EARTHWORKS

Sept. 28, 2015

Bureau of Land Management
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Re: Comments on the proposed mineral withdrawal: Docket No. 2015-15954

I am writing these comments on behalf of Earthworks, a national non-profit organization dedicated to protecting communities and the environment against the adverse impacts of hardrock mining. Earthworks has a long history of advocating for protection of the outstanding resource values in southwest Oregon, and we have members who enjoy hiking, fishing, floating, wildflower viewing and other activities in the region.

We commend the agencies for initiating this process, and we express our strong support for the proposed mineral withdrawal in aid of legislation for 95,806 acres of National Forest System lands on the Rogue River-Siskiyou National Forest and 5,216 acres of Bureau of Land Management lands on the Medford District and Coos Bay Districts. Such legislation is currently pending in the 114th Congress as S. 346 and H.R. 682 and identified as the "Southwestern Oregon Watershed and Salmon Protection Act of 2015."

A mineral withdrawal is needed to protect the extremely high conservation values offered by the public lands in this this region, including wild rivers, world-class salmon runs, globally significant botanical diversity, and tremendous recreational opportunities.

Protecting these resources is incompatible with hardrock mining, particularly nickel laterite strip mining. Owing to the outdated 1872 Mining Law, federal land management agencies have stated

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that they have no authority, outside a mineral withdrawal, to prioritize the protection of the outstanding resource values these public lands offer.

We ask that you provide the maximum possible interim protection available while Congress considers legislation to permanently withdraw those areas. At a minimum, the 5-year withdrawal is critical and immediately necessary. However, the Secretary of Interior should implement the full scope of her authority under FLPMA to implement a 20-year withdrawal, which is warranted in this case due to the area's outstanding values. And, the Forest Service should consent to the mineral withdrawal to provide the maximum protection for these public lands.

A mineral withdrawal is consistent with the considerable public investments in conservation in the region and it has tremendous public support.

Our more detailed comments are outlined below.

Sincerely,

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ATTN: ATTACHMENTS ARE FOUND ON THE ACCOMPANYING FLASH DRIVE.

1. THE MINERAL WITHDRAWAL IS NECESSARY TO PROTECT THE EXTREMELY HIGH CONSERVATION VALUES PROVIDED BY THESE PUBLIC LANDS.

A. Biological Diversity

The proposed mineral withdrawal contains public lands that exhibit tremendous conservation values. The Oregon portion of the Klamath Mountains ecoregion covers much of southwestern Oregon, including the Umpqua Mountains, Siskiyou Mountains and the interior valleys and foothills between these and the Cascade Range. The Oregon Department of Fish and Wildlife's Conservation Strategy 2006, describes the high conservation value of the region:[1]

> Partly because of its unique geology, the Klamath Mountains ecoregion boasts a high rate of species diversity, including many species found only locally. In fact, the Klamath Siskiyou region was included in the World Wildlife Fund's assessment of the 200 locations most important for species diversity worldwide. The region is particularly rich in plant species, including many pockets of endemic communities and some of the most diverse plant communities in the world. For example, there are more kinds of cone-bearing trees found in the Klamath Mountains ecoregion than anywhere else in North America. In all, there are about 4000 native plants in Oregon, and about half of these are found in the Klamath Mountains ecoregion. The ecoregion is noted as an Area of Global Botanical Significance (one of only seven in North America) and world "Center of Plant Diversity' by the World Conservation Union. The ecoregion boasts many unique invertebrates, although many of these are not as well studied as their plant counterparts.

The area's value for biological diversity is reiterated by the Forest Service, "The Klamath Siskiyou Mountains are considered a center of diversity and endemism. Species of special assemblages occur in this geographic area and nowhere else in the world. Much of the area's diversity is attributed to the extensiveness of serpentine landscapes and the endemic species they support."[2]

Roughly 50% of the North Fork of the Smith River watershed supports the unique plant communities associated with ultramafic-derived soils. Larger expanses of this soil type exist in the following subdrainages: upper Chrome Creek, the middle portion of Baldface Creek, Hardtack Creek, Cedar Creek, and Lemmingsworth Gulch.[3]

The Rough and Ready Creek watershed is renowned for its botanical diversity and abundance of rare plant species. Scientific and educational interest in the area (along with the rest of the Josephine Peridotite Sheet) is high. Several botanical areas have been designated within the Rough and Ready Creek area. The BLM ACEC, Forest Service Rough and Ready Botanical Area, Forest Service Oregon Mountain Botanical Area, and the State Botanical Wayside. The

[1] Oregon Department of Fish and Wildlife, Oregon Conservation Strategy, 2006. P. 190.
[2] See: http://www.fs.fed.us/wildflowers/communities/serpentines/center/index.shtml
[3] Id.

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botanical resources are also recognized as an Outstandingly Remarkable Value (ORV) within the Rough and Ready Creek corridor. The presence of many rare and endemic plant species throughout the area has been documented in the following reports:

> *Appendix F of the Siskiyou National Forest Plan FEIS includes a description of the Rough and Ready Botanical Area.
>
> *A Preliminary Flora for the Rough and Ready Creek watershed (Borgias 1994) included 278 species.
>
> *The 1993 Rough and Ready Wild and Scenic River Eligibility Study includes known and potential plant lists.
>
> *The Oregon Natural Heritage Program (ONHP) maintains a database of known rare plant habitats and sites. This database has been updated to include plant surveys accomplished in 1997.
>
> *The West Fork Illinois River Watershed Analysis discusses 45 Siskiyou endemics found within the West Fork Illinois River Watershed, many of which also grow in the Rough and Ready Creek area.

