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Final Environmental Impact Statement

Federal Hardrock Mineral Prospecting Permits

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




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

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Abstract: The Superior National Forest (SNF) proposes to consent to the Bureau of Land Management (BLM) issuing 29 federal hardrock mineral prospecting permits. The Forest Service is also providing BLM with recommendations on surface use and reclamation for specific mineral exploration activities, and proposes to approve 3 associated special use permits needed for access and road construction. The BLM proposes to issue 29 prospecting permits. Recommendations from the Forest Service on conditions of approval for operating plans will be provided. These actions are needed because the federal agencies are mandated by Federal law and mineral regulations to facilitate access to federally held mineral resources to continue to meet the nation's demand for mineral commodities.

The Final Environmental Impact Statement (FEIS) includes analysis of projected impacts derived from potential prospecting permit applications and operating plans. This Forest-wide analysis will be considered for use in analysis by the Forest Service and BLM if and as future proposals are received.

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 no action. The agency preferred alternative is Alternative 4.

Summary

The presence and abundance of minerals in northeastern Minnesota such as 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. Recently, other base and precious minerals have been targeted for exploration. Exploration for hardrock minerals has occurred since 1948 on the SNF (Miller 2002). Exploratory drilling, such as is considered in the proposed prospecting permits and operating plans, is used to determine the extent and location of ore bodies.

Purpose and Need for Action

The purpose of the agencies' actions is to facilitate exploration for various mineral resources in an environmentally sound manner. The proposed action responds to the federal government's overall policy to foster and encourage the development of economically sound and stable industries, in the orderly and economic development of domestic resources to help assure satisfaction of industrial, security and environmental needs (Mining and Minerals Policy Act of 1970).

The proposed action responds to the overall guidance of the Superior National Forest Plan to ensure that the exploration of federal hardrock mineral resources is 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.

The Forest Service and BLM have identified the need to consider issuing 29 hardrock mineral prospecting permits on National Forest System (NFS) lands on the Superior National Forest for the purposes of exploring for valuable deposits of copper, nickel, and platinum group metals, and other associated metals. If issued, the permits would give specific applicants the right to explore for the mineral resources. Once the applicable permits are issued, the BLM may identify the need to approve operating plans with surface use conditions. The plans may include the execution of geophysical surveys, construction and use of drilling sites and associated temporary road access, and reclamation activities. BLM has also identified the need to approve operating plans associated with an extension to an existing prospecting permit. The Forest Service has identified the need to issue special use authorizations for certain support activities (roads, staging areas, etc.) to occur in conjunction with the operating plans on lands not contained in a prospecting permit area.

The BLM administers the mineral estate on Federal lands and has the legal authority and responsibility to consider issuing permits to explore for Federally-owned minerals for potential economic recovery. The Forest Service is the surface management agency and considers consenting to the BLM to issue prospecting permits to the subsurface under its jurisdiction. Stipulations can be specified in the use and protection of the lands and their resources. The BLM is responsible for administering the terms of the prospecting permits, and approving specific operating plans for exploration activities. The Forest Service responds to BLM requests for consultation on operating plans with recommendations for surface use and reclamation aspects of the plans. The Forest Service is responsible for issuing any related special use authorizations for any off-prospecting permit activities.

This project will analyze both the potential effects of 29 permit applications currently under consideration, and the potential impact of mineral prospecting activity Forest-wide in about a twenty year timeframe.

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 29 federal hardrock mineral prospecting permits 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) or their delegates. The Forest Service also proposes to issue three special use permits needed for access and road construction.

The BLM proposes to issue 29 federal hardrock mineral prospecting permits. More detailed descriptions of the Proposed Action are given in Section 2.1.1.

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 FEIS to support their own Record of Decision (ROD).

Based on the purpose and need, the Responsible Official for the Forest Service, is the Forest Supervisor of the SNF. This official will review- the proposed action, the alternatives, and the environmental consequences to make the following decisions:

- Whether or not the Forest Service will provide consent, and with what resource protection stipulations, for: 29 federal hardrock mineral prospecting permits to be issued to Lehmann Exploration, Twin Metals, DMC, and Encampment Resources or their designates. See Table 3 for a list of these permit applications.
- Whether or not to issue three (3) special use permits needed for access road construction and what resource protection measures that will be required for off-prospecting permit area activities associated with operating plans. See Table 5 for a list of the current operating plans requiring a special use permit.

The responsible official for the BLM, the Eastern States Deputy State Director, will decide the following in a Record of Decision:

- Whether or not to approve 29 federal hardrock mineral prospecting permits with the associated stipulations.

Any operating plans within the current 29 prospecting permits would be approved by the BLM with recommendations by the Forest Service on applicable stipulations from this FEIS. New special use authorizations associated with new operating plans would be approved by the Forest Service on a case by case basis. Any future prospecting permit applications will be subject to applicable NEPA compliance at the time they are received by the SNF.

Issuance of prospecting permits, and approval of site-specific operating plans may or may not result in application for a mineral lease. Should exploration activities find valuable deposits of a mineral commodity or commodities, then leasing may be proposed. Any leasing proposal would also be subject to review under NEPA.

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 April 1, 2009. The SNF received comments regarding the potential social impacts (in particular, noise) 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. – Additional comments focused on the administrative side of permitting, such as the adequacy of the analysis, the scope of the project, the appropriateness of current environmental laws and regulations and the Forest Plan policies. Many comments highlighted the positive economic and social benefits of mineral exploration.

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 FEIS, specialist reports or project file.

The issue of noise led the agency to develop the following alternatives to the no-action alternative (Alternative 1) and the proposed action (Alternative 2):

- Alternative 3- Noise reduction in the entire project area regardless of season or location. Noise abatement methods would be required to decrease noise at the source to 70 dBA at 20 feet from the drill rig.
- Alternative 4 –Reduce sound levels reaching receptors to an L50 level of 30 dBA and an L10 level of 35 dBA inside the BWCAW.
- Alternative 5 - Drilling exploration and other project activities would be restricted to occur 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 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 three percent of the national forest lands containing the 29 permit applications, and well below one percent of the Forest-wide 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 landscape 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 effect 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 Biological Evaluation (BE; FEIS Appendix I, attached separately) 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.

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

Threatened and Endangered Species

There are no threatened and endangered plants or habitat within the project area (see Biological Assessment, FEIS Appendix H, attached separately).

The Biological Assessment states that Alternatives 2-5 may affect, and are likely to adversely affect individual lynx because of the potential for increased human disturbance and increased vehicular numbers and speed. The increase in temporary roads may lead to an increase in human disturbance of lynx. The increase in vehicles per day on Highway 1 and the increased vehicle speed on the reconstructed area of Highway 1 may contribute to an increase in vehicle collisions with lynx and could lead to increased mortality. Alternatives 2-5 are not likely to adversely affect lynx critical habitat. Habitat changes and seasonal variation between action alternatives are not likely to adversely affect lynx.

Boundary Waters Canoe Area Wilderness (BWCAW)

Effects to the natural quality of wilderness character would be minor due to stipulations and the limited effects of minerals exploration. Alternative 5 would have the lowest adverse effect to opportunity for solitude, followed by Alternative 4, 3 and 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 would 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, 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. Impacts to scenery would be minimal.

Local economics

Anticipated exploration and associated activities for the current permit applications would provide a minimum of 28 jobs (direct, indirect, and induced) and $1.5 million in labor income (direct, indirect, and induced) and a maximum of 108 jobs and $5.8 million in labor income on an average annual basis within the analysis area.

Anticipated exploration and associated activities for projected minerals exploration Forest-wide would provide a minimum of 51 jobs (direct, indirect, and induced) and $2.7 million in labor income (direct, indirect, and induced) and a maximum of 201 jobs and $10.8 million in labor income on an average annual basis within the analysis area.

Minerals and geology

During the drilling process, the drill core or chips are collected for future mineral, chemical, and other technical identification and analysis. For the 20 year analysis, the estimated 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 3,500 feet. These core 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 SNF, this amount is extremely small and would have no effect on the rock and mineral resources.

Roads

Up to about 116 miles of temporary road may be constructed in the 29 permit application areas included in the Proposed Action. Interim closure and decommissioning at final reclamation limits the mileage of temporary road open at a given time.

For the Forest-wide analysis, a total estimate of 922 acres or 384 miles of temporary road construction over 20 years may be needed 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 Interim closure and decommissioning at final reclamation limits the mileage of temporary road open at a given time.

Comparison of alternatives by response to issues (noise)

The degree of impacts under the action alternatives is limited by the fact that project activities are temporary, and that Minnesota Rules on Noise limit impacts under all alternatives. Impacts would depend on the distance from drill site to receptor, and required mitigation measures. Of the action alternatives, Alternative 2 would have the highest adverse impact to receptors since drilling operations would not include additional noise mitigation measures. Alternative 3 would have lower adverse impacts than Alternative 2 since mitigation would reduce emitted sound levels. Alternative 5 would further reduce adverse 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 the BWCAW for drill sites located near the wilderness by requiring maximum limits for sound levels reaching the wilderness. For drill sites located further away from the wilderness that do not require this mitigation, Alternative 4 may have impacts similar to Alternative 2. Alternative 1 would have the least impact since no drilling or associated project activities would occur.

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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 could 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.
    - *Appendix A:* Disposition of Scoping Comments
    - *Appendix B:* SPreAD-GIS Analysis
    - *Appendix C:* Cumulative Actions
    - *Appendix D:* Road Decommissioning Diagram
    - *Appendix E:* Monitoring Plan
    - *Appendix F:* Changes Between Draft and Final EIS
    - *Appendix G:* Water Resources Technical Memos (attached separately)
    - *Appendix H:* Final Biological Assessment (attached separately)
    - *Appendix I:* Final Biological Evaluation (attached separately)
    - *Appendix J:* Response to Comments on the Draft EIS (attached separately)
    - *Appendix K:* Comment Letters from Federal, Tribal, State and Local Agencies (attached separately)

Additional supporting documentation may be found in the project planning record located at the Supervisor's Office, Duluth, MN and on the SNF website. The SNF website contains permit applications, operating plans, maps, and other supporting documentation, including the United States Department of Interior (USDI) Fish and Wildlife Service Biological Opinion for the project.

1.2 Background

The presence and abundance of minerals in northeastern Minnesota 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. Exploration for hardrock minerals has occurred since 1948 on the SNF (Miller 2002). More recently with improved technology and increased metal prices, other base and precious minerals have been targeted for exploration in northeastern Minnesota. One mine is currently at the permitting stage. Some of these targets include federal hardrock minerals located on the SNF.

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 USDI Bureau of Land Management (BLM). The BLM has sole authority under the mineral leasing act-specific legal framework (see Section 1.7.3) to issue prospecting permits and leases, and the approval of operating plans associated with all phases of exploration, development and extraction of subsurface federal hardrock minerals. On NFS lands, BLM cannot authorize certain activities without Forest Service consent. The SNF 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) establish interagency cooperation 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 USDI BLM is a cooperating agency. A memorandum of understanding for this project between the agencies was signed on April 29, 2008. 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 based on Forest Service consent decisions that may include stipulations in this EIS. The BLM will approve operating plans after considering recommendations from the Forest Service on conditions of approval for surface use and reclamation aspects of the plans.

The Eastern States-Northeastern States Field Office- BLM has received 29 complete federal hardrock mineral prospecting permit applications located within the SNF from DMC (USA) Corporation (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 the associated company. In order for applications to be considered complete, they must include an exploration plan. Twenty nine applications are complete, and therefore eligible for prospecting permits. The companies have also submitted 20 operating plan proposals for activities within these permit areas. There is also one operating plan proposal associated with an extension to an existing permit.

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 minerals. 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.

Ground disturbing activities cannot occur on a prospecting permit unless the permittee has an approved operating plan in place. The applicable regulations require that operations be proposed and conducted consistent with terms, conditions and stipulations on the prospecting permit. Overall, operations would consist of drill pad clearing, drill pad preparation, drill pad reclamation, drilling, geophysical surveys, geologic mapping, soil and rock chip geochemical surveys, access road reconstruction and construction, and the closure and decommissioning of access roads.

Any future operating plans within the current 29 prospecting permits would be approved by the BLM with recommendations by the FS on applicable stipulations from this EIS. New special use authorizations associated with new operating plans would be approved by the FS on a case by case basis. Any future prospecting permit applications will be subject to applicable NEPA compliance at the time they are received by the SNF.

Issuance of prospecting permits, and approval of site-specific operating plans may or may not result in application for a mineral lease. Should exploration activities find valuable deposits of a mineral commodity or commodities, then leasing[1] may be proposed. Any leasing proposal would also be subject to review under NEPA.

The EIS also includes analysis of projected effects from future applications and operating plans Forest-wide. This Forest-wide analysis will be considered for use in the effects analysis by the Forest Service and BLM if and when future proposals are received. Any future applications for prospecting permits, and special use authorizations will be subject to applicable NEPA compliance, and will be analyzed on their own merits at the time they are proposed.

1.3 Project Area

Current Prospecting Permits

The project area is encompassed by the 29 prospecting permit applications (see Maps 1 and 3). Collectively, the permits cover about 38,704 acres of NFS lands. The NFS lands contained in the prospecting permits are a mix of public domain lands, or lands acquired through various acquisition authorities. The results of a land status review shows that several prospecting permits contain about 1,142 acres of NFS lands acquired under the Weeks Act of 1911, or other land acquisition authority (Clark McNary or General Exchange Act, however these lands are managed as having Weeks Act status, see Section 1.7.3). The prospecting permits also contain about 37,562 acres of public domain lands. See Table 3 for specific acreages for each permit.

Future Forest-wide Prospecting Permits

The area analyzed for projected future exploration activity Forest-wide 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. 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). The NEPA analysis of surface resources recognizes that there are reserved and outstanding mineral ownerships intermixed with the Federally owned minerals that are open to mineral exploration and potential development according to the Secretary of Agricultures rules and regulations for acquired lands, mineral ownership deed language, and State law. This Forest-wide area totals approximately 470,497 acres.

[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. Lease applications must contain data resulting from exploration sufficient to allow a valuable deposit determination (43 CFR 3507.17) and a mine plan sufficient to allow analysis of potential surface impacts (43 CFR 3507.18).

The area analyzed Forest-wide is approximately 20 percent of the SNF managed lands minus the lands withdrawn from mineral entry. This area is approximately 39 percent of the SNF managed lands within the forest boundary (see Table 1 below).

Table 1. Ownership and management status of lands within the area analyzed for projected activity Forest-wide

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 other actions on federal land and actions occurring on other ownerships such as state, county, and private lands. Resource sections in Chapter 3 displays the analysis area for each resource.

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 Proposed Action

The SNF proposes to give consent to the BLM issuing 29 federal hardrock mineral prospecting permits with stipulations for use and protection of forest resources (see Section 2.4). The BLM is proposing to issue the 29 permits with terms, conditions and stipulations based on Forest Service consent. The SNF proposes to issue 3 special use permits needed for access and road construction associated with several operating plans within the 29 permit areas as shown in Table 5.

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)	Operating Plans Received
Encampment Resources	9	0
Lehmann Exploration	4	6
DMC	9	10
Twin Metals	5	5
Prime Meridian	2	0
Total	29	21

1.4.1 Federal Hardrock Mineral Prospecting Permits

The Proposed Action (as described in Alternative 2) in Chapter 2, section 2.2.2 would provide Forest Service consent to the BLM issuing permits for 29 federal hardrock mineral prospecting permit applications as described in Table 3. The following table lists the 29 complete prospecting applications organized by company name, permit application numbers and acreage covered by each application. The effects analysis for the action alternatives assumes that BLM would grant 4-year extensions to each of the the prospecting permit applications.

Table 3. Prospecting Permits

Company	BLM Prospecting Permit Application #	Acres	Public Domain Authority	Weeks Act Authority/acres
Lehmann	MNES 053731	590.87	X	
	MNES 054387	1293.8	X	
	MNES 055301	91.44	X	
	MNES 055302	11.15	X	
Encampment Resources	MNES 053462	2423.96	X	
	MNES 053463	2060.95	X	
	MNES 053464	2345.04	X	
	MNES 053465	2345.02	X	
	MNES 053466	1707.28	X	
	MNES 053564	1720	X	
	MNES 053565	1640	X	
	MNES 053566	1898.76	X	
	MNES 054233	160	X	
DMC	MNES 053868	2090.4	X	X 342
	MNES 054037	2329.54	X	
	MNES 054366	2370.8	X	
	MNES 054367	2360	X	
	MNES 054368	1237.96	X	
	MNES 054385	200.22	X	X 40
	MNES 055203	1191.03	X	
	MNES 055205	639.55	X	
	MNES 055206	2515.22	X	
Twin Metals	MNES 054050	.5	X	
	MNES 054194	1780.2	X	X 40

Company	BLM Prospecting Permit Application #	Acres	Public Domain Authority	Weeks Act Authority/acres
	MNES 054195	2033.7	X	
	MNES 054196	947.08	X	X 120
	MNES 055305	320	X	
Prime Meridian	MNES 054045	360.00	X	X 560
	MNES 054217	40.0		X 40
Total Acres		38,704.47	37,562.47	1,142

Three companies have currently submitted 21 federal hardrock operating plans described inTable 4 below. One of these is associated with a prospecting permit extension. Overall, prospecting operations would consist of drilling, geophysical surveys, geologic mapping, soil and rock core analysis, geochemical analysis, and access road reconstruction and construction. The locations of drill pads and access roads have been identified in the operating plans. See Table 4 for a summary of operating plans and associated activities. Operating plans 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 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. Additional operating plans may be submitted to conduct project activities within the 29 permit areas in an iterative process as prospecting results are obtained.

Operating plans are approved through an administrative action by the BLM. Operating plan approval is not a NEPA decision; instead it is an administrative action which implements a NEPA decision to approve a prospecting permit (43CFR 3590.2(a) and 3592.1). Prospecting permit applications typically do not contain detailed site-specific information as to exactly where prospecting activities take place within the permit area; this information is shown in operating plans. This is because minerals exploration is an inherently uncertain and iterative process and operating plans may be frequently adjusted (yearly or even more frequently) to account for initial findings. Thus, a reasonable approach to disclose effects of minerals exploration while completing NEPA compliance is to disclose the estimated impacts of all prospecting activities in the 29 permit areas in the EIS. The 21 operating plans that have already been submitted, the exploration plans accompanying the 29 permit applications, and professional knowledge were used to estimate likely disturbance and impacts from all of the operating plans that may submitted in the 29 permit areas. Mitigation measures described in Section 2.4 of the EIS would limit impacts of current and future operating plans in the permit areas. If an operating plan is submitted that may have impacts not disclosed in the EIS, consideration of the need for additional NEPA documentation would be made at that time.

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

1.4.2 Special Use Authorizations Associated with Off-Permit Area Activities Proposed in Operating Plans

The proposed action includes that the Forest Service would issue three (3) special use permits needed for access road construction and what resource protection measures that will be required for off-prospecting permit area activities associated with operating plans. Table 5 shows which operating plans require a special use permit and the mileage of temporary road that would be built for each special use permit.

Table 5. Miles of roads and operating plans requiring Special Use Authorization summarized by permit applicant

Applicant	**Total Miles**
DMC	2.8
Lehmann	5.6
Twin Metals	0.3
Applicant	**Operating plan**
DMC	053868
DMC	054368
DMC	055205
Lehmann	052446
Lehmann	053731
Lehmann	054387
Lehmann	055301
Lehmann	055302
Twin Metals	050486
Twin Metals	054196
Twin Metals	055305

1.4.3 Future Federal Hardrock Mineral Prospecting Permits and Operating Plans

This EIS will also analyze the projected effects of potential future federal hardrock mineral permit applications and their potential extensions, operating plans and the associated special use permits needed for access on a Forest-wide basis for a 20-year timeframe. See the description of the proposed action in Chapter 2 for more specifics. The analysis of effects of future permit applications will be considered for use at such time that future permit applications are received.

> 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).

A maximum exploration scenario for 20 years was described in the scoping package and has been modified (section 2.2.2.4) based on further analysis by the BLM and SNF staff. These modifications apply to and further refine –the alternative administrative stipulations (in section 2.4.1 and 2.4.2), resource stipulations, Forest Plan standards and guidelines (section 2.4.3), and operating assumptions (2.2.2.3).

1.5 Changes to the Proposed Action

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

- Mineral bulk sampling has been removed from the proposed action and action alternatives based on recommendations from the BLM. Future bulk mineral sampling included in operating plan proposals will be considered as new and separate NEPA analyses.
- The four year prospecting permit extension for Lehmann Exploration has been removed from the proposed action described in the Draft EIS since the permit has already been granted and the permit extension is an administrative action by BLM that does not require a separate decision.
- The analysis considers effects of the four-year permit extensions to 29 current permit applications and to the future permit applications made approximately 5 years following the decision. BLM is authorized to approve permit extensions.
- Twenty nine current permit applications are proposed to be granted instead of 32 applications, and the acreage in the 29 permit applications has been adjusted as shown in Table 3. These changes were made based on further land status and deed review by BLM to ensure that only areas with federal minerals and federal surface ownership are proposed to be included in the permits.
- The proposed action does not include imposing stipulations Forest-wide for all future prospecting activity. Stipulations for future permit applications would be identified as needed at such time that the applications are received.
- Operating plan approval has been removed from the proposed action since it is the position of BLM that this is an administrative action carried out by BLM to implement activities authorized by granting prospecting permits and is not a NEPA decision.

1.6 Purpose and Need for Action

The purpose of the agencies' actions is to facilitate exploration for various mineral resources in an environmentally sound manner. The proposed action is a response to the federal government's overall policy to foster and encourage private enterprise in the development of economically sound and stable industries, to help assure satisfaction of industrial, security and environmental needs (Mining and Minerals Policy Act of 1970).

The proposed action responds to the overall guidance of the SNF Plan to ensure exploration of federal hardrock mineral resources is 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.

The BLM, charged with administration of the mineral estate on these Federal lands, has the legal authority and responsibility to consider issuing permits to explore for Federally-owned minerals for potential economic recovery. The Forest Service considers consenting to the BLM issuing prospecting permits and specifies stipulations to use and protect the surface lands.

1.7 Decision Framework

The authority to grant prospecting permits and approve associated operating plans lies within the United States Department of Interior BLM. Where NFS lands are involved, the BLM and Forest Service work cooperatively to 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 certain lands were acquired. The Forest Service has consent authority to the BLM issuing the prospecting permits, and if consent is given, has the authority to specify resource protection stipulations. The Forest Service will also provide recommendations to the BLM regarding surface use and reclamation aspects of operating plans associated with prospecting permits. Finally, the Forest Service will determine whether to approve special use permits for road access and construction associated with operating plans.

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:

- Whether or not the Forest Service will provide consent, and if consent is given, resource protection stipulations, for: 29 federal hardrock mineral prospecting permits to be issued to Lehmann Exploration, Twin Metals, DMC, and Encampment Resources or their designates. See Table 3 for a list of these permit applications.
- Whether or not to issue, and what resource protection measures that will be required by the Forest Service for special use and occupancy authorizations for off-prospecting permit area activities associated with the operating plans. See Table 5 for a listing of these operating plans requiring special use authorizations.

1.7.2 BLM Decisions

As a cooperating agency, the BLM will adopt the EIS to support their own Record of Decision. The Responsible Official for the BLM is the Eastern States Deputy State Director. He reviews the proposed action, the alternatives, and the environmental consequences in order to make the following decisions:

- Whether or not to approve 29 federal hardrock mineral prospecting permits with the associated stipulations.

Operating plans are approved through an administrative action by the BLM. Operating plan approval is not a NEPA decision; instead it is an administrative action which implements a NEPA decision to approve a prospecting permit. See Section 2.4.3 for further description of the operating plan approval process.

Any future site-specific applications for prospecting permits and associated operating plans, and special use authorizations associated with operating plans will be subject to applicable NEPA compliance.

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.

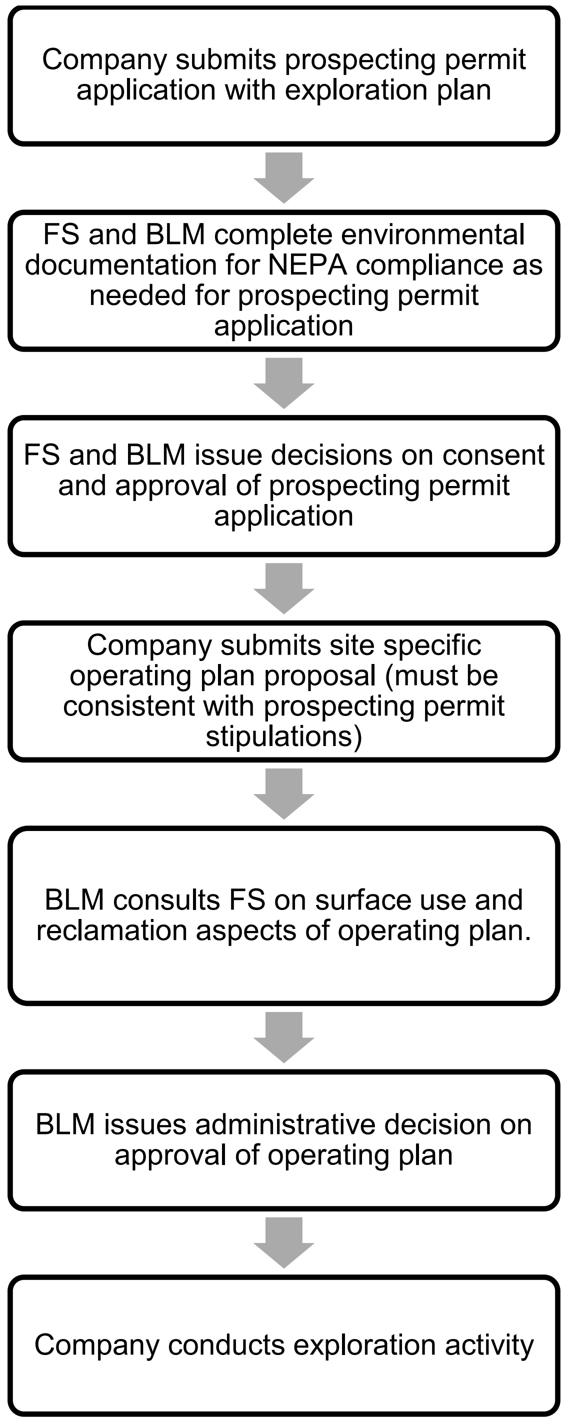

Figure 1. Overview of NEPA compliance process for federal hardrock mineral prospecting permits and administrative approval of operating plans

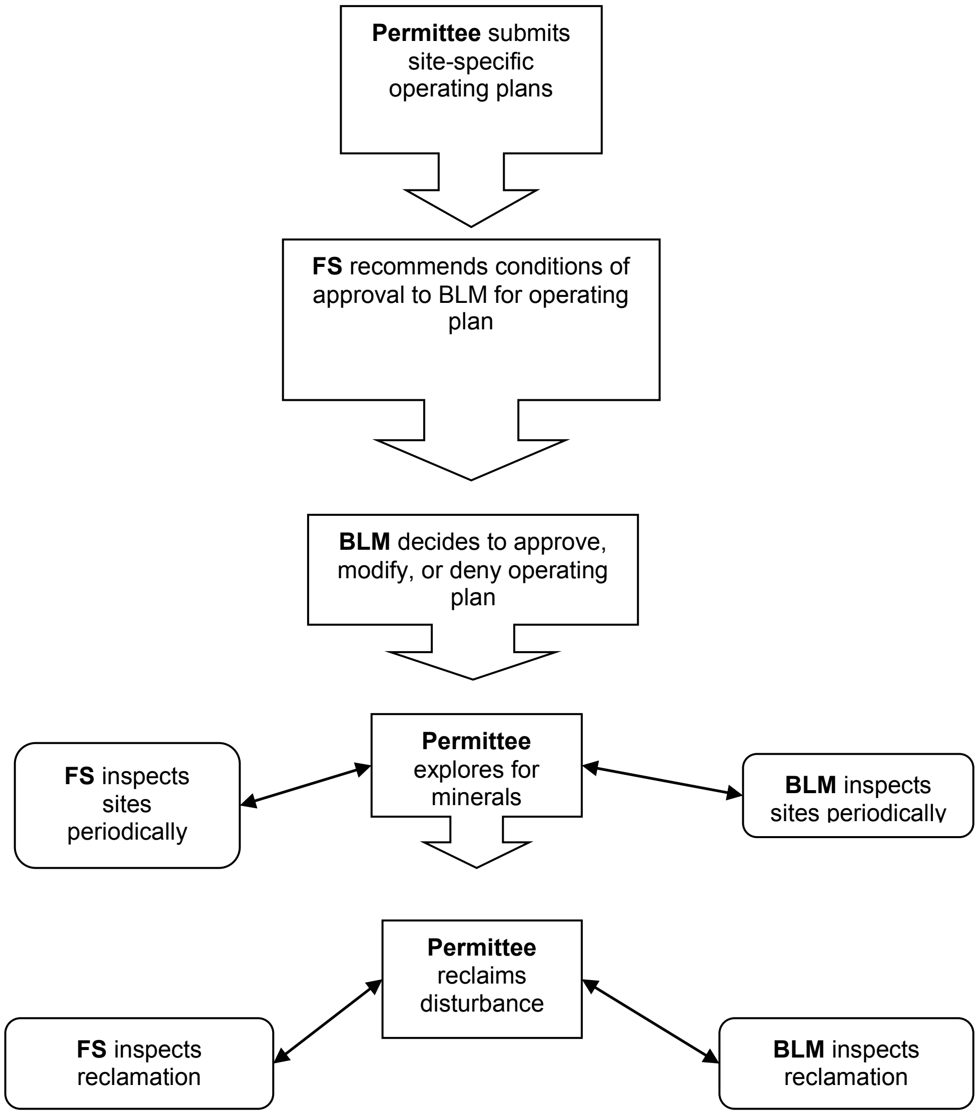

Figure 2. Flowchart showing process for approving an operating plan on a federal hardrock mineral prospecting permit

1.7.3 Authorities

The authority to grant prospecting permits and associated operating plans lies within the United States Department of Interior (USDI) BLM. However, the applicable legal and regulatory framework provide for specific involvement at various points in the process for the surface managing agency (in this case the Forest Service), including that BLM must have the consent of the surface managing agency, before issuing a prospecting permit. Further, the BLM must consult the agency with jurisdiction over the lands before approving operating plans. The agencies must evaluate, as appropriate for the scope of the action, the proposed project for environmental impacts as described under the National Environmental Policy Act (NEPA), and other applicable laws.

On a national level, the Forest Service and BLM have entered into interagency agreements to cooperate and coordinate in managing federally owned minerals within National Forest System lands. The SNF and BLM-Northeastern States Office have 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 outlined in the prospecting permits and plan of operations.

Mineral Law and Regulation

Act of June 30, 1950 (16 U.S.C. 508(b)). 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. This Act authorized the Secretary of the Interior to permit the prospecting of federal hardrock minerals on these NFS lands, and to promulgate regulations to implement the Act (see section below on BLM regulations). The BLM exercises the authority of the Secretary of Interior for exploration and leasing of federally owned minerals.

Weeks Act of 1911 and Mineral Resources on Weeks Act Lands of 1917 and the Reorganization Plan No. 3 of 1946. 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.

The Mineral Resources on Weeks Lands Act of March 4, 1917 gave the Secretary of Agriculture authority 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 16, 1946, which set forth that 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." Thus, for the prospecting permits containing Weeks Act Lands, the Forest Service has legal authority to prescribe binding conditions to protect the purposes for which lands were acquired. The Forest Service will utilize this EIS analysis to administratively determine whether the prospecting is consistent with the purposes for which certain lands were acquired.

In cases where mineral prospecting leads to a submittal of a lease application, the Forest Service would evaluate a leasing proposal on its own merits.

Weeks Act Status for Certain Lands. This Act of September 1958 made all acquired (past and future) NFS lands within the exterior boundaries of National Forests subject to the Weeks Act of 1911, and to all other laws, rules and applicable regulations. Thus, lands in the project area that were acquired under Clark-McNary and General Exchange Act authorities are subject to the same legal and regulatory authorities as lands acquired under the Weeks Act itself, including that the agency has authority to specify conditions to protect the purposes for which the lands were acquired.

Implementing Regulations at 43 CFR 3500. These BLM regulations implement Section 402 of the Reorganization Plan No. 3 of 1946, the Mineral Resources on Weeks Act Lands of 1917, and the Act of June 30, 1950. These regulations detail the process and regulatory authority for issuing prospecting permits, and approving specific operating plans. These regulations give the Forest Service, as a surface managing agency, consent authority to BLM issuing hardrock mineral prospecting permits on NFS lands. Inherent with the consent decision is the ability for the surface managing agency to prescribe conditions for protecting resources on those lands. The regulations further define that the Forest Service, as a surface managing agency, will be consulted by BLM during review of site-specific operating plans on the surface use and reclamation aspects of the plan. The regulations also detail process and requirements for bonding, and requirements of a permittee and/or operator.

Other Applicable Laws. The following laws and executive orders also guides the Federal Hardrock Minerals Prospecting Permits Project analysis.

National Environmental Policy Act of 1969. The Forest Service and BLM have 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."

National Forest Management Act (NFMA). 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.

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. In order to eliminate repetitive discussion and documentation, this analysis tiers to the Forest Plan Final EIS.

The NFMA requires that projects comply with the Forest Plan. This project has been designed according to direction in the 2004 Forest Plan. The Forest Plan identifies standards and guidelines that apply Forest-wide and to management areas. These standards and guidelines have been incorporated into the resource protection stipulations (FEIS Section 2.4).

Table 6 displays the estimated acreage that each permit application contains in each Forest Plan management area. This table is based on acres estimated from a Geographic Information System from Forest Service data; Table 3 displays the acreage determined from land status and deed review by BLM and may be less. All of the management areas displayed in Table 6 allow minerals exploration except eligible Wild River segments (where no permit application is located). No permit applications are proposed in the Boundary Waters Canoe Area Wilderness or Mining Protection Area.

The Unique Biological Area and candidate Research Natural Area/Research Natural Area (cRNA/RNA) prohibit surface occupancy. Permit Application 055203 contains about 488 acres within a UBA, and Permit Application 55206 contains about 160 acres in a UBA and about 639 acres in a RNA. The portions of these Permit Applications within the RNA and UBA MAs are required to be No Surface Occupancy per

Forest Plan direction (S-UB-6, Forest Plan p. 3-29; S-RNA-13, Forest Plan p. 3-35). About 34 acres of Permit Application 054045 are within the Eligible Wild, Scenic and Recreational River MA. In this case, the 34 acres are near the St. Louis River, which is classified as recreational. The Forest Plan prohibits development of federal minerals in a Recreational River MA, but exploration is allowed (S-WSR-12, Forest Plan p. 3-20). Subject to these requirements, minerals exploration in the permit application areas is consistent with Forest Plan direction for Management Areas.

Table 6. Management Area Acreage by Permit Application Area

Permit #	Management Area							
	General Forest	General Forest LR	Recreation Use in a Scenic Landscape	Semi Primitive Motorize	Semi Primitive Non Motorize	Unique Biological Area	cRNA/RNA	Eligible Wild Scenic and Recreational River	Riparian Emphasis
053462	2,417	0	0	0	0	0	0	0	0
053463	669	1,471	0	0	0	0	0	0	0
053464	2,312	65	0	0	0	0	0	0	0
053465	2,295	45	0	0	0	0	0	0	0
053466	0	1,680	0	0	0	0	0	0	0
053564	2,104	0	0	0	0	0	0	0	0
053565	1,634	0	0	0	0	0	0	0	0
053566	1,901	0	0	0	0	0	0	0	0
053731	345	0	237	0	0	0	0	0	0
053868	2,220	0	0	0	4	0	0	0	0
054037	2,353	0	0	0	1	0	0	0	0
054045	326	0	0	0	0	0	0	34	0
054050	0	0	209	0	0	0	0	0	0
054194	1,579	0	0	252	0	0	0	0	0
054195	0	0	0	2,107	0	0	0	0	0
054196	1,060	0	0	169	0	0	0	0	0
054217	2	43	0	0	0	0	0	0	0
054233	476	0	0	0	2	0	0	0	0
054366	2,498	0	0	0	0	0	0	0	0
054367	2,519	0	0	0	2	0	0	0	0
054368	1,228	0	0	0	0	0	0	0	0
054385	117	0	0	0	0	0	0	0	0
054387	705	0	567	0	0	0	0	0	0

055203	787	0	0	0	0	488	1	0	0
055205	939	0	0	99	0	0	0	0	0
055206	1,763	0	0	0	0	160	639	0	0
055301	0	0	83	0	0	0	0	0	0
055302	2	0	129	0	0	0	0	0	0
055305	273	0	42	0	0	0	0	0	0

Federal Land Policy and Management Act of 1976. This law gives the Forest Service the authority to issue special use permits for temporary road construction and other activities in off-permit areas in order to access permit areas for prospecting activity (FLPMA Title V § 504).

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. Canada lynx is the only federally listed species on the Superior National Forest (USDI Fish and Wildlife Service 2012). A Biological Assessment and formal consultation with the US Fish and Wildlife Service have been completed to meet the requirements of the Endangered Species Act.

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. 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 undertakings 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 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) (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. The SNF Archaeologist may notify the Tribal Historic Preservation Officer and the MN State Historic Preservation Office.

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 3.6 for analysis).

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.

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 p. 3-19).

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 p. 2-9). 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.

Agency Policy.

Forest Service Manual. The Forest Service'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).

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. National Forest System lands whether acquired or reserved from the public domain shall not be leased over the objection of the Forest Service (43 CFR 3101.7-1(c)).

Forest Service Manual 2704.32 and 2711.2. This manual direction describes authority for the Forest Service to issue special use permits associated with off-permit activities proposed in operating plans.

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.

In addition to the above federal laws, regulations, and policies, state and local laws may be relevant. This EIS does not present a comprehensive list of relevant state law; entities conducting minerals exploration are responsible for compliance with relevant state and local regulations (in additional to relevant federal regulations).

1.7.4 Permits Needed to Implement the Project

Several federal permits are or may be required to implement the project as listed below (40 CFR 1502.25(b)). Some state permits that may be required are also listed, but this is not intended as an exhaustive list of state or local permits that may be needed. The entities conducting prospecting are responsible for obtaining any required state or local permits and complying with state law and any local regulations (in addition to federal permits). See Forest Service Stipulation #3 in Section 2.4.2.

- A prospecting permit granted by the BLM and an approved operating plan would be required (FEIS Section 1.4 Proposed Action)
- 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 (FEIS Section 3.6).
- If activity is proposed that requires a USACE Section 404 *Individual* Permit, than an MPCA CWA Section 401 Water Quality Certification ensures that the activity will comply with the state water quality standards. Any conditions required within the MPCA Section 401 Certificate are then incorporated into the USACE 40 Permit.

- The physical or chemical removal of emergent aquatic vegetation is regulated by the Minnesota Department of Natural Resources (MnDNR) and may require an aquatic plant management (APM) permit (FEIS Section 3.6).

In addition, the Forest Service has obtained in a Biological Opinion (BO), a Canada lynx Incidental Take Statement under the Endangered Species Act (see mitigations identified in the BO at Section 2.4.3.5).

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 SNF 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. This protocol was updated in March 2011.

For the Federal Hardrock 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 11 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 a draft of the Federal Hardrock Mineral Prospecting Permits Draft Environmental Impact Statement prior to public dissemination.

The Fond Du Lac Band sent in a comment letter during the Draft EIS comment period. In addition, 258 letters from individuals with the Native Vote Alliance and Fond Du Lac ERally were received. On April 27, 2012, the three Bands, 1854 Treaty Authority, GLIFWC and the Forest Supervisor and staff met to discuss a draft of the Federal Hardrock Mineral Prospecting Permits Final 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.

A concern was raised that project activities would result in a decrease in access to the national forest. 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 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. While temporary roads would be closed to public 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 per drill site, plus 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.

The 20 year analysis estimated average annual ground disturbance from all projected minerals exploration activities to be about 186 acres per year (see section Exploration Disturbance Descriptions in Section 2.2.2.4). Over the duration of the 20 year analysis, approximately 3,725 acres could be disturbed. This represents approximately 0.34 percent of the 20 year analysis 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[2] 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 35) 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 would not affect those species that migrate, hibernate, or aestivate. 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 2.4.3), 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. Specific stipulations to protect wild rice are listed in Section 2.4.3.9. 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.

[2] i.e. Vegetation that is cleared in areas such as drill pads and replaced with young vegetation aged 0 to 9 years old.

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 April 1, 2009. Approximately 150 scoping comments were received. A Draft EIS was released and a Notice of Availability was published in the Federal Register on April 1, 2011 and a legal notice was published in the Duluth News Tribune on April 1. 1,736 comments were received on the Draft EIS from individuals, agencies, organizations and governmental entities. In addition, open houses were held at Duluth MN, Virginia, MN and Roseville, MN on April 12, 13 and 14, 2011 where the public could ask questions about the Draft EIS.

1.9.1 Public Issues

Using the scoping comments from the public, other agencies, and organizations (see FEIS Appendix A), 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).

The SNF separated the issues into two groups: issues that drive alternatives, and 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, or 5) 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.

Six 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 pressure level of sound. However, while these indicators may estimate the physical characteristics of the sound, the experience of that sound as noise 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 (in particular noise) 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, defining the differences between each alternative and providing a 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.

Section 2.1.1 is an updated description of the activities associated with mineral exploration originally provided in the Scoping package. Following the descriptions of the alternatives below, Section 2.4 describes in detail the specific requirements that would apply to 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 the 29 submitted permits. Second, Section 2.4.3 lists the resource specific stipulations that would also be applied to the 29 submitted permits[3]. As part of the Forest Service consent, the Forest Service will identify which stipulations are relevant for each permit within FS authority. Additional stipulations are identified that would be in the purview of BLM to adopt. BLM is responsible to ensure that all identified stipulations are carried forward to the approved prospecting permit(s).

In addition to the current permit applications, operating plans and special use authorizations, all action alternatives include an effects analysis for projected mineral exploration activities over a 20 year period Forest-wide. Projected mineral exploration activities are based on a typical disturbance scenario described in Section 2.2.2.4 under Alternative 2. The effects analysis for future mineral activity proposals assumes that the stipulations would be applied. This Forest-wide analysis will be considered for use in effects analysis by the Forest Service and BLM when future proposals are received. A decision on approval of future proposals, and what stipulations to apply for future proposals, would be made at such time that future proposals are received.

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 the analysis for both the 29 current permit applications and the long-term analysis. 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 the 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.

[3] Modifications or waivers may be applied for some stipulations as specified in section 2.4.3 of the EIS.

2.1.1.2 Soil, Vegetation, and Rock Geochemistry Surveys

These surveys are completed during geologic mapping or as independent surveys. Overall, very little ground disturbance is associated with these surveys. Sampling may require small, localized brush cutting to allow the technician to fix his or her 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 may be 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 approximately 1 foot by 1 foot by 2 feet deep; but will vary in size depending on the auger used. Soil surveys are generally sampled on a 650 to 1,600 foot interval in a watershed for initial work. In the more detailed secondary surveys, sampling is completed in a grid pattern at a sampling interval of 50 to 200 feet. The holes are back filled after sampling. The target zone or target horizon is often the interface between the soil and bedrock. Linear paths may be cut through the forest to allow ATV access. However, soil sampling may be performed without clearing vegetation or off-road ATV access.

Vegetation Sampling

Vegetation sampling is often performed as an indirect soil and groundwater sampling to represent the chemical environment. Plants extract elements from depth and transmit them to foliage. The degree to which plants accept or reject elements differs by species. Typically, samples 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 burned and the ashes analyzed for metal content. Ideally, vegetation is sampled on a uniform grid. Limitations of specie occurrence may compromise the sampling pattern.

Rock Sampling

Rock sampling is generally performed through analysis of either rock chip or core sampling. Samples are at standard intervals in a rock outcrop or at standard intervals on the Earth. A one pound sample is commonly obtained in fine-grained rocks and up to five pounds may be obtained in coarse grained rocks. Chips of mineralized fillings and coatings can be collected from fractures or sampled from rocks on the surface.

2.1.1.3 Geophysical Surveys

The geophysical survey techniques proposed within the project area are usually magnetic, electro-magnetic, conductivity, resistivity, and gravity. These surveys enable a geophysicist to look for density or mineralogical variations often called anomalies, in the subsurface without drilling exploratory holes. Variation in the magnetic or conductive responses in the subsurface represent mineral variations. These surveys are completed in a grid pattern. The grid can be up to several square miles. The size of the survey is dependent upon the size of the subsurface rock formation. Electric generators may be used to induce an electrical current into the ground for resistivity surveys. A geophysicist may walk on and/or around these lines carrying hand held instruments laying and pulling small cables while taking readings at specific intervals. The measurement intervals are surveyed in prior to the point of obtaining the geophysical readings. The surveyors will mark the measurement locations with pin flags and may need to cut vegetation that is too dense. There is very little ground disturbance associated with these grid lines. Access to the site may require overland travel during frozen ground conditions, and clearing of overgrown roads and trails. During the coring process, geophysical measurements may be obtained in the drill hole by lowering geophysical instruments into the drill hole and taking measurements at a set interval.

Typically these measurements are obtained while the instrument is entering the hole as well as when the instrument is exiting the drill hole. This allows the geophysicist to have duplicate information.

Airborne geophysical surveys for gravity and magnetics have been flown since the 1950's using helicopter or planes. The Forest Service may be notified when these surveys will take place if they are part of the exploration process in this EIS.

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 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 or 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 stems, drill casing, drill bits, 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 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 that need 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 thus decreasing the amount of ground disturbance. Drilling from barges on lakes and large rivers is not included in the proposed action 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 with 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). The sump pit 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 core holes that may produce ground water or when multiple holes 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 could require a larger drill pad clearing of 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 stipulated by the State of Minnesota

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 could be the 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 the state of Minnesota rules. To prevent water from escaping the drill hole, bentonite clay and rod casings can be used. Organic or bio-degradable synthetic drill “mud” additives may be added to the water to assist with drilling. State requirements for down hole additives are covered under Minnesota Department of Health Rules Chapter 4725.2950. Drilling Fluids regulations are set by the State of Minnesota and are followed for 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. Drill rigs vary in size, and are about the size of a dump truck. When operating, mast heights range from about 20 feet to over 35 feet in height, depending upon rig type and the size of drilling apparatus. The drill rig could operate 24 hours. More than one core hole may be drilled at each site at different angles and directions depending on the target. 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. Materials stored on the drill pad and used during drilling activities include drill core boxes, drilling additives, propane or welding tanks, and petroleum products such as fuels and lubricants. Spill abatement equipment and supplies 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 geology and subsurface location of the target. In the past, exploration drill holes in northern Minnesota were typically 500 to 1,000 feet deep. The current targets are deeper with drilling 1500 to 4500 feet deep. Holes may be vertical or directionally drilled. Directional drilling allows multiple cores to be obtained from a single well pad. Drill holes can take about 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 specific plug and abandon requirements for exploratory drill bore holes. Minnesota allows 10 years before a bore hole would need to be permanently plugged. A company can request an extension to the 10 year time frame from the State of Minnesota.

Figure 4. Truck mounted drill rig

Reclamation Including Drill Hole Abandonment

Final reclamation occurs after drilling, and testing has been completed. The company permanently plugs the exploration drill hole. Companies may propose to leave some drill hole borings temporarily abandoned (sealed) in accordance with Minnesota Rules. In this situation, interim reclamation will occur after drilling operations have ceased and before the borings are permanently abandoned

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 the drill holes in accordance with Minnesota Rules. The decommissioning of road and access routes in accordance with Forest Service requirements may be the final action.

