Draft Assessment

Forest Plan Revision

Mineral, Energy, and Geological Hazards Resources Report

Prepared by:

Janet Plocharsky – NEPA Coordinator, Revision Team

David Hatfield – Forest Planning Specialist, Oregon State University

Contributions by:

Raidon Poe – Geologist, Malheur National Forest

Paul Gennett – Geologist, Umatilla National Forest

Keifer Nace – Geologist, Wallowa-Whitman National Forest

Mark Spendel – Blue Mountain Area Mining Geologist

Kate Fent – Realty Specialist, Wallowa-Whitman National Forest

for:

Malheur, Umatilla, and Wallowa-Whitman National Forests

February 6, 2024

Introduction

National forests provide an essential role in contributing to an adequate and stable supply of mineral and energy resources while continuing to sustain biodiversity and land productivity. Geological resources in the national forests of the Blue Mountains include locatable minerals, such as gold, chromium, silver, and other precious and base metals; leasable energy minerals such as oil, natural gas, coal; saleable minerals, such as sand, gravel, and other rocks used in the construction and landscaping industry; and renewable energy such as hydroelectric, wind, solar, biomass, and geothermal resources.

The Mining and Minerals Policy Act of 1970, National Materials and Minerals Policy, Research and Development Act of 1980, and the Energy Act of 2020 required federal land management agencies to:

- Promote and encourage private enterprise in the development of economically sound and stable domestic materials industries.
- To facilitate the availability, development, environmentally responsible production of domestic resources to meet national material or critical mineral needs.
- And to avoid duplication of effort, prevent unnecessary paperwork, and minimize delays in the administration of applicable laws (including regulations) and the issuance of permits and authorizations necessary to explore for, develop, and produce critical minerals and to construct critical mineral manufacturing facilities in accordance with applicable environmental and land management laws (30 U.S.C. §1602).

Process and Methods

This assessment of the geology, renewable, and nonrenewable mineral and energy resources of the Blue Mountains national forests is based on best available scientific information from numerous resources. These include Federal statutes, laws, and regulations, Forest Service manuals, Malheur, Umatilla, and Wallowa-Whitman National Forest project and permit files, U.S. Geological Survey published documents and maps, U.S. Bureau of Mines published documents, Environmental Protection Agency (EPA) website and published documents, U.S. Energy Information Administration and U.S. Department of Energy (Oak Ridge National Laboratory) data, and other academic and professional peer-reviewed literature. Specific sources of information used in this assessment can be found listed in the “References” section of this report.

Scale

This assessment was conducted for the Blue Mountains national forests as a whole and at the individual national forest scale. Geologic processes that have contributed to the existing condition of the Blue Mountains national forests function on a larger regional basis, while mineral occurrences, geologic hazards or geologic interest areas are best described at the landscape area scale.

Current Forest Plan Direction

Current forest plans for mineral resources applies appropriate federal and state laws and regulations and calls for coordinating with appropriate regulatory agencies. Environmental analyses are conducted prior to exploration, development, and production of all locatable, leasable, and saleable, minerals. This analysis would consider reclamation as appropriate, following disturbance of an area. No management direction in the existing forest plans directly addresses renewable energy sources.

All lands across all three national forests are open to mineral entry under the 1872 Mining Law except lands withdrawn (subject to valid existing rights) such as designated wilderness. Notices of Intent and Plans of Operation are approved and conducted consistent the 1872 Mining Law, NEPA, other federal laws, Forest Service Regulations 36 CFR 228, and Forest Plan management direction.

Lands are administratively available to lease consistent with site-specific leasing decisions and associated forest plan amendments (if any). These decisions will condition any future leasing by the Bureau of Land Management with standard lease terms and with stipulations such as controlled surface use, timing, or no surface occupancy.

Sale of mineral materials is consistent with Management Area goals and desired conditions.

Existing Condition

In the Mining and Minerals Policy Act of 1970, Congress declared that it is the continuing policy of the Federal Government in the national interest to foster and encourage private enterprise in the development of economically sound and stable domestic mineral industries, and in the orderly and economic development of domestic resources to help assure satisfaction of industrial, security, and economic needs (30 U.S.C. §21). Congress furthered its policy in the National Materials and Minerals Policy, Research and Development Act of 1980 and the Energy Act of 2020 stating “It is the continuing policy of the United States to promote an adequate and stable supply of materials necessary to maintain national security, economic well-being and industrial production with appropriate attention to a long-term balance between resource production, energy use, a healthy environment, natural resources conservation, and social needs” (30 U.S.C. §1602).

These Acts also required federal land management agencies to promote and encourage private enterprise in the development of economically sound and stable domestic materials industries; to facilitate the availability, development, and environmentally responsible production of domestic resources to meet national material or critical mineral needs; and to avoid duplication of effort, prevent unnecessary paperwork, and minimize delays in the administration of applicable laws (including regulations) and the issuance of permits and authorizations necessary to explore for, develop, and produce critical minerals and to construct critical mineral manufacturing facilities in accordance with applicable environmental and land management laws (30 U.S.C. §1602).

Locatable Minerals

Locatable mineral resources occur in the Blue Mountains national forests. Historical production has included gold, silver, copper, lead, zinc, platinum, chromium, perlite and precious opal. At one time, gold mines in northeast Oregon were the largest producers in the state. Gold mineralization appears to be associated with granitic intrusive rocks on Dixie Butte, Canyon Mountain, the Greenhorn Mountains, the Elkhorns and the southern Wallowa Mountains.

Placer and lode gold deposits were worked extensively from discovery in 1861 through 1942 and some production continues to the present day. In 2024, Bureau of Land Management records show about 2,407 active claims on the three national forests: 109 on the Malheur National Forest, 47 on the Umatilla National Forest, and 2,407 on the Wallowa-Whitman National Forest.

Placer mining has occurred in the Middle Fork and Upper Fork John Day rivers, on Canyon Mountain, and in the Aldrich mountains, North, Middle, and Upper Fork John Day, Powder River, Burnt River, southern portion of the Wallowa Mountains, and Upper Grande Ronde River. Approximately 1.3 million acres of the national forests, including 910,000 acres in congressionally designated wilderness areas, and the Hells Canyon National Recreation Area, are withdrawn from mineral entry under federal mining laws.

Appendix A contains maps showing the potential for undiscovered deposits of gold, silver, copper, lead and zinc within the plan area. These maps were an attempt by the USGS to determine the quantity and quality of undiscovered deposits using a three-part assessment including the types of deposits permitted by the geology, the amount of metal in typical deposits, and the estimated number of undiscovered deposits. Teams from USGS reviewed geology and deposit models to delineate permissive tracts for each model type and a probability that a particular undiscovered deposit would occur within those tracts. Estimates were made to a depth of one kilometer beneath the surface, and the number of undiscovered deposits were estimated at five different levels of certainty.

Critical and Strategic Minerals

Critical materials and critical minerals are defined at 30 U.S.C. §1606. A critical material is any non-fuel mineral, element, substance, or material that the Secretary of Energy determines has a high risk of supply chain disruption and serves an essential function in 1 or more energy technologies, including technologies that produce, transmit, store and conserve energy or a critical mineral (30 U.S.C. §1606(a)(2)). Critical minerals are any mineral, element, substance, or material designated as critical by the Secretary of Interior because 1) they are essential to the economic or national security of the United States; 2) the supply chain of which is vulnerable to disruption (including restrictions associated with foreign political risk, abrupt demand growth, military conflict, violent unrest, anti-competitive or protectionist behaviors, and other risks throughout the supply chain; and 3) they serve an essential function in the manufacturing of a product (including energy technology-, defense-, currency-, agriculture-, consumer electronics-, and health care-related applications), the absence of which would have significant consequences for the economic or national security of the United States

(30 U.S.C. §1606(c)(4)(A)). The Secretary of the Interior is mandated to maintain and publish the critical mineral list with reviews conducted every 3 years, or more frequently as the Secretary of the Interior considers to be appropriate.

Materials that are considered "strategic" and/or "critical" vary over time and efforts are ongoing to improve the methods and processes used to determine whether materials should be added or removed from the lists. The Secretary of Interior, by and through the U.S. Geologic Survey (USGS), published its most recent critical minerals list in the Federal Register on February 24, 2022 identifying 50 minerals as critical (87 Fed. Reg. 10381-10382). An additional list of critical materials is maintained by the Department of Energy (DOE) and was published in the Federal Register on August 4, 2023. The critical materials list recognizes the Secretary of Interior critical mineral list prepared by the USGS but also lists additional materials important to energy applications (88 Fed. Reg. 51792-51798). Appendix B displays the USGS Critical Mineral Focus Area Maps. Critical and strategic mineral potential in the Blue Mountains include antimony, arsenic, bismuth, chromium, cobalt, gallium, germanium, indium, manganese, scandium, tellurium, tin, tungsten, and zinc.

Section 40206 of the Bipartisan Infrastructure Law (PL 117-58) also recognized the economic and national security importance of critical minerals to the United States which directed that "to the maximum extent practicable, the critical mineral needs of the United States should be satisfied by minerals responsibly produced and recycled in the United States" (30 U.S.C §1607).

Leasable Minerals

Oil and gas resources are known or suspected to occur in a deep sedimentary basin that underlies part of the Blue Mountains national forests within the Columbia Basin. The extent of these resources is unknown due to their depth and the difficulty of exploration through the overlying Columbia River basalts. Minor production occurred from the sedimentary basin in the vicinity of Richland, Washington in the late 1950s, but large-scale commercial production has not occurred, and no economic discovery has been made in the basin to date.

A potential natural gas resource occurs in Mesozoic age rocks beneath the Malheur and Umatilla National Forests. As required by Forest Service regulations, an analysis was completed in 1997 that identified lands administratively available for oil and natural gas leasing within the Malheur and Umatilla National Forests. This decision is incorporated into the existing forest plans by amendment. Lands excluded from the analysis include lands withdrawn from mineral entry or leasing.

