

EarthFax

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Engineers/Scientists
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Telephone 801-561-1555
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September 22, 1994

Mr. Daron Haddock
Permit Supervisor
Utah Division of Oil, Gas, and Mining
3 Triad Center, Suite 350
Salt Lake City, Utah 84180-1203

9/23

Daron Haddock
for ACT/007/019-94

RE: Soil Survey Report for the ~~Aberdeen Mine~~ Left Hand Fork Fan Pad, Andalex Resources, Inc., Centennial Project, ACT/007/019 # 2 Copy PAM

Dear Mr. Haddock:

Please find enclosed two copies of the above referenced report. Mr. Mike Glasson of Andalex has asked me to transmit this report directly to you for your consideration as part of their application to construct the fan portal and pad in Left Fork of Deadman Canyon. If you have any questions, please call me at 561-1555.

Sincerely,
Chris D. Hansen
Chris D. Hansen

enclosures



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September 23, 1994

SEP 23 1994

Mr. Daron Haddock
Permit Supervisor
Utah Division of Oil, Gas, and Mining
3 Triad Center, Suite 350
Salt Lake City, Utah 84180-1203

RE: Corrected Page 1 and Copies of Appendix F, Test pit Logs, Soil Survey Report for the
Aberdeen Mine Left Hand Fork Fan Pad, Andalex Resources, Inc., Centennial Project,
ACT/007/019 #2

Chris D. Hansen

Dear Mr. Haddock:

As we discussed on the telephone this morning, I am sending to you copies of the test pit logs for the above referenced soil survey report. I inadvertently excluded them from the original report that I delivered to your attention at UDOGM. I have enclosed a revised first page and copies of the logs. The paper has already been prepared for insertion into the report. I apologize for any inconvenience this may have caused you. If you have any questions, please call me at 561-1555.

Sincerely,

Chris D. Hansen

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September 22, 1994

Mr. Michael W. Glasson
Senior Geologist/ Western Operations
Andalex Resources, Inc.
Tower Division
P.O. Box 902
Price, Utah 84501

RE: Soils Survey Report for the Aberdeen Mine Left Hand Fork Fan Pad

Dear Mr. Glasson:

EarthFax Engineering, Inc. (EarthFax) is pleased to provide to Andalex Resources, Inc. (Andalex) this letter report detailing the results of the soil survey that was performed at the proposed Aberdeen Mine Left Hand Fork fan pad. This report has been divided into five sections: an introduction containing a brief description of the work performed, a description of the soil survey, descriptions of the soils encountered, calculations of the volume of available topsoil for reclamation based upon the results of the survey, and a description of the vegetation in the survey area. Additionally, the following attachments are included with this report:

- Attachment A - Soils Map,
- Attachment B - Typical Datino and Brycan Pedon Soils Description From Appendix M, Andalex Centennial MRP,
- Attachment C - Estimated Available Topsoil Calculations,
- Attachment D - Vegetation Map,
- Attachment E - References Cited, and
- Attachment F - Test Pit Logs.

INTRODUCTION

EarthFax was retained by Andalex to conduct a soil survey of the proposed Aberdeen Mine Left Hand Fork fan pad area in September, 1994. Andalex provided EarthFax with a map illustrating the area of proposed disturbance associated with the construction of the fan pad and topsoil storage area. The proposed pad area is located in the Left Fork of Deadman Canyon in the NE 1/4 of the NE 1/4 of Sec. 13, T.13S. R.10E., SLBM. The area of the proposed disturbance is approximately 0.93 acre.

ATTACHMENT F

TEST PIT LOGS



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September 22, 1994

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- Attachment A - Soils Map,
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INTRODUCTION

EarthFax was retained by Andalex to conduct a soil survey of the proposed Aberdeen Mine Left Hand Fork fan pad area in September, 1994. Andalex provided EarthFax with a map illustrating the area of proposed disturbance associated with the construction of the fan pad and topsoil storage area. The proposed pad area is located in the Left Fork of Deadman Canyon in the NE 1/4 of the NE 1/4 of Sec. 13, T.13S. R.10E., SLBM. The area of the proposed disturbance is approximately 0.93 acre.

An order 1 soil survey of the site was conducted during the week of September 11, 1994. Three soils ~~with their~~ were encountered during the soil survey: Cabba family extremely stony loam on 30 to 60 percent slopes, Datino very stony loam on 40 to 70 percent slopes, and Brycan loam on 10 to 25 percent slopes. The typical Cabba family extremely stony loam represents an upland very steep stony loam (P-J) range site. The typical Datino loam represents an upland stony loam (P-J) range site. The typical Brycan loam represents a stony loam (oak) range site. An ocular survey of the vegetation was made and the results are presented in the vegetation section of this report.

SOIL SURVEY

The soil survey was conducted by first identifying the limits of the proposed disturbed area. The boundaries of the area had been surveyed Andalex and the area corners flagged prior to the start of the soil survey. The flagging was located by EarthFax personnel and seven potential test pit locations within the proposed disturbed area were located. Due to the difficulty associated with accessing the area with heavy equipment, all test pits were dug by hand. Each of the test pits was excavated to bedrock or terminated at a depth where removing large cobbles or boulders was no longer possible. Each horizon exposed in the test pits was identified and sampled. The soil samples were immediately placed in plastic bags and the bags sealed to maintain the natural moisture content of the soil. The location and extent of each soil was identified in the field and a soils map has been created. Each soil has been identified on the map using a two letter symbol. The extent of the soils within the disturbed area have been mapped using soil boundary lines. A copy of the soils map has been included with this report as Attachment A.

SOILS DESCRIPTION

Two of the three soils encountered during the soil survey, the Datino and Brycan soils, were also identified and studied during the initial soil survey conducted prior to the construction of the Andalex facility located in the Right Fork of Deadman Canyon. The initial soil survey is included in the Andalex Centennial Project Mining and Reclamation Plan (MRP) as Appendix M, Soil Survey and Vegetation Inventory of the Proposed Sunnyside Mine Site and Extension of the Pinnacle Mine Site. Information contained within Appendix M was used to supplement this soils report. Copies of the descriptions of typical Datino and Brycan soils from Appendix M have been included with this report as Attachment B.

Information supplementing the description of the Cabba family extremely stony loam was obtained from the Soil Conservation Service publication: Soil Survey of Carbon Area, Utah, June 1988.

Cabba Family Extremely Stony Loam, 30 to 60 Percent Slope

The Cabba family extremely stony loam, 30 to 60 percent slopes, in the pad area is shallow to moderately deep and well drained. It occurs on steep mountain slopes at elevations between 7075 and 7130. The soil is derived mainly from sandstone and shale. The average annual rainfall is between 12 and 16 inches. The mean annual temperature is 43 to 45 degrees F and the average freeze-free season is 100 to 110 days. The slopes are concave, south and west facing, and relatively short. Vegetation is Upland Very Steep Stony Loam (P-J) range. Surface runoff is slow and erosion is slight under native vegetation. Erodibility is low. These soils are identified as loamy, mixed (calcareous), frigid, shallow Typic Ustorthents.

The Cabba family extremely stony loam, 30 to 60 percent slope identified in the mine area is very similar to the Cabba family, 40 to 70 percent slopes identified and discussed in the Soil Survey of Carbon Area, Utah. Following is brief description of the Cabba family, 40 to 70 percent slopes as presented in the Soil Survey of Carbon Area, Utah.

Cabba family, 40 to 70 percent slopes (Soil Survey of Carbon Area, Utah)

This shallow, well drained soil is on mountain slopes. It is in the vicinity of Wattis and in the Deadman Canyon area. It formed in colluvium derived dominantly from sandstone and shale. Slope is mainly 40 to 70 percent, but it is 30 to 50 percent in about 25 percent of the unit. Slopes are 100 to 200 feet long, are concave or convex, and dominantly have south aspect. The present vegetation in most areas is mainly pinon, juniper, Indian ricegrass, Salina wildrye, and birchleaf mountainmahogany. Elevation is 7,200 to 8600 feet. The average annual precipitation is 14 to 16 inches, the average annual air temperature is 42 to 45 degrees F, and the average freeze-free period is 80 to 120 days. Typically, the surface layer is light yellowish brown extremely stony fine sandy loam about two inches thick. The underlying material to a depth of 15 inches is light yellowish brown gravelly loam over sandstone. Depth to sandstone is 10 to 20 inches.

Included in this unit are about 10 percent soils that are similar to this Cabba family soil but have bedrock at a depth of 20 to 40 inches and about 5 percent Rock outcrop.

Permeability of this Cabba Family soil is moderate. Available water capacity is about 1.5 to 3.0 inches. Water supplying capacity is 3.5 to 6.0 inches. Effective rooting depth is 20 to 40 inches. The organic matter content of the surface layer is 1 to 3 percent.

This unit is used as wildlife habitat, rangeland, and woodland and for mining purposes.

The potential vegetation of the Cabba family soil includes an overstory of pinon and Utah juniper with a canopy of 30 percent. The understory vegetation is 45 percent grasses,

10 percent forbes, and 45 percent shrubs. Among the important plants are birchleaf mountainmahogany, black sagebrush, Salina wildrye, and needleandthread.

The site index for pinon and Utah juniper is 50. Average yield is 6 cords of wood per acre. The potential is poor for the production of posts or Christmas trees. This unit is severely limited for the harvesting of wood products because of the steepness of slope and the hazard of erosion. If wood products are harvested, the slash should be left scattered on the surface to protect the soil from erosion.

