CHAPTER III

OVERBURDEN AND INTERBURDEN ASSESSMENT

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1.0 INTRODUCTION

This section presents the findings of the Overburden Characterization Program for the Wishbone Hill Coal Project. These investigations were conducted to characterize the geochemistry of the overburden and interburden units so that the potential for impacting water quality and revegetation could be assessed. All stratigraphic intervals that will be mined have been sampled and analyzed.

1.1 Background

All overburden characterization methods (including drilling, logging, sampling and analyses) were conducted in accordance with the applicable rules, regulations and recommendations of the State of Alaska Department of Natural Resources Division of Mining (Division) and the Department of Interior - Office of Surface Mining (OSM).

The Division requires chemical analyses of each stratum within the overburden and each stratum immediately below the lowest coal seam to be mined. In addition, the Division requires chemical analyses of the coal for total sulfur content.

1.2 Objectives

The primary objective of the overburden characterization program was to define the physical and chemical characteristics of the overburden units within the permit area so that successful reclamation plans could be developed. Particular emphasis was placed on the identification of acid-forming and toxic-forming zones or strata, and on those overburden chemical characteristics important to post mining revegetation.

The geology of the proposed permit area is described down to and including the stratum immediately below the lowest coal seam to be mined. This description includes the general geology of the permit area, overburden characteristics (including lithologic, physical and chemical properties) of each stratum, chemical analysis of the coal seam and coal group partings (refuse) for acid- and toxic-forming materials. These descriptions and supportive data are submitted in sufficient detail to assist in:

- Defining the major lithostratographic units;
- Determination of potentially acid- and/or toxic-forming strata;
- Identifying potential strata that have physical and chemical properties that may adversely affect a) post-mining ground water quality and b) surface reclamation efforts;
- Identifying the total sulfur content of the coal;
- Development of operational and reclamation plans for handling toxic- and acid-forming materials.

2.0 APPROACH

The overburden characterization program was designed to make full use of existing overburden information to achieve the above objectives. The key elements of the Wishbone Hill Overburden Characterization Program approach were:

- Evaluation of Existing Data - Overburden lithologic, geophysical, and geochemical data from exploration and related drill holes were evaluated.
- Phased Drilling and Sampling - Phased drilling programs to provide additional overburden information were conducted in 1983, 1984, 1988 and 1989. Sampling of overburden materials for chemical analyses was conducted during the 1988 and 1989 drilling programs.
- Combined Non-Statistical and Statistical Evaluation - Lithologic and laboratory chemical data were analyzed and evaluated using statistical and non-statistical approaches. Statistical methods were used to assess variance, minimum, maximum and mean values. The non-statistical elements included evaluation of the overburden based on suitability criteria for reclamation.
- Identification of Overburden/Interburden Groups - Logical overburden units were defined and characterized based on the mining and operations plans.
- Screening of Overburden/Interburden Units - Each unit was screened on the basis of its geochemical characteristics to assess acid- and/or toxic-forming materials and its suitability for reclamation.

2.1 Drilling and Logging

At the time this study was conducted, one hundred forty seven (147) exploration and related bore holes were drilled within the Wishbone Hill Coal Project area (Plate II-3 of the Geology Report). This represents a substantial data base from which to describe the geologic, stratigraphic, lithologic and geochemical characteristics of the overburden/interburden materials. A more complete discussion of the drilling and logging is located in the Geology section of the mine permit application (Chapter II).

A combination of rotary-drilled (chip sampled) and cored drill holes were used for the overburden characterization studies. Each borehole was logged for detailed lithological description of core and cuttings by the site geologist. Project geologists have spent considerable time and effort to obtain consistency between the geologic logs (lithologic descriptions used for each borehole record) collected by various geologists. Lithologic logs were completed on standard forms, with appropriate headings information and scales. Standard descriptions specifying depth interval and characterizing lithologic and mineralogic attributes were completed. Appendix A presents the computerized lithologic logs for drill holes utilized in geochemical and lithologic characterization. Additional lithologic logs are kept on file in the project office in Palmer, Alaska.

All major lithologic units that will be disposed of as spoil have been sampled. Plate II-3 (Geology Report) identifies the drill holes that were sampled and subsequently analyzed for chemical parameters. Drill hole samples were taken from the ground surface down to the first geological stratum below the lowest coal seam to be mined.

In addition to lithologic logs, each borehole was geophysical logged under the supervision of the site geologist. This included the acquisition of gamma caliper, resistivity (electric), and density logs. Sufficient deflection was achieved to adequately identify major lithologic units. Geophysical logs (gamma, resistivity and density) for the 10 drill holes utilized in geochemical characterization are presented in Appendix E. Additional geophysical logs are kept on file in the project office in Palmer, Alaska.

2.2 Sampling

Sampling procedures for cored and rotary-drilled holes followed the guidelines established by western surface coal mine regulatory agencies. Specifically, these guidelines suggest that 10-foot split-core composite samples be obtained from ground to the first under burden unit; and that cuttings from rotary-drilled holes be composite and split-sampled at 5-foot intervals. However, strict adherence to the 5- or 10-foot interval sampling/analysis procedure may actually result in loss of important data. For example, regimented interval sampling may result in the inappropriate compositing of more than one lithotype under some circumstances, making lithologic/geochemical interpretation and correlation more difficult. Similarly, if a sampled interval is lithologically consistent over a considerable depth, then that interval's geochemical attributes may be characterized by a fewer number of properly composite samples. For these reasons, a modified lithologic control sampling technique was utilized to achieve a more accurate and cost-effective approach to the overburden sampling and characterization. The maximum compositing interval was ten feet for cored holes. However, sampling intervals for cored holes were based on lithologic breaks and are frequently less than ten feet. All chip samples were composited over five foot intervals regardless of lithology. Sampling quantities, preparation, and handling procedures followed recommended guidelines. Core samples were composited over the entire sampling interval. Cores were stored in standard core boxes and kept in a dry, cool environment to reduce any chemical or biological oxidation. Chip samples were collected and quickly rinsed with water to remove any contamination from bentonitic drilling muds. The entire chip sample was submitted for laboratory analysis. All samples were ground and sieved through a 2 mm screen prior to conducting the laboratory analyses. All overburden samples were obtained under the supervision of a site geologist.

2.3 Laboratory Analysis

The success of any overburden characterization program is dependent on the quality of the analytical work performed on the samples. Picking a laboratory that is cost-effective, and highly regarded for quality analytical work among peers, industry and regulatory agencies is essential. Two laboratories which have worked with us on a number of projects including the quality control section of the BHP-Utah International Alton coal project are Colorado State University Soil Testing

Laboratory (CSU) and Inter-Mountain Laboratories, Inc. (IML). Both of these laboratories have the qualifications listed above. CSU was chosen for the routine overburden
analytical work, while IML was utilized for the QA/QC portion of the overburden characterization program.

CSU is one of the premier soil and overburden testing facilities in the United States. It has been responsible for the development of numerous analytical procedures for soils and overburden, including the DTPA (diethylenetriaminepentaacetic acid) and AB-DTPA (ammonium bicarbonate-DTPA) extraction procedures which have been used in Alaska soil and overburden projects. In addition, CSU is the recognized authority on soil and overburden analyses utilizing an inductively coupled plasma - atomic emission spectrometry (ICP) system and are the authors of the ICP chapter in "Methods of Soil Analysis" (Page, 1986). The lab has invaluable experience with analysis of western soils and overburden and is often utilized by industry, academia, and regulatory agencies. CSU is routinely involved in Quality Assurance/Quality Control (QA/QC) programs and is one of only a few laboratories in the United States which has passed the State of California Water Quality Control Board's QA/QC for selenium.

2.3.1 Parameters

Review of previous overburden work for Alaska coal mines indicates an extensive laboratory parameter list. However, these past overburden characterization studies have been targeted at topsoil substitution. That is not the intent of the Wishbone Hill overburden characterization program. Therefore, a more traditional parameter list has been developed to accurately define acid-forming and toxic-forming zones or strata.

The following parameters were analyzed on all overburden, interburden, and floor (under burden) samples collected for the overburden characterization program.

- pH
- Electrical Conductivity (EC)
- Saturation Percent (Sat %)

- Texture
- Sodium Absorption Ratio (SAR)
- Total Sulfur
- Calcium Carbonate %
- Acid - Base Potential (ABP)
- Boron (B)
- Selenium (Se)
- Nitrate - Nitrogen

These parameters were selected based on review of current practices, comparison with other western states overburden guidelines, and discussions with the Division and Dr. C. L. Ping (June 20, 1988). Some samples from the 1989 drilling program contained insufficient volumes for a complete laboratory analysis. Therefore, some of these samples lack texture, selenium, boron and nitrate-nitrogen analyses. All of the samples were analyzed for acid and toxic forming materials as required by both state and federal regulations.

In addition to the parameters listed above, the Division (Mr. Sam Dunaway, June 17, 1988 scoping meeting) recommended that additional parameters be evaluated to get a more complete "geochemical picture" for the overburden. Discussions during the June scoping meeting indicated that total elemental analysis would only be necessary on representative samples of each major lithologic unit.

The following parameters were analyzed for total elemental analysis on representative samples from each major lithologic unit.

Al	Cr	Mn	Se
As	Cu	Mo	Sr
B	Fe	Na	Ti
Ba	Hg	Ni	Zn
Ca	K	P	
Cd	Mg	Pb	

Representative samples chosen for these analyses included Wishbone Conglomerate (3990), Tsadaka Conglomerate (4043), glacial gravel (4027), shale (4002), siltstone (3965) and sandstone (3970). These intervals were chosen due to their close proximity to the calculated mean value for

that lithologic or overburden/interburden unit. In addition, total elemental analysis was also conducted on both coarse (4821) and spiral (4822) reject materials.

2.3.2 Analytical Methods

The recommended analytical procedures for the overburden characterization study are those recommended by the Wyoming Department of Environmental Quality - Land Quality Division (Guideline No. 1, 1984). These procedures were discussed with the Division and with Dr. C. L. Ping. The procedures are outlined in Table 3-1.

The procedure for total elemental analysis utilized nitric-perchloric acid digestion followed by ICP analysis. All elements except As, Se and Hg were analyzed by direct nebulization into an ICP. Arsenic and selenium were concentrated using hydride generation. Mercury was analyzed by cold-vapor ICP. Total boron analysis was rerun using teflon digestion tubes due to boron contamination from the pyrex digestion equipment.

2.3.3 Laboratory QA/QC

The analytical laboratory provides geochemical data for use in overburden characterization. To be valuable, the data must be both accurate and precise.

The most common method for determining the accuracy of an analytical procedure is the use of standard reference materials. However, there are few commercially available standard reference materials for overburden. Twenty one (21) overburden sample splits were sent to IML as a check on analytical performance. A variety of statistical methods were used to evaluate the analytical data. These methods included:

- Graphical comparison of CSU and IML data
- Calculation of correlation coefficients for each parameter between the CSU and IML data

Currently, no state or federal regulatory agency requires laboratory QA/QC programs for

overburden characterization studies. However, to insure the validity of the overburden analytical data and to assist in evaluation and interpretation of the potential impacts from any apparent adverse overburden geochemical conditions, a laboratory QA/QC program was included.

The results of this interlaboratory comparisons of the Wishbone Hill sample splits are shown in Appendix C. In general, the results indicate that the data between laboratories are comparable and demonstrate the accuracy (validity) of the overburden chemical data presented in this report.

There is analytical consistency throughout most of the results as indicated by the high correlation coefficients (r) for the data (Appendix C-2). The correlation coefficients (r) values were poor for sand (0.505), silt (0.549), clay (0.183), nitrate-nitrogen (0.498), boron (0.195) and selenium (0.596). All other r values are highly significant: pH (0.916), electrical conductivity (0.839), saturation percent (0.978), calcium (0.978), magnesium (0.994), sodium (0.911), sodium absorption ratio (0.801), total sulfur (0.907), calcium carbonate percent (0.709) and acid-base potential (0.721). The trends of poor analytical performance with selenium, boron and nitrate-nitrogen are consistent with findings of the Western Soil and Overburden Task Force Round Robin Soil and Overburden Analysis Programs (Severson and Fisher 1985; 1986; and 1987). However, the analytical performance presented in this report is superior to that reported by Severson and Fisher (1985, 1986 and 1987).

Although the data are correlated, the IML data for calcium, magnesium, acid-base potential (ABP) and percent sand are consistently higher than CSU. The IML data for pH, sodium absorption ratio (SAR) and clay are consistently lower than CSU. These differences in the data are consistent and relatively easy to explain. IML extracted more bases (calcium, magnesium and calcium carbonate) from the samples. The exact reason for this increase is not known.

The results for boron, selenium and nitrate-nitrogen show increased analytical variability and corresponding lower r values. The reason for the lack of accuracy in these results is due to the low concentration of these parameters. All are near the detection limits of the instruments, thus the increased variability in results is expected. However, it should be pointed out that the results for these parameters (both for the QA/QC results and all of the overburden analyses) are well below the suitability levels outlined in Section 2.5. Therefore, the poor comparability of results for these

parameters is of no concern.

The poor results for clay percentage may be due to a lack of adequate dispersion on the part of IML. This would result in a lower clay percentage and a resultant increase in the sand percentage. This is consistent with the reported results.

2.4 Data Grouping

Initially, the individual lithologic units within the overburden were identified. Secondly, each drill hole was evaluated for its lithologic and geochemical characteristics. This characterization provided the basis for understanding the extent and geochemistry of the various lithologic units that comprise the overburden. The third categorization was then evaluated in context with the anticipated mining and overburden handling operations. To facilitate this subsequent aspect of the overburden evaluation, anticipated mining and overburden handling plans were reviewed. This allowed the development of "overburden/interburden units" that reflect lithologic and geochemical attributes, as well as operational considerations.
These data are then used to develop appropriate plans for handling of the overburden materials during mining and reclamation.

2.4.1 Lithologic

Drill hole geologic logs were used to define the lithologic units within the overburden. Initially, each distinct lithologic unit was evaluated separately. This provided a basis for stratigraphic correlation with the geophysical logs, establishment of lithotypes for overburden/interburden characterization, and a logical basis for the subsequent assignment and interpretation of geochemical data. This evaluation was conducted for drill holes with geochemical data. Lithologic comparisons were also conducted for each distinct overburden/interburden unit.

In addition, representative samples from each lithologic group were submitted for total elemental analyses to get a more "complete" geochemical characterization of the overburden/interburden materials. These representative samples were taken from the following lithotypes: Glacial Gravel, Tsadaka Conglomerate, Wishbone Conglomerate, Chickaloon Shale, Chickaloon Sandstone and Chickaloon Siltstone.

2.4.2 Drill Hole

Thirteen (13) drill holes were evaluated for both lithologic and geochemical characteristics. These drill holes included: PB-60, PB-69A, PB-74, PB-80, PB-84, PB-85, PB-87, PB-92, PB-101, PB-105, PB-107, PB-108, and PB-109.

2.4.3 Overburden/Interburden Unit

Drill holes were then grouped by their appropriate overburden/interburden units. These units include: Glacial Gravel, Tsadaka Conglomerate, Wishbone Conglomerate, Jonesville, Premier, Midway, Eska, Sub Eska, and Burning Bed.

The "overburden/interburden units" were developed on the basis of the following considerations:

- The anticipated mining and overburden handling methods;
- Their relative position in the overburden sequence;
- Their geochemical characteristics with regard to a) surface reclamation/revegetation, and b) post mining water quality

These overburden/interburden units thus not only represent an assemblage of lithotypes (with corresponding physical and geochemical characteristics), but the general means by which they will be handled during the anticipated mining activities.

Because the purpose of this overburden characterization program is oriented primarily towards surface and subsurface reclamation, the focus of the overburden/interburden unit designation approach was on (1) their relative "suitability" for reclamation, and (2) their anticipated fate in the backfill spoils. For example, if the upper 40 feet of the overburden materials (glacial gravel) represent an operational unit of generally suitable materials and will be handled via truck/shovel mining methods, they will tend to be placed in the same relative position in the backfill (i.e., at the surface). Geochemical data from drill holes from the same overburden/interburden group were combined to determine the chemical characteristics of that group.

2.5 Suitability Screening Criteria

Using the overburden/interburden units described in the previous section, a further evaluation was conducted to determine the suitability of these various materials for reclamation. The screening evaluation was based on a variety of criteria, including:

- Acid- and Toxic-forming materials
- Plant root zone suitability
- Vegetative forage material quality
- Backfill water quality

These criteria were reviewed to determine their applicability and appropriateness for screening the quality of the overburden/interburden units. The results of this review, as well as the applicability of these criteria to the Wishbone Hill Coal Project are provided in Table 3-2 and described in subsequent sections.

2.5.1 Acid- and Toxic-Forming Potential

Those chemical parameters indicative of potentially acid- or toxic-forming conditions include low pH (<5), low acid-base potential (ABP < -5 tons CaCO3/1000 tons material), and elevated extractable boron (> 5 mg/kg).

Low pH facilitates potentially phytotoxic conditions due to increased metal availability, especially aluminum. Low acid-base potential is an indicator of acid-forming potential or the lack of neutralization capacity of the spoil materials. Boron in extractable concentrations greater than 5 mg/kg is considered phytotoxic to certain agronomic plant species.

2.5.2 Plant Root Zone Suitability

Chemical parameters that address root zone suitability include the ones listed above as well as high SAR, high pH, and elevated electrical conductivity (EC). Sodium absorption ration (SAR) is an indirect measurement of potential sodium hazard. SAR values greater than approximately 15 can result in unsuitable soil conditions through dispersion and swelling of clays and decreased water infiltration, unless mitigating factors are present. Similarly, high pH (>9.0) is considered an

indication of potential sodic conditions. Electrical conductivity (EC) is an indicator of soil salinity with potential adverse conditions resulting from interferences with the plant-water osmotic potential. Electrical conductivities greater than 12 mmhos/cm are considered detrimental to plant growth.

2.5.3 Vegetative Forage Quality

The importance of selenium (Se) in mine reclamation and revegetation relates primarily to its uptake and accumulation by plants and the resultant toxicity to animals feeding on the plant material. Western states have routinely used extractable selenium values ranging from 0.1 to 2.0 mg/kg as a suitability limit. No suitability values were recommended for selenium in the recent publication on reclaiming mine soils and overburden in the western United States (Fisher et al 1987). Based on the overburden geological/geochemical conditions, the environmental conditions within the Wishbone Hill project area, and a review of existing mining and reclamation practices, a value of < 0.5 mg/kg has been chosen for a suitability limit for this project.

2.5.4 Backfill Water Quality

Several of the above parameters that relate to potential water quality impacts due to mining, include ABP, pH, and EC. In addition, nitrate-nitrogen present in overburden materials can contribute to elevated nitrate conditions in the backfill spoil water. Nitrate-nitrogen values of greater than 50 mg/kg are commonly utilized as a screening value for predicting overburden conditions which potentially may impact the post mining ground water quality.

3.0 RESULTS

The drilling, sampling and laboratory analysis programs provided sufficient data for geological and geochemical evaluations of the overburden materials. These evaluations aided in the identification of acid- and toxic-forming materials and the development of appropriate mining and reclamation plans. These studies were conducted in accordance with recommended overburden guidelines and the applicable rules and recommendations of the Division. The results of the overburden investigations are presented in Sections 3.1 through 3.5. The conceptual geologic framework for

the Wishbone Hill Permit Area (Section 3.1) includes a description of the specific lithologic units that comprise the overburden materials. The geochemical characteristics of these units are discussed in Section 3.2.

3.1 Site Geology

The geology of the Wishbone Hill coal district has been discussed in detail in previous publications (Germer, 1986; Conwell et al, 1982; Barnes, 1967; Warfield, 1962; Barnes and Payne, 1956; Barnes and Ford, 1952; Apell, 1944; Waring, 1934; Martin and Katz, 1912) and in Chapter II of this permit application.

The descriptive geologic "model" for the Wishbone Hill Permit Area consists principally of a technical narrative and geologic cross sections that characterize the stratigraphic, structural, and lithologic attributes of the overburden materials. Based on an extensive drill hole data set, the model forms a physical framework that defines not only the geologic characteristics of the overburden materials, but also correlates the key lithotypes. The model also describes the textural attributes of the key lithotypes, and forms the basis for the geochemical characterizations presented in Section 3.2.

3.1.1 Existing Data

The one hundred forty seven (147) exploration and related drill holes, from recent drilling programs, represent a substantial data base from which to describe the geologic, stratigraphic, and lithologic characteristics of the overburden materials. The available geologic drill hole data set consist of the following: field lithologic descriptions and geophysical logs

The location of these drill holes are presented on the Geologic Cross Section Index and Drill Hole Locations Map (Plate II-3, Geology). This represents a relative drill hole density of approximately one hole per ten acres. The majority of these exploration drill holes penetrated the primary overburden units, and in some cases, deeper geologic units.

3.1.2 General Geologic Setting

The Wishbone Hill coal district is one of four coal districts of the Matanuska coal field. It is located in the lower Matanuska Valley of south central Alaska, approximately 45 miles northeast of Anchorage (Figure 3-1). The district is approximately 2 miles wide and 8 miles long and takes its name from the prominent conglomerate-capped hill that occupies its central part. The location of the Wishbone Hill district is determined by the known extent of the coal-bearing Chickaloon Formation and extends eastward from Moose Creek to the head of Knob Creek. Its northern extent is limited by the Castle Mountain fault. The southern boundary of the district is generally masked by glacial gravel, but lies a few miles north of the Glenn Highway. A more complete description of the geology of the Wishbone Hill Project area is contained in Chapter II of this permit application.

3.1.3 General Stratigraphy

The regional geologic/stratigraphic characteristics of the area are discussed in detail in Chapter II of this permit application. For the purpose of this section on overburden characterization, only a brief summary of the major regional stratigraphic units is given.

The predominant overburden units are of the tertiary Chickaloon Formation. Overlying units in ascending order, consist of Glacial Gravel, Tsadaka Conglomerate or Wishbone Hill Conglomerate. The general stratigraphy is briefly described in the following paragraphs. Geological cross-sections (Plates II-4 through II-10 in Chapter II, Geology) for the proposed mined area provide additional information regarding the stratigraphy of the permit area.

3.1.3.1 Glacial Gravel

Glacial deposits of various types and thicknesses cover nearly the entire district. At most points the bedrock is concealed by a mantle of poorly sorted mixture of clay, sand, gravel, and boulders. This mantle ranges from zero to over one hundred feet in thickness over the Wishbone Hill Project area.

3.1.3.2 Tsadaka Formation

The Tsadaka Formation consists of poorly indurated coarse conglomerate characterized by boulders and cobbles of granite and diorite in a matrix of granitic debris.

3.1.3.3 Wishbone Hill Formation

The Wishbone Hill Formation consists predominantly of conglomerate composed of pebbles, cobbles, and a few boulders in a sandy matrix but it also includes numerous lenticular beds of sandstone and silty claystone.

3.1.3.4 Chickaloon Formation

The upper Chickaloon Formation contains the only known economic coal deposits. Five coal groups are present and include the Jonesville, Premier, Midway, Eska, and the Burning Bed. The predominant lithologic units found in the upper Chickaloon Formation are dark gray shale, carbonaceous black shale, gray claystone, bone, thick coal zones, gray siltstone, tan and light gray fine- to coarse-grain sandstone, and pebble conglomerate. Siderite (ironstone) and calcium carbonate concretions are common within every lithologic unit.

3.2 Overburden Characteristics

Section 2.4 described the general data groupings which include lithologic, drill hole, and overburden/interburden units. Each of these specific groups are described in further detail in the following sections.

3.2.1 Lithologic Characterization

Before detailed evaluation could be performed on the geochemical data, distinct groups of data had to be defined. The most obvious distinctions of groups of similar data are the various lithologic units.

This evaluation resulted in a total of six (6) major lithologic groups which include:

- Glacial Gravel
- Tsadaka Conglomerate
- Wishbone Hill Conglomerate
- Chickaloon Claystones and Shales
- Chickaloon Siltstones
- Chickaloon Sandstones

Some of the drill hole sample intervals for the rotary drilled holes (chip samples) contained more than one of the major lithologic units. In order to evaluate lithologic and geochemical characteristics, it was necessary to remove from consideration the sampling intervals that contained more than one lithologic unit. This helped eliminate complexities caused by the differing chemical characteristics of separate lithologies.

Using this approach, a total of 3983.1 feet of drill hole lithologies were derived from the Wishbone Hill data base and were used to determine the six major lithotypes. The percent of the overburden samples that these represent is presented in Table 3-3. Their sampling percentage is depicted graphically in Figure 3-2. This total does not include twenty three sampled intervals with mixed lithologic units. However, included in the total are eight sample intervals of coal, one of bone and one other interval was composed of ironstone. These minor inclusions (coal, bone and ironstone) are not considered major lithologic units.

Geochemical summary statistics for each of the major lithologic units are given in Table 3-4. Complete statistical evaluations, which included minimum, maximum, mean, standard deviation, and number of observations, are included in Appendix D-2. The general lithologic percentages and geochemical characteristics of the six major lithotypes are discussed in detail in the following sections.

3.2.1.1 Glacial Gravel

Glacial gravel occurs throughout the project area with depths ranging from 0 to over 100 feet. Glacial gravel comprise approximately 18 % of the overburden materials sampled (Table 3.3).

These materials are located below the topsoil and above all other overburden units.

Geochemically, this lithotype is very distinct from the others. The materials are coarse grained (82.2 % sand) and contain the lowest calcium carbonate percentage (0.28 %) of all the overburden lithotypes. Because of this low percentage of calcium carbonate, the glacial gravel also typically have the lowest acid-base potential (2.3). When compared to other lithotypes (Table 3.4), these materials also contain the lowest mean pH (8.0), EC (0.5 mmhos/cm) and SAR (5.66) values. Mean nitrate-nitrogen (1.4 mg/kg), boron (0.25 mg/kg) and selenium (<0.01 mg/kg) are all well below established suitability criteria.

3.2.1.2 Tsadaka Conglomerate

The Tsadaka Conglomerate underlies the glacial gravel in some of the project area and comprises 2.3 % of the overburden material sampled. This conglomerate contains coarse (74.0 % sand) grained materials and exhibits the second lowest EC (1.0 mmhos/cm) and SAR (13.7) values. The mean pH value is higher than in the glacial gravel (8.8) but still within the suitable range. These materials contain the lowest nitrate-nitrogen (0.9 mg/kg) and boron (0.21 mg/kg) values. Selenium values (<0.01 mg/kg) are below detection for most of the sampled intervals. The mean calcium carbonate percentage is 2.0 % with a resultant high ABP (19.6).

3.2.1.3 Wishbone Hill Conglomerate

The Wishbone Conglomerate also underlies the glacial gravel in certain areas within the project areas and comprises 7.0 % of the overburden materials sampled. This conglomerate exhibits relatively fine grained material (53.1 % clay). The pH (8.7) and EC (1.3 mmhos/cm) are within suitable limits. These materials contain the highest nitrate-nitrogen (3.0 mg/kg) and extractable boron (0.50 mg/kg) values of all major lithologic units but these values are still well within suitability guidelines. Mean selenium values are 0.10 mg/kg. Only SAR values (41.4) exceed the suitability criteria listed in Table 3-2. These apparently high SAR values are discussed in more detail in Section 4.1 (Overburden/Interburden Suitability).

3.2.1.4 Chickaloon Shales and Claystone

The vast majority of the overburden within the project area is shale material from the Chickaloon Formation. These shale and claystone lithologic units comprise 37.7% of the Wishbone Hill overburden material sampled. Geochemically, these materials are similar in composition (pH, EC, nitrate-nitrogen, and boron) to the sandstones and siltstones. The mean pH is 8.8, EC is 1.5 mmhos/cm, nitrate-nitrogen value is 1.7 mg/kg, and the extractable boron is 0.33 mg/kg. All these values are within the suitability values listed in Table 3-2. Extractable selenium is 0.09 mg/kg and the calcium carbonate is 1.69 %. The ABP is 15.2 tons $CaCO_3$/1000 tons which demonstrates the high neutralization capacity of these materials. Sodium absorption ration (SAR) values are relatively high (34.1) and are discussed in more detail in Section 4.1.

3.2.1.5 Chickaloon Siltstone

Siltstones from the Chickaloon Formation comprise approximately fourteen (14.7%) percent of the overburden materials sampled. These materials contain a relatively high apparent SAR value (34.1). All other parameters; pH (8.6), EC (1.5 mmhos/cm), nitrate-nitrogen (1.4 mg/kg) boron (0.35 mg/kg), selenium (0.14 mg/kg), and ABP (25.0 tons $CaCO_3$/1000 tons) are all well within suitability limits.

3.2.1.6 Chickaloon Sandstone

Sandstones comprise approximately nineteen percent (19.4%) of the overburden materials sampled. As discussed above, these materials are geochemically similar to the shales and siltstones. The mean values are: pH (9.0), EC (1.2 mmhos/cm), nitrate-nitrogen (1.1 mg/kg), boron (0.33 mg/kg), and selenium (0.13 mg/kg). These materials contain the highest calcium carbonate percentage (3.08%) and a resultant high ABP (30.1 tons $CaCO_3$/1000 tons) These materials contain a relatively high SAR (31.8) value.

3.2.2 Drill Hole Characterization

Thirteen drill holes were utilized for geochemical characterizations. These drill holes included three core holes (PB-60, PB-92, and PB-105) and ten rotary (chip sample) drilled holes (PB-69A, PB-74, PB-80, PB-84, PB-85, PB-87, PB-101, PB-107, PB-108 and PB-109). There are no federal regulations regarding drill hole intensity. However, a number of state regulatory programs have set minimum requirements for drill hole coverage. Drill hole coverage in the western United States ranges from a minimum coverage of 1 hole/640 acres to a maximum of 1 hole/40 acres. Colorado has the minimum standard of 1 hole/640 acres (three hole minimum) followed by New Mexico with 1 hole/150 acres. The most intense drill hole coverage in the United States is 1 hole/40 acres which includes the states of Montana, North Dakota and Wyoming.

Within the Wishbone Hill Mine area 1, a total of 6 drill holes have been utilized for geochemcial characterizations. The approximate area of Mine Area 1 is 81 acres which brings the drill hole intensity to 1 hole/13.5 acres. A total of 7 drill holes have been used for geochemcial characterization in Mine Area 2. The approximate area of Mine Area 2 is 251 acres bringing the coverage to 1 hole/35.8 acres.

Both mine areas have drill hole intensities greater than those recommended by all regulatory agencies (state and federal). In addition, a significant number of drill holes with lithologic and geophysical logs are also within the limits of Mine Areas 1 and 2. Results from these drill holes indicate that the lithologies are relatively consistent throughout the overburden/interburden materials. Thus the approximate 150 drill holes with lithologic and geophysical descriptions provide sufficient documentation and predictability of the geological characteristics of the overburden materials.

The lithologic characterization of each of these drill holes is graphically shown in Figure 3-3 through 3-5. Geochemistry summary statistics are given in Appendix D-1.

3.2.3 Overburden/Interburden Units Characterization

All major overburden/interburden units that will be disposed of as spoil have been sampled. Plate

II-3 in Chapter II identifies the location of the thirteen (13) drill holes which were sampled and analyzed for geochemical characterization. These drill holes represent all major lithologic units located within the overburden and interburden. Table 3-5 gives the general overburden/interburden grouping of each of these drill holes. Figure 3-6 graphically displays the stratigraphic coverage of these drill holes in relationship to the various overburden/interburden units.

The focus of this overburden/interburden assessment is to correlate the average lithologic and geochemical attributes of the major overburden/interburden units located within the project area. The nine (9) major overburden/interburden units that were identified are listed below:

- Glacial Gravel
- Tsadaka Conglomerate
- Wishbone Conglomerate
- Jonesville
- Premier
- Midway
- Eska
- Sub Eska
- Burning Bed

Each of these overburden/interburden units are discussed in detail in the following sections. The lithologic composition of six overburden/interburden units is shown in Figure 3-7. The lithologic composition of glacial gravel, Wishbone Conglomerate and Tsadaka Conglomerate are 100% and are not shown in Figure 3-7. Geochemical summary statistics are given in Table 3-6 for all but glacial gravel, Wishbone Hill Conglomerate and Tsadaka Conglomerate which are located in Table 3-4.

3.2.3.1 Glacial Gravel

The discussion on glacial gravel is contained in Section 3.2.1.1 above.

3.2.3.2 Tsadaka Conglomerate

The discussion on Tsadaka Conglomerate is contained in Section 3.2.1.2 above.

3.2.3.3 Wishbone Hill Conglomerate

The discussion on Wishbone Hill conglomerate is contained in Section 3.2.1.3 above.

3.2.3.4 Jonesville

The overburden material over the Jonesville Coal Group was penetrated by drill hole PB-60. The Jonesville overburden material consists primarily of coarse grained material (62% sandstone). Geochemically, the Jonesville overburden contains the lowest pH (8.0), EC (0.7 mmhos/cm), SAR (4.48), and boron (0.27 mg/kg) of all the overburden/interburden units. Nitrate-nitrogen (1.0 mg/kg), selenium (0.11 mg/kg) and ABP (22.5 tons CaCO3/1000 tons) are all within suitability limits.

3.2.3.5 Premier

The Premier overburden material was characterized geochemically by samples from drill holes PB-80, PB-85, PB-101, PB-105, PB-107, PB-108 and PB-109. This unit represents the largest component of overburden to be removed during the mining process (Chapter II and Section D of the Mine Permit Application).

The Premier overburden material is characterized by an approximate equal mixture of shale (33.2%), siltstone (28.1) and sandstone (38.7). Geochemically, the Premier overburden has higher pH (8.6), EC (1.2 mmhos/cm) and SAR (24.6) values than the Jonesville overburden. Boron (0.36 mg/kg), selenium (0.07 mg/kg), nitrate-nitrogen (1.5 mg/kg) and ABP (23.7 tons CaCO3/1000 tons) are all within suitability levels. A trend of increasing SAR with depth of the stratigraphic units becomes apparent when comparing the data presented in Table 3-6. This trend is graphically displayed in Figure 3-8 and holds true for all the remaining overburden/interburden units.

3.2.3.6 Midway

The materials between the Premier and Midway Coal Groups are classified as Midway overburden.

These overburden materials are characterized geochemically by samples from drill holes PB-69A, PB-80, PB-85, PB-101 and PB-105. The predominant lithotype of this overburden/interburden unit is shale (87 %).

Geochemically these materials are higher in SAR (34.8) than the glacial gravel, Jonesville or Premier overburdens (Figure 3-8). The pH value (8.4) is within suitable levels. Although the value for SAR exceeds the suitability guidelines listed in Table 3-2, impacts to reclamation are not anticipated. This is discussed in more detail in Section 4.1. All other values including pH, EC (1.5 mmhos/cm), nitrate-nitrogen (0.3 mg/kg), boron (0.33 mg/kg) selenium (0.05 mg/kg) and ABP (22.3 tons CaCO3/1000 tons) are all within suitability levels.

3.2.3.7 Eska

The Eska overburden materials are characterized by drill holes PB-69A and PB-74. This overburden contains a high percentage of fine grained materials (78% shale). Geochemically, these materials exhibits increased pH (9.2) and SAR (48.9) over the stratigraphically higher materials. These values fall outside the fair range of suitability listed in Table 3-2. All other chemical parameters are well within suitable levels.

3.2.3.8 Sub Eska

Drill holes PB-69A and PB-74 include materials from above the Sub Eska Coal Group. The trend of increasing fine grained materials changes between the Eska and Sub Eska Coal Groups. This material exhibits a higher percentage of coarse textured material (28% sandstone) than either the Eska or Midway overburden units. Geochemically, the trend of increasing SAR (64.5) continues and the pH value is still relatively high (8.9). All other chemical parameters are well within suitable ranges.

3.2.3.9 Burning Bed

The Burning Bed overburden materials are characterized by drill hole PB-92. In addition, the interval from directly below the lowest coal seam to be mined (391.0 to 391.5 feet) was also sampled and submitted for laboratory analyses in response to the Divisions requirements. The

Burning Bed overburden consists of increasing coarse grained materials (33% sandstone) with 45% siltstone and 8% claystone. The trend of increasing SAR (70.4) continues with a corresponding high pH (9.1). All other chemical parameters are within suitability guidelines.

3.3 Coal Chemistry

Sulfur analysis is often required for high sulfur coals in humid climatic settings where acid production is an issue. Although this is not a concern for Wishbone Hill coals, sulfur analyses have been included to satisfy the Division's requirements. The coal groups within the overburden typically contain less than 0.5 percent sulfur with an average value of 0.31%. Several reports in the literature also document the low sulfur percentages of the Wishbone Hill coals (Rao and Wolff, 1980; Barnes, 1967; Barnes and Payne, 1956; Barnes and Ford, 1952).

Thirty samples of coal representing six separate drill holes (PB-2A, PB-12A, PB-19, PB-23, PB-24, and PB-27) were submitted for chemical analyses for sulfur fractionation. The results are presented in Table 3-7 and demonstrate that pyritic sulfur is present in relatively low percentages (12.7%) compared to the organic sulfur fraction (87.3%). Therefore, acid production potential is extremely low. This is supported by both the overburden geochemical data for ABP (Section 3.2) and the coal slurry water pH (Section 3.4). Acid production from coaly materials is not anticipated within the Wishbone Hill project area.

3.4 Coal Slurry Chemistry

The overburden materials found within the Premier Coal Group (shale partings) received additional geochemical characterization. These materials were subjected to coal washing procedures which are described in more detail in Part D (Operation and Reclamation Plan) of the Permit Application. During the coal washing procedure a sample of the slurry was obtained for chemical analyses. The fresh (unprocessed) water utilized in the process was also analyzed to determine incoming water quality. Throughout the process, the coal slurry pH was monitored and ranged from 8.3 to 8.8. This also demonstrates the relatively high buffering capacity (low acid production) of these materials.

The chemical results were evaluated for potential acid and toxic-forming materials which may impact reclamation. The summary results of the coal slurry chemical analyses are included in Table 3-8. These results indicate that acid and toxic-forming materials are not present in the parting materials within the Premier Coal Group. The complete chemical analyses for the coal slurry is located in Appendix B-3.

3.5 Coal Refuse (Parting) Chemistry

The coal parting materials were also subjected to geochemical analyses, following the coal washing procedure, which included both the standard overburden chemical parameters and total elemental analysis. The specific coal washing process is outline in more detail in Part D (Operation and Reclamation Plans) of the Permit Application. The purpose of the coarse and spiral refuse chemical analysis was to further define the geochemical characteristics of the overburden materials. Emphasis was placed on the identification of acid- and toxic-forming materials which may impact reclamation.

These refuse materials were subjected to the same chemical parameters and analytical methods outline for the overburden in Section 2.3.1 and 2.3.2, respectively. The summary results are provided in Table 3-9. Appendix B-2 contains the standard overburden chemical analyses while Appendix B-4 contains total elemental analyses of the coal refuse (parting) materials.

The results of the coarse refuse chemical analyses indicates that these materials do not contain acid or toxic-forming materials, and therefore, will not impact either surface reclamation or post-mining ground water quality.

4.0 FINDINGS AND CONCLUSIONS

The overburden of the proposed Wishbone Hill Permit area has been described down to and including the stratum immediately below the lowest coal seam (Burning Bed) to be mined. This description includes the lithologic and geochemical characteristics of each overburden/interburden stratum in addition to chemical analyses of the coal. Particular emphasis was placed on the identification of acid-forming and toxic-forming zones or strata, and on those overburden geochemical characteristics important to reclamation.

4.1 Overburden/Interburden Suitability

All overburden/interburden materials have been sampled. The geochemical results have been evaluated according to the suitability criteria outline in Section 2.5 (Suitability Criteria). These criteria represent chemical parameters which identify acid- and toxic-forming materials. In addition, the overburden materials were also assessed for their suitability for a variety of other important reclamation concerns including:

- Plant Root Zone Suitability
- Vegetative Forage Quality
- Backfill Water Quality

The results of the overburden/interburden suitability criteria screening are discussed in the following sections.

4.1.1 Acid- and Toxic-Forming Materials

No acid- and/or toxic-forming materials were identified within the overburden with the exception of the 70.0 to 80.0 foot interval of drill hole PB-69A. This interval contained an acid base potential (ABP) of -10.22. This interval also contained 55 percent coal material (Appendix B-1, Overburden Chemical Data) which contributed a significant amount of organic sulfur to the total sulfur percentage. The calculation of ABP utilizes pyritic sulfur content of the sample for determination of the acid producing potential. The organic sulfur fraction is not considered to be acid forming. Therefore, the negative ABP (-10.22) for the 70-80 foot interval of PB-69A is an overestimation of the actual acid producing potential. In addition, the surrounding intervals 60-70 and 80-90 have more than sufficient buffering capacity (4.88 and 12.34 ABP, respectively) to neutralize any acid produced by this isolated interval.

The results of ABP for all other overburden/interburden units indicate a significant neutralization capacity. Mean values for ABP range from 9.38 to 31.29 (Appendix D-1, Drill Hole Geochemical Summary Statistics). These data indicate that there is sufficient high buffering capacity (9.38 to 31.29 tons of calcium carbonate/1000 tons of material) to neutralize any potential acid production from the overburden/interburden units. In addition, results from baseline groundwater monitoring

and historical mining in this district all indicate that acid- and toxic forming materials are not of concern. Therefore, no impacts from acid-forming materials are anticipated for surface reclamation, surface water or groundwater systems.

4.1.2 Plant Root Zone suitability

Chemical parameters which typically produce root zones which are not suitable for plant growth include pH, EC, boron, selenium, and SAR. Electrical conductivity (EC) and boron values are all well below levels expected of producing unsuitable root zones. The highest EC value reported for all overburden/interburden materials was 3.5 mmhos/cm (PB-69A) which is well within the suitability limits. High boron values (> 5.0 mg/kg) can be phytotoxic to certain agronomic plant species. The highest boron value reported for the overburden/interburden materials was 0.85 mg/kg which occurred in drill hole PB-105. The highest reported selenium value (0.39 mg/kg) occurred in drill hole PB-92 which is below the suggested suitable value listed in Table 3-2.

High pH and SAR values were observed in some overburden/interburden materials. High pH and high SAR are not considered indicative of toxic conditions. High pH values are indicative of a potential sodic condition which impacts the physical characteristics of the root zone material. The geochemical data supports the conclusion that high pH and high SAR values will not impact reclamation which is discussed in the following paragraphs.

The equation for calculation of SAR is given below:

$$SAR = \frac{Na}{\sqrt{\frac{Ca + Mg}{2}}}$$

A relatively low amount of calcium (Ca) and magnesium (Mg) can result in high SAR value. Upon closer inspection of the overburden data it appears that the relatively high SAR values are caused, not by excessive sodium but, by a relatively low concentration of other soluble cations (calcium and magnesium). For instance, the highest reported SAR value (105.4) came from interval 210 to 220 in drill hole PB-74. The high SAR is a result of low calcium (0.04 meq/l) and magnesium (0.01 meq/l). The soluble sodium (16.6 meq/l) is relatively high compared to the calcium and

magnesium values, but this material does not exhibit an overall salt problem as demonstrated by the EC (1.5 mmhos/cm).

It should be pointed out that the applicability of western soil and overburden suitability criteria for sodicity (SAR) may not be directly applicable to Alaska. High SAR overburden materials are common to many western mining operations. These areas are typically low in precipitation and have an abundance of bentonitic or 2:1 type swelling clay materials.

Although some of the overburden materials do exhibit elevated SAR values, these materials are not expected to impact reclamation efforts. Reasons for a reduced severity for the high SAR material include:

- Climatic conditions
- Large volumes of lower SAR overburden materials
- Significant volumes of non-swelling material
- Mixing will reduce the high SAR values
- Weathering will result in lowering of SAR values
- No infiltration problems exist within the high SAR overburden

The climatic conditions (low evaporation) in the Wishbone Hill area are not indicative of those conditions which result in upward migration of sodium as seen in many western states.

Based on the sampling that was done, only a small portion of the overburden materials exhibit excessively high SAR values and have the potential to exhibit expansive characteristics. The majority of the overburden to be mined is of lower SAR (glacial gravel, Jonesville) and has only limited amounts of 2:1 type clays (Premier).