Figure 5. Reclaimed drill pad soon after drilling

For temporary abandonment, the casing must be maintained to prevent the introduction of surface contaminants into the hole and to prevent the passage of water from one aquifer to another. These regulations are outlined by the State of Minnesota. As per these regulations, the casing must be covered to prevent vandalism or entry of debris. Permanent drill hole abandonment must be completed when the prospecting permit expires[4]. 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.

[4] If a company submits a lease application, BLM may require re-entry of the hole to get more data concerning the valuable mineral deposit determination. See Stipulation RECL-2 in Section 2.4.3

Figure 6. Drill site 2 years after reclamation

The BLM requires companies to secure a reclamation bond before prospecting permits or leases and operating plans are approved. A bond estimate would be recommended by the Forest Service that is commensurate with the scope of operations, and is adequate to achieve reclamation goals. The bond is approved by the BLM. The BLM may consider the cost of complying with all permit and lease terms, including royalty and reclamation requirements, when setting bond amounts.

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 level in the entire project area.
- Alternative 4 includes limits on sound level reaching recreation receptors.
- Alternative 5 includes mitigation to reduce sound level in the entire project area, and a seasonal restriction on drilling.

Note that under all alternatives, operations would be required to meet MPCA noise requirements at private and recreational residences, resorts, and other receptors outlined at Minnesota Rules 7030.0040.

2.2.1 Alternative 1 - No Action

Current activities would continue to occur, and current management plans would continue to guide management of the project area. None of the 29 federal hardrock mineral prospecting permits would be issued, and the operating plans and associated SUAs would not be approved at this time. No changes in surface and subsurface resources would result from hardrock mineral prospecting. Applications for these or similar activities could be submitted in the future, and would be considered on their own merits at that time. 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 that 29 federal hardrock prospecting permit applications would be issued, and associated SUAs would be approved. Applicable FS stipulation recommendations to BLM would be made for the current 21 operating plans and any future operating plans submitted to the BLM for approval by prospecting permit holders. See Section 2.4.3 for further description of the operating plan approval process. 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 are described in section 2.1.1. The Proposed Action includes design features developed to reduce overall effects in the form of surface use stipulations that would be added to prospecting permits, and operating conditions that would be part of approving site-specific operating plans. These design features are listed in Section 2.4.

Alternative 2 also includes effects analysis from projected exploratory activity Forest-wide over 20 years. Section 2.2.2.4 provides information on the projected activities.

2.2.2.1 Prospecting Permit Applications

Alternative 2 includes 29 prospecting permit applications. Prospecting permits gives a permittee the exclusive right to access and explore for minerals within the permit area. Based on exploration plans submitted on the 29 prospecting permit applications, and Forest Service and BLM Geologist knowledge of typical exploratory activities, it is estimated that there would be up to about 39 acres of disturbance and construction of up to about 9 miles of temporary road used in each permit area from project activities over the life of the permit. The 39 acres of disturbance includes 16 acres for geophysical surveys, 3.2 acres for drill pads, 10 acres for brushing or reconstructing existing temporary roads, and 9.6 acres for constructing new temporary roads. The 9 miles of temporary roads includes using 5 miles of existing roads and building 4 miles of new temporary road. These figures are drawn from the estimated activities described in Section 2.2.2.4 per prospecting permit. This totals up to about 1,131 acres of disturbance, construction of up to about 116 miles of temporary road and using up to about 145 miles of existing road in the 29 prospecting permit application areas. See FEIS Section 2.2.2.4 for a description of minerals exploration activities per permit.

The effects analysis in Chapter 3 considers effects for the 32 permit applications identified in the Draft EIS. The Final EIS Proposed Action in Section 1.4 includes 29 of these 32 permit applications based on a land status review by BLM. Thus, impacts disclosed in the Final EIS are greater than what would occur from activities in only 29 permit areas. The analysis considers the effects of project activities over the life of the permit, which includes permit extensions and any revised or additional operating plans submitted in the permit areas. 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.

Issuance of permits may result in non-surface disturbing activities such as geologic mapping, soil and rock sampling, and certain geophysical surveys. Surface disturbing activities may occur.only be conducted under an approved operating plan.

2.2.2.2 Operating Plans

Table 7 provides a general summary of the 21 current operating plans proposed by companies. Operating plans must be consistent and responsive to the requirements of the prospecting permit for the protection of nonmineral resources and for reclamation of the surface lands (43 CFR 3592.1(a)). 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. Typical mineral exploration activities and processes are further described in section 2.1.1.

Approval of operating plans would result in surface disturbing activities. 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 pattern. 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,   Operations would not commence before the plans are approved by the BLM with SNF recommendations for applicable surface resource stipulations. 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 7 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 7 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	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
053868	22	22	2.7	1.6	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	Same as above	Same as above	0	1.6	Same as above
054218	4	4	0.26	0	Same as above	Same as above	0.6	0.9	Same as above
054366	1	1	0	0	Same as above	Same as above	0	0.2	Same as above
054367	1	1	0	0	Same as above	Same as above	0	0.2	Same as above
054368	1	1	0.35	1.0	Same as above	Same as above	3.3	0.2	Same as above
054385									
055203	1	1	0	0	Same as above	Same as above	0	0.2	Same as above
055205	1	1	0	0.46	Same as above	Same as above	1.1	0.2	Same as above.
055206	1	1	0	0.08	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							

BLM MNES Application Number	Number of drill pads	Number of drill holes (preliminary)	Miles of new temp. road construction	Miles of temp. road reconstruction	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
		location.							
054050	1	1	0	0	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	Same as above	Same as above	0	0.2	Same as above
054195	1	1	0	0	Same as above	Same as above	0	0.2	Same as above
054196	3	3	300 feet	0.6	Same as above	Same as above	1.6	0.7	Same as above
055305	2	2	0	0.28	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.							
052446	8	18	1.26	0	75' X 75' maximum	10' wide X 15' long X 10' deep	3.1	1.9	4 holes use water access/3 landings. Landings

BLM MNES Application Number	Number of drill pads	Number of drill holes (preliminary)	Miles of new temp. road construction	Miles of temp. road reconstruction	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
									cover approximately 25'x50'.
053731	2	2	0.38	0	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	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	75' X 75' maximum	10' wide X 15' long X 10' deep	1.5	0.7	
055302	4	4	0.73	0	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	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.

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2.2.2.3 Future mineral prospecting permits and operating plans

An 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 approximately the next five years. These assumptions were used to assess potential effects from future mineral exploration activities. See minerals exploration scenario Section 2.2.2.4 for these assumptions.

The Forest-wide analysis for the exploration scenario will be considered for use in effects analysis by the Forest Service and BLM if and when future prospecting permit proposals are received. A decision on approval of future prospecting permit proposals, and what stipulations to apply to future prospecting permit proposals, would be made at such time that future prospecting permit proposals are received.

2.2.2.4 Minerals exploration scenario

This mineral exploration scenario was developed to describe an estimated average exploration scenario for about 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 for future prospecting permits and operating plans in Chapter 3.

These assumptions are based on typical mineral exploration in northern Minnesota for the past five years, current prospecting permit applications and associated operating plans, and professional experience and knowledge of the SNF Geologist and BLM Geologist.

Assumptions

This scenario includes hardrock mineral exploration for federal minerals. It does not include private mineral exploration notifications. Private minerals exploration and exploration under other ownerships is considered under cumulative effects analysis.

This analysis considers an average of 10 prospecting permits would be submitted in the future each year for approximately five years for a total of 50 prospecting permit applications. Currently, there are 45 existing prospecting permit applications. However, only 29 of the new prospecting permit applications are complete with exploration plans. 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 when permit applications are received.

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). Operators have 60 days after permit expiration to submit a lease application.

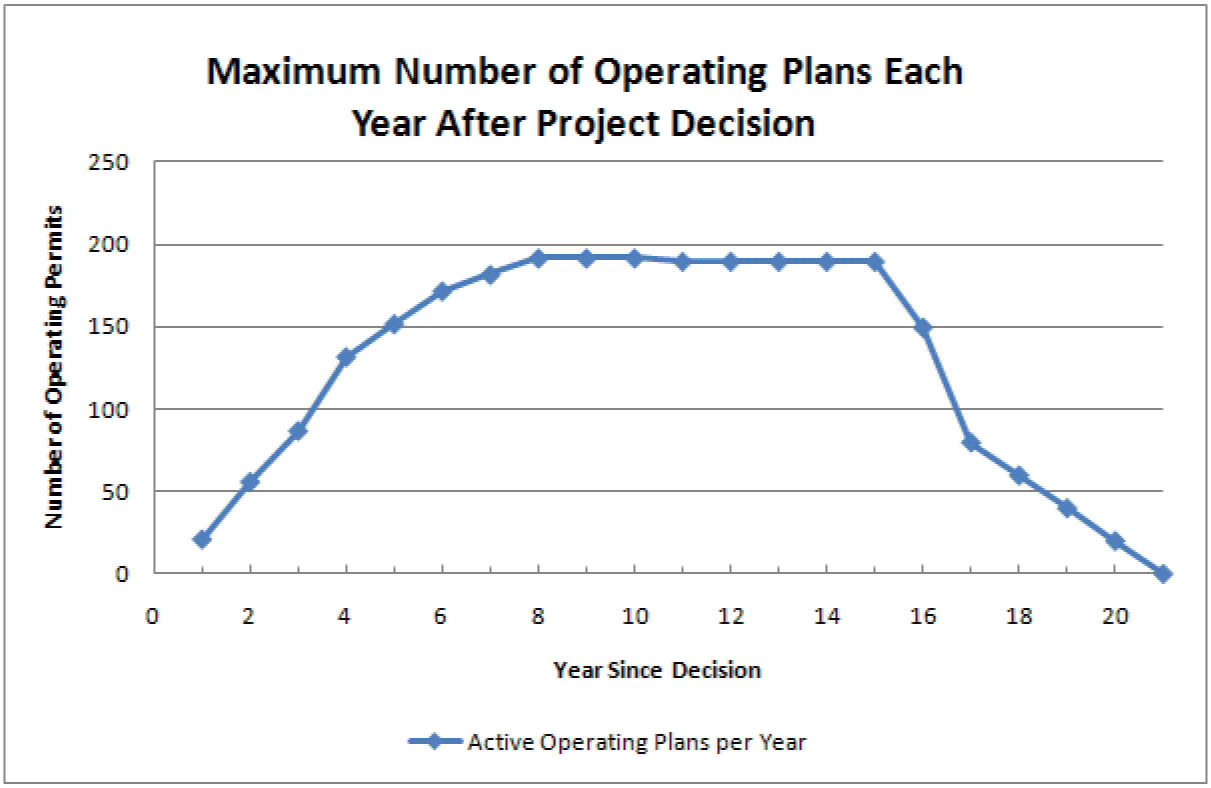


Figure 7. Maximum number of operating plans each year based on project assumptions

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, an operating plan is submitted to BLM for approval. Typically a new operating plan is created for yearly activities. In some cases, multiple operating plans may be submitted in the same year. For the purpose of this analysis, we will assume there may be an average of two operating plans submitted per prospecting permit. This assumption is made for the purpose of estimating total disturbance. The actual number of operating plans per prospecting permit may be higher (or lower) since more than two operating plans may be submitted per prospecting permit to account for iterative changes to activities in a permit area. While the total number of operating plans and the amount of disturbance per operating plan may be different than is assumed in the scenario, the total amount and timing of disturbance is considered a reasonable projection given current knowledge of exploration activities of SNF Geologists.

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) + (50 X 2) = 192)). 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 and are included in the Proposed Action for the Final EIS:

Table 8 Applications for prospecting permits and exploration and operating plans

Company	Prospecting Permit Applications Received	Exploration Plans Received	Operating Plans Received
Encampment Resources	9	9	0
Lehmann Exploration	4	4	5 plus 1 extension
DMC	9	9	10
Twin Metals	5	5	5
Prime Meridian	2	2	0
Total	**29 complete**	**29 Total**	**21 Total**

Of the 29 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.

There are 13 incomplete prospecting permit applications (Park Creek-12 and Encampment Resources-1) and these are assumed 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 operating plan proposal may include an average of 7holes. 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 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 21 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 10 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 9 Surface and mineral ownership, and mineral interest areas within the project area for the 20 year scenario

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[5]. 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 would be a total of approximately 96 ground disturbing geophysical surveys over the 20 years of operations. Surveys would generally be completed in a grid pattern fashion. Each proposal may include approximately 22 miles of cleared lines (of mostly brush and non-to-sub-merchantable trees) that are typically 3-6 feet wide. This equates to up to about 1,536 acres of vegetation clearing over the 20 years. Generally hardrock exploration occurs in phases, so there can be times of high and low activity. On average, there would be about 76.8 acres per year over the 20 years. Vegetation grows back into the cut lines usually within 2 years.

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 could be reduced to allow for the sump construction so that the total disturbance is maintained within the assumed or maximum drill pad size. For these calculations, the sump disturbance is included in 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. 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. The total disturbance associated with drill pads would approximately be between 38.4 to 307.2 acres over the 20 year time frame. Total acres disturbed in any given year would be limited due to ongoing temporary and final reclamation.

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. Annual disturbance associated with this activity will have an assumed average of 48 acres or 24 miles per year for 20 years. The total disturbance for this activity would be approximately 960 acres or 480 miles in 20 years. Total mileage or acres disturbed in any given year would be limited due to ongoing temporary closures and decommissioning upon final reclamation.

[5] An exception to this may occur if a company submits a lease application. In this case, BLM may require re-entry of the hole to get more data concerning the valuable mineral deposit determination. See Stipulation RECL-2 in Section 2.4.

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. Annual disturbance associated with this activity will have an assumed average of 46.1 acres or 19.2 miles per year for 20 years. The total disturbance for this activity would be approximately 922 acres or 384 miles. Total mileage or acres disturbed in any given year would be limited due to ongoing temporary closures and decommissioning upon final reclamation. Figure 35 in Section 3.6 Wildlife shows the mileage of temporary road that may be open in a given year.

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 10 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.	192 operating plans are assumed for estimating disturbance
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

Under Alternative 3, the 29 prospecting permits would be issued, with stipulations for the protection of surface resources. The 21 operating plans and any additional operating plans associated with the 29 permits would be approved with conditions. Alternative 3 applies noise abatement measures at drilling exploration sites across the project area to reduce impact to the BWCAW, and receptors outside the wilderness including campgrounds, residences and dispersed recreation. The intent of the alternative is to reduce sound 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.

Sound levels at 20 feet from the drilling rig are assumed to be approximately 84 decibels without any noise abatement measures. Some drilling rigs may emit lower sound levels than this. In this case, additional mitigation may not be needed to meet the required sound level of 70 dBA at 20 feet from the drill rig under this Alternative.

Detail of noise abatement measures

The permittees would be required to reduce sound level at the source (20 feet from the drill rig) to 70 A-weighted decibels (dBA). 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 built 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 sound by 8-15 decibels (Braslau 2007). Examples of possible mitigation measures (e.g. baffle and/or muffler) are in the project file.

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.

Operations would also meet MPCA noise requirements at private and recreational residences, resorts, and other receptors outlined at Minnesota Rules 7030.0040. See Section 3.1.1 for more information on Minnesota Rules on Noise.

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 sound levels at key receptors as described below.

Table 11 Alternative 4 receptors, thresholds and rationale

Sound Level Threshold (dBA)	Common Noise Sources[a]	Receptor	Rationale and Comments
L50 sound level: 30 dBA L10 Sound level: 35 dBA	Secluded Woods	Wilderness MAs[b]	Wilderness areas consist of remote forests, or "secluded woods", and remote waterways. While the wilderness does not exist in isolation from motor noise, mitigation of noise impacts from exploratory drilling reduces impacts to 'opportunities for solitude' identified in the 1964 Wilderness Act. The Wilderness Act requires that the managing agency preserve wilderness character.

a – MPCA A Guide to Noise Control in Minnesota October 2008 (pg 5).
b– This includes the entire BWCAW. Limits would apply at the BWCAW boundary.

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 in Sections 2.4.2 and 2.4.3. See also Appendix E Monitoring Plan on monitoring for implementation of noise mitigations.

Operations would also meet MPCA noise requirements at private and recreational residences, resorts, and other receptors outlined at Minnesota Rules 7030.0040. Proposed mitigation in the Draft EIS for campgrounds, campsites and residences, and the Semi-Primitive Non-Motorized and Semi Primitive Motorized Management Areas has been removed from the Final EIS because it amounted to a duplication of existing Minnesota Rules on Noise. See FEIS Section 3.1.1.

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 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.

Operations would also meet MPCA noise requirements at private and recreational residences, resorts, and other receptors outlined at Minnesota Rules 7030.0040.

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 of best management practices was completed for water quality and water quantity.

Water Quantity

The SNF has been 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.

Based on public comment, this stipulation has been updated in the FEIS to account for cumulative withdrawals (see FEIS Section 2.4.3.9).

Groundwater withdrawal is regulated by the MN DNR. The type of drilling that may occur in this project is not considered to be high capacity 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 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 utilized on similar exploration projects have proven effective, and therefore, an additional alternative was not developed. However, based on public comment, several water stipulations have been added or revised to further protect water resources (including for brackish water, wild rice, and water withdrawal). As provided for by 36 CFR 200.5(e)(1), the changes in stipulations between Draft and Final EIS are another alternative considered.

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 sound 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 therefore will not be carried forward in the analysis.

In addition, 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 stipulations that would apply under action alternatives (except for Alternative-specific measures as described for the noise stipulations). 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 as appropriate 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 BLM 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 BLM- 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 annual reports on the progress and results of the exploration. The annual 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.
7. The permittee shall file a report with the BLM upon the conclusion of all work, specifying the methods and materials used to properly plug and abandon 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.
8. Any modifications to the operating plan (OP), including timeframes for operations, must be submitted to the BLM for concurrence prior to implementation.
9. BLM concurrence of a permit or operating plan does not relieve the company of their responsibility to comply with applicable state, federal or local laws, rules, or regulations or ordinances.
10. Modification of approved drill sites, access road locations and other surface disturbing activities in the operating plan may be modified after Forest Service recommendation and BLM review and approval.

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 a BLM 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 (including GPS coordinates of drill holes located to an accuracy of 1 meter or less).
    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.
    j. An estimated time frame for any construction or drilling requests so that coordination between other) permit holders or contract holders for surface uses can be established.
3. The permittee shall submit copies of all applicable State and Federal agency permits to the Forest Service prior to starting operations. If permit(s) are not required, the permittee shall submit proof or documentation that a permit is not required.
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. The Forest Supervisor or his/her designated agent will inform BLM such circumstances exist.
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 coordinate with Forest Service Officials to complete pre-construction field review on an approved operating plan to ensure placement of roads and drill sites is consistent with prospecting permit stipulations and operating plan conditions, and provide for resource protection.
9. 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.
10. 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.
11. Terms of the permit are considered violated if not done according to all stipulations.

2.4.3 Resource Stipulations Common to Action Alternatives

This section lists stipulations that may be included as part of Forest Service consent on a prospecting permit, or that the FS may recommend the BLM include on a permit. These stipulations are derived in part from requirements in the Forest Plan direction regarding physical, social and biological resources (these are noted with a citation to the Forest Plan location), other stipulations or operating conditions may be derived from species conservation agreements, or be developed as a result of individual resources analysis. This section includes direction that is not found within the Forest Plan but will ensure resource protection and safe operations during mineral exploration activities.

The following stipulations are designed into each alternative unless otherwise noted. As noted in the below tables, several stipulations may include modifications or waivers based on site specific proposals that are submitted and analyzed, as long as the objective is met. The Forest Service would identify the applicable stipulations for each of the 29 prospecting permits, for example where no surface occupancy, timing restrictions or other protections would be required.

When an operating plan is proposed, it must be designed to be consistent with the protection in the prospecting permit. The BLM and FS will review these plans, and assess if the plans are consistent, in which the FS may make recommendations to BLM on the surface use and reclamation aspects of a plan. These restrictions and protections are shared with the BLM, who has the authority to approve operating plans. The location of proposed sites may be modified slightly in cooperation with the surface managers recommendations.

2.4.3.1 General Administration

Administration	
Best management practices	
GA-1 Stipulation Conditions of Approval (CoA's) drill sites and road access.	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.
GA-2 Stipulation CoA Unique to a quarry	No drilling will be allowed within Forest Service mineral material quarry permit 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-3 Stipulation CoA's drill sites and road access	Permittees may perform activities that accelerate the ground to freeze when operations are limited to frozen ground conditions. Activities to achieve frozen ground access will be identified in the Operating Plan approval process.
Objective	Develop frozen ground conditions at the earliest time during the year to extend the winter drilling season.
Source	SNF minerals program management.
GA-4 Stipulation CoA's drill sites and road access.	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.

Administration	
Objective	To assure drill bore hole abandonment is completed in accordance with Minnesota state rules.
Source	SNF minerals program management.
Health and Safety	
GA-5 Stipulation CoA's drill sites and road access	Health and safety precautions should be followed, including, but not limited to the following list: a. BLM prospecting permit sec.1 (d). 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. i. Sump pits shall be fenced off during drilling operations if drill site is unattended by company representatives or drill rig operators to provide for public safety.
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 CoA's drill sites and road access	All roads, trails, drill pads and other disturbance features shall be staked or flagged on the ground for agency review during the Operating plan approval phase and prior to implementation of the operating plan.
Objective	Provide proposed and permitted disturbance features locations for agency administrative review purposes to determine applicable stipulations.
Source	SNF minerals program management.
Research Natural Areas	
LOC-2 Stipulation CoA's apply to permits with CRNA's	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-3 Stipulation CoA's apply to permits with	No Surface occupancy is allowed within unique biological areas as defined by the Forest Plan (locations are identified in Map 2)

UBA's		
	Objective	To protect unique biological resources
	Source	Forest Plan S-UB-6
Wild and Scenic Rivers		
LOC-4 Stipulation CoA's apply to permits with Wild designation river segments		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

2.4.3.3 Heritage Resources

Heritage Resources		
Unknown locations		
HR-1 Stipulation CoA's drill sites and road access		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 CoA's drill sites and road access		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 CoA's drill sites and road access		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. The SNF Archaeologist may notify the Tribal Historic Preservation Officer and the MN State Historic Preservation Office.
	Objective	Identify, evaluate, protect, monitor, and preserve heritage resources
	Source	Forest Plan O-HR-1 also reference BLM Prospecting Application and Permit, Sec.11
Known locations		
HR-4 Stipulation CoA's drill sites and road access		Historic properties will have no surface occupancy both within the site and a buffer of one chain (66.5 feet) beyond known site limits.
	Objective	Identify, evaluate, protect, monitor, and preserve heritage resources
	Source	Forest Plan S-HR-9
HR-5 Stipulation CoA's drill sites and road access		Any heritage resource sites located prior to prospecting activities shall be no surface occupancy and boundary identified on the ground. 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).
	Objective	Identify, evaluate, protect, monitor, and preserve heritage resources

Heritage Resources	
Source	Forest Plan O-HR-1

2.4.3.4 Recreation, Noise and Visuals

Recreation, Noise and Visuals	
Noise Abatement (Alternative Specific)	
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, using drill rigs that emit lower sound levels, or other measures that may be identified during implementation.
Objective	Reduce level of annoyance for Forest recreation users, and effects to solitude for wilderness.
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.
Source	Issue identified for the Federal Hardrock Minerals Prospecting Permit EIS
RV-3 Stipulation	Under Alternative 4, reduce sound levels emitted by drilling reaching receptors: • to an L50 level of 30 dBA and an L10 level of 35 dBA at the boundary of the BWCAW. This may be accomplished with measures such as installing baffling around the engine, adjusting the location of drilling, or other measures that may be identified during implementation.
Objective	Reduce level of effects to opportunities for solitude in the BWCAW.
Source	Issue identified for the Federal Hardrock Minerals Prospecting Permit EIS
RV-4 Stipulation	Under all action alternatives, receptors that are likely to be in the flight path of helicopters 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.
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
Visual Integrity (see map 7)	
High Scenic Integrity Objective (SIO) areas	
RV-5 **Stipulation** CoA's drill sites and road access in High SIO	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** CoA's drill sites	Adjust the location of the activities if the mechanized activities can be viewed from travelways, recreation sites and bodies of water with access. Adjustments may moving a drill site up to 100 feet to avoid high visibility areas.
Objective	Minimize evidence of management activities
Source	Forest Plan G-SC-6
RV-7 **Stipulation** CoA's drill sites and road access	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).

Recreation, Noise and Visuals	
Source	Forest Plan G-TS-15
Lighting	
RV-8 **Stipulation** CoA's drill sites	Reduce light pollution generated at drill sites by pointing lighting sources for drill rigs downwards and/or shielding lighting as feasible while completing safe drilling operations..
Objective	Reduce light pollution impacts to recreation users and residences.
Source	Forest Plan G-TS-15
Modification or Waiver	Lights may be modified to the extent necessary for safe operations or to protect public safety.
Developed Recreation Areas	
RV-9 **Stipulation** **NSO identified on a map** CoA's drill sites and road access	No surface occupancy 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	
Den Sites	
TES-1 **Stipulation**	Protect known active Canada lynx den sites during the denning season (May 1-July 31) with a buffer of 660 feet (1/8 mile). Site conditions such as topography and vegetation cover may be used by a SNF biologist to refine site-specific distance.
Objective	To reduce human influences on mortality risks
Source	Forest Plan G-WL-1 and G-WL-2, LCAS Project planning guideline F. 1,(Ruediger et al. 2000, page 86),
Vehicles Traveling on Roads	
TES-2 **Stipulation**	Prospecting permit employees and subcontractors who will drive on roads during project activities shall retain in all vehicles information to allow them to identify Canada lynx. The Forest Service will provide this information to permit holders. Any lynx mortality resulting from project activities shall be reported per this information.
Objective	To reduce human influences on mortality risks
Source	USDI Fish and Wildlife Service Biological Opinion dated March 22, 2012: Reasonable and Prudent Measure #1, Term and Condition #2

In addition to TES-2, the action alternatives also include the following actions that would be completed by the Forest Service to fulfill the terms and conditions in the Biological Opinion provided by the USDI Fish and Wildlife Service on this project:

- "Place "Caution!! Entering Wildlife Crossing Area" or similar signs along the stretches of Forest Road 424 and Forest Road 377 identified in the attached Biological Assessment in any areas where lynx crossing may be most likely. Signs may be removed when the traffic volume returns to relatively normal levels (i.e., after year 9 of project implementation). Similar signs may be placed along the stretches of State Highway 1 and State Highway 1/169 identified in the attached Biological Opinion where lynx crossing may be likely and where the Forest has jurisdiction. The signs should adhere to Forest Service sign guidelines."

- "Mortality reports should be provided to the Service by December 31 of each calendar year the Revised Forest Plans are implemented. Reports should include, to the extent known, the cause of mortality, location, and sex of lynx. This report can be in conjunction with reporting for other concurrent projects on the Superior National Forest."

- "Rather than establishing a discrete field monitoring effort to document lynx mortality, contribute to the currently established reporting system maintained by the U.S. Fish and Wildlife Service. The Forest Service should coordinate with partners in state, tribal, county, municipal law enforcement, wildlife management agencies, lynx researchers, and the public to collect information necessary for this reporting system. Information voluntarily provided by these agencies, researchers, and others and compiled by the U.S. Fish and Wildlife Service would fulfill the requirements of the reasonable and prudent measure."

2.4.3.6 Terrestrial Wildlife Species, including 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 using buffers of 10 to 660 feet (1/8 mile). Site conditions such as topography and vegetation cover maybe used by a SNF biologist to refine site-specific distance.
Objective	Maintain and protect sensitive species habitat and reduce adverse effects to species
Source	Avoidance is a 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) using buffers of 10 to 660 feet (1/8 mile). Site conditions such as topography and vegetation cover may be used by a SNF biologist to refine site-specific distance.
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 promptly 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.

RFSS and other species of interest		
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
Gray Wolf (also a Management Indicator Species)		
Den Sites		
RFSS-5 Stipulation		Provide for the protection of known active gray wolf den sites during the denning season (April 1-May 30).This equates to No Surface Occupancy during the timeframe given within a buffer of 660 feet (1/8 mile). Site conditions such as topography and vegetation cover may be used by a SNF biologist to refine site-specific distance.
	Objective	To limit disturbance by humans during denning season
	Source	Forest Plan G-WL-10.
Bald Eagle (also a Forest Plan Management Indicator Species):		
Nests		
RFSS-6 Stipulation		Maintain a buffer of 660 feet (1/4 mile) 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 by humans during breeding and nesting
	Source	National Bald Eagle Management Guidelines (USDI Fish and Wildlife Service 2007)
RFSS-7 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 (USDI Fish and Wildlife Service 2007)
RFSS-8 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 (USDI Fish and Wildlife Service 2007)
Wood Turtles		
Breeding locations		
RFSS-9 Stipulation		A setback of at least 100 feet shall be maintained for drill pad disturbance from perennial streams and rivers
	Objective	To minimize human disturbance to breeding and nesting turtles
	Source	Forest Plan G-WL-19, WAT-8 Stipulation
Boreal Owl		
Nests and Breeding Habitat		
RFSS-10 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
Great Gray Owl		
Nests and Breeding Habitat		
RFSS-11 Stipulation		Prohibit management activities within 660 feet of known great gray owl nest sites. This equates to No Surface Occupancy in the location given.
	Objective	Limit disturbance to breeding and nesting birds
	Source	Forest Plan G-WL-14
Three-toed Woodpecker		

RFSS and other species of interest		
Nests		
RFSS-12 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-13 Stipulation		Protect known locations for: taiga alpine, Freija's grizzled skipper, and Nabokov's northern blue with a 200 foot buffer. If a known location is along an existing road consult with a SNF biologist to define protective timing and/or extent.
	Objective	Minimize disturbance to breeding habitat and individual butterflies
	Source	Forest Plan S-WL-7
Northern Goshawk (also a Management Indictor Species)		
Nests		
RFSS-14 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-15 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
Post fledging areas		
RFSS-16 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-17 Stipulation		No drilling within 330 feet (1/8 mile) of an osprey nest from April 1 through August 15 of each year. No drill sites or roads are allowed within 660 feet of an osprey nest at any time. 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, G-WL-25
Great Blue Heron		
Colonies		
RFSS-18 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-19		No Surface Occupancy within 300 feet of a loon nest site between May 15 and July 1.

RFSS and other species of interest	
Stipulation	
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, hydrologist, geologist or ecologist for consistency with Forest Plan requirements. While ELT mapping on the Forest is considered accurate there may be some instances where on the ground conditions may differ from what is mapped (typically these are small areas considered inclusions too small to map and manage practically at the landscape scale). In those cases, with a review by a SNF soil scientist, hydrologist, geologist or ecologist, exploration activities could occur outside of the guidance established by the following stipulations where and when it is deemed appropriate by agency staff. Those operations would be subject to any alternative stipulations considered applicable by the soil scientist, hydrologist, geologist or ecologist.

Soils	
General Soils	
SOIL-1 Stipulation CoA's drill sites and road access	Salvage and reuse topsoil for site rehabilitation during construction projects or other land use activities including road access, work areas and drill sites where there is soil disturbance. 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
Ecological Land Type (ELT) Restrictions (mapping for locations is available in the project file, too large to include within the FEIS)	
On ELTs 1, 2, 3, 4, 5 and 6	
SOIL-2 Stipulation CoA's drill sites and road access with these ELT's	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, 16 and17	
SOIL-3 Stipulation CoA's drill sites and road access	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

Soils			
		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 CoA's drill sites and road access		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 CoA's drill sites and road access		New access roads would not be authorized. This equates to No Surface Occupancy in these ELTs.
		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 CoA's road access		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 erosion and rutting.
		Source	As recommended in Part 3 of Sustaining Minnesota Forest Resources: Voluntary site-level Management Guidelines, Forest Soil Productivity section.
		Modification or waiver	None
	SOIL-7 Stipulation CoA's road access		Use of wetlands under frozen ground conditions for temporary roads and skid trails will generally be permitted as long as no fill is placed in the wetland and no rutting occurs. These roads or trails will be blocked to discourage vehicle use under unfrozen conditions.
		Objective	To maintain hydrologic function and minimize rutting and compaction (see WAT Objectives)
		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 CoA's road access		Any lapse in exploration activities at a given drill site greater than two weeks requires temporary access road closure. Road closure must effectively prevent access from motorized traffic. The point at which the temporary road is closed shall be determined on a site-specific basis.
		Objective	To limit the amount of human interaction with lynx and wolves
		Source	Forest Plan S-TS-3
	RDS-2		New roads built to access land for resource management will be temporary and not

Roads			
	Stipulation CoA's road access		intended for public motorized use. Temporary roads will be decommissioned and reclaimed after their use is completed. As soon as access use is completed, stabilize temporary roads and effectively close them to motorized traffic. 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 limit the amount of human interaction with lynx and wolves
		Source	Forest Plan G-TS-14, Forest Plan G-TS-16
	RDS-3 Stipulation CoA's road access		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-4 Stipulation CoA's road access		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-5 **Stipulation** CoA's road access	Low Standard access roads used by permittees (temporary, OML-1 and OML-2) 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. h. Maintenance activities may include, but are not limited to, grading, installing or replacing road closure and erosion control or sediment capturing devices. i. Access roads may be temporarily closed if conditions result in evidence of road damage as required by the Authorized Officer. j. Allow for aquatic organism passage in perennial streams. k. 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) l. 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. m. 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. n. Minimize the use of gravel to construct temporary roads. Unless approved in an operating plan, the Authorized Officer must be notified before the use of gravel to construct temporary roads. Any gravel placed when constructing temporary roads shall be removed by the permittee at final closure and reclamation. Royalties may be charged for FS gravel used.
	Objective	To mitigate against soil erosion and to protect water quality.
	Source	SNF Transportation Management and MFRC guidelines
	RDS-6 **Stipulation** CoA's road access.	All permittee caused resource damage on National Forest System Roads (OML 1-5), including rutting, is the responsibility of the permittee and shall be repaired at permittees expense.
	Objective	To mitigate against soil erosion and to protect water quality.
	Source	SNF Transportation Management

2.4.3.9 Water

Water Quality		
Wetlands (see also soil stipulations for restrictions in lowland Ecological Land Types (wetlands))		
	WAT-1 **Stipulation** **CoA's Drill sites & road access**	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. For spills that are five or more gallons, the permit holders are required to contact the MPCA State Duty Officer.
	Objective	Reduce risk of fuel release near water resources
	Source	SNF hydrology program management.
	WAT-2 **Stipulation** **CoA's Drill sites & road access**	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
Drilling		
	WAT-3	If a drill hole boring is to be temporarily sealed, State of Minnesota regulations shall

Water Quality			
	Stipulation CoA's Drill sites & road access		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-4 Stipulation CoA's Drill sites & road access		Drilling shall be under the supervision of a licensed well driller 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.
Sumps and drafting			
	WAT-5 Stipulation CoA's Drill sites & road access		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, cannot result in more than a 2-inch decrease in the water surface elevation in a season. Water intakes shall have a sieve opening no larger than 1/4 –inch 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-6 Stipulation CoA's Drill sites & road access		Sumps to treat the water used in the drilling process shall be constructed (see Figure 3) as surface conditions allow. These sumps (as described FEIS Section 2.1.1.5) 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-7 Stipulation CoA's Drill sites & road access		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-8 Stipulation CoA's Drill sites & road access		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.

Water Quality		
Brackish water		
WAT-9 Stipulation		Boreholes within 500 feet of an existing well that is completed in bedrock shall be permanently abandoned in accordance with Minnesota Department of Health (MDH) regulations within one week of removing the core.
	Objective	Avoid introduction of high saline waters to ground water resources used for residential water supply.
	Source	SNF hydrology program management
	Modification or Waiver	Option #1: The hole can be temporarily abandoned in accordance with MDH regulations if it is tested for chloride after the core is removed and found to contain chloride levels below 250 mg/L. If chloride levels above 250 mg/L are found, the hole shall be permanently abandoned in accordance with Minnesota Department of Health (MDH) regulations within one week of removing the core. Option #2: The hole can be temporarily abandoned in accordance with MDH regulations if it is cased to an elevation 50 ft below the deepest well that is located within 500 ft of the subject hole.
Wild Rice		
WAT-10 Stipulation CoA's road access		Minimize impacts to wild rice during landing construction by moving landings to avoid concentrations of wild rice.
	Objective	Reduce risk of impacts to wild rice
	Source	SNF botany program management
WAT-11 Stipulation CoA's Drill sites		Water for drilling operations shall not be withdrawn from lakes less than 50 acres if the lake is an inventoried wild rice lake.
	Objective	Reduce risk of impacts to wild rice
	Source	SNF botany program management
Stream Crossings		
WAT-12 Stipulation CoA's road access		Temporary stream crossings will follow, at a minimum, Minnesota Forest Resources Council (MFRC) Voluntary Site-Level Forest Management Guidelines for water crossings and cross road drainage (MFRC 2005). All temporary culverts and floodplain fill shall be completely removed upon final reclamation.
	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.

2.4.3.10 Aquatic Species

Aquatic Species		
Non-native invasive species		
AQS-1 Stipulation CoA's water sources		The following measures to control or prevent the spread of non native invasive aquatic 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 no overland surface flow reaches water bodies or wetlands during back-flushing. 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 CoA's water sources		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 CoA's Drill sites & road access		Where possible, core drilling sites and road access 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 CoA's Drill sites & road access		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** **CoA for all heavy equipment and vehicles**	For external equipment surfaces: a. Prior to movement onto the SNF, all off-road equipment (bulldozers, excavators, drill rigs) 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. For internal equipment surfaces: d. 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** **CoA's Drill sites & road access**	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

2.4.3.12 Reclamation Requirements

Reclamation	
General	
RECL-1 **Stipulation** CoA's Drill sites & road access	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.
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-2 Stipulation CoA's Drill sites & road access		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. Remove invasive plants present on the site. 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. Maintain access routes and other disturbed sites to assure the soils are stabilized and erosion will not occur during interim closure. k. Close temporary road entrances with methods that restrict access by motorized vehicles (examples: gates and boulders are acceptable, but berms of soil material are not allowed for access closures). All other site access, including barge landings, 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.

Reclamation			
Final Reclamation			
	RECL-3 Stipulation CoA's Drill sites & road access		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. Remove invasive plants present on the site i. Pull back brush and slash and spread it over all disturbed sites; j. Seed disturbed areas, if deemed necessary by the Authorizing Officer, with a native plant seed mix made up of grasses, shrubs, and forbs; k. As soon as access use is no longer needed, reclaim temporary roads with methods that effectively eliminate access by motorized vehicles, stabilize soils, re-establish drainages, and follow Forest Plan direction (Forest Plan, page 2-50) and as illustrated in Appendix D. Effective decommissioning 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 barge landings, 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.

2.4.4 Stipulations for Special Use Permits

The following stipulations would apply to special use permits issued by the Forest Service for temporary road construction and management in areas outside the prospecting permits. The Standard Terms and Conditions in Form FS 2700-4c (v. 05/09) would apply. In addition, the following special terms and conditions from the Superior National Forest would apply to minimize impacts from temporary road construction and use:

1. The Forest Service may suspend all or any part of the construction/reconstruction activities and/or revoke or terminate the special-use authorization without administrative proceedings upon breach of any of the conditions herein.

   Prior to the suspension, revocations, or termination, the Forest Service shall give the Holder written notice of the grounds for such action and reasonable time to cure any noncompliance. However, the Forest Service may require immediate temporary suspension of all or any part of the activities when the Forest Service determines it is necessary to protect the public health, safety, or the environment. If requested by the Holder, the superior to the officer ordering the suspension, revocations, or termination shall arrange within 10 days of the request for an on-the-ground review of the conditions with the Holder. The superior shall affirm, modify, or cancel the temporary suspension as soon after the review as possible.

2. The Holder shall take reasonable precautions to protect all public land survey monuments and accessories, private property corners, and forest boundary markers. In the event that any such land markers or monuments are damaged or destroyed, the Holder shall re-establish or reference the corner in accordance with directions and procedures to be furnished by the Forest Service.

3. The Holder shall maintain a muffler or spark arrester satisfactory to the Forest Service on the exhausts of all trucks and tractors or other internal combustion engines used in connection with this project.

4. During the fire season, as determined by the Forest Service, the Holder shall furnish and maintain in serviceable condition a fire-tool box and fire tools to be used only for suppression of forest fires. The toolbox shall be located at the site and shall contain the tools necessary for fire suppression as agreed upon by the Holder and the Forest Service.

5. The Holder shall equip each gasoline power saw at all times with a spark-arresting muffler, in good working condition and adapted to that machine. During periods of dangerous fire weather, as determined by the Forest service, the holder must transport and keep with each power saw at all times such fire tools and portable extinguishers as specified and to take other precautionary measures as may be required by the Forest Service.

6. The Forest Supervisor has determined that at this time no performance bond will be required for this permit; provided, however, that at such time as the Forest Supervisor determines that bonding is needed to protect the resources, not to exceed $1,000.00 within 30 days of notification by certified mail. Failure to post the required bond or cash in lieu of bond within the required 30 days will result in the termination of the authorizing permit.

7. To insure against unauthorized public use of the permitted road without interference with the Government's use for administrative purposes, the permittee is authorized to install and/or sign a gate in accordance with design and location approved in advance by the Forest Officer in charge. Once installed, the custody, control, and safety maintenance of said gate is the sole duty and responsibility of the holder.

8. Prior to any road clearing/construction, the USDA Forest Service must assess the timber value, and payment must be made by the permittee.

9. The road design specification, construction and use shall comply with the following stipulations listed in Section 2.4.3 as they apply to temporary road management: GA-1, GA-5, LOC-1 through LOC-4, RDS-1, 2, 4 and 5, RV-9, HR-1 through HR-5, SOIL-1, 2, 3, 5, 6, and 7, TES-1 and 2, RFSS-1 through RFSS-19, NNIS-1 through NNIS-4, WAT-8, WAT-12, RECL-2 and RECL-3.

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 12 Comparison of effects by resource for 29 permit applications

<table>
<tr><th>Resource</th><th>Alternative 1</th><th>Alternative 2</th><th>Alternative 3</th><th>Alternative 4</th><th>Alternative 5</th></tr>
<tr><td>Soils</td><td>No effect</td><td colspan="4">The 29 current permit applications could include up to about 1,131 acres of disturbance in a project area of about 38,704 acres of NFS lands (3% disturbed). 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.</td></tr>
<tr><td>Hydrology</td><td>No effect</td><td colspan="4">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.</td></tr>
<tr><td>Vegetation</td><td>No effect</td><td colspan="4">The 29 current permit applications could include up to about 1,131 acres of disturbance in a project area of about 38,704 acres of NFS lands (3% disturbed). 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.</td></tr>
<tr><td>NNIS</td><td>No risk</td><td colspan="3">Alternative 2, 3, and 4 have a slightly higher risk of non-native invasive plant spread and negative impacts,</td><td>Alternative 5 has a lower risk of NNIP spread due to seasonal restriction.</td></tr>
<tr><td>Threatened Endangered and RFSS-Plants</td><td>No effect</td><td colspan="4">There are no threatened and endangered plants or habitat within the project area (see BE, Appendix I). 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.</td></tr>
</table>

<table>
<tr><th>Resource</th><th>Alternative 1</th><th>Alternative 2</th><th>Alternative 3</th><th>Alternative 4</th><th>Alternative 5</th></tr>
<tr><td>Threatened and Endangered – Wildlife</td><td>No effect</td><td colspan="4">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.</td></tr>
<tr><td>Sensitive Species-Terrestrial Wildlife</td><td>No Effect</td><td colspan="4">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.</td></tr>
<tr><td rowspan="2">Threatened and Endangered – Wildlife</td><td rowspan="2">No effect</td><td colspan="4">Increased traffic volume on collector roads and increased temporary roads may affect and are likely to adversely affect Canada lynx.</td></tr>
<tr><td colspan="4">Habitat changes, including critical habitat, may affect but are not likely to adversely affect Canada lynx.</td></tr>
<tr><td>Sensitive Species-Terrestrial Wildlife</td><td>No Effect</td><td colspan="4">May impact individuals but not likely to cause a trend toward federal listing or loss of viability.</td></tr>
<tr><td>Transportation</td><td>No effect</td><td colspan="4">Up to 128 miles of temporary road may be constructed. Temporary road would be closed when operators are not using the route, and decommissioned upon final reclamation.</td></tr>
<tr><td>TES Aquatics</td><td>No effect</td><td colspan="4">"May impact individuals but not likely to cause a trend to Federal listing or loss of viability".</td></tr>
<tr><td>Minerals & Geology</td><td>No Effect</td><td colspan="4">The amount of rock removed is extremely small and would have no effect on the rock and mineral resources.</td></tr>
<tr><td>Air Quality</td><td>No Effect</td><td colspan="4">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.</td></tr>
<tr><td>Socio-Economics</td><td>No jobs or income would be generated</td><td colspan="4">Anticipated exploration and associated activities for the current permit applications would provide a minimum of 28 jobs (direct, indirect, and induced) and $1.5 million in labor income (direct, indirect, and induced) and a maximum of108 jobs and $5.8 million in labor income on an average annual basis within the analysis area.</td></tr>
<tr><td>Recreation (impacts other than noise)</td><td>No effect</td><td>minor impact to recreation receptors</td><td>minor impact to recreation receptors</td><td>minor impact to recreation receptors</td><td>negative effects would be lower than Alternatives 2-4 due to seasonal restriction to recreation receptors</td></tr>
</table>

<table>
<tr><th>Resource</th><th>Alternative 1</th><th>Alternative 2</th><th>Alternative 3</th><th>Alternative 4</th><th>Alternative 5</th></tr>
<tr><td>Scenery</td><td>No effect</td><td colspan="4">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.</td></tr>
<tr><td>BWCAW</td><td>No Effect</td><td colspan="4">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.</td></tr>
<tr><td>Roadless</td><td>No Effect</td><td colspan="4">None of the proposed permits contain acreage in Forest Plan inventoried roadless areas or RACR areas and would not affect their consideration as roadless areas.</td></tr>
<tr><td>Heritage</td><td>No effect</td><td colspan="4">There would be no direct impact. Heritage resources within and immediately adjacent to drill sites and temporary roads will be buffered to avoid impact.</td></tr>
</table>

Table 13 Comparison of effects by resource for Forest-wide analysis

<table>
<tr><th>Resource</th><th>Alternative 1</th><th>Alternative 2</th><th>Alternative 3</th><th>Alternative 4</th><th>Alternative 5</th></tr>
<tr><td>Soils</td><td>No effect</td><td colspan="4">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.</td></tr>
<tr><td>Hydrology</td><td>No effect</td><td colspan="4">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.</td></tr>
<tr><td>Vegetation</td><td>No effect</td><td colspan="4">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.</td></tr>
<tr><td>NNIS</td><td>No risk</td><td colspan="3">Alternative 2, 3, and 4 have a slightly higher risk of non-native invasive plant spread and negative impacts,</td><td>Alternative 5 has a lower risk of NNIP spread due to seasonal restriction.</td></tr>
<tr><td>Threatened Endangered and RFSS-Plants</td><td>No effect</td><td colspan="4">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</td></tr>
</table>

Resource	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
		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.			
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.			
Threatened and Endangered – Wildlife	No effect	Increased traffic volume on collector roads and increased temporary roads may affect and are likely to adversely affect Canada lynx. Habitat changes, including critical habitat, may affect but are not likely to adversely affect Canada lynx.			
Sensitive Species-Terrestrial Wildlife	No Effect	May impact individuals but not likely to cause a trend toward federal listing or loss of viability.			
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	Anticipated exploration and associated activities for projected minerals exploration Forest-wide would provide a minimum of 51 jobs (direct, indirect, and induced) and $22.7 million in labor income (direct, indirect, and induced) and a maximum of 201 jobs and $1010.8 million in labor income on an average annual basis within the analysis area.			
Recreation (impacts other than	No effect	minor impact to recreation	minor impact to	minor impact to	negative effects would be lower than

Resource	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
noise)		receptors	recreation receptors	recreation receptors	Alternatives 2-4 due to seasonal restriction to recreation receptors
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

Table 14 Comparison of alternatives by for 29 current permit applications

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Recreational Residences	No impact from project	Minnesota Rules reduce impact	reduces impact due to mitigation	Minnesota Rules reduce impact	Avoids most impacts since most use occurs in summer
Private Residences	No impact from project	Minnesota Rules reduce impact	reduces impact due to mitigation	Minnesota Rules reduce impact	Avoids impact to summer users.
Developed Campgrounds	No impact from project	Minnesota Rules reduce impact	Reduces impact due to mitigation	Minnesota Rules reduce impact	Avoids most impacts since most use occurs in summer
BWCAW	No impact from project	Largest negative impact of action alternatives	Minor impact due to mitigation	Minor impact due to requirement for L50 sound level to be 30 dBA/L10 of 35 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	May increase negative impacts above Alternative 3 since drilling

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
				BWCAW winter users.	would only occur in winter

Table 15 Comparison of alternatives by receptor for Forest-wide analysis

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Recreational Residences	No impact from project	Minnesota Rules reduce impact	reduces impact due to mitigation	Minnesota Rules reduce impact	Avoids most impacts since most use occurs in summer
Private Residences	No impact from project	Minnesota Rules reduce impact	reduces impact due to mitigation	Minnesota Rules reduce impact	Avoids impact to summer users.
Developed Campgrounds	No impact from project	Minnesota Rules reduce impact	Reduces impact due to mitigation	Minnesota Rules reduce impact	Avoids most impacts since most use occurs in summer
BWCAW	No impact from project	Largest negative impact of action alternatives	Minor impact due to mitigation	Minor impact due to requirement for L50 sound level to be 30 dBA/L10 of 35 dBA (and less further 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 BWCAW winter users..	May increase negative impacts above Alternative 3 since drilling would only occur in winter

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 for the issue 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 life and 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

3.1.1.1 Analysis Methods

There are several activities associated with this project that generate sound which may impact recreational experiences. These include drilling, helicopter use, fixed wing aircraft 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 more continuous nature of this sound (drilling occurs 24 hours a day, 7 days a week), which has been a focus of public concern on noise for this project. Also evaluated were sounds from helicopters, watercraft and support vehicles which tend to be intermittent and occur mostly during the day.

