# North American Equities, n.v.

# Blazon No. 1 Mine
# Permit Application Package

NORTH AMERICAN EQUITIES, n.v. 1401 17th STREET, SUITE 1510 DENVER, COLORADO 80202

Cross Reference from original application to this PAP

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Prepared for
NORTH AMERICAN EQUITIES NV
1401 Seventeenth Street, Suite 1510
Denver, Colorado 80202

# PERMIT APPLICATION PACKAGE
North American Equities
Blazon No. 1 Mine

RECEIVED
JUN 20 1984
DIVISION OF OIL
GAS & MINING

May 17, 1984

Prepared By
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## UMC 771.23 PERMIT APPLICATIONS - GENERAL REQUIREMENTS FOR FORMAT AND CONTENTS

North American Equities NV requested that the Utah State Historical Society conduct a search to determine the existence of any known cultural and historical resources within the permit area and adjacent areas. The search resulted in the conclusion that there are no resource sites listed or eligible for listing on the National Register of Historic Places within the permit area or adjacent areas.

The Blazon No. 1 Mine facilities are located on privately owned surface which has not been previously disturbed. The mine related disturbance of approximately seven (7) acres over the mine life is expected to have no impact on cultural or historical resources due to the absence of any known historical/cultural resources in the area and the limited amount of area to be disturbed. If any historical/cultural resources are discovered, North American Equities NV will notify the Utah State Historical Society.

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In response to Utah Division of Oil, Gas, and Mining (DOGM) comments, vegetation field work was performed and final report preparation was completed during the month of September, 1983.

The field work was performed at the Blazon No. 1 Mine by:

| | | |
|---|---|---|
| Ms. Claire Semmer<br>Reclamation Biologist<br>P.O. Box 990341<br>Steamboat Village, CO 80499 | and | Ms. Rebecca Gillan<br>Reclamation Technician<br>Route 2<br>Forsyth, Montana 59327 |

Field data reduction and compilation of vegetation reports, submitted as part of the Apparent Completeness Response (ACR) Document on October 7, 1983 and the Determination of Completeness (DOC) Response on March 1, 1984, was completed in Ms. Semmer's Steamboat Springs, Colorado offices.

## UMC 782.13 IDENTIFICATION OF INTEREST

The original Mining and Reclamation Plan listed Blazon Company as permit applicant. Blazon Company was the agent and mining contractor for the mine owner, TOE Investment Company NV.

Effective July, 1981, TOE Investment Company changed its corporate name to North American Equities NV. Evidence of the corporate name change is provided as Exhibit 1, Corporate Name Change Documentation.

Blazon Company has been discharged as agent and mining contractor for North American Equities NV.

North American Equities NV is the permit applicant for the Blazon No. 1 Mine. North American Equities NV has general offices located at the following address:

Identification of Interest

North American Equities NV 124598
1401 17th Street, Suite 1510
Denver, Colorado 80202
(303) 296-9441

All correspondence should be sent to the attention of Mr. Alan W. Smith. 124599

The owners of record of surface areas contiguous to the permit area are shown on the Surface Ownership Map (Map 1) and listed below:

Milton E. Jacob, et al - 2759 Edgewood, Provo, Utah 84604
Calvin K. Jacob, et al - 754 S. Cherry Dr., Orem, Utah 84057
Kanawha & Hocking Coal and Coke (Valley Camp of Utah, Inc.)
- P.O. Box 507, Clear Creek, Utah 84517
The United States Government

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The United States Government

# UMC 782.14 COMPLIANCE INFORMATION

The Blazon No. 1 Mine is currently under interim permit status. The mine produced coal from March 1981 through the time of closure in February 1982. Subsequent personnel cutbacks have delayed North American Equities NV in the continuing efforts to permit the Blazon No. 1 Mine under the Utah Permanent Program.

North American Equities NV has been in contact with DOGM regarding the situation and will continue diligent efforts to complete permitting in a time frame acceptable to DOGM. Submittal of the response to the Apparent Completeness Review ("ACR") will take place no later than October 7, 1983.

North American Equities NV has not forfeited mining bond or similar security deposited in lieu of bond.

The complete list of violations, notices and descriptive information is shown below.

The Notice of Violation referred to in the Mining and Reclamation Plan was number N80-1-7-3 issued October 1, 1980 by DOGM.

- Violation 1. Side Cast Fill Construction. Data was submitted proving construction stability. The violation was vacated December 3, 1980.

- Violation 2. Failure to Pass Surface Drainage Through Sediment Pond. Maintenance was performed on berms and drainage ditches to alleviate the problem. The violation was terminated October 15, 1980.

- Violation 3. Failure to Protect Topsoil. Topsoil stockpiles were moved, consolidated, re-seeded and protection berms constructed. The violation was terminated October 15, 1980.

Violation 2 and Violation 3 carried a civil penalty assessment of $200.00 which was promptly paid.

North American Equities NV contact with the Office of Surface Mining in Albuquerque, New Mexico, indicates that no Federal Notice of Violation has ever been issued.

## UMC 782.17 PERMIT TERM INFORMATION

Surface areas potentially affected by underground coal mining operations at the Blazon No. 1 Mine are graphically depicted on the Mine Plan Map (Map 8) by the "Life of Mine Affected Area" line. The surface area affected by underground mining encompasses approximately 180 acres. The surface area disturbed by installation of surface facilities, roads, topsoil stockpiles, and the mine development waste storage area is less than seven (7) acres.

## UMC 782.18 PERSONAL INJURY AND PROPERTY DAMAGE INSURANCE INFORMATION

North American Equities NV carries both personal injury and property damage insurance covering the Blazon No. 1 Mine. Proof of insurance is provided by Exhibit 2, Certificate of Liability Insurance.

## UMC 783.12 GENERAL ENVIRONMENTAL RESOURCES INFORMATION

The sequence and timing of the subarea mining for Years 6 through 10 is shown on the Mine Plan Map (Map 8).

## UMC 783.13 GENERAL DESCRIPTION OF HYDROLOGY AND GEOLOGY

This application provides a description of geology, hydrology, and ground and surface water quality and quantity on all lands within the mine plan area, adjacent area, and the general area.

The "general area" with respect to hydrology is defined as that topographic basin that surrounds the area to be mined during the life of the operation and as shown on the Surface Watersheds Map (Map 10).

Past and present mining activities as well as continuing exploration projects in the Scofield/Clear Creek vicinity have provided considerable information regarding geology of the area. Details on the geology of the mine plan area and adjacent areas are set forth in Section 783.14, Geology Description. Information regarding hydrology for the permit area and adjacent areas is given in Sections 783.15, 783.16, and 783.17.

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The surface water resources which occur within the permit area and the general area have been categorized on a site by site, parameter by parameter basis. Table 1, Surface Water Summary, provides a listing of discharge flow rates, pH, activity, total dissolved solids (TDS), total suspended solids (TSS), and concentrations of the major identifying parameters for each location sampled during the period October 1980 through December 1981 and September 1983. Numbers are tabulated to show high, low, and average values for the sampling period. In addition, Exhibit 5, Water Analyses, provides results for all parameters analyzed including oil and grease, trace metal concentrations, etc. Surface water sampling locations which consist of B-1, B-2, B-3, B-4, B-5, and B-6 are shown on the Hydrology/Geology Map (Map 5).

Table 1, Surface Water Summary, indicates that the surface water resources are characterized by calcium and bicarbonate as major identifying constituents. The sampling period, October 1980 through

Table 1

SURFACE WATER SUMMARY - Part 1

Sampling Location: B-1

Sampling Period: October 1980 - September 1983

| Parameter | Number of Samples | High | Low | Average |
|---|---|---|---|---|
| Discharge (gpm) | 7 | 1165 | 0 | 277 |
| Total Dissolved Solids (mg/lit) | 10 | 380 | 145 | 249 |
| Total Suspended Solids (mg/lit) | 10 | 247 | 2 | 50 |
| Acidity (as $CaCO_3$) (mg/lit) | 9 | 16 | 0.01 | 2.80 |
| pH | 8 | 8.6 | 7.6 | 8.30 |
| Total Iron (mg/lit) | 10 | 4.15 | 0.11 | 1.126 |
| Total Dissolved Iron (mg/lit) | 9 | 0.830 | 0.02 | 0.183 |
| Total Manganese (mg/lit) | 10 | 0.130 | 0.01 | 0.038 |
| Sulfate (mg/lit) | 10 | 110 | 12 | 28.30 |
| Carbonate (mg/lit) | 10 | 12.00 | 0.01 | 5.28 |
| Bicarbonate (mg/lit) | 10 | 312.32 | 141.52 | 229.67 |
| Chloride (mg/lit) | 10 | 7.90 | 2.3 | 3.98 |
| Calcium (mg/lit) | 10 | 73.60 | 37.60 | 57.50 |
| Magnesium (mg/lit) | 10 | 18.24 | 12.96 | 14.97 |
| Potassium (mg/lit) | 10 | 2.70 | 0.77 | 1.43 |
| Sodium (mg/lit) | 10 | 45.00 | 2.50 | 17.11 |

Table 1

SURFACE WATER SUMMARY - Part 2

Sampling Location: B-2

Sampling Period: October 1980 - September 1983

| Parameter | Number of Samples | High | Low | Average |
|---|---|---|---|---|
| Discharge (gpm) | 9 | 896 | 0 | 120 |
| Total Dissolved Solids (mg/lit) | 9 | 332 | 1.82 | 248 |
| Total Suspended Solids (mg/lit) | 9 | 440 | 2 | 73 |
| Acidity (as $CaCO_3$) (mg/lit) | 9 | 10.0 | 0.01 | 2.375 |
| pH | 9 | 8.7 | 7.6 | 8.2 |
| Total Iron (mg/lit) | 9 | 5.27 | 0.08 | 1.224 |
| Total Dissolved Iron (mg/lit) | 9 | 0.90 | 0.01 | 0.195 |
| Total Manganese (mg/lit) | 9 | 0.32 | 0.01 | 0.055 |
| Sulfate (mg/lit) | 9 | 43.0 | 7.50 | 17.11 |
| Carbonate (mg/lit) | 9 | 9.6 | 0.01 | 3.87 |
| Bicarbonate (mg/lit) | 9 | 309.6 | 173.24 | 224.53 |
| Chloride (mg/lit) | 9 | 88.90 | 1.20 | 13.52 |
| Calcium (mg/lit) | 9 | 71.20 | 45.60 | 58.22 |
| Magnesium (mg/lit) | 9 | 43.92 | 7.20 | 11.25 |
| Potassium (mg/lit) | 9 | 3.50 | 0.93 | 1.45 |
| Sodium (mg/lit) | 9 | 44.50 | 2.80 | 14.48 |

Table 1

SURFACE WATER SUMMARY - Part 3

Sampling Location: B-3

Sampling Period: October 1980 - September 1983

| Parameter | Number of Samples | High | Low | Average |
|---|---|---|---|---|
| Discharge (gpm) | 8 | 2016 | 0 | 44.8 |
| Total Dissolved Solids (mg/lit) | 9 | 395 | 151 | 242 |
| Total Suspended Solids (mg/lit) | 9 | 134 | 2 | 28 |
| Acidity (as $CaCO_3$) (mg/lit) | 9 | 16 | 0.01 | 2.44 |
| pH | 9 | 8.7 | 7.8 | 8.3 |
| Total Iron (mg/lit) | 9 | 1.40 | 0.110 | 0.514 |
| Total Dissolved Iron (mg/lit) | 9 | 0.50 | 0.010 | 0.76 |
| Total Manganese (mg/lit) | 9 | 0.060 | 0.010 | 0.23 |
| Sulfate (mg/lit) | 9 | 128 | 12 | 33.15 |
| Carbonate (mg/lit) | 9 | 9.60 | 0.01 | 3.72 |
| Bicarbonate (mg/lit) | 9 | 306.60 | 146.40 | 226.37 |
| Chloride (mg/lit) | 9 | 36 | 1.60 | 7.09 |
| Calcium (mg/lit) | 9 | 75.20 | 36 | 58.90 |
| Magnesium (mg/lit) | 9 | 18 | 7.68 | 13.38 |
| Potassium (mg/lit) | 9 | 2.50 | 0.71 | 1.19 |
| Sodium (mg/lit) | 9 | 54.10 | 2.50 | 14.98 |

Table 1

SURFACE WATER SUMMARY - Part 4

Sampling Location: B-4

Sampling Period: October 1980 - September 1983

| Parameter | Number of Samples | High | Low | Average |
|---|---|---|---|---|
| Discharge (gpm) | 8 | 582 | 0 | 24.8 |
| Total Dissolved Solids (mg/lit) | 9 | 455 | 195 | 279 |
| Total Suspended Solids (mg/lit) | 9 | 20 | 2 | 10 |
| Acidity (as $CaCO_3$) (mg/lit) | 8 | 20 | 0.01 | 3.50 |
| pH | 9 | 7.8 | 8.5 | 8.1 |
| Total Iron (mg/lit) | 9 | 0.360 | 0.06 | 0.234 |
| Total Dissolved Iron (mg/lit) | 8 | 0.240 | 0.01 | 0.049 |
| Total Manganese (mg/lit) | 9 | 0.030 | 0.01 | 0.018 |
| Sulfate (mg/lit) | 8 | 112 | 3.0 | 31.67 |
| Carbonate (mg/lit) | 8 | 9.60 | 0.01 | 4.81 |
| Bicarbonate (mg/lit) | 8 | 300.12 | 175.68 | 245.38 |
| Chloride (mg/lit) | 8 | 154 | 1.3 | 22.42 |
| Calcium (mg/lit) | 8 | 70.40 | 57 | 61.50 |
| Magnesium (mg/lit) | 8 | 17.50 | 8.64 | 13.71 |
| Potassium (mg/lit) | 8 | 2.10 | 0.77 | 1.17 |
| Sodium (mg/lit) | 8 | 95.90 | 12 | 21.96 |

Table 1

SURFACE WATER SUMMARY - Part 5

Sampling Location: B-5

Sampling Period: October 1980 - September 1983

| Parameter | Number of Samples | High | Low | Average |
|---|---|---|---|---|
| Discharge (gpm) | 5 | 90 | 0 | 36 |
| Total Dissolved Solids (mg/lit) | 6 | 320 | 244 | 280 |
| Total Suspended Solids (mg/lit) | 6 | 23 | 2 | 12 |
| Acidity (as $CaCO_3$) (mg/lit) | 5 | 26 | 0.01 | 9.20 |
| pH | 6 | 8.2 | 7.6 | 8.0 |
| Total Iron (mg/lit) | 6 | 0.390 | 0.050 | 0.212 |
| Total Dissolved Iron (mg/lit) | 5 | 0.080 | 0.020 | 0.043 |
| Total Manganese (mg/lit) | 6 | 0.040 | 0.010 | 0.022 |
| Sulfate (mg/lit) | 5 | 51 | 3.0 | 28.80 |
| Carbonate (mg/lit) | 5 | 7.20 | 0.01 | 1.45 |
| Bicarbonate (mg/lit) | 5 | 335.50 | 231.80 | 294.02 |
| Chloride (mg/lit) | 5 | 7.71 | 2.70 | 5.08 |
| Calcium (mg/lit) | 5 | 78.40 | 45.60 | 65.92 |
| Magnesium (mg/lit) | 5 | 19.68 | 16.80 | 18.34 |
| Potassium (mg/lit) | 5 | 2.10 | 1.02 | 1.31 |
| Sodium (mg/lit) | 5 | 54 | 8.0 | 19.40 |

Table 1

SURFACE WATER SUMMARY - Part 6

Sampling Location: B-6

Sampling Period: September 1983

| Parameter | Number of Samples | High | Low | Average |
|---|---|---|---|---|
| Discharge (gpm) | 1 | | | 300 |
| Total Dissolved Solids (mg/lit) | 1 | | | 245 |
| Total Suspended Solids (mg/lit) | 1 | | | 10 |
| Acidity (as $CaCO_3$) (mg/lit) | 1 | | | |
| pH | 1 | | | 8.2 |
| Total Iron (mg/lit) | 1 | | | 0.040 |
| Total Dissolved Iron (mg/lit) | 1 | | | |
| Total Manganese (mg/lit) | 1 | | | 0.030 |
| Sulfate (mg/lit) | 1 | | | 49 |
| Carbonate (mg/lit) | 1 | | | 0 |
| Bicarbonate (mg/lit) | 1 | | | 207 |
| Chloride (mg/lit) | 1 | | | 7 |
| Calcium (mg/lit) | 1 | | | 63 |
| Magnesium (mg/lit) | 1 | | | 17 |
| Potassium (mg/lit) | 1 | | | 20 |
| Sodium (mg/lit) | 1 | | | 6 |

December 1981, shows month to month seasonal variation in certain parameters and discharge flow rates. Detailed discussion regarding seasonal variations of surface water quantity and quality on a site by site and parameter by parameter basis is provided in Section 783.16, Surface Water Information.

Groundwater resources which occur within the permit area and the general area have been categorized on a site by site, parameter by parameter basis. Table 2, Groundwater Summary, provides a listing of discharge flow rates, pH, acidity, total dissolved solids (TDS), total suspended solids (TSS), and concentrations of the major identifying parameters for each location sampled during the period October 1980 through December 1981 and September 1983. Numbers are tabulated to show high, low, and average values for the sampling period. In addition, Exhibit 5, Water Analyses, provides results for all parameters analyzed including oil and grease, trace metal concentrations, etc. Sample locations including G-1, G-2, G-3, G-4, G-5, G-6, and G-7 of the permit area water well, springs, seeps, and abandoned underground workings are shown on the Hydrology/Geology Map (Map 5). Detailed discussion regarding seasonal variations of groundwater quantity and quality on a site by site and parameter by parameter basis is provided in Section 785.15, Groundwater Information.

North American Equities NV has sampled groundwater, as effluent from the old Clear Creek Mine workings, at location G-6 since October 1980. Analyses of groundwater sampled at locations G-1, G-2, G-3, G-4, and G-5 during September 1983 have been submitted to DOGM and along with data from the water well, location G-7, will be forwarded to provide DOGM with one year of baseline data. Following completion of the baseline sampling work, North American Equities NV will review the data with DOGM to determine additional monitoring which may be required.

Geophysical logs obtained from each of exploration drill holes DHB-1 and DHB-2 indicate that minor occurrences of subsurface water were

Table 2

GROUNDWATER SUMMARY - Part 1

Sampling Location: G-1

Sampling Period: September 1983

| Parameter | Number of Samples | High | Low | Average |
|---|---|---|---|---|
| Discharge (gpm) | 1 | | | 3.5 |
| Total Dissolved Solids (mg/lit) | 1 | | | 450 |
| Total Suspended Solids (mg/lit) | 1 | | | 254 |
| Acidity (as $CaCO_3$) (mg/lit) | 1 | | | |
| pH | 1 | | | 7.5 |
| Total Iron (mg/lit) | 1 | | | 7.5 |
| Total Dissolved Iron (mg/lit) | 1 | | | |
| Total Manganese (mg/lit) | 1 | | | 0.32 |
| Sulfate (mg/lit) | 1 | | | 121 |
| Carbonate (mg/lit) | 1 | | | 0 |
| Bicarbonate (mg/lit) | 1 | | | 269 |
| Chloride (mg/lit) | 1 | | | 11 |
| Calcium (mg/lit) | 1 | | | 109 |
| Magnesium (mg/lit) | 1 | | | 30 |
| Potassium (mg/lit) | 1 | | | 1.5 |
| Sodium (mg/lit) | 1 | | | 12 |

Table 2

GROUNDWATER SUMMARY - Part 2

Sampling Location: G-2

Sampling Period: September 1983

| Parameter | Number of Samples | High | Low | Average |
|---|---|---|---|---|
| Discharge (gpm) | 1 | | | 1 |
| Total Dissolved Solids (mg/lit) | 1 | | | 355 |
| Total Suspended Solids (mg/lit) | 1 | | | 6 |
| Acidity (as $CaCO_3$) (mg/lit) | 1 | | | |
| pH | 1 | | | 7.4 |
| Total Iron (mg/lit) | 1 | | | 180 |
| Total Dissolved Iron (mg/lit) | 1 | | | |
| Total Manganese (mg/lit) | 1 | | | 0.020 |
| Sulfate (mg/lit) | 1 | | | 49 |
| Carbonate (mg/lit) | 1 | | | 0 |
| Bicarbonate (mg/lit) | 1 | | | 318 |
| Chloride (mg/lit) | 1 | | | 11 |
| Calcium (mg/lit) | 1 | | | 106 |
| Magnesium (mg/lit) | 1 | | | 22 |
| Potassium (mg/lit) | 1 | | | 1.5 |
| Sodium (mg/lit) | 1 | | | 8 |

Table 2

GROUNDWATER SUMMARY - Part 3

Sampling Location: G-3

Sampling Period: September 1983

| Parameter | Number of Samples | High | Low | Average |
|---|---|---|---|---|
| Discharge (gpm) | 1 | | | 1 |
| Total Dissolved Solids (mg/lit) | 1 | | | 320 |
| Total Suspended Solids (mg/lit) | 1 | | | 4 |
| Acidity (as $CaCO_3$) (mg/lit) | 1 | | | |
| pH | 1 | | | 7.3 |
| Total Iron (mg/lit) | 1 | | | 0.070 |
| Total Dissolved Iron (mg/lit) | 1 | | | |
| Total Manganese (mg/lit) | 1 | | | 0.020 |
| Sulfate (mg/lit) | 1 | | | 41 |
| Carbonate (mg/lit) | 1 | | | 0 |
| Bicarbonate (mg/lit) | 1 | | | 302 |
| Chloride (mg/lit) | 1 | | | 3 |
| Calcium (mg/lit) | 1 | | | 102 |
| Magnesium (mg/lit) | 1 | | | 18 |
| Potassium (mg/lit) | 1 | | | 1.0 |
| Sodium (mg/lit) | 1 | | | 8 |

Table 2

GROUNDWATER SUMMARY - Part 4

Sampling Location: G-4

Sampling Period: September 1983

| Parameter | Number of Samples | High | Low | Average |
| --- | --- | --- | --- | --- |
| Discharge (gpm) | 1 | | | 1.5 |
| Total Dissolved Solids (mg/lit) | 1 | | | 740 |
| Total Suspended Solids (mg/lit) | 1 | | | 104 |
| Acidity (as $CaCO_3$) (mg/lit) | 1 | | | |
| pH | 1 | | | 7.3 |
| Total Iron (mg/lit) | 1 | | | 1.86 |
| Total Dissolved Iron (mg/lit) | 1 | | | |
| Total Manganese (mg/lit) | 1 | | | 0.060 |
| Sulfate (mg/lit) | 1 | | | 249 |
| Carbonate (mg/lit) | 1 | | | 0 |
| Bicarbonate (mg/lit) | 1 | | | 443 |
| Chloride (mg/lit) | 1 | | | 7 |
| Calcium (mg/lit) | 1 | | | 174 |
| Magnesium (mg/lit) | 1 | | | 57 |
| Potassium (mg/lit) | 1 | | | 2.5 |
| Sodium (mg/lit) | 1 | | | 8 |

Table 2

GROUNDWATER SUMMARY - Part 5

Sampling Location: G-5

Sampling Period: September 1983

| Parameter | Number of Samples | High | Low | Average |
|---|---|---|---|---|
| Discharge (gpm) | 1 | | | 2.5 |
| Total Dissolved Solids (mg/lit) | 1 | | | 8.0 |
| Total Suspended Solids (mg/lit) | 1 | | | 16 |
| Acidity (as $CaCO_3$) (mg/lit) | 1 | | | |
| pH | 1 | | | 6.8 |
| Total Iron (mg/lit) | 1 | | | 1.17 |
| Total Dissolved Iron (mg/lit) | 1 | | | |
| Total Manganese (mg/lit) | 1 | | | 0.50 |
| Sulfate (mg/lit) | 1 | | | 29 |
| Carbonate (mg/lit) | 1 | | | 0 |
| Bicarbonate (mg/lit) | 1 | | | 42 |
| Chloride (mg/lit) | 1 | | | 8 |
| Calcium (mg/lit) | 1 | | | 21 |
| Magnesium (mg/lit) | 1 | | | 2 |
| Potassium (mg/lit) | 1 | | | 1.5 |
| Sodium (mg/lit) | 1 | | | 5 |

Table 2

GROUNDWATER SUMMARY - Part 6

Sampling Location: G-6

Sampling Period: October 1980 - September 1983

| Parameter | Number of Samples | High | Low | Average |
|---|---|---|---|---|
| Discharge (gpm) | 11 | 627 | 90 | 32.8 |
| Total Dissolved Solids (mg/lit) | 16 | 468 | 394 | 420 |
| Total Suspended Solids (mg/lit) | 15 | 37 | 2 | 7 |
| Acidity (as $CaCO_3$) (mg/lit) | 15 | 68 | 1.01 | 20.46 |
| pH | 15 | 7.8 | 6.8 | 7.3 |
| Total Iron (mg/lit) | 16 | 1.980 | 0.40 | 1.02 |
| Total Dissolved Iron (mg/lit) | 15 | 1.320 | 0.01 | 0.626 |
| Total Manganese (mg/lit) | 17 | 0.240 | 0.020 | 0.149 |
| Sulfate (mg/lit) | 15 | 136 | 46.0 | 80.63 |
| Carbonate (mg/lit) | 15 | 4.80 | 0.01 | 0.31 |
| Bicarbonate (mg/lit) | 15 | 453.84 | 292.82 | 381.27 |
| Chloride (mg/lit) | 15 | 10 | 0.25 | 4.14 |
| Calcium (mg/lit) | 15 | 108.80 | 63.50 | 95.91 |
| Magnesium (mg/lit) | 15 | 39.84 | 16.60 | 32.96 |
| Potassium (mg/lit) | 15 | 12.30 | 2.30 | 4.27 |
| Sodium (mg/lit) | 15 | 72.00 | 2.70 | 11.68 |

encountered during drilling of these holes. The water levels have been located on the logs included as Exhibit 3, Lithologic Logs of 1982 Drill Holes. Groundwater occurrences as perched water zones, were encountered during drilling of hole DHB-2 at stratigraphic elevations 150 and 200 feet above the Upper Clear Creek seam within interbedded sandstone and shale strata. Drilling of hole DHB-2 encountered a similar occurrence of a perched water zone at an elevation 75 feet below the Upper Clear Creek seam.

The flow tests completed during drilling indicated that due to very low apparent transmissivity and only very localized existence of the perched water zone no sustained flow occurred. Confirmation of groundwater by temperature survey was not performed since no significant groundwater was encountered.

Drill holes DHB-1 and DHB-2 have been plugged and the locations reclaimed, thereby precluding access to obtain current water level data.

No subsurface water was encountered during drilling of 1982 hole DHB-3. The lithologic log for this hole is included with Exhibit 3, Lithologic Logs of 1982 Drill Holes.

From the drilling activity which was conducted at the Blazon No. 1 Mine, it is concluded that no groundwater exists in the strata immediately below the coal seam to be mined nor above the coal seam to be mined. The Lower Clear Creek coal seam located approximately 200 feet below the coal to be mined has been extensively mined under all of the planned area to be mined by the Blazon No. 1 Mine. This previous mining activity has affected the groundwater resources which may be present below the Blazon No. 1 Mine to an unknown extent by subsidence, intersection of faults, or fracture systems or other activities conducted during or resulting from this previous mining.

## UMC 783.14 GEOLOGY DESCRIPTION

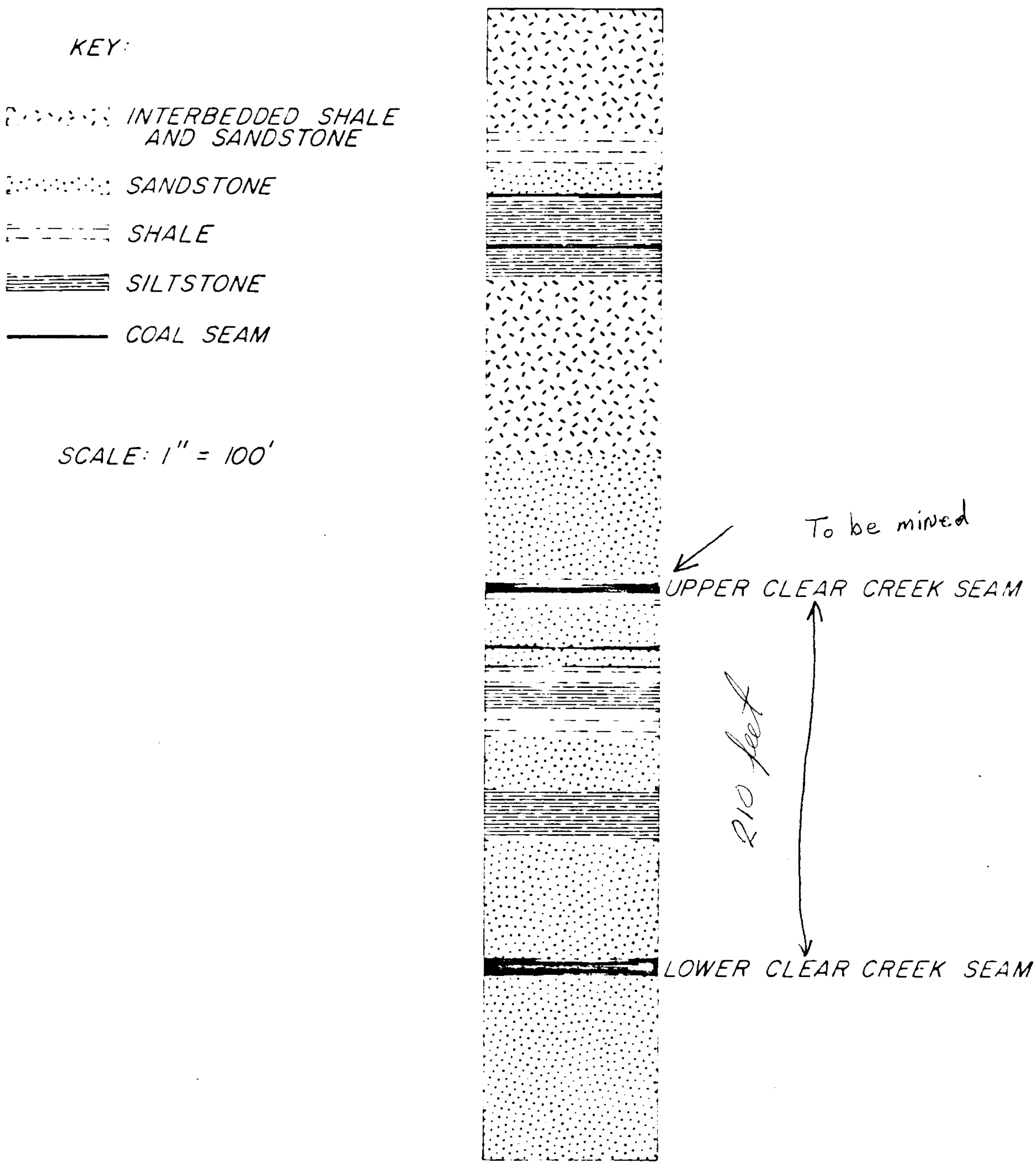
Surface geology of the mine plan area is graphically presented on the Hydrology/Geology Map (Map 5). This map shows the locations of coreholes, coal outcrop, surface traces of known faults, and areas of jointing/fracturing.

The principal geologic formation within the permit area is the Blackhawk Formation.

The Blackhawk Formation is composed of alternating layers of sandstone, shale, siltstone, and interbedded sandstones and shales, and coal seams. A brief discussion is provided for each lithologic member of the Blackhawk Formation based on site specific data from drilling performed within the permit area. The various lithologic units described below are shown on Figure 1, Typical Stratigraphic Section.

- Sandstone - medium to fine grained in texture; generally, quite competent; sometimes interspersed with fine coaly stringers; individual stratum located above the coal seam to be mined range 5 to 20 feet in thickness; approximately 10 feet of very competent sandstone makes up the main roof; stratum below the coal seam to be mined tend to be thicker, 25 to 55 feet. Sandstone member in the roof serves as the overburden which supports the roof of all openings and into which roof bolts are anchored.

- Shale - strata, 5 to 15 feet in thickness, occur in the overburden; a shale layer, 1 to 3 feet thick, forms the immediate roof of the coal to be mined; typically the floor also consists of shale and is 3 to 4 feet thick; these strata exhibit moderate to poor competency as indicated by actual experience in mining; the shale must be held in place by roof support and slacks from exposure to air and water.




TYPICAL STRATIGRAPHIC SECTION

FIGURE 1

- Siltstone - range of thicknesses 5 to 50 feet; often occur as interbedded lenses; moderate competency; located in strata above and below the coal seam to be mined.

- Interbedded sandstones and shales - generally, these strata are the thickest individual members of the Blackhawk Formation within the permit area, ranging in thickness 40 to 85 feet.

- Coal seams - range of thicknesses one foot to 14 feet; the seam to be mined, the Upper Clear Creek Seam, exhibits thicknesses ranging from three and a half (3.5) to five and a half (5.5)feet; as indicated by recent mining activities and exploration drilling, at least three uncorrelated coal seams, one to two feet thick, exist above the Upper Clear Creek Seam. Below the Upper Clear Creek Seam and above the Lower Clear Creek Seam are three thin seams, each 1 to 2 feet thick, locally correlated as the Lower O'Connor Seams; total interburden, including minor coal seams, between the Upper Clear Creek Seam and the Lower Clear Creek Seam is approximately 210 feet within the permit area.

The lateral continuity of individual stratigraphic units of the Blackhawk Formation within the area to be mined is quite poor. As shown on the drill hole logs in Exhibit 3, Lithologic Logs of 1982 Drill Holes, sandstones, shales, siltstones and interbedded sandstones and shale vary significantly in thickness and prevent correlation of each unit across the permit area. The only consistent and correlatable units are the Upper Clear Creek and Lower Creek Coal Seams.

Additional information as to lithologic members and associated thicknesses for the Blackhawk Formation as indicated by the 1982 exploration drill holes is found in Exhibit 3, Lithologic Logs.

These drill hole logs indicate that the Lower Clear Creek Seam lies immediately above the Starpoint Sandstone with little or no interval between the two. Interval thicknesses between the Lower Clear Creek Seam and the contact with the Starpoint Sandstone range from 0 to 6 feet.

Geologic structure of the general Scofield-Clear Creek area is characterized by a series of parallel anticlines and synclines. Major north-south trending fault systems exist as a result of this regional folding. Vertical displacement at individual faults and fault zones range in magnitude from a few feet up to several hundred feet. The largest fault, located west of the permit area and known as the Pleasant Valley fault, displaces nearly 1,000 feet. Transverse faulting associated with the regional north-south major faulting occurs within the permit area and the general area as well.

The Blazon No. 1 Mine is situated on the east flank of the Clear Creek anticline. As with the regional structural setting, faulting in the permit area and area to be mined strikes generally north-south with transverse faulting trending northeast to east-west, as shown on the Hydrology/Geology Map (Map 5) and the Geologic Structure Map (Map 14). Fault displacements have created a series of blocks which, in general, step vertically down or lower the position of the Upper Clear Creek Coal Seam from west to east.

Geology and geologic maps for the permit area have been developed from exploration drilling work performed in the early 1900's and, more recently, during 1982, as well as from mine maps and information gathered during underground mining operations at the Clear Creek No. 1 and No. 2 Mines. The Clear Creek Mines which extracted the Lower Clear Creek Seam extended laterally and underworked nearly all of the area beneath Blazon No. 1 Mine permit area. The old mine maps indicate mining was accomplished within the coal blocks defined by the numerous faults. Quite often, coal was left unmined because faults could not be penetrated due to economic or available technology considerations. Traces of faults encountered during mining of the Clear Creek Mines have been projected from the old mine maps and are shown on the Hydrology/Geology Map (Map 5) and the Geologic Structure Map (Map 14). Recent mining operation experience in the Blazon No. 1 Mine has shown this technique of fault and coal seam elevation projections to be a reasonably accurate prediction of structure that will be encountered.

The mine portal faceup area is on the outcrop of the Upper Clear Creek Seam. Strata strike north to northwest and dip generally east-southeast at angles up to 10 degrees from horizontal. The Geologic Structure Map (Map 14) shows the mine portal faceup area situated within a small local anticlinal structure. The bedded shales and sandstone caprock above the coal seam is heavily fractured and jointed, possibly as a result of this local structure, along the exposed outcrop. Surface traces of fractures and jointing within the area to be mined are shown on the Hydrology/Geology Map (Map 5) as they have been mapped during mining of the Blazon No. 1 Mine and from the old mine maps at the underlying Clear Creek No. 1 and No. 2 Mines.

The fractured and jointed nature of these rocks lends to creep and slumping of blocks situated on very steep terrain as observed within the permit area and along Mud Creek south of the permit area. Infiltration of surface runoff water into the mining area tends to occur in these fractured and jointed areas, particularly where overburden cover is minimal near the outcrop.

A series of igneous dikes and transverse east-west faulting occur within the permit area south of the Snider Creek drainage and are shown on the Hydrology/Geology Map (Map 5) and the Geologic Structure Map (Map 14). The location of these igneous intrusives has been determined from maps of the Clear Creek No. 1 and No. 2 Mines which mined the Lower Clear Creek Seam approximately 200 feet below the Upper Clear Creek Seam. Penetration of these igneous dikes and faults has proven difficult not only in past mining of the Clear Creek Mines but, also in other operations located in the Clear Creek/Scofield vicinity. The vertical extent of dikes and intersection with the Upper Clear Creek Seam within the area to be mined is not known. Existing limited mining activities have not encountered any dikes within the Upper Clear Creek Seam nor has drilling activity delineated any occurrences of igneous intrusives.

Strata within the permit area strike generally north to northwest and dip to the east southeast at angles 0 to 10 degrees from horizontal. Topography and geometry of the permit area have caused strata of the Blackhawk Formation to outcrop on the east and west sides of Mud Creek Canyon. A seep, labeled as Spring G-4 on the Hydrology/Geology Map (Map 5), exhibits seasonal flows of up to one gallon per minute from the updip or west side of Mud Creek Canyon.

The portal faceup area is situated on the downdip or east side of Mud Creek Canyon. Mining has proceeded inby the outcrop in the downdip direction and has encountered no subsurface water. Minor amounts of water which have infiltrated through fractures and joints from the surface were encountered near the outcrop. No areas or zones of subsurface water were or will be exposed at the face-up areas.

A water well was drilled and completed for use during November 1980. North American Equities NV acquired water rights by way of the exchange agreement, included as Exhibit 7, Water Well Exchange Document, with Price River Water Users Association. The exchange agreement and a lithologic log of the well drilled were to have been filed after drilling with the Water Rights Division of the State Engineer's Office. A file search with the Water Rights Division offices in Price and Salt Lake City, Utah has shows that no well log is present. North American Equities NV does not have a lithologic log of the well nor has the driller kept a record of this well. Therefore, this data is not available for inclusion in the DOC document.

Analyses for potential acidity, organic sulfur, and pyritic sulfur performed on samples of stratum above and below the coal seam to be mined and for material contained in the mine development waste pile are provided in Table 3, Analyses of Materials Above and Below Coal Seam and Mine Development Waste. Analysis results indicate that these materials pose no particular environmental hazard.

North American Equities NV has assimilated previously submitted information into the Geologic Structure Map (Map 14). This map uses geologic data from past and recent exploration drilling as well as information from the old Clear Creek Mine workings map and underground surveys of the Blazon No. 1 Mine. This map shows graphically the complex geologic structure present within the permit area and pertinent structural features such as faults, dikes, joints, and outcrops. The strike and dip of the Upper Clear Creek Coal Seam is shown by the structure contours of the top of the coal seam. Elevations of all drill holes are also shown. The names of all geologic formations are identified where they outcrop.

A profile view of the coal seam to be mined and the mined out portions of the Lower Clear Creek seam within the permit area is shown on the Geologic Cross Section Map (Map 15).

Exhibit 4, Coal Analysis, summarizes the results of laboratory analysis on samples from the Upper Clear Creek Coal Seam and includes analysis data on sulfur forms, mineral analysis of the ash, and coking potential.

Table 3

ANALYSES OF MATERIALS ABOVE AND BELOW
COAL SEAM AND MINE DEVELOPMENT WASTE

| Sample I.D. | Sample Date | Lab No. | Boron ppm | Total Sulfur % | Sulfate Sulfur % | Acid-Base[1] Potential | Neutralization Potential (as $CaCO_3$) % | Sand % | Silt % | Clay % | pH | Conductivity[2] | Saturation % | Calcium meq/l | Magnesium meq/l | Sodium meq/l | Acidity | Pyritic Sulfur % | Organic Sulfur % | Sulfate Sulfur % | Total Sulfur % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Blazon No. 1 Mine | | | | | | | | | | | | | | | | | | | | | |
| Development Waste | 9/22/83 | 83-3864-0B* | 1.5 | 0.38 | 0.01 | -7 | 0.6 | 55 | 17 | 28 | 7.3 | 0.6 | 46 | 4.0 | 2.2 | 0.7 | 24.20 | 0.20 | 0.18 | <0.01 | 0.38 |
| Above Coal Seam OB | 9/17/83 | 83-3897-0B | 1.5 | 0.09 | 0.01 | -1 | 0.2 | 15 | 41 | 44 | 7.3 | 0.4 | 52 | 3.2 | 0.4 | 0.9 | 10.15 | 0.07 | 0.03 | <0.01 | 0.10 |
| Below Coal Seam OB | 9/17/83 | 83-3898-0B | 1.5 | 0.03 | 0.01 | 14 | 1.5 | 10 | 48 | 42 | 7.2 | 0.4 | 55 | 2.3 | 0.6 | 0.6 | 7.02 | 0.04 | <0.01 | <0.01 | 0.04 |

[1] Tons $CaCO_3$/1,000 Tons
[2] umhos/cm @ 25°C
* Sample contained a large amount of coal

## UMC 783.15 GROUNDWATER INFORMATION

Groundwater occurrences in the general region are quite low due to the geology of the area. Regionally, wells produce less than 50 gallons per minute and locally production of not more than 10 gallons per minute can be expected.

As reviewed in Section UMC 783.14, Geology Description, the permit area consists of rock units of the Blackhawk formation only. The Star Point Sandstone has been identified as a potential aquifer. All other rock units above the Star Point Sandstone including the Lower Clear Creek Seam and Upper Clear Creek Seam are separated by impermeable shale and siltstone units. Sandstone units are present within these members, but are not laterally continuous and, therefore, contain only minor amounts of groundwater as perched water tables. The lack of continuity laterally prevents communication within the sandstone lenses.

The most significant factor, hydrologically, of the Blackhawk Formation is the extent of faulting and fracture zones. Due to the suspected high clay content of the Blackhawk Formation, faults have been rapidly sealed which prevents significant communication between perched water tables or aquifers like the Star Point Sandstone.

As a result of the sealing nature of the fault and fracture systems, mining at the Blazon No. 1 Mine and any subsequent subsidence will have little or no significant effect on the Star Point Sandstone located some 200 feet below the Upper Clear Creek Seam. In addition, the Lower Clear Creek Seam, located immediately above the Star Point Sandstone has locally been extensively mined and caused subsidence, fracturing and other disruption to only natural local recharge to the Star Point Sandstone within the permit area.

The lithologic units above the Lower Clear Creek Seam have not been identified to contain any groundwater on a regional basis. Drilling conducted by North American Equities NV during the early 1980's confirms that no aquifers exist and only very localized perched water tables are present.

As previously discussed in Section UMC 783.13, Hydrology and Geology, North American Equities NV has summarized for each sampling location changes and fluctuations of values over the sampling period for important identifying parameters in Table 2, Groundwater Summary. A discussion of each sampling location is provided below:

- G-6 This location has a seasonal discharge ranging from 90 gpm in June or July to a high of 627 gpm during December and February. Anomalous concentrations of sodium and chloride occurred in the August 1981 sampling.

- G-1, G-2, G-3, G-4, G-5
  These locations were sampled in September 1983 and analyses have been submitted. Variation data can be interpreted when more sampling information becomes available.

North American Equities NV has sampled groundwater, as effluent from the old Clear Creek Mine workings, at location G-6 since October 1980. Sampling at locations G-1, G-2, G-3, G-4, and G-5 was initiated in September 1983 and will continue on an approved frequency basis until one year of baseline data is completed. North American Equities NV will also sample the water well on the permit area, designated as location G-7, starting in the spring of 1984 and will submit data for baseline purposes. Following completion of the baseline sampling work, North American Equities NV will review the data with DOGM to determine additional monitoring which may be required.

Work by North American Equities and various governmental agencies indicate that groundwater systems in the general area are not continuous but are a series of perched, discontinuous water zones. The mine highwall which has intersected the Upper Clear Creek seam and sandstones above the elevation of Mud Creek is essentially dry with only small seepage present updip on the west side of the Mud Creek Canyon.

Structural features, particularly major and minor faults, in the mine vicinity control the regional direction of groundwater flow. The general direction of any minor ground water flow will follow existing geological features in the mining area. The water in the localized perched water zones, sandstone and coals, emerge in canyon walls as seeps and springs. Springs and seeps mapped within the mine plan area and adjacent area are shown on the Hydrology/Geology Map (Map 5). Quantity and quality data are summarized for these springs and seeps in Exhibit 5, Water Analyses.

The most significant source of groundwater is found near the Clear Creek Mine portal. This flow, presumably flowing through the old workings, varies seasonally in quantity, with a maximum flow of approximately 1/2 cfs.

Recharge to the groundwater system on the property is limited. The annual precipitation averages 23 inches. The overburden materials are shales and fine-grained cemented sandstones and have a low capability to transmit groundwater. Discontinuity of strata substantially limits recharge from surface water due to limited exposure of the perched water zone to the surface water. Similarly, faults which may account for recharge and communication of water from one perched water zone to another are quite tight, exhibit narrow fracture zones, and occur through the swelling shales of the Blackhawk Formation. These factors effectively limit communication of any groundwater between the perched water zones.

The discontinuity of the beds, the minimal recharge (as evidenced by the low discharge), and low annual precipitation contribute to existence of perched groundwater conditions. Observation of the extremely seasonal natural springs and seeps and the low volume of water discharged into Mud Creek from the groundwater system support this assumption.

Rock formations at the North American Equities property dip easterly. The coal seam to be mined is at a high elevation and is truncated by faults that run generally north-south. As a result, the coal seam and sandstones are drained. Water in the coal and sandstone occurs in perched systems which exhibit little lateral or vertical continuity. During the drilling of the three 1982 exploration holes within the mine plan area, no water was encountered.

The location of groundwater rights within the mine plan area and adjacent areas are shown on the Hydrology/Geology Map (Map 5) and listed in Table 4, Groundwater Rights.

Table 4

GROUNDWATER RIGHTS

| Water Use Claim No. | Owner | Source | Flow (cfs) | Purpose of Use | Period of Use |
|---|---|---|---|---|---|
| 91-408 | Calvin K. Jacob | Spring | 0.011 | Stockwatering | May 1 to November 30 |
| 91-3586 | North American Coal Corporation | Clear Creek Spring Area | 0.50<br>Irrigation,<br>Industrial | Domestic, Stock | January 1 to December 31 |
| 91-3590 | North American Coal Corporation (underground water) | Clear Creek Mine Tunnel No. 3 | 0.446 | Industrial | January 1 to December 31 |
| 91-3087 | Anton Michelog | Spring with Storage | 0.011 | Stockwatering | January 1 to December 31 |
| 91-1669 | North American Equities NV | Well | 3.0 acre-feet/year | Mine Fire Protection Dust Suppression | January 1 to December 31 |

## UMC 783.16 SURFACE WATER INFORMATION

The sediment pond discharge point (NPDES point) is clearly shown and labeled on the Drainage and Sediment Control Plan Map (Map 11) and the Surface Facilities Map (Map 9).

As previously discussed in Section UMC 783.13, Hydrology and Geology, North American Equities NV has summarized, for each sampling location, changes and fluctuations of values over the sampling period for important identifying parameters in Table 1, Surface Water Summary. In general, seasonal variations in surface water quality are related to fluctuations of discharge flow rate with some noted anomalous situations causing unusual values. A discussion of each sampling location is provided below:

- B-1 The range of discharge values, 1,165 gpm to less than 1 gpm, show high spring runoff flow rate and winter months when the stream is frozen. High values of TSS are characteristic of runoff months. August, September, and October of 1981 experienced high values of chloride and sodium. Also, high sulfate value in November 1981 can be associated with low flow conditions.

- B-2 The seasonal discharge ranges from 896 gpm to less than 1 gpm. The high TDS and TSS values are related to spring runoff months. August 1981 experienced high values of chloride and sodium.

- B-3 The reported high discharge of 2,016 gpm is suspect to typographical error. This location experienced the high sodium and chloride values during August 1981. As with B-1, B-3 exhibited a high sulfate concentration in November 1981 probably as a result of low flow conditions.

- B-4 Discharge flow rate ranges from 582 gpm to less than 1 gpm. This location experienced high sodium and chloride concentrations in the month of August 1981. As with the other locations, B-4 exhibited a high sulfate value in November 1981 associated with low flow.

- B-5 Measured discharge flow rate ranges from 90 gpm to less than 1 gpm. A high sodium value in October 1981 is noted. Also, higher sulfate concentration experienced in September 1981 can be attributed to low flow conditions.

- B-6 Measured discharge flow rate 300 gpm. This location was sampled in September 1983 and analyses have been submitted. Variation data can be interpreted when more sampling information becomes available.

Anomalous concentrations of sodium and chloride have been recorded at sampling stations B-1, B-2, B-3, B-4, and B-5 during the months of August and October of 1981. North American Equities NV can offer no firm explanation for this anomalous situation. One possibility can be related to the "concentrating" effect at low flow periods. However, due to the fact that all stations, including groundwater location G-1, recorded high levels of sodium and chloride and, furthermore, since there is no correlation between recorded sample levels and upstream/downstream proximity of the mining operation, the possibility exists for laboratory error or sample bottle contamination.

Sampling locations, B-1, B-2, B-3, B-4, B-5, and B-6, are shown on the Hydrology/Geology Map (Map 5). During suspension of mining operations, North American Equities NV samples water at these locations three (3) times annually according to a plan previously approved by DOGM.

The analytical information sheets previously submitted as Exhibit 5, Water Analyses, have been enlarged so that the numbers are more legible.

North American Equities NV has performed anion-cation balance calculations on all previously submitted analytical results of water quality tests for which sufficient data are available. A summary of these calculations is presented in the following table, Table 5, Cation/Anion Balance. All submitted results comply with accuracy and adequacy standards for these calculations. Mr. Ralph Poulsen, Director of Bookcliffs Commercial Laboratories, reviewed the methods for completing anion-cation balance with Mr. Rick Summers to confirm the accuracy of all laboratory analysis.

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The criteria utilized by Bookcliffs Commercial Laboratories for determining anion-cation inbalance is ± 5%. Anion-cation balance criteria utilized by the testing laboratories is not known for other water quality data. All future surface water quality analysis will utilize a ± 5% balance criteria for determining anion-cation inbalance or such analysis criteria as may be in effect at the time of analysis.

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The surface water hydrology of the general area is characteristic of a high altitude, semi-arid area. Runoff occurs predominantly in response to rapid snow melt and heavy rain storms; there is little to no groundwater flow in the streams. The quantity and quality of the surface water reflect moderate precipitation, high evapotranspiration rates, and the predominance of sandstones, shales, and coal in the basins.

The mine plan area is drained by three (3) perennial streams, Mud Creek, Long Creek, and Snider Creek and one (1) ephemeral drainage, Little Snider Creek. All drainage from these streams eventually flow into Scofield Reservoir which in turn flows into the Price River. The surface water drainage patterns are shown on the Hydrology/Geology Map (Map 5) and on the Surface Watersheds Map (Map 10).

Table 5

CATION/ANION BALANCE - Part 1

| Sample I.D. | Location | Sample Date | Cations meq/l | Anions meq/l | CAB % |
|---|---|---|---|---|---|
| B-1 | Mud Creek | 11/21/80 | 5.5 | 5.5 | 0.9 |
| B-1 | Mud Creek | 11/07/80 | 4.4 | 4.5 | 1.0 |
| B-1 | Mud Creek | 05/27/81 | 2.8 | 2.7 | 1.1 |
| B-1 | Mud Creek | 06/29/81 | 3.9 | 3.8 | 1.1 |
| B-1 | Mud Creek | 07/22/81 | 4.6 | 4.6 | 0.3 |
| B-1 | Mud Creek | 08/27/81 | 6.4 | 6.4 | 0.2 |
| B-1 | Mud Creek | 09/23/81 | 4.7 | 4.7 | 0.8 |
| B-1 | Mud Creek | 10/14/81 | 5.5 | 5.5 | 0.0 |
| B-1 | Mud Creek | 11/11/81 | 6.9 | 6.8 | 1.0 |
| B-2 | Long Canyon Creek | 10/21/80 | 4.8 | 4.9 | 1.1 |
| B-2 | Long Canyon Creek | 11/07/80 | 4.2 | 4.3 | 1.2 |
| B-2 | Long Canyon Creek | 05/27/81 | 3.4 | 3.4 | 0.1 |
| B-2 | Long Canyon Creek | 06/29/81 | 3.7 | 3.6 | 0.8 |
| B-2 | Long Canyon Creek | 07/22/81 | 4.2 | 4.3 | 0.3 |
| B-2 | Long Canyon Creek | 08/27/81 | 5.9 | 6.0 | 0.8 |
| B-2 | Long Canyon Creek | 09/23/81 | 4.7 | 4.8 | 1.0 |
| B-2 | Long Canyon Creek | 10/14/81 | 5.7 | 5.7 | 0.2 |
| B-3 | Mud Creek Below Snider Canyon | 10/21/80 | 5.1 | 5.2 | 0.6 |
| B-3 | Mud Creek Below Snider Canyon | 11/07/80 | 4.6 | 4.7 | 0.7 |
| B-3 | Mud Creek Below Snider Canyon | 05/27/81 | 2.9 | 2.9 | 0.3 |
| B-3 | Mud Creek Below Snider Canyon | 06/29/81 | 3.7 | 3.6 | 0.9 |
| B-3 | Mud Creek Below Snider Canyon | 07/22/81 | 4.5 | 4.5 | 0.8 |
| B-3 | Mud Creek Below Snider Canyon | 08/27/81 | 4.7 | 4.8 | 1.2 |
| B-3 | Mud Creek Below Snider Canyon | 09/23/81 | 4.3 | 4.2 | 0.9 |
| B-3 | Mud Creek Below Snider Canyon | 10/14/81 | 5.8 | 5.8 | 0.7 |
| B-3 | Mud Creek Below Snider Canyon | 11/11/81 | 7.0 | 6.9 | 0.7 |

Table 5

CATION/ANION BALANCE - Part 2

| Sample I.D. | Location | Sample Date | Cations meq/l | Anions meq/l | CAB % |
|---|---|---|---|---|---|
| B-4 | Mud Creek at South Boundary | 10/21/80 | 4.8 | 4.9 | 1.0 |
| B-4 | Mud Creek at South Boundary | 11/07/80 | 4.8 | 4.8 | 0.5 |
| B-4 | Mud Creek at South Boundary | 06/29/81 | 3.7 | 3.6 | 0.3 |
| B-4 | Mud Creek at South Boundary | 07/22/81 | 4.6 | 4.6 | 0.0 |
| B-4 | Mud Creek at South Boundary | 08/27/81 | 8.4 | 8.3 | 0.1 |
| B-4 | Mud Creek at South Boundary | 09/23/81 | 4.8 | 4.7 | 0.8 |
| B-4 | Mud Creek at South Boundary | 10/14/81 | 5.8 | 5.8 | 0.3 |
| B-4 | Mud Creek at South Boundary | 11/11/81 | 6.8 | 6.7 | 0.8 |
| B-5 | Snider Canyon Creek at East Property Boundary | 10/21/80 | 5.8 | 5.3 | 4.3 |
| B-5 | Snider Canyon Creek at East Property Boundary | 11/07/80 | 5.8 | 5.9 | 0.9 |
| B-5 | Snider Canyon Creek at East Property Boundary | 07/22/81 | 5.2 | 5.1 | 0.7 |
| B-5 | Snider Canyon Creek at East Property Boundary | 09/23/81 | 5.4 | 5.5 | 0.8 |
| B-5 | Snider Canyon Creek at East Property Boundary | 10/14/81 | 6.2 | 6.2 | 0.3 |
| B-6 | Utah Fuel Company, No. 1 & No. 2 Effluent | 10/22/80 | 7.5 | 7.4 | 0.3 |
| B-6 | Utah Fuel Company, No. 1 & No. 2 Effluent | 11/07/80 | 8.5 | 8.8 | 1.7 |
| B-6 | Utah Fuel Company, No. 1 & No. 2 Effluent | 12/12/80 | 8.0 | 7.9 | 0.7 |
| B-6 | Utah Fuel Company, No. 1 & No. 2 Effluent | 01/28/81 | 8.0 | 8.1 | 0.3 |

Table 5

CATION/ANION BALANCE - Part 3

| Sample I.D. | Location | Sample Date | Cations meq/l | Anions meq/l | CAB % |
|---|---|---|---|---|---|
| B-6 | Utah Fuel Company, No. 1 & No. 2 Effluent | 02/01/81 | 8.2 | 8.2 | 0.1 |
| B-6 | Utah Fuel Company, No. 1 & No. 2 Effluent | 03/11/81 | 8.1 | 8.0 | 0.5 |
| B-6 | Utah Fuel Company, No. 1 & No. 2 Effluent | 04/08/81 | 8.2 | 8.1 | 0.3 |
| B-6 | Utah Fuel Company, No. 1 & No. 2 Effluent | 05/27/81 | 8.0 | 8.1 | 0.8 |
| B-6 | Utah Fuel Company, No. 1 & No. 2 Effluent | 06/29/81 | 7.8 | 7.9 | 0.8 |
| B-6 | Utah Fuel Company, No. 1 & No. 2 Effluent | 07/22/81 | 8.2 | 8.1 | 0.6 |
| B-6 | Utah Fuel Company, No. 1 & No. 2 Effluent | 08/27/81 | 7.8 | 7.8 | 0.2 |
| B-6 | Utah Fuel Company, No. 1 & No. 2 Effluent | 08/23/81 | 7.6 | 7.7 | 0.8 |
| B-6 | Utah Fuel Company, No. 1 & No. 2 Effluent | 10/14/81 | 8.5 | 8.5 | 0.1 |
| B-6 | Utah Fuel Company, No. 1 & No. 2 Effluent | 11/11/81 | 8.1 | 8.0 | 0.5 |
| B-6 | Utah Fuel Company, No. 1 & No. 2 Effluent | 12/23/81 | 8.6 | 8.5 | 0.8 |

Table 5

CATION/ANION BALANCE - Part 4

| Sample I.D. | Lab No. | Sample Date | Date Received | Cations meq/l | Anions meq/l | CAB % |
|---|---|---|---|---|---|---|
| G-1 | 83-3749-W | 9/17/83 | 9/20/83 | 8.5 | 8.2 | 1.8 |
| G-2 | 83-3750-W | 9/17/83 | 9/20/83 | 7.5 | 7.7 | 1.3 |
| G-3 | 83-3751-W | 9/17/83 | 9/20/83 | 7.0 | 7.0 | 0.0 |
| G-4 | 83-3752-W | 9/17/83 | 9/20/83 | 13.8 | 14.3 | 1.8 |
| G-5 | 83-3753-W | 9/17/83 | 9/20/83 | 1.5 | 1.7 | 6.2* |
| G-6 | 83-3754-W | 9/17/83 | 9/20/83 | 9.0 | 9.0 | 0.0 |
| B-1 | 83-3755-W | 9/17/83 | 9/20/83 | 4.5 | 4.7 | 2.2 |
| B-2 | 83-3756-W | 9/17/83 | 9/20/83 | 4.2 | 4.6 | 4.5 |
| B-3 | 83-3757-W | 9/17/83 | 9/20/83 | 4.9 | 5.4 | 4.9 |
| B-4 | 83-3758-W | 9/17/83 | 9/20/83 | 4.8 | 5.3 | 4.8 |
| B-5 | 83-3759-W | 9/17/83 | 9/20/83 | 5.9 | 6.0 | 0.8 |
| B-6 | 83-3760-W | 9/17/83 | 9/20/83 | 4.9 | 5.4 | 4.9 |

Bookcliffs Commercial Laboratories calculates the cation/anion balance (CAB %) using the following equation:

$$\text{CAB \%} = \frac{(\text{Cations meq/l} - \text{Anions meq/l}) \times 100}{(\text{Cations meq/l} + \text{Anions meq/l})}$$

Samples with a CAB % greater than 5% are reanalyzed for suspect parameters.

* Water samples which are low in cations and anions are allowed a CAB % greater than 5%.

Stream flow characteristics of the perennial and ephemeral drainages in the mine plan area of the Blazon operation have been monitored by Vaughn Hansen & Associates during 1980 and 1981. Surface water quantity and quality are summarized in Exhibit 5, Water Analyses.

The location of surface water rights within the mine plan area and adjacent areas are shown on the Hydrology/Geology Map (Map 5) and listed in Table 6, Surface Water Rights.

Table 6

SURFACE WATER RIGHTS - Part 1

| Water Use Claim No. | Owner | Source | Flow (cfs) | Purpose of Use | Period of Use |
|---|---|---|---|---|---|
| 91-592 | John Marakis estate (½ interest) | Mud Creek | ---- | Stockwatering | January 1 to December 31 |
| 91-593 | Nick Marakis (½ interest) | Mud Creek | ---- | Stockwatering | January 1 to December 31 |
| 91-1009 | U.S. Forest Service | Tributary to Snider Canyon Creek | ---- | Stockwatering | July 1 to September 30 |
| 91-1010 | U.S. Forest Service | Tributary to Mud Creek | ---- | Stockwatering | July 1 to September 30 |
| 91-1011 | U.S. Forest Service | Mud Creek | ---- | Stockwatering | July 1 to September 30 |
| 91-1014 | U.S. Forest Service | Tributary to Mud Creek | ---- | Stockwatering | July 1 to September 30 |
| 91-1015 | U.S. Forest Service | Tributary to Mud Creek | ---- | Stockwatering | July 1 to September 30 |
| 91-1016 | U.S. Forest Service | Long Canyon Creek | ---- | Stockwatering | July 1 to September 30 |
| 91-1017 | U.S. Forest Service | Tributary to Long Canyon Creek | ---- | Stockwatering | July 1 to September 30 |
| 91-1018 | U.S. Forest Service | Tributary to Mud Creek | ---- | Stockwatering | July 1 to September 30 |

Table 6

SURFACE WATER RIGHTS - Part 2

| Water Use Claim No. | Owner | Source | Flow (cfs) | Purpose of Use | Period of Use |
|---|---|---|---|---|---|
| 91-3014 | Anton Michelog | Snider Creek | ---- | Stockwatering | January 1 to December 31 |
| 91-3015 | Anton Michelog | Mud Creek | ---- | Stockwatering. | January 1 to December 31 |
| 91-3053 | Milton A. Oman | Clear Creek | ---- | Stockwatering | January 1 to December 31 |
| 91-3082 | Milton A. Oman | Boardinghouse Canyon Creek | ---- | Stockwatering | January 1 to December 31 |
| 91-3084 | Milton A. Oman | Finn Canyon Creek | ---- | Stockwatering | January 1 to December 31 |
| 91-3086 | Anton Michelog | Long Canyon Creek | ---- | Stockwatering | January 1 to December 31 |
| 91-3587 | North American Coal Corporation | Boardinghouse Canyon Creek | ---- | Stockwatering | June 1 to November 30 |
| 91-3588 | North American Coal Corporation | Finn Canyon Creek | ---- | Stockwatering | June 1 to November 30 |
| 91-3589 | North American Coal Corporation | Mud Creek | ---- | Stockwatering | June 1 to November 30 |

## UMC 783.17 ALTERNATIVE WATER SUPPLY INFORMATION

Under the proposed mining sequence shown on the Mine Plan Map (Map 8), development main entries would be driven through the area under Snider Canyon during mine plan year five (5). These development main entries will supply access to coal reserves in the southern portions of the permit area as well as provide ventilation and haulage courses.

North American Equities NV proposes to protect the Snider Canyon, Long Creek, and Mud Creek drainages with a buffer zone 100 feet wide on either side of the stream centerline. Coal production pillaring extraction will not take place within this buffer zone. Development entries will be driven perpendicular to and through the buffer zone. Special ground support measures, including timbering, steel set supports, roof trusses, or other means will be used to help ensure no subsidence.

Potential subsidence near the stream channel could cause interruption and diminution of Snider Creek. In the event that Snider Creek is adversely impacted by mining, North American Equities NV will purchase or otherwise acquire replacement water rights to mitigate mining impacts on surface water sources. Such mitigation efforts will address all potential uses of surface water.

---

The Blazon No. 1 Mine operational activities will not cause contamination, diminution, or interruption of any underground or surface source of water. The consequences of mining on the hydrologic balance, existing water resources, and water rights will not be adverse and probably are non-existent.

Because of the very limited or lack of groundwater in the area of mining, there should be no measurable effects on the groundwater system or groundwater rights. Blazon No. 1 Mine operations may affect several undeveloped, perched water zones within the mine plan boundaries but will not affect any regional, continuous aquifer. Likewise, the mining operations will not alter water quality in the downstream portions of the Price River Basin.

The drainage and sediment control plan prepared for the Blazon No. 1 Mine operation minimizes or eliminates impacts to the Price River Basin. Following the conclusion of mining and reclamation, vegetation will be reestablished and the area will not cause any contamination, diminution, or interruption to the surface water system. The hydrologic features of the general area are shown on the Hydrology/Geology Map (Map 5) and on the Surface Watersheds Map (Map 10). Detailed sediment control structures of the surface facilities area are indicated on the Surface Facilities Map (Map 9), on the Drainage and Sediment Control Plan Map (Map 11), and on the Sediment Pond Design Map (Map 12).

Ground and surface water users are not expected to be impacted in the vicinity of the Blazon No. 1 Mine operations. The uses are limited to stock watering and light industrial consumption in the Clear Creek area. Because North American Equities NV will be mining coal at elevations above the perennial drainages, there will be no impact on uses developed in the canyon floor. The North American Equities NV operations may impact some perched systems within the mine plan area boundaries, but will not affect any regional, continuous aquifer. Because the North American Equities NV operations will not impact any surface water users in the Price River Basin and because the adverse impact on any groundwater perched systems will be limited to actual mine plan area, there is no need to identify alternative water supplies for users in the area.

## UMC 783.19 VEGETATION INFORMATION

Mr. George Cook of the Price, Utah office of the Department of Agriculture Soil Conservation Service (SCS) was contacted on February 14, 1984 regarding verification of production figures. Mr. Cook indicated the information on productivity was compiled by him on March 11, 1980 and was used to estimate production for the five (5) vegetation types. A letter from Mr. Cook verifying the estimated productivity figures is attached as Figure 2, Vegetation Productivity Letter.

The vegetation type has been classified spruce/fir/aspen for the reference area based on information obtained from the March 1980 SCS survey and from the September 1983 vegetation study. The five (5) vegetation types delineated during these studies are shown on the Vegetation Map (Map 4) and described in Exhibit 6, Vegetation Information. Spruce is found within the reference area; however, it is present at a very low density and, therefore, spruce was not encountered during sampling.

In discussions with Susan Linner of DOGM it was determined that a reference area of one (1) acre would be adequate. The selected reference area as shown on the Vegetation Map (Map 4) is located on a 57% slope. Due to the severity of the slope, transects were oriented parallel to the slope. A random numbers table obtained from Statistical Methods, Snedecor and Cochran, 1976, was used to construct sets of numbers for the starting points of the transects. The methods utilized to sample each transect and the reference area is outlined below.

One side of the reference area measures 63 meters. In order to extend the entire 50 meter tape, the starting point from either side running perpendicular to the slope could not exceed 10 meters. The random numbers range from 0 to 9 with 0 representing 10 meters. The initial starting point was the NE corner, at the top of the slope. The first random number represented the number of meters to move west or

Figure 2

VEGETATION PRODUCTIVITY LETTER

350 North 4th East
Price, Utah 84501

February 27, 1984

Allen Smith
North American Equities NV
1401 17th St. Suite 151D
Denver, CO 80202

Dear Sir:

Since the soil survey and vegetation survey was made for Blazon Mining Company, a comprehensive soil and vegetation survey has been completed for Carbon County. The manuscript may be available by this time next year.

