Rainy River Withdrawal

Socioeconomics Report

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Contents

Tables

Figures

Introduction

This analysis considers the direct and indirect effects of the proposed action and the no-action alternative, to the social and economic environment and environmental justice communities of the Arrowhead Region of northern Minnesota.

Relevant Laws, Regulations, and Policy

Regulatory Framework

Land and Resource Management Plan

The 2004 Superior National Forest Land and Resource Management Plan (forest plan; USDA Forest Service 2004) provides desired conditions, standards, and guidelines for socioeconomic resources. A summary of applicable forest-wide desired conditions, standards, and guidelines is provided in table at the end of this report.

Federal Law and Regulation

Multiple statutes, regulations, and executive orders identify the general requirement for applying economic and social evaluation in support of Forest Service planning and environmental review. 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.

Additionally, 43 C.F.R. § 2310.3–2 requires a case file accompanying a withdrawal application to contain an analysis of the economic impact of the proposed changes in use associated with the requested withdrawal on individuals, local communities, state and local government interests, the regional economy, and the nation as a whole.[1]

Executive Orders

Environmental Justice, Executive Order 12898 of 1994

This executive order mandates federal agencies to make achieving environmental justice part of their mission. This includes identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies and activities on minority and low-income populations.

Protection of Children from Environmental Health Risks and Safety Risks, Executive Order 13045 of 1997

This executive order requires that each federal agency: “(a) shall make it a high priority to identify and assess environmental risks and safety risks that may disproportionately affect children; and (b) shall ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks.”

1. See https://www.govinfo.gov/content/pkg/CFR-2011-title43-vol2/pdf/CFR-2011-title43-vol2-sec2310-3-2.pdf.

Topics and Issues Addressed in This Analysis

Resource Concerns and Issues

The public involvement process solicited public comments on the project as described in the public involvement summary. Issues identified through content analysis of public comments are organized into three overarching themes including public health and welfare, economic development and quality of life, and cultural values and heritage. In general, interested members of the public shared a deep sense of concern for how this project's decision would affect their values related to these topics. While these higher-level values are shared by both people who favor the requested withdrawal and those who do not favor a withdrawal, they differ in how they believe the project would affect these values. More in-depth information on this topic is in the Values, Beliefs, and Attitudes section in this analysis. Following is a summary of the diversity of concerns about the project heard through the public involvement process.

- Public Health and Welfare: There is concern that the action alternative, the requested withdrawal, would result in the loss of resources needed to support public institutions like schools and health facilities. Conversely, there is concerns about the public health risks that may occur under the no action alternative to present-day communities and future generations. Health risks to subsistence users were also identified as a primary concern due to consuming resources such as fish with bio-accumulated mercury in their tissues.
- Cultural Values and Heritage: There are concerns about how the cultural heritage of communities closely associated with the withdrawal application area would be adversely affected by both the action and no action alternative. In particular, there are concerns about how character of the place and the communities' sense of identity, and cultural values could be affected. There are also concerns about how impacts on wild rice, referred to as manoomin by the Ojibwe, and other subsistence livelihood could impact the Ojibwe tribe's traditional cultural values, given that certain subsistence activities connect the Ojibwe to the land, their values, cultural heritage and to one another.
- Economic Environment and Quality of Life: There are concerns that pursuing either the action or no action alternative would negatively affect economic development and lead to a decline in the quality of life.

Methodology

Various data sources were used to assess demographic characteristics, social economic conditions, and resource uses in the analysis area. These data sources include the U.S. Census Bureau, the Minnesota Department of Health, the Bureau of Economic Analysis, and the Bureau of Labor Statistics. The social analysis uses information obtained from public comments and meetings. Estimates of social and economic effects rely on effects to resources are described in the recreation, water and aquatic species, tribal needs and values, and air quality reports.

Values, Beliefs, and Attitudes

The social analysis in this report identifies values, beliefs, and attitudes expressed by community members in public meetings and in written comments. Values, attitudes, and beliefs are described generally here as:

Values are "relatively enduring conceptions about the important principles of life, such as what is good or bad and desirable or undesirable; people in a given society or culture share values as well as beliefs."

Personal values are often informed through inter-generational storytelling and shared experiences, as well as the modeling behaviors and actions of older generations.

Beliefs are "judgments about what is true or false—what attributes are linked to a given thing. Beliefs can be based on scientific information, feelings and intuition, or cultural norms." Beliefs can also link actions to effects.

Attitudes are "learned tendencies to react favorably or unfavorably to a situation, individual, object, or concept. Attitudes…indicate individual or group preferences for a certain activity or course of action." (Allen et al 2009).

Theory of Planned Behavior

The assessment of values, beliefs and attitudes is important not only to understand the relative importance of effects to affected populations, but also to understand how beliefs in themselves may contribute to the effects of a project. The theory of planned behavior describes the factors related to beliefs that influence the likelihood of a behavior.

The theory of planned behavior has been used to model predictive behavior related leisure activities, and behaviors that affect health outcomes and sustainability, to name a few topics relevant to this analysis. For example, people were more likely to participate in leisure activities if they believed they had the resources required to perform the activity, they believed the activity would be viewed favorably by people important to them, and the anticipated outcomes, either experiential in nature, or the resulting impact of participating, were positive (Ajzen and Driver 1991).

As such, it is relevant here to consider how the effects of this project may translate into increasing or decreasing the likelihood of behaviors that may influence recreation and tourism participation and the related social and economic benefits.

Community Capital Framework

Resilient rural communities are able to recognize and employ diverse forms of capital (such as cultural, human, natural, social, built, and financial forms of capital) to meet the community's needs and perpetuate sustainable social and economic benefits. The community capital framework used here is taken largely from the work of Flora, Flora, and Fey in their book, Rural Communities and Change (2004). "Capital" is essentially the resources and assets that can be used to create more resources (Flora et al. 2004, 165). Flora et al. (2004) describes seven types of capital including cultural, human, social, financial, built, natural, and political. This report employs the community capital framework to analyze and understand the diversity, as well as the common ground among public values, beliefs, and attitudes described by commenters relating to the project and relating to how the two alternatives would affect meeting the forest plan's desired conditions and objectives.

The following section provides more information on the forms of capital. The affected environment section provides an abbreviated summary of the social history of the study area that aims to provide insight into how these forms of capital are shaped and how they may be affected by the project.

Cultural Capital

Cultural capital can be thought of as the way people interpret and interact with the world around them. Cultural capital is reflected in values, symbols, language, clothing, and customs that are influenced by the daily, seasonal, and annual patterns that shape life in a family or community. Cultural capital is, in part, informed through the intergenerational transfer of knowledge, which can be thought of as a cultural

legacy. Cultural legacies help people define who they are, what their role is in the world, and how they fit in and, therefore, are key in the development of personal and community identity (Flora et al. 2004).

Social Capital

Social capital can also be thought of as social networks or human relationships. Social capital is not something an individual can possess but rather it is the outcome of human interaction.

Human Capital

Human capital includes the diverse assets individuals possess to earn a living, care for their family, enrich their lives and contribute to their community (Flora et al. 2004,). This includes physical and emotional health, formal education and training, skill sets, interpersonal skills, talents, indigenous knowledge systems, and personal capacities. Human capital, like other forms of capital, can be invested and translated into other forms of capital such as financial capital in the form of wages.

Employment opportunities in the primary and secondary labor market would also affect motivation on furthering the personal development, a form of human capital. The quality of the natural capital in a local community, such as the water and air quality, the health and viability of subsistence resources such as fish and wildlife, can greatly influence health outcomes, a form of human capital, for individuals and the larger community.

Financial Capital

Financial capital is monetary resources that can easily be translated to create other forms of capital. Attracting and retaining financial capital is a key part of developing a rural economy. With every dollar that is spent in a local economy, a portion would be retained and recirculated in the local economy; a portion would also leave the local economy to employees and firm located elsewhere. The remaining funds would continue to be circulated in the local economy with some portion of every transaction leaving the local economy. This is referred to as an income multiplier and explains why $1 dollar of income spent in a local community would generate more than the original expenditure. The more robust and diversified a local economy, the better suited the economy is to retain funds circulating in the economy and reduce leakage, thereby further perpetuating the development of the local economy.

Built Capital

Built capital is the physical infrastructure that facilitates productive community development. It includes roads, railroads, schools, hospitals, waste treatment facilities, fiber optic and telephone lines, as well as gas, electrical and water distribution systems. Built capital may in itself provide the means of production, such as a power generation facility or it may provide the platform for the delivery of services such as a school provides a place for students to learn. However, built infrastructure relies on human capital to be used in a productive way (Flora et al. 2004).

Natural Capital

Capital is a resource that can be used to generate other resources (Flora et al. 2004). Natural capital produces a sustainable flow of goods or ecosystem services that Costanza and Daly (1992) describe as natural income. For example, a forest absorbs carbon and produces oxygen contributing to air quality and trees that can be harvested. Natural resources, such as water, soils, terrestrial and aquatic species, minerals, and air may be considered natural capital, but like financial capital, whether this is considered “capital” depends on if they are used as investments or consumed. In other words, if the utilization of natural resources yields more natural resources, then it is considered natural capital. Consumptive practices of natural resources which would not yield a natural income are not considered natural capital.

Political Capital

Political capital refers to the power to either make something happen that would not otherwise occur, or in contrast, to prevent something from happening that would otherwise occur (Flora et al 2004). Political capital is the power to influence the distribution and flow of resources. Political capital in a community can also be thought of as the degree of community autonomy to define problems and solutions and be meaningful agents that affect the outcome.

Distributional Health Risks to At-Risk Populations

Environmental Justice, codified under Executive Order 12898, states that each federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on environmental justice communities, which include minority populations and low-income populations. The emphasis of environmental justice is on health effects or the benefits of a healthy environment. The Council on Environmental Quality (CEQ) has interpreted health effects with a broad definition: “Such effects may include ecological, cultural, human health, economic or social impacts on minority communities, low-income communities, or Indian Tribes …when those impacts are interrelated to impacts on the natural or physical environment” (CEQ 1997). Executive Order 12898 also identifies the need for federal agencies to collect, maintain, and analyze information on consumption patterns of populations that rely principally on subsistence consumption of fish and wildlife. Federal agencies are directed to communicate the risks of consumption patterns to the public.

Executive Order 13045 of 1997 recognizes that children may suffer disproportionate impacts from environmental health risks and safety risks. Children’s behavior patterns considered in the context of their developing neurological, immunological, digestive, and other bodily systems causes them to consume more water, air, and food proportionate to their body weight than adults, increasing their potential for environmental exposure and suffering disproportionately from environmental health risks and safety risks. Federal agencies are directed to make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children, and to ensure that activities and standards address disproportionate risks to children that result from environmental health risks or safety risks.

Understanding the cultural connections to the landscape, in particular within low-income and minority communities and among children, is important to uncover how these populations may be disproportionately and adversely affected by federal actions. Information gleaned from the U.S. Census Bureau and the National Visitor Use Monitoring report on visitation patterns to the Superior National Forest and the Boundary Waters Canoe Area Wilderness provide information about potentially affected low-income, minority communities, and children who may be affected. The historical overview provides insight into cultural connections among the people and the land of the potentially affected populations in the analysis area, which present potential pathways of exposure (in particular, fish and wildlife consumption). This analysis will consider the distribution of risk to low-income and minority communities and children affected by the direct, indirect, and cumulative effects of the project based on known exposure pathways and the likelihood of risk event occurring. Risks will be considered in terms of severity and longevity of impacts on physical and mental health, cultural systems, and economic wellbeing of these populations.

Economic Environment

The analysis of economic effects considers job and labor income from economic impact analyses. No new models were constructed but results from existing work are presented. “Input-output” analysis using the IMPLAN software system[2] is a broadly accepted model for making projections regarding employment and economic impacts and is often used by the Forest Service in the preparation of environmental analysis documents as part of the National Environmental Policy Act (NEPA) process. Input-output analysis is a means of examining relationships within an economy between businesses and final consumers. The direct employment and labor income resulting from exploration, visitor spending, or mine operation 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 may occur 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.

While IMPLAN modeling utilizes the most current observed industry interdependencies calibrated to the local and regional economy of the study area counties, the results of any economic model are only estimates. Assumptions about the interdependencies of the economy, existing conditions, and various alternatives are necessary. In addition, the model is a representation of a snapshot in time and caution should be used when looking too far into the future. As a result, the values presented in this report, as done by various researchers and analysts, should not be considered precise, but rather estimates of the potential economic impacts and provide for relative comparison, as necessary.

Nonmarket values, such as the value of recreation experiences and ecosystem services, by their nature are difficult to quantify. It is Forest Service policy that “when costs and benefits cannot be expressed monetarily but are important to management decisions, use other appropriate quantitative and qualitative indicators of value in addition to financial data for economic efficiency evaluation” (Forest Service Manual 1970, p. 9). Accordingly, the sections on “Non-Market Values and Ecosystem Services” and “Values, Beliefs, and Attitudes” are presented to address social and economic considerations. Other efficiency and non-market aspects of the requested withdrawal and no-action alternative are described in other resource sections of the environmental assessment and resource specialist reports.

Incomplete and Unavailable Information

In preparing the reasonably foreseeable development scenario there are a number of variables and uncertainties considered in the formulation of the baseline condition and parameters for analysis. Legislative changes to leasing laws and regulations, taxation of property and revenue, litigation, and case law, and permitting requirements all could have an effect on the viability of individual operations. Changes in technology could have an effect on future mineral exploration and development success by decreasing costs, allowing for lower cutoff grades, advancing exploration, data collection and modeling, or reduced environmental impacts of mining. Market price and cost of commodity production would also be important in establishing the economic viability of mining.

Spatial and Temporal Context for Effects Analysis

Federal regulation (43 CFR 2301.3-2 (3)(v)) requires the consideration of effects to individuals, communities, the region, the state, and the nation as whole when proceeding with a withdrawal of federal lands. The withdrawal application area contains approximately 225,504 acres of National Forest System

2. See https://implan.com/ for more information.

lands that overlay federally owned minerals in Cook, Lake, and St. Louis Counties, Minnesota located adjacent to the Boundary Waters Canoe Area Wilderness and the mining protection area. The potential mining activity that could occur under the no action alternative would likely generate social and economic effects within these three counties, which are referred to as the Arrowhead Region, and is considered the area of analysis. Some communities within the Arrowhead Region would be more acutely affected than others given existing conditions, such as social values, economic composition, and ancestry to name a few. The type and degree of effect vary by the scale of analysis (geographic or social unit) and over time. Effects beyond the 3-county area are also addressed, as warranted.

This analysis will consider the effects of the no-action alternative in three phases: mineral exploration, mineral development, and post mining operations. Mineral exploration is assumed to occur in a 20-year timeframe as described in the reasonably foreseeable development scenario. The reasonably foreseeable development scenario projects that mining activities could begin within or beyond a 20-year timeframe, and last for 30 years or more. Effects of mining operations (5 years after mining operations have commenced) are considered in this analysis and are intended to describe the potential near term effects of mine operations. Long-term effects are defined as those occurring after mining operations have ceased for 10 years, as it is assumed that any short-term residual effects of the mining operation would have subsided by this time, leaving only the long-term effects.

The social and economic effects discussion focuses on where there is a reasonably predictable change in the likelihood of an effect on the variables under analysis. This includes the individuals and communities within the Arrowhead Region, the State of Minnesota, and the nation as a whole.

Resource Indicators and Measures

Resource indicators and measures are described in table 1. Indicators are used to assess the relative effects to resource elements at three temporal scales to capture the dynamic nature of the social and economic impacts. Under study in this analysis are potential effects to the economic environment, public health and welfare, cultural values and heritage, environmental justice communities, and children. These categories map to the resource concerns and issues described previously.

Table 1. Resource indicators and measures for assessing effects

Issue	Resource Indicator	Assessment of Effect	Used to address:	Source
Economic Environment	Jobs and Labor Income Industry Composition Non-tax Revenue	Change in total jobs and labor income (direct, indirect and induced) in the Arrowhead Region; Relative percentage in the region. Qualitative assessment of economic sectors Qualitative assessment of changes in non-tax revenues.	Key Issue	Forest plan desired condition-SE-1
Public Health and Welfare; Cultural Values and Heritage	Age Education Race and ethnicity Median Household Income	Qualitative assessment of effects population characteristics based on predicted effects to resource elements related to the economic environment and lifestyles.	Not applicable	Forest plan desired condition-SE-1 and objective-SE-1

Issue	Resource Indicator	Assessment of Effect	Used to address:	Source
Heritage and Cultural Values	Cultural Heritage	Qualitative assessment based on the values, beliefs, and attitudes of threats to the perpetuation of cultural heritage by alternative.	Key Issue, Purpose and Need	Forest plan desired condition-SE-2
Public Health and Welfare; Heritage and Cultural Values	Perceptions of the Environment and Amenity Values	Qualitative assessment of the quality of recreation opportunities due to scenic, noise, light impacts, and level of development. Qualitative assessment on perceived risks to water and air quality.	Key Issue, Purpose and Need	Forest plan desired condition-SE-3
Public Health and Welfare; Heritage and Cultural Values	Recreation Patterns	Qualitative assessment on the effects to patterns of recreation visitation based on perceptions of the environment, population characteristics and the economic environment.	Key Issue, Purpose and Need	Forest plan desired condition-SE-2
Public Health and Welfare	Public Infrastructure	Assessment on effects to schools and other public goods and services of relevance.	Key Issue	Forest plan desired condition-SE-1
Public Health and Welfare	Distributional Risks to At-risk populations	Qualitative assessment of disproportionate distribution of risk to low-income and minority populations and children under 5 years of age.	Key Issue, Purpose and Need	Executive Order 12989; Executive Order 13045

Affected Environment

Defining features of an area influence and shape the nature of local economic activity and social character. Among these are population characteristics, industry composition, environmental attributes, and area amenities. Natural amenities may contribute to population growth, economic activity, and quality of life for area residents and visitors. Federal, state, and tribal governments operate as stewards of many natural amenities. This discussion addresses the character and extent of the connections between public land resources and human wellbeing in the planning area and explores the historical context of the withdrawal application area communities.

Historical Context

The Iron Range of the Lake Superior Region refers generally to three iron ore range deposits, the Vermillion Range, the Mesabi Range and the Cuyuna Range. The Mesabi Range is the largest ore deposit and currently has active mining operations. The Cuyuna Range, the most southern of the ranges, and the Vermillion Range, the most northern range in the region, are currently inactive.

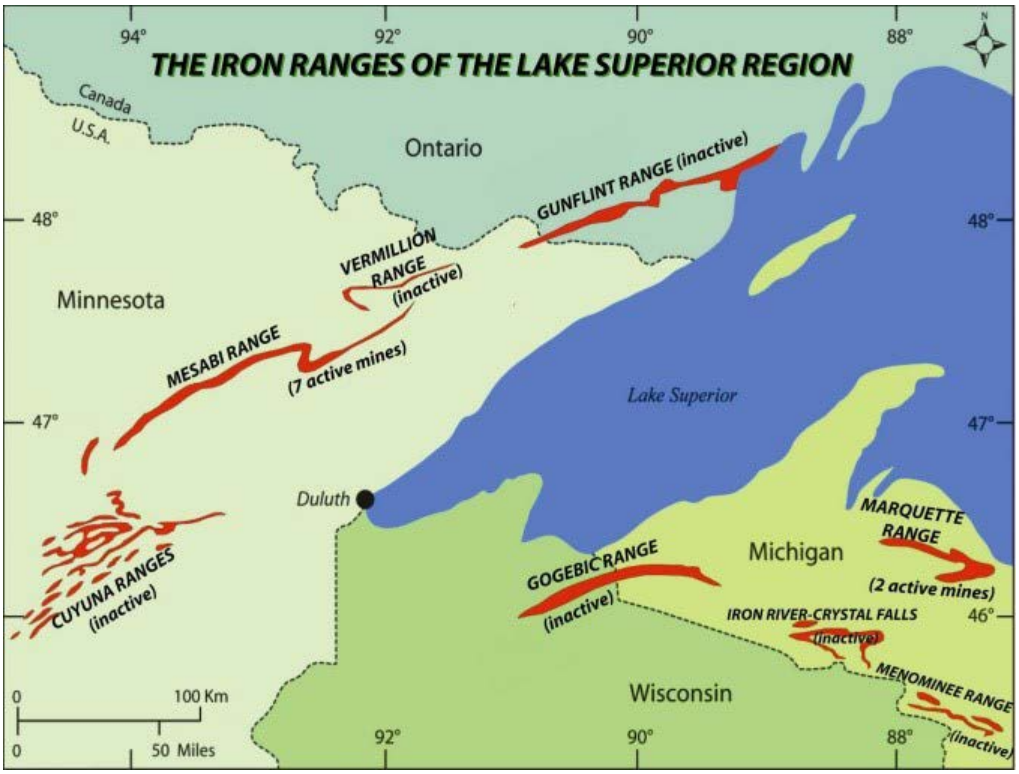

Figure 1. Iron ore ranges of Lake Superior
Source: DOI USGS report, public domain, Wikipedia.

Prior to the ratification of the United States constitution and the naming of Minnesota as a state, the Northwest Ordinance of 1787 was issued as a means of adopting new states from the Ohio Valley to Northern Minnesota into the union and setting a policy of civil law. Policy toward American Indians stated that "their land and property shall never be taken away from them without their consent" (Thompson 2017).

The Great Lakes Region is the ancestral territory of the Anishinaabe people, also known as the Chippewa or Ojibwe Tribe. Both Ojibwe oral histories and archaeological evidence suggest that the Ojibwe migrated to this region from farther east during the 17th or 18th century, displacing other groups, such as the Sioux, Assiniboine, and Cree (USDOI 2002). Archaeological evidence points to ancestral American Indians residing on these lands for at least the past 10,000 years (USDOI 2008). Place-based culturally specific subsistence-based livelihoods affirm the long-standing human history that pre-dated European settlement in the Great Lakes region. See the Tribal Traditional Needs and Values Report for more information on treaties established in the northeastern portion of Minnesota that pertain to lands within the withdrawal application area.

Personal accounts and notes of Alexander Henry, an English fur trader who lived with the Wawatam family, a Chippewa family, between 1763 and 1764, are described in George Quimby's "A Year with a Chippewa Family" (1962) and provide a sense of the integral nature of the Chippewa culture to the land, water, fauna, and flora of the region. In Quimby's essay, Henry describes the seasonal migration of the family unit, which he defined as "an effective workforce of seven people" (Quimby 1962, p 219). Travel in the spring, summer, and autumn was accommodated in birch bark canoes ranging from 12 to 40 feet long that could carry loads up to 6,000 pounds. Summers were spent with the larger community, while during the winter, the families would travel to separate wintering grounds for as Henry stated, "the

convenience, as well of subsistence as of the chase" (Quimby 1962, p. 222). Summer was spent largely at different islands or sites along the shores of the Great Lakes hunting for waterfowl and fishing. Winter with the Wawatam family was spent 50 to 60 miles inland. It was the women who carried loads on their backs and used snowshoes for travel.

This seasonal migration was based on place-specific resources available across the landscape: maple sugar in early spring, fish in later spring and summer, berries and wild rice in the late summer and fall, and wild game in the winter. The patterns of life of the Ojibwe were largely based around provisioning of subsistence resources. Henry also describes limited regional trade among tribes as well as with traders; however, more telling are the stories that illustrate not only the family's understanding of the region and its provisioning capacity but also demonstrate culturally specific knowledge required to transform resources into livelihoods. It is in this way that the people, the land, the water, the flora and fauna are enmeshed and at the heart of the Chippewa culture.