This unit is not grazeable by livestock because of the steepness of slope.

This map unit is in capability subclass VIIIe, non-irrigated, and in the Upland Very Steep Stony Loam (Pinon-Utah Juniper) woodland site.

These soils are identified as loamy, mixed (calcareous), frigid, shallow Typic Ustorthents.

Cabba family extremely stony loam, 30 to 60 percent slope (fan pad)

A typical pedon of Cabba family 30 to 60 percent slope was described in test pit TP-2. TP-2 is located approximately 190 feet south and 30 feet west of the northeast corner of Sec. 13, T.13S. R.10E., SLBM.

A₁ - 0 to 12 inches; brown (10YR5/3) extremely stony loam, subangular blocky structure, soft, very friable, slightly sticky and slightly plastic, common fine to very fine roots, few very fine pores, approximately 25 percent stones, 10 percent cobbles, 5 percent pebbles, and 5 percent boulders, strongly effervescent, abrupt smooth boundary.

C₁ - 12 to 20 inches; yellowish brown (10YR5/6) very cobbly silty loam, subangular blocky structure, soft, very friable, slightly sticky and slightly plastic, few very fine roots, many very fine pores, approximately 15 percent pebbles, 10 percent cobbles, strongly effervescent, abrupt smooth boundary.

Sandstone bedrock at 20 inches below ground surface.

Two additional test pits were excavated in the Cabba family extremely stony loam and their locations are illustrated on the attached soils maps. The thickness of the A₁ horizons in TP-1 and TP-3 varied but was very similar to the soil described in TP-2. A C₂ horizon was identified and described in TP-3.

Datino Loam, 40 to 70 Percent Slopes

This soil is moderately deep, well drained, and moderately permeable. The soil occurs at the base of steep mountain slopes at elevations between 7040 and 7075. This soil is down slope of the Brycan soils in some portions of the pad area. The soil forms from colluvium and alluvium derived mainly from sandstone and shale. The average annual rainfall is between 12 and 16 inches. The mean annual temperature is 43 to 45 degrees F and the average freeze-free season is 100 to 110 days. The slopes are concave, south and west facing, and relatively short. Vegetation is upland stony loam (P-J) range. The taxonomic classification of this soil is loamy-skeletal, mixed, Typic Haploborolls.

The Datino loam, 40 to 70 percent slope, identified in the fan pad area is similar to the Datino very stony loam, 15 to 35 percent slopes identified in Appendix M of the Andalex Centennial MRP. The following is a typical profile of the Datino very stony loam, 15 to 35 percent slopes as described in Appendix M. A copy of the description of two typical pedons of Datino very stony loam, 15 to 35 percent slopes, from Appendix M is included with this report as Attachment B.

Datino very stony loam, 15 to 35 percent slopes (Appendix M, Andalex Centennial MRP)

This soil is very deep and well drained. It occurs on alluvial fans at the toeslope of very steep mountain sideslopes at elevations of 7,100 to 7150 feet. This soil formed in colluvium and alluvium derived mainly from sandstone and shale.

The average annual precipitation is 12 to 16 inches. The mean annual air temperature is 43 to 45 degrees F. The average frost-free season is 100 to 110 days.

Slopes are 15 to 35 percent and area mainly east facing. They are short in length and are mainly concave.

Vegetation is that described for the Upland Stony Loam (P-J) in the vegetation section of this report (Appendix M, Andalex Centennial MRP). Most visible is the dominance of pinon and juniper trees in rather open stands with sagebrush and Salina wildrye grass.

In typical profile, the surface layer is grayish brown very stony sandy loam about 11 inches thick. The underlying layer is pale brown very cobbly silt loam about 7 inches thick. The next layer is pale brown very cobbly silt loam or sandy loam about 42 inches thick.

Permeability is moderate. Available water capacity is 4 to 6 inches. Organic matter content in the surface layer is about 2.5 percent. Effective rooting depth is about 60 inches. Surface runoff is slow and erosion hazard is slight under native vegetation, and moderate if

vegetation is removed. Erodibility is low. This soil is used for grazing of livestock and wildlife habitat.

The taxonomic classification of this soil is loamy-skeletal, mixed, Typic Haploborolls.

Datino loam, 40 to 70 percent slopes (fan pad)

A typical pedon of Datino loam, 40 to 70 percent slopes, in the pad area was described in test pit TP-5. The test pit is located approximately 350 south and 10 feet west of the northeast corner of Sec. 13, T.13S. R.10E., SLBM.

A₁ - 0 to 4 inches; very dark grayish brown (10YR3/2) loam, granular structure, soft, friable, slightly sticky and slightly plastic, common fine roots, common fine interstitial pores, 10 percent pebbles, moderately effervescent, clear wavy boundary.

A₁ - 4 to 21 inches; brown (10YR5/3) very stony loam, subangular blocky structure, soft, very friable, slightly sticky and slightly plastic, many medium to coarse roots, very fine pores, approximately 5 percent pebbles, 20 percent cobbles, and 30 stones, strongly effervescent, clear wavy boundary.

B₁ - 21 to 30 inches; pale brown (10YR6/3) very stony loam, subangular blocky structure, soft, very friable, nonsticky and nonplastic, common fine roots, many fine pores, approximately 10 percent pebbles, 25 percent cobbles, and 30 stones, and moderately effervescent.

An additional test pit, TP-4 was also excavated in the Datino loam. The soils encountered in this excavations were only slightly different from those in test pit TP-5.

Brycan Loam, 10 to 25 Percent Slopes

This soil is moderately deep and well drained. In the pad area, it occurs near the bottom of steep mountain slopes in two areas where the slope begins to flatten out. The elevation of these soils in the pad area is approximately between 7050 and 7075. The soil forms from alluvium derived mainly from sandstone and shale. The average annual rainfall is between 12 and 16 inches. The mean annual temperature is 43 to 45 degrees F and the average freeze-free season is 100 to 110 days. The slopes are 10 to 25 percent, concave, south and west facing, and relatively short. Vegetation is Mountain Stony Loam (oak) range. The taxonomic classification of this soil is fine-loamy, mixed, Cumulic Haploborolls.

Generally, with the exception of the lack of boulders in A₁ horizon, the Brycan loam, 10 to 25 percent slope, identified in the fan pad area, is similar to the Brycan bouldery loam, 8 to 20 percent slopes identified in Appendix M of the Andalex Centennial MRP. The

following is a typical profile of the Brycan bouldery loam, 8 to 20 percent slopes as described in Appendix M. A copy of the Brycan pedon profiles from Appendix M are included with this report in Attachment B.

Brycan bouldery loam, 8 to 20 percent slopes (Soil Survey and Vegetation Inventory of the Proposed Sunnyside Mine Site and Extension of the Pinnacle Mine Site)

This soil is very deep and well drained. It occurs in the bottoms of canyons and on alluvial fans at the foot of very steep mountains slopes at elevations of 7,050 to 7100 feet. This soil formed in alluvium derived mainly from sandstone and shale.

The average annual precipitation is 12 to 16 inches. The mean annual air temperature is 43 to 45 degrees F. The average frost-free season is 100 to 110 days.

Slopes are 8 to 20 percent. They are concave, east and west facing and are short in length.

Vegetation is that described as the Mountain Stony Loam (oak) range site in the following section (Appendix M, Andalex Centennial MRP). Most visible is the fairly dense gambel oak and big tooth maple.

Included in mapping are small areas of Datino soils along the upper margins of small areas of soil identical in all characteristics except it contains more rock fragments throughout the soil profile than is allowed for the Brycan series.

In typical profile, the surface layer is grayish brown bouldery loam about 11 inches thick. The underlying layer is brown bouldery sandy loam about 15 inches thick. The next layer is pale brown sandy clay loam about 14 inches thick. The next layer is light brownish gray light clay loam (31 percent clay) about 14 inches thick. The next layer is pale brown loam about 14 inches thick. This soil has thick layers of buried surface layers.

Permeability is moderate. Available water capacity is about 11 inches to depth of 60 inches. Organic matter content in the surface and in some buried layers, is about 3 percent. Effective rooting depth is about 60 inches. Surface runoff is slow and erosion hazard is slight under native vegetation, and moderate if vegetation is removed. Erodibility is moderate. This soil is used for grazing of livestock and wildlife habitat.

The taxonomic classification of this soil is fine-loamy, mixed, Cumulic Haploborolls.

Brycan loam, 10 to 25 percent slopes (fan pad)

A typical pedon of Brycan loam, 10 to 25 percent slopes, was described in test pit TP-7. The test pit is located approximately 340 south and 70 feet west of the northeast corner of Sec. 13, T.13S. R.10E., SLBM.

O₁ - 0 to 2 inches; organic matter comprised of decaying leaves, clear wavy boundary.

A₁ - 2 to 5 inches; very dark grayish brown (10YR3/3) loam, subangular blocky structure, soft, very friable, slightly sticky and slightly plastic, common very fine roots, common medium pores, approximately 5 percent pebbles, noneffervescent, clear smooth boundary.

A₁₂ - 5 to 9 inches; brown to dark brown (10YR4/3) sandy loam, subangular blocky structure, slightly hard, friable, slightly sticky and slightly plastic, common fine to medium roots, few fine pores, approximately 5 percent pebbles, slight effervescent, clear smooth boundary.

