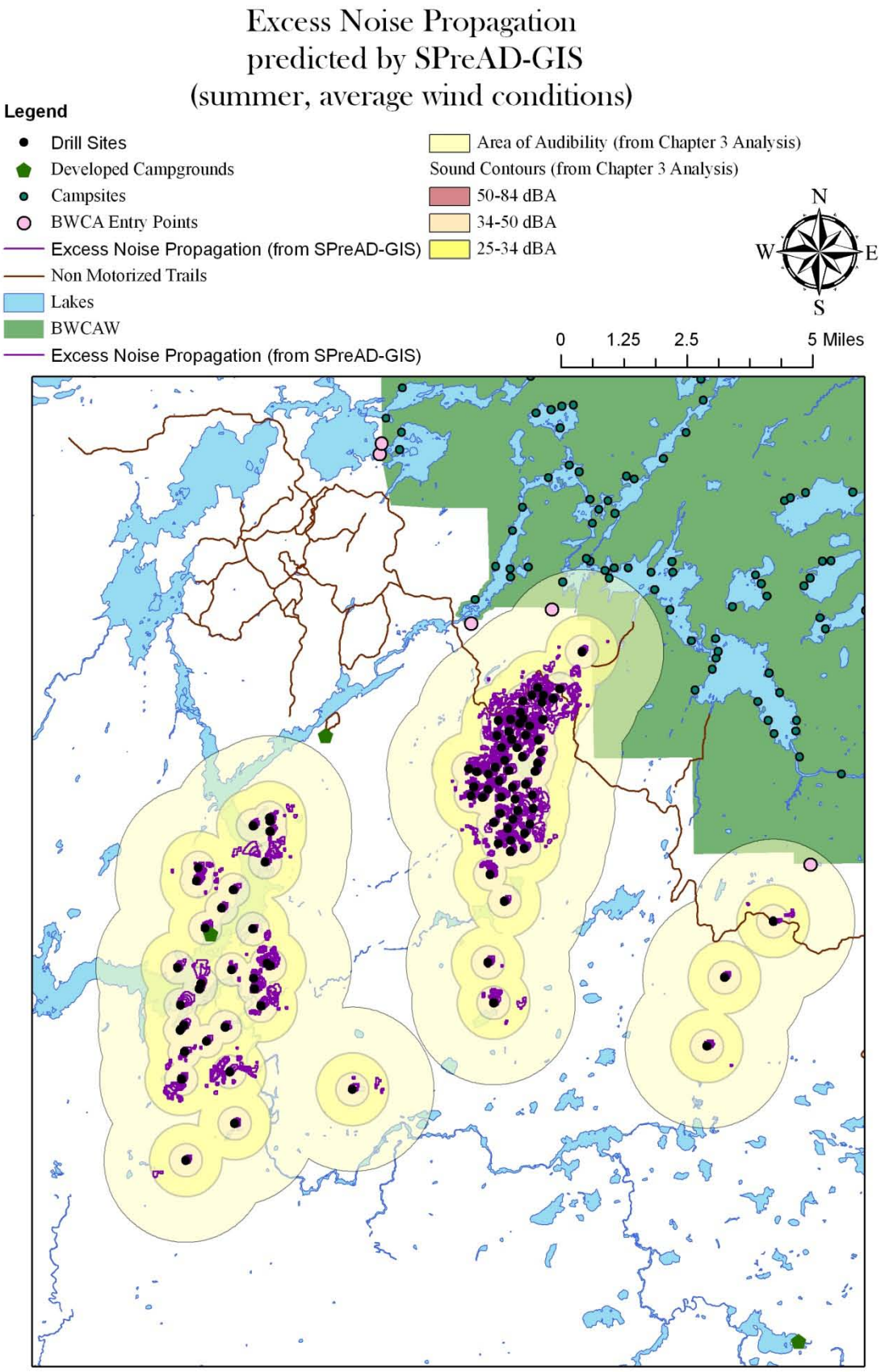

Figure B-43. Excess noise propagation from run #1

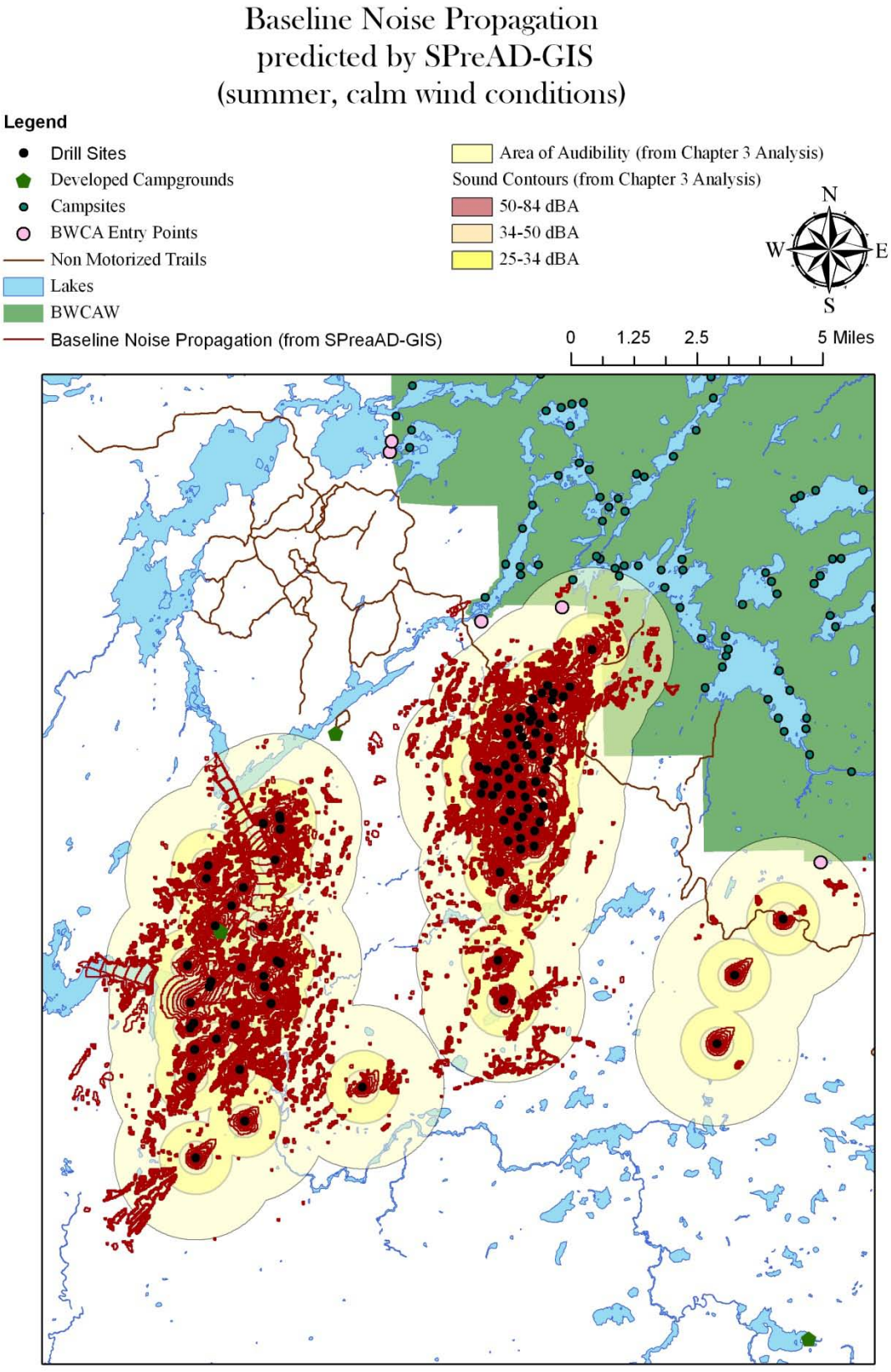

Figure B-44. Baseline noise propagation from run #2

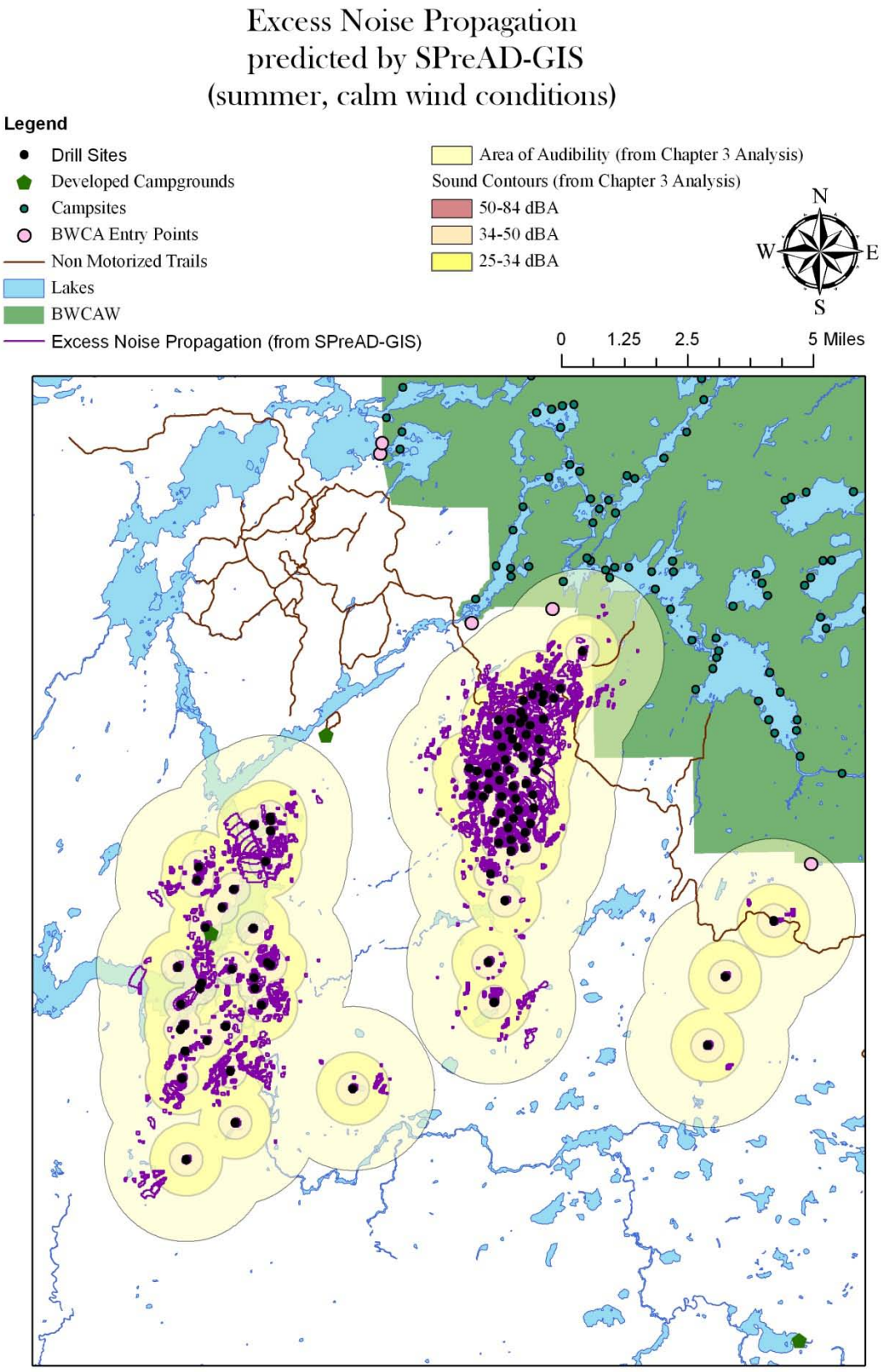

Figure B-45. Excess noise propagation from run #2

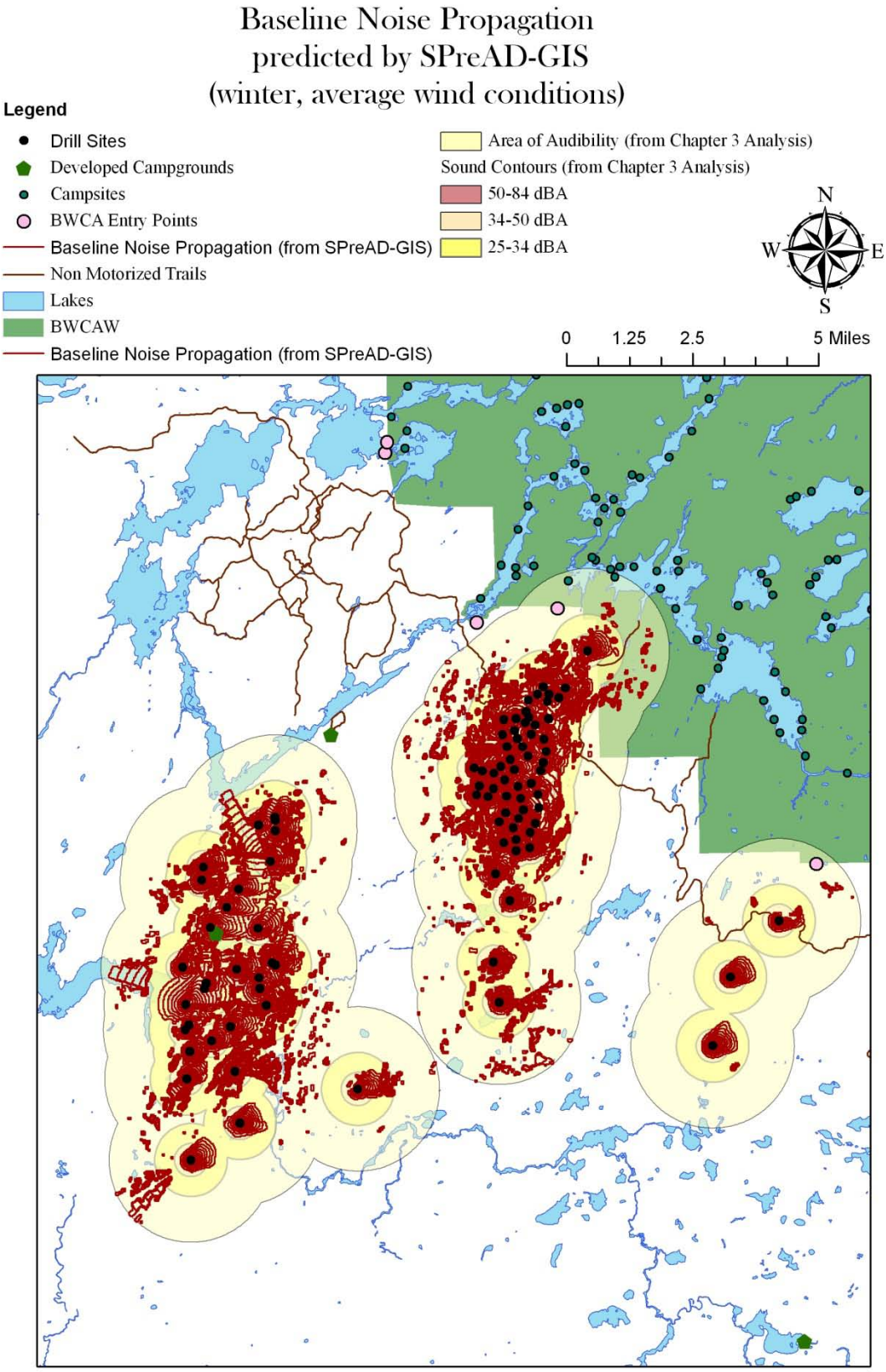

Figure B-46. Baseline noise propagation from run #3

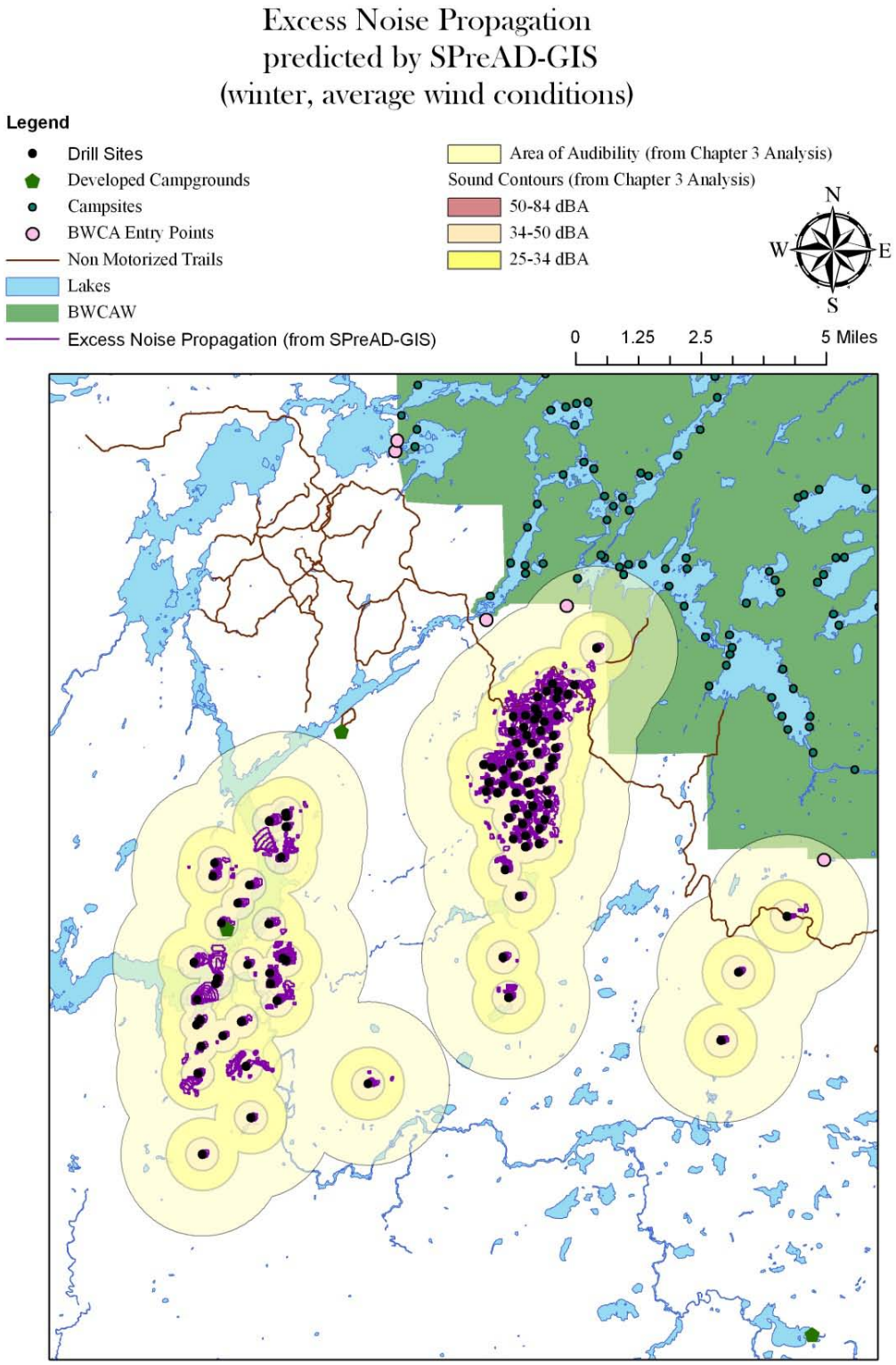

Figure B-47. Excess noise propagation from run #3

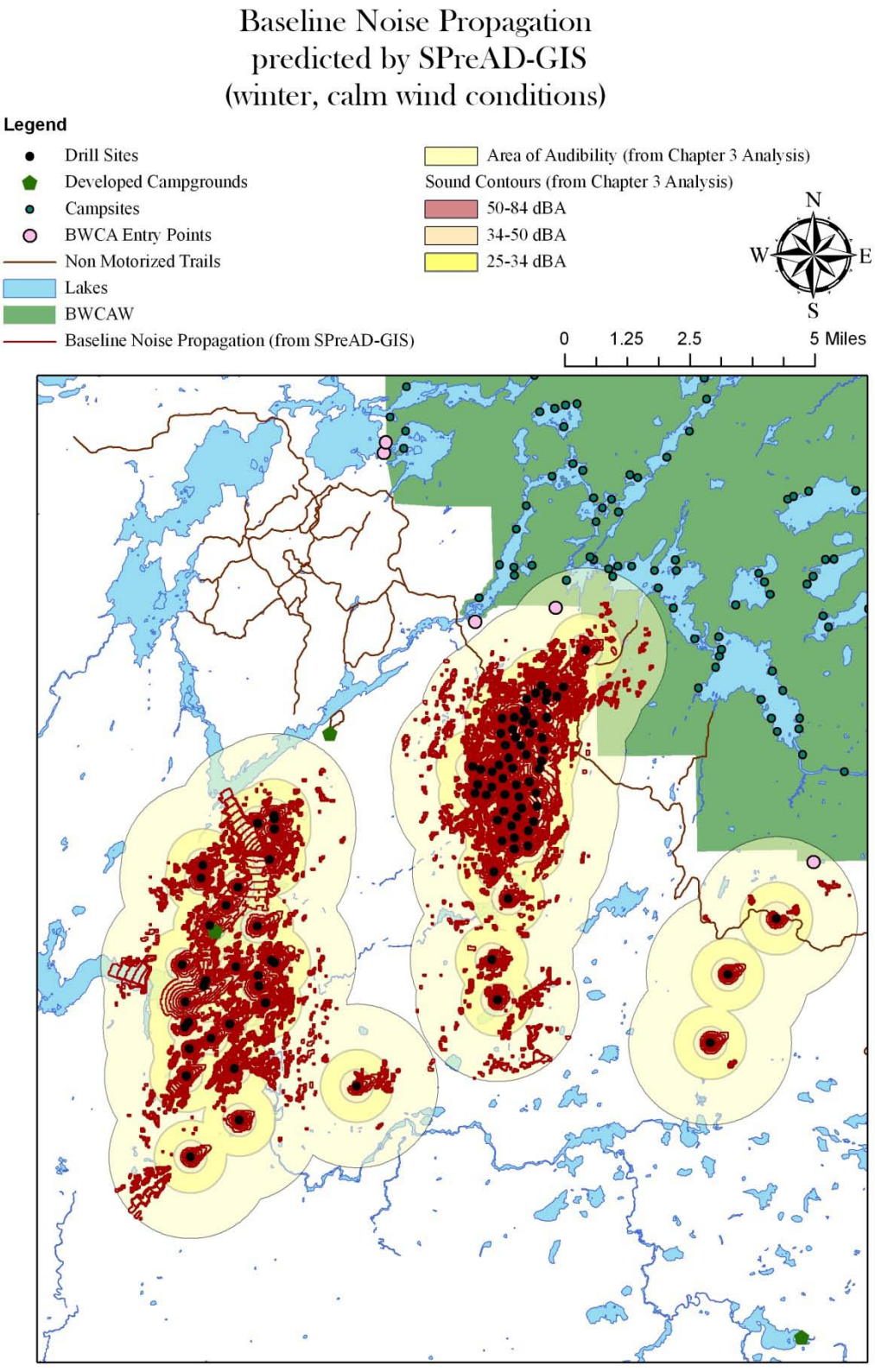

Figure B-48. Baseline noise propagation from run #4

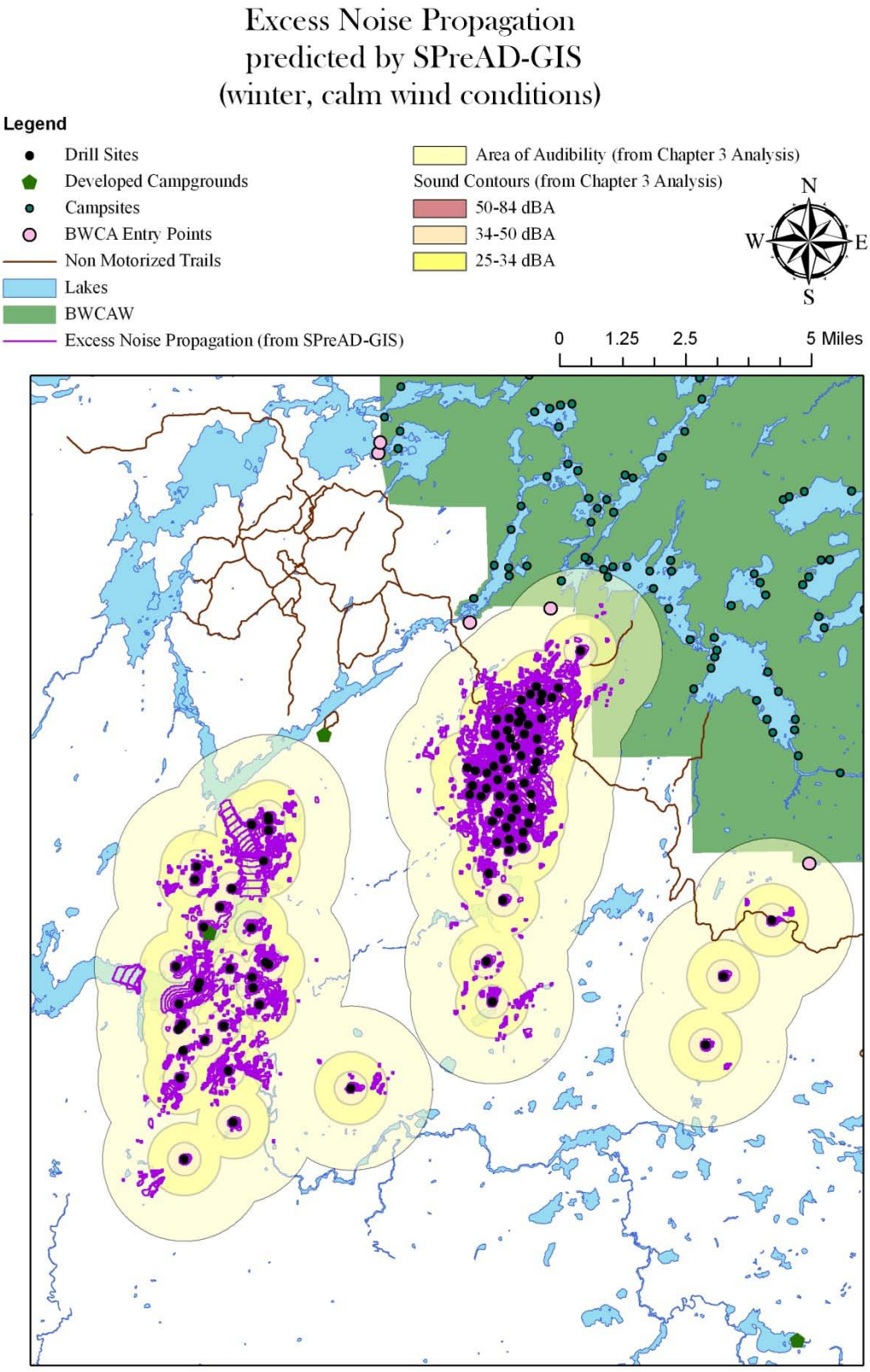

Figure B-49. Excess noise propagation from run #4

Monitoring Data

A Larson Davis 831 sound pressure measurement device was used to collect the data in Table B-55 and Table B-56. The data was collected in August and September of 2010. The device was calibrated before use. The data is summarized below and represents continuous 24 hour data collection over multiple days. The median dBA over a 24 hour period, during the day, and during the night are displayed. The sound level recorded varies according to wind and other natural sounds, and human generated sounds, that are present at a given time. While these values represent a median value, sound levels may be lower at calm moments, or higher due to factors such as high wind speeds. The minimum sound level event recorded during the data collection period is also displayed in Table B-55. The frequency of calm periods versus periods with high wind speeds may be estimated using the windrose charts shown in Figure B-50 through Figure B-53 below. The full data output from calibration and use is more extensive and is in the project file.

