

BASELINE SOIL INVENTORY
NEW WORLD PROJECT
ALTERNATIVES SB-1 and SB-4

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INTRODUCTION

Noranda Minerals Corporation (Noranda) has identified two additional study areas, SB-1 (approximately 150 acres) and SB-4 (approximately 300 acres), as alternative tailings ponds sites at the proposed New World Mine. These areas are located in Gallatin National Forest northeast of Cooke City and west of the Clarks Fork River, Sections 24, T9S, R14E and 19 and 20 T9S, R15E.

Soils in area SB-1 were mapped and evaluated during the land application disposal investigations, but emphasis was placed on soil permeabilities and trace element attenuation. Additional work will be required in area SB-1 to evaluate soils for salvage if more than a reconnaissance soil survey is required. Soils in area SB-4 have never been surveyed for baseline information.

This plan of study (POS) includes two options for a soils baseline inventory on the alternative sites. Option 1 describes a reconnaissance soil survey and option 2 describes an intensive soil survey. Option 1 will consist of conducting an inventory between the level of an Order 1 and Order 2 soil investigation on alternative SB-4. This work will be based upon detailed field mapping of surficial soil and geomorphological characteristics. Limited soil profile information will be recorded and no soil samples will be taken or analyzed. Option 1 will provide sufficient information of major soil physical

characteristics such as wetlands, slope, depth of organic rich horizons, surface field textures and surface coarse fragment content for comparison with the proposed tailings pond area soils baseline data.

Option 2 will consist of conducting an Order 1 soil survey on the alternatives SB-1 and SB-4, based upon detailed field mapping, soil profile descriptions, soil sampling, and soil laboratory analysis. Option two will be conducted at a level equal to the baseline soil inventory conducted for the proposed action, in November, 1990.

SCOPE OF WORK, OPTION 1

Field Mapping

A soil map will be prepared in the field by field traverse and aerial photo verification. Delineations will be made on topographical maps supplied by Noranda for the proposed alternative areas. Mapping will be at a scale of 1:4,800 to 1:12,000. The study area will be mapped at the level of an Order 1 to Order 2 soil survey and mapping units will consist of those units interpolated from the soil baseline study conducted on proposed facility and LAD areas, 1990, or from the Soil Survey of the Gallatin Forest Area, Montana, Draft, 1984. New mapping units will be added when necessary.

Technical Report

The soil survey report will consist of an overall description of the study area and descriptions of each mapping unit identified in the

alternative tailings pond area. Mapping units will be identified by taxonomic units to the family level, phases of these, complexes of taxonomic units, and miscellaneous landforms.

Mapping unit descriptions will consist of parent material, slope, physiographic location, average annual precipitation and growing season. Surface and subsurface colors, field textures, structure, consistence and coarse fragments size and abundance will be evaluated. Surface permeability, drainage class and the potentials for runoff and erosion will also be considered.

The soils map will be included in the report. It will clearly show all map unit boundaries, their assigned symbols, north arrow, section corners, contour intervals, soil sampling and description sites, and an appropriate legend.

SCOPE OF WORK, OPTION 2

If either alternative SB-1 or SB-4 becomes part of the proposed action for the New World Mine, an Order 1 soil survey including soil profile descriptions, soil sampling and laboratory analysis will be required. Alternative SB-1 may require additional sampling and laboratory analysis with emphasis on soil salvage for reclamation. The level of detail for Option 2 will satisfy the requirements of the Montana Metal Mine Reclamation Act, the objectives of the USDA Gallatin National Forest, the general scope of work outlined by Noranda and the National and Montana Environmental Policy Acts.

Field Work, Sampling, Soil Profile Descriptions

A soil map will be prepared in the field by field traverse and aerial photograph verification. Delineations will be made on topographical maps supplied by Noranda for the proposed permit area. Mapping will be at a scale of 1:4800 to 1:12000 or another scale approved by MDSL. The study areas will be mapped at the level of an Order 1 soil survey. Map units will consist of taxonomic units to the family level and their phases. Complexes will be mapped where it is difficult and undesirable to map consociations. Previously disturbed areas will be identified by type of disturbance. Miscellaneous landforms will also be identified.