Industrial era economic development in the late 19th and early 20th century threatened the way of life of the Anishinaabe people. A gold strike during the Civil War, ultimately identified as "fools' gold," heightened American interests in exploring the area's mineral potential (USDOI 2002). The discovery of large iron ore deposits fueled the development of the timber industry. These industrial developments transformed the landscape and the availability of subsistence resources drastically. Dams built to support logging systems changed the hydrology of the wetland ecosystems flooding areas where wild rice had historically grown. Moose, caribou, and other wild game were hunted heavily to supply food for loggers, with some game never to return to the area. The seasonal activities of the Anishinaabe people, such as making maple sugar, ricing, winter hunting and trapping were dramatically impacted (Richner 2002).

During the late 19th and early 20th century, there was a heightened level of pressure for American Indians to assimilate into American life and dispense of their cultural heritage (Meyer 1991; Thompson 2017). The government created policies and programs to advance the assimilation process, such as establishing missions and boarding schools for American Indian children and attempting to control land tenure within reservations by dividing reservation lands into privately held allotments of 160 acres (Meyer 1991). These efforts were ultimately abandoned with little success at assimilation; however, the measures broke apart family units and interrupted the cultural reproduction systems of tribes (Thompson 2017). This was further compounded when the State of Minnesota sought to deny tribes opportunities for off-reservation subsistence hunting, fishing, gathering, and trapping by deeming such activities illegal. Such actions by the State were in direct conflict with rights previously secured through a series of treaties between the Chippewa and the United States government.

The subsistence rights of the Chippewa that provide a foundation for the continuance of their way of life were secured through multiple treaties entered into with the United States government beginning in the 1700s. The most significant to the Arrowhead Region was the Treaty of 1854, which, in part, established reservations in Minnesota, Wisconsin, and Michigan. Thompson (2017) provides a historical overview on the significant treaty authorities and case law that affirmed contemporary rights of the Grand Portage Band of Lake Superior Chippewa and the Bois Forte Band of Chippewa to off-reservation subsistence resources in the territory ceded under the Treaty of 1854. As Thompson explains, this treaty retained rights of the Chippewa that pre-dated the development of the United States to continue subsistence resource harvest in northeastern Minnesota. The treaty rights were strongly contested by the state and public upon the resurgence of renewed tribal activism stemming from the civil rights movement in the 1960s and 1970s (Thompson 2017). The state held that their jurisdiction should prevail over what they conceived of as "lapsed privileges." After numerous court cases across the nation and specific to tribal bands of the Great Lakes region, the courts affirmed that the tribal treaty rights of 1837 and 1854

supersede state law. Treaty rights and resources continue to be a major issue for the tribes and land management agencies. Federal agencies, such as the Forest Service, have a legal obligation to consult with tribes and understand how their management actions may affect tribal sovereignty and treaty reserved rights. As such, management decisions need to take into consideration resources such as moose or wild rice, among others.

Prior to the iron ore boom of at the turn of the 20th century, Michigan's Marquette iron ore mining industry had been well established by Cornish miners in the 1850s, followed by the arrival of Irish, Scandinavian, Finnish, and German miners. Much of the first wave of miners to work in the Mesabi Range migrated from Michigan's Marquette range. By 1890, over half of the nation's iron ore came from the Lake Superior District iron ranges of Minnesota, Wisconsin, and Michigan (Thistle and Langston 2016). Between 1895 and 1910, the population of the Mesabi Range grew from 8,870 to 65,000 to meet the growing demand for labor in the mines. Much of this demand was serviced through direct emigration mainly from northern and eastern Europe. By the turn of the century, the largest ethnic groups working in the mines were Scandinavians, including Finns, Swedes and Norwegians. While many of the Cornish miners had moved on to the Rockies, those who remained were mine bosses or held other positions of power (Sirjamaki 1946).

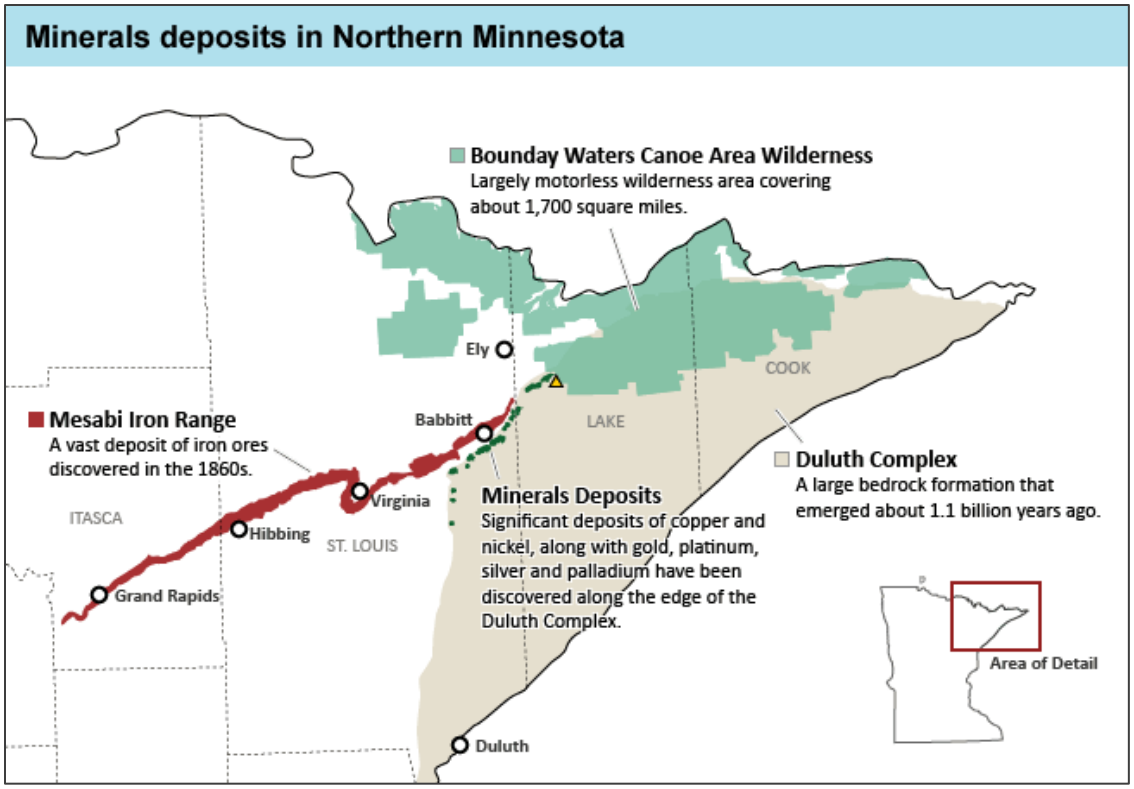

Figure 2. Mineral deposits in northern Minnesota

By the turn of the century, steel corporations in the district had gained control over many of the systems of steel production. With control over the mines as well as the mills, steel corporations exercised a great deal of power in the local community and regional economy. Alenen's The Locations (1982), offers a view of mining company towns and social conditions in the Iron Ranges from 1890 to the 1930s. In the Vermillion and Mesabi Ranges, the great majority of mine workers and their families lived in company towns, known as "locations," where the houses and land were owned or controlled by the company and

situated closely to the mines. The locations offered their residents many perks from low-cost rent at one-third of the housing costs of neighboring towns, to social services, such as schools and access to medical professionals. Alenen notes that the companies were walking a fine line between providing social services to improve health conditions and the quality of life of the workers and limiting certain social activities that inhibited meeting their ultimate goal of increasing productivity, efficiency, and profitability. As such, companies banned alcohol sales in their towns and frowned upon any social organizations that would challenge the status quo. One example was socialist labor groups most commonly organized by the Finnish. Alenen references one mining company executive's statement to the immigration commission investigators in 1911 concerning his views on the Finnish: "We need the Finns in our mines, as they are good laborers, men who can stand the heavy work required, but they are trouble breeders and a class not to be trusted."

The Superior National Forest was designated in 1909. While local elites in Ely were in favor of this conservation move, it posed a threat to local subsistence uses relied on by poorer local residents. This resulted in a deepening of the divide between the two groups of people in their views on nature and on government regulations concerning nature (Johnson 1999).

Benjamin Johnson offers a telling description of the evolution of attitudes towards federal protectionism in the Arrowhead Region that sprang from the mining companies' tight control over the social and economic systems during this time period in his article "Conservation, Subsistence, and Class at the Birth of Superior National Forest" (Johnson 1999). In Ely, the social character of the town Ely was heavily influenced by mine laborers. Finnish and Slovenian immigrants were the dominant ethnic groups, as well as some Swedes and Italians (Johnson 1999). The cultural values and heritage that immigrant communities embodied were maintained through social and religious organizations, as well as highly exclusive sports teams that were organized by ethnic groups.

Mining work was extremely dangerous, with a high rate of death, non-lethal injury, and illness. Dangerous working conditions were the root of organized labor actions and major strikes that were often broken through importing laborers. Mining companies employed alternative strategies to proactively thwart organized labor. Local merchants, who were predominantly Anglo and German, aligned with the mining companies to deny credit during strikes to laborers and labor organizers, who were predominantly Finnish. The mining companies also leveraged their power on wholesale suppliers in Duluth to restrict delivery of goods to cooperative stores opened by labor organizers in response to the local merchant blackout. After the 1907 strike, mining companies reduced their workforce from 18 percent to 8 percent of Finnish employees (Johnson 1999).

Many of the blacklisted strikers and union leaders turned to the land to make a living. Hunting, fishing, and trapping were important during tough economic times. According to Johnson, most area residents, even if they had jobs with the mining or timber industries, supplemented their wages with living off the land to some degree, including hunting, fishing, trapping, harvesting wood to heat their homes, and having livestock and vegetable gardens.

By the 1930s, most of the "locations" had been closed as the growing number of automobiles meant a growing level of autonomy for workers regarding where they would live. Along with the closure of the mines, social conditions diminished, prompting many residents to move away. Many residents of the "locations" lamented the move for a variety of reasons. For many immigrant families this was their first home in the new world and they held a certain level of sentimental connection to the mining towns and the companies that owned them (Alenen 1982).

The federal Shipstead-Newton-Nolan Act of 1930 restricted logging within 400 feet of lakeshores and barred further alteration of natural water levels. In 1933, the state of Minnesota signed into law the "Little Shipstead-Nolan Act" to "preserve shore lines, rapids, waterfalls, beaches, and other natural features in an un-modified state of nature" on state-owned lands in the Shipstead-Nolan area. Then, in 1938 and 1939, the U.S. Forest Service established Superior, Little Indian Sioux, and Caribou Roadless Areas within the Superior National Forest, banning public roads in these areas, while still allowing logging and motorboats. A couple of years later, the Forest Service mandated a "no-cut" zone on 362,000 acres.

In 1947, there was a shift to taconite mining in the region. Much of the area's high-grade iron ore had been extracted due to increased demand for steel during World War II, which led to the switch to taconite, a lower-grade iron ore. Taconite mining was later found to have serious environmental and health impacts, most notably that asbestos from the tailings could move from Lake Superior into drinking water and into the lungs of anyone drinking that water and miners' lungs, causing mesothelioma (Baeten 2017).

During this same period following the end of World War II, there was an increase in outdoor recreation in Minnesota. With outdoor recreation increasing in popularity as a pastime, several northern Minnesota towns, such as Ely and Grand Marais, embraced tourism as a much-needed source of income after the mining industry's presence there had decreased. The area saw an increase in motorboats and airplanes that would fly tourists into resorts or other roadless areas. Many wilderness preservationists saw this as an intrusion of the peace, serenity, and solitude the wilderness area provides. In 1947, Sigurd F. Olson wrote in a letter that the boundary waters "is the playground of the middle west, the only area of its kind between the Adirondacks and the Rocky Mountains, the only area where there is any extensive stretch of wild and undeveloped country" (Harvey 2002).

Wilderness preservationists started focusing on the boundary waters area between northern Minnesota and Canada, seeking to protect its waterways and wild lands. After World War II, the area became a focus of national attention for wilderness protection. In Mark Harvey's article (2002) "Sound Politics: Wilderness, Recreation, and Motors in the Boundary Waters Canoe Area Wilderness, 1945-1965," the author notes several conservation leaders including, Ernest C. Oberholtzer and Sigurd F. Olson, as playing important roles in this effort, as well as Senator Hubert H. Humphrey. Their work was instrumental in the passage of the federal Wilderness Act of 1964; however, it also brought back to light the discord over whether motorized recreation should be allowed in the boundary waters, a contentious issue that divided Minnesota's outdoor recreationists. In defense of eliminating motorized recreation, Wilderness Society President Benton McKaye poetically said this: "Here is the place of places to emulate, in reverse, the pioneering spirit of Joliet and Marquette. They came to quell the wilderness for the sake of civilization. We come to restore the wilderness for the sake of civilization" (Harvey 2002).

During the post-war years, disputes shifted from those centering on proposed logging, roads, and dams in the roadless areas to the use of motorized vehicles. This debate carried on from the mid-1940s into the 1960s, not only in the region, but also nationally. These conflicting viewpoints were not only on motorized vehicles but also signified diverging views of nature and humans' role in it. This debate continues in northern Minnesota to the present day (Harvey 2002). While residents focused on preservation and urban visitors to the area viewed the wilderness area as a land apart from civilization needing protection against man, local people who had mined, hunted, and fished these same areas viewed the land and water as integral to their everyday lives, not a place apart from man.

In 1948, the Thye-Blatnik Act was signed, authorizing the secretary of agriculture to spend an initial amount of $500,000 to acquire private lands within the boundary waters wilderness. On December 17, 1949, President Harry Truman signed an order prohibiting flights below 4,000 feet, effective January 1, 1951. Many resort owners and pilots protested and violated the ban, leading federal marshals to seize

several planes. At this point in history, the Boundary Waters Canoe Area Wilderness was the nation's most protected wilderness area in the country. In 1956, the Wilderness Society began a campaign to institute a national wilderness preservation system. The proposed legislation, led by Minnesota Senator Humphrey, aimed to prohibit logging, mining, and motorized vehicles in wilderness areas. The mining and logging industries objected to the proposed bill. Some tourism outfitters also voiced opposition to the bill.

To gain the support of many who were against the proposed bill, Humphrey eventually agreed to allow motorized vehicles in the Boundary Waters Canoe Area Wilderness. In 1964, Congress enacted the bill and President Lyndon B. Johnson signed the Wilderness Act into law on September 3, 1964. The law declared that it is "the policy of the Congress to secure for the American people of present and future generations the benefits of an enduring resource of wilderness." The subsequent Boundary Waters Canoe Area Wilderness Act of 1978 eliminated much motorboat use from the area (Harvey 2002).

In 1962, just, prior to the passage of the Boundary Waters Canoe Area Wilderness Act, National Park Director Conrad Wirth and a small group of people toured the area, now known as the Voyagers National Park, and decided that day that the area was worthy of preservation as a national park. Voyagers National Park located at the most western boundary of the Boundary Waters Canoe Area Wilderness, was designated as a national park 25 years later in 1987 (Witzig 2004). The designation of the national park was vocally contested by many Minnesotans, who saw this as an extension of the Boundary Waters Canoe Area Wilderness and were concerned about increasing the amount of federal land ownership in Minnesota limiting economic development opportunities (Robertson 1987).

Taconite mining continued to be a driving force in providing a steady flow of jobs and labor income until the early 1980s when global metals market conditions lead to the loss of 60 percent or 10,000 mining related jobs in the Iron range. The abrupt decline in mining jobs and labor income in the region has not recovered due to mining; however, there has been steady but slow recovery driven by the high-quality amenity and recreation opportunities in the region.

Residents of small towns, such as Ely, had historically been dependent on mining industries and motorized recreation for their livelihoods, and thus, were not in favor of conservationists and lawmakers from distant cities, like Washington, D.C. and the Twin Cities, dictating to them what would and would not be allowed in their hometowns. Some felt that wilderness preservationists and others trying to enact legislation protecting the wilderness area did not respect mine and timber workers' livelihoods. These feelings can still be seen in the views of many northern Minnesota residents today.

Existing Condition

Population Demographics and Trends

Population change influences both the extent of the affected population and the demand for human uses of public lands. The total population in the Arrowhead Region was estimated to be 215,695 in 2019, with the majority of the population residing in St. Louis County (199,759). St. Louis County's largest town is Duluth, the county seat, which has a population estimated at 85,915 for 2019. While Cook County has experienced the greatest amount of growth (increasing by 58 percent within the last 50 years), it maintained the smallest population of the region. Both Lake and St. Louis Counties experienced a decline in the population between 1970 and 2020 as shown in table 2. Population estimates from 2010 to 2019 for region indicate that the population is growing (0.1 percent); however, relatively slowly compared to the nation and state. In contrast, the United States population increased 6.8 percent and the Minnesota population increased 6.1 percent over the same time period (USDC 2020a).

Table 2. Arrowhead Region population dynamics by county

Criterion	Cook County	Lake County	St. Louis County
Population 2019*	5,376	10,560	199,759
Percent Change 1970 to 2020**	57.6%	-20.6%	-9.8%
Percent Change 2010-2019*	3.2%	-3.1%	0.1%

*Source: USDC 2020a. American Community Survey 5-year estimates. 2019 represents average characteristics from 2015 to 2019.
**Source: USDC 2021.

Race and Ethnicity

The analysis area population is predominately white (with the exception of the American Indian populations in Cook and St. Louis counties), and much less diverse than the nation and Minnesota's population overall (table 3). Cook and St. Louis counties contain American Indian populations that exceed the average percentage for the State. Of the total population in 2019 in Cook County (5,376), 474 reported that they were American Indian (8.8 percent). In St. Louis County, population of 199,759 people, 3,655 reported that they were American Indian (1.8 percent) (USDC 2017).

The effects to American Indian tribes in the analysis area are considered within the environmental justice analysis as minority communities. The Ojibwe or Chippewa tribe includes three bands that ceded lands to the U.S. government in the Treaty of 1854. The Grand Portage Reservation is located in Cook County, the Bois Forte Reservation is located in northern Minnesota in Koochiching and St. Louis counties, and the Fond du Lac Reservation is located in Carlton and St. Louis counties. American Indian tribes in the analysis area may be disproportionately affected due to impacts on economic values, both monetary (jobs and income) and non-monetary (subsistence income), health outcomes, and cultural or spiritual values.

Table 3. Racial and ethnic composition in the analysis area as a percentage of total population, 2019

Location	White Alone	Black or African American Alone	American Indian Alone	Asian Alone	Native Hawaiian and Other Pacific Islander Alone	Some Other Race Alone	Two or More Races	Hispanic or Latino Origin
Cook County	86.2	0.1	8.8	0.9	0.0	1.5	2.5	2.3
Lake County	96.9	0.6	0.9	0.1	0.2	0.1	1.2	1.4
St. Louis County	92.2	1.6	1.8	1.0	0	0.5	3.0	1.7
Minnesota	82.8	6.4	1.0	4.8	0	1.9	3.0	5.2
United States	72.5	12.7	0.8	5.5	0.2	4.9	3.3	18.0

Source: USDC 2020a

Poverty

Poverty is an important indicator of wellbeing. Individuals with low incomes are more vulnerable to a number of hardships which may negatively affect their health and wellbeing. Estimates of the share of people and families living below the poverty level were considerably higher (about 4 percent above State average) in St. Louis County than Minnesota, as seen in figure 3 below (U.S. Department of Commerce 2020). Approximately 14 percent of people in St. Louis County live in poverty (U.S. Department of Commerce 2020). However, they only exceed the nation's rate by less than 1 percent.

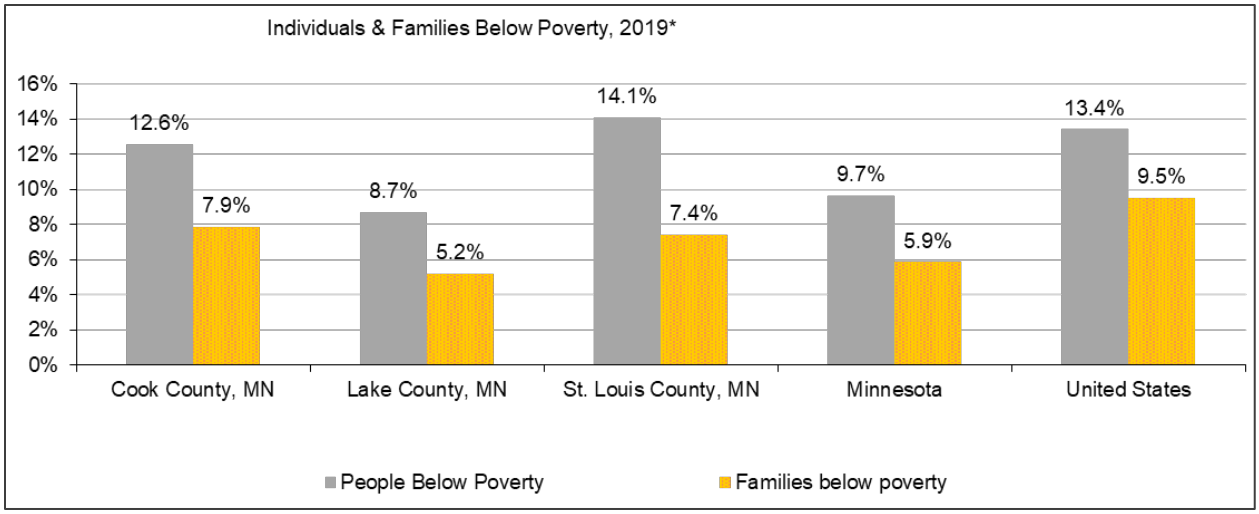

Figure 3. Individuals and families below the poverty level, 2019 (USDC 2020a).

Youth and Elderly Populations

Youth and elderly populations are particularly vulnerable to environmental stresses, more so than people between these two age ranges. Environmental conditions in childhood set the platform for lifelong health. Infants and children are more sensitive than adults to compromised environmental conditions since their bodies are developing rapidly. Children are also typically more active than adults in outdoor activities such as running which increases children's exposure air and quality hazards. Poor health during childhood increases the likelihood of problems in adulthood. Children of economically disadvantaged households are more likely to experience compromised health conditions due to the lack of adequate care through the early phases of life. Elderly populations may have pre-existing chronic conditions that pre-dispose them to be more sensitive to environmental hazards. This population also has a higher rate of non-ambulatory incidence and may not be able to respond rapidly to immediate threats.

The assessment area has a slightly lower percentage of children as a portion of the resident population than compared to the State of Minnesota. Given that the analysis area contains one of the county's most visited wilderness areas and a recreation destination, it is appropriate to consider visitor populations as well. The 2016 National Visitor Use Monitoring report found that an estimated 15 percent of visitors to the Superior National Forest were under the age of 16 (USDA Forest Service 2018a). This means that approximately 134,000 to 140,000 children under the age of 16 visited the Superior National Forest in 2016.

When considering elderly populations, the assessment area exceeds the state's percentage. Lake and Cook counties have dramatically more people over 65 than does the State (figure 4).