Table B-55 displays ambient sound levels at representative receptors locations that may be affected by drilling noise, including Birch Lake Campground, the Kawishiwi Research Station (near Recreation Residences), Norway Point on Birch Lake (a dispersed campsite), and Little Gabbro Lake in the BWCAW.

The data in Table B-56 is the average 1/3 octave frequency decibel measurement taken by a Larson-Davis 831 sound pressure measurement device over a 24 period at a distance of 450 feet from a drill rig operating without without baffling. The 1/3 octave frequency measurement represents the decibel level at a particular sound frequency (which is the pitch of a sound). This data was used as an input for the SPreAD-GIS model. The measurement was taken on 9/14/2010 and the 1000 hertz decibel measurement was 46.8 decibels. Average 24 hour readings taken on 9/13/2010 and 9/15/2010 during drilling operation were 47.9 and 46.4 decibels at 1000 Hz, respectively. A median decibel reading at 1000 Hz over the 3 days was 47 decibels at 450 feet, which was used as an input for the SPreAD-GIS model runs. During these measurements, there was an average wind speed of 4.3 mph and 0 inches of rain fell.

Table B-57 and the windroses in Figure B-50 through Figure B-53 display weather data that was used for input into the SPreAD-GIS model, and to inform the analysis in section 3.1 of the EIS.

Table B-55. Ambient soundscape monitoring data

Birch Lake Campground	**Aug. 10**	**Aug. 11**	**Aug. 12**	**Aug. 13**	**Aug. 14**	**Aug. 15**	**Aug. 16**	**median dBA**
Overall 24 hr data	48.3	46.1	36.9	47.1	45.6	46.8	43.9	46.1
Day 0700 - 2300	48.2	40.6	38.5	48.6	46.3	47.8	42.9	46.3