C₁ - 9 to 14 inches; very dark brown (10YR2/2) loam, subangular blocky structure, soft, very friable, slightly sticky and slightly plastic, common fine to coarse roots, few fine pores, approximately 10 percent pebbles, noneffervescent, clear smooth boundary.

C₂ - 14 to 16 inches; light yellowish brown (10YR6/4) sandy loam, granular structure, soft, very friable, nonsticky and nonplastic, common fine to medium roots, common fine pores, strong effervescent, clear smooth boundary.

C₃ - 16 to 32 inches; dark brown (10YR3/3) loam, subangular blocky structure, soft, very friable, slightly sticky and slightly plastic, common fine to coarse roots, few fine pores, approximately 5 percent pebbles, 10 percent cobbles, and 30 percent stones, noneffervescent.

An additional test pit, TP-6, was also excavated in the Brycan loam. The soils encountered in this excavations were slightly different from those in test pit TP-7. Soils from both test pits exhibited evidence of buried surface layers.

AVAILABLE TOPSOIL VOLUME

Because of the similarities between the soils identified during this survey and the soil survey described and results reported in the Andalex Centennial MRP Appendix M, no additional tests of the soils from the pad area have been conducted. The potential productivity of the soils in the pad area is assumed to be similar to those of the existing mine site.

The volume of topsoil to be removed and stored for reclamation purposes at the proposed pad site has been calculated based on the following: total area to be disturbed, a minimum of six-inches of topsoil will be required as final cover during reclamation, the estimated depth of available topsoil located within the proposed disturbed area. Based on the assumption that 3 inches (0.25 ft) of soil will be removed from the Cabba family soils area (0.45 acres), 4 inches (0.33 ft) of soil will be removed from the Datino family soils area (0.26 acres), and 16 inches (1.3 ft) of soil will be removed from the Brycan soils area (0.22 acres), approximately 786 cubic yards of topsoil will be available for reclamation of the pad area. Additional soil may be available if the Cabba family and Datino soils are removed to a greater depth and the coarse material (cobbles and boulders) are removed and stored for reclamation. A copy of the calculations has been included with this report as Attachment C.

VEGETATION

An ocular survey of the pad area was conducted concurrently with the soil survey. Two range types were identified: the Upland Stony Loam (P-J) of the Cabba family soils and the Datino soils and Mountain Stony Loam (oak) of the Brycan soils. Vegetation present in the Cabba family soils (pad area) includes Salina wildrye, low gray sage, big sage, Utah juniper and pinon pine, plants that are generally included in an Upland Stony Loam plant community. In the relatively limited area of the proposed pad, the Salina wildrye appears to be the most common vegetation type while the sages, Utah juniper and pinon pine are very sparse. Some gambel oak is present in the southern-most portion of the pad area. Vegetative cover present on the Mountain Stony Loam (Brycan soils) consists almost exclusively of gambel oak with minor occurrences of juniper.

Although the Datino soils are classified as Upland Stony Loam (P-J), the vegetative cover of these soils is almost exclusively gambel oak. This is probably due to the limited extent of these Datino soils and the healthy gambel oak community supported by the productive and surrounding Brycan soils.

A map illustrating the extent of the Upland Stony Loam (mapped as pinon-juniper woodland) and the Mountain Stony Loam (mapped as oak) plant communities has been included as Attachment D.

Because the proposed pad area is less than one square acre and the soils types and plant communities present are very similar to those surveyed and discussed in the Andalex Centennial MRP Appendix M, an in-depth vegetation survey was not prepared for this site. Andalex proposes that the reclamation seeding and planting plan proposed in the existing MRP is adequate for this area.

If you have any questions regarding this soil survey report or need additional assistance in your future construction, please call Mr. Jim Coburn or myself at (801) 561-1555.

Sincerely,

A handwritten signature in cursive script, appearing to read "Chris D. Hansen".

Chris D. Hansen

cc: Mr. Daron Haddock
Permit Supervisor, UDOGM

ATTACHMENT A

SOILS MAP

ATTACHMENT B

**TYPICAL DATINO AND BRYCAN PEDON SOILS DESCRIPTION
FROM APPENDIX M, ANDALEX CENTENNIAL MRP**

Slopes are 8 to 20 percent. They are concave, east and west facing and are short in length.

Vegetation is that described as the Mountain Stony Loam (oak) range site in the following section. Most visible is the fairly dense gamble oak and bigtooth maple.

Included in mapping are small areas of Datino soils along the upper margins and small areas of a soil identical in all characteristics except it contains more rock fragments throughout the soil profile than is allowed for the Brycan series.

In a typical profile, the surface layer is grayish brown bouldery loam about 28 centimeters (11 inches) thick. The underlying layer is brown bouldery sandy loam about 38 centimeters (15 inches) thick. The next layer is pale brown sandy clay loam about 35 centimeters (14 inches) thick. The next layer is light brownish gray light clay loam (31 percent clay) about 35 centimeters (14 inches) thick. The next layer is pale brown loam about 35 centimeters (14 inches) thick. This soil has thick layers of buried surface layers.

Permeability is moderate. Available water capacity is about 28 centimeters (11 inches) to a depth of 1.5 meters (60 inches). Organic matter content of the surface, and in some buried layers, is about 3 percent. Effective rooting depth is about 1.5 meters (60 inches). Surface runoff is slow and erosion hazard is slight under native vegetation, and moderate if vegetation is removed. Erodibility is moderate. This soil is used for grazing of livestock and wildlife habitat.

The taxonomic classification of this soil is fine-loamy, mixed, Cumulic Haploborolls.

A typical pedon of Brycan bouldery loam, 8 to 20 percent slope was described near the north boundary of the Sunnyside Area, about 7.5 meters (25 feet) west of the drainage bottom. (See soils map for exact location.)

A11---0 to 28 centimeters (0 to 11 inches); grayish brown (10YR 5/2) bouldery loam; very dark grayish brown (10YR 3/2) moist; moderate, medium platy structure; soft, very friable, slightly sticky, slightly plastic; many fine and medium roots, many fine interstitial pores; about 10 percent boulders; slightly effervescent, mildly alkaline (pH 7.65 in saturated paste); clear wavy boundary. (10 to 35 centimeters thick)

A12---28 to 66 centimeters (11 to 26 inches) brown (10YR 5/3) bouldery sandy loam, dark brown (10YR 3/3) moist; moderate fine granular structure; soft, very friable, slightly sticky, slightly plastic; many fine and medium roots, many fine interstitial pores; about 10 percent stones and boulders; slightly effervescent, neutral (pH 7.37 in saturated paste); clear wavy boundary. (30 to 50 centimeters thick)

C1---66 to 102 centimeters (26 to 40 inches) pale brown (10YR 6/3) sandy clay loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; many fine roots; many fine interstitial pores; few fine gravel; strongly effervescent, moderately alkaline (pH 7.87 in saturated paste); clear wavy boundary. (30 to 40 centimeters thick)

C2---102 to 137 centimeters (40 to 54 inches) light brownish gray (10YR 6/2) light clay loam (31 percent clay), dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; many fine and medium roots; many fine interstitial pores; 15 percent sandstone gravel; strongly effervescent with many threadlike lime segregations, moderately alkaline (pH 8.11 in saturated paste); clear wavy boundary. (30 to 40 centimeters thick)

C3----137 to 173 centimeters (54 to 68 inches) pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, friable, sticky and plastic; many fine and medium roots; many fine interstitial pores; few gravel; strongly effervescent, moderately alkaline (pH 8.23 in saturated paste).

Another typical pedon of Brycan bouldery loam, 8 to 20 percent slopes, was described in the Pinnacle Mine Site extension area about 202 meters (675 feet) south and 60 meters (200 feet) east of the north $\frac{1}{4}$ corner marker section 18, T.13S., R.11E. (See soils map for exact location.)

A11---0 to 18 centimeters (0 to 7 inches) grayish brown (10YR 5/2) bouldery loam, very dark grayish brown (10YR 3/2) moist; moderate thin platy parting to moderate fine granular structure; soft, very friable, slightly sticky, slightly plastic; many fine and medium roots; many fine and very fine interstitial and tubular pores; 10 percent boulders, 25 percent gravel; noneffervescent, neutral (pH 7.0); clear wavy boundary. (10 to 25 centimeters thick)

A12---18 to 33 centimeters (7 to 13 inches) grayish brown (10YR 5/2) gravelly loam, very dark brown (10YR 2/2) moist; weak fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many fine and medium roots; many very fine interstitial and tubular pores; 15 percent gravel; noneffervescent, neutral (pH 7.0); clear wavy boundary. (10 to 20 centimeters thick)

C1----33 to 61 centimeters (13 to 24 inches) brown (10YR 5/3) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; hard, friable, slightly sticky, slightly plastic; many fine

and medium roots; many fine interstitial and tubular pores; 15 percent gravel, 5 percent cobble; slightly effervescent, lime coatings on undersides of gravel, mildly alkaline (pH 7.8); gradual wavy boundary. (23 to 35 centimeters thick)

C2----61 to 109 centimeters (24 to 43 inches) brown (10YR 5/3) gravelly loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; hard, friable, slightly sticky, slightly plastic; many fine and medium roots; many fine interstitial and tubular pores; 15 percent gravel; strongly effervescent, lime coatings on all sides of gravel, moderately alkaline (pH 8.2); gradual wavy boundary. (40 to 60 centimeters thick)

C3----109 to 153 centimeters (43 to 60 inches) light brown (7.5YR 6/4) gravelly loam, dark brown (7.5YR 4/4) moist; massive; hard, friable, slightly sticky, slightly plastic; many fine and medium roots; many fine interstitial and tubular pores; 15 percent gravel, 10 percent cobble; strongly effervescent, moderately alkaline (pH 8.2).