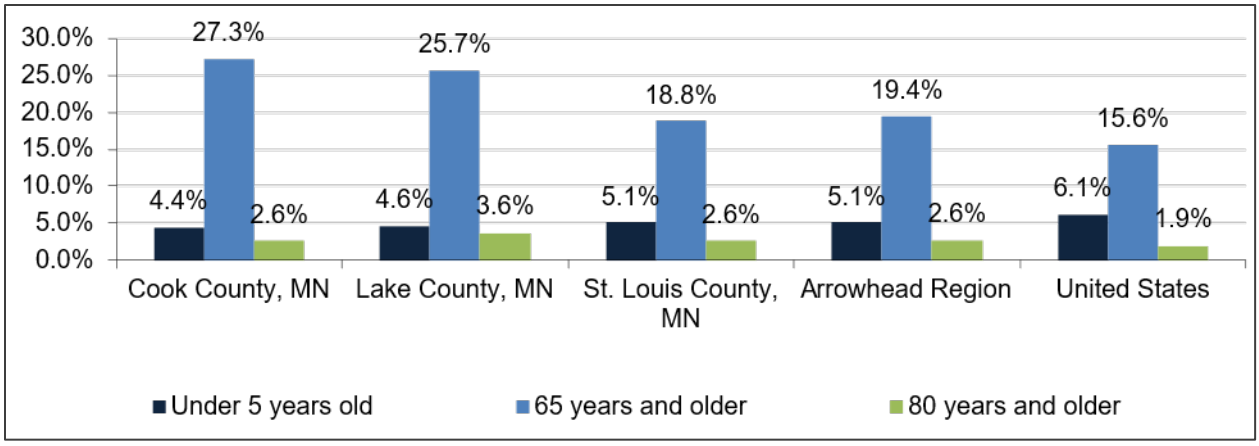

Figure 4. Percent of population by age range (USDC 2020b).

Figure 5 demonstrates that the greatest percent growth in the "65 and older" population in the last decade occurred in Cook County, where this population segment grew by over 8 percent. The childhood population percentage declined the most at the national level and in Lake and St. Louis Counties, while increasing in Cook County by almost 1 percent.

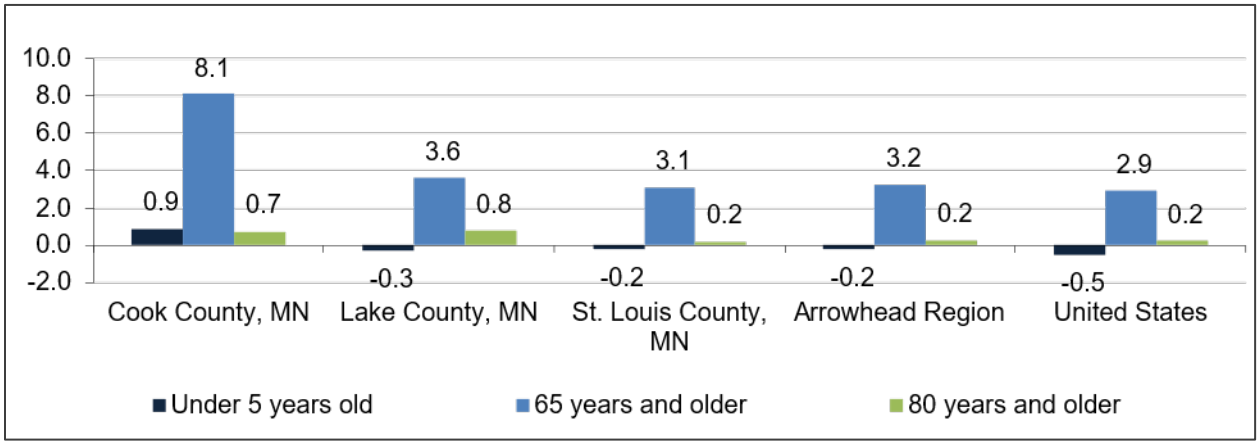

Figure 5. Percent population growth by age range, 2019 (USDC 2020b).

Public Health and Welfare

Access to Healthcare

One of the issues identified through public scoping was concern for how changes in mineral development may affect future access to medical care. The latest data available from the Minnesota Department of Health identified the communities in the northern portion of St. Louis County as Health Provider Shortage Areas for primary care providers (MNDoH 2016). There is concern that the withdrawal would result in the loss of permanent benefitted employment and that, as a result, residents of the Arrowhead Region would rely more heavily on seasonal and temporary jobs, which often do not provide healthcare benefits. The loss of employer subsidized health insurance may result in decreased access to medical care and increase the burden of medical costs on households. Results from the Minnesota Health Access Survey suggests that those working in seasonal or temporary jobs are more likely to be uninsured, accounting for 19 percent of the uninsured population; however, only 10 percent of the general population is uninsured (MNDoH 2021). Since the passage and subsequent phased implementation of the Affordable

Care Act of 2010, the rate of uninsured people in Minnesota declined by more than half from 2013 to 2021 to 4 percent. However, 10 percent of people of color and American Indians in Minnesota continue to be uninsured (MNDoH 2021), suggesting that minority populations may experience a disproportionate lack of access to healthcare compared to the general population. Uninsured people are more likely to go without medically necessary treatments and suffer related health and economic impacts (IoM 2001).

Exposure to Neurotoxicants Early in Life

Methyl mercury, classified as a neurotoxicant, is a known pollutant generated from hardrock mineral mining (Onello et al. 2016). Methyl mercury bio-accumulates in the aquatic food web and can become highly concentrated in predatory fish species, such as the Walleye in Lake Superior, and in aquatic plants, such as wild rice. Historical sources of mercury contamination arose from industrial and municipal discharges and burning coal (GLC 2021). Children and fetuses of women who participate in subsistence livelihoods, in particular consuming fish and wild rice, experience a higher risk of exposure to neurotoxicants and therefore have a higher risk of suffering the health, social, and economic impacts due to early-in-life neurotoxicant exposure. Tribal communities of the Arrowhead would have a higher likelihood of exposure to neurotoxicants in the region due to subsistence livelihoods that are an integral part of the Ojibwe Tribe's cultural values.

A study conducted by Patricia McCann of the Minnesota Department of Health on mercury levels in blood from newborns in the Lake Superior Basin in 2011 found a statistical difference in blood mercury concentration levels between infants born in Minnesota in the summer and winter, versus in the spring or fall. Infants born in summer months had a higher blood mercury concentration than those born in other seasons suggesting a seasonal exposure pattern and would support the theory that fish consumption is the exposure pathway. There was no statistical difference found in blood mercury concentration levels associated with sex or residence in urban or rural locations. The study found that 8 percent of infants studied exceeded the Environmental Protection Agency's reference dose for methyl-mercury and 1 percent exceeded the benchmark dose limit used by the Agency in developing the reference dose (McCann 2011).

A 2006 study updated in 2014 by Philippe Grandjean and Philip Landrigan on the neurobehavioral effects of developmental toxicity identified a suite of neurotoxicants, including methyl mercury, lead, and arsenic and their related impacts on neurological development and impacts later in life. As described in the paper, the developing brain is uniquely vulnerable to exposure to environmental toxins. While in utero, the brains of fetuses are readily exposed to toxins found in the fetal circulation system, causing genetic changes in the brain. Such genetic changes at the developmental stage in life are likely to lead to disease and functional deficits, such as decreased intelligence, autism, antisocial behavior, criminal behavior, violence, and substance abuse that is often untreatable and frequently permanent (Grandjean et al. 2014).

The National Academy of Sciences in reviewing findings from three studies found that even at low concentrations of methyl mercury there is strong evidence for fetal toxicity (Trasande et al. 2005). While the National Academy of Sciences found that exposure to methyl mercury results in toxicity to the kidneys and increases the risk of cancer, the greater amount of research and available information relates to the effects to neurological development (Trasande et al. 2005). Negative effects to neurological development due to exposure of methyl mercury early in life has been found to have lifelong consequences related to personal and professional achievement. One study that evaluated between 316,588 and 637,233 children with cord blood mercury levels over 5.8 micrograms per liter (the level at which development effects become apparent), found that the economic costs in terms of economic productivity later in life were 8.7 billion dollars per year (Transande at al. 2005).

Data from the Minnesota Department of Health on lead levels in infants born in 2016 show that children born in Lake and St. Louis Counties have a slightly greater risk of lead exposure than what is experienced at a statewide level (table 4).

Table 4. Lead levels in children, birth year 2016

Annual Lead Test, children under 6 years of age	Cook County	Lake County	St. Louis County	Minnesota
Percent of Children Tested	52.1%	92.2%	88.8%	81.9%
Children with elevated blood levels, 5 or more micrograms per deciliter	0.0%	1.1%	1.1%	0.8%

Source: Minnesota Department of Health 2022a.

Cancer Rates

Nervous system disorders, lung cancer, and mesothelioma are health concerns related to sulfide-ore mining identified by the public. Data from the Minnesota Department of Health shown in figure 6 and figure 7 demonstrate cancer rates by type per 100,000 people from the years 2014 to 2018. The data show that St. Louis County has an overall lower rate of brain and nervous system related cancers, while Lake County exceeds the State's rate. Conversely, rates for lung related cancers in Lake and St. Louis Counties exceeded the other counties in the analysis area, as well as the State's rate. The data for Cook County suggests a relatively low rate of occurrence of brain, nervous system, and lung cancers.

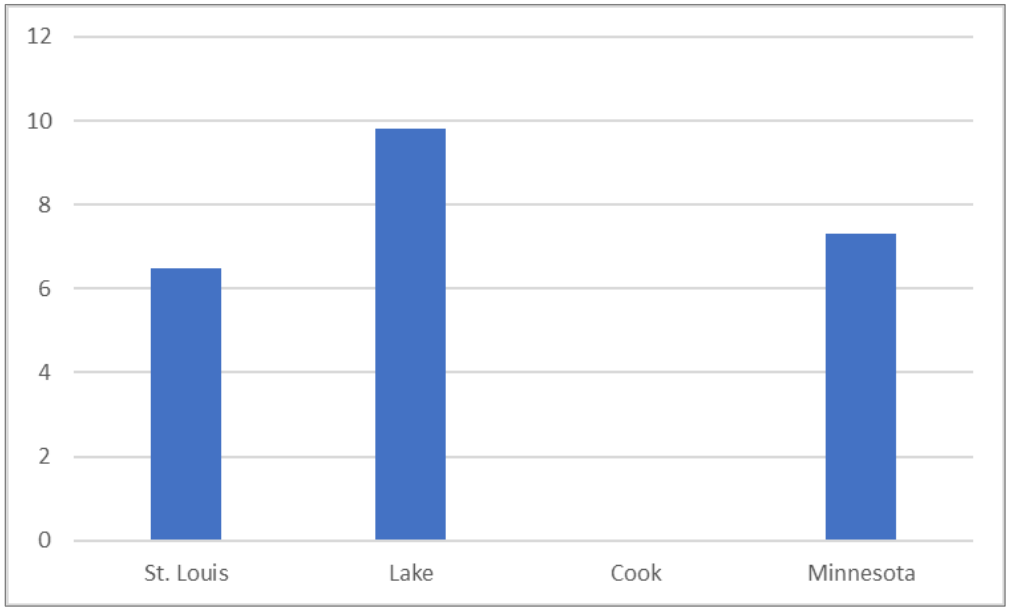

Figure 6. Brain and nervous system cancer rates per 100,000 people, new cases 2014 to 2018.

Source: MNDoH 2022b

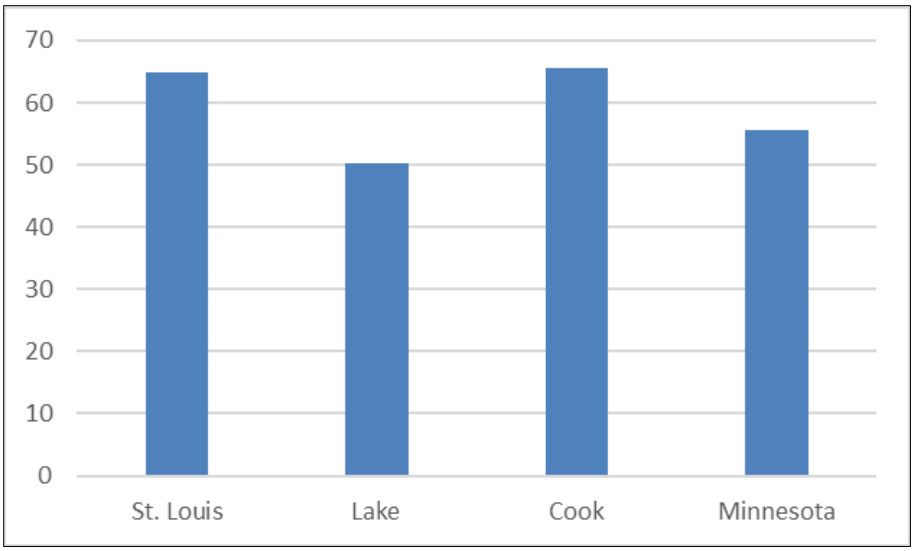

Figure 7. Lung and bronchus cancer rates per 100,000 people, 2014 to 2018.
Source: MNDoH 2022c

Water Quality

Community water system standards in Minnesota require that arsenic concentrations are below 10 micrograms per liter; however, private well systems are not regulated by the state and owners are personally responsible for testing and deciding on the quality suitable for personal use. The Minnesota Department of Health recommends that people do not drink or cook with water over 10 micrograms per liter of arsenic. Data from the Minnesota Department of health displayed in table 5 demonstrates that well systems tested in Cook County exceeded the State's percentage of wells with elevated concentrations of arsenic. However, Lake and St. Louis Counties had less than half of Minnesota's percentage of wells that exceed 10 micrograms per liter of arsenic. As such, people in Cook County who get their drinking water from private wells have a higher likelihood of experiencing health impacts associated with consuming arsenic than other communities across the state and in the neighboring counties. These risks may be compounded by socio-economic conditions for those living in poverty, as the cost to pay for well testing, sourcing alternative water supplies, or treating contaminated water are barriers to identifying and reducing exposure to arsenic. See the Water and Aquatic Species Report for more information on water quality.

Table 5. Percent of private wells tested by county with arsenic concentrations, 2008-2020

Private Wells Tested	Cook County	Lake County	St. Louis County	Minnesota
Arsenic greater than 2 micrograms per liter	41.1%	27.2%	39.2%	48.4%
Arsenic greater than 10 micrograms per liter	12.2%	3.8%	4.1%	11.3%

Source: Minnesota Department of Health, Minnesota Public Health Data Access, County Profiles, 2022d.

Air Quality

Air quality affects public health. Air pollution is associated with heart and lung disease. Fibrous amphibole, one form of asbestos, is known to be present in the withdrawal application area; however, there is no available data on concentration of fibrous amphibole, which is measured as concentrations of particulate matter with a diameter of 10 micrometers or less. When inhaled, these fibers are trapped in lungs where they may cause lung cancer or mesothelioma.

The state of Minnesota does monitor ozone and particulate matter with a diameter of 2.5 micrometers or less concentrations as an indicator of air quality that measures the presences of fine particulates in the air. Particulates include those released from the burning of gasoline, diesel fuels, wood, and other fuels. The national ambient air quality standard for particulate matter with a diameter of 2.5 micrometers or less is 12 micrograms per cubic meter air. Table 6 shows that the three counties within the assessment area did not exceed national air quality standards when measured as an annual average concentration in 2020. See the Air Quality Report for more information.

Table 6. Average concentration of fine particulates, 2020

Criterion	Cook County	Lake County	St. Louis County
Fine particulates monitored micrograms per cubic meter air	2.6	5.3	7.3

National Ambient Air Quality Standard is 12 micrograms per cubic meter air.
Source: Minnesota Department of Health, 2022e.

Education

Educational attainment is a proxy for other socioeconomic conditions, as there is a strong correlation between lack of education, poverty, and poor health. The percent of the population in the Arrowhead Region with less than a high school education in 2019 is illustrated in figure 8. The data demonstrate that the Arrowhead Region has a slightly greater percentage of people with a high school diploma than the State, and those of all counties exceeded the national graduation rate by over 6 percent.

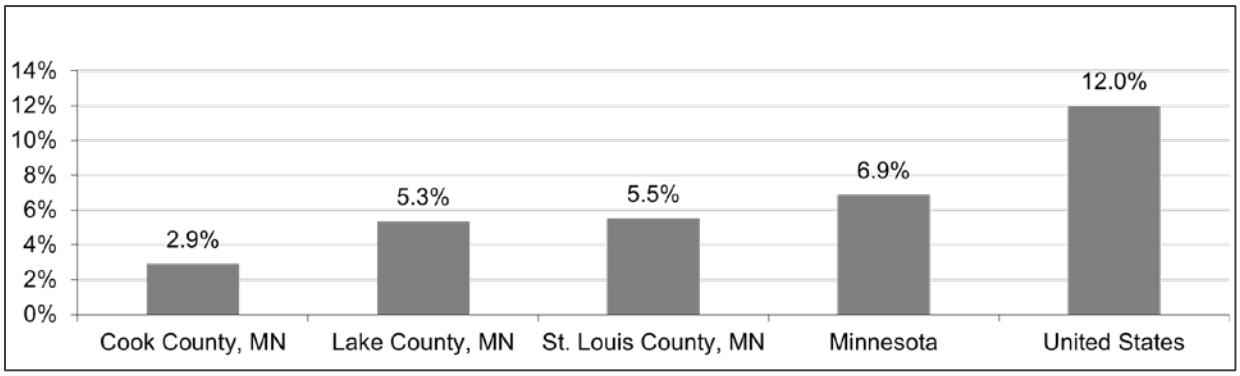

Figure 8. Percent population with less than a high school education*, 2019 (*Highest level of schooling completed by people 25 years and over. (Note: 2019 represents data 2015 to 2019.)
Source: USDC 2020b

When considering trends in educational attainment, all assessment areas demonstrated gains in educational attainment as the percentage of the population with less than a high school diploma decreased slightly over the assessment period. The greatest gains were in Cook County, where the percent population with less than a high school diploma declined by 4.1 percent (figure 9). On a state level, Minnesota lagged slightly behind the nation in changes in the percent of populations with a high school diploma; however, Minnesota overall had higher educational attainment level, as was demonstrated in figure 8.

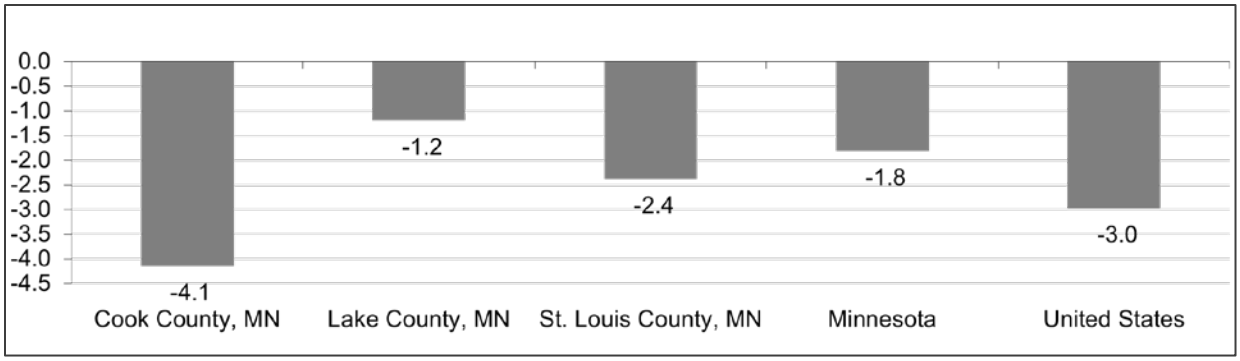

Figure 9. Change in percent population with less than a high school diploma, 2015 to 2019
Source USDC 2020b

School Trust Lands

In 1858, when Minnesota became a state, nearly 8.1 million acres of land was granted to the state government by the federal government "for the use of schools" (MDNR 2020). Much of this land was then sold to private owners under state policy (Skwira and Marx 2001). Approximately 2.5 million acres of these School Trust Lands remain fully under state ownership, and an additional one million acres of mineral rights also remain under state ownership (MDNR 2020). Over 30 percent of School Trust Lands are located in St. Louis, Lake, and Cook counties (MDNR 2020). See table 7.

Table 7. School trust land acreage, by county, fiscal year 2019

County	State Trust Lands (acres)	Percent of Total
St. Louis	474,868	20
Lake	159,290	7
Cook	121,765	5
Analysis Area Total	785,058	32
Statewide Total	2,513,562	100

Source: MDNR 2020

These lands generate revenue through commercial timber harvests, mineral leases, and other use fees and easements such as utilities right-of-way fees and land sales. Revenues from the management of School Trust Lands fund the Permanent School Fund, which serves to support the long-term benefit of public schools (Skwira and Marx 2001).

At the end of the 2019 fiscal year, the Permanent School Fund had reached a market value of approximately $1.5 billion dollars, with about $33 million dollars of spendable income distributed to public schools. For context, the State of Minnesota spends about $14 billion per year on public schools (Census 2020c) suggesting the Permanent School Fund contributes less than one percent of annual school budgets. In fiscal year 2019, $25.4 million dollars was added to the Permanent School Fund from revenues generated on School Trust Lands (table 8). Over 80 percent of fiscal year 2019 revenues were from mineral activity. Mineral-related rentals and royalties have consistently been the largest source of revenue from these lands. These contributions are subject to market fluctuations. For example, the prior fiscal year (2018) total contributions were $14.3 million dollars.

Mineral exploration has occurred on State and private mineral leases within the withdrawal application area. School Trust Lands and private mineral leases would not be subject to the proposed action, and it is

anticipated that those areas would continue to be actively explored regardless of whether the area is withdrawn from operation of the mineral leasing laws. However, given the intermingled ownership, restricting activities on federal lands may indirectly impact future activities on neighboring lands, as mineralized deposits may not be economically viable in spatially limited scenarios. Effects of federal land management are discussed in the Environmental Consequences section.

Table 8. Permanent School Fund revenue contributions by program, fiscal year 2019

Program	Contribution	Percentage of Total
Minerals	$21,429,265	84
Real Estate	$194,400	1
Timber and Forest Management	$3,770,345	15
Total	**$25,394,010**	**100**

Source: MDNR 2020

Federal Payments to States and Counties

Counties with lands managed by the Superior National Forest receive payments through several federal programs. These are federal payments in-lieu of taxes, Secure Rural School and Community Self-determination Act, and Thye-Blatnik Act. Mineral leases on federal lands, where they exist and produce revenue, also result in disbursements to state and local governments.

Mineral Royalties and Rents: Nationally, mineral operators who lease and extract federal minerals pay billions of dollars annually that are shared among federal, state, and Indian tribal governments and are one of the largest nontax sources of revenue to the federal government (GAO 2012). Only non-energy hardrock leasable minerals are addressed here as salable and locatable mineral resources are not subject to the requested withdrawal as described in the Reasonably Foreseeable Development report.

A unique combination of legal authorities allow the Bureau of Land Management to lease federally owned hardrock mineral resources in Minnesota under a different scheme than that in place for disposition of similar minerals found in other parts of the country (see Reasonably Foreseeable Development report). Federal lands for extracting minerals are available through leases requiring payments in the form of rents and bonus bids, which are required to secure and maintain a lease, and royalties, which are based on the market price of the minerals that are extracted. This non-tax revenue is collected and reported by the U.S. Department of the Interior, Office of Natural Resources Revenue. Rents, bonuses, and royalty payments collected by Office of Natural Resources Revenue are distributed to different agencies, funds, and local governments for public use. Federal mineral leases in the withdrawal application area generated rent and royalty payments totaling over $400,000 dollars each in fiscal years 2019 and 2020 (ONRR 2021). These payments were from former federal leases MNES-1352 and 1353 and based on $1 dollar per acre per lease year rental fee and minimum royalty payment in lieu of production royalties of $79 dollars per acre (USDI BLM 2019). From fiscal year 2014 to 2018, rent and royalty revenues from the two former leases within the withdrawal application area averaged approximately $57,000 dollars annually (ONRR 2021). Payments were based on $1 dollar per acre and the minimum royalty of $10 dollars per acre per year (AMEC 2014). The U.S. Treasury returns 49 percent of these revenues to the State where mineral activities occurred. That translates to approximately $200,000 dollars in fiscal years 2019 and 2020 and $28,000 dollars the previous 5 years being disbursed to Minnesota. States may share, at their discretion, a portion of revenues with the local governments where royalties were generated. A portion of mineral revenues not disbursed to state governments is paid into the National Reclamation Fund, which is used to fund water resources management projects in the

United States. The remainder goes into the U.S. Treasury. With the cancelation of federal mineral leases within the withdrawal application area in January 2022, no rents or royalties are currently collected.