There are five vegetation types located in this area.

The aspen type produces about 2,500 pounds understory vegetation and the condition is good.

The steep shrub type produces about 2,300 pounds of vegetation per year. The site is in a high fair to low good condition.

The area along the streambank which is influenced by a watertable from the stream produces about 2,500 pounds per acre and is in good condition.

The spruce-fir woodland site is producing about 800 pounds of understory vegetation per acre. The site is in good condition.

The spruce-fir-aspen site is a seral stage of the spruce-fir woodland site. It is producing 1,500 to 2,200 pounds per acre depending on if there is more aspen than spruce-fir.

G. S. Cook

George S. Cook
Range Conservationist
Soil Conservation Service
Price, Utah

cc: Clair Semmer
ACZ Inc.
P. O. Box 774018
Steamboat Spring, CO 80477

RECEIVED
MAR 2 1984
ACZ Inc.

downslope. The second number reflected the meters to move south, along the slope. At that point, the tape was extended parallel to the slope. Once data was collected for the tape, the tape was taken to the boundary perpendicular to the slope. The random numbers table was utilized each time for tape placement parallel to the slope within the reference area boundary. This procedure was continued until the downslope west boundary was reached. At that time, the same system was utilized going upslope starting at the SW corner. The results of this work are shown in Exhibit 12, Vegetation Field Work Sheets.

The following sampling procedure was used to obtain cover data.

Two (2) samples of 50 hits were obtained from each 50 meter tape. Transects were randomly located. Data from the 10 point frame was collected every 5 meters for a total of 25 meters per transect. The first 50 hits were recorded from the upslope side of the tape. The second set of 50 were recorded from the downslope side of the tape. By alternating the slope position respective to the tape, 2 samples can be independently located per 50 meter tape, a total of 17 samples were obtained.

The vegetation sampling methods utilized by North American Equities NV, including pin frame, belt transects, and point-center quarter measurements, are not randomly located, as described in Section UMC 783.19, Vegetation Information and in Exhibit 6, Vegetation Information. These data were obtained by the systematic stratified sampling methods described above and in Exhibit 6, Vegetation Information.

Shrub density was described on page 13 of Exhibit 6, Vegetation Information, as being obtained by counting all shrubs rooted within one (1) meter of the 50 meter tape. This could be described more precisely as "rooted" within 0.5 meters of either side of the tape. Therefore, the transects measure 1 x 50 m.

The sentence on page 21 "total amount of rooted species within the transect divided by 17" contains a typographical error. The "17" should be 20 and has been corrected in the text, Exhibit 6, Vegetation Information, on the appropriate page.

Determination of points for Douglas fir and aspen were determined in the following manner:

> Points for PCQ readings were spaced at ten (10) meter intervals along randomly located transects. Readings for aspen were initiated at the 0 mark and those for Douglas fir were started at 5. Each transect yields five (5) points for each species. Eight (8) transects provide 40 points which is the maximum number needed as defined in the vegetation guidelines provided by DOGM.

Vegetation types are delineated on the Vegetation Map (Map 4). The divisions shown on the areas of disturbance are the best estimates possible based on surrounding vegetative patterns, slope, aspect, and drainages. Acreage estimates for the five (5) vegetation types thought to have been present within the area prior to disturbance are as follows:

- Spruce/Fir 0.6 acres
- Spruce/Fir/Aspen 1.2 acres
- Mixed Mountain Shrub 0.8 acres
- Meadow 0.9 acres
- Aspen 1.5 acres

The locations of all reference area transects are shown on the Vegetation Map (Map 4).

Copies of all field data sheets and summary sheets compiled during the September 1983 vegetation survey are presented in Exhibit 12, Vegetation Field Work Sheets.

## UMC 783.22 LAND-USE INFORMATION

The existing land uses within the mine plan area and adjacent areas for the Blazon No. 1 Mine can be found on the Pre-Mining and Post-Mining Land Use Map (Map 3). Previous land use for the mine plan area and adjacent areas included underground mining, surface mining, and undeveloped natural vegetation for sheep and wildlife grazing, and National Forest. Other land use includes that for residence in the Town of Clear Creek, located approximately three-quarters of a mile north of the mine portal area.

The land use designations in the mine plan area and adjacent areas are confirmed by contact with the Price, Utah Office of the U.S. Soil Conservation Service.

### Land Condition Capability and Productivity

The present condition of the surface facilities area within the mine plan area can be described as poor for any other major use besides mining at the present time. The soils within the area disturbed by the surface facilities of the underground mine are somewhat limited in their agronomic usefulness. Also, because of the constraints imposed by the narrow valley nature of the mine plan area and adjacent areas, utilization of the area as cropland would be extremely limited because of the lack of available flat terrain.

### Hydrologic Capability

As explained in detail in the discussions under the hydrologic sections, the available surface water supplies in the mine plan area and adjacent area is limited to the flow found in the perennial drainages, Mud Creek, Snider Creek, and Long Creek. Most groundwater is limited to the amount found in the springs and seeps. Only minor amounts of water, surface water penetrating the fractured low cover, have been encountered during recent underground mining. Therefore, groundwater supplies would be extremely limited. Although water flow into the perennial drainages is sufficient to support other land uses, the extent of area capable of benefiting from that water in the immediate area of the North American Equities NV operations is limited or non-existent.

<u>Capability of the Land to Support a Variety of Uses</u>

Physical and social constraints at the present time severely limit the variety of uses suitable for lands within or adjacent to the mine plan area. The potential of the area to support alternative use other than undeveloped grazing, limited residential use, and existing mining is somewhat questionable. Because of the mine plan area's proximity to rail and highway transportation, the area has historically been available for mining operations and, therefore, single-family resident housing locations for individuals working at the mine. However, because of the narrow valley and the dead-end access situation of the Blazon No. 1 Mine, no major housing development or other uses have been contemplated for the area.

Likewise, the limited amount of space available in the area tends to reflect the centralization of population in towns such as Price, where more room is available for housing and development.

Recreational opportunities in the permit area, particularly for the hunting of deer and elk, are somewhat limited because of the availability of access. The possibility for recreation on the mine plan area, as long as mining activities are in progress, is highly unlikely due to the problems involved with safety and potential vandalism. At the conclusion of mining and reclamation activities, the recreational opportunities of the area such as hunting will be restored to the previous pre-mining status. It is anticipated that the majority of the recreation activities will remain to be situated in the National Forest lands located to the south of the mine plan area and near Scofield Reservoir to the north.

No major commercial or residential development, other than minor amounts of housing associated with the mining operation is expected to develop in the areas adjacent to the mine plan area.

Previous Underground Mining

Previous underground mining activities were carried on in the Clear Creek No. 1 and No. 2 Mines located directly under the mine plan area of the Blazon No. 1 Mine and at the Clear Creek No. 3 Mine, located east of the permit area. The Clear Creek No. 1 and No. 2 Mines, situated 200 feet below the Blazon No. 1 Mine, extracted the Lower Clear Creek or Lower O'Connor seam. The seam was approximately 10-12 feet thick and was mined using conventional room and pillar methods. The Clear Creek No. 3 Mine also produced coal from the Lower O'Connor seam. From a search of the literature, production from these abandoned mines during the period of 1900 to 1950 totaled approximately 15 million tons.

Located north of the mine plan area is the Clear Creek Strip Pit. This small surface operation produced a small amount of coal from the Upper O'Connor or Upper Clear Creek seam until 1967, when it was abandoned. The only other adjacent mine is the Old fireside Mine, located just south of the permit area. Appearance indicates that only a few tons of coal were produced from near the outcrop before abandonment. The locations and limits of mining of the abandoned mines, as well as the extent of workings of the Blazon No. 1 Mine at the time of temporary suspension in January 1982, are shown on the Pre-Mining and Postmining Land Use Map (Map 3). Additional map detail regarding extent of underground workings for the Blazon No. 1 Mine can be found on the map provided as Exhibit 11, Current Mine Workings.

From a historical point of view, the pre-mining land use, prior to any underground coal mining, was wildlife habitat and undeveloped lands.

Existing Land Use and Land Use Classifications Under Local Law

The Soil Conservation Service, in conjunction with the Carbon County Planning Commission, have designated the lands within the mine plan area and adjacent areas for uses of "mining".

## UMC 783.24 MAPS: GENERAL REQUIREMENTS

A map of all water supply intakes and water rights for current uses in the permit and adjacent areas is shown on the Hydrology/Geology Map (Map 5). Water Rights are listed in Table 4, Groundwater Rights and Table 6, Surface Water Rights.

Surface lands ownership contiguous to the permit area is shown on the Surface Ownership Map (Map 1). Coal ownership on lands contiguous to the permit area is shown on the Coal Ownership Map (Map 2).

## UMC 783.25 CROSS SECTIONS, MAPS, AND PLANS

North American Equities NV provided the Pre-Mining Topography Map (Map 6), Pre-Mining and Postmining Cross Sections (Map 7), and the Postmining Topography Map (Map 13) in its Response to Apparent Completeness Review comments dated October 7, 1983.

Subsequent review with the DOGM indicated that the information provided was adequate with the exception of a minor drafting clarification on Map 7 (refer to letter of February 14, 1984, A. W. Smith to J. W. Smith). Map 7 has been revised and Maps 6, 7, and 13 are provided for reference.

Reference to the "post mining fill" on page 9 of the DOC letter dated January 25, 1984 questions alterations of the channel of Mud Creek. No alterations of the channel of Mud Creek are planned. The drafting clarification referenced above addresses the apparent disturbance in the Mud Creek drainage.

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As discussed previously in Section UMC 783.14, North American Equities NV has used the accurate and pertinent portions of the previously submitted Geologic/Structure Map (Drawing No. 3032) and old Clear Creek Mine workings map combined with information gathered from the 1982 exploration drilling program to derive the new Geologic Structure Map (Map 14) and the Geologic Cross Section Map (Map 15). The more recent 1982 exploration drilling work has served to confirm the presence of geologic features such as faults shown on the old workings maps.

North American Equities NV has used the old Clear Creek Mine workings maps as a reference for geologic data interpretation and map work. Because the mine has been abandoned for many years and no backup survey or engineering data exists to support the information shown on the old workings map, it is not practical or possible to verify and certify the map information. Therefore, North American Equities NV will use these old maps only as a reference to be used in conjunction with more recent exploration and geologic work.

North American Equities NV has prepared and previously submitted the Pre-Mining and Postmining Cross Section (Map 7), Pre-Mining Topography Map (Map 6) and Postmining Topography Map (Map 13). The slope measurements shown on the Pre-Mining Topography Map (Map 6) represent average slopes measured over the traverse indicated by the arrows. Incremental slope measurements along the traverse indicated by the arrow can be either greater than or less than the average slope measurement. The incremental and average slopes, as drawn on the Pre-Mining and Postmining Cross Sections (Map 7), portray the surface configuration accurately considering scale, size of the area, and possible drafting accuracy.

The sediment pond discharge point (NPDES point) is shown and clearly labeled on the Surface Facilities Map (Map 9) and the Drainage and Sediment Control Plan Map (Map 11).

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The locations of water monitoring sample points are shown on the Hydrology/Geology Map (Map 5).

The approximate lateral extent of abandoned mine workings underlying and adjacent to the mine plan area are shown on the Pre-Mining and Postmining Land Use Map (Map 3). The original Mining and Reclamation Plan included, as Enclosure 6, a mine workings map for the Clear Creek No. 1 and No. 2 Mines that underlie the mine plan area.

Discussion under UMC 783.13, 14 and 15 regarding groundwater hydrology, explains the nature of subsurface water within the mine plan area and the fact that exploration drilling of three holes during 1982 encountered no groundwater occurrences.

The Blazon No. 1 Mine waterwell location is shown on the Hydrology/Geology Map (Map 5) and the Surface Facilities Map (Map 9). This well is completed into the old Clear Creek Mine workings at a depth of 185 feet. Water rights for the well are by way of an exchange agreement with the Price River Water User's Association. A copy of the exchange agreement is provided as Exhibit 7, Water Well Exchange Document. Groundwater rights, including exchanges, are listed in Table 4, Groundwater Rights.

Slope measurements of the pre-mining topography are shown on the Pre-Mining Topography Map (Map 6).

# UMC 784.11 OPERATION PLAN: GENERAL REQUIREMENTS

## Ponds, Impoundments, and Diversions

To control runoff and protect surface quality, North American Equities NV has constructed diversion ditches and sedimentation ponds. The Drainage and Sediment Control Plan Map (Map 11) shows the location of the sediment ponds and diversion structures. The designs and specifications are presented in Exhibit 8, Drainage and Sediment Control Plan and the Sediment Pond Design Map (Map 12).

A theoretical detention time of 24 hours has been used in the design of the sedimentation ponds so that all runoff occurring as a result of the 10-year, 24-hour precipitation event will be treated to produce a total of suspended solids (TSS) concentration less than or equal to 30 milligrams per liter. The pond is designed to provide storage for the inflow entering the pond as a result of a 10-year, 24 hour precipitation event.

The initial phase in the construction of the sedimentation ponds was to clear all unstable material from the location of the ponds. Any fill material used as an embankment was selected to exclude the presence of sod, large roots, or frozen material. The placing, spreading, and compacting of fill material was started at the lowest point of the embankment foundation and continued in thin horizontal lifts to the final design height.

The ponds have been examined periodically for structural weakness, erosion, and other hazardous conditions. Maintenance procedures include mowing or cutting of excessive vegetative growth to facilitate inspections and repairs, as well as keeping ditches, culverts, and spillways free of debris. All combustible material, other than mulch and material required for erosion control and surface stability, is removed on a regular basis. Sediment will be removed from the sedimentation ponds when the volume of sediment accumulates to 60 percent of the designed sediment storage volume. The accumulated sediment found in the ponds will be removed and placed in existing topsoil stockpiles if the sediment meets the appropriate topsoil criteria.

The location of the sedimentation ponds and diversion structures constructed within the mine plan area are shown on the Drainage and Sediment Control Plan Map (Map 11). The Geology/Hydrology Map (Map 5) and the Surface Watersheds Map (Map 10) shows the location of watershed boundaries from which, along with other sources, the design criteria were established. Generally, the pond and spillways were sized and placed according to such hydrological factors as required sediment storage volume, rate of flow, and the volume of flow for the appropriate storm event. The pond, spillways, and construction methods have been designed according to such engineering factors as structural integrity and stability, slope and surface stability, adequacy in height, size, and shape to provide sufficient volume for sediment and detained water and selection of proper spillways and outlet device, passing of designed storm events and proper outflow rates. The ponds have been designed under the direction of a qualified, registered professional engineer.

The purpose of the sedimentation ponds is not only to provide a final measure to prevent additional contributions of sediment outside the mine plan area, but also to provide a means of compliance with all applicable effluent limitations, especially with respect to total suspended solids (TSS).

The effluent quality is regulated by Section 817.40 and by the National Pollutant Discharge Elimination System (NPDES) permit. The NPDES permit was issued by the State of Utah, Department of Health under the National Pollutant Discharge Elimination System, established as a result of the Clean Water Act (33 USC Section 1251, et seq.) A copy of the NPDES permit is found in Exhibit 9, Permits for Mining.

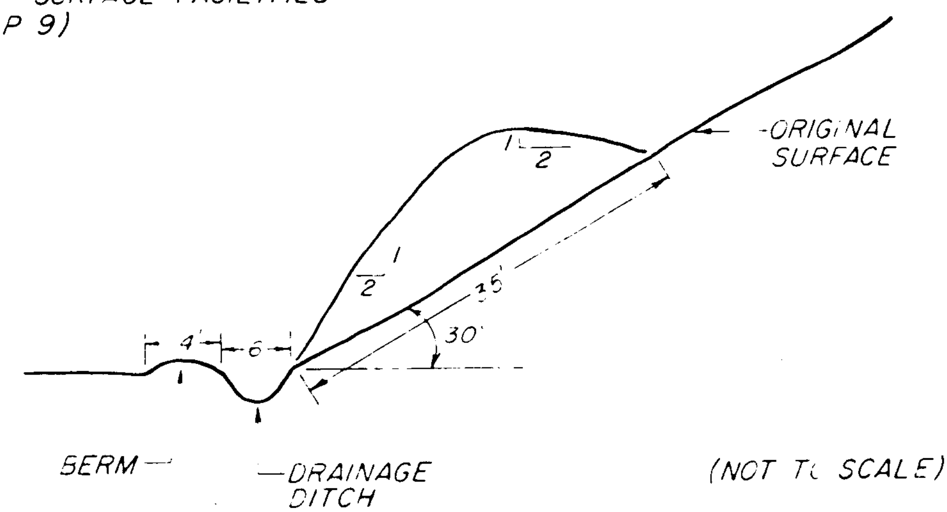
The engineering and design parameters for the sedimentation pond and diversion ditches are included in Exhibit 8, Drainage and Sediment Control Plan.

Main and intermediate coal haulage underground will be accomplished exclusively by belt conveyor systems. Initially, one (1) conveyor drive will be required to mine the entry mains followed by the addition of two (2) more drives to allow panel development.

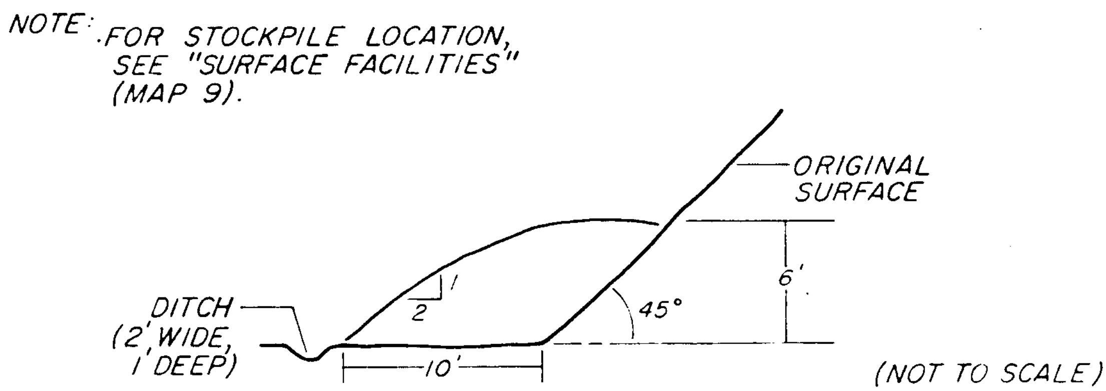
The location of the two (2) topsoil stockpiles, "A" and "B", are shown on the Surface Facilities Map (Map 9). Volume computation and cross sections of each topsoil stockpile are provided on Figure 3, Topsoil Stockpile "A" Cross Section and Figure 4, Topsoil Stockpile "B" Cross Section.

Mine development waste is stored in the valley fill adjacent to the mine portal area as shown on the Surface Facilities Map (Map 9).

NOTE: FOR STOCKPILE LOCATION,
SEE "SURFACE FACILITIES"
(MAP 9)




TOPSOIL STOCKPILE "A"
CROSS SECTION
FIGURE 3




TOPSOIL STOCKPILE "B"
CROSS SECTION
FIGURE 4

## UMC 784.12 OPERATION PLAN: EXISTING STRUCTURES

North American Equities NV has previously submitted descriptions of existing structures within the permit area in Section UMC 784.12, Operation Plan: Existing Structures of the ACR Document dated October 7, 1983. Proof and verification of present condition and repair of these existing structures is shown by the series of photographs and line drawings provided as Exhibit 13, Photographs of Existing Structures.

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North American Equities NV initiated mine and surface facilities construction in mid 1980 with production operations commencing in early 1981. The structures currently in place at the Blazon No. 1 Mine are shown on the Surface Facilities Map (Map 9).

The existing structures can be classified as follows:

- Office, Bath House, and Shop Complex
- Septic Tank and Leach Field
- Run-of-Mine Conveyor System
- Coal Loading Bin
- Mine Ventilation Fan
- Diesel Fuel Storage Tank
- Water Storage Tanks
- Sediment Ponds
- Electrical Substation
- Power Lines
- Roads

### Office, Bath House, and Shop Complex

North American Equities NV maintains a complete repair and warehousing facility for equipment maintenance and mine supplies. Large items, such as mine timber and roof bolts are stored outdoors due to space limitations.

Offices are provided for the mine superintendent and mine engineer. Other office space is provided for clerical/administrative functions.

A restroom, locker area, and showers are provided for use by all employees. Maintenance of the entire complex is performed by mine employees.

The office, bath house, and shop complex was designed and constructed to meet the performance standards of Subchapter K. No additions to these facilities are contemplated.

## Septic Tank and Leach Field

Sewage drainage from the office, bath house, and shop complex is piped to the septic tank and leach field for proper sanitary handling.

Design and construction of the septic tank and leach field meets performance standards of Subchapter K.

## Run-of-Mine Conveyor System

Coal mined underground leaves the portals by way of the run-of-mine conveyor system. Profile of the system is shown on the Surface Facilities Map (Map 9). Coal moving under water sprays and covering of the entire system prevent migration of coal dust. A diversion gate allows for separation of mine development waste from coal bound for the storage bin.

The run-of-mine conveyor system was designed and constructed to comply with the performance standards of Subchapter K. No changes to the system are planned.

## Coal Loading Bin

The coal loading bin provides storage and surge capacity as well as simple gravity loading for coal haulage trucks. The bin has a capacity of approximately 400 tons when fully loaded. The loading gates are pneumatic clam shell type using a small compressor for activation. The bin is completely enclosed to prevent migration of coal particles or dust.

Design and installation of the coal loading bin meets the applicable performance standards of Subchapter K.

## Mine Ventilation Fan

Location of the mine ventilation fan on the portal bench area is shown on the Surface Facilities Map (Map 9). The fan provides exhaust ventilation for the underground mine. The fan has been sized to provide adequate flow rate and air velocity, according to MSHA regulations, for underground operations over the life of the mine.

## Diesel Fuel Storage Tank

The diesel fuel storage tank, shown on the Surface Facilities Map (Map 9), has a capacity of 5,000 gallons. Diesel fuel is used by the surface front end loader and the underground scoop vehicle. A pipeline carries the fuel to the portal bench area to facilitate servicing of the scoop vehicle. The tank is located in a clear open space with a berm constructed to contain spillage. A fire extinguisher is placed nearby in case of emergency.

The diesel fuel storage tank and fuel handling techniques comply with the performance standards of Subchapter K.

Water Storage Tanks

Two (2) water storage tanks, with a capacity of 10,000 gallons each, are located on a small bench above the minesite as shown on the Surface Facilities Map (Map 9). The tanks are filled by pump from the mine water well. Water is used for fire control, coal dust suppression, and bath house purposes.

The water storage tanks and water handling techniques comply with applicable performance standards of Subchapter K.

Sediment Ponds

North American Equities NV passes all disturbed area runoff through the sediment ponds shown on the Surface Facilities Map (Map 9) and the Drainage and Sediment Control Plan (Map 11). The Drainage and Sediment Control Plan (Exhibit 8) and the Sediment Pond Design Map (Map 12) provide complete details of sizing and design methodology used.

The present pond system will provide adequate handling of runoff and sediment of the disturbed area for the life of the mine unless significant additional surface is disturbed. The sediment ponds have been designed, constructed, and maintained to protect the hydrologic balance and comply with the performance standards of Subchapter K.

Electrical Substation

Electrical power is supplied to the surface and underground operations from the electrical substation located as shown on the Surface Facilities Map (Map 9). Primary input voltage is 12,800 with secondary voltages ranging from 4,160 for heavy underground mining equipment to 110 for standard lighting.

The substation is completely self-contained and is equipped with fuse and grounding protection. Only properly qualified persons will repair or maintain any electrical equipment on the permit area. The electrical substation and other electrical gear fulfill the MSHA requirements and meet the performance standards of Subchapter K.

## Power Lines

North American Equities NV is provided electrical power by Utah Power and Light ("UP&L"). UP&L installed service from mainline to the Blazon No. 1 Mine substation tap. Power poles on the permit area meet applicable raptor-proof requirements and performance standards of Subchapter K.

## Roads

Location of all roads on the Blazon No. 1 Mine permit area are shown on the Surface Facilities Map (Map 9). The primary road shown is for access to the permit area and coal haulage by over-the-road tractor/trailer rigs. Other minor roads include secondary roads for access to the mine portal bench and electrical substation. Coal is moved by conveyor from portal to storage bin thereby eliminating the need for additional primary haul road.

Roads have been designed and built to effect compliance with the performance standards of Subchapter K. There will be no additions made to the present roads system.

## UMC 784.13 RECLAMATION PLAN: GENERAL REQUIREMENTS

i) North American Equities NV plans to complete all seeding activities in the fall of the year. Seeding activities will not be conducted during the spring unless weather or other conditions preclude fall seeding.

Planting of any bare root or containerized seedings will be completed during the spring. In the planned reclamation sequence, topsoil replacement follows backfilling and grading in late summer or early fall. Moisture content of the topsoil material will be lowest during this part of the year which will help to minimize compaction during placement activities. Reclaimed areas will be seeded as soon as possible upon completion of topsoil placement to take full advantage of expected precipitation during the winter and spring. This reclamation schedule will promote the rapid establishment of vegetative cover and minimize erosion.

ii) North American Equities NV has revised the seeding rates for drilling and broadcast seeding. The revised seeding rates are shown on Table 7, Reclamation Seed Mixture. Seeding rates are for drill seeding methods. Where broadcast seeding is utilized, the rate will be doubled.

iii) Shrub islands will be created by planting containerized or bare root seedlings if establishment of shrubs by drill and/or broadcast seeding methods are unsuccessful. North American Equities NV plans to monitor the seeded areas to determine the success of establishment of woody plant species.

Table 7

RECLAMATION SEED MIXTURE - Part 1

| Species | Bulk Lbs/Acre | Lbs PLS/Acre | PLS/ft$^2$ |
|---|---|---|---|
| Aspen/Spruce/Fir Vegetation Type | | | |
| Grasses | | | |
| Agropyron riparium<br>Streambank wheatgrass | 2.46 | 2.24 | 8.0 |
| Agropyron trachycaulum<br>Slender wheatgrass | 2.88 | 2.20 | 8.0 |
| Bromus marginatus<br>Mountain brome | 5.32 | 4.84 | 10.0 |
| Poa pratensis<br>Kentucky bluegrass | .24 | .24 | 12.0 |
| Grass Total | 10.90 | 9.52 | 38.0 |
| Forbs | | | |
| Achillea millefolium<br>Western yarrow | .06 | .04 | 2.0 |
| Hedysarum boreali<br>Sweet vetch | 25.90 | 5.18 | 4.0 |
| Lathyrus latifolius<br>Perennial sweetpea | 14.02 | 9.68 | 2.0 |
| Linum lewisii<br>Blue flax | .40 | .30 | 2.0 |
| Medicago sativa var. Ladak<br>Ladak alfalfa | .48 | .42 | 2.0 |
| Forb Total | 40.86 | 15.62 | 12.0 |
| Woody Plants | | | |
| Pseudotsuga menziesii<br>Douglas fir | 4.20 | 2.30 | 2.0 |
| Ribes aureum<br>Golden currant | .36 | .24 | 2.0 |
| Rosa woodsii<br>Woods rose | 3.90 | 2.88 | 3.0 |
| Symphoricarpos albus<br>Snowberry | 2.20 | 1.72 | 3.0 |
| Woody Plants Total | 10.66 | 7.14 | 10.0 |
| TOTAL | 62.42 | 32.28 | 60.0 |

Table 7

RECLAMATION SEED MIXTURE - Part 2

| Species | Bulk Lbs/Acre | Lbs PLS/Acre | PLS/ft$^2$ |
|---|---|---|---|
| Meadow Vegetation Type | | | |
| Grasses | | | |
| Agropyron riparium<br>Streambank wheatgrass | 1.54 | 1.40 | 5.0 |
| Agropyron trachycaulum<br>Slender wheatgrass | 1.08 | .82 | 3.0 |
| Bromus marginatus<br>Mountain brome | 1.60 | 1.45 | 3.0 |
| Phalaris arundinacea<br>Canary reedgrass | .57 | .41 | 5.0 |
| Poa pratensis<br>Kentucky bluegrass | .12 | .08 | 4.0 |
| Grass Total | 4.91 | 4.16 | 20.0 |
| Forbs | | | |
| Achillea millefolium<br>Western yarrow | .15 | .09 | 6.0 |
| Aster chilensis<br>Pacific astor | .14 | .10 | 6.0 |
| Hedysarum boreale<br>Northern sweetvetch | 38.89 | 7.78 | 6.0 |
| Linum lewisii<br>Blue flax | 1.20 | .89 | 6.0 |
| Osmorhiza occidentalis<br>Sweet anis | 9.91 | 8.77 | 6.0 |
| Forb Total | 50.29 | 17.63 | 30.0 |
| TOTAL | 55.20 | 21.79 | 50.0 |

Table 7

RECLAMATION SEED MIXTURE - Part 3

| Species | |
|---|---|
| | Woody Plant Species to be Established Independently of Seeding Activities |
| Woody Plants | |
| Salix spp<br>Willow | Scattered clumps |
| Cornus stolonifera<br>Red osier dogwood | Scattered clumps |
| Betula occidentalis<br>Birch | Scattered clumps |

Revegetation rates for woody plant species are planned to adequately support the proposed post-mining land use of wildlife habitat. North American Equities NV proposes a revegetation standard of 1,000 woody plant stems per acre based upon research addressing wildlife forage requirements on reclaimed lands (Mathews, 1983). While this standard represents a variance from the 90 percent stocking level specified by UMC 817.117(c), it adequately addresses the regulatory intent of equivalent and productive post mining land use. (Susan Linner of DOGM reviewed the proposed variance in September, 1983 and indicated that a stocking density of 1,000 woody stemps per acre would be acceptable given the limited areal disturbance planned).

If drill and broadcast seeding methods are unsuccessful in establishing the necessary woody plant density, North American Equities NV will plant containerized or bare root seedlings to establish the planned density.

iv) Mulch will be anchored on slopes exceeding 20 percent by use of a chemical tactifier. Slopes steeper than 20 percent are considered marginally accessible by small farm implements.

A minimum of 3,500 pounds per acre of clean cereal grain straw or native hay mulch will be utilized after seeding of the graded and topsoiled surfaces is complete to minimize erosion and promote germination.

vi) Post revegetation sampling plans have been revised to minimize disturbance of revegetated areas.

North American Equities NV plans to monitor the reference areas on a five (5) year basis to evaluate range conditions and ensure continued suitability as a reference for evaluation of reclamation success and suitability for bond release.

The revegetated areas will be monitored on an annual basis for the first five (5) years for density, cover, and species diversity to determine the necessity of additional seeding or planting for establishment of a diverse vegetative community. Due to the destructive nature of production monitoring, clipping, and associated production determinations will only be made after the initial five (5) years of revegetation and prior to bond release application.

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Detailed reclamation costs for the permit area are provided in Exhibit 14, Reclamation Cost Calculations.

Seeding of the disturbed area will be initiated prior to the first favorable growing season, either fall or spring, following completion of final grading and topsoil redistribution.

Following completion of final grading areas such as roadcuts, topsoil stockpiles, and portal area sideslopes will be seeded in order to provide cover for stabilization. The proposed seed mixture is composed of all native species with the exception of Medicago Sativa, a species which has been approved by DOGM, and the species Poa pratensis. Poa pratensis is generally considered to have an Eurasian background, however the occurrence of native stands in the intermountain region has been documented in Intermountain Flora, Vol. 6, 1977 Cronquist, et al.

Containerized or bare root woody species will be planted in the revegetated area if woody plant density is not equal to or greater than 1,000 stems/acre. The species to be utilized include Douglas fir, woods rose, snowberry, and currant. The stocking rate for these species will be dependent on the number needed to attain the proposed woody plant density of 1,000 stems/acre. Seeding islands will measure approximately 3 x 5 meters and will be spaced 5 meters to 33 meters apart. The placement of the islands will be dependent on the location of the most favorable microclimates available for woody plant establishment.

Some areas will require broadcast seeding. These areas will be seeded at a rate of 50% greater than the drill rate for grasses and 100% greater for forbs and woody species. These increased seeding rate for broadcast seeding method is required to ensure successful establishment of a diverse, effective, and permanent plant community as required by DOGM regulations. The rates of PLS/$ft^2$ for both seeding methods should be more than adequate to establish such a cover. Revegetation Guidelines for Surface Mined Areas, (Cook et al., December 1974).

There are no known acid forming or toxic forming materials in existence within the top or floor of the coal seam being mined. Therefore, North American Equities NV has not undertaken any special handling procedures for this material. A detailed description of the chemical characteristics of these materials is presented in Section UMC 783.14, Geology Description and Table 3, Analyses of Materials Above and Below Coal Seam.

Seeding of regraded and retopsoiled areas will be completed prior to the first favorable growing season. On steep slopes, the surface will be left rough after retopsoiling to retain small furrows to aid in trapping and covering seed. These steep areas will be broadcast seeded using rotary spreaders at a rate increase of 50% for grasses and 100% for forbes and woody species above the rate reported on Table 7, Reclamation Seed Mixture. Wherever feasible, mechanical means, such as the use of harrows or discs, will be utilized to cover the seed. Freeze-thaw action on these rough soils will also aid in seed coverage. All steep slopes will be mulched by mechanical or manual means with up to 4,000 lbs/acre of straw mulch or native hay. Areas where slopes are less than 10% will be seeded using a heavy duty rangeland drill at the rates specified on Table 3, Reclamation Seed Mixture. These areas will be mulched with approximately 2,000 pounds/acre of straw mulch or native hay. Mulch will be anchored using small farm equipment such as a disc and farm tractor. North American Equities NV does not plan to use hydromulch methods to seed and mulch any regraded surfaces.

Blazon



Should pest and/or plant disease control become necessary, North American Equities NV will consult with DOGM for planning acceptable control measures. No implementation of control measures will be made without prior approval of the Division. Irrigation of the reseeded areas is not planned as necessary due to the relatively abundant moisture which is more than adequate to establish the vegetative species to the disturbed area.

Success of revegetation will be dependent on the three (3) parameters of production, cover, and density. At the time of bond release, production and cover data collected from the reclaimed area will be compared to the data obtained from the reference area. Literature indicates a woody plant density of 1,000 stems/acre is well suited for the post-mining land use of wildlife habitat and livestock grazing (Mathews, 1983). In a consultation with Susan Linner of DOGM in September 1983, she stated that this density would be acceptable due to the small area affected. Prior to bond release, North American Equities NV will compare the density of successfully established woody species on the reclaimed area to the proposed density of 1,000 stems/acre.

A reference area for the meadow area was not required by the Division. North American Equities NV proposes to use information compiled previously by the SCS to establish success standards for revegetation of the meadow community.

North American Equities NV proposes to monitor the reference area each year during the liability period. Cover, production, and woody plant density will be monitored during the growing season. Cover or production will be sampled on an alternating basis for two (2) years. Every third year, all three (3) parameters will be sampled in the reclaimed area and reference area for comparison. Transects will be randomly located within the reference area. Sample size will be dependent on the number needed to attain statistical adequacy using at least minimum sample size as presented in DOGM vegetation information

Blazon



guidelines. Monitoring of temporary and contemporaneously reclaimed areas initiated after one (1) year's growing season will follow the same schedule as that of the reference area. This will provide valuable site specific information, especially in the event it becomes apparent modification to the final vegetation plan will be needed.

## UMC 784.14 RECLAMATION PLAN: PROTECTION OF HYDROLOGIC BALANCE

North American Equities NV plans to conduct surface and groundwater monitoring after mining has been completed and during the period of reclamation liability. The following table, Table 8, Monitoring Sites, lists the monitoring points for both surface and groundwater monitoring as shown on the Hydrology/Geology Map (Map 5). In addition, the purpose or location of each monitoring point is described.

North American Equities NV plans to sample each monitoring location three (3) times annually during the period of reclamation liability. This sampling frequency is consistent with the sampling schedule to be utilized during active mining operations.

All field sampling and laboratory data will be reported to DOGM within 60 days after sampling is completed. Reports will include sampling dates, and field and laboratory measurements. Laboratory standards and quality control information will be available should further clarification and review of the data be required.

North American Equities NV plans to utilize the analysis parameters list recommended by DOGM at the time of final reclamation as a guideline for post mining water monitoring work. Prior to beginning the post mining monitoring program, North American Equities NV will meet with DOGM to review and obtain final approval for the planned water monitoring frequency, sampling procedures, analysis parameters and procedures, and reporting format.

All monitoring points are accessible by vehicle from existing mine roads, and secondary access roads/trails as shown on the Hydrology/Geology Map (Map 5).

Table 8

MONITORING SITES

Surface Water

| Monitoring Point | Purpose/Location with Respect to Area to be Mined |
|---|---|
| B-4 | Upstream/Mud Creek |
| B-3 | Downstream of Confluence Snider Creek on Mud Creek |
| B-5 | Upstream/Snider Creek |
| B-2 | On Long Canyon Upstream from Confluence with Mud Creek |
| B-1 | Downstream/Mud Creek |
| NPDES | Discharge of sediment control structures/at each sediment control structure current and future |
| NPDES-I | Inflow into sediment control structures/at each sediment control structure current and future |

Groundwater

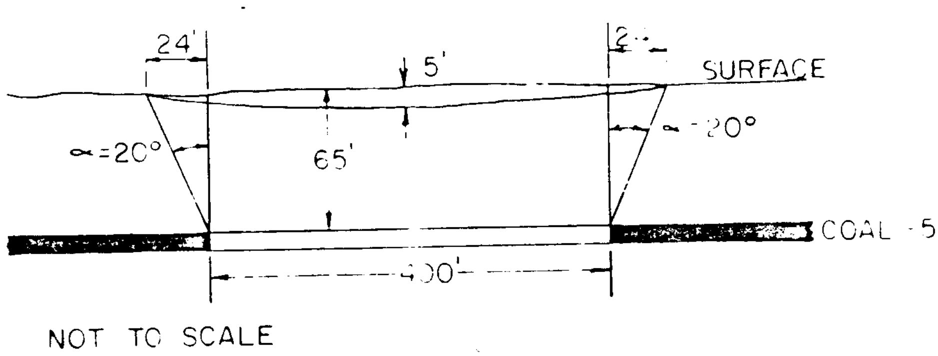
| Monitoring Point | Purpose/Location with Respect to Area to be Mined |
|---|---|
| G-2 | Spring/Seep |
| G-3 | Spring/Seep |
| G-4 | Spring/Seep |
| G-5 | Spring/Seep |
| G-6 | Clear Creek Mine Workings Discharge |
| G-1 | Spring/Seep |

As discussed in Section UMC 783.14, Geology Description, and Section UMC 783.17, Alternative Water Supply Information, North American Equities NV plans to mine beneath perennial streams of the permit area. The area affected by mining is shown on the Mine Plan Map (Map 8). In those areas of a perennial stream, a 100' buffer zone has to be delineated on either side of the stream to ensure that the roof material of the coal seam remains intact and that no subsidence is allowed to occur. Mining activities beneath the perennial streams will be limited to only haulage and ventilation necessary for mining in adjacent areas. No pillars will be removed or altered which may cause some future subsidence.

North American Equities NV has evaluated the effect of room and pillar mining adjacent to the buffer zone to determine effects of mining on the adjacent perennial zone. Detailed calculations are shown on Figure 5, Justification of 100' Buffer Zones for Perennial Streams. These calculations show that subsidence in the pillar areas will not subside the land surface more than 24 feet away from the pillaring activities. Thus the 100' wide buffer zone will be sufficient to protect the perennial stream.

North American Equities NV plans to implement a monitoring program of the surface waters within the permit as part of the post mining reclamation which will be similar to the existing surface water monitoring plan. Prior to reclamation activities, North American Equities NV will develop a monitoring plan for review and approval by DOGM. Following approval of the plan, North American Equities NV will implement the plan for the reclamation liability period or other period as may be required.

North American Equities NV does not plan to develop entry seals to control accumulation of water within the mine workings due to the portals being located at the highest elevation of the coal seam to be mined. Water accumulations within the old works run away from the portal area so no pressure build-up will occur. It is anticipated that




Coal Depth = 65 feet
Angle of Draw ( $\alpha$ ) = 20°
Cut Width = 400 ft

When an angle of draw ( $\alpha$ ) of 20° is specified, the extent of subsidence effect is calculated to be 24 feet at a coal depth of 65 feet. Therefore, the 100 foot buffer zone should be adequate.

JUSTIFICATION OF 100' BUFFER ZONES FOR PERENNIAL STREAMS
Figure 5

From: Subsidence Engineers' Handbook, National Coal Board of Great Britain only minor amounts of water will infiltrate into the mine due to absence of groundwater within the affected area as described in Section UMC 783.15, Groundwater Information.

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North American Equities NV will utilize a plan for hydrologic monitoring that will consist of periodic observation of groundwater and surface water monitoring locations. Monitoring and reporting water data is discussed under Section UMC 817.52.

North American Equities NV intends to utilize a drainage and sediment control plan to minimize any changes to surface water quality and to the prevailing hydrologic balance in both the mine plan area and adjacent areas. The primary method for erosion, sediment, and drainage control will be to minimize the initial potential impact by disturbing no more area than is necessary for the surface support facilities, by promptly reclaiming any disturbed areas, by promoting prompt vegetation, by trapping sediment, and by detaining runoff as close to the disturbed areas as possible. Diversion structures are planned at the locations shown on the Drainage and Sediment Control Plan Map (Map 11) and will serve to divert water from the disturbed areas into a sedimentation pond. Temporary structures are designed and will be maintained to handle the amount of runoff from a 10-year, 24-hour precipitation event and will be constructed using proper roughness characteristics, maintenance of appropriate gradients, revegetation, channeling or detention basins, or a combination of one or more of these measures. Drainage and sediment control systems have been maintained to the extent possible to prevent contributions of suspended solids to run off outside the permit area.

The drainage control from such facilities as roads, parking lots, surface support facilities, coal handling facilities, and other structures will be an important factor in minimizing contributions of sediment outside the permit area. All such facilities will be designed, built, and maintained to provide for proper handling of runoff.

The location of the sediment ponds used at the Blazon No. 1 Mine are shown on the Drainage and Sediment Control Plan Map (Map 11). The Hydrology/Geology Map (Map 5) and the Surface Watersheds Map (Map 10) show the location of watershed boundaries from which, along with other sources, the designs were established.

North American Equities NV currently has an NPDES permit from the Utah Department of Health, Water Quality Division. This permit is presented in Exhibit 9, Permits for Mining.

The water quality and quantity monitoring plan which North American Equities NV plans to utilize during the mining operation and reclamation phases of the Blazon No. 1 Mine is reviewed below.

## Surface Water

As previously stated, North American Equities NV has an existing NPDES permit which lists the water monitoring requirements for the discharge of any waters from the sediment control structure and any water which may be pumped from the underground workings. The NPDES permit is shown in Exhibit 9, Permits for Mining. Surface water monitoring sites are shown on the Hydrology/Geology Map (Map 5). Monitoring frequency will be on a quarterly basis for both perennial streams and intermittent or ephemeral streams. Flow measurements will be taken at each sample site to correlate with quantity and quality information. Quality parameters, which will be analyzed, will consist of the same parameters as the baseline information and shown in Exhibit 5, Water Analyses.

## Groundwater

As reviewed in the Section UMC 783.15, Groundwater Information, no groundwater is known to exist within the permit area. Minor occurrences of groundwater occur in perched conditions as evidenced by seeps and springs within the general area. Therefore, North American Equities NV plans to monitor only three locations for groundwater during the operation and reclamation phases of the operation. Spring G-4 will be monitored on a quarterly basis depending on access for an estimate of flow and to collect a sample for analysis as listed in the baseline data shown in Exhibit 5, Water Analyses. Similarly, water discharged from the Clear Creek Mine workings and the water pumped from the well at the mine facility location will also be monitored on the basis recently approved by DOGM to include flow measurement three times annually and quality analyses semi-annually. Flow rate and quality measurements will be made during the specified months. Constitutents which will be analyzed are listed in Exhibit 5, Water Analyses.

Probable Hydrologic Consequences

Mining activities proposed by North American Equities NV will have little impact on either the groundwater or surface water resources of the mine area. Surface water flows through the area are confined primarily to Mud Creek, Long Creek and Snider Creek, which are the perennial drainages of the mine area. Other small ephemeral drainages feed the small streams. Limited disturbance on the surface, less than seven (7) acres located on Mud Creek, provide little impact on the surface water quality. All surface drainage from the disturbed area is passed through the sediment control pond prior to discharge into Mud Creek. No surface disturbance is planned for either Snider Creek or Long Creek, therefore, no impacts are anticipated.

The Mine Plan which has been developed and is being followed utilizes selective caving operations along with standard room and pillar mining methods. In areas where surface water flows like Snider Creek, Long Creek, or Mud Creek, pillars will not be removed to prevent subsidence of the surface. Areas where pillars will be left to support the roof are shown on the Mine Plan Map (Map 8).

Groundwater resources of the mine area are very limited. Little or no groundwater is in evidence. Those minor groundwater occurrences are shown by minor seeps or springs which have been mapped across the mine area. The locations of the seeps and springs are shown on the Hydrology/Geology Map (Map 5). Only one seep is located on the permit area and falls within the area that will be mined. North American Equities NV believes that the discontinuity of the perched aquifer systems, caused by fault displacement, pinching sandstone units, and swelling interbedded shales will not be affected by underground mining operations. Flows from the springs and seeps are not of sufficient quantity to generate flow for the adjacent perennial streams. Consequences of mining on both surface water and groundwater resources in the area as a result will be insignificant. Continued monitoring of both the surface water and groundwater resources during operations and reclamation will be utilized to determine effects on the other water resources so that any impacts that occur may be mitigated and/or prevented.

## UMC 784.15 RECLAMATION PLAN: POST MINING LAND-USES

North American Equities NV will restore lands affected by surface operations to the original pre-mining uses by implementing the reclamation plan set forth in Section UMC 784.13, Reclamation Plan: General Requirements. Reclaimed areas may require protection from noxious weeds and effects of animal grazing until vegetation becomes sufficiently established. North American Equities NV will develop plans as necessary in consultation with DOGM for control measures such as fencing, herbicides, etc. should they become necessary.

The permit area of the Blazon No. 1 Mine will have a post mining land use as undeveloped natural vegetation grazing area and wildlife habitat. These land uses are shown on the Pre-Mining and Postmining Land Use Map (Map 3).

The primary access road to the permit area and that portion of the secondary access road which terminates at a point above the Snider Canyon Creek, as shown on the Pre-Mining and Postmining Land Use Map (Map 3), will be left intact for use by the surface landowner at his request in connection with domestic grazing.

## UMC 784.16 RECLAMATION PLAN: PONDS, IMPOUNDMENTS, BANKS, DAMS AND EMBANKMENTS

North American Equities NV plans to armor any drainage channels or outlet structures where design flow velocities exceed five (5) feet per second with suitable riprap material in order to prevent erosion and scouring. As shown in Exhibit 8, Drainage and Sediment Control Plan, design flow velocities do not exceed five (5) feet per second for any of the existing or planned drainage ditches. However, design calculations for culverts A through F indicate outlet flow velocities in excess of the five (5) feet per second criteria. Accordingly, North American Equities NV will place riprap at the outlet of these culverts. (The outlet of culvert G will also be riprapped even though flow velocities do not exceed five (5) feet per second.) In addition, the inlets of culverts A, B, and C will be armored due to the flow volumes they are projected to carry. Localized site conditions and soil characteristics will determine the need for riprap at the inlets of the remaining culvert installations.

Selection of riprap material is based upon the design event and resulting flow velocities. The following summarizes riprap specifications for the noted culvert installations:

| Culvert | | Riprap | | | | Bedding | |
|---|---|---|---|---|---|---|---|
| Design | Size | Design | Size | $d_{50}$ | Thickness | Design | Thickness |
| A | 84" | M | 21" | 12" | 18" | Fine Grained, Type II | 6" |
| B | 84" | M | 21" | 12" | 18" | Fine Grained, Type II | 6" |
| C | 84" | M | 21" | 12" | 18" | Fine Grained, Type II | 6" |
| D | 24" | L | 15" | 9" | 14" | Fine Grained, Type II | 4" |

$d_{50}$ - designates mean particle size

| Culvert | | Riprap | | | | Bedding | |
|---|---|---|---|---|---|---|---|
| Design | Size | Design | Size | $d_{50}$ | Thickness | Design | Thickness |
| E | 8" | VL | 12" | 6" | 9" | Fine Grained, Type II | 4" |
| F | 8" | VL | 12" | 6" | 9" | Fine Grained, Type II | 4" |
| G | 8" | VL | 12" | 6" | 9" | Fine Grained, Type II | 4" |

Riprap and bedding material will be obtained locally and will be placed with a small front-end loader or backhoe.

Surface runoff between Ditch B and Mud Creek is contained by a berm located adjacent to Mud Creek as shown on the Drainage and Sediment Control Plan Map (Map 11). The berm prevents uncontrolled surface runoff from entering Mud Creek, routing contained runoff through Ditch B to the sedimentation pond system for treatment. A typical cross-section of the berm was presented as Figure 9, Berm Cross-Sections, in the March 1, 1984 response to DOGM completeness comments.

As shown on the Drainage and Sediment Control Plan Map (Map 11), the natural topographic gradient directs runoff from the road and other disturbed areas to Ditch B. The only area which does not drain naturally to Ditch B is the diesel fuel storage area. The containment berms which have been constructed to capture any potential diesel spill will also contain the majority of the surface water runoff from this area.

Trash racks will be placed on the upstream end of major culverts to capture debris and prevent clogging of the culverts. The racks will be attached to the culvert at the upper end with bolts and brackets and will be angled at 45° to facilitate cleaning.

Cross sections of all berms and diversions are shown in Exhibit 8, Drainage and Sediment Control Plan. The cross sections included are for each of the drainage ditches, A, B, and C, and the two berms. These cross sections are shown on Figures 6, 7, 8, and 9. The locations of these structures are shown on the Drainage and Sediment Control Plan Map (Map 11).

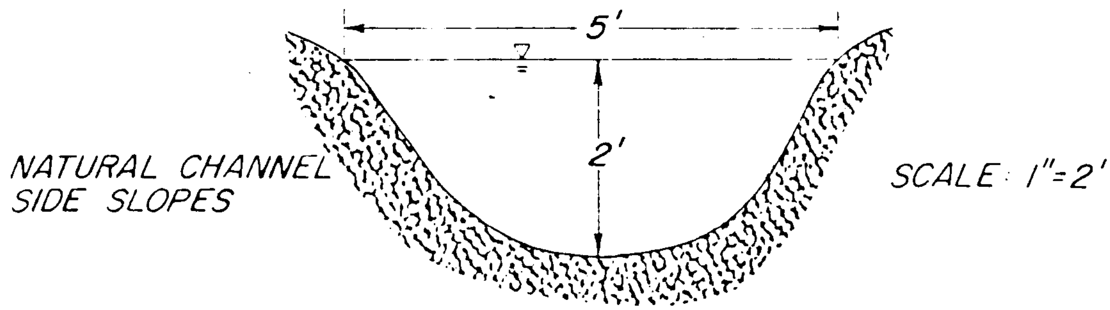
The slopes of all channels (ditches) and culverts are provided in Exhibit 8, Drainage and Sediment Control Plan in the sections titled Drainage Ditch Size Calculations and Culvert Size Calculations. No channel velocities exceed five feet per second as illustrated by these calculations; therefore, protection is not required. Riprap (12") has been placed in Ditch A (Mud Creek) between Culvert B and the disturbed area boundary. Riprap has also been placed for approximately 25 feet upstream and downstream of the 84 inch diameter culverts. This riprap has been installed as a precautionary measure to prevent erosion and scouring of the channel.

The culverts which have been installed at the Blazon No. 1 Mine do not have inlet or outlet control devices installed. Trashracks will be installed on the culverts exceeding 50 feet in length with the exception of Culverts B and C. The types of trashracks to be utilized are shown on Figures 10 and 11, Trashrack Structure and Trashrack Structure for Small Diameter Culverts.

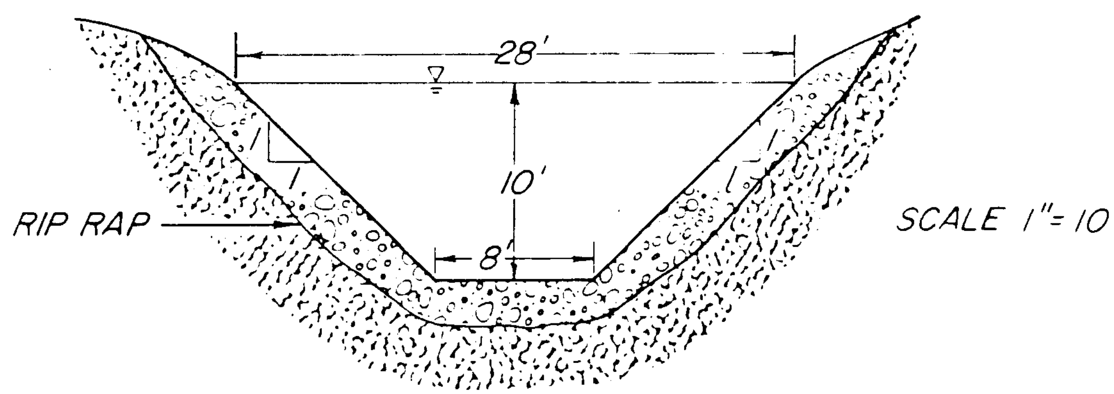
On the 84 inch diameter CSP culverts only the upstream culvert (Culvert A) will have a trashrack. The trashrack design is shown on Figure 10, Trashrack Structure for 84" CSP Culverts.

<u>Removal of Surface Runoff Structures, Embankments and Impoundments</u>

All embankments and impoundments will be completely removed and reclaimed after the termination of mining activities. The sedimentation ponds and diversions will not be removed until the affected area has



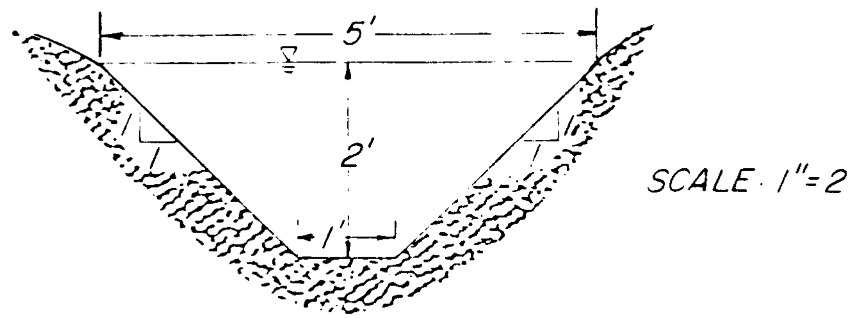

DITCH 'A'
CROSS SECTION B-B'
(UNDISTURBED STREAM CHANNEL)




DITCH 'A'
CROSS SECTION C-C'

NORTH AMERICAN EQUITIES
DITCH 'A' CROSS SECTIONS
FIGURE 6

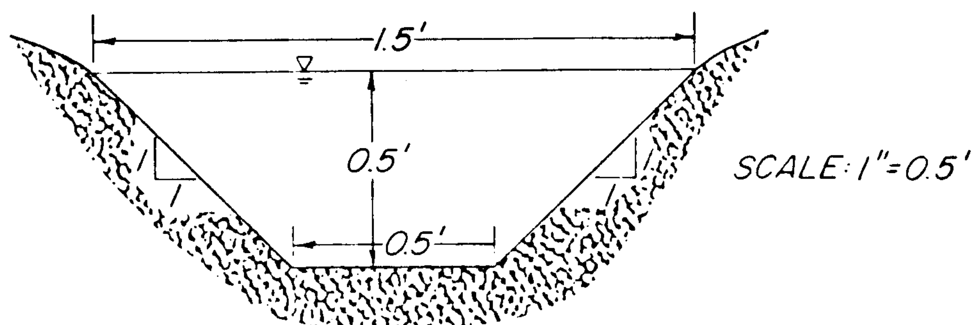
NOTE: FOR CROSS SECTION LOCATIONS SEE
DRAINAGE AND SEDIMENT CONTROL PLAN (MAP 11).




DITCH 'B'
CROSS SECTION D-D'

NORTH AMERICAN EQUITIES
DITCH 'B' CROSS SECTION
FIGURE 7

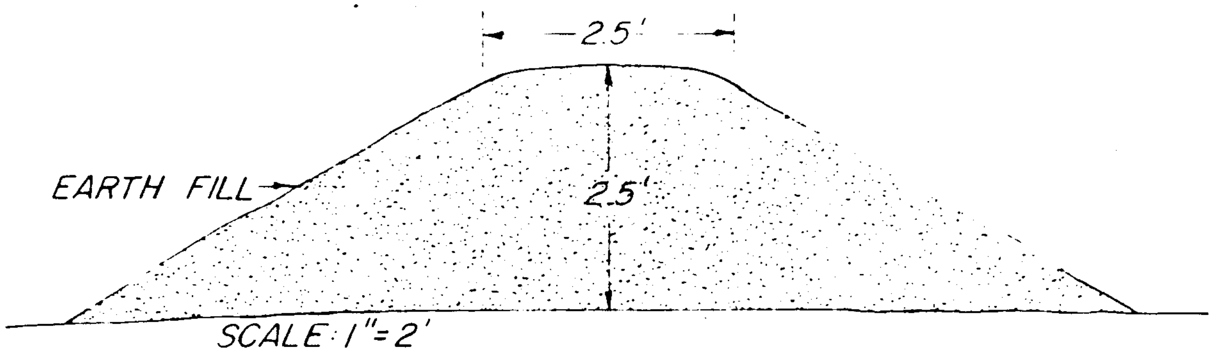
NOTE: FOR CROSS SECTION LOCATION SEE
DRAINAGE AND SEDIMENT CONTROL PLAN (MAP 11)



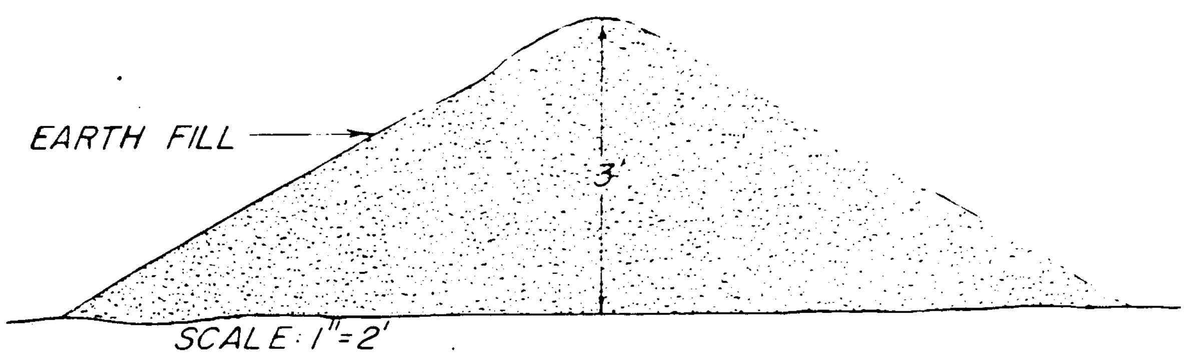

DITCH 'C'
CROSS SECTION E-E'

NORTH AMERICAN EQUITIES
DITCH 'C' CROSS SECTION
FIGURE 8

NOTE: FOR CROSS SECTION LOCATION SEE
DRAINAGE AND SEDIMENT CONTROL PLAN (MAP 11)



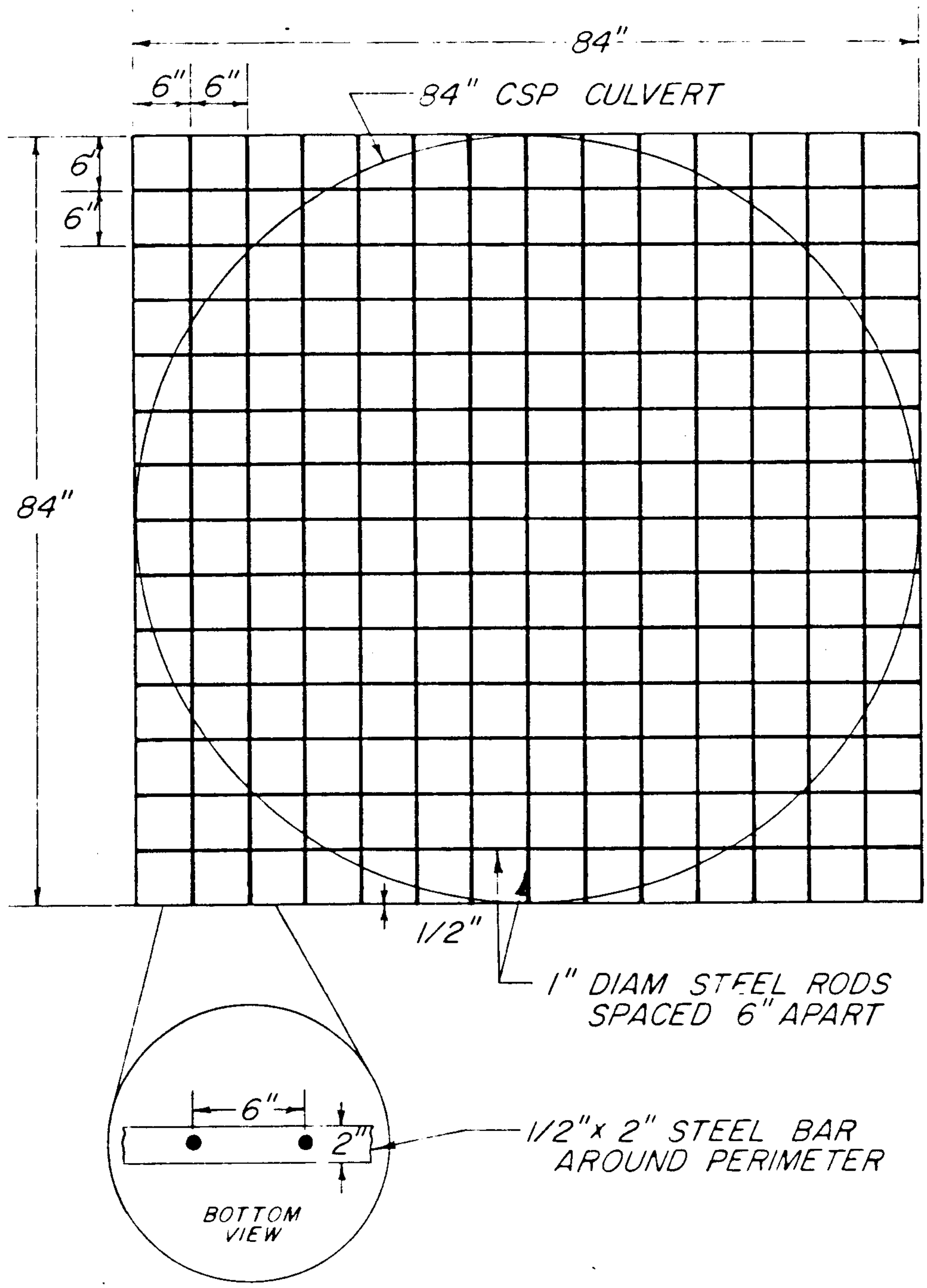

CROSS SECTION F-F'




TOPSOIL STOCKPILE BERM
CROSS SECTION G-G'

NORTH AMERICAN EQUITIES
BERM CROSS SECTIONS
FIGURE 9

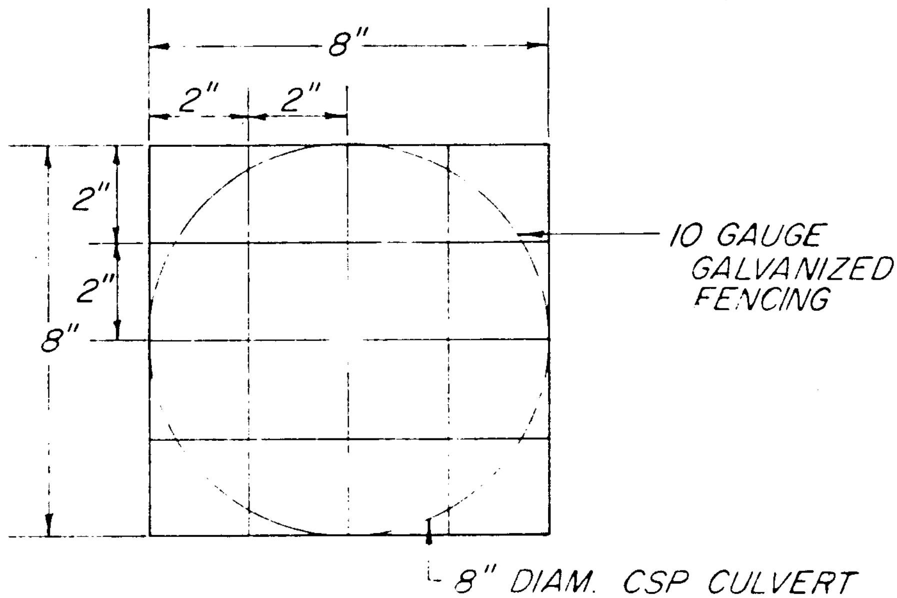
NOTE: FOR CROSS SECTION LOCATIONS SEE
DRAINAGE AND SEDIMENT CONTROL PLAN (MAP II)




NORTH AMERICAN EQUITIES

TRASHRACK STRUCTURE FOR 84" CSP CULVERTS

FIGURE 10




NORTH AMERICAN EQUITIES
TYPICAL TRASHRACK STRUCTURE
FOR SMALL DIAMETER CULVERTS
FIGURE 11

been restored and vegetation reestablished and such that the quality of the surface runoff meets the applicable NPDES effluent requirements. Upon removal of the sediment ponds and diversion ditches, the small areas affected by the ponds and diversions will be regraded and revegetated as described in Section UMC 784.13, Reclamation Plan: General Requirements.

Calculations to check the sizing of drainage diversions and culverts are included in Exhibit 8, Drainage and Sediment Control Plan in the sections titled Drainage Ditch Size Calculations and Culvert Size Calculations. These calculations were performed to determine if the structures as currently implemented are of adequate size. As indicated in Exhibit 8, all diversions and culverts are adequately sized as constructed.

Sedimentation Ponds

The sedimentation ponds have been constructed so that there will be little or no increase in contribution of sediment load to runoff from the disturbed areas. Little or no increase in effluent will result from discharge into receiving waters after retention and settlement.

The location of the sedimentation ponds are presented on the Drainage and Sediment Control Plan (Map 11). The design plans for these ponds are shown on the Sediment Pond Design (Map 12).

A principal spillway is located at an elevation equal to the maximum sediment storage volume. Dewatering will be achieved as necessary to comply with applicable NPDES discharge requirements and to provide storage volume for runoff. Generally, runoff will be contained an average of 24 hours prior to discharge to allow suspended solids to settle.

Sediment will be removed from the sedimentation pond when the volume of the sediment accumulates to the point where efficiency of the pond is reduced. Yearly observations of sediment accumulations will be made. The ponds will be cleaned out when the water level is low or non-existent, and when the least amount of precipitation is expected. The detention time for each pond has been designed to be a minimum of 24 hours to meet applicable effluent limitations with respect to total suspended solids.

The ponds have been constructed so the minimum elevation at the top of the settled embankments are at least one foot above the elevation of the surface water in the ponds when the emergency spillways are flowing at the designed depth. North American Equities NV has designed, constructed and maintained the sedimentation ponds to prevent short circuiting. The inflow to the ponds is at the diagonal opposite end from the outflow area.

The sedimentation ponds embankments are less than 10 feet in vertical height from the downstream toe of the embankments to the bottom of the emergency spillways.

The constructed height for the embankments was 5 percent greater than the designed height. The construction of these ponds was supervised by a Registered Professional Engineer to ensure that all construction was accomplished according to design and applicable regulations. The sedimentation ponds will remain in place until mining activities cease; the ponds will then be removed when the area has been reclaimed and revegetated.

North American Equities NV will examine the sedimentation ponds periodically and complete maintenance of the structure to ensure that it fulfills its intended use. The sediment ponds have not been constructed with liners.