Coal deposits are known to occur in the Troy and Flora areas and west of Ukiah in the Arbuckle coal field. To date, there has been very little coal development in the Blue Mountains national forests. The coal deposits have been explored in the past with little indication that they are of economic value. There is no active, proposed, or anticipated coal mining or coal bed methane operation on the three national forests in the Blue Mountains.

Additional leasable minerals include sodium and potassium, phosphate, gilsonite, oil shale and hardrock minerals located on acquired lands (see 43 CFR 3500 for additional lands that are subject to leasing). None of these minerals are known to occur, but a geospatial analysis of acquired lands within

the three national forests could indicate potential leasing of hardrock minerals. (note: hardrock minerals is the BLM term for locatable minerals that fall under the leasing authorities due to their land status in this part of the country.

Saleable Minerals

Saleable mineral resources exist throughout the Blue Mountains. The abundance of volcanic basalt and andesite formations make this resource readily available. Relatively minor production of rock materials (crushed basalt, riprap, crusher reject material) occurs intermittently on the national forests in the Blue Mountains. Production increases when forest management requires improvements in road surfaces. The economic value has been less than $25,000 annually and commonly extracted under free permits or in-service use.

Renewable Energy

There is no geothermal, solar, or wind energy infrastructure located on the three national forests, and none are proposed at this time. Individual use hydroelectric or solar energy sources are known to occur under permit or as an ancillary portion of an authorization.

Geothermal resources exist throughout the Blue Mountains national forests and are revealed in numerous hot springs and warm water wells. This indicates the presence of a widespread, shallow geothermal resource. This resource is not limited to surface manifestations, such as hot springs, but appears to occur throughout the area; consequently, estimating the development potential is difficult. Future development potential in the Blue Mountains appears to be limited as the distribution of geothermal resources on National Forest System lands is unknown and areas of higher potential exist outside the national forests. Presently, the area of highest known potential is Vale geothermal field, near Vale, Oregon.

Subtitle B of the 2005 Energy Policy Act section 222 amends section 4 of the Geothermal Steam Act of 1970(d) and states: “All future forest plans and resource management plans for areas with high geothermal resource potential shall consider geothermal leasing and development.” Figure 2 shows that geothermal energy development is already present on and adjacent to the Blue Mountains national forests.

Areas with potential for wind energy development have been mapped for northeastern Oregon and southwestern Washington by the U.S. Department of Energy. The most extensive areas with wind energy development potential occur outside the Blue Mountains national forests. Many areas outside of the forests have experienced wind and solar energy development in recent years. The ability to economically connect to the electricity grid favors development near existing transmission lines. The areas with highest potential for development on National Forest System lands are generally found at higher elevation, on ridgelines or other open areas. However, many of these areas are designated wilderness excluding the area from development or the area is outside the current electrical grid.

There are two Federal Energy Regulatory Commission hydroelectric licenses on the Wallowa-Whitman National Forest: the city of Cove on Mill Creek, and Wallowa Falls on the Wallowa River. Individual use hydroelectric or solar energy sources are known to occur under permit or as an ancillary portion of an authorization. The Forest Service has been adding solar energy sources at fire lookout towers and radio repeater sites. Use of solar energy at the local scale is expected to continue as permit and authorization holders find alternative energy opportunities and recreationist supply their camps with energy sources.

Biomass is considered a renewable energy source. Woody biomass can be used for the generation of heat, electricity, and biofuels. In many cases, the technology for converting woody biomass into energy has been established for decades, but because the price of woody biomass energy has not been competitive with traditional fossil fuels, bioenergy production from woody biomass has not been widely adopted. (White, 2010)

Infrastructure within the influence area of the Malheur National Forest includes ongoing development of a cogeneration plant in Prairie City, the conversion of a pellet plant to a bio-char plant in John Day, the operation of firewood processing business in John Day, a post and pole mill in Seneca, a pellet mill in Hines that may produce both alfalfa and wood pellets, and the Harney County Bio-Mass District in Burns, Oregon, which converted the primary and secondary heat source in several buildings to burning biomass. The annual firewood permit sales for 2023 were 10,760 cords.

Umatilla National Forest's nearby facilities processing biomass include a pellet mill in Reith, Oregon and a biomass facility in Wallowa, Oregon that produces firewood, biochar and post and poles. There is also a chip mill in Boardman, Oregon. The 2023 firewood sales for the Umatilla National Forest were 11,270 cords.

The Wallowa Whitman National Forest 2023 firewood permit sales were 12,800 cords.

Key Benefits to People

Exploration, development, and production of mineral and energy resources contribute to the social and economic needs of local communities and are administered to minimize adverse environmental effects on national forest surface resources. Reasonable access is provided to locatable mineral claims, as well as for exploration and production of leasable and locatable mineral resources. Congressionally designated wilderness, wild rivers, municipal watersheds, or other areas of important natural or cultural resource value are withdrawn from mineral entry, subject to valid existing rights.

Risks and Stressors

Trends that affect energy and mineral activity include economics, national and local politics, environmental policies, public perspectives of environmental impacts, cultural shifts toward renewable energy resources such as hydroelectric, solar and wind energy, laws and legal decisions,

and national and international supply and demand for natural resources. All these factors have and continue to change through time and appear to be highly unpredictable.

Locatable Minerals

The potential exists for the discovery and exploration of undiscovered mineral deposits within the bounds of the Blue Mountains national forests on lands open to mineral entry. Increased interest in deposits that were previously considered subeconomic is expected as the United States transitions to a green energy economy. Factors that will influence this are technological advances in the mining industry and new geologic data that may provide additional exploration targets as different commodities take on greater importance in the future. Mining activities on existing, known mining claims is expected. Regulatory policy related to carbon emissions influence the exploration and development of mineral resources nationally and internationally.

Critical and Strategic Minerals

The Energy Act of 2020 (P.L. 116-260, December 27, 2020) defines critical minerals as "any non-fuel mineral, element, substance, or material that the Secretary of Energy determines (i) has a high risk of a supply chain disruption; and (ii) serves an essential function in 1 or more energy technologies, including technologies that produce, transmit, store, and conserve energy" excluding fuel minerals, water, ice, or snow, and common varieties of sand, gravel, stone, pumice, cinders and clay.

The U.S. Geological Survey (Schulz et al., 2017) published a report that included 23 minerals determined to be currently critical to the nation's economy and security based upon four factors:

- The commodity's use.
- The geology and global distribution of the mineral deposit types that account for present and possible future supply of the commodity.
- The current status of production, reserves, and resources in the United States and globally
- Environmental considerations related to the commodity's production from different types of mineral deposits.

The list was updated in 2018 as directed by Executive Order (EO) 13817. This EO entitled "A Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals" defined critical minerals as "A mineral identified by the Secretary of Interior pursuant to subsection (b) of this section to be (i) a nonfuel mineral or mineral material essential to the economic and national security of the United States, (ii) the supply chain of which is vulnerable to disruption, and (iii) that serves an essential function in the manufacturing of a product, the absence of which would have significant consequences for our economy or our national security." The resulting 2018 list of critical minerals includes 35 minerals or mineral materials deemed critical.

This definition was refined to include national security by EO 14017 entitled "America's Supply Chains." This EO distinguished between "critical minerals" as defined by the Strategic and Critical Materials Stockpile Act (50 U.S.C. 98) and "strategic and critical minerals" in the mandated 100-Day Review under Executive Order 14017, Building Resilient Supply Chains, Revitalizing American

Manufacturing, and Fostering Broad-Based Growth. These materials are "[n]eeded to supply the military, industrial, and essential civilian needs of the United States during a national emergency and are not found or produced in the United States in sufficient quantities to meet such need."

Materials that are considered "strategic and critical vary over time and efforts are ongoing to describe the best methods or process by which to determine whether materials should be added or removed from the list. Pursuant to Section 7002 ("Mineral Security") of Title VII ("Critical Minerals") of the Energy Act of 2020 (P.L. 116-260) the Secretary of the Interior acting through the Director of the USGS is tasked with updating the Critical Minerals List every three years. Appendix B displays the USGS Critical Mineral Focus Area Maps.

Pursuant to the law, USGS released the following list of critical and strategic minerals in 2022: Aluminum, antimony, arsenic, barite, beryllium, bismuth, cerium, cesium, chromium, cobalt, dysprosium, erbium, europium, fluorspar, gadolinium, gallium, germanium, graphite, hafnium, holmium, indium, iridium, lanthanum, lithium, lutetium, magnesium, manganese, neodymium, nickel, niobium, palladium, platinum, praseodymium, rhodium, rubidium, ruthenium, samarium, scandium, tantalum, tellurium, terbium, thulium, tin, titanium, tungsten, vanadium, ytterbium, yttrium, zinc, and zirconium.

The Department of Energy has also released a similar list of minerals in 2023 considered critical for energy, including: aluminum, cobalt, copper, dysprosium, electrical steel, fluorine, gallium, iridium, lithium, magnesium, natural graphite, neodymium, nickel, platinum, praseodymium, silicon, silicon carbide and terbium.

Section 40206 of Infrastructure Investment and Jobs Act (P.L. 117-58) recognized the importance of Critical Minerals Supply chains and directed that "to the maximum possible extent practicable, the critical mineral needs of the United State should be satisfied by minerals responsibly produced and recycled in the United States" and that the current permitting process "has been identified as an impediment to mineral production and the mineral security of the United States."

Leasable Minerals

Malheur and Umatilla National Forests issued a final oil and gas availability and leasing environmental impact statement and record of decision February 5, 1997. Mineral potential for all lands in the two forests were assessed by the Bureau of Land Management and Forest Service. Lands were mapped with low or moderate potential for the accumulation of oil and gas because geologic conditions necessary for accumulation may be absent. Development potential for oil, gas, and coal minerals is expected to be low.

Although there are geothermal hot springs and warm water wells throughout the Blue Mountains, the national forests generally have a low development potential.

Salable Minerals

Infrastructure developments both on and off the Blue Mountains national forests will drive the demand and need for a variety of mineral material products including construction aggregate, drain

rock, and rip rap as examples. Road maintenance, mineral development, landscape and abandoned mine restoration activities, and campground management actions are expected to occur within the national forests. Non-federal interest such as county or state governments or private commercial interest may also request development of federal saleable minerals.