The Premier overburden units comprise the greatest volume of overburden to be removed by mining. Within these units, only 33.2 percent is shale material capable of exhibiting expansive 2:1 type clay mineralogy. Based on saturation percentage data, very little of this materials has the potential to exhibit expansive properties as explained below.

Because saturation percentage is an excellent practical indicator of one of the most important

physical manifestations of sodic hazard, soil swelling, it should be used along with SAR to assess sodic hazard (Merrill et al 1987). A saturation percentage of 80 to 95 should be used as an indicator for swelling tendency associated with sodic hazard. Carlstrom et al (1987) recommend that a saturation percentage equal to or greater than 90 be used to screen for materials that may contain reactive (expansive) clays. Only 9.2% of the Premier shale materials (8 of 87 samples) exhibits saturation percentages of equal to or greater than 90. Therefore, the total amount of Premier overburden materials that have the potential for expansive problems is very limited.

No bentonite was identified during the drilling and logging activities. In addition, the saturation percentage values of the overburden materials are relatively low compared to saturation percents typical for bentonite (> 100%). The mineralogical analyses (Appendix B-5) indicate that some minor amounts of smectite type clays do exist in five of the high SAR samples. However, the majority is kaolinite which is a non-swelling type clay.

Infiltration rates were conducted as part of the hydrological investigations. The slowest infiltration rates for the overburden materials ranged from 10^{-2} to 10^{-4} cm/sec which demonstrates rapid infiltration and the lack of bentonitic type materials.

The lowest stratigraphic overburden/interburden unit (Burning Bed) exhibits the highest SAR values but are primarily sandstones (54%) as demonstrated by the lithologic percentages. High SAR values will not cause adverse growth conditions when the textural material is sand or silt or when the material is a non-swelling clay. Although the Midway, Eska, and Sub-Eska overburden materials do contain high percentages of shale (87%, 78% and 72%, respectively) only minor occurrences of saturation percentages exceed 100% occur in these materials. Therefore, bentonite and bentonitic type materials (swelling 2:1 clays) are present in only limited amounts.

Recent mixing studies conducted with truck/shovel operations in Wyoming demonstrate that mixing occurs to a much greater extent that originally anticipated (more than 20%). Although small volumes of excessively high SAR materials do exist, the mixing that occurs with normal truck/shovel mining is expected to reduce high SAR values to more suitable levels.

Although some overburden materials do exhibit a high pH and SAR, these values will decrease

with time due to solubilization of calcite (calcium carbonate) which occurs within the majority of the overburden materials.

In addition to the points presented above, the post-mining land use is primarily wildlife habitat with shrub utilization for moose browse. Shrubs like a more basic soil condition and would benefit from a more basic soil condition.

High pH spoil material has been reported for this coal district. A revegetation demonstration area was established at the abandoned Omlin Strip Mine Pit which is located within the Wishbone Hill project area. Reclamation efforts do not appear to be significantly affected by high pH and SAR spoils, based on the observations on these reclaimed spoils and previous reclamation work in this coal district (Mitchell et al 1980).

The problem with revegetation of high SAR materials is not one of toxicity but rather a physical problem associated with a lack of water infiltration. If water can infiltrate into high SAR materials revegetation can be easily accomplished. For instance, excellent revegetation has been accomplished on raw, abandoned bentonite mine spoils in Wyoming. These raw spoils are typically high pH 9.0-10.5), have very high saturation percentages (> 100%) and have SAR values exceeding 100. Successful reclamation was easily accomplished by simply applying wood chips and nitrogen fertilizer (Smith, 1984; Schuman et al 1984). The wood chips break up the surface and allow water to infiltrate while the fertilizer creates a better balance of the carbon:nitrogen ratio.

The overburden materials should not hamper revegetation efforts at the Wishbone Hill mine site due to the coarse textured nature of the overburden coupled with the low evaporation of the area and the lack of bentonitic or 2:1 type swelling clay materials. The reapplication of topsoil material will further enhance the reestablishment of native vegetation.

4.1.3 Vegetative Forage Materials Quality

No overburden/interburden materials were identified which could produce vegetation toxic to wildlife and/or livestock. Geochemical results indicate that average selenium values are well below levels expected of producing toxic vegetation. In addition, the environmental conditions

(precipitation) present within the Wishbone Hill project area are not conducive to producing selenium toxic vegetation. No occurrences of selenium toxicity have been reported for Alaska.

4.1.4 Backfill Water Quality

Those parameters which typically impact water quality at surface coal mines include low pH, low ABP, EC, selenium and nitrates. All of these parameters are well below levels suspected of producing environmental impacts to post mining water quality. The highest reported nitrate-nitrogen value (11.0 mg/kg for drill hole PB-84) is well below values expected of producing water quality impacts from mining.

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6.0 RESPONSIBLE PARTIES

Mr. David Y. Boon was the principal investigator for the Wishbone Hill Overburden Characterization Project. Prior to forming his own company Environmental Monitoring Services, Inc. (EMS), Mr. Boon served as a soil scientist and overburden chemist for the Wyoming Department of Environmental Quality -Land Quality Division (DEQ) for over three years. In this capacity, Mr. Boon evaluated soil and overburden sections of permit applications for coal mines throughout Wyoming. He was responsible for revising the DEQ Soil and Overburden Guidelines (Guideline No. 1). He also conducted technical reviews of soil and overburden guidelines for the following state regulatory programs: Utah, Montana, New Mexico and Kansas. He also conducted technical reviews of various manuscripts for the Office of Surface Mining and was on the editorial review committee for the book; Reclaiming Mine Soils and Overburden in the Western United States: Analytical Parameters and Procedures (Williams and Schuman, 1987). Mr. Boon is currently the Chairman of the Soil and Overburden Technical Division of the American Society of Surface Mining and Reclamation.

TABLES

TABLE 3-1

OVERBURDEN ANALYTICAL METHODS

Parameter	Procedure - Reference
pH	USDA Handbook 60, Method 2, page 84 and Method 21a, page 102.
Conductivity	USDA Handbook 60, Method 3a, page 84 and Method 4b, page 89-90.
Saturation %	USDA Handbook 60, Method 27a, page 107.
Particle Size	Black (1965), Part 1, Method 43-5, pages 562 - 566.
Texture	USDA Handbook 18, pages 205, 223.
Soluble Ca, and Na	USDA Handbook 60, Method 3a, page 84. Mg, Analysis by ICP
SAR	Calculated: USDA Handbook 60, page 26.
Carbonate %	USDA Handbook 60, Method 23c, page 105.
Selenium	Page (1982), Method 3-5.2.3, page 55; Method 3-5.5.4 page 61, and Method 3-5.5.3 page 60. Analysis by ICP.
Boron	Page (1982) Method 3-5.2.3 page 55 and analysis by ICP.
Nitrate	Page (1982), Method 33-3.2, page 649 and Method 33-8.2, page 679.
Total S	Sulfur furnace
ABP	Calculated: ABP = (Carbonate % x 10) - (Total S x 31.25) Sobek et al (1978).

TABLE 3-2

OVERBURDEN SCREENING CRITERIA

Parameters	Unit	Good	Fair	Poor
pH	SU	5.5 - 8.5	5.0 - 5.5	< 5.0
			8.5 - 9.0	> 9.0
EC	(mmhos/cm)	0 - 8.0	8.0 - 12.0	>12.0
SAR	--	0 - 10	10 - 15	>15.0
Selenium	mg/kg	< 0.1	> 0.1	> 0.5
Boron	mg/kg	< 5.0	--	> 5.0
NO3-N	mg/kg	< 50.0	--	>50.0
ABP	Ton CaCO3 / 1000 Tons	> -5.0	--	<-5.0

Note: Overburden screening criteria were developed from Wyoming DEQ Guideline No. 1 (1984) and from appropriate sections of Williams and Schuman (1987).

TABLE 3-3

MAJOR OVERBURDEN/INTERBURDEN SAMPLED LITHOTYPES

Lithotype	Total Lithologic Footage	Approximate Overburden %
Gravel	701.5	17.9
Tsadaka Conglomerate	90.0	2.3
Wishbone Conglomerate	275.0	7.0
Shale	1478.9	37.7
Sandstone	760.0	19.4
Siltstone	577.1	14.7
Other *	40.6	1.0
	3923.1	100.0

* Other = Coal (39.4'), Bone (0.8') and Ironstone (0.4 ')

TABLE 3-4

LITHOLOGIC GEOCHEMISTRY SUMMARY STATISTICS

Parameter	Overburden Lithotype					
	GG	TC	WC	SH	SL	SS
pH (SU)	8.0	8.8	8.7	8.8	9.0	8.6
EC (mmhos/cm)	0.5	1.0	1.3	1.5	1.2	1.5
SAR	5.66	13.7	41.4	34.1	31.8	36.4
NO3-N (mg/kg)	1.4	0.9	3.0	1.7	1.1	1.4
B (mg/kg)	0.25	0.21	0.50	0.33	0.33	0.35
Se (mg/kg)	<0.01	<0.01	0.10	0.09	0.13	0.14
ABP ($\frac{\text{tons CaCO3}}{1000 \text{ tons}}$)	2.3	19.6	11.4	15.2	30.1	25.0

GG = Glacial Gravel
TC = Tsadaka Conglomerate
WC = Wishbone Conglomerate
SH = Shale
SS = Sandstone
SL = Siltstone

TABLE 3-5

DRILL HOLE OVERBURDEN/INTERBURDEN GROUPING

Drill Hole ID	Overburden/Interburden Unit
PB-60	Jonesville
PB-69A	Midway - Eska - Sub Eska
PB-74	Eska - Sub Eska
PB-80	Premier
PB-84	Wishbone Conglomerate
PB-85	Premier - Midway
PB-87	Tsadaka Conglomerate
PB-92	Burning Bed
PB-101	Premier
PB-105	Premier - Midway
PB-107	Premier
PB-108	Premier
PB-109	Premier

TABLE 3-6

OVERBURDEN/INTERBURDEN UNITS
GEOCHEMICAL SUMMARY

Parameter	Overburden/Interburden Unit					
	JV	PR	MW	ES	BE	BB
pH (SU)	8.0	8.6	8.4	9.2	8.9	9.1
EC (mmhos/cm)	0.7	1.2	1.5	1.8	2.3	1.4
SAR	4.48	24.6	34.8	48.9	64.5	70.4
NO3-N (mg/kg)	1.0	1.5	0.3	2.7	2.6	0.3
B (mg/kg)	0.27	0.36	0.33	0.34	0.15	0.32
Se (mg/kg)	0.11	0.07	0.05	0.12	0.18	0.19
ABP tons CaCO3 / 1000 tons	22.5	23.7	22.3	16.5	49.5	17.9

JV = Jonesville
PR = Premier
MW = Midway
ES = Eska
BE = Below Eska (Sub Eska)
BB = Burning Bed

TABLE 3-7

COAL CHEMICAL ANALYSIS

	%			
	Pyritic	Sulfate	Organic	Total
Mean	0.05	0.00	0.27	0.31
Minimum	0.01	0.00	0.13	0.15
Maximum	0.39	0.00	0.62	1.01
Standard Dev.	0.07	0.00	0.11	0.17

TABLE 3-8

COAL SLURRY CHEMISTRY

		umhos/cm	mg/l				
Sample ID	pH	Cond.	As	Cd	Se	Hg	Pb	B
Fresh *	8.0	387	0.001	<0.01	<0.001	<0.001	<0.05	0.02
Process *	8.0	382	0.002	<0.01	<0.001	<0.001	<0.05	0.02

Fresh* = Pilot Plant Makeup Water (Fresh Water)

Process* = Process Water from Thickener Overflow

TABLE 3-9

COAL REFUSE CHEMISTRY

Parameter	Coarse Reject	Spiral Reject
pH	8.2	7.8
EC (mmhos/cm)	0.4	0.7
SAR	1.0	0.5
NO3-N (mg/kg)	1.4	0.8
B (mg/kg)	0.13	0.10
Se (mg/kg)	0.09	0.05
Total S %	0.052	0.074
CaCO3 %	1.9	2.5
ABP *	17.4	22.7

ABP * = tons of CaCO3/1000 tons of material

FIGURES

FIGURE 3-1

GENERAL LOCATION MAP

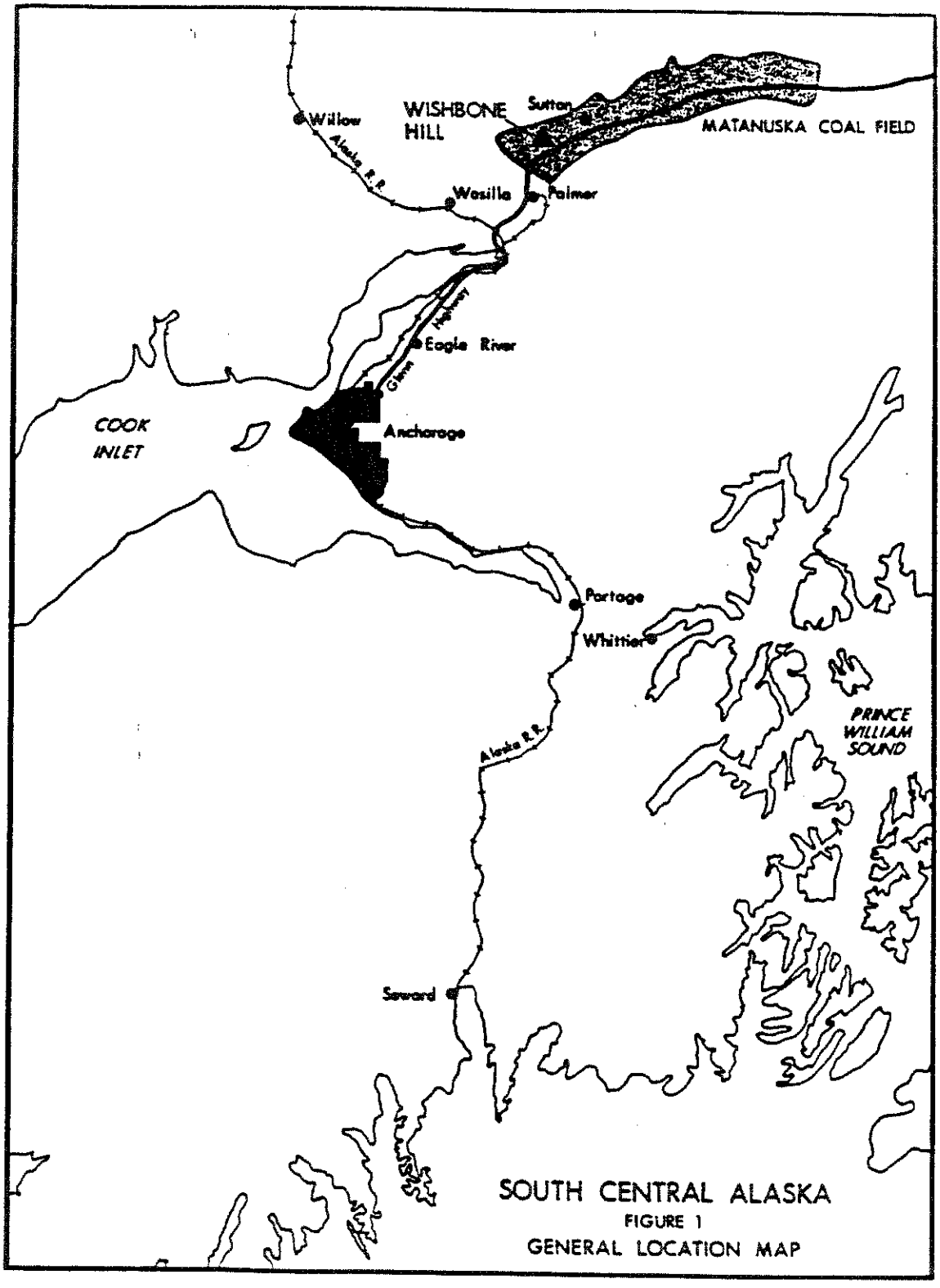
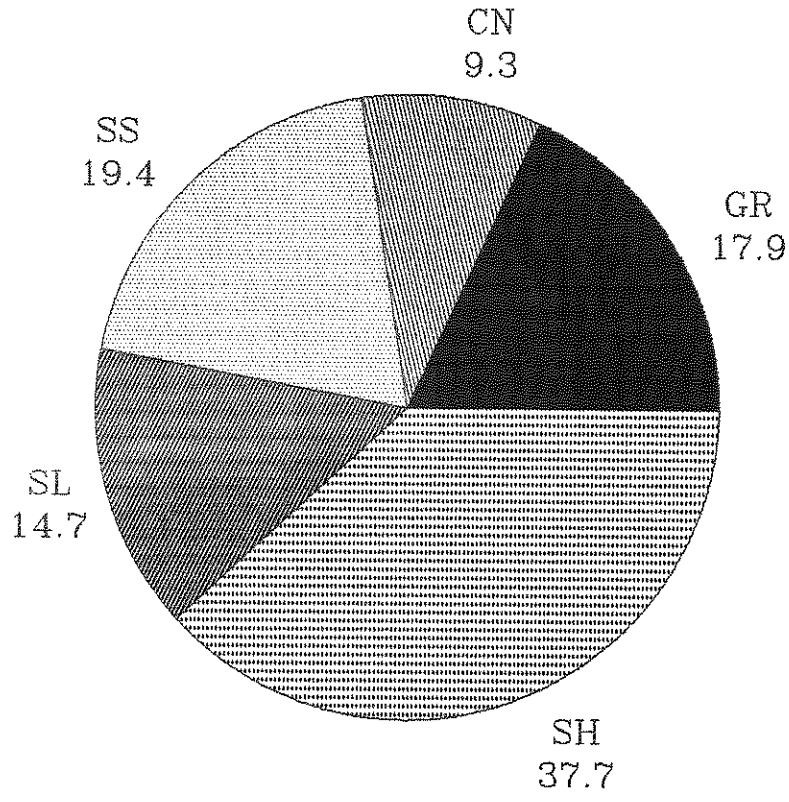


FIGURE 3-2

OVERBURDEN SAMPLE COMPOSITION BY LITHOTYPE

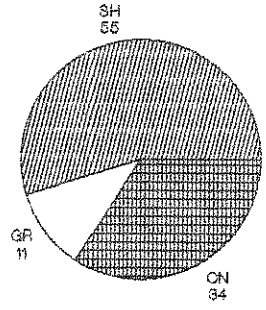


CN = CONGLOMERATE
GR = GRAVEL
SH = SHALE
SL = SILTSTONE
SS = SANDSTONE

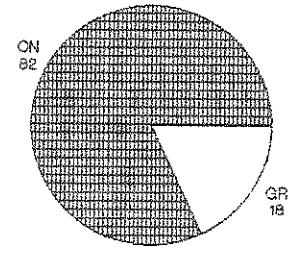
FIGURE 3-3

APPROXIMATE LITHOLOGIC COMPOSITION
FOR DRILL HOLE PB-60, PB-80, PB-84, PB-85 AND PB-87

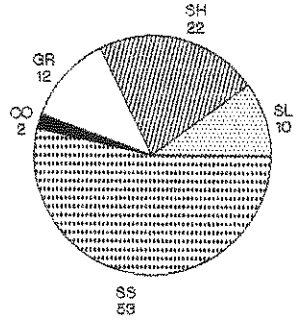
PB-87



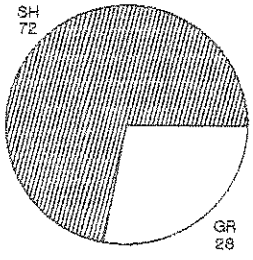
PB-84



PB-60



PB-80



PB-85

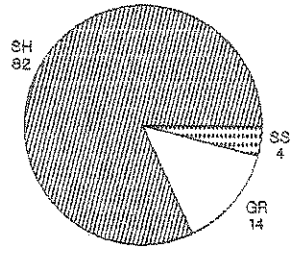
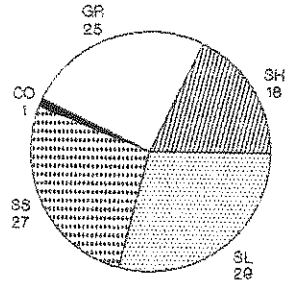


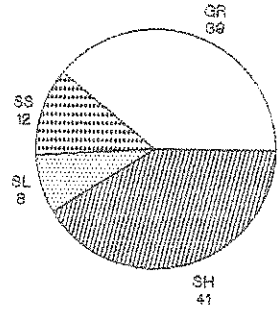
FIGURE 3-4

APPROXIMATE LITHOLOGIC COMPOSITION
FOR DRILL HOLE PB-69A, PB-74, PB-92, PB-101, AND PB-105

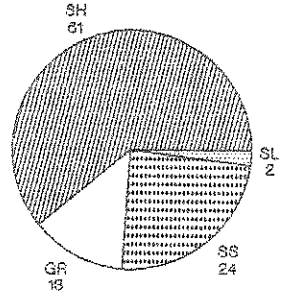
PB-101



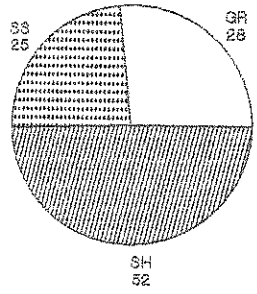
PB-105



PB-69A



PB-74



PB-92

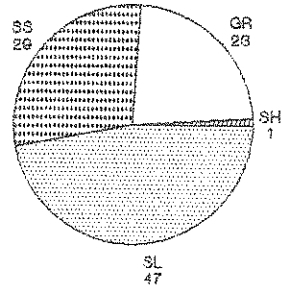
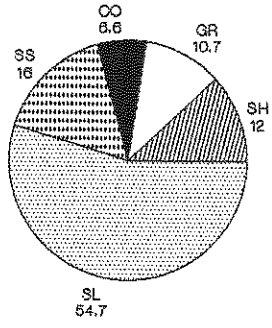


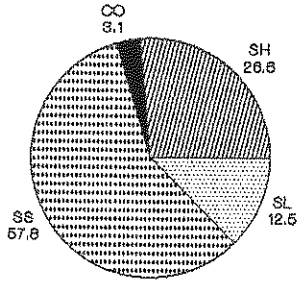
FIGURE 3-5

APPROXIMATE LITHOLOGIC COMPOSITION
FOR DRILL HOLE PB-107, PB-108 AND PB-109

PB-107



PB-108



PB-109

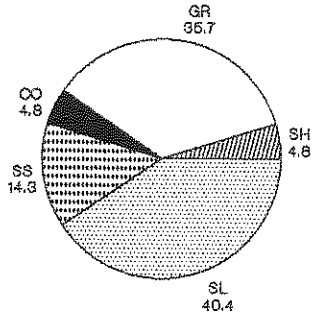


FIGURE 3-6

DRILL HOLE STRATIGRAPHIC COVERAGE

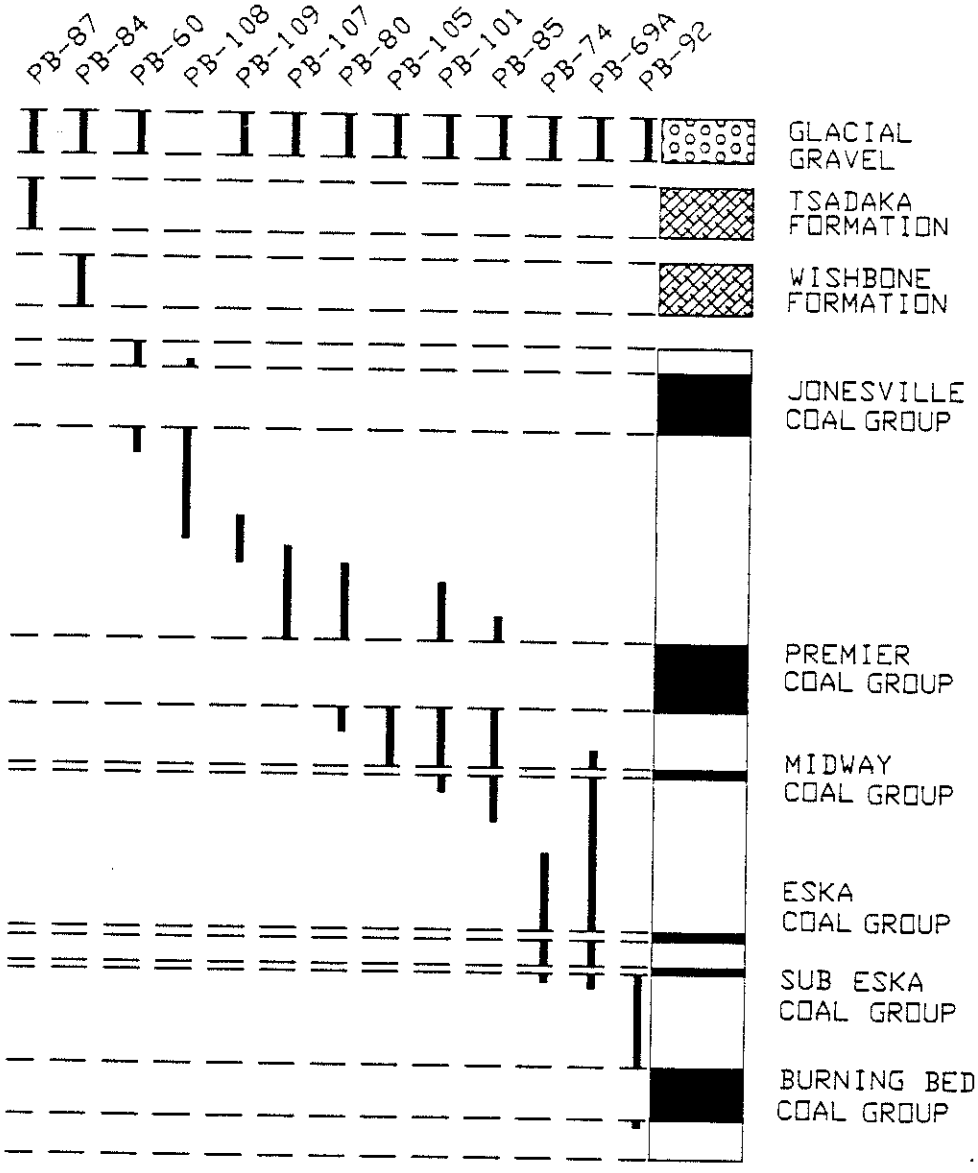
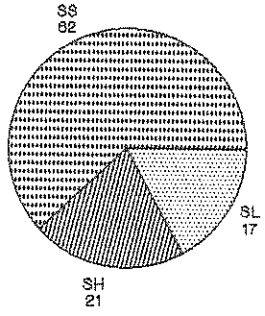


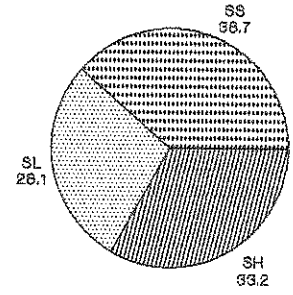
FIGURE 3-7

LITHOLOGIC COMPOSITION OF MAJOR
OVERBURDEN/INTERBURDEN UNITS

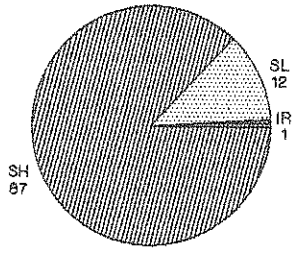
JONESVILLE OVERBURDEN



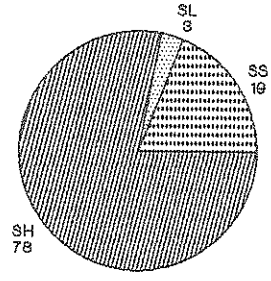
PREMIER OVERBURDEN



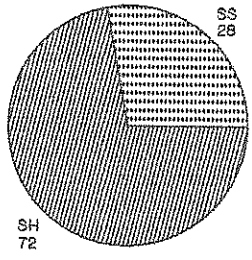
MIDWAY OVERBURDEN



ESKA OVERBURDEN



SUB ESKA OVERBURDEN



BURNING BED OVERBURDEN

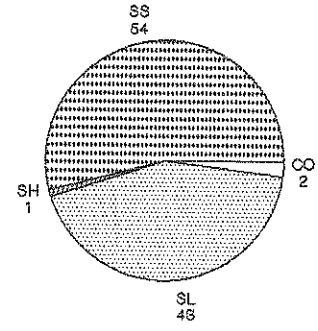
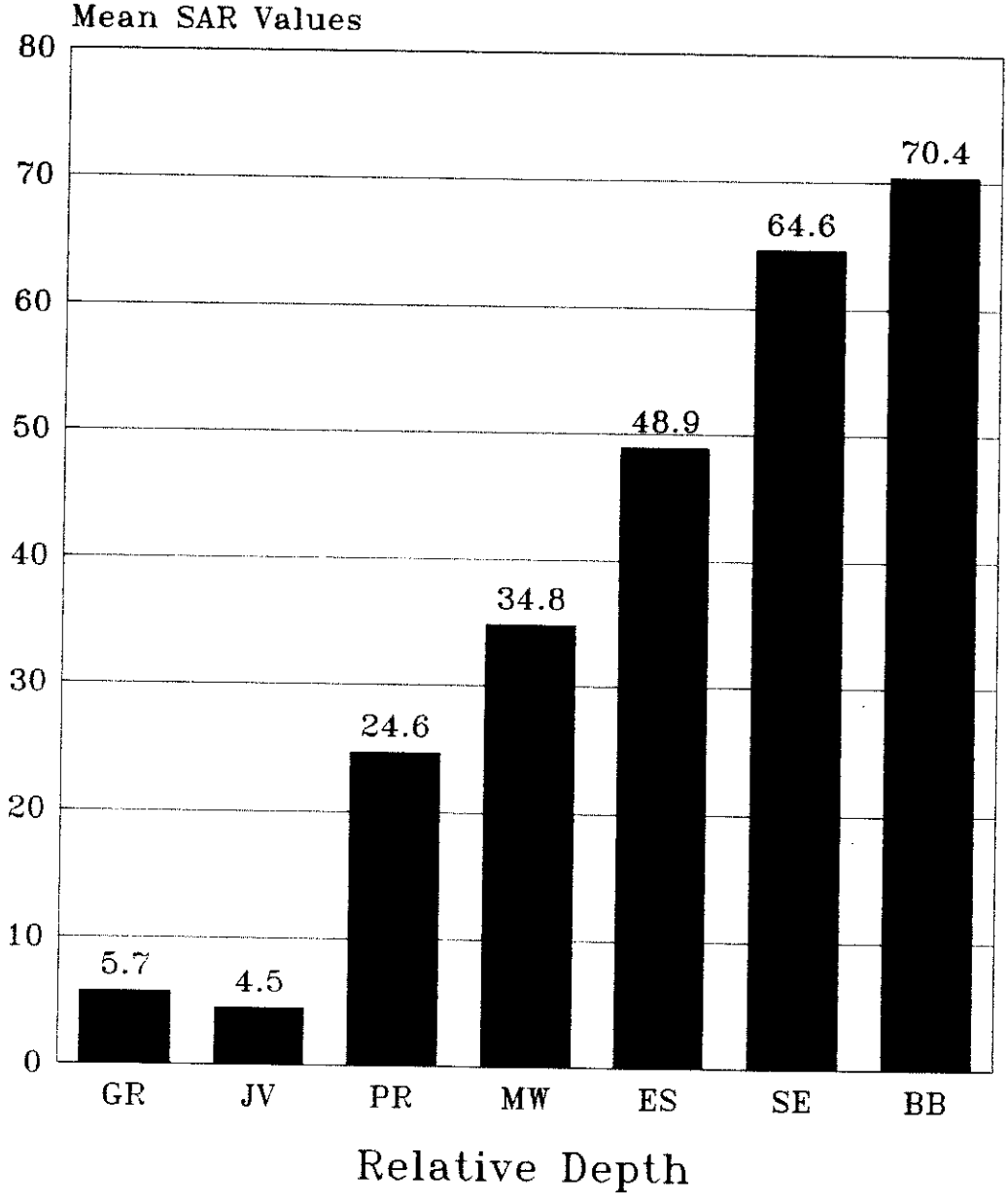


FIGURE 3-8

MEAN SAR VALUES
OVERBURDEN/INTERBURDEN UNITS



APPENDIX

A LITHOLOGIC LOGS

B CHEMICAL DATA

- B-1 OVERBURDEN CHEMICAL DATA
- B-2 TOTAL CHEMICAL ANALYSES
- B-3 COAL SLURRY CHEMISTRY
- B-4 REFUSE CHEMISTRY
- B-5 MINEROLOGY ANALYSIS
- B-6 EXCHANGEABLE SODIUM PERCENT ANALYSIS

C LABORATORY QA/QC

- C-1 IML LABORATORY DATA
- C-2 INTERLABORATORY SPLIT SAMPLE ANALYSES CORRELATION COEFFICIENTS
- C-3 INTERLABORATORY CORRELATION PLOTS

D STATISTICAL SUMMARIES

- D-1 DRILL HOLE
- D-2 LITHOLOGY
- D-3 OVERBURDEN/INTERBURDEN GROUP

E GEOPHYSICAL LOGS

APPENDIX A
LITHOLOGIC LOGS

APPENDIX A
LITHOLOGIC LOGS

LITHOLOGIC CODES

BO	Bone
CL	Claystone
CN	Conglomorate (Wishbone or Tsadaka)
CO	Coal
GR	Glacial gravel
IR	Ironstone
SH	Shale
SL	Siltstone
SS	Sandstone

COAL GROUP CODES

BB	Burning Bed
BE	Below Eska
BY	Below Midway
ES	Eska
JV	Jonesville
MY	Midway
PR	Premier

02/12/89

Wishbone Hill

---Drill Hole Lithology Data---

Preparer: FJM

DIP = 39 Degrees DRILLED: Inclination (-70 Degrees);Azimuth 312

Drill Hole I.D. No.	Interval Thickness	From (Feet)	To (Feet)	Lithology Code	Seam Code	Comments
PB-60	17.00	0.00	17.00	GR		
PB-60	5.90	17.00	22.90	CL		
PB-60	3.30	22.90	26.20	SH		
PB-60	3.10	26.20	29.30	CO		SEAM ABOVE JV
PB-60	0.50	29.30	29.80	SH		
PB-60	8.90	29.80	38.70	SL		
PB-60	4.10	38.70	42.80	SS		
PB-60	8.50	42.80	51.30	SH		
PB-60	28.70	51.30	80.00	SS		
PB-60	2.80	80.00	82.80	SH		
PB-60	3.20	82.80	86.00	BO	JV	
PB-60	4.00	86.00	90.00	CO	JV	
PB-60	0.30	90.00	90.30	BO	JV	
PB-60	1.40	90.30	91.70	CO	JV	
PB-60	0.80	91.70	92.50	SH	JV	
PB-60	0.80	92.50	93.30	CO	JV	
PB-60	0.70	93.30	94.00	SH	JV	
PB-60	6.20	94.00	100.20	SS	JV	
PB-60	3.30	100.20	103.50	SH	JV	
PB-60	1.60	103.50	105.10	CO	JV	
PB-60	1.40	105.10	106.50	BO	JV	
PB-60	25.10	106.50	131.60	SH	JV	
PB-60	2.50	131.60	134.10	CO	JV	
PB-60	3.40	134.10	137.50	SH	JV	
PB-60	0.40	137.50	137.90	CO	JV	
PB-60	1.00	137.90	138.90	BO	JV	
PB-60	0.60	138.90	139.50	CO	JV	
PB-60	0.40	139.50	139.90	BO	JV	
PB-60	2.10	139.90	142.00	CO	JV	
PB-60	0.60	142.00	142.60	BO	JV	
PB-60	1.00	142.60	143.60	CO	JV	
PB-60	0.60	143.60	144.20	SH	JV	
PB-60	1.00	144.20	145.20	CO	JV	
PB-60	1.30	145.20	146.50	BO	JV	
PB-60	1.20	146.50	147.70	SH	JV	
PB-60	3.30	147.70	151.00	CO	JV	
PB-60	1.50	151.00	152.50	BO	JV	

02/12/89

Wishbone Hill

---Drill Hole Lithology Data---

Preparer: FJM

DIP = 39 Degrees DRILLED: Inclination (-70 Degrees);Azimuth 312

Drill Hole I.D. No.	Interval Thickness	From (Feet)	To (Feet)	Lithology Code	Seam Code	Comments
PB-60	0.80	152.50	153.30	CO	JV	
PB-60	1.60	153.30	154.90	BO	JV	
PB-60	2.00	154.90	156.90	CO	JV	
PB-60	0.80	156.90	157.70	BO	JV	
PB-60	0.70	157.70	158.40	CO	JV	
PB-60	1.60	158.40	160.00	BO	JV	
PB-60	1.20	160.00	161.20	CO	JV	
PB-60	1.10	161.20	162.30	BO	JV	
PB-60	20.50	162.30	182.80	SS		
PB-60	12.30	182.80	195.10	SH		
PB-60	15.00	195.10	210.10	SS		
PB-60	3.00	210.10	213.10	SH		
PB-60	4.40	213.10	217.50	SS		

N = 49

04/29/89

Wishbone Hill

---Drill Hole Lithology Data---

Preparer: FJM

DIP = 30 Degrees

Drill Hole I.D. No.	Interval Thickness	From (Feet)	To (Feet)	Lithology Code	Seam Code	Comments
PB-69A	49.00	0.00	49.00	GR		
PB-69A	7.00	49.00	56.00	CL		
PB-69A	15.40	56.00	71.40	SH		
PB-69A	1.90	71.40	73.30	CO	MY	
PB-69A	0.70	73.30	74.00	SH	MY	
PB-69A	3.60	74.00	77.60	CO	MY	
PB-69A	49.10	77.60	126.70	SH		
PB-69A	6.30	126.70	133.00	SS		
PB-69A	12.00	133.00	145.00	SH		
PB-69A	7.00	145.00	152.00	SH		Carbanaeous
PB-69A	25.50	152.00	177.50	SH		
PB-69A	61.00	177.50	238.50	SS		
PB-69A	15.50	238.50	254.00	SH		
PB-69A	12.00	254.00	266.00	SS		
PB-69A	20.00	266.00	286.00	SH		
PB-69A	17.00	286.00	303.00	SH		Carbanaeous
PB-69A	15.00	303.00	318.00	SS		
PB-69A	2.00	318.00	320.00	CO	ES	
PB-69A	3.30	320.00	323.30	SH	ES	
PB-69A	1.90	323.30	325.20	BO	ES	
PB-69A	31.30	325.20	356.50	SH		
PB-69A	2.50	356.50	359.00	BO	BE	
PB-69A	18.00	359.00	377.00	SH	BE	
PB-69A	2.00	377.00	379.00	CO	BE	
PB-69A	4.20	379.00	383.20	SH	BE	
PB-69A	5.50	383.20	388.70	BO	BE	
PB-69A	2.10	388.70	390.80	SH	BE	
PB-69A	4.20	390.80	395.00	BO	BE	
PB-69A	20.00	395.00	415.00	SH		

04/29/89

Wishbone Hill

---Drill Hole Lithology Data---

Preparer: PJM

DIP = 45 Degrees

Drill Hole I.D. No.	Interval Thickness	From (Feet)	To (Feet)	Lithology Code	Seam Code	Comments
PB-74	108.00	0.00	108.00	GR		
PB-74	117.50	108.00	225.50	SH		
PB-74	2.50	225.50	228.00	BO	ES	
PB-74	1.50	228.00	229.50	SH	ES	
PB-74	2.50	229.50	232.00	BO	ES	
PB-74	2.00	232.00	234.00	SH	ES	
PB-74	3.00	234.00	237.00	BO	ES	
PB-74	4.50	237.00	241.50	SH	ES	
PB-74	1.70	241.50	243.20	BO	ES	
PB-74	26.80	243.20	270.00	SH		
PB-74	2.50	270.00	272.50	BO	BE	
PB-74	4.50	272.50	277.00	SH	BE	
PB-74	4.50	277.00	281.50	CO	BE	
PB-74	31.50	281.50	313.00	SH		
PB-74	53.50	313.00	366.50	SS		
PB-74	33.50	366.50	400.00	SH		

N = 15

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Wishbone Hill

---Drill Hole Lithology Data---

Preparer: FJM

Drill Hole I.D. No.	Interval Thickness	DIP = 10 Degrees From (Feet)	To (Feet)	Lithology Code	Seam Code	Comments
PB-80	55.00	0.00	55.00	GR		
PB-80	110.40	55.00	165.40	SH		
PB-80	0.60	165.40	166.00	BD	PR	
PB-80	1.00	166.00	167.00	CD	PR	
PB-80	0.30	167.00	167.30	BD	PR	
PB-80	1.30	167.30	168.60	CD	PR	
PB-80	1.20	168.60	169.80	BD	PR	
PB-80	3.30	169.80	173.10	CD	PR	
PB-80	1.20	173.10	174.30	BD	PR	
PB-80	0.80	174.30	175.10	SH	PR	
PB-80	1.90	175.10	177.00	CD	PR	
PB-80	0.80	177.00	177.80	BD	PR	
PB-80	2.00	177.80	179.80	CD	PR	
PB-80	2.10	179.80	181.90	BD	PR	
PB-80	1.50	181.90	183.40	CD	PR	
PB-80	2.00	183.40	185.40	SH	PR	
PB-80	7.90	185.40	193.30	CD	PR	
PB-80	32.50	193.30	225.80	SH	PR	
PB-80	0.70	225.80	226.50	BD	PR	
PB-80	4.90	226.50	231.40	CD	PR	
PB-80	0.50	231.40	231.90	BD	PR	
PB-80	3.50	231.90	235.40	SH	PR	
PB-80	1.70	235.40	237.10	IR	PR	
PB-80	4.50	237.10	241.60	SH	PR	
PB-80	1.40	241.60	243.00	BD	PR	
PB-80	0.60	243.00	243.60	CD	PR	
PB-80	2.00	243.60	245.60	BD	PR	
PB-80	1.80	245.60	247.40	CD	PR	
PB-80	1.20	247.40	248.60	BD	PR	
PB-80	8.40	248.60	257.00	SH	PR	
PB-80	1.00	257.00	258.00	BD	PR	
PB-80	2.00	258.00	260.00	SH	PR	
PB-80	1.50	260.00	261.50	CD	PR	
PB-80	33.50	261.50	295.00	SH		

N = 33

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Wishbone Hill
---Drill Hole Lithology Data---

Preparer: FJM

Drill Hole I.D. No.	Interval Thickness	DIP = ? From (Feet)	To (Feet)	Degrees Lithology Code	Seam Code	Comments
PB-84	60.00	0.00	60.00	GR		
PB-84	275.00	60.00	335.00	CN		WISHBONE CONGLOMERATE

N = 2

02/12/89

Wishbone Hill

---Drill Hole Lithology Data---

Preparer: FJM

DIP = 10 Degrees

Drill Hole I.D. No.	Interval Thickness	From (Feet)	To (Feet)	Lithology Code	Seam Code	Comments
PB-85	67.00	0.00	67.00	GR		
PB-85	13.00	67.00	80.00	SH		
PB-85	21.00	80.00	101.00	SS		
PB-85	6.20	101.00	107.20	SH		
PB-85	0.80	107.20	108.00	BO	PR	
PB-85	1.60	108.00	109.60	CO	PR	
PB-85	0.60	109.60	110.20	BO	PR	
PB-85	0.90	110.20	111.10	CO	PR	
PB-85	1.00	111.10	112.10	BO	PR	
PB-85	0.70	112.10	112.80	CO	PR	
PB-85	1.00	112.80	113.80	BO	PR	
PB-85	2.00	113.80	115.80	CO	PR	
PB-85	1.40	115.80	117.20	SH	PR	
PB-85	1.60	117.20	118.80	CO	PR	
PB-85	0.60	118.80	119.40	SH	PR	
PB-85	0.60	119.40	120.00	BO	PR	
PB-85	2.50	120.00	122.50	CO	PR	
PB-85	0.60	122.50	123.10	BO	PR	
PB-85	0.90	123.10	124.00	SH	PR	
PB-85	0.50	124.00	124.50	IR	PR	
PB-85	2.00	124.50	126.50	SH	PR	
PB-85	2.10	126.50	128.60	CO	PR	
PB-85	0.90	128.60	129.50	SH	PR	
PB-85	1.70	129.50	131.20	CO	PR	
PB-85	2.70	131.20	133.90	BO	PR	
PB-85	6.70	133.90	140.60	CO	PR	
PB-85	0.60	140.60	141.20	SH	PR	
PB-85	1.70	141.20	142.90	BO	PR	
PB-85	3.20	142.90	146.10	CO	PR	
PB-85	0.80	146.10	146.90	BO	PR	
PB-85	1.60	146.90	148.50	CO	PR	
PB-85	0.50	148.50	149.00	BO	PR	
PB-85	2.40	149.00	151.40	CO	PR	
PB-85	0.80	151.40	152.20	BO	PR	
PB-85	3.80	152.20	156.00	CO	PR	
PB-85	0.70	156.00	156.70	BO	PR	
PB-85	2.40	156.70	159.10	SH	PR	