The U.S. Fish and Wildlife Service also highlights the tremendous conservation value of the region, stating that:

> "The K-S bioregion is well-known for its vast array of unusual and endemic flowering plants. This is exemplified by BLM and USFS having established thousands of acres of Areas of Critical Environmental Concern and designated botanical areas, particularly in Rough and Ready Creek, due to rare and endemic plants. Several of the rare plant species include ESA protected Gentner's fritillary and Cook's desert parsley, which occur in the proposed withdrawal area. Protection of the withdrawal area will further conservation of the listed plants by providing broad distribution and sources of connectivity for these small and isolated plant populations. Straddling the Oregon-California border, the K-S bioregion contains some of the largest concentration of intact watersheds on the west coast and world renowned biodiversity. These exceptionally high resource values, including several federal candidate and listed species, makes mining incompatible with the resource values and conservation investments in the bioregion. For these reasons, I urge the land management agencies to follow through on the proposed mineral withdrawal of the approximately 100,000 acres of federal lands in the K-S bioregion."[4]

Scientists have determined that protecting large, complex landscapes in the Klamath-Siskiyou ecoregion is an important long-term action to alleviate climate change impacts on biodiversity.[5]

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[4] USFWS, Memo to State Director BLM, Comments on the proposed mineral withdrawal by the Bureau of Land management and United States Forest Service in southwestern Oregon, 9/25/2015.
[5] Olson, et al., "Climate Change Refugia for Biodiversity in the Klamath-Siskiyou Ecoregion." Natural Areas Journal, 32(1): 65-74.2012.

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According to a recent journal article, "Although the Klamath-Siskiyou Ecoregion has been a refuge for species during past climate change events, current anthropogenic stressors are likely compromising its effectiveness as a refugium for this century's projected changes. Opportunities for climate change response for vulnerable taxa will necessarily be local due to a limited capacity of many species to move to new habitat, even over relatively small distances where land use practices create inhospitable conditions. The ecoregion's distinctive and endemic serpentine-substrate flora also is at risk and possible refugia are sites that will retain wet soil conditions, such as seeps and bogs."[6]

B. Wild and Scenic Rivers

The proposed mineral withdrawal contains the highest concentration of wild rivers in the nation. It contains the headwaters to a number of nationally significant Wild and Scenic Rivers. Baldface Creek is a tributary of the National Wild and Scenic North Fork Smith River. Rough and Ready Creek is a tributary of the Wild and Scenic Illinois and the Wild and Scenic Rogue rivers. Rough and Ready Creek and Baldface Creek are nationally outstanding and "eligible" to be added to the National Wild and Scenic River System. The USDA recommended Congress designate 34,000 acres of their watersheds as Wilderness in 2004.

Baldface Creek flows into the National wild and Scenic North Fork Smith River just two river miles from the Oregon/California border. In 1994, the Siskiyou National Forest found Baldface Creek and all its perennial tributaries to have outstandingly remarkable water quality and fishery values, making the stream and its tributaries eligible to be added to the National Wild and Scenic River System.[7]

The mainstem creek and its tributaries meet the highest potential classification of a Wild River Area. Taylor Creek and its unnamed tributary are perennial tributaries of Baldface Creek, and as such are eligible Wild and Scenic Rivers with the classification of "Wild." It is the policy of the Forest Service to protect these streams' "outstandingly remarkable values" and classification of all Eligible Wild and Scenic Rivers until Congress acts on the agency's findings.

The main stem and North Fork of Rough and Ready Creek was found eligible for Wild and Scenic River status. Botanical, Wildlife and Geological/Hydrological values were found to be Outstandingly Remarkable.

The Forest Service has already contributed substantial resources to studying the area and has confirmed that the Rough and Ready Creek Watershed contains "incredible natural values" and mining in the area would result in "irreversibÌe and significant" impacts.

Rough and Ready Creek is noted for its unusual channel morphology and large substrate in its lower gradient, unrestricted reaches. The alluvial fan at the mouth of Rough and Ready Creek is unique for a stream of this size within the Klamath Province. Thus, the geological/hydrological

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6 Id.
7 USDA Forest Service, North Fork Smith Wild and Scenic River Management Plan, Siskiyou National Forest, March 2003.

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character of the main stem is considered an Outstandingly Remarkable Value.[8]

C. Nationally Significant Fisheries

The U.S. Fish and Wildlife Service describes the K-S bioregion as an expression of its biological diversity and unique evolutionary history. It says that because of these unique factors, it hosts some of the productive salmon and steelhead fisheries outside of Alaska.[9] The agency further states that "Salmonid strongholds, including ESA listed Coho salmon and nationally significant Wild and Scenic Rivers, occur throughout the proposed withdrawal area. Pacific lamprey, a Service Species of Concern, also occurs throughout the proposed withdrawal area. Withdrawing this area from mining will provide needed long-term habitat conservation benefits to lamprey and native freshwater resident fishes while simultaneously benefiting anadromous salmonid species."[10]

The California Department of Fish and Wildlife considers the Smith River Watershed one of two watersheds in California described as "irreplaceable" with respect to salmonid population resiliency and biodiversity.[11] The CDFW removed the Smith River from further appropriation of water in California in 1998 based on a number of factors including, the basin's uniqueness in California for the river's free-flowing status and highly dynamic discharge, as well as the basin's high botanical diversity, renowned anadromous fisheries, and its Wild and Scenic status.

Baldface Creek is considered essential to the vitality of the world-class fishery in the Smith River watershed, "*The world-class fishery on the Smith River depends on the water and fish produced in the Baldface drainage*."[12] Of the fish producing streams in the North Fork of the Smith watershed, Baldface Creek is remarkable in its variety of habitats and very high fish production potential.[13] The Wild and Scenic River Eligibility Study states that: Baldface Creek provides some of the best water quality and fisheries habitat known on the Siskiyou National Forest.

The Eligibility Study also notes: Numerous springs are fed by groundwater from the highly fractured ultramafic bedrock. The cold water from the seeps and fens, although not great in quantity, contribute to cool summer stream temperatures. (Page 5) There are numerous small wetland seeps, Darlingtonia bogs and springs that aid in maintaining lower [stream] temperatures. (P. 10) Water quality is good to excellent. Water quality (chemical, biological, productivity) could be of [the] highest value for stream in the region (P. 9).