Night 2300 - 0700	49.1	50	25.8	39.9	43.4	43.8	44.2	43.8
Minimum sound level	23.5	17.9	17.7	20.1	18.1	30.4	29.7	20.1
Weather conditions								
Wind speed average (mph)	2	9	2	5	5	13	15	7.2 mph avg
Rain inches	0	0.43	0	0.01	0	0.05	0.01	0.5" total
Research Station - S. Kaw. River	**Aug. 17**	**Aug. 18**	**Aug. 19**	**Aug. 20**	**Aug. 21**	**Aug. 22**	**Aug. 23**	**median dBA**
Overall 24 hr data	47	47.4	37.2	45.4	38.9	39	37.3	39
Day 0700 - 2300	46.3	40.9	38.5	37.1	40.4	40.4	39.9	40.4
Night 2300 - 0700	50.7	51.5	31.9	49.7	30.3	32.8	36.2	36.2
Minimum sound level	25.9	17.8	17.5	18.3	17.3	18.9	23	18.3
Weather conditions								
Wind speed average (mph)	8	7	2	4	0	3	9	4.7 mph avg
Rain inches	0	0.01	0	0.66	0	0	0	0.67" total
Norway Point - Birch Lake	**Aug. 24**	**Aug. 25**	**Aug. 26**	**Aug. 27**	**Aug. 28**	**Aug. 29**	**Aug. 30**	**median dBA**
Overall 24 hr data	44.2	42.7	35.5	45.7	45.3	47.7	43.6	44.2
Day 0700 - 2300	44.2	43.2	36.8	47.3	45.4	48.9	40	44.2
Night 2300 - 0700	43	41.2	30.3	36.4	45	43.5	44.6	43
Minimum sound level	14.3	17.2	17	19.3	27.8	30.6	27	19.3
Weather conditions								
Wind speed average (mph)	8	10	2	4	11	9	9	7.6 mph avg
Rain inches	0.18	0	0	0	0	0	0.03	0.21" total
Little Gabbro Lake BWCAW	**Aug. 31**	**Sept. 1**	**Sept. 2**	**Sept. 3**	**Sept. 4**	**Sept. 5**	**Sept. 6**	**Sept. 7**
Overall 24 hr data	51.9	34.7	39.7	50.7	44.1	27	37.7	42.7
Day 0700 - 2300	52.3	35.7	41.2	52.2	45.7	28.1	37.8	40.5
Night 2300 - 0700	27.4	31.7	30.6	41.5	34.2	22.7	37.3	45.2
Minimum sound level	24.1	18.7	18.9	18.8	18.1	17.4	18	18.9
Weather conditions								
Wind speed average (mph)	12	5	3	11	10	0	3	7
Rain inches	0.08	0	0.31	0.17	0	0	0	1.06