02/12/89

Wishbone Hill

---Drill Hole Lithology Data---

Preparer: FJM

DIP = 10 Degrees

Drill Hole I.D. No.	Interval Thickness	From (Feet)	To (Feet)	Lithology Code	Seam Code	Comments
PB-85	1.60	159.10	160.70	BO	PR	
PB-85	1.70	160.70	162.40	CO	PR	
PB-85	0.80	162.40	163.20	BO	PR	
PB-85	0.40	163.20	163.60	CO	PR	
PB-85	1.70	163.60	165.30	BO	PR	
PB-85	0.60	165.30	165.90	SH	PR	
PB-85	0.90	165.90	166.80	BO	PR	
PB-85	3.90	166.80	170.70	SH	PR	
PB-85	1.60	170.70	172.30	BO	PR	
PB-85	1.10	172.30	173.40	SH	PR	
PB-85	0.70	173.40	174.10	IR	PR	
PB-85	0.90	174.10	175.00	SH	PR	
PB-85	2.10	175.00	177.10	CO	PR	
PB-85	0.70	177.10	177.80	BO	PR	
PB-85	1.30	177.80	179.10	SH	PR	
PB-85	0.50	179.10	179.60	BO	PR	
PB-85	1.10	179.60	180.70	CO	PR	
PB-85	0.80	180.70	181.50	BO	PR	
PB-85	3.00	181.50	184.50	CO	PR	
PB-85	0.50	184.50	185.00	BO	PR	
PB-85	0.40	185.00	185.40	CO	PR	
PB-85	0.80	185.40	186.20	BO	PR	
PB-85	0.60	186.20	186.80	CO	PR	
PB-85	0.80	186.80	187.60	BO	PR	
PB-85	1.60	187.60	189.20	SH	PR	
PB-85	0.60	189.20	189.80	BO	PR	
PB-85	2.20	189.80	192.00	SH	PR	
PB-85	0.40	192.00	192.40	BO	PR	
PB-85	3.40	192.40	195.80	SH	PR	
PB-85	2.70	195.80	198.50	CO	PR	
PB-85	0.50	198.50	199.00	SH	PR	
PB-85	0.40	199.00	199.40	BO	PR	
PB-85	1.00	199.40	200.40	SH	PR	
PB-85	0.50	200.40	200.90	BO	PR	
PB-85	1.30	200.90	202.20	CO	PR	
PB-85	0.80	202.20	203.00	SH	PR	
PB-85	0.30	203.00	203.30	CO	PR	
PB-85	0.50	203.30	203.80	BO	PR	
PB-85	72.30	203.80	276.10	SH		
PB-85	4.30	276.10	280.40	CO	MY	
PB-85	0.60	280.40	281.00	SH	MY	
PB-85	0.80	281.00	281.80	CO	MY	
PB-85	0.40	281.80	282.20	BO	MY	
PB-85	1.40	282.20	283.60	CO	MY	
PB-85	29.20	283.60	312.80	SH		
PB-85	1.00	312.80	313.80	BO	BY	
PB-85	1.10	313.80	314.90	SH	BY	
PB-85	3.90	314.90	318.80	CO	BY	
PB-85	1.00	318.80	319.80	SH	BY	
PB-85	2.00	319.80	321.80	CO	BY	
PB-85	283.20	321.80	605.00	SH		

N = 87

02/12/89

Wishbone Hill

---Drill Hole Lithology Data---

Preparer: FJM

Drill Hole I.D. No.	Interval Thickness	DIP = From (Feet)	? To (Feet)	Degrees Lithology Code	Seam Code	Comments
PB-87	30.00	0.00	30.00	GR		
PB-87	60.00	30.00	90.00	CN		TSADAKA CONGLOMERATE
PB-87	145.00	90.00	235.00	SH		

N = 3

04/29/89

Wishbone Hill

---Drill Hole Lithology Data---

Preparer: PJH

DIP = 64 Degrees DRILLED: Inclination (-70 Degrees);Azimuth 298

Drill Hole I.D. No.	Interval Thickness	From (Feet)	To (Feet)	Lithology Code	Seam Code	Comments
PB-92	80.00	0.00	80.00	GR		
PB-92	41.20	80.00	121.2	SS		
PB-92	16.10	121.20	137.3	SL		
PB-92	2.40	137.30	139.7	SS		
PB-92	30.30	139.70	170.0	SL		
PB-92	2.00	170.00	172.0	CO		
PB-92	2.00	172.00	174.0	BO		
PB-92	59.80	174.00	233.8	SS		
PB-92	35.70	233.80	269.5	SL		
PB-92	1.60	269.50	271.1	SH		
PB-92	1.40	271.10	272.5	BO	BB	
PB-92	5.00	272.50	277.5	SH	BB	
PB-92	5.00	277.50	282.50	CO	BB	
PB-92	0.90	282.50	283.40	BO	BB	
PB-92	7.20	283.40	290.60	SH	BB	
PB-92	0.30	290.60	290.90	BO	BB	
PB-92	1.30	290.90	292.20	CO	BB	
PB-92	13.30	292.20	305.50	SH	BB	
PB-92	5.30	305.50	310.80	BO	BB	
PB-92	3.50	310.80	314.30	SH	BB	
PB-92	0.30	314.30	314.60	CO	BB	
PB-92	0.90	314.60	315.50	SH	BB	
PB-92	2.00	315.50	317.50	BO	BB	
PB-92	9.70	317.50	327.20	CO	BB	
PB-92	0.30	327.20	327.50	BO	BB	
PB-92	3.50	327.50	331.00	CO	BB	
PB-92	0.20	331.00	331.20	BO	BB	
PB-92	0.10	331.20	331.30	SH	BB	
PB-92	16.20	331.30	347.50	SL	BB	
PB-92	0.50	347.50	348.00	SH	BB	
PB-92	1.50	348.00	349.50	BO	BB	
PB-92	0.50	349.50	350.00	CO	BB	
PB-92	1.20	350.00	351.20	BO	BB	
PB-92	1.80	351.20	353.00	SH	BB	
PB-92	15.50	353.00	368.50	SL	BB	
PB-92	0.50	368.50	369.00	SH	BB	
PB-92	2.50	369.00	371.50	BO	BB	

02/12/89

Wishbone Hill

---Drill Hole Lithology Data---

Preparer: FJM

DIP = 64 Degrees DRILLED: Inclination (-70 Degrees);Azimuth 298

Drill Hole I.D. No.	Interval Thickness	From (Feet)	To (Feet)	Lithology Code	Seam Code	Comments
PB-92	2.50	371.50	374.00	SH	BB	
PB-92	1.50	374.00	375.50	SL	BB	
PB-92	0.30	375.50	375.80	SH	BB	
PB-92	1.10	375.80	376.90	CO	BB	
PB-92	1.00	376.90	377.90	SH	BB	
PB-92	5.60	377.90	383.50	SL	BB	
PB-92	0.70	383.50	384.20	SH	BB	
PB-92	0.80	384.20	385.00	CO	BB	
PB-92	0.70	385.00	385.70	BD	BB	
PB-92	3.80	385.70	389.50	SH	BB	
PB-92	1.50	389.50	391.00	CO	BB	
PB-92	0.70	391.00	391.70	SH		
PB-92	29.90	391.70	421.60	SL		
PB-92	8.80	421.60	430.40	CL		
PB-92	36.90	430.40	467.30	SL		
PB-92	4.60	467.30	471.90	CL		
PB-92	3.70	471.90	475.60	SL		

N = 53

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Wishbone Hill

---Drill Hole Lithology Data---

Preparer: FJM

DIP = 30 Degrees

Drill Hole I.D. No.	Interval Thickness	From (Feet)	To (Feet)	Lithology Code	Seam Code	Comments
PB-101	63.00	0.00	63.00	GR		
PB-101	13.10	63.00	76.10	SH		
PB-101	24.40	76.10	100.50	SS		
PB-101	5.60	100.50	106.10	SH		
PB-101	1.30	106.10	107.40	CO		
PB-101	0.80	107.40	108.20	BO		
PB-101	12.90	108.20	121.10	SL		
PB-101	6.50	121.10	127.60	SS		
PB-101	3.90	127.60	131.50	SL		
PB-101	7.30	131.50	138.80	SS		
PB-101	5.30	138.80	144.10	SL		
PB-101	1.40	144.10	145.50	SH		
PB-101	1.10	145.50	146.60	BO	PR	
PB-101	1.50	146.60	148.10	SH	PR	
PB-101	0.90	148.10	149.00	BO	PR	
PB-101	2.50	149.00	151.50	SH	PR	
PB-101	2.40	151.50	153.90	CO	PR	
PB-101	1.50	153.90	155.40	SH	PR	
PB-101	2.00	155.40	157.40	BO	PR	
PB-101	2.40	157.40	159.80	SH	PR	
PB-101	0.60	159.80	160.40	BO	PR	
PB-101	2.60	160.40	163.00	CO	PR	
PB-101	2.80	163.00	165.80	SH	PR	
PB-101	0.80	165.80	166.60	SL	PR	
PB-101	1.80	166.60	168.40	SH	PR	
PB-101	0.90	168.40	169.30	CO	PR	
PB-101	1.00	169.30	170.30	BO	PR	
PB-101	2.20	170.30	172.50	SH	PR	
PB-101	0.80	172.50	173.30	CO	PR	
PB-101	5.10	173.30	178.40	SH	PR	
PB-101	6.60	178.40	185.00	CO	PR	
PB-101	1.30	185.00	186.30	SH	PR	
PB-101	2.00	186.30	188.30	CO	PR	
PB-101	(1.20)	188.30	187.10	BO	PR	
PB-101	6.20	187.10	193.30	SS	PR	
PB-101	3.60	193.30	196.90	CO	PR	
PB-101	3.70	196.90	200.60	SH	PR	

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Wishbone Hill

---Drill Hole Lithology Data---

Preparer: FJM

DIP = 30 Degrees

Drill Hole I.D. No.	Interval Thickness	From (Feet)	To (Feet)	Lithology Code	Seam Code	Comments
PB-101	0.50	200.60	201.10	BB	PR	
PB-101	1.70	201.10	202.80	SH	PR	
PB-101	3.80	202.80	206.60	CO	PR	
PB-101	13.30	206.60	219.90	SH	PR	
PB-101	2.00	219.90	221.90	CO	PR	
PB-101	1.10	221.90	223.00	BO	PR	
PB-101	2.00	223.00	225.00	SH	PR	
PB-101	2.00	225.00	227.00	CO	PR	
PB-101	2.20	227.00	229.20	BO	PR	
PB-101	4.80	229.20	234.00	SH	PR	
PB-101	1.00	234.00	235.00	BO	PR	
PB-101	4.00	235.00	239.00	SL	PR	
PB-101	2.40	239.00	241.40	CO	PR	
PB-101	2.70	241.40	244.10	SH	PR	
PB-101	1.20	244.10	245.30	CO	PR	
PB-101	0.30	245.30	245.60	BO	PR	
PB-101	1.00	245.60	246.60	CO	PR	
PB-101	1.80	246.60	248.40	SH		
PB-101	33.10	248.40	281.50	SL		
PB-101	15.60	281.50	297.10	SS		
PB-101	8.50	297.10	305.60	SL		
PB-101	2.60	305.60	308.20	SH		
PB-101	1.90	308.20	310.10	CO	MY	
PB-101	0.70	310.10	310.80	SH	MY	
PB-101	1.90	310.80	312.70	CO	MY	
PB-101	1.20	312.70	313.90	BO	MY	
PB-101	1.70	313.90	315.60	CO	MY	
PB-101	1.20	315.60	316.80	SH		
PB-101	2.00	316.80	318.80	SL		
PB-101	4.20	318.80	323.00	SH		
PB-101	6.70	323.00	329.70	SL		
PB-101	3.70	329.70	333.40	SH		
PB-101	3.70	333.40	337.10	SL		
PB-101	4.70	337.10	341.80	SS		
PB-101	11.10	341.80	352.90	SH		
PB-101	1.40	352.90	354.30	CO	BY	
PB-101	3.70	354.30	358.00	SH	BY	
PB-101	2.70	358.00	360.70	CO	BY	
PB-101	0.40	360.70	361.10	SH		
PB-101	10.10	361.10	371.20	SS		

N = 76

02/12/89

Wishbone Hill

---Drill Hole Lithology Data---

Preparer: FJM

DIP = 10 Degrees

Drill Hole I.D. No.	Interval Thickness	From (Feet)	To (Feet)	Lithology Code	Seam Code	Comments
PB-105	57.50	0.00	57.50	BR		
PB-105	1.80	57.50	59.30	CO	PR	
PB-105	2.20	59.30	61.50	SH	PR	
PB-105	3.00	61.50	64.50	SL	PR	
PB-105	1.10	64.50	65.60	BO	PR	
PB-105	0.70	65.60	66.30	SH	PR	
PB-105	0.20	66.30	66.50	CO	PR	
PB-105	2.30	66.50	68.80	SH	PR	
PB-105	0.40	68.80	69.20	CO	PR	
PB-105	8.30	69.20	77.50	SH	PR	
PB-105	5.70	77.50	83.20	BO	PR	
PB-105	0.80	83.20	84.00	SL	PR	
PB-105	0.70	84.00	84.70	BO	PR	
PB-105	2.50	84.70	87.20	CO	PR	
PB-105	0.50	87.20	87.70	SH	PR	
PB-105	3.00	87.70	90.70	CO	PR	
PB-105	3.80	90.70	94.50	SH	PR	
PB-105	0.40	94.50	94.90	IR	PR	
PB-105	2.30	94.90	97.20	SL	PR	
PB-105	2.30	97.20	99.50	CO	PR	
PB-105	3.10	99.50	102.60	SH	PR	
PB-105	0.70	102.60	103.30	CO	PR	
PB-105	4.20	103.30	107.50	SH	PR	
PB-105	5.10	107.50	112.60	BO	PR	
PB-105	1.70	112.60	114.30	SH	PR	
PB-105	3.10	114.30	117.40	CO	PR	
PB-105	0.80	117.40	118.20	SH	PR	
PB-105	1.90	118.20	120.10	CO	PR	
PB-105	0.60	120.10	120.70	SH	PR	
PB-105	1.70	120.70	122.40	CO	PR	
PB-105	3.20	122.40	125.60	SH	PR	
PB-105	4.80	125.60	130.40	CO	PR	
PB-105	1.50	130.40	131.90	SH	PR	
PB-105	3.00	131.90	134.90	SL	PR	
PB-105	3.80	134.90	138.70	SH	PR	
PB-105	5.40	138.70	144.10	CO	PR	
PB-105	4.30	144.10	148.40	SH	PR	

02/12/89

Wishbone Hill

---Drill Hole Lithology Data---

Preparer: FJM

DIP = 10 Degrees

Drill Hole I.D. No.	Interval Thickness	From (Feet)	To (Feet)	Lithology Code	Seam Code	Comments
PB-105	0.30	148.40	148.70	SL	PR	
PB-105	10.00	148.70	158.70	SH	PR	
PB-105	0.80	158.70	159.50	SL	PR	
PB-105	1.70	159.50	161.20	CO	PR	
PB-105	0.30	161.20	161.50	BO	PR	
PB-105	1.10	161.50	162.60	SH	PR	
PB-105	0.80	162.60	163.40	SL	PR	
PB-105	1.30	163.40	164.70	SH	PR	
PB-105	7.50	164.70	172.20	CO	PR	
PB-105	6.50	172.20	178.70	SH	PR	
PB-105	4.00	178.70	182.70	SL	PR	
PB-105	0.50	182.70	183.20	SH	PR	
PB-105	2.80	183.20	186.00	CO	PR	
PB-105	2.00	186.00	188.00	SH	PR	
PB-105	2.40	188.00	190.40	CO	PR	
PB-105	24.10	190.40	214.50	SH		
PB-105	9.70	214.50	224.20	SL		
PB-105	1.70	224.20	225.90	SH		
PB-105	1.00	225.90	226.90	CL		
PB-105	0.40	226.90	227.30	IR		
PB-105	9.40	227.30	236.70	SH		
PB-105	16.50	236.70	253.20	SS		
PB-105	14.40	253.20	267.60	SH		
PB-105	3.50	267.60	271.10	CO	MY	
PB-105	0.40	271.10	271.50	CL	MY	
PB-105	3.10	271.50	274.60	CO	MY	
PB-105	8.90	274.60	283.50	SH		

N = 64

08/18/89

Wishbone Hill

---Drill Hole Lithology Data---

Preparer: FJH

DIP = 50 Degrees

Drill Hole I.D. No.	Interval Thickness	From (Feet)	To (Feet)	Lith Code	Seam Code	MINE CODE	True Thick	Comments
PB-107	42.00	0.00	42.00	GR			42.00	
PB-107	173.00	42.00	215.00	SL			111.20	
PB-107	15.00	215.00	230.00	CL			9.64	
PB-107	25.00	230.00	255.00	SL			16.07	
PB-107	45.00	255.00	300.00	SS			28.93	
PB-107	5.00	300.00	305.00	SL			3.21	
PB-107	5.00	305.00	310.00	SS			3.21	
PB-107	5.00	310.00	315.00	SL			3.21	
PB-107	20.00	315.00	335.00	SH			12.86	
PB-107	1.00	335.00	336.00	CO	PR	4	0.64	
PB-107	6.00	336.00	342.00	SH	PR	4	3.86	
PB-107	1.20	342.00	343.20	BO	PR	2	0.77	
PB-107	0.60	343.20	343.80	SH	PR	3	0.39	
PB-107	0.80	343.80	344.60	BO	PR	2	0.51	
PB-107	1.40	344.60	346.00	CO	PR	1	0.90	
PB-107	4.00	346.00	350.00	BO	PR	2	2.57	
PB-107	1.80	350.00	351.80	CO	PR	1	1.16	
PB-107	4.40	351.80	356.20	BO	PR	2	2.83	
PB-107	2.30	356.20	358.50	SH	PR	3	1.48	
PB-107	0.90	358.50	359.40	BO	PR	2	0.58	
PB-107	1.60	359.40	361.00	SH	PR	3	1.03	
PB-107	2.00	361.00	363.00	CO	PR	1	1.29	
PB-107	3.00	363.00	366.00	SH	PR	3	1.93	
PB-107	8.20	366.00	374.20	CO	PR	1	5.27	
PB-107	1.60	374.20	375.80	BO	PR	2	1.03	
PB-107	3.90	375.80	379.70	SH	PR	4	2.51	
PB-107	1.30	379.70	381.00	CO	PR	4	0.84	
PB-107	1.20	381.00	382.20	BO	PR	4	0.77	
PB-107	1.30	382.20	383.50	SH	PR	4	0.84	
PB-107	1.40	383.50	384.90	IR	PR	4	0.90	
PB-107	1.30	384.90	386.20	CO	PR	4	0.84	
PB-107	1.00	386.20	387.20	BO	PR	4	0.64	
PB-107	0.70	387.20	387.90	SH	PR	4	0.45	
PB-107	1.20	387.90	389.10	BO	PR	4	0.77	
PB-107	4.80	389.10	393.90	SH	PR	4	3.09	
PB-107	3.40	393.90	397.30	CO	PR	1	2.19	
PB-107	1.50	397.30	398.80	SH	PR	3	0.96	
PB-107	2.30	398.80	401.10	CO	PR	1	1.48	
PB-107	1.10	401.10	402.20	SH	PR	3	0.71	
PB-107	2.30	402.20	404.50	CO	PR	1	1.48	
PB-107	1.70	404.50	406.20	BO	PR	2	1.09	
PB-107	3.20	406.20	409.40	SH	PR	3	2.06	
PB-107	2.80	409.40	412.20	CO	PR	1	1.80	
PB-107	1.30	412.20	413.50	IR	PR	4	0.84	
PB-107	0.70	413.50	414.20	CO	PR	4	0.45	
PB-107	0.60	414.20	414.80	BO	PR	4	0.39	
PB-107	7.20	414.80	422.00	SH	PR	4	4.63	
PB-107	1.60	422.00	423.60	CO	PR	1	1.03	

PB-107	1.80	423.60	425.40	BO	PR	2	1.16
PB-107	1.00	425.40	426.40	CO	PR	1	0.64
PB-107	1.10	426.40	427.50	BO	PR	2	0.71
PB-107	23.50	427.50	451.00	SH			15.11
PB-107	9.00	451.00	460.00	SS			5.79
PB-107	27.10	460.00	487.10	SH			17.42
PB-107	1.10	487.10	488.20	CO	MY	1	0.71
PB-107	0.60	488.20	488.80	SH	MY	3	0.39
PB-107	0.40	488.80	489.20	BO	MY	2	0.26
PB-107	0.60	489.20	489.80	SH	MY	3	0.39
PB-107	0.80	489.80	490.60	CO	MY	1	0.51
PB-107	24.40	490.60	515.00	SH			15.68

08/18/89

Wishbone Hill

---Drill Hole Lithology Data---

Preparer: RJM

DIP = 55 Degrees

Drill Hole I.D. No.	Interval Thickness	From (Feet)	To (Feet)	Lith Code	Seam Code	MINE CODE	True Thick	Comments
PB-108	80.50	0.00	80.50	GR			80.50	
PB-108	19.50	80.50	100.00	SS			11.18	
PB-108	35.00	100.00	135.00	SH			20.08	
PB-108	5.00	135.00	140.00	SS			2.87	
PB-108	50.00	140.00	190.00	SH			28.68	
PB-108	5.00	190.00	195.00	SS			2.87	
PB-108	15.00	195.00	210.00	SL			8.60	
PB-108	2.10	210.00	212.10	BO	JV	4	1.20	
PB-108	6.50	212.10	218.60	SH	JV	4	3.73	
PB-108	1.40	218.60	220.00	BO	JV	2	0.80	
PB-108	0.90	220.00	220.90	CO	JV	1	0.52	
PB-108	1.10	220.90	222.00	BO	JV	2	0.63	
PB-108	0.70	222.00	222.70	SH	JV	3	0.40	
PB-108	4.10	222.70	226.80	CO	JV	1	2.35	
PB-108	0.60	226.80	227.40	BO	JV	2	0.34	
PB-108	2.40	227.40	229.80	SH	JV	3	1.38	
PB-108	2.00	229.80	231.80	BO	JV	2	1.15	
PB-108	0.70	231.80	232.50	SH	JV	3	0.40	
PB-108	0.50	232.50	233.00	BO	JV	2	0.29	
PB-108	2.00	233.00	235.00	SH	JV	3	1.15	
PB-108	0.60	235.00	235.60	BO	JV	2	0.34	
PB-108	0.90	235.60	236.50	SH	JV	3	0.52	
PB-108	1.90	236.50	238.40	BO	JV	2	1.09	
PB-108	1.60	238.40	240.00	CO	JV	1	0.92	
PB-108	7.50	240.00	247.50	SH			4.30	
PB-108	32.50	247.50	280.00	SL			18.64	
PB-108	10.00	280.00	290.00	SS			5.74	
PB-108	5.00	290.00	295.00	SL			2.87	
PB-108	30.00	295.00	325.00	SH			17.21	
PB-108	25.00	325.00	350.00	SS			14.34	
PB-108	5.00	350.00	355.00	SL			2.87	
PB-108	45.00	355.00	400.00	SH			25.81	
PB-108	150.00	400.00	550.00	SS			86.04	

08/18/89

Wishbone Hill

---Drill Hole Lithology Data---

Preparer: RJM

DIP = 55 Degrees

Drill Hole I.D. No.	Interval Thickness	From (Feet)	To (Feet)	Lith Code	Seam Code	True Thick	Comments
PB-109	76.00	0.00	76.00	GR		76.00	
PB-109	9.00	76.00	85.00	CL		5.16	
PB-109	32.00	85.00	117.00	SS		18.35	
PB-109	83.00	117.00	200.00	SL		47.61	

APPENDIX B

CHEMICAL DATA

APPENDIX B-1

OVERBURDEN CHEMICAL DATA

Dave Boon

CSU Soil Testing Lab
Rm. 6, Voc.Ed. Bldg.
Fort Collins, Co 80523
Date: 1/26/89

Date Rec: 11/22/88

Soil Analysis Report

DRILL HOLE PB-60

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca	Mg	Na	K	SAR	Sat %	---AB-DTPA--- B	Se	2M KCl NO3-N
					--------meq/l--------						-----ppm-----		ppm
R3954	29.8-38.7	SL	7.9	0.5	1.56	0.32	2.6	0.45	2.7	26.4	0.29	0.11	0.6
R3955	38.7-42.8	SS	7.8	0.9	2.46	0.59	4.1	1.42	3.4	26.7	0.26	0.34	0.9
R3956	42.8-51.3	SH	8.1	0.8	1.36	0.36	5.9	0.75	6.4	36.4	0.24	0.04	0.2
R3957	51.3-60.0	SS	8.1	0.7	1.56	0.42	4.7	0.56	4.7	32.7	0.24	0.05	0.4
R3958	60.0-70.0	SS	8.3	0.6	2.39	0.82	2.7	0.31	2.1	32.2	0.42	0.05	0.2
R3959	70.0-80.0	SS	7.9	0.8	2.51	0.71	5.0	0.58	4.0	29.5	0.24	0.05	0.1
R3960	80.0-82.8	SH	8.1	0.7	0.97	0.21	6.3	0.33	8.2	29.3	0.18	0.16	4.6
R3961	162.3-172.3	SS	8.8	1.5	0.24	0.17	15.3	0.26	33.9	25.5	0.13	0.08	<0.1

Dave Boon

CSU Soil Testing Lab
Rm. 6, Voc.Ed. Bldg.
Fort Collins, Co 80523
Date: 1/26/89

Date Rec: 11/22/88

Soil Analysis Report

DRILL HOLE PB-60

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		---------%---------				----------%----------			
R3954	29.8-38.7	42	23	35	CL	<0.01	0.001	0.8	8.03
R3955	38.7-42.8	40	24	36	CL	0.03	0.003	1.8	17.16
R3956	42.8-51.3	42	19	39	CL	0.01	0.002	0.9	8.75
R3957	51.3-60.0	50	15	35	SC/SCL	0.01	0.002	6.9	68.75
R3958	60.0-70.0	73	9	18	SL	0.01	0.003	2.1	20.78
R3959	70.0-80.0	62	10	28	SCL	0.02	0.003	2.0	19.47
R3960	80.0-82.8	34	8	58	C	0.08	0.002	1.7	14.56
R3961	162.3-172.3	63	13	24	SCL	0.02	0.004	1.3	12.50

Dave Boon

Date Rec: 11/22/88
DRILL HOLE PB-69A

CSU Soil Testing Lab
Rm. 6, Voc.Ed. Bldg.
Fort Collins, Co 80523
Date: 1/26/89

Soil Analysis Report

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca	Mg	Na	K	SAR	Sat %	---AB-DTPA--- B	Se	2M KCl NO3-N
					--------meq/l--------						-----ppm-----		ppm
R3998	50-60	CL60SH	7.5	1.5	7.53	2.80	6.8	0.81	3.0	27.2	0.41	0.04	0.1
R3999	60-70	SH	7.8	0.9	2.67	1.76	5.5	0.45	3.7	32.5	0.46	0.07	0.4
R4000	70-80	CD55SH	7.6	0.5	0.94	0.68	2.6	0.75	2.9	43.9	0.14	<0.01	0.4
R4001	80-90	SH	8.2	2.0	2.21	1.69	16.4	0.42	11.7	34.1	0.22	0.08	2.7
R4002	90-100	SH	8.8	1.2	0.11	0.08	12.0	0.12	39.1	24.1	0.24	0.09	1.3
R4003	100-110	SH	8.9	1.3	0.08	0.06	14.3	0.12	53.0	21.9	0.28	0.11	0.8
R4004	110-120	SH	9.0	2.4	0.12	0.13	23.1	0.16	66.0	23.4	0.36	0.16	3.7
R4005	120-130	SH67SS	9.0	1.8	0.09	0.04	18.0	0.10	71.2	55.3	0.33	0.31	1.0
R4006	130-140	SS30SH	8.8	3.5	0.21	0.22	32.9	0.21	70.9	31.1	0.31	0.14	0.5
R4007	140-150	SH	9.2	1.8	0.06	0.04	18.9	0.08	84.5	77.5	0.34	0.18	0.8
R4008	150-160	SH	9.5	1.7	0.05	0.03	17.5	0.06	87.3	187.6	0.44	0.09	
R4009	160-170	SH	9.1	1.8	0.05	0.04	18.6	0.10	87.2	63.1	0.36	0.15	0.7
R4010	170-180	SH75SS	9.2	1.8	0.05	0.03	19.1	0.09	97.9	96.3	0.34	0.16	1.3
R4011	180-190	SS	9.3	1.7	0.05	0.07	18.2	0.13	74.7	46.0	0.33	0.04	2.5
R4012	190-200	SS	9.2	1.4	0.41	0.19	14.4	0.11	26.4	46.5	0.37	0.06	6.8
R4013	200-210	SS	9.3	1.5	0.32	0.25	16.1	0.08	30.2	84.7	0.37	0.09	5.8
R4014	210-220	SS	9.4	1.6	0.25	0.25	16.7	0.09	33.0	48.5	0.37	0.02	6.2
R4015	220-230	SS	9.4	1.8	0.33	0.35	19.5	0.14	33.7	51.7	0.43	0.06	6.8
R4016	230-240	SS85SH	9.4	1.5	0.12	0.13	15.6	0.15	44.4	50.9	0.41	0.06	2.1
R4017	240-250	SH	9.3	2.5	1.16	0.44	23.8	0.17	26.6	58.1	0.37	0.24	0.9
R4018	250-260	SS60SH	9.1	1.8	0.41	0.22	19.9	0.18	35.4	35.4	0.38	0.16	1.5
R4019	260-270	SS60SH	9.5	1.7	0.22	0.38	17.7	0.16	32.4	38.6	0.37	0.08	3.1
R4020	270-280	SH	9.3	1.9	0.28	0.29	19.6	0.15	36.8	34.9	0.37	0.12	1.7
R4021	280-290	SH	9.1	2.3	0.53	0.43	22.8	0.18	32.9	36.0	0.34	0.20	2.6
R4022	290-300	SH	9.1	2.2	0.31	0.56	21.4	0.29	32.5	35.9	0.27	0.14	0.7
R4023	300-310	SS	9.0	2.1	0.37	0.56	22.6	0.13	33.1	40.2	0.37	0.15	1.1
R4024	310-320	SS80CD	9.0	2.7	0.33	0.60	26.5	0.21	38.9	36.4	0.41	0.13	1.8
R4025	395-405	SH	9.2	2.0	0.34	0.46	20.5	0.10	32.5	38.9	0.38	0.17	1.7
R4095	405-415	SH	9.5	1.9	0.14	0.09	18.6	0.13	54.8	27.2	0.41	0.07	3.5
R5327	320-330	SH	8.7	3.2	0.36	0.11	30.4	0.22	62.9	35.6	0.14	0.25	1.4
R5328	330-340	SH	8.6	2.7	0.36	0.10	24.3	0.20	50.7	33.8	0.16	0.26	1.9
R5329	340-350	SH	8.7	2.3	0.20	0.08	21.3	0.16	56.1	32.2	< 0.01	0.14	1.8
R5330	350-360	SH	8.7	2.3	0.31	0.12	21.7	0.18	46.4	28.8	0.02	0.17	4.1
R5331	360-370	SH	8.7	3.6	0.39	0.16	34.6	0.23	65.9	42.0	0.04	0.19	1.9
R5332	370-380	SH	8.8	2.3	0.13	0.06	25.4	0.01	82.8	39.8	0.05	0.21	2.7

Dave Boon

Date Rec: 11/22/88

CSU Soil Testing Lab
Rm. 6, Voc.Ed. Bldg.
Fort Collins, Co 80523
Date: 1/26/89

Soil Analysis Report

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		---%---				---%---			
R3998	50.0-60.0	56	19	25	SCL	0.01	0.010	0.5	5.00
R3999	60.0-70.0	40	22	38	CL	0.04	0.004	0.6	4.88
R4000	70.0-80.0	85	5	10	LS	0.36	0.001	0.1	-10.22
R4001	80.0-90.0	79	9	12	SL	0.22	0.007	1.9	12.34
R4002	90.0-100.0	60	19	21	SCL	0.08	0.002	1.1	8.56
R4003	100.0-110.0	54	21	25	SCL	0.04	0.003	1.0	8.84
R4004	110.0-120.0	44	28	28	CL	0.04	0.007	1.7	15.97
R4005	120.0-130.0	16	43	41	SiC	0.03	0.006	0.6	5.25
R4006	130.0-140.0	52	26	22	SCL	0.05	0.008	1.8	16.69
R4007	140.0-150.0	34	38	28	CL	0.04	0.012	1.5	14.13
R4008	150.0-160.0	40	25	35	CL	0.03	0.009	5.2	51.34
R4009	160.0-170.0	43	31	26	L	0.03	0.006	2.1	20.25
R4010	170.0-180.0	33	37	30	CL	0.03	0.007	1.7	16.28
R4011	180.0-190.0	64	16	20	SCL/SL	0.01	0.002	2.1	20.75
R4012	190.0-200.0	63	18	19	SL	0.01	0.002	2.2	21.75
R4013	200.0-210.0	57	20	23	SCL	0.01	0.002	1.8	17.75
R4014	210.0-220.0	61	17	22	SCL	0.01	0.003	1.8	17.78
R4015	220.0-230.0	60	18	22	SCL	0.01	0.004	1.9	18.81
R4016	230.0-240.0	60	18	22	SCL	0.01	0.004	1.8	17.81
R4017	240.0-250.0	16	36	48	C	0.02	0.013	1.3	12.78
R4018	250.0-260.0	26	19	55	C	0.04	0.006	1.3	11.94
R4019	260.0-270.0	52	20	28	SCL	<0.01	0.003	2.7	27.09
R4020	270.0-280.0	34	32	34	CL	0.01	0.003	2.1	20.78
R4021	280.0-290.0	18	39	43	C	0.03	0.006	0.7	6.25
R4022	290.0-300.0	39	19	42	C	0.04	0.002	0.8	6.81
R4023	300.0-310.0	41	22	37	CL	0.04	0.003	1.8	16.84
R4024	310.0-320.0	31	36	33	CL	0.01	0.006	1.7	16.88
R4025	395.0-405.5	30	26	44	C	0.06	0.002	0.9	7.19
R4095	405.0-415.0	45	25	30	CL/SCL	0.02	0.004	3.4	33.50
R5327	320-330	52	22	26	SCL	0.14	0.002	1.1	6.69
R5328	330-340	34	30	36	CL	0.07	0.004	1.8	15.94
R5329	340-350	46	24	30	SCL	0.04	<0.001	4.3	41.75
R5330	350-360	47	25	28	SCL	<0.01	0.002	5.7	57.06
R5331	360-370	32	24	44	C	0.07	0.008	2.7	25.06
R5332	370-380	30	34	36	CL	0.01	0.006	4.5	44.88

Dave Boon

Date Rec: 11/22/88
DRILL HOLE PB-74

CSU Soil Testing Lab
Rm. 6, Voc.Ed. Bldg.
Fort Collins, Co 80523
Date: 1/26/89

Soil Analysis Report

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca	Mg	Na	K	SAR	Sat %	---AB-DTPA--- B ppm	Se ppm	2M KC NO3-N ppm
					--------meq/l--------								
R4072	10-20	GR	7.7	0.3	0.50	0.33	2.5	0.09	3.9	22.6	0.15	<0.01	0.4
R4073	20-30	GR	7.6	0.3	0.48	0.25	1.9	0.05	3.2	23.0	0.10	<0.01	0.4
R4074	30-40	GR	7.9	0.3	0.59	0.31	2.0	0.08	3.0	28.4	0.17	<0.01	0.9
R4075	40-50	GR	8.2	0.3	0.67	0.38	2.6	0.06	3.5	21.3	0.11	<0.01	1.2
R4076	50-60	GR	8.2	0.3	0.69	0.39	2.3	0.02	3.1	21.7	0.16	<0.01	2.2
R4077	60-70	GR	8.1	0.3	0.50	0.25	2.0	0.02	3.3	32.4	0.06	<0.01	1.2
R4078	70-80	GR	8.2	0.4	0.41	0.22	2.3	0.08	4.1	24.2	0.26	<0.01	2.1
R4079	80-90	GR	8.2	0.5	0.38	0.20	3.3	0.08	6.2	18.2	0.26	<0.01	1.6
R4080	90-100	GR	8.2	0.5	0.78	0.42	4.2	0.19	5.5	22.4	0.24	<0.01	2.6
R4081	100-110	GR80SH	8.4	1.6	1.38	0.82	8.6	0.31	8.2	23.5	0.33	0.03	1.2
R4082	110-120	SH	9.2	1.2	0.13	0.09	16.7	0.14	50.3	43.0	0.40	0.05	2.2
R4083	120-130	SH	9.6	1.2	0.07	0.03	12.7	0.06	56.9	59.8	0.23	0.06	3.9
R4084	130-140	SH	9.9	1.5	0.06	0.04	13.1	0.06	59.2	74.4	0.20	0.09	1.8
R4085	140-150	SH	9.7	1.5	0.90	0.35	16.8	0.05	21.3	63.9	0.26	0.15	4.0
R4086	150-160	SH	9.8	1.2	0.39	0.20	17.0	0.07	31.2	55.7	0.34	0.10	3.4
R4087	160-170	SH	10.0	1.4	0.04	0.02	13.9	0.04	82.2	91.2	0.28	0.16	1.8
R4088	170-180	SH	10.0	1.7	0.36	0.17	15.5	0.05	30.0	88.9	0.27	0.13	5.1
R4089	180-190	SH	9.9	1.6	0.34	0.17	17.3	0.07	34.4	87.4	0.34	0.17	2.5
R4090	190-200	SH	10.0	1.7	0.05	0.02	17.9	0.05	94.9	107.0	0.33	0.22	4.7
R4091	200-210	SH	10.0	1.5	0.06	0.02	18.6	0.05	91.2	96.6	0.36	0.21	6.1
R4092	210-220	SH	9.9	1.5	0.04	0.01	16.6	0.04	105.4	72.2	0.25	0.19	1.4
R4093	220-230	SH55B0	9.8	1.2	0.03	0.02	15.7	0.08	99.8	56.0	0.20	0.13	0.6
R4094	280-290	SH	9.4	1.7	0.09	0.04	13.1	0.09	52.7	38.1	0.19	0.06	1.1
R5333	250-260	SH	8.9	3.1	0.15	0.06	33.3	0.11	103.3	14.3	0.06	0.27	2.1
R5334	260-270	SH	9.0	1.9	0.05	0.02	20.7	<0.01	107.4	91.7	0.08	0.27	2.0
R5335	270-280	SH	8.8	3.0	0.16	0.07	34.7	0.01	103.3	42.6	0.04	0.20	1.4
R5336	280-290	SH	8.6	1.8	0.11	0.04	17.9	0.06	65.2	33.3	< 0.01	0.11	0.9
R5337	290-300	SH	8.8	2.1	0.23	0.07	20.7	0.09	53.9	47.3	0.03	0.21	1.0
R5338	300-310	SH	8.9	2.0	0.13	0.04	19.0	0.07	65.0	102.0	0.05	0.28	1.0
R5339	310-320	SS	9.0	2.2	0.27	0.07	21.7	0.06	52.4	153.3	0.07	0.31	0.8

Dave Boon

Date Rec: 11/22/88
DRILL HOLE PB-74

CSU Soil Testing Lab
Rm. 6, Voc.Ed. Bldg.
Fort Collins, Co 80523
Date: 1/26/89

Soil Analysis Report

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		---%---				---%---			
R4072	10-20	80	4	16	SL	<0.01	<0.001	0.2	2.00
R4073	20-30	86	2	12	LS	0.01	<0.001	0.2	1.69
R4074	30-40	82	2	16	SL	0.01	<0.001	0.2	1.69
R4075	40-50	80	4	16	SL	0.01	<0.001	0.2	1.69
R4076	50-60	80	2	18	SL	<0.01	<0.001	0.3	3.00
R4077	60-70	84	2	14	LS/SL	0.01	0.001	0.3	2.72
R4078	70-80	76	6	18	SL	0.01	<0.001	0.2	1.69
R4079	80-90	68	13	19	SL	0.01	<0.001	0.2	1.69
R4080	90-100	72	12	16	SL	0.01	<0.001	0.4	3.69
R4081	100-110	76	12	12	SL	0.05	0.005	1.3	11.59
R4082	110-120	38	29	33	CL	0.01	0.005	2.5	24.84
R4083	120-130	32	37	31	CL	<0.01	0.002	3.1	31.06
R4084	130-140	28	41	31	CL	<0.01	0.012	1.4	14.38
R4085	140-150	25	44	31	CL	0.01	0.019	2.1	21.28
R4086	150-160	36	34	30	CL	0.01	0.002	1.8	17.75
R4087	160-170	26	44	30	CL	0.01	0.002	2.0	19.75
R4088	170-180	22	47	31	CL	0.01	0.002	1.2	11.75
R4089	180-190	14	50	36	SiCL	0.01	0.003	1.2	11.78
R4090	190-200	18	46	36	SiCL	0.01	0.006	1.3	12.88
R4091	200-210	22	44	34	CL	0.01	0.009	1.4	13.97
R4092	210-220	16	48	36	SiCL	0.03	0.003	1.3	12.16
R4093	220-230	16	42	42	SiC	0.02	0.002	1.1	10.44
R4094	280-290	54	18	28	SCL	0.10	0.002	0.8	4.94
R5333	250-260	34	36	30	CL	<0.01	0.002	3.2	32.06
R5334	260-270	38	29	33	CL	<0.01	0.002	5.3	53.06
R5335	270-280	49	24	27	SCL	0.01	0.002	4.9	48.75
R5336	280-290	64	9	27	SCL	0.12	0.003	1.1	7.34
R5337	290-300	38	34	28	CL	0.10	0.003	2.2	18.97
R5338	300-310	40	36	24	L	0.01	0.005	2.9	28.84
R5339	310-320	36	38	26	L	0.03	0.014	1.8	17.50

Dave Boon

Date Rec: 11/22/88
DRILL HOLE PB-74

CSU Soil Testing Lab
Rm. 6, Voc.Ed. Bldg.
Fort Collins, Co 80523
Date: 1/26/89

Soil Analysis Report

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca	Mg	Na	K	SAR	Sat %	---AB-DTPA--- B	Se	2M KCl NO3-N
					--------meq/l--------						-----ppm-----		ppm
R5340	320-330	SS	9.1	1.6	0.16	0.07	17.0	0.05	49.3	141.1	0.22	0.14	1.8
R5341	330-340	SS	9.1	2.2	0.26	0.07	23.0	0.05	56.4	127.7	0.36	0.09	4.3
R5342	340-350	SS	9.1	1.8	0.19	0.05	17.7	0.04	51.2	117.3	0.36	0.09	4.4
R5343	350-360	SS	9.1	3.5	0.48	0.12	37.9	0.10	69.5	128.8	0.39	0.13	3.2
R5344	360-370	SS	9.2	1.8	0.17	0.04	18.0	0.03	54.9	118.9	0.39	0.11	5.2
R5345	370-380	SH	9.2	1.7	0.10	0.10	17.8	<0.01	56.4	130.5	0.36	0.16	6.0
R5346	380-390	SH	9.1	1.2	0.08	0.03	12.2	<0.01	51.5	158.8	0.23	0.13	3.3
R5347	390-400	SH	9.0	1.4	0.13	0.05	15.0	<0.01	50.3	121.7	0.17	0.12	3.0
SUMMARY - DRILL HOLE PB-74													
	Minimum		7.60	0.30	0.03	0.01	1.91	<0.01	2.96	14.3	<0.01	<0.01	0.40
	Maximum		10.00	3.50	1.38	0.82	37.87	0.31	107.4	158.8	0.40	0.31	6.10
	Mean		9.02	1.45	0.31	0.15	14.82	0.07	48.5	71.1	0.22	0.11	2.44
	S. Deviation		0.70	0.78	0.29	0.16	8.83	0.06	33.6	43.5	0.12	0.09	1.58
	N		38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0