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[8] USDA, Nicore Mining Plan of Operations: Final Environmental Impact Statement, 1999.
[9] USFWS, Memo to State Director BLM, Comments on the proposed mineral withdrawal by the Bureau of Land management and United States Forest Service in southwestern Oregon, 9/25/2015.
[10] Id.
[11] Oregon Water Resources Department, Final Order to Deny, Limited License Application LL-1533, September 30, 2014.
[12] USDA Forest Service, Wild and Scenic River Eligibility Study: Baldface Creek and Its Tributaries, Siskiyou National Forest, November 1993.
[13] USDA Forest Service, North Fork of the Smith River Watershed Analysis, Iteration 1.0, Siskiyou National Forest, October 31, 1995.

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Baldface Creek provides near-pristine spawning and rearing habitat and is a source of high quality water on which the anadromous fishery of the Smith River depends. (P. 11). Baldface Creek and its tributaries provide habitat for native naturally reproducing populations of Chinook Salmon, Coho Salmon, Steelhead trout and cutthroat trout. Coho Salmon are protected under the Endangered Species Act as "threatened."

The Hunter Creek and Pistol River provide habitat for important runs of native salmon, steelhead and cutthroat. The Hunter Creek and Pistol River coho are of the federally threatened Southern Oregon Northern California Coastal Coho Evolutionarily Significant Unit and the small remaining runs in both streams are recognized as dependent populations that help with interconnectivity to independent runs in larger river systems to the north and south.[14] Winter steelhead are state sensitive (vulnerable) species and a federal Species of Concern, and Coastal cutthroat trout are a federal Species of Concern.

D. Rare Wildlife

According to the U.S. Fish and Wildlife, "the forested landscape of the K-S bioregion also provides a stronghold for rare forest carnivores such as the Pacific fisher and Humboldt marten. Federally listed avian species such as the northern spotted owl and marbled murrelet and their designated critical habitats occur here as well. The removal of forest habitat, which is an outcome of strip and hardrock mining, would contribute threats to carnivores and avian species as well as other native terrestrial and aquatic species. Withdrawing this area from mining will alleviate habitat loss threats and contribute to the possibility of not listing candidate species because of intact habitat remaining on the landscape."[15]

2. THE PROPOSED MINERAL WITHDRAWAL IS ESSENTIAL TO PROTECTING THE NATURAL RESOURCES THAT CONTRIBUTE TO THE ECONOMIC HEALTH OF THE REGION.

Wild rivers, world-class fisheries and unique botanical treasures are the basis for a thriving and sustainable recreation/tourism based economy in the region. Travelers spent $245 million in Curry and Josephine Counties in 2013, nearly all of which by those who came to the area as a destination rather than just passing through.[16]

In 2008 recreationists spent more than $40 million (2013 dollars) in Curry and Josephine Counties, combined, on shellfishing, fishing, hunting, and wildlife viewing.[17] According to a

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[14] National Marine Fisheries Service, "Final Recovery Plan for Southern Oregon Northern California Coast Evolutionarily Significant Unit of Coho Salmon (Onchorhynchus kisutch)," (2014) chapters 11 and 12 Available at: http://www.westcoast.fisheries.noaa.gov/protected_species/salmon_steelhead/recovery_planning_and_implementation/southern_oregon_northern_california_coast/southern_oregon_northern_california_coast_salmon_recovery_domain.html
[15] USFWS, Memo to State Director BLM, Comments on the proposed mineral withdrawal by the Bureau of Land management and United States Forest Service in southwestern Oregon, 9/25/2015.
[16] Dean Runyan Associates. 2014. *Oregon Travel Impacts 1991–2013p*. Oregon Tourism Commission, April.
[17] Dean Runyan Associates, Inc. 2009. *Fishing, Hunting, Wildlife Viewing, and Shellfishing in Oregon, 2008*, May.

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study by the Outdoor Industry Association, outdoor recreation in Oregon generates $4 billion in wages and salaries each year.[18]

3. HARDROCK MINING IS INCOMPATIBLE WITH THE PROTECTION OF THE EXCEPTIONALLY HIGH CONSERVATION VALUES CONTAINED IN THE PROPOSED MINERAL WITHDRAWAL AREA, PARTICULARLY FOR MINE PROCESSES WITH AN EXTREMELY LIMITED TRACK RECORD.

The serpentine soils that are the basis for the unique botanical value of the region have attracted foreign mining companies interested in mining nickel laterite deposits in the region. Laterite deposits are close to the surface so they are mined by strip mining methods. These deposits are also low-grade, which results in the production of a significant volume of mine waste. This type of large-scale land disturbance results in impacts that are unavoidable and incompatible with protecting the exceptionally high conservation values within the proposed mineral withdrawal. Mining and other construction activities, including building and road construction, have had a long history of drastic detrimental impact on serpentine plant communities worldwide.[19]

The U.S. Fish and Wildlife Service also contends that strip mining is incompatible with protecting these high conservation values, stating that, "The mineral withdrawal is needed because the Service believes that mining activities are incompatible with the high resource values of this bioregion and do not align with the conservation of Federal trust species which the Service is entrusted to protect and conserve."[20]

Biodiversity

Ni-laterite mining is highly destructive because extensive areas are strip-mined for their soil.[21] Strip-mining for nickel laterite typically involves removing the serpentine topsoil down to bedrock. This results in drastically disturbed barren substrate that is erosive and fails to naturally revegetate, even after several decades. Topsoil application is not possible in the case of Ni laterite mining, where the soil itself is mined and removed as ore.[22] As a result, nickel laterite mining is a direct threat to the high botanical values of the area.

This is well illustrated by the nickel mine near Riddle, Oregon, the only nickel mine in the U.S., which operated until the 1990s. A 2012 Google earth image of the mine clearly shows the lack of vegetation more than twenty years later.