Should any oils accumulate in the sediment ponds at the Blazon No. 1 Mine, a heavy duty sorbent boom or other similar material will be utilized for rapid oil absorbtion. These sorbent booms contain a water resistant vegetable fiber that can absorb and hold 22 times its weight in oil. The booms are floated on the pond surface and absorb the oil.

Discharge Structures

Discharge from the sedimentation ponds will be controlled by the use of overflow risers connected to the principal spillways as shown on the Sediment Pond Design Map (Map 12). An emergency spillway has also been constructed on each sedimentation pond structure. The emergency spillways have been riprapped to control erosion.

Energy Dissipators

Riprap energy dissipators have been constructed at the outlet ends of all primary outlet works including emergency spillways.

Diversions

The drainage and sediment control plan provides for temporary diversion of surface runoff within the disturbed area. Temporary ditches, as shown on the Drainage and Sediment Control Plan (Map 11) will divert runoff from the disturbed areas to the sediment control structures and, in other cases, will be used to divert runoff from the undisturbed areas away from the disturbed area. Temporary diversions have been constructed to pass runoff from the precipitation of a 10-year, 24-hour recurrence interval. The diversions are located so that the minimum gradient to pass the design flow is utilized and have been revegetated with grasses or lined with appropriate riprap material. Upon completion of mining activities, temporary diversions will be reclaimed as required.

None of temporary or permanent diversions control runoff from an area with a watershed greater than one square mile.

Undisturbed runoff above the mine pad area and electrical substation area was incorporated when sizing culverts D, E, and F.

Runoff onto the portal pad from the undisturbed area should be minimal due to the dense vegetation and topography of the area as illustrated on the Pre-Mining Topography Map (Map 6) and Surface Watersheds Map (Map 10).

The majority of this drainage will flow to the north where it meets the Little Snider Canyon drainage and flows into Culvert D where it is carried to Mud Creek (Diversion Ditch A). The remainder of the drainage above the portal bench flows to the south and into Snider Creek. The drainage from the portal bench is carried to the sedimentation ponds via Culvert E and Diversion Ditch B. Calculations regarding sizing of the culverts and drainage diversions are included in Exhibit 8, Drainage and Sediment Control Plan.

Any runoff which reaches the portal pad will be treated as runoff from the disturbed area and will be carried to the sedimentation ponds which have been sized accordingly. Due to the steepness of the hillside above the portal bench, construction of diversion ditches would be extremely difficult.

The undisturbed area above the electrical substation shown on the Drainage and Sediment Control Plan (Map 11) is treated in the same manner as that above the portal bench. The runoff which enters the disturbed area is carried along the roadway to Culvert F then to Ditch B and to the sedimentation ponds. Much of the undisturbed drainage flows to the south to the Little Snider drainage and into Culvert D and then to Ditch A (Mud Creek). The remainder of the drainage flows to the haul road and into the sediment ponds.

## UMC 784.20 SUBSIDENCE CONTROL PLAN

North American Equities NV will review the subsidence survey walkover plan and incorporate available aerial photography to augment the ground work. The planned work will be scheduled after the 1984 spring snowmelt is complete and at least 60 days prior to mine start-up. Following completion of the survey, the report of findings will be submitted to DOGM.

Prior to installation of additional subsidence monitoring points, North American Equities NV will review available ground control data and evaluate the monitoring plan to determine the potential value of additional monitoring points to the north, east, or south of the permit area.

Baseline and continuing subsidence monitoring data will be reviewed annually to determine the necessity and frequency of continued monitoring. If justifiable, the frequency of subsidence monitoring may be reduced to an annual basis. North American Equities NV will review any proposed changes to the monitoring plan with DOGM for approval by the agency before altering the subsidence monitoring plan.

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The existing structures, owned by North American Equities NV, are located within the general vicinity of the Blazon No. 1 Mine are as follows:

- Office, Bathhouse and Shop Complex
- Septic Tank and Leach Field
- Run-of-Mine Conveyor System
- Coal Loading Bin
- Mine Ventilation Fan
- Diesel Fuel Storage Tank
- Water Storage Tanks

- Sediment Ponds
- Electrical Substation
- Power Lines
- Mine Access Road
- Mine Secondary Road

No structures which are owned by other parties exist in the permit or adjacent areas.

Renewable Resource Lands

Renewable resource lands are defined as aquifers and the areas for the recharge of aquifers, areas for agricultural and silvicultural production of food and fiber and pasturelands. Renewable resource lands include the entire permit area. The only renewable resource within the permit area are the soil resources. The soil is composed mainly of Stony Loam and has been designated a grazing area by the SCS.

The areas where potential subsidence could occur are delineated on the Mine Plan Map (Map 8) by the life of mine affected area line. No evidence of prior subsidence has been identified to date.

The pastureland or grazing area considered to be a renewable resource could potentially subside as the result of the mining activity, however, grazing capacity would not be diminished as a result.

Tension or Compression Effects on the Ground Surface

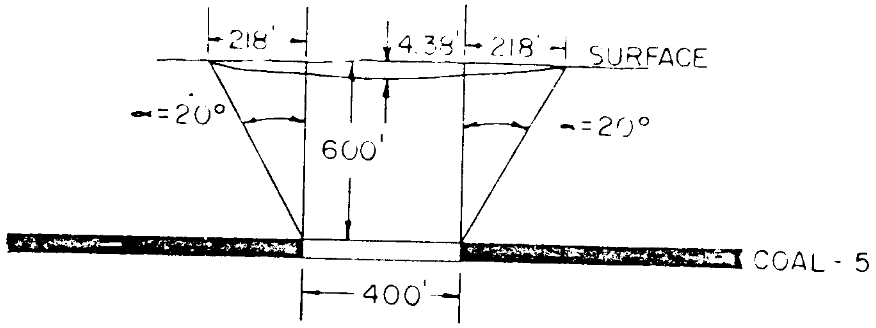
North American Equities NV will perform a survey using surface methods or aerial photography to determine the tension or compression effects on the ground surface over present and past mining areas within the permit area. North American Equities NV respectfully requests that this survey work be done within sixty (60) days of the resumption of planned mining activities. Current site conditions preclude any surface survey work.

Angle of Draw Determinations

The angle of draw or reach of subsidence outside the area of mining is difficult to predict as this angle varies in general case studies from as low as 0° to as low as 45°. Investigations have indicated that the angle of draw decreases as the percentage of sandstone in the overlying strata increases. (Abel and Lee, Lithologic Controls on Subsidence).

It has been suggested by the Utah DOGM that an angle of draw of 20' be used. This 20° angle is approaching the 25° angle which is considered the practical limit of subsidence (SME Handbook, p. 13-2). Subsidence would be expected to be minimal. The projected subsidence and corresponding depth of overburden are shown on Figure 12, Effects of Width of Extraction on Surface Subsidence and Figure 13, Relationship of Subsidence to Width and Depth.

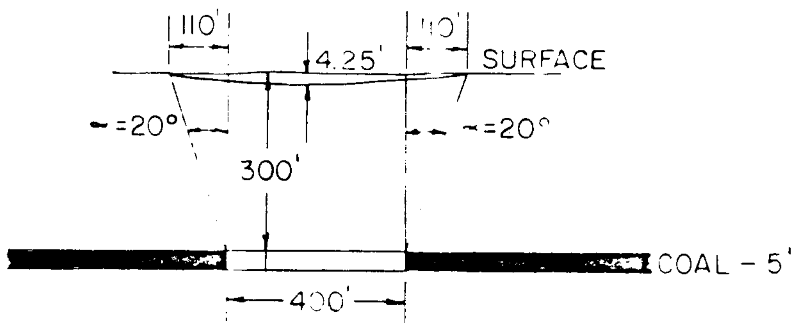
The following criteria has been used to determine maximum theoretical subsidence.




NOT TO SCALE

$w/h = 400/600$
$w/h = .66$
$s/m = 0.875$
$(0.875)(5.0) = 4.38'$

Maximum Coal Depth 600'



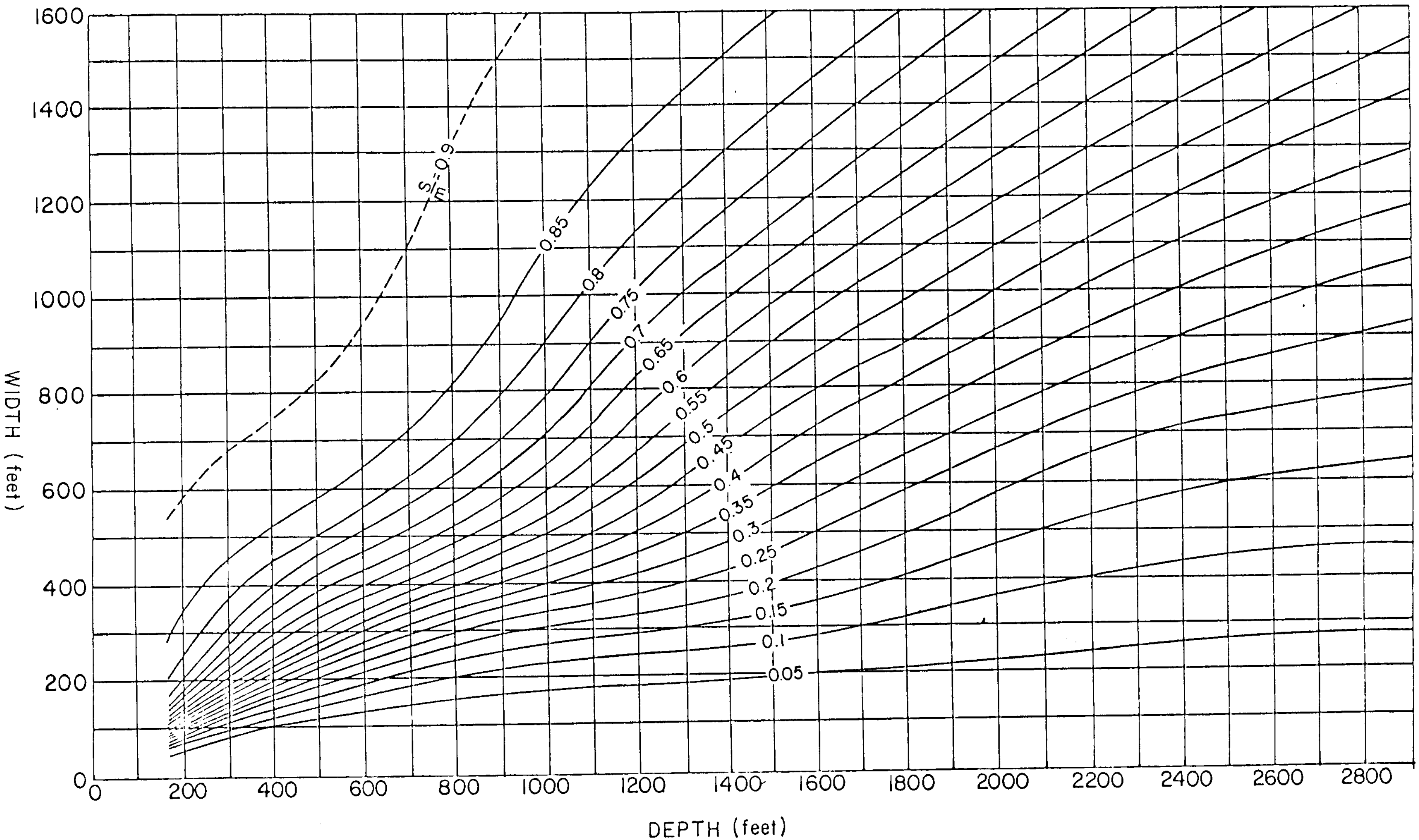

NOT TO SCALE

$w/h = 400/300$
$w/h = 1.33$
$s/m = 0.85$
$(0.85)(5.0) = 4.25'$

Average Coal Depth 300'

EFFECTS OF WIDTH OF EXTRACTION ON SURFACE SUBSIDENCE
Figure 12

From: Subsidence Engineers' Handbook, National Coal Board of Great Britain




RELATIONSHIP OF SUBSIDENCE TO WIDTH AND DEPTH

FIGURE 13

SOURCE: SUBSIDENCE ENGINEERS' HANDBOOK, 1975

1 Ft. = .3048 m

Panel width (W) = 400 ft
Depth to Coal (h) = 300 ft
wh = 400/600 - 1.33
s/m ratio (Figure 13)
s/m = 0.85
Coal thickness = 5 ft (average)
Maximum subsidence = 5.0 x 0.85 = 4.25 ft

The above formulas were obtained from The National Coal Board Subsidence Engineers' Handbook.

Additional subsidence monitoring stations have been located to correspond with each year block of mining. Stations have also been located along the east-west trending fault in year eight (8). The locations of these additional subsidence monitoring points is shown on the Mine Plan Map (Map 8).

North American Equities NV will survey all subsidence monitoring stations prior to underground mining below the respective station location in order to establish pre-mining elevations while mining occurs. Surveying will occur on a twice yearly basis to determine any subsidence which may occur.

Subsidence survey reports will be submitted to the DOGM no later than two (2) months after completion of survey work.

North American Equities NV does not believe there is a need for a plan of mitigation for damage to Seep G-4 or Spring G-5. The seep, G-4, is considered insignificant as a water source as its flow rate is less than one (1) GPM. The Spring, G-5, will not be affected by underground mining at the Blazon No. 1 Mine. This spring, as shown on the Hydrology/Geology Map (Map 5), is located outside the area which could be potentially affected by subsidence. The life of mine affected area line shown on the Hydrology/Geology Map (Map 5) and the Mine Plan Map

(Map 8) delineates areas which could potentially subside as a result of underground mining.

Protection of perennial streams in the area is discussed in Section UMC 784.14, Reclamation Plan: Protection of Hydrologic Balance.

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North American Equities NV Blazon No. 1 Mine will extract coal from the Upper Clear Creek seam which has a thickness of 4 to 5 feet. Past mining operations in the Clear Creek No. 1 and No. 2 Mines, located 200 feet below the proposed mine plan area, removed the 10-12 foot thick Lower Clear Creek seam.

Noticeable surface subsidence effects from the lower seam operation are not evident 60 years after abandonment. Considering this, the subsidence due to mining of the Upper Clear Creek seam in the Blazon No. 1 Mine should be minimal.

Nonetheless, North American Equities NV has delineated those areas with potential for subsidence within the mine plan area on the Mine Plan Map (Map 8). Monitoring stations will be placed at points on the surface before mining begins underground in these locations. Each station will be surveyed and visually inspected each spring and fall during mining. Final survey will be carried out one or two years after coal has been removed beneath the monitoring station.

North American Equities NV does not foresee any adverse effects by potential subsidence as a result of pillar extraction upon retreat and leaving of barrier support pillars. Therefore, no measures will be taken on the surface with respect to subsidence control.

## UMC 784.22 DIVERSIONS

Construction of diversions has been previously completed, therefore, calculations have been utilized to ensure that the sizes of diversions as constructed can safely control runoff from the two-year recurrence interval. These calculations are shown in detail in Exhibit 8, Drainage and Sediment Control Plan (Map 11).

## UMC 784.23 OPERATION PLAN: MAPS AND PLANS

North American Equities NV does not plan any stream channel filling on the Mud Creek or any other intermittent or perennial streams within the permit area as part of their mining and reclamation activities. The present natural condition of the Mud Creek stream channel will not be altered by North American Equities NV, therefore, the requirements of UMC 817.44 (d) are not applicable.

Note: The confusion on stream filling activities appears to stem from a drafting error on Map 7. This error has been corrected. (See Response relating to UMC 783.25.)

North American Equities NV plans to construct a concrete and steel loading box at the discharge of the waste chute. The purpose of the loading box will be to temporarily confine the waste material until it can later be removed for final placement. North American Equities NV will ensure that waste material and any other material discharged from the waste chute will be contained in the loading box and will not overflow or otherwise impact Mud Creek. The planned location of the box is shown on the Surface Facilities Map (Map 9).

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The location of the development waste chute has been shown and clearly labeled on the Surface Facilities Map (Map 9) and the Drainage and Sediment Control Plan Map (Map 11).

Final reclamation of the office building, coal loading bin, and haul road areas, as well as the development waste pile, will require removal of the culverts E, F, and D and reestablishment of the natural Little Snider Canyon drainage. The configuration of the Little Snider drainage, shown on the Postmining Topography Map (Map 13) is a result of regrading and contouring of the canyon to suitable side slopes and a reflection of the diversion of Mud Creek from its original pre-mining channel. No fill or alternation of Mud Creek during reclamation activities is planned.

The location and areal extent of the development waste pile has been shown on the Surface Facilities Map (Map 9) and the Drainage and Sediment Control Plan Map (Map 11).

---

Subsidence monitoring station locations are shown on the Mine Plan Map (Map 8). Stations will be selected and placed at surface locations prior to mining of those blocks.

Topsoil stockpile locations are shown graphically on the Surface Facilities Map (Map 9). Cross sections of stockpiles are provided as Figure 3, Topsoil Stockpile "A" Cross Section and Figure 4, Topsoil Stockpile "B" Cross Section.

The final surface configuration of the disturbed portions of the mine plan area is shown on the Postmining Topography Map (Map 13) and Pre-Mining and Postmining Cross Sections (Map 7).

## UMC 784.24 TRANSPORTATION FACILITIES

Roads within the permit area are shown graphically on the Surface Facilities Map (Map 9). Included are profile, cross section, and design specifications for the general access/coal haulage road. Other roads shown include the access road to the portal bench and mine electrical substation. A profile and typical cross section of the access road to the portal bench is shown on the Secondary Road Design Map, (Map 16).

The outside conveyor system alignment and profile, as well as coal storage bin location, are shown on the Surface Facilities Map (Map 9).

The Pre-Mining and Postmining Land Use Map (Map 3) shows those roads or sections of roads which will remain after completion of reclamation for land owner access.

## UMC 817.22 TOPSOIL: REMOVAL

The soils which have been disturbed by surface activity at the Blazon No. 1 Mine are shown on the Soils Map (Map 17) and consist of three (3) distinct units. These three (3) units are BI stony loam, CI loam, and DI loam.

The mapping unit descriptions for the three (3) units developed by the SCS indicate the following topsoil thicknesses.

- BI Stony Loam 3 inches
- CI Loam 4 inches
- DI Loam 28 inches

The areas which exhibit the most severe soil disturbance include the portal face-up area and mine access road. Both are located in areas where BI Stony loam and CI loam soils are the typical soil units present. The DI loam is found in the Mud Creek drainage and extends approximately 25 feet on either side of the stream channel. Mine related surface activities have resulted in minimal disturbance to areas adjacent to the stream channel, therefore, the majority of the thick DI loam topsoil resource is still in place. Site preparation activities resulted in minimal topsoil disturbance with a small amount of topsoil being stockpiled on the mine site as shown on the Surface Facilities Map (Map 9).

North American Equities NV plans to utilize the existing topsoil stockpiles to reclaim the noted severly disturbed areas of the BI Stony loam and CI loam soil units and the minimal disturbance area of the DI loam soil unit. Calculations indicate that existing stockpiled topsoil will cover these areas to a thickness of approximately two (2) to three (3) inches. The SCS soil unit description indicates the presence of topsoil resources exceeding three (3) inches prior to disturbance. In order to approximate original topsoil thicknesses on reclaimed areas, North American Equities NV plans to utilize suitable topsoil substitute material from the portal bench area. This material will be used to supplement available topsoil material, with the placement objective being a total of six (6) inches of suitable seedbed material for reclamation.

North American Equities NV estimates the volume of suitable topsoil substitute material available on the portal bench to be approximately 7,000 $yd^3$.

North American Equities NV will utilize the guidelines shown on the attached tables (Table 9, Soil Sampling Guidelines; Table 10, Recommended Procedures for Analyzing Soils and Overburden/Interburden Quality; and Table 11, Criteria to Establish Suitability of Topsoil (or Topsoil Substitutes) to confirm topsoil substitute suitability. The portal bench material will be sampled using a hand auger or other site specific hand sampling methods as appropriate to obtain representative samples.

The portal bench area is approximately 300 feet long and 50 feet wide. North American Equities plans to obtain five (5) samples from the bench area for analysis. Three (3) of the samples will be obtained along the crest of the bench and the remaining two (2) samples will be obtained along the toe of the outslope of the bench.

---

The soil sample locations and soil mapping units are shown on the Soils Map (Map 17). The descriptions of soil mapping units are presented in Exhibit 15, Soils Information.

It is possible that at the time of mine construction, North American Equities NV did not salvage the entire depth of topsoil in the soil classification labeled DIB as shown on the Soils Map (Map 17). The SCS Soils Study shows topsoil in this area to be approximately 28 inches thick. The area in which classification DIB is located encompasses

Table 9

SOIL SAMPLING GUIDELINES

- Sampling sites will be clearly identified on an appropriate map
- Sampling sites will be located to accurately represent the predominant soil unit. Transition zones and previously disturbed areas will be avoided.
- A soil profile description will be prepared for each sampling site. The soil profile description will identify and describe each major soil horizon sampled
- Soil samples will be placed into clean polyethylene bags, labeled, and transported to the laboratory for analysis as soon as possible after sampling
- Analytical results for laboratory analyses of soil samples will be presented in a standard tabular form and will identify the sampling date, sample location, soil unit, soil horizon, analysis date, analysis laboratory, analytical job number, and the analysis methodologies used.

Table 10

RECOMMENDED PROCEDURES FOR ANALYZING SOILS AND OVERBURDEN/INTERBURDEN QUALITY - Part 1

| | | | | |
|---|---|---|---|---|
| 1. | pH | pH | Hydrogen ion activity at saturation (paste) | USDA Handbook 60, method (21a), pg. 102 |
| 2. | Conductivity | Conductivity | mmhos/cm @ 25°C | USDA Handbook 60, method (3a), pg. 84 and method (4b), pg. 89-90, or ASA Mono. No. 9, Pt. 2 pg. 937-940 1/ |
| 3. | Saturation | Saturation | Percent | USDA Handbook 60, method (27a & b), pg. 107 |
| 4. | Particle size-Analysis | | % clay, silt, sand, and very fine sand (vfs=0.05 - 0.1 mm) | ASA Mono. No. 9, Pt. I, method 43-5, pgs. 562-566. Sieve Analysis for vfs (140-270 mesh) |
| 5. | | Particle size Analysis | % clay, silt, and sand | ASA Mono. No. 9, Pt. I, method 43-5, pg. 562-566 |
| 6. | Texture | Texture | USDA textural class | USDA Handbook 18, pgs. 205-223 |
| 7. | Soluble Ca, Mg, and Na | Soluble Ca, Mg, and Na | meq/l | Extraction of Ca, Mg, & Na by USDA Handbook 60, method (3a), pg. 84. Analysis by atomic absorption spectrophotometry |
| 8. | Sodium-Adsorption ratio | Sodium-adsorption ratio | SAR calculated from soluble Ca, Mg, & Na concentrations | USDA Handbook 60, pg. 26 |
| 9. | Carbonates 2/ | | Percent | USDA Handbook 60, method (23b), pg. 105 |

Table 10

RECOMMENDED PROCEDURES FOR ANALYZING SOILS AND OVERBURDEN/INTERBURDEN QUALITY - Part 2

| | | | |
|---|---|---|---|
| 10. Selenium 3/ | Selenium | ppm to a lower detection limit of 0.02 | Extraction by ASA Mono. No. 9, pt. 2, method 80-3, pg. 1122; Analysis by the DAN-Fluorometric method (Levesque & Vendett, 1971) or the Gaseous Hydride Method (US EPA 1979) & atomic absorption spectrophotometry |
| 11. Boron | Boron | ppm | Extraction by ASA Mono No. 9, Pt. 2, method 75-4, pg. 1062. Analysis by the curcumin method (Standard Methods, 1976) |
| 12. | Nitrate-Nitrogen | ppm | Extraction by ASA Mono No. 9, Pt. 2, method 84-5. 3.3, pg. 1216 |
| 13. Organic Matter | | Percent | ASA Mono. No. 9 Pt. 2, method 90-3, pg. 1372-1376 |
| 14. | Molybdenum | ppm to a lower detection limit of 0.1 | $(NH_4)_2 CO_3$ extractable (Vlěk, 1975). Acceptable procedure available from LQD |
| 15. | Copper | ppm | DTPA Extraction (Follett & Lindsay, 1971). Analysis by atomic absorption spectrophotometry |

Table 10

RECOMMENDED PROCEDURES FOR ANALYZING SOILS AND OVERBURDEN/INTERBURDEN QUALITY - Part 3

| | | | |
|---|---|---|---|
| 16. | Acid-base potential 4/ | Acid potential in meq $H^+$/100 gr., neutralization potential in tons $CaCO_3$ equiv. / 1000 tons; acid-base potential ± tons $CaCO_3$ equiv. / 1000 tons | Smith R.M. et al. (1974) pg. 48-51 |
| 17. | Lead | ppm | DTPA Extraction (Follett & Lindsay, 1971). Analysis by atomic absorption spectrophotometry |
| 18. | Arsenic | ppm | pH 6.5 Mixed acid extractable As (0.04N HCl & 0.025N $H_2SO_4$), (Nelson et al. 1953). pH 6.5 Bicarbonate-Extractable As (0.4N $NaHCO_3$)(Olson et al. 1954)3 |
| 19. Coarse Fragment | | Percent | USDA Handbook 436, App. I, pg. 472; Soil Survey Laboratory Methods & Procedures for Collecting Soil Samples, pgs. 9 and 12-13 |

1/ Conductivity should be determined immediately after the extract is obtained.
2/ Analysis recommended where calcic horizon is suspected.
3/ Analysis for selenium recommended on soils where primary selenium indicator plants are present (Rosenfeld and Beath, 1964).
4/ Referred to as acid-neutralization account by Smith et al. (1974).

Table 11

CRITERIA TO ESTABLISH SUITABILITY OF TOPSOIL (OR TOPSOIL SUBSTITUTES)

| Parameter | Suitable | | | Unsuitable |
|---|---|---|---|---|
| | Good | Fair | Poor | |
| pH | 6.0 - 8.4 | 5.5 - 6.0<br>8.4 - 8.8 | 5.0 - 5.5<br>8.8 - 9.0 | <5.0<br>>9.0 |
| EC (Conductivity) mmhos/cm | 0 - 4 | 4 - 8 | 8 - 16<br>>8 may prove difficult to revegetate | >16 |
| Saturation Percentage | 25 - 80 | | >80<br><25 | |
| Texture 1/ | sl, l, sil, scl, vfsl, fsl | cl, sicl, sc, ls, lfs | c, sic, s | |
| SAR | < 6 | 6 - 10 | 10 - 15<br>10 - 12 2/ | >15<br>>12 2/ |
| Selenium | < 2.0 ppm | | | >2.0 ppm |
| Boron | < 5.0 ppm | | | >5.0 ppm |
| Calcium Carbonate | 0 - 15% | 15 - 30% | Over 30% | |
| Coars Frag 3-10 in.<br>(% vol) 10 in. | 0 - 15<br>0 - 3 | 15 - 25<br>3 - 7 | 25 - 35<br>7 - 10 | >35<br>>10 |
| Moist Consistency<br>Dry Consistency | vfr, fr,<br>lo, so | lo, fi,<br>sh, h | vfi, exfi,<br>vh | |

1/ SCS 1978. National Soils Handbook, Notice 24

2/ For fine textured soils (Clay 40%) (Gee et al., 1978) approximately 1.26 acres. This would yield approximately 1,019 cubic yards of topsoil if six (6) inches were removed. In the area labeled as soil unit BIG on the Soils Map (Map 17), topsoil is reported to be three (3) inches thick over an area of 1.99 acres. This would yield a topsoil volume of approximately 802 cubic yards. The third soil unit identified, CIG, is present on 1.76 acres of the disturbed area. The topsoil thickness for this soil classification is four (4) inches thick which would yield a topsoil volume of approximately 953 cubic yards. The total available topsoil volume for the disturbed area would be approximately 2,774 cubic yards had all topsoil material been salvaged and stockpiled. North American Equities NV currently has approximately 1,405 cubic yards of topsoil material available for reclamation, therefore, a topsoil substitute will be necessary for reclamation purposes.

A portion of the haul road containing approximately 0.9 acres will be utilized for property owner post mining access to the site so it will, therefore, not be reclaimed. This will reduce the area where topsoil will be replaced to 4.1 acres. The road to be utilized in the post mining land use is shown on the Pre-Mining and Postmining Land Use Map (Map 3).

North American Equities NV proposes to use available portal bench fill material as a topsoil substitute for accomplishing effective reclamation at the Blazon No. 1 Mine. This fill material utilized for the portal bench was obtained from cuts made during facilities construction and construction of the sediment ponds. The character of this fill material appears to be a brownish colored stony clay loam. No physical or chemical analyses of this material is currently available. North American Equities NV will collect samples of this fill material and have the samples tested for the following parameters:

- pH
- Net acidity or alkalinity
- Phosphorus
- Potassium
- Texture class
- Other parameters which may be required by DOGM

Due to the weather conditions and snowfall presence at the mine site, samples will not be taken until the first week of April or when access and sampling is possible during the spring of 1984. The samples will be sent to a certified laboratory for analyses. Upon completion of the analyses, the results, along with a map showing sampling locations, will be forwarded to the DOGM.

Plan for Utilization of Topsoil Substitute

It will be necessary during reclamation to have topsoil/topsoil substitute available for a six (6) inch coverage for 4.1 acres. This will require approximately 3,307 cubic yards of topsoil and topsoil substitute material.

Prior to the reapplication of the topsoil substitute material, the area will be scarified to eliminate compaction and to provide for a good bond with the replaced topsoil substitute material. The topsoil substitute will be applied in a uniform stable thickness of three (3) to four (4) inches. The available topsoil material will then be placed over the topsoil substitute material in a two (2) to three (3) inch layer. Following re-application of the topsoil and the final grading of this material, the topsoil will be scarified with a chisel plow or similar equipment to alleviate any compaction caused by machinery. This treatment will promote root penetration of the planted vegetation. Wind and water erosion will be controlled prior to seeding by leaving reapplied topsoil in a rough condition.

Immediately following mulching and seeding, slope areas will be contour furrowed, if necessary, to reduce topsoil erosion and maintain site stability until vegetation is established.

## UMC 817.23 TOPSOIL: STORAGE

The seed mixture used to stabilize topsoil stockpile is as follows:

| Scientific Name | Common Name |
|---|---|
| Agropyron trachycaulum | Slender wheatgrass |
| Bromus margrinatus | Mountain brome |
| Dactylis glomerata | Orchard grass |
| Phleum pratense | Timothy |

The application rate for this seed mixture was approximately 10 pounds/acre PLS.

The third topsoil stockpile (Stockpile C) has been located on the Facilities Map (Map 9) and the Drainage and Sediment Control Plan Map (Map 11). The estimate volume for this stockpile is five (5) cubic yards.

The stockpile is located directly below a large conifer tree. This location protects the stockpile from erosion due to direct rainfall and the stockpile is protected from runoff by means of the road drainage.

## UMC 817.24 TOPSOIL: REDISTRIBUTION

The total available topsoil salvaged from the disturbed area at the Blazon No. 1 Mine is approximately 1,405 cubic yards. The locations of the three (3) topsoil stockpiles are shown on the Facilities Map (Map 9). The volume of stockpile C is estimated to be approximately five (5) cubic yards. A detailed plan for the use of a topsoil substitute to attain reclamation goals is presented in Section UMC 817.22, Topsoil Removal. The use of available topsoil and topsoil substitute will allow for redistribution of topsoil/topsoil substitute in a depth of six (6) inches over the entire mine area to be reclaimed.

## UMC 817.25 TOPSOIL: NUTRIENTS AND SOIL AMENDMENTS

North American Equities NV will develop a plan for sampling, analysis, and soil amendment of replaced topsoil materials based upon the DOGM guidelines in effect just prior to the completion of mining activities. North American Equities NV will present this plan to DOGM for review and approval prior to initiation of final reclamation.

North American Equities NV will utilize standard farm equipment and implements to apply soil amendments. Fertilization and other soil amendment practices will be scheduled for the fall of the year concurrent with seeding activities, where possible. (Dependent upon the type of soil amendment required, it may be necessary to utilize both the fall and spring seasons for soil amendment applications.)

North American Equities will base selection of appropriate fertilizers or other forms of soil amendment upon the results of the soil sampling program.

## UMC 817.42 HYDROLOGIC BALANCE: WATER QUALITY STANDARDS AND EFFLUENT LIMITATIONS

North American Equities NV is providing water quality records as Exhibit 5, Water Analyses. Water sampling will continue at the approved frequency of, respectively, flow rate three (3) times annually and quality analyses semi-annually in the months specified by DOGM. When active mining operations resume, sampling frequency will be increased to that suggested in published DOGM guidelines. Analytical data compiled from each round of sampling will be promptly submitted to DOGM.

# UMC 817.43 HYDROLOGIC BALANCE: DIVERSIONS AND CONVEYANCE OF OVERLAND FLOW

No permanent diversions are planned at the Blazon No. 1 Mine. All of the diversion structures constructed will be removed upon cessation of mining activities and successful revegetation of the area so that applicable NPDES effluent requirements can be met.

The mine development waste storage area will be reclaimed along with the disturbed area. Excess mine development waste material will be placed underground to backfill the portals. The mine development waste storage area will be contoured and the natural drainage re-established. Topsoil or topsoil substitute will be applied and revegetation established to prevent erosion.

## UMC 817.46 HYDROLOGIC BALANCE: SEDIMENTATION PONDS

The sedimentation ponds at the Blazon No. 1 Mine have been designed to adequately control the disturbed area runoff and sediment volume generated during a 10-year, 24-hour precipitation event. The sizing calculations for the sedimentation ponds are included in Exhibit 8, Drainage and Sediment Control Plan.

The sedimentation ponds will not be removed until the affected area has been restored and vegetation reestablished such that the quality of the surface runoff meets the applicable NPDES effluent requirements.

## UMC 817.50 HYDROLOGIC BALANCE: UNDERGROUND MINE ENTRY AND ACCESS DISCHARGE

The mining operation of North American Equities NV at the Blazon No. 1 Mine advance in the downdip direction from the portal faceup area. No groundwater was encountered during the mine's operation. Downdip mining advance and the absence of groundwater sources adequately preclude the possibility of gravity discharge from mine entries.

## UMC 817.52 HYDROLOGIC BALANCE: SURFACE AND GROUNDWATER MONITORING

Historical water monitoring data are presented in Exhibit 5, Water Analysis.

North American Equities NV will collect and submit to the Utah DOGM water monitoring data at stream sites B-1, B-2, B-3, B-4, B-5, B-6, and G-6, sampling point of effluent from Clear Creek Mine, three (3) times annually. These measurements will be taken during the first two (2) weeks of June, last two (2) weeks of July, and the last two (2) weeks of September. Sites G-1, G-2, G-3, G-4, G-5, and G-7 will be sampled once monthly for a year commencing the first week of April to obtain necessary baseline data. These sampling sites are shown on the Hydrology/Geology Map (Map 5). After completing collection of baseline data, sites will be sampled on a schedule approved by DOGM.

Water quality measurements will be collected two (2) times per year at each spring and stream site in connection with the discharge measurements to be taken in June and September.

The NPDES permit for the Blazon No. 1 Mine has been renewed for the period March 1982 through December 31, 1986. The renewal of the NPDES permit is included as Exhibit 16, NPDES Permit Approval.

## UMC 817.53 HYDROLOGIC BALANCE: TRANSFER OF WELLS

North American Equities NV will abandon and plug the water well upon completion of mining and reclamation activities. The well will be plugged using the following plan:

The well will be filled with sand or gravel from the bottom to the static water level. An inert material (drilling mud or equivalent) will be placed in the interval between the static water level and ten (10) feet below the ground surface. The remaining ten (10) feet will be filled with cement, concrete, or other approved material. Should North American Equities NV decide to transfer the well at the later date, documentation will be submitted to DOGM addressing the regulations under Section UMC 817.53, Hydrologic Balance: Transfer of Wells, including required approval by the State Engineer.

## UMC 817.54 YDROLOGIC BALANCE: WATER RIGHTS AND REPLACEMENTS

North American uities NV will replace any water rights that are contaminated or terrupted as a result of mining activities. Measures of mitigation cc d involve the purchasing of additional water rights, drilling of addi onal water wells, or any other steps deemed necessary to mitigate effe ed water rights.

## UMC 817.55 HYDROLOGIC BALANCE: DISCHARGE OF WATER INTO AN UNDERGROUND MINE

North American Equities NV does not plan to divert any surface or mine discharges into abandoned mine workings. Therefore, Section UMC 817.55 does not apply to the Blazon No. 1 Mine.

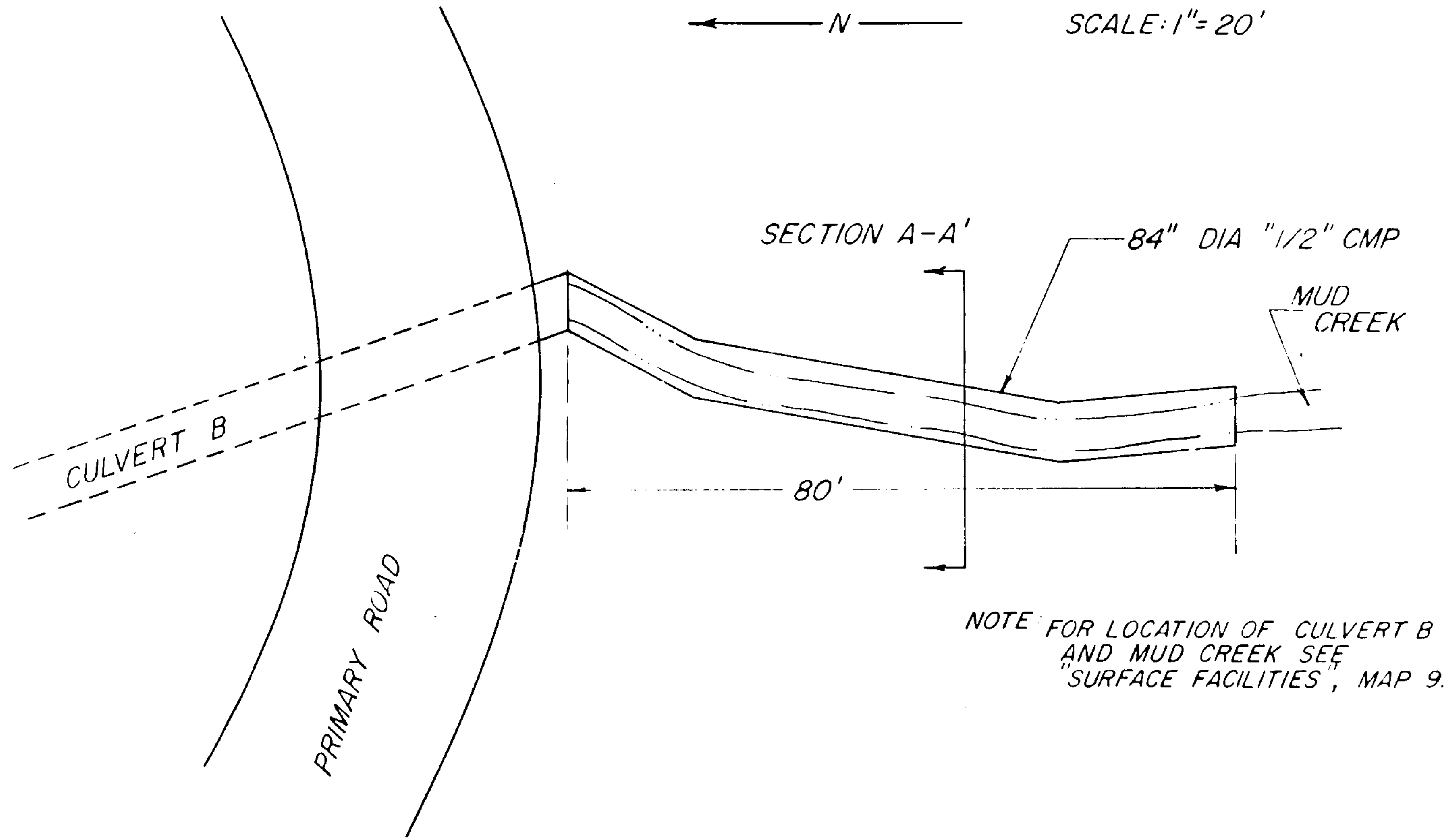
## UMC 817.57 HYDROLOGIC BALANCE: STREAM BUFFER ZONES

North American Equities NV will construct a cover over a section of Mud Creek to prevent coal refuse material from entering the creek. Detailed plan and cross sectional views of the proposed cover for the section of Mud Creek due south of culvert B as shown on the Surface Facilities Map (Map 9) have been prepared. The plan view and cross section of this cover are shown on the following figures, (Figure 14, Mud Creek Cover Plan and Figure 15, Mud Creek Cover Cross Section).

The cover will consist of prefabricated "½" culvert CMP with a diameter of 84 inches. The north end of the ½ culvert will connect to the south end of culvert B, which is also 84 inches in diameter. The 20 foot sections of prefabricated CMP will be placed over Mud Creek by hydraulic cranes and anchored to concrete footings along the length of the structure. The sectional placement plan will allow for adjustments in the alignment to accommodate any slight meanders in Mud Creek. Concrete footings, consisting of 8 inch diameter auger holes three (3) feet deep filled with concrete, will be placed at approximately 10 foot intervals along both sides of the structure. Steel bolts and bearing plates will anchor the structure to the footings.

Construction methods to be utilized will include hand augering of the footing locations, hand placement of the footings and use of a hydraulic crane to place the sections of the cover. Very minimal additional disturbance will be caused to Mud Creek or the adjacent buffer zone during this construction activity.

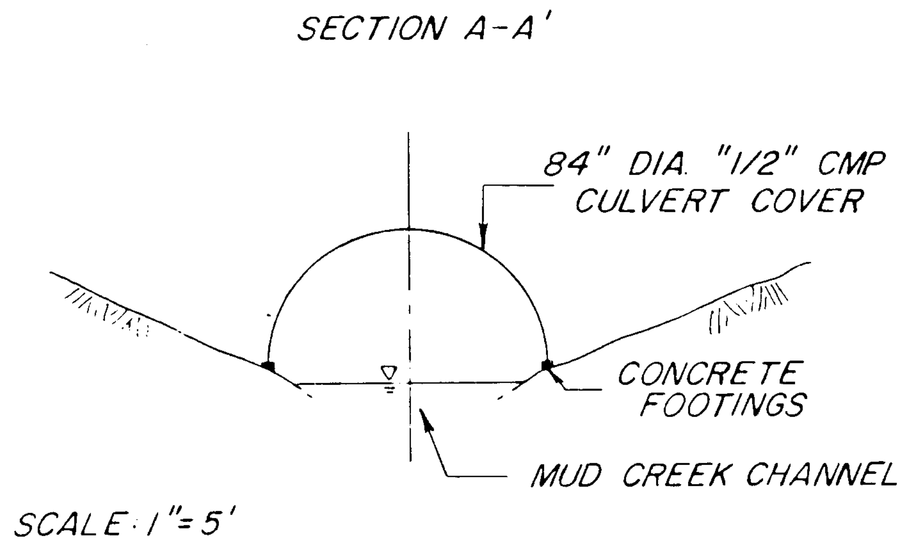
Design calculations for culvert B, as shown in Exhibit 8, Drainage and Sediment Control Plan, have been utilized to size the cover structure. As these calculations indicate, culvert B has been designed for a 100 year, 24 hour precipitation event. Based upon these calculations, the temporary cover structure is sized to pass the same precipitation event as culvert B.




MUD CREEK COVER PLAN

FIGURE 14

817.57-2




MUD CREEK COVER CROSS SECTION

FIGURE 15

Stream buffer zones 100 feet on either side of stream centerline for Snider Creek and Mud Creek are delineated on the Mine Plan Map (Map 8). North American Equities NV will protect these drainages by allowing no pillar mining to take place within the buffer zones.

Signs have been placed on the surface marking the location of each particular stream buffer zone.

Prior to initiation of mining operations, North American Equities NV plans to complete all sedimentation ponds by lining them with a bentonitic clay material. This material will be placed and compacted to a sufficient depth to prevent infiltration of surface water from sedimentation ponds into the groundwater regime or adjacent streams.

## UMC 817.71 DISPOSAL OF EXCESS SPOIL AND UNDERGROUND DEVELOPMENT WASTE: GENERAL REQUIREMENTS

Mine development waste from the Blazon No. 1 Mine is stored in the fill structure located north of the portal bench at the mouth of Little Snider Canyon as shown on the Surface Facilities Map (Map 9) and the Drainage and Sediment Control Map (Map 11).

The fill is constructed as compacted lifts along contour with the canyon side slopes. A rock buttress retaining wall has been placed at the toe of the slope for stability. Runoff from the fill is collected by a drainage ditch and carried to the sediment ponds. Material placed in the fill has been sampled and analyzed for acid forming and other toxic substances. Analytical results are provided in Table 3, Analyses of Materials Above and Below Coal Seam. The fill material contains some coal, but has no potentially harmful substances, therefore, no negative impacts on the hydrologic system are anticipated. A profile of the fill, detailing slope gradients, and drainage system is provided as Section A-A' on the Drainage and Sediment Control Map (Map 11).

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Should it be necessary to dispose of any additional underground development waste at the Blazon No. 1 Mine, it will be transported to abandoned mine areas underground. At the time of reclamation, underground development waste that has been previously stored on the surface north of the portal pad, will either be returned to the abandoned underground workings or utilized as backfill for the portal pad area. North American Equities NV does not anticipate surface disposal of any additional underground development waste due to mining activity. North American Equities NV will work with State and Federal safety officers to ensure safe disposal of underground development waste in the underground workings.

## UMC 817.89 DISPOSAL OF NON-COAL WASTES

Solid waste generated from the mining activities, such as garbage waste, rags, and used paper products will be disposed of in trash containers located at the shop area. A conscious attempt will be made by all individuals at the mine to dispose of garbage material in the appropriate location. This garbage will be hauled and deposited at the designated approved landfill on a regular basis.

Frequency of removal will occur on an as needed regular basis. Particular steps will be taken to keep non-coal waste materials in containers to prevent wind from scattering the materials on the permit and adjacent areas.

Used oil will be stored in 55 gallon drums at the Blazon No. 1 Mine. The used oil will then be removed twice per month or as necessary to a used oil dealer in Price, Utah.

## UMC 817.97 PROTECTION OF FISH, WILDLIFE, AND RELATED ENVIRONMENTAL VALUES

The impacts on seeps and springs in the area due to mining activities of the Blazon No. 1 Mine are anticipated to be minimal. The only spring located within the affected area is Spring G-4 as shown on the Hydrology/Geology Map (Map 5). This seep is considered insignificant as a source of water for wildlife and domestic stock as its flow rate is 1 gpm or less. The remaining seeps and springs, which are shown on the Hydrology/Geology Map (Map 5) are outside the permit area and the life of mine affected area, therefore, no disturbance to these springs or seeps due to subsidence is expected.

North American Equities NV plans to implement a fish and wildlife plan which will incorporate several measures considered necessary to limit impacts to fish and wildlife. The mitigation measures proposed for protection of fish and wildlife include, but are not limited to the following:

- Limiting coal haulage to daylight hours
- Prohibiting firearms on mine property
- Fencing of dangerous area(s)
- Employee education on the protection of wildlife resources
- Use of favored browse and cover plant species for revegetation
- Limiting of off-site exploration during spring moose and elk calfing season (May 16 - July 16)

North American Equities does not plan to disturb additional surface for operations of the Blazon No. 1 Mine. The current disturbance has affected an area approximately 500 feet in length along Mud Creek. Particular care has been taken to minimize the disturbance to the stream channel and adjacent buffer zone. Although this small area has been affected and will continue to be affected during operation of the Blazon

1 Mine permit area. He is currently doing a further check on possible endangered raptors and will submit his findings when the study has been completed.

Mr. George Cook of the Price Office of the SCS reports that a detailed study of the plant life in the vicinity of the Blazon No. 1 Mine has not delineated any threatened or endangered plant species.

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North American Equities NV has completed field work to determine locations of springs and seeps within the permit area. Review of this information indicates that only one spring is present within the permit area and that potential subsidence from this particular area could affect the flow of this spring. Taking consideration of the numerous other springs and seeps surrounding the permit area, it is highly unlikely that the negative impact to one spring within the permit area will affect the wildlife. Therefore, North American Equities NV does not plan to mitigate the potential negative impacts to springs and seeps due to subsidence.

North American Equities does not plan to continue monitoring procedures of road fatalities of wildlife caused by coal haulage and employee traffic to and from the mine. Therefore, no specific reports of wildlife fatalities on the roads will be kept or submitted to any state agency.

North American Equities NV plans to utilize a fish and wildlife plan which is focused around the crucial-critical range or habitat for various species identified by the Utah Division of Wildlife Resources. These critical habitats consist of moose habitat.

Protection of moose will be completed on a year-round basis by the following methods. During the spring calfing times of May 16 through July 15, North American Equities plans to limit exploration and off-site disturbance to the permit area. The surface disturbance for the Blazon No. 1 Mine is less than seven (7) acres and is used for offices, coal handling facilities, and truck loading facilities. Limited coal exploration activities are required for operation of the mine. Due to the limited existing and planned disturbance, the effects or impacts on the moose during the critical spring months is expected to be minimal.

## UMC 817.99 SLIDES AND OTHER DAMAGE

North American Equities NV will notify the Utah DOGM within seven (7) days after the occurrence of any slide or other event resulting in damage with a potential adverse affect on persons, property, health, safety, or the environment. Should this occurrence represent an imminent hazard, North American Equities NV will expeditiously develop and implement a plan, approved by the DOGM, to mitigate the hazard and to stabilize the area. This plan will be submitted to DOGM along with the notification of occurrence.

## UMC 817.100 CONTEMPORANEOUS RECLAMATION

North American Equities NV plans to use final revegetation plans for contemporaneous reclamation and has revised these plans as needed for the requirements under UMC 784.13(b)(5). These areas will be monitored as outlined in the Vegetation Monitoring Plan in Section UMC 817.

The reclamation measures employed to date are topsoil stockpile stabilization. The topsoil stockpiles were seeded with the following species at the rate of 10 lbs/acre PLS:

| Scientific Name | Common Name |
|---|---|
| Agropyron trachycaulum | Slender wheatgrass |
| Bromus margrinatus | Mountain brome |
| Dactylis glomerata | Orchard grass |
| Phleum pratense | Timothy |

These species were chosen for quick establishment of vegetation.

## UMC 817.101 BACKFILLING AND GRADING: GENERAL REQUIREMENTS

Backfilling and grading operations to be accomplished during final reclamation will provide smooth moderate slopes and a reduced highwall. The final topography to be achieved is shown on the Postmining Topography Map (Map 13) and on the Pre-Mining and Postmining Cross Sections Map (Map 7).

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North American Equities NV contracted for a detailed analysis of backfill slope stability which was completed in October 1980. This study, titled Blazon No. 1 Mine Slope Stability Study and included as Exhibit 17, illustrates calculation of the static factor of safety of 1.9 using the method of Slip Circle Failures. The angle of internal friction of the fill material will range from approximately 32° to a conservative low value of 10°. At the low value of 10°, cohesion will have developed and will aid as a resisting force against failure. Results of the calculations of static safety factor are shown in Exhibit 17, Mine Slope Stability.

## UMC 817.106 REGRADING OR STABILIZING RILLS AND GULLIES

Regular site inspections will be made of the reclaimed areas to identify any areas where the formation of rills and gullies is occurring. In any areas where rill erosion becomes evident, North American Equities NV will construct such surface water control devices as water bars, diversion ditches, contour furrows, or other surface features to control the runoff.

Any necessary erosion control features will be constructed using small farm equipment and/or hand methods to minimize disturbance. If rills and gullies must be repaired, leveling or grading in localized areas will be accomplished in a similar manner. Where severe gulling must be repaired, small crawler tractors or front end loaders will be utilized to complete the backfilling and grading work.

In all repair work North American Equities NV will confine disturbance to the immediate area of rills and gullies. Frequent monitoring to identify any erosion will ensure that any necessary repairs are made on a timely basis and that resulting areal disturbance is minimized.

## UMC 817.111 REVEGETATION: GENERAL REQUIREMENTS

North American Equities NV has developed a plan for the establishment of diverse, effective, and permanent vegetative cover on all mine areas disturbed by surface operations and facilities. This plan for reestablishment of vegetative cover is presented under Section UMC 784.13. The plan is formulated such that it will encourage prompt reestablishment of vegetative cover and rapid recovery of productivity levels compatible with the approved post mining land use.

All disturbed lands with exception of the surface areas of the post mining land use access road will be seeded or planted, utilizing an approved seed mixture to achieve a permanent vegetative cover. All vegetative cover to be utilized in reclamation at the Blazon No. 1 Mine will be capable of self-regeneration and plant succession. The proposed vegetative cover will be equal in extent of cover to the natural vegetation of the area with the exception of woody plants as discussed in Section UMC 784.13.

UMC 817.112 REVEGETATION: USE OF INTRODUCED SPECIES

All species utilized with the exception of Medicago Sativa and Poa pratensis are native species. The plant Medicago Sativa is being introduced because of its ease of establishment and its nitrogen fixing characteristics. This introduced species has been approved by DOGM. The other species, Poa pratensis, is indiginous to the area as the occurrence of native stands in the intermountain region has been documented in Intermountain Flora, Volume 6, 1977 Cronquist, et al.

Both of the above mentioned species are compatible with the plant and animal species of the region. Neither species is considered to be poisonous or noxious.

## UMC 817.113 REVEGETATION: TIMING

Seeding and planting of the reclaimed areas will be completed prior to the first favorable growing season following the completion of regrading and topsoil replacement. Should erosion control be necessary, the affected disturbed area will be seeded and planted as contemporaneously as practical after the completion of backfilling and grading. This seeding will utilize small grains, grasses or legumes to establish a temporary cover.

## UMC 817.114 REVEGETATION: MULCHING AND OTHER SOIL STABILIZING PRACTICES

All areas to be revegetated will be mulched by mechanical or manual means. All steep slopes will be mulched with up to 4,000 pounds/acre of straw mulch or native hay. This will be accomplished by mechanical or manual means. The areas were slopes are ten (10) percent or less will be mulched with approximately 2,000 pounds/acre of straw mulch or native hay. Mulch will be anchored by the use of small farm type equipment.

## UMC 817.115 REVEGETATION: GRAZING

The reclaimed land will be used for livestock grazing at a grazing capacity approximately equal to that for similar non-mined lands for at least the last two (2) years of required liability.

Blazon

DOC - 3/84

## UMC 817.116 REVEGETATION: STANDARDS FOR SUCCESS

North American Equities NV has established a reference area as shown on the Vegetation Map (Map 4) for comparison of ground cover and productivity with that of the revegetated mine area. Periodic measurements of vegetation, soils, and water will be conducted at the intervals specified by the Division during the liability period to identify any possible problem conditions. The reclamation monitoring plan is described in Section UMC 784.13, Reclamation Plan: General Requirements.

## UMC 817.117 REVEGETATION: TREE AND SHRUB STOCKING FOR FOREST LAND

The area utilized for the activities at the Blazon No. 1 Mine is not designated as a forest, therefore, UMC 817.117 is not applicable.

## 817.122 SUBSIDENCE CONTROL: PUBLIC NOTICE

North American Equities NV will notify, by mail, the owners of property and residents within the area above underground workings and adjacent areas which would be affected six (6) months prior to mining. A duplicate of this notification will also be sent to DOGM at the prescribed time interval. This notice shall contain the following:

- Identification of specific areas where mining will take place
- Dates of underground operations which could cause subsidence
- Measures to be taken to prevent or control adverse effects

## UMC 817.131 CESSATION OF OPERATIONS: TEMPORARY

Operations at the Blazon No. 1 Mine were temporarily suspended in January 1982 due to the poor coal market. North American Equities NV intends to resume mining operations when economically feasible.

At the time of cessation, approximately seven (7) acres of surface land had been disturbed. The lateral extent of mine workings is shown on the map provided as Exhibit 11, Current Mine Workings.

The mine openings have been securely barricaded to prevent entry into the workings and warning signs placed at the portals. The entire mine site has been cleaned up and materials properly stored to prevent pollution or degradation of the surface.

Drainage ditches and culverts are functional and will be maintained in order that disturbed area runoff is diverted to the sediment ponds. During cessation, a DOGM approved plan of water sampling will be implemented to monitor flow and quality information.

## RECLAMATION SURETY

As shown in Exhibit 14, Reclamation Cost Calculations, equipment rental rates and labor rates have been included. Labor rates shown have been estimated for the Scofield and Price, Utah areas. Equipment rental rates are based on the "Cost Reference Guide for Construction Equipment" by Dataquest Incorporated.

North American Equities NV has not included the salvage value of facilities in the reclamation cost estimate.

A contingency cost of 10% has been included to account for profit for the reclamation work. In addition, an estimate for equipment mobilization is also included.

Exhibit 1

CORPORATE NAME CHANGE DOCUMENTATION

The Undersigned:

GERARD CHRISTOFFEL ANTONIUS SMEETS, a civil-law notary, residing in Curacao, Netherlands Antilles;

herewith certifies:

that the limited liability company: NORTH AMERICAN EQUITIES N.V., established in Curacao, has been legally incorporated under the name: Toe Investment Company N.V., by deed, executed before a substitute of the Undersigned on November 14, 1978, on a draft of which deed the declaration of no-objection, referred to in article 38 of the Commercial Code of the Netherlands Antilles, was issued by the Minister of Justice of the Netherlands Antilles on November 10, 1978, under number 14549/JAZ;

that the articles of incorporation have been amended by deed, executed before the Undersigned, on January 27, 1981, by which deed the company's name has been changed into: T.o.e. Investment Company N.V., on a draft of which deed the declaration of no-objection, referred to in article 97 of the Commercial Code of the Netherlands Antilles, was issued by the Minister of Justice of the Netherlands Antilles on January 26, 1981, under number 343/N.V.;

that the articles have again been amended by deed, executed before a substitute of the Undersigned, on July 16, 1981, by which deed the company's name has been changed into: NORTH AMERICAN EQUITIES N.V., on a draft of which deed the declaration of no-objection, referred to in article 97 of the Commercial Code of the Netherlands Antilles, was issued by the Minister of Justice of the Netherlands Antilles on July 15, 1981, under number 3110/N.V.;

that the registered office of the company is: Handelskade 8, Curacao, Netherlands Antilles;

that the managing directors of the company are: Mr. AAGE OXHOLM, residing in Saudi Arabia, and CURACAO CORPORATION COMPANY N.V., aforementioned;

that the limited liability company: NORTH AMERICAN EQUITIES N.V., is legally existing in good standing under the laws of the Netherlands Antilles.

IN WITNESS WHEREOF, I have set my hand hereunto, after having affixed my official seal of office.

Curacao, October 26, 1981.

# STATE OF COLORADO

DEPARTMENT OF STATE

# CERTIFICATE

*I,* **MARY ESTILL BUCHANAN,** *Secretary of State of the State of Colorado hereby certify that the prerequisites for the issuance of this certificate have been fulfilled in compliance with law and are found to conform to law.*

*Accordingly, the undersigned, by virtue of the authority vested in me by law, hereby issues* AN AMENDED CERTIFICATE OF AUTHORITY TO NORTH AMERICAN EQUITIES, N.V., A NETHERLANDS ANTILLES CORPORATION, FORMERLY KNOWN AS TOE INVESTMENT COMPANY, N.V.

Mary Estill Buchanan
SECRETARY OF STATE

DATED: NOVEMEBER 13, 1981

ORIGINAL

APPLICATION FOR
AMENDED CERTIFICATE OF AUTHORITY
of
FOREIGN PROFIT CORPORATION

FILED

13 NOV '81

STATE OF COLORADO
DEPT. OF STATE

To the Secretary of State
of the State of Colorado:

Pursuant to the provisions of the Colorado Corporation Act, the undersigned corporation hereby applies for an Amended Certificate of Authority to transact business in Colorado, and for that purpose submits the following:

FIRST: A Certificate of Authority was issued to the corporation.

SECOND: The present name of the corporation in Colorado is TOE Investment Company, N.V.

THIRD: It is incorporated under the laws of Netherlands Antilles

FOURTH: The corporate name of the corporation has been changed to North American Equities, N.V.

FIFTH: (only when applicable) Because this name is not available for use in your State it elects to use in Colorado the name Not applicable

SIXTH: This application is accompanied by a copy of its change of name amendment, duly authenticated by the proper officer of the State or Country under the laws of which it is incorporated.

Its Vice President

Its Treasurer/ Secretary

STATE OF Colorado
COUNTY OF Denver ss.

I, Patricia L. Williams a notary public, do hereby certify that on this 13th day of November, 1981, personally appeared before me, Esben S. Svalastog, who, being by me first duly sworn, declared that he is the Vice President and Treasurer/Secy of North American Equities N.V. that he signed the foregoing document as Vice President and Treasurer/Secy of the corporation, and that the statements contained therein are true.

In witness whereof I have hereunto set my hand and seal this 13th day of November A.D. 1981

My commission expires December 2, 1984

Patricia L. Williams
Notary Public

1660 Seventeenth St
Suite 350
Denver, Colorado 80202

Note:
Submit the original typed & one carbon copy of this application
Filing fee $22.50

CORPORATION ANNUAL REPORT
MUST BE FILED PRIOR TO MARCH 1ST

STATE OF UTAH

In compliance with Section 16-10-121 & 122, and Section 16-10-12 or 16-10-110, U.C.A., 1953, the following report, and if applicable the statement of chang of registered office and/or agent, is submitted (PLEASE TYPE OR PRINT CLEARLY!)

EXACT CORPORATE NAME, T.O.E. INVESTMENT COMPANY, N.V.
REGISTERED AGENT C.T. CORPORATION SYSTEM
REGISTERED OFFICE

IF NEW REGISTERED AGENT AND/OR OFFICE, PLEASE COMPLETE

New Registered Agent ______

New Registered Office ______ (Street Address) City ______ State UTAH Zip ______

(With the above change, the address of the registered office and the address of the business office of the registered agent are identical.)

2 IF THE FOLLOWING INFORMATION IS THE SAME AS LAST YEAR, PLEASE CHECK ( ), LIST TITLE, DATE AND SIGN. OTHERWISE FILL IN ALL OF THE INFORMATION REQUIRED BELOW.

3 INCORPORATED UNDER THE LAWS OF NETHERLANDS ANTILLES (STATE OR COUNTR

4 IF INCORPORATED OUTSIDE THE STATE OF UTAH, GIVE THE ADDRESS OF THE PRINCIPAL OFFICE IN THE STATE OR COUNTRY OF INCORPORATION.

HANDELSKADE 8 (Street Address) City CURACAO State or Country NETHERLANDS ANTILLES Zip ______

5 TYPE OF BUSINESS CONDUCTED IN UTAH COAL MINING

6 NAMES AND RESPECTIVE ADDRESSES OF THE OFFICERS AND DIRECTORS OF THE CORPORATION.

| | NAME | STREET ADDRESS | CITY, STATE, ZIP |
|---|---|---|---|
| President | Aage Oxholm | 1660 17th Street | Denver, Colorado |
| Vice-President & Treasurer | Esben S. Svalastog | 1660 17th Street | Denver, Colorado |
| ~~Secretary~~ Controller | Alan Smith | 1660 17th Street | Denver, Colorado |
| ~~Treasurer~~ Managing Director | Curacao Corp. Company | Netherlands Antilles | |

DIRECTORS: IF DIRECTORS ARE SAME AS OFFICERS, PLEASE CHECK ( ), OTHERWISE THEY MUST BE LISTED:

| NAME | STREET ADDRESS | CITY, STATE, ZIP CODE |
|---|---|---|
| 1. | | |
| 2. | | |
| 3. | | |

7 AUTHORIZED SHARES (DO NOT CHANGE THE INFORMATION LISTED.)

| Number of Shares Authorized | Itemized By Class | Series, If Any Within A Class | Par Value Of Shares | Number of Shares Without Par Value |
|---|---|---|---|---|
| 30,000 | Common (all) | N/A | 1.00 | -0- |

8 NUMBER OF SHARES ISSUED (MUST BE COMPLETED.)

| Number of Shares Issued | Itemized By Class | Series, If Any Within A Class | Par Value Of Shares | Number of Shares Without Par Value |
|---|---|---|---|---|
| 6,000 | Common (all) | N/A | 1.00 | -0- |

9 STATED CAPITAL AS OF DATE OF THIS REPORT (Number of Shares Issued X Par Value) $ 9,500,000

Under the penalties of perjury and as an authorized officer, I declare that this annual report and, if applicable, the statement of change of registered office and/or agent, has been examined by me and is, to the best of my knowledge and belief, true, correct, and complete.

10 BY ______ Authorized Officer

11 VICE PRESIDENT
Title or Position

(If Registered Agent and/or Registered Office has been changed on this form, said change must be authorized by a resolution adopted by the Board of Directors, and the President or Vice-President must sign the report.)

12 DATE NOVEMBER 19, , 19 8

FEE $5.00 (If filed after March 1st, $10.00)
Make check payable to: Annual Report Division

Send Report & Remittance to: Annual Report Division
101 State Capitol Bldg.
Salt Lake City, Utah 84114

DO NOT CHANGE OR ALTER THIS FORM

MUST BE FILED PRIOR TO MARCH 1ST

STATE OF UTA[H]

In compliance with Section 16-10-121 & 122, and Section 16-10-12 or 16-10-110, U.C.A., 1953, the following report, and if applicable the statement of cha[nge] of registered office and/or agent, is submitted (PLEASE TYPE OR PRINT CLEARLY)

081886 DATE OF INC. 05/10/1979 F

1) EXACT CORPORATE NAME, North American Equities, N.V., formerly TOE INVESTMENT COMPANY, N. V.

REGISTERED AGENT C. T. CORPORATION SYSTEM

REGISTERED OFFICE 175 SOUTH MAIN SALT LAKE CITY, UTAH 84115

IF NEW REGISTERED AGENT AND/OR OFFICE, PLEASE COMPLETE

New Registered Agent ______

New Registered Office ______ (Street Address) City ______ State UTAH Zip ______

(With the above change, the address of the registered office and the address of the business office of the registered agent are identical.)

2) IF THE FOLLOWING INFORMATION IS THE SAME AS LAST YEAR, PLEASE CHECK (X), LIST TITLE, DATE AND SIGN. OTHERWISE FILL IN ALL OF THE INFORMATION REQUIRED BELOW.

3) INCORPORATED UNDER THE LAWS OF ______ (STATE OR COUNT[RY])

4) IF INCORPORATED OUTSIDE THE STATE OF UTAH, GIVE THE ADDRESS OF THE PRINCIPAL OFFICE IN THE STATE OR COUNTRY OF INCORPORATION.

______ (Street Address) City ______ State or Country ______ Zip ______

5) TYPE OF BUSINESS CONDUCTED IN UTAH ______

6) NAMES AND RESPECTIVE ADDRESSES OF THE OFFICERS AND DIRECTORS OF THE CORPORATION.

| | NAME | STREET ADDRESS | CITY, STATE, ZIP |
|---|---|---|---|
| President | | | |
| Vice-President | | | |
| Secretary | | | |
| Treasurer | | | |

DIRECTORS: IF DIRECTORS ARE SAME AS OFFICERS, PLEASE CHECK ( ), OTHERWISE THEY MUST BE LISTED:

| | NAME | STREET ADDRESS | CITY, STATE, ZIP CODE |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |

7) AUTHORIZED SHARES (DO NOT CHANGE THE INFORMATION LISTED.)

| Number of Shares Authorized | Itemized By Class | Series, If Any Within A Class | Par Value Of Shares | Number of Shares Without Par Value |
|---|---|---|---|---|
| 30,000 | COMMON | | 1.0000 | |

8) NUMBER OF SHARES ISSUED (MUST BE COMPLETED.)

| Number of Shares Issued | Itemized By Class | Series, If Any Within A Class | Par Value Of Shares | Number of Shares Without Par Value |
|---|---|---|---|---|
| | | | | |

9) STATED CAPITAL AS OF DATE OF THIS REPORT (Number of Shares Issued X Par Value)$ ______

Under the penalties of perjury and as an authorized officer, I declare that this annual report and, if applicable, the statement of change of registered office and/or agent, has been examined by me and is, to the best of my knowledge and belief, true, correct, and complete.