Dave Boon

Date Rec: 11/22/88
DRILL HOLE PB-74

CSU Soil Testing Lab
Rm. 6, Voc.Ed. Bldg.
Fort Collins, Co 80523
Date: 1/26/89

Soil Analysis Report

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		---%---				---%---			
R5340	320-330	58	18	24	SCL	<0.01	0.007	8.7	87.22
R5341	330-340	61	17	22	SCL	<0.01	0.002	6.2	62.06
R5342	340-350	62	14	24	SCL	<0.01	0.002	7.9	79.06
R5343	350-360	60	18	22	SCL	<0.01	0.002	4.6	46.06
R5344	360-370	54	22	24	SCL	<0.01	0.002	18.5	185.06
R5345	370-380	54	24	22	SCL	<0.01	0.002	7.9	79.06
R5346	380-390	62	16	22	SCL	<0.01	0.002	4.4	44.06
R5347	390-400	61	19	20	SCL/SL	<0.01	0.002	5.9	59.06

* - tons CaCO3/1000 tons material

SUMMARY - DRILL HOLE PB-74

Minimum	14.00	2.00	12.00		<0.01	<0.001	0.20	1.69
Maximum	86.00	50.00	42.00		0.12	0.019	18.50	185.06
Mean	50.05	24.66	25.29		0.02	0.003	2.90	28.59
S. Deviation	22.16	15.40	7.41		0.03	0.004	3.47	34.98
N	38.0	38.0	38.0		38.0	38.0	38.0	38.0

Dave Boon

CSU Soil Testing Lab
Rm. 6, Voc.Ed. Bldg.
Fort Collins, Co 80523
Date: 1/26/89

Date Rec: 11/22/88

Soil Analysis Report

DRILL HOLE PB-80

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca	Mg	Na	K	SAR	Sat %	---AB-DTPA--- B	Se	2M KCl NO3-N
					--------meq/l--------						-----ppm-----		ppm
R4026	25-35	GR	8.2	0.3	0.69	0.33	2.4	0.06	3.4	26.7	0.13	<0.01	0.7
R4027	35-45	GR	7.9	0.3	0.48	0.26	2.2	0.05	3.6	29.3	0.10	<0.01	0.4
R4028	45-55	GR	8.1	0.4	1.27	0.59	1.6	0.10	1.6	23.2	0.18	<0.01	0.8
R4029	55-65	SH	8.1	0.6	2.01	0.82	3.3	0.11	2.8	20.7	0.21	<0.01	0.4
R4030	65-75	SH	8.8	0.9	1.52	0.51	8.0	0.07	7.9	38.3	0.50	0.02	1.4
R4031	75-85	SH	8.7	0.8	0.79	0.18	7.3	0.05	10.5	29.7	0.43	0.02	1.0
R4032	85-95	SH	8.5	0.8	1.31	0.45	6.6	0.13	7.1	30.1	0.35	0.10	0.3
R4033	95-105	SH	8.3	1.1	2.81	0.95	8.1	0.20	5.9	37.8	0.36	0.01	1.1
R4034	105-115	SH	8.4	0.8	1.36	0.37	7.2	0.13	7.7	33.1	0.37	0.02	1.5
R4035	115-125	SH	8.3	1.2	1.46	0.34	10.8	0.18	11.4	38.9	0.42	0.18	0.4
R4036	125-135	SH	8.1	2.2	2.06	0.59	19.1	0.23	16.6	36.4	0.46	0.14	2.9
R4037	135-145	SH	8.4	1.2	0.98	0.34	11.9	0.12	14.6	27.8	0.40	0.06	2.5
R4038	145-155	SH	8.3	1.8	1.85	0.53	16.2	0.20	14.8	27.8	0.33	0.05	3.7
R4039	155-165	SH	8.5	1.0	1.13	0.38	10.6	0.08	12.2	35.8	0.21	0.06	1.8
R4040	260-270	CO15SH	8.8	1.4	0.87	0.50	13.7	0.12	16.6	31.4	0.29	0.06	0.7

Dave Boon

CSU Soil Testing Lab
Rm. 6, Voc.Ed. Bldg.
Fort Collins, Co 80523
Date: 1/26/89

Date Rec: 11/22/88

Soil Analysis Report

DRILL HOLE PB-80

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		---------%--------				----------%---------			
R4026	25-35	89	1	10	LS	0.01	<0.001	0.4	3.69
R4027	35-45	91	0	9	S	0.03	<0.001	0.5	4.06
R4028	45-55	87	4	9	LS	<0.01	<0.001	0.3	3.00
R4029	55-65	75	8	17	SL	0.02	0.002	0.6	5.44
R4030	65-75					0.03	0.002	1.2	11.13
R4031	75-85	64	14	22	SCL/LS	0.01	0.002	3.6	35.75
R4032	85-95	74	10	16	SCL	0.03	0.003	4.5	44.16
R4033	95-105	66	13	21	SL	0.02	0.003	2.4	23.47
R4034	105-115	62	14	24	SCL	0.01	0.003	2.0	19.78
R4035	115-125	32	21	47	SCL	0.05	0.008	0.9	7.69
R4036	125-135	31	32	37	C	0.04	0.009	2.5	24.03
R4037	135-145	28	28	44	CL	0.01	0.003	2.4	23.78
R4038	145-155	40	20	40	C/CL	0.03	0.006	2.6	25.25
R4039	155-165	58	12	30	SCL	0.02	0.002	3.1	30.44
R4040	260-270	54	13	33	SCL	0.16	0.001	1.6	11.03

* - tons CaCO3/1000 tons material

Dave Boon

CSU Soil Testing Lab
Rm. 6, Voc.Ed. Bldg.
Fort Collins, Co 80523
Date: 1/26/89

Date Rec: 11/22/88

Soil Analysis Report

DRILL HOLE PB-84

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca	Mg	Na	K	SAR	Sat %	---AB-DTPA--- B	Se	2M KCl NO3-N
					--------meq/l--------						-----ppm-----		ppm
R3985	20-30	GR	7.8	0.9	1.89	0.69	3.6	2.33	3.2	26.4	0.12	<0.01	0.5
R3986	30-40	GR	7.8	1.6	1.53	0.82	15.0	0.57	13.9	24.2	0.34	<0.01	<0.1
R3987	40-50	GR	7.6	0.3	0.55	0.28	2.2	0.03	3.4	29.1	0.72	0.01	
R3988	50-60	GR	7.8	0.8	0.59	0.28	8.9	0.30	13.5	36.8	0.43	0.04	6.1
R3989	60-70	CN	8.4	1.1	0.32	0.16	11.7	0.19	23.8	36.2	0.53	0.12	11.0
R3990	70-80	CN	8.7	1.3	0.37	0.19	14.4	0.18	27.3	53.0	0.44	0.14	3.6
R3991	80-90	CN	8.7	1.3	0.35	0.20	14.6	0.16	27.9	36.7	0.49	0.10	1.5
R3992	90-100	CN	8.8	1.2	0.38	0.20	14.3	0.11	26.4	41.1	0.46	0.16	2.9
R3993	100-110	CN	8.7	1.3	0.11	0.12	14.9	0.14	43.7	41.2	0.51	0.10	0.6
R3994	110-120	CN	8.9	1.4	0.11	0.06	17.3	0.14	59.6	37.6	0.48	0.13	1.2
R3995	120-130	CN	8.8	1.3	0.10	0.06	15.3	0.12	55.0	34.5	0.49	0.15	2.0
R3996	130-140	CN	8.8	1.4	0.15	0.10	17.3	0.12	49.6	33.5	0.43	0.08	1.6
R3997	140-150	CN	8.6	1.6	0.13	0.07	18.8	0.14	59.2	31.4	0.66	0.17	2.2

Dave Boon

CSU Soil Testing Lab
Rm. 6, Voc.Ed. Bldg.
Fort Collins, Co 80523
Date: 1/26/89

Date Rec: 11/22/88

Soil Analysis Report

DRILL HOLE PB-84

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		--------%--------				----------%---------			
R3985	20.0-30.0	88	3	9	LS	0.02	<0.001	0.7	6.38
R3986	30.0-40.0	78	12	10	SL	0.08	0.003	0.3	0.59
R3987	40.0-50.0	90	2	8	S	0.07	<0.001	1.6	13.81
R3988	50.0-60.0	38	18	44	C	0.01	0.002	0.5	4.75
R3989	60.0-70.0	10	34	56	C	0.01	0.001	1.1	10.72
R3990	70.0-80.0	10	31	59	C	0.01	0.001	1.0	9.72
R3991	80.0-90.0	5	42	53	SiC	0.01	0.002	0.7	6.75
R3992	90.0-100.0	10	34	56	C	0.01	0.001	0.9	8.72
R3993	100.0-110.0	16	27	57	C	<0.01	<0.001	1.0	10.00
R3994	110.0-120.0	7	37	56	C	0.02	0.001	0.8	7.41
R3995	120.0-130.0	10	31	59	C	0.01	<0.001	1.1	10.69
R3996	130.0-140.0	16	34	50	C	0.01	<0.001	1.6	15.69
R3997	140.0-150.0	30	38	32	CL	<0.01	0.001	2.3	23.03

* - tons CaCO3/1000 tons material

Dave Boon

Date Rec: 11/22/88
DRILL HOLE PB-85

CSU Soil Testing Lab
Rm. 6, Voc.Ed. Bldg.
Fort Collins, Co 80523
Date: 1/26/89

Soil Analysis Report

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca meq/l	Mg meq/l	Na meq/l	K meq/l	SAR	Sat %	---AB-DTPA--- B ppm	Se ppm	2M KCl NO3-N ppm
R4050	10-20	GR	7.8	0.5	1.06	0.36	3.2	0.19	3.7	27.1	0.19	<0.01	1.0
R4051	20-30	GR	7.7	0.7	1.57	1.31	3.4	0.58	2.8	23.7	0.20	<0.01	1.0
R4052	30-40	GR	7.1	0.8	2.77	2.34	2.7	0.97	1.7	35.2	0.50	<0.01	2.0
R4053	40-50	GR	7.3	0.6	1.35	1.17	2.7	0.71	2.4	28.6	0.34	<0.01	1.3
R4054	50-60	GR	7.0	1.0	1.48	1.69	4.2	0.81	3.3	43.0	0.39	<0.01	2.4
R4055	60-70	GR70SH	7.5	1.0	1.69	1.51	8.2	0.63	6.5	31.1	0.20	<0.01	0.6
R4056	70-80	SH	7.7	0.9	2.21	1.01	6.0	0.68	4.8	31.4	0.34	0.01	1.1
R4057	80-90	SS	7.5	1.6	7.98	3.78	6.8	1.49	2.8	33.8	0.32	0.01	0.4
R4058	90-100	SS	7.5	1.8	7.98	4.25	6.0	1.40	2.4	38.0	0.30	<0.01	0.5
R4059	100-110	SH7280	7.7	1.0	3.23	2.19	3.7	0.95	2.3	37.6	0.21	0.02	0.1
R4060	205-215	SH	8.4	0.5	0.49	0.26	4.1	0.20	6.7	51.6	0.15	<0.01	0.2
R4061	215-225	SH	8.6	0.7	0.38	0.19	7.0	0.15	13.1	51.0	0.17	0.02	0.4
R4062	225-235	SH	8.6	0.9	0.42	0.23	9.0	0.16	15.8	39.6	0.26	<0.01	0.8
R4063	235-245	SH	8.5	0.8	0.65	0.47	9.0	0.24	12.0	51.0	0.27	0.01	0.8
R4064	245-255	SH	7.7	0.8	0.51	0.31	8.0	0.24	12.6	51.4	0.32	<0.01	0.6
R4065	255-265	SH	8.2	0.9	0.64	0.34	9.6	0.23	13.7	40.8	0.25	<0.01	0.6
R4066	265-275	SH	8.3	1.4	1.09	0.58	15.7	0.26	17.2	33.7	0.35	<0.01	0.6
R4067	285-295	SH	8.1	2.2	1.28	0.72	24.7	0.34	24.7	44.7	0.39	0.02	2.7
R4068	295-305	SH	8.2	1.0	0.42	0.29	12.7	0.18	21.5	39.0	0.39	<0.01	0.6
R4069	305-315	SH9080	8.4	0.7	0.28	0.16	8.7	0.08	18.5	52.5	0.36	<0.01	0.2
R4070	325-335	SH	8.7	2.1	1.64	0.74	24.3	0.24	22.2	47.1	0.44	0.02	1.1
R4071	335-345	SH	9.0	2.7	1.17	0.64	30.4	0.33	31.9	44.6	0.46	0.04	6.4

Dave Boon

Date Rec: 11/22/88
DRILL HOLE PB-85

CSU Soil Testing Lab
Rm. 6, Voc.Ed. Bldg.
Fort Collins, Co 80523
Date: 1/26/89

Soil Analysis Report

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		---------%---------				----------%---------			
R4050	10-20					0.01	<0.001	0.2	1.69
R4051	20-30	84	2	14	LS/SL	0.04	<0.001	1.2	10.75
R4052	30-40					0.01	<0.001	0.2	1.69
R4053	40-50	78	2	20	SCL/SL	0.01	<0.001	0.2	1.69
R4054	50-60	84	2	14	LS/SL	<0.01	0.001	0.3	3.03
R4055	60-70	82	4	14	SL	0.02	<0.001	0.3	2.38
R4056	70-80	42	22	36	CL	<0.01	<0.001	3.0	30.00
R4057	80-90	58	12	30	SCL	<0.01	0.001	12.8	128.03
R4058	90-100	64	8	28	SCL	0.07	0.001	5.9	56.84
R4059	100-110	72	6	22	SCL	0.01	0.003	5.7	56.78
R4060	205-215	80	2	18	SL	0.28	0.001	0.5	-3.72
R4061	215-225	34	42	24	L	0.16	0.001	1.2	7.03
R4062	225-235	58	8	34	SCL	0.07	<0.001	1.8	15.81
R4063	235-245	48	12	40	SC	0.08	0.002	0.9	6.56
R4064	245-255	58	10	32	SCL	0.07	<0.001	0.9	6.81
R4065	255-265	48	16	36	SC	0.05	<0.001	1.1	9.44
R4066	265-275	36	20	44	C	0.01	<0.001	1.5	14.69
R4067	285-295	28	24	48	C	0.07	<0.001	1.0	7.81
R4068	295-305	52	12	36	SC	0.02	0.001	1.9	18.41
R4069	305-315	56	12	32	SCL	0.07	<0.001	2.0	17.81
R4070	325-335	20	30	50	C	0.08	<0.001	1.1	8.50
R4071	335-345	20	34	46	C	0.02	<0.001	1.4	13.38

* - tons CaCO3/1000 tons material

Dave Boon

CSU Soil Testing Lab
Rm.. 6, Voc.Ed. Bldg.
Fort Collins, Co 80523
Date: 1/26/89
Billing:

Date Rec: 11/22/88

Soil Analysis Report

DRILL HOLE PB-87

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca	Mg	Na	K	SAR	Sat %	---AB-DTPA--- B	Se	2M KCl NO3-N
					--------meq/l--------						-----ppm-----		ppm
R4041	20-30	GR	8.4	0.5	1.42	0.50	3.7	0.08	3.7	20.5	0.25	<0.01	0.6
R4042	30-40	CN	8.5	0.6	1.04	0.37	5.8	0.09	6.9	19.1	0.15	<0.01	1.4
R4043	40-50	CN	8.9	0.4	0.20	0.08	4.9	0.03	13.2	19.5	0.16	<0.01	1.1
R4044	50-60	CN	8.9	0.7	0.64	0.25	8.4	0.04	12.6	27.9	0.25	<0.01	0.8
R4045	60-70	CN	8.8	1.1	0.84	0.33	12.3	0.05	16.0	28.4	0.20	<0.01	
R4046	70-80	CN	8.8	1.4	1.24	0.51	13.8	0.07	14.8	34.2	0.25	<0.01	0.5
R4047	80-90	CN	8.8	1.5	0.79	0.44	14.7	0.09	18.7	29.4	0.27	<0.01	0.7
R4048	90-100	SH	8.7	1.4	0.86	0.39	14.6	0.15	18.5	42.1	0.50	0.05	0.6
R4049	100-110	SH	8.8	1.7	1.15	0.69	17.7	0.18	18.4	38.9	0.50	0.06	2.5

Dave Boon

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Rm. 6, Voc.Ed. Bldg.
Fort Collins, Co 80523
Date: 1/26/89

Date Rec: 11/22/88

Soil Analysis Report

DRILL HOLE PB-87

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		---------%--------				----------%---------			
R4041	20-30	81	7	12	SL	0.02	<0.001	0.5	4.38
R4042	30-40	80	8	12	SL	0.01	<0.001	1.2	11.69
R4043	40-50	83	7	10	LS	<0.01	<0.001	0.6	6.00
R4044	50-60	71	12	17	SL	0.01	0.001	0.5	4.72
R4045	60-70	70	10	20	SCL/SL	0.01	0.002	1.2	11.75
R4046	70-80	66	14	20	SCL/SL	<0.01	0.003	2.8	28.09
R4047	80-90	74	11	15	SL	<0.01	0.002	5.5	55.06
R4048	90-100					0.01	0.003	1.6	15.78
R4049	100-110	24	30	46	C	0.02	0.002	0.8	7.44

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Date Rec: 11/22/88
DRILL HOLE PB-92

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Fort Collins, Co 80523
Date: 1/26/89

Soil Analysis Report

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca	Mg	Na	K	SAR	Sat %	---AB-DTPA--- B ppm	Se ppm	2M KCl NO3-N ppm
					--------meq/l--------								
R3928	81.4-88.9	SS	8.8	1.2	0.07	0.07	12.1	0.14	44.7	40.6	0.33	0.24	0.1
R3929	88.9-97.4	SS	9.1	1.2	0.04	0.05	13.8	0.10	67.0	36.4	0.28	0.21	0.3
R3930	97.4-105.5	SS	9.0	1.5	0.04	0.03	16.3	0.14	85.4	33.1	0.31	0.14	0.4
R3931	105.5-113.8	SS	9.1	2.1	0.12	0.08	22.7	0.18	71.9	34.7	0.30	0.12	0.3
R3932	113.8-121.2	SS	8.9	2.1	0.17	0.09	22.7	0.19	63.7	32.1	0.31	0.13	0.3
R3933	121.2-129.6	SL	8.9	1.5	0.08	0.05	16.7	0.19	65.4	28.6	0.36	0.09	0.4
R3934	129.6-137.3	SL	8.6	2.3	0.19	0.10	25.1	0.27	65.8	26.4	0.37	0.12	0.3
R3935	137.3-139.7	SS	9.1	1.3	0.06	0.05	14.9	0.14	64.7	28.6	0.32	0.09	0.3
R3936	139.7-146.7	SL	8.9	1.4	0.04	0.04	17.0	0.20	82.1	34.8	0.36	0.16	0.3
R3937	146.7-154.5	SL	8.9	2.0	0.10	0.09	22.0	0.27	70.8	28.3	0.35	0.30	0.4
R3938	154.5-162.2	SL	8.7	1.9	0.06	0.05	21.0	0.16	93.0	31.9	0.33	0.13	0.5
R3939	162.2-170.0	SL	8.9	1.4	0.04	0.04	17.3	0.14	87.7	31.2	0.27	0.13	0.3
R3940	170.0-174.0	C05080	9.2	0.6	0.04	0.04	7.3	0.05	35.4	40.6	0.26	0.08	0.3
R3941	174.0-179.5	SS	9.3	1.6	0.07	0.03	17.1	0.07	75.8	51.3	0.67	0.08	0.3
R3942	179.5-187.5	SS	9.0	1.4	0.03	0.02	15.0	0.10	91.4	81.8	0.27	0.18	0.4
R3943	187.5-196.6	SS	9.4	1.3	0.05	0.02	13.4	0.08	70.7	111.9	0.23	0.37	0.4
R3944	196.6-204.4	SS	9.3	1.0	0.03	0.02	11.7	0.06	76.7	113.7	0.30	0.37	0.3
R3945	204.4-212.5	SS	9.4	1.0	0.05	0.03	11.7	0.05	58.6	125.6	0.22	0.35	0.2
R3946	212.5-220.2	SS	9.4	1.0	0.06	0.03	11.2	0.04	52.6	129.1	0.27	0.10	0.1
R3947	220.2-227.8	SS	9.5	1.3	0.03	0.02	14.2	0.04	85.5	121.3	0.20	0.39	0.3
R3948	227.8-233.8	SS	9.4	1.1	0.04	0.02	12.0	0.05	69.6	107.5	0.23	0.13	0.3
R3949	233.8-237.0	SL	9.0	1.2	0.04	0.02	12.4	0.04	68.3	92.8	0.23	0.09	0.3
R3950	237.0-244.6	SL	9.3	1.2	0.04	0.02	12.7	0.05	71.2	94.0	0.23	0.13	0.3
R3951	244.6-252.9	SL	9.2	1.6	0.05	0.04	17.2	0.10	82.1	40.7	0.74	0.35	0.1
R3952	252.9-261.0	SL	9.0	1.7	0.09	0.05	18.4	0.12	71.7	33.1	0.26	0.20	0.3
R3953	261.0-268.5	SL	9.0	1.7	0.10	0.05	18.1	0.13	67.0	30.6	0.31	0.10	0.3

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DRILL HOLE PB-92

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Fort Collins, Co 80523
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Soil Analysis Report

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		---%---				---%---			
R3928	81.4-88.9	33	33	34	CL	0.04	0.003	0.9	7.84
R3929	88.9-97.4	48	24	28	SCL	<0.01	0.001	1.8	18.03
R3930	97.4-105.5	28	28	44	C	0.03	0.001	1.1	10.09
R3931	105.5-113.8	45	25	30	CL/SCL	0.01	0.002	1.9	18.75
R3932	113.8-121.2	29	31	40	C/CL	0.03	0.002	1.3	12.13
R3933	121.2-129.6	34	26	40	C/CL	0.04	0.001	1.2	10.78
R3934	129.6-137.3	36	22	42	C	0.04	0.004	1.0	8.88
R3935	137.3-139.7	52	9	39	SC	<0.01	0.001	17.3	173.03
R3936	139.7-146.7	43	20	37	CL	0.02	0.001	1.2	11.41
R3937	146.7-154.5	46	10	44	SC	0.07	0.009	1.4	12.09
R3938	154.5-162.2	43	12	45	C	0.09	0.007	1.2	9.41
R3939	162.2-170.0	62	6	32	SCL	0.20	0.001	0.6	-0.22
R3940	170.0-174.0	82	6	12	LS/SL	0.43	<0.001	1.1	-2.44
R3941	174.0-179.5	61	18	21	SCL	0.03	0.001	1.7	16.09
R3942	179.5-187.5	34	32	34	CL	0.06	0.001	0.9	7.16
R3943	187.5-196.6	42	31	27	CL/L	0.06	0.001	1.9	17.16
R3944	196.6-204.4	43	23	34	CL	0.04	<0.001	1.7	15.75
R3945	204.4-212.5	42	28	30	CL	0.01	<0.001	1.9	18.69
R3946	212.5-220.2	47	25	28	SCL	<0.01	0.001	2.1	21.03
R3947	220.2-227.8	39	31	30	CL	0.01	0.001	2.1	20.72
R3948	227.8-233.8	41	29	30	CL	0.02	0.001	2.0	19.41
R3949	233.8-237.0	19	44	37	SiCL	0.08	0.001	1.0	7.53
R3950	237.0-244.6	67	12	21	SCL	0.02	0.001	1.8	17.41
R3951	244.6-252.9	56	15	29	SCL	<0.01	0.009	2.1	21.28
R3952	252.9-261.0	61	9	30	SCL	0.07	0.003	2.0	17.91
R3953	261.0-268.5	22	32	46	C	0.20	0.002	2.1	14.81

* - tons CaCO3/1000 tons material

Dave Boon

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Rm. 6, Voc.Ed. Bldg.
Fort Collins, Co 80523
Date: 1/26/89

Date Rec: 11/22/88

Soil Analysis Report

DRILL HOLE PB-101

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca	Mg	Na	K	SAR	Sat %	---AB-DTPA--- B	Se	2M KC NO3-N
					--------meq/l--------						-----ppm-----		ppm
R3974	76.1-86.0	SS	8.8	1.2	0.10	0.08	13.3	0.14	45.1	84.2	0.32	0.15	0.1
R3975	86.0-92.5	SS	8.8	1.5	0.35	0.29	15.0	0.54	26.5	93.4	0.40	0.08	0.1
R3976	92.5-100.5	SS	8.8	1.5	0.28	0.20	14.4	0.95	29.6	77.0	0.39	0.11	<0.1
R3977	100.5-106.1	SH	8.5	1.8	0.28	0.20	18.0	0.23	37.0	38.4	0.53	0.14	0.2
R3978	108.2-114.7	SL	8.1	1.9	0.84	0.54	17.4	0.95	20.9	29.4	0.40	0.05	5.2
R3979	114.7-121.1	SL	8.3	1.0	0.41	0.30	11.5	0.30	19.3	25.8	0.46	0.04	2.9
R3980	121.1-127.6	SS	7.7	1.5	2.33	1.94	12.8	0.62	8.8	25.4	0.47	0.03	0.1
R3981	127.6-131.5	SL	8.1	0.9	0.87	0.64	8.1	0.34	9.4	24.5	0.40	0.06	5.2
R3982	131.5-138.8	SS	7.9	1.9	6.59	4.78	9.7	0.91	4.1	25.8	0.38	0.07	<0.1
R3983	138.8-142.8	SL	7.7	1.3	3.46	2.06	8.1	0.55	4.9	30.6	0.30	0.26	6.4
R3984	254.6-256.8	CO	8.6	1.5	0.44	0.23	14.9	0.22	25.7	32.0	0.30	0.04	0.3

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Soil Analysis Report

DRILL HOLE PB-101

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		--------%--------				----------%----------			
R3974	76.1-86.0	29	38	33	CL	0.03	0.002	1.8	17.13
R3975	86.0-92.5	21	44	35	CL	0.03	0.001	1.6	15.09
R3976	92.5-100.5	30	38	32	CL	0.03	0.002	1.8	17.13
R3977	100.5-106.1	35	20	45	C	0.06	0.005	1.9	17.28
R3978	108.2-114.7	57	15	28	SCL	0.03	0.004	1.6	15.19
R3979	114.7-121.1	63	12	25	SCL	0.04	0.001	2.2	20.78
R3980	121.1-127.6	63	11	26	SCL	0.01	0.004	2.6	25.81
R3981	127.6-131.5	68	11	21	SCL	0.04	0.002	1.6	14.81
R3982	131.5-138.8	64	12	24	SCL	0.01	0.010	2.5	25.00
R3983	138.8-142.8	36	13	51	C	0.03	0.004	0.3	2.19
R3984	254.6-256.8	64	5	31	SCL	0.07	<0.001	0.7	4.81

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Rm. 6, Voc.Ed. Bldg.
Fort Collins, Co 80523
Date: 1/26/89

Date Rec: 11/22/88

Soil Analysis Report

DRILL HOLE PB-105

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca	Mg	Na	K	SAR	Sat %	---AB-DTPA--- B	Se	2M KCl NO3-N
					--------meq/l--------						-----ppm-----		ppm
R3962	190.4-200.0	SH	8.4	1.0	0.05	0.03	11.0	0.13	51.9	34.3	0.19	0.07	0.1
R3963	200.0-210.0	SH	8.8	1.5	0.12	0.08	16.9	0.18	52.6	33.3	0.22	0.05	0.3
R3964	210.0-214.5	SH	8.6	1.5	0.11	0.07	15.8	0.18	51.6	29.2	0.26	0.03	0.6
R3965	214.5-224.2	SL	8.5	2.1	0.31	0.20	21.3	0.39	42.0	30.9	0.33	0.10	0.6
R3966	224.2-225.9	SH	8.5	1.5	0.13	0.09	17.1	0.22	51.8	39.1	0.29	0.04	0.7
R3967	225.9-226.9	CL	9.1	2.5	0.35	0.63	24.1	1.39	34.5	26.0	0.34	<0.01	0.4
R3968	226.9-227.3	IR	8.6	2.1	0.45	0.51	23.1	0.40	33.5	20.4	0.85	<0.01	0.4
R3969	227.3-236.7	SH	8.4	1.3	0.08	0.05	15.1	0.16	58.1	27.3	0.38	0.02	0.2
R3970	236.7-245.0	SS	8.7	1.4	0.19	0.13	15.7	0.22	39.3	23.6	0.32	0.05	0.1
R3971	245.0-253.2	SS	8.4	2.0	0.27	0.16	20.7	1.39	44.3	21.7	0.43	0.04	0.1
R3972	253.2-260.0	SH	7.9	3.2	0.60	0.42	26.4	3.66	36.9	30.6	0.35	0.19	<0.1
R3973	260.0-267.6	SH	8.7	1.8	0.09	0.07	18.6	0.39	66.0	33.8	0.33	0.10	<0.1

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Fort Collins, Co 80523
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Soil Analysis Report

DRILL HOLE PB-105

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		---%---				---%---			
R3962	190.4-200.0	63	8	29	SCL	0.09	0.001	1.1	8.22
R3963	200.0-210.0	57	9	34	SCL	0.04	<0.001	1.7	15.75
R3964	210.0-214.5	53	13	34	SCL	0.02	0.001	1.9	18.41
R3965	214.5-224.2	46	12	42	SL	0.04	0.005	1.9	17.91
R3966	224.2-225.9	45	9	46	C/SC	0.02	<0.001	1.5	14.38
R3967	225.9-226.9	78	6	16	SL	0.01	0.003	18.7	186.78
R3968	226.9-227.3	76	9	15	SL	<0.01	0.002	7.3	73.06
R3969	227.3-236.7	48	20	32	SCL	0.03	<0.001	1.6	15.06
R3970	236.7-245.0	54	17	29	SCL	0.01	0.001	1.1	10.72
R3971	245.0-253.2	50	19	31	SCL	0.02	0.005	1.0	9.53
R3972	253.2-260.0	27	42	31	CL	0.18	0.005	0.2	-3.47
R3973	260.0-267.6	34	19	47	C	0.06	0.002	1.1	9.19

Dave Boon

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Soil Analysis Report

DRILL HOLE PB-107

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca	Mg	Na	K	SAR	Sat %	---AB-DTPA--- B	Se	2M KCl NO3-N
					--------meq/l--------						-----ppm-----		ppm
R 6505	0 - 5	GR	8.6	0.5	0.4	0.1	4.7	0.1	9.9	30.6			
6506	5 - 10	GR	8.2	1.4	0.6	0.3	13.7	0.2	20.3	59.4			
6507	10 - 15	GR	8.4	0.7	0.4	0.2	7.2	0.1	14.2	35.2			
6508	15 - 20	GR	8.5	0.2	0.1	<0.1	1.8	<0.1	6.0	32.6			
6509	20 - 25	GR	8.4	0.3	0.5	0.2	2.1	0.1	3.5	33.8			
6510	25 - 30	GR	8.6	0.3	0.4	0.6	1.7	0.1	2.4	34.2			
6511	30 - 35	GR	8.5	0.2	0.1	<0.1	2.3	<0.1	8.1	33.5			
6512	35 - 40	GR	8.5	0.3	0.1	0.1	2.8	0.1	8.8	33.7			
6513	40 - 45	SL	8.9	0.9	0.3	0.1	8.3	0.1	20.3	61.4			
6514	45 - 50	SL	8.4	0.4	1.1	0.4	2.0	0.3	2.3	48.5			
6515	50 - 55	SL	8.4	0.6	1.1	0.9	3.8	0.5	3.9	21.6			
6516	55 - 60	SL	8.3	0.7	1.2	0.8	3.9	0.5	3.9	34.6			
6517	60 - 65	SL	8.3	0.5	0.8	0.5	3.1	0.4	3.8	30.9			
6518	65 - 70	SL	8.3	0.6	0.9	0.5	3.4	0.4	4.0	32.1			
6519	70 - 75	SL	8.3	0.5	0.6	0.3	3.2	0.3	4.8	32.4			
6520	75 - 80	SL	8.4	0.7	0.7	0.5	5.6	0.4	6.9	25.5			
6521	80 - 85	SL	8.4	0.7	0.7	0.5	5.0	0.4	6.7	29.0			
6522	85 - 90	SL	8.4	0.8	0.5	0.3	9.6	0.4	14.7	27.1			
6523	90 - 95	SL	8.4	0.9	0.5	0.3	7.2	0.4	11.7	26.9			
6524	95 -100	SL	8.4	0.8	0.3	0.1	7.3	0.3	16.1	23.3			
6525	100 -105	SL	8.3	1.2	0.4	0.2	11.4	0.3	22.0	23.8			
6526	105 -110	SL	8.1	2.0	0.7	0.5	18.0	0.6	22.9	21.2			
6527	110 -115	SL	8.5	1.3	0.4	0.3	13.3	0.3	22.1	22.5			
6528	115 -120	SL	8.4	1.8	0.4	0.2	20.3	0.3	39.3	26.2			
6529	120 -125	SL	8.4	2.0	0.3	0.1	21.7	0.4	45.6	21.7			
6530	125 -130	SL	8.3	2.5	0.5	0.3	25.1	0.5	41.3	21.6			
6531	130 -135	SL	8.4	1.5	0.5	0.2	17.0	0.3	29.4	24.3			

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Soil Analysis Report

DRILL HOLE PB-107

	LAB #	Sample ID #	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
			---------%---------				----------%---------			
R	6505	0 - 5				*	*	*	*	*
	6506	5 - 10				*	0.06	*	0.7	*
	6507	10 - 15				*	<0.01	0.001	0.2	1.53
	6508	15 - 20				*	<0.01	<0.001	0.2	1.70
	6509	20 - 25				*	0.01	0.001	0.3	2.72
	6510	25 - 30				*	<0.01	<0.001	0.1	1.30
	6511	30 - 35				*	<0.01	<0.001	0.2	1.60
	6512	35 - 40	58	10	32	SCL	<0.01	0.001	0.2	1.83
	6513	40 - 45				*	<0.01	*	0.5	*
	6514	45 - 50	10	38	52	C	0.03	0.002	0.8	7.33
	6515	50 - 55	50	18	32	SCL	<0.01	0.001	14.0	140.13
	6516	55 - 60	18	38	44	C	0.01	0.001	3.3	32.22
	6517	60 - 65	26	34	40	C/CL	0.01	<0.001	1.6	15.89
	6518	65 - 70	18	38	44	C	0.02	<0.001	1.4	13.38
	6519	70 - 75	18	38	44	C	0.02	<0.001	1.2	10.98
	6520	75 - 80	38	26	36	CL	0.01	0.001	15.5	154.92
	6521	80 - 85	24	36	40	C/CL	0.01	0.001	1.6	16.12
	6522	85 - 90	22	34	44	C	0.02	0.001	1.4	13.51
	6523	90 - 95	30	30	40	C/CL	0.02	0.001	1.6	14.91
	6524	95 -100	36	34	30	CL	0.01	0.001	1.2	12.02
	6525	100 -105	42	30	28	CL	0.01	0.001	1.3	12.42
	6526	105 -110	48	28	24	SCL/L	<0.01	<0.001	6.2	62.00
	6527	110 -115	34	34	32	CL	<0.01	0.001	1.6	15.73
	6528	115 -120	38	30	32	CL	0.02	<0.001	1.3	12.38
	6529	120 -125	38	32	30	CL	0.02	<0.001	2.7	26.38
	6530	125 -130	38	32	30	CL	0.02	0.001	1.1	10.01
	6531	130 -135	38	34	28	CL	0.01	0.001	1.3	12.32

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Soil Analysis Report

DRILL HOLE PB-107

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca	Mg	Na	K	SAR	Sat %	---AB-DTPA--- B	Se -----ppm-----	2M KCl NO3-N ppm
					--------meq/l--------								
6532	135 -140	SL	8.5	1.3	0.3	0.1	13.7	0.2	31.5	23.5			
6533	140 -145	SL	8.4	1.6	0.3	0.1	17.6	0.3	36.9	20.2			
6534	145 -150	SL	8.3	2.8	0.6	0.3	26.4	0.7	39.8	19.8			
6535	150 -155	SL	8.3	1.9	0.4	0.2	20.7	0.4	39.9	21.9			
6536	155 -160	SL	8.5	2.1	0.5	0.2	24.3	0.1	40.1	22.4			
6537	160 -165	SL	8.5	2.2	0.5	0.3	26.0	0.2	42.3	23.7			
6538	165 -170	SL	8.3	1.9	0.8	1.1	26.5	0.2	27.3	20.3			
6539	170 -175	SL	8.5	2.0	0.3	0.1	24.7	0.3	54.2	24.7			
6540	175 -180	SL	8.6	2.1	0.4	0.3	48.7	0.7	83.3	23.6			
6541	180 -185	SL	8.6	0.7	0.1	0.2	6.3	0.2	16.2	19.7			
6542	185 -190	SL	8.6	1.5	0.4	0.6	15.7	0.4	22.6	21.6			
6543	190 -195	SL	8.5	0.6	0.2	0.2	5.0	0.2	10.5	23.4			
6544	195 -200	SL	9.1	1.8	0.4	0.1	19.1	0.3	36.8	15.9			
6545	200 -205	SL	9.0	0.7	0.1	0.1	6.4	0.2	18.1	20.0			
6546	205 -210	SL	8.6	2.3	0.4	0.3	25.2	0.4	43.3	19.1			
6547	210 -215	SL	8.6	1.4	0.3	0.2	15.8	0.3	32.4	19.6			
6548	215 -220	CL	8.5	1.9	0.5	0.4	18.8	0.7	27.8	24.9			
6549	220 -222	CL	8.3	1.9	0.6	0.5	19.6	0.8	27.0	34.5			
6550	222 -225	CL	8.6	0.8	0.2	0.3	7.0	0.4	14.3	32.3			
6551	225 -227	CL	8.4	0.7	0.4	0.2	3.6	0.3	6.8	17.6			
6552	227 -230	CL	8.3	1.5	0.8	0.6	17.3	0.9	20.3	29.8			
6553	230 -235	SL	8.3	1.0	0.5	0.3	9.9	0.4	15.4	28.5			
6554	235 -240	SL	8.5	1.2	0.7	0.4	11.6	0.5	15.2	25.1			
6555	240 -245	SL	8.4	0.7	0.5	0.4	6.3	0.4	9.8	17.1			
6556	245 -250	SL	8.1	2.0	0.8	0.6	23.3	0.5	27.5	22.1			

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LAB #	Sample ID #	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		---------%---------				----------%---------			
6532		38	32	30	CL	0.01	<0.001	1.2	11.19
6533		44	28	28	CL	0.01	0.001	1.0	9.62
6534		46	26	28	SCL	0.01	0.001	1.1	10.52
6535		36	32	32	CL	0.02	<0.001	1.2	10.98
6536		42	28	30	CL	0.02	0.001	1.8	17.21
6537		34	34	32	CL	0.01	0.001	1.5	14.32
6538		46	26	28	SCL	0.02	<0.001	1.8	17.78
6539		36	32	32	CL	0.02	0.001	1.2	11.71
6540		34	34	32	CL	0.02	0.002	1.3	12.54
6541		48	24	28	SCL	0.02	<0.001	5.6	55.68
6542		40	28	32	CL	0.03	0.001	1.6	15.29
6543		40	30	30	CL	0.01	0.001	3.7	36.92
6544		60	18	22	SCL	<0.01	0.001	18.1	181.03
6545		40	28	32	CL	<0.01	0.001	7.3	73.13
6546		48	24	28	SCL	0.01	0.001	*	*
6547		44	28	28	CL	0.02	0.001	5.4	53.21
6548		32	28	40	C/CL	0.02	<0.001	2.2	21.48
6549		20	36	44	C	0.02	0.001	2.1	19.91
6550		20	36	44	C	0.02	*	3.1	*
6551		52	20	28	SCL	0.01	0.002	1.8	17.45
6552		28	28	44	C	0.03	0.001	2.5	23.59
6553		28	30	42	C	0.03	0.002	2.0	18.93
6554		32	28	40	C/CL	*	0.002	2.6	*
6555		56	20	24	SCL	0.02	0.002	1.9	18.44
6556		62	20	18	SL	<0.01	0.001	2.7	27.13

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DRILL HOLE PB-107

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca	Mg	Na	K	SAR	Sat %	---AB-DTPA--- B	Se	2M KCl NO3-N
					--------meq/l--------						-----ppm-----		ppm
6557	250 -255A	SS	8.4	1.6	0.5	0.9	18.0	0.4	21.9	19.6			
6558	250 -255B	SS	8.4	1.0	0.5	0.3	10.1	0.4	15.3	18.4			
6559	255 -260	SS	8.8	1.7	0.3	0.2	18.2	0.3	39.1	19.0			
6560	260 -265	SS	8.5	1.8	0.3	0.2	14.6	0.3	29.4	17.2			
6561	265 -270	SS	8.3	2.1	0.4	0.3	19.3	0.3	32.1	43.7			
6562	270 -275	SS	8.4	2.6	0.4	0.4	24.4	0.6	39.9	50.3			
6563	275 -280	SS	8.5	1.9	0.3	0.2	18.1	0.3	35.1	18.1			
6564	280 -285	SS	8.6	2.3	0.4	0.3	25.6	0.3	44.6	56.7			
6565	285 -290	SS	8.6	2.1	0.3	0.2	29.7	0.3	58.9	18.5			
6566	290 -295	SS	8.6	2.1	0.3	0.2	25.0	0.2	49.9	17.5			
6567	295 -300	SS	8.6	3.0	0.4	0.4	30.7	0.3	48.7	17.8			
6568	300 -305	SL	8.3	2.9	0.6	0.6	30.4	0.1	38.3	18.0			
6569	305 -310	SS	8.3	3.0	0.5	0.4	25.4	0.4	39.1	17.8			
6570	310 -315	SL	8.3	2.6	0.5	0.3	32.8	0.4	51.9	19.8			
6571	315 -320	SH	8.3	1.6	0.3	0.3	28.5	0.4	53.8	18.7			
6572	320 -325	SH	8.3	1.5	0.1	0.1	17.2	0.2	53.8	18.7			
6573	325 -330	SH	8.2	1.5	0.2	<0.1	15.5	0.2	45.4	20.5			
6574	330 -335	SH	8.2	1.7	0.2	0.1	18.3	0.5	46.1	21.0			
6575	335 -340	PR	8.6	1.2	0.2	0.1	22.5	0.2	58.1	21.6			
6576	340 -342	PR	8.4	1.4	0.2	0.1	12.8	0.2	37.0	20.2			
6577	342 -345	PR	8.4	1.4	0.2	0.1	15.3	0.3	42.9	19.4			
6578	345 -347	PR	8.3	1.2	0.2	0.1	15.3	0.3	37.6	21.0			
6579	347 -350	PR	8.3	1.2	0.3	0.2	13.0	0.3	25.3	20.1			