Renewable Energy

The Blue Mountains national forests' rural location, lack of infrastructure, and fire prone landscape will continue to make renewable energy infrastructure a challenge.

The potential for new large-scale hydropower projects exceeding 1 Megawatt (MW) in the planning area is quite limited. A national assessment conducted by Oakridge Laboratories shows that only 5 out of 114 watersheds located on Forest Service lands have the potential for hydropower generation exceeding 1 MW (Kao et al., 2014). These watersheds include:

- Three watersheds of the Lower Grande Ronde River subbasin
    - Lower Grande Ronde River
    - Grossman Creek-Grande Ronde River
    - Mud Creek-Grande Ronde River
- One watershed of the Umatilla subbasin
    - Upper Butter Creek
- One watershed of the Lower John Day subbasin
    - Kahler Creek-John Day River

It is important to note that the Grande Rhonde River is protected under the Wild and Scenic Rivers Act of 1968 from its confluence with the Wallowa River to the Oregon-Washington border. The Wild and Scenic Rivers act prohibits the Federal Energy Regulatory Commission to "license the construction of any dam, water conduit, reservoir, powerhouse, transmission line, or other project works under the Federal Power Act, as amended, on or directly affecting any [designated river]" and "no department or agency of the United States shall assist by loan, grant, license, or otherwise in the construction of any water resources project that would have a direct and adverse effect on the values for which such river might be designated" (Wild & Scenic Rivers Act, 1968, Sec. 7(a)). The protected status of the Grande Rhonde means that the Federal Government is unable to assist in the license, funding, and construction of hydroelectric developments on the Grande Rhonde and is unlikely to be able to do on its tributaries, pending a section 7 review.

Only the uppermost headwaters of Upper Butter Creek and Kahler Creek-John Day watersheds are on lands administered by the Forest Service and thus are unlikely to have hydropower potential greater than one megawatt.

Development of hydroelectric infrastructure on FS lands or projects likely to directly impact FS lands would be required to follow NEPA guidelines and follow all applicable laws, statutes, and regulations.

Facilities that may process biomass for energy are in Grant, Morrow, Harney, Umatilla, and Wallowa, counties, Oregon. Forest products or biomass may reach any of the various processing plant locations and are not specifically tied to a forest or geographic area nor does the Forest Service control the processing of biomass. Biomass is often a by-product of forest management and processing of saw logs at any lumber mill location. Biomass results from sawlog processing in LaGrande, Oregon and biomass sources are used in paper production in Clarkston, Washington.

Information Needs

Locatable Minerals

Development of known locatable mineral occurrences or locations involving current or past mineral activities within a GIS data layer would be helpful. Special emphasis should be put on the USGS and DOE list of critical minerals. This information could be used in development of future forest planning management direction. Forest Service responsibility related to the management of locatable minerals is largely directed by existing law, regulation, and policy. It should also be recognized that many critical and strategic minerals are produced as a by-product in mining operations and not as the primary commodity.

Leasable Minerals

A geospatial database of known leasable mineral occurrences or locations involving current and past leasable mineral activities can aid in future forest planning efforts.

Saleable Minerals

Information needs associated with the management of saleable mineral resources within the Blue Mountains national forests will be influenced by existing and future infrastructure construction and maintenance needs. Knowledge of possible federal and private demand for these resources would be helpful. Geospatial information on known mineral material occurrences or locations involving current or past mineral activities could be used to inform management direction of site-specific projects.

Renewable Energy

The Boardman to Hemingway Transmission Line is an approved, not yet constructed, facility that includes an application for a site certificate approved route approximately 270.8-mile-long single-circuit 500-kV electric transmission line that crosses the Wallowa Whitman National Forest northwest of La Grande. Future renewable energy sources may tie into this transmission line and provide additional opportunities for renewable energy infrastructure on federal lands within the planning area.

Key Findings

Generally, management guidance provided in the 1990 forest plans as amended, along with consultation under the Endangered Species Act and State administration of the Clean Water Act have been sufficient to prevent, preclude, or eliminate unacceptable resource effects while providing opportunities for renewable and nonrenewable energy and mineral resource production. To date, these prescribed and implemented mitigation have largely precluded violation of federal or state statues pertaining to these resource values.

Locatable Minerals

Small-scale mining operations (largely placer) and hard-rock exploration and due-diligence activities to maintain claims in good standing are likely to continue in areas of known mineral potential. Additional areas are expected to become of interest as the administration continues to push for domestic supplies of minerals such as nickel and cobalt. Management of these types of actions may increasingly offer a challenge to the Blue Mountains national forests given their widespread occurrence and proximity to streams with threatened or endangered fish or fish habitat.

Exploration projects on the Wallowa-Whitman National Forest near Unity are currently exploring a potential copper porphyry deposit as well as a known brownfield underground lode deposit. While these projects, and other potential exploration targets do not currently have proposed large scale mines there is always a possibility of large-scale development on any national forest. As commodity prices change and there is a continued push by Congress for domestically sourced minerals (30 U.S.C. 28) conditions may arise that would support development and investment in large-scale mining in Eastern Oregon. Additional exploration work is currently proposed on private lands in the Elkhorns that may impact or involve National Forest System lands in the future.

Leasable Minerals

Oil and gas, hardrock, solid leasable, coal, and non-energy leasable exploration and development in the Blue Mountains national forests are expected to be low. While there is potential for interest in geothermal leasing it is unexpected in the near term as other higher potential areas in the country remain unleased. If a nomination was submitted to the Bureau of Land Management for any leasing activities the effected national forest would be required to consent to the lease. As part of this process an environmental analysis would be performed prior to any consent to lease. During this process the effected forest may add stipulations to a potential lease indicating restricted surface occupancy and other mitigations.

Saleable Mineral

Utilization and demand for mineral materials will likely increase over the life of the forest plan. This increased demand will be related to construction and maintenance of infrastructure located within and adjacent to the Blue Mountains national forests. Most of this demand will come from in-service work, such as road maintenance or road construction for timber sales.

Renewable Energy

There is no geothermal, solar, or wind energy infrastructure at the industrial scale on the three national forests, and none are proposed currently. The Wallowa Whitman Nation Forest has two hydroelectric Federal Energy Regulatory Commission licenses within the planning area. Individual use hydroelectric or solar energy sources are known to occur under permit or as an ancillary portion of an authorization. The forest service has been adding solar energy sources to fire lookouts to improve radio communications throughout the area. The future of biomass as energy like the system developed in Harney county took partners working together. Continued coordination will help drive renewable energy sources. See the Oregon Department of Forestry's video "Biomass Success in Burns Oregon. (https://youtu.be/r2YioqekvTc?si=ZpxK0OWwns6FMqZP).

Literature Cited

Kao, S., McManamay, R.A., Stewart, K.M., Samu, N.M., Hadjerioua, B., DeNeale, S.T., Yeasmin, D., Pashua, F.K., Oubeidillah, A.A., Smith, B.T. 2014, New Stream-Reach Development: A Comprehensive Assessment of Hydropower Energy Potential in the United States: U.S. Department of Energy, 196 p., https://info.ornl.gov/sites/publications/Files/Pub46481.pdf

Schulz, K.J., DeYoung, J.H., Jr., Seal, R.R., II, and Bradley, D.C., eds., 2017, Critical mineral resources of the United States—Economic and environmental geology and prospects for future supply: U.S. Geological Survey Professional Paper 1802, 797 p., http://doi.org/10.3133/pp1802.

State of Oregon, Bordman to Hemingway Transmission Line. December 6, 2023. https://www.oregon.gov/energy/facilities-safety/facilities/pages/b2h.aspx

White, Eric M. 2010. Woody biomass for bioenergy and biofuels in the United States a briefing paper. Gen. Tech. Rep. PNW-GTR-825. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 45 p.

Geological Hazards

Introduction

Geologic hazards are geologic processes or conditions (naturally occurring or altered by humans) that are a potential danger to public health and safety, infrastructure, and resources. Geologic hazards on the Blue Mountains national forests include landslides, floods, acid-producing rocks, waterfall hazards, ultramafic rocks with asbestos minerals, radon, radioactive minerals, regional tectonic and volcanic activity, type and strength of local bedrock units, presence of subsurface voids or hazardous gasses, local climate, the presence of steep topographic slopes and abandoned mines. Some geologic hazards have the potential to affect public safety and infrastructure on and off the Forest and in adjacent communities.

Geologic hazards have the potential to radically change the environment. Landslides are most likely to cause damage to infrastructure and potential loss of life. Despite better engineering, landslides may be triggered by extreme rain events. Current management activities or approaches often do not have the ability to eliminate geological hazards.

Process and Methods

Hazards created by natural causes typically involve topography, precipitation, and inherent cohesion of the soil and rock strata. Human caused hazards typically involve roads, water management systems, dams, and mining operations. Some incidents occur resulting from a combination of human and underlying causes. Natural events typical disturb the ecosystems periodically such as flood or landslides with less frequency. Some historic hard rock mining areas cause acid mine drainage and placer mining negatively impacted stream function and fish habitat. Engineers, geologists, and other specialists are tasked as appropriate to lessen impacts to ecosystems.

Current Management Direction

Federal laws and agency regulations provide some guidance for geologic hazards, noting that hazard zones should be identified, that infrastructure should avoid known hazard zones, and that best practices and common sense should be used to avoid or mitigate known or suspected geologic hazards. Many counties have also prepared emergency plans. Umatilla County's Natural Hazards Mitigation Plan, includes consideration of earthquakes, landslides, and volcanic events.

Existing Condition

Many ancient landslides were formed during periods when the climate was much wetter. Today, landslides may be common where steep slopes, weak geologic structures, certain soil types, human activity, and water as rain, river, or runoff combine.

Geologic hazards today are focused near past and present mining activity. Mining activities are concentrated in areas of higher mineralization formed by natural geologic processes. Mining led to the establishment of communities around the mines.