Table B-56. 1/3 octave measurements of drilling noise on 9/14/2010 at 450 feet from drill rig

Frequency (Hz)	Overall 1/3 Spectra (decibels)
6.3	56.0
8.0	54.2
10.0	52.1
12.5	49.8
16.0	50.8
20.0	45.2
25.0	50.9
31.5	57.9
40.0	48.1
50.0	59.5
63.0	51.2
80.0	54.8
100	53.9
125	40.5
160	39.7
200	43.3
250	44.1
315	46.4

Frequency (Hz)	Overall 1/3 Spectra (decibels)
400	49.7
500	50.0
630	47.4
800	47.3
1000	46.8
1250	44.0
1600	42.0
2000	40.5
2500	36.4
3150	31.9
4000	27.3
5000	23.9
6300	20.6
8000	17.4
10000	14.3
12500	11.7
16000	10.3
20000	9.8

Table B-57. Weather conditions on the Superior National Forest (from RAWS Station, Ely, MN)

Date	Mean Wind Speed (mph)	Mean Wind Direction (deg)	Maximum Wind Gust (mph)	Air Temperature (Deg F)					Relative Humidity (%)		
	Avg.	Vector Avg.	Max.	Avg.	Avg. Daily Max.	Max.	Avg. Daily Min.	Min.	Avg.	Max.	Min.
Jan-04	5.751	295	33	-0.01232	10.9	32	-12.44	-32.99	85.09	100	48
Feb-04	6.069	230.5	26	17.86	29.38	50	5.103	-31.99	78.99	100	29
Mar-04	7.344	241.5	41	27.47	38.13	59	15.94	-4.999	78.28	100	20
Apr-04	6.334	303.8	30	37.77	49.1	78	26	16	65	100	14
May-04	7.415	112	34	47	57.52	73	33.97	20	65.85	100	19
Jun-04	7.186	260.5	39	57.93	69.43	83	44.8	35	68.39	100	24
Jul-04	5.773	226.2	49	64.9	76.77	89	51.93	39	73.66	100	27
Aug-04	6.016	236.2	44	58.05	69.06	85	45.23	33	77.79	100	25
Sep-04	7.911	199.7	37	59.46	70.13	85	48.27	29	80.74	100	33
Oct-04	7.042	210.7	33	43.9	52.84	78	34.55	24	82.28	100	28
Nov-04	7.248	250.9	36	32.25	40.53	51	23.63	6	76.27	100	19
Dec-04	7.094	269.7	34	11.06	21.19	38	-1.257	-37.99	89.43	100	47
Jan-05	6.337	246	32	4.319	15.26	31	-9.451	-45.99	88.36	100	47
Feb-05	6.256	255.2	31	17.01	28.36	53	4.357	-24.99	81.31	100	34
Mar-05	5.467	266.9	31	22.1	36.19	58	5.774	-24.99	68.1	100	20
Apr-05	6.81	114.2	30	43.75	56.33	82	30.1	17	60.24	100	13
May-05	6.898	149.2	37	49.52	59.42	77	39.45	20	74.64	100	14
Jun-05	7.178	173.2	41	64.09	73.77	90	52.4	38	75.3	100	22
Jul-05	6.191	219	38	67.66	79.32	92	54.68	38	72.78	100	25
Aug-05	6.182	240.7	36	64.22	75.13	92	52.1	33	73.46	100	23
Sep-05	6.639	223.5	35	58.64	70.33	89	44.9	28	74.67	100	25
Oct-05	5.685	198.3	33	44.03	53.03	80	34.94	25	85.26	100	34
Nov-05	6.258	259.6	37	28.22	36.57	60	19.97	-8.999	87.14	100	30
Dec-05	5.585	273.9	35	16.49	22.32	38	9.839	-9.99	90.09	100	54
Jan-06	6.699	250.7	32	21.87	29.23	48	12.68	-13.99	86.27	100	43
Feb-06	5.755	291.8	28	8.912	20.61	36	-4.249	-24.99	75.27	99	23
Mar-06	6.081	7.164	29	27.86	38.06	53	16.1	-6.999	69.07	100	17
Apr-06	7.136	111.2	31	45.94	58.37	76	33.53	17	56.69	100	11

Date	Mean Wind Speed (mph)	Mean Wind Direction (deg)	Maximum Wind Gust (mph)	Air Temperature (Deg F)					Relative Humidity (%)		
	Avg.	Vector Avg.	Max.	Avg.	Avg. Daily Max.	Max.	Avg. Daily Min.	Min.	Avg.	Max.	Min.
May-06	7.127	346.2	31	53.98	64.19	90	43.06	27	71.55	100	16
Jun-06	5.675	222.3	34	62.57	74.1	83	49.2	34	69.36	100	22
Jul-06	6.374	230	37	70.19	82.68	95	56.61	45	65.59	99	23
Aug-06	5.867	218.8	30	64.22	75.74	83	50.81	39	72.26	100	26
Sep-06	5.718	199.9	30	52.42	64	82	40.07	28	77.6	100	27
Oct-06	7.233	259	35	37.49	47.03	74	27.81	15	77.93	100	26
Nov-06	6.913	224.9	31	29.95	37.67	60	22.5	-1.999	80.03	100	35
Dec-06	5.997	246.3	27	21.18	28.61	45	12.39	-7.999	87.87	100	33
Jan-07	6.503	255.2	27	11.04	20.03	37	-0.258	-24.99	82.41	100	32
Feb-07	6.961	283.1	31	4.491	14.39	36	-7.713	-32.99	75.85	100	29
Mar-07	7.655	220.3	37	28.26	38.94	73	16.23	-17.99	72.56	100	21
Apr-07	6.547	355.4	32	37.52	50.07	75	23.37	0	62.49	100	15
May-07	8.125	168.4	37	55.16	66.65	86	43.06	28	65.47	100	14
Jun-07	6.688	213.9	43	64	75.33	86	51.4	36	71.06	100	27
Jul-07	5.523	243.9	32	67.2	78.84	94	53.68	40	70.69	100	28
Aug-07	6.054	238.2	29	63.57	75.71	89	49.06	34	69.37	100	26
Sep-07	7.932	223.3	40	56.21	66.27	87	45.77	29	74.59	100	0
Oct-07	7.343	237.9	38	46.22	54.71	69	38.23	20	79.23	100	23
Nov-07	7.66	252.4	32	27.03	33.17	50	20.03	-13.99	77.54	100	33
Dec-07	5.707	243.7	31	11.69	19.13	34	0.5161	-24.99	90.37	100	54
Jan-08	6.806	244.6	34	9.055	18.52	40	-2.515	-28.99	83.31	100	39
Feb-08	6.242	249.7	34	8.922	20.83	46	-6.378	-31.99	75.11	98	34
Mar-08	7.413	220.2	36	21.03	32.45	45	7.065	-24.99	68.31	100	21
Apr-08	7.821	9.131	36	36.58	46.7	70	25.8	9	69.44	98	14
May-08	7.292	343.5	40	46.7	58.58	78	34.03	25	65.67	98	20
Jun-08	7.291	303	45	59.37	70.23	83	48	36	70.28	98	17
Jul-08	7.121	246.9	41	64.61	75.16	84	53.1	41	73.08	98	27
Aug-08	6.9	130.2	33	64.41	76.71	87	50.42	34	69.63	99	26
Sep-08	6.835	195.2	29	55.03	65.23	85	44.17	32	81.72	100	36

Date	Mean Wind Speed (mph)	Mean Wind Direction (deg)	Maximum Wind Gust (mph)	Air Temperature (Deg F)					Relative Humidity (%)		
	Avg.	Vector Avg.	Max.	Avg.	Avg. Daily Max.	Max.	Avg. Daily Min.	Min.	Avg.	Max.	Min.
Oct-08	7.19	227.8	31	43.43	51.87	69	34.58	18	81.54	100	27
Nov-08	7.251	285.3	30	27.94	33.87	68	21.03	-1.999	87.78	100	28
Dec-08	6.773	258.3	30	3.812	13.48	34	-8.676	-29.99	88.05	100	48
Jan-09	6.194	259.2	46	1.006	13.03	36	-13.83	-42.99	84.86	100	35
Feb-09	6.709	270.2	42	13.09	24.36	41	-0.3928	-30.99	82.69	100	24
Mar-09	7.819	195.5	34	24.08	35.65	60	11.29	-28.99	73.04	100	24
Apr-09	7.163	346.9	33	38.88	50.17	70	27.97	15	65.87	100	13
May-09	8.758	266.1	40	48.98	60.94	87	35.97	26	63.95	100	17
Jun-09	6.961	243.4	36	59.54	70.43	88	47.07	29	72.1	100	18
Jul-09	7.241	273.2	40	60.27	70.42	80	48.35	38	78.92	100	28
Aug-09	6.808	228.3	35	61.7	73.16	88	49.29	32	81.86	100	33
Sep-09	5.771	194.1	35	60.48	73.1	82	47.97	26	81.48	100	25
Oct-09	6.841	286.9	36	37.88	44.39	58	32.03	20	90.62	100	34
Nov-09	6.399	220.2	30	35.53	43.77	58	27.6	14	80.3	100	26
Dec-09	5.856	303.3	27	9.96	17.16	33	0.8065	-16.99	77.52	97	41
Jan-10	6.121	261.4	29	9.011	20.1	44	-1.418	-31.99	73.1	99	26
Feb-10	4.113	18.07	24	11.96	29.5	42	-4.678	-22.99	61.9	96	12
Mar-10	6.536	229.2	31	36.49	49.74	68	23.87	0	65.46	100	19
Apr-10	7.726	132.7	37	46.57	60.23	71	31.47	15	52.88	98	12
May-10	7.073	182.4	36	54.85	66.65	89	41.06	23	62.93	100	15
Jun-10	6.024	178.8	40	59.97	69.9	81	49.47	35	78	100	23
Jul-10	6.728	234.6	30	68.1	78.32	88	56.42	45	74.55	100	35
Aug-10	7.694	220	41	67.55	77.84	88	56.77	40	75.91	100	30
Sep-10	7.246	281.8	33	50.28	60.07	75	40.47	26	78.87	100	0
Oct-10	7.273	242.8	31	45.36	56.87	81	33.65	21	69.21	99	25
Nov-10	7.164	242.6	35	29.92	39	65	20.37	-2.999	77.11	100	29
Dec-10	5.833	335.4	26	11.14	19.74	36	3.194	-27.99	79.05	100	23
Jan-11	5.315	307.3	30	3.703	11.94	25	-6.483	-36.99	75.95	94	47

Date	Mean Wind Speed (mph)	Mean Wind Direction (deg)	Maximum Wind Gust (mph)	Air Temperature (Deg F)					Relative Humidity (%)		
	Avg.	Vector Avg.	Max.	Avg.	Avg. Daily Max.	Max.	Avg. Daily Min.	Min.	Avg.	Max.	Min.
				Mean Temperature					Mean Relative humidity		
Winter Average	6.3100	242.391	--	14.305					78.885		
Summer Average	6.626	224.957	--	61.666					74.418		

The following windroses display the direction from which wind is blowing (for example, if it is blowing out of the west, the wind is moving east); the wind speed (represented by the colors); and the percent of the time it is blowing in that speed and direction (represented by the percentage labeled contours). The percent of time there is calm conditions is in the center of the windrose.