The following guidelines, developed by MDSL, will be used in mapping:

- o Soils of high contrast. Soils of high contrast will be delineated separately if they are two acres or larger in size. No mapping unit will have more than 15 percent dissimilar soils. Easily-defined bodies of these kinds of soils having boundary limits less than the above stated size will be mapped separately whenever possible.
- o Soils of low contrast. Soils of low contrast will be delineated separately if they are five acres or larger. No map unit will have more than 25 percent similar soils.

Each soil or taxonomic unit will be described in the field as it occurs spatially (as a landform) and as a pedon, which includes a detailed profile description.

For description and sampling purposes, soil pits will be located so that they adequately characterize each soil type. Road cuts will be cleaned, described, and sampled if they are determined to be well-positioned.

Shallow soils (soils with less than two inches of salvageable soil) and soils containing a high percentage of coarse fragments (more than 50 percent by volume), will not be sampled for laboratory analyses, but will be described in the field. If suitable soils are in short supply, soil salvage limitations will be reviewed in close consultation with MDSL, Noranda, and USFS.

Samples will be collected from at least one site for each disturbed taxonomic unit. A phase of a taxonomic unit will be sampled separately if there are distinct differences in observable or inferred properties. Sampling will be to a minimum depth of 45 inches except where bedrock or unsuitable salvage material are encountered at a shallower depth. Representative samples will be collected from each sequential genetic horizon or contrasting subhorizon. Except for the A horizon, horizons or lenses 3 inches or less will not be sampled separately, but will be combined with a similar adjacent horizon.

All sampled soils will be accompanied by a detailed description of the pedon. Descriptions will be in accordance with standards developed by the SCS. Sample and description sites will be located by legal description and will be shown on the soil map.

Soil samples will be shipped to and analyzed by an acceptable laboratory. Each sample will be analyzed by accepted laboratory methods and standards. To remain consistent with the proposed action the following physical and chemical parameters will be considered:

- Organic matter
- pH
- Electrical conductivity
- Particle size (percentages of sand coarser than very fine sand, fine sand, silt, and clay)
- Coarse fragment content
- Saturation percentage
- Cation exchange capacity
- Base saturation

If the pH is less than 5 the soil will be analyzed for As, Zn, Mn, Cu, Cd, Al, Pb, and Ni.

Technical Report

The soil survey report will consist of an overall description of the study area followed by a soil profile and map unit description representing each map unit identified in the New World Project. The soil profile and map unit descriptions will include taxonomic units, phases, complexes of taxonomic units and miscellaneous landforms. Detailed map unit descriptions will include the following: 1) depth, drainage class, parent material, slope, physiographic location, average annual precipitation, and growing season; 2) taxonomic class; 3)

location; 4) a profile description that will include kind, thickness, and arrangement of horizons; structure, color, texture, pH, coarse fragment size and content, content of carbonates and other salts; abundance and diameter of roots; and consistence and plasticity; 5) range in characteristics of each soil series; 6) associated soils and percent of each type in the map unit; 7) permeability classes effective rooting depth, and surface runoff; 9) each soil's reclamation limitations and depths for use as suitable topsoil; 10) limitations for stability in constructing roads and facility structures; and 11) wind and water erodibility characteristics.

The soil map (at an approved scale) will be included in the report. It will clearly show all map unit boundaries, their assigned symbols, north arrow, section corners, contour intervals, soil sampling and description sites, and an appropriate legend.

Soil physical and chemical characteristics, as well as soil salvage depths and limitations, will be tabulated and discussed. This section will outline criteria used to determine soil suitability for economically sound topsoil salvage techniques.