Key Benefits to People

Key contributions to social and economic sustainability from ecosystem services, multiple uses, infrastructure and operations.

The Big Sink and Magone Lake: The Big Sink, on the Umatilla National Forest, is a large depression that may have formed following the end of the ice age. It is 1 kilometer wide by more than 3 km long. The Confederated Tribes of the Umatilla Indian Reservation believes this area is spiritually un-natural and members should avoid this area.

Another landslide in the early 1800s formed Magone Lake on the Malheur National Forest. Today, it is a popular recreational destination.

Risks and Stressors

Historically, landslides and extensive downstream flooding are often triggered by rain-on-snow events.

Trends and Drivers

While the goal is zero negative events, we can't control them completely. We can avoid some activities that may cause or be affected by events or mitigate the effects through better engineering and design. We can better identify hazards through more precise studies and our ability to recognize, study, and mitigate geological hazards continually improves.

Currently abandoned mine lands are being examined and remediated while current mining activities are monitored, and reclamation bonds ensure mining sites will be cleaned up following activities. Landslides may occur creating fish barriers and increased sediment in rivers, to the detriment of aquatic creatures.

The Blue Mountains national forests encompass a large geographic area with a variety of geologic parent materials, including both bedrock and surficial geologic features. Such features include basic igneous rocks, clay producing deposits, acid igneous rocks, lakebed sediments, metamorphic rocks, and sedimentary rocks. It also includes glacial deposits (till, outwash), recent and old alluvium, and aerially deposited materials, such as loess and volcanic ash. All have been modified to a degree by the actions of wind, water, gravity, and vegetation over time resulting in the wide variety of taxonomically defined soils present today.

Information Needs

Inventory of know landslides and a map of lands with high landslide potential.

Key Findings

Landslides and floods and other geologic hazards have occurred historically and will continue to occur. Existing policy and agency guidance to managers regarding geologic hazards is sufficient to address and remediate incidents. Additional forest plan management direction is not needed.

Appendix A – National Mineral Resource Assessment Maps

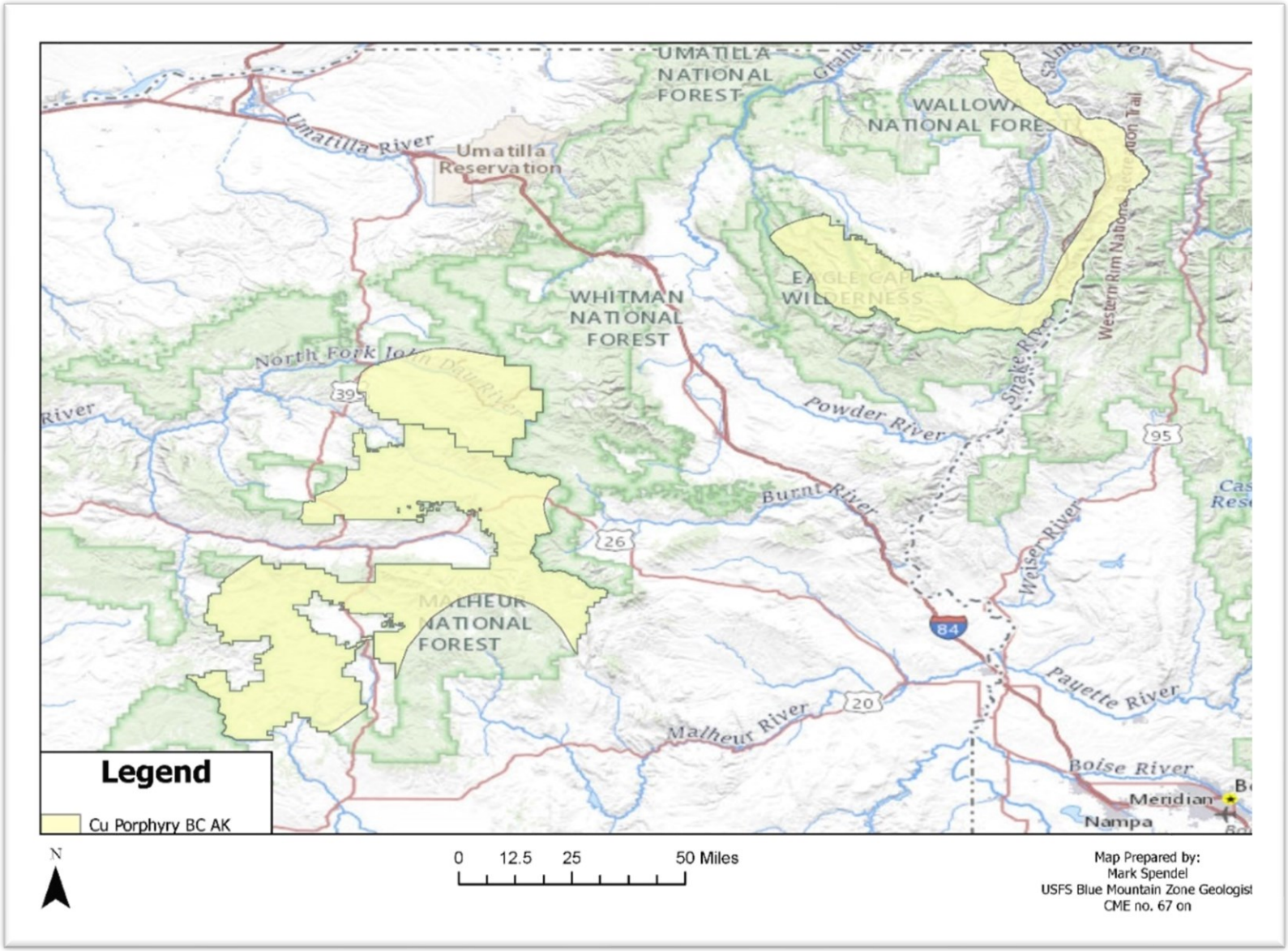

Figure 1. USGS National Mineral Resource Assessment (1998) Copper Porphyry British Columbia Alaska Type.

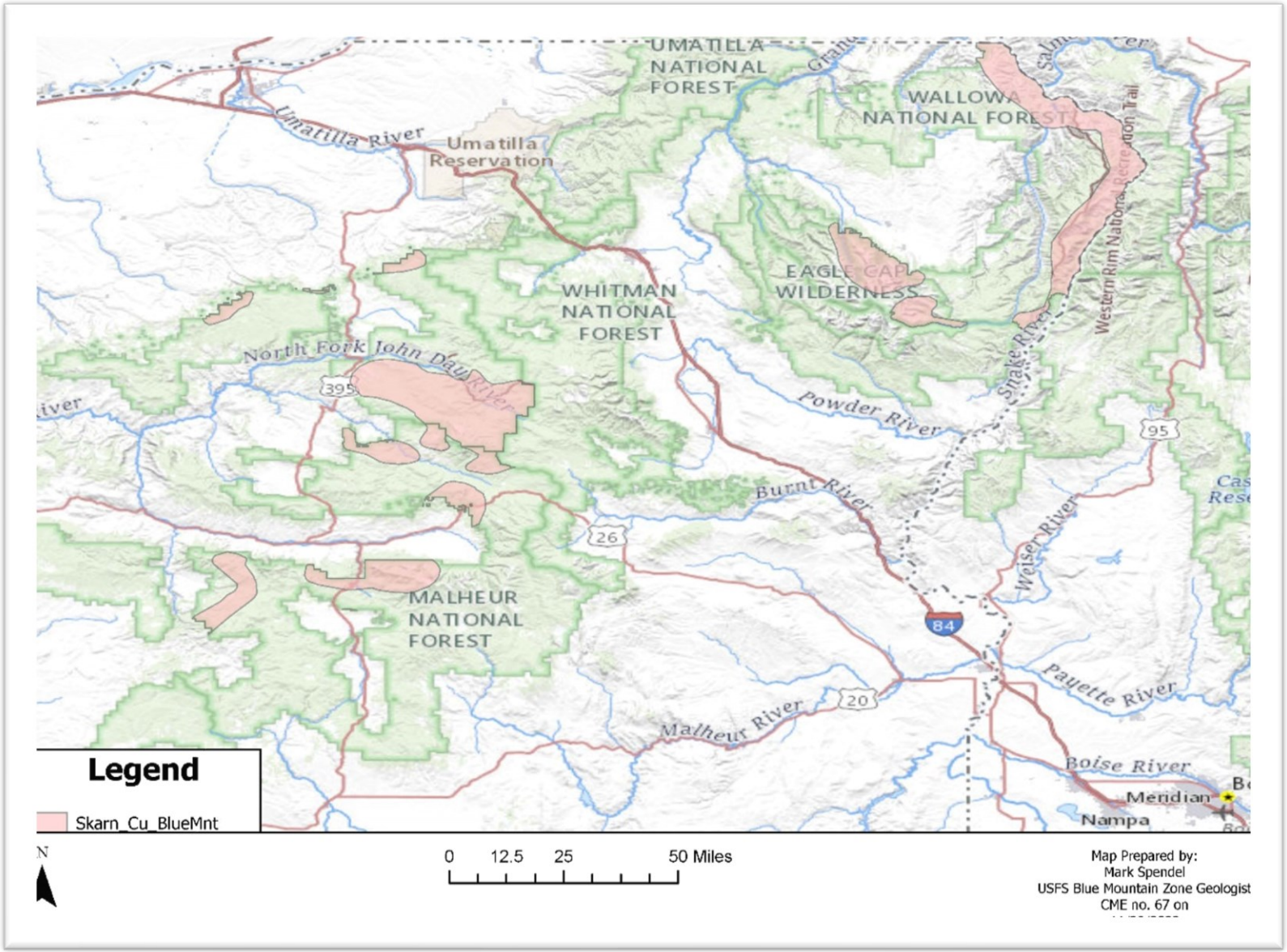

Figure 2. USGS National Mineral Resource Assessment (1998) Copper Porphyry British Columbia Alaska Type.