Bd Brycan soils disturbed

This soil is the same in all characteristics as the Ba Brycan bouldery loam, except it has been physically disturbed by earth moving equipment in roadbed preparation and other related mining activities. It is devoid of vegetation and contains the major haul roads and facility locations. Many of the pedons are truncated while others have thick depositions of surface materials.

Da Datino very stony loam, 15 to 35 percent slopes

This soil is very deep and well drained. It occurs on alluvial fans at the toeslope of very steep mountain sideslopes at elevations of 2,160 to 2,175 meters (7,100 to 7,150 feet). This soil formed in coluvium and alluvium derived mainly from sandstone and shale.

The average annual precipitation is 30 to 41 centimeters (12 to 16 inches). The mean annual air temperature is 6 to 7 degrees centigrade (43 to 45 degrees F.). The average frost-free season is 100 to 110 days.

Slopes are 15 to 35 percent and are mainly east facing. They are short in length and are mainly concave.

Vegetation is that described for the Upland Stony Loam (P-J) in the vegetation section of this report. Most visible is the dominance of pinyon and juniper trees in rather open stands with sagebrush and salina wildrye grass.

In a typical profile, the surface layer is grayish brown very stony sandy loam about 28 centimeters (11 inches) thick. The underlying layer is pale brown very cobbly loam about 18 centimeters (7 inches) thick. The next layer is pale brown very cobbly silt loam or sandy loam about 107 centimeters (42 inches) thick.

Permeability is moderate. Available water capacity is 10 to 15 centimeters (4 to 6 inches) to a depth of 1.5 meters (60 inches). Organic matter content in the surface layer is about 2.5 percent. Effective rooting depth is about 1.5 meters (60 inches). Surface runoff is slow and erosion hazard is slight under native vegetation, and moderate if vegetation is removed. Erodibility is low. This soil is used for grazing of livestock and wildlife habitat.

The taxonomic classification of this soil is loamy-skeletal, mixed, Typic Haploborolls.

A typical pedon of Datino very stony loam, 15 to 35 percent slopes was described about 120 meters (400 feet) north of the south boundary of the Sunnyside Mine Site area about 15 meters (50 feet) west of the drainage bottom. (See soils map for exact location.)

A1----0 to 28 centimeters (0 to 11 inches) grayish brown (10YR 5/2) very stony sandy loam, very dark grayish brown (10YR 3/2) moist; moderate thin platy parting to moderate fine granular structure; soft, very friable, nonsticky, nonplastic; many fine and very fine roots; many fine interstitial pores; 20 percent stones, 15 percent cobble, 10 percent gravel; noneffervescent, neutral (pH 7.0); clear wavy boundary. (25 to 35 centimeters thick)

B2----28 to 46 centimeters (11 to 18 inches) pale brown (10YR 6/3) very cobbly loam, dark brown (10YR 3/3) moist; moderate fine subangular blocky structure; hard, very friable, slightly sticky, slightly plastic; many fine and medium roots; many fine interstitial pores; 20 percent cobble, 15 percent gravel, 5 percent stones; weakly effervescent, neutral (pH 7.2); clear wavy boundary. (13 to 23 centimeters thick)

C1ca--46 to 153 centimeters (18 to 60 inches) pale brown (10YR 6/3) very cobbly silt loam, brown (10YR 4/3) moist; massive; hard, friable, slightly sticky, slightly plastic; many fine and medium roots; many fine interstitial pores; 25 percent cobble, 20 percent gravel, 15 percent stones; strongly effervescent, moderately alkaline (pH 8.2).

Another typifying pedon of Datino very stony sandy loam was described approximately 225 meters (750 feet) due south of the north $\frac{1}{4}$ corner marker, section 18, T.13S., R.11E. in the Pinnacle Mine Site extension area. (See soils map for exact location.)

A11---0 to 10 centimeters (0 to 4 inches) grayish brown (10YR 5/2) very stony sandy loam, very dark brown (10YR 2/2) moist; moderate thin platy structure; very friable, nonsticky, nonplastic; many fine and medium roots; many very fine interstitial and tubular pores; 15 percent gravel, 5 percent cobble, 5 percent stones; noneffervescent, neutral (pH 7.2); clear wavy boundary. (7 to 15 centimeters thick)

A12---10 to 33 centimeters (4 to 13 inches) grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, very friable, slightly sticky, slightly plastic; many fine and medium roots; many very fine interstitial and tubular pores; 25 percent gravel, 5 percent cobble; noneffervescent, neutral (pH 7.2); clear wavy boundary. (16 to 30 centimeters thick)

B2----33 to 51 centimeters (14 to 20 inches) pale brown (10YR 6/3) gravelly loam, brown (10YR 4/3) moist; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; many fine and medium roots; many very fine interstitial and tubular pores; 15 percent gravel, 10 percent cobble, 5 percent stones; weakly effervescent; mildly alkaline (pH 7.8); abrupt smooth boundary. (10 to 20 centimeters thick)

C1ca--51 to 66 centimeters (20 to 26 inches) pale brown (10YR 6/3) very gravelly sandy loam, brown (10YR 4/3) moist; massive; hard, friable, slightly sticky, slightly plastic; many fine and medium roots; many fine interstitial and tubular pores; 30 percent gravel, 5 percent cobble, 5

5 percent stones; strongly effervescent, moderately alkaline (pH 8.2); abrupt smooth boundary. (30 to 45 centimeters thick)

C2ca--66 to 92 centimeters (26 to 36 inches) very pale brown (10YR 7/3) gravelly sandy loam, brown (10YR 4/3) moist; weak fine subangular blocky structure; hard, friable, slightly sticky, slightly plastic; many fine and medium roots; many fine interstitial and tubular pores; 10 percent gravel, 5 percent cobble; strongly effervescent, moderately alkaline (pH 8.2); abrupt smooth boundary. (20 to 30 centimeters thick)

C3ca--92 to 153 centimeters (36 to 60 inches) pale brown (10YR 6/3) very gravelly sandy loam, brown (10YR 4/3) moist; massive; hard, friable, nonsticky, nonplastic; many fine and medium roots; many fine interstitial and tubular pores; 25 percent gravel, 10 percent cobble, 10 percent stones; strongly effervescent; moderately alkaline (pH 8.2). (50 or more centimeters thick)

R0 Rock outcrop, 50 to 100 percent slopes

This land type occurs only in the Pinnacle Mine Site extension area. It occurs as a rock face on an extremely steep canyon side facing west. It consists mainly of sandstone with a few thin layers of shale. It is essentially devoid of vegetation; consequently has no associated range site. Permeability is essentially zero. Runoff is very high and erosion hazard is very slight (hard rock). This land type is used for aesthetics and watershed.

It has no taxonomic classification; that is, it is classified as Not Soil; consequently, it has no water or nutrient-holding capacity and no effective rooting depth.

ATTACHMENT C

ESTIMATED AVAILABLE TOPSOIL CALCULATIONS

**ANDALEX RESOURCES, INC.
ABERDEEN MINE LEFT HAND FORK
ESTIMATED AVAILABLE TOPSOIL VOLUME CALCULATIONS**

Cabba Family Soils

Area: 19,652 SF
Average depth of available topsoil: 0.25 ft
Volume of topsoil: 19,652 SF X 0.25 ft = 4913 CF
4913 CF / 27 CF/CY = 182 CY

Datino Soils

Area: 11,252 SF
Average depth of available topsoil: 0.33 ft
Volume of topsoil: 11,252 SF X 0.33 ft = 3713 CF
3713 CF / 27 CF/CY = 137 CY

Bryan Soils

Area: 9704 SF
Average depth of available topsoil: 1.3 ft
Volume of topsoil: 9704 SF X 1.3 ft = 12,615 CF
12,615 CF / 27 CF/CY = 467 CY

TOTAL ESTIMATED AVAILABLE TOPSOIL 786 CY

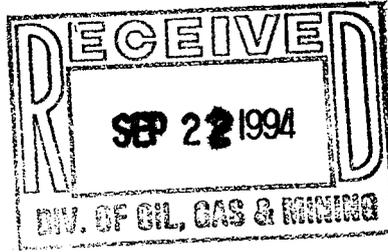
ATTACHMENT D
VEGETATION MAP

ATTACHMENT E
REFERENCES CITED

References Cited:

Soil Survey and Vegetation Inventory, Appendix M. Andalex Resources, Inc, Mining and Reclamation Plan, Vol 1, ACT/007/019.

Soil Conservation Service, 1988. Soil Survey of Carbon Area, Utah. United States Department of Agriculture.