Economic Environment

Uses and resources administered by land management agencies contribute to local economies and management decisions can have implications for these economies. USDA's Economic Research Service has developed a set of county-level typology codes that captures a range of economic and social characteristics. These County Typology Codes classify Cook, Lake and St. Louis Counties as recreation-dependent economies according to their six categories of economic dependence. Lake County was also classified as a mining-dependent economy (USDA ERS 2017).

The 3-county analysis area had over 135,000 jobs (both full and part time employment) in 2019 (IMPLAN 2019). This represents 4 percent of all jobs in the State of Minnesota. The distribution of employment among economic sectors for the 3-county analysis area largely follows the distribution seen in the state with a few exceptions (table 9). Over 40 percent of all mining sector jobs in the state are located within the 3-county analysis area. Sectors associated with recreation and tourism, such as, retail trade, accommodation, and food service sectors, make up a higher proportion of total jobs in the study area relative to the statewide average (IMPLAN 2019).

Total job numbers tell only part of the economic picture. Average annual wages vary by sector. Mining, utility, and management sectors have some of the highest per job wages on an average annual basis, while agriculture and forestry, arts, entertainment, recreation, and retail trade all have below average annual wages (IMPLAN 2019). Below average wages are more common in seasonal, part time, or low skills jobs that are often found in the food, accommodations, retail, and agricultural sectors.

Table 9. Percentage of jobs, by sector, 2019

IMPLAN Sector Title	3-County Analysis Area	Minnesota
Agriculture, Forestry, Fish, and Hunting	1%	2%
Mining	3%	0%
Utilities	1%	0%
Construction	5%	5%
Manufacturing	5%	9%
Wholesale Trade	2%	4%
Retail trade	10%	8%
Transportation and Warehousing	4%	5%
Information	1%	1%
Finance and insurance	4%	6%
Real estate and rental	3%	4%
Professional, scientific and tech services	5%	7%
Management of companies	1%	2%
Administrative and waste services	2%	5%
Educational services	2%	2%
Health and social services	21%	14%
Arts, entertainment, and recreation	2%	2%
Accommodation and food services	10%	7%
Other services	6%	6%
Government	13%	10%

Source: IMPLAN 2019

Local Mining Economy

In 2019, mining-related employment was an estimated 3 percent (4,350 jobs out of 135,900 jobs) of total employment in the three-county analysis area (IMPLAN 2019). In this region, most of these jobs are in the iron ore mining sector, but jobs in metal mining support services, sand and gravel mining, and oil and gas extraction would also be included in this estimate of total mining-related employment (IMPLAN 2019).

Although mining sector jobs make up a small portion of the regional economy, these jobs can be important to localized economies and individuals who rely on mining activities for jobs and income. In addition, the average wage in natural resource extraction sectors is generally high compared to wages in many other sectors. The average annual wage in the iron-ore mining sector was an estimated $109,000 dollars in 2019 within the 3-county analysis area compared to the average annual wage across all sectors within the analysis area of $54,000 dollars (IMPLAN 2019).

Although the region has a long history of mineral extraction, it has not necessarily been a consistent source of employment. Resource extraction industries are often subject to boom-and-bust cycles in the economy and their economic impacts depend on global prices and production, as well as changes in technology. While the United States has seen an overall increase in employment in the mining sector (which includes four sub-sectors: oil and gas extraction, coal mining, metal ore mining, and nonmetallic minerals mining), the State and region have seen an overall decline since 1998 (figure 10).

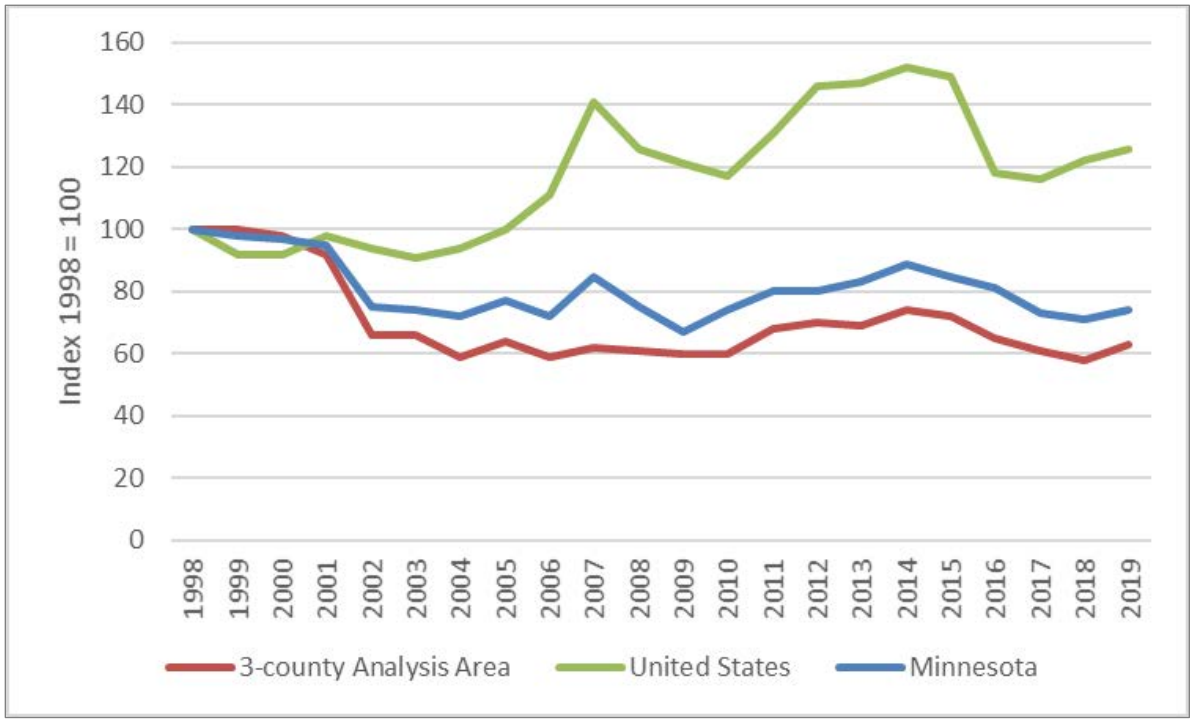

Figure 10. Mining sector employment over time, 1998 to 2019 (Note: The mining sector represented in this figure includes four sub-sectors: oil and gas extraction, coal mining, metal ore mining, and nonmetallic minerals mining.

Source: USDC 2021

Since 2019, mineral activity on National Forest System lands within the withdrawal application area was limited to former mineral lease MNES-1352. Activity within former mineral lease MNES-1352 has, in recent years, been focused on geotechnical and hydrogeologic data gathering for development and engineering design of the proposed underground mining operation within the same lease area. These

activities are similar or identical to construction of exploration sites and diamond core drilling. The 2012 Federal Hardrock Mineral Prospecting Permits Environmental Impact Statement contains a description of these types of activities (USDA Forest Service 2012). Additional activities within the withdrawal application area include exploration and environmental (geotechnical and hydrogeologic) hole abandonment, and site and access reclamation. As recently as November 2021, abandonment and reclamation was completed at 26 holes.

Mineral Commodities and Potential Market Demand

The lands within the requested withdrawal area contain over 67,000 acres with high potential for the occurrence of leasable copper, nickel, cobalt, and platinum-group metals metallic minerals. The Mineral Potential Report discusses the relative size of the deposits and comparisons of deposits within the withdrawal application area to other active and identified mineral deposits. These comparisons suggest the quantities contained within the withdrawal application area are substantial at a national scale.

The occurrences of a mineral resource does not necessarily imply that the mineral can be economically extracted or is likely to be developed. Economic quantities, in this context, are defined by U.S. Geological Survey (2022, p. 198) as where profitable extraction or production under defined investment assumptions has been established, analytically demonstrated, or assumed with reasonable certainty. The region has seen 70 years of study generating mine development proposals as recently as 2019. Twin Metals Minnesota LLC's 2013 Preference Right Lease Application for lands within the withdrawal application area outlined their claim of economic viability based on a conceptual mine plan, benchmarking against other projects and citations of independent economic experts. A Bureau of Land Management review of the 2013 Preference Right Lease Application resulted in a preliminary valuable deposit determination stating, in part "Based on the information provided by [Twin Metals Minnesota] and [Bureau of Land Management-Eastern States] own analysis and research, we conclude that there is a reasonable prospect of success in developing a profitable mine" (USDI BLM 2020). Based on the previously submitted preference right lease applications, history of exploration activity, and Bureau of Land Management's preliminary valuable deposit determination, it is not unreasonable to assume there exists economic quantities within the withdrawal application area. This assumption is also reflected in the reasonably foreseeable development report, which assumes preference right leases would be requested within the withdrawal application area under the no-action alternative, and the Mineral Potential Report conclusion that the sub regions of the withdrawal application area—specifically the Duluth Complex—may be highly valuable and constitute a substantial domestic source of base and precious metals.

The mineral deposits within the withdrawal application area are known to contain critical minerals. A critical mineral, in this context, is defined "as a non-fuel mineral or mineral material essential to the economic or national security of the U.S. and which has a supply chain vulnerable to disruption." Critical minerals are also characterized as "…serving an essential function in the manufacturing of a product, the absence of which would have significant consequences for the economy or national security" (USGS 2022). The Mineral Potential Report identifies all critical minerals present, or likely to be present, in the withdrawal application area, as well as a description of withdrawal application area and global hardrock mineral resources.

In the United States, the leading uses for minerals found in this deposit include, but are not limited to, the production of superalloys in aircraft turbine engines (cobalt), building construction and electrical and electronic products (copper), and stainless and alloy steel (nickel) (USGS 2022). Demand for minerals present in the withdrawal application area has increased in recent years due to strong global manufacturing activity (USGS 2022). Future demand for non-fuel mineral commodities is expected to increase, by some estimates drastically, due to emerging and low-carbon technologies and national and

international interest in advancing the use of these technologies (IEA 2022). The type and volume of mineral needs varies by technology. Examples include cobalt and nickel for rechargeable batteries, rare earth elements in permanent magnets and electronics such as wind turbines and electric vehicle motors, and platinum-group metals in some hydrogen electrolysers and fuel cell types (IEA 2022). Copper is a necessary mineral in most electricity-related technologies. Actual future demand for minerals is dependent on technology advances and developments, and ambitions of United States and international climate-related policies.

Extraction of minerals from United States locations would contribute raw materials to the domestic and international market to help meet future demand for these minerals. The relationship between domestic extraction and domestic demand and consumption is complicated. Many factors are considered when assessing the impact on each mineral commodity's supply chain from extraction, through smelting, refining, intermediary products, and final mineral products. These factors, in part, influence United States foreign reliance on critical minerals. For example, even with domestic extraction, due to a lack of downstream processing capability, the United States may still be an importer of the refined or final form of a mineral commodity. For example, nickel, a United States critical mineral, is extracted from a single domestic mine, which exports the ore for smelting and refining before sale on an international market (Nassar et al. 2020). Some mines may have supply contracts with firms which would help track the destination of mineral materials. For example, MP Materials has an agreement to supply United States-sourced and manufactured rare earth alloy and magnets for General Motors' electric vehicle program claiming a "fully integrated U.S. supply chain" (MP Materials 2022). Without specific binding contracts for the extracted minerals, contracts which can be with domestic or international firms, there is no way to know the destination of raw minerals. The extracted minerals are a fungible (essentially interchangeable) commodity sold in a world market.

Regardless of the international nature of mineral markets, there is policy interest to increase domestic supply of critical minerals. Disruptions to U.S. mineral supply may be caused by a variety of factors, including natural disasters, trade disputes, conflict, government actions, and others (Nassar et al 2020). Concerns about a reliable supply of mineral commodities stems largely when extraction or processing are highly concentrated in a few countries (Nassar et al 2020). Increasing domestic production of raw minerals is one strategy for building a resilient supply chain to meet future U.S. demand for critical minerals (White House 2021). Indeed, the recently passed Inflation Reduction Act of 2022 offers a production tax credit equal to 10 percent of production costs to mining companies excavating "applicable critical minerals", which includes cobalt, nickel, and platinum-group metals (Inflation Reduction Act 2022).

The economic impact in this analysis is primarily focused on the effects to the local and regional economy, which are driven by the extraction activities. This analysis does not address the location (potentially international) of activities after extraction, nor does this analysis directly address impacts to United States foreign reliance on critical minerals. The 2020 U.S. Geological Survey published *Investigation of U.S. Foreign Reliance on Critical Minerals* which provides additional context for consideration. It provides a summary of foreign reliance considerations, trends observed in the past decade, and technical options for addressing supply concerns (Nassar et al. 2020 p 14). Increasing domestic primary production is one strategy identified to improve of the resiliency of domestic mineral supply chains. Other strategies include secondary (recycling) production, diversifying global supply chains, securing supplies with reliable partners, developing alternative materials, maintaining strategic inventories, material thrifting, and enhancing manufacturing techniques (Nassar et al. 2020 p. 12).The 2021 100-day review under Executive Order 14017, *Building Resilient Supply Chains, Revitalizing American Manufacturing, and Fostering Broad-Based Growth*, has similar recommendations (White House 2021).

Mineral commodities, uses and demand are also addressed in the Financial and Built Capital analysis of the Values, Beliefs, and Attitudes section of this report.

Amenity and Recreation-Driven Economy

The aesthetic beauty, environmental quality, and quality of life provided by the Arrowhead Region, serves as an economic driver for the region. The U.S. Department of Agriculture's Economic Research Service county typology codes classify all three Arrowhead Region county economies as recreation-dependent (USDA ERS 2017).

In 2019, recreation and tourism-dependent sectors (retail trade, arts, entertainment and recreation and accommodation and food services) employment was an estimated 22 percent (30,000 jobs out of 135,900 jobs) of total employment in the three-county analysis area (table 9; IMPLAN 2019). The totality of these sectors also capture jobs not directly tied to outdoor recreation. The State of Minnesota estimates travel and tourism in Minnesota generates $44 million dollars in sales daily and 11 percent of total private sector employment, including an estimated 13,000 jobs in the three counties in the leisure and hospitality industry in 2018 (Explore Minnesota Tourism 2020).

Looking at a longer-term trend of the growth in employment in these three sectors show similar growth in the retail trade and accommodation and food services when compared to the state-level trend (figure 11). The 3-county region saw greater growth in employment in the arts, entertainment, and recreation sector relative to the state as a whole. A past study by the University of Minnesota-Duluth's, Bureau of Business and Economic Research also found steep growth in service sector economic activity, measured by total wages, relative to all other sectors, including mining, when looking at the 1980 through 2004 time period (University of Minnesota-Duluth 2006, p.12).

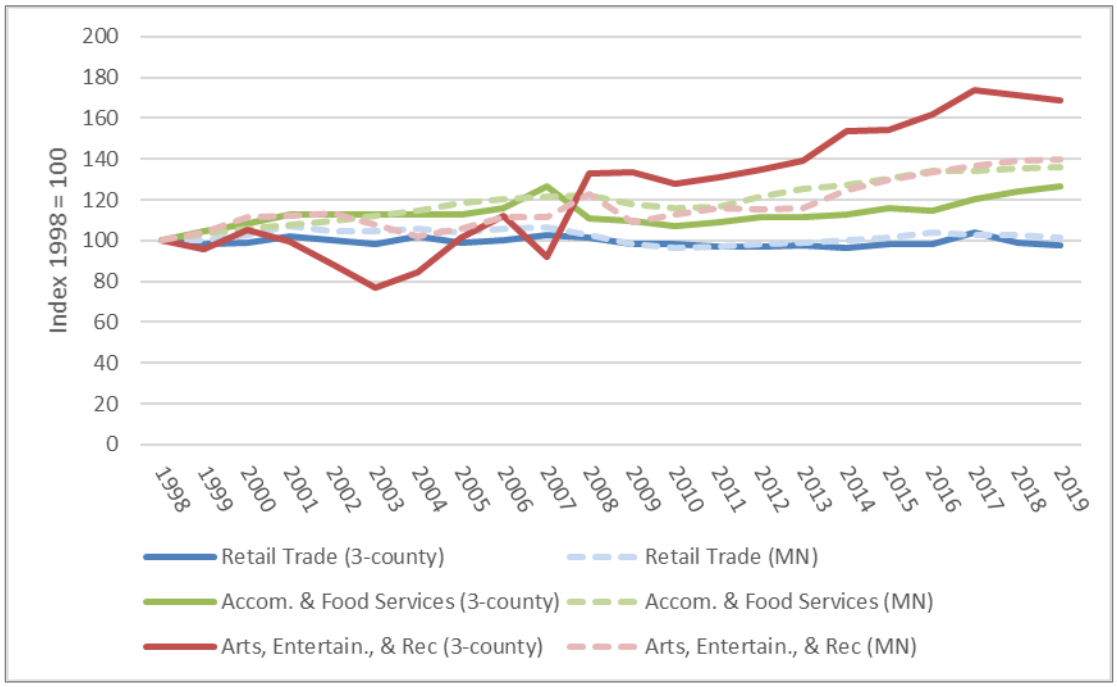

Figure 11. Comparison of select service sector employment trends, 1998 to 2019.
Source: USDC 2021.

Housing

Between census 2000 and 2010 the portion of housing units in the three-county region for seasonal, recreational, or occasional use increased from 12 to 15 percent. However, this average obscures the variation between counties. According to the 2010 census, in Cook County over 50 percent of all housing units were seasonal, recreational, or occasional use, with over 30 percent in Lake County. A survey of four townships surrounding Ely, Minnesota, found over 60 percent of properties were seasonal (Sungur et al. 2014). These seasonal real estate holders remain in the area for approximately 4 months each year and contribute about half as much to the local economy annually as a permanent resident (Sungur et al. 2014).

National Forest Recreation Visitors

Recreation visitors to the Superior National Forest spend money in many local economic sectors, including the food, lodging, transportation, retail, and recreation. The Forest Service collects recreation visitor spending data through the National Visitor Use Monitoring program. Recreation opportunities on the Superior National Forest attract people who live within the analysis area as well as some neighboring counties; however, it also attracts people from around the world. An estimated 11 percent of visitors were from foreign countries, and over 50 percent of travel greater than 200 miles (USDA Forest Service 2018a). The total estimated visits to the Superior National Forest are 893,000 annually, based on the most recent round of sampling completed in fiscal year 2016 (USDA Forest Service 2018a). These visitors spent an estimated $56 million dollars in the local economy annually (USDA Forest Service 2018b). This visitation and spending support jobs, labor income, and tax revenue in the local economy.

Input-output analysis is used as a means of examining relationships, within an economy, between businesses, as well as relationships between businesses and final consumers (see the Methodology section). One such modeling estimate finds recreation visitors to the Superior National Forest support an estimated 1,410 jobs (both full and part-time, direct, and indirect) and $31 million dollars in labor income on an average annual basis (USDA Forest Service 2018b).

A Forest Service white paper using input-output analysis looking more specifically at the contribution of visitation to the Boundary Waters Canoe Area Wilderness estimated these visitors contributed between 230 to 570 full and part time jobs and $6 million to $14.8 million dollars in labor income annually (Eichman 2018). Another study found Boundary Waters Canoe Area Wilderness recreation visitors supported over 1,100 full and part time jobs and $28 million dollars in labor income annually (Hjerpe 2018). A third recent study assumes jobs supported and affected by the Boundary Waters Canoe Area Wilderness are between 3,516 and 5,274—one-quarter to one-half of all jobs in the region (Stock and Bradt 2020).

Non-Market Values and Ecosystem Services

National Forest System lands provide a wide range of environmental goods and services which society benefits from. Ecosystem Services are commonly defined as benefits people obtain from ecosystems. Ecosystem benefits can be categorized into four types: provisioning, regulating, supporting, and cultural services (Millennium Ecosystem Assessment 2005).

Superior National Forest provides a diversity of ecosystem services. Cultural services provided include recreational opportunities (for example, hunting, wildlife viewing, camping, canoeing, swimming, and fishing); opportunities for cultural or spiritual practices of Ojibwe, heritage communities, individuals, and friends and families. Provisioning services provided include water and air for drinking and breathing, food and forage for people and animals, and timber and fuelwood. Regulating and supporting services include disease regulation, water filtration and purification, and carbon, water storage, and nutrient cycling. These services are also addressed in the Values, Beliefs, and Attitudes section and other resource reports.

Some ecosystem services like timber or forage for cattle, can more easily be valued because forest products and livestock feed can be bought and sold in markets. The economic contribution from recreational visitor spending on outfitters and guides, food, and accommodations also can be relatively easily estimated. Estimates of the economic contribution of recreation visitors is presented in the National Forest Recreation Visitors section. Other resources provided by these lands, such as ecological processes and habitat for unique species, cannot be bought and sold in traditional markets, which is why they are often characterized as non-market goods.

Non-market values can be broken down into two categories, use and non-use values. The use-value of a non-market good is the value to society from the direct use of the asset; these values are derived from National Forest System lands through recreational activities such as hiking, bird watching, and Off-highway vehicle use. Cultural services such as recreation opportunities may affect the consumption of market goods, such as lodging, food, and gas that result from recreation activities. Amenity values, which are influenced by cultural and provisioning services such as scenic quality, sense-of-place, and environmental quality, may influence migration patterns, real estate values, and the demand for residential goods and services. Provisioning and regulating services can affect human health outcomes and have a related effect on the economic and emotional wellbeing of individuals and households. Supporting services affect the regenerative capacity of the land and water to provide a continual flow of goods and services in perpetuity.

Non-use, or passive use, values of a non-market good reflect the value of an asset beyond its current use. These can be described as existence, option, and bequest values. Existence values can be measured in terms of the amount society is willing to pay to guarantee the very existence of places and species, even when the individual has not ever seen, or even planned on ever seeing, the species or place. For example, some local residents and non-local visitors are willing to pay for the preservation of wildlife and natural places through donations or taxes, even if they know that they may never actually encounter a particular species or visit the location. Option values exist when people are conscious that they might want to enjoy (either consumptively or non-consumptively) some species of fish (for example), on the forest in the future, but are unsure whether it will be available at that time. They may be willing to pay a premium to ensure its future availability. Lastly, there are bequest values, where individuals attach value from the fact that plant, fish, wildlife species or place will be available for the enjoyment of future generations. All three types of passive-use values exist for the Superior National Forest and the Boundary Waters Wilderness Area. Recognizing their value is important, since without recognition, these resources may be undervalued and decisions regarding their use may not accurately reflect their true value to society. There is a large body of research to estimate economic values for benefits provided to humans by nature. In particular, Bowker et al. (2014) and Holmes et al (2016) provide reviews of the economic values of wilderness. In the Holmes et al. (2016) synthesis, the authors conclude the aggregate value of wilderness recreation and preservation will continue to grow. Hjerpe (2018) addresses the unique value of ecosystem services provided by wilderness areas. Loomis and Richardson (2001) reviews what is known about all economic values provided by wilderness—recreation, community, existence, option, and bequest, scientific, biodiversity, education, and ecological services.