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[18] https://outdoorindustry.org/images/ore_reports/OR-oregon-outdoorrecreationeconomy-oia.pdf
[19] Odell, Ryan E. and Victor P. Claasen, Serpentine Revegetation: A Review, Northeastern Naturalist, 16(5) 253-271.
[20] USFWS, Memo to State Director BLM, Comments on the proposed mineral withdrawal by the Bureau of Land management and United States Forest Service in southwestern Oregon, 9/25/2015.
[21] Id.
[22] Harrison and Rajakaruna, Serpentine: the Evolution and Ecology of a Model System, University of California Press, 2011.

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The impacts of nickel mining to serpentine soils and the rare plants they support has also been acknowledged by the federal and state agencies involved in The Interagency Serpentine Fen Conservation Agreement, which states: “large scale mining of serpentine associated minerals (nickel, chromium, copper and gold) would clearly pose a threat to these taxa if undertaken in areas where they occur.”[23] The agencies also point to past mining operations as the likely cause for the local extinction of serpentine Darlingtonia plant communities: “The mining at Nickel Mountain was likely responsible for loss of the Douglas County population of rare plants.”[24]

In its “Conservation Assessment for the Gasquet Manzanita,” the Forest Service also identifies nickel mining as a conservation threat to Gasquet Manzanita, another high value conservation species: *“Based on the renewed interest in nickel mining in the Siskiyou Mountains this activity must be considered a conservation threat to this species because of its affinity to occur within the ultramafic serpentine soils which are the same areas where nickel can be found.”*[25]

Habitat loss and impacts to biodiversity from nickel laterite mining have been documented at other operations as well.[26]

Water Quality/Fisheries/Wildlife

Strip mining exposes heavy metals and compounds that can runoff and leach into streams. Such pollution can impair the habitat of fish and other aquatic species, thereby reducing population levels. Even where species survive, toxic materials can lower reproduction and growth rates. Strip mining also causes increased turbidity and siltation of streams and ponds, greater variation in stream flow levels and water temperature, and stream dewatering, all of which can contribute to the endangerment of aquatic species.[27]

A landscape level study found that mines can act as a regional source of stress to stream fishes, similar to urban land use and agriculture.[28] In that study, fish assemblage threshold responses to mining were detected in three large ecoregions and through use of thousands of samples, indicated that mining may have negative effects on assemblage diversity and evenness, numbers of game species, as well as numbers of species with specific life history strategies, habitat preferences and trophic ecologies. Fish metric threshold responses detected in this study occurred with relatively low densities of mines in stream catchments. For example, a single mine

[23] USFWS, Conservation Agreement for Hastingsia bracteosa, H. atropurpurea, Gentiana setigera, Epilobium oreganum, and Viola primulifolia ssp. Occidentalis and serpentine Darlingtonia wetlands and fens from Southwestern Oregon and Northwestern California. 2006. Available at: https://www.fws.gov/oregonfwo/ToolsForLandowners/HabitatConservationPlans/ConsvAgreements/SerpentineFen-CA_6-2006.pdf
[24] Id.
[25] USDA, “Conservation Assessment for Gasquet Manzanita (Arctostaphylos hispidula) Within the State of Oregon,” March 2010. http://www.fs.fed.us/r6/sfpnw/issssp/documents/planning-docs/ca-va-arctostaphylos-hispidula-2010-03.pdf
[26] Devalsam, I., et al., “Laterite Exploitation and its Impact on Vegetation Cover in Calabar Metropolis, Nigeria, Journal of Environment and Earth Science Vol 4, No. 6, 2014
[27] Udall, “The Environmental Effects of Strip Mining,”
[28] Wesley M. Daniels, et al. “Characterizing coal and mineral mines as a regional source of stress for stream fish assemblages” Ecological Indicators 50 (21014) 50-61

in a medium-sized river basin (>1000 square km.) has the potential to alter fish assemblage in the stream draining that catchment.

Metals can be discharged from mine operations and associated facilities and enter surface water, ground water, and soils. The EPA has determined that the main anthropogenic sources of nickel in water are primary nickel production, metallurgical processes, combustion and incineration of fossil fuels, and chemical and catalyst production (USEPA 1986). This can adversely affect aquatic life, vegetation, and terrestrial wildlife. For example, the Glenbrook ore loading and stockpiling facility in Coos Bay, which was used for off-loading, storage and distribution of nickel ore from 1992 to 1998, resulted in water and soil contamination.[29] Two large nickel ore stockpiles were located on the eastern half of the property. The ore was dried, crushed and shipped from the site to Glenbrook's nickel smelting facility in Riddle Oregon. The State of Oregon determined that nickel and manganese were released into groundwater in four locations at the site. They also found soils contaminated with petrochemicals and sediment around the dock contaminated with nickel and manganese, which levels that presented a risk to birds.[30] Nickel was detected at levels that ranged from 1,420 mg/kg to 7,600 mg/kg. The ROD concluded that soil contamination posed a threat through a direct exposure pathway for ecological receptors, especially birds. Groundwater contained levels of arsenic, manganese, and nickel that exceeded marine criteria. Oregon DEQ also found approximately 39,000 cubic yards of soils contaminated with metals and petroleum and the Glenbrook Nickel mine site near Riddle, Oregon.[31]

Scientists have determined that metal contamination in surface water can cause fish to lose their sense of smell, thus affecting their ability to mate, find food and avoid predators.[32] Nickel specifically attacks neurons that help fish smell food.[33] Numerous studies spanning several species have shown that ecologically relevant exposures to common pollutants such as metals and pesticides can interfere with fish olfaction and disrupt life history processes that determine individual survival and reproductive success.[34] Avoidance thresholds for some of these exist in the microgram per liter range (e.g. copper and nickel).[35]

Chemicals used to process the ore have the potential to enter the environment as a result of truck wrecks, on-site spills, tailings spills product concentrate slurry spills or water collection and treatment failures. Sulfuric acid, or other processing chemicals, are used to process the ore at nickel laterite operations.