EarthFax

EarthFax
Engineering Inc.
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Telephone 801-561-1555
Fax 801-561-1861

September 22, 1994

Mr. Daron Haddock
Permit Supervisor
Utah Division of Oil, Gas, and Mining
3 Triad Center, Suite 350
Salt Lake City, Utah 84180-1203

9/23

Daron Haddock
for ACT/007/019-94
#2 Copy PAM

RE: Soil Survey Report for the Aberdeen Mine Left Hand Fork Fan Pad, Andalex Resources, Inc., Centennial Project, ACT/007/019

Dear Mr. Haddock:

Please find enclosed two copies of the above referenced report. Mr. Mike Glasson of Andalex has asked me to transmit this report directly to you for your consideration as part of their application to construct the fan portal and pad in Left Fork of Deadman Canyon. If you have any questions, please call me at 561-1555.

Sincerely,

Chris D. Hansen

enclosures



EarthFax

EarthFax
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Midvale, Utah 84047
Telephone 801-561-1555
Fax 801-561-1861

September 23, 1994

SEP 23 1994

Mr. Daron Haddock
Permit Supervisor
Utah Division of Oil, Gas, and Mining
3 Triad Center, Suite 350
Salt Lake City, Utah 84180-1203

RE: Corrected Page 1 and Copies of Appendix F, Test pit Logs, Soil Survey Report for the
Aberdeen Mine Left Hand Fork Fan Pad, Andalex Resources, Inc., Centennial Project,
ACT/007/019 #2 logs DM

Dear Mr. Haddock:

As we discussed on the telephone this morning, I am sending to you copies of the test pit logs for the above referenced soil survey report. I inadvertently excluded them from the original report that I delivered to your attention at UDOGM. I have enclosed a revised first page and copies of the logs. The paper has already been prepared for insertion into the report. I apologize for any inconvenience this may have caused you. If you have any questions, please call me at 561-1555.

Sincerely,

Chris D. Hansen

enclosures



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September 22, 1994

Mr. Michael W. Glasson
Senior Geologist/ Western Operations
Andalex Resources, Inc.
Tower Division
P.O. Box 902
Price, Utah 84501

RE: Soils Survey Report for the Aberdeen Mine Left Hand Fork Fan Pad

Dear Mr. Glasson:

EarthFax Engineering, Inc. (EarthFax) is pleased to provide to Andalex Resources, Inc. (Andalex) this letter report detailing the results of the soil survey that was performed at the proposed Aberdeen Mine Left Hand Fork fan pad. This report has been divided into five sections: an introduction containing a brief description of the work performed, a description of the soil survey, descriptions of the soils encountered, calculations of the volume of available topsoil for reclamation based upon the results of the survey, and a description of the vegetation in the survey area. Additionally, the following attachments are included with this report:

- Attachment A - Soils Map,
- Attachment B - Typical Datino and Brycan Pedon Soils Description From Appendix M, Andalex Centennial MRP,
- Attachment C - Estimated Available Topsoil Calculations,
- Attachment D - Vegetation Map,
- Attachment E - References Cited, and
- Attachment F - Test Pit Logs.

INTRODUCTION

EarthFax was retained by Andalex to conduct a soil survey of the proposed Aberdeen Mine Left Hand Fork fan pad area in September, 1994. Andalex provided EarthFax with a map illustrating the area of proposed disturbance associated with the construction of the fan pad and topsoil storage area. The proposed pad area is located in the Left Fork of Deadman Canyon in the NE 1/4 of the NE 1/4 of Sec. 13, T.13S. R.10E., SLBM. The area of the proposed disturbance is approximately 0.93 acre.

ATTACHMENT F

TEST PIT LOGS



EarthFax

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September 22, 1994

Mr. Michael W. Glasson
Senior Geologist/ Western Operations
Andalex Resources, Inc.
Tower Division
P.O. Box 902
Price, Utah 84501

RE: Soils Survey Report for the Aberdeen Mine Left Hand Fork Fan Pad

Dear Mr. Glasson:

EarthFax Engineering, Inc. (EarthFax) is pleased to provide to Andalex Resources, Inc. (Andalex) this letter report detailing the results of the soil survey that was performed at the proposed Aberdeen Mine Left Hand Fork fan pad. This report has been divided into five sections: an introduction containing a brief description of the work performed, a description of the soil survey, descriptions of the soils encountered, calculations of the volume of available topsoil for reclamation based upon the results of the survey, and a description of the vegetation in the survey area. Additionally, the following attachments are included with this report:

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INTRODUCTION

EarthFax was retained by Andalex to conduct a soil survey of the proposed Aberdeen Mine Left Hand Fork fan pad area in September, 1994. Andalex provided EarthFax with a map illustrating the area of proposed disturbance associated with the construction of the fan pad and topsoil storage area. The proposed pad area is located in the Left Fork of Deadman Canyon in the NE 1/4 of the NE 1/4 of Sec. 13, T.13S. R.10E., SLBM. The area of the proposed disturbance is approximately 0.93 acre.

An order 1 soil survey of the site was conducted during the week of September 11, 1994. Three soils with their were encountered during the soil survey: Cabba family extremely stony loam on 30 to 60 percent slopes, Datino very stony loam on 40 to 70 percent slopes, and Brycan loam on 10 to 25 percent slopes. The typical Cabba family extremely stony loam represents an upland very steep stony loam (P-J) range site. The typical Datino loam represents an upland stony loam (P-J) range site. The typical Brycan loam represents a stony loam (oak) range site. An ocular survey of the vegetation was made and the results are presented in the vegetation section of this report.

SOIL SURVEY

The soil survey was conducted by first identifying the limits of the proposed disturbed area. The boundaries of the area had been surveyed Andalex and the area corners flagged prior to the start of the soil survey. The flagging was located by EarthFax personnel and seven potential test pit locations within the proposed disturbed area were located. Due to the difficulty associated with accessing the area with heavy equipment, all test pits were dug by hand. Each of the test pits was excavated to bedrock or terminated at a depth where removing large cobbles or boulders was no longer possible. Each horizon exposed in the test pits was identified and sampled. The soil samples were immediately placed in plastic bags and the bags sealed to maintain the natural moisture content of the soil. The location and extent of each soil was identified in the field and a soils map has been created. Each soil has been identified on the map using a two letter symbol. The extent of the soils within the disturbed area have been mapped using soil boundary lines. A copy of the soils map has been included with this report as Attachment A.

SOILS DESCRIPTION

Two of the three soils encountered during the soil survey, the Datino and Brycan soils, where also identified and studied during the initial soil survey conducted prior to the construction of the Andalex facility located in the Right Fork of Deadman Canyon. The initial soil survey is included in the Andalex Centennial Project Mining and Reclamation Plan (MRP) as Appendix M, Soil Survey and Vegetation Inventory of the Proposed Sunnyside Mine Site and Extension of the Pinnacle Mine Site. Information contained within Appendix M was used to supplement this soils report. Copies of the descriptions of typical Datino and Brycan soils from Appendix M have been included with this report as Attachment B.

Information supplementing the description of the Cabba family extremely stony loam was obtained from the Soil Conservation Service publication: Soil Survey of Carbon Area, Utah, June 1988.

Cabba Family Extremely Stony Loam, 30 to 60 Percent Slope

The Cabba family extremely stony loam, 30 to 60 percent slopes, in the pad area is shallow to moderately deep and well drained. It occurs on steep mountain slopes at elevations between 7075 and 7130. The soil is derived mainly from sandstone and shale. The average annual rainfall is between 12 and 16 inches. The mean annual temperature is 43 to 45 degrees F and the average freeze-free season is 100 to 110 days. The slopes are concave, south and west facing, and relatively short. Vegetation is Upland Very Steep Stony Loam (P-J) range. Surface runoff is slow and erosion is slight under native vegetation. Erodibility is low. These soils are identified as loamy, mixed (calcareous), frigid, shallow Typic Ustorthents.

The Cabba family extremely stony loam, 30 to 60 percent slope identified in the mine area is very similar to the Cabba family, 40 to 70 percent slopes identified and discussed in the Soil Survey of Carbon Area, Utah. Following is brief description of the Cabba family, 40 to 70 percent slopes as presented in the Soil Survey of Carbon Area, Utah.

Cabba family, 40 to 70 percent slopes (Soil Survey of Carbon Area, Utah)

This shallow, well drained soil is on mountain slopes. It is in the vicinity of Wattis and in the Deadman Canyon area. It formed in colluvium derived dominantly from sandstone and shale. Slope is mainly 40 to 70 percent, but it is 30 to 50 percent in about 25 percent of the unit. Slopes are 100 to 200 feet long, are concave or convex, and dominantly have south aspect. The present vegetation in most areas is mainly pinon, juniper, Indian ricegrass, Salina wildrye, and birchleaf mountainmahogany. Elevation is 7,200 to 8600 feet. the average annual precipitation is 14 to 16 inches, the average annual air temperature is 42 to 45 degrees F, and the average freeze-free period is 80 to 120 days. Typically, the surface layer is light yellowish brown extremely stony fine sandy loam about two inches thick. The underlying material to a depth of 15 inches is light yellowish brown gravelly loam over sandstone. Depth to sandstone is 10 to 20 inches.

Included in this unit are about 10 percent soils that are similar to this Cabba family soil but have bedrock at a depth of 20 to 40 inches and about 5 percent Rock outcrop.

Permeability of this Cabba Family soil is moderate. Available water capacity is about 1.5 to 3.0 inches. Water supplying capacity is 3.5 to 6.0 inches. Effective rooting depth is 20 to 40 inches. The organic matter content of the surface layer is 1 to 3 percent.