Consistent with Forest Service handbook 1970, this document does not assign monetary values to non-market values within the withdrawal application area. While not quantified, relevant non-market values and ecosystem services are represented throughout the affected environment, effects analysis, and in other resource sections.

Values, Beliefs, and Attitudes

In terms of stakeholder values, beliefs and attitudes the effect of the action or no action alternative would depend largely on the groups' beliefs of how their interests would be affected by the continuance of mineral exploration and development or the withdrawal of new mineral exploration and development over the next 20 years (and related potential development activities beyond year 20 as described in the Reasonably Foreseeable Development report). Written comments and public scoping meetings, as well the consideration of historical analysis and socioeconomic data, inform this discussion of the values, beliefs, and attitudes of area residents organized within the community capital framework. In such cases where values are clearly tied to a particular scale of consideration (for example national, regional communities, household, or personal), it is identified within the framework. References and comments provided during the scoping period are cited within to further illustrate the values, attitudes, and beliefs, and to more fully describe and understand the information or worldviews they are based upon.

In general, commenters across the board, value the withdrawal application area for its contributions to livelihoods and their cultural heritage. Commenters agree that the area proposed for withdrawal contains many resources that sustain a way of life and tie people to historical uses of the land. These activities and areas provide connections to the past and a sense of identity. Commenters are vehement that their communities, families, or selves would be in danger of demise should the forest do nothing (the no-action alternative) or implement the withdrawal (the proposed action). The perspectives and information presented in the framework are aimed at uncovering the systems of beliefs that inform these attitudes.

Natural Capital

Commenters across the board, regardless of their attitudes towards the requested withdrawal, expressed comments that they value the natural resources of the region including water, air, fish, and wildlife. Commenters differed in respect to their belief on how these values would be affected by future mining exploration and development.

Some commenters identified the rich mineral deposits inherent in the landscape and were expressly concerned about opportunities to develop these mineral resources. Commenters described the continued development of mining resources as central to supporting many other values, such their cultural heritage and strong sense of identity related to mining, the higher quality of life supported by benefitted full-time employment in mining-related industries, educational opportunities for children funded through local and state level tax revenues, and strengthened national security through the provision of domestic strategic metals. Related specifically to natural capital, commenters expressed an appreciation and connection with the natural resources of the region and did not identify a real sense of threat to those values from proposed mining.

For some commenters, the natural capital (rich mineral deposits in the region) is a unique asset to the community that provides needed opportunities for economic development.

> "We're blessed with an abundant natural resource upon which we should be able to take full advantage. There is no surprise we're struggling up here, and we need this opportunity."

Some commenters have strong personal connections to the region's land and water, and expressed that they had been mischaracterized as not caring about the region's environmental quality. These commenters value outdoor opportunities and the quality of life afforded in the region and do not believe there is a risk to natural resource conditions from proposed mining.

> "People who say or suggest that we don't care about the local land, water and air are wrong. I hunt and I fish. I take pride in the land where I live because it is where I spend my free time. I

> also take pride in working in an industry that provides me with a quality of life on the Iron Range. Quite frankly, it is insulting to have people from outside of this region tell me that my job isn't worth the risk and that I don't care about the environment. No one here would ever support a project moving forward if it didn't prove it could meet or exceed our strict environmental standards."
>
> "I believe there's a misconception that maybe people from the mine—from the Range and miners don't care about or aren't concerned about the environment. This is so far from the truth. We live here, we play here, and we plan to stay here. We enjoy many of the things that our opponents are battling for."
>
> "I have canoed, camped, and paddled in the Boundary Waters for 60 years. I worked in the mines for 31½ years. Nobody wants to see the Boundary Waters destroyed—and that's the reason we're here."

There is a belief that environmental standards and regulations and advances in technology would assure environmental quality is maintained while existing and new mining opportunities are developed.

> "State and federal laws are already in place, and we have very high, stringent standards, not only at the federal level but here in Minnesota. Minnesota businesses value those standards. We are proud of our environmental stewardship. And Minnesota Chamber members support strong, science based and fair standards. Mine development, a strong economy and a pristine environment can coexist. It's not an either/or option. Just look at this region—there is no finer example."
>
> "We've been performing the work to the utmost of science. The standards are often met or exceeded, which come often from recommendations from our local workforces who want to make sure that when they're out enjoying the great outdoors up here that everything is in great condition and they can enjoy it just like the tourists from the rest of the country who are coming in to visit and the rest of the state."

Some commenters are concerned about risks to the region's water and air quality and the health of aquatic and terrestrial ecosystems posed from potential sulfide ore mining. These concerns were commonly expressed in terms of environmental quality and its influence on human health and development; economic development of high amenity communities and the recreation and tourism industry; cultural values such as quality of life, sense of place, and cultural heritage; and social values related to bonding opportunities for families and groups. Very few commenters identified intrinsic natural resource values, such as "any mammals that eat aquatic plants experience reduced availability of important foods and are exposed to toxic pollutants through the foods they eat" (comment 45278-11); but rather, the majority of commenters identified explicit values natural resources related to the withdrawal application area held for them. At the heart of the concern of environmental quality cited by commenters is the high likelihood toxic contamination would occur given the proximity to water, the length of time mining waste would continue to present a risk, the severity and systemic nature of the impacts, the longevity of the impacts on environmental quality and the diverse values related to it.

> "And in order to make this work, they're going to have to fly in the face of two things you can't fight—water and time. Right? Water will always seek its own level. Water is supple and yielding, but it is the most powerful thing. Look at the Grand Canyon. You can't stop water. They plan to treat it indefinitely. You also can't fly in the face of time. Long after we are dead and bones, long after our communities are gone and transformed, this material will be toxic. This proposal flies in the face of water and time. Common sense says you don't fight water and time. They always win."

Many commenters, such as the Minnesota Academy of Family Physicians, provided technical information on the chemical processes activated when mining sulfide containing ores. They are concerned with the resultant liberation of toxic heavy metals and acids into surface and ground waters for an indefinite length of time.

> "Sulfide mining has significant potential for the release of toxic chemicals into the environment. These include a number of chemicals identified by the World Health Organization as being of major public health concern: arsenic, asbestos, cadmium, lead and mercury. Given this ominous list, and the possible synergistic effects of co-exposure to more than one of these chemicals, it is important that physicians understand why concerns are being raised about this type of mining. Pyrite (FeS2) is exposed to air (O2) and water (H2O) a sequence of reactions occur creating sulfate, ferric hydroxide and hydrogen ions. Additional chemical reactions occur involving pyrite, iron sulfate and water, resulting in the release of sulfuric acid. Sulfuric acid promotes release of other metals from rock and causes harm to aquatic ecosystems…. By understanding the general concept of sulfide mineral oxidation, one can see how toxic metals are mobilized from solid rock into the environment and can generate sulfuric acid. This reaction can result in ongoing leaching of metals from mine ore and waste rock, which can continue for centuries."

Given the high rainfall, extensive waterbodies and complex subterranean hydrology present in the area, commenters are concerned about the heightened level of risk given that the exposure of mining tailings to water is a key catalyst to the release of toxic metals.

> "Aqueous sulfuric acid is released into the surrounding environment and leaches heavy metals from the rock. The release of sulfuric acid and heavy metals into surface and ground water, and eventually into streams and lakes, is called "acid mine drainage." Many of the copper sulfide mines currently operating in the United States are located in the Southwest, a region that receives little rain and snow; thus, communication between surface and groundwater resources is limited. In wetter climates like Minnesota's, surface and shallow groundwater are more vulnerable to the negative effects of sulfide mining. …Minnesota has not experienced large-scale release of toxic metals from iron mine waste into the environment. …When the sulfide mineral ore and wastes come into contact with air and water, chemical reactions occur that result in seepage of sulfuric acid, sulfate and toxic metals into surface and ground water."

Other commenters are equally concerned about the magnitude of the environmental impact on water and air quality. They were highly concerned that assurances to maintain environmental standards are not realistic and pointed to case studies of similar types of mining operations that had experienced leaks resulting in acid mine drainage.

> "As physicians we are concerned about the near certain likelihood of failure to prevent pollution to surface and groundwater and acid mine drainage which will result in toxicity to human health. Kuipers et al (2006) studied 25 operating hardrock mines across the U.S. and the environmental impact statements which had been submitted before operation commenced. All of the mines predicted compliance with water quality standards. However, pollution from 85 percent of the mines near surface water exceeded water quality standards and pollution from 93 percent of the mines near ground water exceeded water quality standards. Of the sites that developed acid mine drainage, 89 percent had inaccurately predicted that they would not create acid mine drainage. Most of these contaminants to surface or ground water included toxic heavy metals-mercury, lead, arsenic, cadmium, copper, nickel, zinc and sulfate.1 Earthworks (2012) studied 14 currently operating copper mines representing 89 percent of U.S. copper production in 2010. These mines had been operating for more than 5 years. 100 percent of the mines had had pipeline spills or other accidental releases. In 92 percent of the mines water collection and treatment systems failed to control contaminated mine seepage, resulting in significant water quality impact, including acid mine drainage."

Another commenter believes that human error cannot be eliminated even in engineered systems and cited failures due to human error in other industries such as nuclear reactors that also carry environmental risk.

> "It should be obvious from this discussion that as long as engineered systems are dependent on human design, operation, and maintenance, theoretically perfect engineering will not eliminate the risk of accidents, failures, and releases of pollutants to the environment. The risk of human error is always foreseeable. While it is true that the likelihood of a given failure event and the degree of impact it would have are unknown, this does not foreclose a qualitative discussion of risk."

Another commenter cited historical toxic heavy metal leaks in the region and the demonstrated lack of enforcement of environmental compliance and remediation. The commenter is concerned that if toxic contamination were to occur in the withdrawal application area there would be little to no action to remediate the environmental damage.

> "The USFS granted the International Nickel Company (INCO) permission to remove a 10,000-ton sample for milling and metallurgical tests. … It became apparent the next summer (1975) that subsidence of the surface had occurred and a seep from the base of the sample site had developed. The site was refilled, regraded, and reseeded. However, water samples taken in 1975 and 1976 continued to show high levels of copper, nickel, and sulfate in this seep. High levels of these toxic heavy metals were also found in a tributary to Filson Creek (which drains into the South Kawishiwi River).[1] In spite of directives from the USFS and the Minnesota Pollution Control Agency (MPCA) to correct this situation, it has never been abated and continues to the present day. The Friends of the Boundary Waters tested water from this seep and water which flowed from the seep into a wetland near this tributary on July 4, 2010. These tests showed high levels of the toxic heavy metals copper, nickel, arsenic, manganese, iron, and high levels of sulfate. They brought this to the attention of the MPCA and the MPCA stated that they haven't been monitoring this site since 1976. …The take-home message here is that neither the federal government nor Minnesota state government has the interest, ability, or will to clean up even a very small bulk sample site which continues to cause acid mine drainage after 44 years."

Other commenters cite the permanence of the impacts and the values that would never be regained once they were lost.

> "Copper sulfide ore mining will destroy it. There's no back-up wilderness, no wilderness reserve, no technology can restore this wilderness. What we stand to lose: An exceptional place of peace and quiet. A place where kids can learn about wild habitat. A place where visitors experience moments they've never imagined. A place where we can learn personal attributes we never realized we had. There will be economic degradation: Area businesses and communities will decline as watershed pollution, 24/7 noise pollution and wild life flight occur."

Human Capital

All commenters voiced concerns about the project's potential impact on human capital. Some believe the withdrawal would negatively influence educational outcomes on a local and statewide level due to forgone tax revenues to support schools that could result from mining receipts. There is also concern that limiting domestic mining opportunities would inhibit opportunities for innovation and technological advancement. Others are concerned that sulfide ore mining would create acute and chronic health impacts that would undermine long-term health outcomes and create personal, household, and community hardships that span future generations.

There is concern that should a 20-year withdrawal be implemented, tax revenues that support investment in education would continue to diminish, with declining investments in facilities and programs that would disadvantage local children now and into the future.

> "A couple of generations ago, schools were one of the highest priorities in communities. Many communities still believe schools are a priority. … Take a good look at the schools on the Range—beautiful buildings, in their day, but that was a long time ago. So why are the schools on the Range struggling? One of the reasons is that the school districts are not given the privilege of taxing their largest businesses…. Your recommendation to propose a 20-year mining ban on 234,000 acres causes a devastating hardship on the future of our students. … Allow schools in the Iron Range equivalent opportunities as other parts of the state to have funds so they can have good salary schedules, robust science and technology labs, fieldhouses, domed athletic complexes—after all, we enjoy nine months of winter in the Great White North."

> "But, you know, I think the two groups here tonight are really more alike than we think. Many of us who are pro mining enjoy sitting around a campfire in the Boundary Waters, eating trail mix and singing "Kumbaya" with our families just like you do. The difference is we have a harder time buying granola because the grocery stores in our communities are closed or are closing, and our kids don't know those songs because our schools are going broke and we've had to cut our music programs."

Other commenters believe that the current economy does not afford opportunities for many of the people to access medical care due to low wages and lack of health insurance coverage, and see mining development as a way to secure higher paying benefitted jobs that would lend to improved health care access.

> "The environmental impact statement should study the implications to the region's healthcare system/infrastructure of continuing declining populations, lagging personal incomes, and increasing seasonal residency. The environmental impact statement should study the disparity in health insurance coverage available to families in the region, whether they must depend on seasonal tourism jobs with few or no benefits, or whether jobs are available that provide strong healthcare benefits."

Commenters shared their attitudes and beliefs on how the mining industry contributes to advancing technological innovations for healthcare, such as pacemakers, social connectivity such as cell phones, and green technologies such as fuel cells that improve.

> "We should also strive to develop and manufacture the wonderful products made from these metals right here on the Iron Range. I am hoping the people will steer public mandate in a positive direction to support the exploration in mining. Then science and technology can drive us to cleaner, healthier, and a fully employed future."

Commenters voiced strong attitudes for allowing mining to continue in the region as they believe that past experience in managing mining risk within a strict regulatory environment are qualities and the skills the local workforce embodies given the historical prevalence of mining in the region.

> "There's 30 plus precious minerals in these things that we all rely on every day. The minerals have to come from somewhere. They should come from the area where we have the best environmental regulations and the strictest compliance for laws."

> "I join the Iron Range community in solidarity and opposition to remove over 234,000 acres from mining in the Superior National Forest. The fact of the matter is we've got the brains, the science, the need and the political will to mine and to protect the environment, and we must do both. After 135 years of mining on the Iron Range, we've got the cleanest, purest water in the state, and we're going to keep it that way."

> "This district is the most mining centric district in the United States of America as far as legislative districts are, and I'm proud that I can call the Queen City my home, where my new child, Josiah—and happy anniversary quick to my wife, before I forget to say that—can go catch trout with me, hopefully someday after work, right in a reclaimed mine pit from where our city water is drawn. And to me that's a phenomenal example of how past generations have left it for us, and moving forward, that our generations can leave it for the next ones coming forward."

Other commenters argue that sulfide ore mining is inherently different than taconite mining and come with a different set of risks. These commenters believe that the local community is not fully aware of the risks associated with this new type of mining.

> "Sulfide mining (specifically copper-nickel sulfide mining) represents a significant departure from Minnesota's iron mining tradition. Sulfide mining can produce acid waste and sulfates that mobilize the release of heavy metals into the environment. These metals include known neurotoxins such as lead and mercury. Mining activities also create airborne fibers and pollutants that can contribute to increased morbidity. The short- and long-term effects of exposure to these substances on human health should be considered in present and future sulfide mining proposals. In addition, Minnesota physicians need to understand the potential adverse mental and physical health effects of sulfide mining on mine workers and residents of communities near mining operations."

> "Sulfide ore mining is entirely different. If mining were permitted on the lands on which mining leases and exploration permits are held or are sought, vast stretches, tens of thousands of acres in the heart of the Superior National Forest would be single use, not multiple use. They would be off limits to all those other activities, and indeed would be made permanently unsuitable as a practical matter for many of those activities."

> "I don't believe there has been enough study of the potential risks to human health from ground and surface water contamination including mercury levels in the watersheds, air pollution including dust and machinery exhaust, and mine-supporting industry such as the generation of electricity needed and a potential increase in population and the ability of local towns to support that. Since the St Louis River watershed already has some health concerns regarding mercury levels in newborns and higher rates of some diseases, none of which are well understood, it seems irresponsible to move forward with an industry that is likely to worsen these or add others."

Commenters also voiced concern over the broad spatial distribution impacts of pollution that could not be easily contained such as air pollution and its effects, not only on mine workers, but also communities downwind and visitors to the area.

> "Contaminants can also enter sediment and become part of a cycle of moving between sediment and the water column and move downstream during storm transport of bedload sediment. Flows into and between groundwater and surface waters would make remediation particularly complex and improbable. Mines in wet regions, such as the Boundary Waters Canoe Area Wilderness, are highly likely to have a spill, leak, seep, failure, unanticipated impact, human error, and/or other unintended event that results in an irrecoverable release of contaminants to ground water and/or surface waters. A review of the track record of water quality impacts from sulfide-ore copper mines found severe impacts to water, contamination of farmland, contamination of water body sediments, harm to and loss of fish and wildlife and habitat, and risks to public health."

> "Finally, there is a higher-than-normal level of mesothelioma among iron miners in northern Minnesota. The possibility that sulfide mining might also contribute to this dreadful form of cancer and other potential health issue, also deserves rigorous study. Very fine dust carried in the wind can lodging in the lungs of miners, dust from miners clothing could impact their family members, dust in the wind could impact those living near the mines, and dust could even impact those visitors to the area with compromised breathing capabilities or other health problems, so there must be a broad, comprehensive health study looking at the potential of both acute and chronic health issues."

Commenters value human health and development potential and are concerned that exposure to heavy metals early in life due to sulfide ore mining pollution of water and fish species would pose acute and chronic impacts to children's health that would be perpetuated throughout adolescences and into adulthood in terms of diminished intelligence, increased incidence of physical disabilities, and compromised mental health outcomes.

> "Methylmercury, lead, arsenic, and other heavy metals (inevitable by-products of sulfide-ore copper mining), once in the environment, food, and water supply, have a strong affinity for nerve/brain tissue. This is the result of a simple chemical property shared by nerve/brain tissue and by the species of fish (for example, walleye pike, northern pike, lake trout, bass) most known to be repositories for methylmercury. Namely, the methylmercury has a high affinity for fatty substances, and these fish species, along with human nerve/brain tissue, have a high content of fat cells. The adverse health effects of heavy metals in human nerve/brain tissue can be outlined by stages of human development.
>
> 1. Fetal stage: The child in-utero is at a triple-disadvantage in absorption of heavy metals (for example, methylmercury, lead, and arsenic) to which the mother is exposed.
>
>   A. The placenta, which filters many compounds in the blood from reaching the fetus, is not able to filter heavy metals, and thus these compounds reach the child's circulation;
>
>   B. The blood-brain barrier, which keeps older children and adults somewhat insulated from toxins in the bloodstream entering the brain tissue, is not fully formed until approximately age 2 to 3 years. Therefore, from the 9 months before birth to the first two years of life, the child's vulnerability to exposures is increased;
>
>   C. Once heavy metals or other toxins reach nerve/brain tissue, the amount of damage done is proportional to the rate of growth and cell division of that same nerve/brain tissue. The brain doubles in size the first year of life, and by age three it grows to approximately 80 percent of its adult volume. This makes the brains of young children extremely vulnerable to neurotoxins.
>
> 2. Pre-school and Early School ages: Neurodevelopmental Disorders, including Dyslexia and other Learning Disorders, Autism, Cerebral Palsy, Intellectual disability (low IQ), and ADHD (all know effects of methylmercury and other heavy metal exposure) are often diagnosed during this time period;
>
> 3. Late Adolescence/Early Adulthood: Proven outcomes from early life lead exposure include low academic achievement, high rates of educational/work disability, and increased rates of aggression and criminal behavior. In addition, each of the early childhood conditions noted above increases the risk for depression and anxiety disorders;
>
> 4. Older Adulthood: Early life lead and methylmercury exposure has been shown to cause higher rates of early cognitive decline/dementia and other neurodegenerative processes."

> "Consequently, any mammals that eat aquatic plants experience reduced availability of important foods and are exposed to toxic pollutants through the foods they eat. The health effects of heavy metal exposure on humans are well known (Crisponi et al. 2010, Hessett-Sipple et al. 1997, Mahaffey et al. 1997, Merger et al. 2007) and include cancer, heart disease, organ failure, nervous system dysfunction, and abnormal development of the nervous systems of fetuses through adolescents (Obiri et al. 2010, Mergler et al. 1994, Rodrigues-agudelo et al. 2006). Exposure to methyl-mercury injures the nervous and cardio-vascular systems and can cause death. Exposure of pregnant women to any form of mercury leads to elevated blood levels in fetuses that average 1.7 times the blood levels in mothers. Tissue levels of mercury in otters (*Lontra canadenses*) and minks, which eat large numbers of fishes, amphibians and crustaceans, are usually about 10x the levels found in the food in their diets, whose levels of mercury can exceed by 106x the background levels in the water column (Grigal 2003, Rudd 1995, Scudder Eikenberry 2015, Ullrich et al. 2001). The mercury levels in otter and mink fetuses should be substantially higher than those in their mothers, as occurs in humans (Hesset-Sipple et al. 1997, Mahaffey et al. 1997). Humans are, after all, mammals and share most aspects of physiology and development with other mammals. Consequently, similar or identical effects are expected from exposure to heavy metals in other mammals as in humans."

There is heightened concern voiced for the Ojibwe people given their cultural systems and reliance on subsistence resources such as locally collected wild rice and fish species that are known to uptake and concentrate heavy metals.

> "The Lake Superior Bands of Ojibway retain usufructory rights (use and enjoyment) to hunt, fish, and gather on these lands. Many depend on hunting, fishing, and harvesting wild rice and other plants for subsistence living. They can be poisoned by the toxic heavy metals released from sulfide-ore copper mining."

Some commenters believe that the impacts to environmental quality and the natural character of the region would result in negative impacts to mental health and wellbeing.

> "Assessment of the risks and costs of disrupting this sensitive and unique region of our state is imperative for inclusion. These risks/costs would include but would not be limited to: * The loss of wellness that will result if communities around the Boundary Waters were to transition from communities which serve as the gateway to pristine wilderness to communities which are a gateway to large industrial mine sites. * The cost of erosion of the pristine wilderness that has sustained an outdoor recreation industry in Minnesota that contributes to a stable tax base, jobs in a range of sectors, and the retention and talent and wealth locally as well as in greater Minnesota. * The cost of the erosion of the pristine wilderness that serves as a source of mental and spiritual health, healing, and rehabilitation not only for the local region, but for countless individuals across our state and nation who utilize this region. * Noise pollution to surrounding wilderness and loss of serenity that this wilderness provides to utilizers as well as local residents. * The cost for health care, special education, loss productivity resulting from potential human health impairments. * The cost and capability of increasing mental health providers in this region to meet increasing needs, a region that currently has an inadequate number of mental health professionals and facilities to meet even its current needs."

Other commenters believe that mining would degrade opportunities for personal growth, challenge, and renewal for helping people overcome the challenges of everyday life and more personal challenges such as post-traumatic stress disorder or substance abuse.