10) BY X [signature] Authorized Officer

11) X Vice President Title or Position

(If Registered Agent and/or Registered Office has been changed on this form, said change must be authorized by a resolution adopted by the Board of Directors, and the President or Vice-President must sign the report.)

12) DATE X June 11-82 19

FEE $5.00 (If filed after March 1st, $10.00)
Make check payable to: Annual Report Division

Send Report & Remittance to: Annual Report Division
101 State Capitol Bldg.
Salt Lake City, Utah 84114

DO NOT CHANGE OR ALTER THIS FORM

Exhibit 2

CERTIFICATE OF LIABILITY INSURANCE

(COAL)

CERTIFICATE OF LIABILITY INSURANCE
Issued to: State of Utah
Department of Natural Resources
Division of Oil, Gas, and Mining

THIS IS TO CERTIFY, That the Continental Insurance Company
(Name of Insurance Company)
of P. O. Box Drawer AA Aurora, Colorado 80014
(Home Office Address of Company)
has issued to Blazon Company c/o North American Equities of
(Name of Permit Applicant)
1401 Seventeenth St. Suite 1510 Policy No. L 295 30 28
(Address of Permit Applicant) Denver, Colorado 80202
effective from 12-1- 19,82 and continuing until cancelled, nonrenewed, or changed as provided herein, which policy provides personal injury and property damage insurance covering the obligations imposed upon such permit applicant with regard to Permit No. act/007/021 according to provisions of the coal mining and reclamation program of Utah, (Utah Code Annotated 40-10-1 et seq.), specifically Section UMC/SMC 806.14.

Underwriting Agent: Price Insurance Agency P.O.Drawer Y Price,Ut84501

Company Name: Phone: 801-637-3351

Address:

The above-named insurance company agrees to notify the Division in writing of any substantive change in the above coverage, including cancellation, failure to renew, or other material change. No change shall be effective until at least thirty (30) days after such notice is received by the Division.

The undersigned affirms that the above information is true and complete to the best of his or her knowledge and belief, and that he or she is an authorized representative of the above-named insurance company.

Roy A Nikas

(Date, Signature, and Title of Authorized Representative of Insurance Company)

8-16-83 Roy A. Nikas

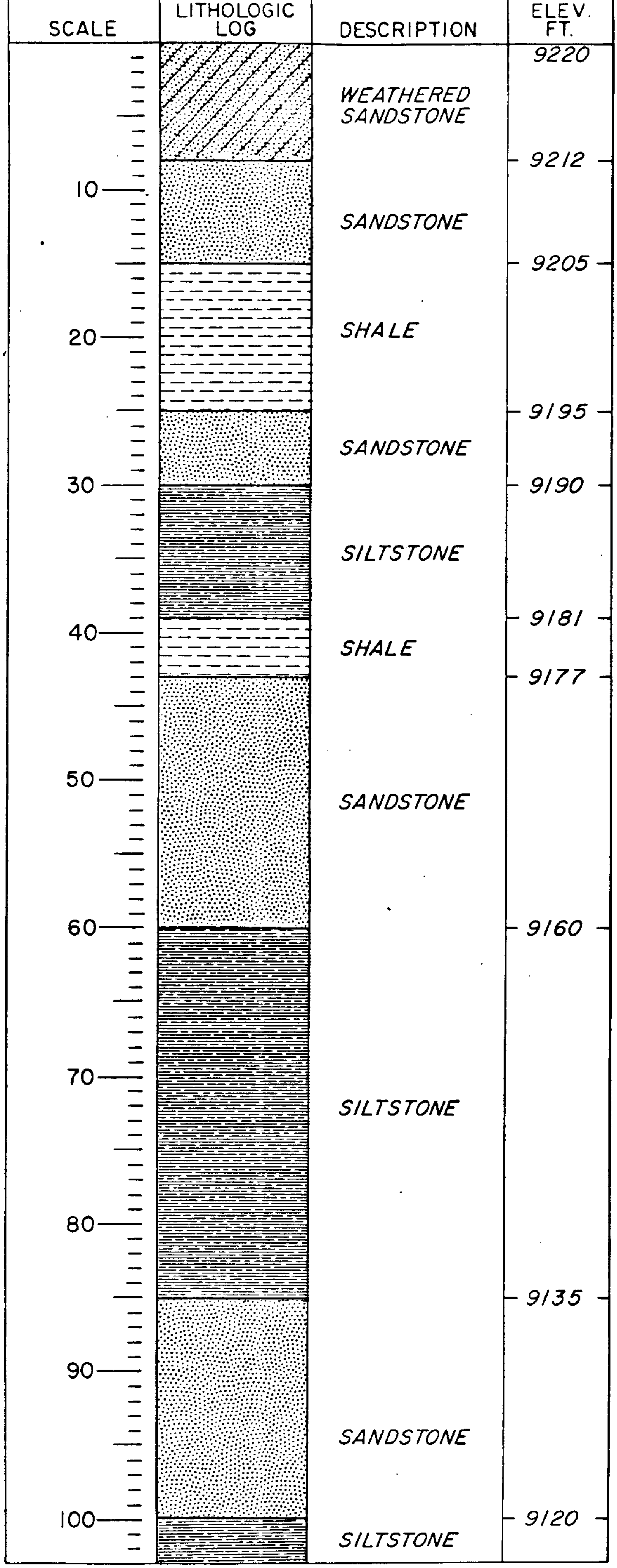
Signed and sworn to before me by Roy A. Nikas this the 16th day of August, 1983.

(Notary)

My Commission Expires: June 30, 1985

Exhibit 3

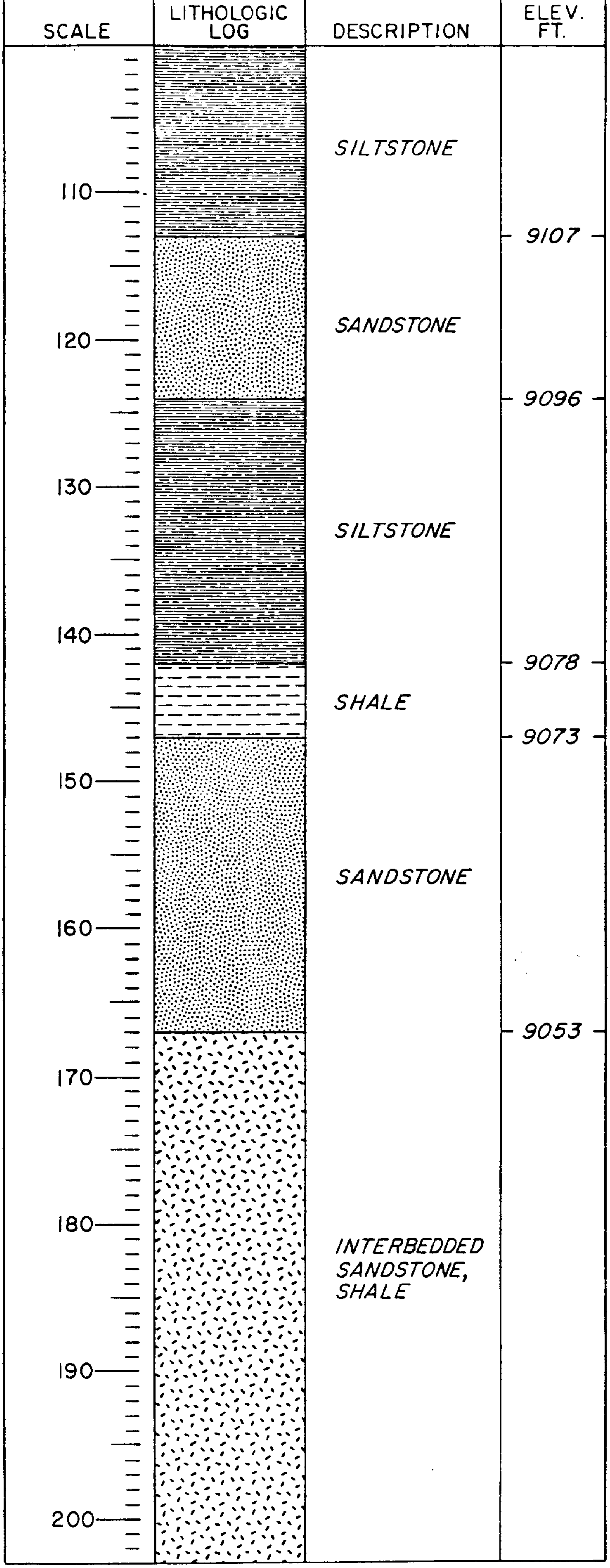
LITHOLOGIC LOGS OF 1982 DRILL HOLES




LITHOLOGIC LOG

EXPLORATION DRILL HOLE No. DHB1

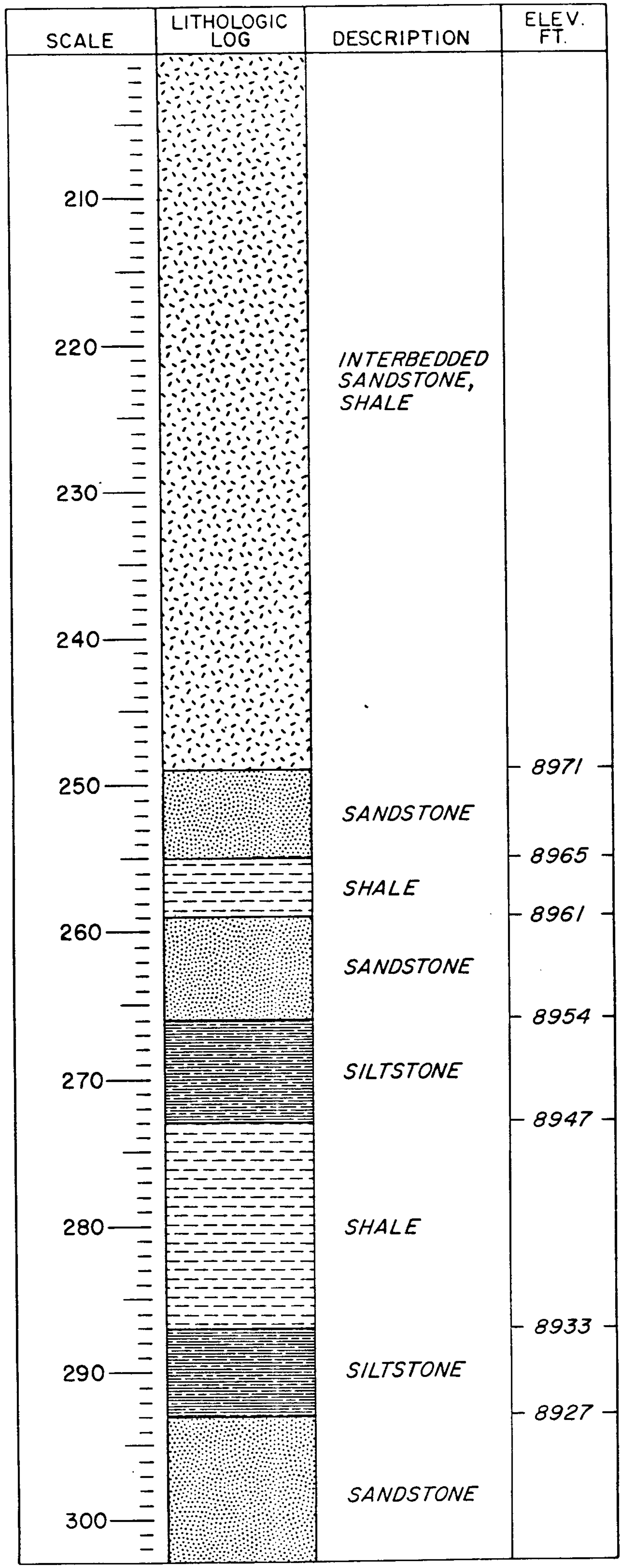
PAGE 1 OF 9




LITHOLOGIC LOG

EXPLORATION DRILL HOLE No. DHB1

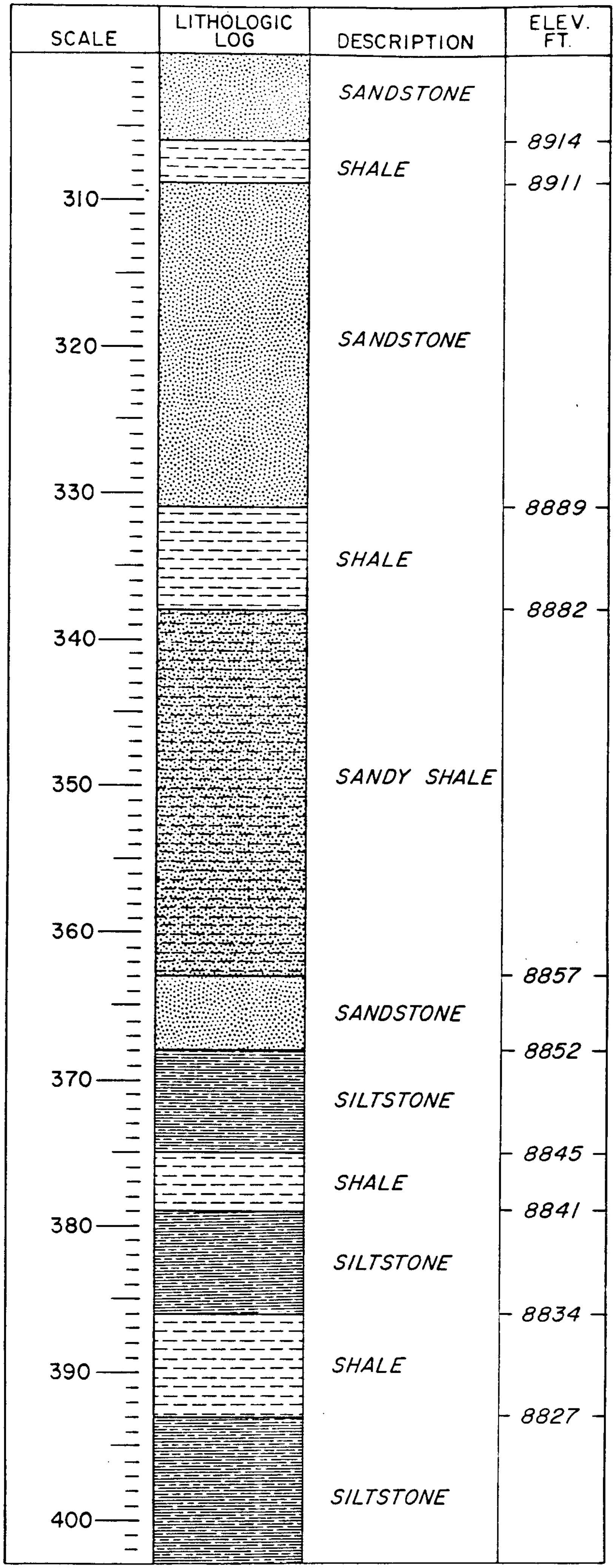
PAGE 2 OF 9




LITHOLOGIC LOG

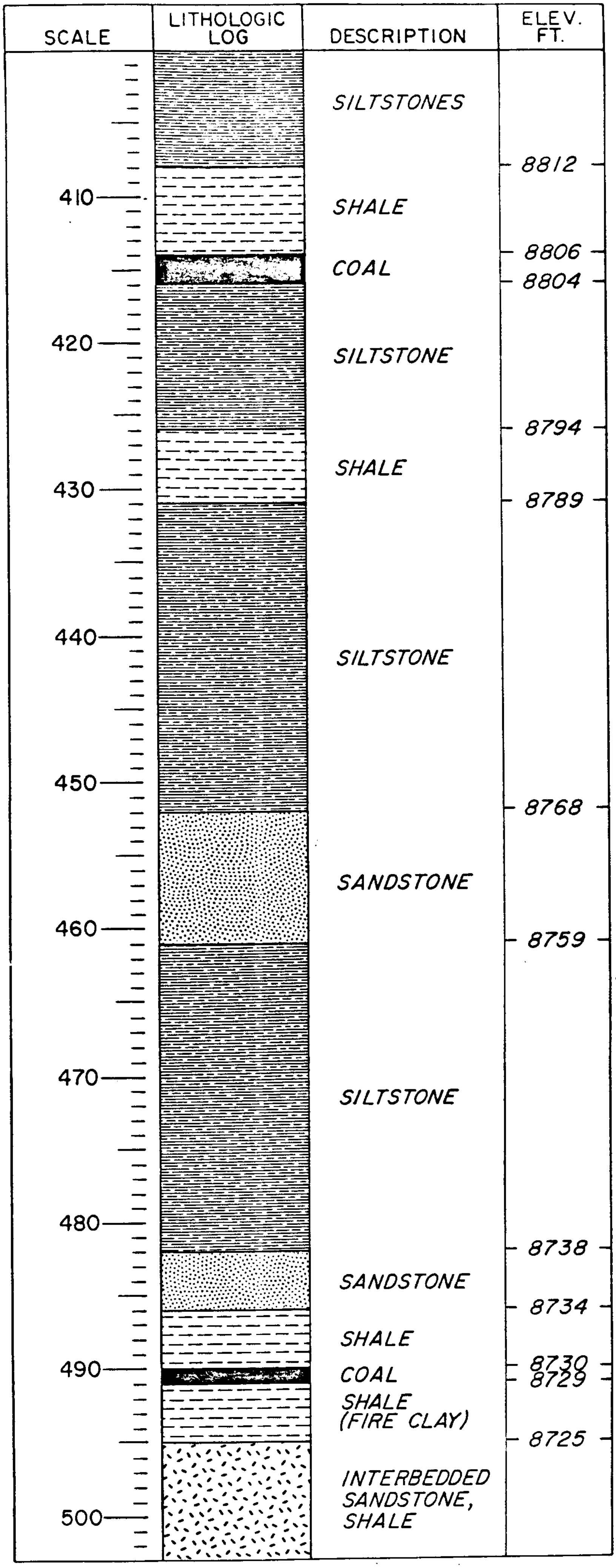
EXPLORATION DRILL HOLE No. DHB1

PAGE 3 OF 9




LITHOLOGIC LOG

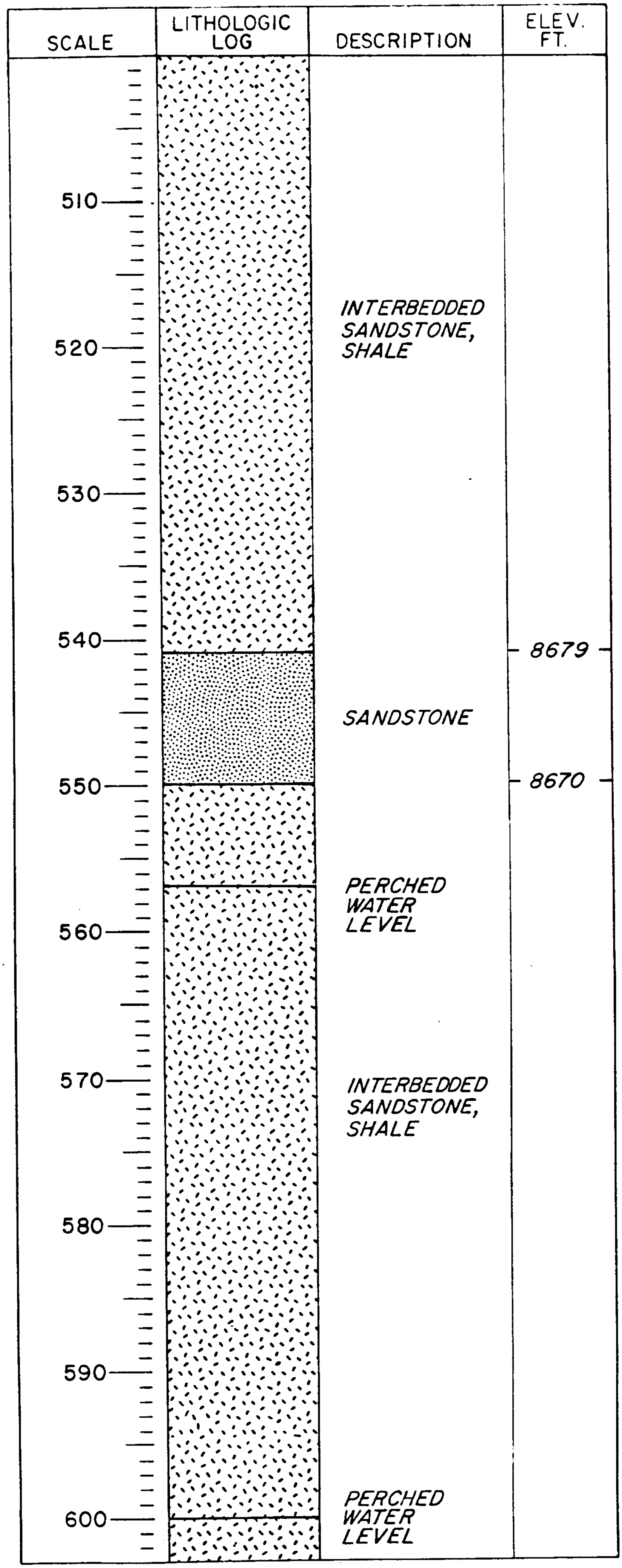
EXPLORATION DRILL HOLE No. DHB1




LITHOLOGIC LOG

EXPLORATION DRILL HOLE No. DHB1

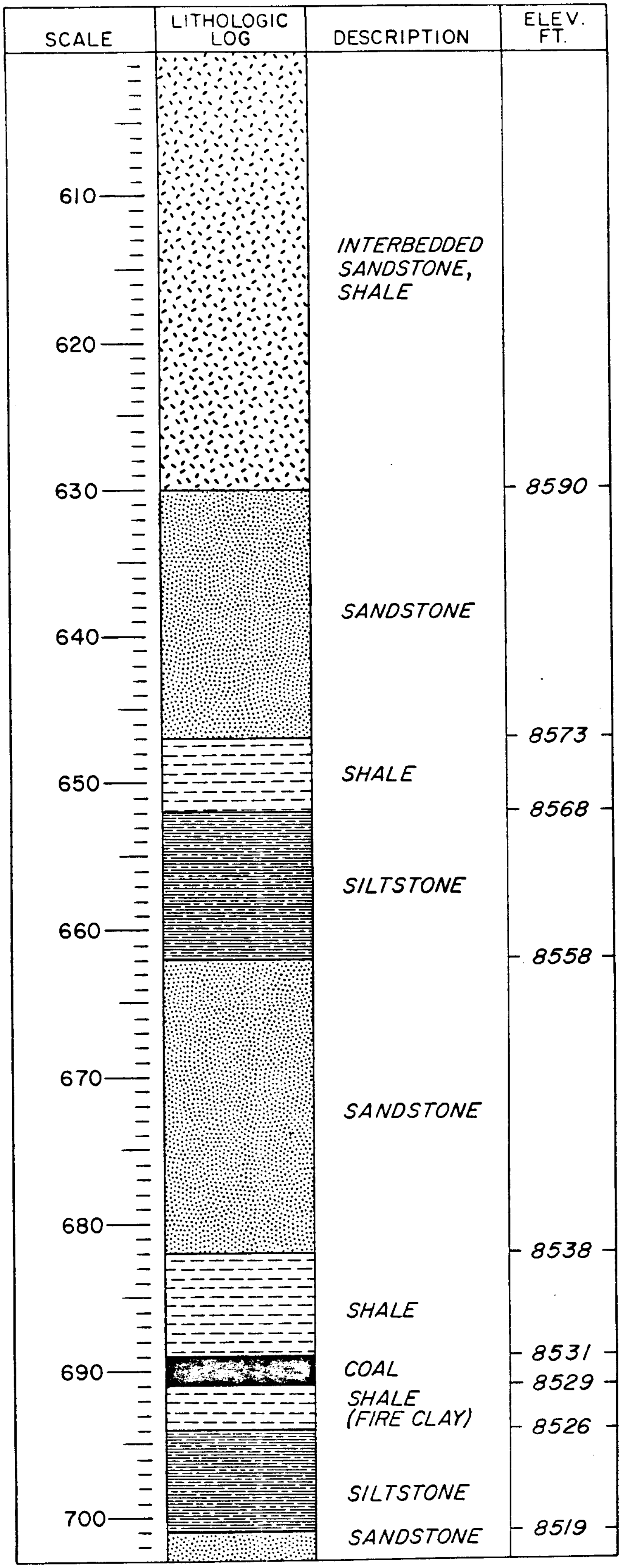
PAGE 5 OF 9




LITHOLOGIC LOG

EXPLORATION DRILL HOLE No. DHB1

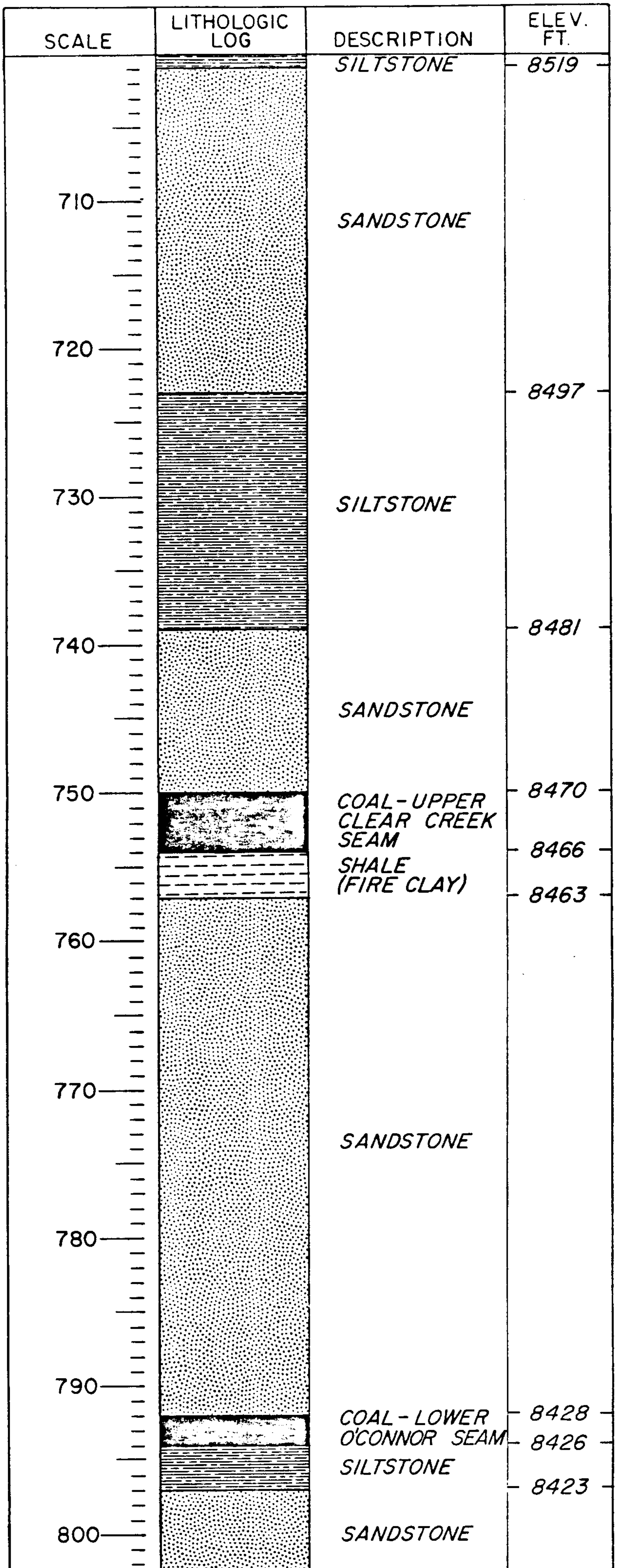
PAGE 6 OF 9




LITHOLOGIC LOG

EXPLORATION DRILL HOLE No. DHB1

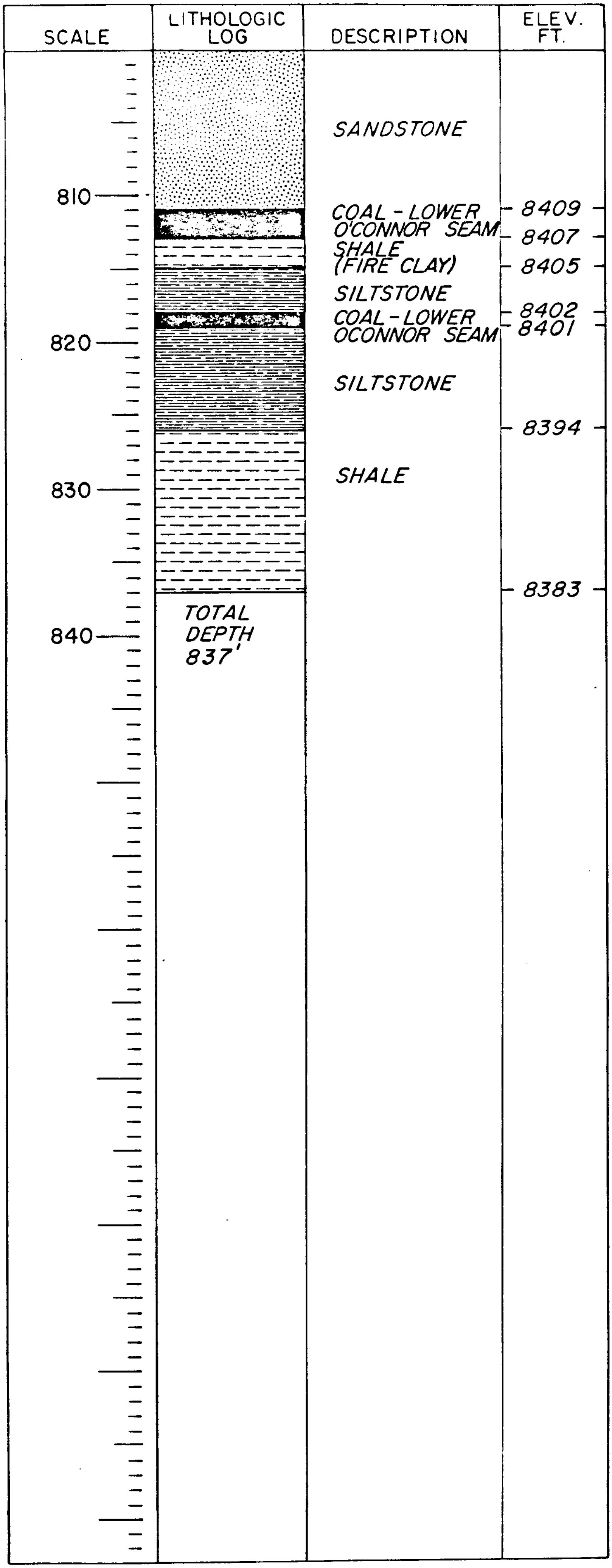
PAGE 7 OF 9




LITHOLOGIC LOG

EXPLORATION DRILL HOLE No. DHB1

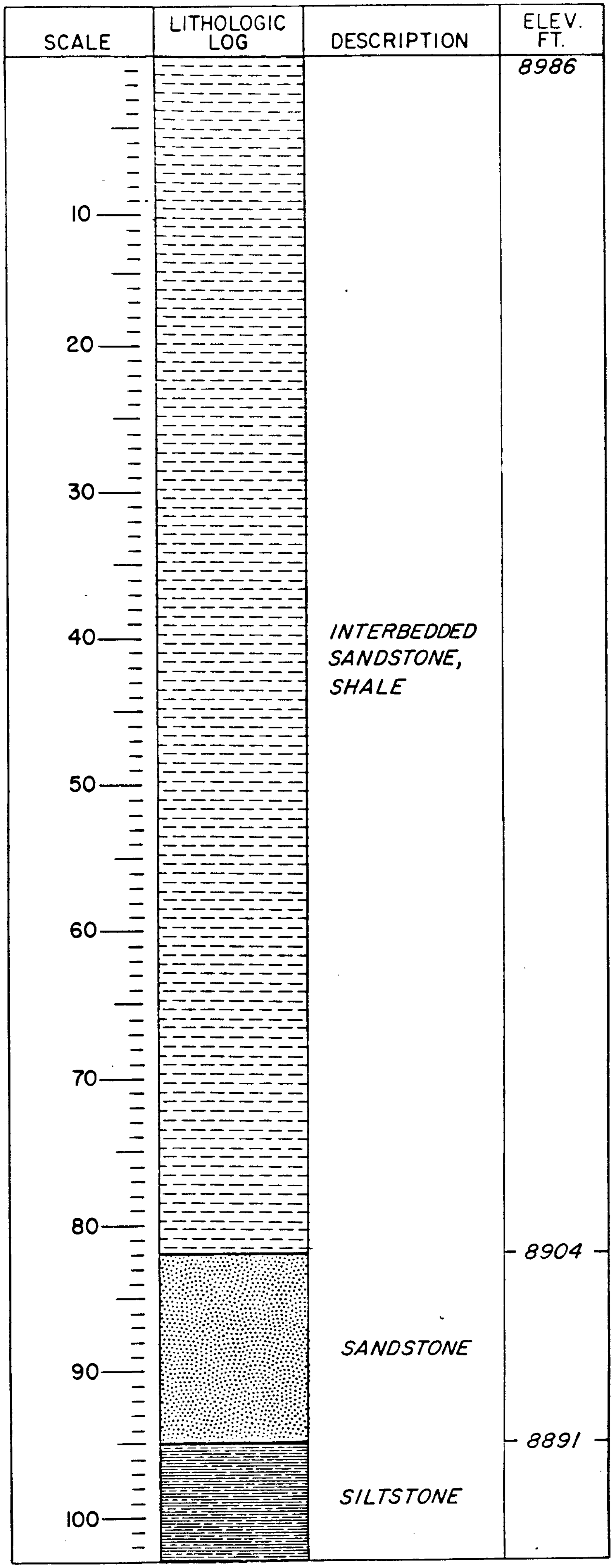
PAGE 8 OF 9




LITHOLOGIC LOG

EXPLORATION DRILL HOLE No. DHBI

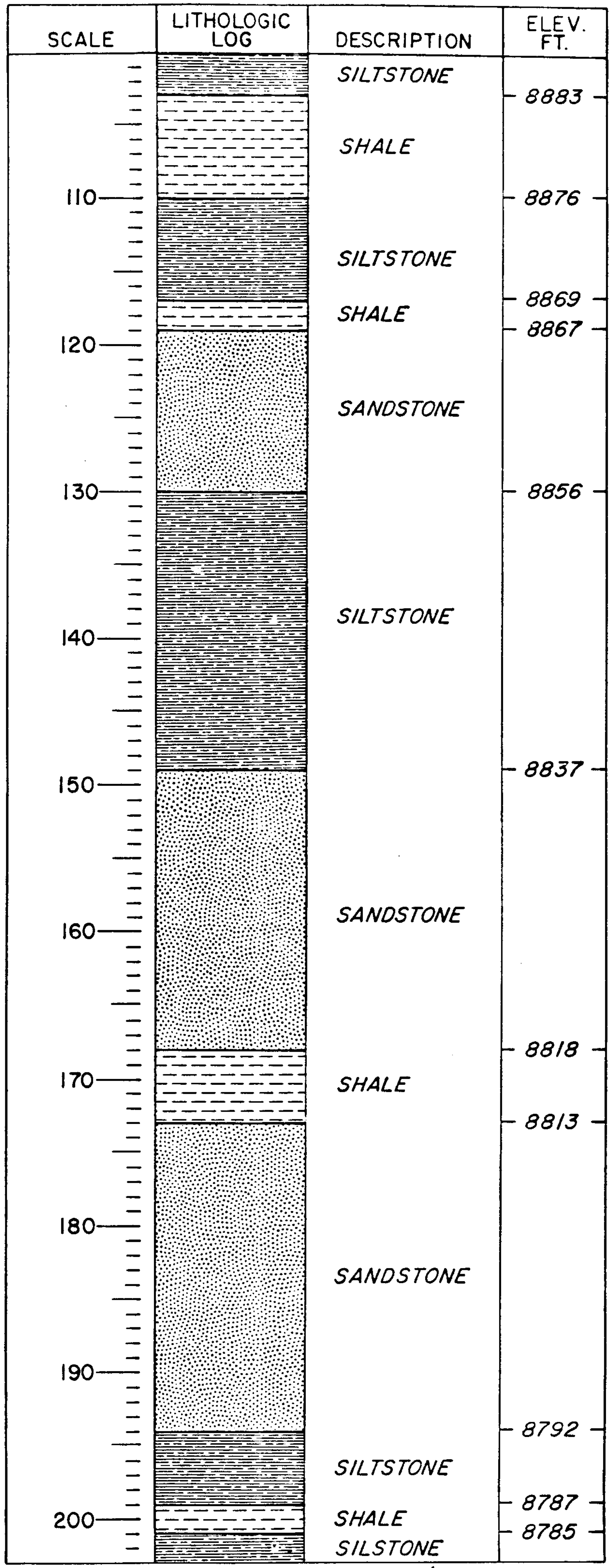
PAGE 9 OF 9




LITHOLOGIC LOG

EXPLORATION DRILL HOLE No. DHB2

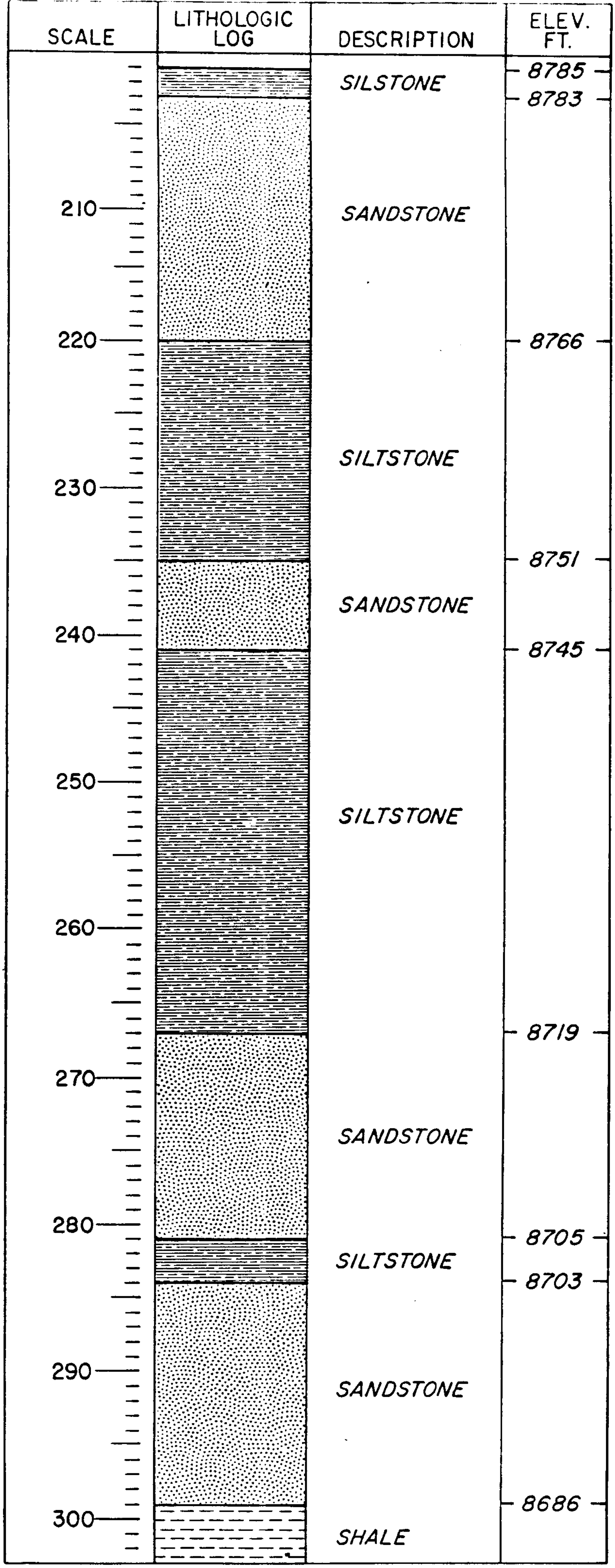
PAGE 1 OF 10




LITHOLOGIC LOG

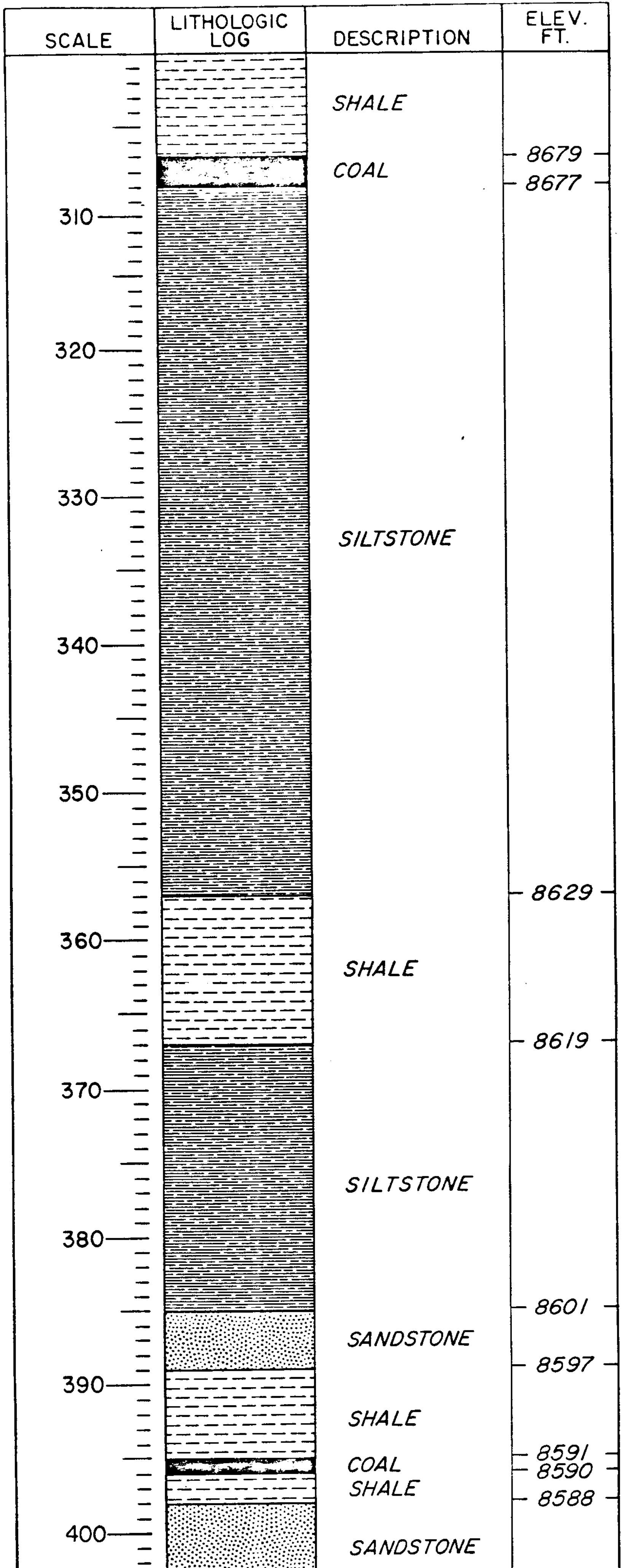
EXPLORATION DRILL HOLE No. DHB2

PAGE 2 OF 10




LITHOLOGIC LOG

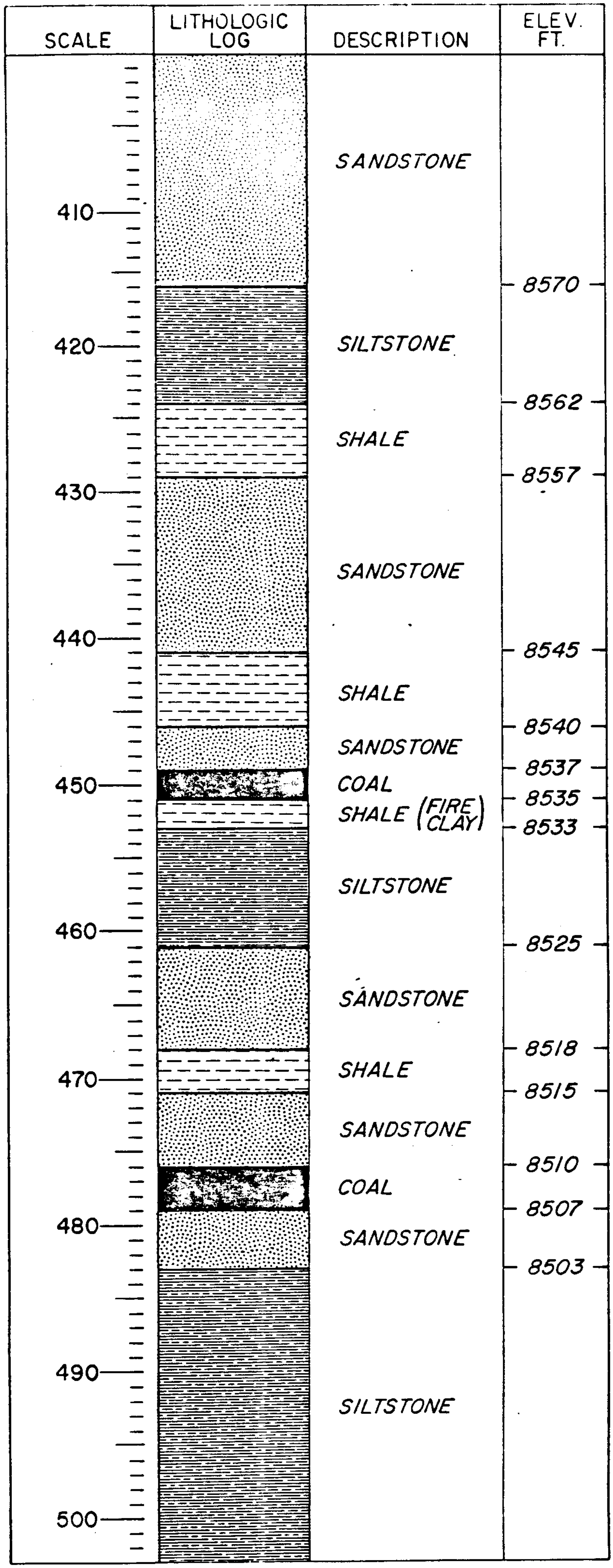
EXPLORATION DRILL
HOLE No. DHB2




LITHOLOGIC LOG

EXPLORATION DRILL HOLE No. DHB2

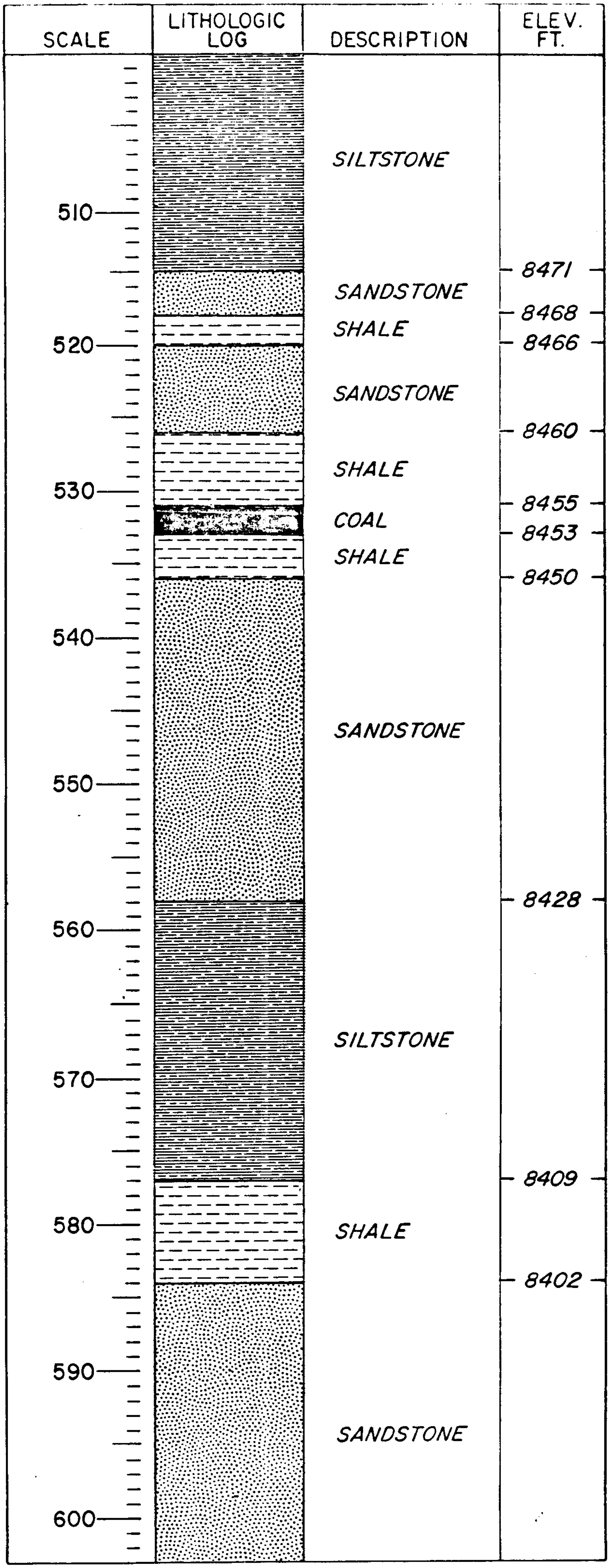
PAGE 4 OF 10




LITHOLOGIC LOG

EXPLORATION DRILL HOLE No. DHB2

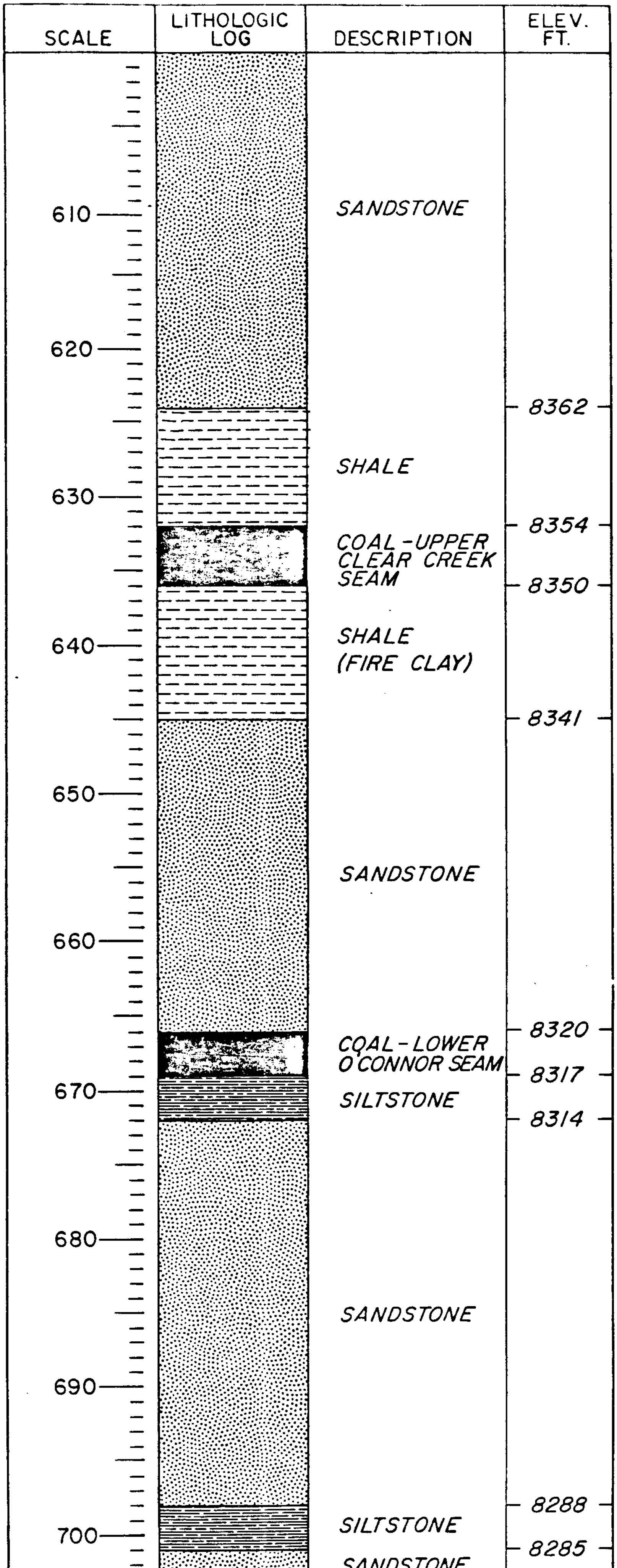
PAGE 5 OF 10




LITHOLOGIC LOG

EXPLORATION DRILL HOLE No. DHB2

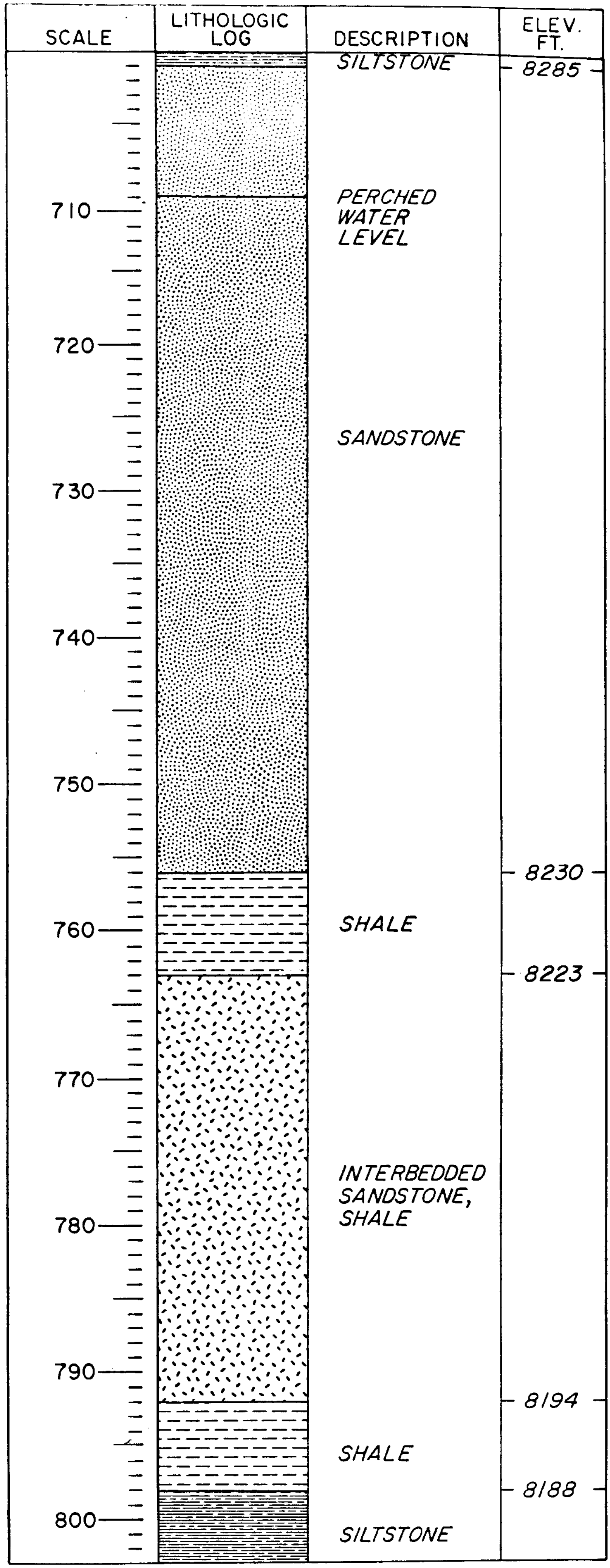
PAGE 6 OF 10




LITHOLOGIC LOG

EXPLORATION DRILL HOLE No. DHB2

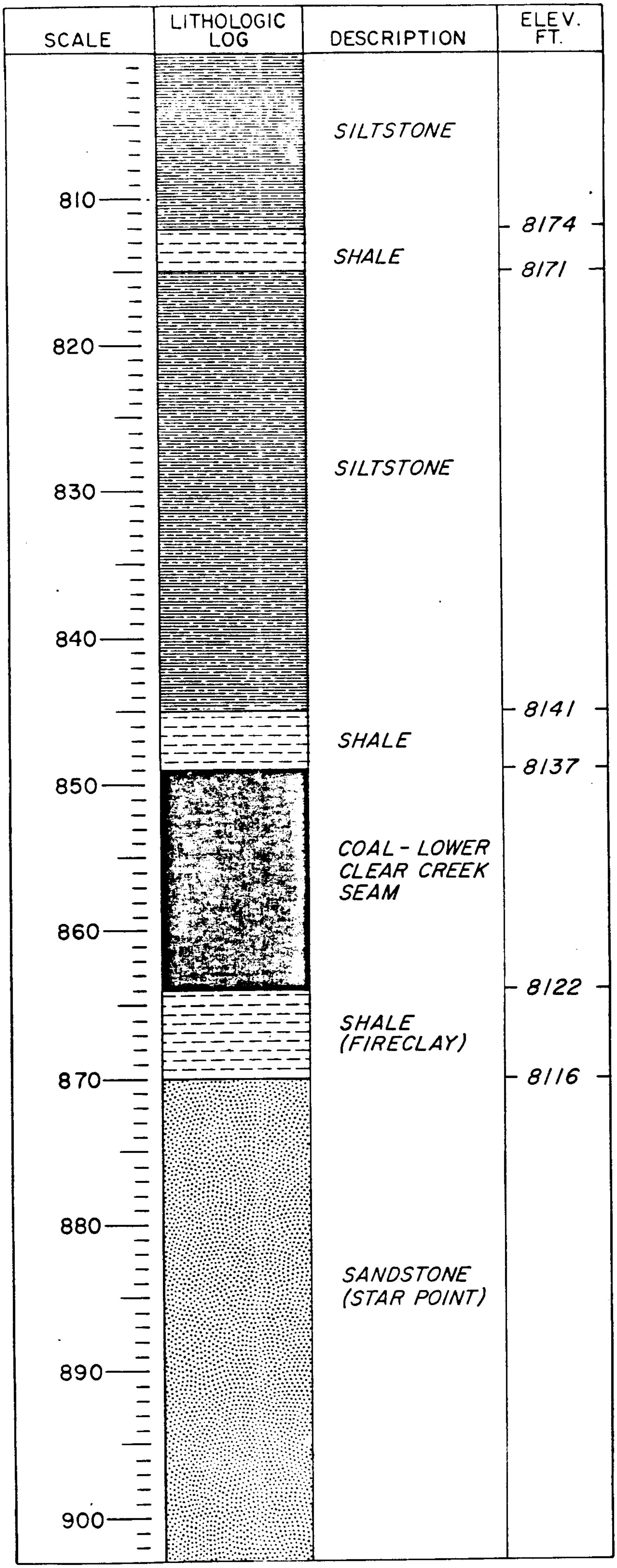
PAGE 7 OF 10




LITHOLOGIC LOG

EXPLORATION DRILL
HOLE No. DHB2

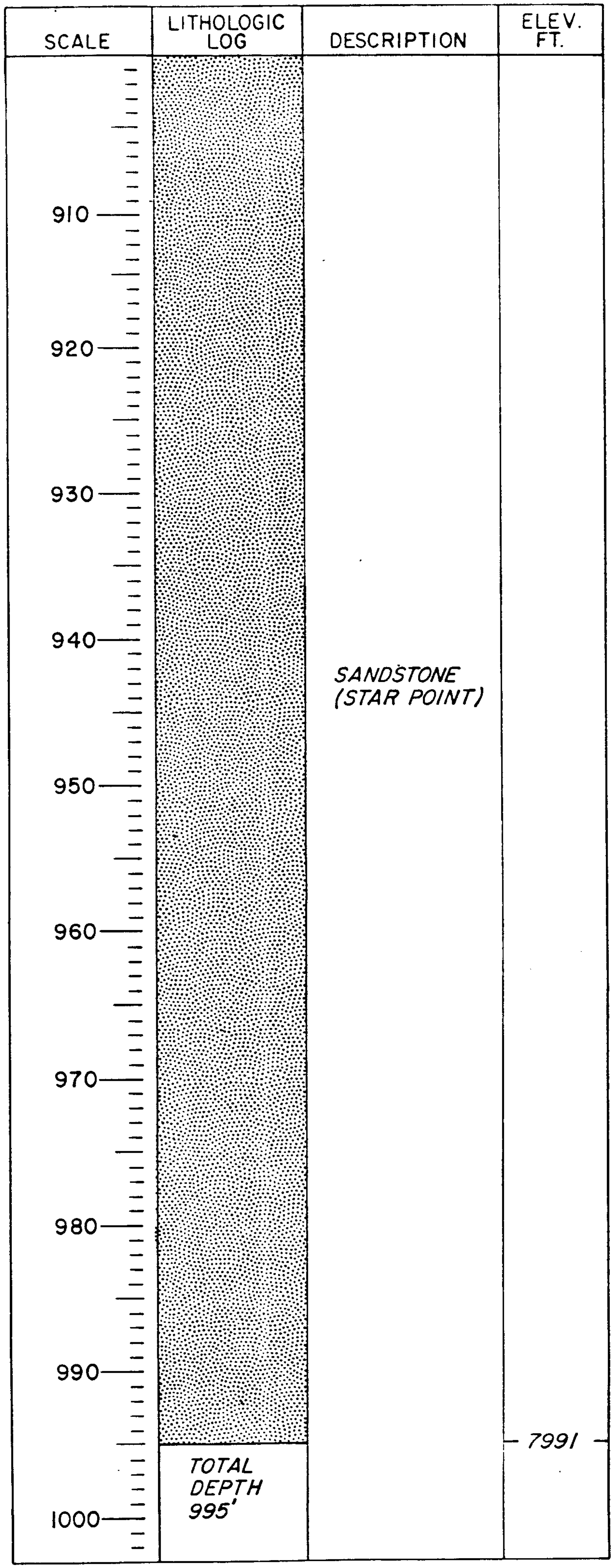
PAGE 8 OF 10




LITHOLOGIC LOG

EXPLORATION DRILL HOLE No. DHB2

PAGE 9 OF 10




LITHOLOGIC LOG

EXPLORATION DRILL HOLE No. DHB2

# CORE DATA SHEET



Hole Number Blazon #3

Sec. 4 T. 14S R. 7E

Project Number C451-30

County Carbon

State Utah

T. D. 105.6

Elevation 8,531

Co-ordinate N. -5,890

E. +1,345

Date Cored 12-10-82

Core Run No.

Logged by John O. Ennis

Date Shipped

Shipped by

Shipped via

Core Diameter NX Wireline

Company PM Exploration

Address 1901 Prospector Square

Park City, Utah 84060

| ...t | Sum. of Core Rec. | Sum of +4" Pieces | Length of Run | Core Recovery (%) | RQD (%) |
|---|---|---|---|---|---|
| | I | II | III | I/III x 100 | II/III x 100 |
| | | | | | |
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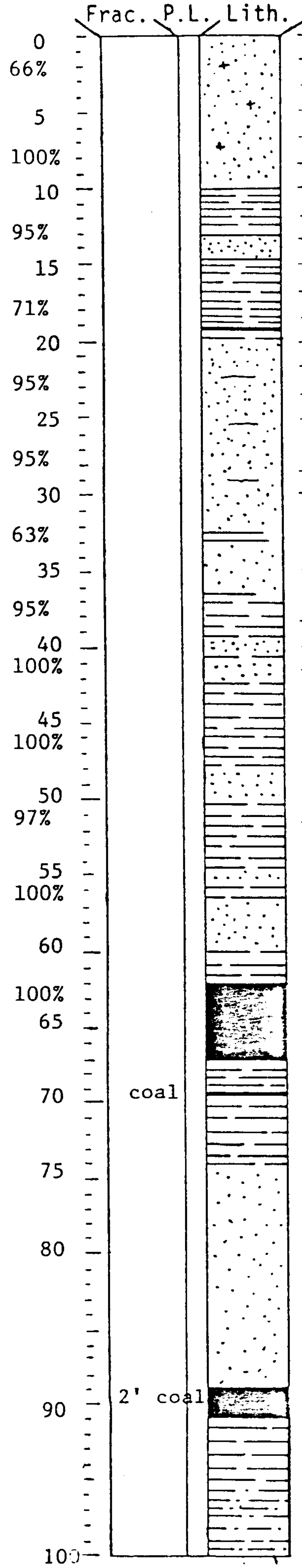



spud at 3:00 Sun Nov. 20, 1982
1st run 0'-3' 16/24 lost first ft.
66% recover
ss, med to fine gr. gryst org. arhos
10 YR 7/4, some Fe oxides @8' friable
2nd rn 3'-9' 60/60-100% recovry
well sorted
~~3rd run 9'-14' 57/60, 95% rec. sh dk~~
gy to med gy, many carb. strings
horizontal to bedding
ss, vfgr, pale yell brn 10 YR 6/2,
4th run 14'-19', 43"/60", 71%
coal seam, blk Ut, poor sam. Sulphur
5th run-19'-24' - 55/60
ss, vfgr, shale, lt gr, brn, ss with
fe stain, some minor carb bedding
6th run 24/29, 55/60
frac at 27', near vertical to core

7th run 29-34/ 38/60
poor recovery, lt org, ss
sh, dk gray carbonaceous
8th run, 34-39, 56/60
sh, dk gy, vf gr.

9th run 39-44' 60/60
ss vfgr, lt gy, leached, lt org brn.
many strings of carbonaceous matter
10th run 44'-49' 60/60 sh, dk to med
gy 11th run 49'54' 58/60 ss fg lt-me
gy interbedded w/carb. matter fe oxi
leachedsh, dk, gy to black much carb
material frac at 5,11'@4° to vert. s
to 55' 12th run, 54'59'-60/60,
ss, Med gy to med tan, med grain
Fe ox, leached
13th run 59'64', 56/60,
sh, dk gy, to lt gy
coal, sulphur sh partings

14th run, 64'-69' 60/60
sh, med to dk gy

15th run 69-73' 60/60 thin coal. sea
6" sand, sh, gy, Fe oxide stain
16th run 73-78 60/60
med ss, lt brn-tan, med gran

Fe oxide @ 82' 17th run 78.5-83.5
60/60 ss med to coarse grained
tan to lt gy,
18th run, 81/89 - 60/60

19th run, 89-94 58/60
sh, lt gy silty
94.5 dk gy green clay
96.25 Fe oxide strings at 15° off hor
vfg grain ss, lt gy 20 th run, 94-99
97.5 blebs of Fe oxide in lt gy to
med gy ss 99.4 Fe oxide stringer a
10° to hor.

# CORE DATA SHEET

Hole Number Blazon #3

Sec. 4 T. 14S R. 7E

Project Number C451-30

County Carbon

State Utah

T. D. 105.6'

Elevation 8,531

Co-ordinate N. -5,890

E. +1,345

Date Cored 12-10-82

Core Run No.

Logged by John Ennis

Date Shipped

Shipped by

Shipped via

Core Diameter

Company PM Exploration

Address 1901 Prospector Square

Park City, Utah 84060

| Unit | Sum. of Core Rec. I | Sum of +4" Pieces II | Length of Run III | Core Recovery (%) I/III x 100 | RQD (%) II/III x 100 |
|---|---|---|---|---|---|
| | | | | | |

Frac. | P.L. | Lith.

TD 105.6'

21st run 99'-104' 49/60, ss f grn, med tan, w sorted, Fe-oxides increasing, w rnd.

22nd run, 105'-105', 10/12, same abo

23rd run, 105'-105.6', same above

Exhibit 4

COAL ANALYSES

**COMMERCIAL TESTING & ENGINEERING CO.**
GENERAL OFFICES: 228 NORTH LA SALLE STREET, CHICAGO, ILLINOIS 60601 · AREA CODE 312 726-8434

TERN DIVISION MANAGER
LLOYD W. TAYLOR, JR.