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

- Sound – (a) Oscillation in pressure, stress, particle displacement, particle velocity, etc., in a medium with internal forces (e. g. elastic or viscous), or the superposition of such propagated oscillations. (b) Auditory sensation evoked by the oscillation described above (ANSI S1.1-1994, 3.01).

- Noise – (a) Undesired sound. By extension, noise is any unwarranted disturbance within a useful frequency band, such as undesired electric waves in a transmission channel or device. (b) Erratic, intermittent, or statistically random oscillation (ANSI S1.1-1994, 3.25).

- A-Weighted Decibel (dBA) – The commonly used unit for measuring sound pressure levels (MPCA Guide to Noise Control in Minnesota, page 15). The A-weighted decibel scale is used since the 'A weighting' most closely approximates sounds heard by the human ear.

- Ambient sound. All-encompassing sound at a given place, usually a composite of sounds from many sources near and far *(ANSI S1.1-1994, 3.26).*
- background sound: all-encompassing sound associated with a given environment without contributions from the source or sources of interest (ANSI S12.9 Part 3, 5.3).
- Audible – 'capable of being heard; loud enough to be heard; actually heard.'
- L90 Level– The sound level that is exceeded 90% of the time (for a one hour measurement period).
- L50 Level – The sound level that is exceeded 50% of the time (also the median level; for a one hour measurement period).
- L10 Level – The sound level that is exceeded 10% of the time (for a one hour measurement period).

Mitigation Measures

Several mitigations for noise impacts are proposed in the action alternatives:

Alternative 2: No mitigation is included in the Proposed Action. Sound level at 20 feet from the drilling rig is assumed to be approximately 84 dBA without any noise abatement measures.

Alternative 3: The permittees would be required to reduce sound level to 70 dBA at 20 feet from the drill rig. 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 analysis area. The intent of the alternative is to reduce sound 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. Exact methods to achieve the required mitigation are not prescribed since this allows for flexibility during implementation. Monitoring would verify that the intent of the alternatives are met (see Chapter 4).

Alternative 4: See Table 16. The permittees would be required to meet the thresholds at the BWCAW boundary.

Table 16 Alternative 4 receptors, thresholds and rationale

Decibel (dBA) Threshold	Common Noise Sources	Receptor	Rationale and Comments
L50 sound level: 30 dBA L10 Sound level: 35 dBA	Secluded Woods	Wilderness MAs[6]	Wilderness areas consist of remote forests, or "secluded woods", and remote waterways. While the wilderness does not exist in isolation from motor noise, mitigation of noise impacts from exploratory drilling reduces impacts to 'opportunities for solitude' identified in the 1964 Wilderness Act. The Wilderness Act requires that the managing agency preserve wilderness character.

Source – MPCA A Guide to Noise Control in Minnesota October 2008 (pg 4).

Alternative 5: 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

[6] This includes the entire Boundary Waters Canoe Area Wilderness (BWCAW). Thresholds would be required to be met at the border of the BWCAW.

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, the sound level reduction requirements from Alternative 3 also apply to Alternative 5.

Minnesota Rules on Noise

The State of Minnesota regulates noise reaching certain receptors which apply under all Alternatives. These Rules are found in the state statutes at Section 7030 (MPCA 2008). The Noise Standards at Section 7030.040 say that they are "are consistent with speech, sleep, annoyance, and hearing conservation requirements for receivers within areas grouped according to land activities by the noise area classification (NAC) system established in part 7030.0050." Section 7030.0040 states that sound levels reaching Noise Area Classification-1 (NAC-1) receptors must have an L50 level of 60 dBA and an L10 of 65 dBA during the daytime, and an L50 level of 50 dBA and an L10 level of 55 dBA during the nighttime. *NAC-1 receptors of potential relevance in the analysis area include but are not limited to residences, resorts and group camps, and designated campsites and campgrounds*. Federally designated wilderness is not listed in the Noise Area Classification Tables.

Since it is not efficient to set up mitigation for the night and remove it during the day, the drilling operations run 24 hours a day and do not move until drilling is completed, it is very likely that any mitigation applied to achieve the night time limits would also be used during the day (Wirz 2012). Therefore, sound levels reaching these receptors from drilling noise during the day are assumed to be the same as during the night (a L50 limit of 50 dBA and L10 limit of 55 dBA, or less).

In addition, Minnesota Rules at Section 86B.321 limit motorboat sound to 82 dBA at a distance of 50 feet for boat manufactured after January 1, 1982, and Section 6100.5700 limits snowmobile sound to 78 dBA at a distance of 50 feet for snowmobiles manufactured after April 1, 1975.

Indicators

The effects of noise from the project on receptors may occur because of a change in the type of sound, sound level, duration, or area of effect. 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. Six indicators evaluating these factors are described below. Assumptions and limitations accompanying the use of each indicator are also described. Calculations used for evaluation of the indicators are contained in the project file.

Indicator 1: *Type of Sound*

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.

Assumptions and Limitations: It is recognized that soundscapes are variable, and not all types of sounds are present at a given moment. In addition, the difference between some sounds (e.g. from two different motors) may not be discernible. However, an overall look at activities in the analysis area will give a sense of what types of sounds are generally present.

Indicator 2: *Duration and Daily Scheduling of Sound*

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

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

Assumptions and Limitations: Duration and daily scheduling may be estimated, but will vary during implementation. A drill hole may take a few days to six weeks to complete, with an average of three weeks. The duration that noise may be audible will be variable due to ambient sound conditions even if the activity is continuous. For example, even though drilling would occur 24 hours a day, it may not be audible 24 hours a day due to wind conditions which sometimes render the sound inaudible for a receptor.

Indicator 3: ***Area of Audibility***
Sound from project activities may be audible even if the sound level is lower 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.

It is assumed that drilling noise may be audible up to the location that sound level emitted from a drill rig attenuates to a level that is 8 dBA below ambient A-weighted sound level. This is identified by the National Park Service at 64 FR 3969-3972 for noise emitted by aircraft that may affect Park visitors.

As discussed under Analysis Methods, Indicator 4, the 26 log D decay curve is used to estimate sound propagation from drill rigs in the forested environment in the analysis area. The 26 log D decay curve was used to estimate the distance from a drill rig that the sound level would be 8 dBA below the ambient level. These figures were input into a GIS to create the maps displaying area of audibility (see Figures 13, 15 and 17). The area of audibility of the drill rig sound assuming an L50 ambient sound level and an L90 ambient sound level are displayed. The area of audibility displayed assuming an L50 ambient sound level would be smaller than what is displayed for 50% of the time, and the L90 level for 90% of the time. The L90 level may be considered a plausible ‘upper bound’ of the area of audibility.

Assumptions and Limitations: There may be some variability when comparing sound propagation from aircraft engines as done by the Park Service versus a drill rig engine. In addition, it is recognized that a spectral analysis would provide more accurate results than applying the 8 dBA method. However, a spectral analysis is not considered necessary to estimate impacts in this project. Even if a spectral analysis was completed, those results would apply most directly only for the locations measured and environmental conditions present during those measurements such as temperature, wind speed and wind direction. The prospecting permits are located across thousands of acres, and factors including terrain, vegetation, and environmental conditions would be variable. Further, drill site locations may be identified or adjusted during implementation, affecting estimates based on a given location. Thus, a reasonable approach is to apply the 8 dBA method, and describe how factors that alter sound propagation may alter effects (the key factor identified by field monitoring being wind speed and direction).

Recognizing the variability in conditions that may produce longer or shorter distances that a drill rig may be audible, the 8 dBA method is considered adequate to estimate audible distance from drill rigs, and present differences between alternatives.

Indicator 4: Sound Level Measured in A-Weighted Decibels at Receptors

To estimate the sound level at receptor locations affected by drilling, a model was used to estimate sound level. The distance and area associated with benchmark dBA levels was then calculated using model results. 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 estimates the level 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. Table 17 below displays the dBA levels at various distances from a CS-4000 type drill rig[7]. While the CS-4000 rig is assumed for this analysis, equipment that emits higher or lower sound levels may be used during implementation[8]. Outputs of the 26 Log D decay curve were input into a GIS to create the maps displaying sound contours (see Figures 14, 16 and 18). While the sound contours from all of the drill sites are displayed, this calculation assumes that the drill sites are not in simultaneous operation. Methods to estimate simultaneous operation on sound levels is discussed below (see *Adding Sound Sources*). Effects of simultaneous operation are disclosed in the Direct, Indirect, and Cumulative Effects analysis.

Table 17 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 estimates sound levels at most receptors. Further, drilling locations may be identified or adjusted up to 500 feet during implementation that include or exclude a hilltop or barrier between a source and receptor, rendering such an analysis moot.

[7] The data for the 20 foot distance was taken from a CS 4000 Noise Survey conducted in 1997, and calculated for longer distances based on the 26 log D decay curve.
[8] It is more likely that drill rigs emitting lower sound levels would be used (Braslau 2011; Idea Drilling 2007)

For sound generated by watercraft, it is assumed that the watercraft engine is 82 dBA at 50 feet (MPCA 2008). 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 sound level. Methods for estimating sound levels created by multiple sources are discussed below. According to the 2008 Minnesota Pollution Control Agency's A Guide to Noise Control in Minnesota, (page 5), adding sources of sound of equal value increases the decibel level by 3 decibels as shown in Table 18.

Table 18 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 18. A more accurate way to calculate addition of decibels with differing levels is found in Table 19 (retrieved from www.acousticalsurfaces.com, November, 2007).

Table 19 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

Indicator 5: Level of Annoyance

In this analysis, 'level of annoyance' refers to effects outside the BWCAW. Noise impacts to receptors outside the wilderness are an important part of the issue described in the Wilderness Section of this EIS. In particular, private landowners, cabin users, and recreationists spending vacations on the Forest may be impacted by noise, and Indicator 5 evaluates this effect.

While Indicators 1-4 provide a comparison of the alternatives for the type, duration, timing, area and sound level, this does not by itself answer the question of if and how the sound is experienced by people as an annoying noise. Sound is experienced differently depending on the person and the expectations of that person. Thus, Indicator 5 has a qualitative component and may not capture the feelings or expectations of every person.

Five metrics are considered for annoyance produced by drill sound:

Recreation Setting

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. Further information on what a listener may expect, depending on the recreation setting, is presented in the Affected Environment section.

Scheduling

Scheduling is described under Indicator 2 and is evaluated for level of annoyance.

Distance from Drill Site

Dsitance is described under Indicators 3 and 4 and is evaluated for level of annoyance.

Sleep disturbance

For residences and campgrounds and campsites in the analysis area, noise exposure criteria that protect good sleeping conditions are considered. ANSI S12.2 recommends 30-35 dB(A) as recommended sound levels at the sleeper's ear.

Annoyance Dose-Response Curve

Miller (1999) estimated annoyance based from aircraft flights to visitors to national parks. No research on annoyance response to motor noise on the Superior National Forest or the BWCAW appears to exist, and the National Park Service suggests that this study could be considered (along with other indicators and the management context for this project) in providing an indication of impacts (National Park Service 2012). Figure 8 displays the percentage of people experiencing annoyance in several National Park locations depending on the difference between background ambient and the sound level of the aircraft. The 'Wahaula' curve is considered in this analysis since this is the median curve of the 5 displayed in a variety of settings. It is recognized that this data may not represent the population using the SNF and their response to drill noise to a very high degree of accuracy; thus it is one of several indicators considered.

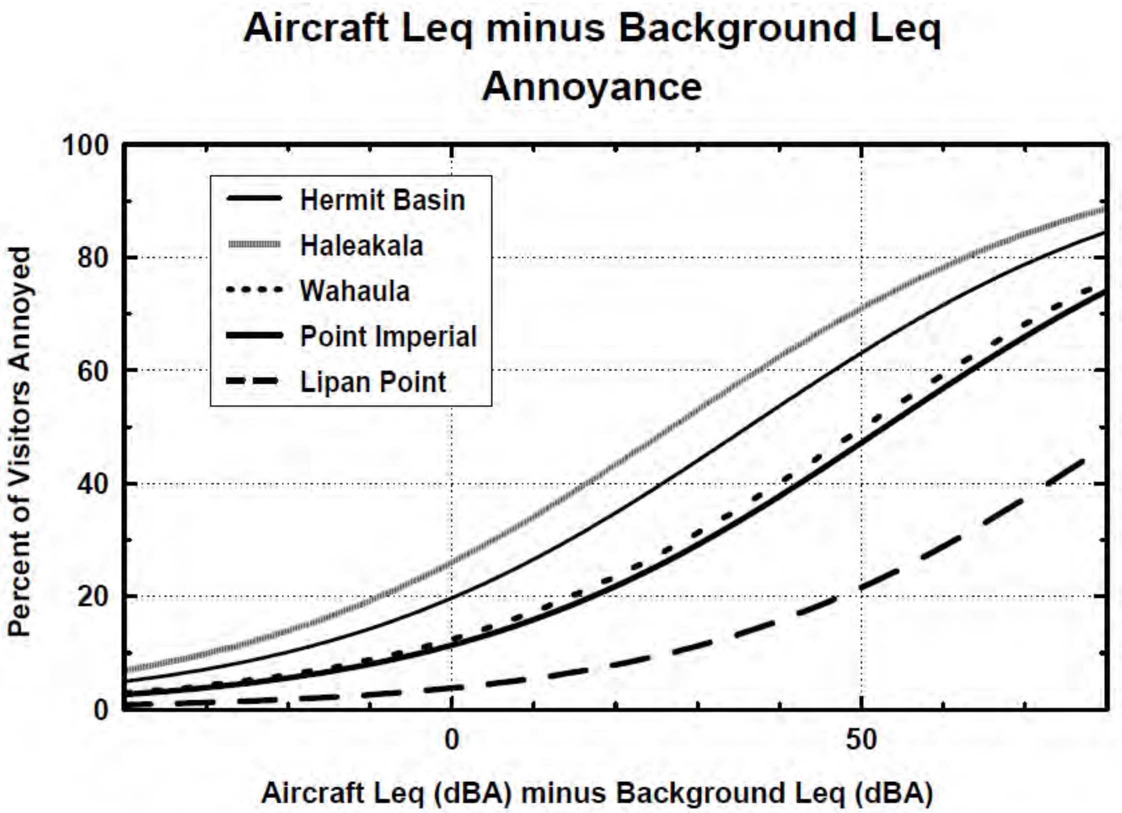


Figure 8 Dose Response Curve for Annoyance (Miller 1999)

Figure 9 provides descriptions of common noises at various sound levels which can help equate a sound level in A-weighted decibels to the resulting human experience.

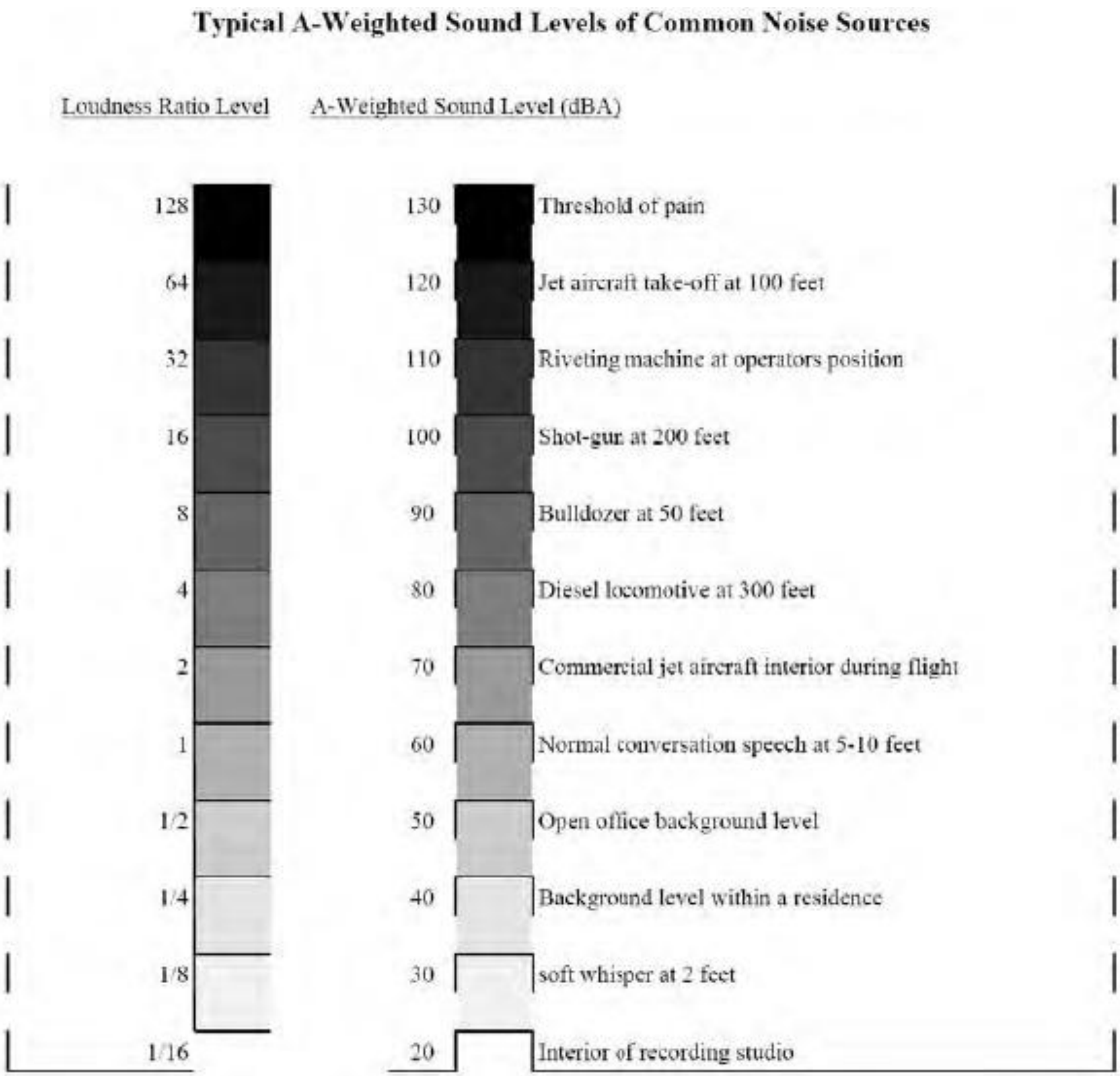


Figure 9 Sound levels of common sound sources (Braslau 2011).

Assumptions and Limitations: This analysis refers to levels of annoyance from higher to lower as ‘substantial’, ‘moderate’, ‘minor’, or nonexistent. There is no single variable that can allow for a conclusion. However, the greater the degree of effect displayed in Indicators 1-4, along with higher expectations for a quiet environment according to MA and ROS class, leads towards estimating a higher level of annoyance for a receptor. It is recognized that different people may have different viewpoints than the Forest Service on the level of impact a noise has on a receptor.

Indicator 6: Level of Effects to Opportunities for Solitude
Indicator 6 is evaluated using methods described under Indicators 1-5. An exception for the dose-response curve is to use the 'interference with natural quiet' metric displayed in Miller (1999) instead of annoyance. Interference with natural quiet is considered more directly applicable for the wilderness setting. This curve (Figure 10) indicates greater sensitivity than that for annoyance, which matches the expectations and setting of the wilderness. The 'Wahaula' curve is considered in this analysis since this is the median curve of the 5 displayed in a variety of settings.

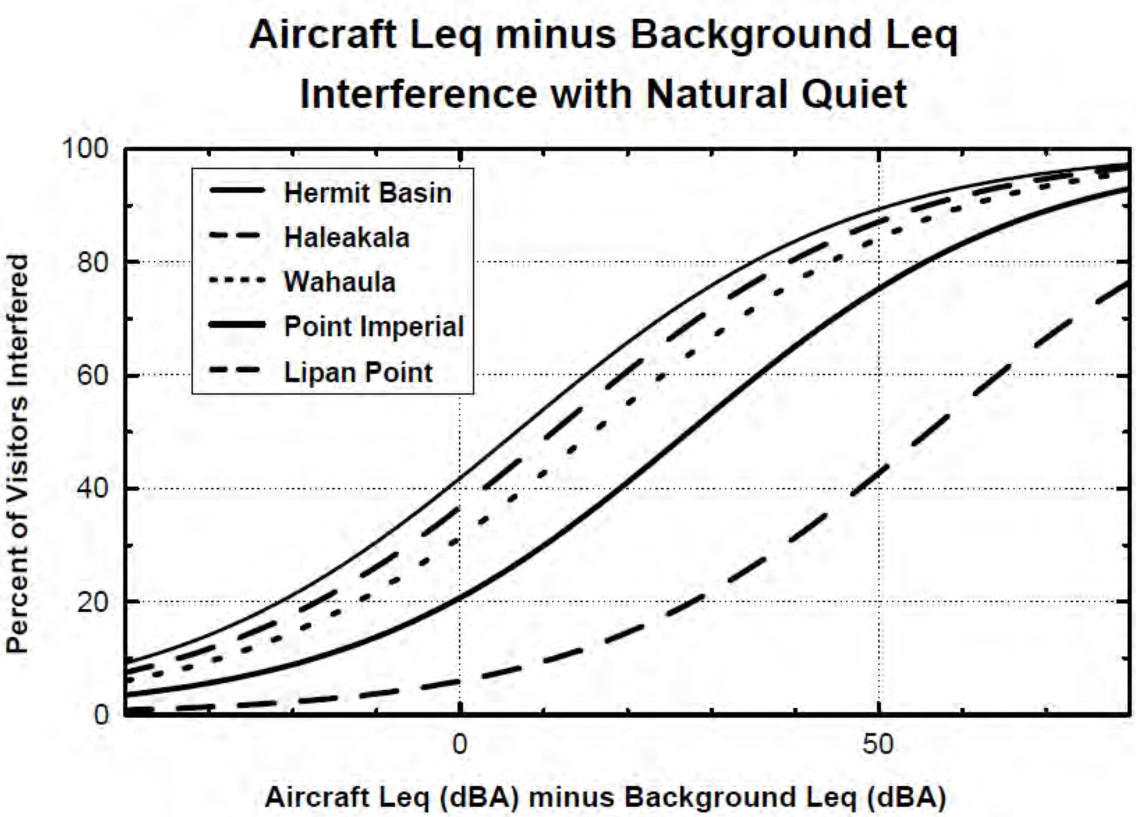


Figure 10 Dose Response Curve for Interference with Natural Quiet (Miller 1999)

Indicator 6 is also evaluated differently than Indicator 5 since effects to opportunity for solitude differ from noise impacts outside the wilderness in several ways. In general, the BWCAW is considered a more sensitive receptor to noise due to the wilderness designation. In addition, the wilderness itself is considered a resource that may be impacted (in addition to visitors who may be present to hear the noise). This is because the Wilderness Act identifies this quality of wilderness character as an *opportunity* for solitude. The Forest Plan Wilderness Management Areas provide context on how opportunities for solitude vary depending on which Management Area of the Wilderness may be impacted. In addition, the existing soundscape which includes natural and human-made sounds is considered when evaluating the impact of a project proposal. See the Wilderness Section of the EIS for further discussion on Wilderness Management Areas and opportunity for solitude.

Assumptions and Limitations: While the Forest Service may estimate impacts to opportunities for solitude, this is a qualitative attribute and different people may have different viewpoints on how large an impact to wilderness character a given activity may have.

SPreAD-GIS Analysis

An alternative analysis using the SPreaAD-GIS model for the area of audibility, and sound levels affecting receptors (Indicators 3-4), was conducted. 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.

Analysis Parameters (area and timeframe of impacts)

Current Prospecting Permits
The analysis area for direct, indirect and cumulative effects for the 32 prospecting permit applications (this analysis includes 32 permit applications; only 29 of these 32 applications are included in the Proposed Action in the FEIS; see Section 1.4) includes the area on all ownerships within 3.4 miles of the prospecting permit areas since this covers the area where sound from activities in the prospecting permit areas may potentially be heard. 3.4 miles is assumed to be an upper bound to audible distance; (18,240 feet; see Table 21). 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 3.4 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.

The analysis timeframe for each prospecting permit is six years (although these six years are not necessarily consecutive). Activities from operating plans associated with a given permit would be complete within this timeframe and sound does not last beyond the time that activities occur.

Future Prospecting Permits
The analysis area for direct, indirect and cumulative effects for the future prospecting permits includes the area on all ownerships within 3.4 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 (3.4 miles is assumed to be an upper bound to audible distance; see Analysis Methods). See Map 3 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 3.4 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 analysis 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. Dispersed recreation activities occur on most lakes, roads, and trails. Popular dispersed recreation activities in the analysis area include fishing, camping, boating, hunting, scenic driving, hiking, canoeing, berry picking, all-terrain vehicle use, skiing, dog sledding, and snowmobiling.

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

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

Current Prospecting Permit Applications and Operating Plans

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. See Map 7 displaying management areas. See Chapter 3 of the Forest Plan for a description of MAs.

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. See Map 7 displaying ROS classes. See Forest Plan for a description of ROS classes and their recreational setting.

Future Prospecting Permit Applications

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.

3.1.2.2 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 recreation residences).

Current Prospecting Permit Applications and Operating Plans

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

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

There are numerous 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 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).

3.1.2.3 Existing Soundscape

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 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. Approximately 1,960 core holes have been drilled to date in the basal zones of the complex within the Superior National Forest (Wirz 2012). 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 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 6 for possible future drilling areas on existing leases.

Sound level would fluctuate based on time and location and could be higher or lower if factors such as wind speed changes, wave action on lakes is present or human made sound enters the area. The most important factor affecting ambient sound level in the project area is wind, and there is a strong relationship between wind speeds and ambient sound level (Sipson 1978, SNF Monitoring Crew personal communication). Since higher winds tend to be present more during the day than during the night, median sound levels tend to be lower at night than day. Sound levels tend to be higher in the summer than in the winter primarily due to the sound generated by wind hitting foliage (Sipson 1978).

Data displaying wind speeds during the summer and winter in the project area (Ely, MN) is displayed in Appendix B. As shown from this data, calm conditions may be present about 2% of the time or less during the day, and 14 to 22% of the night. Conditions with high winds that generate high ambient sound levels (7.2 meters/second or 16 miles per hour/mph or more) occur less than 10% of the time (Sipson 1978 pp. 14-15). High winds are more prevalent during the day than the night.

During calm wind conditions, ambient sound levels are generally lower. Sound introduced by drilling may be audible for a greater distance under these conditions than when wind speeds are greater and ambient sound levels are higher.

Ambient Sound Levels

Several data sources were considered to estimate ambient sound levels in the project area. 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).

An extensive monitoring effort for ambient sound levels in Northeastern Minnesota, including in the analysis area, was made as a part of the Minnesota Environmental Quality Board Regional Copper-Nickel Study (Sipson 1978). While this study is more than 30 years old, ambient sound levels monitored at that time would be considered a conservative estimate since additional development has occurred since, which would likely increase ambient sound levels in some locations. The Sipson study summarized findings on ambient sound levels as follows:

> The major results of the study were to show that the region is quiet compared with most residential areas and that a major portion of the region is, at present, very lightly impacted by man-made sounds at any level. Measurements were made in a variety of vegetation types, including jackpine, birch, aspen, black spruce, and red pine stands, as well as in clearcuts. *The results indicate that L50 values in the region range from 24 to 32 dBA in the winter and from 25 to 36 dBA in the summer. Correspondingly, winter L90 values are 15 to 19 dBA and summer L90 values are 14 to 25 dBA.* Values for L10 range from 31 to 45 dBA in the winter, up to 32 to 52 dBA in the summer. As expected, the dominant source of natural sound in the area is the result of wind interaction with vegetation, explaining the fact that sound levels are higher under the full foliage conditions of summer than during the winter. The relative quiet in the region makes it particularly sensitive to new sound sources. *(emphasis added)*

The SNF has also conducted monitoring with a Larson-Davis 831 meter in representative areas of the analysis area (including the BWCAW and the Birch Lake/Kawishiwi River area). See Appendix B for results. The SNF monitoring results tended to show higher sound levels than that of the Copper-Nickel study, which may be due to an increase in human-caused sounds between 1978 and 2010-2011, or the more limited sample size of the SNF data. The SNF monitoring generally indicated lower sound levels at night than in the day, and higher sound levels in developed areas such as campgrounds than in less developed areas such as the BWCAW.

Taking these available data into account and giving greatest weight to the Copper-Nickel Study, it is conservatively assumed that the median (L50) ambient sound level in the analysis area is 34 dBA during the day and 25 dBA at night. The L90 ambient sound level is assumed to be 15 dBA at night. It is recognized that L50 and L90 ambient sound levels are in reality likely higher than these assumptions. Therefore, impacts disclosed in this EIS are likely greater than what may occur from implementing the alternatives and represent a conservative estimate.

3.1.3 Direct and Indirect Effects of Current Prospecting Permit Applications

The 32 current prospecting permit applications include the operating plans discussed in Section 3.1.6 (32 are analyzed, although the Proposed Action for the FEIS includes only 29 of these 32 applications; see FEIS Section 1.5). Additional operating plans may be submitted in these 32 permit application areas and this EIS discloses impacts of all operating plan activities in the permit application areas. Potential receptors are displayed in Figure 12 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.

3.1.3.1 Alternative 1

Under this alternative, none of the 32 prospecting permit applications 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 20 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 20 Sound level 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 11 displays sound levels as a helicopter increases in elevation and distance from a receptor.

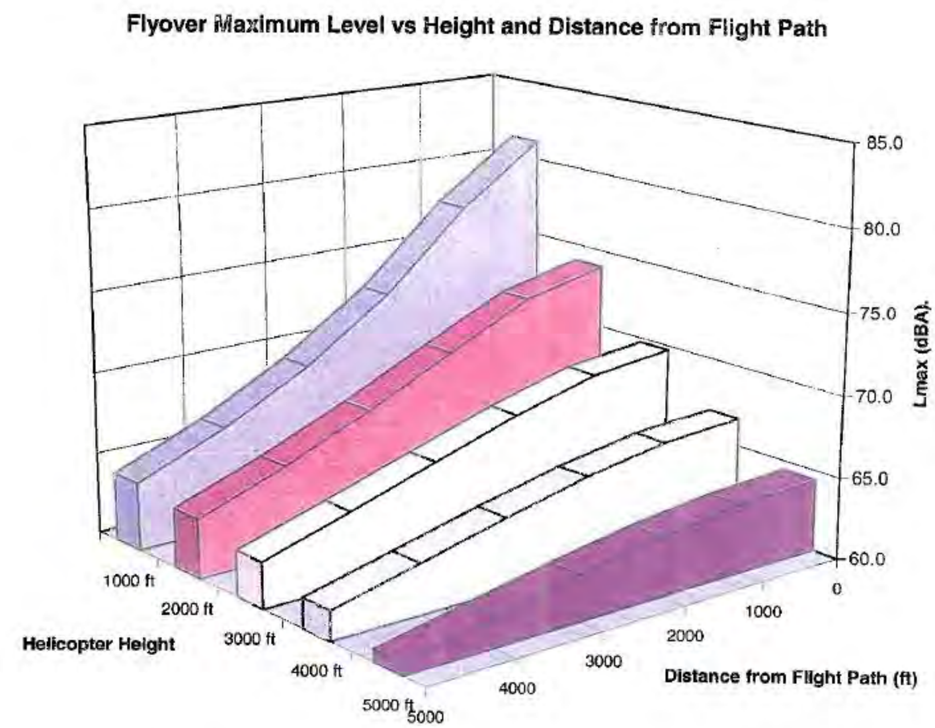


Figure 11 Helicopter sound attenuation with elevation and distance (Braslau 2007)

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. Impacts would be minimized per Stipulation RV-4 (see Section 2.4.3).

Impacts to Designated Campgrounds and Campsites, Residences and Resorts

Minnesota Rules on Noise would apply under all alternatives for these receptors and others displayed in Minnesota Rules 7030.0050. See Section 3.1.1.1 for a description of the sound level limits in Minnesota Rules that would apply for drilling noise reaching these receptors. Impacts to these receptors are discussed further in Sections 3.1.3.3, 3.1.5 and 3.1.7.

Indicator 1: Type of Sound

As displayed on Map 6, 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 2-4 (see Analysis Methods for Indicator descriptions)

Potential receptors are displayed below in Figure 12. 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 21. 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 21 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			
Daily Scheduling 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 for L50 ambient (Indicator 3)	0 acres	4164 acres	349 acres	Depends on Location [a]	349 acres
	0 feet	7600 feet	2200 feet	Depends on Location	2200 feet
Area/Distance of Audibility for L90 ambient (Indicator 3)	0 acres	23,982 acres	1,994 acres	Depends on Location	1,994 acres
	0 feet	18240 feet	5260 feet	Depends on Location	5260 feet
Area/Distance of Sound Louder than nighttime residential L50 standard [b] (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 L50 daytime 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 L50 nighttime 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
Area/Distance of Sound Louder than L90 nighttime ambient (15 to 25 dBA) (Indicator 4)	0 acres	4707 acres	395 acres	Depends on Location	395 acres
	0 feet	3811 to 8934 feet	1074 to 2576 feet	Depends on Location	1074 to 2576 feet
Sound Level in BWCAW (Indicator 4)	0 dBA	Less than 84 dBA to inaudible, depending on location [c]	Less than 70 dBA to inaudible, depending on location [c]	L50 level of 30 dBA to inaudible, depending on location	Less than 70 dBA to inaudible, depending on location [c]

a - Effects per drill site depend on location for Alternative 4 because mitigation would need to be implemented depending on whether a receptor close enough to the receptors to exceed limits specified in Table 16. See Figure 17 for an example of mitigated and unmitigated drill sites depending on location for Alternative 4.
b – Sound levels must comply with Minnesota Rules at designated campgrounds and campsites, and residences and resorts, and other relevant receptors in the Noise Area Classification Tables shown in Minnesota Rules on Noise.
c – Sound levels would attenuate to less than the these values inside the BWCAW since drilling is not allowed inside the BWCAW

Alternative 4 would require mitigation when drilling is close enough to the receptors (in this case, the border of the BWCAW) to exceed limits specified in Table 16. If receptors are distant enough to comply with these limits, mitigation would not be required. Therefore, the area of audibility and sound level would depend on the mitigation measures selected at each drill site to comply with the limits. Impacts would be similar to Alternative 3 in cases where a drill site is within about 500 feet of campsites, residences and othe NAC-1 receptors covered by Minnesota Rules and within about 2500 feet of the BWCAW. These distances would trigger the need for mitigation if the drill rig emits sound levels at 84 dBA 20 feet from the rig as assumed in this analysis. Impacts would be similar to Alternative 2 when further away and mitigation is not required.

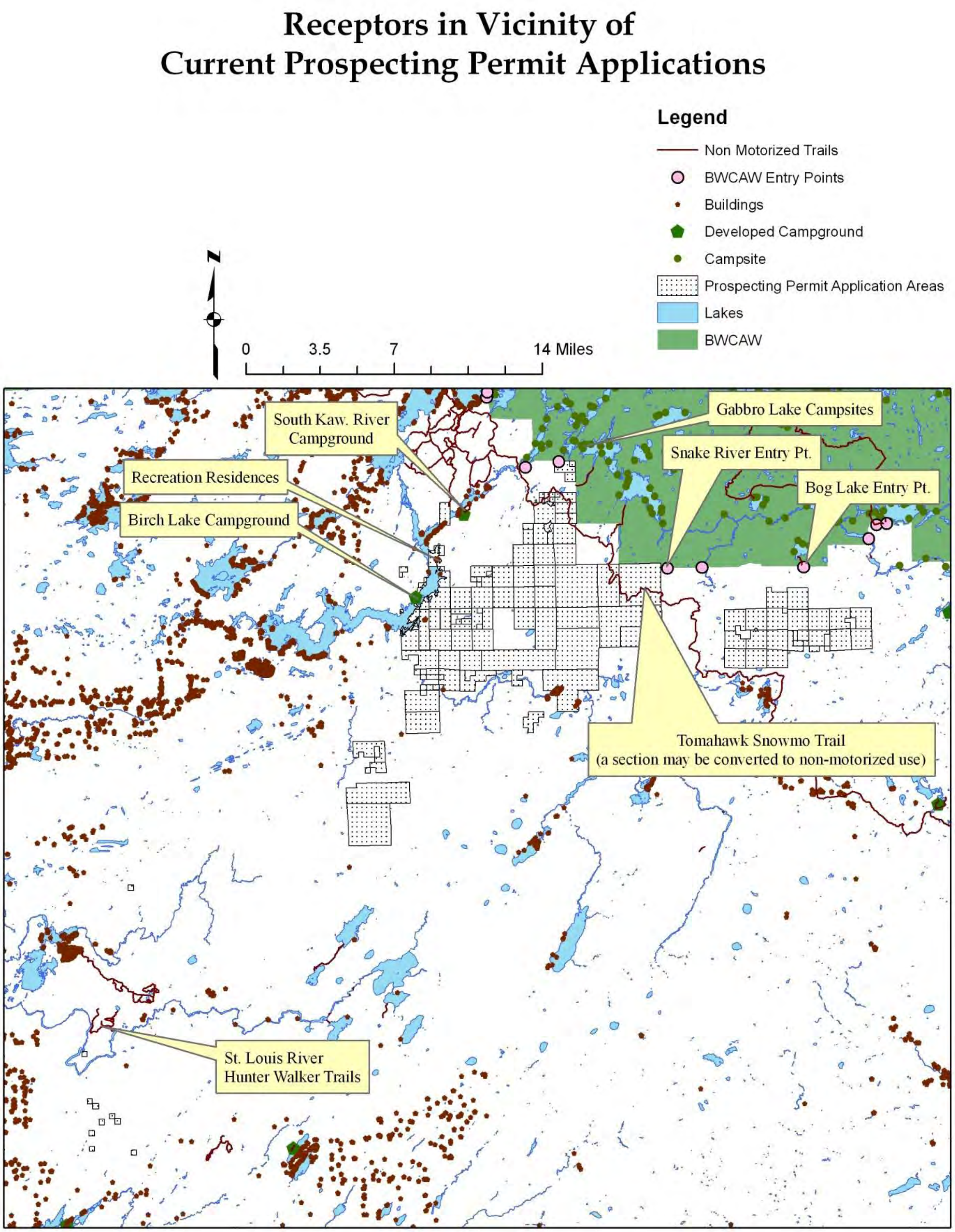


Figure 12 Receptors in range of current prospecting permit applications

Indicator 5: Annoyance

All Action Alternatives

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 continuous 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).

Scheduling of Activity
Drilling activities are temporary, which limits the scope of impacts. Receptors may experience annoyance during drilling activities (an average of 3 weeks per drill site).

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. However, it could increase impacts for winter residents and visitors.

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 21 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.

- 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, there would be a substantial level of annoyance. It is unlikely that receptors would linger this close to a drill site, so this level of effect is unlikely to occur. Campgrounds, campsites, residences and resorts would not likely experience sound levels above 50 dBA due to the application of Minnesota Rules on noise since mitigation to achieve night time sound level requirements would likely also be used during the day.
- 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 sound 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 experience minor annoyance from audible sound during the day. Moderate annoyance may be present on calm nights and in the winter in more remote settings.
- Below 25 dBA, fewer people would perceive the sound and for most people, and there would be minor or no effect. Minor effects may be present in the range of 15-25 dBA, but only on an occasional basis when wind speed is low or calm (10% of the time drilling is in operation based on L90 ambient levels).
- Receptors located outside of the area of audibility would not be affected.

Dose-Response for Annoyance

Figure 8 displays dose-response for percentage of people annoyed depending on the difference between introduced sound levels and ambient sound level. During the daytime when ambient sound levels are higher, up to 20% of individuals may be annoyed (16 dBA difference between up to 50 dBA reaching receptors and a L50 ambient level of 34 dBA). If drilling sound at 50 dBA reaches receptors at night when it is assumed that nighttime L50 ambient is 25 dBA, up to 30% of individuals may be annoyed.

Sleep Disturbance

Buildings would provide sound attenuation to further reduce sound levels so that the sound level inside would be lower than an L50 level of 50 dBA. The amount of attenuation would depend on the building construction but for houses could be approximately 27 dBA with windows closed, and 17 dBA with windows open (USEPA 'Levels Document', Table B-4).Thus, if drilling noise resulted in sound levels of 50 dBA at the outside of the residence, the sound level inside residences and other buildings could be about 33 dBA in the summer with windows open, and 23 dBA with windows closed. These sound levels are at or below sound levels cited by ANSI S12.2 as being conducive for sleeping (30-35 dBA).

Sound levels reaching designated campgrounds and campsites outside the BWCAW may have some sleep disturbance for tent campers since a building would not provide sound attenuation and sound levels could be up to 50 dBA.

Indicator 6: 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).

Scheduling
Drilling activities are temporary, which limits the scope of impacts. Opportunity for solitude may be impacted during drilling activities (an average of 3 weeks per drill site), and this impact would end when drilling stops.

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 but may increase impacts somewhat for winter visitors.

Distance from Drill Site

People usually stay on portages, lakes and campsites. Drilling sound may also impact opportunity for solitude in other areas of the wilderness away from campsites and travel routes, although few people are present in other areas.

Alternatives 2, 3 and 5

- If receptors 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 and small area, the impact would not be substantial.
- Receptors hearing 34 to 50 dBA would be likely to hear sound above ambient levels. This sound level would occur continuously and thus may have a moderate impact to solitude.
- Receptors receiving between 25 and 34 dBA may hear an audible drill sound during the day during low wind speed conditions. 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. This may occur on an occasional basis when wind speeds are low or calm (e.g. 10% of the time drilling is in operation as shown in L90 Audibility Area in Table 21).
- 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 a L50 limit 30 dBA or less. This would be below L50 daytime ambient sound level of 34 dBA in the wilderness. The sound may be more noticeable for some people at night when the L50 ambient sound level is assumed to be 25 dBA. 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 attenuation with distance. Sound produced by drill sites near the wilderness would be audible in the wilderness for a greater distance during low wind speed conditions (i.e. 10% of the time as analyzed for L90 ambient sound level conditions). There would be minor impacts to opportunity for solitude from drill sound in the wilderness due to the required mitigation.

Sleep Disturbance

Alternative 2, 3 and 5

Campers in the BWCAW might experience sleep disturbance if drill rigs are located close enough to campsites to produce a sound level of 35 dBA or more at the campsite (see Table 21). This is unlikely under Alternatives 3 and 5 since a drill site outside the BWCAW is very unlikely to be within 480 feet of a BWCAW campsite (campsites are further in the BWCAW).

Alternative 4

A L50 level of 30 dBA and an L90 level of 35 dBA is required at the wilderness boundary. This would meet the recommendations for sleeping conditions in ANSI S12.2. These recommendations would very likely be exceeded (even lower sound levels) where sleepers are located in the BWCAW since they would likely camp inside the BWCAW instead at the boundary, which would provide additional sound attenuation with distance, topography, etc.

Dose-Response for Interference with Natural Quiet

Figure 10 displays that some people consider their experience of natural quiet impacted even when the introduced sound level is below that of the ambient level and is still audible (values less than zero on the X axis). This result is reasonable when it is considered that people generally have higher expectations for natural quiet in the BWCAW than elsewhere on the Forest.

Alternatives 2, 3 and 5

Impacts would depend on the sound level reaching receptors in the BWCAW. Alternative 2 would produce the greatest interference due to a lack of required mitigation to reduce sound levels. It is likely that Alternatives 3 and 5 would have impacts similar to Alternative 4 since mitigation to reduce sound levels under Alternatives 3 and 5 may result in similar sound levels reaching the wilderness. Under Alternative 5, potential interference is avoided in the winter.

Alternative 4

Figure 10 displays dose-response for percentage of people interfered depending on the difference between introduced sound levels and ambient sound level. During the daytime when ambient sound levels are higher, up to 25% of individuals may be interfered (-4 dBA difference between up to 30 dBA reaching receptors and a L50 ambient level of 34 dBA). If drilling sound at 30 dBA reaches receptors at night when it is assumed that nighttime L50 ambient is 25 dBA, up to 35% of individuals may be interfered. The percent interfered would be lower in areas further into the wilderness beyond the boundary due to sound attenuation with distance, vegetation, and topography.

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 level of sound. Since changes in sound level of 5 dBA or more is generally noticeable (MPCA 2008), drilling from other projects is unlikely to result in a substantial change in cumulative sound level.

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 6. 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 FEIS.

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 up to 3 to 4 dBA to total level of sound if timber harvest and drilling occur in close proximity, which would be a minor difference. Cumulative additions in duration of sound are unlikely since sound from timber harvest activities is intermittent instead of continuous in nature like that of drilling.