> "Other significant health risks of such activity would include the loss of what has become a critical therapeutic habitat for citizens receiving treatment for significant mental health disabilities. Programs treating veterans and other traumatized individuals suffering from Post-Traumatic Stress Disorder, and programs treating youth with emotional, behavioral, substance use, and developmental disorders, represent another important health-promoting presence in the Boundary Waters. … A threatened ecosystem would also threaten the critical effectiveness of these programs."

> "Now, more than ever, we desperately need wild places. We need to disconnect from the often frantic pace of daily life. We need places where our kids can truly explore and take risks. We need to immerse ourselves in beauty and silence."

Financial Capital

National level

Some commenters believe that the economic and physical security of the nation rest upon the ability to develop the mineral deposits within the withdrawal application area.

> "The environmental impact statement must study the impact to the economic and physical security of the U.S. in denying the exploration and mining of these resources within the proposed withdrawal area. Northeastern Minnesota has one of the largest known undeveloped deposits of strategic metals in the world. With the growing U.S. demand for strategic metals like copper and nickel, coupled with growing political unrest throughout the world, exploring our domestic resources is more important than ever."

Other commenters believe that there are other ways to a stockpile of strategic metals and argue that the cost of production in the U.S. of rare-earth metals has in the past exceeded the market price and resulted in a mine closure, which could be reopen should market forces change.

> "If the U.S. concludes it is necessary to be prepared in the event of a severe interruption in supply (by trade) of elements and minerals of critical strategic importance to the U.S., then the federal government should rebuild the U.S. strategic stockpiles of critical minerals. Most of the identified critical minerals have both strategic and non-strategic uses (such that the non-essential uses could be prohibited in a time of supply constraint), and that the U.S. obtains any one important mineral usually from multiple countries (many of them close trading partners), as is shown in annual mineral commodity summaries and yearbooks. The prospect of China constraining the flow of minerals (usually rare earth elements are given as an example), but examples of such behavior are very rare, and successful hostile examples are even rarer."

State Level

Commenters shared beliefs that the withdrawal would negatively impact Minnesota state schools that garner a large portion of their budget from revenues generated from mining royalties.

> "Withdrawing an additional 234,238 acres will devastate the long-term ability to produce school trust fund revenue from mineral leases in this part of Minnesota. The scale of the negative impact on school trust land long term revenues is likely to be in the billions of dollars."

> "Federal government here is proposing the withdrawal of leases for mine exploration and continued development. This is government overreach and could jeopardize thousands of potential jobs, billions of dollars of investment in Northeastern Minnesota, and billions of dollars of investment in our schools."

Regional Level

Many commenters shared their beliefs regarding the importance of diversifying the region's economy through attracting residents and investment through maintaining a high-quality amenity values.

> "The three-county Arrowhead region of northeastern Minnesota has a diversified, diversifying, and growing amenity-based economy. The prime natural amenity in the region is the Boundary Waters - the most-visited Wilderness Area in the National Wilderness Preservation System, and a uniquely accessible, pure water-filled, world-class wilderness fishing and backcountry canoe trekking destination. Amenity-based development - which extends well-beyond the important and insufficiently appreciated impacts of recreation and tourism- has taken the place of mining as the engine of economic development in the Arrowhead region. The economic significance of year-round and seasonal residents who choose to live in the Arrowhead region cannot be overstated. The knowledge, professional skills, jobs, incomes, businesses, and retirement savings they bring with them have diversified and fueled the economy of northeastern Minnesota."

Other commenters shared concerns about the potential loss of jobs and tax revenues should sulfide-ore mining commence.

> "The arrival of sulfide-ore copper mining in the Boundary Waters watershed would prompt the departure of many residents - up to 23 [percent] in the Ely service area alone. Economic analysis by Key-Log Economics found that the departure of people from the region and the loss of their talent and capital would do significant harm to the regional economy. It is estimated that 5,000 or more jobs and between $402 million and $1.6 billion in annual income would be lost, with the exact amount depending on the degree to which sulfide-ore copper mining suppresses or reverses growth in the amenity-based economy, which has been the backbone of the region's recovery since the early 1980s" (Comment 1479-2).

Other commenters were concerned that the impacts of mining would decrease the economic diversity of the region, which would then be highly vulnerable to changes in the global metals market.

> "Erratic boom and bust cycles associated with mining would have economic costs, as well, as they would create instability in the labor markets and increase strain on public services."

Community Level

Commenters also expressed values for solitude in the wilderness, recreation opportunities, and human health for future generations. They believe that mining negatively impacts their experience and ecosystem services. Any potential negative impacts from mining activities to ecosystem health would threaten human health via contamination of air, water, soil, and wildlife. They believe that "having clean water and a healthy landscape is sustainable, profitable, good for the economy and good for the people of the region."

One commenter reflected on their personal experience with mining following World War II and their belief about the long-term impact mining would have on the boundary waters.

> "I just celebrated my 80th birthday. I have nothing prepared. I have nothing to read from. I have nobody to yield to. I'm just an old man with a simple story. I remember the Second World War. I remember when the iron from this Range built the ships and the tanks and the planes that saved the world. I also remember following World War II there was a copper mine in the state of Washington, because copper was needed to fight the war. Immediately after the war, the mine closed because the price for copper dropped. The mine was abandoned by the mining company. It's still there. It's underground. It's full of water. The water is leaching into a pristine trout stream called Railroad Creek. Downstream from the mine, nothing is alive; upstream, fine trout fishing. The stream is running into a fjord like lake in Washington called

> Lake Chelan. It is slowly dying because of this mine that closed in 1947. The same thing is going to happen here. The mining company is going to be gone. The mine will continue to leach for generations, hundreds of years, and it will eventually kill the Boundary Waters."

Some commenters believe that sulfide-ore mining would have a negative effect on the local economy by contributing to a loss in spending and investment driven by amenity based economic development, resulting in less jobs, income, and tax revenues in the local community.

> "Evidence regarding the type and potential magnitude of those avoided costs, including conservative quantitative estimates of a small subset of those costs, were provided in Phillips and Alkire 2017. These include a decline in spending as potential visitors choose alternative destinations with high quality scenic and recreational amenities undiminished by nearby mining activity. The study estimated an annual loss of $288 million in spending that would otherwise support 4,490 local jobs, $76 million in residents' income, $31 million in state and local taxes, and $181 million in proprietor's income and business-to-business transactions; 5,066 to 22,791 lost jobs, and between $402 million and $1.6 billion in lost annual income in the rest of the three-county Arrowhead economy if sulfide-ore copper mining suppresses or reverses growth in the region's amenity-based economy; and $509 million in lost property value. This is a one-time drop in asset value that will spawn annual reductions in local property tax revenue throughout the three-county Arrowhead region. By implementing the proposed action, these and other costs would be avoided, thus delivering a benefit to the American people and Minnesotans equivalent to a one-time payment of more than $6.1 billion.106 In addition, the mining withdrawal could save between 9,556 and 27,281 jobs, with the range determined by the extent to which sulfide-ore copper mining would suppress or reverse the region's observed rate of amenity-based development. Clearly the economic costs of sulfide-ore copper mining (or the economic benefits of withdrawing lands from the mineral leasing program) are significant and worthy of consideration as part of the NEPA review."

Commenters also believe that the economic contributions of mining would not materialize for local communities in the form of jobs, labor income, and tax revenue due to advances in technology, automation, and remote location of workers in the mining industry.

> "Opponents of the proposed action have argued that every mining job will be a good one, at least in terms of average wages, and will, on net, do more for the regional economy than a job in tourism or in another industry in the existing amenity-based economy. These contentions are dubious for several reasons, as explained below. a. Incorrect use of a deeply flawed economic report First, opponents consistently and dramatically overstate (by more than an order of magnitude) the jobs and income that that sulfide-ore copper mining would bring. …Robotic automation of mining equipment and operations is accelerating the long-standing trend of declining jobs in mining. The claims of increased mining employment must be viewed in light of an accelerating trend of falling labor intensity in the mining industry. As robotic automation and remote monitoring are steadily shrinking the job-related benefits of mining, the best paid positions are some of those most likely to be shifted away from the community hosting a mine. That means the "shared-value paradigm" of a mine not only making profits for the company owners, but also delivering significant job and income and tax revenue benefits to the host community and area residents, is failing."

Some commenters believe that they need mining jobs so there would be a few jobs that offer good wages and tax revenues that would sustain the community.

> "To quote Rudy Perpich, "This is about jobs, jobs, jobs for the Range and to keep and save our middle class." This is about full time, not part time jobs for our building trades, vendors and miners, and not part time seasonal jobs that do nothing to sustain a family."

Household Level

Commenters are concerned with the impacts to families and opportunities for grown children to continue to live in the community with opportunities for jobs with a livable wage.

> "I want to see our children be able to stay here, our schools thrive. Right now my oldest might have to be leaving the area because they can't find—she can't find work. She's got a two-year degree from Ely and a two-year degree from Mesabi, and it's difficult for her to find work in her field. We need opportunities here."

Some commenters believe that the impacts to environmental quality and increased health related problems caused by sulfide ore mining would stretch the financial capacity of households to meet this need and of the community to provide such services.

> "Assessment of the risks and costs of disrupting this sensitive and unique region of our state is imperative for inclusion. These risks/costs would include but would not be limited to: …* the cost for health care, special education, loss productivity resulting from potential human health impairments. * The cost and capability of increasing mental health providers in this region to meet increasing needs, a region that currently has an inadequate number of mental health professionals and facilities to meet even its current needs."

Built Capital

National

Some commenters believe the value of the mineral development goes well beyond fueling local economic development, and see it as critical for fueling technological advancements that improve the quality of life and environmental quality through furthering the development of goods and green infrastructure.

> "America's military might and security depend upon mining and American steel, and America's ability to lead the battle to address climate change, create more good paying jobs and a greener economy and save our planet for future generations is directly dependent on mining the copper, nickel and other precious minerals we have in abundance here so the Iron Range. The fact of the matter is these minerals are critical to life saving medical research, as well as to our communications, our transportation, our national energy independence, and our environment."

Regional and Local

Some commenters believe that the local economy is dwindling, and without mining jobs there would be few jobs that offer good wages and tax revenues that would sustain the community and public infrastructure.

> "The human factor is being ignored. Our communities are suffering from decreased populations; our populations are aging and people on set incomes cannot afford tax increases for infrastructure repairs; few young families are moving into our communities with young children for our schools leading to decreased school enrollments and cut courses at our schools; students are constantly fundraising to help fund their school sports, band, etc.; our hospitals are cutting services such as delivering babies due to too few births each year; more people are dying in our communities than babies being born; tourist jobs are seasonal and do not pay a livable wage to provide for a family; people have to work two or three jobs to make ends meet; hundreds of homes and businesses have sat for years on the for sale lists; tourism has been decreasing for the past ten years; few people working tourism jobs can afford to buy a home or a car; Ely hasn't had a new industry come to town in twenty years that employees more than 50-100 people that pays a livable wage; mining jobs pay a livable wage and allow families to buy a house, buy a vehicle, make other big purchases, visit local restaurants and stores; good paying jobs sheer up all the businesses in our towns; more people moving into our communities increases the tax base to provide for all the needed services and keep our local government going."

Cultural Capital

Some people shared beliefs about the importance of youth outdoor excursions and their concern over the potential loss of these types of experiences and personal development opportunities offered through the Boy Scout, Girl Scouts, and Outward Bound should the Boundary Waters be polluted from sulfide ore mining.

> "Thousands of youth go on their first Boundary Waters trip each year. The Girl Scouts' only wilderness base camp in the nation is on the outskirts of Ely, on Fall Lake. The Boy Scouts' Northern Tier High-Adventure Camp also is located outside of Ely on Moose Lake. Both base camps are just half a lake from the Wilderness boundary. Also serving visitors, many of them youth, are Voyageurs Outward Bound School (which also serves military veterans), four YMCA wilderness camps, and scores of resorts and outfitting companies. For generations, these youth camps, wilderness institutions, and businesses have introduced thousands of youths each year to the challenges of the border country's lakeland wilderness, and the opportunities for personal growth and leadership development found there. Their canoe treks take them through the path of pollution."

Other commenters shared beliefs about the importance of preserving the Boundary Waters for their family and future generations.

> "Protecting the Boundary Waters from all mining practices for ever ensures a future for the area including a never-ending source of economic wellbeing, a healthy place for people to live, a healthy place for all things to live, a beautiful heritage we can all be proud of and a place we can look our children and our grandchildren in the eye and say - this, this land is your land, our land, and the land your children and grandchildren will live by and enjoy."

For some commenters, mining is an integral part of their family heritage and personal identity, as is the Boundary Waters and the quality of outdoor opportunities it affords. These commenters believe that mining and maintaining the quality of the land and water are not mutually exclusive.

> "This mining heritage has continued through the last five generations in my family, through great uncles, uncles, cousins, my dad, my brother-in-law, my husband, and now three of my nephews. I guess you can say mining is in my blood. We value our way of life on the Range, and we are a hardworking, proud people who respect our heritage and love the communities we live, work, worship and volunteer in. We want nothing more than to continue our mining heritage and provide quality jobs for our children, all while continuing to maintain our love for our forests, lakes, and outdoor experiences."

Some commenters shared their beliefs about how limited mining exploration has impacted the sense-of-place afforded by the Boundary Waters Canoe Area Wilderness, characterized by an overall low level of development, high scenic quality, dark night skies, quietness, and solitude, and shared how these impacts affected their willingness to continue to visit these areas.

> "Please look at the deleterious effects on forest removal for mining operations. ... You can see scarred lands already along the Spruce Road. You can hear the sounds of exploratory drilling in the [Boundary Waters Canoe Area Wilderness]. Exploratory activities have already caused degradation of the wilderness character of this area. Because of this, I no longer use the South Kawishiwi and Little Gabbro entry points for [Boundary Waters Canoe Area Wilderness] trips. I have seen the INCO bulk mining site off the Spruce Road, which is devoid of plant life and has the telltale orange water acid mine drainage coming from its site. I visited No Name Creek and Bob's Bay with the late Ernie Lehman. No Name Creek carries acid mine drainage from the Dunka Pit into Bob's Bay on Birch Lake. This site continues to be permitted because it would become a superfund site if it were closed. These are harbingers of what could happen if full-scale mining is allowed."

Other commenters believe the noise and development due to exploration and mining near the Boundary Waters Canoe Area Wilderness would degrade the wilderness aesthetic and opportunities for solitude.

> "A substantial amount of the lands considered for withdrawal are within 5 miles of the [Boundary Waters Canoe Area Wilderness]. Solitude and unconfined quality is one of the important factors that draws visitors to the wilderness (USDA Forest Service. 2012). Solitude and unconfined quality is defined as not being influenced by the "sights and sounds of people or sights and sounds of occupied and modified areas outside the wilderness" (USDA Forest Service. 2008). If lands were not withdrawn from mineral entry and mining allowed to occur, all phases of mining including exploratory drilling, pit development and operation, transportation infrastructure, and processing would affect solitude."

Some commenters expressed beliefs that they are dependent on revenues generated by the mining industry to support the local economy, heritage, and the quality of life that mining provides. They believe jobs available to them in the local economy in the tourism industry afford little opportunity to make a good wage and benefits. Mining is also a way of life in the area for many people that grew up in families and communities that were dependent on mineral resources. These commenters believe that any actions that reduce mining operations would negatively impact these values.

> "This is about jobs, jobs, jobs for the Range and to keep and save our middle class. This is about full time, not part time jobs for our building trades, vendors and miners, and not part time seasonal jobs that do nothing to sustain a family."

> "My wife and I then decided to move back to the Range to raise our four children closer to our families. There my good fortune continued when I was hired at the Minorca Mine. I now have a quality union job that pays a living wage, provides health benefits for me and my family, and allows me to raise my children close to our families. Unfortunately, many people I know aren't so fortunate. I know many people from all across the Range that would love to work and live here, but they are not able to do so. There aren't enough good paying jobs to keep them—keep enough people employed up here. I also know many less fortunate people who still live on the Range but need to work two, three, or even four jobs just to get by. They don't have the luxury of having a single job that can pay all their bills. I feel like I'm speaking for all future generations on the Range. We want what's best for our children. We want them to get a quality education. We want a diversified economy that provides for all types of skillsets. We want clean water, but we also want mining."

Some commenters do not see mining and environmental quality as mutually exclusive and believe that halting mining would impede their way of life.

> "The federal government owns nearly seven percent of the land in Minnesota. However, the protections provided to Minnesota's pristine landscape are largely the result of its citizens and their desire to preserve our way of life. If all development and economic activity is prohibited, that way of life will come to a grinding halt. Sound environmental stewardship and positive economic growth do not have to be mutually exclusive."

Other commenters voiced a concern and value for stable jobs outside of mining and to consider mining jobs as boom and bust. They believe this chaotic cycle also leaves behind abandoned mines that are human and ecosystem health concerns for residents. Therefore, their attitudes towards the withdrawal were generally positive.

> "I've been a camper, fisherman, canoer, cross country skier in the Boundary Waters for over 50 years. I've also been a union member, union activist for 50 years. I have received over three major awards for successful union political organizing, and I've held umpteen union offices. Most importantly, my daughter and her husband live in this area. Number two,

> economic science cries out for diversification. As a union activist, I care about jobs. I care deeply about everybody having a good paying job. Copper/nickel mining is going to be a real economic crapshoot. China has been stockpiling copper for years to control pricing. Cheap Asian steel devastated the already established taconite mining industry in this area. Think about what cheap steel can do to—excuse me, what cheap copper can do to fragile new mining. If you're hurting for employment in this area, go to your local politicians and demand economic developments plans B, C, D, F and G. Telling locals that all we can do is copper/nickel mining or we've got nothing for you is totally unacceptable."

Social Capital

Comments voiced in public meetings demonstrated a high level of social division over the issue of the future economic development of the region.

Commenters who oppose the withdrawal expressed beliefs that demonstrate frustration with the perceived lack of local control over local land-use and economic development.

> "This has been a very polarizing and divisive issue for everyone, has led to deeply rooted sentiment and bitter entrenchment on both sides. Open comments like this are good for both sides so everyone understands how everyone else feels and what the facts actually are. I hope this is a meaningful discussion tonight versus lipstick on a predetermined conclusion."

> "We are tired of Washington telling us what we can and cannot do. The people I represent are sick and tired of Washington telling us what we can and cannot do. This meeting here tonight—as a child, I was born and raised on a farm south of town. We showed ponies. We showed horses. I never showed dogs, so I don't know what a dog and pony show is, but this sure as heck feels like one."

> "Boycotting the St. Paul hearing was a statement, a statement that pointed out to everyone that we live here, we work here, we play here, we drink the water from our pits, we breathe the air from here; decisions to be made about our backyard should be made here. We aren't saying, "Not in my backyard." We are saying, "This is our backyard." We don't want others telling us how to manage our backyard. In a sense, it was a declaration of independence."

Commenters who support the withdrawal expressed distrustful beliefs about the mining companies and who advocate for sulfide-ore mining.

> "The mining industry is hanging the carrot of jobs in front of us. We need to know exactly what it will cost if we bite that carrot. We also need to study whether or not our water quality regulations are adequate. Those who support mining like to claim that our strong environmental laws will make mining safe. Is that really true? If so, why is it that 40 percent of the waters assessed in Minnesota do not meet water quality standards? Why is it that some taconite mines under—operate under expired permits and the water draining out of them exceeds standards?"

> "I support the withdrawal of federal lands in the watershed from sulfide ore-copper mining because I value clean water. Mining companies are notorious for leaving large pools of sludge behind when they are done raping the lands of its mineral resources. The BWCA should be left alone. Protect our water sources."

Political Capital

Some commenters expressed frustration over what may be perceived as a continually growing loss of autonomy for local communities to determine their own economic development future in the face of what may be perceived as growing restrictions on federal lands.

> "In 1978, the Forest Service made a promise, and the United States government. "If you give up this land, here is going to be the new Boundary Waters. It's expanded. And we're going to keep mining outside of that buffer zone that you put aside. We are going to let you keep mining, logging, and recreating in the Superior National Forest." So keep your promise. Government breaks enough promises."

> "We all want to be stewards of the land that's produced so many natural resources for the Range and the state as a whole. But that discussion needs to be focused on the needs of our residents, not distant bureaucrats who don't know the history and the significance of our mining heritage."

Distributional Health Risks to At-Risk Populations

Consideration of Risk

Executive Orders 12898 and 13045 are concerned with risk and how equitably that risk is distributed among the population. Risk is an inherent aspect of mining that can be reduced through regulations and technological advancements; however, it cannot be fully eliminated as described in the Accidents and Failures section of the Water and Aquatic Species Report. Acid mine drainage is a known risk of sulfide-ore mining. It occurs when sulfide minerals present in ore bodies are exposed to air and water, which results in sulfuric acid. The subsequent increases in the water's pH causes other harmful metals such as copper, zinc, lead, cadmium, iron, and nickel to leach from the ore bodies (Onello et al. 2016, Miller et al. 2002, MDNR 2015, Kellogg 2014, Lapakko et al. 2004, Lapakko 2012). While regulatory and production design measures reduce the likelihood of occurrence in the near term, the risk of acid mine drainage occurring would extend beyond the life of mining operations, for hundreds to thousands of years (National Research Council 1999, USEPA 2014). Risks related to toxic contamination would continue to grow long after mining operations have ended, given that waste management would require longer-time spans than engineering systems have been tested for, financial circumstances, political priorities, and changes in ownership. These factors are unpredictable and may affect the management and operation of storage facilities and the legacy mine sites (Martin et al. 2002, Chambers and Higman 2011). It is uncertain if future generations would benefit economically from the mine; however, they would inherit the responsibility to manage the risks and impacts of potential mine accidents and failures should they occur. This analysis does not attempt to predict risk events, but rather acknowledges the communities at risk, the pathways of exposure, the relative change in likelihood of a failure occurring during different time horizons, and the relative severity of the risk to the populations under consideration.

Exposure Pathways

The Environmental Protection Agency defines exposure pathways as the course a chemical or contaminant takes from its source to the person being contacted (USEPA 2016). The risks of exposure to acid mine drainage (including trace metals such as lead, methyl-mercury, chromium, cadmium, and arsenic that would arise from activities associated with hardrock mineral exploration and sulfide-ore mining operations) has the potential to contaminate air resources and ground water supplies in the Rainy River watershed (Lapakko and Antonson 2012, USEPA 1994, Brooke et al. 2004, Pearson et al. 2020). Aquatic plants, such as wild rice, uptake and concentrate toxins in plant tissues. Fish, waterfowl, terrestrial and aquatic wildlife dependent on aquatic plants and the surface waters of the Rainy River watershed ingest plants, water, or otherwise absorb and bio-accumulate toxic contaminants in their tissues

(Sakar et al. 2022, Onello et al. 2016, Brooke et al. 2004, National Research Council 1999). People may be exposed to these contaminants by drinking contaminated well water, swimming in contaminated surface waters, breathing polluted air, or ingesting game, fish, or aquatic plants from the Rainy River watershed.

Communities at Risk

Tribes within the Rainy River watershed are acutely sensitive and at risk for exposure to these toxic contaminants given their cultural heritage and socioeconomic conditions, as the Ojibwe are integrally connected with the health of land and water through cultural and spiritual practices tribal communities often experience a relatively high level of poverty and low levels of income (Sarkar et al. 2022; Bouayad 2020; Glick and Han 2015). Ojibwe tribal communities of Cook County and St. Louis County are of particular attention to this analysis as they qualify as minority communities potentially affected who have a long-standing cultural pattern of subsistence use including harvest of fish, game, and aquatic plants (Bouayad 2020), which are primary exposure pathways for toxic exposure. Of particular concern are the effects to children and fetal development while in utero within this minority community, as in utero populations experience the highest level of risk for long-term severe health effects (Trasande et al 2005). Cook County already has higher than recommended levels of arsenic and at a greater percentage than experienced at the state level (MNDoH 2020), hence tribal communities, pregnant women and children may already be experiencing higher than normal levels of risk to their health and wellbeing.