This unit is used as wildlife habitat, rangeland, and woodland and for mining purposes.

The potential vegetation of the Cabba family soil includes an overstory of pinon and Utah juniper with a canopy of 30 percent. The understory vegetation is 45 percent grasses,

10 percent forbes, and 45 percent shrubs. Among the important plants are birchleaf mountainmahogany, black sagebrush, Salina wildrye, and needleandthread.

The site index for pinon and Utah juniper is 50. Average yield is 6 cords of wood per acre. The potential is poor for the production of posts or Christmas trees. This unit is severely limited for the harvesting of wood products because of the steepness of slope and the hazard of erosion. If wood products are harvested, the slash should be left scattered on the surface to protect the soil from erosion.

This unit is not grazeable by livestock because of the steepness of slope.

This map unit is in capability subclass VIIIe, non-irrigated, and in the Upland Very Steep Stony Loam (Pinon-Utah Juniper) woodland site.

These soils are identified as loamy, mixed (calcareous), frigid, shallow Typic Ustorthents.

Cabba family extremely stony loam, 30 to 60 percent slope (fan pad)

A typical pedon of Cabba family 30 to 60 percent slope was described in test pit TP-2. TP-2 is located approximately 190 feet south and 30 feet west of the northeast corner of Sec. 13, T.13S. R.10E., SLBM.

A₁ - 0 to 12 inches; brown (10YR5/3) extremely stony loam, subangular blocky structure, soft, very friable, slightly sticky and slightly plastic, common fine to very fine roots, few very fine pores, approximately 25 percent stones, 10 percent cobbles, 5 percent pebbles, and 5 percent boulders, strongly effervescent, abrupt smooth boundary.

C₁ - 12 to 20 inches; yellowish brown (10YR5/6) very cobbly silty loam, subangular blocky structure, soft, very friable, slightly sticky and slightly plastic, few very fine roots, many very fine pores, approximately 15 percent pebbles, 10 percent cobbles, strongly effervescent, abrupt smooth boundary.

Sandstone bedrock at 20 inches below ground surface.

Two additional test pits were excavated in the Cabba family extremely stony loam and their locations are illustrated on the attached soils maps. The thickness of the A₁ horizons in TP-1 and TP-3 varied but was very similar to the soil described in TP-2. A C₂ horizon was identified and described in TP-3.

Datino Loam, 40 to 70 Percent Slopes

This soil is moderately deep, well drained, and moderately permeable. The soil occurs at the base of steep mountain slopes at elevations between 7040 and 7075. This soil is down slope of the Brycan soils in some portions of the pad area. The soil forms from colluvium and alluvium derived mainly from sandstone and shale. The average annual rainfall is between 12 and 16 inches. The mean annual temperature is 43 to 45 degrees F and the average freeze-free season is 100 to 110 days. The slopes are concave, south and west facing, and relatively short. Vegetation is upland stony loam (P-J) range. The taxonomic classification of this soil is loamy-skeletal, mixed, Typic Haploborolls.

The Datino loam, 40 to 70 percent slope, identified in the fan pad area is similar to the Datino very stony loam, 15 to 35 percent slopes identified in Appendix M of the Andalex Centennial MRP. The following is a typical profile of the Datino very stony loam, 15 to 35 percent slopes as described in Appendix M. A copy of the description of two typical pedons of Datino very stony loam, 15 to 35 percent slopes, from Appendix M is included with this report as Attachment B.

Datino very stony loam, 15 to 35 percent slopes (Appendix M, Andalex Centennial MRP)

This soil is very deep and well drained. It occurs on alluvial fans at the toeslope of very steep mountain sideslopes at elevations of 7,100 to 7150 feet. This soil formed in colluvium and alluvium derived mainly from sandstone and shale.

The average annual precipitation is 12 to 16 inches. The mean annual air temperature is 43 to 45 degrees F. The average frost-free season is 100 to 110 days.

Slopes are 15 to 35 percent and area mainly east facing. They are short in length and are mainly concave.

Vegetation is that described for the Upland Stony Loam (P-J) in the vegetation section of this report (Appendix M, Andalex Centennial MRP). Most visible is the dominance of pinon and juniper trees in rather open stands with sagebrush and Salina wildrye grass.

In typical profile, the surface layer is grayish brown very stony sandy loam about 11 inches thick. The underlying layer is pale brown very cobbly silt loam about 7 inches thick. The next layer is pale brown very cobbly silt loam or sandy loam about 42 inches thick.

Permeability is moderate. Available water capacity is 4 to 6 inches. Organic matter content in the surface layer is about 2.5 percent. Effective rooting depth is about 60 inches. Surface runoff is slow and erosion hazard is slight under native vegetation, and moderate if

vegetation is removed. Erodibility is low. This soil is used for grazing of livestock and wildlife habitat.

The taxonomic classification of this soil is loamy-skeletal, mixed, Typic Haploborolls.

Datino loam, 40 to 70 percent slopes (fan pad)

A typical pedon of Datino loam, 40 to 70 percent slopes, in the pad area was described in test pit TP-5. The test pit is located approximately 350 south and 10 feet west of the northeast corner of Sec. 13, T.13S. R.10E., SLBM.

A₁ - 0 to 4 inches; very dark grayish brown (10YR3/2) loam, granular structure, soft, friable, slightly sticky and slightly plastic, common fine roots, common fine interstitial pores, 10 percent pebbles, moderately effervescent, clear wavy boundary.

A₁ - 4 to 21 inches; brown (10YR5/3) very stony loam, subangular blocky structure, soft, very friable, slightly sticky and slightly plastic, many medium to coarse roots, very fine pores, approximately 5 percent pebbles, 20 percent cobbles, and 30 stones, strongly effervescent, clear wavy boundary.

B₁ - 21 to 30 inches; pale brown (10YR6/3) very stony loam, subangular blocky structure, soft, very friable, nonsticky and nonplastic, common fine roots, many fine pores, approximately 10 percent pebbles, 25 percent cobbles, and 30 stones, and moderately effervescent.

An additional test pit, TP-4 was also excavated in the Datino loam. The soils encountered in this excavations were only slightly different from those in test pit TP-5.

Brycan Loam, 10 to 25 Percent Slopes

This soil is moderately deep and well drained. In the pad area, it occurs near the bottom of steep mountain slopes in two areas where the slope begins to flatten out. The elevation of these soils in the pad area is approximately between 7050 and 7075. The soil forms from alluvium derived mainly from sandstone and shale. The average annual rainfall is between 12 and 16 inches. The mean annual temperature is 43 to 45 degrees F and the average freeze-free season is 100 to 110 days. The slopes are 10 to 25 percent, concave, south and west facing, and relatively short. Vegetation is Mountain Stony Loam (oak) range. The taxonomic classification of this soil is fine-loamy, mixed, Cumulic Haploborolls.

Generally, with the exception of the lack of boulders in A₁ horizon, the Brycan loam, 10 to 25 percent slope, identified in the fan pad area, is similar to the Brycan bouldery loam, 8 to 20 percent slopes identified in Appendix M of the Andalex Centennial MRP. The

following is a typical profile of the Brycan bouldery loam, 8 to 20 percent slopes as described in Appendix M. A copy of the Brycan pedon profiles from Appendix M are included with this report in Attachment B.

Brycan bouldery loam, 8 to 20 percent slopes (Soil Survey and Vegetation Inventory of the Proposed Sunnyside Mine Site and Extension of the Pinnacle Mine Site)

This soil is very deep and well drained. It occurs in the bottoms of canyons and on alluvial fans at the foot of very steep mountains slopes at elevations of 7,050 to 7100 feet. This soil formed in alluvium derived mainly from sandstone and shale.

The average annual precipitation is 12 to 16 inches. The mean annual air temperature is 43 to 45 degrees F. The average frost-free season is 100 to 110 days.

Slopes are 8 to 20 percent. They are concave, east and west facing and are short in length.

Vegetation is that described as the Mountain Stony Loam (oak) range site in the following section (Appendix M, Andalex Centennial MRP). Most visible is the fairly dense gambel oak and big tooth maple.

Included in mapping are small areas of Datino soils along the upper margins of small areas of soil identical in all characteristics except it contains more rock fragments throughout the soil profile than is allowed for the Brycan series.

In typical profile, the surface layer is grayish brown bouldery loam about 11 inches thick. The underlying layer is brown bouldery sandy loam about 15 inches thick. The next layer is pale brown sandy clay loam about 14 inches thick. The next layer is light brownish gray light clay loam (31 percent clay) about 14 inches thick. The next layer is pale brown loam about 14 inches thick. This soil has thick layers of buried surface layers.

Permeability is moderate. Available water capacity is about 11 inches to depth of 60 inches. Organic matter content in the surface and in some buried layers, is about 3 percent. Effective rooting depth is about 60 inches. Surface runoff is slow and erosion hazard is slight under native vegetation, and moderate if vegetation is removed. Erodibility is moderate. This soil is used for grazing of livestock and wildlife habitat.

The taxonomic classification of this soil is fine-loamy, mixed, Cumulic Haploborolls.

Brycan loam, 10 to 25 percent slopes (fan pad)

A typical pedon of Brycan loam, 10 to 25 percent slopes, was described in test pit TP-7. The test pit is located approximately 340 south and 70 feet west of the northeast corner of Sec. 13, T.13S. R.10E., SLBM.