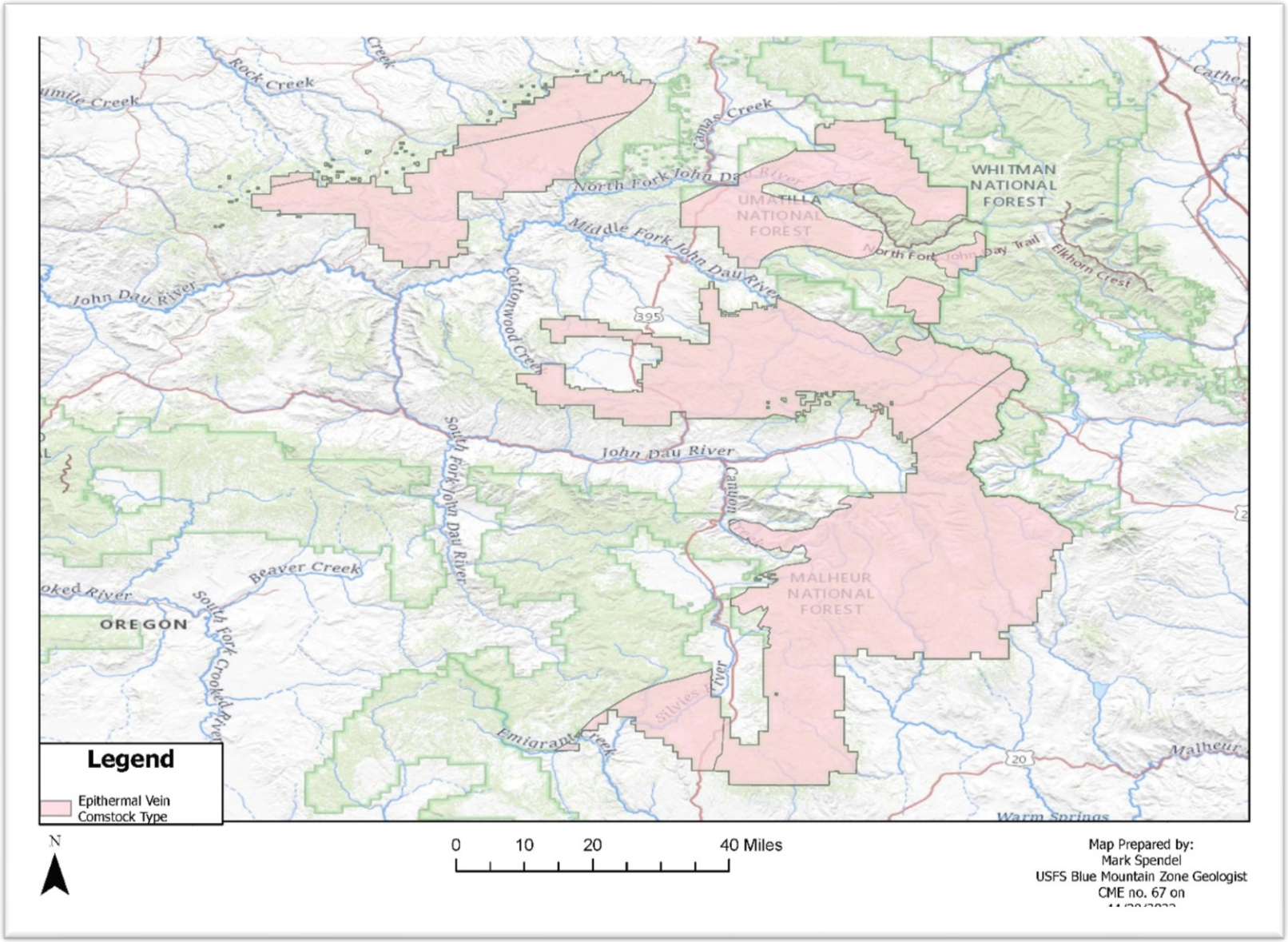

Figure 3. USGS National Mineral Resource Assessment (1998) Epithermal Vein Comstock Type.

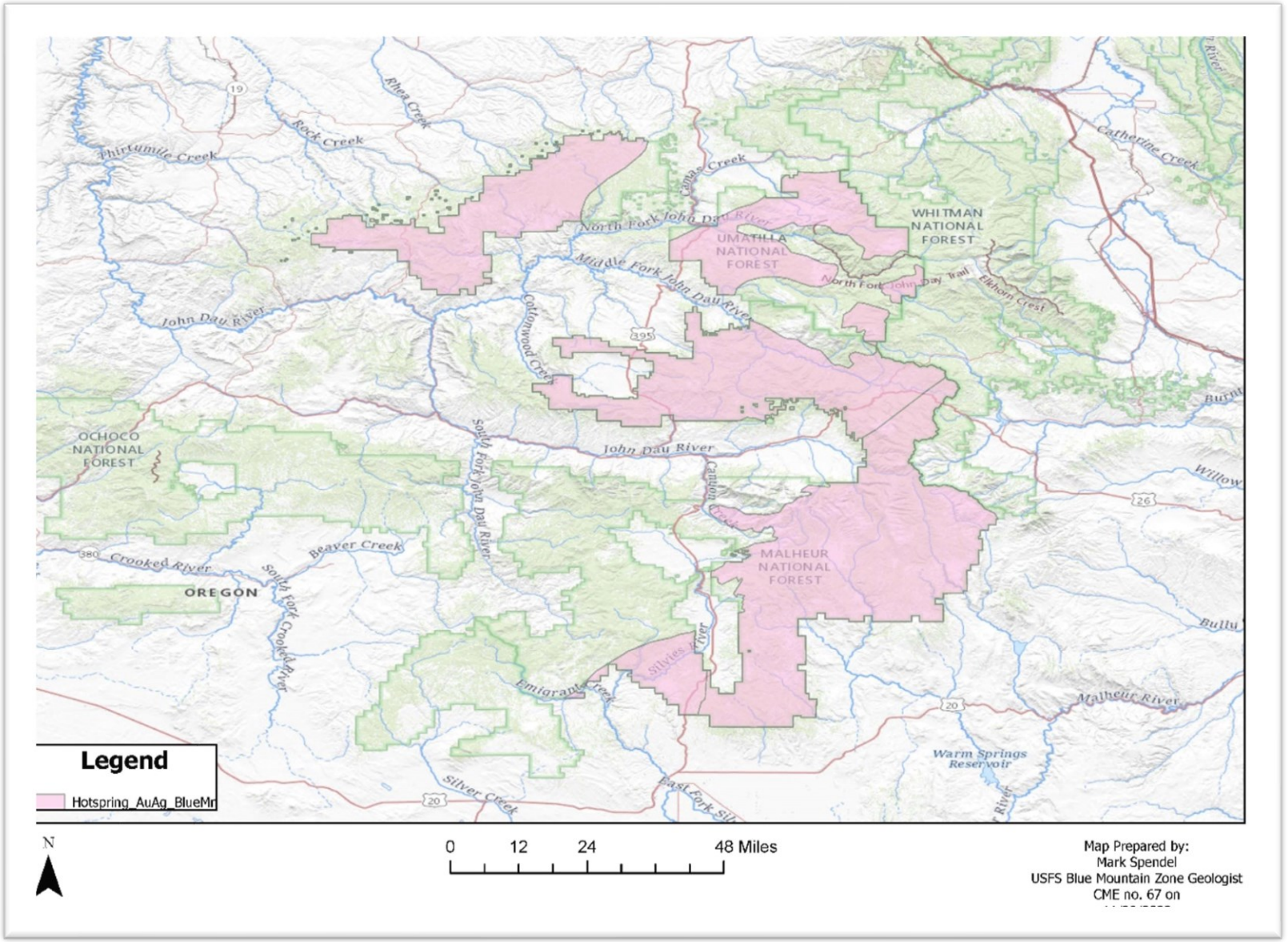

Figure 4. USGS National Mineral Resource Assessment (1998) Hot Spring Au Ag.