Children and children in utero who have acute or chronic exposure to neurotoxins are of concern to this analysis due to their heightened vulnerability, the severity and longevity of the risks, and the multitude of exposure pathways (Trasande et al. 2005). Children who live near the withdrawal application area would likely experience a higher risk by having more direct and long-term exposure to toxins than children who visit the withdrawal application area but reside outside of the Arrowhead Region, as their overall exposure would be limited in duration. Children and children in utero in the Lake Superior Basin currently experience adverse disproportionate risks from exposure to mercury. The McCann study (2011) presented earlier found a statistical difference in blood mercury concentration levels between infants born in the Lake Superior Basin in Minnesota and those born in Wisconsin and Michigan, where there was no difference. The seasonal exposure pattern of exposure also suggests that consumption of fish is the primary pathway of exposure.

All counties within the Arrowhead Region exceeded the State’s rates for individuals living in poverty. St. Louis County accounts for the largest population within the region, and exceeded the State’s percentage of people in poverty by 4.4 percent (USDoC 2020). When considering the historical context of Arrowhead Region communities, hunting and fishing were activities households traditionally employed to sustain their livelihoods in times of economic hardship (Johnson 1999). While low-income households today may not engage in these activities to the extent their ancestors did, these activities are likely a part of the cultural heritage of families who experience inter-generational poverty. As such, these low-income communities may have a higher risk of exposure to neurotoxins due to subsistence patterns of hunting and fishing. In addition, low-income communities often have worse physical and mental health conditions and are more likely to suffer from chronic conditions such as asthma, which makes them more susceptible to suffer from adverse impacts to air quality (Kozyrskyj et al. 2010).

Environmental Consequences

A description of each alternative can be found in the environmental assessment.

Alternative A – Proposed Action (Withdrawal)

Economic Environment

There are no leases in the withdrawal application area. During the 20-year withdrawal period, new mineral development authorizations would not occur, precluding mineral prospecting and development and associated economic contributions. The proposed action would result in forgoing economic contributions, in terms of jobs, income, and tax and nontax revenues, stemming from potential new mining activity on the withdrawn lands. This outcome would be similar to the existing condition, because no economic activity from hardrock minerals development is currently occurring in the analysis area. There are other proposed and operational mines outside the withdrawal application area in Northern Minnesota, such as taconite mines and the Northmet Mining project, which may provide new or continued opportunities for employment supported by mining activities. Alternatively, existing mines outside the withdrawal application area may become inactive or close. The proposed action would not impact the current structure of local economies, leaving existing economic trends to continue.

No hardrock minerals are currently extracted from the withdrawal application area. As shown in table 7 of the Mineral Potential Report, a substantial portion of reserves of platinum-group metals, copper, nickel and cobalt within the United States are located within the withdrawal application area. Accordingly, supply of these metals from the withdrawal application area, a domestic U.S. location, would be unavailable for up to 20 years by the requested withdrawal.

A relatively small fraction of world reserves of these metals are located within the withdrawal application area (table 7, Mineral Potential Report). As discussed in the Mineral Commodities and Potential Market Demand section, extracted minerals are a fungible (essentially interchangeable) commodity sold in a world market. Critical minerals for U.S. manufacturing, defense, and other domestic uses including production of renewable energy technologies would continue to be supplied through contracts with national and international corporations based on the availability of these minerals and their prices in the world market. While alternative A could have effects on the availability of minerals for renewable energy technologies and defense technologies because of lengthy and uncertain causal chains in geographically diverse global locations over long timeframes, such effects are not reasonably foreseeable at this time.

Future demand for critical minerals is anticipated to substantially increase. Other strategies for meeting this demand would be relied on during the analysis timeframe (see Mineral Commodities and Potential Market Demand section).

Regardless of world reserves, there is interest to increase domestic supply of critical minerals. Disruptions to U.S. mineral supply may be caused by a variety of factors, including natural disasters, trade disputes, conflict, government actions, and others (Nassar et al 2020). Concerns about a reliable supply of mineral commodities stems largely when extraction or processing are highly concentrated in a few countries (Nassar et al 2020). Increasing domestic production is one strategy for building a resilient supply chain to meet future U.S. demand for critical minerals. Indeed, the recently passed Inflation Reduction Act of 2022 offers a production tax credit equal to 10 percent of production costs to mining companies excavating “applicable critical minerals,” which includes cobalt, nickel, and platinum-group metals.

Amenity and Recreation-Driven Economy

The amenity-based economy could continue its current growth trend or accelerate due to certainty in recreation experience and environmental quality provided by the requested withdrawal for at least 20 years. The amenity-based economy driven by local and seasonal residents, recreation, tourism, and in-migration for the lifestyle and quality of life would continue to grow. As such, the current structure of local economies would remain unchanged, leaving existing economic trends to continue. Consumer confidence in the amenity driven-real estate in St. Louis and Lake Counties may improve due to beliefs that amenity values would remain intact over the time period of the requested withdrawal. This increased consumer confidence could continue to attract mobile entrepreneurs and professionals supporting a diversity of local economic sectors. Stock and Bradt (2020) provide a review of literature that finds recreation, natural amenities, and public lands as sources of sustainable economic growth. Stock and Bradt also contribute to this literature by focusing on the withdrawal application area and surrounding economies. Their study finds the existing recreation economy to be a sustainable source of growth over the 20-year requested withdrawal time frame, and that the requested withdrawal would avoid negative impacts to the amenity-economy and in-migration (Stock and Bradt 2020). Another study finds environmental regulations limiting extractive activities on protected lands is correlated with relatively rapid population, income, and employment growth (Lorah and Southwick 2003).

Non-Market Values and Ecosystem Services

Non-market and ecosystem services values not reflected in the amenity and mineral economy discussion previously are addressed in the recreation, water and aquatic species, air quality, and tribal traditional needs and values reports, as well as in the public health and welfare and the heritage and cultural values effects that follows.

State Trust Lands and Federal Payments to States and Local Governments (Nontax Revenue)

Withdrawing lands from mineral exploration and development would have no impact on current levels of federal payments distributed to local governments under payments in-lieu of taxes, Secure Rural Schools and Community Self-Determination Act and Thye-Blatnik Act. School Trust Lands would continue to be managed by the State to support public schools through the Permanent School Fund. The existing levels of funding would not be impacted by the requested withdrawal. The withdrawal would not affect valid existing rights, including state-owned minerals estates managed for the School Trust. Exploration and development of known deposits within the boundaries of the requested withdrawal could potentially occur over the next 20 years, but would be limited to State and private mineral estates. It is possible that a mineral development proposal could seek to encompass federal minerals requested for withdrawal and non-federal minerals on School Trust lands or other ownerships. No such proposal is reasonably foreseeable (see the Reasonably Foreseeable Development report). However, given the intermingled ownership, restricting activities on federal lands may affect future activities on neighboring lands, as mineralized deposits may not be economically viable in such a spatially limited scenario. Therefore, potential future rents and royalties from new mineral leases on state and private lands stemming from authorizations that may have otherwise occurred during the 20-year withdrawal period may be reduced or not realized.

With the January 2022 cancelation of federal mineral leases within the withdrawal application area, no revenue is currently generated from federal mineral leases or production. During the 20-year withdrawal period, new mineral development authorizations would not occur, precluding mineral prospecting and development and associated mineral lease and royalty payments generated from leasing and extracting minerals on these federal lands for at least 20 years. The distribution of these funds would not be

available to support local, state, and federal government under the requested withdrawal. The effects of the proposed action would result in forgoing future federal mineral lease and royalty payments outlined under the no-action alternative.

Public Health and Welfare

Population Characteristics

Without construction and operation of a mine, no major structural changes to the economy that may affect population characteristics are anticipated from the action alternative. As such, the current structure of local populations would remain unchanged, leaving existing population and demographic trends to continue. This includes population or demographic trends lead by the amenity-based economy including local and seasonal residents, recreation, tourism, and in-migration for the lifestyle and quality of life.

Distributional Health Risks to At-Risk Populations

Adverse disproportionate risks to low-income and minority communities, children, and children in utero are not likely to result from the proposed action as it would not create or change toxic exposure pathways.

Heritage and Cultural Values

Recreation patterns would not be affected, current trends would continue. Perceptions of the environment quality would not change from existing conditions or be affected by the proposed action. Existing trends that influence the perpetuation of cultural heritage of social communities within the Arrowhead Region would continue.

The requested withdrawal may be perceived by individuals as an impact on their ability to exercise local control and self-determination. The extent of federal land ownership and influence on economic development opportunities in Minnesota is a long-standing issue that dates back to the debates surrounding the designation of the Boundary Waters Canoe Area Wilderness (Witzig 2004). No changes to the economic structure or related population characteristics and trends are anticipated.

Table 10. Direct and indirect effects of alternative A, requested withdrawal

Issue	Resource Indicator	Direct and Indirect Effect
Economic Environment	Jobs and Labor Income Nontax Revenue Industry Composition Economic Stability/Vulnerability	Amenity-based economy would continue growth trend with no negative impacts from mineral activity. No change to current levels of nontax revenue. No change to industry composition.
Public Health and Welfare	Age Education Race Ethnicity Median Household Income	No effect
Public Health and Welfare	Risks to low-income and minority populations Risks to fetal development and children under 5 years of age	No effect
Heritage and Cultural Values	Perceptions of the Environment and Amenity Values Recreation Patterns Cultural Heritage	Increased certainty in amenity values preservation. No change in behaviors based on perceived amenity values or environmental conditions. Perceptions mining heritage is at risk.

Alternative B – No Action (No Withdrawal)

The effects of minerals exploration and development as described in the reasonably foreseeable development scenario are analyzed under this alternative.

Mineral Exploration

The effects are not expected to be distributed evenly across the analysis area. It is anticipated that since most of the activities considered in the reasonably foreseeable development scenario would occur in the western portion of the withdrawal application area in Lake and St. Louis Counties, that most of the direct effects would also occur in the northwest portion of the three-county region including Lake and St. Louis Counties. Cook County is likely to be affected indirectly by exploratory mining activities in Lake and St. Louis counties.

Economic Environment

Prospecting

The Superior National Forest's 2012 Federal Hardrock Mineral Prospecting Permits Environmental Impact Statement (2012 prospecting permits Environmental Impact Statement) reviewed and assessed the potential impacts to economic resources from activities associated with minerals prospecting on the Superior National Forest (USDA Forest Service 2012). The impacts were measured by estimating the employment (full- and part-time jobs) and labor income generated by geophysical activities and exploratory drilling activities for a 20-year analysis period. Employment and labor income response coefficients (employment and labor income per operating plan proposal) estimated for the 2012 prospecting permits Environmental Impact Statement are reported below (table 11). 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. Labor income is updated from the 2011 dollars reported in the 2012 prospecting permits Environmental Impact Statement, to 2022 dollars using the U.S. Department of Agriculture's Economic Research Service projected gross domestic product deflator (USDA Forest Service 2012).

Table 11. Response coefficients per operating plan proposal (direct, indirect, and induced), average annual

Activity	Employment: Minimum	Employment: Maximum	Labor Income (2022 dollars): Minimum	Labor Income (2022 dollars): Maximum
Ground and aerial survey	0.2	0.4	$7,559	$15,769
Site prep and restoration	0.1	0.2	$6,562	$9,844
Drilling	5.3	21.2	$409,096	$1,636,383
Total	5.6	21.8	$423,217	$1,661,996

Source: USDA Forest Service 2012; Dollars inflated using USDA ERS 2022

Note: The response coefficients were created as a snapshot in time and may not accurately reflect current or future analysis area realities.

The reasonably foreseeable development scenario assumes 24 new prospecting permit applications would be filed and sent to the Forest Service for processing and consent over the next 20 years. If the Forest Service consents to the 24 permits, the 24 prospecting permits could result in 48 operation plans. This analysis makes the simplifying assumption that the prospecting permits would be evenly distributed over the 20-year analysis period. They are likely to be unequally distributed and activities on those permits may also be distributed unequally over time. Employment and income are examined on an annual basis. The response coefficients estimated in the 2012 prospecting permits Environmental Impact Statement

were multiplied by the number of anticipated annual operating plan proposals during the 20-year analysis period. These are useful for understanding the potential magnitude of economic effects of anticipated activities under the no-action alternative. Actual response coefficients may be greater or smaller for certain activity types and the level of activity or number of other operating plan proposals submitted over the next 20 years may differ from those projected in the Reasonably Foreseeable Development report. The response coefficients were created as a snapshot in time, based on analysis, assumptions, and interviews with operators and are unique to the analysis area (USDA Forest Service 2012). Several factors may affect the accuracy of the response coefficients since actual costs depends on a variety of unanticipated factors, as well as industry changes impacting these estimates since they were developed for the 2012 prospecting permits environmental impact statement. Finally, these are not necessarily new jobs, but may occur in industries with capacity to take on additional work.

In addition to direct and indirect jobs supported by the prospecting activities reported in the Superior National Forest's 2012 Federal Hardrock Mineral Prospecting Permits Environmental Impact Statement other pre-mining activities including exploration, baseline and permitting studies employ local experts and generate indirect economic benefits through lodging, food, and other expenditures in the surrounding communities

Table 12. Average annual jobs and labor income (direct, indirect, and induced effects) supported by prospecting permits under the no-action alternative

Activity	Employment: Minimum	Employment: Maximum	Labor income (2022 dollars): Minimum	Labor income (2022 dollars): Maximum
Ground and aerial survey	0.48	0.96	$ 18,142	$ 37,846
Site prep and restoration	0.24	0.48	$ 15,749	$ 23,625
Drilling	12.72	50.88	$ 981,831	$ 3,927,320
Total	13.44	52.32	$ 1,015,722	$ 3,988,791

Source: Forest Service estimates using response coefficient estimates from USDA Forest Service 2012.

Amenity and Recreation-Driven Economy

The Recreation Report and the heritage and cultural values sections that follow describe potential shifts in recreation patterns due to exploration and prospecting. These changes could have localized impacts to the amenity and recreation-driven economy as recreation patterns change. Even small shifts in visitor use can be felt by individuals whose jobs and income are impacted. Larger shifts could be experienced as expectations about future mining activities are anticipated. This is discussed further in the Mineral Development section that follows.

Non-Market Values and Ecosystem Services

Non-market and ecosystem services not reflected in the amenity and mineral economy discussion previously are addressed in the recreation, water and aquatic species, air quality, and tribal traditional needs and values reports, as well as in the public health and welfare and the heritage and cultural values effects following.

State Trust Lands and Federal Payments to States and Local Governments

The no-action alternative would have no impact on current levels of federal payments distributed to local governments under payments in-lieu of taxes, Secure Rural Schools and Community Self-Determination Act, and Thye-Blatnik Act.

This analysis assumes that lease applications would be submitted for areas previously under federal mineral leases (see the Reasonably Foreseeable Development report). If consent to lease is granted, and the BLM were to issue new federal leases, federal mineral lease and royalty payments would be realized from these lands. In fiscal year 2020, rent and minimum royalty in lieu of production payments were over $400,000 dollars. Actual future payments would be based on the terms and conditions of the any new leases, acreage held under leases, volume of minerals extracted, and the market value of mineral production. These funds would be available to support local, state, and federal government.

School Trust Lands managed by the State of Minnesota would continue to support public schools through the Permanent School Fund. Given the intermingled ownership, lease activities on federal lands may affect future activities on neighboring lands. Therefore, potential future rents and royalties from new mineral leases on state and private lands stemming from authorizations may be realized.

Public Health and Welfare

Population Characteristics

The effects anticipated during mineral exploration on the population characteristics within the planning area are negligible given the limited number of jobs and labor income that may be generated. The jobs and labor income generated from the exploration activities are not predicted to be sizeable enough to create an influx of new workers or effect major changes in population characteristics.

Distributional Health Risks to At-Risk Populations

Adverse disproportionate risks to low-income and minority communities, children, and children in utero are not anticipated from mineral exploration as there are no exposure pathways created or changed by minerals exploration or related activities.

Public Infrastructure, such as local and state schools, would continue to receive funding from Secure Rural Schools and Community Self-Determination Act payments, which are not tied to local exploration activity. School Trust Lands managed by the State of Minnesota would continue to support public schools through the Permanent School Fund.

Tax revenue generated by local and state governments on businesses affected directly or indirectly, or affected from induced spending may be affected; however, the magnitude or direction of this effect is unknown. This is because tax revenue generated from mineral exploration may increase tax revenue; however, this increase may be counter-balanced by a decrease in tax revenues from other market sectors (such as tourism) which may contract in response to mineral exploration.

Heritage and Cultural Values

Recreation patterns in the analysis area may change due to exploration activities impacting the recreational opportunity setting or public perceptions regarding the recreation opportunity setting. It is anticipated that exploration activities, such as drilling and the associated activities such as lighting, increased traffic, and pad development are expected to be concentrated in the western portion of the withdrawal application area in St. Louis and Lake Counties. Hence, visitors from out of the analysis area who visit for day-use, wilderness experiences, or general forest day or overnight use may opt to visit eastern areas of the withdrawal application area that may continue to offer quiet recreation settings, opportunities for solitude, dark night skies, and low levels of development, and traffic. Communities such as Ely, which is reliant in part on recreation expenditures, may experience a decline in visitation and related expenditures, while communities further to the east may experience an increase in visitation and related expenditures.

Recreation visitation to areas near Birch Lake, South Kawishiwi River, and the Boundary Waters Canoe Area Wilderness entry points near Gabbro and Little Gabbro lakes may decrease in response to the impacts to the auditory environment. Almost half of the respondents surveyed in the National Visitor Use Monitoring survey of 2016 indicated that they would travel over 200 miles to recreate elsewhere for the same activity should they not be able to visit the Superior National Forest (USDA Forest Service 2018a). While recreationists may be able to visit the impacted area, they may opt to visit other locations where recreation opportunities dependent upon quiet settings can be enjoyed. The extent of potential increased noise and to which visitors would respond is unknown. While the noise effect is somewhat limited in scope and duration, related impacts from the drilling (roads, drill pads, light, noise, and increased industrial traffic) may influence the visiting population's perception of the area and related beliefs about the environmental quality and recreation opportunities beyond the immediate scope of the affected area.

Given that amenity values, such as scenic quality, quietness, and the perceived low level of development may be adversely affected by activities related to minerals exploration, it is anticipated that the communities near the Birch Lake and South Kawishiwi River may no longer be as attractive to some retirees, mobile entrepreneurs, or remote workers.

People who have long-standing ties to areas in proximity to the prospecting sites that are culturally dependent on quiet and scenic recreation settings may experience a sense of loss from the immediate, although short-term impacts associated with mineral exploration activities, in terms of a loss of connection to the types of activities that connected them to the land and the people they enjoyed these experiences with. The Tribal Traditional Needs and Values Report further describes Ojibwe cultural values and tribal treaty resources within the withdrawal application area and the related effects from mineral exploration.

People who may have experienced an erosion of their cultural heritage through the decline of the mining industry in the area since the 1980s may have a renewed sense of hope. Allowing for future activities in the near term may also come with a sense of hope for a future jobs and income generated from mining. The no action alternative may represent hope opportunities to perpetuate the cultural heritage of communities closely connected to mining industries.

Communities who have relied historically on commodity industries in the region may feel a heightened sense of autonomy should the federal withdrawal not occur, in addition to witnessing the investment in mineral prospecting. On the other hand, communities who are supportive of developing an amenity-based economic development model would likely feel a loss of autonomy to affect the future of their community and economic development.

Table 13. Direct and indirect effects of alternative B, mineral exploration period

Issue	Resource Indicator	Direct and Indirect Effect
Economic Environment	Jobs and Labor Income Non-Tax Revenue Industry Composition Economic Stability/Vulnerability	Jobs and income generated from prospecting. Limited non-tax revenue from leases. Negligible effects to industry composition. Shifting confidence in mining and amenity economies
Public Health and Welfare	Age Education Race Ethnicity Median Household Income	Negligible Effects

Issue	Resource Indicator	Direct and Indirect Effect
Public Health and Welfare	Disproportionate adverse risk to low-income and minority populations Risks to fetal development and children under 5 years of age	Negligible Effects
Heritage and Cultural Values	Perceptions of the Environment and Amenity Values Recreation Patterns Cultural Heritage	Disruption of Recreation Patterns - In proximity to minerals exploration. Mining Heritage - Increased sense of connection and autonomy. Preservation Heritage - Decrease sense of connection and hope and autonomy.

Mineral Development

Economic Environment

Mineral Commodities

Mineral resources would be developed, and minerals would be removed, suppling raw materials to the national and international market. Future demand for critical minerals found in the withdrawal application area is expected to substantially increase due to emerging and low-carbon technologies and national and international interest in advancing the use of these technologies (IEA 2022). Increasing domestic primary production is one strategy identified to reduce risk and improve resilience in the domestic mineral supply chains (Nassar et al. 2020). The Mineral Potential Report provides a detailed assessment of the mineral occurrence and development potential of the subject lands included in the proposed Rainy River withdrawal. Also see the “Mineral Commodity and Potential Market Demand” section previously.

The destination of the materials extracted is unknowable at this time. Hardrock minerals found in the withdrawal application area are traded on commodity markets and are therefore assumed to be fungible products sold on an international market. No assumptions are made in this report as to the refining, intermediary, or final manufacturing destinations of potential minerals extracted. Critical minerals for United States manufacturing, defense, and other domestic uses including production of renewable energy technologies such as batteries would continue to be supplied through contracts with national and international corporations based on the availability of these minerals and their prices in the world market (see the Mineral Potential Report for a description of withdrawal application area and global hardrock mineral resources). Also see the Mineral Commodities and Potential Market Demand section previous.

Mining Operations

The specifics of any potential mining operation are speculative to predict (see the Reasonably Foreseeable Development report). A mine operation has the potential to support a substantial number of jobs in the local economy during operation. Eagle Mine, an underground nickel and copper mine in Michigan, and Greens Creek Mine, an underground silver, gold zinc and lead mine in Alaska, each employ over 400 people (Eagle Mine 2022, Alaska Miners Association 2022). Lac des Iles Mine, an underground palladium operation in Ontario, Canada employs more than 875 employees and contractors (Impala Canada 2022). Rosemont Copper, a proposed open pit copper mine in Arizona, is estimated by different parties to provide between 430 and 585 direct jobs during active mining (USDA Forest Service 2013; Rosemont Copper Company 2017). Similarly, Resolution Copper, a large proposed underground copper mine in Arizona, was estimated to support roughly 1,400 direct jobs annually during operation (USDA Forest Service 2021 and Elliott Pollack & Company 2011). A regional example, PolyMet’s NorthMet mine proposal, was estimated to contribute 236 direct jobs (two percent of existing Minnesota mining sector jobs in 2019) to the regional economy during operation (University of Minnesota-Duluth 2006).