SINCE 1908

PLEASE ADDRESS ALL CORRESPONDENCE TO:
139 SOUTH MAIN, HELPER, UTAH 84526
OFFICE TEL. (801) 472-3537

May 5, 1981

BLAZON COMPANY
Clear Creek Star Route
Helper, Utah 84526

Sample identification
by
Blazon Company

| | |
|---|---|
| Kind of sample reported to us | Coal |
| Sample taken at | Blazon Company |
| Sample taken by | Blazon Company |
| Date sampled | 3-3-81 |
| Date received | 3-3-81 |

Analysis report no. 57-5737 Page 1

PROXIMATE ANALYSIS

| | As Received | Dry Basis |
|---|---|---|
| % Moisture | 8.85 | xxxxx |
| % Ash | 5.30 | 5.82 |
| % Volatile | 40.77 | 44.73 |
| % Fixed Carbon | 45.08 | 49.45 |
| | 100.00 | 100.00 |
| Btu/lb. | 12211 | 13397 |
| % Sulfur | 0.54 | 0.59 |

Moisture, Ash-free Btu = 14225

ULTIMATE ANALYSIS

| | As Received | Dry Basis |
|---|---|---|
| % Moisture | 8.85 | xxxxx |
| % Carbon | 66.55 | 73.01 |
| % Hydrogen | 5.30 | 5.81 |
| % Nitrogen | 1.12 | 1.23 |
| % Chlorine | 0.01 | 0.01 |
| % Sulfur | 0.54 | 0.59 |
| % Ash | 5.30 | 5.82 |
| % Oxygen (diff) | 12.33 | 13.53 |
| | 100.00 | 100.00 |

SULFUR FORMS

| | As Received | Dry Basis |
|---|---|---|
| % Pyritic Sulfur | 0.07 | 0.08 |
| % Sulfate Sulfur | 0.00 | 0.00 |
| % Organic Sulfur (Diff) | 0.47 | 0.51 |
| % Total Sulfur | 0.54 | 0.59 |

FUSION TEMPERATURE OF ASH

| | Reducing | Oxidizing |
|---|---|---|
| Initial Deformation | 2210°F | 2300°F |
| Softening (H=W) | 2360°F | 2410°F |
| Softening (H=½W) | 2440°F | 2500°F |
| Fluid | 2570°F | 2610°F |

HARDGROVE GRINDABILITY INDEX = 44.0 at 1.00 % Moisture

EQUILIBRIUM MOISTURE = xxxx

FREE SWELLING INDEX = xxxx

JDB/ap

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Manager, Helper Laboratory

# COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 228 NORTH LA SALLE STREET, CHICAGO, ILLINOIS 60601 · AREA CODE 312 726-8434

PLEASE ADDRESS ALL CORRESPONDENCE TO:
139 SOUTH MAIN, HELPER, UTAH 84526
OFFICE TEL. (801) 472-3537

SINCE 1908

;TERN DIVISION MANAGER
Gail Palmer

BLAZON COMPANY
Clear Creek Star Route
Helper, Utah 84526

April 10, 1981

Sample identification
by
Blazon Company

| | |
|---|---|
| Kind of sample reported to us | Coal |
| Sample taken at | Blazon Company |
| Sample taken by | Blazon Company |
| Date sampled | 3-3-81 |
| Date received | 3-3-81 |

Analysis report no. 57-5737 page 3

| MINERAL ANALYSIS OF ASH | Percent Weight Ignited Basis |
|---|---|
| Silica, $SiO_2$ | 62.02 |
| Alumina, $Al_2O_3$ | 13.51 |
| Titania, $TiO_2$ | 0.83 |
| Ferric oxide, $Fe_2O_3$ | 6.53 |
| Lime, CaO | 5.97 |
| Magnesia, MgO | 1.26 |
| Potassium oxide, $K_2O$ | 0.67 |
| Sodium oxide, $Na_2O$ | 0.78 |
| Sulfur trioxide, $SO_3$ | 5.76 |
| Phos. pentoxide, $P_2O_5$ | 0.08 |
| Strontium Oxide, SrO | 0.10 |
| Barium Oxide, BaO | 0.02 |
| Manganese Oxide, $Mn_3O_4$ | 0.16 |
| Undetermined | 0.00 |
| | 97.69 |

Alkalies as $Na_2O$, Dry Coal Basis = .06
Silica Value = 81.84
Base: Acid Ratio = 0.20
ESTIMATED VISCOSITY at critical viscosity
Temperature of xxxx °F = xxxx Poises
$T_{250}$ Temperature = 2897 °F

Fouling Index = 0.2
Slagging Index = <0.6

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Jack Blair

Manager, Helper Laboratory

JB/gp



Charter M

# COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 228 NORTH LA SALLE STREET, CHICAGO, ILLINOIS 60601 · AREA CODE 312 726-8434

SINCE 1908

**Reply to**
Instrumental Analysis Division
490 Orchard Street
Golden, CO 80401

Phone: 303-278-9521


April 9, 1981

Jack Blair
C T & E
139 South Main Street
Helper, Utah 84526

PETROGRAPHIC MACERAL, REFLECTANCE AND COKE STABILITY DATA FOR :

IAD #97-G120-335-01

Sample: 57-5737

Peter R. Kremer
Coal Petrographer

M. L. Jacobs, Ph.D., Mngr.
Instrumental Analysis Div.

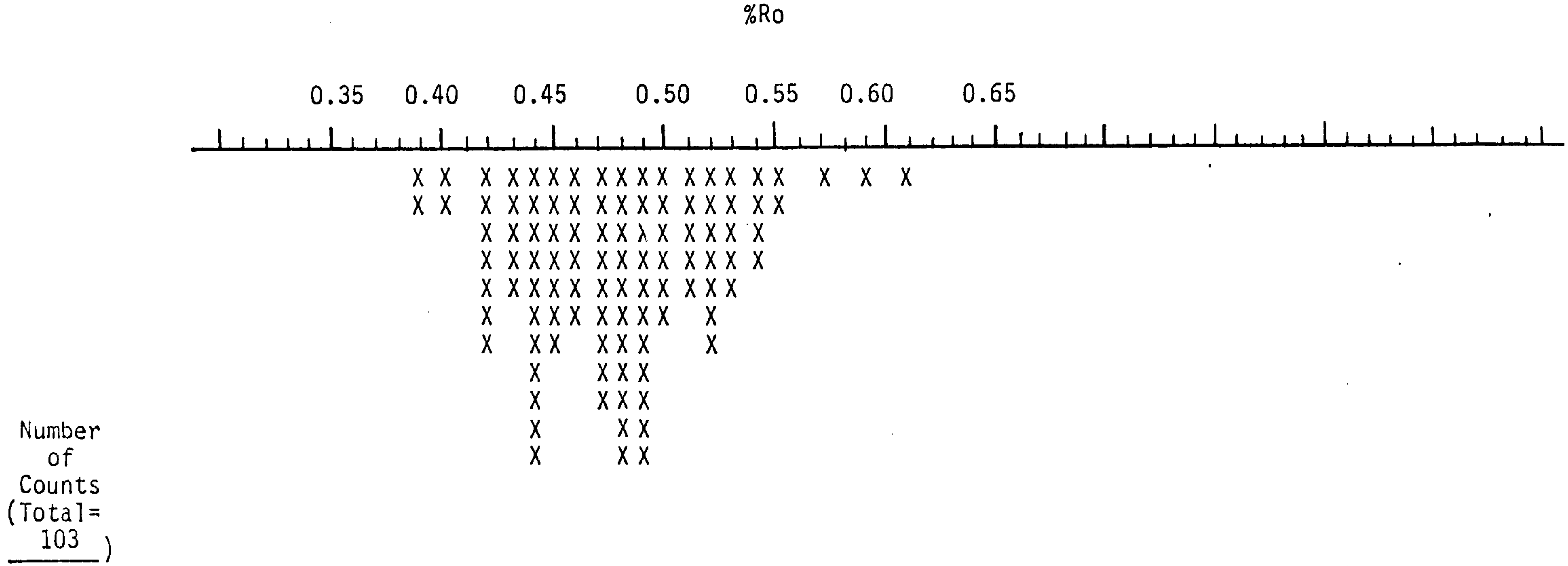
IAD Batch: 97-G120-335-01

Report of Analysis on Sample: 57-5737

## REFLECTANCE ANALYSIS

Mean-Maximum Vitrinite Ro : 0.47

Distribution of Vitrinite Reflectance Readings:




V-Type Table for Vitrinites (=100%)

| V-3 | V-4 | V-5 | V-6 |
|---|---|---|---|
| 2.0 | 67.0 | 30.0 | 1.0 |

V-Type Table for Vitrinites (= 85.5%)

(Adjusted to = Maceral % of Reactive Vitrinites)

| V-3 | V-4 | V-5 | V-6 |
|---|---|---|---|
| 1.7 | 57.3 | 25.6 | 0.9 |

IAD BATCH NUMBER: 97-G120-335-01

REPORT OF ANALYSIS ON SAMPLE: 57-5737

3/ 3/81

MACERAL ANALYSIS
(VOLUME PERCENT)
(MINERAL-MATTER CONTAINING BASIS)

| MACERAL | | MACERAL GROUP | |
|---|---|---|---|
| VITRINITE | 85.5 | VITRINITE | 85.5 |
| PSEUDOVITRINITE | 0.0 | | |
| EXINITE | 2.8 | EXINITE (LIPTINITE) | 3.1 |
| RESINITE | 0.3 | | |
| SEMI-FUSINITE* | 5.8 | | |
| SEMI-MACRINITE* | 0.1 | | |
| FUSINITE | 1.6 | INERTINITE | 8.2 |
| MACRINITE | 0.2 | | |
| MICRINITE | 0.5 | | |
| MINERAL MATTER** | 3.2 | | 3.2 |
| TOTAL | 100% | | 100% |

TOTAL REACTIVES- 90.6
TOTAL INERTS- 9.4

++++++++++++

* CONSIDERED 1/3 REACTIVE, 2/3 INERT FOR PURPOSES OF COKE STABILITY PREDICTIONS.

** CALCULATED FROM 5.82 % DRYASH, 0.59 % DRY SULFUR

COMMERCIAL TESTING & ENGINEERING CO.

IAD BATCH NUMBER: 97-G120-335-01

REPORT OF ANALYSIS ON SAMPLE: 57-5737

3/ 3/81

COKE STABILITY PREDICTION
CALCULATED RESULTS
++++++++++++++++++++++++++

| | |
|---|---|
| TOTAL REACTIVES- | 90.6 |
| TOTAL INERTS- | 9.4 |
| OPTIMUM INERT INDEX- | 21.90 |
| COMPOSITION-BALANCE INDEX- | 0.43 |
| OPTIMUM STRENGTH- | 213.33 |
| STRENGTH INDEX- | 2.36 |

PREDICTED ASTM
TUMBLER STABILITY:

- 0 -

COMMERCIAL TESTING & ENGINEERING CO.

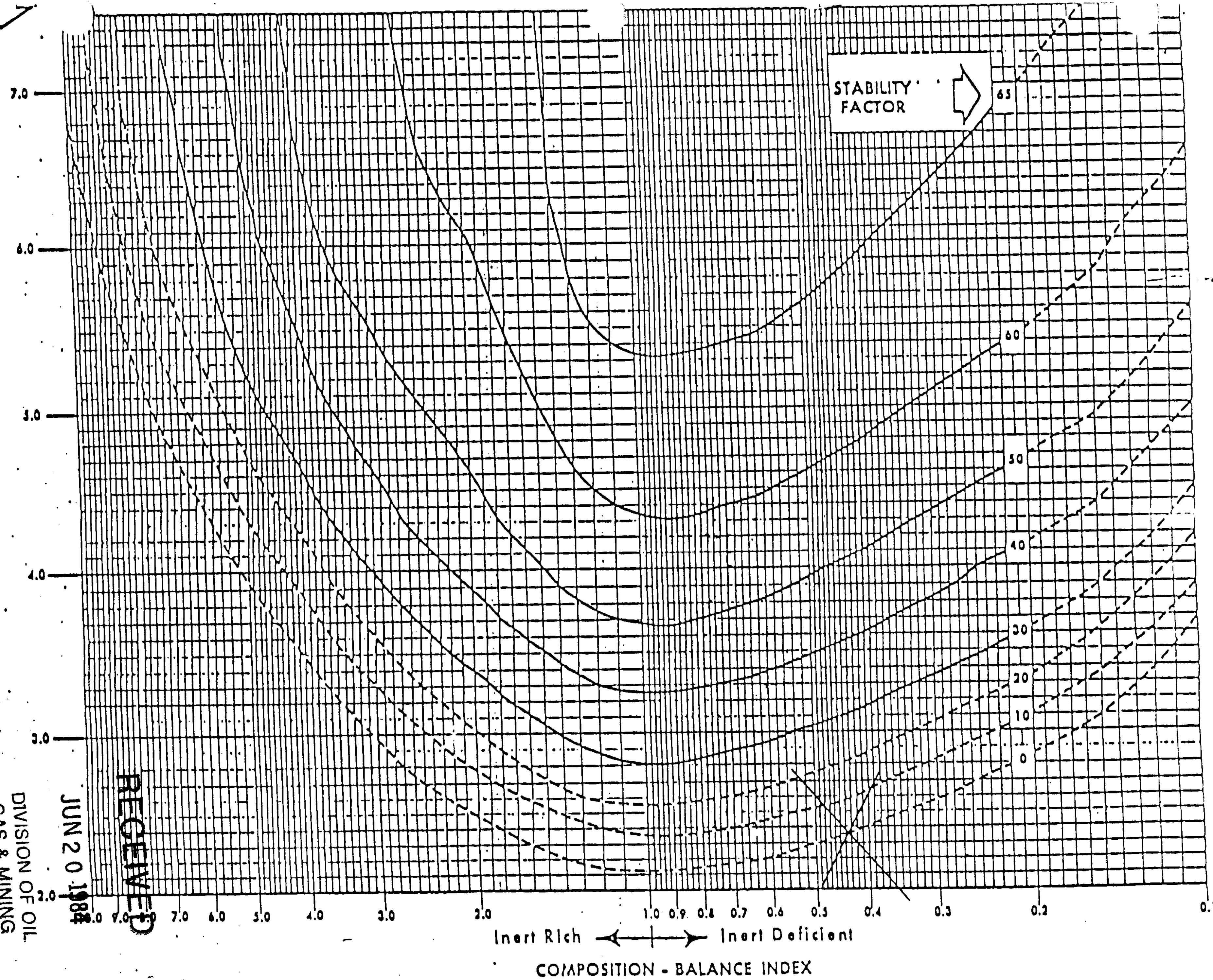

STABILITY FACTOR
65
60
50
40
30
20
10
0
7.0
6.0
5.0
4.0
3.0
2.0
10.0 9.0 8.0 7.0 6.0 5.0 4.0 3.0 2.0 1.0 0.9 0.8 0.7 0.6 0.5 0.4 0.3 0.2 0.1
Inert Rich
Inert Deficient
COMPOSITION - BALANCE INDEX

Exhibit 5

WATER ANALYSES

Exhibit 5

WATER ANALYSES



Date: September 30, 1983

# BOOKCLIFFS COMMERCIAL LABORATORIES
## WATER ANALYSIS REPORT

Client: North American Equities
Address: 1401 Seventeenth Street, Suite 1510
Denver, Colorado 80202

Attn: Mr. Alan Smith

Sample I.D. G-1

Sample Date: 9/17/83
Date Received: 9/20/83

Air Temperature: 65°F
Water Temperature: 40°F
Flow Rate: 2-5 gpm
Lab No. 83-3749-W

| Parameter | Concentration mg/l | Parameter | Concentration mg/l |
|---|---|---|---|
| Aluminum | 3.1 | Manganese | 0.32 |
| Arsenic | <0.002 | Mercury | <0.001 |
| Barium | 0.3 | Molybdenum | <0.2 |
| Bicarbonate (as $CaCO_3$) | 269 | Nickel | <0.02 |
| Boron | 0.03 | Nitrogen, Ammonia | 0.06 |
| Cadmium | <0.005 | Nitrogen, $NO_3/NO_2$ | 0.95 |
| Calcium | 109 | pH (units) | 7.5 |
| Carbonate (as $CaCO_3$) | 0 | Phosphorus, Ortho | <0.02 |
| Chloride | 11 | Potassium | 1.5 |
| Chromium | <0.02 | Selenium | <0.002 |
| Conductivity[1] | 760 | Sodium | 12 |
| Copper | <0.02 | Solids, Dissolved | 450 |
| Fluoride | 0.33 | Solids, Suspended | 254 |
| Hardness (as $CaCO_3$) | 396 | Sulfate | 121 |
| Iron, Total | 7.5 | Sulfide | <0.2 |
| Lead | 0.05 | Zinc | 0.051 |
| Magnesium | 30 | | |

[1] (umhos/cm @ 25°C)

Metals are total recoverable

Ralph V. Poulsen, Director

BOOKCLIFFS
COMMERCIAL LABORATORIES

Date: September 30, 1983

BOOKCLIFFS COMMERCIAL LABORATORIES
WATER ANALYSIS REPORT

Client: North American Equities
Address: 1401 Seventeenth Street, Suite 1510
Denver, Colorado 80202

Attn: Mr. Alan Smith

Sample I.D. G-2

Sample Date: 9/17/83
Date Received: 9/20/83

Air Temperature: 65°F
Water Temperature: 40°F
Flow Rate: 1 gpm
Lab No. 83-3750-W

| Parameter | Concentration mg/l | Parameter | Concentration mg/l |
|---|---|---|---|
| Aluminum | <0.2 | Manganese | 0.02 |
| Arsenic | <0.002 | Mercury | <0.001 |
| Barium | 0.4 | Molybdenum | <0.2 |
| Bicarbonate (as $CaCO_3$) | 318 | Nickel | <0.02 |
| Boron | 0.02 | Nitrogen, Ammonia | 0.05 |
| Cadmium | <0.005 | Nitrogen, $NO_3/NO_2$ | 0.22 |
| Calcium | 106 | pH (units) | 7.4 |
| Carbonate (as $CaCO_3$) | 0 | Phosphorus, Ortho | <0.02 |
| Chloride | 11 | Potassium | 1.5 |
| Chromium | <0.02 | Selenium | <0.002 |
| Conductivity[1] | 640 | Sodium | 8 |
| Copper | <0.02 | Solids, Dissolved | 355 |
| Fluoride | 0.26 | Solids, Suspended | 6 |
| Hardness (as $CaCO_3$) | 356 | Sulfate | 49 |
| Iron, Total | 0.18 | Sulfide | <0.2 |
| Lead | 0.07 | Zinc | <0.005 |
| Magnesium | 22 | | |

[1] (umhos/cm @ 25°C)
Metals are total recoverable

Ralph V. Poulsen, Director

BOOKCLIFFS
COMMERCIAL LABORATORIES

Date: September 30, 1983

# BOOKCLIFFS COMMERCIAL LABORATORIES
## WATER ANALYSIS REPORT

Client: North American Equities
Address: 1401 Seventeenth Street, Suite 1510
Denver, Colorado 80202

Attn: Mr. Alan Smith

Sample I.D. G-3

Sample Date: 9/17/83
Date Received: 9/20/83

Air Temperature: 65°F
Water Temperature: 35°F
Flow Rate: 1 gpm
Lab No. 83-3751-W

| Parameter | Concentration mg/l | Parameter | Concentration mg/l |
|---|---|---|---|
| Aluminum | <0.2 | Manganese | <0.02 |
| Arsenic | <0.002 | Mercury | <0.001 |
| Barium | 0.3 | Molybdenum | <0.2 |
| Bicarbonate (as $CaCO_3$) | 302 | Nickel | <0.02 |
| Boron | 0.02 | Nitrogen, Ammonia | 0.06 |
| Cadmium | <0.005 | Nitrogen, $NO_3/NO_2$ | 0.54 |
| Calcium | 102 | pH (units) | 7.3 |
| Carbonate (as $CaCO_3$) | 0 | Phosphorus, Ortho | <0.02 |
| Chloride | 3 | Potassium | 1.0 |
| Chromium | <0.02 | Selenium | <0.002 |
| Conductivity[1] | 580 | Sodium | 8 |
| Copper | <0.02 | Solids, Dissolved | 320 |
| Fluoride | 2.14 | Solids, Suspended | <4 |
| Hardness (as $CaCO_3$) | 329 | Sulfate | 41 |
| Iron, Total | 0.07 | Sulfide | <0.2 |
| Lead | 0.03 | Zinc | <0.005 |
| Magnesium | 18 | | |

[1] (umhos/cm @ 25°C)
Metals are total recoverable

Ralph V. Poulsen, Director

BOOKCLIFFS
COMMERCIAL LABORATORIES

BOOKCLIFFS COMMERCIAL LABORATORIES
WATER ANALYSIS REPORT

Client: North American Equities
Address: 1401 Seventeenth Street, Suite 1510
Denver, Colorado 80202

Attn: Mr. Alan Smith

Sample I.D. G-4

Sample Date: 9/17/83
Date Received: 9/20/83

Air Temperature: 65°F
Water Temperature: 42°F
Flow Rate: 1-2 gpm
Lab No. 83-3752-W

| Parameter | Concentration mg/l | Parameter | Concentration mg/l |
|---|---|---|---|
| Aluminum | 0.5 | Manganese | 0.06 |
| Arsenic | <0.002 | Mercury | <0.001 |
| Barium | 0.5 | Molybdenum | <0.2 |
| Bicarbonate (as $CaCO_3$) | 443 | Nickel | <0.02 |
| Boron | 0.07 | Nitrogen, Ammonia | 0.05 |
| Cadmium | <0.005 | Nitrogen, $NO_3/NO_2$ | <0.02 |
| Calcium | 174 | pH (units) | 7.3 |
| Carbonate (as $CaCO_3$) | 0 | Phosphorus, Ortho | <0.02 |
| Chloride | 7 | Potassium | 2.5 |
| Chromium | <0.02 | Selenium | <0.002 |
| Conductivity[1] | 1,090 | Sodium | 8 |
| Copper | <0.02 | Solids, Dissolved | 740 |
| Fluoride | 0.18 | Solids, Suspended | 104 |
| Hardness (as $CaCO_3$) | 670 | Sulfate | 249 |
| Iron, Total | 1.86 | Sulfide | <0.2 |
| Lead | 0.08 | Zinc | 0.008 |
| Magnesium | 57 | | |

[1] (umhos/cm @ 25°C)
Metals are total recoverable

Ralph V. Poulsen, Director

BOOKCLIFFS
COMMERCIAL LABORATORIES

Date: September 30, 1983

BOOKCLIFFS COMMERCIAL LABORATORIES
WATER ANALYSIS REPORT

Client: North American Equities
Address: 1401 Seventeenth Street, Suite 1510
Denver, Colorado 80202

Attn: Mr. Alan Smith

Sample I.D. G-5

Sample Date: 9/17/83
Date Received: 9/20/83

Air Temperature: 65°F
Water Temperature: 37°F
Flow Rate: 2-3 gpm
Lab No. 83-3753-W

| Parameter | Concentration mg/l | Parameter | Concentration mg/l |
|---|---|---|---|
| Aluminum | 0.4 | Manganese | 0.05 |
| Arsenic | <0.002 | Mercury | <0.001 |
| Barium | 0.4 | Molybdenum | <0.2 |
| Bicarbonate (as $CaCO_3$) | 42 | Nickel | <0.02 |
| Boron | 0.07 | Nitrogen, Ammonia | 0.07 |
| Cadmium | <0.005 | Nitrogen, $NO_3/NO_2$ | 0.49 |
| Calcium | 21 | pH (units) | 6.8 |
| Carbonate (as $CaCO_3$) | 0 | Phosphorus, Ortho | 0.04 |
| Chloride | 8 | Potassium | 1.5 |
| Chromium | <0.02 | Selenium | <0.002 |
| Conductivity[1] | 120 | Sodium | 5 |
| Copper | <0.02 | Solids, Dissolved | 80 |
| Fluoride | 0.22 | Solids, Suspended | 16 |
| Hardness (as $CaCO_3$) | 61 | Sulfate | 29 |
| Iron, Total | 1.17 | Sulfide | <0.2 |
| Lead | 0.02 | Zinc | <0.005 |
| Magnesium | 2 | | |

[1] (umhos/cm @ 25°C)
Metals are total recoverable

Ralph V. Poulsen, Director

BOOKCLIFFS
COMMERCIAL LABORATORIES

Date: September 30, 1983

BOOKCLIFFS COMMERCIAL LABORATORIES
WATER ANALYSIS REPORT

Client: North American Equities
Address: 1401 Seventeenth Street, Suite 1510
Denver, Colorado 80202

Attn: Mr. Alan Smith

Sample I.D. G-6

Sample Date: 9/17/83
Date Received: 9/20/83

Air Temperature: 65°F
Water Temperature: 40°F
Flow Rate: 250 gpm
Lab No. 83-3754-W

| Parameter | Concentration mg/l | Parameter | Concentration mg/l |
|---|---|---|---|
| Aluminum | <0.2 | Manganese | 0.24 |
| Arsenic | <0.002 | Mercury | <0.001 |
| Barium | 0.5 | Molybdenum | <0.2 |
| Bicarbonate (as $CaCO_3$) | 331 | Nickel | <0.02 |
| Boron | <0.02 | Nitrogen, Ammonia | 0.08 |
| Cadmium | <0.005 | Nitrogen, $NO_3/NO_2$ | <0.02 |
| Calcium | 110 | pH (units) | 7.1 |
| Carbonate (as $CaCO_3$) | 0 | Phosphorus, Ortho | <0.02 |
| Chloride | 5 | Potassium | 3.0 |
| Chromium | <0.02 | Selenium | <0.002 |
| Conductivity[1] | 750 | Sodium | 6 |
| Copper | <0.02 | Solids, Dissolved | 465 |
| Fluoride | 0.19 | Solids, Suspended | 4 |
| Hardness (as $CaCO_3$) | 436 | Sulfate | 109 |
| Iron, Total | 1.27 | Sulfide | <0.2 |
| Lead | 0.03 | Zinc | <0.005 |
| Magnesium | 39 | | |

[1] (umhos/cm @ 25°C)
Metals are total recoverable

Ralph V. Poulsen, Director

BOOKCLIFFS
COMMERCIAL LABORATORIES

BOOKCLIFFS COMMERCIAL LABORATORIES
WATER ANALYSIS REPORT

Client: North American Equities
Address: 1401 Seventeenth Street, Suite 1510
Denver, Colorado 80202

Attn: Mr. Alan Smith

Sample I.D. B-1

Sample Date: 9/17/83
Date Received: 9/20/83

Air Temperature: 65°F
Water Temperature: 47°F
Flow Rate: 275 gpm
Lab No. 83-3755-W

| Parameter | Concentration mg/l | Parameter | Concentration mg/l |
|---|---|---|---|
| Aluminum | 0.4 | Manganese | 0.02 |
| Arsenic | <0.002 | Mercury | <0.001 |
| Barium | <0.2 | Molybdenum | <0.2 |
| Bicarbonate (as $CaCO_3$) | 187 | Nickel | <0.02 |
| Boron | 0.05 | Nitrogen, Ammonia | 0.06 |
| Cadmium | <0.005 | Nitrogen, $NO_3/NO_2$ | 0.06 |
| Calcium | 59 | pH (units) | 8.5 |
| Carbonate (as $CaCO_3$) | 0 | Phosphorus, Ortho | 0.01 |
| Chloride | 5 | Potassium | 1.5 |
| Chromium | <0.02 | Selenium | <0.002 |
| Conductivity[1] | 380 | Sodium | 5 |
| Copper | <0.02 | Solids, Dissolved | 215 |
| Fluoride | 0.18 | Solids, Suspended | 10 |
| Hardness (as $CaCO_3$) | 213 | Sulfate | 41 |
| Iron, Total | 0.26 | Sulfide | <0.2 |
| Lead | <0.02 | Zinc | <0.005 |
| Magnesium | 16 | | |

[1] (umhos/cm @ 25°C)
Metals are total recoverable

Ralph V. Poulsen, Director

BOOKCLIFFS
COMMERCIAL LABORATORIES

BOOKCLIFFS COMMERCIAL LABORATORIES
WATER ANALYSIS REPORT

Client: North American Equities
Address: 1401 Seventeenth Street, Suite 1510
Denver, Colorado 80202

Attn: Mr. Alan Smith

Sample I.D. B-2

Sample Date: 9/17/83
Date Received: 9/20/83

Air Temperature: 65°F
Water Temperature: 55°F
Flow Rate: 30 gpm
Lab No. 83-3756-W

| Parameter | Concentration mg/l | Parameter | Concentration mg/l |
|---|---|---|---|
| Aluminum | 0.3 | Manganese | <0.04 |
| Arsenic | <0.002 | Mercury | <0.001 |
| Barium | <0.2 | Molybdenum | <0.2 |
| Bicarbonate (as $CaCO_3$) | 174 | Nickel | <0.02 |
| Boron | 0.02 | Nitrogen, Ammonia | 0.06 |
| Cadmium | <0.005 | Nitrogen, $NO_3/NO_2$ | <0.02 |
| Calcium | 56 | pH (units) | 8.5 |
| Carbonate (as $CaCO_3$) | 0 | Phosphorus, Ortho | 0.1 |
| Chloride | 6 | Potassium | 2.0 |
| Chromium | <0.02 | Selenium | <0.002 |
| Conductivity[1] | 330 | Sodium | 6 |
| Copper | <0.02 | Solids, Dissolved | 195 |
| Fluoride | 0.16 | Solids, Suspended | 42 |
| Hardness (as $CaCO_3$) | 185 | Sulfate | 43 |
| Iron, Total | 1.13 | Sulfide | <0.2 |
| Lead | <0.02 | Zinc | <0.005 |
| Magnesium | 11 | | |

[1] (umhos/cm @ 25°C)
Metals are total recoverable

Ralph V. Poulsen, Director

BOOKCLIFFS
COMMERCIAL LABORATORIES

BOOKCLIFFS COMMERCIAL LABORATORIES

WATER ANALYSIS REPORT

Client: North American Equities
Address: 1401 Seventeenth Street, Suite 1510
Denver, Colorado 80202

Attn: Mr. Alan Smith

Sample I.D. B-3

Sample Date: 9/17/83
Date Received: 9/20/83

Air Temperature: 65°F
Water Temperature: 42°F
Flow Rate: 250 gpm
Lab No. 83-3757-W

| Parameter | Concentration mg/l | Parameter | Concentration mg/l |
|---|---|---|---|
| Aluminum | 0.2 | Manganese | 0.03 |
| Arsenic | <0.002 | Mercury | <0.001 |
| Barium | <0.2 | Molybdenum | <0.2 |
| Bicarbonate (as $CaCO_3$) | 201 | Nickel | <0.02 |
| Boron | 0.03 | Nitrogen, Ammonia | 0.07 |
| Cadmium | <0.005 | Nitrogen, $NO_3/NO_2$ | 0.13 |
| Calcium | 65 | pH (units) | 8.3 |
| Carbonate (as $CaCO_3$) | 0 | Phosphorus, Ortho | 0.1 |
| Chloride | 6 | Potassium | 1.0 |
| Chromium | <0.02 | Selenium | <0.002 |
| Conductivity[1] | 400 | Sodium | 4 |
| Copper | <0.02 | Solids, Dissolved | 215 |
| Fluoride | 0.16 | Solids, Suspended | 12 |
| Hardness (as $CaCO_3$) | 228 | Sulfate | 56 |
| Iron, Total | 0.11 | Sulfide | <0.2 |
| Lead | <0.02 | Zinc | <0.005 |
| Magnesium | 16 | | |

[1] (umhos/cm @ 25°C)

Metals are total recoverable

Ralph V. Poulsen, Director

BOOKCLIFFS
COMMERCIAL LABORATORIES

BOOKCLIFFS COMMERCIAL LABORATORIES
WATER ANALYSIS REPORT

Client: North American Equities
Address: 1401 Seventeenth Street, Suite 1510
Denver, Colorado 80202

Attn: Mr. Alan Smith

Sample I.D. B-4

Sample Date: 9/17/83
Date Received: 9/20/83

Air Temperature: 65°F
Water Temperature: 42°F
Flow Rate: 192 gpm
Lab No. 83-3758-W

| Parameter | Concentration mg/l | Parameter | Concentration mg/l |
|---|---|---|---|
| Aluminum | 0.3 | Manganese | 0.03 |
| Arsenic | <0.002 | Mercury | <0.001 |
| Barium | 0.2 | Molybdenum | <0.2 |
| Bicarbonate (as $CaCO_3$) | 207 | Nickel | <0.02 |
| Boron | 0.02 | Nitrogen, Ammonia | 0.04 |
| Cadmium | <0.005 | Nitrogen, $NO_3/NO_2$ | 0.11 |
| Calcium | 66 | pH (units) | 8.4 |
| Carbonate (as $CaCO_3$) | 0 | Phosphorus, Ortho | 3.1 |
| Chloride | 6 | Potassium | 1.0 |
| Chromium | <0.02 | Selenium | <0.002 |
| Conductivity[1] | 400 | Sodium | 5 |
| Copper | <0.02 | Solids, Dissolved | 225 |
| Fluoride | 0.15 | Solids, Suspended | 20 |
| Hardness (as $CaCO_3$) | 227 | Sulfate | 45 |
| Iron, Total | 0.19 | Sulfide | <0.2 |
| Lead | <0.02 | Zinc | <0.005 |
| Magnesium | 15 | | |

[1] (umhos/cm @ 25°C)
Metals are total recoverable

Ralph V. Poulsen, Director

BOOKCLIFFS
COMMERCIAL LABORATORIES

BOOKCLIFFS COMMERCIAL LABORATORIES
WATER ANALYSIS REPORT

Client: North American Equities
Address: 1401 Seventeenth Street, Suite 1510
Denver, Colorado 80202

Attn: Mr. Alan Smith

Sample I.D. B-5

Sample Date: 9/17/83
Date Received: 9/20/83

Air Temperature: 65°F
Water Temperature: 45°F
Flow Rate: 60 gpm
Lab No. 83-3759-W

| Parameter | Concentration mg/l | Parameter | Concentration mg/l |
|---|---|---|---|
| Aluminum | 0.2 | Manganese | 0.04 |
| Arsenic | <0.002 | Mercury | <0.001 |
| Barium | <0.2 | Molybdenum | <0.2 |
| Bicarbonate (as $CaCO_3$) | 230 | Nickel | <0.02 |
| Boron | 0.02 | Nitrogen, Ammonia | 0.07 |
| Cadmium | <0.005 | Nitrogen, $NO_3/NO_2$ | 0.60 |
| Calcium | 77 | pH (units) | 8.0 |
| Carbonate (as $CaCO_3$) | 0 | Phosphorus, Ortho | 0.7 |
| Chloride | 6 | Potassium | 1.5 |
| Chromium | <0.02 | Selenium | 0.003 |
| Conductivity[1] | 500 | Sodium | 6 |
| Copper | <0.02 | Solids, Dissolved | 295 |
| Fluoride | 0.24 | Solids, Suspended | 8 |
| Hardness (as $CaCO_3$) | 279 | Sulfate | 58 |
| Iron, Total | 0.05 | Sulfide | <0.2 |
| Lead | <0.02 | Zinc | <0.005 |
| Magnesium | 21 | | |

[1] (umhos/cm @ 25°C)
Metals are total recoverable

Ralph V. Poulsen, Director

BOOKCLIFFS
COMMERCIAL LABORATORIES

Date: September 30, 1983

# BOOKCLIFFS COMMERCIAL LABORATORIES
## WATER ANALYSIS REPORT

Client: North American Equities
Address: 1401 Seventeenth Street, Suite 1510
Denver, Colorado 80202

Attn: Mr. Alan Smith

Sample I.D. B-6

Sample Date: 9/17/83
Date Received: 9/20/83

Air Temperature: 65°F
Water Temperature: 45°F
Flow Rate: 300 gpm
Lab No. 83-3760-W

| Parameter | Concentration mg/l | Parameter | Concentration mg/l |
|---|---|---|---|
| Aluminum | 0.2 | Manganese | 0.03 |
| Arsenic | <0.002 | Mercury | <0.001 |
| Barium | <0.2 | Molybdenum | <0.2 |
| Bicarbonate (as $CaCO_3$) | 207 | Nickel | <0.02 |
| Boron | 0.02 | Nitrogen, Ammonia | 0.04 |
| Cadmium | <0.005 | Nitrogen, $NO_3/NO_2$ | <0.02 |
| Calcium | 63 | pH (units) | 8.2 |
| Carbonate (as $CaCO_3$) | 0 | Phosphorus, Ortho | 0.4 |
| Chloride | 7 | Potassium | 2.0 |
| Chromium | <0.02 | Selenium | 0.002 |
| Conductivity[1] | 410 | Sodium | 6 |
| Copper | <0.02 | Solids, Dissolved | 245 |
| Fluoride | 0.16 | Solids, Suspended | 10 |
| Hardness (as $CaCO_3$) | 227 | Sulfate | 49 |
| Iron, Total | 0.04 | Sulfide | <0.2 |
| Lead | <0.02 | Zinc | <0.005 |
| Magnesium | 17 | | |

[1] (umhos/cm @ 25°C)
Metals are total recoverable

Ralph V. Poulsen, Director

BOOKCLIFFS
COMMERCIAL LABORATORIES

VAUGHN HANSEN ASSOCIATES
Consultants / Engineers

# WATER QUALITY DATA

Station 8-1
Location Mud Creek

| Date | Time | Flow (cfs) | Temperature Air (°C) | Temperature Water (°C) | pH | Coliform Total | Coliform Fecal | Fecal Strep | COD | BOD | TOC | Dissolved Oxygen | Oil & Grease | Phenol | Nitrogen: Ammonia as N | Nitrate as N | Nitrite as N | [illegible] | [illegible] | Phosphate Total as $PO_4$ | Ortho as $PO_4$ | Sulfate as $SO_4$ | [illegible] | [illegible] | Solids: TSS | Total [illegible] | TDS | Total [illegible] | Total [illegible] | Cond | Turbidity | [illegible] as $CO_3$ | [illegible] as $HCO_3$ | Total [illegible] | Total [illegible] | Acidity | [illegible] | [illegible] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10-21-80 | 14:25 | 0.4 | -3 | 0 | 7.9 | | | | | | | | 0.40 | | <0.01 | 0.10 | | 0.03 | | 0.040 | 0.030 | 15.0 | | | 13.0 | | 225 | | | 420 | | <0.01 | 252.37 | 256 | | 14.0 | | |
| 11-7-80 | 9:45 | | | | 7.6 | | | | | | | | <0.01 | | <0.01 | 0.09 | | 0.02 | | 0.150 | 0.020 | 19.5 | | | 22.0 | | 219 | | | 340 | | <0.01 | 246.88 | 202 | | 16.0 | | |
| 12-13-80 | 11:01 | -0- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1-29-81 | Frozen | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2-11-81 | Frozen | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3-11-81 | Frozen | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4-6-81 | 11:59 | -0- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5-27-81 | 14:50 | 2.6 | 13 | 10 | 8.0 | | | | | | | | 1.00 | | 0.10 | 0.20 | 0.02 | | | 1.580 | | 15.0 | | | 247 | | 145 | | | 190 | | <0.01 | 141.52 | 116 | 130 | 190 | | |
| 6-27-81 | 14:12 | 0.2 | 23 | 16 | 8.5 | | | | | | | | 0.40 | | 0.10 | <0.01 | | 0.20 | | 0.330 | 0.140 | 18.0 | | | 260 | | 185 | | | 272 | | 9.60 | 183 | 146 | | <0.01 | | |
| 7-22-81 | 11:45 | 0.2 | 20 | 10 | 8.6 | | | | | | | | 2.6 | | <0.01 | 0.03 | | 0.03 | | 0.130 | 0.170 | 21.0 | | | 13.0 | | 226 | | | 250 | | 12.00 | 211.6 | 200 | | <0.01 | | |
| 8-27-81 | 14:02 | | 21 | 18 | | | | | | | | | 0.40 | | <0.01 | <0.01 | | 0.01 | | 0.160 | 0.060 | 13.5 | | | 2.0 | | 235 | | | 305 | | 12.00 | 243.2 | 196 | | <0.01 | | |
| 7-28-81 | 7:00 | 0.11 | 18 | 14 | 8.5 | | | | | | | | 1.20 | | <0.01 | <0.01 | | 0.10 | | 0.185 | 0.065 | 12.0 | | | 15.0 | | 230 | | | 312 | | 2.00 | 252.2 | 212 | | <0.01 | | |
| 9-28-81 | 7:20 | 0.2 | 0 | 1 | 8.5 | | | | | | | | 2.20 | | 0.19 | 0.15 | | 0.24 | | 0.300 | 0.048 | 18.0 | | | 71.0 | | 280 | | | 430 | | 2.40 | 295.5 | 245.3 | | <0.01 | | |
| 11-11-81 | 1:45 | | 10 | 1 | | | | | | | | | 0.80 | | 0.30 | 0.11 | | 0.25 | | 0.490 | 0.030 | 110 | | | 30.0 | | 380 | | | 255 | | 4.80 | 251.[illegible] | 220.2[illegible] | | <0.01 | | |
| 12-29-81 | 11:12 | | In-Accessible | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| Date | Aluminum Total | Antimony Total | Arsenic Total | Barium Total | Beryllium Total | Boron Total | Cadmium Total | Calcium Total | Chloride Diss. | Chromium Hexavalent | Cobalt Total | Copper Total | Cyanide as CN | Fluoride Diss. | [illegible] Total | Iron Diss. | Iron Total | Lead Total | Magnesium Total | Manganese Total | Mercury Total | Molybdenum Total | Nickel Total | Potassium Total | Selenium Total | Silica as $SiO_2$ | Silver Total | Sodium Total | Zinc Total | [illegible] Total | | | | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10-21-80 | | | <0.001 | 0.020 | | 0.040 | <0.001 | 73.60 | 3.6 | <0.001 | | <0.001 | <0.001 | 0.01 | | 0.040 | 0.260 | <0.001 | 13.44 | 0.010 | <0.0002 | <0.001 | | 1.12 | <0.001 | | <0.001 | 15.00 | 0.048 | | | | | |
| 11-7-80 | | | <0.001 | 0.030 | | 0.424 | <0.001 | 60.80 | 4.7 | 0.007 | | 0.020 | | 0.09 | | 0.590 | 4.150 | 0.023 | 12.96 | 0.130 | <0.0002 | <0.001 | | 0.80 | <0.001 | | <0.001 | 6.50 | 0.080 | | | | | |
| 12-13-80 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1-29-81 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2-11-81 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3-11-81 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4-6-81 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5-27-81 | | | <0.001 | 0.035 | | 0.020 | <0.001 | 37.60 | 2.00 | <0.001 | | 0.020 | | 0.11 | | 0.830 | 2.860 | 0.009 | 8.64 | 0.120 | 0.0035 | <0.001 | <0.001 | 1.16 | <0.001 | | 0.002 | 1.90 | 0.020 | | | | | |
| 6-27-81 | | | <0.001 | 0.030 | | 0.025 | <0.001 | 49.60 | 3.14 | <0.001 | | 0.010 | | 0.15 | | 0.030 | 0.290 | 0.003 | 14.88 | 0.020 | <0.0002 | <0.001 | | 0.77 | <0.001 | | <0.001 | 2.50 | 0.035 | | | | | |
| 7-22-81 | | | <0.001 | 0.025 | | 0.016 | <0.001 | 58.20 | 4.08 | <0.001 | | 0.020 | | 0.15 | | 0.020 | 0.110 | <0.001 | 18.28 | 0.010 | <0.0002 | <0.001 | | 0.95 | <0.001 | | <0.001 | 2.90 | 0.025 | | | | | |
| 8-27-81 | | | <0.001 | 0.030 | | 0.031 | <0.001 | 61.60 | 77.90 | <0.001 | | 0.009 | | 0.15 | | 0.035 | 1.290 | <0.001 | 15.84 | 0.014 | <0.0002 | <0.001 | | 1.05 | 0.005 | | <0.001 | 17.20 | 0.020 | | | | | |
| 7-28-81 | | | <0.001 | 0.065 | | 0.019 | <0.001 | 64.00 | 6.00 | <0.001 | | 0.010 | | 0.16 | | 0.020 | 0.450 | <0.001 | 15.84 | 0.020 | <0.0002 | <0.001 | | 1.90 | 0.005 | | <0.001 | 4.00 | 0.020 | | | | | |
| 9-28-81 | | | <0.001 | 0.030 | | 0.015 | <0.001 | 47.60 | 4.10 | <0.001 | | 0.010 | | 0.12 | | 0.020 | 1.250 | 0.015 | 15.84 | 0.015 | <0.0002 | <0.001 | | 2.70 | <0.001 | | <0.001 | 45.00 | 0.044 | | | | | |
| 11-11-81 | | | <0.001 | 0.038 | | 0.025 | <0.001 | 68.00 | 2.30 | <0.001 | | 0.012 | | 0.15 | | 0.065 | 1.335 | 0.010 | 18.00 | 0.018 | <0.0002 | <0.001 | | 2.30 | <0.001 | | <0.001 | 41.60 | 0.050 | | | | | |
| 12-29-81 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | Frozen- Snow |

6-1-75

VAUGHN HANSEN ASSOCIATES
Consultants / Engineers

# WATER QUALITY DATA

Station: B-1
Location: Mud Creek

| DATE | TIME | FLOW cfs | TEMPERATURE AIR °C | TEMPERATURE WATER °C | pH | COLIFORM TOTAL | COLIFORM FECAL | FECAL STREP | B.O.D. | C.O.D. | T.O.C. | DISSOLVED OXYGEN | OIL & GREASE | PHENOL | NITROGEN | | | | | PHOSPHATE TOTAL | PHOSPHATE ORTHO | SULFATE | | | SOLIDS | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| DATE | ALUMINUM mg/L | ANTIMONY mg/L | ARSENIC mg/L | BARIUM mg/L | BERYLLIUM mg/L | BORON mg/L | CADMIUM mg/L | CALCIUM mg/L | CHLORIDE mg/L | CHROMIUM HEX. CR mg/L | COBALT mg/L | COPPER mg/L | CYANIDE mg/L | FLUORIDE mg/L | [illegible] mg/L | IRON mg/L | IRON TOTAL mg/L | LEAD mg/L | MAGNESIUM mg/L | MANGANESE mg/L | MERCURY mg/L | MOLYBDENUM mg/L | NICKEL mg/L | POTASSIUM mg/L | SELENIUM mg/L | SILICA $SiO_2$ mg/L | SILVER mg/L | SODIUM mg/L | ZINC mg/L | [illegible] mg/L | S.A.R. | NITRATE NITRITE MG/L | | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9.21.80 | | | <0.001 | 0.015 | | 0.030 | <0.001 | | | <0.001 | | <1.001 | | | | 0.040 | 0.260 | <0.001 | | | | | | | <0.001 | | <0.001 | | 0.040 | | | | | |
| 11.7.80 | | | <0.001 | 0.020 | | 0.020 | <0.001 | | | <0.001 | | <1.001 | | | | 0.510 | 4.150 | 0.005 | | | | | | | <0.001 | | <0.001 | | 0.030 | | | | | |
| 12.17.80 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.28.81 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.11.81 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3.11.81 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4.9.81 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5.27.81 | | | <0.001 | 0.025 | | 0.020 | <0.001 | | | <0.001 | | <0.001 | | | | 0.130 | 2.860 | 0.002 | | 0.100 | 0.0030 | <0.001 | <0.001 | | <0.001 | | <0.001 | | 0.045 | | | | | |
| 6.23.81 | | | <0.001 | 0.020 | | 0.012 | <0.001 | | | <0.001 | | <0.001 | | | | 0.030 | 0.590 | 0.002 | | 0.011 | <0.0002 | <0.001 | | | <0.001 | | <0.001 | | 0.120 | | | | | |
| 7.22.81 | | | <0.001 | 0.020 | | 0.010 | <0.001 | | | <0.001 | | 0.010 | | | | 0.020 | 0.110 | <0.001 | | 0.010 | | | | | <0.001 | | <0.001 | | 0.010 | | | | | |
| 8.27.81 | | | <0.001 | 0.020 | | 0.020 | <0.001 | | | <0.001 | | <0.001 | | | | 0.035 | 0.290 | <0.001 | | 0.010 | <0.0002 | <0.001 | | | <0.001 | | <0.001 | | 0.025 | | | | | |
| 9.23.81 | | | <0.001 | 0.025 | | 0.010 | <0.001 | | | <0.001 | | <0.001 | | | | 0.020 | 0.450 | <0.001 | | 0.010 | | | | | <0.001 | | <0.001 | | 0.015 | | | | | |
| 10.27.81 | | | <0.001 | 0.015 | | 0.002 | <0.001 | | | <0.001 | | <0.001 | | | | 0.020 | 1.250 | <0.001 | | 0.011 | | | | | <0.001 | | <0.001 | | 0.005 | | | | | |
| 11.18.81 | | | <0.001 | 0.020 | | 0.010 | <0.001 | | | <0.001 | | 0.010 | | | | 0.065 | 1.535 | <0.001 | | 0.013 | | | | | <0.001 | | <0.001 | | 0.010 | | | | | |
| 12.28.81 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

VAUGHN HANSEN ASSOCIATES
Consultants / Engineers

# WATER QUALITY DATA

Station B-2
Location Long Canyon Creek

| C/M | Date | Time | Flow (cfs) | Temp. Air (°C) | Temp. Water (°C) | pH | Coliform Total | Coliform Fecal | Fecal Strep | COD | BOD | TOC | Dissolved Oxygen | Oil & Grease | Phenols | Nitrogen Ammonia | Nitrogen Nitrate | Nitrogen Nitrite | Nitrogen Total | Nitrogen Organic | Phosphate Total | Phosphate Ortho | Sulfate | | | Solids TSS | Solids Total Settleable | Solids TDS | Solids Total Vol. | Solids Total Vol. Susp. | Cond | Turbidity | Carbonate | Bicarbonate | Total Hardness | Total | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.1 | 10.21.80 | 09:05 | 0.02 | -3 | 0 | 7.6 | | | | | | | | 0.80 | | <0.01 | 0.13 | | 0.02 | | 0.040 | 0.020 | 9.0 | | | 26.0 | | 240 | | | 320 | | <0.01 | [illegible] | 232 | | 11.0 | | |
| 1.2 | 11.7.80 | 14:15 | | | | 7.6 | | | | | | | | 0.60 | | 0.09 | 0.08 | | 0.10 | | 0.180 | 0.030 | 15.00 | | | 31.0 | | 215 | | | 520 | | <0.01 | 244 | 200 | | 7.0 | | |
| • | 12.11.80 | 10:59 | -0- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1.28.81 | Frozen | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 2.18.81 | Frozen | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 3.11.81 | Frozen | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 4.8.81 | 11:58 | -0- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 5.27.81 | 14:35 | 2 | | | 8.0 | | | | | | | | <0.01 | | 0.10 | 0.12 | 0.01 | | | 0.600 | | 19.5 | | | 440 | | 332 | | | | | <0.01 | [illegible] | 142 | 154 | 0.95 | | |
| | 6.29.81 | 13:57 | 0.01 | 23 | 22 | 8.1 | | | | | | | | 1.60 | | 1.60 | <0.01 | | 0.70 | | 0.230 | 0.200 | 12.0 | | | 8.0 | | 182 | | | 282 | | 4.80 | [illegible] | 164 | | <0.01 | | |
| | 7.22.81 | 11:38 | 0.01 | 20 | 11 | 8.3 | | | | | | | | 2.40 | | <0.01 | 0.04 | | 0.02 | | 0.130 | 0.220 | 21.0 | | | 35.0 | | 214 | | | 330 | | 2.20 | [illegible] | 176 | | <0.01 | | |
| | 8.21.81 | 14:11 | 0.002 | 21 | 16 | 8.7 | | | | | | | | 2.40 | | <0.01 | <0.01 | | 0.02 | | 0.130 | 0.070 | 7.5 | | | 2.0 | | 315 | | | 272 | | 6.40 | [illegible] | 165 | | <0.01 | | |
| | 9.21.81 | 12:20 | 0.01 | 22 | 12 | 8.4 | | | | | | | | 4.00 | | 0.68 | 0.10 | | 0.90 | | 0.520 | 0.010 | 9.0 | | | 7.0 | | 240 | | | 285 | | 9.60 | [illegible] | 218 | | <0.01 | | |
| | 10.14.81 | 13:33 | 0.02 | 0 | 0 | 8.4 | | | | | | | | 1.80 | | 0.19 | 0.08 | | 0.25 | | 0.100 | 0.050 | 18.0 | | | 68.0 | | 295 | | | 440 | | 4.80 | [illegible] | 261.16 | | <0.01 | | |
| | 11.18.81 | 11:45 | -0- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 12.22.81 | 10:30 | | In-Accessible | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| Date | Aluminum Total | Antimony Total | Arsenic Total | Barium Total | Beryllium Total | Boron Total | Cadmium Total | Calcium Total | Chloride | Chromium Hexavalent | Cobalt Total | Copper Total | Cyanide | Fluoride | Total | Iron Dis. | Iron Total | Lead Total | Magnesium Total | Manganese Total | Mercury Total | Molybdenum Total | Nickel Total | Potassium Total | Selenium Total | Silica $SiO_2$ | Silver Total | Sodium Total | Zinc Total | Total | | | | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10.21.80 | | | <0.001 | 0.140 | | 0.040 | <0.001 | 71.20 | 2.5 | <0.001 | | 0.010 | <0.001 | 0.01 | | 0.030 | 0.410 | <0.001 | 2.00 | 0.050 | <0.0002 | <0.001 | | 1.17 | <0.001 | | <0.001 | 5.00 | <0.001 | | | | | |
| 11.7.80 | | | <0.001 | 0.058 | | 0.050 | <0.001 | 52.60 | 1.2 | <0.001 | | 0.010 | | 0.09 | | 0.530 | 1.020 | <0.001 | 2.68 | 0.020 | <0.0002 | <0.001 | | 0.95 | <0.001 | | <0.001 | 15.00 | 0.02[illegible] | | | | | |
| 12.11.80 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.15.81 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.18.81 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3.11.81 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4.8.81 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5.27.81 | | | <0.001 | 0.080 | | 0.050 | <0.001 | 45.60 | 4.00 | 0.002 | | 0.020 | | 0.18 | | 0.900 | 5.270 | 0.015 | 9.60 | 0.320 | <0.0002 | <0.001 | <0.001 | 1.02 | <0.001 | | <0.001 | 5.12 | 0.050 | | | | | |
| 6.29.81 | | | <0.001 | 0.050 | | 1.029 | <0.001 | 48.80 | 3.03 | <0.001 | | 0.010 | | 0.18 | | 0.020 | 0.080 | <0.001 | 13.44 | 0.015 | <0.0002 | <0.001 | | 1.03 | <0.001 | | <0.001 | 2.50 | 0.020 | | | | | |
| 7.22.81 | | | <0.001 | 0.031 | | 0.025 | <0.001 | 56.80 | 5.16 | <0.001 | | 0.030 | | 0.16 | | 0.020 | 0.170 | <0.001 | 13.92 | 0.010 | <0.0002 | <0.001 | | 1.18 | <0.001 | | <0.001 | 5.00 | 0.018 | | | | | |
| 8.21.81 | | | <0.001 | 0.038 | | 0.026 | <0.001 | 56.80 | 18.90 | <0.001 | | 0.010 | | 0.16 | | 0.020 | 0.440 | <0.001 | 12.96 | 0.012 | 0.0002 | <0.001 | | 1.14 | 0.005 | | <0.001 | 48.50 | 0.030 | | | | | |
| 9.21.81 | | | <0.001 | 0.080 | | 0.014 | <0.001 | 63.20 | 9.00 | <0.001 | | 0.010 | | 0.17 | | 0.030 | 0.600 | 0.031 | 13.44 | 0.018 | 0.0002 | <0.001 | | 1.04 | 0.003 | | <0.001 | 43.00 | 0.025 | | | | | |
| 10.14.81 | | | <0.001 | 0.028 | | 0.016 | <0.001 | 48.00 | 4.10 | <0.001 | | 0.010 | | 0.13 | | 0.010 | 1.900 | 0.012 | 3.20 | 0.010 | <0.0002 | <0.001 | | 3.50 | <0.001 | | <0.001 | 32.00 | 0.03[illegible] | | | | | |
| 11.18.81 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | Frozen- Snow |
| 12.22.81 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

6-1-78

VAUGHN HANSEN ASSOCIATES
Consultants / Engineers

# WATER QUALITY DATA

Station: B-2
Location: Long Canyon Creek

| Date | Aluminum Diss. mg/l | Antimony Diss. mg/l | Arsenic Diss. mg/l | Barium Diss. mg/l | Beryllium Diss. mg/l | Boron Diss. mg/l | Cadmium Diss. mg/l | Calcium Diss. mg/l | Chloride Diss. mg/l | Chromium Hexavalent mg/l | Cobalt Diss. mg/l | Copper Diss. mg/l | Cyanide mg/l | Fluoride Diss. mg/l | [illegible] Diss. mg/l | Iron Diss. mg/l | Iron Total mg/l |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/21/8[illegible] | | | <0.001 | 0.020 | | 0.035 | <0.001 | | | <0.001 | | <0.001 | | | | 0.030 | 0.410 |
| [illegible] | | | <0.001 | 0.030 | | 0.030 | <0.001 | | | <0.001 | | 0.001 | | | | 0.530 | 1.020 |
| [illegible] | | | | | | | | | | | | | | | | | |
| [illegible] | | | | | | | | | | | | | | | | | |
| [illegible] | | | | | | | | | | | | | | | | | |
| [illegible] | | | | | | | | | | | | | | | | | |
| 4 8 81 | | | | | | | | | | <0.001 | | 0.010 | | | | 0.900 | 5.270 |
| 5 21 81 | | | <0.001 | 0.015 | | 0.030 | <0.001 | | | <0.001 | | <0.001 | | | | 0.020 | 0.080 |
| 6 24 81 | | | <0.001 | 0.040 | | 0.020 | <0.001 | | | <0.001 | | <0.001 | | | | 0.020 | 0.170 |
| 7 23 81 | | | <0.001 | 0.035 | | 0.120 | <0.001 | | | <0.001 | | <0.001 | | | | 0.020 | 0.440 |
| 8 7 81 | | | <0.001 | 0.030 | | 0.020 | <0.001 | | | <0.001 | | 0.010 | | | | 0.030 | 0.600 |
| 9 23 81 | | | <0.001 | 0.035 | | 0.010 | <0.001 | | | <0.001 | | <0.001 | | | | 0.010 | 1.900 |
| 10 7 81 | | | <0.001 | 0.025 | | 0.010 | <0.001 | | | | | | | | | | |
| 11 [illegible] 81 | | | | | | | | | | | | | | | | | |
| 12 21 81 | | | | | | | | | | | | | | | | | |

| Date | Lead Diss. mg/l | Magnesium Diss. mg/l | Manganese Diss. mg/l | Mercury Diss. mg/l | Molybdenum Diss. mg/l | Nickel Diss. mg/l | Potassium Diss. mg/l | Selenium Diss. mg/l | Silica as $SiO_2$ mg/l | Silver Diss. mg/l | Sodium Diss. mg/l | Zinc Diss. mg/l | Vanadium Diss. mg/l | S.A.R. | Nitrate + Nitrite mg/l | | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/21/8[illegible] | <0.001 | | | | | | | <0.001 | | <0.001 | | <0.001 | | | | | |
| [illegible] | <0.001 | | | | | | | <0.001 | | <0.001 | | 0.020 | | | | | |
| [illegible] | | | | | | | | | | | | | | | | | |
| [illegible] | | | | | | | | | | | | | | | | | |
| [illegible] | | | | | | | | | | | | | | | | | |
| [illegible] | | | | | | | | | | | | | | | | | |
| 4 8 81 | 0.001 | | 0.290 | <0.0002 | <0.001 | <0.001 | | <0.001 | | <0.001 | | 0.015 | | | | | |
| 5 21 81 | <0.001 | | 0.010 | <0.0002 | <0.001 | | | <0.001 | | <0.001 | | 0.010 | | | | | |
| 6 24 81 | <0.001 | | 0.010 | | | | | <0.001 | | <0.001 | | 0.012 | | | | | |
| 7 23 81 | <0.001 | | 0.012 | <0.0002 | <0.001 | | | <0.001 | | <0.001 | | 0.012 | | | | | |
| 8 7 81 | <0.001 | | 0.012 | | <0.001 | | | <0.001 | | <0.001 | | 0.015 | | | | | |
| 9 23 81 | <0.001 | | 0.004 | | | | | <0.001 | | <0.001 | | 0.010 | | | | | |
| 10 7 81 | | | | | | | | | | | | | | | | | |
| 11 [illegible] 81 | | | | | | | | | | | | | | | | | |
| 12 21 81 | | | | | | | | | | | | | | | | | |

11-80

VAUGHN HANSEN ASSOCIATES
Consultants / Engineers

# WATER QUALITY DATA

Station B-3
Location Mud Creek below Snyder Canyon

| Date | Time | Flow | Temp. Air | Temp. Water | pH | Coliform Total | Coliform Fecal | Fecal Strep | COD | BOD | TOC | | Oil & Grease | Phenol | Nitrogen | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 31 80 | 10:00 | 1.4 | -2 | 0 | 7.8 | | | | | | | | 0.60 | | <0.01 | 0.13 | | 0.01 | |
| 11 7 80 | 15:15 | | | | 7.8 | | | | | | | | <0.01 | | <0.01 | 0.12 | | 0.05 | |
| 12 17 80 | 11:04 | -0- | | | | | | | | | | | | | | | | | |
| 1 28 81 | Frozen | | | | | | | | | | | | | | | | | | |
| 2 18 81 | Frozen | | | | | | | | | | | | | | | | | | |
| 3 11 81 | Frozen | | | | | | | | | | | | | | | | | | |
| 4 8 81 | | -0- | | | | | | | | | | | | | | | | | |
| 5 27 81 | 12:45 | 4.5 | 13 | 8 | 8.0 | | | | | | | | <0.01 | | 0.10 | 0.10 | 0.01 | | |
| 6 29 81 | 12:00 | 0.4 | 25 | 20 | 8.5 | | | | | | | | 0.80 | | <0.01 | <0.01 | | 0.02 | |
| 7 20 81 | 11:10 | 0.6 | 21 | 10 | 8.5 | | | | | | | | 2.80 | | <0.01 | 0.03 | | <0.01 | |
| 8 21 81 | 13:48 | 0.1 | 20 | 15 | 8.7 | | | | | | | | 0.80 | | <0.01 | <0.01 | | 0.08 | |
| 9 23 81 | 12:23 | 0.14 | 17 | 12 | 8.6 | | | | | | | | 1.00 | | <0.01 | <0.01 | | 0.15 | |
| 10 14 81 | 11:48 | 0.3 | -1 | 0 | 8.3 | | | | | | | | 28.00 | | 0.21 | 0.16 | | 0.30 | |
| 11 4 81 | 10:58 | | 7 | 1 | 8.0 | | | | | | | | 6.20 | | 0.30 | 0.08 | | 0.35 | |
| 12 2 81 | 10:30 | | Inaccessible | | | | | | | | | | | | | | | | |

| Date | Phosphate Total | Phosphate Ortho | | | | Solids | | | | | Cond | Turbidity | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 31 80 | 0.040 | 0.035 | 12.0 | | | 3.0 | | 255 | | | 590 | | <0.01 | 295.4 | 242 | | 4.0 | | |
| 11 7 80 | 0.170 | 0.050 | 18.0 | | | 10.0 | | 231 | | | 350 | | <0.01 | 258.4 | 212 | | 16.0 | | |
| 12 17 80 | | | | | | | | | | | | | | | | | | | |
| 1 28 81 | | | | | | | | | | | | | | | | | | | |
| 2 18 81 | | | | | | | | | | | | | | | | | | | |
| 3 11 81 | | | | | | | | | | | | | | | | | | | |
| 4 8 81 | | | | | | | | | | | | | | | | | | | |
| 5 27 81 | 0.980 | | 18.0 | | | 134 | | 151 | | | 130 | | <0.01 | 146.4 | 120 | 126 | 1.90 | | |
| 6 29 81 | 0.220 | 0.220 | 15.0 | | | 88.0 | | 182 | | | 215 | | 8.60 | 221.5 | 162 | | <0.01 | | |
| 7 20 81 | 0.330 | 0.130 | 25.0 | | | 6.0 | | 228 | | | 350 | | 9.60 | 247.2 | 192 | | <0.01 | | |
| 8 21 81 | 0.980 | 0.080 | 13.5 | | | 2.0 | | 246 | | | 285 | | 3.60 | 207.4 | 176 | | <0.01 | | |
| 9 23 81 | 0.990 | 0.100 | 14.0 | | | 9.0 | | 212 | | | 289 | | 4.80 | 219.2 | 184 | | <0.01 | | |
| 10 14 81 | 0.200 | 0.039 | 30.0 | | | 10.0 | | 300 | | | 460 | | 2.40 | 366.6 | 255.50 | | <0.01 | | |
| 11 4 81 | 0.490 | 0.030 | 128 | | | 9.0 | | 575 | | | 232 | | 3.80 | 249.3 | 209 | | <0.01 | | |
| 12 2 81 | | | | | | | | | | | | | | | | | | | |

| Date | Aluminum Total | Antimony Total | Arsenic Total | Barium Total | Beryllium Total | Boron Total | Cadmium Total | Calcium Total | | Chromium | Cobalt Total | Copper Total | Cyanide | Fluoride |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 31 80 | | | <0.001 | 0.020 | | 1.020 | <0.001 | 75.20 | 2.9 | <0.001 | | 0.010 | <0.001 | <0.01 |
| 11 7 80 | | | <0.001 | 0.035 | | 0.056 | <0.001 | 69.00 | 1.6 | <0.001 | | <0.001 | | 0.09 |
| 12 17 80 | | | | | | | | | | | | | | |
| 1 28 81 | | | | | | | | | | | | | | |
| 2 18 81 | | | | | | | | | | | | | | |
| 3 11 81 | | | | | | | | | | | | | | |
| 4 8 81 | | | | | | | | | | | | | | |
| 5 27 81 | | | <0.001 | 0.006 | | 0.015 | <0.001 | 36.00 | 4.00 | <0.001 | | <0.001 | | 0.10 |
| 6 29 81 | | | <0.001 | 0.026 | | 0.024 | <0.001 | 48.00 | 3.20 | <0.001 | | 0.010 | | 0.16 |
| 7 20 81 | | | <0.001 | 0.030 | | 0.016 | <0.001 | 60.10 | 4.11 | <0.001 | | 0.030 | | 0.14 |
| 8 21 81 | | | 0.003 | 0.024 | | 0.017 | <0.001 | 50.00 | 26.0 | <0.001 | | 0.011 | | 0.15 |
| 9 23 81 | | | <0.001 | 0.030 | | 0.028 | <0.001 | 63.20 | 7.00 | <0.001 | | 0.030 | | 0.16 |
| 10 13 81 | | | <0.001 | 0.033 | | 0.014 | <0.001 | 52.20 | 5.90 | <0.001 | | <0.001 | | 0.19 |
| 11 4 81 | | | <0.001 | 0.015 | | 0.016 | <0.001 | 66.60 | 2.20 | <0.001 | | 0.002 | | 0.13 |
| 12 2 81 | | | | | | | | | | | | | | |

| Date | | Iron | Iron Total | Lead Total | Magnesium Total | Manganese Total | Mercury Total | Molybdenum Total | Nickel Total | Potassium Total | Selenium Total | Silica | Silver Total | Sodium Total | Zinc Total | | | | | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 31 80 | | 0.030 | 0.870 | <0.001 | 11.04 | 0.020 | <0.0002 | <0.001 | | 0.97 | <0.001 | | <0.001 | 10.0 | <0.001 | | | | | |
| 11 7 80 | | 0.020 | 0.140 | <0.001 | 21.8 | 0.010 | <0.0002 | <0.001 | | 0.78 | <0.001 | | <0.001 | 12.0 | 0.016 | | | | | |
| 12 17 80 | | | | | | | | | | | | | | | | | | | | |
| 1 28 81 | | | | | | | | | | | | | | | | | | | | |
| 2 18 81 | | | | | | | | | | | | | | | | | | | | |
| 3 11 81 | | | | | | | | | | | | | | | | | | | | |
| 4 8 81 | | | | | | | | | | | | | | | | | | | | |
| 5 27 81 | | 0.500 | 1.400 | 0.003 | 8.64 | 0.060 | <0.0002 | <0.001 | <0.001 | 0.71 | <0.001 | | <0.001 | 7.00 | 0.030 | | | | | |
| 6 29 81 | | 0.010 | 0.800 | <0.001 | 13.92 | 0.030 | <0.0002 | <0.001 | | 0.90 | <0.001 | | <0.001 | 2.50 | 0.035 | | | | | |
| 7 20 81 | | 0.030 | 1.320 | <0.001 | 16.32 | 0.010 | <0.0002 | <0.001 | | 0.87 | <0.001 | | <0.001 | 5.10 | 0.030 | | | | | |
| 8 21 81 | | 0.026 | 0.350 | <0.001 | 13.44 | 0.012 | <0.0002 | <0.001 | | 0.94 | 0.003 | | <0.001 | 14.30 | 0.045 | | | | | |
| 9 23 81 | | 0.040 | 0.330 | 0.004 | 11.52 | 0.010 | <0.0002 | <0.001 | | 0.89 | 0.010 | | <0.001 | 2.80 | 0.020 | | | | | |
| 10 13 81 | | 0.010 | 0.370 | 0.197 | 12.28 | 0.013 | <0.0002 | <0.001 | | 2.20 | <0.001 | | <0.001 | 40.00 | 0.020 | | | | | |
| 11 4 81 | | 0.019 | 0.450 | 0.144 | 18.00 | 0.020 | <0.0002 | <0.001 | | 2.90 | <0.001 | | <0.001 | 54.00 | 0.020 | | | | | |
| 12 2 81 | | | | | | | | | | | | | | | | | | | | Frozen: Snow |