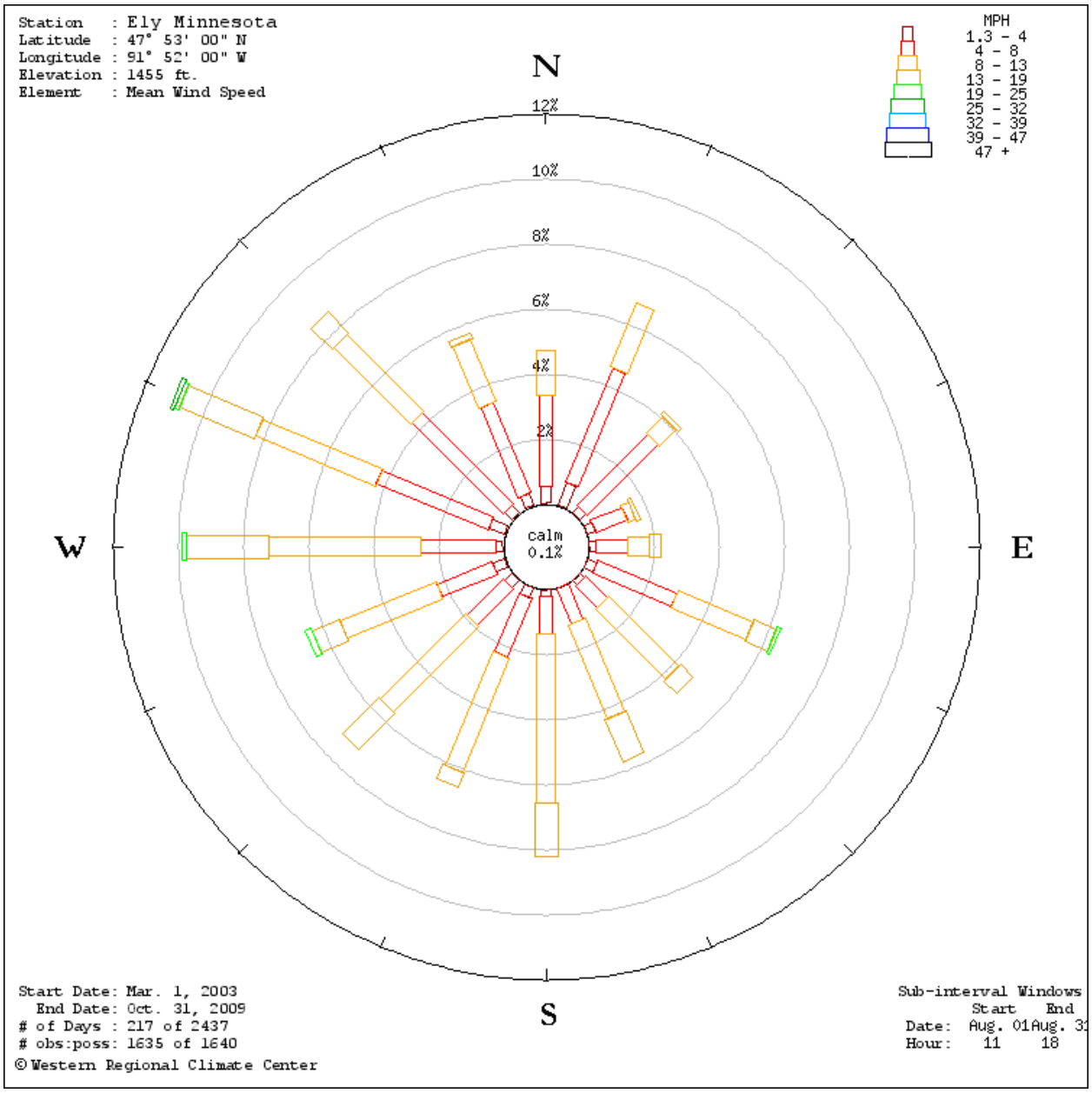

Figure B-50. Windrose: summer, daytime, Ely, MN

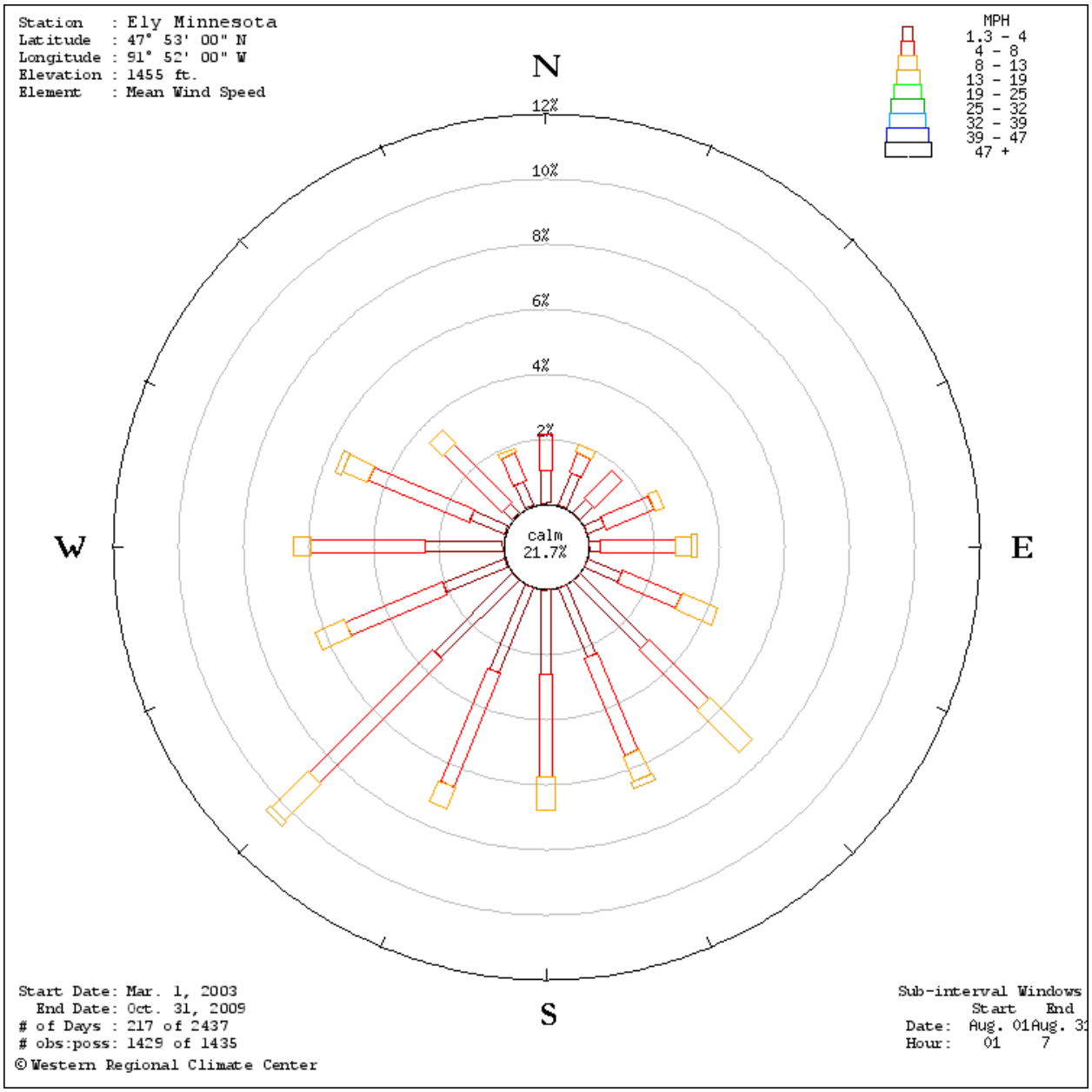

Figure B-51. Windrose, summer, nighttime, Ely, MN

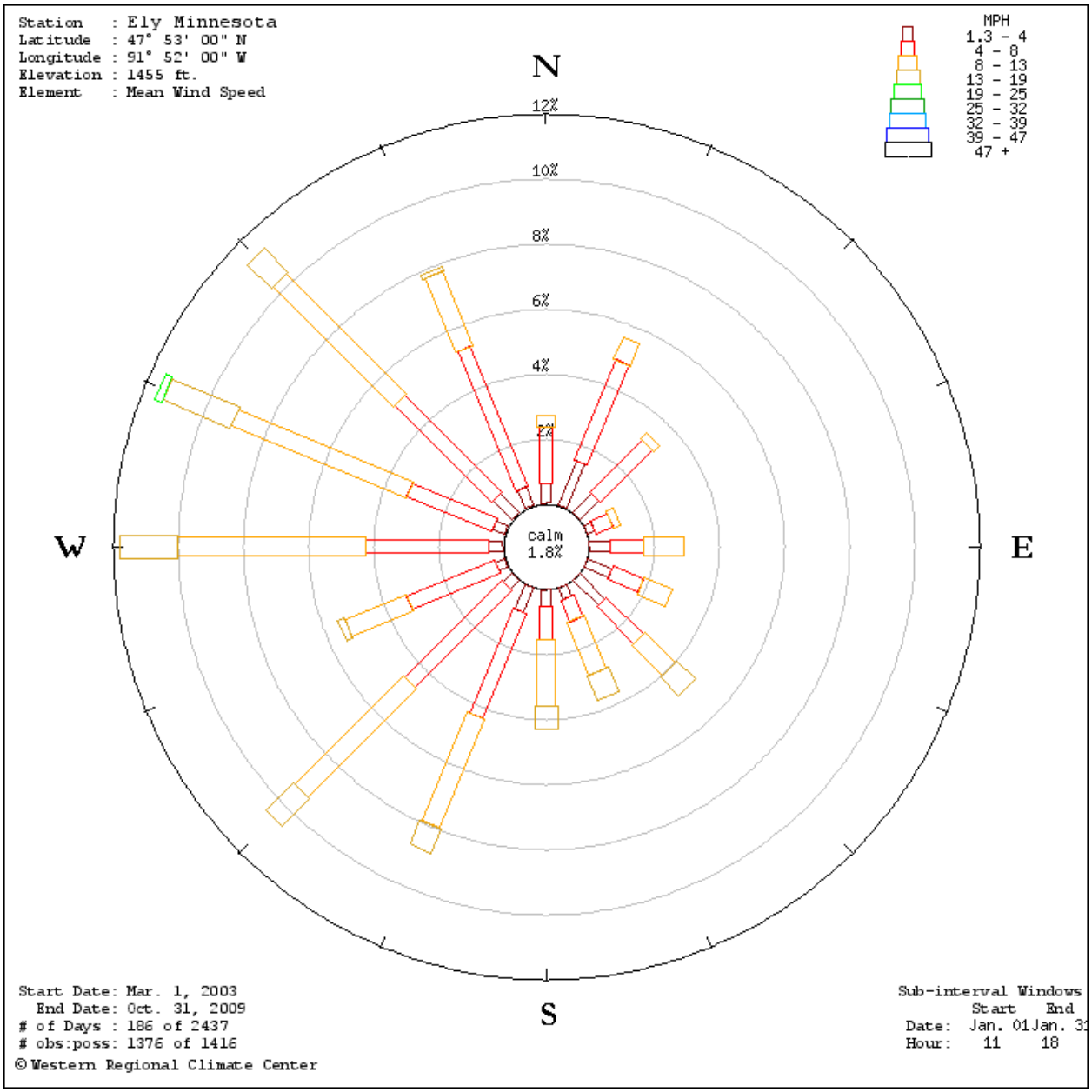

Figure B-52. Windrose, winter, daytime, Ely, MN

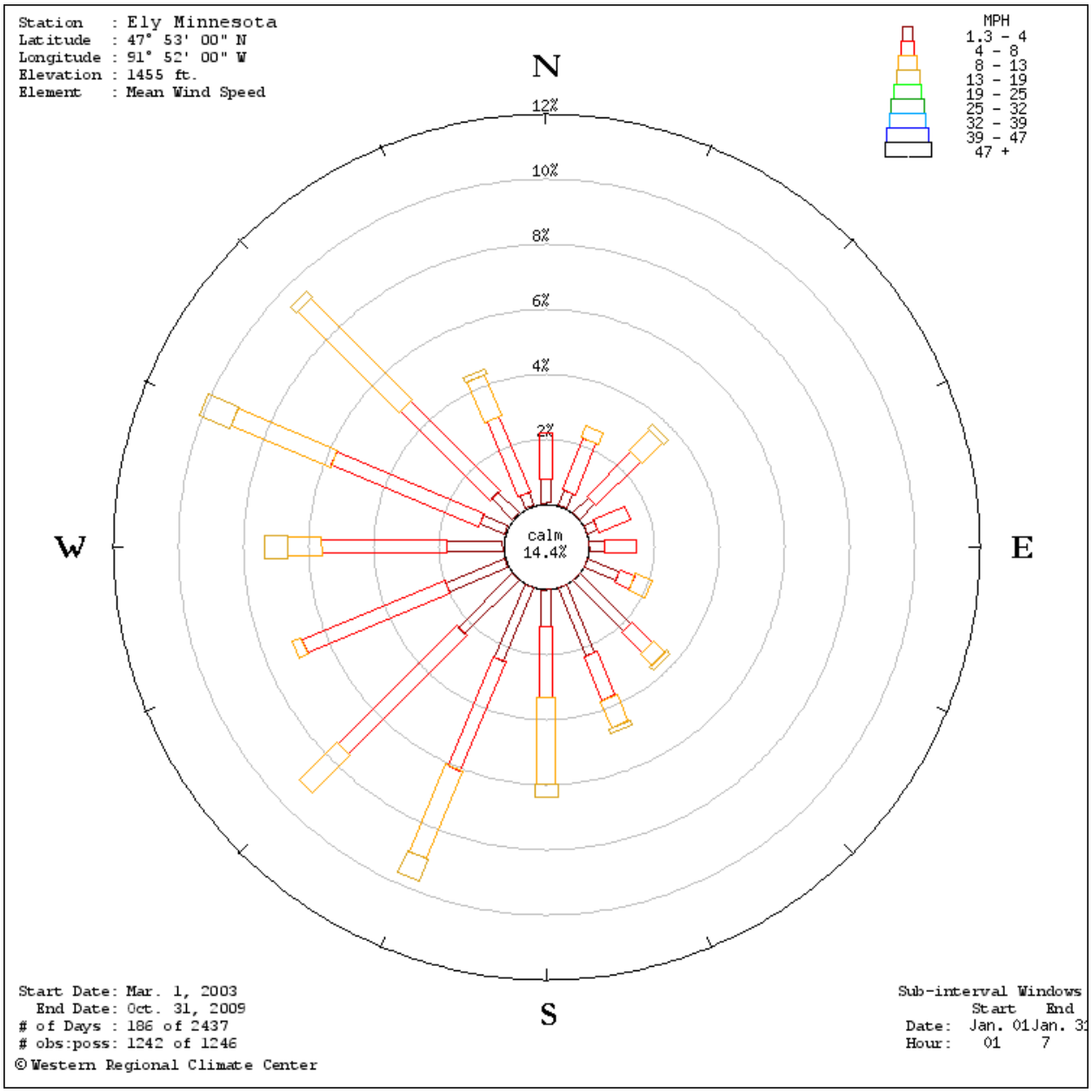

Figure B-53. Windrose, winter, nighttime, Ely, MN

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Appendix C - Past, Present, and Reasonably Foreseeable Actions Relevant to the Cumulative Effects Analysis

The resource analyses provided in Chapter 3 use this information in the cumulative effects analysis. Instead of listing these projects numerous times under each resource section, they are provided here and resource analyses will refer back to this section

Cumulative Effects area of analysis

The cumulative effects area of analysis varies by resource area. See each resource section for definition of cumulative effects analysis area.

Past, present, and reasonably foreseeable actions

The IDT has made the following assumptions about activities on private, state or federal lands that may influence cumulative effects analysis for this project:

1. Drilling for mineral exploration is most likely to cause cumulative impacts for this project because drilling would cause greatest possible overlap in noise effects, and would contribute to cumulative temporary road quantity.

2. Vegetation projects could affect cumulative temporary road construction and use as well as contribute to noise effects.

3. Increased recreation levels could add to annoyance/effects to solitude

Minerals management projects on National Forest System land.
Current and past prospecting and lease activities on Federal and non federal lands are displayed in Map 6. This map is too large in scale to include in the EIS, but is available on the SNF website at www.fs.usda.gov/goto/superior/projects or available upon request (either paper copy or digitally).

The following list includes current and proposed minerals management projects on the SNF. The exploration projects are anticipated to construct a total of 10 miles or less of temporary access roads. Temporary roads are not authorized for use by the public, and a relatively low amount of traffic comprised of vehicles conducting resource management would be on these roads. The effects from these projects are considered in the appropriate cumulative effects sections of Chapter 3.

- PolyMet Mining, Inc. - NorthMet Project- Proposed hardrock mine and land exchange. Reserved and outstanding minerals. EIS is ongoing.

- PolyMet Mining, Inc. - Permitted. Reserved minerals. Drilling and soil boring. NorthMet Mine site. 123 drill holes and up to 10 soil borings. Categorical Exclusion (CE) signed February 24, 2009. Work began on January 10, 2010 and the CE will expire on January 10, 2011. 66 of the 123 permitted drill holes were completed at 65 sites with 0.57 miles of temporary road construction. Reclamation of all permitted drill sites and temporary road was completed by April, 2010.