The proposed Polymet Northmet mine is located about 2.3 miles from the nearest permit application. It is possible that mine operations could coincide in time with drilling activities on some of these permit applications. Due to sound attenuation with distance, vegetation and topography, there would be less than 3 dBA or most likely no cumulative increase in sound level where the impacted areas overlap (see Table 19, see also Polymet Draft EIS page 4.7-13 in project file which estimates little impact for a receptor 2 miles away). Cumulative additions in duration of motorized sound are unlikely since the Polymet mine could operate for 20 years and the drilling could be for a few weeks on an occasional basis inside that timeframe.

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

Considering the context provided by Forest Plan Management Areas and Recreation Opportunity Spectrum, the existing soundscape, the sound levels introduced by project activities, the temporary nature of project activities, Minnesota Rules on Noise and mitigations proposed in the Alternatives, and the potential for sleep disturbance, annoyance, and interference with natural quiet, the following overall conclusions are made:

- There could be minor to moderate impacts in areas outside the wilderness. Moderate impacts would be more likely under Alternatives 2 and 4 for people located outside buildings, particularly for tent campers located near drill sites. Alternatives 3 and 5 would usually cause minor impacts, although moderate impacts may still occur for receptors very close to a drill site.

- There could be minor impacts to opportunities for solitude for Alternatives 3, 4 and 5 due to mitigations that reduce sound levels reaching the wilderness. There could be minor to moderate impacts to opportunities for solitude for Alternative 2.

3.1.6 Direct and Indirect Effects for Current Operating Plans

3.1.6.1 Alternative 1

Under this alternative, no 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 20 displays estimated dBA levels with increasing distance across open water from an engine that generates 82 dBA at 50 feet.[9] Overall, impacts to receptors on Birch Lake would be minor due to the common presence of motorboats.

[9] 82 dBA at 50 feet is identified as a limit for sound generated by motorized watercraft built after January 1, 1982 (MPCA 1999).

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 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

Indicator 2: Duration and Daily Scheduling 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. Although drilling would occur 24 hours a day, drilling noise would be less noticeable or inaudible during periods of higher winds, limiting the effective duration of impact to less than 24 hours a day. However, higher winds (i.e. 16 mph or more) tend to occur less than 10% of the time, limiting this change.

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

Only a portion of drill sites could be active at any one time (up to about 10); therefore only a portion of the acreage identified in Figure 13 would contain audible drilling sound at a given time (up to 41,640 acres for L50 ambient and 239,820 acres for L90 ambient).

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 (L50 area of audibility). A larger area including more of Gabbro and other lakes could be impacted by audible sound occasionally (10% of the time drilling is in operation) as displayed in the L90 area of audibility. This would likely be during calm or low wind speeds.

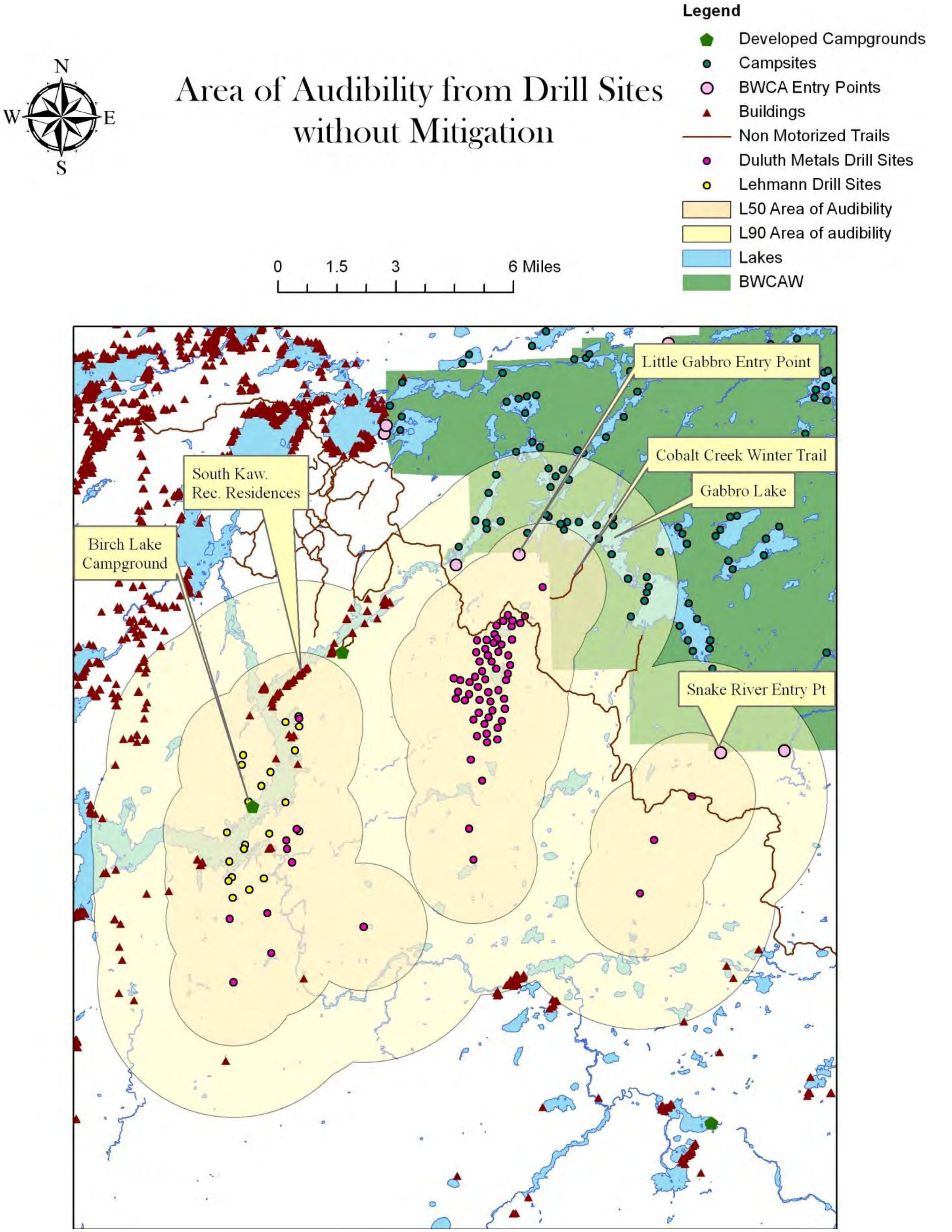


Figure 13 Area of audibility for operating plans under Alternative 2

Indicator 4: Sound Level in A-Weighted Decibels at Receptors

The area where sound above L50 ambient daytime levels may be heard is displayed on Figure 14 at the 34 dBA contour line. The area where sound above L50 ambient nighttime levels may be heard is displayed on Figure 14 at the 25 dBA contour line. The area where sound above L90 ambient nighttime levels may be heard is displayed on Figure 14 at the 15 dBA contour line. Only a portion of drill sites would be active at any one time (up to 10 drill rigs) therefore up to about 8,430 acres would contain drilling sound above L50 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 up to 3-4 dBA to the sound level. Table 21 displays impacts per drill site under Alternative 2.

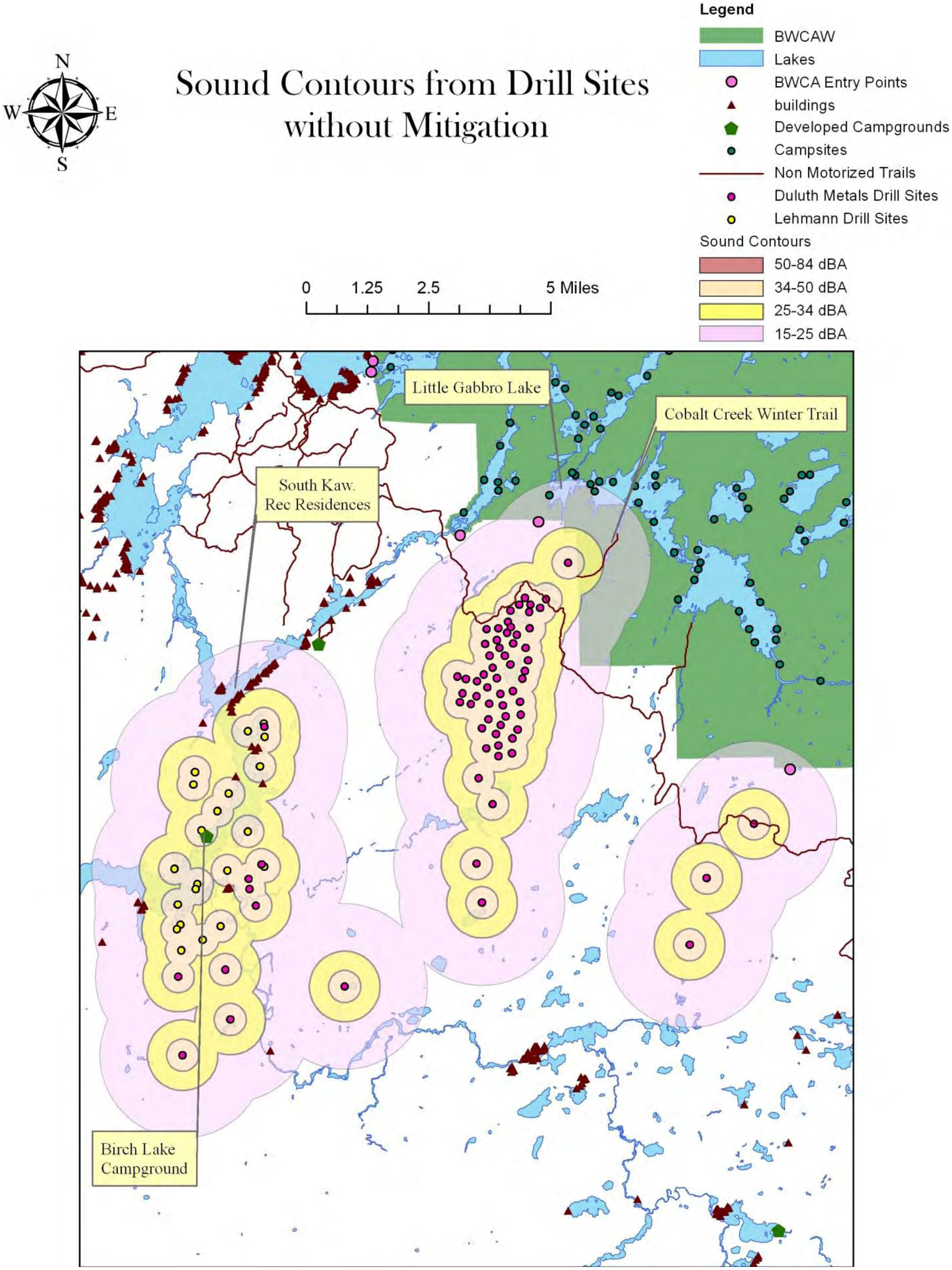


Figure 14 Sound contours for operating plans under Alternative 2

As displayed in Figure 14, 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. Sound levels from 34 to 50 dBA 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 approximate distances from a drill rig for several sound level benchmarks.

Additional receptors that could be exposed to sound levels from 25 to 34 dBA include several South Kawishiwi Cabin Group residences and the Cobalt Creek Winter Trail in the BWCAW. A few campsites on Little Gabbro and Gabbro Lakes may experience sound levels about L90 ambient (15 to 25 dBA).

Indicator 5: Level of Annoyance

In the vicinity of the operating plans, the receptor that is most likely to experience 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. 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 L50 level (25-34 dBA). This is below Minnesota Rules for sound reaching nighttime residences (50 dBA). Sleep disturbance would not occur inside buildings since sound levels would be below 35 dBA inside the buildings (see discussion on sleep disturbance in Section 3.1.3). People camping in tents at Birch Lake Campground may experience sleep disturbance since sound levels could be between 35 and 50 dBA (see Figure 14).

Overall, given the location of the operating plan drill sites, drilling sound would to result minor or no annoyance to receptors and be small in scope. The exception is camping areas and recreation residences located immediately adjacent to drilling sites around Birch Lake which could experience moderate annoyance.

Indicator 6: Level of effects to Opportunities for Solitude

Sound reaching the Cobalt Creek Winter Trail would be below daytime L50 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 14). Thus, there would be minor effects to opportunity for solitude of recreationalists on this trail from sound below daytime ambient levels. In addition, a portion of 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 (i.e. L90 ambient area of audibility shown in Figure 13). Some recreationalists may still find that audible motorized sound impacts the wilderness experience (see Figure 10). Most of this impact would occur for about three weeks during one year from the drill site closest to the wilderness shown in Figure 13. Sleep disturbance is unlikely since sound levels would be below 35 dBA inside the wilderness where campsites are located.

3.1.6.4 Alternative 3-Noise Reduction for Entire Project Area

Indicator 2: Duration and Daily Scheduling of Sound

The duration and daily scheduling 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. Up to 10 drill sites could be active at any one time; therefore about 3,490 acres would contain audible drilling sound at a given time under L50 ambient conditions. Drilling sound would be audible to receptors at a small portion of 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 some of Birch Lake (Figure 15). The area of audibility would expand to additional South Kawisihwi residences under L90 ambient conditions.

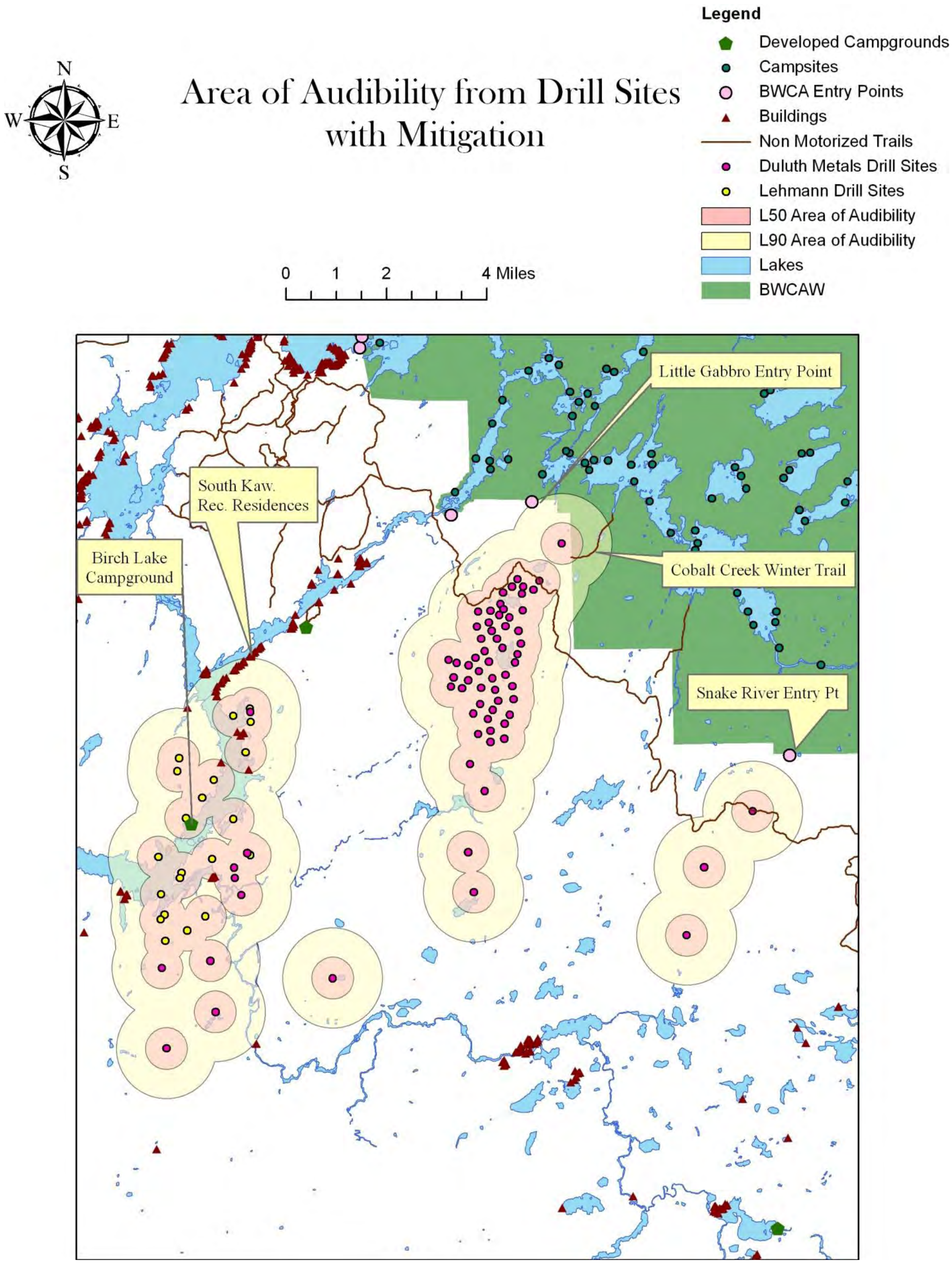


Figure 15 Area of audibility for operating plans under Alternatives 3 and 5

Indicator 4: Sound Levels in A-Weighted Decibels at Receptors

The area where sound above L50 ambient daytime levels may be heard is displayed on Figure 16 at the 34 dBA contour line. The area where sound aboveL50 ambient nighttime levels may be heard is displayed on Figure 16 at the 25 dBA contour line. The area where sound above L90 ambient nighttime levels may be heard is displayed on Figure 16 at the 15 dBA contour line. Up to 10 drill sites could be active at any one time; therefore about 660 acres would contain drilling sound above L50 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).

Table 21 displays the acreage per drill site impacted under Alternative 3. The area affected by operating plans, and the area drill site are smaller in Alternative 3 than Alternative 2 due to sound mitigation.

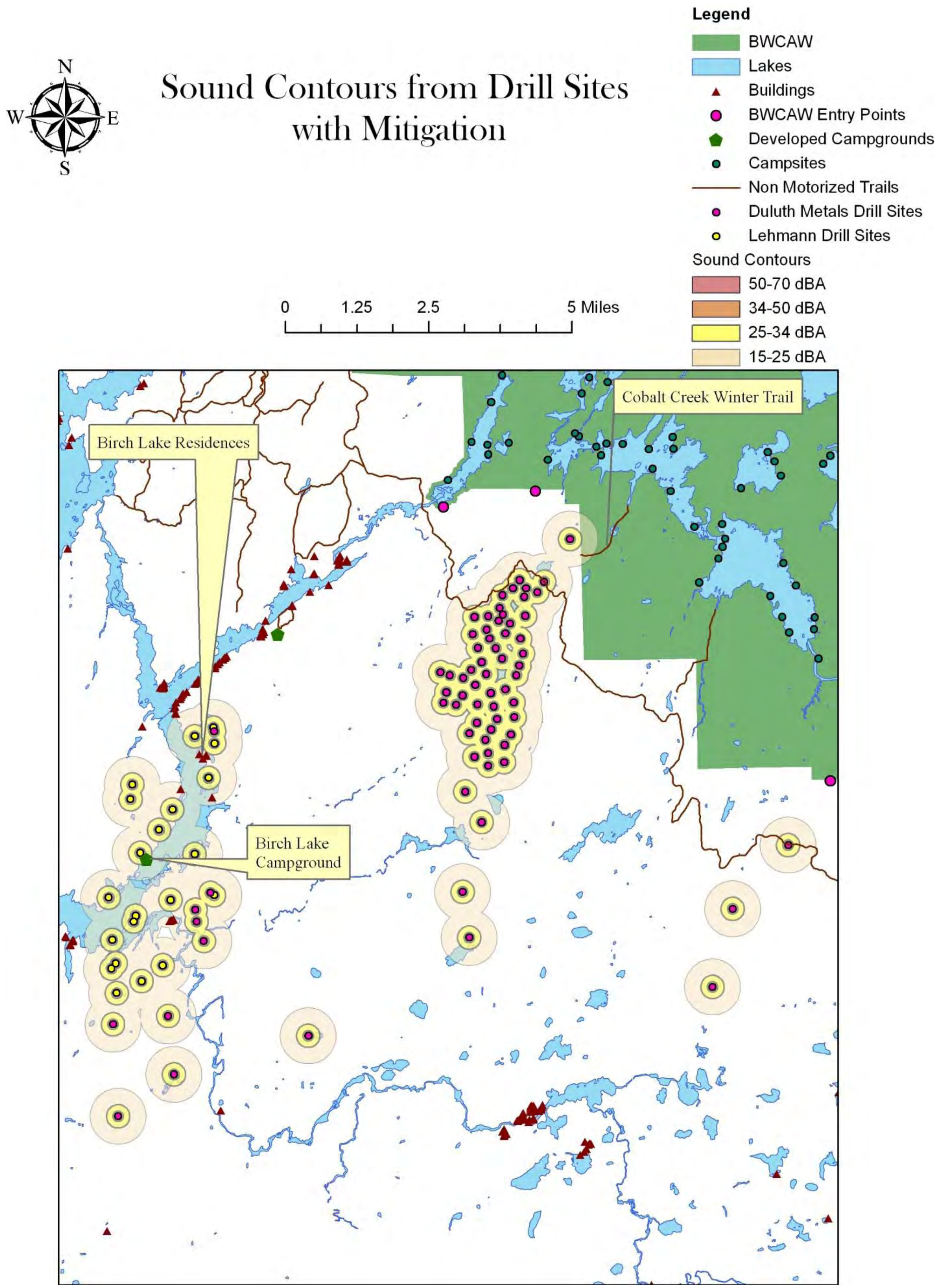


Figure 16 Sound contours for operating plans under Alternatives 3 and 5

As displayed in Figure 16, 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. Table 21 displays distances from a drill rig for several sound level benchmarks. The affected area and sound 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 L50 ambient level. In Alternative 3, the Cobalt Creek Winter Trail in the BWCAW would not experience sound above nighttime L50 ambient level.

Indicator 5: Level of Annoyance

This alternative does not include sound above nighttime L50 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 receptors with the exception of camping areas and recreation residences located immediately adjacent to drilling sites around Birch Lake. These receptors may experience minor to moderate annoyance when recreating outside buildings. Sleep disturbance would not occur inside buildings since sound levels would be below 35 dBA (see discussion on sleep disturbance in Section 3.1.3), and most tent campers would not experience sleep disturbance either (Birch Lake Campground is located in the 25-34 dBA sound contour on Figure 16).

Indicator 6: Level of effect to Opportunity for Solitude

This alternative does not include sound above nighttime L90 ambient levels reaching wilderness campsites. For some wilderness visitors, sound near the wilderness border may be audible and interfere with their sense of natural quiet (see Figure 10). Visitors would be unlikely to linger in these areas. Sleep disturbance would not occur since sound levels would be below 35 dBA inside the wilderness (see discussion on sleep disturbance in Section 3.1.3). There would be minor to no effects to opportunities for solitude.

3.1.6.5 Alternative 4-Noise Reduction for Recreational Experience

Indicator 2: Duration and Daily Scheduling of Sound

The duration and daily scheduling 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 16, additional mitigation beyond that required in Alternative 3 may in some cases be implemented. This would further reduce the area of audibility. An example of area of audibility is presented for the current operating plans in Figure 17. Drill sites near the BWCAW have a smaller area of audibility because these are mitigated to meet Alternative 4 noise mitigation requirements.

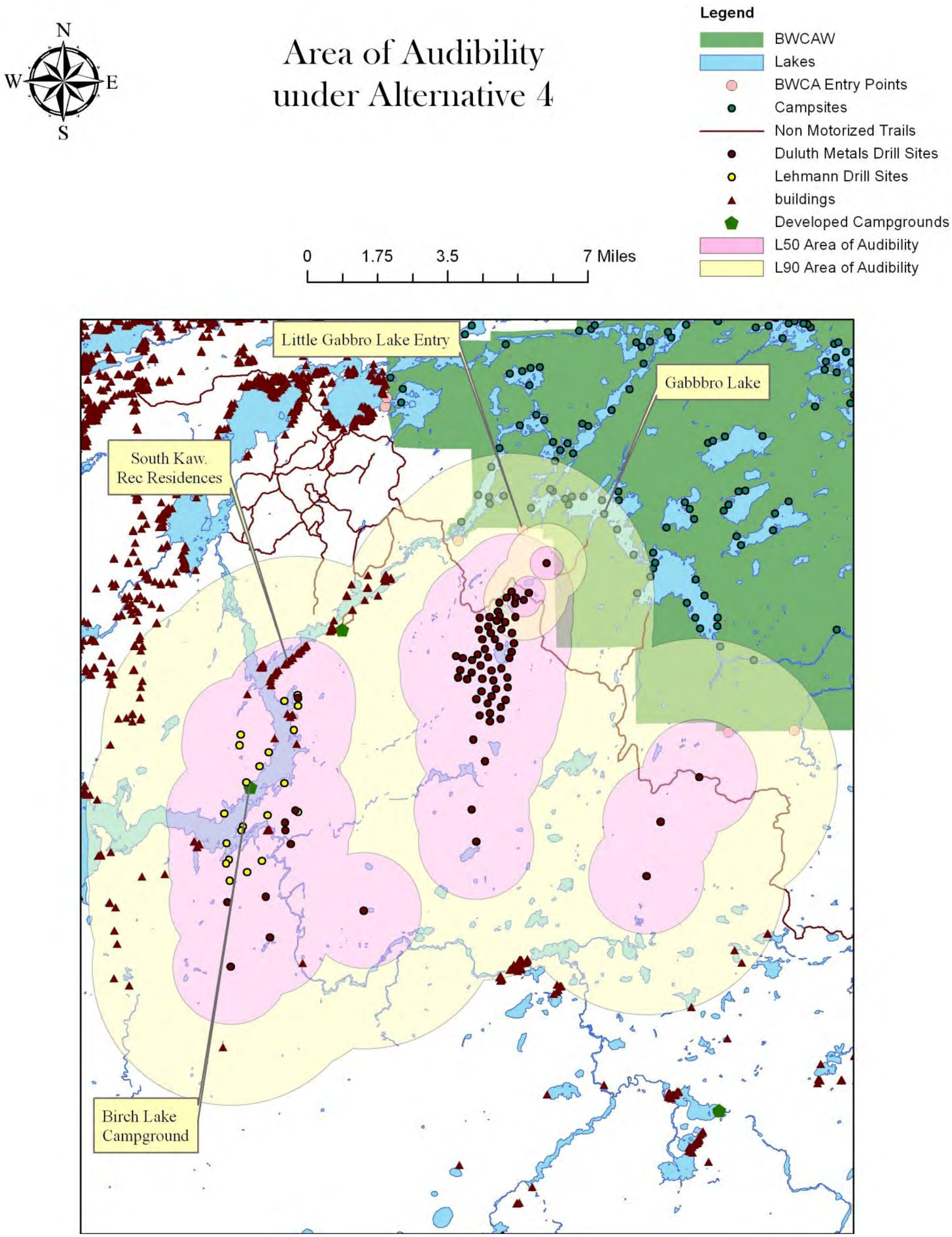


Figure 17 Area of Audibility for Alternative 4

Indicator 4: Sound Level in A-Weighted Decibels at Receptors

The area of sound above ambient level would depend on whether mitigation was implemented on a particular drill site. Estimated areas of sound above ambient level for drilling without mitigation are discussed under Alternative 2 and with mitigation under Alternative 3. To meet limits listed in Table 12, 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. Figure 18 provides an example of this in the current operating plans. Drill sites near the BWCAW are mitigated, while those further away are not. Minnesota Rules on Noise would also need to be met for receptors outside the BWCAW.

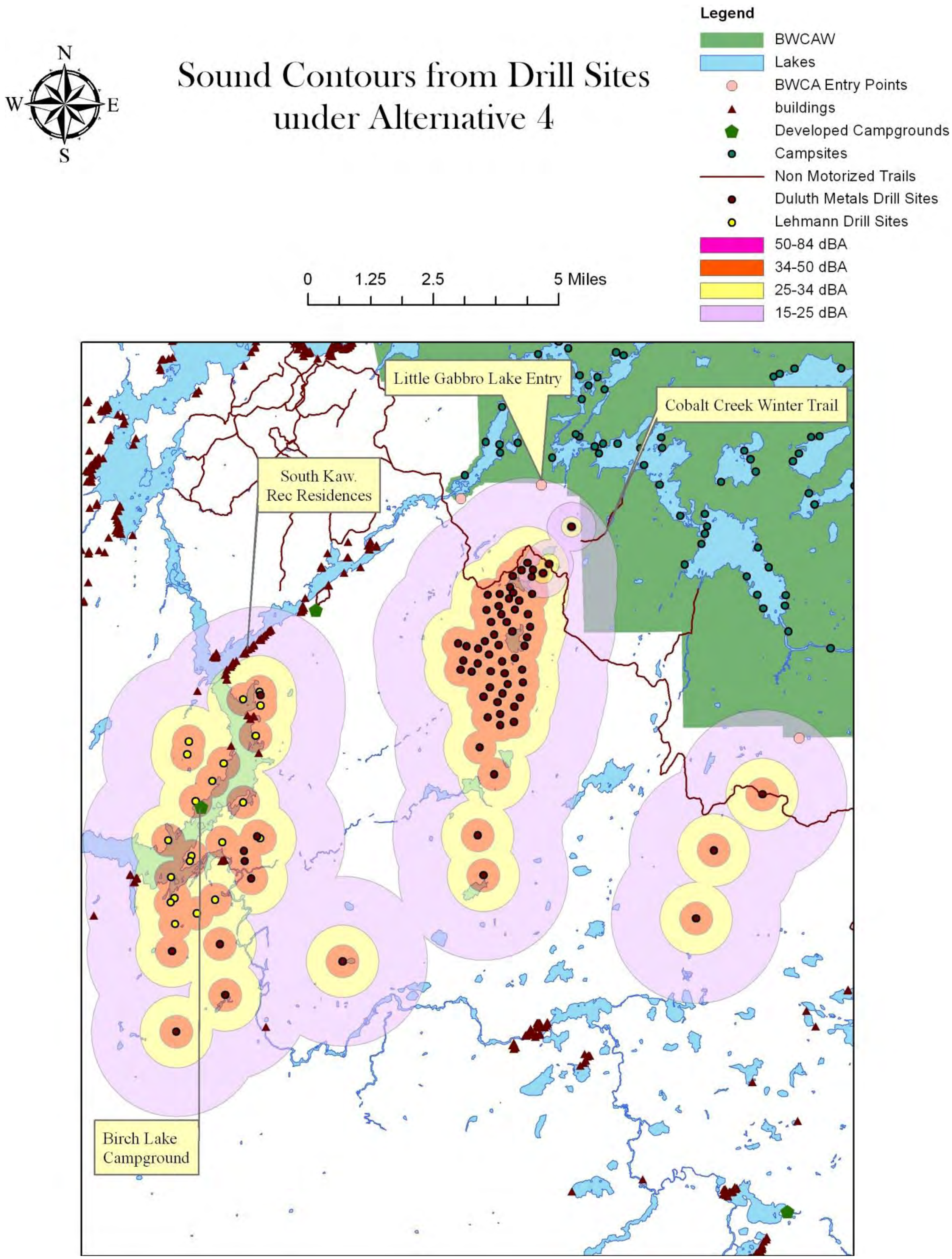


Figure 18 A-weighted sound levels at receptors for Alternative 4

Indicator 5: Level of Annoyance

Under this alternative, impacts to receptors outside the wilderness would be similar to Alternative 2. Impacts would be limited with the application of Minnesota Rules on Noise.

Indicator 6: Level of effects to Opportunity for Solitude

Sound levels reaching the wilderness would be below L50 nighttime ambient, limiting impacts. Audible sound would reach campsites on lakes near the wilderness boundary (see Figure 17). Some recreationalists may still find that audible motorized sound interferes a sense of natural quiet (see Figure 10). Sleep disturbance would not occur since sound levels would be below 35 dBA inside the wilderness (see discussion on sleep disturbance in Section 3.1.3). Impacts to opportunity for solitude would be minor.

3.1.6.1 Alternative 5

Indicator 2: Duration and Daily Scheduling of Sound

The impacts from duration of sound would be the similar to Alternative 2, although scheduling would be different. 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 15.

Indicator 4: Sound Level in A-Weighted Decibels at Receptors

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 16 and Table 21.

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 5: Level of Annoyance

Impacts would be the same as Alternative 3 except that 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). 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 6: 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 adverse 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, up to 3 to 4 dBA may be added to the total level of sound. Since changes in sound level of 5 dBA or more are clearly noticeable (MPCA 2008), drilling from other projects would not result in a substantial change in cumulative sound level.

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 sound level if timber harvest and drilling occur in adjacent areas, which would be a minor difference. Cumulative additions in duration of sound are unlikely since sound from timber harvest activities is intermittent instead of constant in nature like that of drilling.

The proposed Polymet Northmet mine is located about 7.3 miles from the nearest drill site identified in submitted operating plans. It is possible that mine operations could coincide in time with drilling activities on some of these operating plans. Due to sound attenuation with considerable distance, vegetation and topography, there would be very little or no cumulative increase in sound level where the impacted areas overlap (see Table 19, see also Polymet Draft EIS page 4.7-13 in project file stating that there would be little impact to a receptor two miles away). Cumulative additions in duration of motorized sound are unlikely since the Polymet mine could operate for 20 years and the drilling could be for a few weeks on an occasional basis inside that timeframe.

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 Figures 14, 16 and 18, 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. Stipulation RV-4 to reduce travel routes of helicopters over receptors to the extent possible would reduce impacts from helicopter operations.

3.1.7.3 Alternative 5

Alternative 5 would have similar 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

Considering the context provided by Forest Plan Management Areas and Recreation Opportunity Spectrum, the existing soundscape, the sound levels introduced by project activities, the temporary nature of project activities, Minnesota Rules on Noise and mitigations proposed in the Alternatives, and the potential for sleep disturbance, annoyance, and interference with natural quiet, the following overall conclusions are made:

- There could be minor to moderate impacts in areas outside the wilderness. Moderate impacts would be more likely under Alternatives 2 and 4 for people located outside buildings, particularly for tent campers located near drill sites (e.g. Birch Lake Campground). Alternatives 3 and 5 would usually cause minor annoyance, although moderate impacts may still occur for receptors very close to a drill site.
- There could be minor impacts to opportunities for solitude for Alternatives 3, 4 and 5 due to mitigations that reduce sound levels reaching the wilderness. There could be minor to moderate impacts to opportunities for solitude for Alternative 2.

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.

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. 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 4) 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 (although temporary) duration of drilling as compared to sporadic sound generated by other motorized sources.

3.1.9.3 Differences among Action Alternatives

Indicators 2-4

Since the methods for drilling are anticipated to be similar in the future, the analysis that identifies effects per drill site could be relevant for future prospecting permit applications. Differences between action alternatives per drill site are discussed in Section 3.1.3.3 and summarized in Table 21.

Indicators 5 and 6: 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 Forest-wide analysis 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 Overall Conclusion

The degree of impacts under the action alternatives is limited by the fact that project activities are temporary, and that Minnesota Rules on Noise limit impacts under all alternatives. Impacts would depend on the distance from drill site to receptor, and required mitigation measures.

Of the action alternatives, Alternative 2 would have the highest adverse impact to recreation receptors since drilling operations would not include additional noise mitigation measures. Alternative 3 would have lower adverse impacts than Alternative 2 since mitigation would reduce emitted sound levels. Alternative 5 would further reduce adverse 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 the BWCAW for drill sites located near the wilderness by requiring maximum limits for sound levels reaching the wilderness. For drill sites located further away from the wilderness that do not require this mitigation, Alternative 4 may have impacts similar to Alternative 2. Alternative 1 would have the least impact since no drilling or associated project activities would occur.

3.1.12 Monitoring Recommendations

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

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 preserve 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 daily scheduling of sound, area of audibility, and sound levels at 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 managed by 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 and permit applications. 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 22 shows visitor use for these areas.

Table 22 Overnight and self-issue visitor use of the BWCAW entry points nearest the proposed drill sites and permit application areas

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

Entry Point	Overnight Use Permits 2009		Self-Issue Day Use Permits 2009	
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. There is no action proposed manipulating the wilderness, such as setting prescribed fire inside the wilderness. There are no structures or human facilities developed inside the wilderness as a part of the action alternatives.

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 expected to be minimal 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. See Section 3.6.

Wildlife

The Boundary Waters Canoe Area Wilderness would continue to provide abundant, well distributed wildlife habitat, especially in the northern portion of the Superior National Forest (See Section 3.8).

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. Stipulations to allow for adjusting drill pad locations (RV-6), and shielding for lighting at night (RV-8) would further minimize impacts. 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. Overall, the wilderness setting should provide for a more natural soundscape than what exists outside the wilderness and this is a common expectation among users.

Table 23 Wilderness campsites affected by audible noise (assuming L50 ambient sound levels) 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

Considering the context provided by Forest Plan Management Areas and Recreation Opportunity Spectrum, the existing soundscape, the sound levels introduced by project activities, the temporary nature of project activities, Minnesota Rules on Noise and mitigations proposed in the Alternatives, and the potential for sleep disturbance, annoyance, and interference with natural quiet, the following overall conclusions are made:

- There could be minor impacts to opportunities for solitude for Alternatives 3, 4 and 5 due to mitigations that reduce sound levels reaching the wilderness. There could be minor to moderate impacts to opportunities for solitude for Alternative 2. See Section 3.1

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 for private minerals or 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. 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). Monitoring has also shown that closure and decommissioning may be completed with effective results (2005-2007 SNF Monitoring Reports Transportation and OHV Sections; 2011 SNF Road Closure Report). 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 effect since no project activities would occur. Effects to the natural quality of wilderness character would be similar 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 minor adverse 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 boundary to an L50 level of 30 dBA and an L10 level of 35 dBA, which would result in minor impacts since sound would attenuate to lower levels inside the wilderness, which may be audible near the wilderness boundary but would be below ambient levels a majority 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 Section 3.1.

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 in relation to recreation use locations. Exploration activities have the potential to impact recreationalists at several locations. Effects of the project on noise are disclosed in Section 3.1 of the FEIS. Effects of the project on other aspects of recreation, such as wildlife viewing and enjoying the natural environment are disclosed in Section 3.3 of the FEIS.

Spatial and Temporal Context for Effects Analysis

The analysis area for current permit applications include the permit application areas shown in Maps 3.1 through 3.13 along with temporary road construction proposed under special use permit in the Proposed Action. This is an appropriate boundary because the effects of the current prospecting permits would occur at various developed and dispersed recreation sites within the permit areas.

The analysis area for the Forest-wide analysis encompasses the entire Superior National Forest excluding the BWCAW and Mining Protection Area. This is an appropriate boundary because the effects of the 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 or Mining Protection Area.

The effects of the project on aspects of the BWCAW are disclosed in the Section 3.2.

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 to 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. Currently the Forest hosts 23 campgrounds, 2,328 dispersed campsites (outside the BWCAW), 666 miles of hiking trail, 516 miles of cross country ski trails, 120 miles of snowshoe trail and 91 miles of dog sled trail. In addition the Forest hosts 2.1 million acres of national forest system lands which allow public use.

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 direct or indirect effects on the recreation resource. The effects resulting from currently approved minerals exploration projects would continue.

3.3.3.2 Alternatives 2, 3, 4, and 5

Current prospecting permits and operating plans

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 (Stipulation RV-9). Dispersed areas such as trail corridors or general forest areas may be directly impacted depending on the location of drilling sites. 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. Impacts from drill pads would also be minimized with the application of Stipulation RV-6, which allows for adjusting the location of drill pads to minimize impacts to recreation use and visual quality. Stipulation RV-8 would minimize impacts to campers and nighttime activities by reducing artificial light pollution. Longer-term effects would be avoided with the application of interim and final reclamation measures shown in Stipulations RECL-2 and RECL-3.

Wildlife may be impacted by minerals exploration as disclosed in FEIS Section 3.8, the BE and the BA. As disclosed in the BE and BA, populations of species would remain viable and wildlife viewing opportunities would be present on the Forest. There may be minor changes in the location of wildlife viewing activities since recreationists may seek areas not adjacent to in-progress drilling operations.

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

Alternative 1-Since there are no direct or indirect effects, there are no cumulative effects.

Alternatives 2, 3, 4, and 5 – Potential cumulative effects include logging, mineral exploration and mining activities, other recreation uses, private developments, and any activities occurring within the national forest boundaries as displayed in FEIS Appendix C.

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 an increase in the number and length of temporary roads. 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 Geological Survey (MGS) 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 MGS 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.

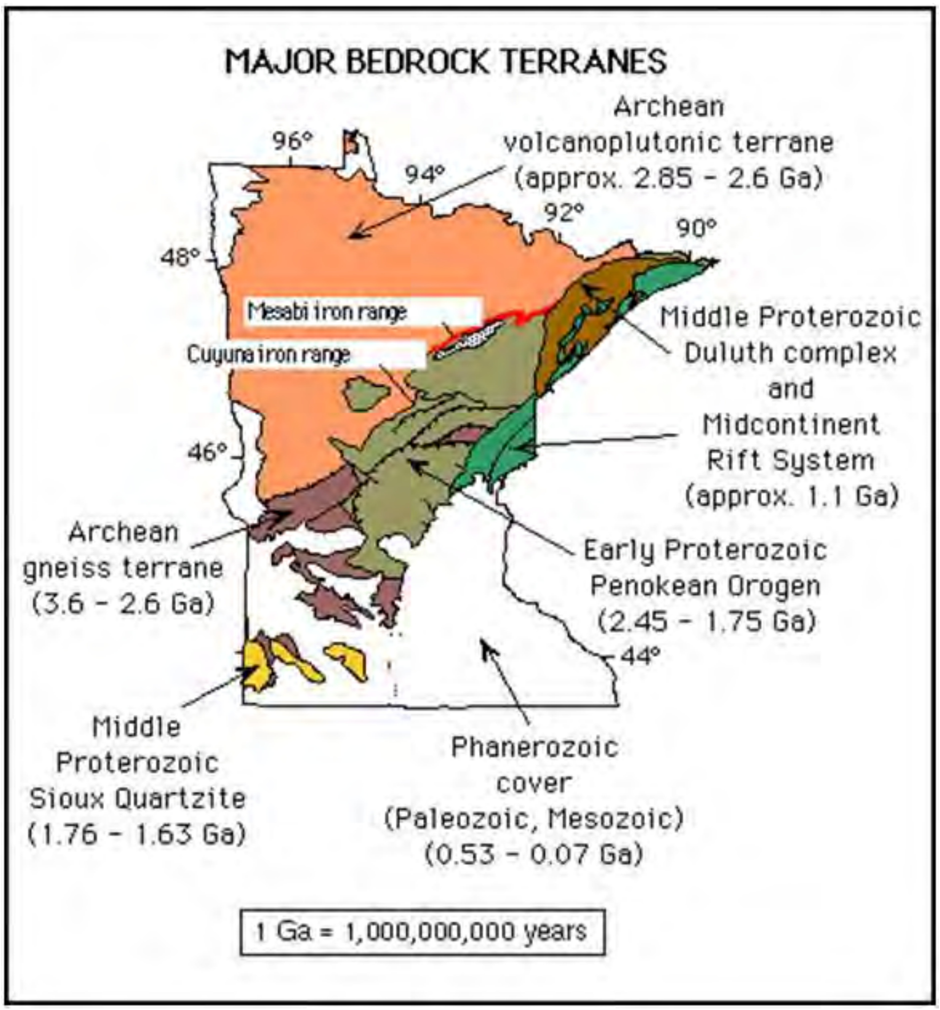


Figure 19 Bedrock geology of Minnesota

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.

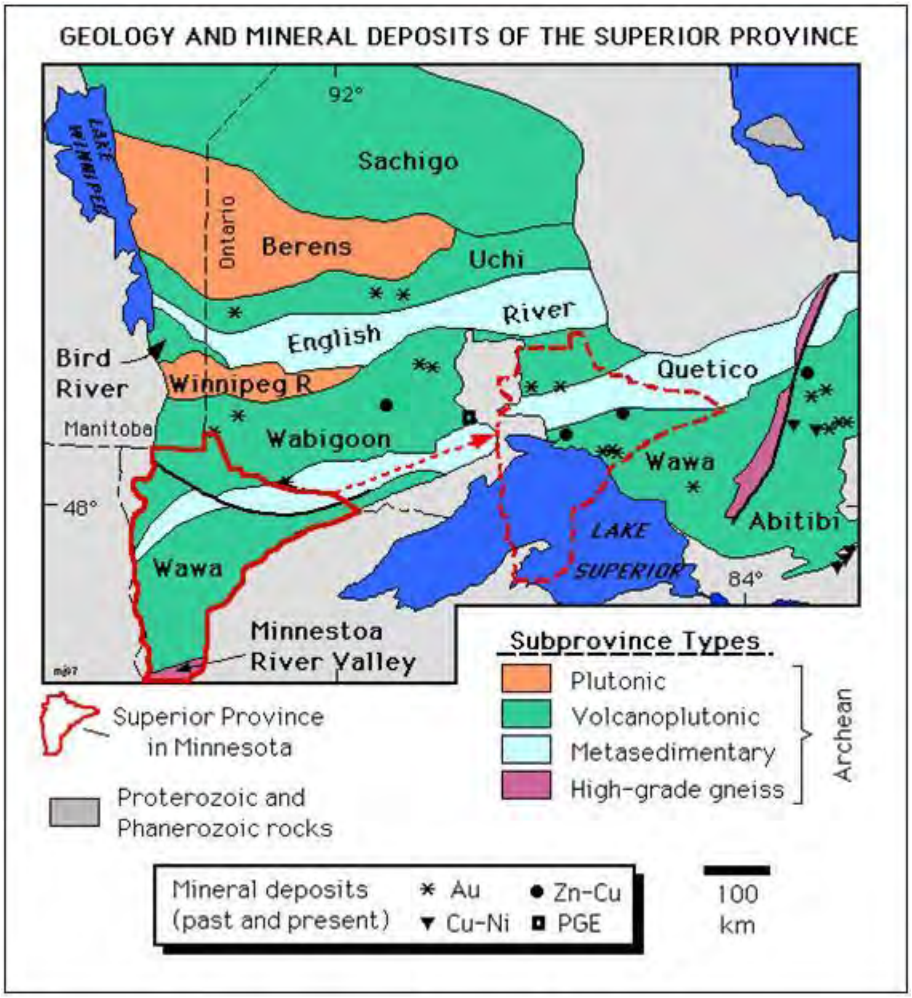


Figure 20 Mineral deposits of the Superior Province

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.

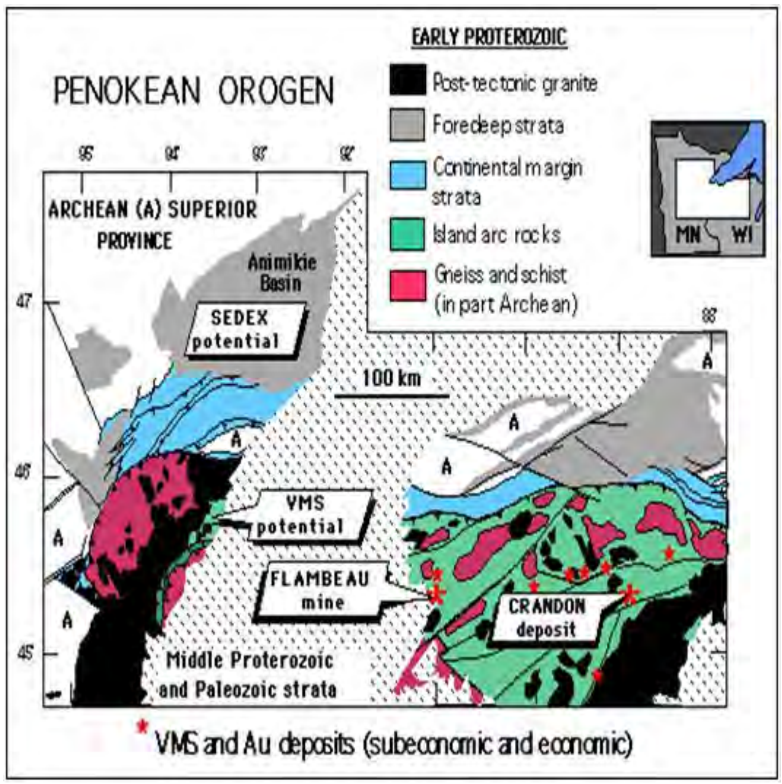


Figure 21 Mineral potential of the Penokean Orogen

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.