VAUGHN HANSEN ASSOCIATES
Consultants / Engineers

# WATER QUALITY DATA

Station: B-3
Location: Mud Creek below Snyder Canyon

| DATE | TIME | FLOW | TEMPERATURE AIR | TEMPERATURE WATER | pH | COLIFORM TOTAL | COLIFORM FECAL | FECAL STREP | C.O.D. | B.O.D. | T.O.C. | DISSOLVED OXYGEN | OIL & GREASE | PHENOL | NITROGEN | | | | | PHOSPHATE TOTAL | PHOSPHATE ORTHO | | | | SOLIDS | | | | | COND | TURBIDITY | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| DATE | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | CADMIUM | CALCIUM | [illegible] | CHROMIUM HEXAVALENT | COBALT | COPPER | CYANIDE | [illegible] | [illegible] | IRON | IRON TOTAL | LEAD | [illegible] | [illegible] | [illegible] | [illegible] | NICKEL | [illegible] | [illegible] | SILICA | SILVER | [illegible] | ZINC | [illegible] | S.A.A. | NITRATE NITRITE | | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2-21-8 | | | <0.001 | 1.010 | | 0.010 | <0.001 | | | <0.001 | | 0.010 | | | | 0.030 | 0.870 | <0.001 | | | | | | | <0.001 | | <0.001 | | <0.001 | | | | | |
| 11-7-80 | | | 0.001 | 0.020 | | 0.050 | <0.001 | | | <0.001 | | <0.001 | | | | 0.020 | 0.140 | <0.001 | | | | | | | <0.001 | | 0.001 | | 0.010 | | | | | |
| 2-12-81 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1-28-81 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2-0-81 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3-11-81 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4-8-81 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5-27-81 | | | <0.001 | 0.002 | | 0.010 | <0.001 | | | <0.001 | | <0.001 | | | | 0.500 | 1.400 | <0.001 | | 0.060 | <0.0002 | <0.001 | <0.001 | | <0.001 | | <0.001 | | 0.015 | | | | | |
| 6-29-81 | | | <0.001 | 0.020 | | 0.020 | <0.001 | | | <0.001 | | <0.001 | | | | 0.010 | 0.800 | <0.001 | | 0.010 | <0.0002 | <0.001 | | | <0.001 | | <0.001 | | 0.010 | | | | | |
| 7-22-81 | | | <0.001 | 0.020 | | 0.010 | <0.001 | | | <0.001 | | <0.001 | | | | 0.130 | 0.320 | <0.010 | | 0.110 | | | | | <0.001 | | <0.001 | | 0.030 | | | | | |
| 8-21-81 | | | <0.001 | 0.015 | | 0.010 | <0.001 | | | <0.001 | | <0.001 | | | | 0.026 | 0.350 | <0.001 | | 0.009 | <0.0002 | <0.001 | | | <0.001 | | <0.001 | | 0.007 | | | | | |
| 11-23-81 | | | <0.001 | 0.015 | | 0.020 | <0.001 | | | <0.001 | | <0.001 | | | | 0.040 | 0.330 | 0.002 | | <0.001 | | | | | <0.001 | | <0.001 | | 0.002 | | | | | |
| 10-21-81 | | | <0.001 | 0.015 | | 0.011 | <0.001 | | | <0.001 | | <0.001 | | | | 0.010 | 0.370 | <0.001 | | 0.010 | | | | | <0.001 | | <0.001 | | 0.005 | | | | | |
| 11-11-81 | | | <0.001 | 0.020 | | 0.012 | <0.001 | | | <0.001 | | <0.001 | | | | 0.009 | 0.450 | 0.003 | | 0.014 | | | | | <0.001 | | <0.001 | | 0.003 | | | | | |
| 2-23-81 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

VAUGHN HANSEN ASSOCIATES
Consultants / Engineers

# WATER QUALITY DATA

Station: R-4
Location: Mud Creek at South boundary

| Date | Time | Flow (cfs) | Temperature Air (°C) | Temperature Water (°C) | pH | Coliform Total | Coliform Fecal | Fecal Strep | COD | BOD | TOC | Dissolved Oxygen | Oil & Grease | Phenol | Ammonia as N | Nitrate as N | Nitrite as N | Nitrogen Total Kjeldahl | Nitrogen Organic |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10-21-80 | 10:25 | 0.16 | -2 | 0 | 7.9 | | | | | | | | 1.40 | | <0.01 | 0.13 | | 0.01 | |
| 11-25-80 | 15:45 | 1.3 | | | 7.8 | | | | | | | | <0.01 | | <0.01 | 0.15 | | 0.02 | |
| 12-18-80 | 11:15 | -0- | | | | | | | | | | | | | | | | | |
| 1-21-81 | Frozen | | | | | | | | | | | | | | | | | | |
| 2-11-81 | Frozen | | | | | | | | | | | | | | | | | | |
| 3-11-81 | Inaccessible | | | | | | | | | | | | | | | | | | |
| 4-14-81 | 11:45 | -0- | | | | | | | | | | | | | | | | | |
| 5-27-81 | 14:00 | Inaccessible | | | | | | | | | | | | | | | | | |
| 6-29-81 | 14:30 | 0.5 | 24 | 18 | 8.4 | | | | | | | | 0.40 | | <0.01 | <0.1 | | 0.02 | |
| 7-20-81 | [illegible]:20 | 0.3 | 11 | 9 | 7.9 | | | | | | | | 1.20 | | <0.01 | 0.05 | | 0.02 | |
| 8-27-81 | 12:36 | 0.3 | 19 | 14 | 8.5 | | | | | | | | <0.01 | | <0.01 | <0.01 | | 0.02 | |
| 9-23-81 | 15:05 | 0.4 | 25 | 10 | 8.5 | | | | | | | | 3.80 | | <0.01 | <0.01 | | 0.20 | |
| 10-14-81 | 11:10 | 0.6 | -2 | 0 | 7.5 | | | | | | | | 11.20 | | 0.18 | 0.06 | | 1.24 | |
| 11-11-81 | 12:22 | | 9 | 1 | 8.0 | | | | | | | | 1.00 | | 0.30 | 0.08 | | 0.29 | |
| 12-23-81 | 11:50 | | Inaccessible | | | | | | | | | | | | | | | | |

| Date | Phosphate Total as P | Phosphate Ortho as P | Sulfate | Fluoride | Surfactant (MBAS) | TSS | Total Settleable Solids | TDS | Total Solids | Total Volatile Solids | Cond | Turbidity | Carbonate Alk as $CaCO_3$ | Bicarbonate Alk as $CaCO_3$ | Total Alk as $CaCO_3$ | Total Hardness as $CaCO_3$ | Acidity as $CaCO_3$ | Gross Alpha Activity | Gross Beta Activity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10-21-80 | 0.070 | 0.030 | 3.0 | | | 2.0 | | 244 | | | 380 | | <0.01 | 291.8 | 238 | | 8.0 | | |
| 11-25-80 | 0.180 | 0.050 | 12.0 | | | 4.0 | | 238 | | | 430 | | <0.01 | 278.6 | 228 | | 20.0 | | |
| 12-18-80 | | | | | | | | | | | | | | | | | | | |
| 1-21-81 | | | | | | | | | | | | | | | | | | | |
| 2-11-81 | | | | | | | | | | | | | | | | | | | |
| 3-11-81 | | | | | | | | | | | | | | | | | | | |
| 4-14-81 | | | | | | | | | | | | | | | | | | | |
| 5-27-81 | | | | | | | | | | | | | | | | | | | |
| 6-29-81 | 0.370 | 0.260 | 17.0 | | | 12.0 | | 195 | | | | | 9.60 | 125.6 | 160 | | <0.01 | | |
| 7-20-81 | 0.320 | 0.160 | 31.0 | | | 10.0 | | 225 | | | 360 | | 7.20 | 202.6 | 190 | | <0.01 | | |
| 8-27-81 | 0.240 | <0.001 | 15.0 | | | 8.0 | | 455 | | | 285 | | 3.60 | 212.6 | 186 | | <0.01 | | |
| 9-23-81 | 0.230 | 0.015 | 20.0 | | | 12.0 | | 230 | | | 250 | | 6.00 | [illegible] | 304 | | <0.01 | | |
| 10-14-81 | 0.100 | 0.040 | 30.0 | | | 7.0 | | 310 | | | 480 | | 4.80 | [illegible] | 254 | | <0.01 | | |
| 11-11-81 | 1.010 | 0.040 | 112 | | | 16.0 | | 378 | | | 225 | | 2.20 | 245 | [illegible] | | <0.01 | | |
| 12-23-81 | | | | | | | | | | | | | | | | | | | |

| Date | Aluminum Total | Antimony Total | Arsenic Total | Barium Total | Beryllium Total | Boron Total | Cadmium Total | Calcium Total | Chloride Diss. | Chromium Hexavalent | Cobalt Total | Copper Total | Cyanide as CN | Fluoride Diss. | [illegible] Total | Iron Diss. | Iron Total | Lead Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10-21-80 | | | <0.001 | 0.020 | | 0.020 | <0.001 | 67.20 | 5.0 | <0.001 | | 0.10 | <0.001 | 0.01 | | 0.030 | 0.150 | <0.001 |
| 11-25-80 | | | <0.001 | 0.038 | | 0.040 | <0.001 | 70.40 | 1.3 | <0.001 | | <0.001 | | 0.08 | | 0.030 | 0.060 | <0.001 |
| 12-18-80 | | | | | | | | | | | | | | | | | | |
| 1-21-81 | | | | | | | | | | | | | | | | | | |
| 2-11-81 | | | | | | | | | | | | | | | | | | |
| 3-11-81 | | | | | | | | | | | | | | | | | | |
| 4-14-81 | | | | | | | | | | | | | | | | | | |
| 5-27-81 | | | | | | | | | | | | | | | | | | |
| 6-29-81 | | | <0.001 | 0.125 | | 0.020 | <0.001 | 48.00 | 3.21 | <0.001 | | 0.010 | | | | 0.010 | 0.620 | 0.002 |
| 7-20-81 | | | <0.001 | 0.135 | | 0.018 | <0.001 | 60.80 | 3.75 | <0.001 | | 0.120 | | 0.14 | | 0.240 | 0.240 | <0.001 |
| 8-27-81 | | | 0.003 | 0.025 | | 0.015 | <0.001 | 60.80 | 1.54 | <0.001 | | 0.012 | | 0.15 | | 1.010 | 0.330 | <0.001 |
| 9-23-81 | | | <0.001 | 0.033 | | 0.017 | <0.001 | 64.80 | 8.00 | <0.001 | | 0.010 | | 0.14 | | 0.025 | 0.310 | <0.001 |
| 10-14-81 | | | <0.001 | 0.028 | | 0.020 | <0.001 | 52.00 | 3.10 | <0.001 | | <0.001 | | 0.13 | | 0.020 | 0.350 | 0.008 |
| 11-11-81 | | | <0.001 | 0.050 | | 0.025 | <0.001 | 48.00 | 2.30 | <0.001 | | <0.001 | | 0.12 | | 0.030 | 0.330 | 0.009 |
| 12-23-81 | | | | | | | | | | | | | | | | | | |

| Date | Magnesium Total | Manganese Total | Mercury Total | Molybdenum Total | Nickel Total | Potassium Total | Selenium Total | Silica as $SiO_2$ | Silver Total | Sodium Total | Zinc Total | Uranium Total | | | | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10-21-80 | 11.04 | 0.010 | <0.0002 | <0.001 | | 0.85 | <0.001 | | <0.001 | 12.00 | 0.010 | | | | | |
| 11-25-80 | 8.64 | 0.010 | <0.0002 | <0.001 | | 0.77 | 0.001 | | <0.001 | 12.20 | 0.018 | | | | | |
| 12-18-80 | | | | | | | | | | | | | | | | |
| 1-21-81 | | | | | | | | | | | | | | | | |
| 2-11-81 | | | | | | | | | | | | | | | | |
| 3-11-81 | | | | | | | | | | | | | | | | |
| 4-14-81 | | | | | | | | | | | | | | | | |
| 5-27-81 | | | | | | | | | | | | | | | | |
| 6-29-81 | 14.40 | 0.016 | <0.0002 | <0.001 | | 0.83 | <0.001 | | <0.001 | 2.50 | 0.010 | | | | | |
| 7-20-81 | 16.32 | 0.020 | <0.0002 | <0.001 | | 1.05 | <0.001 | | <0.001 | 4.40 | 0.010 | | | | | |
| 8-27-81 | 12.96 | 0.015 | <0.0002 | <0.001 | | 0.94 | 0.004 | | <0.001 | 9.50 | 0.012 | | | | | |
| 9-23-81 | 14.80 | 0.020 | <0.0002 | <0.001 | | 0.88 | 0.001 | | <0.001 | 2.90 | 0.010 | | | | | |
| 10-14-81 | 12.00 | 0.017 | <0.0002 | <0.001 | | 1.90 | <0.001 | | <0.001 | 49.00 | 0.015 | | | | | |
| 11-11-81 | 11.50 | 0.025 | <0.0002 | <0.001 | | 2.10 | <0.001 | | <0.001 | 36.00 | 0.015 | | | | | |
| 12-23-81 | | | | | | | | | | | | | | | | Frozen - Snow |

6-1-79

VAUGHN HANSEN ASSOCIATES
Consultants / Engineers

# WATER QUALITY DATA

Station : B-4
Location: Mud Creek at South Boundary

| DATE | Aluminum Diss. mg/l | Antimony Diss. mg/l | Arsenic Diss. mg/l | Barium Diss. mg/l | Beryllium Diss. mg/l | Boron Diss. mg/l | Cadmium Diss. mg/l | Calcium Diss. mg/l | Chloride Diss. mg/l | Chromium Hexavalent mg/l | Cobalt Diss. mg/l | Copper Diss. mg/l | Cyanide as CN mg/l | Fluoride Diss. mg/l | [illegible] Diss. mg/l |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| [illegible] | | | <0.001 | 0.010 | | 0.008 | <0.001 | | | <0.001 | | 0.10 | | | |
| [illegible] | | | <0.001 | 0.020 | | 0.030 | <0.001 | | | <0.001 | | <0.001 | | | |
| 7/2 80 | | | | | | | | | | | | | | | |
| 1 23 81 | | | | | | | | | | | | | | | |
| 2 11 81 | | | | | | | | | | | | | | | |
| 3 11 81 | | | | | | | | | | | | | | | |
| 4 8 81 | | | | | | | | | | | | | | | |
| 5 27 81 | | | | | | | | | | | | | | | |
| 6 29 81 | | | <0.001 | 0.020 | | 0.015 | <0.001 | | | <0.001 | | <0.001 | | | |
| 7 22 81 | | | <0.001 | 0.025 | | 0.010 | <0.001 | | | <0.001 | | 0.010 | | | |
| 8 21 81 | | | <0.001 | 0.020 | | 0.010 | <0.001 | | | <0.001 | | <0.001 | | | |
| 9 23 81 | | | <0.001 | 0.015 | | 0.010 | <0.001 | | | <0.001 | | 0.010 | | | |
| [illegible] | | | <0.001 | 0.020 | | 0.015 | <0.001 | | | <0.001 | | <0.001 | | | |
| [illegible] | | | <0.001 | 0.025 | | 0.015 | <0.001 | | | <0.001 | | <0.001 | | | |
| [illegible] | | | | | | | | | | | | | | | |

| DATE | Iron Diss. mg/l | Iron Total mg/l | Lead Diss. mg/l | Magnesium Diss. mg/l | Manganese Diss. mg/l | Mercury Diss. mg/l | Molybdenum Diss. mg/l | Nickel Diss. mg/l | Potassium Diss. mg/l | Selenium Diss. mg/l | Silica as $SiO_2$ mg/l | Silver Diss. mg/l | Sodium Diss. mg/l | Zinc Diss. mg/l | Vanadium Diss. mg/l | S.A.R. | Nitrate Nitrite mg/l | | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| [illegible] | 0.030 | 0.130 | <0.001 | | | | | | | <0.001 | | <0.001 | | 0.010 | | | | | |
| [illegible] | 0.030 | 0.060 | <0.001 | | | | | | | <0.001 | | <0.001 | | 0.010 | | | | | |
| 7/2 80 | | | | | | | | | | | | | | | | | | | |
| 1 23 81 | | | | | | | | | | | | | | | | | | | |
| 2 11 81 | | | | | | | | | | | | | | | | | | | |
| 3 11 81 | | | | | | | | | | | | | | | | | | | |
| 4 8 81 | | | | | | | | | | | | | | | | | | | |
| 5 27 81 | | | | | | | | | | | | | | | | | | | |
| 6 29 81 | 0.010 | 0.120 | 0.002 | | 0.002 | <0.0002 | <0.001 | | | <0.001 | | <0.001 | | 0.025 | | | | | |
| 7 22 81 | 0.250 | 0.250 | <0.001 | | 0.020 | | | | | <0.001 | | <0.001 | | 0.020 | | | | | |
| 8 21 81 | 0.010 | 0.330 | <0.001 | | 0.013 | <0.0002 | <0.001 | | | <0.001 | | <0.001 | | 0.010 | | | | | |
| 9 23 81 | 0.025 | 0.560 | <0.001 | | <0.001 | | | | | <0.001 | | <0.001 | | 0.002 | | | | | |
| [illegible] | 0.020 | 0.350 | <0.001 | | 0.010 | | | | | <0.001 | | <0.001 | | 0.015 | | | | | |
| [illegible] | 0.030 | 0.335 | <0.001 | | 0.020 | | | | | <0.001 | | <0.001 | | 0.010 | | | | | |
| [illegible] | | | | | | | | | | | | | | | | | | | |

I-81

VAUGHN HANSEN ASSOCIATES
Consultants / Engineers

# WATER QUALITY DATA

Station C B-5
Location Snider Canyon Creek at East property boundary

| Date | Time | Flow cfs | Temperature Air °C | Temperature Water °C | pH | Coliform Total | Coliform Fecal | Fecal Strep | COD mg/l | BOD mg/l | TOC mg/l | Dissolved Oxygen mg/l | Oil & Grease mg/l | Phenol mg/l | Nitrogen Ammonia as N mg/l | Nitrogen Nitrate as $NO_3$-N mg/l | Nitrogen Nitrite as $NO_2$-N mg/l | Nitrogen Total Kjeldahl mg/l | Nitrogen Organic mg/l | Phosphate Total as $PO_4$-P mg/l | Phosphate Ortho as $PO_4$-P mg/l | Sulfate as $SO_4$ mg/l | Sulfide as S mg/l | Surfactant as MBAS mg/l | Solids TSS mg/l | Solids Total Settleable Solids mg/l | Solids TDS mg/l | Solids Total mg/l | Solids Total Volatile mg/l | Cond µmhos | Turbidity FTU | Alkalinity as $CO_3$ mg/l | Alkalinity as $HCO_3$ mg/l | Total Hardness as $CaCO_3$ mg/l | Total Hardness mg/l | Acidity as $CaCO_3$ mg/l | Alpha Activity | Beta Activity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9.21.80 | 11:00 | 0.2 | -2 | 0 | 7.9 | | | | | | | | 0.40 | | <0.01 | 0.53 | | 0.01 | | 0.050 | 0.020 | 3.0 | | | 2.0 | | 244 | | | 430 | | <0.01 | 314.76 | 258 | | 18.0 | | |
| 11.28.80 | 16:30 | | | | 7.6 | | | | | | | | <0.01 | | <0.01 | 0.30 | | 0.04 | | 0.160 | 0.060 | 18.0 | | | 18.0 | | 280 | | | 470 | | <0.01 | [illegible] | 270 | | 26.0 | | |
| 12.17.80 | 11:30 | -0- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.21.81 | Frozen | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.11.81 | Frozen | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3.11.81 | Frozen | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4.8.81 | 11:27 | -0- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5.27.81 | Inaccessible | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6.24.81 | Not Sampled | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7.22.81 | 10:38 | 0.02 | 12 | 10 | 8.2 | | | | | | | | 0.20 | | <0.01 | 0.07 | | 0.02 | | 0.380 | 0.010 | 42.0 | | | 230 | | 260 | | | 400 | | 7.20 | 231.[illegible] | 202 | | <0.01 | | |
| 8.27.81 | 13:44 | -0- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9.25.81 | 13:04 | 0.01 | 13 | 7 | 8.2 | | | | | | | | 0.20 | | 0.44 | <0.01 | | 1.30 | | 0.440 | 0.120 | 51.0 | | | 7.0 | | 280 | | | 490 | | <0.01 | 258.4 | 212 | | 2.00 | | |
| 10.?.81 | 11:32 | 0.03 | -3 | 0 | 8.0 | | | | | | | | 14.60 | | 0.17 | 0.13 | | 0.25 | | 0.100 | 0.047 | 30.0 | | | 15.0 | | 320 | | | | | <0.01 | 395.5 | 275 | | <0.01 | | |
| 11.?.81 | 12:06 | -0- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12.?.81 | 1:50 | | Inaccessible | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| Date | Aluminum Total mg/l | Antimony Total mg/l | Arsenic Total mg/l | Barium Total mg/l | Beryllium Total mg/l | Boron Total mg/l | Cadmium Total mg/l | Calcium Total mg/l | Chloride Dis. mg/l | Chromium Hexavalent mg/l | Cobalt Total mg/l | Copper Total mg/l | Cyanide as CN mg/l | Fluoride Dis. mg/l | Total mg/l | Iron Dis. mg/l | Iron Total mg/l | Lead Total mg/l | Magnesium Total mg/l | Manganese Total mg/l | Mercury Total mg/l | Molybdenum Total mg/l | Nickel Total mg/l | Potassium Total mg/l | Selenium Total mg/l | Silica as $SiO_2$ mg/l | Silver Total mg/l | Sodium Total mg/l | Zinc Total mg/l | Vanadium Total mg/l | | | | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9.21.80 | | | <0.001 | 0.020 | | 1.020 | <0.001 | 74.40 | 3.9 | <0.001 | | 0.010 | <0.01 | 0.05 | | 0.030 | 0.050 | <0.001 | 19.20 | 0.010 | 0.0002 | <0.001 | | 1.02 | <0.001 | | <0.001 | 12.0 | 0.010 | | | | | |
| 11.28.80 | | | <0.001 | 0.040 | | 0.045 | <0.001 | 78.40 | 2.7 | <0.001 | | <0.001 | | 0.14 | | 0.020 | 0.370 | <0.001 | 16.80 | 0.030 | <0.0002 | <0.001 | | 1.03 | <0.001 | | <0.001 | 10.00 | 0.030 | | | | | |
| 12.17.80 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.21.81 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.11.81 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3.11.81 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4.8.81 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5.27.81 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6.24.81 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7.22.81 | | | <0.001 | 0.026 | | 0.025 | <0.001 | 64.00 | 7.71 | <0.001 | | 0.020 | | 0.22 | | 0.050 | 0.140 | <0.001 | 19.65 | 0.020 | <0.0002 | <0.001 | | 1.31 | <0.001 | | <0.001 | 8.00 | 0.025 | | | | | |
| 8.27.81 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9.25.81 | | | <0.001 | 0.040 | | 0.024 | <0.001 | 67.20 | 7.00 | <0.001 | | 0.015 | | 0.22 | | 0.039 | 0.270 | <0.001 | 17.76 | 0.010 | <0.0002 | <0.001 | | 1.07 | 0.012 | | <0.001 | 13.00 | 0.010 | | | | | |
| 10.?.81 | | | <0.001 | 0.035 | | 0.022 | <0.001 | 45.60 | 4.10 | <0.001 | | 0.010 | | 0.20 | | 0.030 | 0.390 | 0.008 | 18.24 | 0.020 | <0.0002 | <0.001 | | 2.10 | <0.001 | | <0.001 | 54.00 | 0.035 | | | | | |
| 11.?.81 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12.?.81 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | Frozen-Snow |

VAUGHN HANSEN ASSOCIATES
Consultants / Engineers

# WATER QUALITY DATA

Station B-5
Location Snider Canyon Creek at East boundary

| DATE | TIME | FLOW (cfs) | TEMPERATURE AIR (°C) | TEMPERATURE WATER (°C) | pH | COLIFORM TOTAL | COLIFORM FECAL | FECAL STREP | C.O.D. | B.O.D. | T.O.C. | DISSOLVED OXYGEN | OIL & GREASE | PHENOL | NITROGEN [illegible] | NITROGEN [illegible] | NITROGEN [illegible] | NITROGEN TOTAL KJELDAHL | NITROGEN ORGANIC | PHOSPHATE TOTAL | PHOSPHATE ORTHO | [illegible] | [illegible] | [illegible] | SOLIDS [illegible] | SOLIDS TOTAL [illegible] | SOLIDS [illegible] | SOLIDS TOTAL [illegible] | SOLIDS TOTAL VOLATILE | COND | TURBIDITY | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| DATE | ALUMINUM DISS. | ANTIMONY DISS. | ARSENIC DISS. | BARIUM DISS. | BERYLLIUM DISS. | BORON DISS. | CADMIUM DISS. | CALCIUM DISS. | CHLORIDE DISS. | CHROMIUM HEX or TR | COBALT DISS. | COPPER DISS. | CYANIDE | FLUORIDE DISS. | [illegible] DISS. | IRON DISS. | IRON TOTAL | LEAD DISS. | MAGNESIUM DISS. | MANGANESE DISS. | MERCURY DISS. | MOLYBDENUM DISS. | NICKEL DISS. | POTASSIUM DISS. | SELENIUM DISS. | SILICA as $SiO_2$ | SILVER DISS. | SODIUM DISS. | ZINC DISS. | [illegible] DISS. | S.A.R. | NITRATE NITRITE | | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | | MG/L | | |
| 4 21 80 | | | <0.001 | 0.010 | | 0.010 | <0.001 | | | <0.001 | | <0.001 | | | | 0.030 | 0.050 | <0.001 | | | | | | | <0.001 | | <0.001 | | 0.010 | | | | | |
| 7 28 80 | | | <0.001 | 0.020 | | 0.040 | <0.001 | | | <0.001 | | <0.001 | | | | 1.020 | 0.370 | <0.001 | | | | | | | <0.001 | | <0.001 | | 0.010 | | | | | |
| [illegible] 80 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 23 81 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 11 81 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 [illegible] 81 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 [illegible] 81 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 27 81 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 29 81 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 22 81 | | | <0.001 | 0.025 | | 0.020 | <0.001 | | | <0.001 | | 0.010 | | | | 0.050 | 0.140 | <0.001 | | 0.010 | | | | | <0.001 | | <0.001 | | 0.015 | | | | | |
| 8 [illegible] 81 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 23 81 | | | <0.001 | 0.017 | | 0.020 | <0.001 | | | <0.001 | | 0.008 | | | | 0.033 | 0.270 | <0.001 | | <0.001 | | | | | <0.001 | | <0.001 | | 0.001 | | | | | |
| 10 [illegible] 81 | | | <0.001 | 0.025 | | 0.013 | <0.001 | | | <0.001 | | <0.001 | | | | 0.080 | 0.390 | <0.001 | | 0.015 | | | | | <0.001 | | <0.001 | | 0.012 | | | | | |
| 11 8 81 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 21 81 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

1-81

VAUGHN HANSEN ASSOCIATES
Consultants / Engineers

# WATER QUALITY DATA

Station [illegible]
Location Utah Fuel Co. No. 1 & 2
Effluent

| Date | Time | Flow | Temp. Air | Temp. Water | pH | Coliform Total | Coliform Fecal | Fecal Strep | COD | BOD | TOC | Dissolved Oxygen | Oil & Grease | Phenol | Ammonia as N | Nitrate as N | Nitrite as N | Kjeldahl Total | Organic | Phosphate Total as $PO_4$ | Ortho as $PO_4$ | Sulfate as $SO_4$ | [illegible] | [illegible] | TSS | Total Settleable | TDS | Total [illegible] | Total Volatile | Cond. | Turbidity | Carbonate as $CO_3$ | Bicarbonate as $HCO_3$ | Total Alk. as $CaCO_3$ | Total Hardness as $CaCO_3$ | Acidity as $CaCO_3$ | Gross Alpha | Gross Beta |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7/28/[illegible] | 15:05 | 1 | 13 | 7 | 7.4 | | | | | | | | 0.20 | | <0.01 | 0.02 | | 0.01 | | 0.035 | <0.001 | 123 | | | 8.0 | | 400 | | | 610 | | <0.01 | 292.8 | 240 | | 5.0 | | |
| [illegible] | 17:30 | | | 7.1 | | | | | | | | | 0.60 | | <0.01 | 0.01 | | 0.03 | | 0.160 | 0.050 | 63.0 | | | 3.0 | | 440 | | | 620 | | <0.01 | [illegible] | 372 | | 68.0 | | |
| [illegible] | 2:00 | 1.4 | 4 | 8 | 7.2 | | | | | | | | 1.60 | | <0.01 | 0.03 | | 0.15 | | 0.040 | 0.020 | 46.0 | | | 6.0 | | 394 | | | 600 | | <0.01 | [illegible] | 348 | | 26.0 | | |
| [illegible] | 4:30 | 0.7 | 3 | 7 | 7.0 | | | | | | | | 1.20 | | <0.01 | <0.01 | | 0.02 | | 0.050 | 0.040 | 60.0 | | | 2.0 | | 400 | | | 387 | | <0.01 | [illegible] | 336 | | 28.0 | | |
| [illegible] | 13:30 | 1.3 | 5 | 7 | 7.0 | | | | | | | | <0.01 | | <0.01 | <0.01 | | 0.02 | | 0.070 | <0.001 | 51.0 | | | 2.0 | | 400 | | | 610 | | <0.01 | 427 | 350 | | 24.0 | | |
| [illegible] | 7:23 | | -1 | 6 | 7.6 | | | | | | | | 1.40 | | <0.01 | <0.01 | | <0.01 | | 0.020 | 0.010 | 66.0 | | | 6.0 | | 400 | | | 383 | | <0.01 | [illegible] | 324 | | 12.0 | | |
| [illegible] | 17:06 | 0.5 | 5 | | 7.3 | | | | | | | | 0.80 | | <0.01 | 0.02 | | 0.05 | | 0.190 | <0.001 | 76.0 | | | 3.0 | | 418 | | | 419 | | <0.01 | [illegible] | 322 | | 24.0 | | |
| 5/[illegible] | | | | | 7.8 | | | | | | | | <0.01 | | <0.01 | 0.02 | <0.01 | | | 0.480 | | 28.0 | | | 32.0 | | 420 | | | | | <0.01 | [illegible] | 316 | 378 | 4.25 | | |
| [illegible] | 3:15 | 0.2 | 27 | 12 | 6.8 | | | | | | | | <0.01 | | <0.01 | <0.01 | | 0.02 | | 0.200 | 0.130 | 20.5 | | | 8.0 | | 410 | | | 500 | | <0.01 | [illegible] | 316 | | [illegible] | | |
| [illegible] | 6:06 | 0.5 | 23 | 13 | 7.5 | | | | | | | | 0.60 | | <0.01 | 0.04 | | 0.03 | | 0.210 | 0.080 | 28.0 | | | 15.0 | | 419 | | | 650 | | <0.01 | [illegible] | 316 | | [illegible] | | |
| [illegible] | 13:30 | 0.3 | 24 | 10 | 7.3 | | | | | | | | 0.10 | | <0.01 | <0.01 | | 0.10 | | 0.190 | 0.120 | 19.5 | | | 4.0 | | 420 | | | 410 | | <0.01 | [illegible] | 314 | | [illegible] | | |
| [illegible] | 15:40 | 0.6 | 15 | 7 | 7.8 | | | | | | | | 0.20 | | 1.45 | <0.01 | | 0.60 | | 0.200 | 0.115 | 86.0 | | | 1.0 | | 470 | | | 485 | | <0.01 | [illegible] | 282 | | 2.00 | | |
| [illegible] | 2:41 | 1.0 | 5 | 7 | 7.2 | | | | | | | | 6.70 | | 0.21 | 0.35 | | 0.35 | | 0.200 | 0.050 | 90.0 | | | | | 440 | | | 680 | | 4.10 | [illegible] | 325 | | <0.01 | | |
| [illegible] | 12:45 | | 9 | 7 | 7.5 | | | | | | | | <0.01 | | 0.10 | 0.020 | | 0.45 | | 0.470 | 0.050 | 92.0 | | | 5.0 | | 422 | | | 425 | | <0.01 | 369 | 302.5 | | 26.0 | | |
| [illegible] | 12:00 | | -9 | 6 | 7.4 | | | | | | | | 0.40 | | 2.41 | 1.43 | | 2.80 | | 0.220 | 0.070 | 136 | | | 2.0 | | 468 | | | 425 | | <0.01 | [illegible] | [illegible] | | [illegible] | | |

| Date | Aluminum Total | Antimony Total | Arsenic Total | Barium Total | Beryllium Total | Boron Total | Cadmium Total | Calcium Total | Chloride Diss. | Chromium Hex. | Cobalt Total | Copper Total | Cyanide as CN | Fluoride Diss. | [illegible] Total | Iron Diss. | Iron Total | Lead Total | Magnesium Total | Manganese Total | Mercury Total | Molybdenum Total | Nickel Total | Potassium Total | Selenium Total | Silica as $SiO_2$ | Silver Total | Sodium Total | Zinc Total | Vanadium Total | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| [illegible] | | | <0.001 | 0.030 | | 0.060 | <0.001 | 92.40 | 1.8 | <0.001 | | 0.010 | <0.001 | 0.06 | | 0.010 | 0.800 | <0.001 | 29.78 | 0.165 | <0.0002 | <0.001 | | 2.55 | <0.001 | | <0.001 | 2.80 | <0.001 | | |
| [illegible] | | | <0.001 | 0.050 | | 0.065 | <0.001 | 96.10 | 4.1 | <0.001 | | <0.001 | | 0.14 | | 1.370 | 1.950 | 0.016 | 30.24 | 0.170 | <0.0002 | <0.001 | | 2.40 | <0.001 | | <0.001 | 26.00 | 0.055 | | |
| [illegible] | | | <0.001 | 0.045 | | 0.160 | <0.001 | 100.80 | 0.25 | <0.001 | | 0.015 | | 0.18 | | 0.260 | 0.990 | 0.005 | 28.08 | 0.030 | <0.0002 | <0.001 | | 2.53 | <0.001 | | <0.001 | 3.20 | 0.017 | | |
| [illegible] | | | <0.001 | 0.015 | | 0.150 | <0.001 | 97.90 | 2.10 | <0.001 | | <0.001 | | 0.20 | | 1.020 | 1.600 | 0.003 | 25.92 | 0.200 | <0.0002 | <0.001 | | 2.52 | <0.001 | | <0.001 | 8.00 | 0.017 | | Snowing |
| [illegible] | | | 0.002 | 0.045 | | 0.036 | <0.001 | 76.80 | 5.68 | <0.001 | | 0.010 | | 0.27 | | 0.820 | 1.100 | 0.002 | 35.52 | 0.160 | <0.0002 | <0.001 | | 2.55 | 0.002 | | <0.001 | 7.00 | 0.018 | | |
| [illegible] | | | 0.001 | 0.020 | | 0.055 | <0.001 | 89.20 | 6.38 | <0.001 | | <0.001 | | 0.20 | | 0.710 | 0.900 | 0.001 | 36.00 | 0.165 | <0.0002 | <0.001 | <0.001 | 7.54 | <0.001 | | <0.001 | 2.72 | 0.025 | | |
| [illegible] | | | <0.001 | 0.050 | | 0.055 | <0.001 | 104 | 4.00 | <0.001 | | 0.011 | | 0.16 | | 0.960 | 1.580 | 0.004 | 34.08 | 0.188 | <0.0002 | <0.001 | | 2.60 | <0.001 | | 0.017 | 3.00 | 0.020 | | |
| [illegible] | | | <0.001 | 0.010 | | 0.035 | <0.001 | 91.20 | 6.00 | <0.001 | | 0.015 | | 0.19 | | 0.710 | 0.790 | <0.001 | 35.04 | 0.180 | 0.0018 | <0.001 | <0.001 | 2.30 | <0.001 | | <0.001 | 12.00 | 0.020 | | |
| [illegible] | | | <0.001 | 0.050 | | 0.055 | <0.001 | 81.60 | 3.27 | <0.001 | | <0.001 | | 0.29 | | 0.850 | 1.000 | 0.004 | 33.12 | 0.178 | <0.0002 | <0.001 | | 2.50 | <0.001 | | <0.001 | 20.00 | 0.025 | | |
| [illegible] | | | <0.001 | 0.050 | | 0.035 | <0.001 | 100 | 4.09 | <0.001 | | 0.010 | | 0.20 | | 0.270 | 0.870 | 0.002 | 36.00 | 0.170 | <0.0002 | <0.001 | | 2.51 | <0.001 | | <0.001 | 3.10 | 0.020 | | |
| [illegible] | | | <0.001 | 0.015 | | 0.045 | <0.001 | 13.50 | 11.00 | <0.001 | | <0.001 | | 0.19 | | 0.640 | 0.930 | 0.002 | 4.60 | 0.160 | <0.0002 | 0.002 | | 2.48 | <0.001 | | <0.001 | 10.00 | 0.030 | | |
| [illegible] | | | <0.001 | 0.050 | | 0.040 | <0.001 | 85.60 | 7.00 | <0.001 | | 0.017 | | 0.22 | | 1.030 | 0.730 | <0.001 | 34.08 | 0.150 | <0.0002 | <0.001 | | 2.38 | 0.010 | | <0.001 | 11.00 | 0.025 | | |
| [illegible] | | | <0.001 | 0.040 | | 0.050 | <0.001 | 96.00 | 9.20 | <0.001 | | <0.001 | | 0.19 | | 0.560 | 0.930 | 0.009 | 39.84 | 0.155 | <0.0002 | <0.001 | | 11.20 | <0.001 | | <0.001 | 3.00 | 0.025 | | |
| [illegible] | | | <0.001 | 0.065 | | 0.044 | <0.001 | 94.80 | 2.00 | <0.001 | | <0.001 | | 0.19 | | 0.077 | 0.450 | <0.001 | 34.00 | 0.020 | <0.0002 | <0.001 | | 12.00 | <0.001 | | <0.001 | 3.50 | 0.028 | | |
| [illegible] | | | <0.001 | 0.070 | | 1.150 | <0.001 | 105 | 4.59 | <0.001 | | <0.001 | | 0.22 | | 0.080 | 0.410 | 0.010 | 34.50 | 0.022 | <0.0002 | <0.001 | | 12.30 | <0.001 | | <0.001 | 3.63 | 0.035 | | |

VAUGHN HANSEN ASSOCIATES
Consultants / Engineers

# WATER QUALITY DATA

Station
Location *Utah Fuel No. 1 & No. 2 Effluent*

| Date | Time | Flow | Temperature Air | Temperature Water | pH | Coliform Total | Coliform Fecal | Fecal Strep | COD | BOD | TOC | Dissolved Oxygen | Oil & Grease | Phenol | Nitrogen Ammonia | Nitrogen Nitrate | Nitrogen Nitrite | Nitrogen Total Kjeldahl | Nitrogen Organic | Phosphate Total | Phosphate Ortho | Sulfate | Chloride | Sulfide | Solids TSS | Solids Total Dissolved | Solids TDS | Solids Total | Solids Total Volatile | Color | Turbidity | Alkalinity | Bicarbonate | Total | Total Hardness | Alpha Gross Activity | Beta Gross Activity | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| Date | Aluminum | Antimony | Arsenic | Barium | Beryllium | Boron | Cadmium | Calcium | Chloride | Chromium | Cobalt | Copper | Cyanide | Fluoride | [illegible] | Iron | Iron Total | Lead | Magnesium | Manganese | Mercury | Molybdenum | Nickel | Potassium | Selenium | Silica as $SiO_2$ | Silver | Sodium | Zinc | Vanadium | S.A.R. | Nitrate Nitrite | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | mg/l | | mg/l | |
| [illegible] | | | <0.001 | 0.010 | | 0.010 | <0.001 | | | <0.001 | | 0.010 | | | | 0.010 | 0.800 | <0.001 | | | | | | | <0.001 | | <0.001 | | <0.001 | | | | |
| [illegible] | | | <0.001 | 0.010 | | 0.050 | <0.001 | | | <0.001 | | <0.001 | | | | 1.320 | 1.980 | 0.004 | | | | | | | <0.001 | | <0.001 | | 0.030 | | | | |
| [illegible] | | | <0.001 | 0.045 | | 0.100 | <0.001 | | | <0.001 | | 0.010 | | | | 0.760 | 0.990 | <0.001 | | | | | | | <0.001 | | <0.001 | | 0.010 | | | | |
| [illegible] | | | <0.001 | 0.042 | | 0.025 | <0.001 | | | <0.001 | | <0.001 | | | | 1.020 | 1.600 | 0.001 | | | | | | | <0.001 | | <0.001 | | 0.005 | | | | |
| [illegible] | | | <0.001 | 0.050 | | 0.030 | <0.001 | | | <0.001 | | <0.001 | | | | 0.820 | 1.100 | <0.001 | | | | | | | <0.001 | | <0.001 | | 0.005 | | | | |
| [illegible] | | | <0.001 | 0.045 | | 0.035 | <0.001 | | | <0.001 | | <0.001 | | | | 1.350 | 0.900 | 0.001 | | 0.160 | <0.0002 | <0.001 | <0.001 | | <0.001 | | <0.001 | | 0.002 | | | | |
| [illegible] | | | <0.001 | 0.040 | | 0.030 | <0.001 | | | <0.001 | | 0.010 | | | | 0.960 | 1.580 | 0.003 | | 0.140 | | | | | <0.001 | | <0.001 | | 0.014 | | | | |
| [illegible] | | | <0.001 | 0.040 | | 0.030 | <0.001 | | | <0.001 | | 0.010 | | | | 0.710 | 0.780 | <0.001 | | 0.150 | 0.0010 | <0.001 | <0.001 | | <0.001 | | <0.001 | | 0.010 | | | | |
| [illegible] | | | <0.001 | 0.045 | | 0.030 | <0.001 | | | <0.001 | | <0.001 | | | | 0.950 | 1.000 | 0.002 | | 0.170 | <0.0002 | <0.001 | | | <0.001 | | <0.001 | | 0.015 | | | | |
| [illegible] | | | <0.001 | 0.040 | | 0.020 | <0.001 | | | <0.001 | | 0.010 | | | | 1.770 | 0.920 | <0.001 | | 0.120 | | | | | <0.001 | | <0.001 | | 0.011 | | | | |
| [illegible] | | | <0.001 | 0.040 | | 0.028 | <0.001 | | | <0.001 | | <0.001 | | | | 0.640 | 0.930 | <0.001 | | 0.150 | | | | | <0.001 | | <0.001 | | 0.024 | | | | |
| [illegible] | | | <0.001 | 0.040 | | 0.130 | <0.001 | | | <0.001 | | 0.110 | | | | 0.030 | 0.230 | <0.001 | | 0.090 | | | | | <0.001 | | <0.001 | | 0.002 | | | | |
| [illegible] | | | <0.001 | 0.045 | | 0.035 | <0.001 | | | <0.001 | | <0.001 | | | | 0.560 | 0.950 | 0.003 | | 0.140 | | | | | <0.001 | | <0.001 | | 0.005 | | | | |
| 11-11-81 | | | <0.001 | 0.040 | | 0.035 | <0.001 | | | <0.001 | | <0.001 | | | | 0.077 | 0.400 | <0.001 | | 0.018 | | | | | <0.001 | | <0.001 | | 0.016 | | | | |
| [illegible] | | | <0.001 | 0.040 | | 0.030 | <0.001 | | | <0.001 | | <0.001 | | | | 1.080 | 0.410 | <0.001 | | 0.015 | | | | | <0.001 | | <0.001 | | 0.020 | | | | |

Exhibit 6

VEGETATION INFORMATION

Exhibit 6

# VEGETATION INFORMATION

## VEGETATION TYPE DESCRIPTIONS

### Meadow

The meadow vegetation type is found along drainages and often within one to ten feet of waterways. Slopes are gentle to moderate, 2-5 percent, and soils are deep and moderately well drained.

The area is considered to be a good range condition. Using SCS production guidelines for average precipitation years, usable forage would be 2,000 lbs/acre. Grasses and forbs dominate the area with canary reedgrass, sedges and nettles being prominent. Clumps of willow are located sporadically along the waterways. The site specific species list is on Table 1, Vegetation Species - Meadow.

### Mixed Mountain Shrub

The mixed mountain shrub type of vegetation is generally found on moderately steep to very steep mountain slopes of 40-65 percent. Exposures are west to southwest. The soils are moderately deep and well drained.

According to SCS guidelines, this area, reported in good condition, would yield 3,500 lbs/acre of usable forage.

The dominant overstory shrub is big sagebrush and the prevalant grass is Kentucky bluegrass. Major forbs consisted of monument plant and penstemon. The species list for mixed mountain shrub vegetation type is on Table 2, Vegetation Species - Mixed Mountain Shrub.

Table 1 - Part 1

VEGETATION SPECIES - MEADOW

| Scientific Name | Common Name |
|---|---|
| Grasses and Grasslike | |
| Agropyron trachycaulum | slender wheatgrass |
| Bromus anomalus | nodding brome |
| Bromus carinatus | mountain brome |
| Carex nebraskensis | sedge |
| Carex spp. | sedge |
| Elymus canadensis | Canada wild rye |
| Juncus spp. | rush |
| Phalaris arundinacea | canary reedgrass |
| Poa pratensis | Kentucky bluegrass |
| Stipa lettermanii | Letterman needlegrass |
| Forbs | |
| Achillea millefoliom | yarrow |
| Artemisia dracunculus | false tarragon |
| Circium spp. | thistle |
| Delphinium occidentalis | tall larkspur |
| Equisetum arvense | field horsetail |
| Epilobium paniculatum | willowherb |
| Erigeron speciosus | fleabane |
| Fragaria spp. | wild strawberry |
| Frasera speciosa | monument plant |
| Geranium richardsonii | wild geranium |
| Hackelia floribunda | false forget-me-not |
| Heracleum sphondylium | cow parsnip |
| Heuchera parvifolia | alum root |
| Lathyrus spp. | aspen peavine |
| Osmorhiza occidentalis | sweet anise |
| Polemonium spp. | jacob's ladder |
| Potentilla gracilis | cinquefoil |

Table 1 - Part 2

VEGETATION SPECIES - MEADOW

| Scientific Name | Common Name |
|---|---|
| Forbs (continued) | |
| Potentilla spp. | cinquefoil |
| Rudbeckia laciniata | western coneflower |
| Senecio eromophilus var. kingii | groundsel |
| Senecio serra | groundsel |
| Smilacina stellata | false solomon seal |
| Thalictrum fendleri | meadow rue |
| Trifolium spp. | clover |
| Urtica dioica | stinging nettles |
| Shrubs | |
| Ribes spp. | currant |
| Rubus spp. | wild raspberry |
| Symphoricarpos spp. | snowberry |

Table 2 - Part 1

VEGETATION SPECIES - MIXED MOUNTAIN SHRUB

| Scientific Name | Common Name |
|---|---|
| Grasses | |
| Agropyron trachycaulum | slender wheatgrass |
| Bromus marginatus | mountain brome |
| Elymus canadensis | Canada wild rye |
| Poa pratensis | Kentucky bluegrass |
| Forbs | |
| Achillea millefolium | western yarrow |
| Agastache urticifolia | nettleleaf horsemint |
| Androsace septentrionalis | rock primrose |
| Aster spp. | aster |
| Castilleja spp. | Indian paintbrush |
| Chaenactis douglasii | false yarrow |
| Delphinium occidentalis | tall larkspur |
| Eriogonum spp | buckwheat |
| Frasera speciosa | monument plant |
| Geranium spp. | geranium |
| Heliomeris multiflora | little sunflower |
| Ipomopsis aggregata | skyrocket gilia |
| Linum lewisii | prairie flax |
| Mahonia repens | Oregon grape |
| Penstemon spp. | penstemon |
| Potentilla spp. | cinquefoil |
| Ranunculus spp. | buttercup |
| Rudbeckia laciniata | western coneflower |
| Senecio serra | groundsel |
| Tragopogon dubius | salsify |
| Vicia americana | American vetch |

Table 2 - Part 2

VEGETATION SPECIES - MIXED MOUNTAIN SHRUB

| Scientific Name | Common Name |
|---|---|
| Shrubs | |
| Artemisia tridentata | big sagebrush |
| Chrysothamnus nauseosus | rubber rabbitbrush |
| Chrysothamnus viscidiflorus | green rabbitbrush |
| Ribes cereum | wax currant |
| Sambucus spp. | elderberry |
| Symphoricarpos spp. | snowberry |

## Aspen

The aspen vegetation type occurs on all aspects but is predominantly found on north and east facing slopes. The slopes are generally steep, 50-70 percent, and soils are moderately deep and well drained. This type is in good condition and, according to SCS guidelines, will produce approximately 4,000 lbs/acre of usable forage.

The dominant overstory is aspen with Kentucky bluegrass, nodding brome, and aspen peavine being prominent in the understory. Table 3, Vegetation Species - Aspen, lists specific species for this area.

## Spruce/Fir

The spruce/fir vegetation type is generally located on north facing slopes although may be spread from the northeast to northwest portion of a hillside. Slopes are 50-70 percent with moderately deep and well drained soils. Reported in fair condition, usable forage would be 800 lbs/acre.

Douglas fir is the dominant overstory with litter being the major understory component. Site specific species are found on Table 4, Vegetation Species - Spruce/Fir.

## Spruce/Fir/Aspen

This vegetation type is found between spruce/fir and aspen vegetation types on steep slopes of 50-70 percent. Soils are moderately deep and well drained. The aspect is generally north to northwest. Determined to be in good condition, the SCS guidelines report 2,400 lbs/acre of usuable forage for this type.

Co-dominant overstory species are Douglas fir and aspen with an upward trend of Douglas fir seedlings and consequent decline of aspen saplings. The understory dominants were nodding brome, wild strawberry and snowberry. Vegetation species of this community are shown on Table 5, Vegetation Species - Spruce/Fir/Aspen.

Table 3 - Part 1

VEGETATION SPECIES - ASPEN

| Scientific Name | Common Name |
|---|---|
| <u>Grasses and Grasslike</u> | |
| Agropyron trachycaulum | slender wheatgrass |
| Bromus anomalus | nodding brome |
| Bromus carinatus | mountain brome |
| Carex spp. | sedge |
| Elymus canadensis | Canada wild rye |
| Elymus glaucus | blue wild rye |
| Poa pratensis | Kentucky bluegrass |
| Stipa lettermannii | letterman needlegrass |
| <u>Forbs</u> | |
| Achillea millefolium | western yarrow |
| Androsace septentrionalis | rock primrose |
| Aster spp. | aster |
| Delphinium spp. | larkspur |
| Dugaldia hoopesii | orange sneezeweed |
| Epilobium angustifolium | fireweed |
| Erigeron spp. | fleabane |
| Erysimum spp. | wallflower |
| Frageria spp. | wild strawberry |
| Frasera speciosa | monument plant |
| Galium spp. | bedstraw |
| Geranium spp. | geranium |
| Hackelia floribunda | false forget-me-not |
| Lathyrus spp. | aspen peavine |
| Lupinus spp. | lupine |
| Mahonia repens | Oregon grape |
| Osmorhiza occidentalis | sweet anise |
| Polemonium spp. | jacob's ladder |
| Potentilla spp. | cinquefoil |

Table 3 - Part 2

VEGETATION SPECIES - ASPEN

| Scientific Name | Common Name |
|---|---|
| Forbs (continued) | |
| Senecio spp. | groundsel |
| Smilacina stellata | false solomon seal |
| Taraxacum officianale | dandelion |
| Thalictrum fendleri | meadowrue |
| Vicia americana | American vetch |
| Viola spp. | violet |
| Shrubs | |
| Arcotostaphylos uva-ursi | kinnikinnik |
| Rosa woodsii | woods rose |
| Shepherdia canadensis | buffaloberry |
| Symphoricarpos spp. | snowberry |
| Physocarpus spp. | ninebark |
| Sambucus spp. | elderberry |
| Ribes cereum | wax currant |
| Ribes spp. | currant |
| Trees | |
| Populus tremuloides | quaking aspen |

Table 4

VEGETATION SPECIES - SPRUCE/FIR

| Scientific Name | Common Name |
| --- | --- |
| <u>Grasses</u> | |
| Bromus anomalus | nodding brome |
| <u>Forbs</u> | |
| Mahonia repens | Oregon grape |
| <u>Shrubs and Subshrubs</u> | |
| Arctostaphylos uva-ursi | kinnikinnik |
| <u>Trees</u> | |
| Picea engelmannii | Engelmann spruce |
| Picea pungens | Colorado blue spruce |
| Pseudotsuga menziesii | Douglas fir |

Table 5 - Part 1

VEGETATION SPECIES - SPRUCE/FIR/ASPEN

| Scientific Name | Common Name |
|---|---|
| Grasses and Grasslike | |
| Agropyron trachycaulum | slender wheatgrass |
| Agrostis spp. | redtop |
| Bromus anomalus | nodding brome |
| Bromus carinatus | mountain brome |
| Carex spp. | sedge |
| Elymus canadensis | Canada wild rye |
| Elymus glaucus | blue wild rye |
| Poa pratensis | Kentucky bluegrass |
| Stipa lettermannii | Letterman needlegrass |
| Forbs | |
| Achillea millefolium | yarrow |
| Androsace septentrionalis | rock primrose |
| Aster spp. | aster |
| Delphinium spp. | larkspur |
| Dugaldia hoopesii | orange sneezeweed |
| Epilobium angustifolium | fireweed |
| Erigeron spp. | fleabane |
| Erysimum spp. | wallflower |
| Fragaria spp. | wild strawberry |
| Frasera speciosa | monument plant |
| Galium spp. | bedstraw |
| Geranium spp. | geranium |
| Hackelia floribunda | false forget-me-not |
| Lathyrus spp. | aspen peavine |
| Lupinus spp. | lupine |
| Mahonia repens | Oregon grape |
| Osmorphiza occidentalis | sweet anise |
| Polemonium spp. | polemonium |

Table 5 - Part 2

VEGETATION SPECIES - SPRUCE/FIR/ASPEN

| Scientific Name | Common Name |
|---|---|
| Forbs (continued) | |
| Potentilla spp. | cinquefoil |
| Senecio spp. | groundsel |
| Similacina stellata | false solomon seal |
| Taraxacum officianale | dandelion |
| Thalictrum fendleri | meadowrue |
| Vicea americana | American vetch |
| Viola spp. | violet |
| Shrubs | |
| Arcostaphylos uva-ursi | bearberry |
| Rosa woodsii | woods rose |
| Shepherdia canadensis | buffaloberry |
| Symphoricarpos spp. | snowberry |
| Physocarpus spp. | ninebark |
| Sambucus spp. | elderberry |
| Ribes cereum | wax current |
| Ribes spp. | current |
| Trees | |
| Picea engelmannii | Engelmann spruce |
| Picea pungens | Colorado blue spruce |
| Populus tremuloides | quaking aspen |
| Pseudotsuga menziesii | Douglas fir |

## Disturbed

Areas of disturbance include roads, the portal pad, office and shop building areas, conveyor area, refuse area and are chiefly limited to the east side of Mud Creek at the base of the slope.

## Reference Area

A reference area was selected in the spruce/fir/aspen vegetation type. The location of this reference area was based on similarities of slope, aspect, soils, and drainage proximity to that of the previously disturbed area. The Vegetation Map (Map 4) shows the location of the one acre reference area in Long Canyon.

## SAMPLING METHODS

A vegetation sampling program was initiated in September, 1983 for the spruce/fir/aspen reference area within the permit area of the Blazon #1 Mine near Clear Creek, Utah. The vegetation parameters of cover and woody plant density were quantified during this survey. Information concerning plant production has been compiled from Soil Conservation Service surveys.

A reference area of approximately one acre in size was established for the spruce/fir/aspen vegetation type. The reference area established is delineated on the Vegetation Map (Map 4). This reference area was selected for use in determining success of reclamation for the disturbed area. During discussions with DOGM personnel, it was agreed that this vegetative community most accurately represented the area which has been disturbed by the surface facilities of the Blazon #1 Mine.

In September, quantitative vegetation data for cover and density was collected at the reference area. The techniques utilized for field data collection involved the use of a 50 meter tape and a standard 10-point frame. Transects were randomly located within the reference area. To determine cover, the ten point frame was read at every five meters along the 50 meter tape which yielded a total of 50 hits per transect, thus 2 transects per 50 meter tape. Shrub density was obtained by counting all shrubs rooted within one meter of the 50 meter tape. Tree density was obtained using the Point-Center-Quarter method. Center-points were located every ten meters along the 50 meter tape.

The statistical method for sample adequacy recommended in the State of Utah Vegetation Guidelines for Permanent Program Submissions for Coal Mines, was used to determine minimum sample size. The sample adequacy formula is:

$$m = \frac{t^2 s^2}{(dx)^2}$$

where:

m = the minimum number of observations needed

t = t-table value,

(t = 1.282 for 80% confidence,

t = 1.645 for 90% confidence)

s = the sample standard deviation

d = the desired change in the mean (.1)

x = the sample mean of the parameter in question

The reference area is considered a woodland, therefore, the 80% confidence interval was used where t = 1.282.

## RESULTS

### Total Cover

A total of 17 transects were taken in the reference area to document cover. The mean total vegetative cover was 25.06 hits per 50 points (50.12%). Standard deviation was 5.67. The required sample size determined was 9, which was acceptable.

### Density (Shrub)

A total of 20 - 1 x 50 meter belt transects were taken in the reference area to determine density for shrubs. The mean density for this area was 14.95 shrubs/transects, with the standard deviation of 5.13. The required sample size was determined to be 20; therefore, sample adequacy was met for this area.

### Density (Tree)

A total of 80 Point-Center-Quarter points, 40 points each for Douglas fir and aspen, were taken to determine tree density for the reference area. Tree density was calculated using the following approved formula in the Utah Vegetation guidelines:

For each point: $$\left(\frac{y^1 = y^2 = y^3 = y^4}{4}\right)^2 = A_j$$

$$\text{Density} = 43{,}560 \div \frac{\sum A_j}{n}$$

where yi = measurement from point to nearest plant in the ith quarter (in feet)

$A_j$ = mean area/plant at the $j^{th}$ point

n = sample size (number of points sampled)

Density = plants/acre

The mean density of Douglas fir was 556.5 stems/acre with a standard deviation of 491.9. Aspen values were 910.5 and 598.3, respectively. The average tree density was 733.5 stems/acre with a standard deviation of 572.6. Using the average tree values, the minimum sample size was over 100. Therefore, 40 PCQ points were sampled for each which is the maximum sample size as delineated by the Utah State Guidelines, and thus is adequate.

## Production

Production estimates for each vegetation type shown on the Vegetation Map (Map 4) were obtained from information compiled from Soil Conservation Service surveys. The preliminary soil and vegetation survey for the Blazon Mining Company was conducted on March 11, 1980. Included in this study are production estimates for range sites found on and adjacent to the permit area. Using these estimates in conjunction with SCS field data compiled on July 23, 1980 and field survey notes of September 17, 1983, annual yield in pounds per acre for each of the five vegetation types was obtained. The respective amounts are reported in the preceding vegetation type descriptions and summarized below:

- Meadow 2,000 lbs/acre
- Mixed Mountain Shrub 3,500 lbs/acre
- Aspen 4,000 lbs/ acre
- Spruce/Fir 800 lbs/acre
- Spruce/Fir/Aspen 2,400 lbs/acre

North American Equities NV proposes to initiate a production sampling program prior to reclamation. Site sepcific data will serve as a basis for success standards for production.

## VEGETATIVE COVER SUMMARY

Vegetative cover is compiled and presented by species type in Table 6, Vegetative Cover Summary. The total vegetative cover is 50.12 percent.

Grass and grasslike species compose 9.42 percent of total cover and 18.77 percent of relative vegetative cover (composition). Nodding brome and Kentucky bluegrass are the dominant grasses of the reference area.

The forbs compose a total of 32.82 percent for total cover and 65.52 percent of composition. The prevalant forbs are wild strawberry, aspen peavine, Oregon grape and violet.

The remainder of total vegetative cover, 7.88 percent, is provided by shrubs and trees. This lifeform provides 15.75 percent of the vegetative composition. Douglas fir was the prevalent tree; snowberry and woods rose were dominant shrubs.

Total litter is 45.77 percent, bare ground 2.82 percent and rocks comprise 1.29 percent.

Diversity for each species has been calculated using the Shannon Wiener Index Formula, as approved by the Utah Vegetation Guidelines:

$$H' = \sum Pi \log Pi$$

where: $H'$ = diversity measure

$$Pi = \frac{Ni}{N}$$

$Ni$ = cover value of species i

$N$ = sum of all species cover value

The total reported diversity is 1.306.

Table 6 - Part 1

VEGETATIVE COVER SUMMARY

| Species | Percent Cover | Composition | Diversity |
|---|---|---|---|
| Grasses and Grasslike | | | |
| Agropyron trachycaulum<br>slender wheatgrass | .24 | .48 | .011 |
| Agrostis spp.<br>bentgrass | .47 | .96 | .019 |
| Bromus anomalus<br>nodding brome | 4.47 | 8.92 | .094 |
| Carex spp.<br>sedge | .59 | 1.16 | .022 |
| Elymus canadensis<br>Canadian wild rye | .94 | 1.87 | .032 |
| Poa pratensis<br>Kentucky bluegrass | 2.71 | 5.38 | .068 |
| Sub-Total | 9.42 | 18.77 | .246 |
| Forbs | | | |
| Achillea millefolium<br>western yarrow | 1.88 | 3.75 | .053 |
| Androsace septentrionalis<br>rock primrose | .24 | .48 | .011 |
| Aster spp.<br>aster | .47 | .96 | .019 |
| Dugaldia hoopesii<br>orange sneezeweed | 2.36 | 4.70 | .062 |
| Epilobium spp.<br>fireweed | .11 | .24 | .006 |
| Erigeron spp.<br>fleabane | .11 | .24 | .006 |
| Forb #1<br>unknown | .24 | .48 | .011 |
| Fragaria spp.<br>wild strawberry | 4.94 | 9.84 | .099 |

Table 6 - Part 2

VEGETATIVE COVER SUMMARY

| Species | Percent Cover | Composition | Diversity |
|---|---|---|---|
| Forbs (continued) | | | |
| Frasera speciosa | 1.18 | 2.35 | .038 |
| monument plant | | | |
| Galium spp. | .35 | .72 | .015 |
| bedstraw | | | |
| Geranium spp. | .12 | .24 | .006 |
| geranium | | | |
| Hackelia floribunda | .12 | .24 | .006 |
| false forget-me-not | | | |
| Lathyrus spp. | 4.24 | 8.45 | .091 |
| aspen peavine | | | |
| Lupinus spp. | .94 | 1.87 | .032 |
| lupine | | | |
| Lycopodium spp. | .82 | 1.63 | .029 |
| clubmoss | | | |
| Mahonia repens | 4.00 | 7.97 | .088 |
| Oregon grape | | | |
| Osmorhiza spp. | 2.12 | 4.22 | .058 |
| sweet anise | | | |
| Senecio spp. | .47 | .96 | .019 |
| groundsel | | | |
| Smilacina stellata | .82 | 1.63 | .029 |
| false solomon seal | | | |
| Taraxacum officianale | .24 | .48 | .011 |
| dandelion | | | |
| Thalictrum fendleri | .58 | 1.16 | .022 |
| meadow rue | | | |
| Vicia americana | .35 | .72 | .015 |
| American vetch | | | |
| Viola spp. | 6.12 | 12.19 | .111 |
| violet | | | |
| Sub-Totals | 32.82 | 65.52 | .837 |

Table 6 - Part 3
VEGETATIVE COVER SUMMARY

| Species | Percent Cover | Composition | Diversity |
|---|---|---|---|
| Shrubs and Trees | | | |
| Arctostaphylos vra-ursi kinnikinnik | .35 | .72 | .015 |
| Physocarpos spp. ninebark | .12 | .24 | .006 |
| Populus tremuloides aspen | .71 | 1.40 | .026 |
| Pseudotsuga menziesii Douglas fir | 4.23 | 8.45 | .091 |
| Rosa woodsii woods rose | 1.06 | 2.11 | .035 |
| Shepherdia canadensis buffalo berry | .35 | .72 | .015 |
| Symphoricarpos spp. snowberry | 1.06 | 2.11 | .035 |
| Sub-Totals | 7.88 | 15.75 | .223 |
| TOTAL | 50.12 | 100.04 | 1.306 |

WOODY PLANT DENSITY SUMMARY

Woody plant density is compiled and presented by species in Table 7.

Shrub density was determined by 1 x 50 m belt transects. the total amount of rooted species within the transect was divided by 20 (total transects) to determine average stem number per transect. This number is then divided by 50 (for stems/$m^2$). Finally, the stems/$m^2$ is multiplied by a factor of 4,047 to determine density of stems/acre. Snowberry and woods rose were found to be the dominant shrubs.

Tree density was acquired with the utilization of the Point Center Quarter method. Density values were obtained by the utilization of the accepted formula as previously outlined in Methodology: Density (Trees).

The density of Douglas fir is 556.5 stems/acre and that of aspen is 910.5 stems/acre. These values totaled yield 1,467.0 mature woody stems/acre.

Both shrub and tree densities combined indicate the selected reference area has a total woody plant density of 2,677.05 stems per acre.

Table 7

SPRUCE/FIR/ASPEN WOODY PLANT DENSITY SUMMARY

| Species | Average Stems/Acre |
|---|---|
| Shrubs | |
| 1 x 50 belt transects | |
| Arctostaphylos uva-ursi kinnikinnik | 141.65 |
| Ribes cereum squaw currant | 12.14 |
| Ribes spp. currant | 20.24 |
| Rosa woodsii wood's rose | 424.94 |
| Shepherdia canadensis buffaloberry | 36.42 |
| Symphoricarpos spp. snowberry | 574.67 |
| Sub-Total | 1,210.06 |
| Trees | |
| Point Center Quarter | |
| Populus tremuloides aspen | 910.5 |
| Pseudotsuga menziesii Douglas fir | 556.5 |
| Sub-Total | 1,467.0 |
| TOTAL | 2,677.06 |

Exhibit 7

WATER WELL EXCHANGE DOCUMENT

BEFORE THE STATE ENGINEER OF THE STATE OF UTAH

| | | |
|---|---|---|
| IN THE MATTER OF EXCHANGE APPLI-<br>CATION NUMBER 1669 (91 Area) | )<br>)<br>) | MEMORANDUM DECISION |

Exchange Application Number 1669 (91 Area) was filed by T. O. E. Investment Company, 909 17th Street, Denver, Colorado 80202 and was made for the right to exchange a maximum of 3.0 acre-feet of water represented by Stock Certificate Number 3667, Price River Water User's Association, indicating the ownership by the applicant of one share of the capitol stock of said association which has storage rights in Scofield Reservoir. Stock Certificate Number 3667 has been stamped NON-TRANSFERABLE by the Price River Water User's Association. A maximum of 3.0 acre-feet of water will be released from Scofield Reservoir into the Price River and, in lieu thereof, a maximum of 3.0 acre-feet of water will be diverted from a four-inch well at a point South 2640 feet and East 1056 feet from the NW Corner of Section 4, T14S, R7E, SLB&M. The water will be used for the operation of a coal mine.