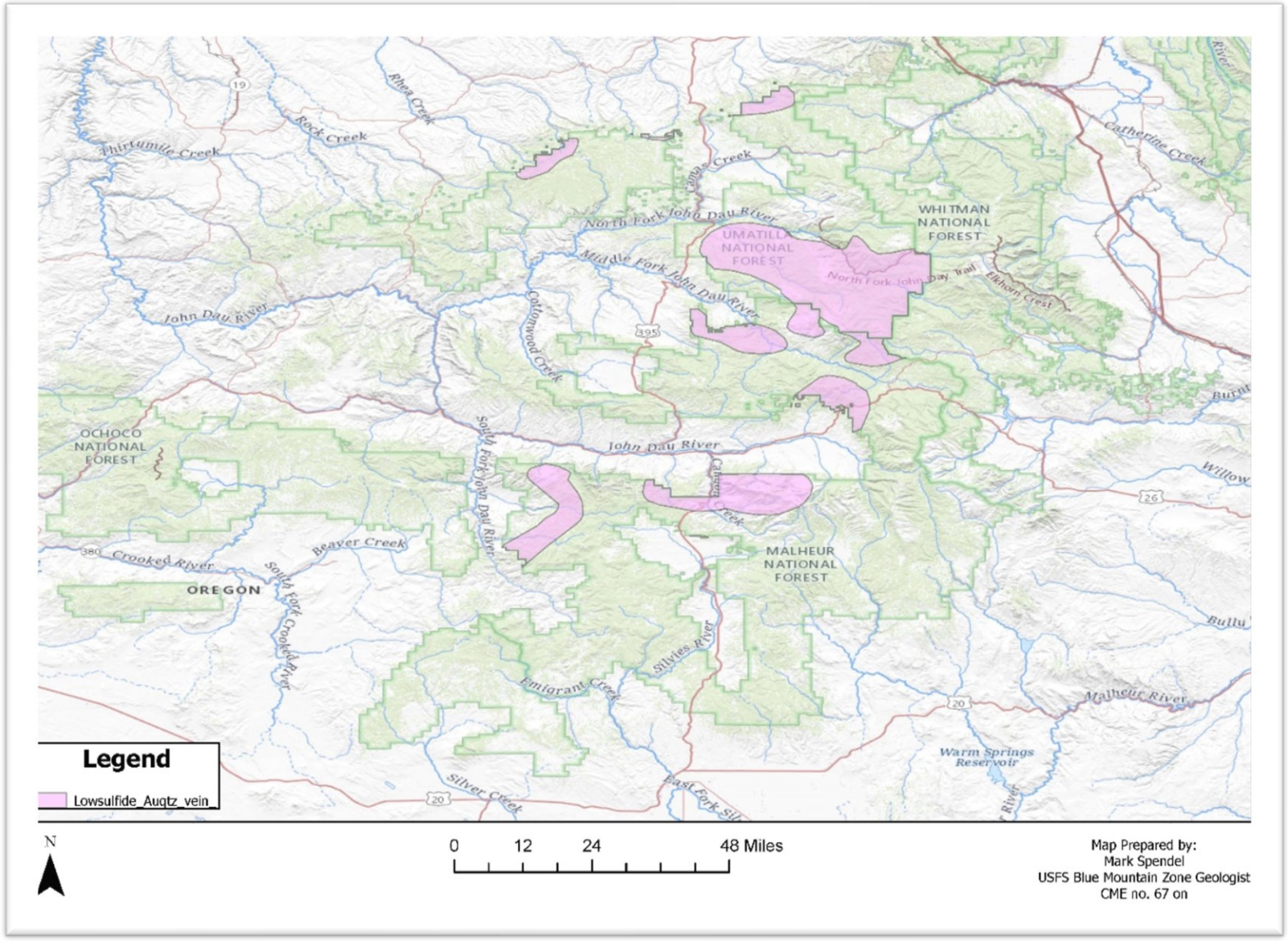

Figure 5. USGS National Mineral Resource Assessment (1998) Low Sulfide Au Quartz Vein.

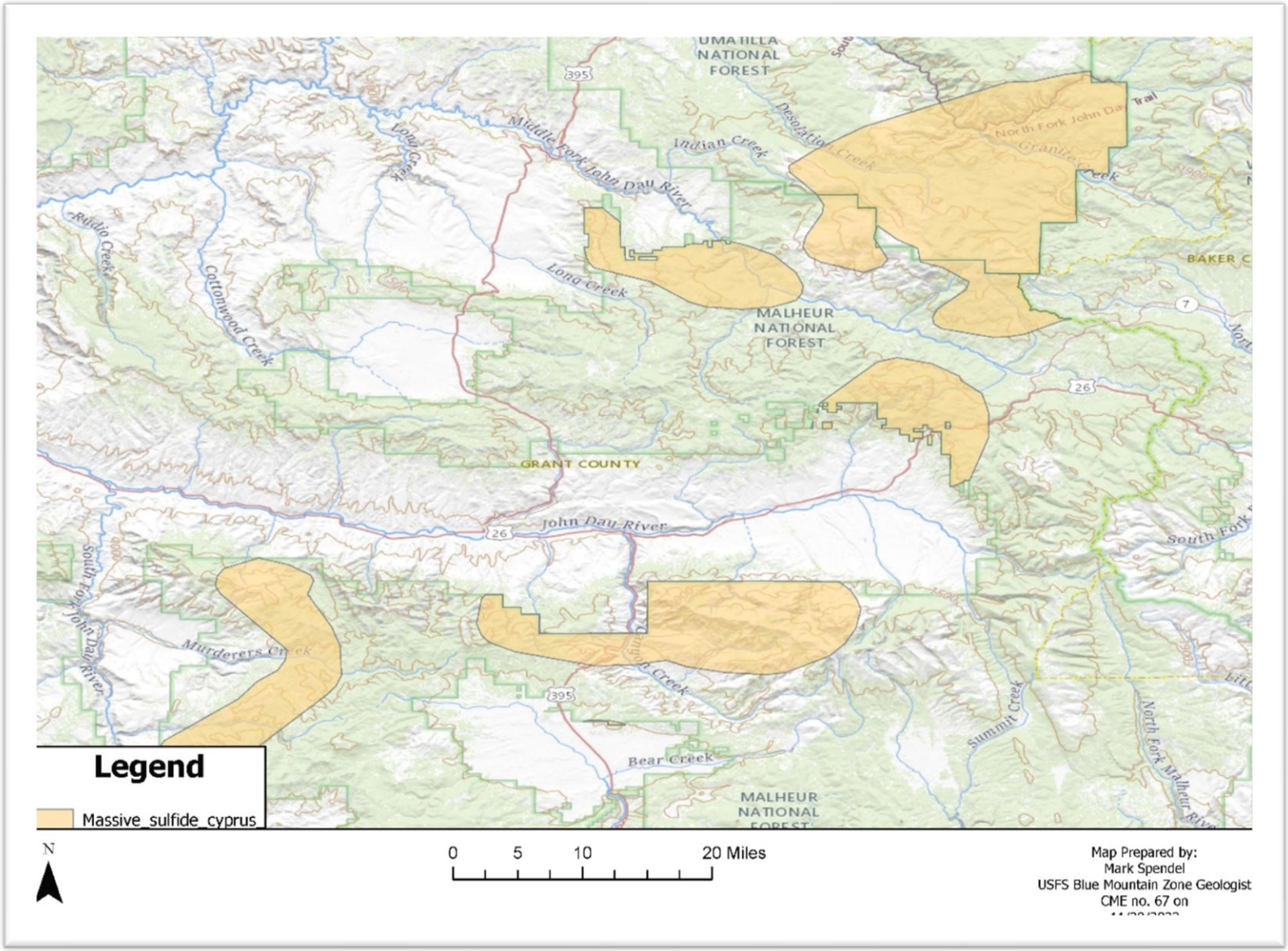

Figure 6. USGS National Mineral Resource Assessment (1998) Massive Sulfide Cyprus Type.

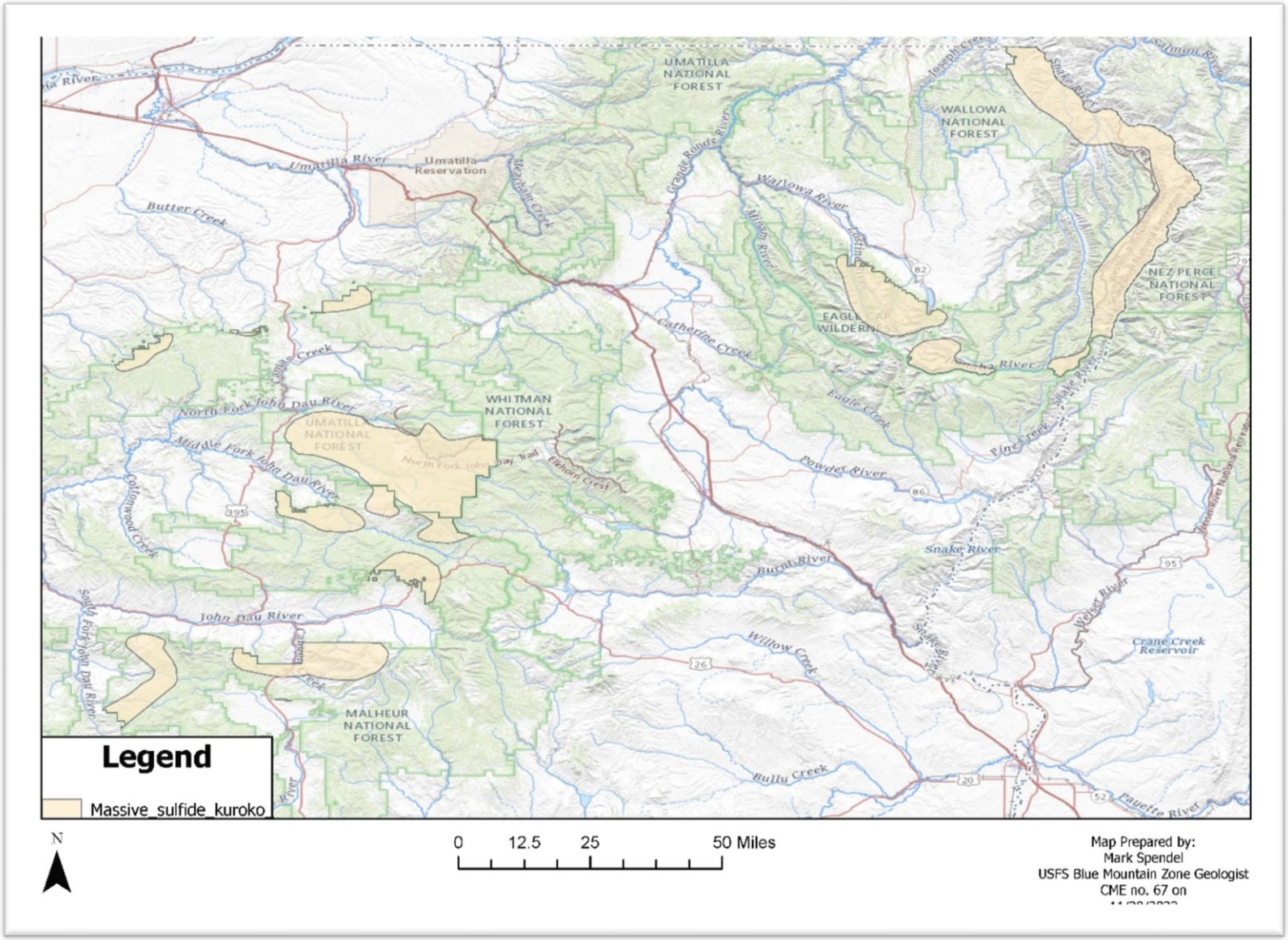

Figure 7. USGS National Mineral Resource Assessment (1998) Massive Sulfide Kuroko Type.