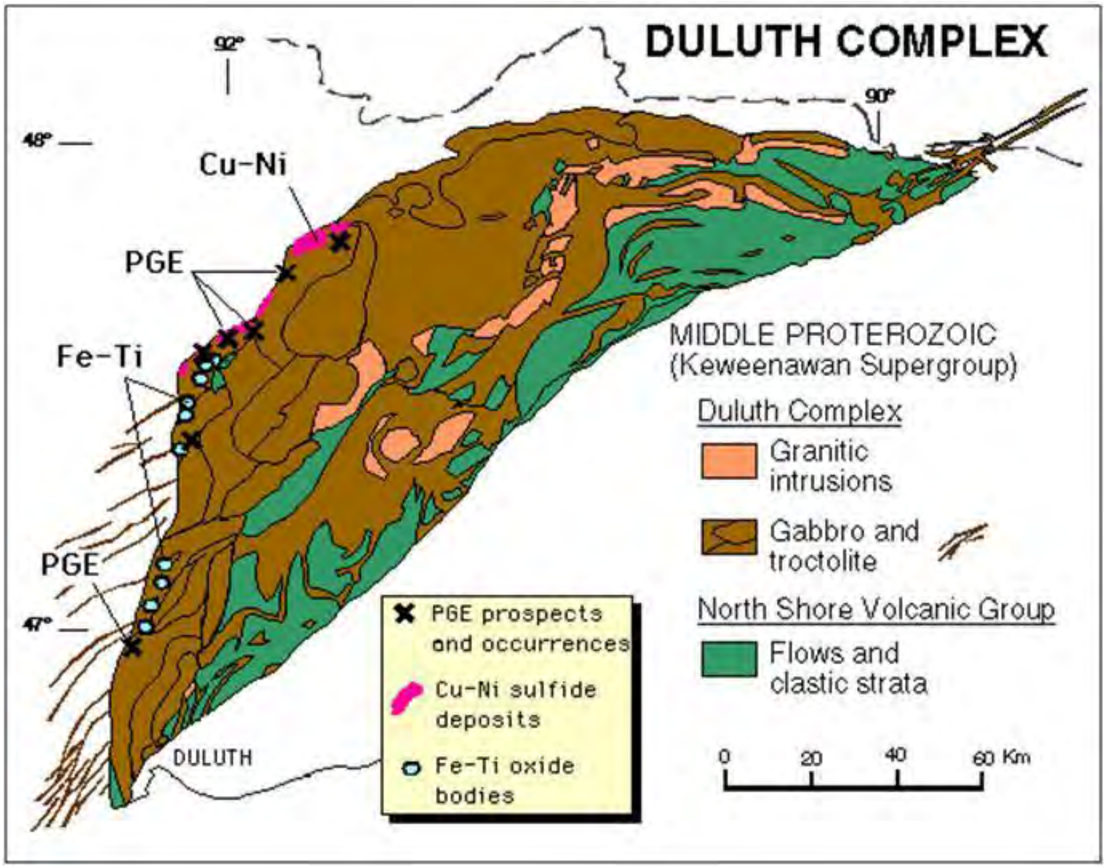


Figure 22 Mineral potential of the Duluth Complex

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.

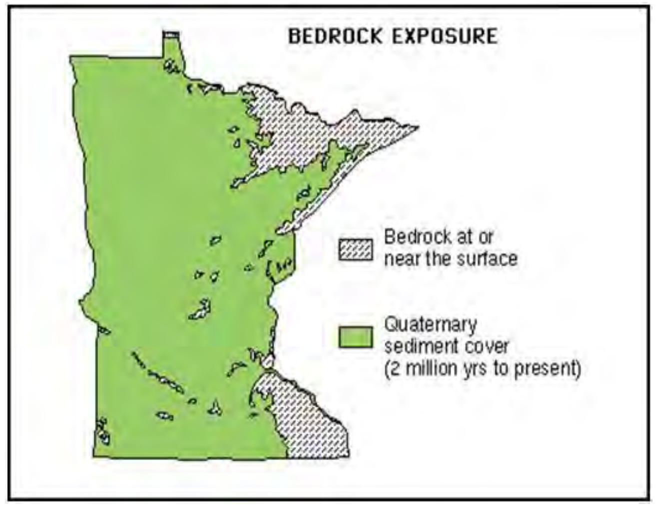


Figure 23 Bedrock exposure in Minnesota

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 for the current permit applications 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 in the permit application areas shown in Maps 3.1 through 3.13 along with temporary road construction proposed under special use permit in the Proposed Action. The analysis area for the future permit applications 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 24 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

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 soil resources.

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).

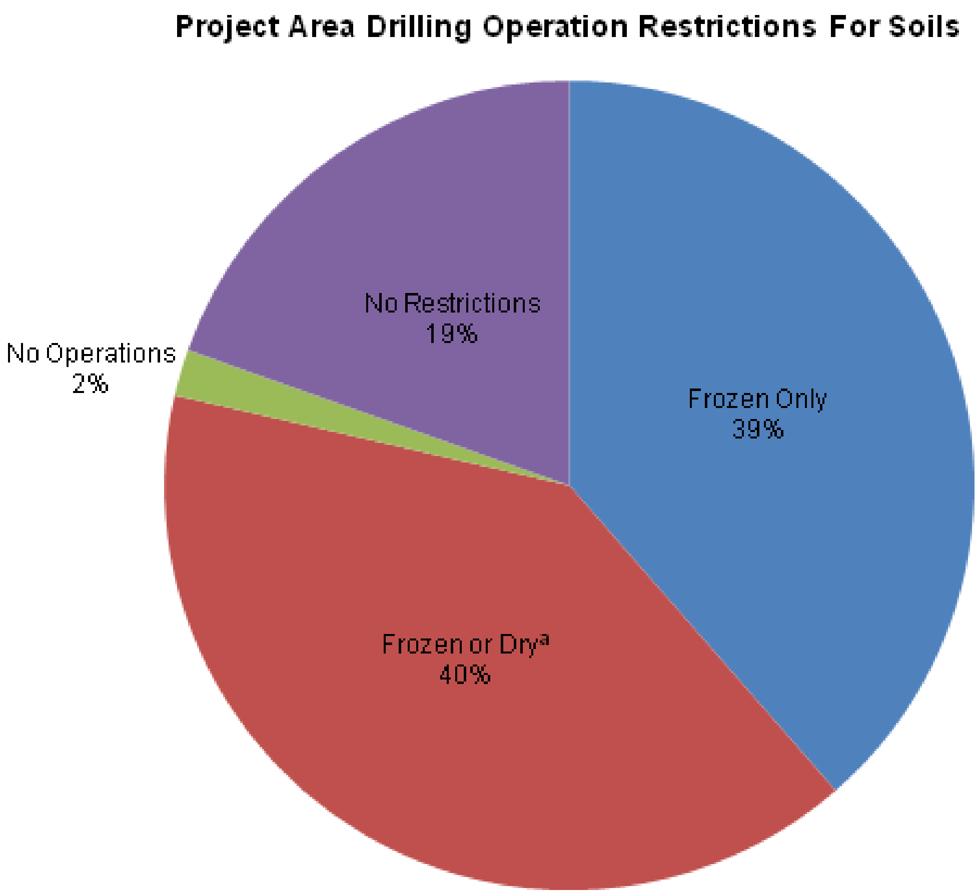
Figure 24 Planking utilized during spring thaw to prevent rutting and compaction

Following the stipulations outlined in Section 2.4.3 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 Forest-wide analysis 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 24. ELTs 10, 14, 15, 16 and 17 represent 40 percent of the Forest-wide analysis area.

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 25.

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 Forest-wide analysis area. The area discussed in this section represents Federal lands within the project area and are depicted in Figure 26.

Figure 25 Example of ELT 12



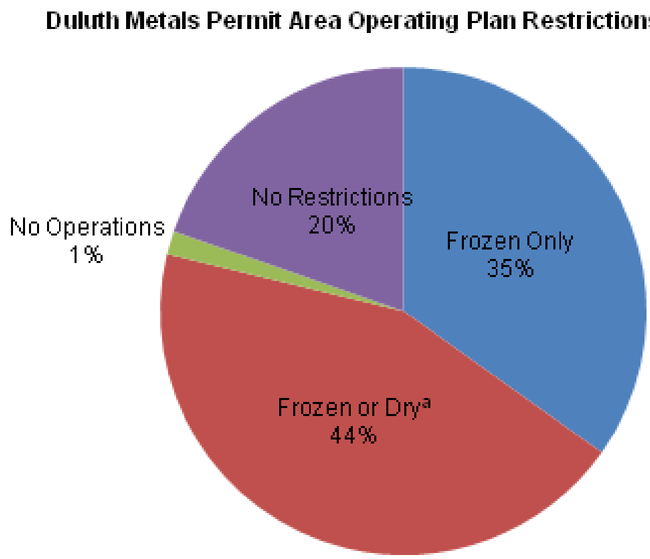
a - Activities would occur during frozen soil or the normal dry period to prevent rutting and compaction or exploration activities would need to employ techniques and equipment designed to eliminate impacts to the soil.

Figure 26 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.

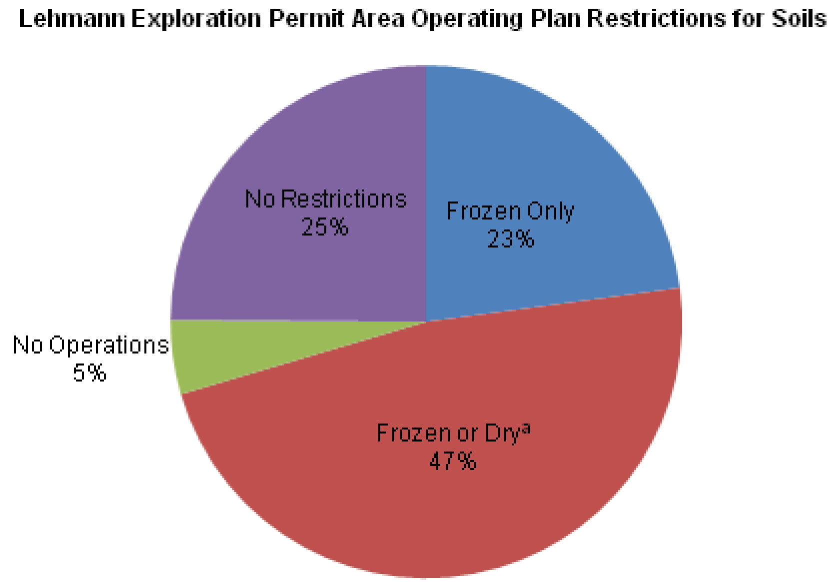
Current Operating Plans

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 27 through Figure 29 depict the operating restriction configuration for the permit areas covered by Duluth Metals, Lehmann Exploration, and Twin Metals respectively.



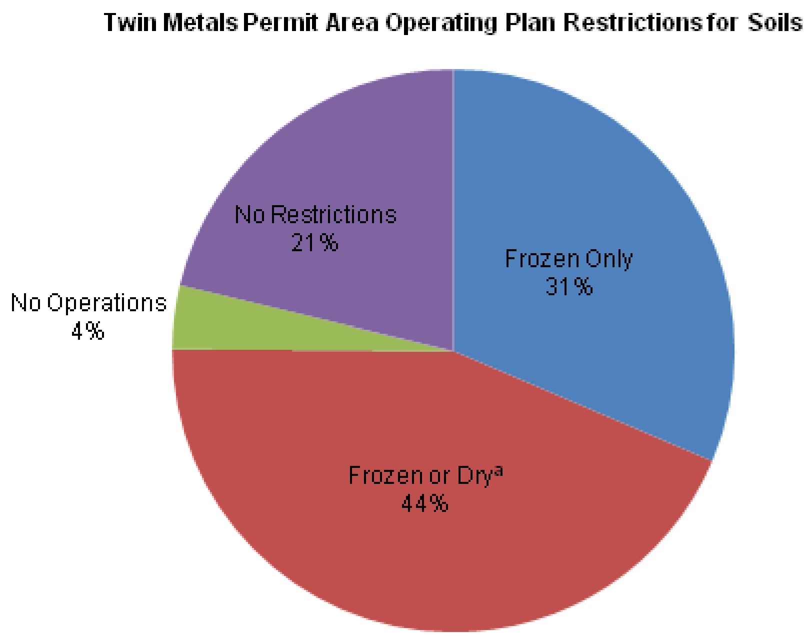
a - Activities would occur during frozen soil or the normal dry period to prevent rutting and compaction or exploration activities would need to employ techniques and equipment designed to eliminate impacts to the soil.

Figure 27 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 28 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 29 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 (for example, see 2005-2009 SNF Monitoring Reports, Soils Section). 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 25 Indicators for potential effects on water resources

<table>
<tr><th>Constituent</th><th>Indicator</th><th>Threshold</th><th>Spatial Scale</th><th>Temporal Scale</th></tr>
<tr><td>Groundwater Quality</td><td>Potability of groundwater as determined by MN Department of Health Drinking Water Standards</td><td>Exceeds potability standards</td><td rowspan="2">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 (for current permit applications, the project area is shown where permit applications are located in Maps 3.1 through 3.13. For future permit applications, the project area is National Forest with federal minerals outside the BWCAW and MPA)</td><td>25 years – While the transmissitivity rates can vary significantly, it is assumed that impacts will occur within 5 years of the drilling activity.</td></tr>
<tr><td>Groundwater Quantity</td><td>Production capacity of existing wells</td><td>Interference with existing well production</td><td>25 years – It is assumed that the impacts well production would occur shortly after drilling</td></tr>
<tr><td>Surface Water Quality</td><td>Clean Water Act standards</td><td>Exceeds Clean Water Act</td><td rowspan="2">The analysis area consists of all HUC 6 watersheds that intersect the entire project area (which includes some acreage in the BWCAW). The project area for current permit applications is shown where permit applications are located in Maps 3.1 through 3.13.

For future permit applications, the project area is National Forest with federal minerals outside the BWCAW and MPA. 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</td><td>20 years – It is assumed that the impacts to surface water quality would occur during the drilling process</td></tr>
<tr><td>Surface Water Quantity</td><td>Divergence from existing water levels</td><td>Reduction of flow in a stream by 10% or drop in water levels in a basin by more than 2”.</td><td>20 years – The impacts to surface water quantity would occur during the drilling process.</td></tr>
</table>

			analysis is directed toward each lake or stream	
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 (which consists of the area shown in Maps 3.1 through 3.13 for current permit applications and Forest-wide except the BWCAW and MPA for future applications). 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 possible 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 possible migration of cuttings off-site to 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. 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 CWA is administered by the Minnesota Pollution Control Agency (MPCA) and is regulated by MnRules Chapter 7050. 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

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, the landings considered herein are for *access to* drilling activities that are on Federal Lands (i.e. the drill sites themselves are 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 to accommodate the 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, including wild rice. 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 to 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 (and possibly grubbing) 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. If activity is proposed that requires a USACE Section 404 *Individual* Permit, than an MPCA CWA Section 401 Water Quality Certification ensures that the activity will comply with the state water quality standards. Any conditions required within the MPCA Section 401 Certificate are then incorporated into the USACE 40 Permit. Based on these measures, the physical and biological 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 25for the spatial and temporal scale of analysis for each indicator.

The analysis area for the groundwater and surface water is considered the same based upon the consideration that “Many field studies conducted in humid regions note that the water table in unconfined aquifers usually has the same general shape as the surface topography” (Fetter, 1988). It is recognized that the area groundwater influence can be different for different aquifers and defining areas of influence in fractured areas is especially difficult. 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. Although the breadth of these similarities can vary, the reach is assumed to be 1 mile long for this analysis. 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.

Within the analysis area there are 114 inventoried lakes, streams, and rivers that support known populations of wild rice (MNDNR 2008). Impacts to known wild rice populations and wild rice suitable habitat are considered below.

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's 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 under the supervision of a driller licensed by the Minnesota Department of Health (Rye 2012a). 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 under the supervision of 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.

Saline groundwater conditions near Lake Superior have been a known phenomena to local well drillers for a number of years. However, saline groundwater has also occurred in other portions of the SNF. Saline water or water high in chloride concentrations are recognized in the Copper-Nickel Study authored in 1979 which states, "*Highly saline water has been encountered in some bedrock areas in the Study Area…The source and spatial distribution of this water in the Study Area is unknown*" (Thingvold, Eger, Hewitt, Honetschlager, Lapakko, & Mustalish, 1979). Monitoring of active drill sites in 2012 confirmed the presence of elevated chloride conditions (Rye, 2012f), (Rye, 2012g). The presence of saline water is closer to the surface near Lake Superior than other portions of the SNF and is generally deeper in the area of intense mineral exploration activity. Additional detail on the extent of the saline water conditions is provided in the appendix of this report and project file (Rye, 2012c; Larson, 2012).

The water quality of existing wells is protected by stipulation WAT-9. This stipulation requires the abandonment of the borehole within a week of completion when it is within 500 ft of an existing well completed in the bedrock. If it is desired to temporarily abandon the borehole, it must either be tested to affirm the chloride concentration is below the drinking water standard of 250 mg/l or cased to 50 ft below the nearby well. Additional discussion regarding WAT-9 is provided in the appendix of this report (Rye, 2012d). This provision along with the existing state regulations adequately protect the groundwater resource.

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. It is unlikely that the proposed exploratory holes would fulfill all of these requisites to produce a noticeable effect on the yield potential of other wells since the fractures are generally very tight and the bedrock is highly impervious.

Conclusion: Approximately 1,960 core holes have been drilled to date in the basal zones of the complex within the Superior National Forest (Wirz 2012) (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 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. If they are extreme enough, fluctuating water levels caused by surface water removal can potentially affect wild rice abundance and seed production. 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 WAT-5 in Section 2.4.3.9. This includes a stipulation that prevents water withdrawal from wild rice lakes less than 50 acres. Implementation of these protection measures would protect the aquatic biota, including wild rice.

Submitted Operating Plans were evaluated for consistency with WAT-5 (Rye, 2012f). The majority of the basin water sources identified have sufficient water to supply drilling operations. Some basins will need to be checked at the time of proposed drilling and an alternative source may have to be used. The streams in the area generally do not have sustained high baseflow discharges because of thinner glacial drift to store water and relatively small contributing drainage areas (Siegel and Ericson, 1980; Rye, 2012e). While local streams can and do have a flow in excess of 1 cfs for portions of the year, alternative or backup water sources (such as Birch Lake / South Kawishiwi River or other large lakes) will need to be considered as alternatives. The water sources will need to be reviewed by the applicant and the USFS / BLM near the time of operation to affirm flow conditions, the presence / condition of beaver ponds, and site conditions at the time of use.

Based upon these mitigation measures, the divergence of water levels and flows will not exceed natural variation and will have little impact on 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, including wild rice. Discharge of exploratory wastes (cuttings, drilling fluid, and sediment laden waters) are not allowed to be discharged directly to any stream, lake, or wetland, nor allowed to discharge materials in such a manner that the materials may be deposited into a lake, stream, or wetland.

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 in runoff from these disturbed drill sites would be small. The drill sites would also be dispersed so the runoff volume, rate, and quality to the surrounding waterbodies would be within the natural buffering capacity of these systems. Sumps are constructed, in part, to prevent drill cuttings from moving off the drill site (see Figure 3 and Section 2.1.1.5) The 100 foot setback for drill pads (stipulation WAT-8) from lakes, open water wetlands and perennial streams and rivers would further protect surface water quality and aquatic biota, including wild rice; this setback includes wild rice lakes and stream and river segments containing wild rice. This separation minimizes the opportunity for direct surface contribution to the surface water systems. In addition, the soil medium will provide some treatment and buffering for the water that does soak into the ground. Stipulation WAT-6 further protects water quality by not allowing sumps in wetlands or where there is insufficient soil depth. A more detailed description of the holding tanks used in wetlands is provided as an appendix and in the project file (Rye, 2011a). Additional description of the operation of sumps is also provided in Appendix G and in the project file (Rye, 2011b). Based upon these considerations and stipulations there should be no impact on surface waters, and the project should not cause surface waters to be considered impaired by any chemical or physical 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 in the current permit application areas would be approved under future 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 stipulations in this EIS. As described above, new temporary roadways in the operating plans within this EIS and future proposed roadways and stream crossings 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. As a result, winter use of the landings would be the preferred condition. On sites where there is insufficient ice thickness to support over-ice travel, use of the landings during the open water season is required. One example of this condition occurs in Birch Lake where 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 river. 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 30 Left-location of previous landing (2000 – 2004); right-access route of previous landing (2000–2004)

Figure 31 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 to accommodate the 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 in Figure 30 and 31.

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 water 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. The physical or chemical removal of emergent aquatic vegetation is regulated by the Minnesota Department of Natural Resources (MnDNR) and may require an aquatic plant management (APM) permit.

Of the eight landings proposed for construction on Birch Lake, wild rice is present at three and absent from the remaining five (Butcher 2010). The landing for site 302-B is proposed in a bay with an approximately 3.5 acre wild rice bed, the landing for site 302-C is proposed on a shoreline with a fringe of wild rice, and the landing for site FS-10FF has sparse scattered wild rice plants (Butcher 2010). Site visits showed that by moving the landing locations along the shoreline a short distance, impacts to the existing wild rice could be minimized. Moving landing 302-B south away from the rice bed 300-400 feet would place it along a stretch of shoreline that has just a narrow fringe of wild rice thus minimizing disturbance to wild rice. Placing landing 302-C at a nearby site where there is a gap in the wild rice would also minimize disturbance to wild rice. The rice at landing site FS-10-FF is very sparse, and landing construction at the proposed site would have minimal impacts to wild rice. Landing construction and use at these known sites would cause short term impacts to a very small portion of wild rice populations. Plants would be uprooted and suitable habitat would be disrupted in the short term, but after a few years adjacent rice populations would likely re-colonize these areas. Impacts to occupied wild rice habitat caused by landings used for future mineral exploration would be minimal because landing sites with wild rice would be moved to avoid concentrations of wild rice (see stipulation WAT-10).

Inventoried wild rice populations

Twenty-one operating plans have been submitted by the companies proposing mineral exploration. When proposed drill pads and access road locations are compared to inventoried rice waters (MNDNR 2008), the nearest proposed drill pads are210 and 250 yards from the nearest creek (Denley Creek), and 380 and 310 yards from the Stony River, which has an inventoried wild rice population at this location. These drill pads hold a very low risk of impacts to this wild rice population from drill site disturbance or water quality impacts due to the distance of the pads from the creek. For the drill pad north of Denley Creek, the company would use as its water source a beaver pond to the north near Forest Road 1437 (Operating Plan for MNES-55305). For the drill pad south of Denley Creek, the company would use Denley Creek as its water source (Operating Plan for MNES-55305). Stipulation WAT-5 would be enforced to ensure water withdrawals do not impact wild rice or other aquatic resources.

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 26.

Table 26 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, lakes and streams. This includes the mechanized land clearing (grading, dozing, grubbing of trees, 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 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 that 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

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 (Stipulation WAT-12 and RECL-3; see also Forest Plan FEIS, p. 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:

- filling of wetlands, streams, and lakes 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 1 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 27. 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 27 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	It is assumed the voluntary best management practices are being employed

Action	Assumptions / Description of Elements
Service Public Land	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 for the current permit applications include the permit application areas shown in Maps 3.1 through 3.13. The analysis area used to examine the direct and indirect effects of each alternative for future permit applications is National Forest System land outside the Boundary Waters Canoe Area Wilderness (BWCAW) and Mining Protection Areas (MPAs), and Wild segments of Wild, Scenic and Recreational Rivers (WSR), 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 wild river segments. 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 28.

Table 28 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 28 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.

The 29 current permit applications could include up to about 1,131 acres of disturbance in a project area of about 38,704 acres of NFS lands (3% disturbed). Impacts from the 29 current permit applications are also expected to be similarly minimal.

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.

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.

Figure 32 Example of a typical drill pad site two growing seasons after activity has been completed

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.

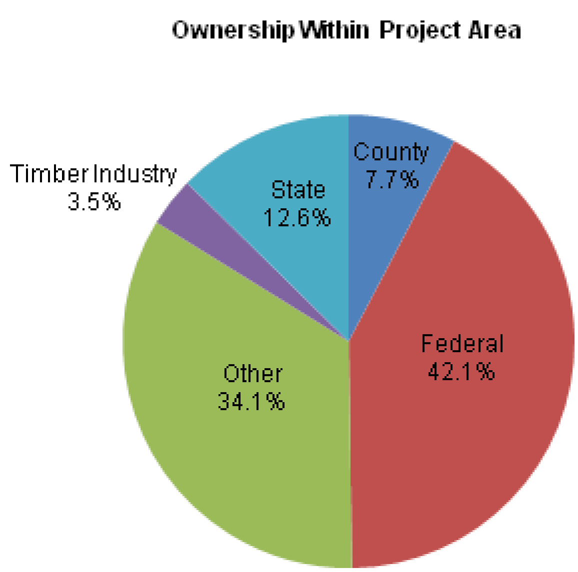


Figure 33 Pie chart showing land ownership within the project area

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 summarizes the effects of the project to wildlife species or groups of concern to the public, federally threatened, or endangered species, and Regional Forester Sensitive Species (RFSS). The public expressed concern about animals in addition threatened and sensitive species which include trumpeter swan, moose, reptiles and amphibians, raptors, migratory birds, snowshoe hare, game species, American marten, and owls. These species and more are evaluated by using Management Indicator Habitat as a representation of available habitat.

Effects to Canada lynx, the only federally listed species in the project area, and its critical habitat are summarized from the evaluation in the Biological Assessment (FEIS Appendix H).

Gray wolf and its critical habitat are included in the Biological Assessment because at the time of writing gray wolf was a threatened species. The gray wolf is no longer a federally threatened species but is now a Regional Forester's Sensitive Species. The effects analysis for gray wolf, aside from critical habitat, is the same for either designation so the analysis remains in the Biological Assessment. Evaluation of critical habitat for gray wolf is no longer necessary but was completed prior to delisting and remains in the Biological Assessment.

Regional Forester Sensitive Species evaluated in the terrestrial wildlife portion of the Biological Evaluation (FEIS Appendix I) include:

- Heather vole
- Little brown myotis (bat)
- Northern myotis (bat)
- Tri-colored bat
- Bald eagle
- Northern goshawk
- Boreal owl
- Great gray owl
- Olive-sided flycatcher

Bay-breasted warbler
Connecticut warbler
American three-toed woodpecker
Taiga (Disa, Mancinus) alpine(butterfly)
Nabokov's blue butterfly
Freija's grizzled skipper (butterfly)
Wood turtle

Analysis Period
The time period for direct and indirect effects for all indicators except noise is from the time project activities begin to ten years after project activities cease. The time period for noise is 20 years because after operations end related noise will not continue.

Analysis Area for Current operating plans and 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 habitat effects to lynx, wolf, and other wildlife habitat and human disturbance. Additional lynx analysis units are evaluated for traffic volume estimates for lynx. 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. The analysis area for noise effects to wildlife is the acreage affected by 10 drill rigs operating at one time.

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. The habitat 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). The analysis area for noise effects to wildlife is the acreage affected by 10 drill rigs operating at one time.

3.8.1.1 Indicators

The indicators reflect those changes likely to directly affect animals during various seasons or to indirectly affect them because of changes to their habitat or their ability to move across the landscape. Indicators vary by species and are included in the Biological Assessment for federally endangered, threatened, proposed, or candidate species and the Biological Evaluation for Regional Forester Sensitive Species. Species' analyses are grouped by indicator (Project file: Road and habitat analysis). Animals of public concern are evaluated below.

Indicator 1. Acres and percent of young upland forest less than 10 years old (MIH 1)
This indicator shows the general change in wildlife habitat from existing habitat conditions to a temporary opening condition. Management Indicator Habitat (MIH) 1 includes all upland forest types with percentages based on acreage (956,358 acres) on the Superior National Forest outside the Boundary Waters Canoe Area Wilderness. Upland forest is used to evaluate habitat changes because it is widespread in potential operating areas. Lowlands may be impacted but uplands are more likely to be impacted than lowlands because of soil and wetland mitigations. Operating plans provide the 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. For these reasons, it is not reasonable to analyze changes in age by forest type, by upland and lowland, or according to more specific habitat types.

Indicator 2. Miles of temporary roads open for drilling activities
This indicator highlights the difference between the no action, the action alternatives, and temporary road mileage predicted in the Forest Plan EIS. Miles of temporary roads open in any year serves as a surrogate for the level of project activity because operations associated with the project will take place while the temporary road is open.

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 to occur 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 34 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.

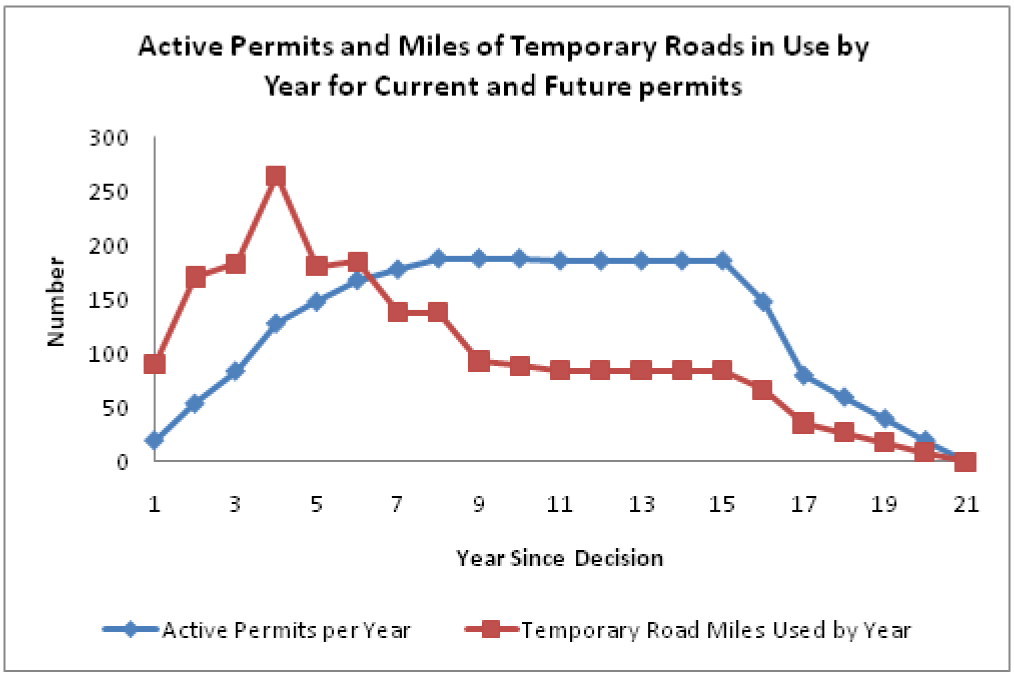


Figure 34 Active prospecting permits and miles of temporary roads in use by year for current and future permits

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 activities over the last five years and professional experience. 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 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.

The SNF Forest Plan FEIS 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 based upon this assumption along with the miles of roads needed to meet the Allowable Sale Quantity of timber. Timber harvest funding in 2009 was 59 percent of the Allowable Sale Quantity (USDA Forest

Service 2010c, timber section). Therefore the FEIS estimate of temporary road miles needed for each decade were multiplied by 59 percent to attain temporary road mileage proportionate to the current timber harvest level. The FEIS estimated temporary road mileage at 754 miles for Decade 1, 764 miles for Decade 2, and 761 miles for Decade 3).

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 were approved for decommissioning in eight NEPA decisions between 2004 and 2009 but are not yet accomplished. 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.

Indicator 3. Season of activities

The season of activities is a good indicator because it reflects disturbance to wildlife whether during the breeding season or nonbreeding periods. Season of operations would vary by alternative, Alternatives 2-4 allowing operations all year and Alternative 5 allowing only winter operations from November 1 to April 30. Alternatives 2-4 would see the majority of the activity in the winter in order to meet soil and wetland restrictions. The difference between Alternatives 2-4 and Alternative 5 in when activities would take place is small. Noise is considered in this indicator because it would only occur when the activities take place.

Seasonal variation in the numbers of species present is dramatic in the woods of the Superior National Forest. More species would be present in the project area in Alternatives 2-4 than in Alternative 5. Winter noise levels would have no effect on species that migrate from the area for the winter. Season of activities considers that the fewest number of wildlife species are present during the winter and that noise effects may impact wildlife at any time of the year. Table 29 lists the species for this analysis and the time during which they would be present in the project area in a life form most likely affected by noise.

Table 29 Seasonal occurrence of sensitive and public concern species.

Inactive/not present during winter because of hibernation, aestivation, or migration**	Active/present during winter
Sensitive Species	*Sensitive Species*
Little brown myotis Northern myotis Tri-colored bat Olive-sided flycatcher Bay-breasted warbler Connecticut warbler Wood turtle* Taiga alpine* Nabokov's blue* Freija's grizzled skipper*	Gray wolf Heather vole Bald eagle Northern goshawk Great gray owl Boreal owl American three-toed woodpecker
Species of Public Concern	*Species of Public Concern*
Trumpeter swan Reptiles and amphibians Migratory birds	Moose American marten
*Known locations would be protected from disturbance all year.	

**Migration, hibernation, and aestivation timing is generalized.

Indicator 4. Traffic Volume

This indicator addresses risks to lynx in crossing roads and the potential for vehicle-animal collisions. This indicator is evaluated in full in the Biological Assessment and summarized here. This indicator was evaluated only for lynx because it is a threatened species and there is good lynx habitat near the current prospecting permit and operating plan areas. Regional Forester Sensitive species and other animals are not included in the analysis because the species are wide spread across the forest, not concentrated along these roads, and population levels are less likely to be negatively affected by incidental loss from traffic collision.

The length of the analyzed roads totals 69 miles. Section of roads considered are: 39 miles of Highway 1 south of Ely to Isabella; two miles of Highways 1 and 169 west of Ely; sixteen miles of Forest Road 424 (the Denley Road) and St. Louis County Highway 623, west of Highway 1; and twelve miles of Forest Road 377 (the Tomahawk Road).

The measurement for traffic volume is annual average daily traffic volume. Annual average traffic volume on collector roads reflects the changes from existing condition for project-related traffic. Traffic volume data comes from the Minnesota Department of Transportation and the Superior National Forest. The traffic volume is very low, ranging from 25 to 578 vehicles per day on all of the above mentioned roads, except for a daily traffic volume of 2,635 vehicles on the two miles of Highway 1/169.

Animal mortality from traffic on minor roads with speeds of 38-50 miles per hour and traffic volumes of 100 to 5000 vehicles per day have been shown have a higher rate than major roads in an urban environment. This is due in part to mitigations such as barriers or widely mowed buffer strips used to keep wildlife from using sections of major roads or allow drivers to see animals from farther away, allowing the vehicle to avoid the animal. Minor roads also often have a larger total length than the cumulative length of major roads. This research must be viewed in light of the fact that the project area is not an urban area but mainly a rural and small town environment.

Indicator 5. Noise: Area of Audible Sound

During public scoping, concerns were raised that noise production from the proposed core drilling activities would affect wildlife. To respond to that concern papers and reviews (Laiolo 2010, Turina and Barber 2011) of noise research were evaluated. The majority of noise research is focused on responses by single species or to chronic noise and is not specifically relevant to our species or this project, but generalized effects can be applied.

This analysis focuses on terrestrial wildlife species using the season of activities (Indicator 2 from Section 3.1) and the area of audible sound from the drilling rig (Indicator 3 from Section 3.1). The affected area and season of activities are shown in Table 30.

Noise parameters for effects to wildlife are adapted from EIS Section 3.1, Noise, which evaluates effects of sound on human recreationists. Road noise is not evaluated because it already exists on the landscape and increases in traffic are expected to remain in the very low traffic volume category (Forest Engineers, personal comments).

This project would affect individuals for days to weeks in any one location as compared to the research reviewed for chronic or urban noise exposures. It is estimated that up to ten rigs would be operating at the same time and be spread across the permit application areas. The duration of noise at any drill rig in this project is expected to last 24 hours a day and range from 3 days to 6 weeks. Up to one proposal per year may use a helicopter to transport equipment (EIS Section 2.2.4).

Noise area reflects the difference between the alternatives using acreage affected by audible sound under L50 and L90 conditions as defined in Section 3.1, Noise. The L50 and L90 conditions were evaluated using sound levels measured in A-weighted decibels. While some wildlife may hear sound in greater range of frequencies than the A-weighted scale used in Section 3.1 and others less, the estimates of L50 and L90 audible conditions in Section 3.1 are considered to present differences between alternatives for potential impacts to the variety of wildlife in the analysis area. Also, drill sound produces only low energy levels at higher 1/3 octave frequencies (see Larson Davis 831 data measuring drill sound in project file) which receive less emphasis on the A-weighted scale, so impacts to wildlife at higher frequencies are unlikely.

Sound levels at L_{50} are used to evaluate effects to wildlife because this is the ambient sound level under which species have evolved. A 3 dB increase in noise is equal to a 30% reduction in alerting distance and a 10 dB increase equates to a 90% reduction in alerting distance (Barber et al. 2009). Noise commonly elevates low frequency ambient sounds (those similar to drill rigs) by 40 dB and an increase in 10 dBA doubles the perceived loudness to humans and this equates to a 90 percent reduction in alerting distance (Barber et al. 2010).

Pijanowski et al. (2011) categorize ambient sounds occurring at a site as biophony, the composition of sounds created by organisms; geophony, nonbiological ambient sounds such as rain, thunder, wind, and so on; and anthrophony, sounds caused by humans. It is anthrophony as it relates to potential effects to biophony that is analyzed here for the Minerals Hardrock Prospecting Permits activities.

Barber et al. (2010) write that acoustical cues play a dominant role in sexual communication, territory defense, habitat quality assessment, and predator-prey relationships. Hearing functions during waking, sleep, and hibernation, and is equally or more important than vision to detect environmental cues (Barber et al. 2009). Potential impacts are masking of important cues, acoustical communication (foraging, parental care, mating), interference, increased anti-predator behavior affecting foraging parental care and mating, and reduced numbers near anthropogenic noise. Much forest bird song lies in the same part of the frequency spectrum as industrial noise and may interfere with bird communication via song (Habib et al. 2007).

Individual animals and wildlife communities are affected by increases in noise. Species' response to noise may include changes in foraging and anti-predator behavior, reproductive success, density, and community structure (Barber et. al 2009, 2010). Effects of noise to animals are extremely variable and dependent on a multitude of factors such as timing, duration, frequency, time of year, distance, type, and volume. Animal responses to noise are also highly variable and include fleeing, avoidance, immune response, startle responses, reduced feeding, increased vigilance, frequency, amplitude, and/or temporal communication shifts to avoid noise conflict, and adaptation (Turina and Barber 2011, Barber et. al 2009, 2010, Pijanowski et al. 2011).

Animals may adapt to anthropogenic noise but the documented responses are generally neutral or maladaptive (Laiolo 2010). In research conducted with noise duration similar to this project, immune function has been found to change in laboratory animals exposed to low-intensity, chronic intermittent unpredictable noise regimen ([white noise, 85 dB, 2020 kHz] for 10 hours per day, 15 minutes per hour over a total period of 3 weeks) (Van Raaij et.al 1996, abstract in Turina and Barber 2011).

Francis et al. (2011) found that noise-reducing baffles around oil compressors lessened the spatial area impacted by non-baffled compressors by 70 percent. Both a New Mexico study by Francis et al. (2011) and a study by Bayne et al. (2008) in Canadian boreal forest report that noise from oil compressors could affect bird communities up to 700 meters from the compressor stations. The noise from oil compressors in the above references cannot be directly compared to noise from drilling rigs because noise parameters (decibel weighting, distance from source) in the studies differ from those used for this project's noise analysis, therefore the areas of noise detection used here are taken from Section 3.1, Noise.

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 and the project area. Drill sites and access roads may be located in any of these habitat types with stipulations applied to protect forest resources. See Forest Plan FEIS for a full description of wildlife habitat (USDA Forest Service 2004, Section 3.3).

Temporary roads exist in the project area at different stages of construction, closure, and decommissioning. Forest wide temporary road construction and mileage is estimated to range from 523 to 628 miles open in any year during the next 20 years. This range is 58 percent to 67 percent of the miles analyzed in the Forest Plan FEIS.

Activities take place all year and include timber harvest, road construction, closure, and decommissioning, and recreation of many types.

EIS Section 3.1.2.3 describes the existing soundscape. Intermittent noise occurs on the forest from heavy equipment used during timber harvest. Timber harvest does not take place 24 hours a day but heavy machinery may be active for several weeks within a harvest unit.

Recent research considers northeastern Minnesota largely unfragmented (2011 Programmatic Biological Assessment, page 81). Habitat continuity, the opposite of fragmentation, in LAUs outside the BWCAW ranges from 75 percent to 96 percent on SNF land (US Forest Service 2011a). Habitat fragmentation is different from forest fragmentation where areas of forest are permanently changed to non-forested conditions. This project will not result in permanent forest removal and therefore forests fragmentation is not evaluated.

3.8.3 Direct and Indirect Effects to Wildlife

The following analysis applies to both current and future prospecting permits because activities from both current and future exploration would have similar methods, and have potential effects on the same overall species on the SNF (although the threatened, endangered and sensitive species lists could change in the future).

3.8.3.1 Design Features and Mitigation Measures

In all action alternatives stipulations in Section 2.4 would protect known locations of sensitive species and maintain suitable physical distances and activity restrictions during critical breeding seasons according to each 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 determined by the district biologist would provide protection of new sensitive or threatened species areas as they are located.

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 site because of the presence of the equipment operators. Planning and stipulations would protect rare and sensitive species.

Clearing overgrowth on existing temporary or closed roads for drill rig passage may occur. Stipulations would 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 by forest personnel (see Appendix E). The Superior NF has monitored road decommissioning and has found decommissioning to be effective.

Large raptor breeding habitat would be protected around known breeding sites 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.

3.8.3.2 Alternative 1 – No Action and Existing Condition

Current and future prospecting permits and operating plans

Indicator 1. Acres and percent of young upland forest less than 10 years old (Management Indicator Habitat 1)
The amount of upland forest currently in a young condition of 0-9 years old is 65,093 acres or 6.8 percent. Natural disturbances would be depended upon to create young forest for deer and moose forage (as prey for wolves), ruffed grouse, and wolves.

Indicator 2. Miles of temporary road:
No temporary roads would be created for prospecting under this decision. Temporary road mileage is estimated to decline from 628 to 523 miles over the next 20 years (Existing Condition in Figure 1). This range is 67 percent to 58 percent, respectively, of the miles analyzed in the Forest Plan FEIS.

Indicator 3. Season of activities:
About 39 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.

Indicator 4. Traffic Volume
Traffic volume would not change as a result of this project. In the future traffic is expected to increase because of increased human population levels.

Indicator 5. Noise
Alternative 1 would have the fewest effects because no activities would take place and only activities currently taking place or occurring on other ownerships or in other projects might increase.

3.8.3.3 Effects Common to Action Alternatives

Current and future prospecting permits and operating plans

Indicator 1: Acres and percent of young upland forest less than 10 years old (MIH 1)
The amount of young upland forest would change from 6.8 percent to 7.3 percent of the Superior National Forest outside the Boundary Waters Canoe Area Wilderness. This amount of change stays within the desired young age-class condition of the Forest Plan for upland forest which calls for 11 percent in Decade 2 of the plan. The small percent of forest changed to 0-9 years old would be a discountable change in wildlife habitat for any species. Clearing drill pads will change habitat by less than 0.5 percent in any Lynx Analysis Unit or area. This habitat change will be temporary and few canopy trees will be removed. Habitat analysis may be found in the project file (Roads–habitat analysis.xls and the Biological Assessment).

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. Affected areas are expected to retain their pre-disturbance habitat 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.

Indicator 2. Miles of temporary road:
Temporary road mileage created under the current applications is estimated to range from no miles to 163 miles depending on the year since the decision (Figure 35, Current Applications). This would be a range of 58 percent to 84 percent of the Forest Plan FEIS estimated mileage over the life of the project.

Temporary road miles created by future prospecting permits are estimated to range from no miles to 131 miles depending on the year since the decision (Figure 35, Future Applications). This would be a range of 59 percent to 79 percent of the Forest Plan FEIS estimated mileage over the life of the project.

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**.** Existing temporary road estimates plus the current and future application mileage would result in an estimate of 532 to 860 miles of temporary road miles during the 20 year life of the project (Figure 35, Sum of Existing Condition and Action Alternatives). This equates to 59 percent to 95 percent of the temporary road mileage evaluated in the Forest Plan EIS (Figure 35, Forest Plan FEIS).

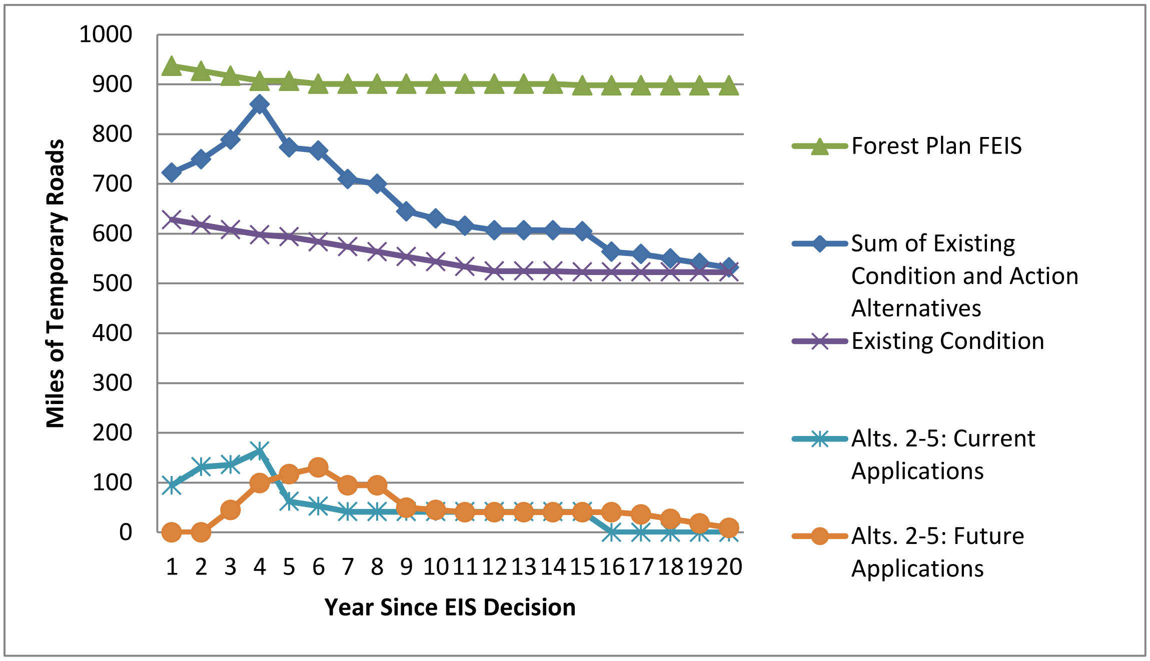


Figure 35. Comparison of Forest Plan FEIS and Hardrock Minerals Temporary Road Mileage

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 (Duffy 2010).