O₁ - 0 to 2 inches; organic matter comprised of decaying leaves, clear wavy boundary.

A₁ - 2 to 5 inches; very dark grayish brown (10YR3/3) loam, subangular blocky structure, soft, very friable, slightly sticky and slightly plastic, common very fine roots, common medium pores, approximately 5 percent pebbles, noneffervescent, clear smooth boundary.

A₁₂ - 5 to 9 inches; brown to dark brown (10YR4/3) sandy loam, subangular blocky structure, slightly hard, friable, slightly sticky and slightly plastic, common fine to medium roots, few fine pores, approximately 5 percent pebbles, slight effervescent, clear smooth boundary.

C₁ - 9 to 14 inches; very dark brown (10YR2/2) loam, subangular blocky structure, soft, very friable, slightly sticky and slightly plastic, common fine to coarse roots, few fine pores, approximately 10 percent pebbles, noneffervescent, clear smooth boundary.

C₂ - 14 to 16 inches; light yellowish brown (10YR6/4) sandy loam, granular structure, soft, very friable, nonsticky and nonplastic, common fine to medium roots, common fine pores, strong effervescent, clear smooth boundary.

C₃ - 16 to 32 inches; dark brown (10YR3/3) loam, subangular blocky structure, soft, very friable, slightly sticky and slightly plastic, common fine to coarse roots, few fine pores, approximately 5 percent pebbles, 10 percent cobbles, and 30 percent stones, noneffervescent.

An additional test pit, TP-6, was also excavated in the Brycan loam. The soils encountered in this excavations were slightly different from those in test pit TP-7. Soils from both test pits exhibited evidence of buried surface layers.

AVAILABLE TOPSOIL VOLUME

Because of the similarities between the soils identified during this survey and the soil survey described and results reported in the Andalex Centennial MRP Appendix M, no additional tests of the soils from the pad area have been conducted. The potential productivity of the soils in the pad area is assumed to be similar to those of the existing mine site.

The volume of topsoil to be removed and stored for reclamation purposes at the proposed pad site has been calculated based on the following: total area to be disturbed, a minimum of six-inches of topsoil will be required as final cover during reclamation, the estimated depth of available topsoil located within the proposed disturbed area. Based on the assumption that 3 inches (0.25 ft) of soil will be removed from the Cabba family soils area (0.45 acres), 4 inches (0.33 ft) of soil will be removed from the Datino family soils area (0.26 acres), and 16 inches (1.3 ft) of soil will be removed from the Brycan soils area (0.22 acres), approximately 786 cubic yards of topsoil will be available for reclamation of the pad area. Additional soil may be available if the Cabba family and Datino soils are removed to a greater depth and the coarse material (cobbles and boulders) are removed and stored for reclamation. A copy of the calculations has been included with this report as Attachment C.

VEGETATION

An ocular survey of the pad area was conducted concurrently with the soil survey. Two range types were identified: the Upland Stony Loam (P-J) of the Cabba family soils and the Datino soils and Mountain Stony Loam (oak) of the Brycan soils. Vegetation present in the Cabba family soils (pad area) includes Salina wildrye, low gray sage, big sage, Utah juniper and pinon pine, plants that are generally included in an Upland Stony Loam plant community. In the relatively limited area of the proposed pad, the Salina wildrye appears to be the most common vegetation type while the sages, Utah juniper and pinon pine are very sparse. Some gambel oak is present in the southern-most portion of the pad area. Vegetative cover present on the Mountain Stony Loam (Brycan soils) consists almost exclusively of gambel oak with minor occurrences of juniper.

Although the Datino soils are classified as Upland Stony Loam (P-J), the vegetative cover of these soils is almost exclusively gambel oak. This is probably due to the limited extent of these Datino soils and the healthy gambel oak community supported by the productive and surrounding Brycan soils.

A map illustrating the extent of the Upland Stony Loam (mapped as pinon-juniper woodland) and the Mountain Stony Loam (mapped as oak) plant communities has been included as Attachment D.

Because the proposed pad area is less than one square acre and the soils types and plant communities present are very similar to those surveyed and discussed in the Andalex Centennial MRP Appendix M, an in-depth vegetation survey was not prepared for this site. Andalex proposes that the reclamation seeding and planting plan proposed in the existing MRP is adequate for this area.

If you have any questions regarding this soil survey report or need additional assistance in your future construction, please call Mr. Jim Coburn or myself at (801) 561-1555.

Sincerely,

A handwritten signature in black ink, appearing to read "Chris D. Hansen". The signature is written in a cursive style with a large, sweeping initial "C".

Chris D. Hansen

cc: Mr. Daron Haddock
Permit Supervisor, UDOGM

ATTACHMENT A

SOILS MAP

ATTACHMENT B

**TYPICAL DATINO AND BRYCAN PEDON SOILS DESCRIPTION
FROM APPENDIX M, ANDALEX CENTENNIAL MRP**

Slopes are 8 to 20 percent. They are concave, east and west facing and are short in length.

Vegetation is that described as the Mountain Stony Loam (oak) range site in the following section. Most visible is the fairly dense gamble oak and bigtooth maple.

Included in mapping are small areas of Datino soils along the upper margins and small areas of a soil identical in all characteristics except it contains more rock fragments throughout the soil profile than is allowed for the Brycan series.

In a typical profile, the surface layer is grayish brown bouldery loam about 28 centimeters (11 inches) thick. The underlying layer is brown bouldery sandy loam about 38 centimeters (15 inches) thick. The next layer is pale brown sandy clay loam about 35 centimeters (14 inches) thick. The next layer is light brownish gray light clay loam (31 percent clay) about 35 centimeters (14 inches) thick. The next layer is pale brown loam about 35 centimeters (14 inches) thick. This soil has thick layers of buried surface layers.

Permeability is moderate. Available water capacity is about 28 centimeters (11 inches) to a depth of 1.5 meters (60 inches). Organic matter content of the surface, and in some buried layers, is about 3 percent. Effective rooting depth is about 1.5 meters (60 inches). Surface runoff is slow and erosion hazard is slight under native vegetation, and moderate if vegetation is removed. Erodibility is moderate. This soil is used for grazing of livestock and wildlife habitat.

The taxonomic classification of this soil is fine-loamy, mixed, Cumulic Haploborolls.

A typical pedon of Brycan bouldery loam, 8 to 20 percent slope was described near the north boundary of the Sunnyside Area, about 7.5 meters (25 feet) west of the drainage bottom. (See soils map for exact location.)

A11---0 to 28 centimeters (0 to 11 inches); grayish brown (10YR 5/2) bouldery loam; very dark grayish brown (10YR 3/2) moist; moderate, medium platy structure; soft, very friable, slightly sticky, slightly plastic; many fine and medium roots, many fine interstitial pores; about 10 percent boulders; slightly effervescent, mildly alkaline (pH 7.65 in saturated paste); clear wavy boundary. (10 to 35 centimeters thick)

A12---28 to 66 centimeters (11 to 26 inches) brown (10YR 5/3) bouldery sandy loam, dark brown (10YR 3/3) moist; moderate fine granular structure; soft, very friable, slightly sticky, slightly plastic; many fine and medium roots, many fine interstitial pores; about 10 percent stones and boulders; slightly effervescent, neutral (pH 7.37 in saturated paste); clear wavy boundary. (30 to 50 centimeters thick)

C1----66 to 102 centimeters (26 to 40 inches) pale brown (10YR 6/3) sandy clay loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; many fine roots; many fine interstitial pores; few fine gravel; strongly effervescent, moderately alkaline (pH 7.87 in saturated paste); clear wavy boundary. (30 to 40 centimeters thick)

C2----102 to 137 centimeters (40 to 54 inches) light brownish gray (10YR 6/2) light clay loam (31 percent clay), dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; many fine and medium roots; many fine interstitial pores; 15 percent sandstone gravel; strongly effervescent with many threadlike lime segregations, moderately alkaline (pH 8.11 in saturated paste); clear wavy boundary. (30 to 40 centimeters thick)

C3----137 to 173 centimeters (54 to 68 inches) pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, friable, sticky and plastic; many fine and medium roots; many fine interstitial pores; few gravel; strongly effervescent, moderately alkaline (pH 8.23 in saturated paste).

Another typical pedon of Brycan bouldery loam, 8 to 20 percent slopes, was described in the Pinnacle Mine Site extension area about 202 meters (675 feet) south and 60 meters (200 feet) east of the north $\frac{1}{4}$ corner marker section 18, T.13S., R.11E. (See soils map for exact location.)

