APPENDIX I
ECONOMICS REPORT

Nicore Economics Report

There is much uncertainty pertaining to the economic situation associated with the Nicore Mining Proposal. This report explores that uncertainty, the potential effects of technology changes, the world market for nickel and associated products, assumptions used in this analysis, and the value of other resources located within the Rough and Ready Watershed.

The uncertainties associated with the economics of the Nicore Mining Proposal are mainly associated with world markets, processing ore, and smelting a product. Where and how does processing/smelting occur or is it going to occur? What is the value of the product? The answers to these questions are unknown. However, the value of processed nickel laterite is a known commodity on the world market. Modest assumptions of value and a sensitivity analysis can assess the economic feasibility depending upon processing costs and market conditions.

Different views of the economic values of mining nickel laterites at Nicore are available. One view is that such mining is not economical. Two papers, submitted to the Forest Service in response to the public comment period for the Draft EIS for Nicore, summarize this conclusion (Resource Strategies, 1998 and Barrick, 1998). According to this view, given the world markets and mining/processing costs, proposals such as Nicore are not economically viable. "On the basis our preliminary evaluation of various processing routes including Brokerage, Steel Mill Production and Smelting to produce a 3.5% Nickel Pig, there does not appear to be an economically attractive processing route to recover and market nickel products from the Oregon laterite ores" (Barrick, 1998). Conclusions of the "Economics of the Nicore Project" state the ore grades are at the extreme low end and the size of the orebody is far smaller than other similar ore bodies being considered for commercial use. Nickel prices are declining. There is an adequate supply of very low cost new mine projects in the pipeline and the large Voisey's Bay project in Canada will greatly expand production capability. Advances in nickel technology which could reduce costs for the Nicore material will have similar effects on other competing nickel resources and probably would not alter the competitive picture. Oregon is an unsuitable location for downstream investment in stainless steel operations given its distance from both the product and scrap markets.

An additional view is presented by David Russell, referenced from a talk given December 8th, 1997 in Kalgoorlie, Western Australia. He states "As recently as twenty years ago around 70% of nickel production came from 30% of the world's nickel resources that are in sulfides (Nicore deposits are nickel laterites, not sulphides). Today those statistics are still valid but in the very near future West Australian projects such as Murrin Murrin, Bulong and Cawse will start to change this ratio with a technologically driven move to increased production from laterite ores using acid leach metallurgical processing. As metallurgical technology advances, a step-like improvement in recoveries is apparent, and pressure acid leach is the current technology. With 70% of the world's nickel resources in laterites it will not be long before the balance of production swings in favor of the laterite deposits starting with the commissioning of three acid leach projects" (in Australia) (Russell, 1997). For purposes of this EIS, it is important to note that Nicore has made absolutely no proposals to utilize an acid leach process.

"The only nickel smelter in the United States closed in April 1998 because of low nickel prices. The smelter, near Riddle, Oregon, had been producing ferronickel from ores imported from New Caledonia. The adjoining mine on Nickel Mountain has been idle since 1996. 158 facilities in the United States reported nickel consumption. The principal consuming state was Pennsylvania, followed by West Virginia and Ohio. Approximately 44% of the primary nickel consumed went into stainless and alloy steel production. About 66,000 tons of nickel was recovered from purchased scrap in 1998. This represented about 35% of the reported consumption for the year." (Kuck, Peter, USGS, Jan. 1999)

"Stainless steel accounts for 40% of primary nickel consumed in the United States and two-thirds of world primary consumption. U.S. production of nickel-bearing stainless steel was down 6% from 1997's near-record 1.36 million tons. Demand for nickel-free grades of stainless steel remained strong because of robust automotive sales." (Kuck, Peter, USGS, Jan. 1999)

Notwithstanding the predominance of laterite ore, by far the largest source of nickel production continues to be from sulfides for economic reasons. However, as the growth in world nickel consumption continues, fuelled largely by expanding consumerism in Asia, there is increasing pressure to exploit the laterites (Reimann, M., O'Kane, T., and Cruz, E., 1998).

"The world nickel supply grew faster than demand in 1998. In August, the London Metal Exchange (LME) cash price dropped below $4,300 per metric ton ($1.95 per pound) - the lowest level in more than a decade. A sharp rise in exports of stainless steel scrap from Russia to the European Union contributed to the oversupply situation and offset cutbacks in world ferronickel production. The oversupply situation is expected to continue for 4 or 5 years because of mine and smelter capacity additions in Australia, Canada, Indonesia, and Venezuela. Since 1975, world demand for stainless steel has grown at an average rate of 4.5% per year. This growth rate is projected to continue for the next 20 years." (Kuck, Peter, Nickel Mineral Commodity Summaries, U.S. Geological Survey, January 1999).