Road closure stipulations would require that roads be closed when operations cease for more than two weeks. Road closures would reduce, to the extent feasible, human influences on mortality risk and help to restrict public use to that allowed under the Forest Plan.

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. The intersections of new, closed temporary roads with roads open to the public are likely to become available as parking areas for 1-2 cars. 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 and 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.

Species using openings, such as moose and bats, may benefit from open temporary roads after activities cease and before the trees grow back. Bats use linear canopy openings to forage for insects and moose forage on young trees and shrubs. Many wildlife species such as moose, wolves, and lynx benefit from expending less energy while traveling on roads as compared to thick vegetation.

Effects from temporary roads are expected to be minimized by stipulations for seasonal restrictions, monitoring, and treatment of non-native invasive plants, restricted public access, and site-specific protection of known occurrences of sensitive species.

3.8.3.4 Differences among the Action Alternatives

Current and future prospecting permits and operating plans

Indicator 3. Season of activities:
Alternatives 2-4

Activities would take place year round, but about 60 percent of the project area 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 some of the roads. Alternatives 2-4 would impact the greatest number of species during breeding to effects from road collisions or noise.

Alternative 5

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.

Indicator 4. Traffic Volume
Alternatives 2-4

Daily traffic volume would vary by year corresponding to Biological Assessment Table 11 and Figure 1 (pages 22 and 23), with the highest volume expected 4 years after the Environmental Impact Statement decision date. Daily traffic volume is likely to be highest in any year during dry conditions and the summer season.

Some traffic volume from drilling rigs is similar to logging with one to several heavy commercial vehicles transported to a location for a few weeks and remaining stationary during operations. Total daily traffic to drill sites is estimated to include 10 trips to a site transporting fuel, supplies, water, workers, and drill cores (Wirz 2012). It is estimated that up 10 drill sites would be active at any time (FEIS Section 2.2.4). This would mean an increase of 100 vehicles per day spread over 2-10 lynx analysis units at any one time but many of the vehicles would be collecting on Highway 1 to access Ely, Babbitt, or State Highway 61.

There is increased likelihood of a vehicle collision with lynx but Highway 1 traffic volume has not resulted in any known lynx mortalities.

Alternative 5

Average daily traffic volume would increase similarly to Alternatives 2-4 but would take place mostly during the winter when drilling is allowed.

Indicator 5. Noise
It is likely that up to 10 drill rigs may be in operation at one time. Indicator 3 in Section 3.1, Noise is used for effects to wildlife because audibility may mask sounds created or received by animals to communicate or avoid predation. The area of audibility of the drill rig sound assuming an L50 ambient sound level and an L90 ambient sound level are displayed in Table 30.

Table 30 evaluates the area and scheduling differences between the alternatives. This assumes that all drill rigs are far enough apart to have independent sound impacts and represents the maximum area likely to be affected. For the effects of sound from more than one drill rigs see *Adding Sound Sources* in Section 3.1.

Table 30 Maximum effects of area, seasonal scheduling, and sound level of ten drilling operations on wildlife for alternatives 1 – 5.

Noise Indicator	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
L50: 50 percent of the time drill sound level would be audible					
Area of Audibility for L50 ambient	0 acres	41,640 acres or 65.1 $miles^2$	3,490 acres or 5.5 $miles^2$	3,490 – 41,640 acres or 5.5 to 65.1 $miles^2$ depending on location [a]	3,490 acres or 5.5 $miles^2$
Percent of high and moderate mineral interest areas**	0 %	14.4 %	1.2%	1.2 to 14.4 %	1.2 %
L90: 10 percent of the time drill sound level would be audible					
Area of Audibility for L90 ambient	0	239,820 acres or 374.7 $miles^2$	19,940 acres or 31.2 $miles^2$	19,940 – 239,820 acres or 31.2 - 374.7 $miles^2$ depending on location	19,940 acres or 31.2 $miles^2$
Percent of high and moderate mineral interest areas**	0	82.9%	6.9%	6.9% and 82.9%, depending on location	6.9%
Season of drilling	No drilling	Mostly winter, some summer	Mostly winter, some summer	Mostly winter, some summer	Only winter (November 1 to April 30)
Range of sound levels *	0 dBA	0 - 84 dBA	0 - 70 dBA	0 - 84 dBA	0 - 70 dBA

Noise Indicator	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5

*Numbers are derived from EIS Section 3.1, Table 21, Impacts per drill site for alternatives 1 – 5.
**High mineral interest acreage (87,288 acres) and moderate interest area acreage (201,884 acres), with a total of 289,172 acres, are from EIS Section 2.2.2.4.
Note: all action alternatives would be required to meet Minnesota Rules on Noise including for private and recreational residences, resorts and campgrounds.

a - Effects per drill site depend on location for Alternative 4 because mitigation would need to be implemented depending on whether a receptor close enough to the receptors to exceed limits specified in Table 16.

Alternative 2
Alternative 2 is the Proposed Action. No sound mitigations. Alternative 2 would have the largest noise impacts to wildlife because no sound mitigations would be put into place, activities would take place year-round, and the maximum sound level allowed is the highest of all alternatives.

Up to 14.4 percent of the high and moderate mineral interest areas may be subject to noise levels above ambient sound levels for more than 50 percent of the time. Year-round sound from drilling activities and helicopter use would affect all species of wildlife. Although it is difficult to determine how each sensitive species or species of public concern might be affected, it is likely that in Alternative 2 all species would be impacted by reduced communication and predator avoidance abilities to some degree during the entire year in the largest area of all alternatives.

Alternative 3
Alternative 3 includes mitigation to reduce sound volume in the entire project area. Alternative 3 would have more effects than Alternative 5 but fewer effects than Alternatives 2 and 4.

Up to 1.2 percent of the high and moderate mineral interest areas would be subject to noise above ambient sound levels for more than 50 percent of the time, the same as Alternative 5, because all drill rigs would be baffled, but activities would take place year-round. Year-round sound from drilling activities and helicopter use would affect all species of wildlife. Although it is difficult to determine how each sensitive species or species of public concern might be affected, it is likely that in Alternative 3 all species would be impacted by reduced communication and predator avoidance abilities to some degree during the entire year.

Alternative 4
Alternative 4 includes limits on sound volume reaching recreation receptors. Alternative 4 would have more effects than Alternatives 3 and 5 but fewer effects than Alternative 2.

The affected area would be range from 1.2 percent up to 14.4 percent depending on the adjacency of drill rigs to recreation receptors. Only drill rigs near receptors mitigated under Alternative 4 or Minnesota Rules on Noise would be baffled but others would not be baffled resulting in higher sound levels near those rigs far enough from recreation receptors to not need baffling. Activities would take place year-round, affecting all species during breeding season and those that spend the winter. Year-round sound from drilling activities and helicopter use would affect all species of wildlife. Although it is difficult to determine how each sensitive species or species of public concern might be affected, it is likely that in Alternative 4 all species would be impacted by reduced communication and predator avoidance abilities to some degree during the entire year.

Alternative 5
Alternative 5 includes mitigation to reduce sound volume in the entire project area, and a seasonal restriction on drilling. Alternative *5* would have the least noise effects to wildlife of the action alternatives.

The affected area would be 1.2 percent, the same as Alternative 3, because all drill rigs would be baffled, but activities would only take place during the winter. Fewer animals would experience increased noise in Alternative 5 because all drill rigs would have sound baffles to reduce noise levels and the fewest number of species would be present in the project area. Alternative 5 would not affect migratory species such as song birds and trumpeter swans and would not affect most species during their breeding periods. It would increase the effects to species like wintering great gray and boreal owls that rely heavily on sound cues to find prey. Both species are winter visitors or residents and highly mobile. Although they would be able to move to suitable hunting habitat away from the noise of drill rigs they may risk losing territorial advantages and have increased energy expenditures in new surroundings. Noise from helicopters would disturb the fewest number of species during the breeding season, which starts in early spring for eagles.

3.8.4 Cumulative Effects

3.8.4.1 Analysis Area and Timeframe

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 wildlife population distribution and habitat components in northeastern Minnesota.

The time period used for analyzing cumulative effects for all permits and plans is from 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.

Alternative 1

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

Effects Common to all action alternatives

Indicator 1: Acres and percent of young upland forest less than 10 years old (MIH 1)

There would be no cumulative effects to upland forest because there would be no direct or indirect effects.

Indicator 2. Miles of temporary road:
Temporary road creation on other ownerships may increase as human population levels and resource demands increase resulting in a potential increase in car collisions with wildlife.

Indicator 3. Season of activities:
Seasonal actions on other ownerships are expected to take place during the same timeframes as current conditions resulting in no change to wildlife.

Indicator 4. Traffic Volume

Traffic volume forecasting data was not available to anticipate cumulative effects to traffic volume over the next 20 years. The best data available was vehicle miles traveled from 1992 to 2009 (MN DOT 2010). Changes in socioeconomic indicators and gas prices can affect vehicle miles traveled. Vehicle miles of travel in Minnesota have been growing linearly since the 1970s, but since 2004 growth has been flat and slightly declined from 2007 to 2009. The potential for car collisions with wildlife would increase or decrease with traffic volume changes.

Indicator 5. Noise

Noise from drilling rigs would add to noise already found on the forest because of management, roads, recreation, and aircraft. It would add to the cumulative effects of noise generated on other ownerships and from the above mentioned activities and from drilling on other ownerships. The cumulative effects would reduce the area of the forest with ambient levels of sound and increase the area where communication and predator avoidance may be impacted.

Other Issues:
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.

3.8.5 Conclusions

Alternative 1

There would be no impact to any sensitive species since no exploration or permitting would occur. The National Forest System lands would continue to be managed under Forest Plan direction to maintain, protect, or improve habitat for all sensitive species (O-WL-18) and to ensure that management would not lead to a trend toward federal listing (S-WL-5).

This alternative would have no effect on lynx because forest habitat for lynx and snowshoe hare would remain unchanged and/or continue at present successional rate. Habitat would continue to be sufficient for lynx. Road and snow compacted trail density would remain unchanged. Temporary road changes would result from cumulative projects but not from this project. Lynx critical habitat would remain unchanged and/or continue at present successional rate.

Alternatives 2-4

For sensitive species Alternatives 2-4 may impact individuals but are not likely to cause a trend to Federal listing or loss of viability. For sensitive species and species of concern to the public:

- Habitat disturbance associated with the project, including temporary road construction, temporary road reconstruction, geophysical surveys, drill pad construction, and drilling activities, could reduce or create suitable habitat for terrestrial animals however the change would be discountable. Habitat would change by less than one percent over the 20 years of the project and disturbed vegetation from drill pad operations and road construction or reconstruction would grow back after road closure.

- Miles of temporary road created will remain within the amount expected in the Forest Plan. Temporary road closures and decommissioning are incorporated into permits and results will be monitored.

- Seasonal variation of alternatives will be minor because of the need to operate on frozen soils in all action alternatives. Stipulations for the reduction of human disturbance near known sensitive species occurrences would be applied, reducing the likelihood of disturbance to individuals at nesting or denning sites.

- Noise would vary by alternative with Alternative 3 having the lowest level of effects, Alternative 4 having more effects, and Alternative 2 having the most effects.

These actions may affect, and are likely to adversely affect lynx because

- The increase in temporary roads would increase the opportunities for interspecific competition and human caused disturbance or mortality; however closing roads when they are not actively in use would reduce those factors. Temporary roads miles would increase but stay within the range evaluated in the Forest Plan EIS.
- Indirectly, the increased vehicular travel on roads and highways accessing temporary roads may result in an increased risk of lynx-vehicle collisions on OML 1-5 roads and highways. However, no increase in the density of OML 1-5 roads would take place in any alternative and road mileage changes are not proposed in this project.
- Increased daily traffic volume on Highway 1 from nonfederal actions, the Kawishiwi Mineral Exploration project, the Glacier vegetation project, and this project could make it harder for lynx to safely cross Highway 1.
- The location of the upgrading of Highway 1 coincides with the likely travel corridors used in this project, the Kawishiwi minerals project, and the Glacier vegetation management project. This would result in increased traffic speeds in the section of Highway 1 most affected by an increase in traffic volume. Increased traffic speed of all vehicles along with an increase in heavy truck traffic, which takes longer to stop and is wider than a car, may lead to an increase in the likelihood of vehicle-lynx collisions.

These actions may affect, and are not likely to adversely affect lynx because

- Road and snow compacted trail density would remain unchanged.
- Habitat for lynx and snowshoe hare would not change more than 0.5 percent in any area. After 3 to5 years the forested habitat cleared for this project would grow back into hare habitat.
- Prospecting activities would be spread across the entire year in alternatives 2-4, reducing inter-specific effects resulting from snow compaction, but increasing potential denning season disturbance near drill sites as compared to Alternative 5.
- Changes to critical habitat would not reduce or remove understory vegetation within boreal forest stands on a scale proportionate to the large landscape used by lynx. As prospecting is completed in permit areas, habitat changed to 0-9 years old would grow back in 3-5 years, creating hare habitat.

Alternative 5

For sensitive species Alternative 5 may impact individuals but is not likely to cause a trend to Federal listing or loss of viability. For sensitive species and species of concern to the public:

- Habitat disturbance associated with the project, including temporary road construction, temporary road reconstruction, geophysical surveys, drill pad construction, and drilling activities, could reduce or create suitable habitat for terrestrial animals however the change would be discountable. Habitat would change by less than one percent over the 20 years of the project and disturbed vegetation from drill pad operations and road construction or reconstruction would grow back after road closure.

- Miles of temporary road created will remain within the amount expected in the Forest Plan. Temporary road closures and decommissioning are incorporated into permits and results will be monitored.

- Stipulations for the reduction of human disturbance near known sensitive species occurrences would be applied, reducing the likelihood of disturbance to individuals at nesting or denning sites.

- Alternative 5 includes mitigation to reduce sound level in the entire project area, and a seasonal restriction on drilling. Alternative *5* would have the least noise effects to wildlife of the action alternatives because activities would only take place during the winter in a small area (1.2%).

These actions may affect, and are likely to adversely affect lynx because

- The increase in temporary roads would increase the opportunities for interspecific competition and human caused disturbance or mortality; however closing roads when they are not actively in use would reduce those factors. Temporary roads miles would increase but stay within the range evaluated in the Forest Plan EIS.
- Indirectly, the increased vehicular travel on roads and highways accessing temporary roads may result in an increased risk of lynx-vehicle collisions on OML 1-5 roads and highways. However, no increase in the density of OML 1-5 roads would take place in any alternative and road mileage changes are not proposed in this project.
- Seasonal restrictions to only winter activities may allow greater inter-specific competition during snow season, but there may be beneficial effects from fewer disturbances during the breeding season because prospecting activity would end April 30, at about the time when the denning season begins.

These actions *may affect and are not likely to adversely affect* lynx because

- Road and snow compacted trail density would remain unchanged.
- Habitat for lynx and snowshoe hare would not change more than 0.5 percent in any area. After 3 to5 years the forested habitat cleared for this project would grow back into hare habitat.
- Changes to critical habitat would not reduce or remove understory vegetation within boreal forest stands on a scale proportionate to the large landscape used by lynx. As prospecting is completed in permit areas, habitat changed to 0-9 years old would grow back in 3-5 years, creating hare habitat.

3.8.6 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 32 permit application areas, 21 site specific operating plans, and future permit applications 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 32.

Indicator 1: Acres of non-native invasive plants known from the 32 permit application areas and one permit extension.

This indicator describes the acreage of known infestations within the 32 permit application areas (29 of which are proposed for consent and permitting in the FEIS; see FEIS Section 1.4 Proposed Action). 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 for the current permit applications are the permit areas shown in Maps 3.1 through 3.13 and adjacent areas of the BWCAW within one mile of permit areas adjoining the wilderness. The area covered by the analysis of direct and indirect effects for future permit applications (Forest-wide) 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 31 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 31 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 Forest-wide 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 31 Non-native invasive plants known in the Forest-wide 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.

Species	MN Status[a]	Life History/Habitat Summary	**Acres[b]**	**Ecological Risk[c]**

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 Forest-wide analysis area has a relatively low level of non-native invasive plant infestation (Table 31). The total known infestation acreage is approximately 1,933 acres, or about 0.2 percent of Forest Service ownership in the Forest-wide 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 32 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 32 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 32); 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 32 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 31). 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.

As noted above, temporary roads constructed for access to drill pads would create disturbed ground that could be colonized by non-native invasive plants. Construction and use of the roads during drilling operations would be one likely source of new invasive plant infestations. An additional source of non-native invasive plants is possible illegal ATV use on these roads. Although these temporary roads would be closed to motorized use when permit operations are not taking place, ATVs may get around the closure and use the road, thus risking non-native invasive plant spread. However, past monitoring of road closure effectiveness has shown that closures are largely successful at restricting motorized use; 90% of the closures monitored in 2011 were effective with no motorized use (USDA Forest Service 2011). This same monitoring found invasive plants on most of the monitored roads but that the invasives did not dominate the site (USDA Forest Service 2011). This monitoring supports the conclusion that temporary road construction associated with prospecting activities would result in spread of invasives, but that illegal ATV use on closed roads is not likely to be a major source of non-native invasive plant spread.

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 Forest-wide analysis, approximately 3,725 acres would be affected by ground disturbance associated with the project (Table 32). These activities would cause the same types of effects on invasive plants as described above. This analysis assumes that multiple small areas will be disturbed by temporary road construction and drill pad construction. These areas will be distributed across the landscape wherever exploration takes place, which could be pretty widespread judging by the operating plans submitted by Lehmann Exploration, DMC, and Twin Metals. Some of these areas would be locations that had not recently been disturbed by human activity. 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. Intervening non-disturbed forest lands would prevent invasive plant infestations from coalescing into one large infestation. Instead, effects would be happening at multiple discrete locations. In a worst-case scenario, even if every acre disturbed by mineral exploration 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 33.

Table 33 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 FEIS 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 57) 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 57 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 (Appendix C), 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 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 (Appendix C) 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 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 in the BWCAW would be hand pulled or possibly treated with herbicide, pending a decision in the BWCAW NNIP Management Project). 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 Forest-wide 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 34 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 36 shows values or features characterizing inventoried roadless areas that were considered in the Forest Service Roadless Area Conservation FEIS (Vol. 1, 3–3 to 3–7).

3.10.1.3 2005 State Petitioning Rule and Subsequent Court Rulings

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.

On October 21, 2011 the 10th Circuit reversed the Wyoming District Court and upheld USDA's 2001 Roadless Rule. At the time of this EIS analysis, the injunction against the Roadless Rule remains in place until it has been lifted by the District Court of Wyoming. Timing will depend on whether the parties to the case seek further review by the 10th Circuit or the Supreme Court. There are other ongoing court challenges to the rule. The Roadless Rule is also being challenged by the State of Alaska and others in the U.S. District Court for the District of Columbia in State of Alaska v. USDA.

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 37. 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 35 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

SNF Forest Plan Revision Roadless Area Inventory	NFS Acres	Management Area Allocation
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 35 lists all Forest Plan inventoried roadless areas in the SNF. Table 34 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 36 and Table 37 show how and why the inventoried roadless area analysis for this project considered these criteria as potential effects indicators.

Table 36 Roadless Area Conservation Rule 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 0 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 37 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	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

Criteria Focus	Criteria Description	Used in this Analysis	Rationale
	existing wilderness (regional guideline). No acre limit adjacent to existing wilderness.		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.

None of the current 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 3 weeks to 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 36. 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 FEIS Section 1.3, Project Area.

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 34 and Table 35 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 35 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 38 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 38 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

Name	Total Acres	NFS Acres	Acres of Federal Mineral Rights	Acres in the Mining Protection Area	Federal Mineral Rights Outside of MPA
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 39 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 39 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

Name	Total Acres	NFS Acres	Acres of Federal Mineral Ownership	Acres in the Mining Protection Area	Acres Fed Minerals outside MPA
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 40 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

Name	NFS Acres	Mineral Potential Interest Levels	Mineral Potential Interest Level Acres	NFS Federal Mineral acres outside of MPA
		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 41 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 42).

Table 42 . 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	17,147	86	0.5%	30,503	153	0.5%

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	%
acres in Roadless Outside of MPA						

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 36 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 could be a wild rice stand which has been harvested on a regular basis by a distinct, living community for the past 100 years (King and Parks 1998: 1). TCPs and historic properties are defined in the National Historic Preservation Act (NHPA-as amended), which provides the enabling legislation by which federal agencies consider effects to historic properties when undertakings are proposed, permitted, or funded by federal agencies. A summary of the NHPA and the Superior National Forest's Programmatic Agreement regarding the process for compliance with Section 106 of the NHPA is provided in the *Compliance with relevant direction* section. 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 undertakings 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 (32 permit applications, although only 29 are proposed in the FEIS; see FEIS Section 1.4 Proposed Action) and operating plans (21). Because heritage resources are a static, non-renewable resource, a buffer placed around each heritage resource site ensures adequate protection from ground disturbance. There are a total of 34 known heritage resources on National Forest 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 historic sites include known ore ranges, areas associated with historic logging roads and rail-lines, and areas with turn-of-the century homestead activity.

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 analysis area for the current prospecting permit application areas includes the national forest lands covered by these applications which is displayed in Maps 3.1 through 3.13. The analysis area for future permit applications includes all national forest land outside the BWCAW and MPA. 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 (46 surveys totaling 42,360 acres), only a small portion has been covered by more intensive survey (93 surveys totaling 2367.2), with approximately 1300 acres having never been surveyed.. The areas which have not received archaeological survey to date mostly consist of water saturated wetlands and landforms with slopes above 10%; both of which are considered low-probability locations for heritage resources. Block survey consists of aerial survey (i.e., identifying locations via aerial photographs or locations identified during helicopter flights and conducting subsequent ground survey). Although very little of the project area as a whole has received more intensive survey, the vast majority of high-probability locations within the project area have received intensive survey by way of walkover pedestrian transects and/or intensive shovel testing of 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 current 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 ruined 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 current prospecting permit application areas is summarized in Table 43.

Table 43 Number of sites by type within the current 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 were reported to PA signatories 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 EIS 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 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 for the current permit applications includes the areas covered by the permit applications displayed in Maps 3.1 through 3.13. The boundary for direct and indirect effects for the Forest-wide analysis 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 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 could 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 seeding the disturbed areas.

There is a potential for artificial lights to be seen at night from drilling operations. Up to 10 light sources might be present from drilling operations at a given time (since it is estimated that up to 10 drill rigs may operate at a time for the project). Because drilling operations would be temporary, impacts from artificial lighting would also be temporary and end with the completion of operations. Drilling operations would represent a small fraction of artificial lighting compared to local towns. For example, the town of Ely likely has thousands of artificial light sources. Also, forest cover would reduce light that might be perceived by any individuals at residences or camping areas near the drill rigs.

Stipulations to protect scenery include a requirement for No Surface Occupancy in developed recreation facilities (e.g. campgrounds and trailheads), removal of flagging and other equipment upon completion of project activities, to adjust the location of drill sites up to 100 feet to avoid sensitive scenery, and to shield lights to reduce light pollution (see FEIS Section 2.4.3, Recreation, Visuals and Noise Stipulations). Reclamation requirements would also reduce impacts by requiring actions to return disturbed areas to a natural condition (RECL-2 and RECL-3). These stipulations would minimize impacts to scenery.

3.12.4 Cumulative Effects

The boundaries for cumulative effects for the current permit applications includes all land ownerships within the area covered by the current permit applications. The boundaries for cumulative effects for the Forest-wide analysis 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 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 Forest Service 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 36).

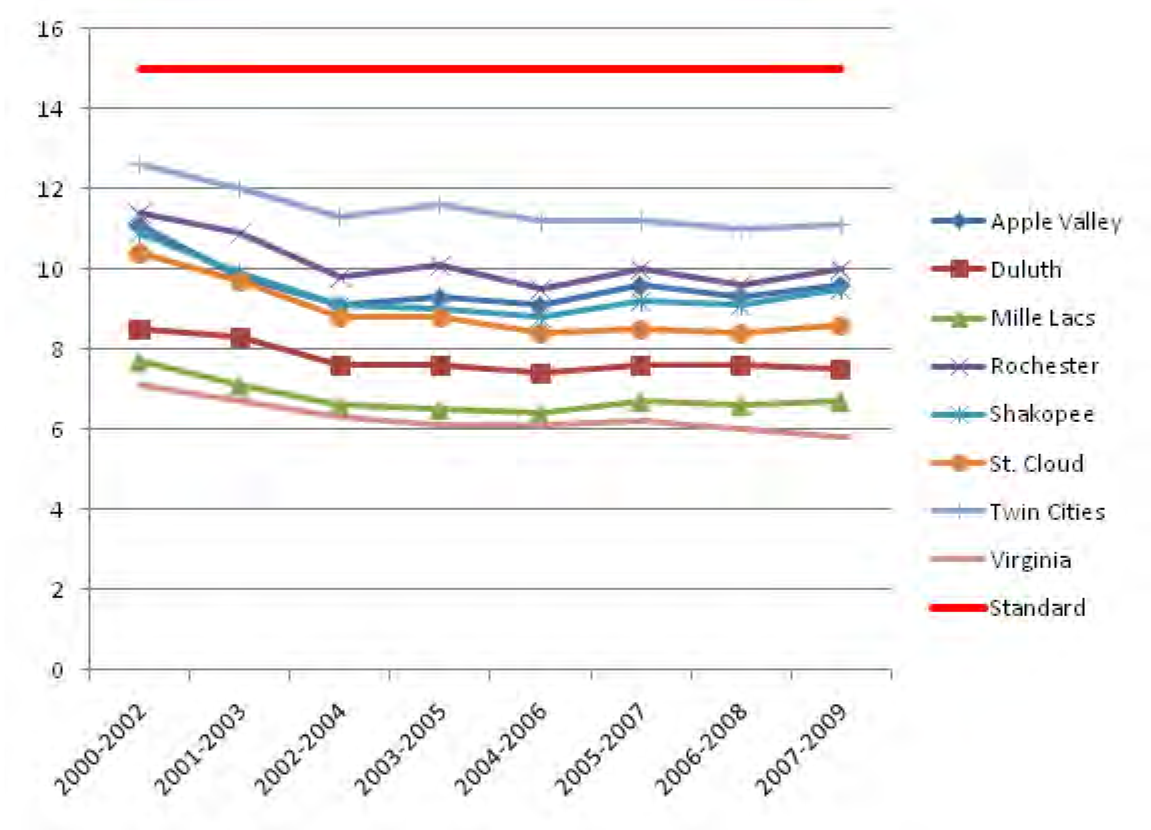


Figure 36 Fine particulate matter monitoring results for Minnesota (MPCA 2010)

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 that 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 Social, Economic and Environmental Justice

3.14.1 Introduction

Social, 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 discussion of social, economic and environmental justice conditions and effects in this section focuses on exploration and not minerals development since actions authorizing development are not covered under this EIS, as stated in Section 1.2.

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.

When we look at the effects of federal land management actions, the most critical impacts may be to small, rural communities (USDA USFS 2000). The values, beliefs and attitudes of area communities are presented to address social considerations where economic or other effects on area communities cannot be quantified due to absence of primary information specific to this effort and unavailable secondary data. Direction provided in 40 CFR 1502.23 and Forest Service Handbook 1909.15 (4/1/11) and 22.35 (9/1/10) 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 FEIS.

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 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.

Geographically defined communities are an important and relevant level for social assessment however, the geographically based community refers to physical or political boundaries and not to the relationships among people who reside within these boundaries. Consequently, social relationships are examined regardless of geography in the section on Values, Beliefs and Attitudes.

3.14.2 Affected Environment

3.14.2.1 Demographic Overview

Between 1970 and 2010 population change in Itasca, Koochiching, Lake, and St. Louis counties was 26, -22, - 19, and - 9 percent, respectively. Growth in these counties was outpaced by growth in the nation and the state of Minnesota which increased by 51 and 39 percent, respectively. In contrast Cook County population growth outpaced the state and was the same as the nation increasing by 51 percent over this period (Figure 37). 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 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.

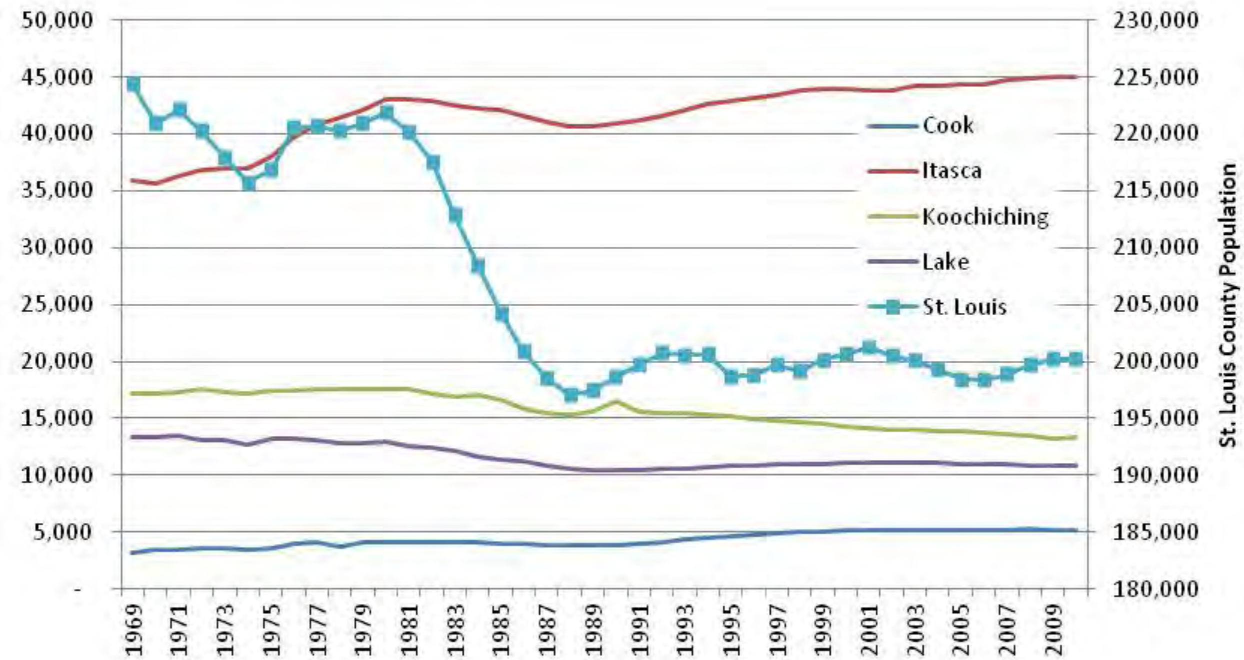


Figure 37 Population change in counties in the analysis area (US Department of Commerce 2010)

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, Asian, two or more races and Hispanic were greater in St. Louis County than their shares in the analysis (Table 44).

Table 44 Population by race (2010)

	White	Black or African American	American Indian and Alaska Native	Asian	Native Hawaiian or Other Pacific Islander	Two or more races	Some other race	Hispanic
Minnesota	85.3%	5.2%	1.1%	4.0%	0.0%	2.4%	1.9%	4.7%
Analysis area	93.3%	1.1%	2.5%	0.7%	0.0%	2.2%	0.2%	1.1%
Cook	88.1%	0.3%	8.6%	0.5%	0.1%	2.1%	0.3%	1.1%
Itasca	93.6%	0.3%	3.5%	0.3%	0.0%	2.0%	0.2%	0.9%
Koochiching	94.6%	0.6%	2.3%	0.3%	0.0%	1.9%	0.2%	1.1%
Lake	97.7%	0.1%	0.5%	0.3%	0.0%	1.3%	0.1%	0.7%
St. Louis	93.0%	1.4%	2.2%	0.9%	0.0%	2.3%	0.2%	1.2%

Source: Department of Commerce 2010

3.14.2.2 Economic Specialization and Employment

Employment within the analysis area is distributed amongst industry sectors and displayed below in Figure 38 (IMPLAN 2009). Support activities for other mining (does not include oil and gas) is an IMPLAN sub-sector disaggregated here to highlight its relevance to this EIS since it includes employment in exploratory drilling and other hardrock related activities. Identification of employment specialization within the analysis area provides a frame of reference for contributions from exploration and associated activities covered under this EIS. Employment specialization is examined using a 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). Using this criterion applied with 2009 data, the analysis area can be characterized as specialized with respect to employment in the Support activities for other mining sector.

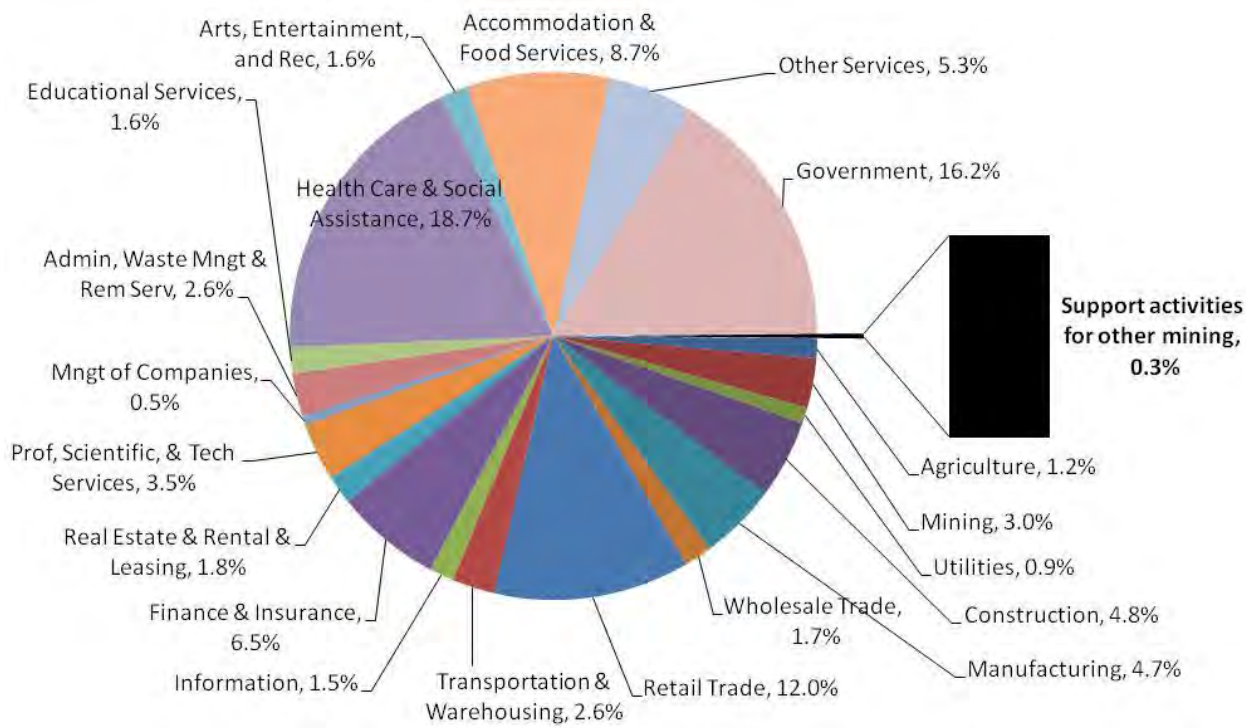


Figure 38 Analysis area industry employment distribution (Source: IMPLAN 2009)

From 1970 to 2009, total employment in the analysis area increased by 41.4 percent (from 112,592 to 159,179 jobs classified as full and part-time employment) (US Department of Commerce 2009). Within the analysis area the private sectors examined in can be lumped into Services related sectors (Transportation & Utilities, Wholesale trade, Finance, etc.) and Non-services related sectors (Farm, Agriculture, Mining, Construction, and Manufacturing) [10]. The total employment growth seen in these counties is largely due to increases between 1970 and 2009 in Services related employment. The share of total employment attributable to the Services related sectors increased from 47.3 to 69.3 percent. Employment in the Non-services related sectors decreased as a share of total employment over this period (from 30.2 to 13.4 percent) (US Department of Commerce 2011).

[10] Changes in employment for Services and Non-Services related sectors are discussed over the period from 1970 to 2010 despite the US Census Bureau changed its industry classification convention in 2000. The degree of error is much smaller when aggregating to two broad sector groupings (Services vs. Non-services sectors) and are used to depict general trends. Thus the author recognizes the potential for some discrepancy however, are not relevant for discussing general trends with broad sector aggregations.

3.14.2.3 Economic Well-Being and Poverty

As noted above, the Services sectors increased in their share of total employment while the Non-services related sectors decreased. However, the Services related sectors jobs may not pay as much, which could decrease area economic well being. In 2010 the Non-services and Services related sectors paid average annual wages of $55,271 and $32,578, respectively (US Department of Labor 2011). These wages indicate that while the services related sectors 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 services related sectors. 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 of the area. 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 2009, annual TPI in the economic analysis area increased by $4.3 billion to $9.8 billion, and annual PCPI increased from $19,145 to $36,188 (all measures adjusted for inflation to 2010 dollars). This translates to an TPI increase of 77 percent and a PCPI increase of 89 percent over this time period (US Department of Commerce 20011b). 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 2009 by 89 percent, average earnings per job rose by less than one percent (from $41,075 to $41,081;values adjusted for inflation to 2010 dollars) (US Department of Commerce 2011c). So while PCPI bounced back after job loss in the iron industry, real earnings per job have stagnated. Alongside observed increases in non-labor income associated with the aging population discussed above, the changes in PCPI make sense. Regardless real earnings per have stagnated indicating no increase in economic well-being for wage earners.

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. Since 2000, unemployment has continued to follow state and national trends and rose to 9.7 percent in 2009. Since 2009 unemployment has departed from national and state trends falling to 7.4 percent in August of 2011(US Department of Labor 2011b). 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).

The percent of people living below the poverty level was greater than the state in Koochiching and St. Louis counties (Table 45). However, the lower bound estimate of the Koochiching County estimate was slightly less than the upper bound state estimate at the 90 percent confidence interval indicating that estimates of poverty in Koochiching County are only greater than the state at lower levels of confidence. Regardless the data indicate populations living in poverty exist in the five county area at concentrations greater than the state overall. (US Department of Commerce 2010b).

Table 45 Share of population living below poverty level (US Department of Commerce 2010b)

Name	Poverty Percent All Ages	90% CI Lower Bound	90% CI Upper Bound
United States	**15.3**	**15.2**	**15.4**
Minnesota	**11.5**	**11.3**	**11.7**
Cook County	**9.6**	**7.3**	**11.9**
Itasca County	**12.2**	**9.8**	**14.6**
Koochiching County	**14.6**	**11.6**	**17.6**
Lake County	**11.2**	**9.0**	**13.4**
St. Louis County	**17.4**	**16.0**	**18.8**

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 56.5 percent of all income in 2009 (U.S. Department of Commerce, 2011d). The Manufacturing sector was the largest components of labor income in 2009 for the economic analysis area (Figure 39). The sector related to exploratory drilling broken out on the right of Figure 39 (Support activities for other mining[11]) makes up 0.01 percent of analysis area labor income.

[11] Support activities for other mining (does not include oil and gas) is an IMPLAN sub-sector disaggregated here to highlight its relevance to this EIS since it includes employment in exploratory drilling and other hardrock related activities.

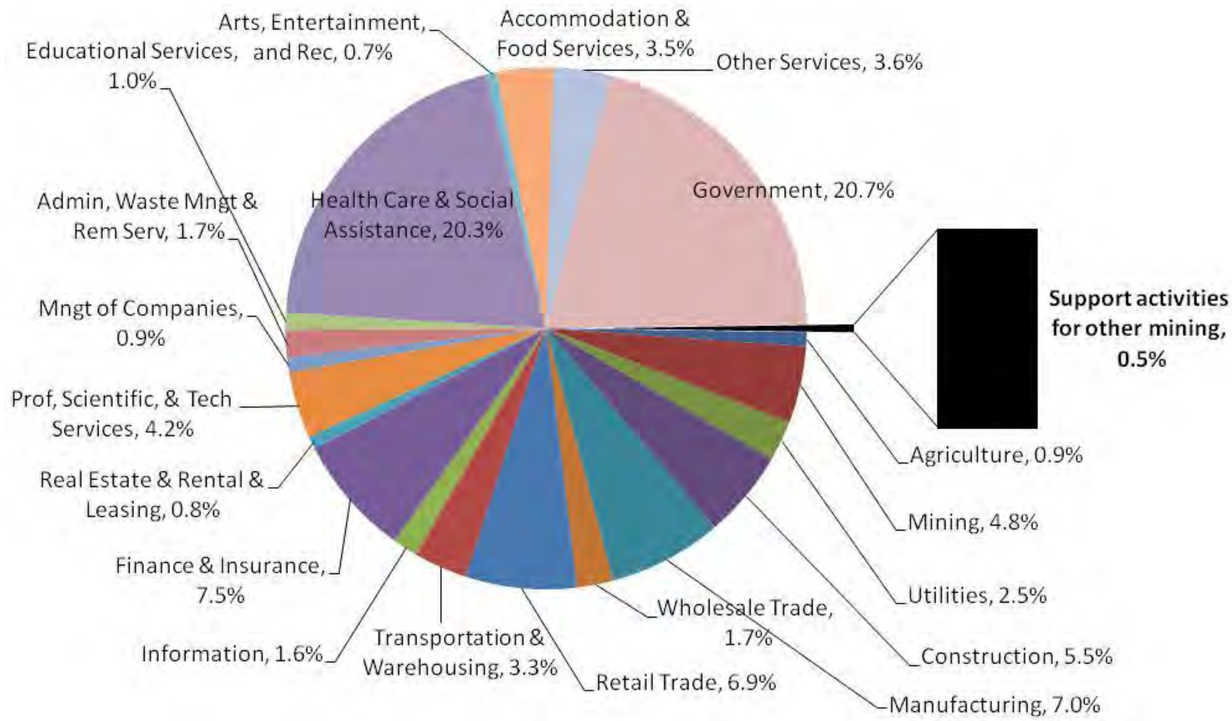


Figure 39 Economic analysis area labor income distribution (IMPLAN 2009)

While labor earning's share of TPI has decreased from 1970 to 2009 (from 75.0 to 56.5 percent), the share of non-labor income has risen (from 25 to 43.5 percent). As a share of TPI, investment income and transfer payments rose from 12.8 to 18.3 and 12.2 to 25.3 percent, respectively, over this 40-year time period. In 2009 the largest component of transfer payments were medical payments (24.5 percent while age related payments (classified as Retirement and Disability Insurance and Medicare/Medicaid Benefits) were second largest accounting for 19.1 percent of total transfer payments (U.S. Department of Commerce, 2011d).

These patterns reflect the importance of the aging population noted above, who 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). In addition, comments received on the Draft EIS emphasized the importance of natural amenities in the quality of life of area residents. Many of the natural amenities in the area are managed by the SNF and thus, indirectly contribute to area labor and non-labor income.

3.14.2.5 Values, Beliefs and Attitudes of Area Communities

Communities within analysis area can be described by the areas they live in and by their connections to the local landscape and the SNF. During the public involvement process for this EIS, the public has provided insightful information about their connections to the land and their interests in management under this EIS. This information has provided the SNF with community characteristics and values that help when defining communities connected to management under this EIS.

A range of values were evident from comments received as part of the public involvement process for this EIS. This section is presented to address social considerations where economic or other effects on area communities cannot be quantified due to absence of primary information specific to this effort and unavailable secondary data. Effects to these values are addressed here qualitatively as directed in 40 CFR 1502.23 and Forest Service Handbook 1909.15, (4/1/11) and 22.35 (9/1/10). Other social values (e.g. wilderness character, species viability, clean water) are discussed in other resource sections of the FEIS.

Effects related to water quality and noise from exploratory activities were noted of concern to area property values. Area residents and recreationists were also concerned about changes to their quality of life and recreation experiences from changes to noise, pollution, other environmental damage and loss of natural values from exploratory activities. Area residents noted that displaced recreation use could affect local economies and affect quality of life important to area residents. Values held by individuals and groups interested in exploratory drilling were evident from public comments. The cost to drilling operators of noise restrictions and other proposed stipulations was also noted as a concern. Others were concerned that these increasing costs would discourage exploration reducing discovery of future hardrock mineral sources.

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 44 shows that St. Louis County contained populations of those identifying as African American, Asian, two or more races and Hispanic were greater in St. Louis County than their shares in the analysis area in 2010. 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 was greater than the state in Koochiching and St. Louis counties (Table 45). However, the lower bound estimate of the Koochiching County estimate was slightly less than the upper bound state estimate at the 90 percent confidence interval indicating that estimates of poverty in Koochiching County are greater than the state at lower levels of confidence. Regardless the data indicate populations living in poverty exist in the five county area at concentrations greater than the state overall. 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, (4/1/11) and 22.35 (9/1/10) provides for the use of qualitative analysis to evaluate the effects of these non-market values. Accordingly, the section on Values, Beliefs and Attitudes of Area Communities is presented to address social considerations where economic or other effects on area communities cannot be quantified due to absence of primary information specific to this effort and unavailable secondary data. Other efficiency and non-market aspects of each proposed activity are 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 2009). 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 46) for the 20 year analysis period. Effects from potential minerals development are not included since these activities are not covered under this EIS. Table 46 below provides the list of activities and assumptions used in the economic analysis.

Table 46 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 operating plan 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 operating plan proposal per year may utilize helicopter support.

Employment and labor income response coefficients (employment and labor income per operating plan proposal) were estimated for the activities in Table 46. The response coefficients indicate the number of full- and part-time jobs and dollars of labor income generated per operating plan 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 47).

Table 47 Employment and labor income response coefficients (direct, indirect and induced effects per operating plan proposal)

Activities	Employment (Jobs per Operating Plan Proposal)		Labor Income (2011 Dollars) ($ per Operating Plan Proposal)	
	Minimum	Maximum	Minimum	Maximum
Geophysical Activities				
Ground and aerial survey	0.2	0.4	$6,210	$12,955
Drilling Activities				
Site prep and restoration	0.1	0.2	$5,391	$8,087
Drilling	5.3	21.2	$336,085	$1,344,339

It is important to note that while response coefficients may be greater for certain activity types, the economic effects to the analysis area depend on the level of activity or number of operating plan proposals that 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 operating plan 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 40). Estimates of employment and income under current and future prospecting permits depicted in Table 50 are annual averages of the estimates depicted in Figure 40.

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. Consideration of these impacts alongside additional social, ecological or other resource considerations provide a complete comparison of the EIS alternatives. The Values, Beliefs and Attitudes of area communities are presented to address social considerations where economic or other effects on area communities cannot be quantified due to absence of primary information specific to this effort and unavailable secondary data. In addition, other social values (e.g. wilderness character, species viability, clean water) are described in other resource sections of the EIS and specialist reports.

Environmental Justice

The potential for disparate and adverse effects to minority and low-income populations, as defined by the CEQ, are presented in the discussion of the alternatives below.

Spatial and Temporal Context for Effects Analysis

The timeframe over which activities may occur as a result of implementing operating plan 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 plan proposals would be approved. Consequently employment and income levels associated with exploratory drilling activities would not change from the current conditions described above. Current contributions from prospecting supported by the SNF would not be supported once permits expired. Thus employment and income depicted in Table 48 would no longer be supported by the SNF.