Although there are no nickel laterite operations in the U.S. to determine failure rates, spills have been well documented at nickel acid leaching operations elsewhere, including the Goro Mine,[36]

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[29] Oregon DEQ, Record of Decision, "Glenbrook Nickel Coos Bay Facility, Unit 1 Uplands Area, Coos Bay, Oregon. Nov. 2006. http://www.deq.state.or.us/lq/ ECSI/ecsidetail.asp?seqnbr=3408
[30] Id.
[31] http://www.oregon.gov/DEQ/pages/index.aspx
[32] Azizishirazi, Ali, et. al. Olfactory recovery of wild yellow perch from metal contaminated lakes, Ecotoxicology and Environmental Safety, 88(2013) 42-47
[33] Id.
[34] Keith Tierney, et. al., "Olfactory Toxicology in Fish," Aquatic Toxicology, 96 (2010) 2-26. http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/docs/cmnt081712/sldmwa/tierneyetal2009.pdf
[35] Id.
[36] http://www.canadianminingjournal.com/news/comment-riots-at-goro-cause-30m-in-damage/1003085909/

which has experienced five spills since 2009, the Raventhorpe operations,[37] and the Ramu Mine.[38]

Potential failure rates for nickel laterite mines for spills and other accidental releases, wastewater collection and seepage failures can be found by referring to copper sulfide mines in the U.S. Many of these operations also use sulfuric acid leaching for processing. A recent peer-reviewed study, which reviewed government records for pipeline failures or other accidental releases at 14 out of 16 currently operating copper porphyry mines in the U.S. found that 100% experienced at least one or more accidental release.[39] This failure rate indicates a high likelihood that an accidental release may occur at the proposed operations.

The risks may also be greater at nickel mining operations because nickel laterites require larger concentrations of acid than gold or copper leaching operations. According to Galea et al. 2010, nickel laterites average >300 kg/ton of sulfuric acid, compared to 0.1-0.5 for gold and 6-18 kg/ton for copper sulfides.[40]

The perception that modern mining techniques can effectively prevent water quality impacts has been effectively challenged by a recent comprehensive study of modern U.S. mines.[41] The study compared predicted water quality impacts to observed impacts found at a sample of 25 U.S. mines. In summary it found that:

- 100% of mines predicted compliance with water quality standards prior to operations (assuming pre-operations water quality was in compliance).
- 76% of mines exceeded water quality criteria as a result of mining.
- 64% of mines employed mitigation measures that failed to prevent water quality contamination.

Similarly, extensive case studies in *Fisheries* describe the impacts to aquatic life from modern hardrock mines regulated under the 1872 Mining Law, and identify the inadequacies of the existing regulatory structure.[42]

Mining the nickel laterite deposits in the proposed mineral withdrawal area is of particular concern because there is little to so little experience with heap leaching of nickel laterite deposits in the U.S. or elsewhere. Of the various acid leaching methods (HPAL, EPAL, etc.) available, a representative from the Red Flat Nickel Corporation stated that heap leaching is the most likely

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[37] http://www.proactiveinvestors.com/companies/news/58806/first-quantum-shuts-ravensthorpe-nickel-plant-due-to-acid-spill-58806.html

[38] http://ramumine.wordpress.com/2011/03/08/serious-chemical-spill-at-ramu-mine-refinery/

[39] Earthworks. 2012. *U.S. Copper Porphyry Mines Report: The Track Record of Water Quality Impacts Resulting from Pipeline Spills, Tailings Failures and Water Collection and Treatment Failure*. Washington, DC. Available at: http://ofmpub.epa.gov/eims/eimscomm.getfile?p_download_id=513584USEPA (U.S. Environmental Protection Agency). 2014. 910-R-14-001.

[40] Dhawan, Safarzadeh, Miller, Rajamani, Moats. Insights into heap leach technology, SME Annual Meeting, Seattle, WA February 19-22, 2012. Preprint 112-119.

[41] Kuipers, J.R., Maest, A.S., MacHardy, K.A., and Lawson, G. 2006. Comparison of Predicted and Actual Water Quality at Hardrock Mines: The reliability of predictions in Environmental Impact Statements. Available at: http://ofmpub.epa.gov/eims/eimscomm.getfile?p_download_id=513581

[42] Woody et. al., The Mining Law of 1872: Change is Overdue," Fisheries, Vol. 35, No. 7. July 2010.

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method the company would use for processing.[43] Yet, according to a paper presented at a 2013 mining conference in San Antonio Texas, no stand-alone commercial operation for heap leaching of nickel laterite ores has been established.[44] Although there are numerous gold and copper heap leach operations in the U.S., heap leaching for laterite ores presents unique challenges and there are no long-term heap leach laterite ore operations to demonstrate that this process can be done without adverse impacts.

The paper points to many unique risks associated with this heap leach processing of laterite ores, including heap instability, especially in high rainfall locations.[45] Heap leach operations require high acid consumption, and the heaps also typically operate at close to 100C so that expensive materials of construction are needed. The problems and risks associated with heap leaching of laterite ore is further discussed in a May 2009 presentation:[46]

> The geotechnical behavior of laterites is significantly different from other ore types, and this is aggravated by strong acid leaching. Freshly agglomerated nickel laterite ores can have relatively good strength and permeability, but both non-agglomerated and leached agglomerates can have very poor geotechnical properties. Leached ore can also experience significant changes in physical and chemical properties with time and exposure to acid, creating complexities in modeling the behavior as well as sampling and testing. Shear strength will decrease as the agglomerates degrade and a large fraction (20 to 30%) of the mass of the ore is dissolved. Permeability decreases (often by a factor of 100) due to the same factors and can be aggravated by reprecipitation of iron compounds as is common in two-stage leaching. As the permeability decreases the in-leach ore experiences increasing saturation, which increases the vulnerability to liquefaction. By the end of the leach cycle, which can be longer than one year, the permeability may be sufficiently low that the heap effectively does not drain. This makes either working over the leached lift (in a multi-stack heap) or removing the ripios (in a dynamic heap) complicated in that even after weeks of drainage the ripios can be at over 90% saturation. Tests from several sites indicated that CBR (a common measure of traffic support capacity) can be under 5, which is too weak to support even low ground pressure equipment without some form of ground improvement (e.g., treatment and compaction, addition of a layer of waste rock, use of reinforcing grids, or a combination of all of these approaches). When placed in a ripios dump the traffic support capacity can be further reduced since any cohesion or fabric retained in the heap is lost, and the act of dumping the ripios can create excess pore pressures, reducing the shear strength and destabilizing the slopes.