"The estimated global resource of nickel laterite is around 8 billion tons grading 1.4% nickel, containing some 118mt of nickel. (The Nicore deposits are purported to be approximately 0.8 to 1% nickel and have 3,800 tons of nickel.) Of this world resource only 4.6 billion tons are classed as reserves, and contain 70mt of nickel. This is sufficient for around 70 years of total world demand at current levels.
The major nickel laterite deposits are located in New Caledonia, Cuba, Indonesia and the Philippines which together account for 75% of the total world nickel laterite resources. New Caledonia accounts for around 25% of the currently reported laterite resources. In addition in Central Africa some 5% of the world's known laterites are found in Burundi (Russell, 1998)." Anaconda Nickel Limited has recently announced a joint venture with Cobra to develop substantial nickel laterite deposits with an inferred resource of 255 million tons at 1.41% nickel and 0.08% cobalt (Anaconda, 1998). "The marketed products of nickel laterite projects include bulk ore, matte, ferronickel, nickel oxide sinter, mixed sulphides, electronickel and nickel metal powder." (Russell, 1997)

The USGS estimates world nickel reserves contain at least 130 million tons of nickel (60% in laterites and 40% in sulfide deposits). In addition, extensive deep-sea resources of nickel are in

manganese crusts and nodules covering large areas of the ocean floor, particularly in the Pacific Ocean. Substitutes for nickel would result in increased cost or some trade-off in the economy or performance of the product. Aluminum, coated steels, and plastics can replace stainless steel to a limited extent in many applications.

Cobalt is a valuable by-product of nickel laterites. The average cobalt credit per pound of nickel produced at the 1995 level is 24 cents (AME Mineral Economics, 1998).

Current utilization of the total Western World nickel mining capacity is around 86%, an historically high figure. Operating rates are predicted to decline as low as 76% with the opening of new mines at Voisey's Bay in Canada in 2001-2003(AME Mineral Economics, 1998). Anaconda Nickel Limited of Australia, has predicted a long term period of depressed nickel prices of around $2.25/pound as the nickel market prepares for the imminent substantial supply of nickel from new low-cost producers (Anaconda Media Release, 17th July 1998).

"The nickel concentration in limonite (clay portion of the more developed soil part of the deposits) considered to have economic value is in the range of 1% to 1.8% with an average near the lower end of the scale, while saprolite (weathered rock part of the deposits) runs in the range of 1.8% to 3.5%. An average of 2.3% nickel is considered high grade" (Reimann, et.al., 1998).

The Economics of Mining

"The value of an ore body in the ground begins with the value of the contained metals which by application of the relevant metal prices, gives a gross value per ton of ore. From there, two cost factors are the determinants of potential profitability: the cost of getting it out of the ground (mining) and the cost of extracting the marketable metal (processing). Finally, the reserves of ore must be such that the capital cost of putting the operation in place can be recovered, leaving an income stream from which a these parameters in common, hence they form the basis for comparison.

Laterites are by nature large, low grade nickel cobalt deposits, and can therefore be compared with equivalent low grade gold and low grade copper deposits. However, Nicore would be a relatively small operation, not a large deposit. The 0.05 ounce per ton gold, valued at $19 per ton of ore, is a typical Nevada heap leaching situation which can and is being profitably mined. 0.5% copper ore at $10 per ton is being commercially mined in Arizona. By comparison, a laterite of typical grade contains $115 worth of metals per ton" (Reimann, et.al., 1998). The grade at Nicore is probably lower than that of the typical operating grade material. "The cost of mining all three types of ore is similar, and should be in the order of $2-$5 per ton, as all are open pit, large volume situations. By comparison, hard rock, under ground mining as is typical for sulfide ores, is highly labour intensive and can cost five times as much. From the above comparison, it is apparent that laterite nickel ore enjoys a major advantage in the combination of low mining cost with high value content. These two factors provide a strong incentive to find economic means of extracting nickel from laterites"(Reimann, et.al., 1998).

Economics of Processing

"Nickel is considered to be a sophisticated metal, particularly with respect to the industrial processes needed to extract it from its ores. Unlike gold, which can be mined and sold by individual operators with rudimentary equipment, the production and marketing of nickel is complex and capital intensive, with the result that only a few large corporations have so far succeeded in becoming profitable producers" (Reimann, et.al., 1998). There are no known processes that seem feasible for the production of nickel on the small scale envisioned by Nicore. Moreover, there are no large smelter operations identified by the claimant to process the ore thus this question must remain a major uncertainty.