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LAB #	Sample ID #	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		--------%--------				---------%---------			
6557	-255A	58	18	24	SCL	0.01	0.002	1.5	14.65
6558	250 -255B	56	20	24	SCL	0.01	0.001	2.4	23.82
6559	255 -260	68	12	20	SCL/SL	<0.01	0.003	2.9	28.69
6560	260 -265	68	14	18	SL	0.02	0.004	1.8	17.50
6561	265 -270	64	16	20	SCL/SL	0.04	0.004	1.7	16.28
6562	270 -275	68	12	20	SCL/SL	0.03	0.002	6.0	58.93
6563	275 -280	64	16	20	SCL/SL	0.03	0.004	2.0	18.99
6564	280 -285	68	16	16	SL	<0.01	0.002	1.9	19.06
6565	285 -290	66	14	20	SCL/SL	<0.01	0.002	2.5	24.66
6566	290 -295	68	14	18	SL	<0.01	0.001	2.6	25.63
6567	295 -300	78	8	14	SL	<0.01	0.003	6.7	67.49
6568	300 -305	68	14	18	SL	0.22	0.009	2.0	13.21
6569	305 -310	62	18	20	SCL/SL	0.11	0.007	1.6	12.38
6570	310 -315	62	14	24	SCL	0.07	0.008	1.1	8.66
6571	315 -320	68	10	22	SCL	0.06	0.005	1.2	10.48
6572	320 -325	68	8	28	SCL	0.09	0.003	0.9	6.58
6573	325 -330	64	8	28	SCL	0.06	0.002	0.8	5.99
6574	330 -335	60	10	30	SCL	0.06	0.001	0.8	5.66
6575	335 -340	70	8	22	SCL	0.05	0.002	4.4	42.50
6576	340 -342				*	0.03	0.002	3.8	37.43
6577	342 -345	68	8	24	SCL	0.03	0.002	2.0	19.13
6578	345 -347	70	6	24	SCL	0.06	0.001	1.5	13.36
6579	347 -350	72	6	22	SCL	0.13	0.001	1.3	8.87

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Soil Analysis Report

DRILL HOLE PB-108

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca meq/l	Mg meq/l	Na meq/l	K meq/l	SAR	Sat %	---AB-DTPA--- B ppm	Se ppm	2M KCl NO3-N ppm
6580	230 -235	JV	8.6	0.8	0.6	0.4	8.7	0.3	12.8	24.4			
6581	235 -240	JV	8.6	1.0	0.1	0.1	12.1	0.1	39.2	25.6			
6582	240 -245	SH	8.4	1.0	0.2	0.1	10.6	0.1	28.9	24.4			
6583	245 -250	SH	8.6	1.9	0.2	0.1	20.2	0.2	52.3	24.2			
6584	250 -255	SL	8.6	1.4	0.2	0.1	14.9	0.1	40.7	24.4			
6585	255 -260	SL	8.7	1.5	0.2	0.1	17.3	0.1	46.8	35.8			
6586	260 -265	SL	8.6	1.4	0.2	0.2	14.8	0.2	34.0	34.2			
6587	265 -270	SL	8.9	1.4	0.2	0.1	15.0	0.1	43.4	59.2			
6588	270 -275	SL	9.1	1.8	0.2	<0.1	21.9	0.1	70.7	56.6			
6589	275 -280	SL	9.1	2.0	0.2	0.1	23.3	0.1	61.3	91.4			
6590	280 -285	SS	9.1	1.3	0.2	0.1	13.8	0.1	32.1	98.6			
6591	285 -290	SS	8.9	2.6	0.3	0.1	28.6	0.1	67.1	37.6			
6592	290 -295	SL	9.0	2.8	0.3	0.1	31.6	0.2	72.5	43.7			
6593	295 -300	SH	8.9	1.0	0.1	0.3	12.3	0.2	28.2	47.6			
6594	300 -305	SH	8.8	2.1	0.2	0.2	28.1	0.2	63.8	44.1			
6595	305 -310	SH	9.1	1.0	0.7	1.1	12.2	0.4	12.7	64.2			
6596	310 -315	SH	9.1	1.6	0.1	0.1	21.2	0.1	70.1	94.0			
6597	315 -320	SH	9.0	3.0	0.4	1.0	43.4	0.4	51.3	96.2			
6598	320 -325	SH	9.1	2.0	0.2	0.2	22.7	0.2	48.2	111.0			
6599	325 -330	SS	9.0	1.4	0.1	0.1	14.7	0.1	43.0	115.1			
6600	330 -335	SS	9.0	1.0	0.2	0.5	10.7	0.2	18.0	101.9			
6601	335 -340	SS	9.1	1.3	0.3	0.4	12.9	0.1	22.0	116.3			
6602	340 -345	SS	9.2	1.3	0.3	0.6	15.0	0.3	22.9	132.9			
6603	345 -350	SS	9.2	1.3	0.3	0.4	13.6	0.2	22.9	121.3			
6604	350 -355	SL	9.2	1.4	0.2	0.2	14.4	0.1	32.3	84.6			
6605	355 -360	SH	9.1	1.5	0.3	0.3	15.3	0.2	26.6	60.9			

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DRILL HOLE PB-108

LAB #	Sample ID #	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		---%---				---%---			
6580	230 -235	56	12	32	SCL	0.17	0.003	1.1	5.28
6581	235 -240				*	0.38	0.001	0.9	-2.64
6582	240 -245	46	26	28	SCL	0.07	0.002	0.7	4.88
6583	245 -250	56	20	24	SCL	0.08	0.005	2.2	19.56
6584	250 -255	56	20	24	SCL	0.08	0.004	3.3	30.53
6585	255 -260	54	20	26	SCL	0.04	0.002	6.6	64.41
6586	260 -265	44	24	32	CL	0.04	0.001	1.9	18.93
6587	265 -270	28	30	42	C	0.05	0.002	1.2	12.26
6588	270 -275	34	34	32	CL	0.04	0.002	2.1	21.06
6589	275 -280	42	30	28	CL	<0.01	0.002	2.9	28.66
6590	280 -285	46	26	28	SCL	*	*	*	*
6591	285 -290	64	16	20	SCL/SL	<0.01	0.005	15.1	150.86
6592	290 -295	46	18	36	SC	0.09	0.002	2.7	27.06
6593	295 -300	24	18	58	C	0.09	<0.001	1.0	10.00
6594	300 -305	24	16	60	C	0.08	0.001	0.8	8.33
6595	305 -310	36	24	40	C/CL	0.45	0.001	2.6	25.53
6596	310 -315				*	0.09	*	2.3	*
6597	315 -320	38	30	32	CL	<0.01	*	2.5	*
6598	320 -325	40	24	36	CL	<0.01	0.002	2.0	20.36
6599	325 -330	36	32	32	CL	0.02	*	*	*
6600	330 -335	36	34	30	CL	0.01	*	*	*
6601	335 -340	32	36	32	CL	0.01	*	*	*
6602	340 -345	20	44	36	SiCL/CL	0.05	*	1.9	*
6603	345 -350	30	38	32	CL	0.06	0.001	2.0	20.03
6604	350 -355	38	36	26	L	0.03	*	1.9	*
6605	355 -360	30	20	50	C	0.04	0.001	2.2	21.93

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Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca	Mg	Na	K	SAR	Sat %	---AB-DTPA--- B	Se	2M KCl NO3-N ppm
					--------meq/l--------						-----ppm-----		
6606	360 -365	SH	9.0	0.9	0.6	0.6	8.8	0.3	11.3	46.3			
6607	365 -370	SH	8.9	1.6	0.4	0.4	15.5	0.3	24.0	39.2			
6608	370 -375	SH	9.2	1.2	0.4	0.2	12.2	0.1	23.9	70.0			
6609	375 -380	SH	9.1	1.0	0.6	1.4	9.6	0.3	9.6	108.7			
6610	380 -385	SH	9.1	1.3	0.1	0.2	13.3	0.1	34.1	126.2			
6611	385 -390	SH	9.2	1.8	0.2	0.2	19.5	0.1	44.1	88.4			
6612	390 -395	SH	9.1	1.6	0.2	0.1	17.0	0.1	46.1	83.5			
6613	395 -400	SH	9.1	1.3	0.2	0.2	14.5	0.1	32.0	84.5			
6614	400 -405	SS	9.2	1.3	0.1	0.4	14.2	0.1	27.8	70.0			
6615	405 -410	SS	9.3	1.2	0.2	0.5	12.1	0.1	21.4	82.4			
6616	410 -415	SS	9.2	1.2	0.1	0.1	13.1	0.1	39.8	75.5			
6617	415 -420	SS	9.3	0.9	0.1	0.2	9.5	0.1	24.0	89.8			
6618	420 -425	SS	9.2	1.1	0.1	0.1	16.1	0.1	47.2	66.2			
6619	425 -430	SS	9.3	1.1	0.1	0.2	12.9	0.1	33.1	129.1			
6620	430 -435	SS	9.3	0.8	0.2	0.2	9.0	0.2	20.5	116.9			
6621	435 -440	SS	9.2	0.7	0.2	0.3	7.3	0.2	14.5	108.0			
6622	440 -445	SS	9.4	0.9	0.2	0.4	10.2	0.1	18.6	125.1			
6623	445 -450	SS	9.4	0.7	0.2	0.3	7.6	0.2	14.2	139.1			
6624	450 -455	SS	9.3	0.6	0.3	0.3	5.9	0.1	10.5	115.9			
6625	455 -460	SS	9.5	0.7	0.3	0.8	7.9	0.2	10.4	144.3			
6626	460 -465	SS	9.4	0.7	0.4	0.8	7.3	0.2	9.3	150.5			
6627	465 -470	SS	9.4	0.9	0.8	1.7	11.1	0.4	9.8	125.4			
6628	470 -475	SS	9.4	0.9	0.2	0.3	9.7	0.1	20.0	124.7			
6629	475 -480	SS	9.4	1.1	0.2	0.5	12.1	0.2	20.4	130.2			
6630	480 -485	SS	9.4	0.9	0.1	0.2	9.5	0.1	23.3	139.7			

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LAB #	Sample ID #	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		---%---				---%---			
6606	360 -365	40	14	46	C	0.18	0.002	2.0	20.46
6607	365 -370	54	12	34	SCL	0.14	0.001	4.1	40.73
6608	370 -375	32	36	32	CL	0.04	0.001	1.6	16.03
6609	375 -380	36	34	30	CL	0.04	0.002	1.9	19.06
6610	380 -385	42	32	26	L	0.03	0.003	1.4	14.49
6611	385 -390	40	38	22	L	0.03	0.002	1.8	18.46
6612	390 -395	52	28	20	SCL/L/SL	0.02	0.002	1.8	17.96
6613	395 -400	52	26	22	SCL	0.02	0.001	2.0	20.33
6614	400 -405	54	28	18	SL	0.03	0.001	1.8	17.63
6615	405 -410	56	26	18	SL	<0.01	0.001	1.6	16.03
6616	410 -415	64	22	14	SL	<0.01	0.001	5.7	56.83
6617	415 -420	58	20	22	SCL	0.01	0.001	1.9	19.23
6618	420 -425	60	22	18	SL	<0.01	0.001	5.6	56.23
6619	425 -430	62	16	22	SCL	0.01	0.001	2.9	28.53
6620	430 -435	64	18	18	SL	<0.01	0.001	1.8	18.23
6621	435 -440	64	14	22	SCL	<0.01	0.001	2.3	23.03
6622	440 -445	60	18	22	SCL	0.01	0.001	1.6	15.63
6623	445 -450	60	14	26	SCL	<0.01	0.001	1.6	16.33
6624	450 -455	60	14	26	SCL	<0.01	0.001	1.9	18.53
6625	455 -460	60	14	26	SCL	<0.01	0.001	1.9	19.13
6626	460 -465	60	14	26	SCL	<0.01	0.001	1.7	17.03
6627	465 -470	64	12	24	SCL	<0.01	0.001	3.9	39.13
6628	470 -475	68	10	22	SCL	<0.01	<0.001	1.7	16.60
6629	475 -480	66	12	22	SCL	<0.01	0.001	2.4	24.33
6630	480 -485	64	12	24	SCL	<0.01	0.001	1.6	15.73

Dave Boon

CSU Soil Testing Lab
Rm. 6, Voc.Ed. Bldg.
Fort Collins, Co 80523

Soil Analysis Report

DRILL HOLE PB-108

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca	Mg	Na	K	SAR	Sat %	---AB-DTPA--- B	Se	2M KCl NO3-N
					--------meq/l--------						-----ppm-----		ppm
6631	485 -490	SS	9.4	0.9	0.1	0.1	10.3	0.1	31.5	122.7			
6632	490 -495	SS	9.3	1.0	0.1	0.2	9.8	<0.5	26.5	96.4			
6633	495 -500	SS	9.4	1.2	0.2	0.1	13.9	0.3	37.9	60.3			
6634	500 -505	SS	9.3	1.4	0.1	0.1	15.3	0.5	45.8	56.8			
6635	505 -510	SS	9.2	0.9	0.3	0.5	8.6	0.3	14.2	55.4			
6636	510 -515	SS	9.3	0.9	0.2	0.4	12.8	0.1	23.5	70.6			
6637	515 -520	SS	9.4	0.9	0.2	0.3	13.0	0.1	26.0	83.4			
6638	520 -525	SS	9.2	1.2	0.3	0.7	19.3	0.2	26.5	60.3			
6639	525 -530	SS	9.1	1.2	0.3	0.1	12.9	0.1	25.9	40.3			
6640	530 -535	SS	9.2	1.3	0.2	0.2	14.6	0.1	31.4	48.9			
6641	535 -540	SS	9.0	1.1	0.4	0.2	12.3	0.1	23.7	31.1			
6642	540 -545	SS	9.0	1.0	0.4	0.3	10.1	0.2	17.4	37.8			
6643	545 -550	SS	9.1	1.1	0.1	0.1	11.9	0.1	36.4	60.2			

Dave Boon

CSU Soil Testing Lab
Rm. 6, Voc.Ed. Bldg.
Fort Collins, Co 80523

Date Rec: 11/22/88

Soil Analysis Report

DRILL HOLE PB-108

LAB #	Sample ID #	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		---%---				---%---			
6631	485 -490	64	12	24	SCL	<0.01	<0.001	2.0	19.70
6632	490 -495	72	8	20	SCL/SL	<0.01	0.001	3.2	31.93
6633	495 -500	72	2	26	SCL	<0.01	0.001	10.7	106.63
6634	500 -505	76	8	16	SL	<0.01	0.001	11.1	111.43
6635	505 -510	64	14	22	SCL	0.01	0.001	3.3	32.93
6636	510 -515	66	14	20	SCL/SL	<0.01	0.001	2.6	26.33
6637	515 -520	64	12	24	SCL	<0.01	0.001	3.2	31.53
6638	520 -525	74	8	18	SL	<0.01	0.001	6.9	68.73
6639	525 -530	68	12	20	SCL/SL	<0.01	0.003	14.7	146.69
6640	530 -535	72	8	20	SCL/SL	<0.01	0.001	12.5	125.03
6641	535 -540	68	12	20	SCL/SL	<0.01	0.002	8.6	85.86
6642	540 -545	64	16	20	SCL/SL	<0.01	0.002	6.3	62.96
6643	545 -550	62	22	16	SL	*	*	*	*

Dave Boon

CSU Soil Testing Lab
Rm. 6, Voc.Ed. Bldg.
Fort Collins, Co 80523

Soil Analysis Report

DRILL HOLE PB - 109

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca	Mg	Na	K	SAR	Sat %	---AB-DTPA--- B	Se	2M KCl NO3-N ppm
					--------meq/l--------						-----ppm-----		
6644	0 - 5	GR	6.4	0.6	0.4	0.1	5.0	0.1	10.5	23.4			
6645	5 - 10	GR	6.5	1.5	5.6	1.9	4.2	1.4	2.1	14.8			
6646	10 - 15	GR	7.9	0.3	0.5	0.1	2.0	0.1	3.4	29.7			
6647	15 - 20	GR	8.0	0.2	0.2	0.1	1.6	<0.5	4.6	30.9			
6648	20 - 25	GR	8.0	0.2	0.2	0.1	2.1	<0.5	6.0	28.0			
6649	25 - 30	GR	8.3	0.3	0.2	0.1	1.9	0.1	5.2	31.9			
6650	30 - 35	GR	8.5	0.5	0.3	0.1	4.7	0.1	11.4	31.5			
6651	35 - 40	GR	8.4	0.4	0.3	0.1	3.3	0.1	7.4	25.9			
6652	40 - 45	GR	8.5	0.3	0.2	0.1	1.9	0.1	5.5	32.9			
6653	45 - 50	GR	8.7	0.4	0.2	0.1	3.3	0.1	9.3	30.6			
6654	50 - 55	GR	8.6	0.3	0.3	<0.5	2.6	0.1	7.2	31.8			
6655	55 - 60	GR	8.5	0.3	0.4	0.1	1.8	0.3	3.8	36.3			
6656	60 - 65	GR	8.4	0.3	0.2	<0.5	0.7	0.4	2.2	32.6			
6657	65 - 70	GR	8.4	0.3	0.3	0.1	1.9	0.2	4.0	33.8			
6658	70 - 75	GR	8.3	0.4	0.8	0.5	2.4	0.2	3.1	33.2			
6659	75 - 80	CL	8.2	0.5	0.6	0.2	3.3	0.2	5.2	21.9			
6660	80 - 85	CL	8.6	0.6	0.9	0.2	4.7	0.2	6.4	30.2			
6661	85 - 90	SS	8.5	0.7	0.8	0.3	5.9	0.3	8.1	20.2			
6662	90 - 95	SS	8.5	0.6	0.6	0.2	4.5	0.2	7.2	19.9			
6663	95 -100	SS	8.4	0.6	0.2	4.5	0.2	5.6	7.1	22.9			
6664	100 -105	SS	8.5	0.9	0.9	0.4	6.2	0.3	7.7	18.6			
6665	105 -110	SS	8.1	0.9	0.5	0.3	9.1	0.3	14.8	21.8			
6666	110 -115	SS	8.1	0.7	0.3	0.1	6.3	0.2	14.3	20.5			

Dave Boon

CSU Soil Testing Lab
Rm. 6, Voc.Ed. Bldg.
Fort Collins, Co 80523

Date Rec: 11/22/88

Soil Analysis Report

DRILL HOLE PB-109

Lab #	Sample ID #	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		---%---				---%---			
6644	0 - 5	86	4	10	LS	<0.01	0.002	*	0.06
6645	5 - 10	88	4	8	LS	<0.01	<0.001	*	*
6646	10 - 15				*	<0.01	<0.001	0.1	1.10
6647	15 - 20				*	<0.01	<0.001	0.1	0.80
6648	20 - 25				*	<0.01	<0.001	0.1	0.90
6649	25 - 30				*	0.01	<0.001	0.1	0.69
6650	30 - 35	98	2	0	S	0.01	<0.001	0.2	1.39
6651	35 - 40				*	0.01	<0.001	0.2	1.89
6652	40 - 45	98	0	2	S	0.01	<0.001	0.1	0.89
6653	45 - 50				*	0.01	<0.001	*	*
6654	50 - 55				*	0.01	<0.001	0.2	1.49
6655	55 - 60	98	2	0	S	*	<0.001	*	*
6656	60 - 65	98	2	0	S	0.01	<0.001	0.1	0.69
6657	65 - 70				*	0.01	*	0.2	*
6658	70 - 75				*	0.01	<0.001	0.2	1.59
6659	75 - 80	56	20	24	SCL	<0.01	0.001	0.4	4.43
6660	80 - 85	40	26	34	CL	*	0.001	*	*
6661	85 - 90	56	20	24	SCL	0.01	0.001	1.8	17.42
6662	90 - 95	48	24	28	SCL	0.01	0.001	1.2	12.12
6663	95 -100	42	28	30	CL	0.02	0.001	1.1	10.51
6664	100 -105	40	30	30	CL	0.02	0.001	1.3	12.01
6665	105 -110	42	24	34	CL	0.01	0.001	1.3	12.62
6666	110 -115	42	28	30	CL	0.02	0.001	1.3	11.91

Dave Boon

CSU Soil Testing Lab
Rm. 6, Voc.Ed. Bldg.
Fort Collins, Co 80523

Soil Analysis Report

DRILL HOLE PB - 109

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca meq/l	Mg meq/l	Na meq/l	K meq/l	SAR	Sat %	---AB-DTPA--- B ppm	Se ppm	2M KCl NO3-N ppm
6667	115 -120	SL	8.2	0.9	0.4	0.2	9.0	0.3	17.1	21.0			
6668	120 -125	SL	8.3	0.8	0.2	0.1	8.3	0.2	22.8	17.9			
6669	125 -130	SL	8.3	1.4	0.5	0.2	12.4	0.3	21.4	21.6			
6670	130 -135	SL	8.4	0.8	0.3	0.2	6.8	0.2	13.9	19.5			
6671	135 -140	SL	8.3	0.7	0.2	0.1	6.7	0.2	19.3	21.3			
6672	140 -145	SL	8.4	0.9	0.1	0.1	8.1	0.2	22.3	19.7			
6673	145 -150	SL	8.3	0.8	0.2	0.1	7.7	0.3	18.4	19.9			
6674	150 -155	SL	8.4	1.4	0.2	0.1	16.7	0.1	45.9	19.6			
6686	155 -160	SL	8.6	1.5	0.3	0.1	16.0	0.2	34.0	18.9			
6687	160 -165	SL	8.6	1.7	0.2	0.1	19.6	0.2	49.1	15.3			
6688	165 -170	SL	8.5	1.4	0.2	0.1	15.6	0.2	42.4	19.5			
6689	170 -175	SL	8.5	1.0	0.2	0.1	11.1	0.2	31.5	18.1			
6690	175 -180	SL	8.4	1.0	0.2	0.1	10.6	0.2	26.6	18.9			
6691	180 -185	SL	8.2	0.9	0.3	0.2	8.7	0.3	18.8	18.8			
6692	185 -190	SL	8.2	0.9	0.2	0.2	7.3	0.2	16.9	18.6			
6693	190 -195	SL	8.2	0.6	0.2	0.1	5.4	0.2	14.3	19.0			
6694	195 -200	SL	8.2	0.7	0.2	0.1	7.4	0.2	17.1	17.8			

* Not enough sample

Dave Boon

CSU Soil Testing Lab
Rm. 6, Voc.Ed. Bldg.
Fort Collins, Co 80523

Date Rec: 11/22/88

Soil Analysis Report

DRILL HOLE PB-109

	LAB #	Sample ID #	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
			---------%---------				----------%---------			
R	6667	115 -120	42	26	32	CL	0.02	0.001	1.3	12.93
	6668	120 -125	50	24	26	SCL	0.02	*	2.0	*
	6669	125 -130	44	20	36	CL	0.03	0.003	2.3	22.59
	6670	130 -135	50	20	30	SCL	0.02	0.001	1.2	11.73
	6671	135 -140	50	18	32	SCL	0.04	0.001	1.2	11.53
	6672	140 -145	50	20	30	SCL	*	*	*	*
	6673	145 -150	50	20	30	SCL	0.01	*	1.3	*
	6674	150 -155	58	16	26	SCL	*	0.001	5.9	*
	6686	155 -160	50	20	30	SCL	<0.01	*	1.5	*
	6687	160 -165	66	12	22	SCL	<0.01	0.001	9.8	98.03
	6688	165 -170	58	14	28	SCL	0.01	0.001	2.7	26.93
	6689	170 -175	62	12	26	SCL	0.01	0.001	4.9	49.33
	6690	175 -180	52	18	30	SCL	0.02	*	2.9	*
	6691	180 -185	54	16	30	SCL	0.02	0.001	1.4	14.13
	6692	185 -190	54	18	28	SCL	0.02	0.001	1.8	17.53
	6693	190 -195	54	20	26	SCL	0.01	0.001	1.8	18.13
	6694	195 -200	54	18	28	SCL	0.01	*	3.0	*

* Not enough sample

APPENDIX B-2
TOTAL CHEMICAL ANALYSES

Dave Boon

CSU Soil Testing Lab
Room 6, Voc. Ed. Bldg.
Fort Collins, CO 80523
303-491-5061

NOTE: Your samples will be automatically discarded 30 days from the date on this report unless you notify the lab to keep the samples. Thank you.

Date Rec: 11/22/88
Date Rec: 2/6/89

Date: 2/17/89
Billing: 506587

Research Soil Analysis

Lab #	Sample ID #	Total Ca (%)	Mg (%)	Na (%)	K (%)	P (%)	Al (%)	Fe (%)	Mn (%)	Ti (%)	Cu (mg/kg)	Zn (mg/kg)	Ni (mg/kg)
R3965	214.5-224.2	0.79	1.02	0.63	1.28	0.05	7.25	5.46	0.24	0.49	62.5	128	60.3
3970	236.7-245.0	0.46	0.93	0.98	1.30	0.03	7.23	2.65	0.11	0.53	53.9	146	51.4
3990	70-80	0.46	1.54	0.85	1.71	0.04	7.64	5.38	0.18	0.52	68.7	150	62.5
4002	90-100	0.63	0.76	1.00	1.38	0.09	6.70	2.19	0.10	0.45	51.2	136	35.2
4027	35-45	3.10	1.40	2.44	0.85	0.08	6.73	3.77	0.18	0.39	39.2	204	23.8
4043	40-50	2.08	0.60	3.88	0.69	0.04	6.94	1.46	0.09	0.14	18.5	51.1	7.0
R4821	Coarse Rej.	0.69	0.98	0.28	1.17	0.06	8.00	4.20	0.15	0.53	64.6	112	42.2
4822	Spiral Rej.	1.64	1.35	0.28	0.96	0.08	7.43	5.28	0.19	0.43	58.1	150	39.7

Lab #	Sample ID #	Total Mo (mg/kg)	Cd	V	Cr	Sr	B	Ba	Pb	As	Se	Hg
R3965	214.5-224.2	9.7	3.7	211	128	159	5.0	842	56	0.85	<0.25	0.10
3970	236.7-245.0	8.8	3.2	169	112	131	1.6	786	56	6.10	<0.25	0.09
3990	70-80	12.0	4.3	220	125	158	7.1	982	74	1.55	<0.25	0.23
4002	90-100	6.3	2.4	143	112	154	1.5	892	43	0.86	<0.25	0.21
4027	35-45	7.8	2.9	151	70.6	296	1.6	561	45	0.57	<0.25	<0.05
4043	40-50	7.9	3.2	45.4	21.2	574	0.2	843	52	0.32	<0.25	0.08
R4821	Coarse Rej.	11.9	4.0	141	93.7	207	3.3	927	60	1.76	<0.25	0.21
4822	Spiral Rej.	9.7	3.3	124	82.1	201	2.5	870	48	1.79	<0.25	0.25

APPENDIX B-3
COAL SLURRY CHEMISTRY

Dave Boon

CSU Soil Testing Lab
Room 6, Voc. Ed. Bldg.
Fort Collins, CO 80523
303-491-5061

NOTE: Your samples will be automatically discarded 30 days from the date on this report unless you notify the lab to keep the samples. Thank you.
Date:
Billing:

Date Rec: 2/6/89
Project: Wishbone Hill Coal
Test #2 Jan 26, 1989

Water Analysis

Lab #	Sample ID #	Na	K	Ca	Mg	As	Fe	Mn	Cd	Se	Zn	Hg	Pb
		mg/l											
W4587	Fresh*	4.3	<0.5	47.8	14.7	0.001	0.10	0.02	<0.01	<0.001	0.01	<0.001	<0.05
4588	Process*	6.2	0.5	45.3	15.6	0.002	0.14	0.04	<0.01	<0.001	<0.01	<0.001	<0.05

Lab #	Sample ID #	Cr	Al	Cu	Ba	B	F	NO2-N	NO3-N	NH4-N	Total N**	Organic P	Total P
		mg/l											
W4587	Fresh*	<0.01	<0.1	0.02	0.06	0.02	1.29	<0.01	<0.1	<0.01	<0.1	<0.1	<0.1
4588	Process*	<0.01	<0.1	<0.01	0.09	0.02	1.24	<0.01	<0.1	<0.01	<0.1	<0.1	<0.1

** Does not include NO3-N

Lab #	Sample ID #	SO4	Cl	pH	Cond.	Acidity as CaCO3	CO3	HCO3	Hardness as CaCO3	TDS	TSS	Settleable Solids	Color*
		----mg/l---			umhos/cm	----------	----------	----------	mg/l	----------	----------	----------	
W4587	Fresh*	65.6	1.6	8.0	387	-921	<1	134	180	200	16.0	12.0	<1
4588	Process*	70.6	3.6	8.0	382	-968	<1	149	177	200	278	260	<1

* Color units at pH 8.0

Lab #	Sample ID #

W4587 Fresh* = Pilot Plant Makeup Water (Fresh Water)
4588 Process* = Process Water(Clarified) from Thickener Overflow

APPENDIX B-4

COAL REFUSE CHEMISTRY

Dave Boon

CSU Soil Testing Lab
Room 6, Voc. Ed. Bldg.
Fort Collins, CO 80523
303-491-5061

NOTE: Your samples will be automatically discarded 30 days from the date on this report unless you notify the lab to keep the samples. Thank you.

Date Rec: 2/6/89
Project: Wishbone Hill Coal
Test #2 Jan 26, 1989

Date: 2/17/89
Billing:

Research Analysis

Lab #	Sample ID #	% H2O as rec.	paste pH	sat.ext. Cond. mmhos/cm	---meq/l in sat.ext.--- Ca	Mg	Na	K	SAR	% Sat.	---AB-DTPA--- B	Se
											----mg/kg----	
R4821	Coarse Reject	5.6	8.2	0.4	1.5	1.1	1.2	0.2	1.0	33.2	0.13	0.09
4822	Spiral Reject	26.4	7.8	0.7	3.7	2.3	0.9	0.4	0.5	38.7	0.10	0.05

Lab #	Sample ID #	2M KCl ppm NO3-N	% Sand	% Silt	% Clay	Texture	Total % S	% SO4-S	% CaCO3 equiv.	Acid-Base Potential*
R4821	Coarse Reject	1.4	71	5	24	SCL	0.052	0.003	1.9	17.4
4822	Spiral Reject	0.8	90	1	9	S	0.074	0.004	2.5	22.7

* tons of CaCO3/1000 tons of material

APPENDIX B-5
MINEROLOGY ANALYSIS

D. Boone Clay Mineralogy Results Roger Hopper 8/11/89

Note: These values should be used only as a guide
in comparing the composition of the samples.
The absolute values may vary 10-15% in some cases.

	(%)						
Sample No.	Interstratified Smectite & Illite	Smectite	Vermiculite	Chlorite	Illite	Kaolinite	Quartz
R3929	0	27	3	10	18	40	2
R3953	0	9	0	9	38	40	4
R3963	0	0	1	4	30	61	4
R3976	0	75	0	6	6	10	3
R4014	8	35	13	12	10	19	3
R4021	0	6	2	13	37	37	5
R5332	0	10	6	10	26	44	4
R5333	0	50	0	10	10	26	4
R5342	0	86	0	7	1	2	4
R6546	0	0	0	11	22	62	5

D. Boone Clay Mineralogy Results Roger Hopper 8/11/89

Very High	>65%
High	40% - 65%
Moderate	15% - 40%
Low	5% - 15%
Trace	<5%

Sample No.	Interstratified Smectite & Illite	Smectite	Vermiculite	Chlorite	Illite	Kaolinite	Quartz
R3929	-	Moderate	Trace	Low	Moderate	High	Trace
R3953	-	Low	-	Low	Moderate	High	Trace
R3963	-	-	Trace	Trace	Moderate	High	Trace
R3976	-	Very High	-	Low	Low	Low	Trace
R4014	Low	Moderate	Low	Low	Low	Moderate	Trace
R4021	-	Low	Trace	Low	Moderate	Moderate	Trace
R5332	-	Low	Low	Low	Moderate	High	Trace
R5333	-	High	-	Low	Low	Moderate	Trace
R5342	-	Very High	-	Low	Trace	Trace	Trace
R6546	-	-	-	Low	Moderate	High	Trace

APPENDIX B-6

EXCHANGEABLE SODIUM PERCENT

Dave Boon

CSU Soil Testing Lab
Room 6, Voc. Ed. Bldg.
Fort Collins, CO 80523
303-491-5061
Date:
Billing:

Research Soil Analysis

Lab #	Sample ID #	Exch. Na meq/100g	CEC meq/100g	ESP
R 3929		7.5	15.4	48.8
3953		7.3	13.0	55.9
3963		3.9	11.6	34.0
3976		10.1	27.8	36.3
4014		5.3	12.2	43.4
4021		3.2	13.8	23.2
5332		9.8	17.3	56.8
5333		15.7	21.2	74.1
5342		25.7	33.3	77.2
6546		3.3	12.3	26.6

APPENDIX C
LABORATORY QA/QC

APPENDIX C-1

IML LABORATORY DATA

Inter-Mountain Laboratories, Inc.
1633 Terra Avenue
Sheridan, Wyoming 82801
Tel. (307) 672-8945

EMS
FT. COLLINS, COLORADO

March 6, 1989

Lab No.	Location	Depths	pH	EC mmhos/cm @ 25°C	Saturation %	Calcium meq/l	Magnesium meq/l	Sodium meq/l	SAR	Sand %	Silt %	Clay %	Texture
28444	R3939		8.5	1.20	27.4	0.72	0.24	14.1	20.4	77.0	17.0	6.0	LOAMY SAND
28445	R3953		8.8	1.74	29.2	0.65	0.23	21.9	33.0	80.5	16.0	3.5	LOAMY SAND
28446	R3958		8.0	0.64	25.1	2.87	0.83	2.64	1.94	85.1	12.4	2.5	LOAMY SAND
28447	R3960		7.0	0.81	28.3	1.81	0.37	7.06	6.76	81.5	14.1	4.4	LOAMY SAND
28448	R3964		8.5	1.24	21.9	0.64	0.17	17.6	27.7	76.0	17.8	6.2	SANDY LOAM
28449	R3973		8.6	1.23	30.9	0.87	0.37	17.3	22.0	71.5	18.7	9.8	SANDY LOAM
28450	R3976		8.9	1.16	83.8	0.47	0.15	15.5	27.8	38.7	46.0	15.3	LOAM
28451	R3982		7.7	1.94	25.6	8.27	5.32	10.3	3.95	73.3	19.6	7.1	SANDY LOAM
28452	R3975		8.9	1.19	97.9	0.46	0.23	16.0	27.2	30.5	51.5	18.0	SILT LOAM
28453	R3928		8.6	1.68	34.7	0.66	0.23	23.6	35.4	56.0	30.5	13.5	SANDY LOAM
28454	R3932		8.7	1.88	32.5	0.46	0.21	26.3	45.4	64.2	25.1	10.7	SANDY LOAM
28455	R3935		8.8	1.55	22.9	0.42	0.25	23.6	40.8	64.4	24.0	11.6	SANDY LOAM
28456	R3954		7.7	0.48	27.0	1.78	0.33	3.16	3.08	72.5	19.5	8.0	SANDY LOAM
28457	R3955		7.6	0.74	25.2	2.91	0.57	4.42	3.35	70.7	22.2	7.1	SANDY LOAM
28458	R4059		7.4	0.99	34.5	3.97	2.58	3.73	2.06	82.2	11.8	6.0	LOAMY SAND
28459	R4061		8.1	0.69	40.8	0.42	0.16	7.54	14.0	92.2	5.5	2.3	SAND
28460	R3956		7.8	0.64	25.9	1.10	0.28	5.01	6.03	71.6	20.4	8.0	SANDY LOAM
28461	R3957		7.8	0.58	24.5	1.69	0.38	4.14	4.07	74.4	19.4	6.2	SANDY LOAM
28462	R3959		7.5	1.04	23.1	4.34	1.02	5.95	3.63	78.0	16.7	5.3	LOAMY SAND
28463	R3962		8.2	0.94	24.6	0.52	0.16	12.5	21.4	81.6	16.8	1.6	LOAMY SAND

Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage, Exch= Exchangeable, Avail= Available

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EMS
FT. COLLINS, COLORADO

March 6, 1989

Lab No.	Location	Depths	Total Sulfur %	T.S. AB t/1000t	Neut. Pot. t/1000t	T.S. ABP t/1000t	Nitrate-Nitrogen ppm	Boron ppm	Selenium ppm
28444	R3939		0.21	6.56	12.1	5.49	4.43	0.66	0.08
28445	R3953		0.20	6.25	54.3	48.0	4.75	0.37	0.09
28446	R3958		0.08	2.50	57.8	55.3	4.31	0.13	0.05
28447	R3960		0.17	5.31	5.61	0.30	8.47	0.30	0.11
28448	R3964		0.09	2.81	29.5	26.7	5.00	0.28	<0.02
28449	R3973		0.09	2.81	21.9	19.1	4.43	0.39	0.08
28450	R3976		0.07	2.19	28.1	25.9	4.87	0.17	0.08
28451	R3982		0.12	3.75	70.1	66.3	5.63	0.12	0.07
28452	R3975		0.09	2.81	38.7	35.9	6.64	0.18	0.08
28453	R3928		0.11	3.44	23.5	20.1	5.19	0.28	0.13
28454	R3932		0.08	2.50	31.0	28.5	6.39	0.25	0.09
28455	R3935		0.08	2.50	101.	98.6	6.70	0.26	0.05
28456	R3954		0.09	2.81	14.0	11.1	5.88	0.23	0.08
28457	R3955		0.08	2.50	30.3	27.8	7.21	0.22	0.06
28458	R4059		0.10	3.12	88.5	85.4	7.90	0.18	0.03
28459	R4061		0.24	7.50	25.0	17.5	7.16	0.25	0.04
28460	R3956		0.07	2.19	19.2	17.0	6.97	0.23	0.04
28461	R3957		0.08	2.50	41.6	39.1	5.69	0.20	0.04
28462	R3959		0.09	2.81	45.1	42.3	6.67	0.18	0.05
28463	R3962		0.17	5.31	59.5	54.2	5.93	0.23	0.06

Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neut. Pot.= Neutralization Potential

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EMS
FT. COLLINS, COLORADO

March 6, 1989

Lab No.	Location	Depths	pH	EC mmhos/cm @ 25°C	Saturation %	Calcium meq/l	Magnesium meq/l	Sodium meq/l	SAR	Sand %	Silt %	Clay %	Texture
28456	R3954		7.7	0.48	27.0	1.78	0.33	3.16	3.08	72.5	19.5	8.0	SANDY LOAM
28467	28456(DUP)		7.7	0.41	27.6	1.58	0.32	2.27	2.33	73.6	20.2	6.2	SANDY LOAM
28462	R3959		7.5	1.04	23.1	4.34	1.02	5.95	3.63	78.0	16.7	5.3	LOAMY SAND
28468	28462(DUP)		7.5	0.98	22.5	4.01	0.94	5.92	3.76	76.4	18.3	5.3	LOAMY SAND

Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage, Exch= Exchangeable, Avail= Available

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EMS
FT. COLLINS, COLORADO

March 6, 1989

Lab No.	Location	Depths	Total Sulfur %	T.S. AB t/1000t	Neut. Pot. t/1000t	T.S. ABP t/1000t	Nitrate-Nitrogen ppm	Boron ppm	Selenium ppm
28456	R3954		0.09	2.81	14.0	11.1	5.88	0.23	0.08
28467	28456(DUP)		0.08	2.50	13.7	11.2	6.99	0.25	0.07
28462	R3959		0.09	2.81	45.1	42.3	6.67	0.18	0.05
28468	28462(DUP)		0.10	3.12	47.8	44.7	5.88	0.21	0.06

Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neut. Pot.= Neutralization Potential

COLORADO STATE UNIVERSITY

Sample Site: Wishbone Hills Process Water (clarified) from Thickener Overflow Test #2
Lab No: 897591
Date Sampled:
Date Received: 02/15/89

Lab pH, s.u.	8.20
Lab Conductivity, umhos/cm @ 25C	330
Total Dissolved Solids (180), mg/l	244
Total Dissolved Solids (calc), mg/l	213
Boron, mg/l	0.26
Fluoride, mg/l	1.30
Ammonia Nitrogen as N, mg/l	0.16
Total Kjeldahl Nitrogen, mg/l	0.6
Ortho Phosphorus as P, mg/l	<0.001
Total Organic Phosphorus as P, mg/l	0.196
Total Phosphorus as P, mg/l	0.305
Total Alkalinity as CaCO3, mg/l	124
Total Acidity as CaCO3, mg/l	<1
Total Hardness as CaCO3, mg/l	183
Sodium Adsorption Ratio	0.19
Color, c.u.	<1
Total Suspended Solids, mg/l	258
Settleable Solids, ml/l	1.5

	mg/l	meq/l
Bicarbonate as HCO3	151	2.48
Carbonate as CO3	0	0.00
Chloride	3.2	0.09
Nitrate as N, mg/l	0.05	<0.01
Nitrite as N, mg/l	<0.01	<0.01
Sulfate	64	1.33
Calcium	49	2.44
Magnesium	15	1.22
Potassium	2.0	0.05
Sodium	6.0	0.26

Major Anions	3.90
Major Cations	3.97
Cation/Anion Difference	0.89 %

Trace Metals (Dissolved Concentrations), mg/l

Aluminum	0.1	Iron	<0.05
Arsenic	<0.005	Lead	<0.02
Barium	<0.5	Manganese	<0.02
Cadmium	<0.002	Mercury	<0.001
Chromium	<0.02	Selenium	<0.005
Copper	<0.02	Zinc	<0.01

Trace Metals (Total Concentrations), mg/l

Chromium, mg/l	0.04
Iron, mg/l	9.64
Manganese, mg/l	0.05

COLORADO STATE UNIVERSITY QUALITY ASSURANCE

ATOMIC ABSORPTION TRACE METAL ANALYSIS

Identification: EPA QC WS378-5,12,18, WP287-1
(Analyzed concurrently with Wishbone Hills samples)
Analyzed: February 16 - February 24, 1989

Parameter	Result	True Value	95% Confidence Interval
Arsenic, ug/l	56.0	51.0	41.6-58.7
Cadmium, ug/l	8.0	7.4	5.3-8.8
Lead, ug/l	36.0	34.0	27.6-39.8
Mercury, ug/l	3.1	3.0	2.16-3.85
Selenium, ug/l	23.0	25.0	17.4-28.3

ICAP TRACE METAL ANALYSIS

Identification: EPA QC WP1083 ICAP-19, ICAP-7
(Analyzed concurrently with Wishbone Hills samples)
Analyzed: February 17, 1989

Parameter	Result	True Value	% Recovery
Aluminum, ug/l	101	97.0	104.1
Barium, ug/l	101	97.0	104.1
Chromium, ug/l	100	103	97.1
Copper, ug/l	99.5	103	96.6
Iron, ug/l	98.5	102	96.6
Manganese, ug/l	98.0	102	96.1
Zinc, ug/l	97.1	101	96.1

NUTRIENT ANALYSIS

Identification: EPA QC WP284, WP486, WS378
(Analyzed concurrently with Wishbone Hills samples)
Analyzed: February 16 - 22, 1989

Parameter	Result	True Value	95% Confidence Interval
Ammonia as N, mg/l	2.09	2.00	1.78 - 2.18
Nitrate as N, mg/l	0.09	0.10	0.06 - 0.16
Total Kjeldahl as N, mg/l	0.54	0.50	0.31 - 0.70
Orthophosphate as P, mg/l	0.497	0.50	0.46 - 0.54

APPENDIX C-2

INTERLABORATORY SPLIT SAMPLE ANALYSES
CORRELATION COEFFICIENTS

Simple Regression X_1: CSU-PH Y_1: IML-PH

Count:	R:	R-squared:	Adj. R-squared:	RMS Residual:
20	.916	.838	.829	.236

Analysis of Variance Table

Source	DF:	Sum Squares:	Mean Square:	F-test:
REGRESSION	1	5.205	5.205	93.241
RESIDUAL	18	1.005	.056	p = .0001
TOTAL	19	6.21		

No Residual Statistics Computed

Simple Regression X_1: CSU-PH Y_1: IML-PH

Beta Coefficient Table

Variable:	Coefficient:	Std. Err.:	Std. Coeff.:	t-Value:	Probability:
INTERCEPT	-1.795				
SLOPE	1.183	.123	.916	9.656	.0001

Confidence Intervals Table

Variable:	95% Lower:	95% Upper:	90% Lower:	90% Upper:
MEAN (X,Y)	8.044	8.266	8.063	8.247
SLOPE	.926	1.441	.971	1.396