- Encampment Minerals Inc. - Permitted. Federal Minerals. Drilling. T62N R11W Sec 25, T61N R11W Sec 2, 10 Revised Kawishiwi EA project. 44 drill holes, 2.5 miles of temporary road construction

permitted. 6 sites drilled with 0.34 miles of temporary road construction completed. Reclamation of completed drill sites and temporary roads completed by April 2010.

- Encampment Minerals Inc. - Permitted. Reserved minerals. T57N R14W Sec. 3 and T58N R14W Sec 34. CE signed December 8, 2009 permitting 13 core drilling sites and 0.97 miles of temporary road construction. No work on this project has been completed.
- Encampment Minerals Inc. - Permitted. Reserved Minerals. T59N, R14W Sec. 25 and 26. CE signed December 8, 2009 permitting 6 core drilling sites and 0.33 miles of temporary road construction. No work on this project has been completed.
- Twin Metals Minnesota LLC - Permitted. Federal minerals. Drilling. Kawishiwi EA project. T61N, R11W, Sec.4 and 8 and T62N, R11W, Sec. 33, 34, and 35. 10 core drilling sites and 1.1 miles of temporary road construction permitted. 4 sites have been completed including interim site reclamation and temporary road closure.
- Franconia Minerals Corporation - Permitted. Federal minerals. Drilling. Kawishiwi EA project. T61N, R11W, Sec 5 and 6, T62N, R11W, Sec. 32. 23 core drilling sites and 2.1 miles of temporary road construction permitted. Company has not implemented this project.
- Prime Meridian - Permitted. Reserved Minerals Phase I - Geophysical survey. T57N R14W, Sections 28 and 33.
- Franconia Minerals Corporation - Permitted. Outstanding Minerals. Birch Lake. T61N, R12W, Sec 25, Lots 5&6. 1 core drilling sites and associated temporary road access. Company has not implemented this project.
- Seppi Bros. Concrete Products Corporation - Permitted. Gravel quarry. Five year mineral material contract renewal. Contract renewed on January 26, 2010. Estimated production over the term of the contract is expected around 400,000 cubic yards of sand and gravel valued at $380,000.00.
- Cold Springs Granite Company- Permitted. Mesabi Black Granite quarry. Five year mineral material contract renewal. Contract renewed on June 15, 2010. Estimated production over the term of the contract is expected around 550,000 cubic feet of dimension stone valued at $481,750.00.
- Cold Spring Granite Company- Permitted. Lake Superior Green Granite quarry. Five year mineral material contract renewal. Contract renewed on December 12, 2010. Estimated production over the term of the contract is expected around 100,000 cubic feet of dimension stone valued at $94,750.00.
- Encampment Minerals, Inc - Proposed core drilling and geophysical surveys. Reserved minerals. T56N, R12W, Sec. 17. 1 proposed drill site with associated geophysical survey lines and 0.86 miles of temporary road construction.
- Encampment Minerals, Inc. - Proposed core drilling. Reserved minerals. T57N, R14W, Sec. 10. 2 proposed core drilling sites and 0.88 miles of temporary road construction.
- Encampment Minerals, Inc. - Proposed core drilling. Reserved minerals. T60N, R12W, Sec. 21. 4 core drilling sites and 0.22 miles of temporary road construction proposed.