"The chemical reaction (oxide reduction) which must take place to free the metallic nickel is endothermic. This means that a net input of energy (usually in the form of heat) is needed to free the nickel. By contrast, the process to free nickel from sulfide ores is accompanied by oxidation, namely the burning of the sulfur. This gives off energy, so that, on balance, the processing of sulfides is less energy intensive than processing laterites" (Reimann, et.al., 1998).

"The energy needed to reduce the nickel ores is most commonly provided by heating, in a process called smelting. This process is well understood, and has been used for decades by the large producers. It is a high temperature, high energy operation with good nickel recovery but low cobalt recovery. Smelting is not amenable to processing limonite because the iron content is too high and the nickel grade too low to be economic. Saprolite is more suitable, with lower iron and higher nickel concentrations. In this case, the end product is an iron-nickel all known as ferronickel, or if sulfur is added, a high grade nickel matte. Most of world production achieved from lateritic ore uses high-grade saprolite as feed stock" (Reimann, et.al., 1998). The lateritic ore from Nicore is relatively low grade.

Some new processes are becoming available for processing lower grade saprolite and limonite, such as that found at Nicore. However, even with the new processes, the amount of reserves and lower grade of the reserves would probably make Nicore a marginal economic operation. Any process favorable for reducing the processing costs would generally make those operations with larger reserves and higher ore percentages even more favorable over the smaller, lower percentage ore bodies such as Nicore.

The assumptions used in this economic analysis are as follows:

1. Under the proposed action, 3.5 acres per year for ten years would be mined to a depth of 12 feet of which 50% would be usable after screening. This amount of material would produce 380 tons of nickel per year.

2. Smelting costs of nickel are $2.25 per lb. This cost would actually vary depending upon the process used and the grade of ore present (Barrick, 1998).

3. Processing Costs of raw material is $25/ton (Barrick, 1998).

4. Extraction and Transportation Costs are listed in the process record for each alternative, but generally exceed $6/ton. Transportation costs beyond the stockpile site are assumed to be part of the processing costs. (This assumption is a very generous one but since there is no indication where the ore will ultimately be processed, speculation on transportation costs beyond that point is not meaningful. But it must be recognized that the cost used herein is likely the minimum that would be experienced.

5. The value of nickel and associated metals at Nicore is $2.27 per pound on the world market. It is assumed that the making of stainless steel with nickel can be accomplished with ores throughout the world.

6. An internal rate of return is 4%. (This assumption is also conservative and is suggested by the Forest Service Economic and Social Analysis Handbook SSH1909.17, section 15.42-1.)

7. Inflation affects both the price of metals and the costs of production equally.

The value of other resources in the proposed project area include the areas undeveloped character, the botanical resource, the potential wild and scenic river resource, the water quality of Rough and Ready Creek and the fisheries resource . For the these valuable resources, no quantification of value is presented. But it is of note, that all of these resources are becoming increasingly scarce in the United States and consequently are increasing in value.

Effects of Implementation

The following chart summarizes the effects of implementation for the Nicore Alternatives for economics. The reader needs to refer to the other sections of the SDEIS for detailed effects on undeveloped character, botanical resources, and fish resources.

For the economic analysis, all alternatives have a negative present net value. All sites individually have a negative present value. This is mainly due to the high production costs associated with nickel. Major changes in the world situation for nickel or in the technology for producing nickel would have to occur before significant change in the relative economic status of the Nicore proposal could exist.

Though the economic impacts are uncertain, the impacts on the other values of the watershed definitely would occur and are displayed by alternative in other sections of this document. Economics is a study in relative scarcity which allow comparison of monetary and nonmonetary values. Clearly the more scarce resources at this point in time to the nation and the world are the environmental qualities of the Rough and Ready Creek area which will be diminished by any development. There are numerous readily available sources of nickel exploitation which offer considerably better cost/benefit scenarios.

Indicator	Proposed Action	Alternative 6	Alternative 7	Alternative 8	Alternative 9	Alternative 10	Alternative 11	No Action Alternative
Present Net Value of Mining	-$10.1 mm	-$10.6 mm	-$10.2 mm	-$9.5 mm	-$0.97 mm	-$9.0 mm	-$7.5 mm	0
Benefit Cost Ration	0.58	0.57	0.57	0.57	0.10	0.55	0.59	n/a
Certainty of Economics	Uncertain	Uncertain	Uncertain	Uncertain	Uncertain	Uncertain	Uncertain	High degree of Accuracy

The benefit cost ratios for each alternative are displayed. All of the ratios have costs exceeding benefits. The sampling option, because it would use an expensive helicopter, has the lowest ratio. However, this ratio is not to be compared with the full development alternatives as it could lead to full development or no action. All other ratios for action alternatives are between 0.5 and 0.6. The most economically efficient alternative, measured by a benefit/cost ratio is alternative 11. These ratios would change as assumptions of values and costs of production change.