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[43] See: https://vimeo.com/114082431 for presentation by Obie Stickler, Geologist for Red Flat Mining Corp.

[44] Taylor, Alan, "Laterites: Still a Frontier of Nickel Process Development" Presented at the March 3-7, 2013 TMS conference. http://www.altamet.com.au/wp-content/uploads/2013/04/Laterites-Still-a-Frontier-of-Nickel-Process-Developoment1.pdf

[45] Id.

[46] Steemson ML, and Smith ME: The Development of Nickel Laterite Heap Leach Projects," Proceedings of ALTA 2009 Nickel/Cobalt Conference, ALTA Metallurgical Services, Perth, Australia, May 2009. http://www.ausenco.com/uploads/papers/64024_The_Development_of_Nickel_Laterite_Heap_Leach_Projects.pdf

The authors also identified further post closure risks unique to laterite heap leach operations: Most mine closure designs are addressing large quantities of relatively stable waste rock or well-contained tailings. For spent nickel leach ore and plant residues, however, the materials are both relatively weak and degrading with time (especially if any residual acidity remains). This poses a challenge for the designer in predicting the long-term physical and chemical properties of the residues. The fact that nickel leach products age is something not well recognized in geotechnical engineering and some (perhaps most) data produced from geotechnical laboratories is not properly connected to the state of the samples tested (that is, the history of their production, the handling and ageing post-production) and this causes some problems in applying that data in the design. Thus, a key point in nickel project closure – both heap leaching as well as more conventional PAL or HPAL – is to properly address this in the geotechnical program.

Some of the other key closure issues facing nickel laterite heap leaching are:

- High rainfall: the need for and long-term performance of closure capping systems including the erosion control components.

- Settlement: heaps, residue dumps and RSFs will be subject to large post-closure settlement, which can disrupt drainage courses, affect pipes and other structural components, and rupture the capping system unless conservatively predicted and properly accommodated in the design. Large settlements can also adversely affect slope stability both by changing the slope configuration and by reducing the effectiveness of diversion and drainage systems (and wet slopes are far more likely to fail than dry ones).

- Post-closure maintenance: this will be more important than in an "average" mine due to factors such as climate, the physical and chemical properties of the residues, and often the high seismicity of the sites.

- Effluent management: All of the waste facilities will produce some effluent for some period after closure (e.g. consolidation water from the dumps and heaps), which could continue for several years after cessation of operations and completion of the closure construction. Some facilities, such as conventional slurry TSFs, can produce effluent on a long-term basis.

Given the lack of experience in the U.S. and elsewhere with heap leaching of laterite ores, the risks to the high conservation values in the proposed mineral withdrawal are considerable. This is not the place to experiment with unproven processing methods. Even if other mine processes are used, nickel laterite strip mining has unavoidable impacts that are incompatible with protecting the region for their high conservation values.

4. THE PROPOSED MINERAL WITHDRAWAL IS NECESSARY BECAUSE RECLAMATION OF SERPENTINE SOILS AND VEGETATION IS HIGHLY UNCERTAIN.

The presence of serpentine/ultramafic (lateritic) soils makes reclamation highly uncertain for exploration and mineral development in the proposed withdrawal area. Serpentine substrates are

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stressful environments for plant growth because of their adverse nutrient conditions, which limit plant productivity and reduce ground cover, even in some undisturbed sites. Serpentine substrates are frequently deficient in the essential macronutrients nitrogen (N), phosphorus (P) and potassium (K), have low calcium: magnesium (Ca:Mg) molar ratios and potentially high levels of phytotoxic heavy metals, including nickel (Ni), chromium (Cr) and cobalt (Co). Floras rich in endemics have evolved in response to the chemically adverse features of serpentine soils.

Mining and construction activities typically remove serpentine topsoil down to bedrock. Removal of topsoil results in loss of the important biological features associated with it, including rooting depth, water holding capacity, cation exchange capacity, organic matter, plant essential nutrients, plant seed, mycorrhizal propagules, and associated microbial communities.[47] These losses result in drastically disturbed barren substrate that is erosive and fails to naturally revegetate, even after several decades. The barren substrate results in elevated sediment and heavy metal transport to watersheds and are a source of windborne heavy metal and asbestos pollution. Topsoil application is not possible in the case of Ni laterite mining, where the soil itself is mined and removed as ore.[48]

The inability of such sites to become revegetated by natural processes leaves them susceptible to erosion and mass wasting, resulting in further degradation of the environment through sedimentation of local watersheds. Limited information exists on approaches to effectively revegetate severely disturbed, barren, subgrade (unconsolidated parent material) serpentine substrates.[49] Additionally, little is known about the invasion potential of exotic species from non-serpentine environments into adjacent, relatively uninvaded serpentine environments following restoration efforts.