Values, Beliefs and Attitudes of Area Communities

A range of values were evident from comments received as part of the public involvement process for this EIS. This section is presented to address social considerations where economic or other effects on area communities cannot be quantified due to absence of primary information specific to this effort and unavailable secondary data. Effects to these values are addressed here qualitatively as directed in 40 CFR 1502.23 and Forest Service Handbook 1909.15, (4/1/11) and 22.35 (9/1/10). Other social values (e.g. wilderness character, species viability, clean water) are discussed in other resource sections of the FEIS.

As discussed above, prospecting permits and operating plan proposals would not be approved under the No Action Alternative. Thus additional effects to property values from water quality and noise from exploratory activities would not occur. Also additional changes to the quality of recreation experience from changes to water quality and noise from exploratory activities would not occur. Thus recreation use would not be displaced and local economies dependent on recreation would not be affected. Since prospecting permits and operating plan proposals would not be approved under this alternative, concerns about additional cost of noise restrictions and other proposed stipulations would not occur. However, concerns regarding discovery of future hardrock mineral sources would remain since no prospecting permits and operating plan proposals would be approved under this alternative. Thus, long run costs to industry would be greater under this alternative than with additional costs of noise restrictions and proposed stipulations under the action alternatives if the opportunity cost of forgone hardrock mineral discovery is considered under this alternative.

3.14.3.2 Alternatives 2 - 5

Current operating plans

Under the action alternatives the current 21 proposed operating plan proposals (and extension) would be approved. Consequently geophysical and exploratory drilling activities would occur as anticipated in Figure 7. The response coefficients shown in Table 47 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 48).

Table 48 Annual average economic effects of current operating plan proposals under the action alternatives

Activities	Employment (Jobs per Operating Plan Proposal)		Labor Income (2011 Dollars) ($ per Operating Plan Proposal)	
	Minimum	Maximum	Minimum	Maximum
Geophysical Activities				
Ground and aerial survey	0.2	0.4	$6,521	$13,602
Drilling Activities				
Site Prep and restoration	0.2	0.2	$5,571	$8,357
Drilling	6.5	25.8	$347,527	$1,389,509
Total	6.8	26.4	$359,619	$1,411,468

Over the 20 year analysis period, anticipated exploration and associated activities would provide a minimum of 7 jobs (direct, indirect, and induced) and $360,000 in labor income (direct, indirect, and induced) and a maximum of 26 jobs and $1.4 million in labor income on an average annual basis within the analysis area[12]. 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 plan proposals under the action alternatives.

Current prospecting permits

Under the action alternatives the current 46 prospecting permits (only 29 are proposed for permitting in the FEIS, see Section 1.4 Proposed Action) may have two operating plans per permit under the assumptions of the scenario in FEIS Section 2.2.2.4, thus there could be a total of 92 operating plan proposals 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 47 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 49).

Table 49 Annual average economic effects of current prospecting permits under the action alternatives

Activities	Employment (Jobs per Operating Plan Proposal)		Labor Income (2011 Dollars) ($ per Operating Plan Proposal)	
	Minimum	Maximum	Minimum	Maximum
Geophysical Activities				
Ground and aerial survey	0.4	0.9	$14,283	$29,796
Drilling Activities				
Site Prep and restoration	0.6	1.0	$22,967	$34,451
Drilling	26.6	106.4	$1,431,960	$5,727,242
Total	27.7	108.2	$1,469,211	$5,791,488

[12] While the estimate of total jobs (direct, indirect and induced) may seem small in comparison to perceptions of the number of people employed in the industry, one job can be composed of multiple people who work on the Superior National Forest for a portion of the year. For example, a drilling operator may work on state or private land during 9 months out of the year and on the SNF for 3 months thus, a quarter of the operator's annual job is attributable to exploratory drilling on the Superior National Forest. This applies to all IMPLAN estimates of employment in this document.

With these additional operating plan proposals, anticipated exploration and associated activities would provide a minimum of 28 jobs (direct, indirect, and induced) and $1.5 million in labor income (direct, indirect, and induced) and a maximum of 108 jobs and $5.8 million 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 plan proposals. Consequently geophysical and exploratory drilling activities would occur for these 50 additional permits as anticipated in Figure 7. The response coefficients shown in Table 47 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 50).

Table 50 Annual average economic effects of current plus future prospecting permits under the action alternatives

Activities	Employment (Jobs per Operating Plan Proposal)		Labor Income (2011 Dollars) ($ per Operating Plan Proposal)	
	Minimum	Maximum	Minimum	Maximum
Geophysical Activities				
Ground and aerial survey	0.6	1.2	$19,459	$40,591
Drilling Activities				
Site Prep and restoration	1.2	1.8	$42,830	$64,245
Drilling	49.6	198.4	$2,670,167	$10,680,068
Total	51.4	201.4	$2,732,455	$10,784,904

With the additional operating plan proposals authorized under these anticipated permits, exploration and associated activities would provide a minimum of 51 jobs (direct, indirect, and induced) and $2.7 million in labor income (direct, indirect, and induced) and a maximum of 201 jobs and $10.8 million 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.

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 40).

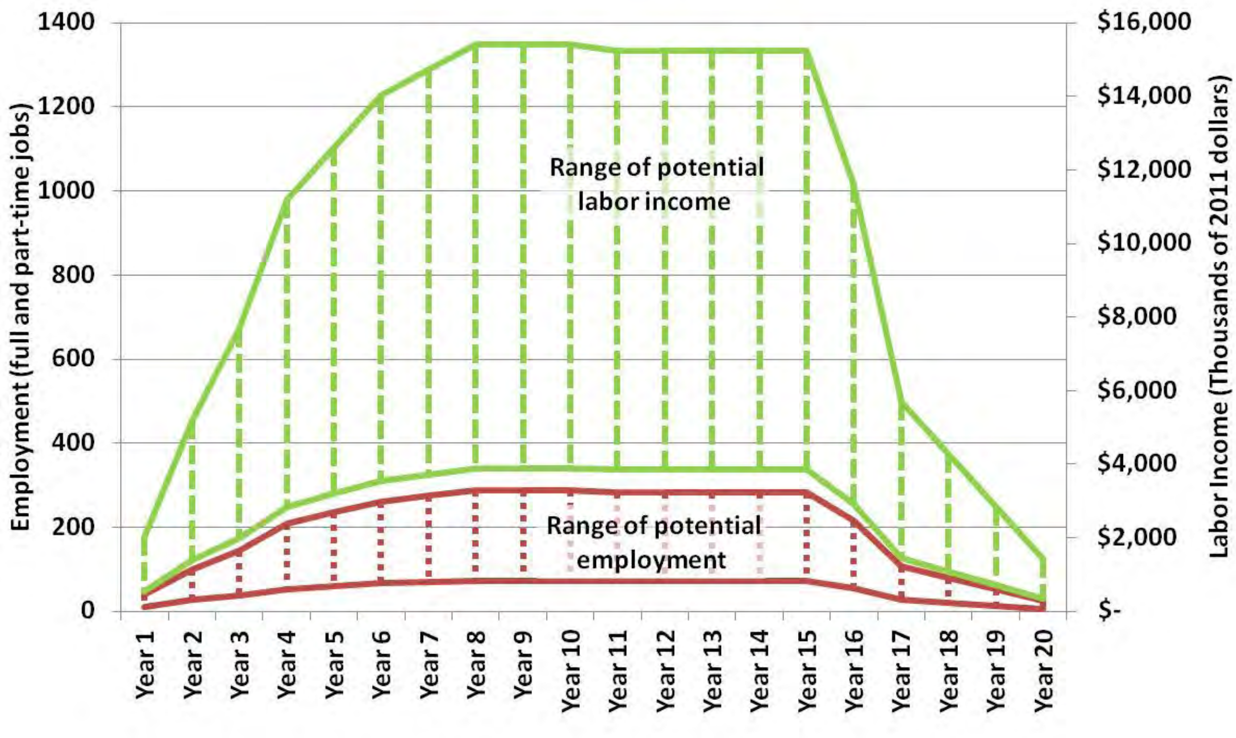


Figure 40 Annual estimates of minimum and maximum employment and income under the action alternatives

Between years 8 and 10 the maximum potential employment and labor income contribution is possible (Figure 40). Over this period exploration and associated activities would provide a minimum of 73 jobs (direct, indirect, and induced) and 3.9 million in labor income (direct, indirect, and induced) and a maximum of 287 jobs and $15.4 million in labor income on an average annual basis across all sectors of the analysis area economy.

Maximum potential contributions would account for less than one percent of analysis area employment and labor income totals but larger portions of sub-sectors in the analysis area economy. Potential maximum direct effects to the support activities for other mining sector[13] occurring in years 8 through 10 would constitute 21 percent and 16 percent of sub-sector employment and labor income, respectively. It is important to note that these are not necessarily new jobs or income, but rather jobs and income that may be attributed to activities associated with current and future prospecting permits. Employment estimates included above are not necessarily new jobs but may accrue in industries with capacity to take on additional work.

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. Adverse effects from increases in-migration to accommodate employment under this EIS were noted of concern to

[13] An IMPLAN sub-sector disaggregated here to highlight its relevance to this EIS since it includes employment in exploratory drilling and other hardrock related activities.

socioeconomic conditions, infrastructure and services important to minority or low income populations; such as housing prices and medical services. Employment estimates included above are not necessarily new jobs but may accrue in industries with capacity to take on additional work. If any additional employment is required as a result of this EIS, it would likely be met by local labor supply, given the levels of unemployment described above in the affected environment section. Thus adverse effects to minority or low income populations would not occur.

Values, Beliefs and Attitudes of Area Communities

A range of values were evident from comments received as part of the public involvement process for this EIS. This section is presented to address social considerations where economic or other effects on area communities cannot be quantified due to absence of primary information specific to this effort and unavailable secondary data. Effects to these values are addressed here qualitatively as directed in 40 CFR 1502.23 and Forest Service Handbook 1909.15, (4/1/11) and 22.35 (9/1/10). Other social values (e.g. wilderness character, species viability, clean water) are discussed in other resource sections of the FEIS.

Potential effects to property values from exploratory activities would be short term (up to 3 weeks; see Minerals exploration scenario section) lasting as long as drilling noise was apparent. Potential effects would be further mitigated with stipulations to address drilling and helicopter noise. Long-term property value effects are unlikely to be affected since property values are largely determined by factors outside the scope of management under this EIS.

As noted in the recreation section of this EIS only temporary effects on dispersed users are anticipated; Short-term effects may impact trails and trail users and effects would last as long as the recreationist was at or near the drill pad. While some recreation use would be displaced to other parts of the forest, contributions to local economies from these uses would remain; thus local economies dependent on recreation would not be affected.

While additional costs to operators from noise restrictions and other proposed stipulations would occur under the action alternatives they would be less than under the No Action Alternative where the long run costs would be greater if the opportunity cost of forgone hardrock mineral discovery is considered. In addition, the additional marginal costs of drilling restrictions represent a small portion of overall drilling costs and are outweighed by benefits of hardrock mineral discovery.

Summary of Effects

Under the action alternatives, anticipated exploration and associated activities would provide a minimum of 51 jobs (direct, indirect, and induced) and $2.7 million in labor income (direct, indirect, and induced) and a maximum of 201 jobs and $10.8 million in labor income on an average annual basis within the analysis area (Table 50). Employment estimates are not necessarily new jobs but may accrue in industries with capacity to take on additional work. If any additional employment is required as a result of this EIS, it would likely be met by local labor supply, given the levels of unemployment described above in the affected environment section. 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

The economy and socioeconomic concerns brought up during public involvement for this effort (recreation, property values, etc.) 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.

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. Potential maximum direct effects to the support activities for other mining sector[14] from activities under current and future prospecting permits would account for less than 21 percent in employment and labor income annually in any given year of the 20 year analysis scenario. Total employment supported in all sectors of the analysis area economy would not exceed a half of a percent in any given year.

3.15 Required and Other 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 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 landscape ecosystem (LE) composition and age class distribution have been identified as a

[14] An IMPLAN sub-sector disaggregated here to highlight its relevance to this EIS since it includes employment in exploratory drilling and other hardrock related activities.

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 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):

3.15.2.1 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.

3.15.3 Adverse Impacts That Cannot Be Avoided If the Project is Implemented

The scope of disturbance of minerals exploration is limited (e.g. projected to be 3,725 acres over 20 years Forest-wide). In addition, application of stipulations, Forest Plan direction, relevant state and federal laws and regulations, and monitoring would avoid and mitigate adverse impacts as discussed throughout this EIS. Impacts of the project are disclosed in FEIS Chapter 3.

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 3.15.2.1 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.

3.15.4.5 Wild and Scenic River Act

The proposed action includes a permit area which contains about 34 acres near the St. Louis River designated as a recreational river in the Forest Plan. Actual disturbance within this area would be less than 34 acres since exploration activities only disturb a fraction of the permit application area. Stipulations shown in Section 2.4.3 including RV-6, RV-8, WAT-5, WAT-8, RECL-2, and RECL-3 would further minimize impacts in this small area and meet Forest Plan Management Area direction for this recreational river. The outstandingly remarkable values, free flowing character, and classification would be maintained. See also sections 3.3, 3.12 and 3.6 which indicate that exploratory activities would have limited impacts to recreation, scenery and water resources.

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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.

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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
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Friends of the Boundary Waters Canoe Area
Friends of the Boundary Waters Wilderness
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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
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TriTech Inc
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4.1.1.1 Public Comment on Draft EIS

See FEIS Appendix J for a listing of commenters on the Draft EIS. Notification of the availability of the Final EIS will be sent to this same list of individuals and organizations.

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.

Alerting distance The maximum distance at which a signal can be perceived. Alerting distance is pertinent in biological contexts where sounds are monitored to detect potential threats.

Ambient Sound All-encompassing sound at a given place, usually a composite of sounds from many sources near and far *(ANSI S1.1-1994, 3.26).*

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.

Background Sound All-encompassing sound associated with a given environment without contributions from the source or sources of interest (ANSI S12.9 Part 3, 5.3).

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	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.
A' Weighted Decibel (dBA)	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.
Known Occurrences	A record of the location and date that a rare species is observed and documented through a scientific reporting process which evaluates the legitimacy of the species identification and location or is reported by an expert. The observation must be of a natural (non-captive) occurrence that is made at a location having habitat that functionally supports the species.
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.

Mitigation	Action taken for the purpose of eliminating, reducing or minimizing negative impacts of management activities on the environment.
Noise	(a) Undesired sound. By extension, noise is any unwarranted disturbance within a useful frequency band, such as undesired electric waves in a transmission channel or device. (b) Erratic, intermittent, or statistically random oscillation (ANSI S1.1-1994, 3.25).
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 is reviewed by the BLM and FS and authorized by the BLM. It may be active during through the course of the prospecting permit.
Other Species of Interest	The Superior National Forest's Land and Resource Management Plan designates the following as other species of interest and defines objectives or guidelines for their management: aquatic and terrestrial game species, osprey, great blue heron, and common loon.
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.
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 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	(a) Oscillation in pressure, stress, particle displacement, particle velocity, etc., in a medium with internal forces (e. g. elastic or viscous), or the superposition of such propagated oscillations. (b) Auditory sensation evoked by the oscillation described above (ANSI S1.1-1994, 3.01).
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 by Forest Service personnel in order to ensure the operating

inspection	plan 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.

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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 interdisciplinary team review and grouping exercise. These are issues that can be resolved therefore are briefly discussed in the EIS or in Table 51 below. Please note that comments that resulted in the same disposition statement were grouped together.

Table 51 Issue disposition

Comment	Disposition	Location of Discussion in DEIS/FEIS
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 BWCAW 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 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 0 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/FEIS
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 1.5). 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.	Water 3.6
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.	Section 2.2.2.4
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 BE 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/FEIS
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. 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 (3.8)
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/FEIS
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.	Approximately 1,960 core holes have been drilled to date in the basal zones of the complex within the Superior National Forest (Wirz 2012). (see Map 6). 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). Based upon these mitigation measures, the	Water (3.6)

Comment	Disposition	Location of Discussion in DEIS/FEIS
	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.	Impacts to the BWCAW, including to water resources in the BWCAW are discussed in Section 3.2. More detailed information on water resources is in Section 3.6 and FEIS Appendix G. Mining is not part of the proposed action.	Wilderness (3.2) 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, 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.	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. Brackish water is considered in Section 3.6 and FEIS Appendix G, Tech Memo 4 and 4a. 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 1.5) 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/FEIS
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 sound levels affecting receptors (Indicators 3-5 listed in the Noise Section of this EIS), was conducted to corroborate the analysis in the Noise Section 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 the Noise Section 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 the Noise Section of the EIS (e.g. the Affected Environment section, and the discussion for Indicators 5 and 6).

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. See Table 52.

Model Runs

Several model runs were completed to estimate potential sound level and area impacted by the proposed drill sites in the current operating plans. The input parameters used are shown in Table 53. 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 the Noise Section of the EIS are measured in A-weighted decibels. While this does not allow for a direct comparison between the model outputs for impact to the human experience, it allows for an alternative analysis method from the analysis in the Noise Section of the EIS. The two models were compared to evaluate whether the analysis in the Noise Section of the EIS represents a conservative estimate of negative effects. In other words, does the analysis in the Noise Section 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 the Noise Section of the EIS does.

Table 52 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-4. The drill rig was measured at 47 decibels at the 1000 hertz frequency, 450 feet from the drill rig.
Ambient Soundscape	The table from p. 11 of the SPreAD-GIS instruction manual was used in consideration of the model run conditions and monitoring for sound levels done on the SNF. The values chosen are shown in Table 53.
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-5. Windroses for Ely, MN are displayed in Figures B-15 through B-18.
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 41 through Figure 48. The SPreAD-GIS model may be run to display 'baseline noise propagation'[15], 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'[16] 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 41 through Figure 48.

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

[15] 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)

[16] 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)

generated from the SPreAD-GIS model are overlaid on the L50 area of audibility and sound contours produced from the analysis in the Noise Section of the EIS. This allows for a comparison of the results between the two analyses. While the sound contours from all of the drill sites are displayed, the model runs assume that the drill sites are not in simultaneous operation. The effect of simultaneous operation is discussed in the Noise Section of the EIS.

Table 53 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 41, baseline noise propagation is almost completely within the area of impact predicted in the Noise Section of the EIS. As shown in Figure 42, excess noise propagation predicted by SPreAD-GIS is far less than what is predicted in the Noise Section of the EIS as displayed by the ‘area of audibility’ and sound contours shown on Figure 42. 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 the Noise Section of the EIS. In other words, the analysis in the Noise Section of the EIS conservatively estimates 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 the Noise Section of the EIS. See Figure 43 and Figure 44.

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 41 and Figure 42 to Figure 45 and Figure 46, 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 the Noise Section of the EIS. See Figure 47 and Figure 48.

Conclusion

The model runs display noise propagation that generally shows a similar or smaller impact area than what is displayed in the Noise Section 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 the Noise Section of the EIS. Therefore, the analysis in the Noise Section of the EIS generally represents a conservative estimate of sound impacts that would occur from drilling.

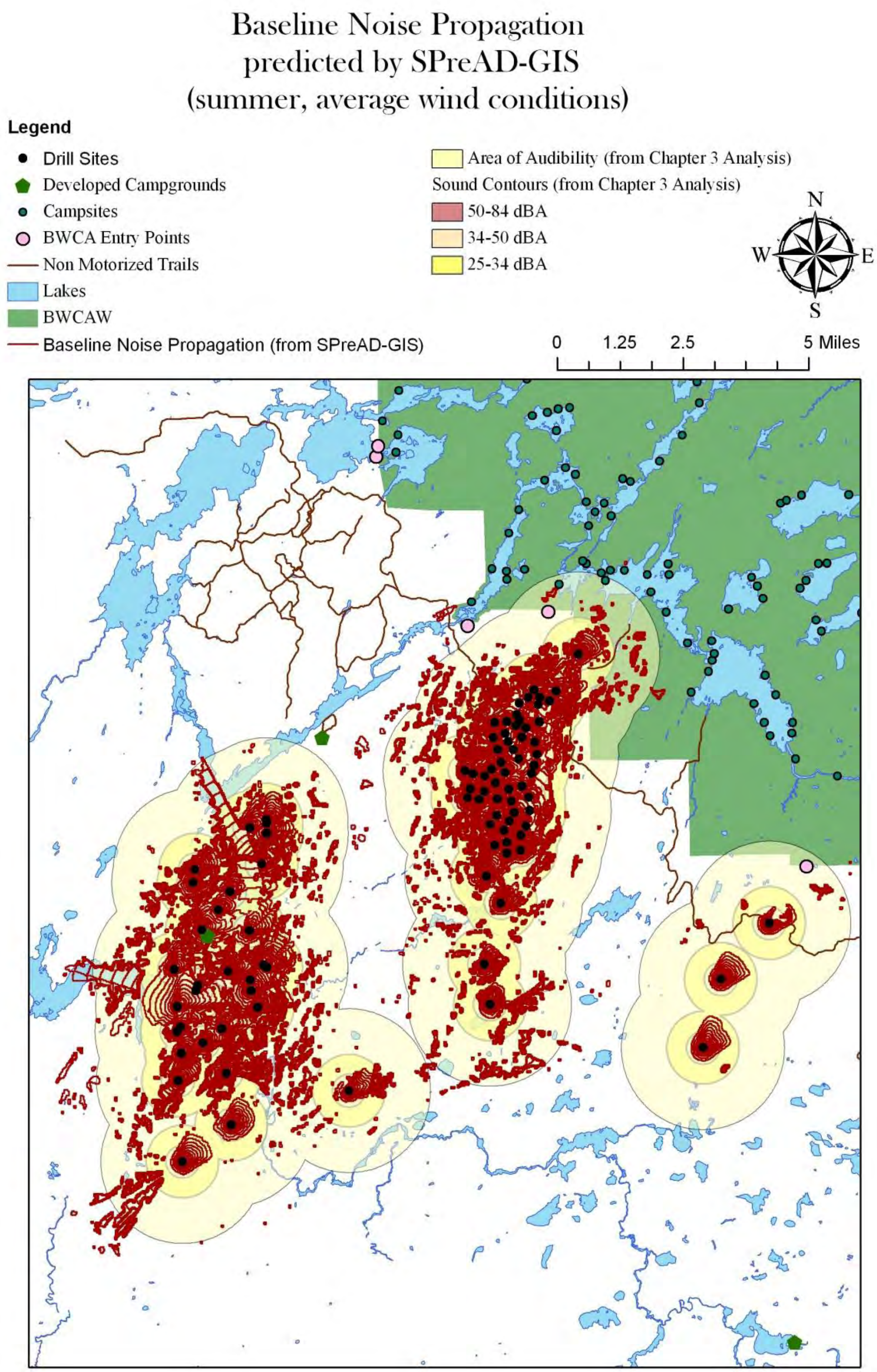


Figure 41 Baseline noise propagation from run #1

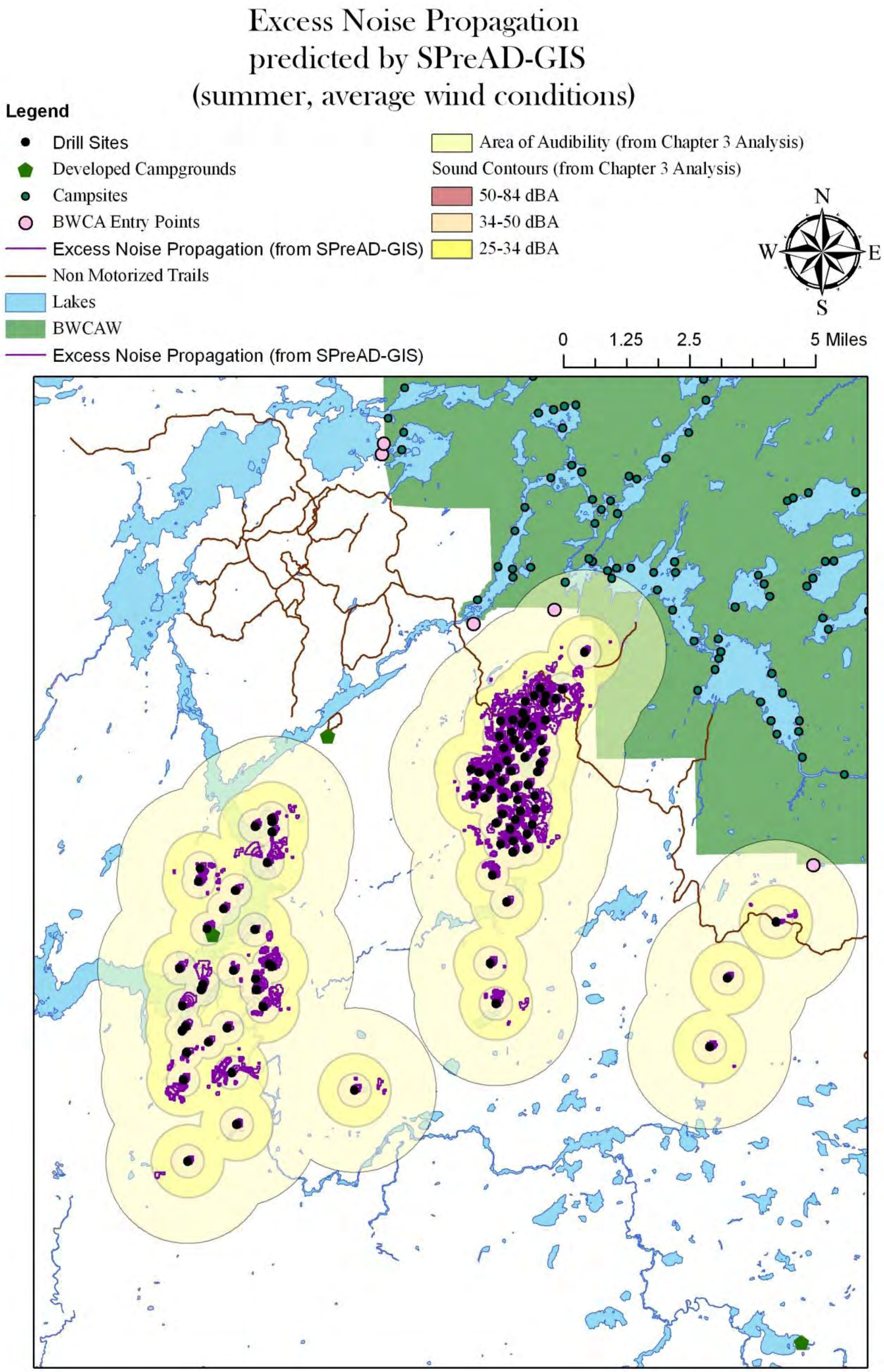


Figure 42 Excess noise propagation from run #1

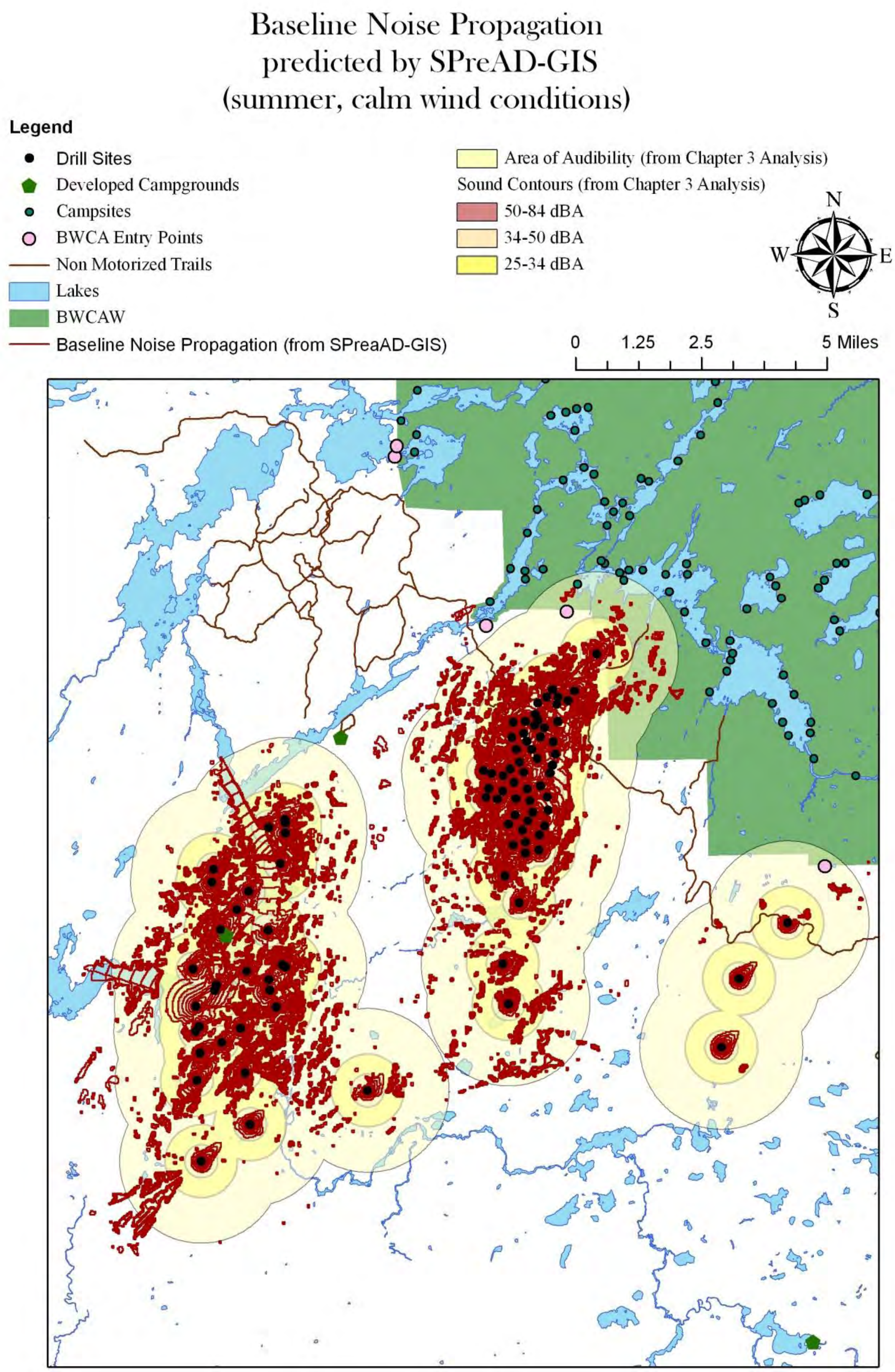


Figure 43 Baseline noise propagation from run #2

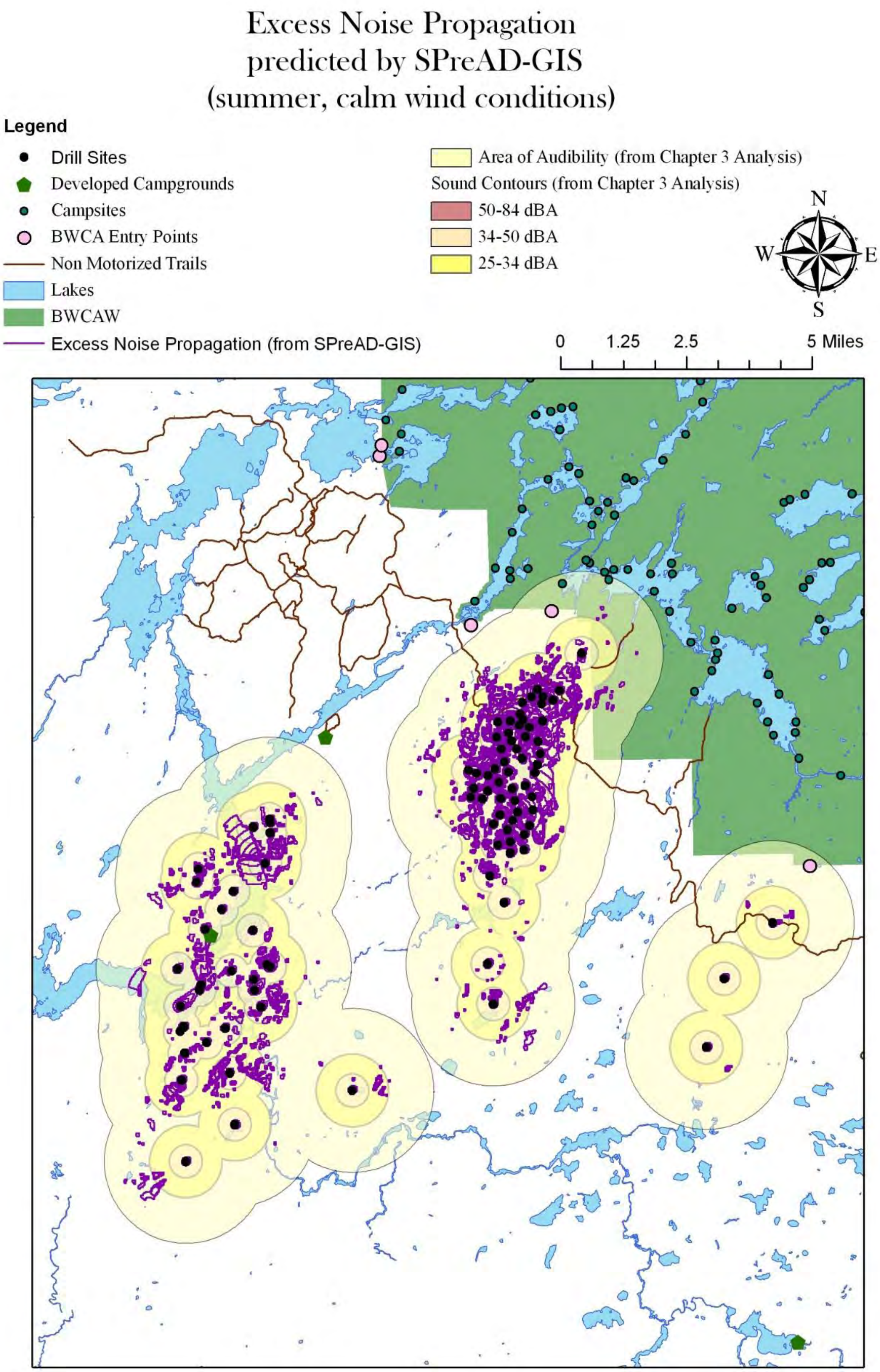


Figure 44 Excess noise propagation from run #2

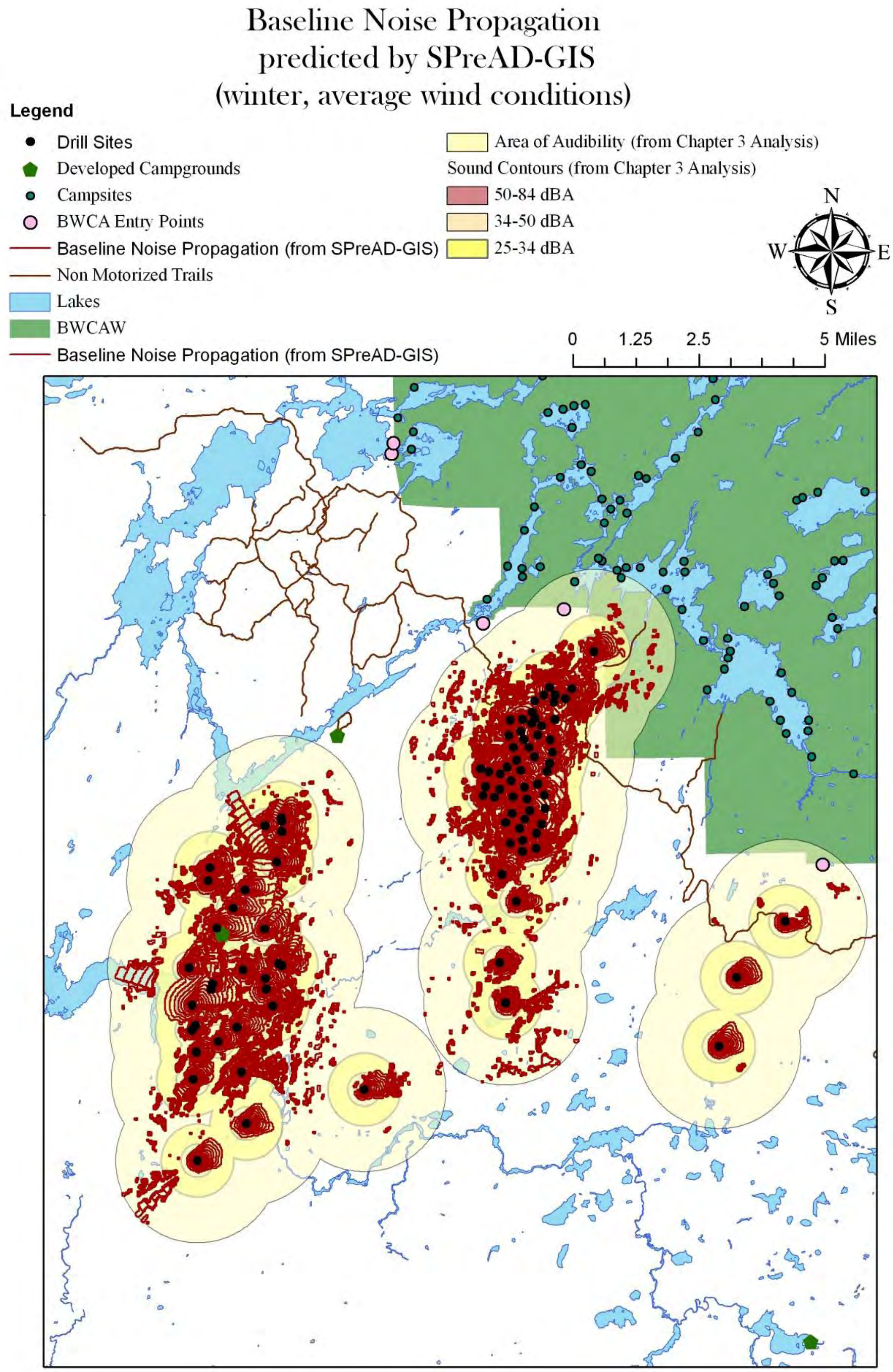


Figure 45 Baseline noise propagation from run #3

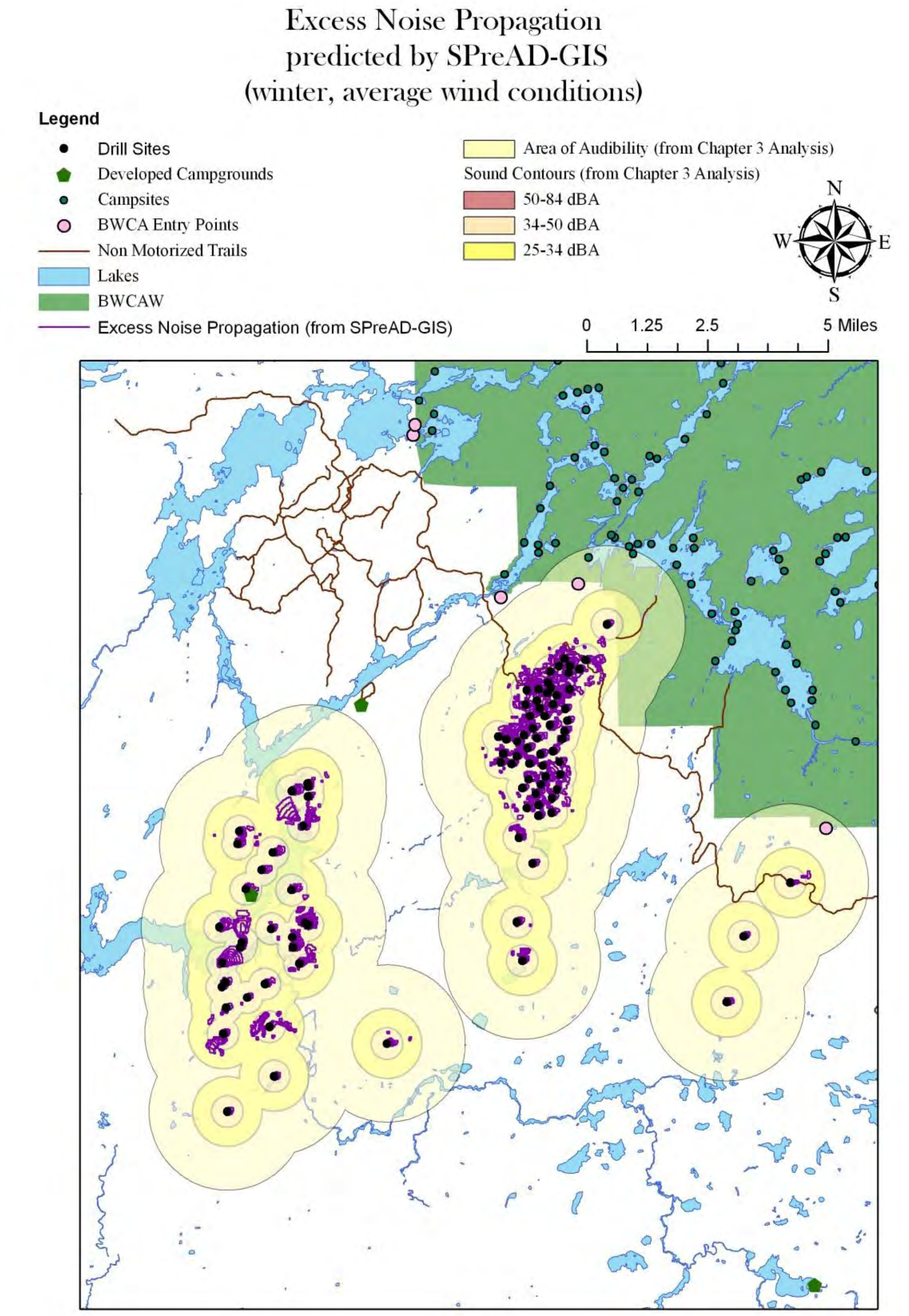


Figure 46 Excess noise propagation from run #3

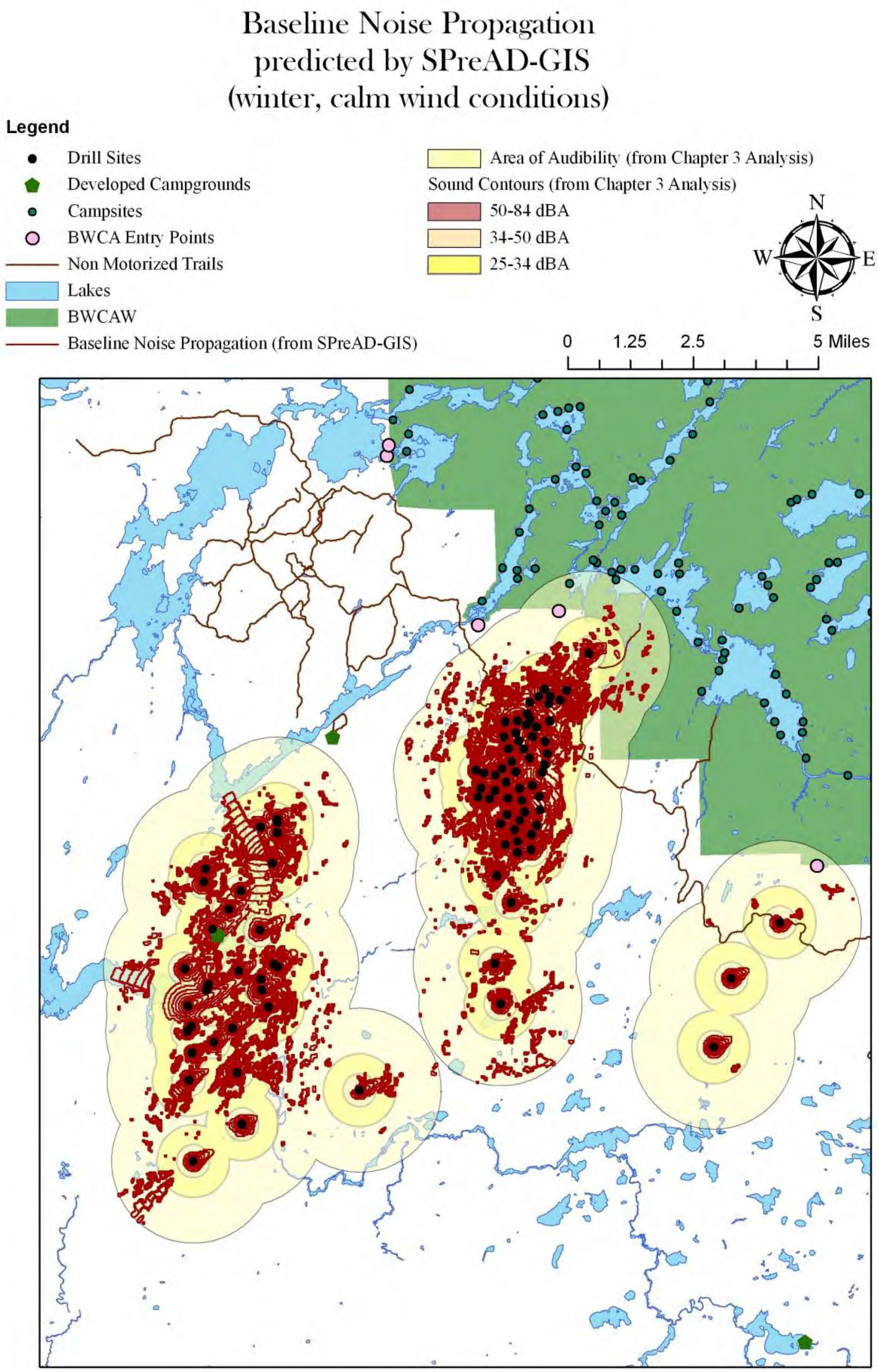


Figure 47 Baseline noise propagation from run #4

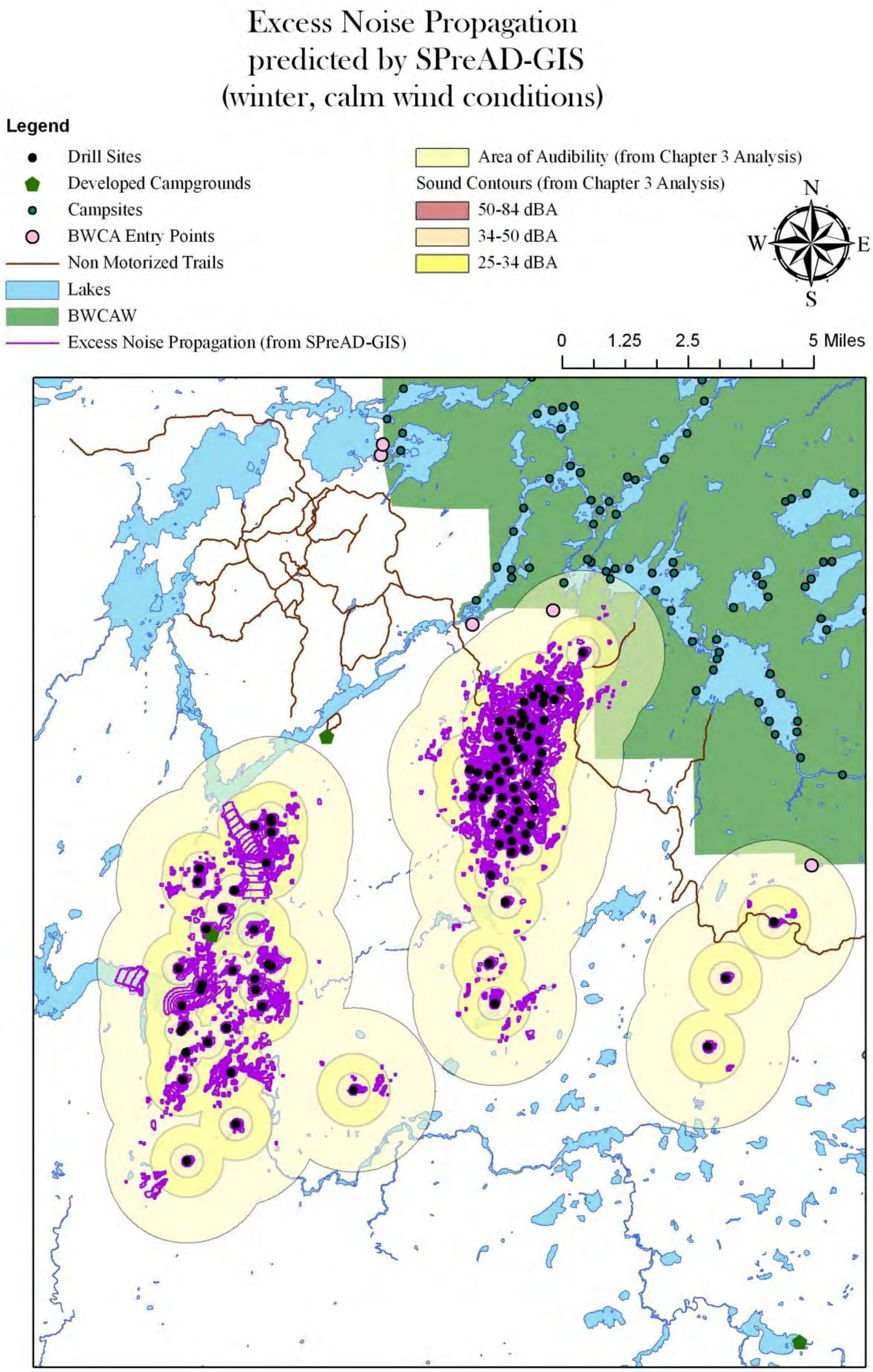


Figure 48 Excess noise propagation from run #4

Monitoring Data

A Larson Davis 831 sound pressure measurement device was used to collect the data in Table 54 and Table 55. 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 54. The frequency of calm periods versus periods with high wind speeds is shown on the windrose charts in Figures B-15 through B-18. The full data output from calibration and use is more extensive and is in the project file.