The breakeven point (the price at which costs equal revenue) for the price of nickel and associated minerals such as cobalt and iron varies for the different alternatives. The proposed action's costs would equal its revenue when the world market is $3.75/pound for the price of nickel and associated minerals. In contrast, alternative 7's breakeven point is at $4.02 per pound. If and when the price for nickel and associated minerals would reach $5.54/pound, the proponent would receive a reasonable rate of return for the investment on all alternatives. Within the last five years, nickel did reach a price of $3.73/pound in 1995. However, as noted above, the price has fallen significantly to $1.95/pound in August, 1998 (lowest in a decade) and long term trends are not expected to exceed $3.00 per pound (Anaconda Media Release, 17th July 1998).

When the cost of the Environmental Impact Statement is factored into the analysis, the present net worth of all alternatives is decreased by approximately $300,000. The benefit cost ratios are also decreased by several percent except for alternative 9 where the decrease is much greater due to the small benefits accrued.

Employment Potential

George Trahern and Michael Schneyder of the Josephine County Tax Assessor's Office were interviewed (see Mendenhall Report) to discuss potential effects of the Nicore mine with regard to employment. They stated that the Proposed Action and all alternatives would create employment. The road construction/reconstruction would create a one-time employment increase and then subside. The excavation and hauling of ore material could provide longer-term employment.

Others have indicated that the mining could also reduce employment through indirect effects related to quality of life. The Jospehine County Homebuilders Association, for example, oppose the mine partly on the basis that it could reduce the number of new homes people decide to build in the area. Fire Mountain Gems also indicated that jobs could leave the area if people did not want to live or work around an active mine. The Josephine County Homebuilders Association and Fire Mountain Gems letters are in the analysis files.

The Illinois Valley Community Response Team, and other groups interested in economic development, have endeavored to create opportunities for diversified industries that maintain steady employment and contribute to Quality of Life goals. Market driven cycles in "boom-and-bust" industries like mining can adversely affect economies of small towns.

Property Values

Trahern and Schneyder were also approached for information regarding property values (see Mendenhall Report). They agreed that the personal values of people who cherish solitude and living in a rural environment could be decreased by the mine site, but said that this shouldn't be confused with property values. Some people may move away because they do not like the effects of the mining, others may not buy property because of the mining operations, and others may not have strong preferences. The mining proposed for the next ten years would have the greatest effects on those living closest to the operations (see discussions elsewhere in the EIS). However, overall trends related to property values are not likely to be affected by the operation.

Private road improvements contemplated in Alternatives 6 and 11 would likely lead to increased property values (see Mendenhall report), despite the loss of personal values (quiet, solitude) residents may experience.

A baseline for property values has been established through the Assessor's Office (see Mendenhall report for references). For 1,101 parcels of land in T40S, R9 and R10W (excluding federal land), the average value for "vacant land" was $19,999. The average value for the "improved land" was $78,849. For 412 parcelsin T40S, R9W, the average value for "vacant land" was $19, 495. The average value for the "improved land" was $65, 791. Values have tended to increase over recent years and that trend can be expected to continue, regardless of alternative chosen.

Trends in property values in neighboring Douglas County may provide relevant information regarding potential effects from Nicore (see Methany data, Mendenhall report). The actual

property values for Riddle increased 10% just for 1997 (though, by the effect of a new law, they also decreased by nearly an equal amount). Overall property values in the Riddle area increased 60% from 1991 to 1996 (ibid.). Mining had been discontinued near Riddle, however the smelter there continued to operate.

Property values from 1982 through 1989, however, show a negative trend: values decreased 8% for residential properties smaller than 10 acres, and decreased 6% for properties larger than 10 acres but less than 40 (ibid.). Active mining occurred at Riddle during those years. The mine near Riddle is visible from Highway 5 and throughout the town.

Soda Springs, Idaho is another small town with an active mining operation. Preston Phelps of the Caribou County Assesor's Office stated that property values reflected an increasing trend over many years (ibid.), despite the presence of a mine. Between 1995 and 1999 property values increased 40% for seven residential properties priced from $65,000 to $125,000.

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6/99