Simple Regression X_1: CSU-EC Y_1: IML-EC

Count:	R:	R-squared:	Adj. R-squared:	RMS Residual:
20	.839	.704	.687	.251

Analysis of Variance Table

Source	DF:	Sum Squares:	Mean Square:	F-test:
REGRESSION	1	2.684	2.684	42.729
RESIDUAL	18	1.131	.063	p = .0001
TOTAL	19	3.815		

No Residual Statistics Computed

Simple Regression X_1: CSU-EC Y_1: IML-EC

Beta Coefficient Table

Variable:	Coefficient:	Std. Err.:	Std. Coeff.:	t-Value:	Probability:
INTERCEPT	.214				
SLOPE	.75	.115	.839	6.537	.0001

Confidence Intervals Table

Variable:	95% Lower:	95% Upper:	90% Lower:	90% Upper:
MEAN (X,Y)	1	1.236	1.021	1.215
SLOPE	.509	.991	.551	.949

Simple Regression X_1: CSU-SAT Y_1: IML-SAT

Count:	R:	R-squared:	Adj. R-squared:	RMS Residual:
20	.978	.956	.954	4.3

Analysis of Variance Table

Source	DF:	Sum Squares:	Mean Square:	F-test:
REGRESSION	1	7295.469	7295.469	394.481
RESIDUAL	18	332.889	18.494	p = .0001
TOTAL	19	7628.358		

No Residual Statistics Computed

Simple Regression X_1: CSU-SAT Y_1: IML-SAT

Beta Coefficient Table

Variable:	Coefficient:	Std. Err.:	Std. Coeff.:	t-Value:	Probability:
INTERCEPT	-8.6				
SLOPE	1.13	.057	.978	19.862	.0001

Confidence Intervals Table

Variable:	95% Lower:	95% Upper:	90% Lower:	90% Upper:
MEAN (X,Y)	32.27	36.31	32.622	35.958
SLOPE	1.01	1.25	1.031	1.229

Simple Regression X_1: CSU-Ca Y_1: IML-Ca

Count:	R:	R-squared:	Adj. R-squared:	RMS Residual:
20	.978	.956	.953	.424

Analysis of Variance Table

Source	DF:	Sum Squares:	Mean Square:	F-test:
REGRESSION	1	69.428	69.428	386.608
RESIDUAL	18	3.232	.18	p = .0001
TOTAL	19	72.66		

No Residual Statistics Computed

Simple Regression X_1: CSU-Ca Y_1: IML-Ca

Beta Coefficient Table

Variable:	Coefficient:	Std. Err.:	Std. Coeff.:	t-Value:	Probability:
INTERCEPT	.324				
SLOPE	1.174	.06	.978	19.662	.0001

Confidence Intervals Table

Variable:	95% Lower:	95% Upper:	90% Lower:	90% Upper:
MEAN (X,Y)	1.552	1.951	1.587	1.916
SLOPE	1.048	1.299	1.07	1.277

Simple Regression X_1: CSU-Mg Y_1: IML-Mg

Count:	R:	R-squared:	Adj. R-squared:	RMS Residual:
20	.994	.989	.988	.132

Analysis of Variance Table

Source	DF:	Sum Squares:	Mean Square:	F-test:
REGRESSION	1	27.816	27.816	1587.377
RESIDUAL	18	.315	.018	p = .0001
TOTAL	19	28.132		

No Residual Statistics Computed

Simple Regression X_1: CSU-Mg Y_1: IML-Mg

Beta Coefficient Table

Variable:	Coefficient:	Std. Err.:	Std. Coeff.:	t-Value:	Probability:
INTERCEPT	.071				
SLOPE	1.096	.028	.994	39.842	.0001

Confidence Intervals Table

Variable:	95% Lower:	95% Upper:	90% Lower:	90% Upper:
MEAN (X,Y)	.642	.766	.653	.755
SLOPE	1.039	1.154	1.049	1.144

Simple Regression X_1: CSU-Na Y_1: IML-Na

Count:	R:	R-squared:	Adj. R-squared:	RMS Residual:
20	.911	.829	.82	3.304

Analysis of Variance Table

Source	DF:	Sum Squares:	Mean Square:	F-test:
REGRESSION	1	953.246	953.246	87.325
RESIDUAL	18	196.49	10.916	p = .0001
TOTAL	19	1149.736		

No Residual Statistics Computed

Simple Regression X_1: CSU-Na Y_1: IML-Na

Beta Coefficient Table

Variable:	Coefficient:	Std. Err.:	Std. Coeff.:	t-Value:	Probability:
INTERCEPT	.028				
SLOPE	1.143	.122	.911	9.345	.0001

Confidence Intervals Table

Variable:	95% Lower:	95% Upper:	90% Lower:	90% Upper:
MEAN (X,Y)	10.565	13.67	10.836	13.399
SLOPE	.886	1.4	.931	1.355

Simple Regression X_1: CSU-SAR Y_1: IML-SAR

Count:	R:	R-squared:	Adj. R-squared:	RMS Residual:
20	.801	.642	.622	8.847

Analysis of Variance Table

Source	DF:	Sum Squares:	Mean Square:	F-test:
REGRESSION	1	2525.513	2525.513	32.27
RESIDUAL	18	1408.706	78.261	p = .0001
TOTAL	19	3934.219		

No Residual Statistics Computed

Simple Regression X_1: CSU-SAR Y_1: IML-SAR

Beta Coefficient Table

Variable:	Coefficient:	Std. Err.:	Std. Coeff.:	t-Value:	Probability:
INTERCEPT	5.553				
SLOPE	.392	.069	.801	5.681	.0001

Confidence Intervals Table

Variable:	95% Lower:	95% Upper:	90% Lower:	90% Upper:
MEAN (X,Y)	13.342	21.655	14.068	20.929
SLOPE	.247	.537	.272	.511

Simple Regression X_1: CSU-SAND Y_1: IML-SAND

Count:	R:	R-squared:	Adj. R-squared:	RMS Residual:
20	.505	.255	.214	13.203

Analysis of Variance Table

Source	DF:	Sum Squares:	Mean Square:	F-test:
REGRESSION	1	1076.712	1076.712	6.177
RESIDUAL	18	3137.797	174.322	p = .023
TOTAL	19	4214.51		

No Residual Statistics Computed

Simple Regression X_1: CSU-SAND Y_1: IML-SAND

Beta Coefficient Table

Variable:	Coefficient:	Std. Err.:	Std. Coeff.:	t-Value:	Probability:
INTERCEPT	50.024				
SLOPE	.462	.186	.505	2.485	.023

Confidence Intervals Table

Variable:	95% Lower:	95% Upper:	90% Lower:	90% Upper:
MEAN (X,Y)	64.892	77.298	65.975	76.215
SLOPE	.071	.853	.14	.785

Simple Regression X_1: CSU-SILT Y_1: IML-SILT

Count:	R:	R-squared:	Adj. R-squared:	RMS Residual:
20	.549	.301	.262	9.279

Analysis of Variance Table

Source	DF:	Sum Squares:	Mean Square:	F-test:
REGRESSION	1	667.958	667.958	7.758
RESIDUAL	18	1549.792	86.1	p = .0122
TOTAL	19	2217.75		

No Residual Statistics Computed

Note: 1 case deleted with missing values.

Simple Regression X_1: CSU-SILT Y_1: IML-SILT

Beta Coefficient Table

Variable:	Coefficient:	Std. Err.:	Std. Coeff.:	t-Value:	Probability:
INTERCEPT	11.797				
SLOPE	.471	.169	.549	2.785	.0122

Confidence Intervals Table

Variable:	95% Lower:	95% Upper:	90% Lower:	90% Upper:
MEAN (X,Y)	16.89	25.61	17.652	24.848
SLOPE	.116	.827	.178	.765

Simple Regression X_1: CSU-CLAY Y_1: IML-CLAY

Count:	R:	R-squared:	Adj. R-squared:	RMS Residual:
20	.183	.033	-.02	4.427

Analysis of Variance Table

Source	DF:	Sum Squares:	Mean Square:	F-test:
REGRESSION	1	12.165	12.165	.621
RESIDUAL	18	352.784	19.599	p = .441
TOTAL	19	364.949		

No Residual Statistics Computed

Simple Regression X_1: CSU-CLAY Y_1: IML-CLAY

Beta Coefficient Table

Variable:	Coefficient:	Std. Err.:	Std. Coeff.:	t-Value:	Probability:
INTERCEPT	4.704				
SLOPE	.086	.109	.183	.788	.441

Confidence Intervals Table

Variable:	95% Lower:	95% Upper:	90% Lower:	90% Upper:
MEAN (X,Y)	5.575	9.735	5.938	9.372
SLOPE	-.143	.315	-.103	.275

Simple Regression X_1: CSU-TOTAL S Y_1: IML-TOTAL S

Count:	R:	R-squared:	Adj. R-squared:	RMS Residual:
20	.907	.823	.813	.023

Analysis of Variance Table

Source	DF:	Sum Squares:	Mean Square:	F-test:
REGRESSION	1	.042	.042	83.451
RESIDUAL	18	.009	.001	p = .0001
TOTAL	19	.051		

No Residual Statistics Computed

Simple Regression X_1: CSU-TOTAL S Y_1: IML-TOTAL S

Beta Coefficient Table

Variable:	Coefficient:	Std. Err.:	Std. Coeff.:	t-Value:	Probability:
INTERCEPT	.075				
SLOPE	.755	.083	.907	9.135	.0001

Confidence Intervals Table

Variable:	95% Lower:	95% Upper:	90% Lower:	90% Upper:
MEAN (X,Y)	.105	.126	.107	.124
SLOPE	.582	.929	.612	.899

Simple Regression X_1: CSU-CaC03 Y_1: IML-CaCO3

Count:	R:	R-squared:	Adj. R-squared:	RMS Residual:
20	.709	.502	.474	1.84

Analysis of Variance Table

Source	DF:	Sum Squares:	Mean Square:	F-test:
REGRESSION	1	61.402	61.402	18.143
RESIDUAL	18	60.919	3.384	p = .0005
TOTAL	19	122.321		

No Residual Statistics Computed

Note: 1 case deleted with missing values.

Simple Regression X_1: CSU-CaC03 Y_1: IML-CaCO3

Beta Coefficient Table

Variable:	Coefficient:	Std. Err.:	Std. Coeff.:	t-Value:	Probability:
INTERCEPT	2.664				
SLOPE	.478	.112	.709	4.259	.0005

Confidence Intervals Table

Variable:	95% Lower:	95% Upper:	90% Lower:	90% Upper:
MEAN (X,Y)	3.12	4.848	3.271	4.697
SLOPE	.242	.713	.283	.672

Simple Regression X_1: CSU-ABP Y_1: IML-ABP

Count:	R:	R-squared:	Adj. R-squared:	RMS Residual:
20	.721	.519	.493	18.309

Analysis of Variance Table

Source	DF:	Sum Squares:	Mean Square:	F-test:
REGRESSION	1	6518.577	6518.577	19.447
RESIDUAL	18	6033.64	335.202	p = .0003
TOTAL	19	12552.217		

No Residual Statistics Computed

Simple Regression X_1: CSU-ABP Y_1: IML-ABP

Beta Coefficient Table

Variable:	Coefficient:	Std. Err.:	Std. Coeff.:	t-Value:	Probability:
INTERCEPT	23.602				
SLOPE	.484	.11	.721	4.41	.0003

Confidence Intervals Table

Variable:	95% Lower:	95% Upper:	90% Lower:	90% Upper:
MEAN (X,Y)	27.628	44.831	29.13	43.329
SLOPE	.253	.714	.294	.674

Simple Regression X_1: CSU-NITRATE,NITROGEN Y_1: IML-NITRATE,NITROGEN

Count:	R:	R-squared:	Adj. R-squared:	RMS Residual:
20	.498	.248	.206	1.072

Analysis of Variance Table

Source	DF:	Sum Squares:	Mean Square:	F-test:
REGRESSION	1	6.822	6.822	5.94
RESIDUAL	18	20.672	1.148	p = .0254
TOTAL	19	27.493		

No Residual Statistics Computed

Simple Regression X_1: CSU-NITRATE,NITROGEN Y_1: IML-NITRATE,NITROGEN

Beta Coefficient Table

Variable:	Coefficient:	Std. Err.:	Std. Coeff.:	t-Value:	Probability:
INTERCEPT	5.711				
SLOPE	.605	.248	.498	2.437	.0254

Confidence Intervals Table

Variable:	95% Lower:	95% Upper:	90% Lower:	90% Upper:
MEAN (X,Y)	5.508	6.514	5.595	6.427
SLOPE	.083	1.127	.175	1.036

Simple Regression X_1: CSU-BORON Y_1: IML-BORON

Count:	R:	R-squared:	Adj. R-squared:	RMS Residual:
20	.195	.038	-.016	.119

Analysis of Variance Table

Source	DF:	Sum Squares:	Mean Square:	F-test:
REGRESSION	1	.01	.01	.71
RESIDUAL	18	.253	.014	p = .4106
TOTAL	19	.263		

No Residual Statistics Computed

Simple Regression X_1: CSU-BORON Y_1: IML-BORON

Beta Coefficient Table

Variable:	Coefficient:	Std. Err.:	Std. Coeff.:	t-Value:	Probability:
INTERCEPT	.344				
SLOPE	-.309	.367	-.195	.842	.4106

Confidence Intervals Table

Variable:	95% Lower:	95% Upper:	90% Lower:	90% Upper:
MEAN (X,Y)	.2	.311	.21	.301
SLOPE	-1.08	.462	-.945	.327

Simple Regression X_1: CSU-SELENIUM Y_1: IML-SELENIUM

Count:	R:	R-squared:	Adj. R-squared:	RMS Residual:
20	.596	.355	.319	.023

Analysis of Variance Table

Source	DF:	Sum Squares:	Mean Square:	F-test:
REGRESSION	1	.005	.005	9.894
RESIDUAL	18	.009	.001	p = .0056
TOTAL	19	.014		

No Residual Statistics Computed

Simple Regression X_1: CSU-SELENIUM Y_1: IML-SELENIUM

Beta Coefficient Table

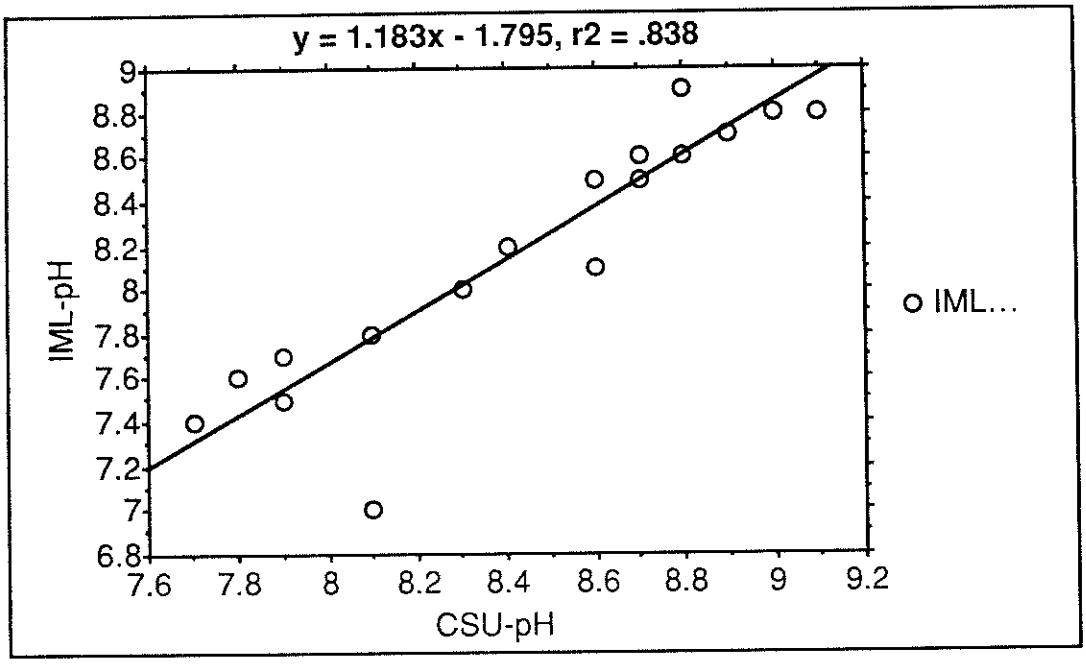
Variable:	Coefficient:	Std. Err.:	Std. Coeff.:	t-Value:	Probability:
INTERCEPT	.045				
SLOPE	.212	.067	.596	3.145	.0056

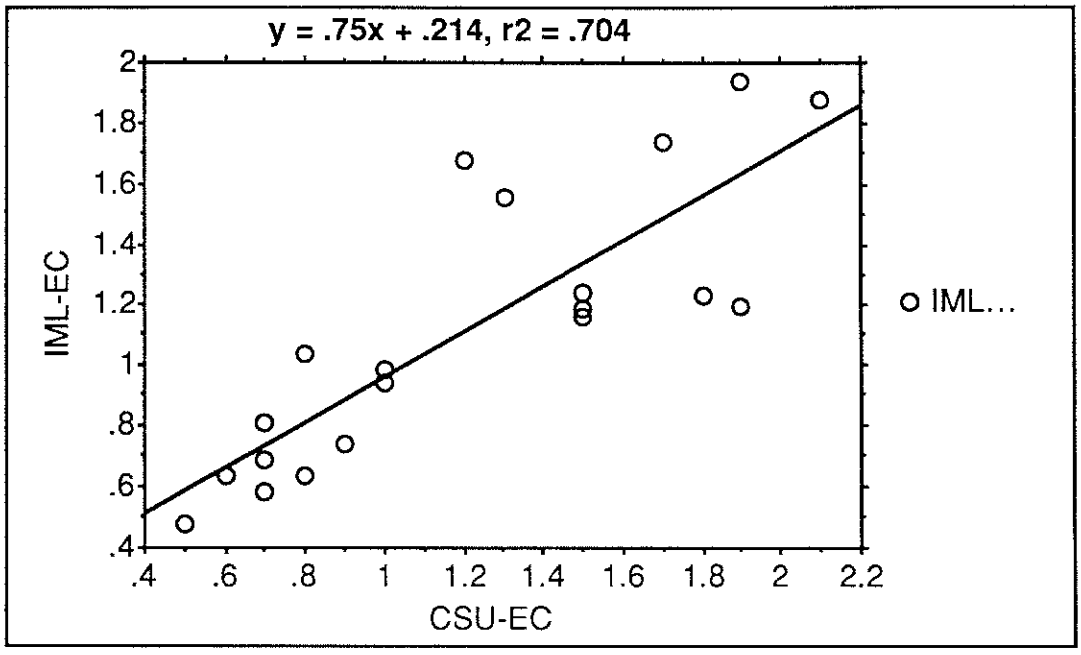
Confidence Intervals Table

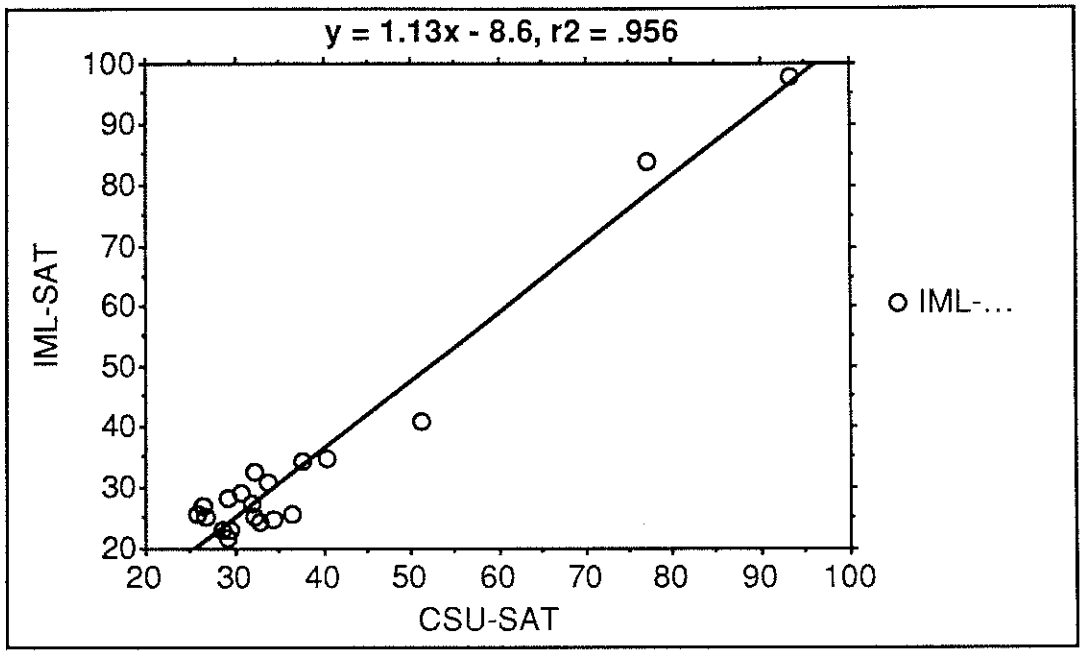
Variable:	95% Lower:	95% Upper:	90% Lower:	90% Upper:
MEAN (X,Y)	.056	.077	.058	.075
SLOPE	.07	.354	.095	.329

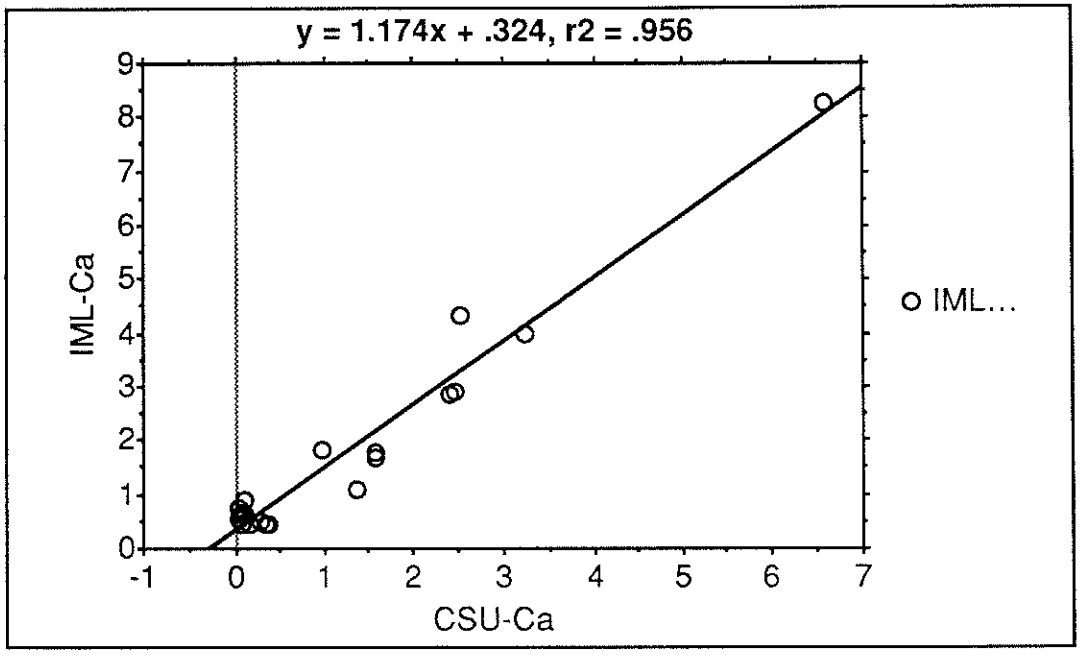
APPENDIX C-3

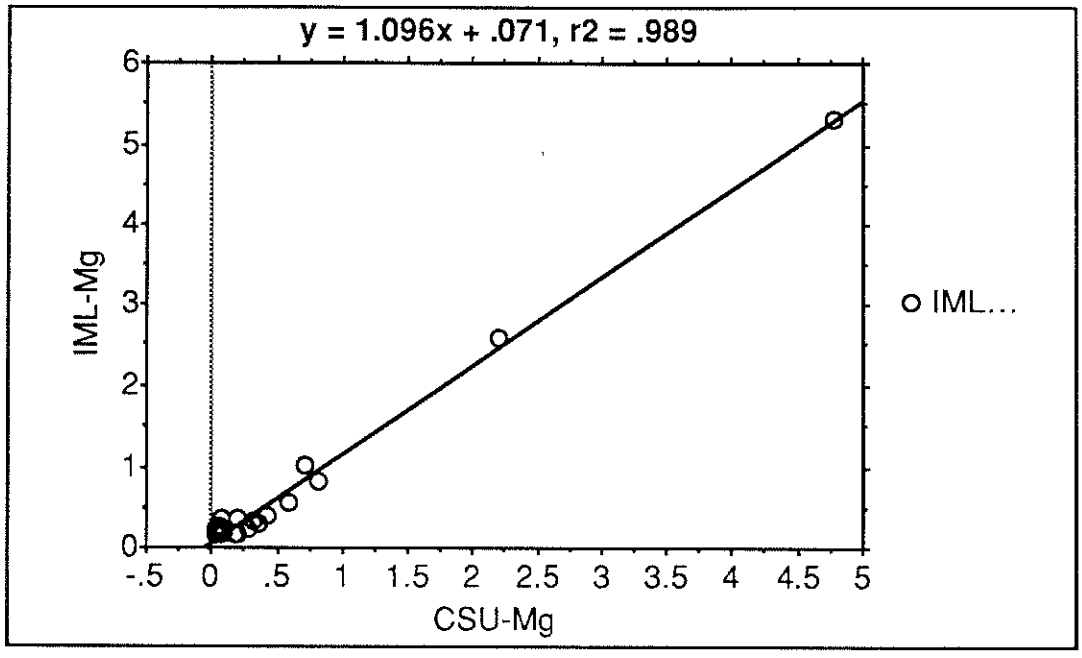
INTERLABORATORY CORRELATION PLOTS

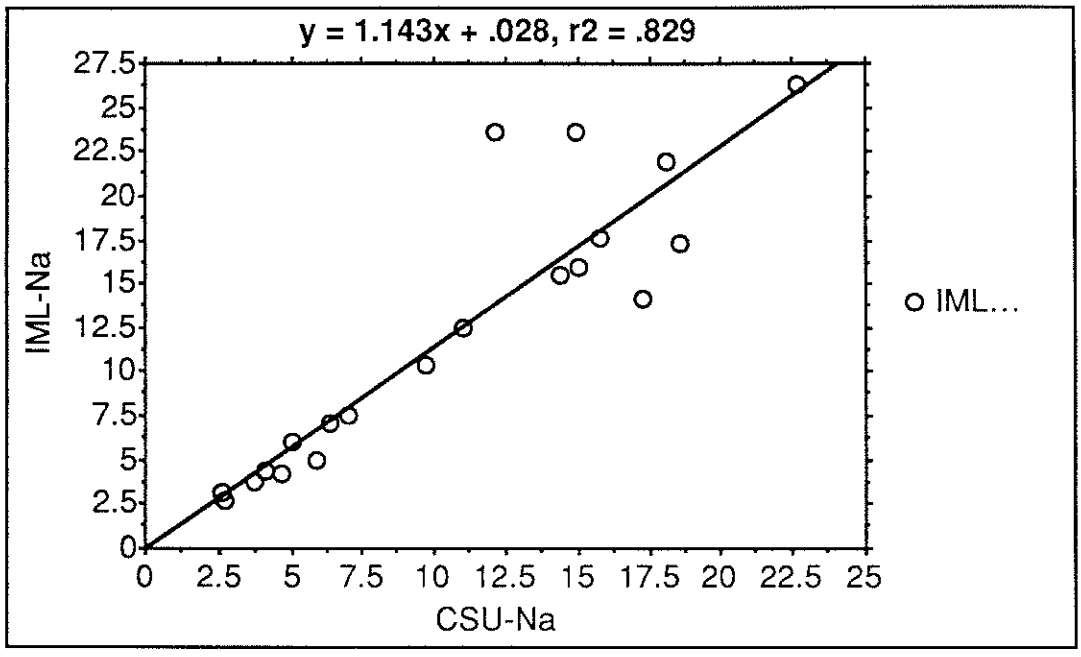

y = 1.183x - 1.795, r2 = .838
IML-pH
CSU-pH
9
8.8
8.6
8.4
8.2
8
7.8
7.6
7.4
7.2
7
6.8
7.6
7.8
8
8.2
8.4
8.6
8.8
9
9.2
IML...

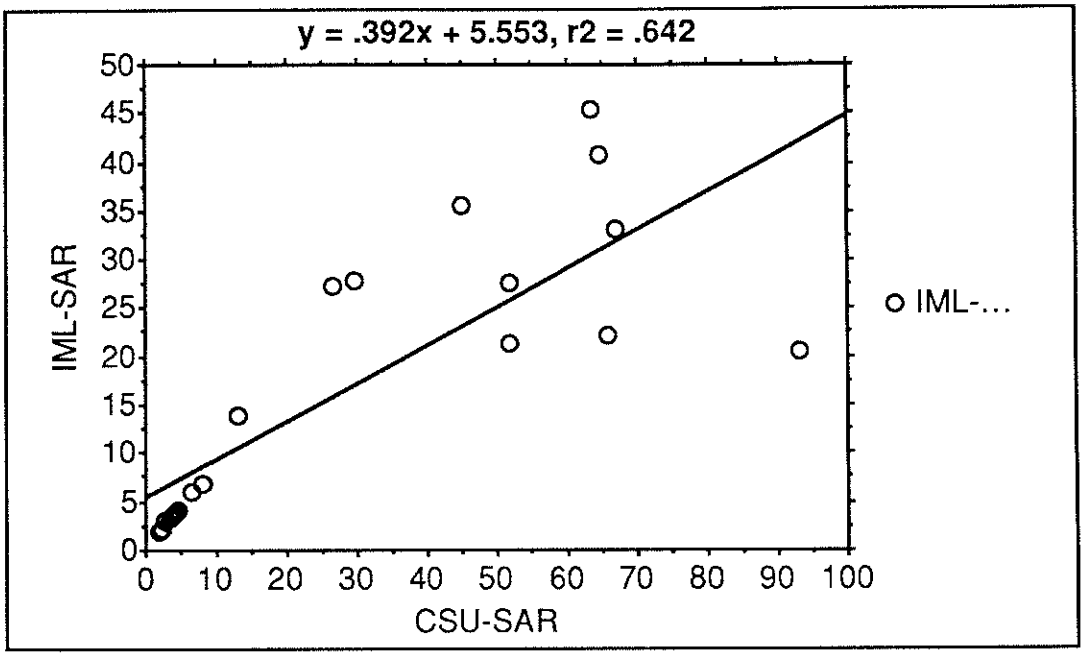

y = .75x + .214, r2 = .704
IML-EC
CSU-EC
2
1.8
1.6
1.4
1.2
1
.8
.6
.4
.4
.6
.8
1
1.2
1.4
1.6
1.8
2
2.2
IML...

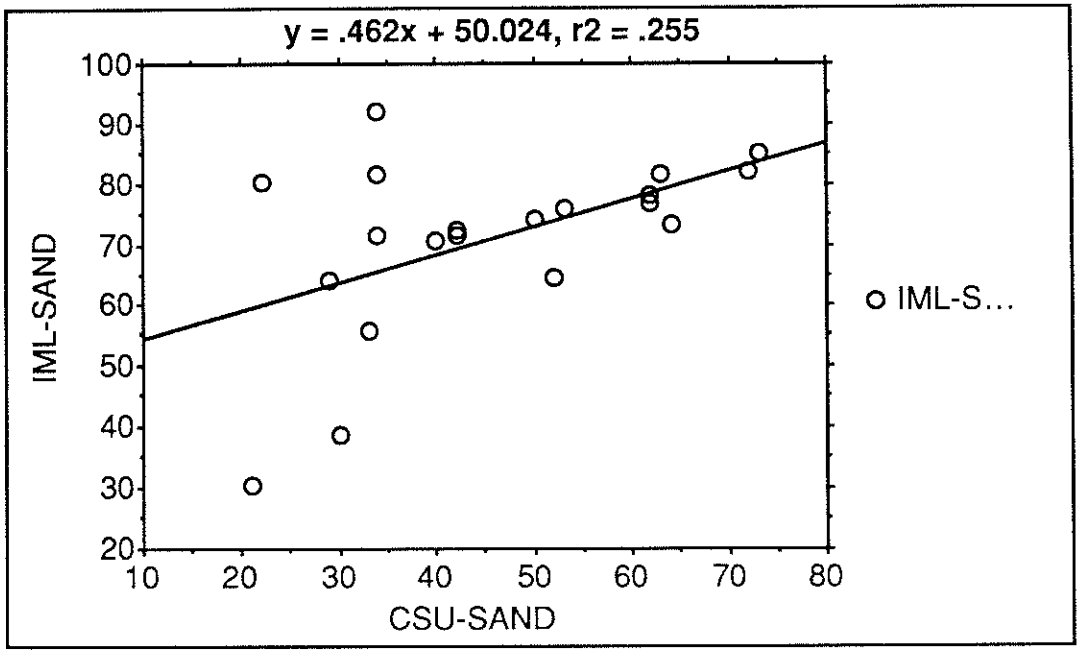

y = 1.13x - 8.6, r2 = .956
IML-SAT
CSU-SAT
100
90
80
70
60
50
40
30
20
20
30
40
50
60
70
80
90
100
IML-...

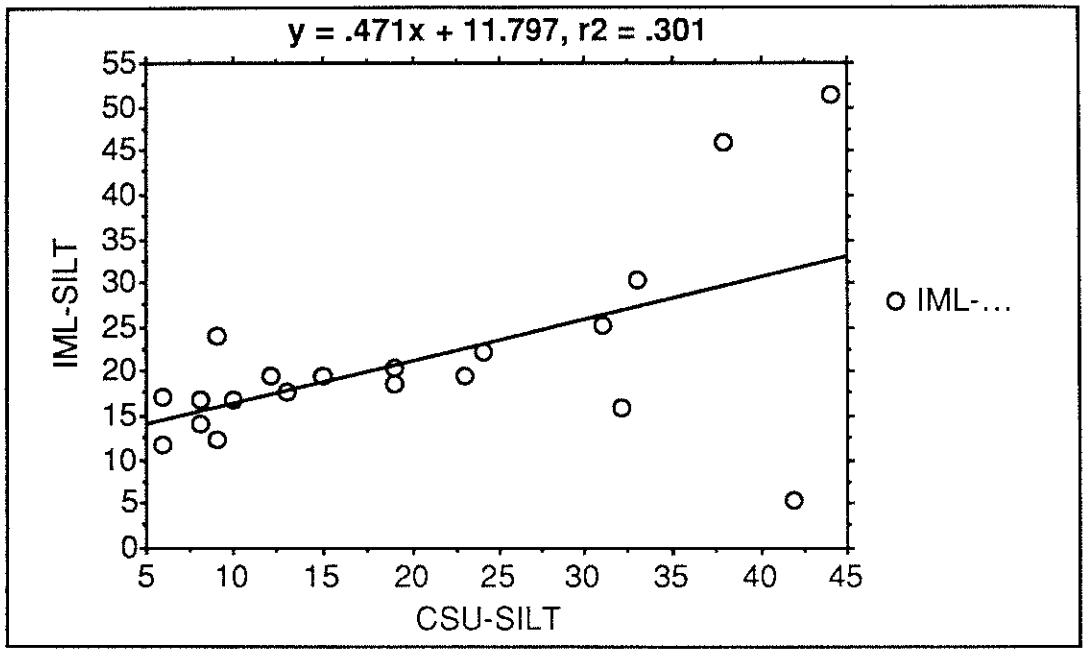

y = 1.174x + .324, r2 = .956
IML-Ca
CSU-Ca
IML...
9
8
7
6
5
4
3
2
1
0
-1
0
1
2
3
4
5
6
7

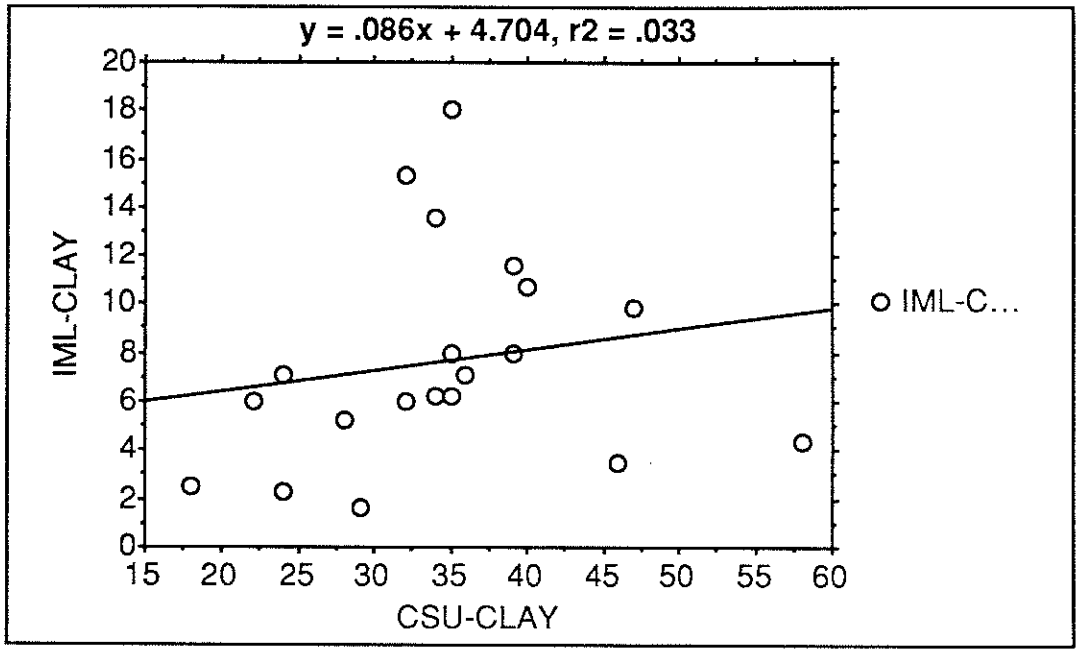

y = 1.096x + .071, r2 = .989
IML-Mg
CSU-Mg
0
1
2
3
4
5
6
-.5
0
.5
1
1.5
2
2.5
3
3.5
4
4.5
5
IML...

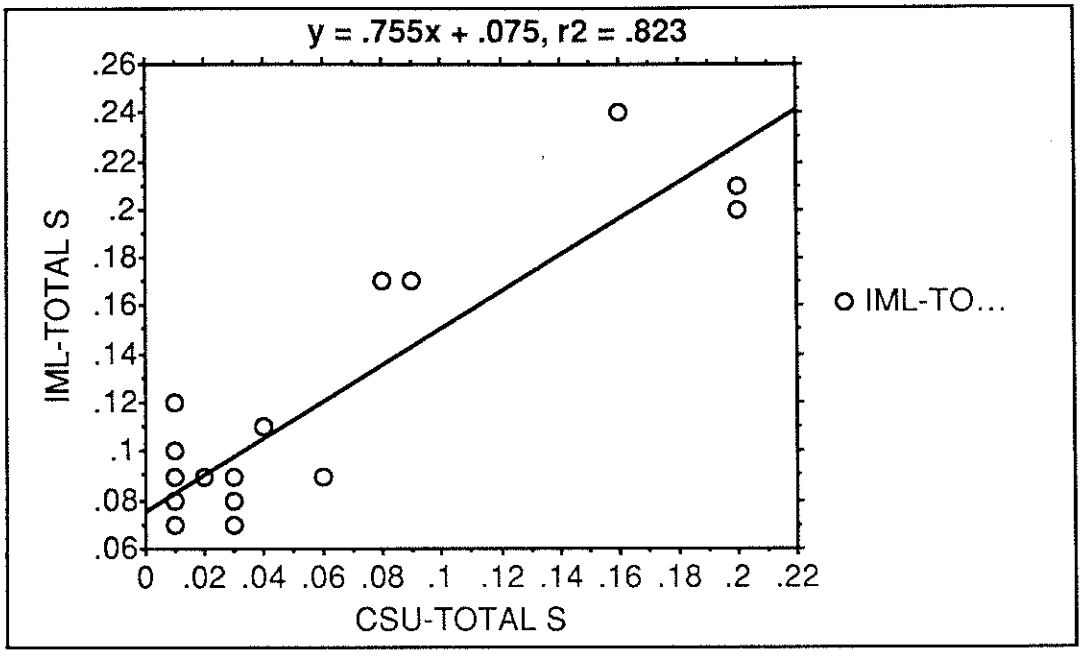

y = 1.143x + .028, r2 = .829
IML-Na
CSU-Na
0
2.5
5
7.5
10
12.5
15
17.5
20
22.5
25
27.5
IML...

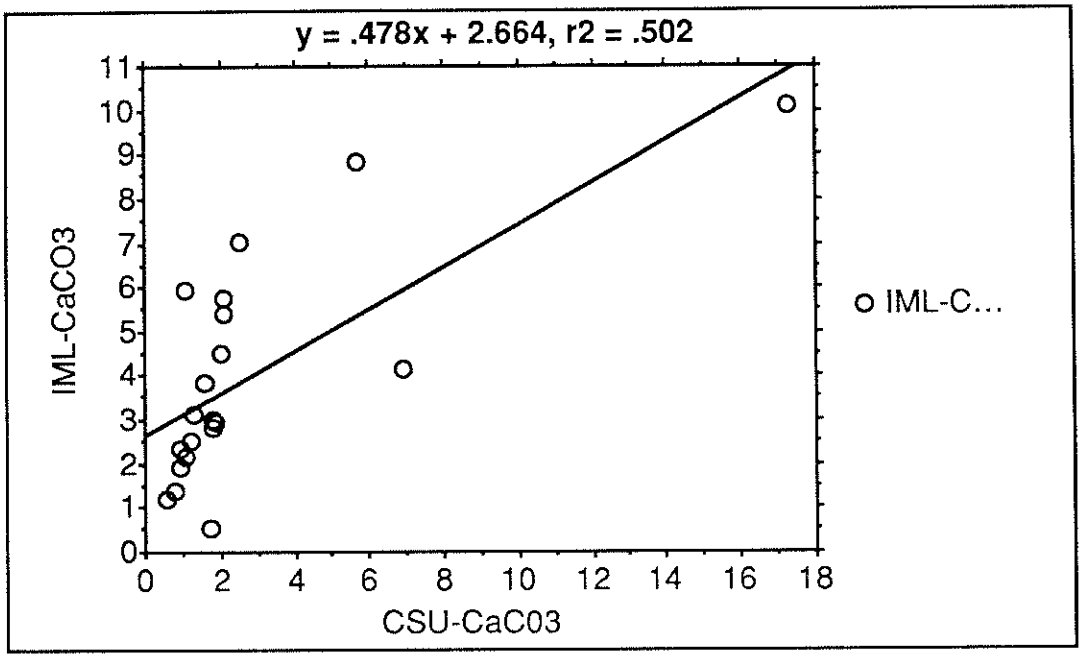

y = .392x + 5.553, r2 = .642
IML-SAR
CSU-SAR
0
5
10
15
20
25
30
35
40
45
50
0
10
20
30
40
50
60
70
80
90
100
IML-...