These examples are included to illustrate the range of direct employment potentials based on a variety of existing and proposed mines in North America. The actual number of jobs supported by mining operations within the withdrawal application area would be based on future proposals. While the true number and timing of these jobs is unknown, resource extraction supports jobs which are generally high paying. Numerous studies have documented the job creation of natural resource extraction industries, including those specific to Minnesota (Orr et al. 2018, University of Minnesota-Duluth 2006, Haynes et al. 2020). Many future factors, such as increasing automation of mine operations, would impact how many and where these jobs are located. Mine construction supports more jobs than its operational phase, but these jobs are confined to a shorter period of time, likely 2 to 3 years, ending once construction is complete. Estimates of direct employment impacts during construction of the NorthMet mine were approximately 50 percent higher than the operation phase, but again, construction employment is short-term (University of Minnesota-Duluth 2006). Another study looking at ferrous and nonferrous mining in Northeastern Minnesota estimates the 1- to 3-year capital and construction investment phase to support 27 percent more jobs than operational phase (Haynes et al. 2020).

The economic contributions to a regional economy of mining operation extend beyond the direct employment of the mine. Mining operations require substantial capital investments, some of that investment is spent in the local and regional economy. There are additional indirect and induced effects, also known as multiplier effects, generated as a result of direct activities. For example, mining operations spend money on employees, equipment, and supplies. Mineral support businesses buy supplies from other businesses. The employees of these firms spend their earnings on a variety of goods and services throughout the economy. One study of the NorthMet mining operations found multiplier effects for operations on those projects to range from 1.45 to 3.16 (University of Minnesota-Duluth 2006).

Caution should be used when considering economic impacts so far into the future, in this case greater than 20 years out. The economic viability and contributions of mining operations are a function of operating costs and metal prices. Technological changes would impact mining operational response to both. For example, increased robotic mining capabilities could reduce demand and operating costs related to employment. Other technological changes could improve utilization of ore, allowing the mine to operate at market prices lower than previously deemed economical.

Amenity and Recreation-Driven Economy

Mine operations have the potential to impact the existing and growing amenity-based economy. Were sulfide-ore copper mining to proceed within the withdrawal application area, a contraction in tourism and recreation-based economic activity could plausibly occur, depending on the extent of mining drawbacks that diminish the real or anticipated recreation experience as well as the severity or expectation of spills, breaches, or drainage. The exact timing or magnitude of any impacts is uncertain. Some impacts could begin as the certainty increases and details of the actual mining operation are solidified, while some impacts would continue to occur as construction and operation progress.

As recreation patterns adjust due to mining activity effects to the amenity and recreation-economy could be localized to those areas experiencing these changes. Some individuals and business would experience negative economic consequences of visitors relocating their activities and spending. See the recreation report for more details on these impacts.

Stock and Bradt (2020) in a study focused specifically on northeastern Minnesota, through a series of simulations, found mining produces an initial, but temporary growth in employment and income. They found over time the economic gains of mining tend to be outweighed by the negative impact of mining on the recreation economy. Most of their scenarios found a negative net present value of income resulting from a 20-year mining project (Stock and Bradt 2020).

A survey by Sungur et al. (2014) found that 23 percent of residents within four townships surrounding Ely, Minnesota, stated mining was a factor that would make them move. Twenty-one percent cited pollution, often related to mining, as a factor that would make them leave. This estimate may be high, as not all who consider moving may actually do so. At a minimum, this finding suggests mine development and operation may slow amenity-driven in-migration and has the potential to encourage out-migration.

Amenity driven housing markets may also be impacted by beliefs about the perceived changes in the quality of natural resources and recreation opportunities. One study analyzed the impacts to housing values over the course of 1,600 toxic plants opening and closing in five large U.S. states. The study found that real estate in closer proximity to the plants declined in value prior to the opening of the plant and did not rebound to pre-plant development values after the closing of the plants (Currie et al. 2015). While this study was focused on plants whose pollutants were largely airborne, it is unknown what the potential range or perceived range of health effects related to sulfide-ore mining developments would be. However, what is useful to note here is the behavioral response to perceived negative health outcomes that affected a decline in real estate values that began prior to plant opening and persisted after the plant closed, illustrating that market values respond to beliefs about risk rather than the actual risk event.

Another study assessing the value of hazardous waste remediation compared real estate values of properties near Superfund hazardous waste sites across the United States prior to and after investment in environment clean-up and remediation. The study found that the clean-ups have a small effect on the value of local housing and suggested two likely explanations for this phenomenon. First being, people who live near hazardous waste sites before and after clean-ups have a low willingness-to-pay to avoid exposure. The second is that it is thought that consumers may not believe that the clean-up reduces the health risks related to the Superfund site (Greenstone and Gallagher 2008). As such, the impacts to real estate values and may persist long after direct or indirect threats are abated. The persistence of these beliefs and their effects on the real estate market could be a plausible indicator of effects to other industries in the amenity market affected by perceptions of environmental quality.

Non-Market Values and Ecosystem Services

Mine operations would occupy land area that would no longer be available for timber production or fuelwood harvest. The reasonably foreseeable development scenario assumes an estimated footprint of all mine facilities ranges from 2,600 to 5,700 acres, and therefore would be removed from timber production.

Other non-market and ecosystem services not reflected in the amenity and mineral economy discussion previously are addressed in the other resource reports, such as recreation, water and aquatic species, air quality, and tribal traditional needs and values reports, as well as in the public health and welfare and the heritage and cultural values effects that follows.

State Trust Lands and Federal Payments to States and Local Governments

In addition to annual rental fees on lands held under federal leases, mine development and operations on federal leases would generate mineral royalties from mineral extraction once mining operations commenced. Actual future payments would be based on the terms and conditions of any new leases, acreage held under leases, volume of minerals extracted and the market value of mineral production. For example, terms of former federal leases in the withdrawal application area included $1 dollar per acre per lease year rental fee and a 6 percent production royalty with exceptions for a minimum royalty payments in lieu of production (USDI BLM 2019). These funds would be available to support local, state, and federal government.

Mine development and operations would have no effect on current levels of federal payments distributed to local governments under payments in-lieu of taxes, Secure Rural Schools and Community Self-Determination Act, and Thye-Blatnik Act. School Trust Lands would continue to be managed by the state to support public schools through the Permanent School Fund. Given the intermingled ownership, mineral exploration, and development activities on federal lands may affect future activities on neighboring state and private lands. Therefore, royalties from mineral leases on state and private lands may be realized when a mine is operational. Revenue from mineral leases on School Trust Lands would be used to support Minnesota public schools through the Permanent School Fund.

Public Health and Welfare

Population Characteristics

The specifics of any potential mining operation are speculative to predict; however, estimates of the number of direct jobs supported suggest it could be in the hundreds (Haynes et al. 2020; University of Minnesota-Duluth 2006). Indirect and induced jobs would also be supported by mineral extraction. If we assume most of these jobs would be created in communities near the mine, it is plausible this would likely drive a sizeable in-migration of people of working age and families to communities near the mine. This may reduce the median age of the population with St. Louis and Lake Counties, reducing the portion of the population over 65 and increasing the portion of the population under 5 years to more closely reflect the state's broader population.

The average annual wage in the metal mining services sector was an estimated $106,000 dollars in 2019 within the three-county analysis area compared to the average annual wage across all sectors within the analysis area of $54,000 dollars (IMPLAN 2019). Median household incomes may rise and the percentage of families and people in poverty may decline. Employment opportunities offered through mining and sectors directly supported by mine construction and operation, such as construction and building trades, often include non-wage benefits, such as health insurance, paid time off and labor agreements. With increasing prosperity at the household and community level, it is likely that social metrics such as educational attainment and access to healthcare may continue to improve in St. Louis and Lake Counties. Should households and individuals be better off economically, it may be reasonable to anticipate that non-labor income from hardship payments to decline as a percent of total household income.

The demographics in portions of the planning area would likely change as people who have the perception that there is a risk related to potential toxic contamination may opt to move out of the local area. Studies suggest that people seeking to live in high amenity communities, such as retirees and mobile entrepreneurs, who believe that amenity values in communities near operating mines may be threatened, may move away from the immediate area or choose not to locate in these communities (Sungur et al. 2014, Currie et al. 2015, Greenstone and Gallagher 2008, McGranahan et al 2011). On the other hand, people employed to work the mine may be in-migrating. A potential increased economic specialization in mining may increase the susceptibility of these communities to boom-and-bust cycles associated with mineral development.

The communities in Cook County are physically distanced from the potential direct and downstream effects of mining operations and hence may experience an increase in retirees migrating to the area. The growing size of the age cohort over 65 years old may increase social and economic vulnerability. Loss of the elder cohort over time, through death or moving to communities that offer advanced personal care services, could create a substantial loss of income to Cook County communities reliant upon expenditures within the community that are driven by age-related (dividends, interest, social security) non-labor income.

More mobile entrepreneurs, referred to as the "creative class," and mobile professionals are increasingly opting to migrate to and invest in rural areas with high amenity values (McGranahan et al. 2011). Given that amenity values within Cook County would not be likely to be affected at the onset of mining operations, communities in Cook County may experience an increase in mobile entrepreneurs and professionals who may have otherwise chosen to relocate from St. Louis or Lake Counties. An increase in the mobile professionals may increase the economic diversity of Cook County and mitigate risks associated with a large aging population. However, the median age of Cook County, may continue to be disproportionately skewed to the over 65 age group. There are no known factors related to this project that are likely to affect the ethnic or racial composition of communities in the withdrawal application area.

Distributional Health Risks to At-Risk Populations

Native American populations in Cook and St. Louis Counties within the Arrowhead Region would experience a disproportionate level of adverse risk from the potential for acid mine drainage pollution to the Rainy River watershed from sulfide-ore mining, due to cultural practices associated with the harvesting and consumption of wild rice, fish, and fowl from the region (Bouayad 2020). In addition, low-income communities in the withdrawal application area, many of which have a long-standing tradition of subsistence harvest and consumption (see historical overview) may also be more likely to consume self-caught fish (Smith and Morton 2009, Stackleberg et al. 2017), a known source of risk in exposure to methyl-mercury in the region (Sakar et al. 2022, Pearson et al. 2020).

Children under 1 year of age and children in utero—via maternal ingestion of contaminated food or water—are particularly susceptible to suffering life-long impairments due to exposure to neurotoxicants (Grandjean et al. 2014, Trasande et al. 2005). Therefore, mineral development could result in a disproportionate adverse risk to children in the Arrowhead Region.

It is also expected that low-income communities would suffer disproportionate adverse risks to their health from recreation patterns. See the Heritage and Cultural Values section that follows for the supporting rationale.

Regulation, mine design, and monitoring may reduce risk; however, this risk cannot be eliminated and would persist long term.

Heritage and Cultural Values

Discernible physical impacts on the character of neighboring communities and federal lands are anticipated due to an increased number of roads, industrial traffic, light pollution from mining and processing facilities, and noise associated with ore processing and tailings transportation, which may change the character of the nearby communities. See the recreation, soundscapes, and dark skies reports for more information on these points.

Mining activities are likely to have localized scenic effects near the mine. However, the impact of mine operation on perceptions about the environmental quality may extend beyond the immediate area. As was demonstrated through public comments, some individuals have firm beliefs about the potential effects to air and water quality and the related adverse impacts to human health and child development due to the exposure to toxic contaminants from sulfide-ore mining. People with the perspective that mining is likely to increase risk to human health would be motivated to avoid leisure activities in areas they believe are affected.

For national forest visitors who live in close proximity to mining activity, visiting an alternative recreation site may not be a feasible option as it would add considerable costs in terms of travel and time. For low-income households in this area who are concerned about health risks, the only feasible option to avoid risks may be to not visit the national forest or not participate in lake and river water-based recreation opportunities. Studies have shown that low-income communities living near toxic industrial areas have a higher mental health impact due to a sense of powerlessness to avert risk (Downey and Willigen 2005). Alternatively, existing recreation patterns by some low-income individuals could be maintained should substituting locations with less risk not be a feasible option. For this reason, low-income households experience a higher disproportionate adverse health risk than economically advantaged households who may be more likely to have the ability to modify their recreation patterns (locations) in order to reduce risks while maintaining important social connections and cultural traditions.

For many visitors to the national forest, the ability to adjust recreation patterns is a relatively easy option as there are numerous high amenity vacation recreation destinations that people may elect to recreate in instead. The recreation survey results in 2016 estimated that almost half of forest visitors would be willing to travel over 200 miles to alternative destination in substitution for visiting the Superior National Forest (USDA Forest Service 2018a). See the Recreation Report for more information.

This may translate into changes in recreation patterns for local and non-local national forest visitors. Hence, it is likely that recreation visitation for developed day-use recreation, overnight developed camping at Birch Lake Campground or South Kawishiwi Recreation Residences, overnight dispersed camping, and wilderness entries and use near Gabbro and Little Gabbro lakes would decline.

For some individuals and groups, opportunities to perpetuate shared experiences, with both current and future generations, and the cultural values sustained by the region are threatened by the perceived increased risk to air and water quality and related health effects from mining, as well as the impacts to their sense-of-place that has traditionally attracted visitors to the withdrawal application area.

For communities suffering a loss of cultural connections to the land, mental health is likely to be adversely affected due to a sense of loss of heritage and connection to social communities developed around shared or personal experiences.

The portion of the population that would avoid visiting personally treasured places, in order to avoid the perceived risk of exposure to toxic contaminants, may in turn suffer effects to their psychological wellbeing. The perceived long-term loss of visitation to places where they may have deeply personal transformative experiences that shaped their sense of self and their connection to their community may be undermined. This is one of the fundamental bases of human wellbeing, a sense of connection to others and a sense of belonging to place and community. It is likely that risks to mental health and wellbeing may be increased in this respect. A term recently coined to describe mental distress or depression caused by environmental degradation is solastalgia (Eisenman et al. 2015).

For others, mining may enrich their cultural capital as it would maintain an active connection to family heritage. Individuals who value a mining heritage may experience a sense of pride and affirm their identity in connection to the mining industry and the community in place. How extensive this impact would be is dependent upon the actual number of people employed.

Table 14. Direct and indirect effects of alternative B, mining operations

Issue	Resource Indicator	Direct and Indirect Effect
Economic Development	Jobs and Labor Income Non-Tax Revenue Industry Composition Economic Stability/Vulnerability	Mining operations and mining-support sector activities support jobs and labor income in local economy; Indirect jobs throughout local economy supported from mining sector growth. Mineral royalties based on production volume and value paid to local, state and federal governments. Amenity-based economy negatively impacted.
Public Health and Welfare	Age Education Race Ethnicity Median Household Income	Changing population composition as some area see mining sector growth and others see change in amenity-based economy. Mine sector employment increases some household income. Beneficial effect on well-being derived from mining heritage. Adverse effect on well-being derived from environmentalism and recreation heritage.
Public Health and Welfare	Risks to low-income and minority populations Risks to fetal development and children under 5 years of age	Disproportionate adverse risk to Environmental Justice communities and children.
Heritage and Cultural Values	Perceptions of the Environment and Amenity Values Recreation Patterns Cultural Heritage	Adverse effect on perceptions of environmental quality. Decline in recreation visitation for day-use, overnight and wilderness entry in localized areas. Increase in recreation visitation in locations farther from disturbed areas due to displacement of recreationist Beneficial effect on mining heritage. Adverse effect on environmentalism and Recreation Heritage.

Post Mining Operations

Economic Environment

Following the closure of a hardrock mine, any jobs previously created would no longer be supported, leaving a potential economic vulnerability most heavily felt within northern Lake and St. Louis counties. Jacobsen and Parker (2016) studied county-level data for the American West and examined the consequences of oil and gas well drilling arising from the oil price increases of the 1970s and early 1980s. They found “that the boom created substantial short-term economic benefits, but also longer-term hardships that persisted in the form of joblessness and depressed local incomes.... In the longer run, after the full boom-and-bust cycle had concluded, we find that local per capita income was about 6 percent lower than it would have been if the boom had never occurred” (p. 1093).

Allcott and Keniston (2018) studied United States county-level manufacturing data in connection with oil and gas booms and concluded that "while county-level population, employment, wages, and revenue productivity are all procyclical [that is, all go up in the initial extractive stage], the booms are cancelled out by the busts. By the end of the 1990s, we see no significant remaining long-term effects."

Most of the research on mineral related boom-bust cycles pertain to oil and gas, but are relevant to hardrock mining since it is also highly susceptible to price volatility. Any potential for this boom-bust economic cycle to replicate in a Northern Minnesota hardrock mining economy could potentially be exacerbated by the unique existing economy surrounding the Boundary Waters Canoe Area Wilderness and the potential for mineral extraction to negatively impact the amenity-based economy. This is discussed in the Amenity and Recreation-Driven Economy section previously. Lorah and Southwick (2003) find that environmental regulations limiting extractive activities on protected lands is correlated with relatively rapid population, income, and employment growth. However, , they also speculate that some regions most able to rebound from the loss of income and population after the loss of extractive industries are those with unique amenity values needed to support growth in other sectors(Lorah and Southwick 2003).

Following the closure of a hardrock mine, any royalties previously paid would no longer be generated. This nontax revenue is would no longer be available to support local, state, and federal governments.

School Trust Lands would continue to be managed by the state to support public schools through the Permanent School Fund.

Public Health and Welfare

Population Characteristics

With the closure of a hardrock mine, the population would be in transition in size and composition as there would be fewer employment opportunities.

Distributional Health Risks to At-Risk Populations

The risks of acid mine drainage into the Rainy River watershed would increase relative to the early mine operations stage described previously in this analysis. The need to control water pollution and air pollution from tailing facilities could extend across centuries or indefinitely, which carries the risk that society may not sustain such controls across such timeframes. Remediation, should a leak occur, may be expensive and ineffective because long-term isolation of intercepted contaminated groundwater is difficult to achieve (see the Water and Aquatic Species Report). Hardrock mineral mines have a documented history of leaks or infrastructure failures in many cases. Under the no-action alternative, multiple mining operations may occur (see the Reasonably Foreseeable Development report), which would carry more risk than one mine.

The disproportionate adverse risks associated with the development of hardrock mines on the health effects of Native American communities reliant upon subsistence resources of the Rainy River watershed may continue to increase over time. There is a continued risk of adverse effects to children and children in utero of the Arrowhead Region due to their heightened vulnerability to exposure to neurotoxicants.

There is a continued risk of adverse effects to low-income communities in the northwestern portion of the withdrawal application area. Low-income communities that are geographically situated in areas that are hydrologically connected to mines have a higher risk of toxic contamination, as compared to middle and high-income households who have a greater capacity to respond to and avoid health risk that arise out of environmental contamination. The extent and severity of adverse effects would range from low to high and depend on project-specific factors such as location and local conditions.

Heritage and Cultural Values

Public perceptions of the northwestern portion of the withdrawal application area may be heavily influenced by the presence of mines, although these are no longer in operation. Public concern over risks from exposure to contaminated water are most likely higher than they have been in the preceding time frames considered in this analysis, as mines would have been developed to its fullest extent. Some people may avoid areas that, in their perspective, increase the risk of adverse health impacts. This would mean that communities and areas near mines that were once popular recreation destinations may not continue to be popular recreation destinations. Locations farther from mining sites may continue to experience an increased level of recreation and tourism visitation from displaced recreation patterns.

A sense of connectedness to mining heritage may be largely dependent on more mining activities continuing in this area; however, it is unknown if such economic opportunities would arise after mines have closed. Heritage and social values rooted in the environmental attributes and outdoor recreation opportunities may be functionally impaired due to the changes that occurred in the communities during the mine operations and following mine closure.

Table 15. Direct and indirect effects of alternative B, post mining operations

Issue	Resource Indicator	Direct and Indirect Effect
Economic Development	Jobs and Labor Income Nontax Revenue Industry Composition Economic Stability/Vulnerability	Loss of mining-related jobs. Mineral production royalties no longer paid to governments. Negative impacts to amenity-based economy may continue
Public Health and Welfare	Age Education Race Ethnicity Median Household Income	Population size and composition in transition; income opportunities decrease.
Public Health and Welfare	Risks to low-income and minority populations Risks to fetal development and children under 5 years of age	Disproportionate adverse risk to Environmental Justice communities and children.
Heritage and Cultural Values	Perceptions of the Environment and Amenity Values Recreation Patterns Cultural Heritage	Public perceptions of environmental quality heavily influenced by risks associated with hardrock minerals mining. Long-term disruption/displacement of recreationists. Loss of preservation heritage. Effects to mining heritage dependent on status of mining.

Compliance with Superior National Forest Land and Resource Management Plan and Other Relevant Laws, Regulations, Policies, and Plans

The consideration of the economic effects considered in this analysis comply with the requirements of the National Forest Management Act and 43 U.S. Code section 1714 (FLPMA) and 43 CFR section 2310.3-2.

In the long term, hardrock minerals development that could occur under the no action alternative would risk degrading natural capital, and adversely affecting individual and community health in the northwestern portion of the Arrowhead Region. In addition, there is the risk of disproportionate and adverse effects on environmental justice communities and children in communities that are hydrologically connected to mines.

The risks associated with minerals development that could occur under the no action alternative are long-term and may result in adverse impacts that would endure for multiple generations. Such risks, should they be realized, may result in the impairment of the recreational, watershed, fish and wildlife resources within the Rainy River watershed. Table 16 displays an analysis of the compliance of the alternatives in meeting the desired conditions and objectives identified in the forest plan. The potential effects described may displace recreationists, affect cultural heritage, create long-term adverse risk to human health, and undermine the diversity of economic development opportunities over the long-term. Desired conditions (D-SE-1; D-SE-2; D-SE3) and objectives (O-SE-1; O-SE-3) for the social and economic environment identified in the plan may not be met over the long term in the northwest portion of the Arrowhead Region due to the long-term potential effects of hardrock mineral mining.

Table 16. Summary of compliance with the land and resource management plan

Resource Area	Applicable Forestwide Desired Conditions, Standards and Guidelines	Alternative A (Withdrawal) – Consistency with Plan	Alternative B (No Action) – Consistency with Plan
Socioeconomics	D-SE-1The forest provides commodity resources in an environmentally sustainable and acceptable manner to contribute to the social and economic sustainability and diversity of local communities. D-SE-2 The forest provides non-commodity opportunities in an environmentally sustainable and socially acceptable manner to contribute to social sustainability and vitality of local resident's way of life cultural integrity and social cohesion. D-SE-3 The forest continues to provide rare or unique benefits that may not be common on or available for other public or private lands, such as opportunities for experiences solitude in remote settings, recreating where lakeshores are undeveloped, harvest unique natural resources, and providing habitat for some federal and/or state endangered, threatened, or sensitive species.	Withdrawal is consistent because it avoids the risks and potential effects associated with sulfide-bearing minerals development that could result in inconsistency.	Consent authority would be used on a case-by-case basis to achieve consistency. However, the risks of inconsistency that would be avoided under Alternative A are possible under Alternative B (see narrative immediately preceding table 16).
Socioeconomics	O-SE-1 Contribute to local-scale social and economic vitality by promoting and/or protecting area cultural values, traditional employment, recreation opportunities, historical landscape features, commodity related natural resources, and aesthetic qualities of the forest. O-SE-2 An annual and sustainable program of commercial timber sales and other products are offered and/or available. O-SE-3 Increase accessibility of a diversity of people and members of underserved and low-income populations to the full range of uses, values, products, and services. Executive Order 12898 requires federal agencies identification and respond to disproportionately high and adverse human health or environmental effects of its activities on minority and low-income populations. EO 13045 requires federal agencies to ensure that its activities address disproportionate risks to children that result from environmental health risks or safety risks.	Withdrawal is consistent because it avoids the risks and potential effects associated with sulfide-bearing minerals development that could result in inconsistency.	Consent authority would be used on a case-by-case basis to achieve consistency. However, the risks of inconsistency that would be avoided under Alternative A are possible under Alternative B (see narrative immediately preceding table 16).

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