Table 54 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. Winter data is also shown for the BWCAW and the Kawishiwi Research Station.

The data in Table 55 is the 1/3 octave frequency sound level 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. 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 54 and the windroses in Figures 49 through 52 display weather data that was used for input into the SPreAD-GIS model, and to inform the analysis in the Noise Section of the EIS.

As described in Section 3.1.1, ambient sound levels identified in the Regional Copper Nickel Study were used for the analysis in Section 3.1)

Table 54 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	Sept . 8	total median dBA
Overall 24 hr data	51.9	34.7	39.7	50.7	44.1	27	37.7	42.7	29.1	39.7
Day 0700 - 2300	52.3	35.7	41.2	52.2	45.7	28.1	37.8	40.5	31.3	40.5
Night 2300 - 0700	27.4	31.7	30.6	41.5	34.2	22.7	37.3	45.2	27.9	31.7
LAFminimum	24.1	18.7	18.9	18.8	18.1	17.4	18	18.9	19.5	18.8
Wind speed average (mph)	12	5	3	11	10	0	3	7	6	6.3 mph avg
Rain inches	0.08	0	0.31	0.17	0	0	0	1.06	0	1.62" total

Little Gabbro Lake BWCAW 2011 (winter)							
Little Gabbro Lake	24-Feb	25-Feb	26-Feb	27-Feb	28-Feb	1-Mar	total median dBA
Overall 24 hr data	40.8	36.5	37	48.4	39.4	49.8	40.1
Day 0700 - 2300	41.2	38.2	38.8	50.1	40.7	52.8	41.0
Night 2300 - 0700	25.7	20.6	20	28.1	33.2	45.2	26.9
LAFminimum	16.7	16.4	16	16.1	16.3	21.3	16.4

South Kawishiwi River/Spruce Road March 2011 (winter)							
S. Kaw River/Spruce Road					8-Mar	9-Mar	total median dBA
Overall 24 hr data					29	27.2	28.1
Day 0700 - 2300					29	29.4	29.2
Night 2300 - 0700					29.6	22.8	26.2
LAFminimum					16.4	16.4	16.4

Table 55. 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 56 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.

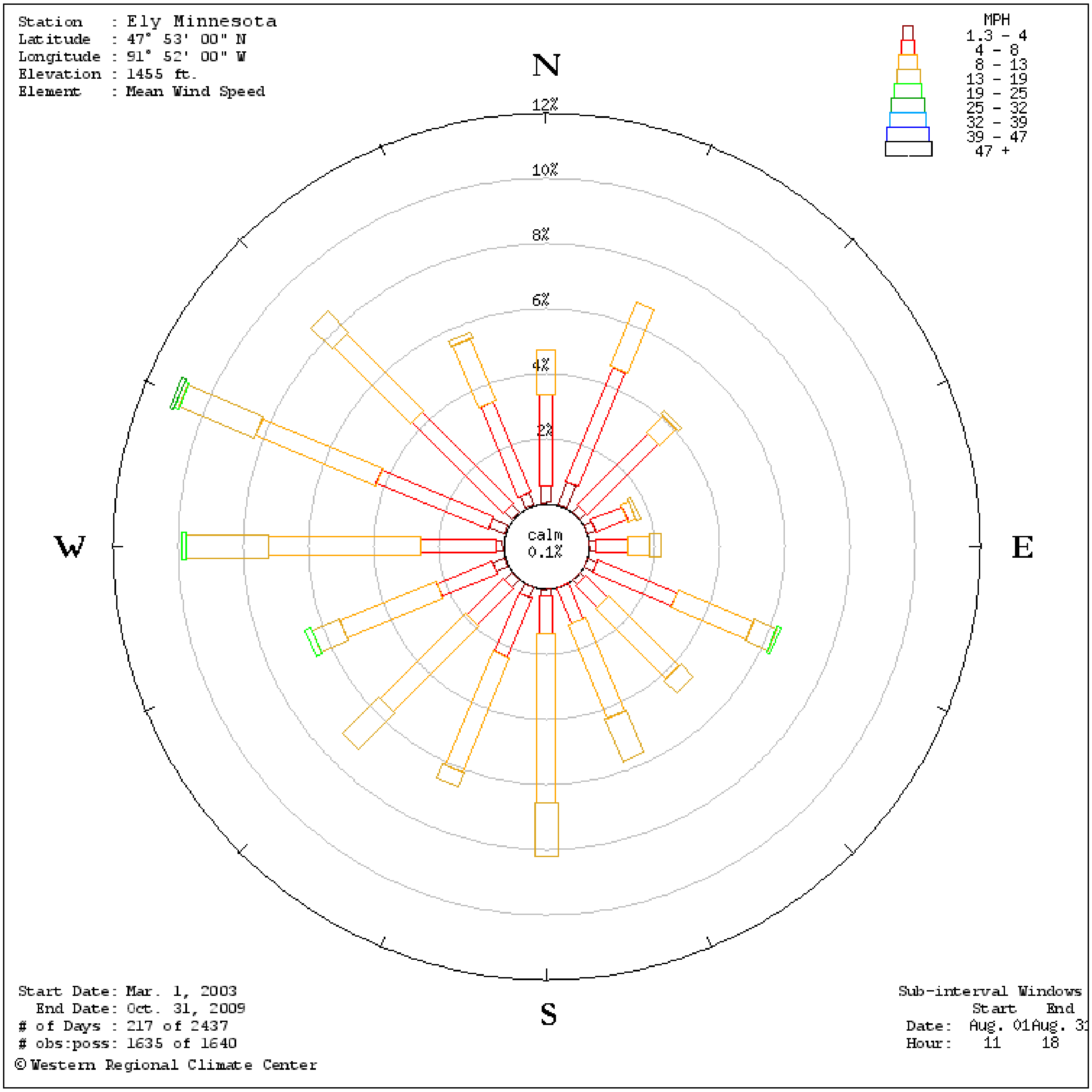


Figure 49 Windrose: summer, daytime, Ely, MN

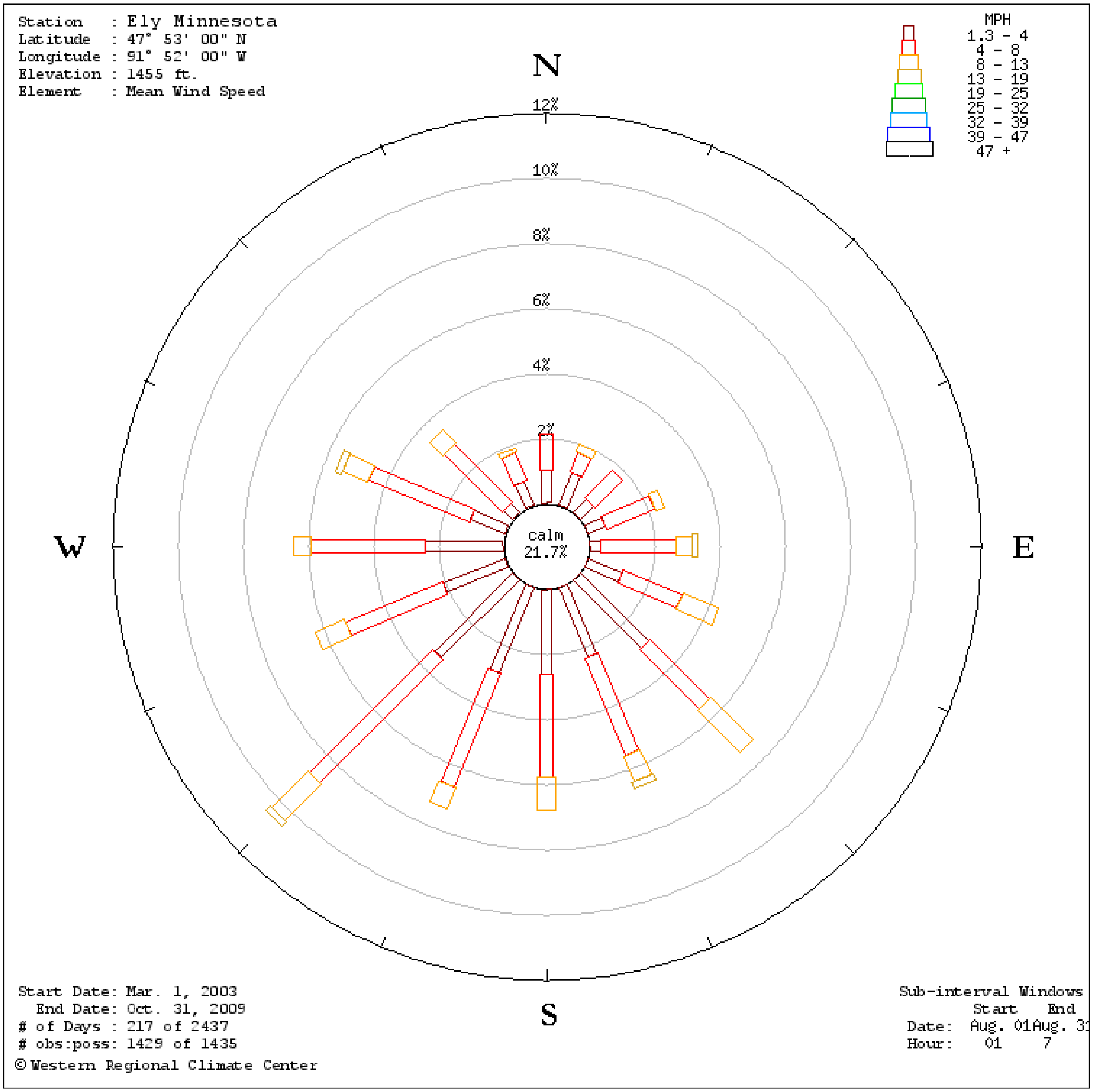


Figure 50 Windrose, summer, nighttime, Ely, MN

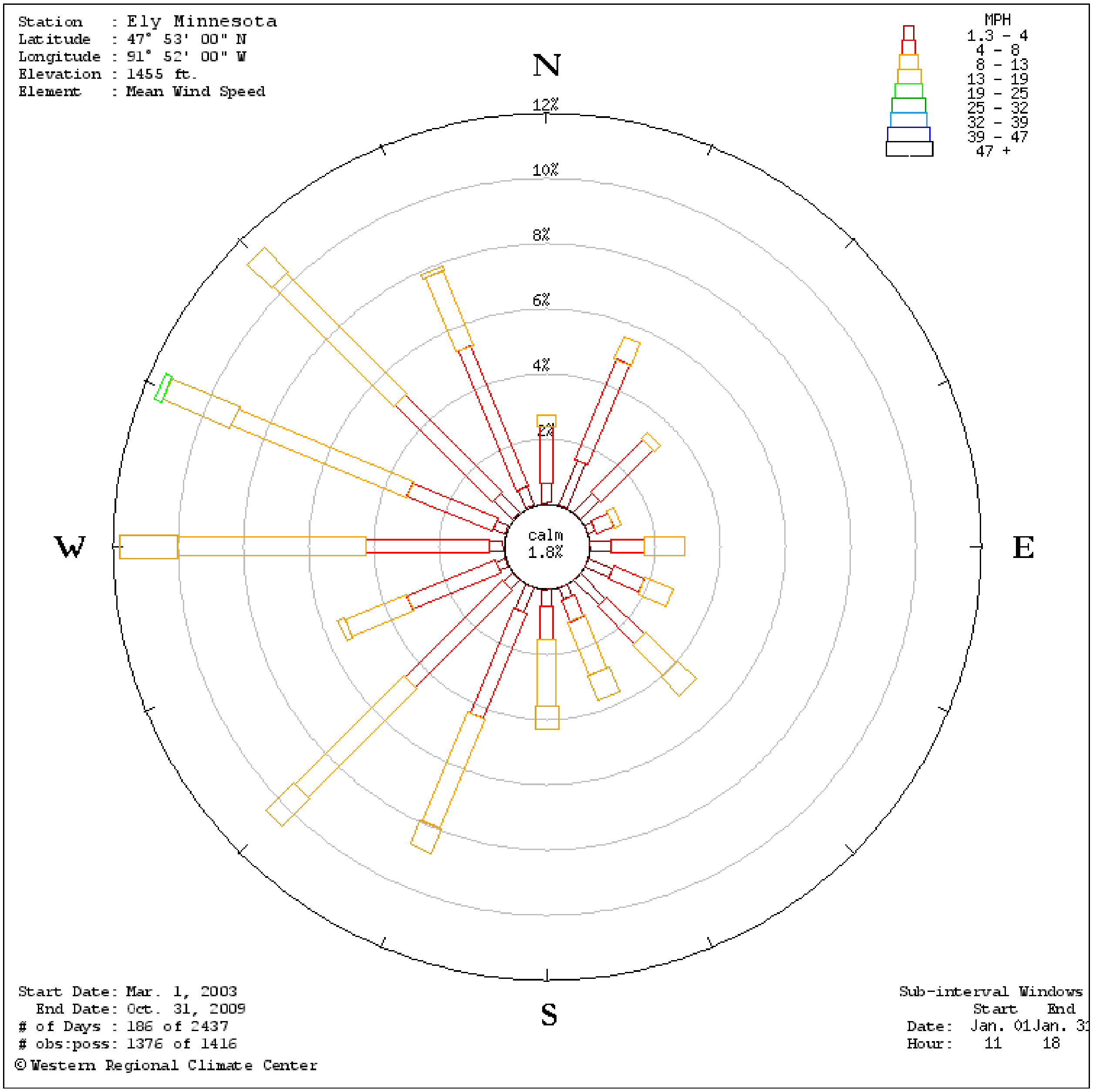


Figure 51 Windrose, winter, daytime, Ely, MN

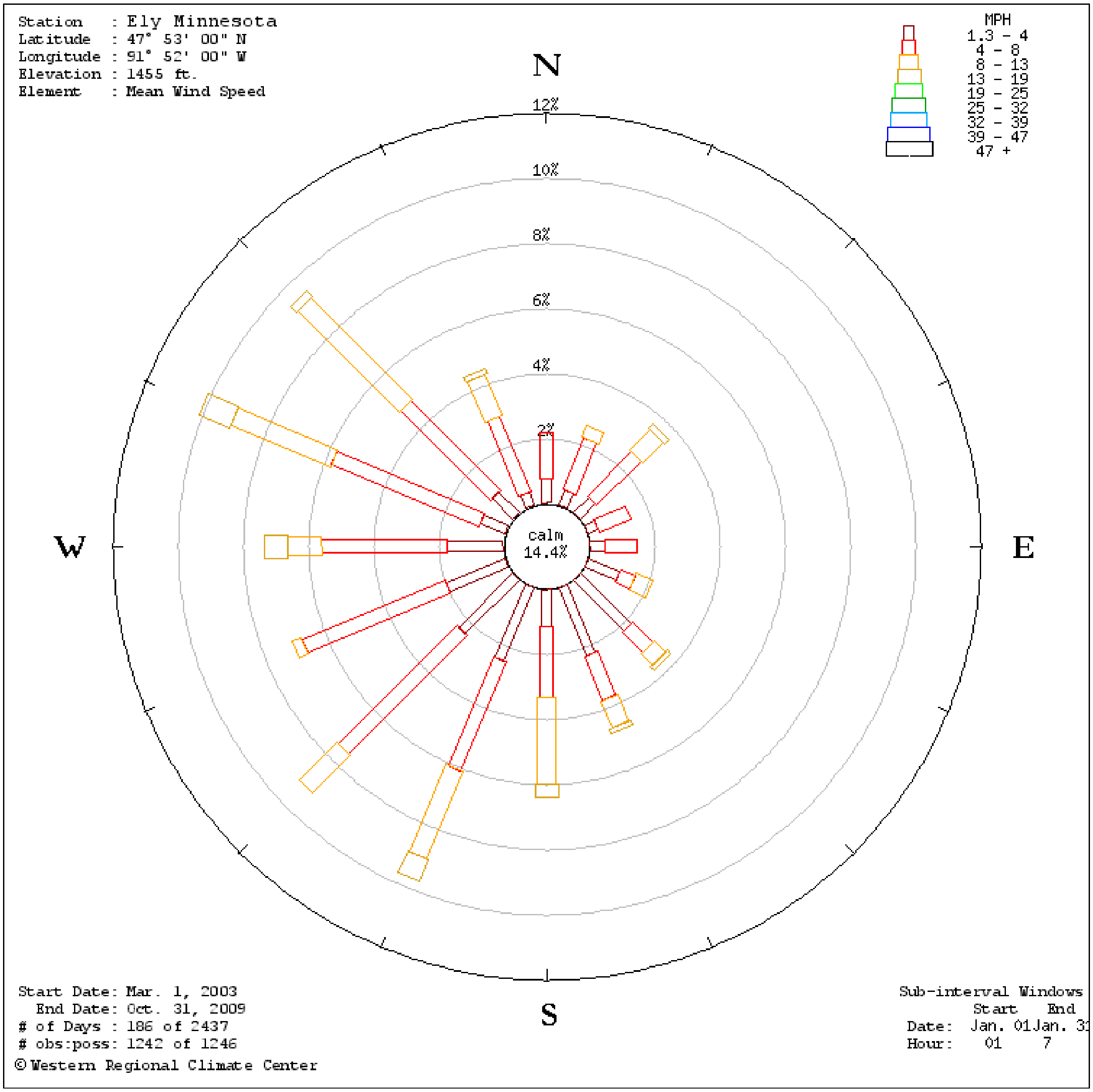


Figure 52 Windrose, winter, nighttime, Ely, MN

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 interdisciplinary team 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 could cause a possible overlap in noise effects, and could contribute to cumulative temporary road quantity and use.
2. Vegetation management projects could affect cumulative temporary road construction and use as well as contribute to noise effects.
3. Increased recreation activity 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 about 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. The proposed Polymet mine is located about 2.3 miles away from the nearest of the 29 current permit application areas. For most resources, the limited effect of minerals exploration in these 29 permit areas has little or no overlap with the effects of the mine located 2.3 or more miles away. There could be a limited overlap in noise impacts (see FEIS Section 3.1).
- 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 expired 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.

- PolyMet Mining, Inc.-Permitted. Polymet Monitoring Well Installation Project. Installation of 22 water monitoring wells and associated access roads at the proposed NorthMet mine site. 15 sites are located on National Forest Lands with 7 sites on land in county or private ownership.

- 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. Skibo Mineral Exploration Project. T57N R14W Sec. 3 and T58N R14W Sec 34. CE signed January 21, 2009 permitting 6 core drilling sites and 0.68 miles of temporary road construction. The CE for this project expired on January 21, 2010. Work on this project has been completed, including reclamation.

- Encampment Minerals Inc. - Permitted. Reserved Minerals. Siphon Mineral Exploration Project. T59N, R14W Sec. 25 and 26. CE signed January 21, 2009 permitting 4 core drilling sites and 0.25 miles of temporary road construction. The CE for this project expired on January 21, 2010. Work on this project has been completed, including reclamation.

- 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. 11 core drilling sites and 2.1 miles of temporary road construction permitted. 11 sites have been completed including interim site reclamation and temporary road closure..

- Prime Meridian - Permitted. Reserved Minerals Phase I - Geophysical survey. T57N R14W, Sections 28 and 33. Work on this project has been completed.

- Franconia Minerals Corporation - Permitted. Outstanding Minerals. Birch Lake. T61N, R12W, Sec 25, Lots 5&6. 1 core drilling site and associated temporary road access. Company has completed work on this project. Reclamation is currently being completed.

- 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.- Permitted. Reserved minerals. Greenwood Lake South Mineral Exploration Project. T56N, R12W, Sec. 17. CE signed March 4, 2011 permitting 1 core drill site with associated geophysical survey lines and 0.72 miles of temporary road construction. Company has not implemented this project.

- Encampment Minerals, Inc.- Permitted. Reserved minerals. Serpentine Mineral Exploration Project. T60N, R12W, Sec. 21. CE signed March 7, 2011 permitting 4 core drilling sites and 0.22 miles of temporary road construction. Work on this project is currently on-going.
- Encampment Minerals, Inc. – Permitted. Reserved minerals. Skibo South Mineral Exploration Project. T57N, R14W, Sec. 9 and 10. CE signed February 7, 2011 permitting 2 core drilling sites and 0.88 miles of temporary road construction. Work on this project has been completed, including reclamation.
- Encampment Minerals, Inc. – Permitted. Reserved minerals. Mud Lake Mineral Exploration Project. T57N, R12W, Sec 15 and 27. CE signed February 16, 2012 permitting 4 core drilling sites with associated geophysical survey lines and 0.97 miles of temporary road construction. Geophysical surveys have been completed for this project, the 4 core drilling sites have not been implemented.
- DMC (USA) LLC – Permitted. Reserved and outstanding minerals. Land 'O' Dixie Mineral Exploration Project. T60N, R11W, Sec. 14, 15, 32, and 33. CE signed November 30, 2011 permitting 4 core drilling sites. No temporary road construction was proposed for this project. Work on this project has been completed, including reclamation.
- DMC (USA) LLC – Not permitted. Reserved Minerals. Ramasa Mineral Exploration Project. T62N, R10W, Sec. 29 and 30. Project currently under analysis (CE) for 4 core drilling sites and no new temporary road construction.

Vegetation Management Projects

Vegetation 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. Effects would be avoided, minimized and mitigated through the application of Forest Plan standards and guidelines and Minnesota Forest Resource Council Guidelines, as disclosed in project EA and EIS documents and in the Forest Plan FEIS.

Table 57 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.

Project Name	District	Decision Date	Project Description
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
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	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	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	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.

Project Name	District	Decision Date	Project Description
Lima Green EA	Gunflint	Expected 2012	This project proposes to enhance moose habitat, restore red & white pine, enhance the scenic quality along the Gunflint Trail & improve forest conditions through vegetation management, harvests and planting. Temporary roads would be used for access. Location: UNIT - Gunflint Ranger District. STATE - Minnesota. COUNTY - Cook, Lake. T63N R1W, 1E & 2E and T64N R1W, 1E & 2E.
Pelican EA	LaCroix	Expected 2012	The LaCroix Ranger District proposes to create young forest, promote existing white pine regeneration, enhance scenic quality, reduce hazardous fuels, manage forest roads, and conduct vegetation management through harvest, non-harvest, and planting. Location: UNIT - LaCroix Ranger District. STATE - Minnesota. COUNTY - St. Louis. LEGAL - T65-68N, R17-20W. Activities would be located on NFS lands in portions of the Pelican Project Area which is bounded by state Hwy 53 on the west, county Hwy 23 on the south, and the Vermilion River on part of the east.
North Shore EA	Gunflint /Tofte	Expected 2012	This project is to revitalize and maintain a healthy ecosystem along the North Shore of Lake Superior by restoring/maintaining native trees and associated forest communities. This project is in conjunction with the North Shore Forest Collaborative. Location: UNIT - Gunflint Ranger District, Tofte Ranger District. STATE - Minnesota. COUNTY - Cook, Lake. LEGAL -T62N R4E, 3E, 2E, 1E, 1W, 2W; T61N R1W, 2W, 3W, 4W, 5W. The project area is approximately three to five miles inland, along the North Shore of Lake Superior.
Skibo EA	Laurentian	Expected 2013	The proposed activities in the project area are intended to move vegetation from its existing condition toward the desired conditions as described in the Forest Plan by managing forest vegetation age, composition, structure, and spatial patterns. Location: UNIT - Laurentian Ranger District. STATE - Minnesota. COUNTY - St. Louis. LEGAL - T56-58N, R12-14W. Activities would be located on NFS lands in portions of the Skibo Project Area East of Hoyt Lakes, MN.
NNIP EA	Forestwide	2006	The project controls non-native invasive plants (NNIP) on the Superior National Forest using an integrated pest management approach.
BWCAW NNIP EIS	Forestwide	Expected 2012	Proposal for an integrated pest management approach to treat non-native invasive plants beginning with approximately 13 acres of infestations scattered across the 1.1 million acre BWCAW and possibly expanding up to 20 acres over the next 10 years. Location: UNIT - Gunflint Ranger District, Kawishiwi Ranger District, Tofte Ranger District, LaCroix Ranger District. STATE- Minnesota. COUNTY - Cook, Lake, St. Louis. Over 1000 small treatment sites are located throughout the 1.1 million acre BWCAW, primarily at campsites, portages, and old cabin/resort sites.

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 58 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	Decommission or add unclassified roads to the national forest transportation system. Designate routes available for travel by OHVs and motor vehicles.
Hwy 1 Construction	Multi-district	ongoing 2010	Road Improvements to Highway 1
Road decommissioning (various projects)	Forestwide	Ongoing	See Travel Management Project and various Vegetation Management projects

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 59 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	August 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.

Special Uses and Land Exchanges
Small special use projects happen on the Forest on a regular basis authorized with a categorical exclusion. These would not contribute to cumulative impacts unless otherwise noted in FEIS Chapter 3 since the scale of impact is very small and localized (e.g. a special use permit to access a private inholding). The proposed MnDOT ARMER EA would not contribute appreciable cumulative impacts since new road construction would total 0.5 miles for the Pine Mountain tower located near the Gunflint Trail where minerals exploration is not currently proposed and is unlikely in the future. Minerals exploration would contribute very limited impacts to scenery (Section 3.12) that would generally occur below the tree canopy, limiting the area exploration activity is visible, so cumulative impacts to scenery from the proposed tower at Forest Center would be unlikely.

Land exchanges would not have the potential to contribute cumulative effects unless a change in land use after exchange results in physical impacts to resources. Past land exchanges are accounted for in the existing conditions described in the EIS. The pending Crane Lake Sustainable Land Corporation Land Exchange would have limited and localized changes to physical resources, and is located in the Low Interest minerals area on the LaCroix District in the northwestern portion of the Forest (see Map 4). Thus it would not contribute cumulative impacts. The Polymet Northmet project is considered as appropriate (see **Minerals management projects on National Forest System land** above).

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). Within ¼ mile of the BWCAW, the State of Minnesota maintains a Minerals Management Corridor in which exploratory drilling on state land is prohibited. This would limit cumulative impacts to the BWCAW since noise sources on state land from drilling would be located at least ¼ mile from the BWCAW, and this would also reduce cumulative mileage of temporary road near the BWCAW accessing state land for minerals exploration.

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.

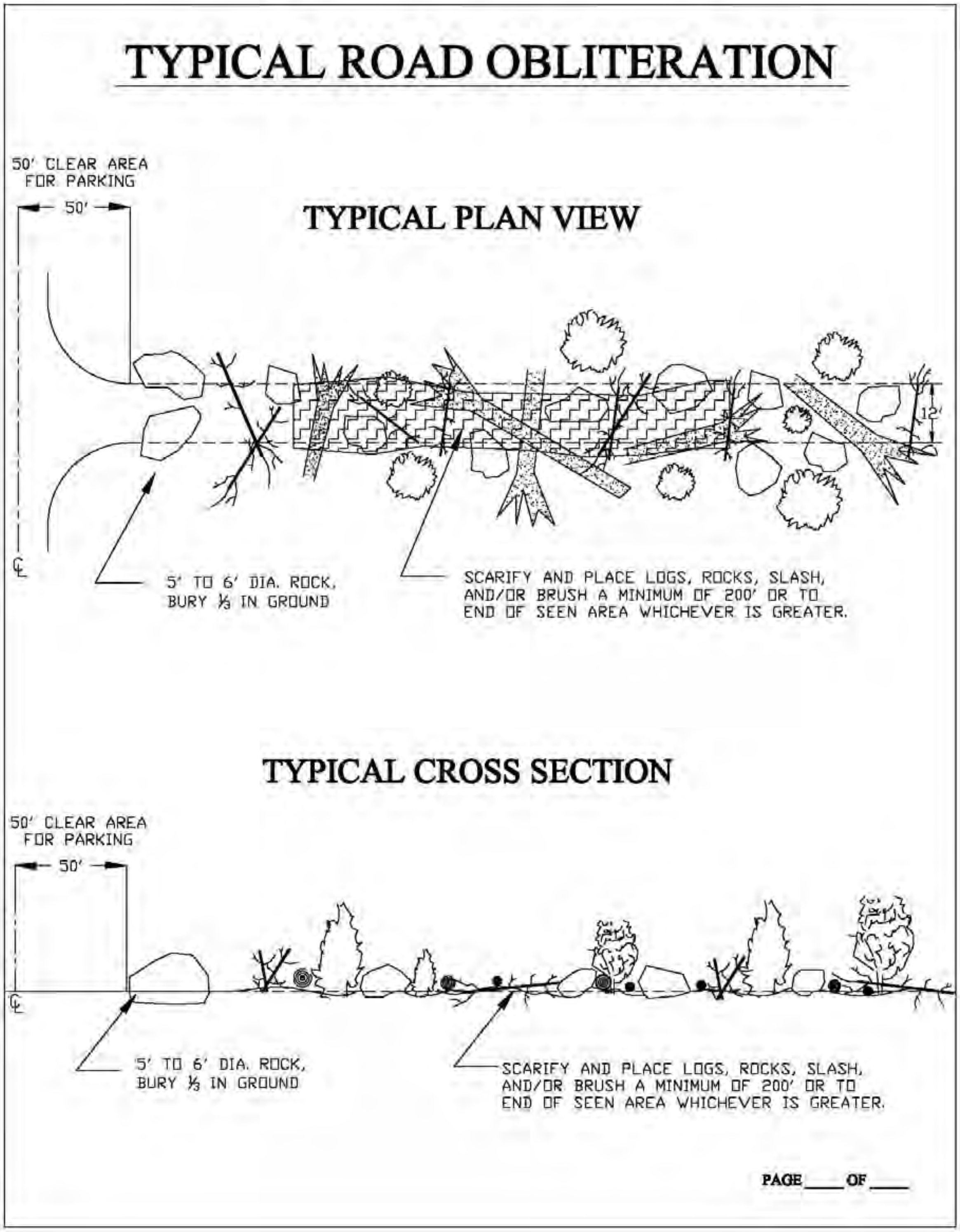
Cumulative Actions Generating Noise

The following categories of activities generate noise which may impact recreation receptors. See Section 3.1 (Noise) and 3.2 (Wilderness) for more information.

- Drilling on state and private land, and reserved and outstanding minerals on federal land
- Fixed wing aircraft flights used for geophysical surveys for minerals exploration
- 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 would be implemented while the prospecting permits are active and after reclamation where specifically stated. Monitoring would occur as permitted by personnel, budget and time available.

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 nine monitoring items associated with the project. In addition to these nine items, the ongoing Superior NF monitoring program will also provide useful information to assess the implementation of this project. Scheduling of all monitoring activities, including monitoring and evaluation of minerals exploration activities, would 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 per any stipulations selected in the decision on this project.

Protocols and Methods

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 measure ambient sound levels and sound levels introduced by project activities, for multiple day and night recordings when possible. 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.

Complete measurements in consideration of Minnesota Rules on Noise at 7030.0060 Measurement Methodology. When measuring drill rig sound levels at the source, measure drill rigs at four 50 foot measurements, evenly spaced at 90 degrees as allowed by site conditions.

Location

Receptors located near drilling sites, including developed campgrounds, resorts, residences, dispersed campsites, and campsites in the BWCAW (see FEIS Section 3.1 for location of receptors and potential distances from drill site to receptor to evaluate for impacts 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 and changes in vegetation (e.g. leaf on/leaf off).

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 required mitigations.

Soil and Water

Objectives

Document impacts of minerals exploration activities (if any) to soil and water resources per SOIL and WAT stipulations in Section 2.4.3.

Protocols and Methods

Parameters

Visual evidence of correct sump operation and effectiveness, and potential rutting or erosion from temporary road construction and use. Volume of water from streams, lakes and ponds for drilling operation. Flow in streams used for source water. Water chemistry of the borehole and / or sump chemistry. Inspection of the exploratory borehole to ensure it is not a flowing artesian hole.

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. Volume of water used for drilling operation will be important to monitor when smaller (not Birch Lake or South Kawishiwi River, etc.) is used as a source. The source being used will be confirmed. Flow in smaller streams will be measured or visually inspected to confirm flow is in excess of 1 cfs. Water chemistry including the pH, conductivity, and chloride concentration may be collected during the site visit. This water quality information will be used as general information in the project file.

Location

Drill pads and temporary roads where project activities would occur. Flow rates of streams would be confirmed by visits to the source stream.

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

Hydrologic Technician, Biological Science Technician, Ecologist, Soil Scientist and/or Geologist.

Responsible Individual

SNF Geologist, Soil Scientist, Hydrologist or Ecologist.

Adaptive Management

Work with operators to minimize and eliminate any soil or water resource damage discovered during project activities to ensure compliance with stipulations (SOIL and WAT Stipulations in Section 2.4.3).

Road/Trail Closure Effectiveness

Objectives

Determine the implementation and effectiveness of road closures and reclamation and practices in prohibiting illegal motorized use per RDS Stipulations in Section 2.4.3.

Protocols and Methods

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

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 (RDS Stipulations in Section 2.4.3).

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 and aquatics infestation in the project area per NNIS and AQS stipulations in Section 2.4.3.

Protocols and Methods

Parameters

(a) Visual evidence of new and expanding NNIS populations (b) Visual evidence of subsequent corrective actions (pulling, spraying etc) (c) Compliance of cleaning heavy equipment per stipulation NNIS-3.

Methodology

Conduct baseline or pre-activity and post activity Monitor 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.

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 minerals exploration becomes a management issue, corrective actions will be pursued (e.g. pulling and spraying weeds). (NNIS Stipulations in Section 2.4.3)

Safety

Objectives

Ensure implementation of safety measures by mineral exploration operators as defined in the stipulations (Section 2.4.3, Stipulation GA-5).

Protocols and Methods

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). Monitor for proper signage used per Stipulation GA-5.

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. Ensure Stipulation GA-5 is implemented.

Threatened, endangered, and sensitive wildlife species

Objectives

Avoid or minimize disturbance to threatened, endangered, sensitive, and other species of interest and their breeding locations within the project area per TES and RFSS Stipulations in Section 2.4.3.

Protocols and Methods

Parameters

(a) Visual evidence of new and existing large raptor nests (b) Visual evidence of breeding activity.

Methodology

Use the 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 (TES and RFSS Stipulations in Chapter 2).

Visuals

Objectives

Minimize impacts to visual resources per Stipulations RV-3 through RV-6.

Protocols and Methods

Parameters

Monitor removal of equipment, flagging, tools, etc at the completion of exploratory drilling activities. Monitor location of drill site in relation to any mitigation for visual impacts approved in operating plans.

Methodology

Location

In High and Moderate Scenic Integrity Objective Areas, and at drill sites. Focus on drill sites near visual resources of particular interest (e.g. scenic trails, campgrounds, adjacent to BWCAW).

Frequency/duration

Sample of drill sites each year.

Data Storage

District and Forest monitoring files

Analysis Report

Summary in Forest Monitoring Report

Personnel

Recreation technicians, monitoring technicians

Responsible Individual

Geologist

Adaptive Management

Work with permitees to meet the objectives of stipulations if deviations are found during monitoring.

Heritage

Objectives

Ensure compliance with HR Stipulations in Section 2.4.3 to avoid impacts to heritage resources.

Protocols and Methods

Parameters

Known locations, unknown locations, and sites found during implementation per HR Stipulations in Section 2.4.3.

Methodology

Known site locations will be field verified and boundary flagged prior to implementation. High probability locations will be surveyed prior to implementation, and if located, sites will be boundary flagged for avoidance. If new heritage resources are discovered during implementation, the Forest Archaeologist will be notified and appropriate mitigations will be developed.

Frequency/duration

For known and unknown locations, before ground disturbing activities occur. For sites discovered during implementation, as needed.

Data Storage

Forest Archaeology Files

Analysis Report

SHPO Report, summary in Forest Monitoring Report

Personnel

Archaeologist, Archaeologist Technician

Responsible Individual

Archaeologist

Adaptive Management

Stipulation HR-3 (Sites found during implementation) provides methodology for adaptive management to avoid impacts to heritage resources.

Location and Extent of Areas to be Occupied

Objectives

Follow LOC stipulations in FEIS Section 2.4.3 for location and extent of areas to be occupied. This may be relevant for any permits that include acreage that contains Research Natural Areas (RNA), Unique Biological Areas (UBA). In addition, consider permits adjacent to the Boundary Waters Canoe Area Wilderness (BWCAW), Mining Protection Area (MPA) and Wild River Segments. Finally, this is relevant for developed recreation facilities where No Surface Occupancy is allowed (Stipulation RV-7).

Protocols and Methods

Parameters

Identify location of surface occupancy by permittees in relation to RNA, UBA, BWCAW, MPA, Wild River Segments and developed recreation facilities.

Methodology

Monitor surface occupancy locations with Global Positioning System (GPS) devices and/or surveying equipment.

Location

Proposed activities in permit areas that are near (within 100 feet) of Management Areas which are No Surface Occupancy (RNA and UBA), which prohibit exploration (BWCAW, MPA and Wild River Segments), and developed recreation facilities.

Frequency/duration

When operating plans propose activities adjacent to RNA, UBA, BWCAW, MPA, Wild River Segments or developed recreation facilities.

Data Storage

District and Supervisor's Office files

Analysis Report

Operating plan files, summary in Forest Monitoring Report Minerals Section

Personnel

Geologist, Monitoring Technicians, Surveyors

Responsible Individual

Geologist

Adaptive Management

If any surface occupancy is discovered in prohibited areas, inform the permittee, require remediation of surface impacts, and identify and correct any problems in boundary identification to prevent a recurrence.

Reclamation

Objectives

Ensure that interim and final reclamation is effectively completed per RECL Stipulations in Section 2.4.3. Monitoring for other resources (Road/Trail Closure, Soil/Water, and Invasive Species) is also relevant for reclamation efforts.

Protocols and Methods

Parameters

Parameters include road closure or decommissioning, backfill of sumps, recontouring, removal of equipment, removal of invasive species, planting of only native vegetation to reclaim sites, and other tasks. See Stipulations RECL-2 and RECL-3 in FEIS Section 2.4.3.

Methodology

Site visits in which visual review and photographs document compliance with necessary reclamation procedures.

Location

Drill sites and access routes.

Frequency/duration

During and after interim and final reclamation work is completed.

Data Storage

District and Supervisor's Office files

Analysis Report

Operating plan files, summary in Forest Monitoring Report Minerals Section

Personnel

Geologist, Monitoring Technicians

Responsible Individual

Geologist

Adaptive Management

If reclamation is not completed per RECL Stipulations in Section 2.4.3, work with companies to achieve compliance. The Bureau of Land Management may utilize a bond to complete reclamation work if necessary (see BLM Stipulation #1).

Appendix F – Changes Between Draft and Final EIS

Based on public comment and internal review, changes were made between the Draft and Final EIS. The rationale for the changes is documented in resource sections of Appendix J Response to Comment, Chapter 3 and the project file.

The following items summarize the changes.

- Summary: This was updated to reflect the changes made in the body of the FEIS.
- Chapter 1: The Purpose and Need was updated to reflect Forest Service policy for minerals management and Forest Plan direction. The Proposed Action and Decision Framework sections were updated to clarify what actions the Forest Service and BLM would take, the role of the 20 year analysis, and to include more specific information on the special use permits for temporary roads outside the prospecting permit areas. The prospecting permits and permit acreage was also updated based on a land status review by the BLM. The Tribal Involvement and Public Involvement sections were updated based on additional steps that have been taken in these areas.
- Chapter 2: The description of mineral exploration activities was updated based on input from BLM. The Alternatives were updated to reflect changes in the noise analysis. In addition, several stipulations in Section 2.4 were revised or added based on public comment and internal review. Some stipulations were changed based on clarifications in the roles that the Forest Service and BLM have for the project (Sections 2.4.1 and 2.4.2). Resource stipulations in Section 2.4.3 were edited based on public comment, internal review, and/or because stipulations in the Draft EIS were not specific enough, irrelevant to the actions proposed or duplicative of other stipulations or existing requirements.

  Section 2.4.1

  - Stipulation #5 in the Draft EIS was edited in Final EIS to require annual instead of quarterly reports.
  - Stipulations 7 through 10 were added to the Final EIS. These were identified as stipulations #12, 14, 15 and 16 in Section 2.4.2 in the Draft EIS.

  Section 2.4.2

  - Stipulation #2 in the Draft EIS was edited to specify locating drill holes in the Final EIS.
  - Stipulation #3 in the Draft EIS was edited in the Final EIS to clarify requirements on other permits.
  - Stipuation #8 in the Draft EIS was removed from the Final EIS. Stipulation #8 in the Final EIS was added (different stipulation).
  - Stipulation #10 in the Draft EIS is Stipulation #9 in the Final EIS.
  - Stipulation #11 in the Draft EIS is Stipulation #10 in the Final EIS.

- o Stipulation #13 in the Draft EIS is Stipulation #11 in the Final EIS.

Section 2.4.3

- o GA-1 in the Draft EIS was removed since the BLM and Forest Service do not have this authority.
- o GA-5 and GA-7 in the Draft EIS were removed from the Final EIS.
- o GA-8 in the Draft EIS was updated in the Final EIS to include a requirement on fencing sump pits (GA-5 in the Final EIS).
- o LOC-2, LOC-6 and LOC-7 in the Draft EIS were removed from the Final EIS.
- o HR-4 was updated to include a specific buffer distance.
- o RV-3 was updated in the Final EIS to include only the BWCAW as a receptor with sound limits under Alternative 4, and to use L50 and L10 metrics for the limits.
- o RV-4 in the Draft EIS was removed from the Final EIS.
- o RV-6 in the Draft EIS was updated in the Final EIS to specify adjusting location instead of scheduling.
- o RV-8 in the Final EIS was added.
- o RV-8 in the Draft EIS is RV-9 in the Final EIS.
- o Multiple wildlife stipulations were revised to include buffer distances.
- o TES-1 in the Draft EIS was removed from the Final EIS.
- o TES-3 in the Draft EIS was included as RFSS-5 in the Final EIS.
- o TES-2 and other requirements from the Fish and Wildlife Service Biological Opinion were added to the Final EIS.
- o RFSS-10, RFSS-12 in the Draft EIS was removed from the Final EIS.
- o RFSS-18 and RFSS-19 in the Draft EIS were edited and combined into RFSS-17 in the Final EIS.
- o Implementation of soils stipulations is discussed further in the Final EIS in section 2.4.3.7.
- o Stipulations RDS-1, RDS-3, RDS-4, RDS-5, and RDS-7 in the Draft EIS were removed from the Final EIS.
- o Stipulation RDS-1 and RDS-6 in the Final EIS were added.
- o Stipulation RDS-9 in the Draft EIS was updated as RDS-5 in the Final EIS to include a clause to minimize use of gravel to construct temporary roads.
- o WAT-3 and WAT-11 in the Draft EIS was removed in the Final EIS.
- o WAT-6 in the Draft EIS was edited as WAT-5 in the Final EIS.

- WAT-10 in the Draft EIS was edited as WAT-12 in the Final EIS.
- WAT-12 in the Draft EIS was edited as WAT-9 in the Final EIS
- WAT-11 and WAT-12 in the Final EIS were added.
- AQS-1 was edited between Draft and Final EIS.
- NNIS-3, clause (a) was edited between Draft and Final EIS.
- RECL-1 in the Draft EIS was removed from the Final EIS.
- RECL-2 and RECL-3 were edited to include a clause to remove invasive plants.

Section 2.4.4

- This section was added to the Final EIS to display mitigations that would be required for the construction, use and reclamation of temporary roads built outside the prospecting permit areas to access locations inside the prospecting permit areas.

- Chapter 3: The noise section was revised and updated based on public comment and advice from the National Park Service. These changes include revised definitions of terminology, addition of sound contours assuming L90 ambient sound levels, additional discussion of annoyance based on sleep disturbance and dose-response research, and other clarifications. Several changes were also made to the water, wildlife, heritage, non-native invasive species, wilderness, scenery and economics sections based on public comment and internal review. Other resources sections of Chapter 3 had minor edits.
- Chapter 4: The list of references was updated to reflect references cited in response to public comment or edits between the Draft and Final EIS. Several terms in the Glossary were also updated based on additional analysis completed in the Final EIS and consideration of public and internal input.
- Appendix A: No Changes
- Appendix B: No changes
- Appendix C: Cumulative actions have been updated based on any projects that have become reasonably foreseeable since the Draft EIS was published as needed.
- Appendix D: No Changes
- Appendix E: The Monitoring Plan has been updated to include several additional resource areas (Visuals, Heritage, Extent of Areas Occupied and Reclamation) and include further information on several existing resources areas.
- Appendix F: This appendix was added to the Final EIS to explain changes between Draft and Final EIS.
- Appendix G: The Water Resources Technical Memos was added to the Final EIS. These memos are supporting information for the water resources analysis in Chapter 3 and the Response to Comments.
- Appendix H: The Final Biological Assessment was added to the Final EIS (the Draft Biological Assessment was published with the Draft EIS).

- Appendix I: The Final Biological Evaluation was added to the Final EIS (the Draft Biological Evaluation was published with the Draft EIS).
- Appendix J: Response to Comments made on the Draft EIS was added to the Final EIS.
- Appendix K: Comments by government were added to the Final EIS.
- Maps, Figures and Tables: The Maps were updated to reflect that the Proposed Action includes 29 permit applications. Several figures in the Section 3.1 Noise were updated based on review of public comment and revised analysis methods. Tables in several resource sections in Chapter 3 were added or updated to reflect revised analysis based on public comment.

Additional changes for grammar, spelling, organization or other minor clarifications and corrections of the document were also made.

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