Vegetation Management Projects

Timber management activities will continue to affect forest resources over the next 20 years. The Forest Plan (USDA 2004) projected probable timber harvests for the first decade after plan implementation at

approximately 131,908 acres and for the second decade at approximately 132,416 acres. This suggests that nearly 30 percent of the 944,908 acres of forest land suitable for timber management may be harvested by 2024. This ongoing industry will continue to have effects over time on transportation through the development of temporary roads and continued improvement and use of existing roads, noise, vegetation, potential soil erosion, and other resources on the forest.

Table C-58: Past, present, and reasonably foreseeable future vegetation management projects on the Superior National Forest

Project Name	District	Decision Date	Project Description
Border EIS	LaCroix	2009	Vegetation management project to move existing forest vegetation condition and transportation system towards the desired conditions stated in the Forest Plan. The Project Area encompassed NFS land south of Voyageurs NP, west of the BWCAW, north of Echo Lake, and east of the Forest boundary to include all or portions of sections in T65-68N and R16-19W.
Clara EA	Tofte	2009	Vegetation management project to create young forest through final harvest, improving stand diversity through intermediate harvest and restoring forest conditions through site preparation and prescribed burning. Temporary roads were to be used for access. Project area to include T60N R3W, T61N R3 and 4W, T62N R3 and 4W, T63N R2 and 3W.
Glacier EIS	Kawishiwi	2009	Vegetation management project to move existing forest vegetation condition and transportation system towards the desired conditions stated in the Forest Plan. The Project Area encompassed NFS land from approximately 5 to 20 miles east of Ely in the vicinity of the Fernberg Road and Highway 1 to include all or portions of sections in T61N R9W, T62N R10W, T63N R11W.
Maple Hill EA	Gunflint	2009	Fuel reduction project through timber harvest. Project Area was located in Cook County in T62N R1W.
Cascade EA	Gunflint	2008	Vegetation management project to move existing forest vegetation condition and transportation system towards the desired conditions stated in the Forest Plan.
Devil Trout EA	Gunflint	2007	Vegetation management project to move existing forest vegetation condition and transportation system towards the desired conditions stated in the Forest Plan.
Echo Trail Forest Mgt EIS	LaCroix Kawishiwi	2007	Vegetation management project to move existing forest vegetation condition and transportation system towards the desired conditions stated in the Forest Plan. The Project Area encompassed NFS land north and south of Echo Trail County RD 116 from Vermillion River to Burntside Lake and Lake Vermillion to BWCAW to include T62-66N R11-17W.
Mid-Temperence Vegetation Management EA	Tofte	2007	Vegetation management project to move existing forest vegetation condition and transportation system towards the desired conditions stated in the Forest Plan
Whyte Forest Management EA	Laurentian	2007	Vegetation management project to move existing forest vegetation condition and transportation system towards the desired conditions stated in the Forest Plan
Inga South	Tofte	2006	Vegetation management project to move existing forest vegetation condition and transportation system towards the desired conditions stated in the Forest Plan.
Dunka EA	Kawishiwi	2005	Transportation actions do not include construction of new roadways. There will be proposed vegetative management projects that will include logging and replanting. These will be managed through the standards and guidelines of the Forest Plan and the State Best Management Practices

Project Name	District	Decision Date	Project Description
Twins EA	Gunflint	2010	This project proposes creating a young forest through final harvest, improving stand diversity through intermediate harvest, and restoring forest conditions through site preparation and prescribed burning. Temporary roads would be used for access. The Project Area includes T63N R1W-R1E and T62N R1W-R1E.
Tracks Project EIS	Laurentian	Expected 2011	The Laurentian Ranger District proposes to manage the vegetation condition and transportation system towards the desired conditions stated in the Forest Plan. The Tracks Project Area is located approximately 10 miles east and southeast of Aurora, MN and approximately 40 miles north of Duluth in St. Louis and Lake Counties. Activities could be located on NFS land in portions of T56-59N R11-14W.
Toohey Project EA	Tofte	Expected 2011	The Tofte District proposes to create young forest and improve stand diversity through harvest, and restore forest conditions and reduce hazardous fuels through site preparation and prescribed burning. Temporary roads would be used for access. The Project Area stretches about 25 miles northeast from the eastern side of Dumbbell Lake to Sawbill Lake and including T59N R6-7W, T60N R5-7W, T61N R4-6W, and T62N R4-5W.
Birch Project EA	Kawishiwi	Expected 2011	The Kawishiwi District proposes to manage the vegetation and road system in the Birch Project Area towards the desired conditions stated in the Forest Plan. The Project Area is located near Ely, MN and south and west of Ely and project activities could be located on NFS land in portions of T61-63N R11-13W.

Roads Projects

The Forest Plan predicts that future road development practices Forest-wide include the construction of 82 miles of OML-1 roads for summer use and 167 miles of OML-1 roads for winter use over the next several years.

Table C-59: Past, present, and reasonably foreseeable future road management projects on the Superior National Forest

Project Name	District	Decision Date	Project Description
FR 424 Reconstruction EA	Kawishiwi	2009	Minor road realignment, widening, and paving of FR 424 (Denley Road) and minor ATV/snowmobile trail reroutes on the Stony Spur Trail. Project Area located southeast of Babbitt, MN to include T60N R10-12W.
Travel Management Project	Forest wide	ongoing 2010	
Hwy 1 Construction	Multi-district	ongoing 2010	

Recreation Projects

Recreational use of the Forest for winter, water-based, and developed land activities is predicted to grow faster than the population (Cordell's Projections of Outdoor Recreation Participation to 2050, Forest Plan. An indicator of this growth is seen in the 9.3 million Recreational Visitor Days on the Superior National Forest in 2000, up nearly four times than the same measure 3 years earlier. The Forest Plan (USDA 2004) reported that motorized noise-producing recreational activities (e.g., off-road driving, snowmobiling, motorboating) in the Northern Region of the state would increase by 5 to 13 percent by 2020. The

continued growth of outdoor recreation use (including several noise-producing activities) both on and off the Forest will continue to rise over the next several years and affect Forest resources and users.

Table C-60: Past, present, and reasonably foreseeable future recreation management projects on the Superior National Forest

Project Name	District	Decision Date	Project Description
South Fowl Lake Snowmobile Access Project EIS	Gunflint	Expected Spring 2011	The project would provide safe access for snowmobilers/anglers to South Fowl Lake. This would route current access off County roads to improve safety for drivers and snowmobilers. The Project Area includes the McFarland Lake/South Fowl Lake area (T64N R3E Sections 10-12).
Tomahawk Trail Victor Lake By-pass EA	Tofte	On hold	Permission has been denied for the Tomahawk Snowmobile Trail where it is on private property near Victor Lake. This project is considering alternative trail routes in T60N R9W Section 13 and vicinity.

Lands of Other Ownership

All lands within the project area are National Forest System. However, there are lands adjacent and intermixed with the project area which are under other private, state or federal ownership. Activities on these private, state or federal lands may influence cumulative effects analysis for some resource areas for this project including mining, quarries, mineral exploration, mineral processing plants, timber harvesting, and recreational activities (including motorized and non-motorized uses).

Current and past minerals prospecting and lease activities on non federal lands are displayed in Map 6. This map is too large in scale to include in the EIS, but is available on the SNF website at www.fs.usda.gov/goto/superior/projects or available upon request (either paper copy or digitally).

On State of Minnesota land, Subsection Forest Management Plans for the North Shore and Border Lakes Subsections show that there are access needs for resource management, but these are almost all ‘resource management access routes’ and ‘temporary access routes’ that are closed to motorized use by the public (see these State Plans in the project file). Roads built on private land for resource management projects would likely not be accessible to the public.

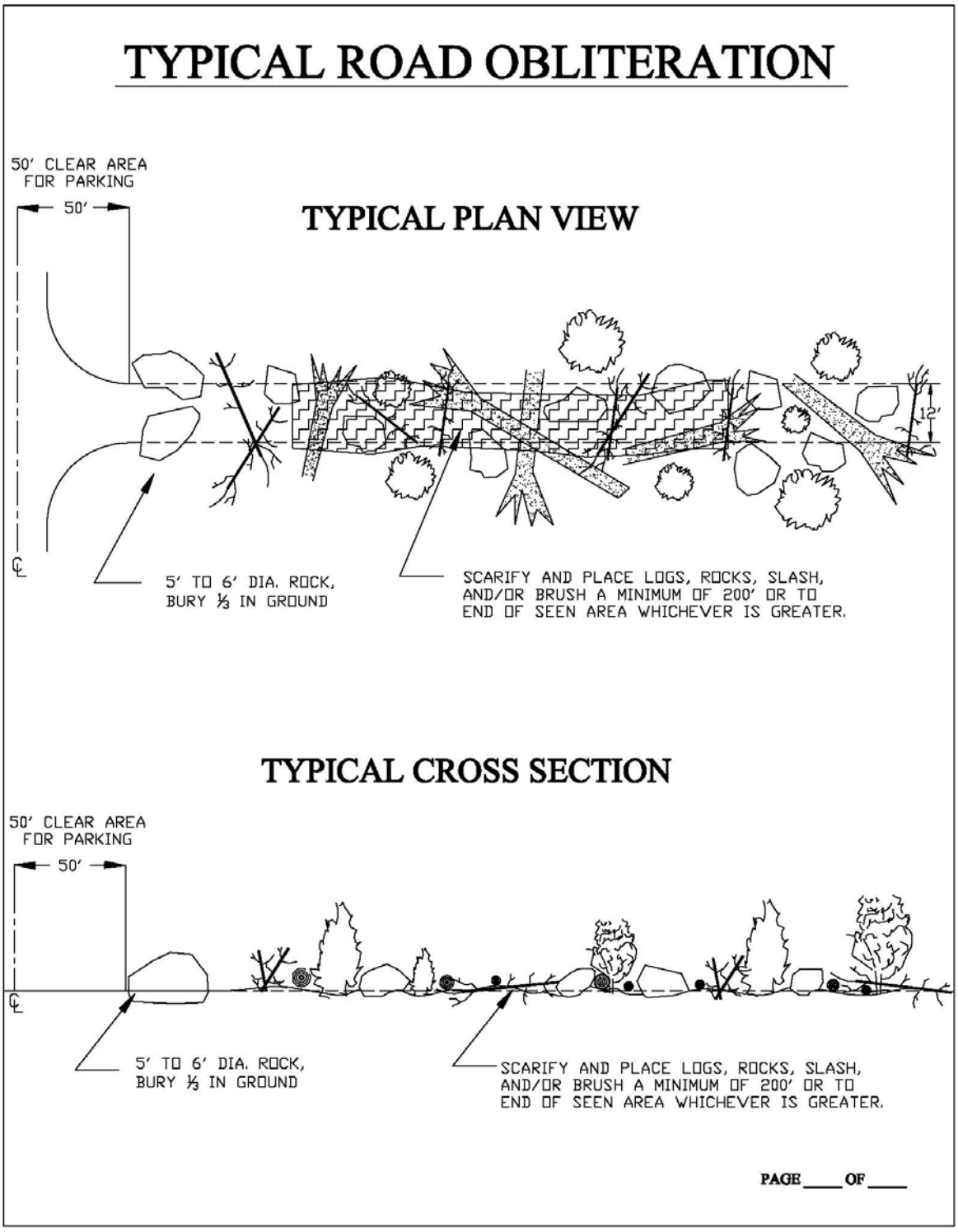
Cumulative Actions Generating Noise

The following categories of activities generate noise which may impact recreation receptors. See Section 3.1 (Noise and 3.2 (Wilderness) for more specific information.