SCHEDULE

The following schedule approximates timeframes for meeting the study objectives.

<u>Task</u>	<u>Schedule</u>	
	<u>Timeframe</u>	<u>Completion</u>
Field work (mapping, soil profile descriptions, sampling)	08/19/91	08/30/91
Laboratory data and analysis	08/31/91	10/30/91
Technical report	10/30/91	01/31/91

ESTIMATED COSTS

Table 1 provides a detailed cost estimate by task for each option of the POS.

Table 1. Estimated costs to implement each option of the POS.

Preparation of POS

Labor:

Soil Scientist	12 hrs @ \$40/hr	\$ 480.00
Secretary	2 hrs @ \$20/hr	40.00

Expenses:

Phone, postage, etc.	<u>50.00</u>
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Sub-total \$ 570.00

OPTION 1 (300 acres)

Field Mapping

Labor:

Soil Scientist	38 hrs @ \$40/hr	\$ 1,520.00
Soil Scientist	38 hrs @ \$35/hr	1,330.00

Expenses:

Postage, film, copying, etc.		100.00
Per diem	8 days @ \$50/day	400.00
Mileage	600 @ \$0.40/mile	<u>240.00</u>

Sub-total \$ 3,590.00

Technical Report

Labor:

Soil Scientist	24 hrs @ \$40/hr	\$ 960.00
Soil Scientist	40 hrs @ \$35/hr	1,400.00

Expenses:

Copying		100.00
Drafting and map reproduction		<u>750.00</u>

Sub-total \$ 3,210.00

GRAND TOTAL - OPTION 1 \$ 7,370.00

OPTION 2 (450 acres)

Field Mapping, Sampling, Soil Profile Description

Labor:

Soil Scientist	56 hrs @ \$40/hr	\$ 2,240.00
Soil Scientist	56 hrs @ \$35/hr	1,960.00

Expenses:

Postage, sample bags, film, copying, etc.		250.00
Per diem	14 days @ \$50/day	700.00
Mileage	750 @ \$.40/mile	300.00
Backhoe & operator	16 hrs @ \$40/hr	<u>640.00</u>

Sub-total \$ 6,090.00

Laboratory Costs:

Costs depend upon the number of soil samples and laboratory used - estimate only for budgeting purposes

Approximately 45-60 samples
@ \$67.50/sample \$ 3,037.50 - \$ 4,050.00

If analyses are required for trace elements it will cost approximately an additional \$35/sample

Maximum cost \$ 2,100.00

Noranda will be invoiced for laboratory analysis at cost plus 15% for handling

Technical Report

Labor:

Soil Scientist	40 hrs @ \$40/hr	\$ 1,600.00
Soil Scientist	60 hrs @ \$35/hr	2,100.00

Expenses:

Copying		400.00
Drafting and map reproduction		<u>800.00</u>

Sub-total \$ 4,900.00

GRAND TOTAL - OPTION 2 \$ 14,597.50 - \$ 17,710.00
(depending on lab costs)

Table 2. Charge Schedule

Category

Labor:

Soil Scientist (D. Noel, Survey Leader)	\$40/hour
Soil Scientist (Michael Houlton)	\$35/hour

Expenses:

Mileage	\$ 0.40/mile
Per diem	\$50.00/day
Copying	\$ 0.12/copy
Map reproduction (blueprints)	\$ 0.30/ft ²
Field supplies	at cost
Other expenses	at cost

LITERATURE CITED

- Montana Department of State Lands. 1986. Soil Survey Guidelines. Helena, Montana.
- Noel, et al. 1990. Soils Baseline Inventory, New World Project Area, Park County, Montana in Application for a Hard Rock Operating Permit and Proposed Plan of Operation, New World Project, Park County, Montana. Crown Butte Mines, Inc. and Noranda Minerals Corp.
- USDA. 1984. Gallatin National Forest area land system inventory. U.S. Forest Service, Gallatin National Forest. Bozeman, Montana.