A11---0 to 18 centimeters (0 to 7 inches) grayish brown (10YR 5/2) bouldery loam, very dark grayish brown (10YR 3/2) moist; moderate thin platy parting to moderate fine granular structure; soft, very friable, slightly sticky, slightly plastic; many fine and medium roots; many fine and very fine interstitial and tubular pores; 10 percent boulders, 25 percent gravel; noneffervescent, neutral (pH 7.0); clear wavy boundary. (10 to 25 centimeters thick)

A12---18 to 33 centimeters (7 to 13 inches) grayish brown (10YR 5/2) gravelly loam, very dark brown (10YR 2/2) moist; weak fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many fine and medium roots; many very fine interstitial and tubular pores; 15 percent gravel; noneffervescent, neutral (pH 7.0); clear wavy boundary. (10 to 20 centimeters thick)

C1----33 to 61 centimeters (13 to 24 inches) brown (10YR 5/3) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; hard, friable, slightly sticky, slightly plastic; many fine

and medium roots; many fine interstitial and tubular pores; 15 percent gravel, 5 percent cobble; slightly effervescent, lime coatings on undersides of gravel, mildly alkaline (pH 7.8); gradual wavy boundary. (23 to 35 centimeters thick)

C2----61 to 109 centimeters (24 to 43 inches) brown (10YR 5/3) gravelly loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; hard, friable, slightly sticky, slightly plastic; many fine and medium roots; many fine interstitial and tubular pores; 15 percent gravel; strongly effervescent, lime coatings on all sides of gravel, moderately alkaline (pH 8.2); gradual wavy boundary. (40 to 60 centimeters thick)

C3----109 to 153 centimeters (43 to 60 inches) light brown (7.5YR 6/4) gravelly loam, dark brown (7.5YR 4/4) moist; massive; hard, friable, slightly sticky, slightly plastic; many fine and medium roots; many fine interstitial and tubular pores; 15 percent gravel, 10 percent cobble; strongly effervescent, moderately alkaline (pH 8.2).

Bd Brycan soils disturbed

This soil is the same in all characteristics as the Ba Brycan bouldery loam, except it has been physically disturbed by earth moving equipment in roadbed preparation and other related mining activities. It is devoid of vegetation and contains the major haul roads and facility locations. Many of the pedons are truncated while others have thick depositions of surface materials.

Da Datino very stony loam, 15 to 35 percent slopes

This soil is very deep and well drained. It occurs on alluvial fans at the toeslope of very steep mountain sideslopes at elevations of 2,160 to 2,175 meters (7,100 to 7,150 feet). This soil formed in coluvium and alluvium derived mainly from sandstone and shale.

The average annual precipitation is 30 to 41 centimeters (12 to 16 inches). The mean annual air temperature is 6 to 7 degrees centigrade (43 to 45 degrees F.). The average frost-free season is 100 to 110 days.

Slopes are 15 to 35 percent and are mainly east facing. They are short in length and are mainly concave.

Vegetation is that described for the Upland Stony Loam (P-J) in the vegetation section of this report. Most visible is the dominance of pinyon and juniper trees in rather open stands with sagebrush and salina wildrye grass.

In a typical profile, the surface layer is grayish brown very stony sandy loam about 28 centimeters (11 inches) thick. The underlying layer is pale brown very cobbly loam about 18 centimeters (7 inches) thick. The next layer is pale brown very cobbly silt loam or sandy loam about 107 centimeters (42 inches) thick.

Permeability is moderate. Available water capacity is 10 to 15 centimeters (4 to 6 inches) to a depth of 1.5 meters (60 inches). Organic matter content in the surface layer is about 2.5 percent. Effective rooting depth is about 1.5 meters (60 inches). Surface runoff is slow and erosion hazard is slight under native vegetation, and moderate if vegetation is removed. Erodibility is low. This soil is used for grazing of livestock and wildlife habitat.

The taxonomic classification of this soil is loamy-skeletal, mixed, Typic Haploborolls.

A typical pedon of Datino very stony loam, 15 to 35 percent slopes was described about 120 meters (400 feet) north of the south boundary of the Sunnyside Mine Site area about 15 meters (50 feet) west of the drainage bottom. (See soils map for exact location.)

A1----0 to 28 centimeters (0 to 11 inches) grayish brown (10YR 5/2) very stony sandy loam, very dark grayish brown (10YR 3/2) moist; moderate thin platy parting to moderate fine granular structure; soft, very friable, nonsticky, nonplastic; many fine and very fine roots; many fine interstitial pores; 20 percent stones, 15 percent cobble, 10 percent gravel; noneffervescent, neutral (pH 7.0); clear wavy boundary. (25 to 35 centimeters thick)

B2----28 to 46 centimeters (11 to 18 inches) pale brown (10YR 6/3) very cobbly loam, dark brown (10YR 3/3) moist; moderate fine subangular blocky structure; hard, very friable, slightly sticky, slightly plastic; many fine and medium roots; many fine interstitial pores; 20 percent cobble, 15 percent gravel, 5 percent stones; weakly effervescent, neutral (pH 7.2); clear wavy boundary. (13 to 23 centimeters thick)

C1ca--46 to 153 centimeters (18 to 60 inches) pale brown (10YR 6/3) very cobbly silt loam, brown (10YR 4/3) moist; massive; hard, friable, slightly sticky, slightly plastic; many fine and medium roots; many fine interstitial pores; 25 percent cobble, 20 percent gravel, 15 percent stones; strongly effervescent, moderately alkaline (pH 8.2).

Another typifying pedon of Datino very stony sandy loam was described approximately 225 meters (750 feet) due south of the north $\frac{1}{4}$ corner marker, section 18, T.13S., R.11E. in the Pinnacle Mine Site extension area. (See soils map for exact location.)

A11---0 to 10 centimeters (0 to 4 inches) grayish brown (10YR 5/2) very stony sandy loam, very dark brown (10YR 2/2) moist; moderate thin platy structure; very friable, nonsticky, nonplastic; many fine and medium roots; many very fine interstitial and tubular pores; 15 percent gravel, 5 percent cobble, 5 percent stones; noneffervescent, neutral (pH 7.2); clear wavy boundary. (7 to 15 centimeters thick)

A12---10 to 33 centimeters (4 to 13 inches) grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, very friable, slightly sticky, slightly plastic; many fine and medium roots; many very fine interstitial and tubular pores; 25 percent gravel, 5 percent cobble; noneffervescent, neutral (pH 7.2); clear wavy boundary. (16 to 30 centimeters thick)

B2----33 to 51 centimeters (14 to 20 inches) pale brown (10YR 6/3) gravelly loam, brown (10YR 4/3) moist; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; many fine and medium roots; many very fine interstitial and tubular pores; 15 percent gravel, 10 percent cobble, 5 percent stones; weakly effervescent; mildly alkaline (pH 7.8); abrupt smooth boundary. (10 to 20 centimeters thick)

C1ca--51 to 66 centimeters (20 to 26 inches) pale brown (10YR 6/3) very gravelly sandy loam, brown (10YR 4/3) moist; massive; hard, friable, slightly sticky, slightly plastic; many fine and medium roots; many fine interstitial and tubular pores; 30 percent gravel, 5 percent cobble, 5

5 percent stones; strongly effervescent, moderately alkaline (pH 8.2); abrupt smooth boundary. (30 to 45 centimeters thick)

C2ca--66 to 92 centimeters (26 to 36 inches) very pale brown (10YR 7/3) gravelly sandy loam, brown (10YR 4/3) moist; weak fine subangular blocky structure; hard, friable, slightly sticky, slightly plastic; many fine and medium roots; many fine interstitial and tubular pores; 10 percent gravel, 5 percent cobble; strongly effervescent, moderately alkaline (pH 8.2); abrupt smooth boundary. (20 to 30 centimeters thick)

C3ca--92 to 153 centimeters (36 to 60 inches) pale brown (10YR 6/3) very gravelly sandy loam, brown (10YR 4/3) moist; massive; hard, friable, nonsticky, nonplastic; many fine and medium roots; many fine interstitial and tubular pores; 25 percent gravel, 10 percent cobble, 10 percent stones; strongly effervescent; moderately alkaline (pH 8.2). (50 or more centimeters thick)

R0 Rock outcrop, 50 to 100 percent slopes

This land type occurs only in the Pinnacle Mine Site extension area. It occurs as a rock face on an extremely steep canyon side facing west. It consists mainly of sandstone with a few thin layers of shale. It is essentially devoid of vegetation; consequently has no associated range site. Permeability is essentially zero. Runoff is very high and erosion hazard is very slight (hard rock). This land type is used for aesthetics and watershed.

It has no taxonomic classification; that is, it is classified as Not Soil; consequently, it has no water or nutrient-holding capacity and no effective rooting depth.

ATTACHMENT C

ESTIMATED AVAILABLE TOPSOIL CALCULATIONS

**ANDALEX RESOURCES, INC.
ABERDEEN MINE LEFT HAND FORK
ESTIMATED AVAILABLE TOPSOIL VOLUME CALCULATIONS**

Cabba Family Soils

Area: 19,652 SF
Average depth of available topsoil: 0.25 ft
Volume of topsoil: 19,652 SF X 0.25 ft = 4913 CF
4913 CF / 27 CF/CY = **182 CY**

Datino Soils

Area: 11,252 SF
Average depth of available topsoil: 0.33 ft
Volume of topsoil: 11,252 SF X 0.33 ft = 3713 CF
3713 CF / 27 CF/CY = **137 CY**

Brycan Soils

Area: 9704 SF
Average depth of available topsoil: 1.3 ft
Volume of topsoil: 9704 SF X 1.3 ft = 12,615 CF
12,615 CF / 27 CF/CY = **467 CY**

TOTAL ESTIMATED AVAILABLE TOPSOIL **786 CY**

ATTACHMENT D
VEGETATION MAP

ATTACHMENT E
REFERENCES CITED

References Cited:

Soil Survey and Vegetation Inventory, Appendix M. Andalex Resources, Inc, Mining and Reclamation Plan, Vol 1, ACT/007/019.

Soil Conservation Service, 1988. Soil Survey of Carbon Area, Utah. United States Department of Agriculture.