- Drilling on state and private land, and reserved and outstanding minerals on federal land
- Federal, state and private vegetation management projects
- Prescribed burning and wildfire suppression with aircraft, motorboats, generators, etc.
- Fire patrols with aircraft
- Search and rescue missions with aircraft
- Law Enforcement with motorboats and aircraft
- Approved Department of natural Resources activities with motorboats and aircraft
- Department of Homeland Security border security activities with motorboats and aircraft
- Recreation activities on federal, state, county, and private land

- Vehicle traffic on roads
- Recreational motorized use (watercraft, OHV, snowmobiles)
- Noise generated at or near buildings (generators, leafblowers, snowblowers, lawnmowers, music, etc)

Appendix D - Typical Road Obliteration Diagram



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Appendix E - Monitoring and Evaluation

Introduction

Monitoring of activities proposed in the Federal Hardrock Minerals Prospecting Permits EIS would be implemented while the prospecting permits are active and for a period of years after reclamation where specifically stated. Monitoring would occur as permitted by personnel, budget and time available. There is a stipulation for minerals companies to provide funding for this monitoring as needed, and it is likely that funding and staff would be available to complete the work.

Monitoring and evaluation would help ensure that stipulations and required mitigation are carried out; that the goals and objectives of the proposal are achieved; and that assumptions and models used in the analysis remain valid. Monitoring would generally occur during project activities, and at final reclamation to ensure that necessary stipulations for both of these phases are met. Pretreatment activity may be necessary for some resources to assess baseline conditions.

The Superior National Forest (SNF) has monitored minerals exploration activities for several years. Monitoring proposed as a part of this project will build on this experience.

Monitoring Items

There are five monitoring items associated with project implementation listed below. In addition to these five items, the ongoing Superior NF monitoring program will also provide useful information to assess the implementation of this proposal. Scheduling of all monitoring activities, including monitoring and evaluation of minerals exploration activities, will occur at the beginning of each calendar year.

Noise

Objectives

Document noise levels at receptor locations including in the BWCAW that may be affected by drilling noise.

Protocols and Methods

Priority

High

Parameters

Collect base level and activity decibel levels at known distances between sound source and receptor (e.g. campground, residence, wilderness boundary).

Methodology

Use sound monitoring equipment to capture ambient non activity and activity generated decibel (including, as feasible and needed, low ambient sound levels) levels for multiple day recordings. Monitor for the effectiveness of any mitigation measures selected in the decision on this project. Attempt to monitor multiple times to capture weather and location variability.

Location

Receptors located near drilling sites, including developed campgrounds, recreation residences, dispersed campgrounds, and campsites in the BWCAW (see Figure 11 for location of receptors for this project).

Frequency/duration

As needed in locations with the potential for noise impacts. Attempt to monitor multiple times to capture weather and location variability.

Data Storage

District and Supervisor's Office files

Analysis Report

Field documentation and a report at the end of the fiscal year

Personnel

Biological Technicians, Geologist and/or Monitoring Coordinator

Responsible Individual

Geologist or Monitoring Coordinator

Adaptive Management

Change monitoring sites and techniques based on new information in order to better capture potential sound impacts. Work with operators as needed to achieve any required mitigations selected in the decision on this project.

Soil and Water

Objectives

Document impacts of minerals exploration activities (if any) to the soil and water resource.

Protocols and Methods

Priority

High

Parameters

Visual evidence of correct sump operation and effectiveness, and potential rutting or erosion from temporary road construction and use

Methodology

Photo documentation would occur with field visits to drill pads and temporary roads. The number of field visits each year is variable but often is at least once per month.

Location

Drill pads and temporary roads where project activities would occur.

Frequency/duration

Monitoring would occur during drilling project activities, and when drilling is complete to inspect interim and final reclamation.

Data Storage

District and Supervisor's Office files

Analysis Report

Field documentation and on-site photographs before drill pad or temporary road construction, during implementation and after final reclamation.

Personnel

GS-5 Hydro or other Technician and/or Geologist

Responsible Individual

Geologist or Forest Soil Scientist or Hydrologist or Zone Soil Scientist

Adaptive Management

Work with operators to minimize and eliminate any soil or water resource damage discovered during project activities to ensure compliance with stipulations.

Road/Trail Closure Effectiveness

Objectives

Determine the implementation and effectiveness of road closures and reclamation and practices in prohibiting illegal motorized use.

Prior Monitoring

The SNF has monitored road closure/decommissioning since 2001, including 13 miles of roads decommissioned since the Revised Forest Plan was approved in 2004. We have found that the majority of road decommissioning projects incorporated practices outlined in FEIS Appendix F-1 and Guideline G-TS-16 and have subsequently been effectively closed and blend into the surrounding landscape (SNF Monitoring Reports for FY 2005, pp. 183-194 and 200-208; FY 2006, pp. 94-104; FY 2007, pp. 87-93).

Protocols and Methods

Priority

High

Parameters

(a) Visual evidence that road closure practices such as signing, gating, rock placement, and other travel barriers are implemented. (b) Visual evidence that road decommissioning practices as outlined in Appendix F-1 of FEIS and Forest Plan G-TS-16 are implemented. (c) Visual evidence that unauthorized motorized travel is not occurring on closed or decommissioned roads.

Methodology

Monitoring will be accomplished through field verification of the planned road closures including:

- Establish photo points at beginning, mid way, and termination of closed or reclaimed road.
- Visually document implementation or establishment of closure practices (gates, berms, rocks, etc) or road decommissioning practices as described under Forest Plan G-TS-16 and Appendix F pages F-15through F-17.
- Visually document if closures and/or decommissioning is preventing motorized travel on road. If unauthorized travel is occurring, document tracks and resource vegetation with photos and notes.

Location

Temporary roads constructed or utilized in this project. Pay particular attention to any segments within ½ mile of the wilderness.

Frequency/duration

Monitor during project implementation, and after project activities are complete. Attempt to assess closure/reclamation effectiveness prior to hunting season as the majority of recreation motor vehicle (RMV) travel occurs during this period.

Data Storage

District and Supervisor's Office files

Analysis Report

Prepare progress report at end of each calendar year.

Personnel

One GS-5 Bio-Technician, one GS-7 Bio-Technician and/or Geologist

Responsible Individual

Geologist or Recreation Program Manager or Forest Monitoring Coordinator

Adaptive Management

If road closure or decommissioning practices are determined to be unsuccessful or ineffective, they will be redone or revised.

Non Native Invasive Species (NNIS)

Establishment and spread of NNIS infestations, particularly routes adjacent to the BWCAW

Objectives

Avoid or minimize the establishment and spread of non-native plant infestation in the project area.

Prior Monitoring

Past monitoring has shown that operational standards and guidelines to reduce weed spread have been successful (SNF 2008 Monitoring Report, p. 7-1).

Protocols and Methods

Priority

Very high

Parameters

(a) Visual evidence of new and expanding NNIS populations (b) Visual evidence of subsequent corrective actions (pulling, spraying etc)

Methodology

Conduct baseline or pre-activity and post activity Monitor a on a sample of roads and drill pads to assess establishment and spread of NNIS attributed to mining activities. Focus on roads near BWCAW. Treat NNIS if found and monitor effectiveness of treatments..

Location

(1) Known problem areas (2) Within the vicinity of roads and drill pads particularly near the BWCAW.

Frequency/duration

Annually for at least 3 years after drill pads and temporary roads are built, and after reclamation. decision is implemented.

Data Storage

District and Supervisor’s Office files

Analysis Report

Prepare progress report at end of each fiscal year.

Personnel

Bio-technicians and Geologist

Responsible Individual

Geologist or Forest Plant Ecologist or Biological Technician

Adaptive Management

If NNIS establishment and expansion resulting from OHV use becomes a management issue, corrective actions will be pursued (e.g. pulling and spraying weeds).

Safety

Objectives

Ensure implementation of safety measures by mineral exploration operators as defined in the stipulations.

Protocols and Methods

Priority

Very High

Parameters

Visual and documentary evidence that safety measures (e.g. signage, fire control measures and keeping unauthorized personnel out of drilling sites) are being implemented appropriately

Methodology

Monitoring of drill pads and temporary roads during project activities during field visits (usually at least once per month).

Location

Drill pads and temporary roads where project activities occur.

Frequency/duration

When project activities are occurring, usually once a month, as needed.

Data Storage

Forest and district files

Analysis Report

Progress report will be completed at the end of each fiscal year.

Personnel

Engineering technicians and/or Geologist

Responsible Individual

Geologist, Forest Monitoring Coordinator, Forest Safety Officer or Zone Engineers

Adaptive Management

Forest personnel will adapt safety measures depending on public input and if safety issues arise.

Threatened, endangered, and sensitive wildlife species

Objectives

Avoid or minimize disturbance to loons and sensitive species of raptors (bald eagle, osprey, northern goshawk, great gray owl, and boreal owl) and breeding locations during species' breeding periods within the project area.

Prior Monitoring

High

Protocols and Methods

Priority

Very high

Parameters

(a) Visual evidence of new and existing large raptor nests (b) Visual evidence of breeding activity.

Methodology

Forest Service's current survey protocol for each species.

Location

(1) Known breeding locations and territories (2) Surveys for unknown breeding locations in suitable habitat to at least 660 feet from project activities.

Frequency/duration

The breeding season prior to permit operations and annually during the breeding season while the permit is active.

Data Storage

District and Supervisor's Office files

Analysis Report

Report breeding season sightings within 24 hours to District biologist. Prepare progress report at end of each fiscal year.

Personnel

Wildlife technicians and/or biologists

Responsible Individual

Geologist or District Wildlife Biologist

Adaptive Management

Mitigate effects through timing or location of activities to avoid disturbance.

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