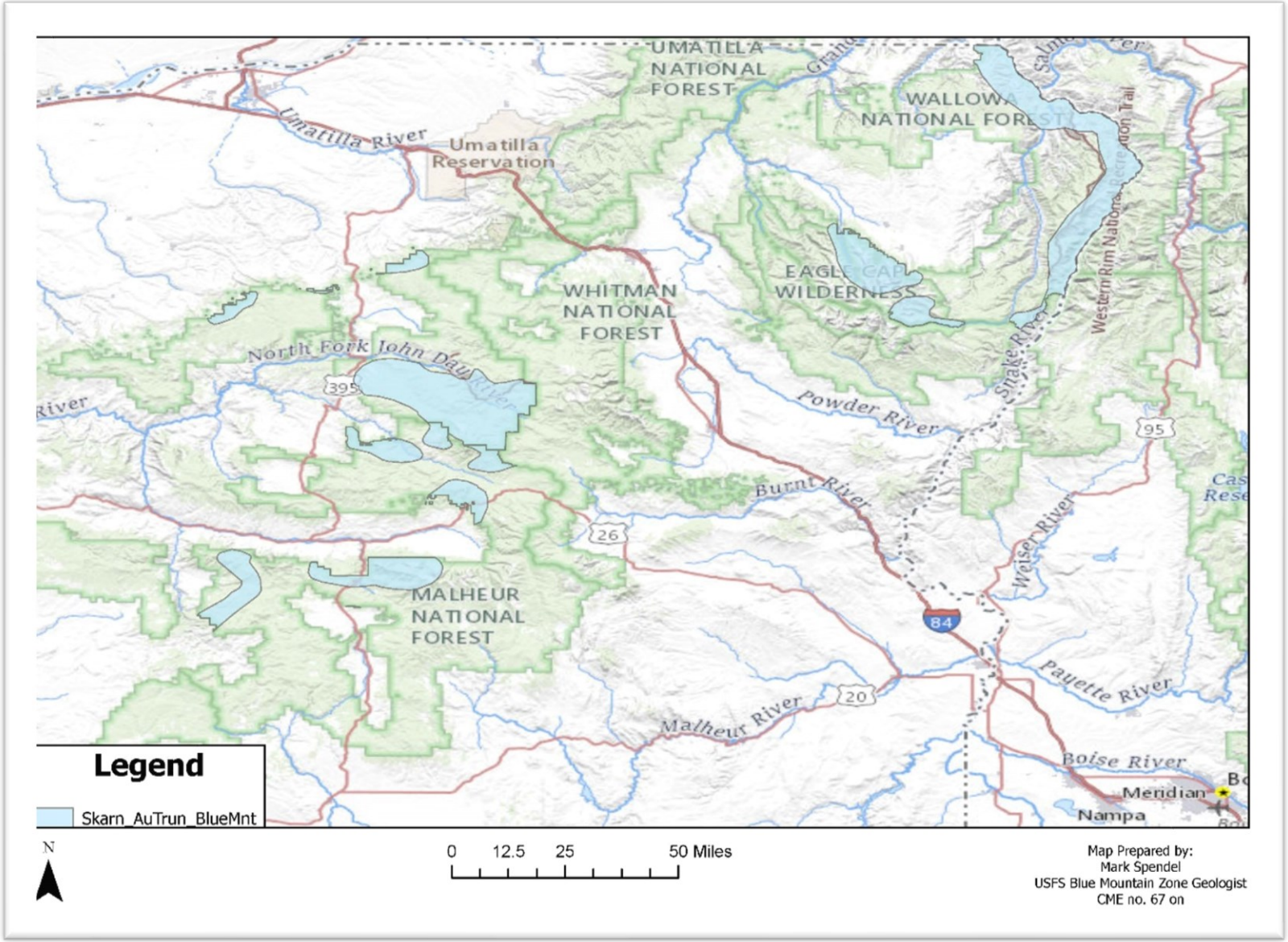

Figure 8. USGS National Mineral Resource Assessment (1998) Copper Porphyry British Columbia Alaska Type.

Appendix B – USGS Critical Mineral Focus Area Maps

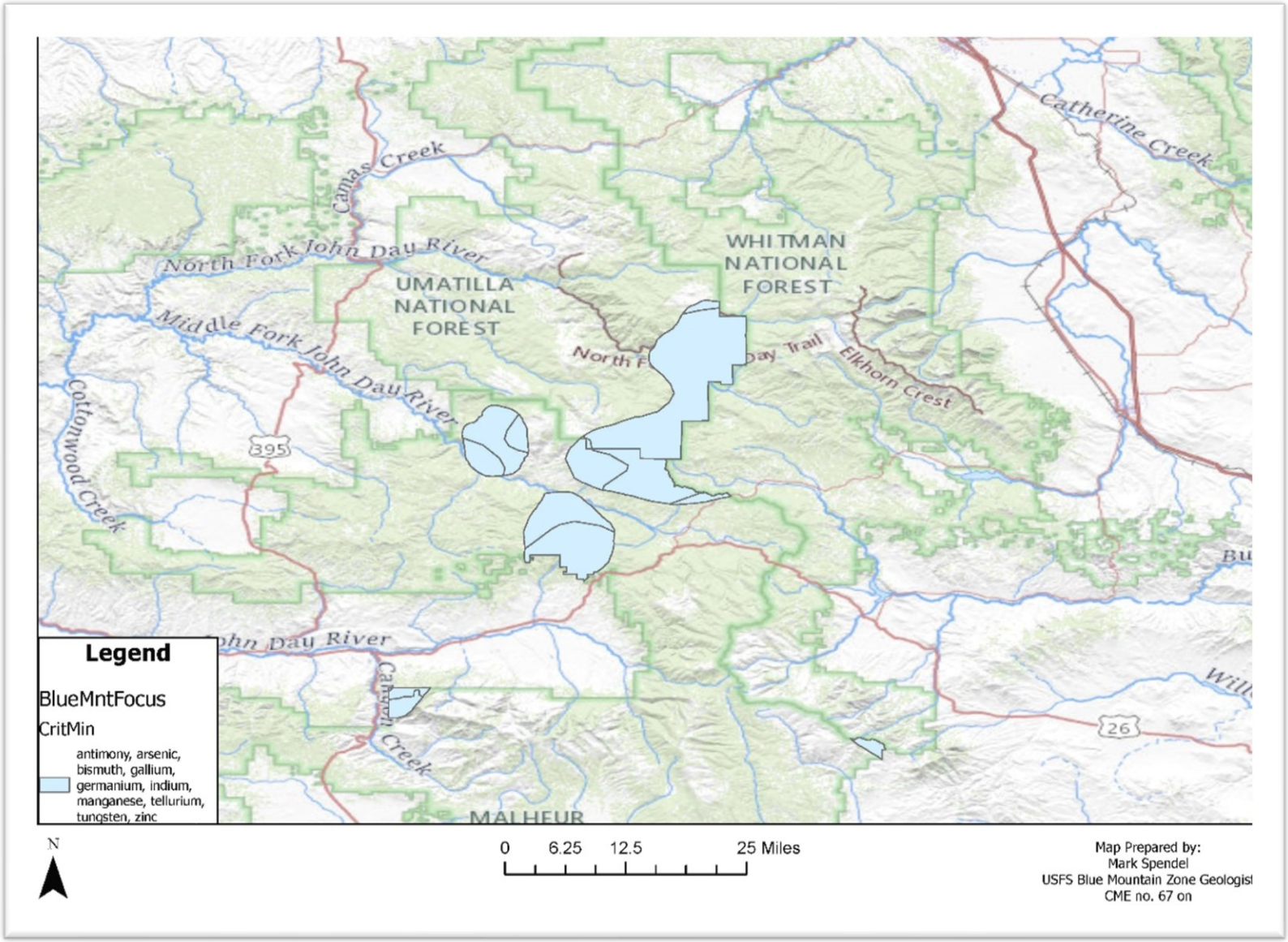

Figure 9. USGS Earth MRI Critical and Strategic Mineral Focus Area: Antimony, Arsenic, Bismuth, Gallium, Germanium, Indium, Manganese, Tellurium, and Zinc.