It is the opinion of the State Engineer that this exchange may be made providing that the provisions of the Scofield Exchange Policy of the Utah State Engineer, as outlined herein, are adhered to.

It is, therefore, ORDERED and Exchange Application Number 1669 (91 Area) is hereby APPROVED subject to the following stipulations:

1. No more water may be diverted during the use period than is represented by the Stock in the Price River Water User's Association, which is the basis for the exchange.

2. Installation of a totalizing water meter at the expense of the applicant will be required before any water is diverted. Water meters shall be available to the Price River Commissioner for examination at all reasonable times.

3. The water being exchanged shall be regulated by the Price River Commissioner at the expense of the applicant.

4. Continued ownership of the Stock Certificate which is the basis for the exchange shall be required in order to maintain this exchange.

5. No change of point of diversion or place of use of the water covered by this exchange shall be made without first obtaining the approval of the State Engineer.

This decision is subject to the provisions of Section 73-3-14, Utah Code Annotated, 1953, which provides for plenary review by the filing of a civil action in the appropriate district court within sixty days from the date hereof.

Dated this 24th day of October, 1980.

Dee C. Hansen

Dee C. Hansen, State Engineer

DCH:MP/dph

Mailed a copy of the foregoing Memorandum Decision this 24th day of October, 1980, to:

T. O. E. Investment Company
909 17th Street
DENVER CO 80202

PRICE RIVER WATER USERS ASSOCIATION
C/o Ms. Ann O'Brien, Secretary
Carbon County Courthouse
Price, UT 84501

PRICE RIVER DISTRIBUTION SYSTEM
C/o Mr. Lyle Bryner, President
Route One, Box 169
Price, UT 84501

Mr. David S. Rowley, Jr.
PRICE RIVER COMMISSIONER
Route One, Box 73
Helper, UT 84526

By: Debra P. Horrocks

Debra P. Horrocks, Secretary

FORM 108

Exchange Application No. 1664

91 aiia

# APPLICATION FOR THE RIGHT
# OF EXCHANGE OF WATER
# STATE OF UTAH

WATER RIGHTS

For the purpose of obtaining permission to make an exchange of water, application is hereby made to State Engineer, based upon the following showing of facts submitted in accordance with the requirements of Sec. 73-3-20, Utah Code Annotated, 1953.

1. The name of the applicant is T.O.E. Investment Co.
2. The post office address of the applicant is 907 17th St. Denver, Colo. 80202
3. The right to be exchanged was acquired by Stock Cert. No. 3667, 3 shares Price River Water Users Assn
   (Give application No., certificate No., Decree, stock purchase, or other identification.)
4. The quantity of water is ______ second-feet, or 3 acre-feet.
5. The period of use from March 15 (Month) (Day) to Nov. 15 (Month) (Day), inc.
6. The period of storage from Jan. 1 (Month) (Day) to Dec. 31 (Month) (Day), inc.
7. The direct source of supply is Scofield Reservoir tributary to Price River in Carbon county.
8. The point of diversion is* North 850' West 1080' From SE Corner Sec. 10, T.12S., R7E
9. The water is, or was, to be used for the following purposes: Irrigation — Price River
   ______, Total ______ acres.
   (Give place of use by legal subdivision of land)

THE FOLLOWING EXCHANGE IS PROPOSED

10. ______ second-feet or 3 acre-feet of water represented by the foregoing right will be delivered from Jan (Month) 1 (Day) to DEC (Month) 31 (Day) incl. of each year, to satisfy other rights, into Price River at a point* North 850' West 1080' from SE Corner Sec. 10, T.12S., R7E
11. In exchange for the water delivered and described in par. 10, there will be ______ second-feet or 3 acre-feet diverted from Jan. 1 (Month) (Day) to Dec. 31 (Month) (Day) incl., of each year from a well 4" Dia. - 180' deep (diameter and depth) or stream ______, at a point* South 2640' East 1056' from N.W. Corner Sec. 4, T.14S., R7E (Sn[illegible] Canyon)
12. The water will be used for Coal Mine fire protection and dust suppression
    — ¼ sec 4 T14S, R7E, SLB&M. Total ______ acres.

NOTE: *The point of diversion, point of return or point of delivery must be located by course and distance or by rectangular distances with reference to some United States land survey corner.*

# EXPLANATORY

The following additional facts are set forth in order to define more clearly the full purpose of the proposed application:

Eden S. Svalesta - Treasurer
Signature of Applicant*

*If applicant is a corporation or other organization, signature must be the name of such corporation or organization by its proper officer, or in the name of the partnership by one of the partners, and the names of the other partners shall be listed. If there is more than one applicant, a power of attorney, authorizing one to act for all should accompany the application.

This section is not to be filled in by applicant

## STATE ENGINEER'S ENDORSEMENTS

| | | |
|---|---|---|
| 1. | 5-13-80 | Application received by mail / over counter in State Engineer's office by up |
| 2. | | Priority of Application brought down to, on account of |
| 3. | 5-16-80 | Application fee, $ 15.00, received by SW Rec. No. 07066 |
| 4. | June ... | Application microfilmed by ... indexed by SW |
| 5. | July 30, 80 | Application platted by (D14-7) 4 bcb, RW |
| 6. | 5-13-80 | Application examined by up |
| 7. | | Application returned , or corrected by office |
| 8. | | Corrected Application resubmitted by mail / over counter to State Engineer's Office. |
| 9. | 5-13-80 | Application approved for advertisement by up |
| 10. | JUL 1 1980 | Notice to water users prepared by JCCO |
| 11. | JUL 10 1980 | Publication began; was completed JUL 24 1980 |
| | | Notice published in Sun Advocate |
| 12. | 7/3/80 | Proof slips checked by CO |
| 13. | 8/25/80 | Application protested by ... (NO HEARING REQ...) |
| 14. | 8/11/80 | Publisher paid by M.E.V. No. 6310839 |
| 15. | | Hearing held by |
| 16. | | Field examination by |
| 17. | 9-27-80 | Application designated for approval / rejection SG; KP |
| 18. | 10/24/80 | Application microfilmed and/or photostated by dph |
| 19. | 10/24/80 | Application approved |

*THIS APPLICATION IS APPROVED ON THE FOLLOWING CONDITIONS:*

See Memorandum Decision dated October 24, 1980.

Dee C. Hansen
Dee C. Hansen, State Engineer

Exchange Application No. 1669

Exhibit 8

DRAINAGE AND SEDIMENT CONTROL PLAN

## SEDIMENT POND DESIGN METHODOLOGY

Runoff and peak flow values were determined using the rational method which can be summarized as follows:

- Determine the contributing area (A in acres)
- Select appropriate coefficient of imperviousness (C)
- Determine the rainfall intensity (i) for 10 year, 24 hour and 100 year, 24 hour events (0.10 in/hr and 0.15 in/hr respectively)
- Calculate runoff for 10 year, 24 hour event by:

$$Q = CiA$$

- Determine 3 year sediment volume by:

$$V_s = \left(\frac{0.1 \text{ Acre-Feet}}{\text{Acre}}\right) \left(A \text{ (acres)}\right)$$

- Determine pond size (V) by:

$$V = Qt$$

## EMERGENCY SPILLWAY DESIGN CRITERIA

- Use Manning's Equation for open channel flow:

$$Q = 1.49\ AR^{2/3}\ S^{1/2} \text{ - derived to } Q = \frac{K}{N}\ D^{8/3}\ S^{1/2}$$

where: K = varies with the trapezoidal channel
n = .035

- Peak flow for a 100 year, 24 hour event was determined using the Rational Method described previously

- Depth D is determined by Manning's Equation:

$$D = \left(\frac{Qn}{KS^{\frac{1}{2}}}\right)^{3/8} \quad \left(\frac{(.30)\ (.035)}{(30.0)\ (.01)^{\frac{1}{2}}}\right)^{.375} = 0.120 \text{ feet}$$

- Width of channel base is determined by:

$$b = D/.05 = .12/.05 = 2.4 \text{ Ft}$$

- Total depth of spillway is determined by adding 1.0 feet of freeboard to D

$$H = D + 1.0 = 0.12 + 1.0 = 1.12 \text{ Ft}$$

DIVERSION DITCH DESIGN CRITERIA

- Use Manning's Equation for open channel flow:

$$Q = \frac{1.49}{n} AR^{2/3} S^{1/2} \text{ - derived to } A = \frac{K}{n} D^{8/3} S^{1/2}$$

where: K = varies with trapezoidal channel
n = .035

- Peak Discharge (Q) for a 10 year, 24 hour event was determined using the Rational Method described in the Sediment Pond Design Methodology Section

- D/b ratio and side slopes are defined

- Depth D is calculated by the Manning's equation:

$$D = \left(\frac{Qn}{KS^{1/2}}\right)^{3/8}$$

- Ditch Depth is determined by adding 1.0 foot of freeboard to water depth D

$$H = D + 1$$

## CULVERT DESIGN CRITERIA

- Culvert Designs were checked by Manning's Equation utilizing the peak runoff determined by the Rational Method

$$Q = VA = \frac{0.59}{n} D^{2/3} S^{1/2} A$$

where: Q = discharge of culvert in cfs

n = roughness coefficient of culvert

D = diameter of culvert in Ft

S = slope of culvert

A = cross sectional area of culvert in cu ft

## SEDIMENT POND

### Runoff and Sediment Volume Calculations

| | |
|---|---|
| Drainage Area (Sq Ft) | 139,392 |
| (Acres) | 3.2 |
| Coefficient of imperviousness (i) = | 0.60 |

Rainfall intensity for 10 year, 24 hour runoff (0.10 in/hr)

| | |
|---|---|
| Discharge (cfs) | |
| 10 year, 24 hour event | 0.19 |
| 100 year, 24 hour event | 0.29 |

Runoff volume (acre-feet) 0.38

$$V_R = \frac{(0.19\text{ cfs})\ (24\text{ hours})\ (3600\text{ sec/hr})}{43{,}560\text{ ft}^2\text{/acre}}$$

Sediment volume 0.32

$$\frac{0.1\text{ acre-ft}}{\text{acre}}\ (3.2\text{ acres})$$

Pond volume (acre-feet) 0.70

The two ponds, as constructed in series, have the capacity to hold this runoff volume and sediment volume.

REVISED

# DRAINAGE DITCH SIZE CALCULATIONS

Ditch Number A

| Area | Description |
|---|---|
| | Undisturbed |

Total: 92,826,360 $ft^2$

2131 acres

$Q = CiA$

$C = 0.2$ $Q = 63.93$ cfs

$i = 0.15$ in/hr

$A = 2131$ Acres

| | |
|---|---|
| Design Event | 100 year, 24 hour |
| Design Peak Discharge | 63.93 |
| Ditch Length | 1200 |
| Ditch Slope | 2% |
| Ditch Configuration | |

$$D = \left(\frac{Qn}{KS^{\frac{1}{2}}}\right)^{3/8}$$

Side Slopes @ 1H:1V

D/b = 0.25

K = 6.04

n = 0.33

S = 0.02

Q = 63.93 cfs

D = 2.923 ft

b = 8.0ft, h = 10 ft

$$D = \left[\frac{(63.93)\ (0.33)}{(6.04)\ (.02)^{\frac{1}{2}}}\right]^{.375} = 3.329 \text{ ft}$$

$$A = (8.0)(3.329) + 3(3.329)^2 = 59.88 \text{ ft}^2$$

Ditch Number A (Continued)

A = 59.88 $ft^2$

$$V = (1.49/n)(R^{2/3}S^{1/2})$$
$$V = (1.49/.33)(4.11^{2/3})(.02^{1/2})$$

V = 1.62 ft/sec

freeboard = 1.0 ft

The ditch as installed will adequately pass the 100 year, 24 hour storm.

Ditch Number B

| Area | Description |
|---|---|
| | Disturbed |

Total: 304,920 $ft^2$
7 acres

$Q = CiA$

$C = 0.20$ $\quad$ $Q = 0.21$ cfs
$i = 0.15$ in/hr
$A = 7$ Acres

Design Event $\quad$ 100 year, 24 hour

Design Peak Discharge $\quad$ 0.21

Ditch Length $\quad$ 900

Ditch Slope $\quad$ 2%

Ditch Configuration

$$D = \left(\frac{Qn}{KS^{\frac{1}{2}}}\right)^{3/8}$$

Side Slopes @ 1H:1V

$D/b = 0.25$
$K = 6.04$
$n = 0.35$
$S = 0.02$
$Q = 0.21$ cfs
$D = 0.35$ ft
$b = 1.0$ ft, $h = 2.0$ ft
$A = 1.036$

$$D = \left[\frac{(0.21)\ (0.35)}{(6.04)\ (.20)}\right]^{.375} = .399 \text{ ft}$$

$$A = (1.4)(.399) + 3(.35)^2 = 1.036 \text{ ft}^2$$

$$V = (1.49/n)(R^{2/3}\ S^{1/2})$$
$$V = [1.49/0.35][(.58)^{2/3} .02^{1/2}]$$

Ditch Number B

V = 0.41 ft/sec
freeboard = 1.0 ft

V = 0.24 ft/sec

The ditch as installed will adequately pass the 100 year, 24 hour storm.

Ditch Number C

| Area | Description |
| --- | --- |
| | Disturbed |

Total: 17,500 $ft^2$
0.40 acres

$Q_p$ = CiA
C = 0.2
i = 0.15 in/hr
A = 0.40

$Q_p$ = 0.012 cfs

| | |
| --- | --- |
| Design Event | 100 year, 24 hour |
| Design Peak Discharge | 0.012 |
| Ditch Length | 420 |
| Ditch Slope | 1% |
| Ditch Configuration | |

$$D = \left(\frac{Qn}{KS^{\frac{1}{2}}}\right)^{3/8}$$

Side Slopes @ 1H:1V
D/b = 0.25
K = 6.04
n = 0.35
S = 0.01
Q = 0.012 cfs
D = 0.16 ft
b = 0.5 ft, n = 1.5 ft
A = 0.18 $ft^2$

$$D = \left[\frac{(.012)\ (0.35)}{(6.04)\ (.10)}\right]^{.375} = 0.16 \text{ ft}$$

$$A = (.62)(.16) + 3(.16)^2 = 0.18 \text{ ft}^2$$

Ditch Number C (Continued)

$$V = (1.49/n)(R^{2/3}\ S^{1/2})$$
$$V = (1.49/.35)(.22^{2/3}(.01)^{1/2})$$

V = 0.15 ft/sec

freeboard = 0.30 ft

The ditch as installed will adequately pass the 100 year, 24 hour storm required by State and Federal Regulations

# CULVERT SIZE CALCULATIONS

Culvert A, B, C

| Area | Description |
|---|---|
| | Undisturbed |

Total: 92,826,360 $ft^2$
2131 acres

| | |
|---|---|
| Design Event | 100 year, 24 hour |
| Design Peak Discharge | 63.93 |
| Culvert Length | 75 ft |
| Culvert Slope | 2% |

$$Q = VA = \frac{0.59}{n} D^{2/3} S^{1/2} A$$

$Q = 63.93$ cfs
$n = 0.022$
$D = 84" = 7.0$ ft
$S = 0.02$
$A = 38.49\ ft^2$

$$Q = \frac{0.59}{0.22} (7)^{2/3} (.02)^{1/2} (38.49) = 532.73 \text{ cfs}$$

Existing culverts A, B, and C can discharge a storm runoff of about 532.73 cfs. Therefore, the existing 84 inch culverts are adequate to pass the 100 year, 24 hour storm.

Culvert D

| Area | Description |
| --- | --- |
| | Undisturbed |

Total: 5,880,600 $ft^2$
135 acres

Design Event 100 year, 24 hour

Design Peak Discharge 4.05

$Q = CiA$

$C = 0.2$

$i = 0.15$ in/hr

$A = 135$ acres

Culvert Length 285 ft

Culvert Slope 23%

$$Q = VA = \frac{0.59}{n} D^{2/3} S^{1/2} A$$

$Q = 4.05$ $\quad$ $Q = 64.02$ cfs

$n = 0.022$

$D = 2.0$ ft

$S = 0.23$

$A = 3.14\ ft^2$

Existing culvert can discharge a storm runoff of 64 cfs. The existing culvert is, therefore, adequate to pass the 100 year, 24 hour storm.

Culvert E

| Area | Description |
|---|---|
| | Disturbed |

Total: 21,780 $ft^2$
0.5 acres

Design Event 100 year, 24 hour

Design Peak Discharge 0.05 cfs

$Q = CiA$

$C = 0.2$

$i = 0.15$ in/hr

$A = 0.5$ acres

Culvert Length 65 ft

Culvert Slope 46%

$$Q = VA = \frac{0.59}{n} D^{2/3} S^{1/2} A$$

$Q = 0.022$

$n = 0.022$

$D = 8" - .667$ ft

$S = 0.46$

$A = 0.349\ ft^2$

$$Q = \frac{0.59}{0.022} (.667)^{2/3} (0.46)^{1/2} (.349) = 4.84 \text{ cfs}$$

The existing 8 inch culvert can discharge a storm runoff of 4.84 cfs, therefore, it is adequate to pass the 100 year, 24 hour storm.

Culvert F

| Area | Description |
|---|---|
| | Disturbed |

Total: $10{,}800\ ft^2$
0.25 acres

| | |
|---|---|
| Design Event | 100 year, 24 hour |
| Design Peak Discharge | 0.023 cfs |
| Culvert Length | 150 ft |
| Culvert Slope | 23% |

$$Q = VA = \frac{0.59}{n} D^{2/3} S^{1/2} A$$

$$Q = \frac{0.59}{0.022} (.667)^{2/3} (.23)^{1/2} (1.39)$$

$Q = 4.49$
$n = 0.022$
$D = 8" - .667\ ft$
$S = 0.23$
$A = 0.349\ ft^2$

$$Q = \frac{0.59}{0.022} (.667)^{2/3} (0.23)^{1/2} (0.349) = 3.38\ cfs$$

The existing culvert F can discharge a storm runoff of approximately 3.38 cfs, therefore, it is adequate to pass the 100 year, 24 hour storm.

Culvert G

| Area | Description |
|---|---|
| | Disturbed |

Total: $117{,}612\ ft^2$
2.70 acres

| | |
|---|---|
| Design Event | 100 year, 24 hour |
| Design Peak Discharge | 0.243 cfs |
| Culvert Length | 30 ft |
| Culvert Slope | 1% |

$$Q = VA = \frac{0.59}{n} D^{2/3} S^{1/2} A$$

$$Q = \frac{0.59}{0.022} (1.5)^{2/3} (.01)^{1/2} (1.77)$$

$Q = 6.22$ cfs
$n = 0.022$
$D = 8" - .667$ ft
$S = 0.01$
$A = 0.349\ ft^2$

$$Q = \frac{0.59}{0.022} (.667)^{2/3} (0.01)^{1/2} (0.349) = 0.71 \text{ cfs}$$

The existing culvert G can discharge a storm runoff of approximately 0.71 cfs, therefore, it is adequate to pass the 100 year, 24 hour storm.

Exhibit 9

PERMITS FOR MINING

United States
Environmental Protection
Agency

Suite 103
1860 Lincoln St.
Denver, CO. 80295

North Dakota,
South Dakota,
Utah, Wyoming

EPA

AUG 12 1980

Ref: 8E-WE

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. Joseph A. Harvey
Blazon Company
Box 327
Ferron, Utah 84523

Dear Mr. Harvey:

Herewith enclosed is the NPDES permit for Blazon Company, No. 1 Mine, UT-0023647. This permit shall become effective upon the date specified, unless within thirty (30) days following the date of receipt you submit a request for an evidentiary hearing in accordance with the provisions of 40 CFR Section 124.74. Such request must be addressed to:

Roger L. Williams (8E-WE)
Regional Administrator
U.S. Environmental Protection Agency
Region VIII, Suite 103
1860 Lincoln
Denver, Colorado 80295

If you have any legal questions with regard to this matter, please contact Mr. Alfred C. Smith of this Agency at (303) 837-4812. Questions regarding monitoring requirements should be directed to Mr. Doug Skie of this office at (303) 837-4335.

Sincerely yours,

Lance C. Vinson
Director
Enforcement Division

Enclosures

NPDES Discharge Permit
EPA Form 3320-1 for reporting self-monitoring

MI

Permit No.: UT-0023647

AUTHORIZATION TO DISCHARGE UNDER THE

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Clean Water Act, as amended (33 U.S.C. 1251 et. seq.)(hereinafter referred to as "the Act"),

Blazon Company, No. 1 Mine,

is authorized to discharge from a facility located at Section 4, Township 14 South, Range 7 East, Carbon County, Utah,

to receiving waters named Mud Creek, which is a tributary of the Price River,

in accordance with effluent limitations, monitoring requirements and other conditions set forth in Parts I, II, and III hereof.

This permit shall become effective on the date of issuance.*

This permit and the authorization to discharge shall expire at midnight, December 31, 1980.

Signed this 12th day of August, 1980.

for / Roger E. Frenette

Lance C. Vinson
Director
Enforcement Division

*Thirty (30) days after the date of receipt of this permit by the Applicant.

# Exhibit 10

# RECLAMATION CALCULATIONS

Exhibit 10

RECLAMATION CALCULATIONS

Structure Salvage

All surface facilities will be dismantled by local scrap dealers for the salvage value.

Removal of Culverts

Caterpillar 980C Wheel Loader
(7 culverts) ÷ (1 culvert/sch hr) = 7 scheduled hours
10-ton truck
Same hours as Loader 7 scheduled hours

Removal of Footings and Foundations

Caterpillar 980C Wheel Loader
(1900 cu yd) ÷ (34 cu yd/sch hr) = 59 scheduled hours
10-ton truck
Same hours as Loader 59 scheduled hours

Grading

Caterpillar D7G Tractor
Average push distance - 40 feet
Production - 400 LCY/sch hr
(5700) LCY) ÷ (400 LCY/sch hr) = 15 scheduled hours

Portal Backfilling

Caterpillar 980C Wheel Loader
Backfill portals 10 feet
(37 cu yd/portal) x (3 portals) ÷ (34 cu yd/sch hr) = 4 scheduled hours

Topsoil Replacement

Caterpillar 980C Wheel Loader
(1400 cu yds) ÷ (68 cu/yd/sch hr) = 21 scheduled hours

Scarification

Caterpillar D7G Tractor
(5.5 acres) ÷ (1.20 acres/sch hr) = 5 scheduled hours

Mulching and Seeding

50 hp farm tractor
(5.5 acres) ÷ (0.67 acres/sch hr) = 8 scheduled hours

SUMMARY

Equipment Requirements

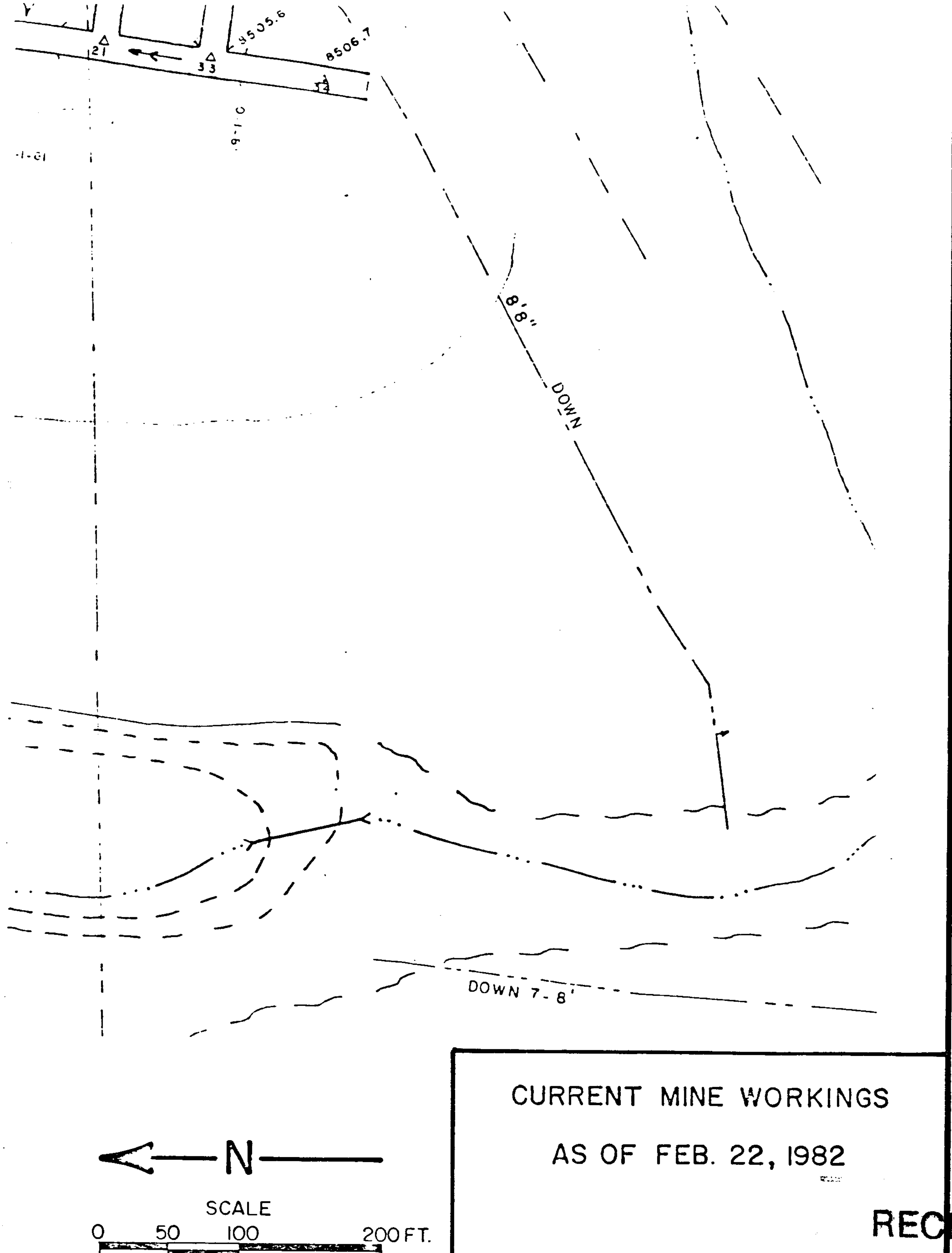
| | |
|---|---|
| Caterpillar 980C Wheel Loader | 91 scheduled hours |
| 10-ton dump truck | 66 scheduled hours |
| Caterpillar D7G track-type tractor | 20 scheduled hours |
| 50 hp farm tractor | 8 scheduled hours |

Seed and Mulch Requirements

Mulch 18,000 lbs Mulch
Seed 100 lbs Seed

Exhibit 11

CURRENT MINE WORKINGS




CURRENT MINE WORKINGS

AS OF FEB. 22, 1982

EXHIBIT II

RECEIVED
JUN 20 1984
DIVISION OF OIL
GAS & MINING

Exhibit 12

VEGETATION FIELD WORK SHEETS

LOCATION: [illegible] SUMMARY OF FIELD S[illegible] S

VEGETATION TYPE: Spruce fir Aspen Reference Area FIELD DATE: 9.17 and 9.18.83

PARAMETER: Cover UNITS: COMMENTS: 10 POINT FRAME

TRANSECTS

| ecies | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | TOTAL | AVERAGE | COMPOSITION | DIVERSITY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| rostis | 1 | | | | 1 | 2 | | | | | | | | | | | | | | | 4 | .24 | [illegible] | .01 |
| tra | | | 1 | | | | | 1 | | | | | | | | | | | | | 2 | .12 | [illegible] | .01 |
| an | 1 | 1 | 1 | 2 | | 5 | 2 | | 1 | | 3 | | 1 | 1 | 12 | 6 | 2 | | | | 38 | [illegible] | [illegible] | .04 |
| ex | | 2 | | | | | | | | | 1 | | 2 | | | | | | | | 5 | [illegible] | 1.10 | [illegible] |
| sa | | | 3 | | | | 2 | 1 | | | | 1 | | | | 1 | | | | | 8 | .47 | [illegible] | [illegible] |
| ppr | 3 | 2 | 1 | | 2 | 6 | | 9 | | | | | | | | | | | | | 23 | 1.35 | [illegible] | [illegible] |
| | | | | | | | | | | | | | | | | | | | | | (80) | [illegible] | [illegible] | [illegible] |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| mic | 3 | 2 | 2 | 2 | | | 1 | | | | 1 | | 1 | 1 | 3 | | | | | | 16 | .94 | 3.75 | [illegible] |
| se | | | | | | | | 1 | | | | | | 1 | | | | | | | 2 | .12 | [illegible] | .011 |
| ter | | 2 | | 1 | 1 | | | | | | | | | | | | | | | | 4 | .24 | [illegible] | [illegible] |
| ho | 5 | | 2 | 3 | | | 2 | | | 1 | | 1 | | 1 | 1 | 3 | 1 | | | | 20 | 1.18 | [illegible] | .016 |
| ilo | | | | | | | | | | | | 1 | | | | | | | | | 1 | .06 | [illegible] | .007 |
| igeron | 1 | | | | | | | | | | | | | | | | | | | | 1 | .06 | [illegible] | .00 |
| b UNK | | | | | | | | | 1 | | 1 | | | | | | | | | | 2 | .12 | [illegible] | .01 |
| garia | | 4 | 4 | 6 | 1 | 4 | 1 | 1 | 1 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 6 | | | | 42 | [illegible] | [illegible] | [illegible] |
| sp | | 5 | | | 1 | | 2 | 1 | | | | | | | | | 1 | | | | 10 | [illegible] | [illegible] | [illegible] |
| ium | | 1 | | | | 1 | 1 | | | | | | | | | | | | | | 3 | [illegible] | [illegible] | .01 |
| ramium | | | | | | 1 | | | | | | | | | | | | | | | 1 | .06 | [illegible] | .00 |
| L | | | | | | | 1 | | | | | | | | | | | | | | 1 | [illegible] | [illegible] | .00 |
| lly | 1 | 2 | | | 1 | 3 | 1 | 3 | | 3 | 5 | 3 | 1 | 5 | 4 | 3 | 1 | | | | 36 | [illegible] | [illegible] | .09 |
| pine | | | | | | 1 | | | | | 2 | 1 | 2 | | 2 | | | | | | 8 | [illegible] | [illegible] | .03 |
| cop | | | 2 | | 2 | | | | 2 | | | | | | | 1 | | | | | 7 | .41 | [illegible] | .02 |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| ase | | | 8 | 2 | 3 | 6 | 1 | 8 | | | | | 3 | 3 | | | | | | | 34 | 2.00 | [illegible] | [illegible] |
| mon | 3 | | | | | 2 | 2 | 1 | | | 3 | 1 | | 1 | | 2 | 3 | | | | 18 | 1.06 | [illegible] | [illegible] |
| ce | | | | | 4 | | | | | | | | | | | | | | | | 4 | .24 | [illegible] | [illegible] |
| ira | | | | 1 | 1 | | | | | 4 | | | | | 1 | | | | | | 7 | .41 | [illegible] | .02 |
| btotals | | | | | | | | | | | | | | | | | | | | | (217) | [illegible] | [illegible] | [illegible] |
| rage | 18 | 21 | 24 | 17 | 17 | 31 | 16 | 26 | 5 | 11 | 19 | 10 | 12 | 15 | 24 | 17 | 14 | | Sub-totals | | 297 | [illegible] | [illegible] | [illegible] |

N90/10= X=

/10= Adequacy data on page #2 S=

SUMMARY BY: [illegible]

SUMMARY DATE: 10 / 03 / 83

SUMMARY OF FIELD SP[illegible]S

LOCATION: [illegible] Mine #1

VEGETATION TYPE: Spruce fir / Aspen Reference Area

FIELD DATE: 9.17.83 and 9.18.83

PARAMETER: Cover

UNITS:

COMMENTS: 10 POINT FRAME

TRANSECTS

| Species | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | # / TOTAL | AVERAGE | COMPOSITION | DIVERSITY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ...ag |  | 1 |  |  |  |  | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  | 2 | .12 | .4[illegible] | .0[illegible] |
| ...ie |  |  |  |  |  |  |  |  | 1 | 1 |  | 1 | 2 |  |  |  |  |  |  |  | 5 | .[illegible] | 1.1[illegible] | .0[illegible] |
| ...iam |  |  |  |  |  |  |  |  |  |  |  | 1 | 1 | 1 |  |  |  |  |  |  | 3 | .18 | .7[illegible] | .01 |
| ...ola | 2 | 2 |  | 4 |  | 2 | 4 | 6 | 3 | 1 | 1 | 6 | 5 |  | 3 | 7 | 6 |  |  |  | 52 | 3.06 | 12.19 | .11 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | (62) | (3.65) | 14.[illegible] | (.15) |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 279 | 16.41 | 65.[illegible] | (.8[illegible]) |
| ...ruv | 1 |  |  |  |  |  |  |  |  | 1 |  | 1 |  |  |  |  |  |  |  |  | 3 | .18 | .72 | .01 |
| ...yso |  |  |  |  |  |  |  |  |  | 1 |  |  |  |  |  |  |  |  |  |  | 1 | .06 | .24 | .00 |
| ...la |  | 2 |  | 1 |  |  |  |  |  |  |  |  | 1 | 1 |  | 1 |  |  |  |  | 6 | .35 | 1.40 | .03 |
| ...sme | 4 | 2 |  |  | 1 | 1 | 2 |  | 5 | 4 |  | 6 | 5 | 1 | 2 | 2 | 1 |  |  |  | 36 | 2.12 | 8.45 | .091 |
| ...owo |  | 2 |  |  | 1 |  |  |  | 1 |  |  |  |  | 1 | 2 | 2 |  |  |  |  | 9 | .53 | 2.11 | .03 |
| ...ica |  |  | 3 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 3 | .18 | .72 | .01 |
| ...nor |  | 2 |  | 1 |  | 2 |  |  |  | 3 |  |  |  |  |  | 1 |  |  |  |  | 9 | .53 | 2.11 | .03 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | (67) | (3.95) | 15.7[illegible] | (.2[illegible]) |
| SUBTOTAL | 7 | 11 | 3 | 6 | 2 | 5 | 7 | 6 | 10 | 11 | 1 | 15 | 14 | 4 | 7 | 13 | 7 |  |  |  | 129 | 7.60 | 30.[illegible] |  |
| Bare | 1 | 2 | 3 | 4 | 6 | 2 | 1 | 2 | - | - | - | - | - |  | 1 | 2 |  |  |  |  | 24 | 2.[illegible] |  |  |
| Rock | 2 | 1 | 2 | 2 | 1 | - | - | 1 |  |  | - | - | - | - | 2 | - | - |  |  |  | 11 | 1.2[illegible] |  |  |
| Litter | 22 | 15 | 18 | 21 | 24 | 12 | 26 | 15 | 35 | 28 | 30 | 25 | 24 | 31 | 16 | 18 | 29 |  |  |  | 389 | 45.77 |  |  |
| TOTAL | 25 | 32 | 27 | 23 | 19 | 36 | 23 | 32 | 15 | 22 | 20 | 25 | 26 | 19 | 31 | 30 | 21 |  |  |  | 426 | 25.10 | 100.0[illegible] | 1.3[illegible] |
| Average / TOTAL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

17

N90/10=

/10= $\frac{(1.64)(32.15)}{6.28} = 8.39 \Rightarrow N_m = 9$

X= 25.06

S= 5.67

SUMMARY BY: [illegible]

SUMMARY DATE: 10 / 03 / 83

6:40

| | |
|---|---|
| PARAMETER: Plant Cover | METHOD: [illegible] |
| LOCATION: [illegible] #1 | EXAMINER: [illegible] |
| RANGE SITE: [illegible] fir | TRANSECT NO. 1 sample 1+2 |
| DATE: 9.17 1983 | |

COMMENTS: DF = Doug fir
Forb#1 = long green leaf thing (Aster)
UK#grass = muhly-agrostis looking grass

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|
| DF | Osmo | | | ~~Acmi~~ | | | | | ~~Forb#1~~ |
| | | R | L | | L | L | ~~B~~ | L | |
| **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** | **19** | **20** |
| DF | Bran | | | | Acmi | Viola | | | UK#grass |
| | | L | R | L | | | L | L | |
| **21** | **22** | **23** | **24** | **25** | **26** | **27** | **28** | **29** | **30** |
| | F | | Osmo | F#1 | | | | Lathy | Vio |
| L | | L | | | L | L | L | | |
| **31** | **32** | **33** | **34** | **35** | **36** | **37** | **38** | **39** | **40** |
| F#1 | | | Asmi | Popr | Erigeron | Popr | | | |
| | L | L | | | | | L | L | L |
| **41** | **42** | **43** | **44** | **45** | **46** | **47** | **48** | **49** | **50** |
| F#1 | DF | | | | Aruv | Popr | | Acmi | F#1 |
| | | L | L | L | | | L | | |
| **51** | **52** | **53** | **54** | **55** | **56** | **57** | **58** | **59** | **60** |
| | | | Aster | | Carex | | | Acmi | Carex |
| L | L | L | | L | | L | R | | |
| **61** | **62** | **63** | **64** | **65** | **66** | **67** | **68** | **69** | **70** |
| Syor | Bran | | Acmi | Taof | Potr | | Frsp | Frsp | Lathy |
| | | L | | | | L | | | |
| **71** | **72** | **73** | **74** | **75** | **76** | **77** | **78** | **79** | **80** |
| Popr | Frsp | Frag | Fran | Lathy | Gallium | Popr | | Frag | Syor |
| | | | | | | | L | | |
| **81** | **82** | **83** | **84** | **85** | **86** | **87** | **88** | **89** | **90** |
| DF | | Viola | | Rom | Rom | | | | Frag |
| | L | | L | | | ~~L~~ | ~~L~~ | L | |
| **91** | **92** | **93** | **94** | **95** | **96** | **97** | **98** | **99** | **100** |
| DF | Acmi | Viola | | | | Frag | Frag | | Potr |
| | | | L | L | L | | | L | |

SUMMARY

| Plant Symbols | Hits | [illegible] |
|---|---|---|
| ~~Popr~~ | 3 | 020 |
| ~~Fran~~ | 1 | 1 |
| ~~Unknown G#1~~ | 1 | 1 |
| ~~Osmo~~ | 3 | 3 |
| ~~Doug Fir~~ | 4 | 4 |
| ~~Aruv~~ | 1 | 1 |
| ~~Viola~~ | 2 | 2 |
| ~~Acmi~~ | 3 | 3 |
| Forb#1 | 5 | 4 |
| Erigeron | 1 | 1 |
| Lathy | 1 | 1 (25) |
| B | 1 | |
| R | 2 | |
| L | 22 | 150 |
| Bran | 1 | 1 |
| Carex | 2 | 1 |
| Popr | 2 | 1 |
| Acmi | 2 | 2 |
| Aster | 2 | 2 |
| Frag | 4 | 2 |
| Frsp / Fra's | 5 | |
| ~~Lathyr~~ | 2 | 2 |
| Gallium | 1 | 1 |
| Taof | 1 | 1 |
| Viola | 2 | 2 |
| Potr | 2 | 2 |
| Syor | 2 | 2 |
| Doug fir | 2 | 2 |
| TOTAL | | |
| Kowa | 2 | 1 |
| B | 2 | |
| R | 1 | |
| L | 15 | |

= 150

Symbol For Hits

| | |
|---|---|
| Bare Soil | B |
| Rock | R |
| Litter | L |
| Live Plants | Plant Symbol |

Phenology Record

GRASSES
- Stage 0 to 10 Leaf growth starts
- Stage 10 to 20 Flower stalks appear
- Stage 20 to 30 Heads full out
- Stage 30 to 40 Anthesis
- Stage 40 to 50 Dough
- Stage 50 to 60 Hard seed
- Stage 60 to 70 Dissemination starts
- Stage 70 to 80 Drying
- Stage 80 to 90 Dormant

SHRUBS
- Stage 0 to 10 Leaf growth starts
- Stage 10 to 20 Twig growth starts
- Stage 20 to 30 Flower buds appear
- Stage 30 to 40 First bloom
- Stage 40 to 50 Full bloom
- Stage 50 to 70 Bloom over
- Stage 60 to 70 Seed ripe
- Stage 70 to 80 Dissemination & over
- Stage 80 to 90 Leaves dry

| PARAMETER: Plant Cover | METHOD: 10 pt frame |
|---|---|
| LOCATION: Pigeon Mine #1 | EXAMINER: [illegible] |
| RANGE SITE: [illegible] | TRANSECT NO. 3 + 4 sample | DATE: 9.17 1983 |

COMMENTS: 7#2 = ? [illegible]

Pott ~ dense

Summary for #4 on [illegible]

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Ami | Frag | Frag | Shea | | |
| L | L | L | L | | | | | L | L |
| **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** | **19** | **20** |
| Make | | | | | | | Popr | | F#1 |
| | | | | B | L | L | | B | |
| **21** | **22** | **23** | **24** | **25** | **26** | **27** | **28** | **29** | **30** |
| | Mam | | | | Moss | Mam | | | Bran |
| L | | L | R | R | | | L | L | |
| **31** | **32** | **33** | **34** | **35** | **36** | **37** | **38** | **39** | **40** |
| Shea | Shea | | Mam | | Moss | | | | |
| | | L | | | | L | B | L | L |
| **41** | **42** | **43** | **44** | **45** | **46** | **47** | **48** | **49** | **50** |
| Elca | Ami | F#1 | Elca | Elca | | Frag | | Poka | |
| | | | | | L | | | | L |
| **51** | **52** | **53** | **54** | **55** | **56** | **57** | **58** | **59** | **60** |
| Bran | Ami | Ami | | Frag | Smila | | | Frag | Agar |
| | | | L | | | L | L | | |
| **61** | **62** | **63** | **64** | **65** | **66** | **67** | **68** | **69** | **70** |
| | F#2 | | | | | Vida | F#1 | Frag | |
| L | | L | L | L | L | | | | L |
| **71** | **72** | **73** | **74** | **75** | **76** | **77** | **78** | **79** | **80** |
| | | F#1 | F#1 | Frag | | | | Viola | Mam |
| L | L | | | | R | L | L | | |
| **81** | **82** | **83** | **84** | **85** | **86** | **87** | **88** | **89** | **90** |
| | | Viola | | | | | | | Frag |
| L | L | | L | B | R | L | L | L | |
| **91** | **92** | **93** | **94** | **95** | **96** | **97** | **98** | **99** | **100** |
| SAR | | | | | Bran | Mam | Viola | | Poka |
| | B | L | L | B | | | | R | |

SUMMARY for # 3

| Plant Symbols | Hits | [illegible] |
|---|---|---|
| Grasses | | 0 |
| Popr | 1 | 1 |
| Bran | 1 | 1 |
| Elca | 3 | 1 |
| Agtr | 1 | 1 |
| Forbs | | |
| Ami | 2 | 2 |
| F#1 | 2 | 2 |
| Frag | 4 | 2 |
| Mare | 8 | 3 |
| Moss | 2 | 2 |
| Shea | 3 | 2 |
| Tot Veg (27) | | |
| B | ~~39~~ | |
| L | 18 | |
| R | 2 | |
| TOTAL | 50 | ////////// |

**Symbol For Hits**

| | |
|---|---|
| Bare Soil | B |
| Rock | R |
| Litter | L |
| Live Plants | Plant Symbol |

**Phenology Record**

| GRASSES | SHRUBS |
|---|---|
| Stage 0 to 10 Leaf growth starts | Stage 0 to 10 Leaf growth starts |
| Stage 10 to 20 Flower stalks appear | Stage 10 to 20 Twig growth starts |
| Stage 20 to 30 Heads full out | Stage 20 to 30 Flower buds appear |
| Stage 30 to 40 Anthesis | Stage 30 to 40 First bloom |
| Stage 40 to 50 Dough | Stage 40 to 50 Full bloom |
| Stage 50 to 60 Hard seed | Stage 50 to 60 Bloom over |
| Stage 60 to 70 Dissemination starts | Stage 60 to 70 Seed ripe |
| Stage 70 to 80 Drying | Stage 70 to 80 Dissemination & over |
| Stage 80 to 90 Dormant | Stage 80 to 90 Leaves dry |

| PARAMETER: Plant Cover | METHOD: 10 pt |
|---|---|
| LOCATION: Blacon Mine #1 | EXAMINER: CS + EQ |
| RANGE SITE: Aspen [illegible] | TRANSECT NO. (3) 5 + 6 sample — DATE: 9.17 1983 |
| COMMENTS: # (Yama spotted) | Summary for 6 on back → |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|
| Mare | | | | Lathy | | Popr | Mare | [illegible] | → |
| | L | L | R | | L | | | | |

| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|
| | | | Aster | Popr | | Senecio | → | | Popr |
| L | L | L | | | L | | | L | |

| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
|---|---|---|---|---|---|---|---|---|---|
| [illegible] | Fraga | Smila | | | | | | | |
| | | | L | L | L | B | B | L | L |

| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
|---|---|---|---|---|---|---|---|---|---|
| Mare | DF | | | | | | | | |
| | | L | → | | | | | | |

| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
|---|---|---|---|---|---|---|---|---|---|
| [illegible] | | | | | | | | Moss | Senecio |
| | L | L | B | B | L | B | B | | |

| 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
|---|---|---|---|---|---|---|---|---|---|
| Mare | | Frag | → | Lathy | Frag | | Mare | | Frag |
| | L | | | | | L | | L | |

| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 |
|---|---|---|---|---|---|---|---|---|---|
| Mare | → | Bran | → | | | | Bran | | |
| | | | | L | L | L | | B | L |

| 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
|---|---|---|---|---|---|---|---|---|---|
| Popr | Grass #1 | Grass #1 | Mare | Bran | Bran | Grass #1 | Cyclam | | |
| | | | | | | | | B | L |

| 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
|---|---|---|---|---|---|---|---|---|---|
| Popr | Xmr | Mare | DF | Popr | Mare | | [illegible] | | |
| | | | | | | L | | L | L |

| 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |
|---|---|---|---|---|---|---|---|---|---|
| Senecio | Popr | Aster | [illegible] | [illegible] | [illegible] | Viola | Lathy | Lathy | |
| | | | | | | | | | L |

SUMMARY for #5

| Plant Symbols | Hits | freq |
|---|---|---|
| ~~Grasses~~ | | 0 0 |
| Popr | 2 | 2 |
| ~~Grass #1~~ | 1 | 1 |
| Aster | 1 | 1 |
| Frag | 1 | 1 |
| Fras | 1 | 1 |
| Lathy | 1 | 1 |
| Mare | 3 | 2 |
| Moss | 2 | 1 |
| Senecio | 4 | 2 |
| Smila. | 1 | 1 |
| Rowo | 1 | 1 |
| Doug-Fir | 1 | 1 |
| Tot Veg = (19) | | |
| B | 6 | 2 |
| R | 1 | 1 |
| L | 24 | |
| TOTAL | 50 | //////// |

Symbol For Hits

| | |
|---|---|
| Bare Soil | B |
| Rock | R |
| Litter | L |
| Live Plants | Plant Symbol |

Phenology Record

| GRASSES | SHRUBS |
|---|---|
| Stage 0 to 10 Leaf growth starts | Stage 0 to 10 Leaf growth starts |
| Stage 10 to 20 Flower stalks appear | Stage 10 to 20 Twig growth starts |
| Stage 20 to 30 Heads full out | Stage 20 to 30 Flower buds appear |
| Stage 30 to 40 Anthesis | Stage 30 to 40 First bloom |
| Stage 40 to 50 Dough | Stage 40 to 50 Full bloom |
| Stage 50 to 60 Hard seed | Stage 50 to 70 Bloom over |
| Stage 60 to 70 Dissemination starts | Stage 60 to 70 Seed ripe |
| Stage 70 to 80 Drying | Stage 70 to 80 Dissemination & over |
| Stage 80 to 90 Dormant | Stage 80 to 90 Leaves dry |

| | |
|---|---|
| PARAMETER: Plant Cover | METHOD: 10 pt frame |
| LOCATION: Blasom mine #1 | EXAMINER: CS + BG |
| RANGE SITE: Aspen/spruce fir | TRANSECT NO. 7+8 sample |
| DATE: 9/17 1983 | |

COMMENTS: Summary for 8

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|
| Exno | → | | Gall. | | Viola | → | | Amu | Fram |
| | | Δ | | Δ | | | Δ | | |
| **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** | **19** | **20** |
| | | | | Osmo | Bran | Taof | | | |
| Δ | L | L | Δ | | | | Δ | Δ | Δ |
| **21** | **22** | **23** | **24** | **25** | **26** | **27** | **28** | **29** | **30** |
| | | | | | | | | | F#1 |
| | Δ | Δ | L | L | L | L | Δ | Δ | |
| **31** | **32** | **33** | **34** | **35** | **36** | **37** | **38** | **39** | **40** |
| Frsp | Frsp | Mare | | | | Viola | Bran | | |
| | | | L | B | L | | | L | L |
| **41** | **42** | **43** | **44** | **45** | **46** | **47** | **48** | **49** | **50** |
| [illegible] | Viola | F#1 | | Osmo | DF | | DF | Galli | |
| | | | L | | | L | | | Δ |
| ~~51~~ | ~~52~~ | ~~53~~ | ~~54~~ | ~~55~~ | ~~56~~ | ~~57~~ | ~~58~~ | ~~59~~ | ~~60~~ |
| Apr | | | Popr | Osmo | Viola | → | → | | |
| | L | L | | | | | | L | L |
| **61** | **62** | **63** | **64** | **65** | **66** | **67** | **68** | **69** | **70** |
| Popr | → | | Mare | Popr | Lathu | | Amen | Viola | Elna |
| | | Δ | | | | Δ | | | |
| **71** | **72** | **73** | **74** | **75** | **76** | **77** | **78** | **79** | **80** |
| Frsp | | Mare | Frag | | Mare | Lathu | | Mare | Galli |
| | Δ | | | L | | | L | | |
| **81** | **82** | **83** | **84** | **85** | **86** | **87** | **88** | **89** | **90** |
| Popr | Mare | Amse | | | | Popr | | | Popr |
| | | | L | R | L | | L | B | |
| **91** | **92** | **93** | **94** | **95** | **96** | **97** | **98** | **99** | **100** |
| | | Viola | | Mare | Mare | Viola | Mare | | Arc |
| Δ | B | | L | | | | | Δ | |

SUMMARY FOR #7 (for 8 see back)

| Plant Symbols | Hits | f.q. |
|---|---|---|
| Grasses | | |
| Bran | 2 | 2 |
| ~~Elna~~ | 2 | 1 |
| Forbs | | |
| ~~Ammi~~ | 1 | 1 |
| ~~F#1~~ | 3 | 1 |
| ~~Frag~~ | 1 | 1 |
| Frsp | 2 | 1 |
| Hafi | 1 | 1 |
| Lathu | 1 | 1 |
| Gallium | 1 | 1 |
| Mare | 1 | 1 |
| Taof | 1 | 1 |
| Viola | 4 | 3 |
| Osmo | 2 | 2 |
| DF | 2 | 1 |
| Tot Veg = 23 | | |
| L | 5½ | |
| B | 1 | |
| TOTAL | 30 | ///////// |

Symbol For Hits

| | |
|---|---|
| Bare Soil | B |
| Rock | R |
| Litter | L |
| Live Plants | Plant Symbol |

Phenology Record

| GRASSES | SHRUBS |
|---|---|
| Stage 0 to 10 Leaf growth starts | Stage 0 to 10 Leaf growth starts |
| Stage 10 to 20 Flower stalks appear | Stage 10 to 20 Twig growth starts |
| Stage 20 to 30 Heads full out | Stage 20 to 30 Flower buds appear |
| Stage 30 to 40 Anthesis | Stage 30 to 40 First bloom |
| Stage 40 to 50 Dough | Stage 40 to 50 Full bloom |
| Stage 50 to 60 Hard seed | Stage 50 to 70 Bloom over |
| Stage 60 to 70 Dissemination starts | Stage 60 to 70 Seed ripe |
| Stage 70 to 80 Drying | Stage 70 to 80 Dissemination & over |
| Stage 80 to 90 Dormant | Stage 80 to 90 Leaves dry |

| PARAMETER: Plant Cover | METHOD: 10 pt |
|---|---|
| LOCATION: Blazon mine #1 | EXAMINER: [illegible] |
| RANGE SITE: Aspen / Sp Fir | TRANSECT NO. 9+10 sample |
| DATE: 9.17 1983 | |
| COMMENTS: (Epilobium spotted) | |

Summary T-10 on Back

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|
| | | Broin | | | | | | Frag | |
| L | L | | L | L | L | L | L | | L |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| DF | | | | | | | | | |
| | Δ | | | | | | | | |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| Thfe | Viola | → | | | | | | | |
| | | | L | | | | | | |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| | | | | | | DF | | | |
| L | | | | | | | | | |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| | | | | | Forb | ~~Bran~~ | Viola | Moss | Moss |
| Δ | | | | | | | | | |
| 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| | | | | | | | | | |
| Δ | | | | | | | | | |
| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 |
| Lo[illegible] | Pru[illegible] | Thfe | Smila | → | | Smila | → | | |
| | | | | | L | | | L | L |
| 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
| Sibre | Physo | | | | | | | | |
| | | | | | | | | | L |
| 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
| FN | Frag | DF | DF | → | | | | | |
| | | | | | | L | | | |
| 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |
| Viola | Why | → | Sver | → | Frag | → | | | |
| | | | | | | | L | | |

(T-9) SUMMARY

| Plant Symbols | Hits | T-10 |
|---|---|---|
| Grasses | | |
| ~~Bran~~ | 1 | 1 |
| Forbs | | |
| ~~Forb~~ | 1 | 1 |
| ~~Frag~~ | 1 | 1 |
| ~~Moss~~ | 2 | 1 |
| Thfe | 1 | 1 |
| Viola | 3 | 2 |
| ~~DF~~ | 5 | 2 |
| Prun | 1 | 1 |
| Veg total = | 15 | |
| L | 35 | |
| TOTAL | 50 | |

Symbol For Hits

| | |
|---|---|
| Bare Soil | B |
| Rock | R |
| Litter | L |
| Live Plants | Plant Symbol |

Phenology Record

GRASSES
- Stage 0 to 10 Leaf growth starts
- Stage 10 to 20 Flower stalks appear
- Stage 20 to 30 Heads full out
- Stage 30 to 40 Anthesis
- Stage 40 to 50 Dough
- Stage 50 to 60 Hard seed
- Stage 60 to 70 Dissemination starts
- Stage 70 to 80 Drying
- Stage 80 to 90 Dormant

SHRUBS
- Stage 0 to 10 Leaf growth starts
- Stage 10 to 20 Twig growth starts
- Stage 20 to 30 Flower buds appear
- Stage 30 to 40 First bloom
- Stage 40 to 50 Full bloom
- Stage 50 to 70 Bloom over
- Stage 60 to 70 Seed ripe
- Stage 70 to 80 Dissemination & over
- Stage 80 to 90 Leaves dry

| PARAMETER: Plant Cover | METHOD: 10 pt frame |
|---|---|
| LOCATION: Flagon Mine #1 | EXAMINER: Claire D Sumner Becky Shaw |

| RANGE SITE: [illegible] | TRANSECT NO. ⑥ sample 11 & 12 | DATE: 9.18 1983 |
|---|---|---|

COMMENTS:

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|
| Bran | Ami | | | | Frag | | Bran | Viola | Lupine |
| | | L | L | L | | L | | | |
| **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** | **19** | **20** |
| | | | | | | | | | Forb |
| L | → | → | → | → | → | → | → | → | |
| **21** | **22** | **23** | **24** | **25** | **26** | **27** | **28** | **29** | **30** |
| | Lathy | → | → | | | | | | Carex |
| L | | | | L | → | → | → | → | |
| **31** | **32** | **33** | **34** | **35** | **36** | **37** | **38** | **39** | **40** |
| Osmo | → | Frag | Osmo | Frag | | | | | |
| | | | | | L | → | → | → | → |
| **41** | **42** | **43** | **44** | **45** | **46** | **47** | **48** | **49** | **50** |
| Bran | Lathy | | Lathy | Lupine | | | | | |
| | | L | | | L | → | → | → | → |
| ~~51~~ | ~~52~~ | ~~53~~ | 54 | 55 | ~~56~~ | ~~57~~ | ~~58~~ | 59 | ~~60~~ |
| Osmo | Viola | Thfe | Lupine | | | | | | |
| | | | | L | → | → | → | → | → |
| **61** | **62** | **63** | **64** | **65** | **66** | **67** | **68** | **69** | **70** |
| Viola | DF | Viola | DF | | | | | | |
| | | | | L | → | → | → | → | → |
| **71** | **72** | **73** | **74** | **75** | **76** | **77** | **78** | **79** | **80** |
| DF | → | → | → | Lathy | → | | | | |
| | | | | | | L | → | → | → |
| **81** | **82** | **83** | **84** | **85** | **86** | **87** | **88** | **89** | **90** |
| F#1 | Viola | Bran | Viola | | | | | | |
| | | | | L | → | → | → | → | → |
| **91** | **92** | **93** | **94** | **95** | **96** | **97** | **98** | **99** | **100** |
| Viola | Epilob | Viola | Frag | → | Lathy | Epa | | | |
| | | | | | | | L | → | → |

SUMMARY for T-11

| Plant Symbols | Hits | 4's |
|---|---|---|
| Grasses | | |
| Bran | 3 | 2 |
| Carex | 1 | 1 |
| | | |
| Forbs | | |
| Ammi | 1 | 1 |
| Forb | 1 | 1 |
| Frag | 3 | 2 |
| Lathyr | 5 | 2 |
| Lupine | 2 | 2 |
| Osmo | 3 | 1 |
| Viola | 1 | 1 |
| | | |
| Tot hits | 20 | |
| | | |
| L | 30 | |
| (25) TOTAL | 50 | //////// |

Symbol For Hits

| | |
|---|---|
| Bare Soil | B |
| Rock | R |
| Litter | L |
| Live Plants | Plant Symbol |

Phenology Record

GRASSES

- Stage 0 to 10 Leaf growth starts
- Stage 10 to 20 Flower stalks appear
- Stage 20 to 30 Heads full out
- Stage 30 to 40 Anthesis
- Stage 40 to 50 Dough
- Stage 50 to 60 Hard seed
- Stage 60 to 70 Dissemination starts
- Stage 70 to 80 Drying
- Stage 80 to 90 Dormant

SHRUBS

- Stage 0 to 10 Leaf growth starts
- Stage 10 to 20 Twig growth starts
- Stage 20 to 30 Flower buds appear
- Stage 30 to 40 First bloom
- Stage 40 to 50 Full bloom
- Stage 50 to 70 Bloom over
- Stage 60 to 70 Seed ripe
- Stage 70 to 80 Dissemination ½ over
- Stage 80 to 90 Leaves dry

| PARAMETER: Plant Cover | METHOD: 10 pt frame |
|---|---|
| LOCATION: Plain Mine #1 | EXAMINER: Claire Sommer Becky Gillan |
| RANGE SITE: Upper Grassland | TRANSECT NO. (1) sample 13 & 14 — DATE: 9-18 1983 |
| COMMENTS: | |

T-14 Summary on over →

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|
| DF | Lathy | Thfe | DF | DF | Vida | → | | | |
| | | | | | | | L | → | → |
| **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** | **19** | **20** |
| Maro | DF | Maro | DF | | | | | | |
| | | | | L | → | → | → | → | → |
| **21** | **22** | **23** | **24** | **25** | **26** | **27** | **28** | **29** | **30** |
| Fran | → | Thfe | Vida | Bron | Carex | → | | | |
| | | | | | | | L | → | → |
| **31** | **32** | **33** | **34** | **35** | **36** | **37** | **38** | **39** | **40** |
| Vida | → | Ami | | | | | | | |
| | | | L | → | → | → | → | → | → |
| **41** | **42** | **43** | **44** | **45** | **46** | **47** | **48** | **49** | **50** |
| Vim | Maro | Atr | Lupine | → | | | | | |
| | | | | | L | → | → | → | → |
| ~~51~~ | ~~52~~ | ~~53~~ | ~~54~~ | ~~55~~ | ~~56~~ | ~~57~~ | ~~58~~ | ~~59~~ | ~~60~~ |
| Maro | Maro | Atr | Maro | → | | | | | |
| | | | | | L | → | → | → | → |
| **61** | **62** | **63** | **64** | **65** | **66** | **67** | **68** | **69** | **70** |
| Aemi | Bron | | | | | | | | |
| | | L | → | → | → | → | → | → | → |
| **71** | **72** | **73** | **74** | **75** | **76** | **77** | **78** | **79** | **80** |
| DF | Lathy | | | | | | | | |
| | | L | → | → | → | → | → | → | → |
| **81** | **82** | **83** | **84** | **85** | **86** | **87** | **88** | **89** | **90** |
| Fran | → | Bron | | | | | | | |
| | | | L | → | → | → | → | → | → |
| **91** | **92** | **93** | **94** | **95** | **96** | **97** | **98** | **99** | **100** |
| Lathy | → | → | → | A#1 | Aemi | Arse | | | |
| | | | | | | | L | → | → |

| SUMMARY for T-13 | | |
|---|---|---|
| Plant Symbols | Hits | fr. |
| Grasses | | |
| ~~Bron~~ | 1 | 1 |
| ~~Carex~~ | 2 | 1 |
| | | |
| Forbs | | |
| ~~Aemi~~ | 1 | 1 |
| Fran | 2 | 1 |
| Lathy | 1 | 1 |
| Lupine | 2 | 1 |
| Maro | 3 | 2 |
| Thfe | 2 | 2 |
| Vim | 1 | 1 |
| Viola | 5 | 3 |
| | | |
| Pstr | 1 | 1 |
| DF | 5 | 2 |
| Total live - | (26) | |
| L | 24 | |
| TOTAL | 50 | /////// |

**Symbol For Hits**

| | |
|---|---|
| Bare Soil | B |
| Rock | R |
| Litter | L |
| Live Plants | Plant Symbol |

**Phenology Record**

GRASSES
- Stage 0 to 10 Leaf growth starts
- Stage 10 to 20 Flower stalks appear
- Stage 20 to 30 Heads full out
- Stage 30 to 40 Anthesis
- Stage 40 to 50 Dough
- Stage 50 to 60 Hard seed
- Stage 60 to 70 Dissemination starts
- Stage 70 to 80 Drying
- Stage 80 to 90 Dormant

SHRUBS
- Stage 0 to 10 Leaf growth starts
- Stage 10 to 20 Twig growth starts
- Stage 20 to 30 Flower buds appear
- Stage 30 to 40 First bloom
- Stage 40 to 50 Full bloom
- Stage 50 to 70 Bloom over
- Stage 60 to 70 Seed ripe
- Stage 70 to 80 Dissemination & over
- Stage 80 to 90 Leaves dry

| PARAMETER: Plant Cover | METHOD: |
|---|---|
| LOCATION: | EXAMINER: Becky Gillan Claire Senior |
| RANGE SITE: | TRANSECT NO. (8) Sampled 15+16 |
| DATE: 9/18 1983 | |

COMMENTS: Forb#3 Frsp

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|
| Bran | → | → | → | Frag | Lathy | Bran | Armi | | |
| | | | | | | | | L | L |
| **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** | **19** | **20** |
| Bran | | | Bran | Bran | Armi | Vidla | Armi | | |
| | B | R | | | | | | L | L |
| **21** | **22** | **23** | **24** | **25** | **26** | **27** | **28** | **29** | **30** |
| Bran | Rown | → | Lupine | Vidla | Lupine | Bran | | | |
| | | | | | | | L | → | → |
| **31** | **32** | **33** | **34** | **35** | **36** | **37** | **38** | **39** | **40** |
| DF | DF | Smila | Bran | F#1 | Bran | | | | |
| | | | | | | L | → | → | → |
| **41** | **42** | **43** | **44** | **45** | **46** | **47** | **48** | **49** | **50** |
| Vidla | | Lathy | → | → | | | | | |
| | K | | | | L | → | → | → | → |
| **51** | **52** | **53** | **54** | **55** | **56** | **57** | **58** | **59** | **60** |
| Vidla | DF | DF | Vidla | Bran | Osmo | Vidla | | Rown | |
| | | | | | | | L | | L |
| **61** | **62** | **63** | **64** | **65** | **66** | **67** | **68** | **69** | **70** |
| | | Sipr | Astr | Vidla | → | | Osmo | | |
| B | L | | | | | L | | L | L |
| **71** | **72** | **73** | **74** | **75** | **76** | **77** | **78** | **79** | **80** |
| Moss | Frag | Bran | F#1 | | Bran | | | | |
| | | | | B | | L | → | → | → |
| **81** | **82** | **83** | **84** | **85** | **86** | **87** | **88** | **89** | **90** |
| Viola | Bran | F#1 | Lathy | → | F#1 | Lathy | | | |
| | | | | | | | L | → | → |
| **91** | **92** | **93** | **94** | **95** | **96** | **97** | **98** | **99** | **100** |
| Rown | Vidla | Bran | Vidla | Bran | | | | | |
| | | | | | L | → | → | → | → |

SUMMARY T-15

| Plant Symbols | Hits | Freq |
|---|---|---|
| Grasses | | |
| ~~Bran~~ | 12 | 4 |
| Forbs | | |
| Armi | 3 | 2 |
| Frag | 1 | 1 |
| Forb#1 | 1 | 1 |
| Lathy | 4 | 2 |
| Lupine | 2 | 1 |
| Smila | 1 | 1 |
| Vidla | 3 | 3 |
| Rown | 2 | 1 |
| DF | 2 | 1 |
| Tot Veg = | 31 | |
| B | 1 | |
| R | 2 | |
| L | 16 | |
| TOTAL | 50 | //////// |

| Symbol For Hits | |
|---|---|
| Bare Soil | B |
| Rock | R |
| Litter | L |
| Live Plants | Plant Symbol |

Phenology Record

| GRASSES | SHRUBS |
|---|---|
| Stage 0 to 10 Leaf growth starts | Stage 0 to 10 Leaf growth starts |
| Stage 10 to 20 Flower stalks appear | Stage 10 to 20 Twig growth starts |
| Stage 20 to 30 Heads full out | Stage 20 to 30 Flower buds appear |
| Stage 30 to 40 Anthesis | Stage 30 to 40 First bloom |
| Stage 40 to 50 Dough | Stage 40 to 50 Full bloom |
| Stage 50 to 60 Hard seed | Stage 50 to 70 Bloom over |
| Stage 60 to 70 Dissemination starts | Stage 60 to 70 Seed ripe |
| Stage 70 to 80 Drying | Stage 70 to 80 Dissemination & over |
| Stage 80 to 90 Dormant | Stage 80 to 90 Leaves dry |

| | |
|---|---|
| PARAMETER: Plant Cover | METHOD: 10 pt frame |
| LOCATION: Blazon mine #1 | EXAMINER: Claire Dunmire Becky Gillan |
| RANGE SITE: Aspen Alpn Fir | TRANSECT NO. (9) sample 17 |
| DATE: 9.18 1983 | |
| COMMENTS: | (1 Salix present) |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|
| Viola | → | Osmo | → | Viola | Osmo | Bron | | | |
| | | | | | | | L | → | |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| | | | | | | | | | |
| L | → | | | | | | | | |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| Lathy | DF | | | | | | | | |
| | | L | → | | | | | | |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| Viola | Frag | → | Viola | F#1 | Viola | | | | |
| | | | | | | L | → | | |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| Bron | Frag | → | F#3 | Frag | → | | | | |
| | | | | | | L | → | | |
| ~~51~~ | ~~52~~ | ~~53~~ | ~~54~~ | ~~55~~ | ~~56~~ | ~~57~~ | ~~58~~ | ~~59~~ | 60 |
| | | | | | | | | | |
| | | | | | | | | | |
| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 |
| | | | | | | | | | |
| | | | | | | | | | |
| 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
| | | | | | | | | | |
| | | | | | | | | | |
| 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
| | | | | | | | | | |
| | | | | | | | | | |
| 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |
| | | | | | | | | | |
| | | | | | | | | | |

SUMMARY T-17

| Plant Symbols | Hits | fre |
|---|---|---|
| Grasses | | 0 0 |
| ~~Bron~~ | 2 | 2 |
| | | |
| | | |
| ~~Forbs~~ | | |
| ~~F#1~~ | 1 | 1 |
| ~~F#3~~ | 1 | 1 |
| ~~Frag~~ | 6 | 2 |
| ~~Lathy~~ | 1 | 1 |
| ~~Osmo~~ | 3 | 1 |
| ~~Viola~~ | 6 | 2 |
| | | |
| ~~DF~~ | 1 | 1 |
| | | |
| Total veg | 21 | |
| | | |
| | | |
| L | 29 | |
| | | |
| TOTAL | 50 | //////// |

Symbol For Hits

| | |
|---|---|
| Bare Soil | B |
| Rock | R |
| Litter | L |
| Live Plants | Plant Symbol |

Phenology Record

GRASSES
- Stage 0 to 10 Leaf growth starts
- Stage 10 to 20 Flower stalks appear
- Stage 20 to 30 Heads full out
- Stage 30 to 40 Anthesis
- Stage 40 to 50 Dough
- Stage 50 to 60 Hard seed
- Stage 60 to 70 Dissemination starts
- Stage 70 to 80 Drying
- Stage 80 to 90 Dormant

SHRUBS
- Stage 0 to 10 Leaf growth starts
- Stage 10 to 20 Twig growth starts
- Stage 20 to 30 Flower buds appear
- Stage 30 to 40 First bloom
- Stage 40 to 50 Full bloom
- Stage 50 to 70 Bloom over
- Stage 60 to 70 Seed ripe
- Stage 70 to 80 Dissemination & over
- Stage 80 to 90 Leaves dry

LOCATION Hazon Mine #1 SUMMARY OF FIELD S' TS w/ ... ...