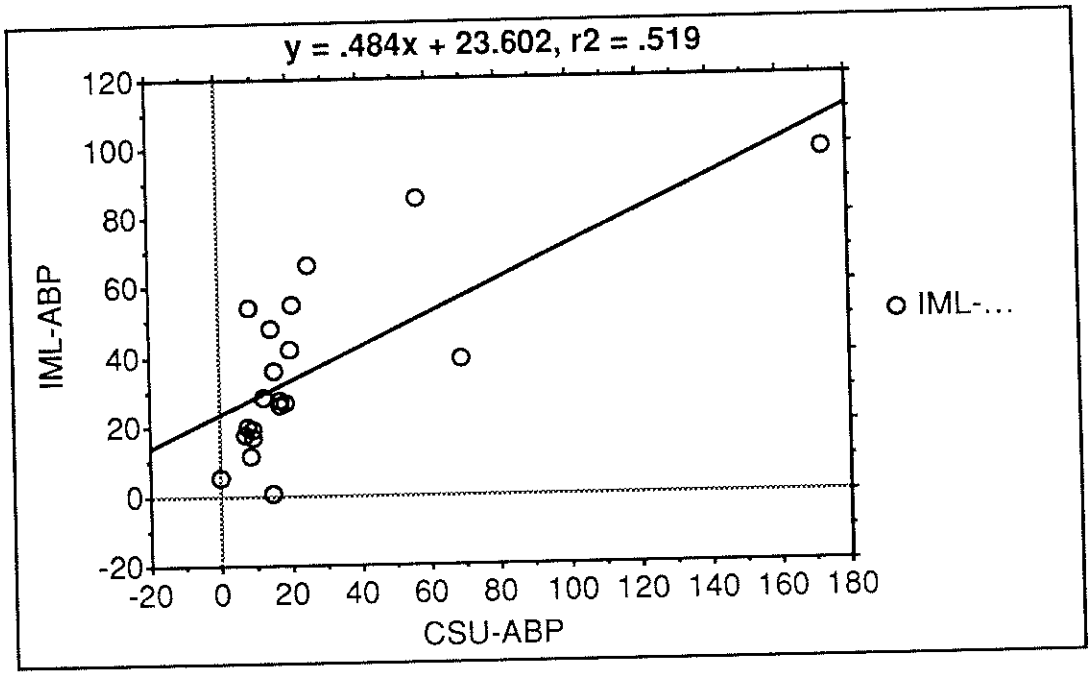

y = .462x + 50.024, r2 = .255
IML-SAND
CSU-SAND
100
90
80
70
60
50
40
30
20
10
20
30
40
50
60
70
80
IML-S...

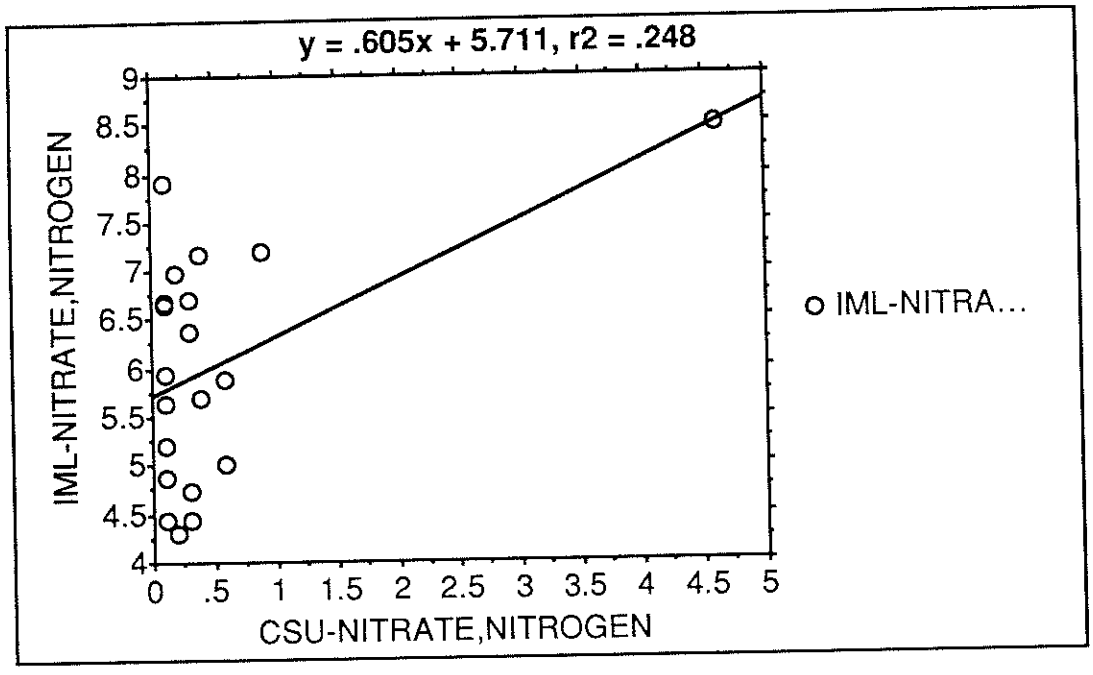

y = .471x + 11.797, r2 = .301
IML-SILT
CSU-SILT
0
5
10
15
20
25
30
35
40
45
50
55
5
10
15
20
25
30
35
40
45
IML-...

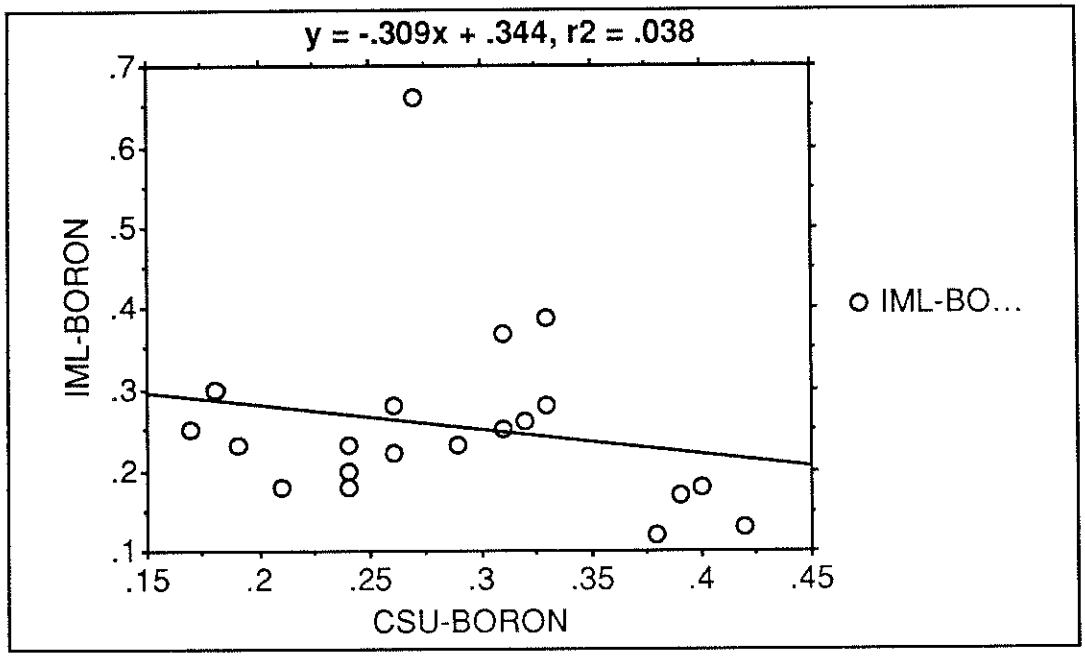

y = .086x + 4.704, r2 = .033
IML-CLAY
CSU-CLAY
IML-C...
0
2
4
6
8
10
12
14
16
18
20
15
20
25
30
35
40
45
50
55
60

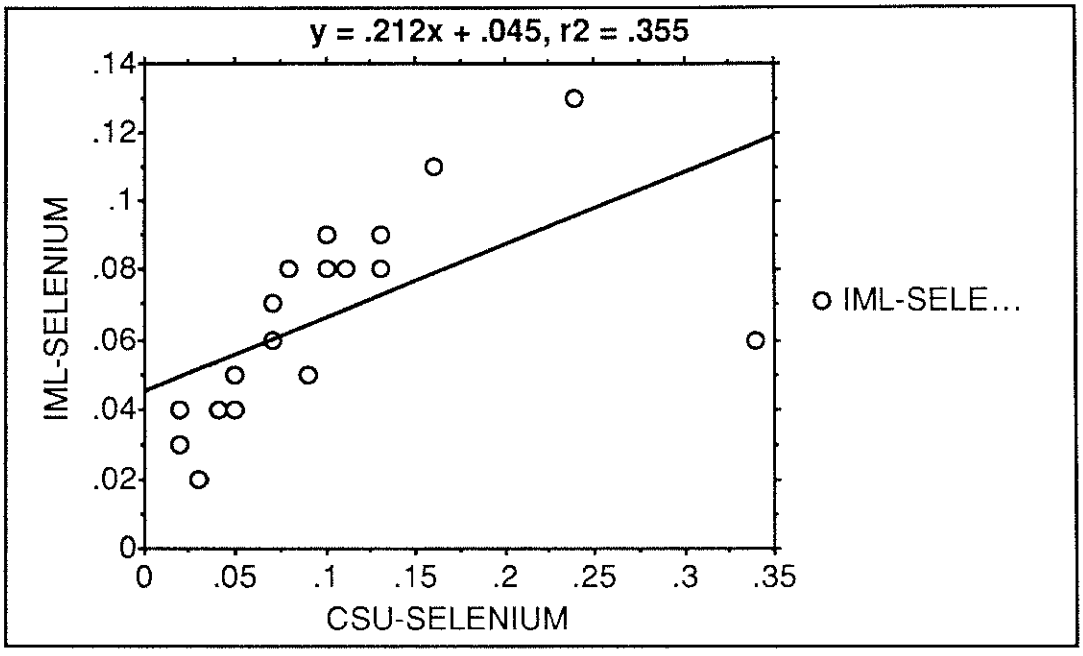

y = .755x + .075, r2 = .823
IML-TOTAL S
.26
.24
.22
.2
.18
.16
.14
.12
.1
.08
.06
0 .02 .04 .06 .08 .1 .12 .14 .16 .18 .2 .22
CSU-TOTAL S
IML-TO...


y = .478x + 2.664, r2 = .502
IML-CaCO3
CSU-CaC03
IML-C...
0
1
2
3
4
5
6
7
8
9
10
11
0
2
4
6
8
10
12
14
16
18


y = .484x + 23.602, r2 = .519
IML-ABP
CSU-ABP
120
100
80
60
40
20
0
-20
-20
0
20
40
60
80
100
120
140
160
180
IML-...


y = .605x + 5.711, r2 = .248
IML-NITRATE,NITROGEN
9
8.5
8
7.5
7
6.5
6
5.5
5
4.5
4
0
.5
1
1.5
2
2.5
3
3.5
4
4.5
5
CSU-NITRATE,NITROGEN
IML-NITRA...


y = -.309x + .344, r2 = .038
IML-BORON
.7
.6
.5
.4
.3
.2
.1
.15
.2
.25
.3
.35
.4
.45
CSU-BORON
IML-BO...


y = .212x + .045, r2 = .355
IML-SELENIUM
.14
.12
.1
.08
.06
.04
.02
0
0
.05
.1
.15
.2
.25
.3
.35
CSU-SELENIUM
IML-SELE...

APPENDIX D
STATISTICAL SUMMARIES

APPENDIX D-1

DRILL HOLE GEOCHEMICAL SUMMARY STATISTICS

DRILL HOLE	pH	E.C.	Ca	Mg	Na	K	SAR	Sat	B	Se	NO3-N	Snd	Slt	Cly	Total S	SO4-S	CaCO3	Acid-Base Pot.
	-----paste-----	mmhos/cm	--------meq/l--------					%	---AB-DTPA--ppm		2M KCl ppm	---------%			----------%-------			
PB-69A																		
Minimum	7.5	0.5	0.05	0.03	2.6	0.01	2.9	21.9	<0.01	<0.01	0.1	16	5	10	<0.01	<0.01	0.1	-10.22
Maximum	9.5	3.6	7.53	2.80	35.0	0.81	97.9	187.6	0.46	0.31	6.8	85	43	55	0.36	0.013	5.7	57.06
Mean	8.9	2.0	0.61	0.39	19.3	0.20	46.9	46.9	0.30	0.13	2.2	45	25	30	0.05	0.005	1.9	18.15
S. Deviation	0.5	0.6	1.31	0.57	6.6	0.18	24.8	29.2	0.13	0.07	1.8	16	8	10	0.07	0.003	1.3	13.56
PB-80																		
Minimum	7.9	0.3	0.48	0.18	1.6	0.05	1.6	20.7	0.10	<0.01	0.3	28	0	9	<0.01	<0.001	0.3	3.00
Maximum	8.8	2.2	2.81	0.95	19.1	0.23	16.6	38.9	0.50	0.18	3.7	91	32	47	0.16	0.009	4.5	44.16
Mean	8.4	1.0	1.37	0.48	8.6	0.12	9.1	31.1	0.32	0.05	1.3	61	14	26	0.03	0.003	1.9	18.18
S. Deviation	0.3	0.5	0.59	0.20	5.0	0.06	5.0	5.4	0.12	0.05	1.0	21	9	13	0.04	0.003	1.2	12.36
PB-87																		
Minimum	8.4	0.4	0.20	0.08	3.7	0.03	3.7	19.1	0.15	<0.01	0.5	24	7	10	<0.01	<0.001	0.5	4.38
Maximum	8.9	1.7	1.42	0.69	17.7	0.18	18.7	42.1	0.50	0.06	2.5	83	30	46	0.02	0.003	5.5	55.06
Mean	8.7	1.0	0.91	0.40	10.6	0.09	13.6	28.9	0.28	0.01	1.0	69	12	19	0.01	0.001	1.6	16.10
S. Deviation	0.2	0.5	0.34	0.16	4.8	0.05	5.0	7.9	0.12	0.02	0.6	18	7	11	0.01	0.001	1.5	15.44
PB-85																		
Minimum	7.0	0.5	0.28	0.16	2.7	0.08	1.7	23.7	0.15	<0.01	0.1	20	2	14	<0.01	<0.001	0.2	-3.72
Maximum	9.0	2.7	7.98	4.25	30.4	1.49	31.9	52.5	0.50	0.04	6.4	84	42	50	0.28	0.003	12.8	128.03
Mean	8.0	1.1	1.83	1.12	9.5	0.50	11.0	39.8	0.31	0.01	1.2	55	14	31	0.05	0.001	2.1	18.88
S. Deviation	0.5	0.6	2.09	1.11	7.5	0.40	8.6	8.5	0.10	0.01	1.3	20	11	11	0.06	0.001	2.8	28.38
PB-74																		
Minimum	7.6	0.3	0.03	0.01	1.9	<0.01	3.0	14.3	<0.01	<0.01	0.4	14	2	12	<0.01	<0.001	0.20	1.69
Maximum	10.0	1.7	1.38	0.82	37.9	0.31	107.0	158.8	0.40	0.31	6.1	86	50	42	0.12	0.019	18.50	185.10
Mean	9.0	1.5	0.31	0.15	14.8	0.07	48.5	71.1	0.22	0.11	2.4	49	25	25	0.02	0.003	2.90	28.59
S. Deviation	0.7	0.8	0.29	0.16	8.8	0.06	33.6	43.5	0.12	0.09	1.6	22	15	9	0.03	0.004	3.50	34.98

DRILL HOLE	-----paste----- pH	E.C. mmhos/cm	Ca	Mg	Na	K	SAR	Sat %	---AB-DTPA-- B	Se ppm	2M KCl NO3-N ppm	Snd	Slt	Cly %	Total S	SO4-S %	CaCO3	Acid-Base Pot.
			meq/l															
PB-92																		
Minimum	8.6	0.6	0.03	0.02	7.3	0.04	35.4	26.4	0.20	0.08	0.1	19	6	12	<0.01	<0.001	0.6	-2.44
Maximum	9.5	2.3	0.19	0.10	25.1	0.27	93.0	129.1	0.74	0.39	0.5	82	44	46	0.43	0.009	17.3	173.03
Mean	9.1	1.4	0.07	0.04	15.9	0.12	70.7	60.0	0.32	0.18	0.3	44	22	33	0.06	0.002	2.1	19.41
S. Deviation	0.2	0.4	0.04	0.02	4.2	0.07	13.2	36.8	0.12	0.10	0.1	14	10	8	0.09	0.002	3.1	31.32
PB-60																		
Minimum	7.8	0.5	0.24	0.17	2.6	0.26	2.1	25.5	0.13	0.04	<0.1	34	8	18	<0.01	0.001	0.8	8.03
Maximum	8.8	1.5	2.51	0.82	15.3	1.42	33.9	36.4	0.42	0.34	4.6	73	24	58	0.08	0.004	6.9	68.75
Mean	8.1	0.8	1.63	0.45	5.8	0.58	8.2	29.8	0.25	0.11	0.9	51	15	34	0.02	0.003	2.2	21.25
S. Deviation	0.3	0.3	0.75	0.22	3.8	0.35	9.9	3.5	0.08	0.09	1.4	13	6	11	0.02	0.001	1.8	18.47
PB-105																		
Minimum	7.9	1.0	0.05	0.03	11.0	0.13	33.5	20.4	0.19	<0.01	<0.1	27	6	15	<0.01	<0.001	0.2	-3.47
Maximum	9.1	3.2	0.60	0.63	26.4	3.66	66.0	39.1	0.85	0.19	0.7	78	42	47	0.18	0.005	18.7	186.78
Mean	8.6	1.8	0.23	0.20	18.8	0.72	46.9	29.2	0.36	0.06	0.3	53	15	32	0.04	0.002	3.3	31.29
S. Deviation	0.3	0.6	0.16	0.19	4.2	0.98	9.6	5.4	0.16	0.05	0.2	14	9	10	0.05	0.002	5.0	50.15
PB-101																		
Minimum	7.7	0.9	0.10	0.08	8.1	0.14	4.1	24.5	0.30	0.03	<0.1	21	5	21	0.01	<0.001	0.3	2.19
Maximum	8.8	1.9	6.59	4.78	18.0	0.95	45.1	93.4	0.53	0.26	6.4	68	44	51	0.07	0.010	2.6	25.81
Mean	8.3	1.5	1.45	1.02	13.0	0.52	21.0	44.2	0.40	0.09	1.9	48	20	32	0.03	0.003	1.7	15.93
S. Deviation	0.4	0.3	1.90	1.36	3.2	0.29	12.8	25.4	0.07	0.07	2.4	17	13	9	0.02	0.003	0.7	6.90
PB-84																		
Minimum	7.6	0.3	0.10	0.06	2.2	0.03	3.2	24.2	0.12	<0.01	<0.1	5	2	8	<0.01	<0.001	0.3	0.59
Maximum	8.9	1.6	1.89	0.82	18.8	2.33	59.6	53.0	0.72	0.17	11.0	90	42	59	0.08	0.003	2.3	23.03
Mean	8.4	1.2	0.51	0.25	13.0	0.35	31.3	35.5	0.47	0.09	2.8	31	26	42	0.02	0.001	1.0	9.87
S. Deviation	0.5	0.3	0.54	0.23	4.9	0.59	19.5	7.1	0.14	0.06	2.9	31	13	20	0.02	0.001	0.5	5.30

DRILL HOLE	paste pH	paste E.C. mmhos/cm	Ca meq/l	Mg meq/l	Na meq/l	K meq/l	SAR	Sand %	Silt %	Clay %	Total S %	SO4-S %	CaCO3 %	Acid-Base Potential *
PB-107														
Minimum	8.1	0.2	0.10	<0.1	1.7	<0.1	2.3	10	6	14	<0.01	<0.001	.0	1.30
Maximum	9.1	3.0	1.20	1.10	48.7	0.90	83.3	78	38	52	0.22	0.009	18.1	181.03
Mean	8.4	1.4	0.44	0.30	15.3	0.33	27.7	47	24	30	0.02	0.001	2.5	24.32
S. Deviation	0.2	0.7	0.23	0.21	9.5	0.17	17.3	17	10	8	0.03	0.002	3.2	31.83
PB-108														
Minimum	8.4	0.6	0.10	<0.1	5.9	<0.1	9.3	20	2	14	<0.01	<0.001	0.7	7.06
Maximum	9.5	3.0	0.80	1.70	43.4	0.50	72.5	76	44	60	0.45	0.005	15.1	150.86
Mean	9.1	1.3	0.25	0.33	14.4	0.17	31.6	52	21	27	0.04	0.001	3.2	30.44
S. Deviation	0.2	0.5	0.15	0.32	6.3	0.10	16.2	15	9	9	0.08	0.001	3.3	33.67
PB-109														
Minimum	6.4	0.2	0.10	<0.1	0.2	<0.1	2.1	40	0	0	<0.01	0.001	0.1	0.06
Maximum	8.7	1.7	5.60	4.50	19.6	5.60	49.1	98	30	36	0.04	0.003	9.8	98.03
Mean	8.3	0.7	0.48	0.30	6.4	0.35	14.7	59	17	24	0.01	0.001	1.4	9.38
S. Deviation	0.5	0.4	0.85	0.73	4.6	0.86	11.9	18	8	11	0.01	0.001	1.9	17.37

* - tons CaCO3/1000 tons material

APPENDIX D-2
LITHOLOGIC GEOCHEMICAL SUMMARY STATISTICS

LITH CODE : GR

Lab #	Sample ID#	Lith	pH (paste)	E.C. (paste) mmhos/cm	Ca meq/l	Mg meq/l	Na meq/l	K meq/l	SAR	Sat %	B (AB-DTPA) ppm	Se (AB-DTPA) ppm	2M KCl NO3-N ppm
R4028	45-55	GR	8.1	0.4	1.27	0.59	1.6	0.10	1.6	23.2	0.18	<0.01	0.8
R4041	20-30	GR	8.4	0.5	1.42	0.50	3.7	0.08	3.7	20.5	0.25	<0.01	0.6
R4050	10-20	GR	7.8	0.5	1.06	0.36	3.2	0.19	3.7	27.1	0.19	<0.01	1.0
R4051	20-30	GR	7.7	0.7	1.57	1.31	3.4	0.58	2.8	23.7	0.20	<0.01	1.0
R4052	30-40	GR	7.1	0.8	2.77	2.34	2.7	0.97	1.7	35.2	0.50	<0.01	2.0
R4053	40-50	GR	7.3	0.6	1.35	1.17	2.7	0.71	2.4	28.6	0.34	<0.01	1.3
R4054	50-60	GR	7.0	1.0	1.48	1.69	4.2	0.81	3.3	43.0	0.39	<0.01	2.4
R4072	10-20	GR	7.7	0.3	0.50	0.33	2.5	0.09	3.9	22.6	0.15	<0.01	0.4
R4073	20-30	GR	7.6	0.3	0.48	0.25	1.9	0.05	3.2	23.0	0.10	<0.01	0.4
R4074	30-40	GR	7.9	0.3	0.59	0.31	2.0	0.08	3.0	28.4	0.17	<0.01	0.9
R4075	40-50	GR	8.2	0.3	0.67	0.38	2.6	0.06	3.5	21.3	0.11	<0.01	1.2
R4076	50-60	GR	8.2	0.3	0.69	0.39	2.3	0.02	3.1	21.7	0.16	<0.01	2.2
R4077	60-70	GR	8.1	0.3	0.50	0.25	2.0	0.02	3.3	32.4	0.06	<0.01	1.2
R4078	70-80	GR	8.2	0.4	0.41	0.22	2.3	0.08	4.1	24.2	0.26	<0.01	2.1
R4079	80-90	GR	8.2	0.5	0.38	0.20	3.3	0.08	6.2	18.2	0.26	<0.01	1.6
R4080	90-100	GR	8.2	0.5	0.78	0.42	4.2	0.19	5.5	22.4	0.24	<0.01	2.6
R3985	20-30	GR	7.8	0.9	1.89	0.69	3.6	2.33	3.2	26.4	0.12	<0.01	0.5
R3986	30-40	GR	7.8	1.6	1.53	0.82	15.0	0.57	13.9	24.2	0.34	<0.01	<0.1
R3987	40-50	GR	7.6	0.3	0.55	0.28	2.2	0.03	3.4	29.1	0.72	0.01	
R3988	50-60	GR	7.8	0.8	0.59	0.28	8.9	0.30	13.5	36.8	0.43	0.04	6.1
R4026	25-35	GR	8.2	0.3	0.69	0.33	2.4	0.06	3.4	26.7	0.13	<0.01	0.7
R4027	35-45	GR	7.9	0.3	0.48	0.26	2.2	0.05	3.6	29.3	0.10	<0.01	0.4

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		---------%---------				----------%---------			
R4028	45-55	87	4	9	LS	<0.01	<0.001	0.3	3.000
R4041	20-30	81	7	12	SL	0.02	<0.001	0.5	4.375
R4050	10-20					0.01	<0.001	0.2	1.688
R4051	20-30	84	2	14	LS/SL	0.04	<0.001	1.2	10.750
R4052	30-40					0.01	<0.001	0.2	1.688
R4053	40-50	78	2	20	SCL/SL	0.01	<0.001	0.2	1.688
R4054	50-60	84	2	14	LS/SL	<0.01	0.001	0.3	3.031
R4072	10-20	80	4	16	SL	<0.01	<0.001	0.2	2.000
R4073	20-30	86	2	12	LS	0.01	<0.001	0.2	1.688
R4074	30-40	82	2	16	SL	0.01	<0.001	0.2	1.688
R4075	40-50	80	4	16	SL	0.01	<0.001	0.2	1.688
R4076	50-60	80	2	18	SL	<0.01	<0.001	0.3	3.000
R4077	60-70	84	2	14	LS/SL	0.01	0.001	0.3	2.719
R4078	70-80	76	6	18	SL	0.01	<0.001	0.2	1.688
R4079	80-90	68	13	19	SL	0.01	<0.001	0.2	1.688
R4080	90-100	72	12	16	SL	0.01	<0.001	0.4	3.688
R3985	20-30	88	3	9	LS	0.02	<0.001	0.7	6.375
R3986	30-40	78	12	10	SL	0.08	0.003	0.3	0.594
R3987	40-50	90	2	8	S	0.07	<0.001	1.6	13.813
R3988	50-60	38	18	44	C	0.01	0.002	0.5	4.750
R4026	25-35	89	1	10	LS	0.01	<0.001	0.4	3.688
R4027	35-45	91	0	9	S	0.03	<0.001	0.5	4.063

LITH CODE : GR

Lab #	Sample ID#	Lith	paste pH	paste E.C. mmhos/cm	Ca meq/l	Mg meq/l	Na meq/l	K meq/l	SAR	Sat %	AB-DTPA B ppm	AB-DTPA Se ppm	2M KCl NO3-N ppm
R 6505	0-5	GR	8.6	0.5	0.4	0.1	4.7	0.1	9.9	30.6			
6506	5-10	GR	8.2	1.4	0.6	0.3	13.7	0.2	20.3	59.4			
6507	10-15	GR	8.4	0.7	0.4	0.2	7.2	0.1	14.2	35.2			
6508	15-20	GR	8.5	0.2	0.1	<0.1	1.8	<0.1	6.0	32.6			
6509	20-25	GR	8.4	0.3	0.5	0.2	2.1	0.1	3.5	33.8			
6510	25-30	GR	8.6	0.3	0.4	0.6	1.7	0.1	2.4	34.2			
6511	30-35	GR	8.5	0.2	0.1	<0.1	2.3	<0.1	8.1	33.5			
6512	35-40	GR	8.5	0.3	0.1	0.1	2.8	0.1	8.8	33.7			
6644	0-5	GR	6.4	0.6	0.4	0.1	5.0	0.1	10.5	23.4			
6645	5-10	GR	6.5	1.5	5.6	1.9	4.2	1.4	2.1	14.8			
6646	10-15	GR	7.9	0.3	0.5	0.1	2.0	0.1	3.4	29.7			
6647	15-20	GR	8.0	0.2	0.2	0.1	1.6	<0.5	4.6	30.9			
6648	20-25	GR	8.0	0.2	0.2	0.1	2.1	<0.5	6.0	28.0			
6649	25-30	GR	8.3	0.3	0.2	0.1	1.9	0.1	5.2	31.9			
6650	30-35	GR	8.5	0.5	0.3	0.1	4.7	0.1	11.4	31.5			
6651	35-40	GR	8.4	0.4	0.3	0.1	3.3	0.1	7.4	25.9			
6652	40-45	GR	8.5	0.3	0.2	0.1	1.9	0.1	5.5	32.9			
6653	45-50	GR	8.7	0.4	0.2	0.1	3.3	0.1	9.3	30.6			
6654	55-60	GR	8.6	0.3	0.3	<0.5	2.6	0.1	7.2	31.8			
6655	60-65	GR	8.5	0.3	0.4	0.1	1.8	0.3	3.8	36.3			
6656	65-70	GR	8.4	0.3	0.2	<0.5	0.7	0.4	2.2	32.6			
6657	75-80	GR	8.4	0.3	0.3	0.1	1.9	0.2	4.0	33.8			
6658	80-85	GR	8.3	0.4	0.8	0.5	2.4	0.2	3.1	33.2			
SUMMARY - ALL SAMPLES													
	Minimum		6.40	0.20	0.10	<0.1	0.70	<0.1	1.61	14.80	0.06	<0.01	<0.01
	Maximum		8.70	1.60	5.60	2.34	15.04	2.33	20.30	59.40	0.72	0.04	6.10
	Mean		8.04	0.49	0.76	0.41	3.43	0.25	5.66	29.52	0.25	<0.01	1.40
	S. Deviation		0.52	0.32	0.91	0.51	2.78	0.42	3.96	7.16	0.15	<0.01	1.27
	N		44.00	44.00	44.00	44.00	44.00	44.00	44.00	44.00	22.00	22.00	21.00

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		---%---				---%---			
R 6505	0-5				*	*	*	*	*
6506	5-10				*	0.06	*	0.7	*
6507	10-15				*	<0.01	0.001	0.2	1.53
6508	15-20				*	<0.01	<0.001	0.2	1.70
6509	20-25				*	0.01	0.001	0.3	3.03
6510	25-30				*	<0.01	<0.001	0.1	1.30
6511	30-35				*	<0.01	<0.001	0.2	1.60
6512	35-40	58	10	32	SCL	<0.01	0.001	0.2	1.83
6644	0-5	86	4	10	LS	<0.01	0.002	*	0.06
6645	5-10	88	4	8	LS	<0.01	<0.001	*	*
6646	10-15				*	<0.01	<0.001	0.1	1.10
6647	15-20				*	<0.01	<0.001	0.1	0.80
6648	20-25				*	<0.01	<0.001	0.1	0.90
6649	25-30				*	0.01	<0.001	0.1	0.69
6650	30-35	98	2	0	S	0.01	<0.001	0.2	1.39
6651	35-40				*	0.01	<0.001	0.2	1.89
6652	40-45	98	0	2	S	0.01	<0.001	0.1	0.89
6653	45-50				*	0.01	<0.001	*	*
6654	55-60				*	0.01	<0.001	0.2	1.49
6655	60-65	98	2	0	S	*	<0.001	*	*
6656	65-70	98	2	0	S	0.01	<0.001	0.1	0.69
6657	75-80				*	0.01	*	0.2	*
6658	80-85				*	0.01	<0.001	0.2	1.59
SUMMARY - ALL SAMPLES									
	Minimum	38.00	0.00	0.00		<0.01	<0.001	0.10	0.060
	Maximum	98.00	18.00	44.00		0.08	0.003	1.60	13.813
	Mean	82.20	4.59	13.18		0.02	<0.001	0.28	2.263
	STD.	12.54	4.43	9.13		0.02	<0.001	0.29	2.584
	N	26.00	26.00	26.00		42.00	41.000	39.00	38.000

LITH CODE: CN

Lab #	Sample ID#	Lith	paste pH	paste E.C. mmhos/cm	Ca meq/l	Mg meq/l	Na meq/l	K meq/l	SAR	Sat %	AB-DTPA B ppm	AB-DTPA Se ppm	2M KCl NO3-N ppm
R4042	30-40	CN	8.5	0.6	1.04	0.37	5.8	0.09	6.9	19.1	0.15	<0.01	1.4
R4043	40-50	CN	8.9	0.4	0.20	0.08	4.9	0.03	13.2	19.5	0.16	<0.01	1.1
R4044	50-60	CN	8.9	0.7	0.64	0.25	8.4	0.04	12.6	27.9	0.25	<0.01	0.8
R4045	60-70	CN	8.8	1.1	0.84	0.33	12.3	0.05	16.0	28.4	0.20	<0.01	
R4046	70-80	CN	8.8	1.4	1.24	0.51	13.8	0.07	14.8	34.2	0.25	<0.01	0.5
R4047	80-90	CN	8.8	1.5	0.79	0.44	14.7	0.09	18.7	29.4	0.27	<0.01	0.7
R3989	60-70	CN	8.4	1.1	0.32	0.16	11.7	0.19	23.8	36.2	0.53	0.12	11.0
R3990	70-80	CN	8.7	1.3	0.37	0.19	14.4	0.18	27.3	53.0	0.44	0.14	3.6
R3991	80-90	CN	8.7	1.3	0.35	0.20	14.6	0.16	27.9	36.7	0.49	0.10	1.5
R3992	90-100	CN	8.8	1.2	0.38	0.20	14.3	0.11	26.4	41.1	0.46	0.16	2.9
R3993	100-110	CN	8.7	1.3	0.11	0.12	14.9	0.14	43.7	41.2	0.51	0.10	0.6
R3994	110-120	CN	8.9	1.4	0.11	0.06	17.3	0.14	59.6	37.6	0.48	0.13	1.2
R3995	120-130	CN	8.8	1.3	0.10	0.06	15.3	0.12	55.0	34.5	0.49	0.15	2.0
R3996	130-140	CN	8.8	1.4	0.15	0.10	17.3	0.12	49.6	33.5	0.43	0.08	1.6
R3997	140-150	CN	8.6	1.6	0.13	0.07	18.8	0.14	59.2	31.4	0.66	0.17	2.2

SUMMARY - ALL SAMPLES

Minimum	8.40	0.40	0.10	0.06	4.91	0.03	6.89	19.10	0.15	<0.01	0.50
Maximum	8.90	1.60	1.24	0.51	18.83	0.19	59.62	53.00	0.66	0.17	11.00
Mean	8.74	1.17	0.45	0.21	13.24	0.11	30.31	33.58	0.38	0.08	2.22
S. Deviation	0.14	0.33	0.36	0.14	3.92	0.05	17.63	8.23	0.15	0.07	2.58
N	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	14.00

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		-----%-----				-----%-----			
R4042	30-40	80	8	12	SL	0.01	<0.001	1.2	11.688
R4043	40-50	83	7	10	LS	<0.01	<0.001	0.6	6.000
R4044	50-60	71	12	17	SL	0.01	0.001	0.5	4.719
R4045	60-70	70	10	20	SCL/SL	0.01	0.002	1.2	11.750
R4046	70-80	66	14	20	SCL/SL	<0.01	0.003	2.8	28.094
R4047	80-90	74	11	15	SL	<0.01	0.002	5.5	55.063
R3989	60-70	10	34	56	C	0.01	0.001	1.1	10.719
R3990	70-80	10	31	59	C	0.01	0.001	1.0	9.719
R3991	80-90	5	42	53	SiC	0.01	0.002	0.7	6.750
R3992	90-100	10	34	56	C	0.01	0.001	0.9	8.719
R3993	100-110	16	27	57	C	<0.01	<0.001	1.0	10.000
R3994	110-120	7	37	56	C	0.02	0.001	0.8	7.406
R3995	120-130	10	31	59	C	0.01	<0.001	1.1	10.688
R3996	130-140	16	34	50	C	0.01	<0.001	1.6	15.688
R3997	140-150	30	38	32	CL	<0.01	0.001	2.3	23.031

SUMMARY - ALL SAMPLES

Minimum	5.00	7.00	10.00	<0.01	<0.001	0.50	4.719
Maximum	83.00	42.00	59.00	0.02	0.003	5.50	55.063
Mean	37.20	24.67	38.13	0.01	0.001	1.49	14.669
STD.	30.76	12.23	19.49	0.01	0.001	1.23	12.391
N	15.00	15.00	15.00	15.00	15.000	15.00	15.000

* - tons CaCO3/1000 tons material

LITH CODE SS

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca	Mg	Na	K	SAR	Sat %	---AB-DTPA--- B ppm	Se ppm	2M KCl NO3-N ppm
					--------meq/l--------								
R4057	80-90	SS	7.5	1.6	7.98	3.78	6.8	1.49	2.8	33.8	0.32	0.01	0.4
R4058	90-100	SS	7.5	1.8	7.98	4.25	6.0	1.40	2.4	38.0	0.30	<0.01	0.5
R3928	81.4-88.9	SS	8.8	1.2	0.07	0.07	12.1	0.14	44.7	40.6	0.33	0.24	0.1
R3929	88.9-97.4	SS	9.1	1.2	0.04	0.05	13.8	0.10	67.0	36.4	0.28	0.21	0.3
R3930	97.4-105.5	SS	9.0	1.5	0.04	0.03	16.3	0.14	85.4	33.1	0.31	0.14	0.4
R3931	105.5-113.8	SS	9.1	2.1	0.12	0.08	22.7	0.18	71.9	34.7	0.30	0.12	0.3
R3932	113.8-121.2	SS	8.9	2.1	0.17	0.09	22.7	0.19	63.7	32.1	0.31	0.13	0.3
R3935	137.3-139.7	SS	9.1	1.3	0.06	0.05	14.9	0.14	64.7	28.6	0.32	0.09	0.3
R3941	174.0-179.5	SS	9.3	1.6	0.07	0.03	17.1	0.07	75.8	51.3	0.67	0.08	0.3
R3942	179.5-187.5	SS	9.0	1.4	0.03	0.02	15.0	0.10	91.4	81.8	0.27	0.18	0.4
R3943	187.5-196.6	SS	9.4	1.3	0.05	0.02	13.4	0.08	70.7	111.9	0.23	0.37	0.4
R3944	196.6-204.4	SS	9.3	1.0	0.03	0.02	11.7	0.06	76.7	113.7	0.30	0.37	0.3
R3945	204.4-212.5	SS	9.4	1.0	0.05	0.03	11.7	0.05	58.6	125.6	0.22	0.35	0.2
R3946	212.5-220.2	SS	9.4	1.0	0.06	0.03	11.2	0.04	52.6	129.1	0.27	0.10	0.1
R3947	220.2-227.8	SS	9.5	1.3	0.03	0.02	14.2	0.04	85.5	121.3	0.20	0.39	0.3

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential	*
		---%---				---%---				
R4057	80-90	58	12	30	SCL	<0.01	0.001	12.8	128.031	
R4058	90-100	64	8	28	SCL	0.07	0.001	5.9	56.844	===
R3928	81.4-88.9	33	33	34	CL	0.04	0.003	0.9	7.844	
R3929	88.9-97.4	48	24	28	SCL	<0.01	0.001	1.8	18.031	
R3930	97.4-105.5	28	28	44	C	0.03	0.001	1.1	10.094	
R3931	105.5-113.8	45	25	30	CL/SCL	0.01	0.002	1.9	18.750	===
R3932	113.8-121.2	29	31	40	C/CL	0.03	0.002	1.3	12.125	
R3935	137.3-139.7	52	9	39	SC	<0.01	0.001	17.3	173.031	
R3941	174.0-179.5	61	18	21	SCL	0.03	0.001	1.7	16.094	
R3942	179.5-187.5	34	32	34	CL	0.06	0.001	0.9	7.156	
R3943	187.5-196.6	42	31	27	CL/L	0.06	0.001	1.9	17.156	
R3944	196.6-204.4	43	23	34	CL	0.04	<0.001	1.7	15.750	
R3945	204.4-212.5	42	28	30	CL	0.01	<0.001	1.9	18.688	
R3946	212.5-220.2	47	25	28	SCL	<0.01	0.001	2.1	21.031	
R3947	220.2-227.8	39	31	30	CL	0.01	0.001	2.1	20.719	

LITH CODE SS

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca	Mg	Na	K	SAR	Sat %	---AB-DTPA--- B	Se	2M KCl NO3-N ppm
					--------meq/l--------						-----ppm-----		
6590	280-285	SS	9.1	1.3	0.2	0.1	13.8	0.1	32.1	98.6			
6591	285-290	SS	8.9	2.6	0.3	0.1	28.6	0.1	67.1	37.6			
6599	325-330	SS	9.0	1.4	0.1	0.1	14.7	0.1	43.0	115.1			
6600	330-335	SS	9.0	1.0	0.2	0.5	10.7	0.2	18.0	101.9			
6601	335-340	SS	9.1	1.3	0.3	0.4	12.9	0.1	22.0	116.3			
6602	340-345	SS	9.2	1.3	0.3	0.6	15.0	0.3	22.9	132.9			
6603	345-350	SS	9.2	1.3	0.3	0.4	13.6	0.2	22.9	121.3			
6614	400-405	SS	9.0	1.4	0.1	0.1	14.7	0.1	43.0	115.1			
6615	405-410	SS	9.0	1.0	0.2	0.5	10.7	0.2	18.0	101.9			
6616	410-415	SS	9.1	1.3	0.3	0.4	12.9	0.1	22.0	116.3			
6617	415-420	SS	9.2	1.3	0.3	0.6	15.0	0.3	22.9	132.9			
6618	420-425	SS	9.2	1.3	0.3	0.4	13.6	0.2	22.9	121.3			
6614	400-405	SS	9.2	1.3	0.1	0.4	14.2	0.1	27.8	70.0			
6615	405-410	SS	9.3	1.2	0.2	0.5	12.1	0.1	21.4	82.4			
6616	410-415	SS	9.2	1.2	0.1	0.1	13.1	0.1	39.8	75.5			
6617	415-420	SS	9.3	0.9	0.1	0.2	9.5	0.1	24.0	89.8			
6618	420-425	SS	9.2	1.1	0.1	0.1	16.1	0.1	47.2	66.2			
6619	425-430	SS	9.3	1.1	0.1	0.2	12.9	0.1	33.1	129.1			
6620	430-435	SS	9.3	0.8	0.2	0.2	9.0	0.2	20.5	116.9			
6621	435-440	SS	9.2	0.7	0.2	0.3	7.3	0.2	14.5	108.0			
6622	440-445	SS	9.4	0.9	0.2	0.4	10.2	0.1	18.6	125.1			

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potentia
		---%---				---%---			
6590	280-285	46	26	28	SCL	*	*	*	*
6591	285-290	64	16	20	SCL/SL	<0.01	0.005	15.1	150.86
6599	325-330	36	32	32	CL	0.02	*	*	*
6600	330-335	36	34	30	CL	0.01	*	*	*
6601	335-340	32	36	32	CL	0.01	*	*	*
6602	340-345	20	44	36	SiCL/CL	0.05	*	1.9	*
6603	345-350	30	38	32	CL	0.06	0.001	2.0	20.03
6614	400-405	36	32	32	CL	0.02	*	*	*
6615	405-410	36	34	30	CL	0.01	*	*	*
6616	410-415	32	36	32	CL	0.01	*	*	*
6617	415-420	20	44	36	SiCL/CL	0.05	*	1.9	*
6618	420-425	30	38	32	CL	0.06	0.001	2.0	20.03
6614	400-405	54	28	18	SL	0.03	0.001	1.8	17.63
6615	405-410	56	26	18	SL	<0.01	0.001	1.6	16.03
6616	410-415	64	22	14	SL	<0.01	0.001	5.7	56.83
6617	415-420	58	20	22	SCL	0.01	0.001	1.9	19.23
6618	420-425	60	22	18	SL	<0.01	0.001	5.6	56.23
6619	425-430	62	16	22	SCL	0.01	0.001	2.9	28.53
6620	430-435	64	18	18	SL	<0.01	0.001	1.8	18.23
6621	435-440	64	14	22	SCL	<0.01	0.001	2.3	23.03
6622	440-445	60	18	22	SCL	0.01	0.001	1.6	15.63