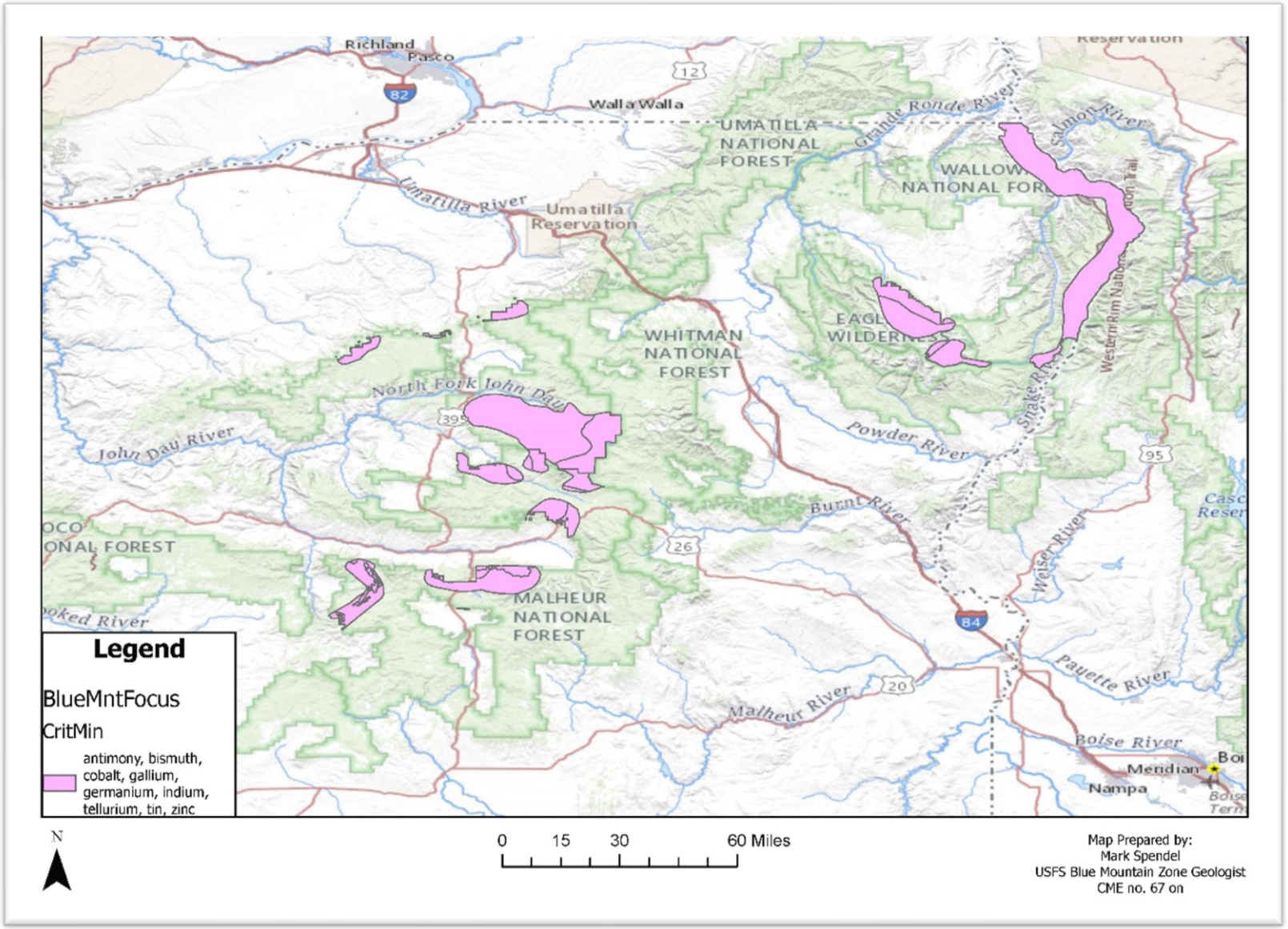

Figure 10. USGS Earth MRI Critical and Strategic Mineral Focus Area: Antimony, Bismuth, Cobalt, Gallium, Germanium, Indium, Tellurium, Tin, and Zinc.

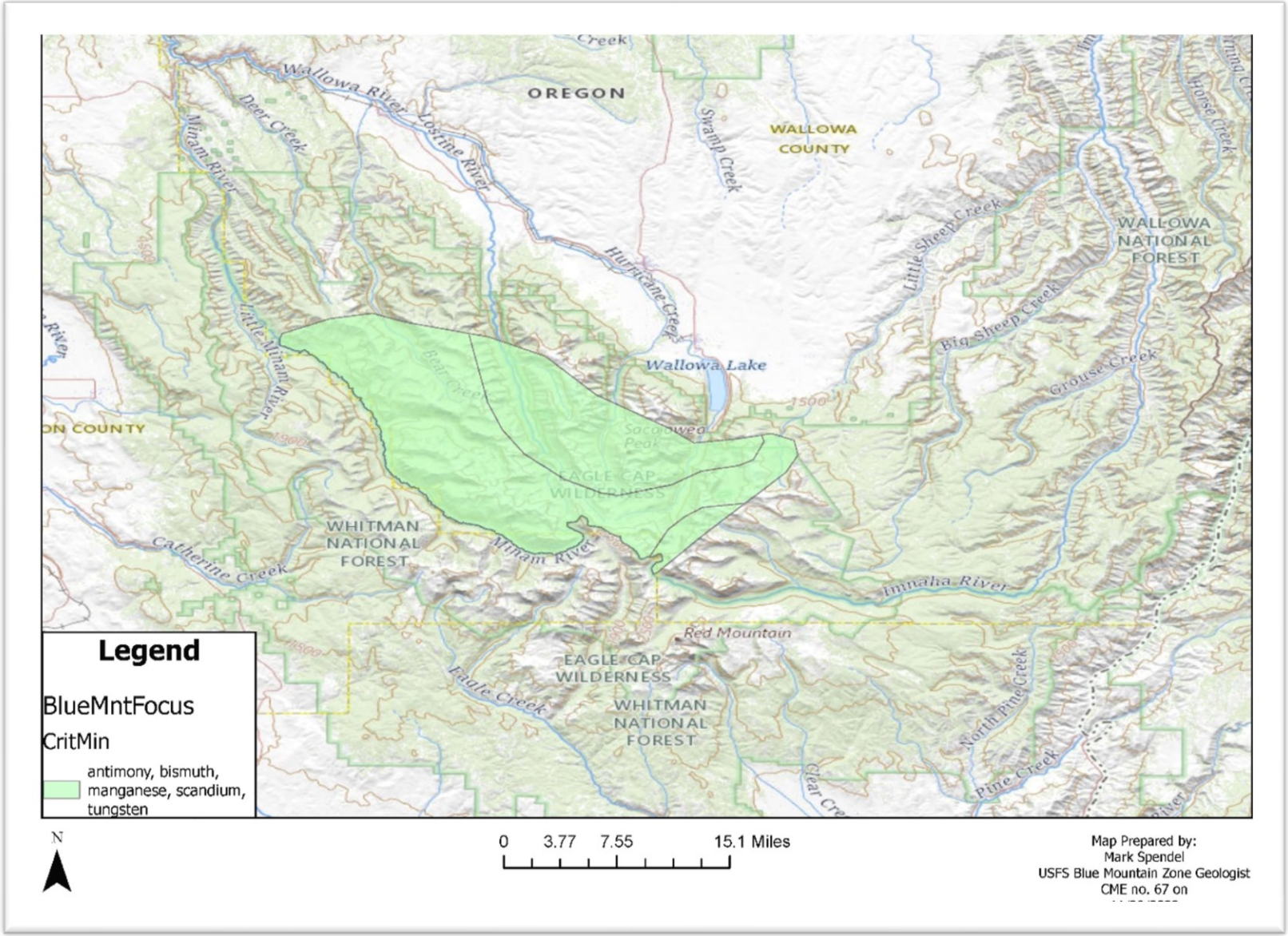

Figure 11. USGS Earth MRI Critical and Strategic Mineral Focus Area: Antimony, Bismuth, Manganese, Scandium, and Tungsten.

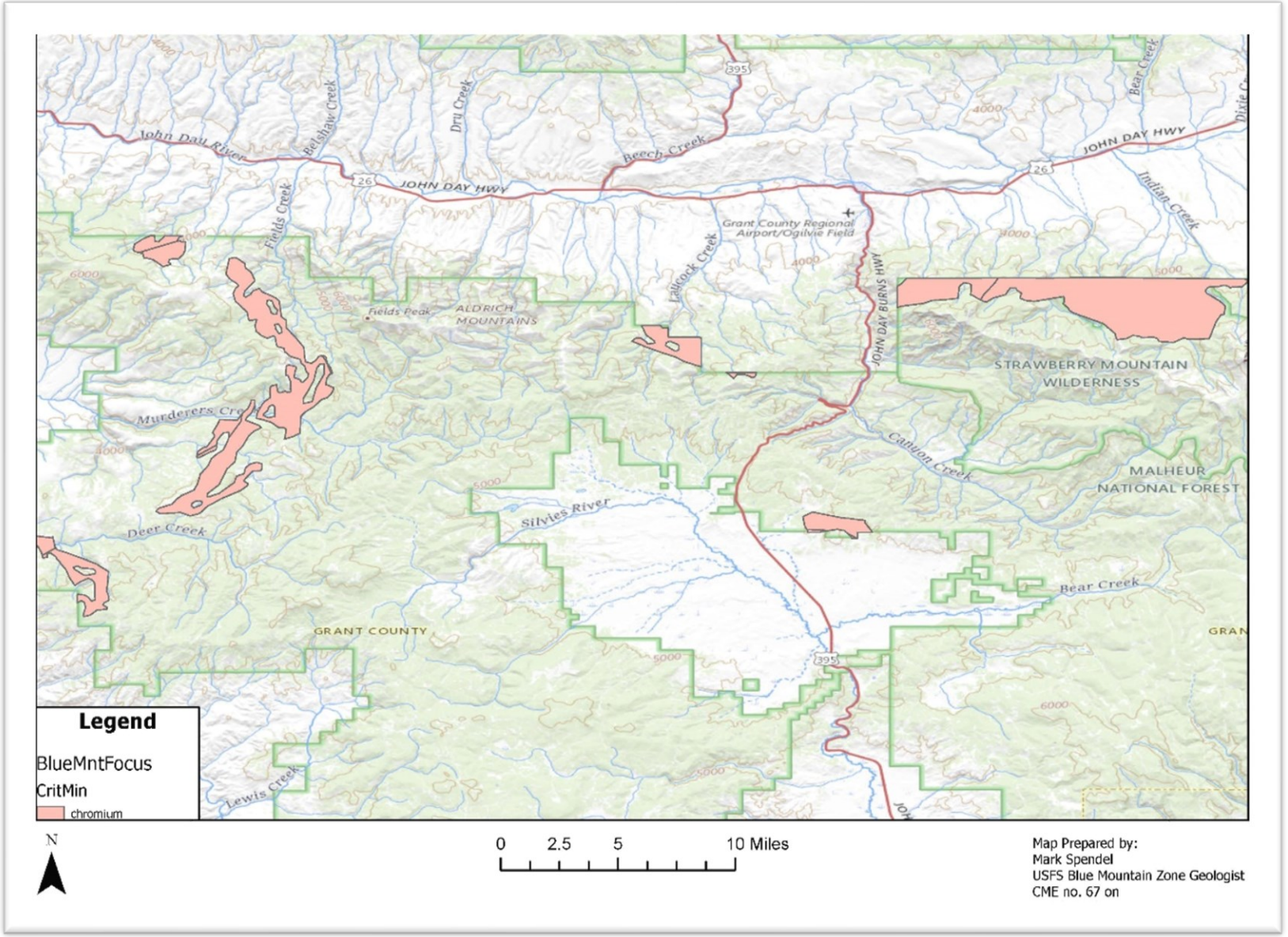

Figure 12. USGS Earth MRI Critical and Strategic Mineral Focus Area: Chromium.