EGETATION TYPE: Aspen- Spruce fir - reference FIELD DATE: 9-18-83

ARAMETER: 1X50m shrub density UNITS: ______ COMMENTS: includes Arctostaphylos uva-ursi as woody sub shrub

TRANSECTS

| pecies | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | TOTAL | # stems AVERAGE | stem & / m² COMPOSITION | stem # / acre DIVERSITY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aruv | | 1 | 2 | 5 | 1 | 5 | | 1 | 1 | 1 | 1 | 1 | 4 | 4 | 3 | | 2 | | 2 | 1 | 35 | 1.75 | .035 | 141. |
| Rice | | | | | | | | | | | | | 1 | | 1 | 1 | | | | | 3 | .15 | .003 | 12.1 |
| [illegible] sp | | | | | | | | | | | | | 2 | | | 2 | | | | | 5 | .25 | .005 | 20.2 |
| Rowo | 9 | 7 | 2 | 3 | 4 | 2 | 1 | 1 | 2 | 6 | 6 | 4 | 4 | 10 | 10 | 6 | 4 | 5 | 11 | 8 | 105 | 5.25 | .105 | 424.9 |
| Shca | | | | | | 1 | | | | | | | 5 | 1 | 1 | 1 | | | | | 9 | .45 | .009 | 36.4 |
| Sypr | 7 | 5 | 5 | 9 | 11 | 10 | 8 | 5 | 9 | 3 | 3 | 6 | 7 | 6 | 9 | 8 | 7 | 6 | 9 | 9 | 142 | 7.10 | .142 | 574.6 |
| verage | 16 | 13 | 9 | 17 | 17 | 18 | 9 | 7 | 12 | 10 | 10 | 11 | 23 | 2[illegible] | 24 | 18 | 13 | 11 | 22 | 18 | 299 | 14.95 | .299 | 1,210 |

$\frac{(1.644)(24.32)}{2.24}$

20 N90/10= X= 14.95 SUMMARY BY: Claire Schimmer / Becky Gillan

0/10= $19.38 = (20)\left[\frac{(1.282)(s)}{(\bar{x})(.1)}\right]^2$ S= 5.13476 SUMMARY DATE: Sept / 30 / 1983

| | | | |
|---|---|---|---|
| PARAMETER: Plant Density | | METHOD: ×50m belt transect | |
| LOCATION: Blazon mine #1 | | EXAMINER: Claire Simmer | |
| RANGE SITE: Aspen Spr Fir | TRANSECT NO. 1-9 | DATE: 9.18 | 1983 |
| COMMENTS: Recording of Potr + DF for curiosity - density values for these done by PCQ | | | |

| Sample Plot No. | Species | DISTANCES Pt.-Quarter | $m^2$ NUMBERS Quadrat | Plot No. | Species | DISTANCES Pt.-Quarter | $m^2$ NUMBERS Quadrat |
|---|---|---|---|---|---|---|---|
| 1 | Syor | ~~IIII~~ II 7 | | 12:30 5 | Rowo | IIII | |
| | Potr | ~~IIII~~ III 8 | 16 | | Aruv | I | 17 |
| | DF | II 2 | | | Syor | ~~IIII~~ ~~IIII~~ I | |
| | Rowo | ~~IIII~~ IIII 9 | | | Potr | I | |
| | | | | | Ribes | I | |
| 2 | DF | ~~IIII~~ | | 12:40 6 | Aruv | ~~IIII~~ | 18 |
| | Syor | ~~IIII~~ | 13 | | Syor | ~~IIII~~ ~~IIII~~ | |
| | Rowo | ~~IIII~~ II | | | Rowo | II | |
| | Potr | IIII | | | Shep can | I | |
| | Aruv | I | | 12:45 7 #2 | Syor | ~~IIII~~ III | |
| | | | | | DF | II | 9 |
| 3 | DF | I | | | Potr | III | |
| | Potr | I | 9 | | Rowo | I | |
| | Syor | ~~IIII~~ | | 8 | Syor | ~~IIII~~ | |
| | Aruv | II | | | Potr | III | |
| | Rowo | II | | | DF | I | 7 |
| | | | | | Rowe | I | |
| 4 | Aruv | ~~IIII~~ | | | Aruv | I | |
| | Syor | ~~IIII~~ IIII | 17 | 9 | Syor | ~~IIII~~ IIII | |
| | DF | II | | | DF | II | 12 |
| | Rowo | III | | | Rowo | II | |
| | Potr | I | | | Potr | I | |

| PARAMETER: Plant Density | METHOD: 1 / 50 m belt-transect |
|---|---|
| LOCATION: Bloom Mine #1 | EXAMINER: Claire Sommer |
| RANGE SITE: Aspen / Snow fir · TRANSECT NO. 10-12 | DATE: 9.18 1980 3 |

COMMENTS: DF + Potr not included in determining shrub density

| Plot No. | Species | DISTANCES Pt.-Quarter | $m^2$ NUMBERS Quadrat | Plot No. | Species | DISTANCES Pt.-Quarter | $m^2$ NUMBERS Quadrat |
|---|---|---|---|---|---|---|---|
| 10 | Syor | III | | 12 | Syor | ~~IIII~~ I | |
| | DF | II | | | ArUV | I | |
| | Rowo | ~~IIII~~ I | 10 | | Rowo | IIII | 11 |
| | ArUV | I | | | DF | I | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| 11 | Potr | I | | | | | |
| | Rowo | ~~IIII~~ I | | | | | |
| | Syor | III | 10 | | | | |
| | DF | I | | | | | |
| | ArUV | I | | | | | |
| | | | | | | | |
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| PARAMETER: Plant Density | METHOD: 50 belt |
|---|---|
| LOCATION: Blazon mine #1 | EXAMINER: Claire Semmer + Becky Giller |

| RANGE SITE: Aspen/Spr Fir | TRANSECT NO. 13-18 | DATE: 9.18 1980 3 |
|---|---|---|

COMMENTS: Potr + DF not included for shrub density calc

| Plot No. | Species | DISTANCES Pt.-Quarter | $m^2$ NUMBERS Quadrat | Plot No. | Species | DISTANCES Pt.-Quarter | $m^2$ NUMBERS Quadrat |
|---|---|---|---|---|---|---|---|
| 13 | Ribes #1 (19 lvs) | 2 | | 16 | Rowo | 6 | |
| | Aruv | 4 | | | Syor | 8 | |
| | Sheca | 5 | | | Potr | 1 | Σ=(18) |
| | DF | 2 | | | DF | 1 | |
| | Rowo | 4 | Σ=(23) w/out Potr+DF | | Sheca | 1 | |
| | Syor | 7 | | Rice | Ribes #1 | 2 | |
| | Potr | 1 | | | Ribes #2 | 1 | |
| Rice | Ribes #2 | 1 | | | | | |
| | | | | 17 | Syor | 7 | |
| 14 | Rowo | 10 | | | Rowo | 4 | Σ=(13) |
| | Syor | 6 | Σ=(21) | | Aruv | 2 | |
| | DF | 3 | | | Potr | 1 | |
| | Aruv | 4 | | | | | |
| | Sheca | 1 | | 18 | Rowo | 5 | |
| | | | | | Potr | 1 | ~~Σ=14~~ |
| 15 Rice | Ribes #2 | 1 | | | DF | 2 | Σ= 11 |
| – | Picea | – present | | | Syor | 6 | |
| | Rowo | 10 | Σ=(24) | | | | |
| | Syor | 9 | | | | | |
| | Aruv | 3 | | | | | |
| | Potr | 3 | | | | | |
| | DF | 1 | | | | | |

| | |
|---|---|
| PARAMETER: Plant Density | METHOD: 1X 50 belt |
| LOCATION: Blazon mine #1 | EXAMINER: BG - Becky Gillam |

| | | |
|---|---|---|
| RANGE SITE: Aspen Spr 71R | TRANSECT NO. 19+20 | DATE: Sept. 21 1980 3 |

COMMENTS:

| (T-19) Plot No. | Species | ~~DISTANCES Pt. Quarter~~ | $m^2$ NUMBERS Quadrat | (T-20) Plot No. | Species | ~~DISTANCES Pt. Quarter~~ | $m^2$ NUMBERS Quadrat |
|---|---|---|---|---|---|---|---|
| | SyoR | 卌 IIII | | | Rowo | 卌 III | |
| | Rown | 卌 卌 I | | | | | |
| | | | | | SyoR | 卌 IIII | |
| | | | | | | | |
| | | | | * | Aruv | I | |
| * | Aruv | II | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | 17/18 | |
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| | | 20/23 | | | | | |
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LOCATION [illegible] SUMMARY OF FIELD S IS

VEGETATION TYPE: Spruce Fir / Aspen

FIELD DATE: 7 · 18 · 93

PARAMETER: Density by PCQ

UNITS: —

COMMENTS: numbers are density in Plants/acre.

TRANSECTS

| pecies | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | TOTAL | AVERAGE | COMPOSITION | DIVERSITY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Potr | 580.12 | 1745.66 | 743.76 | 34.55 | 533.13 | 1951.42 | 1179.12 | 1242.00 | 493.84 | 2621.01 | 1412.60 | 600.09 | 960.53 | 1570.8[illegible] | 264.34 | 487.85 | 1138.81 | 1646.8[illegible] | 1610.71 | 755.0[illegible] | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| Psme | 69.60 | 409.76 | 225.35 | 427.94 | 386.06 | 505.25 | 160.89 | 166.15 | 91.02 | 3086.9[illegible] | 1016.6[illegible] | 324.37 | 185.34 | 292.41 | 403.31 | 676.89 | 780.12 | 726.53 | 358.42 | 911.38 | | | | |
| verage | | | | | | | | | | | | | | | | | | | | | | | | |

N90/10=

X=

80/10= sample adequacy on page 2 S=

SUMMARY BY: [illegible]

SUMMARY DATE: 10 / 07 / 93

SUMMARY OF FIELD SP 'S

LOCATION: [illegible]

VEGETATION TYPE: Spruce fir / Aspen

FIELD DATE: 9.18.83

PARAMETER: Density by PCQ

UNITS: —

COMMENTS: numbers are density in plants/acre

TRANSECTS

| Species | 21 | 22 | 23 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | TOTAL | AVERAGE | COMPOSITION | DIVERSITY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Potr | 1129.81 | 1561.07 | 587.24 | 261.33 | 379.00 | 688.10 | 847.56 | 773.31 | 1417.34 | 401.41 | 460.28 | 764.93 | 453.38 | 392.09 | 543.93 | 524.53 | 1570.82 | 1433.70 | 244.88 | 378.43 | | | | |
| Psme | 127.43 | 737.42 | 561.29 | 298.39 | 477.85 | 540.95 | 406.74 | 229.39 | 453.38 | 521.71 | 604.39 | 386.06 | 592.87 | 453.38 | 540.95 | 671.39 | 1050.65 | 1064.16 | 235.24 | 396.40 | | | | |
| Average | | | | | | | | | | | | | | | | | | | | | | | | |

COMBINED Potr + Psme

$N90/10 = \frac{(1.282)^2 (S)^2}{[(.1)(\bar{x})]^2}$

| | Potr + Psme (combined) | | Potr | Psme |
|---|---|---|---|---|
| N90/10 = | 728.48 | $\bar{X}$ = | 911.29 | 546.36 |
| N=80 | 560.79 | S = | 576.26 | 486.05 |

N=40

SUMMARY BY: [illegible]

SUMMARY DATE: 10 / 07 / 83

MATHEMATICAL CALCULATIONS FOR PCQ DENSITY

| PARAMETER: Plant Density | METHOD: |
|---|---|
| LOCATION: | EXAMINER: Claire Semmer |
| RANGE SITE: TRANSECT NO. | DATE: 10 07 1983 |

COMMENTS: ① Ave m = sum of all 4 pts % 4 ② Ave ft = Ave m × 3.28
③ $A_i = [②]^2$ ④ $D = 43,560 \% \Sigma A_i / n \Rightarrow$ stems/acre

| Plot No. | Species | DISTANCES Pt.-Quarter | $m^2$ NUMBERS Quadrat | Plot No. | Species | DISTANCES Pt.-Quarter | $m^2$ NUMBERS Quadrat |
|---|---|---|---|---|---|---|---|
| 11 | Potr | ① 1.69 m | ③ $A_i$ = 30.84 | 16 | Potr | ① 2.88 m | $A_i$ = 89.29 |
| | | ② 5.55 ft | ④ D = 1,412.60 | | | ② 9.45 ft | ④ D = 487.85 |
| | Psme | ① 2.00 m | ③ 42.84 = $A_i$ | | Psme | ① 2.45 m | ③ $A_i$ = 64.35 |
| | | ② 6.55 ft | ④ D = 1,016.69 | | | ② 8.02 ft | ④ D = 676.39 |
| 12 | Potr | ① 2.60 m | ③ $A_i$ = 72.49 | 17 | Potr | ① 1.79 m | ③ $A_i$ = 38.25 |
| | | ② 8.51 ft | ④ D = 600.90 | | | ② 6.18 ft | ④ D = 1,138.81 |
| | Psme | ① 3.53 m | ③ 134.33 = $A_i$ | | Psme | ① 2.28 m | ③ $A_i$ = 55.84 |
| | | ② 11.59 ft | ④ D = 324.27 | | | ② 7.47 ft | ④ D = 780.12 |
| 13 | Potr | ① 2.05 m | ③ 45.35 = $A_i$ | 18 | Potr | ① 1.57 m | ③ $A_i$ = 26.45 |
| | | ② 6.73 ft | ④ 960.53 = D | | | ② 5.14 ft | ④ D = 1,646.87 |
| | Psme | ① 4.67 m | ③ $A_i$ = 235.02 | | Psme | ① 2.36 m | ③ $A_i$ = 59.96 |
| | | ② 15.33 ft | D = 185.34 | | | ② 7.74 ft | ④ D = 726.53 |
| 14 | Potr | ① 1.61 m | ③ $A_i$ = 27.73 | 19 | Potr | ① 1.59 m | ③ $A_i$ = 27.04 |
| | | ② 5.27 ft | ④ D = 1,570.82 | | | ② 5.20 ft | ④ D = 1,610.71 |
| | Psme | ① 3.72 m | ③ $A_i$ = 148.97 | | Psme | ① 3.36 m | ③ $A_i$ = 121.53 |
| | | ② 12.21 ft | ④ D = 292.41 | | | ② 11.02 ft | ④ D = 358.42 |
| 15 | Potr | ① 3.91 m | ③ $A_i$ = 164.79 | 20 | Potr | ① 2.32 m | ③ $A_i$ = 57.69 |
| | | ② 12.84 ft | ④ D = 264.34 | | | ② 7.60 ft | ④ D = 755.05 |
| | Psme | ① 3.17 m | ③ $A_i$ = 108.01 | | Psme | ① 2.39 m | ③ $A_i$ = 61.23 |
| | | ② 10.39 ft | ④ D = 403.31 | | | ② 7.83 ft | ④ D = 711.38 |
| | | | | | | | |
| | | | | | | | |

MATHEMATICAL CALCULATIONS FOR PCQ DENSITY

| PARAMETER: Plant Density | METHOD: |
|---|---|
| LOCATION: | EXAMINER: Claire Semmer |
| RANGE SITE: | TRANSECT NO. / DATE: 10·07 1980 3 |

COMMENTS: ① Ave m = sum of all pts ÷ 4 ② Ave ft = Ave m × 3.28
③ $A_i = [②]^2$ ④ $D = 43{,}560 \div \Sigma A_i/n$ ⇒ stems/acre

| Plot No. | Species | DISTANCES Pt.-Quarter | $m^2$ NUMBERS Quadrat | Plot No. | Species | DISTANCES Pt.-Quarter | $m^2$ NUMBERS Quadrat |
|---|---|---|---|---|---|---|---|
| 21 | Potr | ① 1.29 m | ③ $A_i$ = 38.56 | 26 | Potr | ① 2.43 m | ③ $A_i$ = 63.30 |
| | | ② 4.21 ft | ④ D = 1,129.81 | | | ② 7.96 ft | ④ D = 688.10 |
| | Psme | ① 5.64 m | ③ $A_i$ = 341.82 | | Psme | ① 2.74 m | ③ $A_i$ = 80.52 |
| | | ② 18.49 ft | ④ D = 127.43 | | | ② 8.97 ft | ④ D = 540.95 |
| 22 | Potr | ① 1.61 m | ③ $A_i$ = 27.90 | 27 | Potr | ① 2.19 m | ③ $A_i$ = 51.39 |
| | | ② 5.28 ft | ④ D = 1,561.07 | | | ② 7.17 ft | ④ D = 847.56 |
| | Psme | ① 2.34 m | ③ $A_i$ = 59.07 | | Psme | ① 2.11 m | ③ $A_i$ = 48.04 |
| | | ② 7.69 ft | ④ D = 737.42 | | | ② 6.93 ft | ④ D = 906.74 |
| 23 | Potr | ① 2.63 m | ③ $A_i$ = 74.18 | 28 | Potr | ① 2.29 m | ③ $A_i$ = 56.33 |
| | | ② 8.61 ft | ④ D = 587.24 | | | ② 7.51 ft | ④ D = 773.31 |
| | Psme | ① 2.69 m | ③ $A_i$ = 77.61 | | Psme | ① 4.20 m | ③ $A_i$ = 189.89 |
| | | ② 8.81 ft | ④ D = 561.29 | | | ② 13.78 ft | ④ D = 229.39 |
| 24 | Potr | ① 3.94 m | ③ $A_i$ = 166.69 | 29 | Potr | ① 1.66 m | ③ $A_i$ = 29.49 |
| | | ② 12.91 ft | ④ D = 261.33 | | | ② 5.43 ft | ④ D = 1,477.34 |
| | Psme | ① 3.68 m | ③ $A_i$ = 145.93 | | Psme | ① 2.99 m | ③ $A_i$ = 96.08 |
| | | ② 12.08 ft | ④ D = 298.39 | | | ② 9.80 ft | ④ D = 453.38 |
| 25 | Potr | ① 3.27 m | ③ $A_i$ = 114.93 | 30 | Potr | ① 3.18 m | ③ $A_i$ = 108.52 |
| | | ② 10.72 ft | ④ D = 379.00 | | | ② 10.42 ft | ④ D = 401.41 |
| | Psme | ① 2.91 m | ③ $A_i$ = 91.16 | | Psme | ① 2.79 m | ③ $A_i$ = 83.50 |
| | | ② 9.55 ft | ④ D = 477.85 | | | ② 9.14 ft | ④ D = 521.71 |
| | | | | | | | |
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# MATHEMATICAL CALCULATIONS FOR PCQ DENSITY

| | |
|---|---|
| PARAMETER: Plant Density | METHOD: |
| LOCATION: | EXAMINER: Claire Sommer |
| RANGE SITE: TRANSECT NO. | DATE: 10 · 07 1983 |

COMMENTS: ① Ave m = sum of all p's ÷ 4 ② Ave ft = Ave m × 3.28
③ $A_j = [②]^2$ ④ $D = 43{,}560 \div \Sigma A_j / n \Rightarrow$ stems/acre

| Plot No. | Species | DISTANCES Pt.-Quarter | m² NUMBERS Quadrat | Plot No. | Species | DISTANCES Pt.-Quarter | m² NUMBERS Quadrat |
|---|---|---|---|---|---|---|---|
| 1 | Potr | ① 2.63 m | ③ Ai = 74.32 | 6 | Potr | ① 1.44 m | ③ 22.32 = Ai |
| | | ② 8.62 ft | ④ D = 586.12 | | | ② 4.72 ft | ④ D = 1,951.42 |
| | Psme | ① 7.63 m | ③ 625.88 | | Psme | ① 2.83 m | ③ Ai = 86.22 |
| | | ② 25.02 ft | ④ 69.60 | | | ② 9.29 ft | ④ D = 505.25 |
| 2 | Potr | ① 1.52 m | ③ Ai = ~~34~~24.95 | 7 | Potr | ① 1.85 m | ③ Ai = 36.94 |
| | | ② 5.00 ft | ④ D = 1745.64 | | | ② 6.08 ft | D = 1,179.12 |
| | Psme | ① 3.14 m | ③ Ai = 106.31 | | Psme | ① 5.02 m | ③ Ai = 270.74 |
| | | ② 10.31 ft | ③ D = 409.76 | | | ② 16.45 ft | ④ D = 160.89 |
| 3 | Potr | ① 2.33 m | ③ Ai = 58.57 | 8 | Potr | ① 1.81 m | ③ Ai = 35.07 |
| | | ② 7.65 ft | ④ D = 743.76 | | | ② 5.92 ft | ④ D = 1,242.00 |
| | Psme | ① 4.24 m | ③ Ai = 193.30 | | Psme | ① 4.94 m | ③ Ai = 262.17 |
| | | ② 13.90 ft | ④ D = 225.35 | | | ② 16.19 ft | ④ D = 166.15 |
| 4 | Potr | ① 10.82 m | ③ Ai = 1,260.86 | 9 | Potr | ① 2.56 m | ③ Ai = 88.21 |
| | | ② 35.51 ft | ④ D = 34.55 | | | ② 9.39 ft | ④ D = 493.84 |
| | Psme | ① 3.08 m | ③ Ai = 101.79 | | Psme | ① 6.67 m | ③ Ai = 478.56 |
| | | ② 10.09 ft | ④ D = 427.97 | | | ② 21.88 ft | ④ D = 91.02 |
| 5 | Potr | ① 2.76 m | ③ Ai = 81.71 | 10 | Potr | ① 1.24 m | ③ Ai = 16.62 |
| | | ② 9.04 ft | ④ D = 533.13 | | | ② 4.08 ft | ④ D = 2,621.0[illegible] |
| | Psme | ① 3.24 m | ③ Ai = 112.83 | | Psme | ① 1.15 m | ③ Ai = 14.11 |
| | | ② 10.62 ft | ④ D = 386.06 | | | ② 3.76 ft | ④ D = 3,0[illegible] |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

MATHEMATICAL CALCULATIONS FOR PCQ DENSITY

| PARAMETER: Plant Density | | METHOD: |
|---|---|---|
| LOCATION: | | EXAMINER: Claire Semnur |
| RANGE SITE: | TRANSECT NO. | DATE: 10-07 1983 |

COMMENTS: ① Ave m = sum of all pts ÷ 4 ② Ave ft = Ave m × 3.28
③ $A_j = [②]^2$ ④ $D = 43{,}560 \div \Sigma A_j / n$ ⇒ stems/acre

| Plot No. | Species | DISTANCES Pt.-Quarter | NUMBERS $m^2$ Quadrat | Plot No. | Species | DISTANCES Pt.-Quarter | NUMBERS $m^2$ Quadrat |
|---|---|---|---|---|---|---|---|
| 31 | Potr | ① 2.97 m | ③ $A_j$ = 94.64 | 36 | Potr | ① 2.78 m | ③ $A_j$ = 83.05 |
| | | ② 9.73 ft | ④ D = 460.25 | | | ② 9.11 ft | ④ D = 524.53 |
| | Psme | ① 2.59 m | ③ $A_j$ = 72.07 | | Psme | ① 2.46 m | ③ $A_j$ = 64.88 |
| | | ② 8.49 ft | ④ D = 604.39 | | | ② 8.05 ft | ④ D = 671.39 |
| 32 | Potr | ① 2.30 m | ③ $A_j$ = 56.95 | 37 | Potr | ① 1.61 m | ③ $A_j$ = 27.73 |
| | | ② 7.55 ft | ④ D = 764.93 | | | ② 5.27 ft | ④ D = 1,570.82 |
| | Psme | ① 3.24 m | ③ $A_j$ = 112.83 | | Psme | ① 1.96 m | ③ $A_j$ = 41.46 |
| | | ② 10.62 ft | ④ D = 386.06 | | | ② 6.44 ft | ④ D = 1,050.65 |
| 33 | Potr | ① 2.99 m | ③ $A_j$ = 96.08 | 38 | Potr | ① 1.68 m | ③ $A_j$ = 30.38 |
| | | ② 9.80 ft | ④ D = 453.38 | | | ② 5.51 ft | ④ D = 1,433.70 |
| | Psme | ① 2.61 m | ③ $A_j$ = 73.47 | | Psme | ① 1.95 m | ③ $A_j$ = 40.93 |
| | | ② 8.57 ft | ④ D = 592.87 | | | ② 6.40 ft | ④ D = 1,064.16 |
| 34 | Potr | ① 3.21 m | ③ $A_j$ = 111.10 | 39 | Potr | ① 4.07 m | ③ $A_j$ = 177.88 |
| | | ② 10.54 ft | ④ D = 392.09 | | | ② 13.34 ft | ④ D = 244.88 |
| | Psme | ① 2.99 m | ③ 96.08 = $A_j$ | | Psme | ① 4.15 m | ③ $A_j$ = 185.18 |
| | | ② 9.80 ft | ④ D = 453.38 | | | ② 13.61 ft | ④ D = 235.24 |
| 35 | Potr | ① 2.73 m | ③ $A_j$ = 80.08 | 40 | Potr | ① 3.27 m | ③ $A_j$ = 115.11 |
| | | ② 8.95 ft | ④ D = 543.93 | | | ② 10.73 ft | ④ D = 378.43 |
| | Psme | ① 2.74 m | ③ $A_j$ = 80.52 | | Psme | ① 3.20 m | ③ $A_j$ = 109.89 |
| | | ② 8.97 ft | ④ D = 540.95 | | | ② 10.48 ft | ④ D = 396.40 |
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| PARAMETER: Plant Density | METHOD: PCQ |
|---|---|
| LOCATION: [illegible] Mine #1 | EXAMINER: Claire [illegible] |

| RANGE SITE: Spruce Fir /Aspen | TRANSECT NO. 1-5 | DATE: 9·18 198~~0~~3 |
|---|---|---|

COMMENTS:

| Plot No. | Species | DISTANCES Pt.-Quarter (in meters) | DBH cm ~~NUMBERS~~ $m^2$ Quadrat | Plot No. | Species | DISTANCES Pt.-Quarter (in meters) | DBH cm ~~NUMBERS~~ $m^2$ Quadrat |
|---|---|---|---|---|---|---|---|
| 1 | Potr | .92 m | 92 cm | 3 | DF | 5.12 m | 8.3 cm |
| | | 4.75 | 8.0 cm | | | 4.62 | 13.6 |
| | | 4.54 | 11.0 | | | 3.02 | 20.3 |
| | | .30 | 10.2 | | | 4.19 | 18.2 |
| | Psme | 4.34 | 5.5 | 4 | Potr | 4 34 | 8.0 |
| | | 12.61 | 3.2 | | | .75 | 9.8 |
| | | 5.97 | 1.2 | | | 54.2 | 15.4 |
| | | 7.58 | 8.0 | | | 14.1 | 12.4 |
| 2 | Potr | .86 | 5.8 | | DF | 1.30 | 1.0 |
| | | 1.63 | 14.0 | | | 3.80 | 7.6 |
| | | 193 | 11.8 | | | 3.65 | 10.4 |
| | | 1.67 | 10.8 | | | 3.55 | 21.0 |
| | DF | 1.27 | 7.5 | 5 | Potr | 2.36 | 10.6 |
| | | 5.03 | 9.8 | | | 4.13 | 7.9 |
| | | 4.34 | 7.0 | | | 1.62 | 13.3 |
| | | 1.93 | 6.2 | | | 2.91 | 10.8 |
| 3 | Potr | 3.09 | 4.8 | | DF | 3.48 | 7.6 |
| | | 3.86 | 18.3 | | | 2.37 | 17.2 |
| | | 1.94 | 9.2 | | | 1.40 | 16.3 |
| | | .44 | 9.0 | | | 5.70 | 22.2 |
| | | | | | | | |
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| PARAMETER: Plant Density | METHOD: PCQ |
|---|---|
| LOCATION: Blazon mine #1 | EXAMINER: Claire Sommer |

| RANGE SITE: Aspen / Spr Fir | TRANSECT NO. 6-10 | DATE: 9.18 1983 |
|---|---|---|

COMMENTS: [2 willows]

| Plot No. | Species | DISTANCES (m) Pt.-Quarter | m² NUMBERS Quadrat | Plot No. | Species | DISTANCES (m) Pt.-Quarter | m² NUMBERS Quadrat |
|---|---|---|---|---|---|---|---|
| 6 | Potr | .45/9.8 | | 8 (cont.) | DF | 8.35/5.4 | |
| | ↓ | .75/9 | 144 | | ↓ | 3.38/1.2 | |
| | ↓ | 3.08/9.8 | | | ↓ | 5.46/8.3 | 493.5 |
| | ↓ | 1.48/14 | | | ↓ | 2.55/1.6 | |
| | DF | 2.86/12 | | 9 | Potr | 2.98/9.2 | |
| | ↓ | .84/24.5 | 283 | | ↓ | 2.68/7.6 | |
| | ↓ | 3.17/17.6 | | | ↓ | 3.42/9.8 | 246.25 |
| | ↓ | 3.65/21.8 | | | ↓ | 2.37/10.4 | |
| 7 | Potr | .23/.8 | | | DF | 1.44/8 | |
| | ↓ | 2.13/13.6 | 145.25 | | ↓ | 7.70/9 | |
| | ↓ | 3.79/10.5 | | | ↓ | 10.37/1.3 | 1661.75 |
| | ↓ | 1.26/16 | | | ↓ | 2.16/7.3 | |
| | DF | 3.95/1 | | 10 | Potr | 1.78/5.8 | |
| | ↓ | 5.29/1.8 | 501.5 | | ↓ | 1.82/7.2 | 124.25 |
| | ↓ | 6.27/11.4 | | | ↓ | .53/5.4 | |
| | ↓ | 4.55/8.2 | | | ↓ | .84/7.4 | |
| 8 | Potr | 4.11/19 | | | DF | .41/1.8 | |
| | ↓ | .56/7.2 | 180.5 | | ↓ | .55/1.8 | 114.5 |
| | ↓ | 1.25/8.2 | | | ↓ | 1.78/2.8 | |
| | ↓ | 1.25/12 | | | ↓ | 1.84/1 | |
| | | | | | | | |
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| | |
|---|---|
| PARAMETER: Plant Density | METHOD: PCQ |
| LOCATION: Blazon mine #1 | EXAMINER: C. S[illegible] |
| RANGE SITE: Aspen Sbr Fir · TRANSECT NO. 11–15 | DATE: 9.18 1983 |
| COMMENTS: | |

| Plot No. | Species | DISTANCES (in meters) Pt.-Quarter / DBH in cm | NUMBERS $m^2$ Quadrat | Plot No. | Species | DISTANCES (m) Pt.-Quarter / DBH in cm | NUMBERS $m^2$ Quadrat |
|---|---|---|---|---|---|---|---|
| 11 | Potr | 2.49/5.8 | | 13 | DF | 1.59.5/22.2 | |
| | ↓ | 1.15/6.4 | | | ↓ | 5.05/7.8 | 336.363 |
| | ↓ | 2.38/6.4 | 169.25 | | ↓ | 3.45/13.5 | |
| | ↓ | .75/13.5 | | | ↓ | 3.60/.8 | |
| | DF | .87/27 | | 14 | Potr | .84.2/9.0 | |
| | ↓ | 2.18/7.8 | 199.5 | | ↓ | .92/10.8 | |
| | ↓ | 2.78/7.4 | | | ↓ | 3.28/14.9 | |
| | ↓ | 2.15/20 | | | ↓ | .78.2/7.8 | |
| 12 | Potr | 2.14.2/11.8 | | | DF | 3.48/14.6 | 264 |
| | ↓ | 1.29/7.8 | | | ↓ | 3.37.7/9.8 | |
| | ↓ | 3.84.2/7.8 | Σ of 60: | | ↓ | 2.58/20.9 | |
| | ↓ | 3.11.4/8.2 | 8 = | | ↓ | 3.45.2/31.8 | |
| | DF | 2.48.2/5.2 | 306.6 | 15 | Potr | 2.36.4/8.8 | |
| | ↓ | 5.00/8.1 | | | ↓ | 5.05.6/9.0 | 354.2 |
| | ↓ | 4.79.8/9.8 | | | ↓ | 4.00/14.8 | |
| | ↓ | 1.76/6.2 | | | ↓ | 3.31/.5 | |
| 13 | Potr | .32.2/6.2 | | | DF | .76.2/.5 | |
| | ↓ | 2.74.2/7.2 | | | ↓ | 3.38.2/6.8 | |
| | ↓ | 3.48/11.5 | | | ↓ | 4.97.2/10.6 | |
| | ↓ | 1.67/10 | | | ↓ | 3.06/11.8 | |
| | | | | | | | |
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| PARAMETER: Plant Density | METHOD: PCQ |
|---|---|
| LOCATION: Blazon mine #1 | EXAMINER: BSGibson |

| RANGE SITE: Aspen / Scr Fir | TRANSECT NO. 16-20 | DATE: 9.18 1983 |
|---|---|---|

COMMENTS:

| Plot No. | Species | DISTANCES Pt.-Quarter (P-Q / DBH, cm / cm) | $m^2$ NUMBERS Quadrat | Plot No. | Species | DISTANCES Pt.-Quarter (DBH, cm / cm) | $m^2$ NUMBERS Quadrat |
|---|---|---|---|---|---|---|---|
| 16 | Potr | .70/10 | | 18 (cont.) | DF | 220/3 | |
| | ↓ | 3.48/13 | | | ↓ | 180.2/20 | 196.45 |
| | ↓ | 2.24/16 | Σ of Both = | | ↓ | .94.2/3.4 | |
| | ↓ | 5.10/6.3 | | | ↓ | 450/16 | |
| | DF | 1.34/3 | 266.25 | 19 | Potr | 1.50/8 | |
| | ↓ | 1.88/4 | | | ↓ | 1.50/2 | |
| | ↓ | 2.49/2 | | | ↓ | .54/9 | |
| | ↓ | 4.07/1 | | | ↓ | 2.80/7.1 | 547.25 |
| 17 | Potr | .40/14 | | | DF | 1.80/2.3 | |
| | ↓ | 4.40/9 | | | ↓ | 2.34/1 | |
| | ↓ | 1.47/8 | | | ↓ | 6.70/7.3 | |
| | ↓ | 1.27/10 | 208.13 | | ↓ | 2.60/7.4 | |
| | DF | 2.23/1.8 | | 20 | Potr | .650/9 | |
| | ↓ | 3.30/2 | | | ↓ | 4.10/12 | |
| | ↓ | .24/2 | | | ↓ | 1.10.1/14 | |
| | ↓ | 3.34/40 | | | ↓ | 2.56/2 | 535.175 |
| 18 | Potr | .80/7 | | | DF | 4.96/2.3 | |
| | ↓ | 1.10.2/9 | | | ↓ | 2.20.8/3 | |
| | ↓ | 1.40/1 | | | ↓ | .90/2.5 | |
| | ↓ | 2.97/14 | | | ↓ | 1.48/3 | |
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PARAMETER: Plant Density | METHOD: PCQ

LOCATION: Bacon Mine #1 | EXAMINER: Claire Semmer

RANGE SITE: Aspen/Spruce Fir | TRANSECT NO. 21-25 | DATE: 9-18 1983

COMMENTS:

| Plot No. | Species | meters DISTANCES Pt.-Quarter | DBH in cm $m^2$ ~~NUMBERS~~ ~~Quadrat~~ | Plot No. | Species | meters DISTANCES Pt.-Quarter | DBH in cm $m^2$ ~~NUMBERS~~ Quadrat |
|---|---|---|---|---|---|---|---|
| 21 | Potr | .74 | 6.1 | 23 | DF | 2.92 | 32.0 |
| | | 3.30 | 14.0 | | | 2.28 | 2.0 |
| | | 1.63 | 10.1 | | | 1.84 | 1.2 |
| | | 1.90 | 10.0 | | | 3.70 | 10.0 |
| | DF | 7.30 | 7.4 | 24 | Potr | 7.00 | 15.3 |
| | | 7.80 | 18.2 | | | 2.10 | .7 |
| | | 4.84 | 2.2 | | | 2.65 | 9.8 |
| | | 2.60 | 7.2 | | | 4.00 | 9.0 |
| 22 | Potr | 1.27 | 7.2 | | DF | 7.91 | 3.0 |
| | | 2.90 | 1.0 | | | 2.21 | 1.5 |
| | | .87 | 20.0 | | | 1.91 | 1.0 |
| | | 1.40 | 6.0 | | | 2.70 | 1.0 |
| | DF | 1.30 | 6.0 | 25 | Potr | 2.69 | 6.8 |
| | | 1.27 | 2.1 | | | 4.63 | 7.5 |
| | | 2.60 | 28.0 | | | 1.45 | 9.2 |
| | | 4.20 | 20.0 | | | 4.3 | 12.4 |
| 23 | Potr | 1.00 | 24.0 | | DF | 1.81 | 5.8 |
| | | 4.11 | 14.6 | | | 5.52 | 20.4 |
| | | 1.70 | 7.0 | | | 1.68 | 18.5 |
| | | 3.70 | 12.0 | | | 2.63 | 14.2 |
| | | | | | | | |
| | | | | | | | |

| PARAMETER: Plant Density | METHOD: PCQ |
|---|---|
| LOCATION: Blazon mine #1 | EXAMINER: Claire Smith |
| RANGE SITE: Aspen/Spr Fir | TRANSECT NO. 26-30 · DATE: 9.18 1983 |
| COMMENTS: Spruce 11 | |

| Plot No. | Species | DISTANCES Pt.-Quarter | $m^2$ NUMBERS Quadrat | Plot No. | Species | DISTANCES Pt.-Quarter | $m^2$ NUMBERS Quadrat |
|---|---|---|---|---|---|---|---|
| 26 | Potr | 333.4/5.4 | | 28 (cont.) | DF | 5.6/7.0 | |
| | | 150/7.4 | | | | 39.4/4.8 | |
| | | 202/7.6 | | | | 58[illegible]/1.4 | (80/4) |
| | ↓ 2.12 | 211.5/10.8 | | | ↓ | 347.8/.8 | |
| | DF | 334/1.8 | 232.963 | 29 | Potr | 253.5/15.5 | |
| | | 253.2/1.8 | | | | 136/17 | |
| | | 290.1/1.6 | | | | 125/3.8 | |
| | ↓ 2.17 | 205/12.5 | | | ↓ | 148/9.5 | 232.125 |
| 27 | Potr | 144.2/9.2 | | | DF | 149.2/2.0 | |
| | | [illegible] | | | | 417.8/14.2 | |
| | | 328.2/1.2 | | | | 335/9.4 | (284/1) |
| | ↓ 1.52 | 168.8/5.8 | | | ↓ | 243.2/1.4 | |
| | DF | 25[illegible]/1.8 | 214.775 | 30 | Potr | 244.2/12.8 | |
| | 1.51 | 120.6/3.2 | | | | 253.2/17.8 | |
| | 3.92 | 397.6/4.8 | | | | 511.4/16.8 | |
| | ↓ 1.5 | 180.6/14.4 | | | ↓ | 262.4/12.8 | 297.8125 |
| 28 | Potr | 25[illegible].2/8.8 | | | DF | 204.6/12.8 | |
| | | 339/14.4 | | | | 336.5/15.5 | |
| | | 243.4/10.8 | 280.138 | | | 394.2/21.2 | |
| | ↓ 3.57 | 307.8/12.5 | | | ↓ | 176/13.5 | |
| | | | | | | | |
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| PARAMETER: Plant Density | METHOD: |
|---|---|
| LOCATION: Alazon Mine #1 | EXAMINER: F. Gillan |

| RANGE SITE: Kentucky Fir | TRANSECT NO. 31-35 | DATE: Sept. 21 1983 |
|---|---|---|

COMMENTS:

| Plot No. | Species | DISTANCES Pt.-Quarter | (DBH in cm) NUMBERS $m^2$ Quadrat | Plot No. | Species | DISTANCES Pt.-Quarter | (DBH in cm) NUMBERS $m^2$ Quadrat |
|---|---|---|---|---|---|---|---|
| 31 | DF | 114 cm) | 12.5 | 33 (cont) | Potr | 256 | 13.5 |
| | \| | 271.1 | 8.5 | | \| | 82.2 | 23 |
| | \| | 420 | 46.2 | | \| | 370 | 18 |
| | ↓ | 230 | 18.2 | | ↓ | 487 | 12.1 |
| | Potr | 469.2 | 11.6 | 34 | DF | 313 | 25.3 |
| | \| | 418.2 | 11.4 | | \| | 261.5 | 1.0 |
| | \| | 177 | 12 | | \| | 170 | 5 |
| | ↓ | 122 | 10 | | ↓ | 450 | 2.3 |
| 32 | DF | 199 | 1.0 | | Potr | 350 | 13.5 |
| | \| | 294 | 17.4 | | \| | 305 | 19.3 |
| | \| | 415 | 33 | | \| | 220 | 13.3 |
| | ↓ | 387 | 20 | | ↓ | 410 | 18.1 |
| | Potr | 306 | 8.3 | 35 | DF | 270.2 | 15.2 |
| | \| | 281 | 12.1 | | \| | 181 | 1 |
| | \| | 163.2 | 12.0 | | \| | 283 | 2 |
| | ↓ | 170 | 18.4 | | ↓ | 360 | 26.3 |
| 33 | DF | 279 | 17.0 | | Potr | 430 | 10.5 |
| | \| | 300 | 2.5 | | \| | 270 | 8.0 |
| | \| | 230 | 13.8 | | \| | 190 | 12.1 |
| | ↓ | 236 | 18.2 | | ↓ | 201.3 | 17.3 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

| PARAMETER: Plant Density | METHOD: PCQ |
|---|---|
| LOCATION: Blazon Mine #1 | EXAMINER: B Gillam |

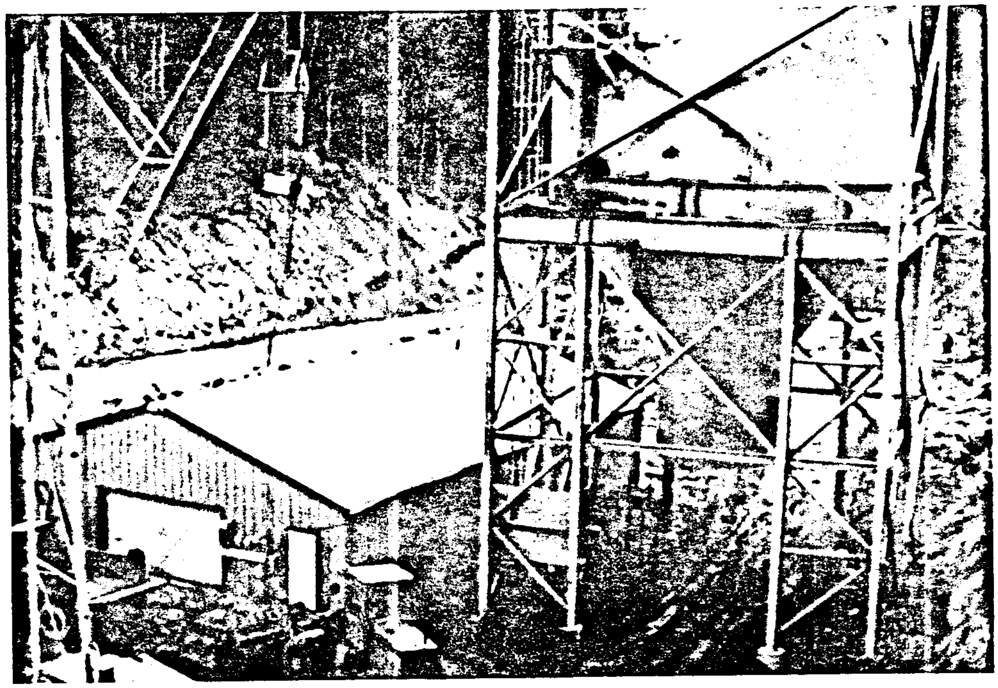
| RANGE SITE: Aspen/Spr. Fir | TRANSECT NO. 36-40 | DATE: Sept. 21 198~~0~~3 |
|---|---|---|

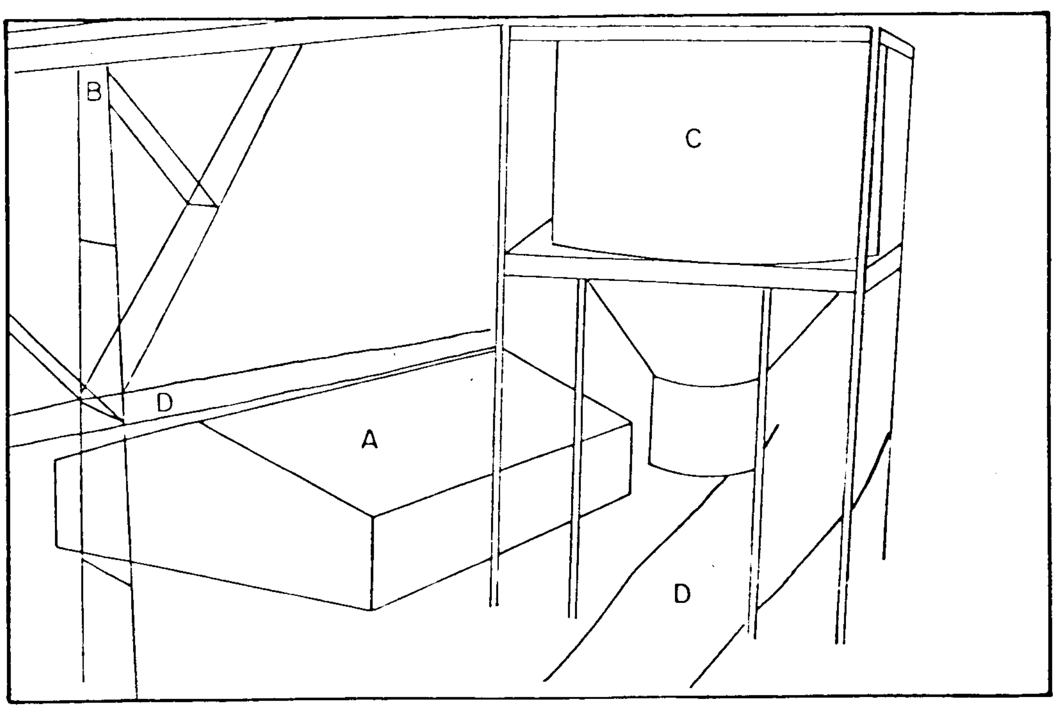
COMMENTS:

| Plot No. | Species | DISTANCES Pt.-Quarter | NUMBERS $m^2$ Quadrat | Plot No. | Species | DISTANCES Pt.-Quarter | NUMBERS $m^2$ Quadrat |
|---|---|---|---|---|---|---|---|
| 36 | DF | 153 | 16.2 | 38 cont.) | Potr | 30 | 6.2 |
| | | 200 | 8.1 | | | 200 | 11.3 |
| | | 259.1 | 8.9 | | | 270 | 6.1 |
| | | 370 | 1.3 | | | 171.5 | 15.2 |
| | Potr | 55.1 | 6.2 | 39 | DF | 594.2 | 42.5 |
| | | 490.3 | 14 | | | 590.5 | 15.6 |
| | | 326.2 | 9.0 | | | 150 | 1.3 |
| | | 240 | 12.3 | | | 324.4 | 7.3 |
| 37 | DF | 208 | 2.0 | | Potr | 1020 | 13.2 |
| | | 160 | 2.8 | | | 180 | 9.2 |
| | | 156.8 | 15.2 | | | 201 | 8.0 |
| | | 260 | 1.5 | | | 225 | 9.1 |
| | Potr | 60 | 8.6 | 40 | DF | 4630 | 42.8 |
| | | 320 | 9.0 | | | 101.2 | 10.0 |
| | | 85.1 | 13.3 | | | 219 | 12.3 |
| | | 177.0 | 10.8 | | | 495 | 5.8 |
| 38 | DF | 300 | 21.7 | | Potr | 687.4 | 8.3 |
| | | 50 | 2 | | | 144.4 | 12.8 |
| | | 241 | 2.05 | | | 361 | 9.1 |
| | | 189.1 | 1.5 | | | 116 | 8.4 |
| | | | | | | | |
| | | | | | | | |

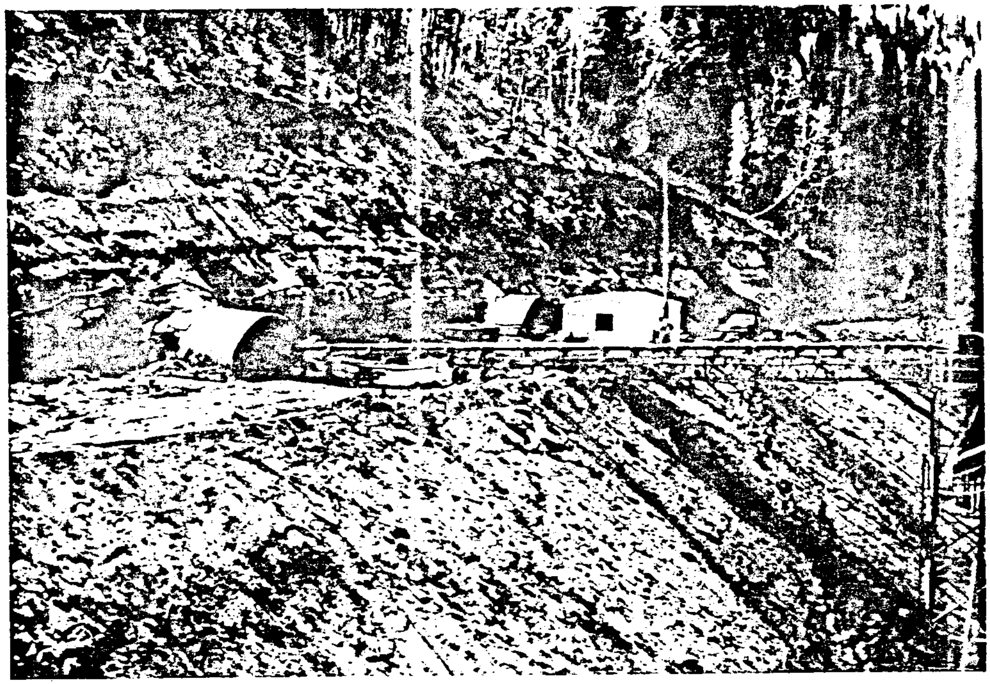
Exhibit 13

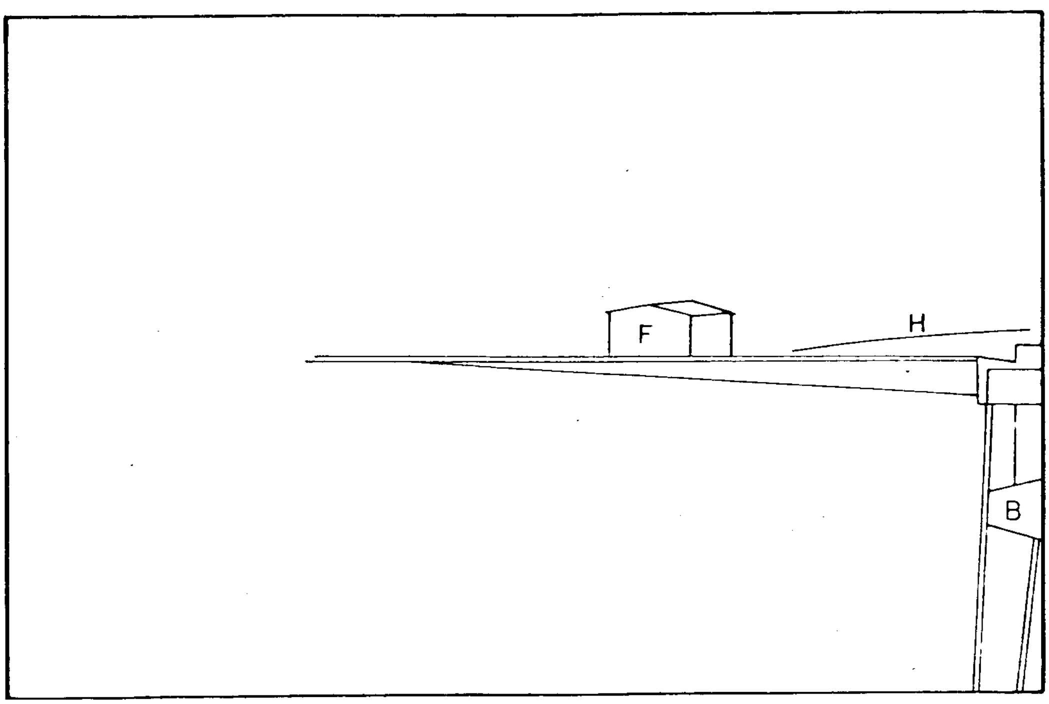
PHOTOGRAPHS OF EXISTING STRUCTURES



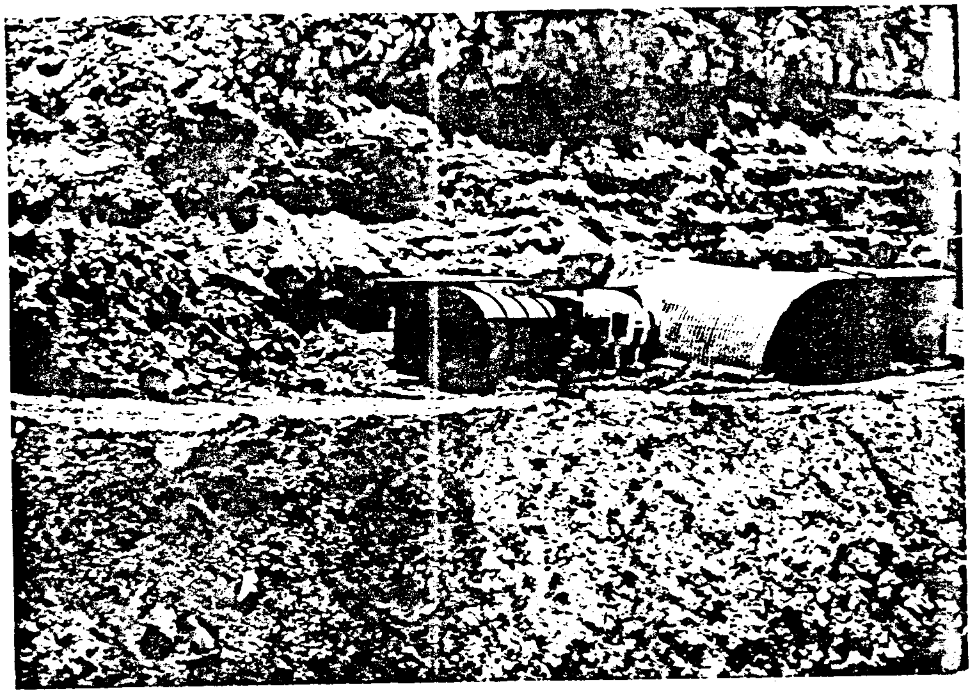


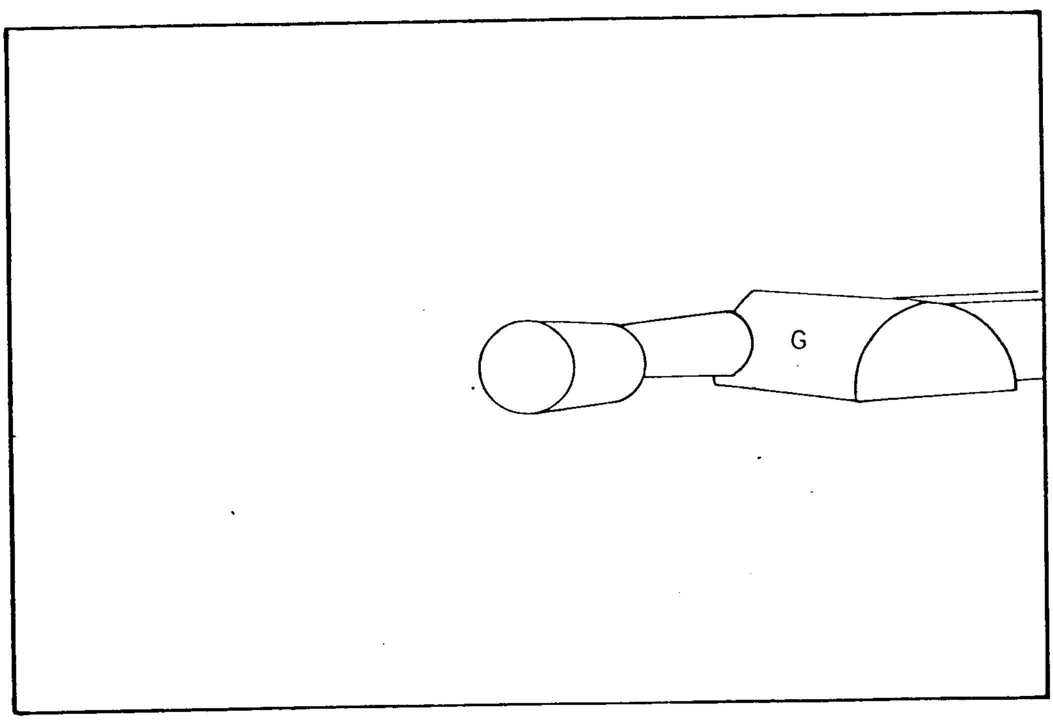

Photograph Number 1 - Looking northwest: A-Office, Bathhouse, Shop Complex; B-Run-of-Mine Conveyor System; C-Coal Loading Bin; D-Primary Road (main access and coal haulage)



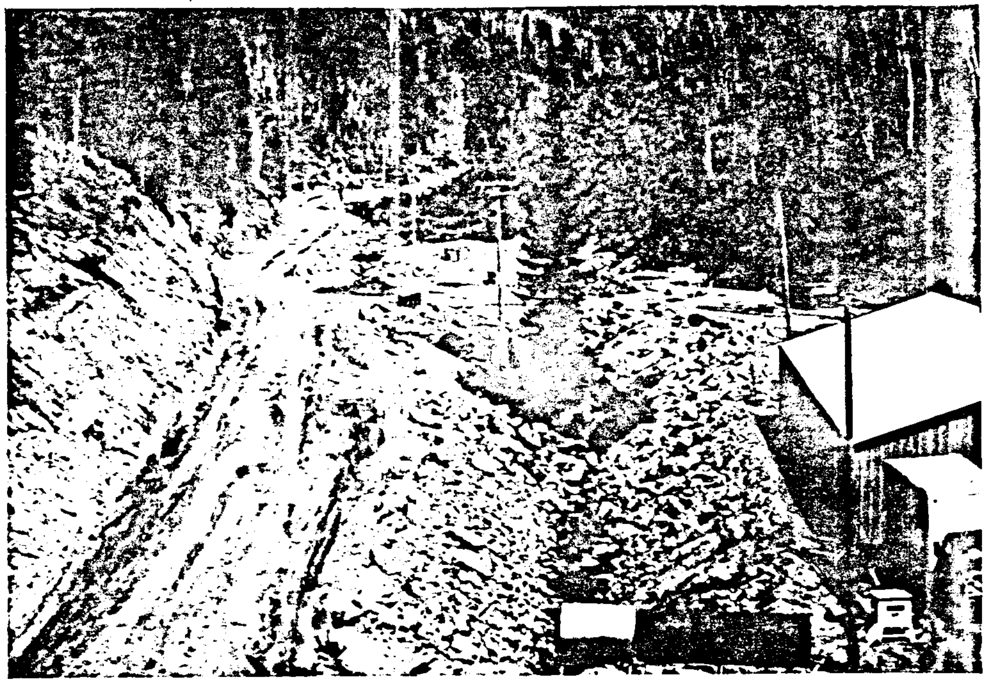


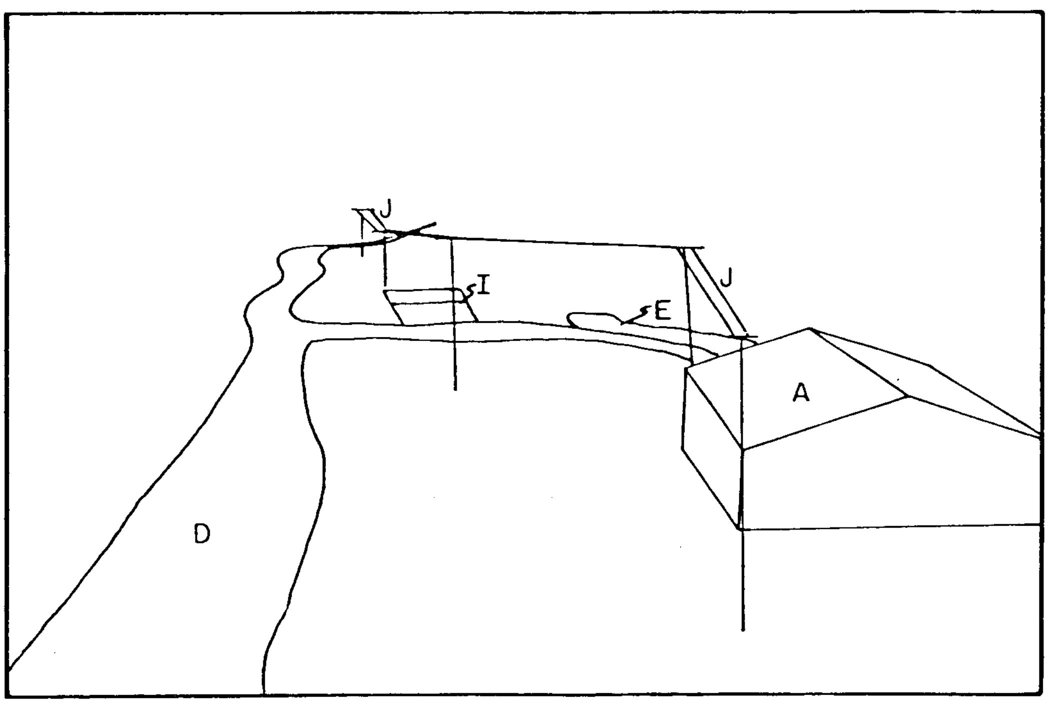

Photograph Number 2 - Looking southeast: B-Run-of-Mine Conveyor System; F-Storage Shed; H-Secondary Road (portal area access)



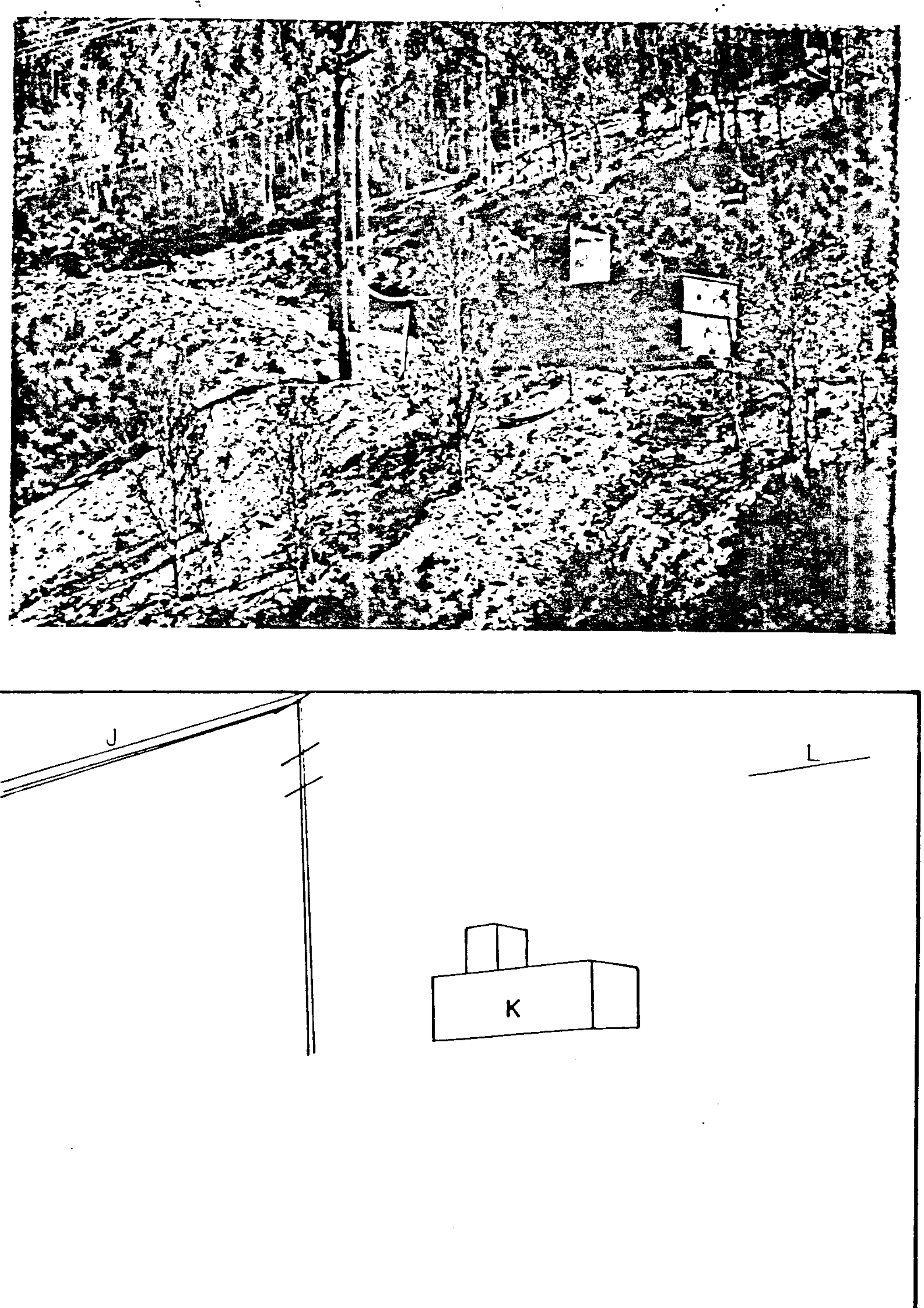



Photograph Number 3 - Looking east: G-Mine Ventilation Fan






Photograph Number 4 - Looking north: A-Office, Bathhouse, Shop Complex; D-Primary Road (main access and coal haulage); E-Septic Tank and Leach Field (buried); I-Sediment Ponds; J-Power Lines




Photograph Number 5 - Looking east: J-Power Lines; K-Electrical Substation; L-Water Storage Tanks