5. THE MINERAL WITHDRAWAL IS NECESSARY TO PROTECT AGAINST THE PUBLIC HEALTH RISKS ASSOCIATED WITH THE EXPLORATION AND MINING ON SERPENTINE SOILS THAT CONTAIN ASBESTOS

Asbestos Related Health Risks

Most ultramafic rocks, including serpentinite, contain naturally occurring asbestos (NOA) particles microscopic needlelike particles of asbestos or asbestos-like fibers.[50] Asbestos has been classified as a carcinogen by state and federal agencies. The amount of asbestos that is typically present in these rocks range from less than 1% up to about 25%, and sometimes more.[51] Asbestos is released from ultramafic and serpentine rock when it is broken or crushed. This can happen when cars drive over unpaved roads or driveways, which are surfaced with these rocks, when land is graded for building purposes, or at quarrying operations. It is also released naturally

[47] Odell, Ryan E. and Victor P. Claasen, Serpentine Revegetation: A Review, Northeastern Naturalist, 16(5) 253-271.
[48] Harrison and Rajakaruna, Serpentine: the Evolution and Ecology of a Model System, University of California Press, 2011.
[49] Odell and Claasen et al. 2006. Relative performance of native and exotic grass species in response to amendment of drastically disturbed serpentine substrates. Journal of Applied Ecology, Volume 43, Issue 5, pages 898-908, October 2006.
[50] University of California, Division of Agriculture and Natural Resources, Facts about Serpentine Rock and Soil in California, August 2009. http://anrcatalog.ucdavis.edu/pdf/8399.pdf
[51] California EPA, http://www.arb.ca.gov/toxics/asbestos/general.htm

through weathering and erosion. Once released from the rock, asbestos can become airborne and may stay in the air for long periods of time. Soil disturbances that destroy soil aggregates and liberate individual particles or expose the parent rock to the atmosphere may increase the risk of exposure to asbestos particles.[52] It can present a public health hazard if released into the air as a result of mining operations, land clearing, road building, mine traffic, storm-water runoff, etc. Any exposure to asbestos fibers involves some risk of disease.[53]

The USDI's 2005 Mineral Report for the Nicore claim group states: Asbestos has been found in small veinlets with serpentinite at a number of locations within the Nicore Claims Group. How extensive or significant these occurrences are unknown. Asbestos is regulated as a hazardous air pollutant under the Clean Air Act, and the potential for generating airborne asbestos would need to be evaluated prior to any mining activity.

Hazardous Air Emissions

Nickel mining and smelting can result in public health risks associated with air emissions. In 1998, citizens filed a class action lawsuit against Glenbrook Nickel as a result of dust from mine operations.[54] The EPA also identified the public health risks of emissions at nickel smelter operations, including the Glenbrook smelter near Riddle, Oregon in its proposed rule-making to address hazardous air pollutants.[55] The proposed rules outline some of the serious human health and environmental impacts associated with metal mining and processing.[56]

6. DEVELOPMENT OF NICKEL LATERITE DEPOSITS IN THE PROPOSED MINERAL WITHDRAWAL AREA ARE UNLIKELY TO BE ECONOMICAL GIVEN ITS REMOTE LOCATION, LOW GRADE, INACCESSIBILITY TO PROCESSING FACILITIES AND LACK OF INFRASTRUCTURE

Historically, most nickel production has been derived from sulfide ores with laterite ores providing only a modest source. The major reason for this is the difficulty of processing nickel laterites compared to sulfides – laterite ores require extensive and complex treatment to extract nickel, and has historically been more expensive than sulfide ores.[57] There have been very few mining projects extracting laterite ores, and many of these have had major technical and financial difficulties (e.g. Moa Bay in Cuba or Greenvale-Yabulu in Australia).[58]

According to reports, the Red Flat and Cleopatra deposits contain <1.5% nickel[59], which would be more likely to be processed by hydrometallurgical methods (acid leaching) (See diagram

52 Id.
53 Id.
54 http://www.stollberne.com/case/honer-v-glenbrook-nickel-company
55 http://www.gpo.gov/fdsys/pkg/FR-1998-08-04/html/98-20511.htm
56 http://www.epa.gov/ttn/atw/ferroa/ferrofs.pdf
57 Mudd, G. M., 2009, *Nickel Sulfide Versus Laterite: The Hard Sustainability Challenge Remains*. Proc. "48th Annual Conference of Metallurgists", Canadian Metallurgical Society, Sudbury, Ontario, Canada, August 2009.
58 Id.
59 BLM, Nicore Mine Mineral Report, January 31, 2005.

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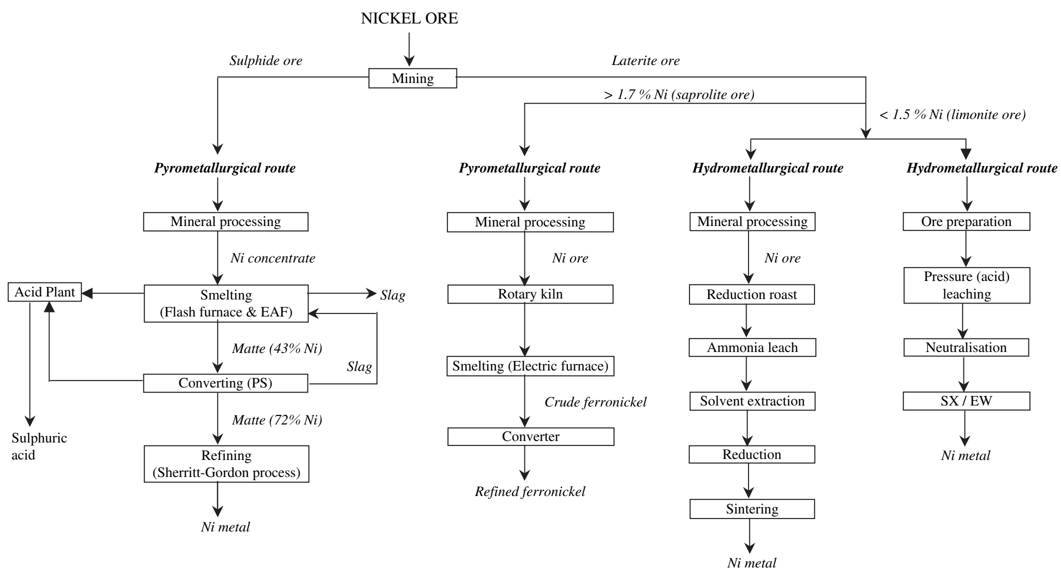
below).[60]

Currently, there are no nickel processing facilities in the U.S. The last processing facility was located in Riddle, Oregon, which closed due to declining nickel prices in the 1980s. As noted above, although the Red Flat Nickel Corporation said it is most likely to use heap leach processing, there are no stand alone, commercial heap leach nickel operations in the U.S. It is questionable whether the deposits in the proposed mineral withdrawal can be mined economically given their remote location, lack of infrastructure and the inaccessibility of processing facilities.



7. THE 1872 MINING LAW PRIORITIZES MINING OVER ALL OTHER LAND USES AND FAILS TO PROVIDE ADEQUATE SAFEGUARDS TO PROTECT THE HIGH CONSERVATION VALUE OF THE REGION.

The General Mining Law of 1872, more commonly known as the 1872 Mining Law, is the fundamental statute governing hardrock mineral development on the public lands.[61] Its central tenet, unchanged in 127 years, is that: "all valuable mineral deposits in lands belonging to the United States, both surveyed and unsurveyed, shall be free and open to exploration and purchase, and the lands in which they are found to occupation and purchase . . ."

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[60] Jahanshahi, Sharif, Assessing the environmental impacts of metal production processes. Journal of Cleaner Production. 2006.

[61] Act of May 10, 1872, 17 Stat. 91 (codified as amended at 30 U.S.C. §§ 22-47 (1994)). The Law, although originally covering most minerals, is now limited to what are commonly known as "locateable" minerals. The most important of these types of minerals are "hardrock" minerals such as gold, silver, copper, molybdenum, and uranium, among others. Non-uranium "fuel" minerals such as oil and gas and coal, were removed from operation of the Mining Law by the Mineral Leasing Act of 1920, 30 U.S.C. §§ 201-210 (1994) and are regulated under entirely separate statutory and regulatory regimes. In addition, the Surface Resources Act of 1947, as amended in 1955, removed "common varieties" of sand, stone, gravel, and clay from operation of the 1872 Law. *See* 30 U.S.C. §§ 601-615 (1994).

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Under The General Mining Law of 1872 and related case law, the United States Department of Agriculture (USDA) Forest Service prioritizes mining over all other land uses. The agencies assert that they have no authority to prohibit an otherwise reasonable plan of operations for such mining (i.e., one that can be characterized as the logical next step in the orderly development of a mine). As a result, the agency can only work to minimize the impacts of mining, rather than denying mining operations that would have adverse effects on high conservation values.

It is the position of the Forest Service that absent a mineral withdrawal the agency has no authority to prevent mining from occurring even to protect exceptional conservation values. This position is described in a preliminary decision memo regarding the proposal to conduct exploratory drilling at Red Flat *RFG38), Gold Beach Ranger Tina Lanier stated: "Under this law and related case law the United States Department of Agriculture (USDA) Forest Service has no authority to prohibit an otherwise reasonable plan of operations for such mining.[62] As a result, a mineral withdrawal is necessary to protect high conservation values. Despite efforts to effectively regulate mining, impacts commonly occur to water quality, quantity, air quality, wildlife habitat, aquatic life, and vegetation.

Indeed, four of the five preceding Forest Service Chief's have described the insufficiencies of the 1872 Mining Law, stating that, "*The Act has led, and continues to lead, to some mining in inappropriate locations and circumstances*."[63] They recommend modification or replacement of the 1872 Mining Act that includes, "*mechanisms whereby alternative uses and values of lands (fish and wildlife, water, recreation, grazing, and timber production) are weighed in the balance against values for mineral extraction in a process clearly described by Congress*."

8. THE PROPOSED MINERAL WITHDRAWAL IS CONSISTENT WITH THE CONSIDERABLE PUBLIC INVESTMENT IN CONSERVATION OF NATURAL RESOURCES IN THE REGION.

From 1995 – 2013, nearly $1 million dollars were spent on restoration efforts in the Hunter Creek/Pistol River Watershed.[64] The Red Flat Mine could undo decades of work and investment there. From 1995-2013 over $3.3 million dollars were spent on restoration efforts in the Illinois Valley Watershed.[65] The RNR mine could easily undo decades of work and investment. In the last decade approximately $80 million non-federal dollars have been spent on projects and land acquisition that benefit the Smith River's nationally outstanding salmon and steelhead habitat.

9. THE PROPOSED MINERAL WITHDRAWAL IS BROADLY SUPPORTED AND IS CONSISTENT WITH THE LENGTHY EFFORTS TO PROTECT THIS IMPORTANT REGION.

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[62] Preliminary Decision Memo, RFG38, Test Drilling for Red Flat Nickel Corporation, Nov. 6, 2013.

[63] Letter to Senate Energy and Natural Resources Committee from R. Max Peterson, Jack Ward Thomas, Michael Dombeck, and Dale Bosworth, former Chiefs, U.S. Forest Service, April 8, 2008.

[64] http://oe.oregonexplorer.info/restorationtool/Report.aspx?Extent=Hunter%20Creek/Pistol%20River%20Watershed%20Council&Years=1995,1996,1997,1998,1999,2000,2001,2002,2003,2004,2005,2006,2007,2008,2009,2010,2011,2012,2013&geoType=Watershed%20Council&Basin=SouthCoast

[65] http://oe.oregonexplorer.info/restorationtool/Report.aspx?Extent=Illinois%20Valley%20Watershed%20Council&Years=1995,1996,1997,1998,1999,2000,2001,2002,2003,2004,2005,2006,2007,2008,2009,2010,2011,2012,2013&geoType=Watershed%20Council&Basin=Rogue

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The proposed mineral withdrawal is strongly supported by Oregon congressional members Senator Wyden, Senator Merkley, and Rep. Defazio, and California's Rep. Huffman,[66] and it follows on a long history of efforts to protect the high conservation values in the region. There is strong public support for the mineral withdrawal, as illustrated at the public meetings,[67] and the tens of thousands of letters of support that have been sent on behalf of the proposed withdrawal.

[66] http://defazio.house.gov/media-center/press-releases/defazio-huffman-wyden-merkley-praise-temporary-ban-on-mining-projects-in
[67] http://www.currypilot.com/News/Local-News/Citizens-oppose-river-strip-mining

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