LITH CODE SS

Lab #	Sample ID#	Lith	paste pH	paste E.C. mmhos/cm	Ca meq/l	Mg meq/l	Na meq/l	K meq/l	SAR	Sat %	AB-DTPA B ppm	AB-DTPA Se ppm	2M KCl NO3-N ppm
R3948	227.8-233.8	SS	9.4	1.1	0.04	0.02	12.0	0.05	69.6	107.5	0.23	0.13	0.3
R3955	38.7-42.8	SS	7.8	0.9	2.46	0.59	4.1	1.42	3.4	26.7	0.26	0.34	0.9
R3957	51.3-60.0	SS	8.1	0.7	1.56	0.42	4.7	0.56	4.7	32.7	0.24	0.05	0.4
R3958	60.0-70.0	SS	8.3	0.6	2.39	0.82	2.7	0.31	2.1	32.2	0.42	0.05	0.2
R3959	70.0-80.0	SS	7.9	0.8	2.51	0.71	5.0	0.58	4.0	29.5	0.24	0.05	0.1
R3961	162.3-172.3	SS	8.8	1.5	0.24	0.17	15.3	0.26	33.9	25.5	0.13	0.08	<0.1
R3970	236.7-245.0	SS	8.7	1.4	0.19	0.13	15.7	0.22	39.3	23.6	0.32	0.05	0.1
R3971	245.0-253.2	SS	8.4	2.0	0.27	0.16	20.7	1.39	44.3	21.7	0.43	0.04	0.1
R3974	76.1-86.0	SS	8.8	1.2	0.10	0.08	13.3	0.14	45.1	84.2	0.32	0.15	0.1
R3975	86.0-92.5	SS	8.8	1.5	0.35	0.29	15.0	0.54	26.5	93.4	0.40	0.08	0.1
R3976	92.5-100.5	SS	8.8	1.5	0.28	0.20	14.4	0.95	29.6	77.0	0.39	0.11	<0.1
R3980	121.1-127.6	SS	7.7	1.5	2.33	1.94	12.8	0.62	8.8	25.4	0.47	0.03	0.1
R3982	131.5-138.8	SS	7.9	1.9	6.59	4.78	9.7	0.91	4.1	25.8	0.38	0.07	<0.1
R4011	180-190	SS	9.3	1.7	0.05	0.07	18.2	0.13	74.7	46.0	0.33	0.04	2.5
R4012	190-200	SS	9.2	1.4	0.41	0.19	14.4	0.11	26.4	46.5	0.37	0.06	6.8
R4013	200-210	SS	9.3	1.5	0.32	0.25	16.1	0.08	30.2	84.7	0.37	0.09	5.8
R4014	210-220	SS	9.4	1.6	0.25	0.25	16.7	0.09	33.0	48.5	0.37	0.02	6.2
R4015	220-230	SS	9.4	1.8	0.33	0.35	19.5	0.14	33.7	51.7	0.43	0.06	6.8
R4023	300-310	SS	9.0	2.1	0.37	0.56	22.6	0.13	33.1	40.2	0.37	0.15	1.1

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		---%---				---%---			
R3948	227.8-233.8	41	29	30	CL	0.02	0.001	2.0	19.406
R3955	38.7-42.8	40	24	36	CL	0.03	0.003	1.8	17.156
R3957	51.3-60.0	50	15	35	SC/SCL	0.01	0.002	6.9	68.750
R3958	60.0-70.0	73	9	18	SL	0.01	0.003	2.1	20.781
R3959	70.0-80.0	62	10	28	SCL	0.02	0.003	2.0	19.469
R3961	162.3-172.3	63	13	24	SCL	0.02	0.004	1.3	12.500
R3970	236.7-245.0	54	17	29	SCL	0.01	0.001	1.1	10.719
R3971	245.0-253.2	50	19	31	SCL	0.02	0.005	1.0	9.531
R3974	76.1-86.0	29	38	33	CL	0.03	0.002	1.8	17.125
R3975	86.0-92.5	21	44	35	CL	0.03	0.001	1.6	15.094
R3976	92.5-100.5	30	38	32	CL	0.03	0.002	1.8	17.125
R3980	121.1-127.6	63	11	26	SCL	0.01	0.004	2.6	25.813
R3982	131.5-138.8	64	12	24	SCL	0.01	0.010	2.5	25.000
R4011	180-190	64	16	20	SCL/SL	0.01	0.002	2.1	20.750
R4012	190-200	63	18	19	SL	0.01	0.002	2.2	21.750
R4013	200-210	57	20	23	SCL	0.01	0.002	1.8	17.750
R4014	210-220	61	17	22	SCL	0.01	0.003	1.8	17.781
R4015	220-230	60	18	22	SCL	0.01	0.004	1.9	18.813
R4023	300-310	41	22	37	CL	0.04	0.003	1.8	16.844

LITH CODE SS

Lab #	Sample ID#	Lith	paste pH	paste E.C. mmhos/cm	Ca meq/l	Mg meq/l	Na meq/l	K meq/l	SAR	Sat %	AB-DTPA B ppm	AB-DTPA Se ppm	2M KCl NO3-N ppm
6623	445-450	SS	9.4	0.7	0.2	0.3	7.6	0.2	14.2	139.1			
6624	450-455	SS	9.3	0.6	0.3	0.3	5.9	0.1	10.5	115.9			
6625	455-460	SS	9.5	0.7	0.3	0.8	7.9	0.2	10.4	144.3			
6626	460-465	SS	9.4	0.7	0.4	0.8	7.3	0.2	9.3	150.5			
6627	465-470	SS	9.4	0.9	0.8	1.7	11.1	0.4	9.8	125.4			
6628	470-475	SS	9.4	0.9	0.2	0.3	9.7	0.1	20.0	124.7			
6629	475-480	SS	9.4	1.1	0.2	0.5	12.1	0.2	20.4	130.2			
6630	480-485	SS	9.4	0.9	0.1	0.2	9.5	0.1	23.3	139.7			
6617	415-420	SS	9.4	0.9	0.1	0.1	10.3	0.1	31.5	122.7			
6618	420-425	SS	9.3	1.0	0.1	0.2	9.8	<0.5	26.5	96.4			
6619	425-430	SS	9.4	1.2	0.2	0.1	13.9	0.3	37.9	60.3			
6620	430-435	SS	9.3	1.4	0.1	0.1	15.3	0.5	45.8	56.8			
6621	435-440	SS	9.2	0.9	0.3	0.5	8.6	0.3	14.2	55.4			
6622	440-445	SS	9.3	0.9	0.2	0.4	12.8	0.1	23.5	70.6			
6623	445-450	SS	9.4	0.9	0.2	0.3	13.0	0.1	26.0	83.4			
6624	450-455	SS	9.2	1.2	0.3	0.7	19.3	0.2	26.5	60.3			
6625	455-460	SS	9.1	1.2	0.3	0.1	12.9	0.1	25.9	40.3			
6640	530-535	SS	9.2	1.3	0.2	0.2	14.6	0.1	31.4	48.9			
6641	535-540	SS	9.0	1.1	0.4	0.2	12.3	0.1	23.7	31.1			
6642	540-545	SS	9.0	1.0	0.4	0.3	10.1	0.2	17.4	37.8			
6643	545-550	SS	9.1	1.1	0.1	0.1	11.9	0.1	36.4	60.2			
6667	115-120	SS	8.5	0.7	0.8	0.3	5.9	0.3	8.1	20.2			
6668	120-125	SS	8.5	0.6	0.6	0.2	4.5	0.2	7.2	19.9			
6669	125-130	SS	8.4	0.6	0.2	4.5	0.2	5.6	7.1	22.9			
6670	130-135	SS	8.5	0.9	0.9	0.4	6.2	0.3	7.7	18.6			
6671	135-140	SS	8.1	0.9	0.5	0.3	9.1	0.3	14.8	21.8			
6672	140-145	SS	8.1	0.7	0.3	0.1	6.3	0.2	14.3	20.5			
SUMMARY - ALL SAMPLES													
	Minimum		7.50	0.60	0.03	0.02	0.20	<0.1	2.10	18.60	0.13	<0.01	<0.01
	Maximum		9.50	2.60	7.98	4.78	28.60	5.60	91.41	150.5	0.67	0.39	6.80
	Mean		8.99	1.20	0.62	0.50	12.33	0.32	31.80	74.72	0.33	0.13	1.06
	S. Deviation		0.49	0.40	1.45	0.93	4.79	0.66	22.36	40.73	0.09	0.11	2.00
	N		81.00	81.00	81.0	81.00	81.00	81.00	81.00	81.00	34.00	34.00	34.00

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		---%---				---%---			
6623	445-450	60	14	26	SCL	<0.01	0.001	1.6	16.33
6624	450-455	60	14	26	SCL	<0.01	0.001	1.9	18.53
6625	455-460	60	14	26	SCL	<0.01	0.001	1.9	19.13
6626	460-465	60	14	26	SCL	<0.01	0.001	1.7	17.03
6627	465-470	64	12	24	SCL	<0.01	0.001	3.9	39.13
6628	470-475	68	10	22	SCL	<0.01	<0.001	1.7	16.60
6629	475-480	66	12	22	SCL	<0.01	0.001	2.4	24.33
6630	480-485	64	12	24	SCL	<0.01	0.001	1.6	15.73
6617	415-420	64	12	24	SCL	<0.01	<0.001	2.0	19.70
6618	420-425	72	8	20	SCL/SL	<0.01	0.001	3.2	31.93
6619	425-430	72	2	26	SCL	<0.01	0.001	10.7	106.63
6620	430-435	76	8	16	SL	<0.01	0.001	11.1	111.43
6621	435-440	64	14	22	SCL	0.01	0.001	3.3	32.93
6622	440-445	66	14	20	SCL/SL	<0.01	0.001	2.6	26.33
6623	445-450	64	12	24	SCL	<0.01	0.001	3.2	31.53
6624	450-455	74	8	18	SL	<0.01	0.001	6.9	68.73
6625	455-460	68	12	20	SCL/SL	<0.01	0.003	14.7	146.69
6640	530-535	72	8	20	SCL/SL	<0.01	0.001	12.5	125.03
6641	535-540	68	12	20	SCL/SL	<0.01	0.002	8.6	85.86
6642	540-545	64	16	20	SCL/SL	<0.01	0.002	6.3	62.96
6643	545-550	62	22	16	SL	*	*	*	*
6667	115-120	56	20	24	SCL	0.01	0.001	1.8	17.42
6668	120-125	48	24	28	SCL	0.01	0.001	1.2	12.12
6669	125-130	42	28	30	CL	0.02	0.001	1.1	10.51
6670	130-135	40	30	30	CL	0.02	0.001	1.3	12.01
6671	135-140	42	24	34	CL	0.01	0.001	1.3	12.62
6672	140-145	42	28	30	CL	0.02	0.001	1.3	11.91
SUMMARY - ALL SAMPLES									
	Minimum	20.00	2.00	14.00		<0.01	<0.001	0.90	7.156
	Maximum	76.00	44.00	44.00		0.07	0.010	17.30	173.030
	Mean	52.06	21.29	26.65		0.01	0.001	3.08	30.110
	S. Deviation	14.47	9.90	6.33		0.02	0.001	3.59	36.300
	N	81.00	81.00	81.00		79.00	71.000	73.00	71.000

* - tons CaCO3/1000 tons material

LITH CODE: SL

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca	Mg	Na	K	SAR	Sat %	---AB-DTPA--- B	Se	2M KCl NO3-N ppm
					--------meq/l--------						-----ppm-----		
R3933	121.2-129SL		8.9	1.5	0.08	0.05	16.7	0.19	65.4	28.6	0.36	0.09	0.4
R3934	129.6-137SL		8.6	2.3	0.19	0.10	25.1	0.27	65.8	26.4	0.37	0.12	0.3
R3936	139.7-146SL		8.9	1.4	0.04	0.04	17.0	0.20	82.1	34.8	0.36	0.16	0.3
R3937	146.7-154SL		8.9	2.0	0.10	0.09	22.0	0.27	70.8	28.3	0.35	0.30	0.4
R3938	154.5-162SL		8.7	1.9	0.06	0.05	21.0	0.16	93.0	31.9	0.33	0.13	0.5
R3939	162.2-170SL		8.9	1.4	0.04	0.04	17.3	0.14	87.7	31.2	0.27	0.13	0.3
R3949	233.8-237SL		9.0	1.2	0.04	0.02	12.4	0.04	68.3	92.8	0.23	0.09	0.3
R3950	237.0-244SL		9.3	1.2	0.04	0.02	12.7	0.05	71.2	94.0	0.23	0.13	0.3
R3951	244.6-252SL		9.2	1.6	0.05	0.04	17.2	0.10	82.1	40.7	0.74	0.35	0.1
R3952	252.9-261SL		9.0	1.7	0.09	0.05	18.4	0.12	71.7	33.1	0.26	0.20	0.3
R3953	261.0-268SL		9.0	1.7	0.10	0.05	18.1	0.13	67.0	30.6	0.31	0.10	0.3
R3954	29.8-38.7SL		7.9	0.5	1.56	0.32	2.6	0.45	2.7	26.4	0.29	0.11	0.6
R3965	214.5-224SL		8.5	2.1	0.31	0.20	21.3	0.39	42.0	30.9	0.33	0.10	0.6
R3978	108.2-114SL		8.1	1.9	0.84	0.54	17.4	0.95	20.9	29.4	0.40	0.05	5.2
R3979	114.7-121SL		8.3	1.0	0.41	0.30	11.5	0.30	19.3	25.8	0.46	0.04	2.9
R3981	127.6-131SL		8.1	0.9	0.87	0.64	8.1	0.34	9.4	24.5	0.40	0.06	5.2
R3983	138.8-142SL		7.7	1.3	3.46	2.06	8.1	0.55	4.9	30.6	0.30	0.26	6.4

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		---------%--------				----------%---------			
R3933	121.2-129	34	26	40	C/CL	0.04	0.001	1.2	10.78
R3934	129.6-137	36	22	42	C	0.04	0.004	1.0	8.88
R3936	139.7-146	43	20	37	CL	0.02	0.001	1.2	11.41
R3937	146.7-154	46	10	44	SC	0.07	0.009	1.4	12.09
R3938	154.5-162	43	12	45	C	0.09	0.007	1.2	9.41
R3939	162.2-170	62	6	32	SCL	0.2	0.001	0.6	-0.22
R3949	233.8-237	19	44	37	SiCL	0.08	0.001	1.0	7.53
R3950	237.0-244	67	12	21	SCL	0.02	0.001	1.8	17.41
R3951	244.6-252	56	15	29	SCL	<0.01	0.009	2.1	21.28
R3952	252.9-261	61	9	30	SCL	0.07	0.003	2.0	17.91
R3953	261.0-268	22	32	46	C	0.2	0.002	2.1	14.81
R3954	29.8-38.7	42	23	35	CL	<0.01	0.001	0.8	8.03
R3965	214.5-224	46	12	42	SL	0.04	0.005	1.9	17.91
R3978	108.2-114	57	15	28	SCL	0.03	0.004	1.6	15.19
R3979	114.7-121	63	12	25	SCL	0.04	0.001	2.2	20.78
R3981	127.6-131	68	11	21	SCL	0.04	0.002	1.6	14.81
R3983	138.8-142	36	13	51	C	0.03	0.004	0.3	2.19

LITH CODE: SL

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca	Mg	Na	K	SAR	Sat %	---AB-DTPA--- B	Se	2M KCl NO3-N
					--------meq/l--------						-----ppm-----		ppm
6513	40-45	SL	8.9	0.9	0.3	0.1	8.3	0.1	20.3	61.4			
6514	45-50	SL	8.4	0.4	1.1	0.4	2.0	0.3	2.3	48.5			
6515	50-55	SL	8.4	0.6	1.1	0.9	3.8	0.5	3.9	21.6			
6516	55-60	SL	8.3	0.7	1.2	0.8	3.9	0.5	3.9	34.6			
6517	60-65	SL	8.3	0.5	0.8	0.5	3.1	0.4	3.8	30.9			
6518	65-70	SL	8.3	0.6	0.9	0.5	3.4	0.4	4.0	32.1			
6519	70-75	SL	8.3	0.5	0.6	0.3	3.2	0.3	4.8	32.4			
6520	75-80	SL	8.4	0.7	0.7	0.5	5.6	0.4	6.9	25.5			
6521	80-85	SL	8.4	0.7	0.7	0.5	5.0	0.4	6.7	29.0			
6522	85-90	SL	8.4	0.8	0.5	0.3	9.6	0.4	14.7	27.1			
6523	90-95	SL	8.4	0.9	0.5	0.3	7.2	0.4	11.7	26.9			
6524	95-100	SL	8.4	0.8	0.3	0.1	7.3	0.3	16.1	23.3			
6525	100-105	SL	8.3	1.2	0.4	0.2	11.4	0.3	22.0	23.8			
6526	105-110	SL	8.1	2.0	0.7	0.5	18.0	0.6	22.9	21.2			
6527	110-115	SL	8.5	1.3	0.4	0.3	13.3	0.3	22.1	22.5			
6528	115-120	SL	8.4	1.8	0.4	0.2	20.3	0.3	39.3	26.2			
6529	120-125	SL	8.4	2.0	0.3	0.1	21.7	0.4	45.6	21.7			
6530	125-130	SL	8.3	2.5	0.5	0.3	25.1	0.5	41.3	21.6			
6531	130-135	SL	8.4	1.5	0.5	0.2	17.0	0.3	29.4	24.3			
6532	135-140	SL	8.5	1.3	0.3	0.1	13.7	0.2	31.5	23.5			
6533	140-145	SL	8.4	1.6	0.3	0.1	17.6	0.3	36.9	20.2			

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		---------%---------				----------%---------			
6513	40-45				*	<0.01	*	0.5	*
6514	45-50	10	38	52	C	0.03	0.002	0.8	8.26
6515	50-55	50	18	32	SCL	<0.01	0.001	14.0	140.13
6516	55-60	18	38	44	C	0.01	0.001	3.3	32.53
6517	60-65	26	34	40	C/CL	0.01	<0.001	1.6	16.20
6518	65-70	18	38	44	C	0.02	<0.001	1.4	14.00
6519	70-75	18	38	44	C	0.02	<0.001	1.2	11.60
6520	75-80	38	26	36	CL	0.01	0.001	15.5	155.23
6521	80-85	24	36	40	C/CL	0.01	0.001	1.6	16.43
6522	85-90	22	34	44	C	0.02	0.001	1.4	14.13
6523	90-95	30	30	40	C/CL	0.02	0.001	1.6	15.53
6524	95-100	36	34	30	CL	0.01	0.001	1.2	12.33
6525	100-105	42	30	28	CL	0.01	0.001	1.3	12.73
6526	105-110	48	28	24	SCL/L	<0.01	<0.001	6.2	62.00
6527	110-115	34	34	32	CL	<0.01	0.001	1.6	15.73
6528	115-120	38	30	32	CL	0.02	<0.001	1.3	13.00
6529	120-125	38	32	30	CL	0.02	<0.001	2.7	27.00
6530	125-130	38	32	30	CL	0.02	0.001	1.1	10.63
6531	130-135	38	34	28	CL	0.01	0.001	1.3	12.32
6532	135-140	38	32	30	CL	0.01	<0.001	1.2	11.50
6533	140-145	44	28	28	CL	0.01	0.001	1.0	9.93

LITH CODE: SL

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca	Mg	Na	K	SAR	Sat %	---AB-DTPA--- B	Se	2M KCl NO3-N ppm
					--------meq/l--------						-----ppm-----		
6534	145-150	SL	8.3	2.8	0.6	0.3	26.4	0.7	39.8	19.8			
6535	150-155	SL	8.3	1.9	0.4	0.2	20.7	0.4	39.9	21.9			
6536	155-160	SL	8.5	2.1	0.5	0.2	24.3	0.1	40.1	22.4			
6537	160-165	SL	8.5	2.2	0.5	0.3	26.0	0.2	42.3	23.7			
6538	165-170	SL	8.3	1.9	0.8	1.1	26.5	0.2	27.3	20.3			
6539	170-175	SL	8.5	2.0	0.3	0.1	24.7	0.3	54.2	24.7			
6540	175-180	SL	8.6	2.1	0.4	0.3	48.7	0.7	83.3	23.6			
6541	180-185	SL	8.6	0.7	0.1	0.2	6.3	0.2	16.2	19.7			
6542	185-190	SL	8.6	1.5	0.4	0.6	15.7	0.4	22.6	21.6			
6543	190-195	SL	8.5	0.6	0.2	0.2	5.0	0.2	10.5	23.4			
6544	195-200	SL	9.1	1.8	0.4	0.1	19.1	0.3	36.8	15.9			
6545	200-210	SL	9.0	0.7	0.1	0.1	6.4	0.2	18.1	20.0			
6546	210-215	SL	8.6	2.3	0.4	0.3	25.2	0.4	43.3	19.1			
6547	215-220	SL	8.6	1.4	0.3	0.2	15.8	0.3	32.4	19.6			
6548	220-225	SL	8.5	1.2	0.7	0.4	11.6	0.5	15.2	25.1			

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		---------%---------				---------%---------			
6534	145-150	46	26	28	SCL	0.01	0.001	1.1	10.83
6535	150-155	36	32	32	CL	0.02	<0.001	1.2	11.60
6536	155-160	42	28	30	CL	0.02	0.001	1.8	17.83
6537	160-165	34	34	32	CL	0.01	0.001	1.5	14.63
6538	165-170	46	26	28	SCL	0.02	<0.001	1.8	18.40
6539	170-175	36	32	32	CL	0.02	0.001	1.2	12.33
6540	175-180	34	34	32	CL	0.02	0.002	1.3	13.16
6541	180-185	48	24	28	SCL	0.02	<0.001	5.6	56.30
6542	185-190	40	28	32	CL	0.03	0.001	1.6	16.23
6543	190-195	40	30	30	CL	0.01	0.001	3.7	37.23
6544	195-200	60	18	22	SCL	<0.01	0.001	18.1	181.03
6545	200-210	40	28	32	CL	<0.01	0.001	7.3	73.13
6546	210-215	48	24	28	SCL	0.01	0.001	*	*
6547	215-220	44	28	28	CL	0.02	0.001	5.4	53.83
6548	220-225	32	28	40	C/CL	*	0.002	2.6	*

LITH CODE: SL

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca	Mg	Na	K	SAR	Sat %	---AB-DTPA--- B	Se	2M KCl NO3-N
					--------meq/l--------						-----ppm-----		ppm
6549	220-222	SL	8.4	0.7	0.5	0.4	6.3	0.4	9.8	17.1			
6556	245-250	SL	8.1	2.0	0.8	0.6	23.3	0.5	27.5	22.1			
6568	300-305	SL	8.3	2.9	0.6	0.6	30.4	0.1	38.3	18.0			
6570	310-315	SL	8.3	2.6	0.5	0.3	32.8	0.4	51.9	19.8			
6584	250-255	SL	8.6	1.4	0.2	0.1	14.9	0.1	40.7	24.4			
6585	255-260	SL	8.7	1.5	0.2	0.1	17.3	0.1	46.8	35.8			
6586	260-265	SL	8.6	1.4	0.2	0.2	14.8	0.2	34.0	34.2			
6587	265-270	SL	8.9	1.4	0.2	0.1	15.0	0.1	43.4	59.2			
6588	270-275	SL	9.1	1.8	0.2	<0.1	21.9	0.1	70.7	56.6			
6589	275-280	SL	9.1	2.0	0.2	0.1	23.3	0.1	61.3	91.4			
6592	290-295	SL	9.0	2.8	0.3	0.1	31.6	0.2	72.5	43.7			
6604	350-355	SL	9.2	1.4	0.2	0.2	14.4	0.1	32.3	84.6			
SUMMARY - ALL SAMPLES													
	Minimum		7.70	0.40	0.04	<.001	2.00	0.04	2.30	15.90	0.23	0.04	0.10
	Maximum		9.30	2.90	3.46	2.06	48.70	0.95	93.00	94.00	0.74	0.35	6.40
	Mean		8.55	1.47	0.48	0.30	15.93	0.30	36.40	31.78	0.35	0.14	1.44
	S. Deviation		0.33	0.64	0.49	0.32	8.88	0.18	24.98	17.69	0.11	0.08	2.03
	N		64.00	64.00	64.00	64.00	64.00	64.00	64.00	64.00	17.00	17.00	17.00

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		--------%--------				----------%---------			
6549	220-222	56	20	24	SCL	0.02	0.002	1.9	19.06
6556	245-250	62	20	18	SL	<0.01	0.001	2.7	27.13
6568	300-305	68	14	18	SL	0.22	0.009	2.0	20.08
6570	310-315	62	14	24	SCL	0.07	0.008	1.1	10.85
6584	250-255	56	20	24	SCL	0.08	0.004	3.3	33.03
6585	255-260	54	20	26	SCL	0.04	0.002	6.6	65.66
6586	260-265	44	24	32	CL	0.04	0.001	1.9	18.93
6587	265-270	28	30	42	C	0.05	0.002	1.2	12.26
6588	270-275	34	34	32	CL	0.04	0.002	2.1	21.06
6589	275-280	42	30	28	CL	<0.01	0.002	2.9	28.66
6592	290-295	46	18	36	SC	0.09	0.002	2.7	27.06
6604	350-355	38	36	26	L	0.03	*	1.9	*
SUMMARY - ALL SAMPLES									
	Minimum	10.00	6.00	18.00		<0.01	<0.001	0.30	-0.22
	Maximum	68.00	44.00	52.00		0.20	0.009	18.10	181.00
	Mean	41.64	25.59	32.76		0.03	0.002	2.61	24.95
	STD.	13.25	8.84	7.73		0.04	0.002	3.26	33.16
	N	63.00	63.00	63.00		63.00	62.000	63.00	60.00

* - tons CaCO3/1000 tons material

Soil Analysis Report

LITH CODE: SH

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca	Mg	Na	K	SAR	Sat %	---AB-DTPA--- B ppm	Se ppm	2M KCl NO3-N ppm
					--------meq/l--------								
R4070	325-335	SH	8.7	2.1	1.64	0.74	24.3	0.24	22.2	47.1	0.44	0.02	1.1
R4071	335-345	SH	9.0	2.7	1.17	0.64	30.4	0.33	31.9	44.6	0.46	0.04	6.4
R4082	110-120	SH	9.2	1.2	0.13	0.09	16.7	0.14	50.3	43.0	0.40	0.05	2.2
R4083	120-130	SH	9.6	1.2	0.07	0.03	12.7	0.06	56.9	59.8	0.23	0.06	3.9
R4084	130-140	SH	9.9	1.5	0.06	0.04	13.1	0.06	59.2	74.4	0.20	0.09	1.8
R4085	140-150	SH	9.7	1.5	0.90	0.35	16.8	0.05	21.3	63.9	0.26	0.15	4.0
R4086	150-160	SH	9.8	1.2	0.39	0.20	17.0	0.07	31.2	55.7	0.34	0.10	3.4
R4087	160-170	SH	10.0	1.4	0.04	0.02	13.9	0.04	82.2	91.2	0.28	0.16	1.8
R4088	170-180	SH	10.0	1.7	0.36	0.17	15.5	0.05	30.0	88.9	0.27	0.13	5.1
R4089	180-190	SH	9.9	1.6	0.34	0.17	17.3	0.07	34.4	87.4	0.34	0.17	2.5
R4090	190-200	SH	10.0	1.7	0.05	0.02	17.9	0.05	94.9	107.0	0.33	0.22	4.7
R4091	200-210	SH	10.0	1.5	0.06	0.02	18.6	0.05	91.2	96.6	0.36	0.21	6.1
R4092	210-220	SH	9.9	1.5	0.04	0.01	16.6	0.04	105.4	72.2	0.25	0.19	1.4
R4094	280-290	SH	9.4	1.7	0.09	0.04	13.1	0.09	52.7	38.1	0.19	0.06	1.1
R4095	405-415	SH	9.5	1.9	0.14	0.09	18.6	0.13	54.8	27.2	0.41	0.07	3.5
R3956	42.8-51.3	SH	8.1	0.8	1.36	0.36	5.9	0.75	6.4	36.4	0.24	0.04	0.2
R3960	80.0-82.8	SH	8.1	0.7	0.97	0.21	6.3	0.33	8.2	29.3	0.18	0.16	4.6
R3962	190.4-200.0	SH	8.4	1.0	0.05	0.03	11.0	0.13	51.9	34.3	0.19	0.07	0.1
R3963	200.0-210.0	SH	8.8	1.5	0.12	0.08	16.9	0.18	52.6	33.3	0.22	0.05	0.3
R3964	210.0-214.5	SH	8.6	1.5	0.11	0.07	15.8	0.18	51.6	29.2	0.26	0.03	0.6
R3966	224.2-225.9	SH	8.5	1.5	0.13	0.09	17.1	0.22	51.8	39.1	0.29	0.04	0.7
R3969	227.3-236.7	SH	8.4	1.3	0.08	0.05	15.1	0.16	58.1	27.3	0.38	0.02	0.2
R3972	253.2-260.0	SH	7.9	3.2	0.60	0.42	26.4	3.66	36.9	30.6	0.35	0.19	<0.1
R3973	260.0-267.6	SH	8.7	1.8	0.09	0.07	18.6	0.39	66.0	33.8	0.33	0.10	<0.1
R3977	100.5-106.1	SH	8.5	1.8	0.28	0.20	18.0	0.23	37.0	38.4	0.53	0.14	0.2

Soil Analysis Report

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		---------%--------				----------%---------			
R4070	325-335	20	30	50	C	0.08	<0.001	1.1	8.5
R4071	335-345	20	34	46	C	0.02	<0.001	1.4	13.375
R4082	110-120	38	29	33	CL	0.01	0.005	2.5	24.84375
R4083	120-130	32	37	31	CL	<0.01	0.002	3.1	31.0625
R4084	130-140	28	41	31	CL	<0.01	0.012	1.4	14.375
R4085	140-150	25	44	31	CL	0.01	0.019	2.1	21.28125
R4086	150-160	36	34	30	CL	0.01	0.002	1.8	17.75
R4087	160-170	26	44	30	CL	0.01	0.002	2.0	19.75
R4088	170-180	22	47	31	CL	0.01	0.002	1.2	11.75
R4089	180-190	14	50	36	SiCL	0.01	0.003	1.2	11.78125
R4090	190-200	18	46	36	SiCL	0.01	0.006	1.3	12.875
R4091	200-210	22	44	34	CL	0.01	0.009	1.4	13.96875
R4092	210-220	16	48	36	SiCL	0.03	0.003	1.3	12.15625
R4094	280-290	54	18	28	SCL	0.1	0.002	0.8	4.9375
R4095	405-415	45	25	30	CL/SCL	0.02	0.004	3.4	33.5
R3956	42.8-51.3	42	19	39	CL	0.01	0.002	0.9	8.75
R3960	80.0-82.8	34	8	58	C	0.08	0.002	1.7	14.5625
R3962	190.4-200.0	63	8	29	SCL	0.09	0.001	1.1	8.21875
R3963	200.0-210.0	57	9	34	SCL	0.04	<0.001	1.7	15.75
R3964	210.0-214.5	53	13	34	SCL	0.02	0.001	1.9	18.40625
R3966	224.2-225.9	45	9	46	C/SC	0.02	<0.001	1.5	14.375
R3969	227.3-236.7	48	20	32	SCL	0.03	<0.001	1.6	15.0625
R3972	253.2-260.0	27	42	31	CL	0.18	0.005	0.2	-3.46875
R3973	260.0-267.6	34	19	47	C	0.06	0.002	1.1	9.1875
R3977	100.5-106.1	35	20	45	C	0.06	0.005	1.9	17.28125

Fort Collins, Co 80523
Date: 1/26/89

Soil Analysis Report

LITH CODE: SH

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca meq/l	Mg meq/l	Na meq/l	K meq/l	SAR	Sat %	---AB-DTPA--- B ppm	Se ppm	2M KCl NO3-N ppm
R4029	55-65	SH	8.1	0.6	2.01	0.82	3.3	0.11	2.8	20.7	0.21	<0.01	0.4
R4030	65-75	SH	8.8	0.9	1.52	0.51	8.0	0.07	7.9	38.3	0.50	0.02	1.4
R4031	75-85	SH	8.7	0.8	0.79	0.18	7.3	0.05	10.5	29.7	0.43	0.02	1.0
R4032	85-95	SH	8.5	0.8	1.31	0.45	6.6	0.13	7.1	30.1	0.35	0.10	0.3
R4033	95-105	SH	8.3	1.1	2.81	0.95	8.1	0.20	5.9	37.8	0.36	0.01	1.1
R4034	105-115	SH	8.4	0.8	1.36	0.37	7.2	0.13	7.7	33.1	0.37	0.02	1.5
R4035	115-125	SH	8.3	1.2	1.46	0.34	10.8	0.18	11.4	38.9	0.42	0.18	0.4
R4036	125-135	SH	8.1	2.2	2.06	0.59	19.1	0.23	16.6	36.4	0.46	0.14	2.9
R4037	135-145	SH	8.4	1.2	0.98	0.34	11.9	0.12	14.6	27.8	0.40	0.06	2.5
R4038	145-155	SH	8.3	1.8	1.85	0.53	16.2	0.20	14.8	27.8	0.33	0.05	3.7
R4039	155-165	SH	8.5	1.0	1.13	0.38	10.6	0.08	12.2	35.8	0.21	0.06	1.8
R4048	90-100	SH	8.7	1.4	0.86	0.39	14.6	0.15	18.5	42.1	0.50	0.05	0.6
R4049	100-110	SH	8.8	1.7	1.15	0.69	17.7	0.18	18.4	38.9	0.50	0.06	2.5
R4056	70-80	SH	7.7	0.9	2.21	1.01	6.0	0.68	4.8	31.4	0.34	0.01	1.1
R4060	205-215	SH	8.4	0.5	0.49	0.26	4.1	0.20	6.7	51.6	0.15	<0.01	0.2
R4061	215-225	SH	8.6	0.7	0.38	0.19	7.0	0.15	13.1	51.0	0.17	0.02	0.4
R4062	225-235	SH	8.6	0.9	0.42	0.23	9.0	0.16	15.8	39.6	0.26	<0.01	0.8
R4063	235-245	SH	8.5	0.8	0.65	0.47	9.0	0.24	12.0	51.0	0.27	0.01	0.8
R4064	245-255	SH	7.7	0.8	0.51	0.31	8.0	0.24	12.6	51.4	0.32	<0.01	0.6
R4065	255-265	SH	8.2	0.9	0.64	0.34	9.6	0.23	13.7	40.8	0.25	<0.01	0.6
R4066	265-275	SH	8.3	1.4	1.09	0.58	15.7	0.26	17.2	33.7	0.35	<0.01	0.6
R4067	285-295	SH	8.1	2.2	1.28	0.72	24.7	0.34	24.7	44.7	0.39	0.02	2.7
R4068	295-305	SH	8.2	1.0	0.42	0.29	12.7	0.18	21.5	39.0	0.39	<0.01	0.6

Fort Collins, Co 80523
Date: 1/26/89

Soil Analysis Report

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		--------%--------				----------%---------			
R4029	55-65	75	8	17	SL	0.02	0.002	0.6	5.4375
R4030	65-75					0.03	0.002	1.2	11.125
R4031	75-85	64	14	22	SCL/LS	0.01	0.002	3.6	35.75
R4032	85-95	74	10	16	SCL	0.03	0.003	4.5	44.15625
R4033	95-105	66	13	21	SL	0.02	0.003	2.4	23.46875
R4034	105-115	62	14	24	SCL	0.01	0.003	2.0	19.78125
R4035	115-125	32	21	47	SCL	0.05	0.008	0.9	7.6875
R4036	125-135	31	32	37	C	0.04	0.009	2.5	24.03125
R4037	135-145	28	28	44	CL	0.01	0.003	2.4	23.78125
R4038	145-155	40	20	40	C/CL	0.03	0.006	2.6	25.25
R4039	155-165	58	12	30	SCL	0.02	0.002	3.1	30.4375
R4048	90-100					0.01	0.003	1.6	15.78125
R4049	100-110	24	30	46	C	0.02	0.002	0.8	7.4375
R4056	70-80	42	22	36	CL	<0.01	<0.001	3.0	30
R4060	205-215	80	2	18	SL	0.28	0.001	0.5	-3.71875
R4061	215-225	34	42	24	L	0.16	0.001	1.2	7.03125
R4062	225-235	58	8	34	SCL	0.07	<0.001	1.8	15.8125
R4063	235-245	48	12	40	SC	0.08	0.002	0.9	6.5625
R4064	245-255	58	10	32	SCL	0.07	<0.001	0.9	6.8125
R4065	255-265	48	16	36	SC	0.05	<0.001	1.1	9.4375
R4066	265-275	36	20	44	C	0.01	<0.001	1.5	14.6875
R4067	285-295	28	24	48	C	0.07	<0.001	1.0	7.8125
R4068	295-305	52	12	36	SC	0.02	0.001	1.9	18.40625

Soil Analysis Report

LITH CODE: SH

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca	Mg	Na	K	SAR	Sat %	---AB-DTPA--- B ppm	Se ppm	2M KCl NO3-N ppm	Lab #
					--------meq/l--------									
R3999	60-70	SH	7.8	0.9	2.67	1.76	5.5	0.45	3.7	32.5	0.46	0.07	0.4	R3999
R4001	80-90	SH	8.2	2.0	2.21	1.69	16.4	0.42	11.7	34.1	0.22	0.08	2.7	R4001
R4002	90-100	SH	8.8	1.2	0.11	0.08	12.0	0.12	39.1	24.1	0.24	0.09	1.3	R4002
R4003	100-110	SH	8.9	1.3	0.08	0.06	14.3	0.12	53.0	21.9	0.28	0.11	0.8	R4003
R4004	110-120	SH	9.0	2.4	0.12	0.13	23.1	0.16	66.0	23.4	0.36	0.16	3.7	R4004
R4007	140-150	SH	9.2	1.8	0.06	0.04	18.9	0.08	84.5	77.5	0.34	0.18	0.8	R4007
R4008	150-160	SH	9.5	1.7	0.05	0.03	17.5	0.06	87.3	187.6	0.44	0.09		R4008
R4009	160-170	SH	9.1	1.8	0.05	0.04	18.6	0.10	87.2	63.1	0.36	0.15	0.7	R4009
R4017	240-250	SH	9.3	2.5	1.16	0.44	23.8	0.17	26.6	58.1	0.37	0.24	0.9	R4017
R4021	280-290	SH	9.1	2.3	0.53	0.43	22.8	0.18	32.9	36.0	0.34	0.20	2.6	R4021
R4022	290-300	SH	9.1	2.2	0.31	0.56	21.4	0.29	32.5	35.9	0.27	0.14	0.7	R4022
R4025	395-405	SH	9.2	2.0	0.34	0.46	20.5	0.10	32.5	38.9	0.38	0.17	1.7	R4025

Soil Analysis Report

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		---------%---------				---------%---------			
R3999	60-70	40	22	38	CL	0.04	0.004	0.6	4.875
R4001	80-90	79	9	12	SL	0.22	0.007	1.9	12.34375
R4002	90-100	60	19	21	SCL	0.08	0.002	1.1	8.5625
R4003	100-110	54	21	25	SCL	0.04	0.003	1.0	8.84375
R4004	110-120	44	28	28	CL	0.04	0.007	1.7	15.96875
R4007	140-150	34	38	28	CL	0.04	0.012	1.5	14.125
R4008	150-160	40	25	35	CL	0.03	0.009	5.2	51.34375
R4009	160-170	43	31	26	L	0.03	0.006	2.1	20.25
R4017	240-250	16	36	48	C	0.02	0.013	1.3	12.78125
R4021	280-290	18	39	43	C	0.03	0.006	0.7	6.25
R4022	290-300	39	19	42	C	0.04	0.002	0.8	6.8125
R4025	395-405	30	26	44	C	0.06	0.002	0.9	7.1875

Soil Analysis Report

LITH CODE: SH

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca	Mg	Na	K	SAR	Sat %	---AB-DTPA--- B	Se	2M KCl NO3-N
					--------meq/l--------						-----ppm-----		ppm
6548	215-220	CL	8.5	1.9	0.5	0.4	18.8	0.7	27.8	24.9			
6549	220-222	CL	8.3	1.9	0.6	0.5	19.6	0.8	27.0	34.5			
6550	222-225	CL	8.6	0.8	0.2	0.3	7.0	0.4	14.3	32.3			
6551	225-227	CL	8.4	0.7	0.4	0.2	3.6	0.3	6.8	17.6			
6552	227-230	CL	8.3	1.5	0.8	0.6	17.3	0.9	20.3	29.8			
6553	230-235	SH	8.3	1.6	0.3	0.3	28.5	0.4	53.8	18.7			
6554	235-240	SH	8.3	1.5	0.1	0.1	17.2	0.2	53.8	18.7			
6555	240-245	SH	8.2	1.5	0.2	<0.1	15.5	0.2	45.4	20.5			
6556	245-250	SH	8.2	1.7	0.2	0.1	18.3	0.5	46.1	21.0			
6582	240-245	SH	8.4	1.0	0.2	0.1	10.6	0.1	28.9	24.4			
6583	245-250	SH	8.6	1.9	0.2	0.1	20.2	0.2	52.3	24.2			
6593	295-300	SH	8.9	1.0	0.1	0.3	12.3	0.2	28.2	47.6			
6594	300-305	SH	8.8	2.1	0.2	0.2	28.1	0.2	63.8	44.1			
6595	305-310	SH	9.1	1.0	0.7	1.1	12.2	0.4	12.7	64.2			

Soil Analysis Report

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		---------%---------				----------%---------			
6548	215-220	32	28	40	C/CL	0.02	<0.001	2.2	22.10
6549	220-222	20	36	44	C	0.02	0.001	2.1	20.53
6550	222-225	20	36	44	C	0.02	*	3.1	*
6551	225-227	52	20	28	SCL	0.01	0.002	1.8	17.76
6552	227-230	28	28	44	C	0.03	0.001	2.5	24.53
6553	230-235	68	10	22	SCL	0.06	0.005	1.2	12.36
6554	235-240	68	8	28	SCL	0.09	0.003	0.9	9.39
6555	240-245	64	8	28	SCL	0.06	0.002	0.8	7.86
6556	245-250	60	10	30	SCL	0.06	0.001	0.8	7.53
6582	240-245	46	26	28	SCL	0.07	0.002	0.7	7.06
6583	245-250	56	20	24	SCL	0.08	0.005	2.2	22.06
6593	295-300	24	18	58	C	0.09	<0.001	1.0	10.00
6594	300-305	24	16	60	C	0.08	0.001	0.8	8.33
6595	305-310	36	24	40	C/CL	0.45	0.001	2.6	25.53

Soil Analysis Report

LITH CODE: SH

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca	Mg	Na	K	SAR	Sat %	---AB-DTPA--- B	Se	2M KCl NO3-N
					--------meq/l--------						-----ppm-----		ppm
6596	310-315	SH	9.1	1.6	0.1	0.1	21.2	0.1	70.1	94.0			
6597	315-320	SH	9.0	3.0	0.4	1.0	43.4	0.4	51.3	96.2			
6598	320-325	SH	9.1	2.0	0.2	0.2	22.7	0.2	48.2	111.0			
6605	355-360	SH	9.1	1.5	0.3	0.3	15.3	0.2	26.6	60.9			
6606	360-365	SH	9.0	0.9	0.6	0.6	8.8	0.3	11.3	46.3			
6607	365-370	SH	8.9	1.6	0.4	0.4	15.5	0.3	24.0	39.2			
6608	370-375	SH	9.2	1.2	0.4	0.2	12.2	0.1	23.9	70.0			
6609	375-380	SH	9.1	1.0	0.6	1.4	9.6	0.3	9.6	108.7			
6610	380-385	SH	9.1	1.3	0.1	0.2	13.3	0.1	34.1	126.2			
6611	385-390	SH	9.2	1.8	0.2	0.2	19.5	0.1	44.1	88.4			
6612	390-395	SH	9.1	1.6	0.2	0.1	17.0	0.1	46.1	83.5			
661	395-400	SH	9.1	1.3	0.2	0.2	14.5	0.1	32.0	84.5			
6659	400-405	CL	8.2	0.5	0.6	0.2	3.3	0.2	5.2	21.9			
6660	405-410	CL	8.6	0.6	0.9	0.2	4.7	0.2	6.4	30.2			

SUMMARY - ALL SAMPLES

Minimum	7.70	0.50	0.04	<0	3.30	0.04	2.80	17.60	0.15	<0.1	<0.01
Maximum	10.00	3.20	2.81	1.76	43.40	3.66	105.4	187.6	0.53	0.24	6.40
Mean	8.78	1.45	0.62	0.35	15.06	0.26	34.10	49.06	0.33	0.09	1.70
S. Deviation	0.57	0.55	0.64	0.35	6.79	0.40	24.49	28.94	0.09	0.07	1.57
N	87.00	87.00	87	87.00	87.00	87.00	87.00	87.00	60.00	60.00	59.00

Soil Analysis Report

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		---------%--------				----------%---------			
6596	310-315				*	0.09	*	2.3	*
6597	315-320	38	30	32	CL	<0.01	*	2.5	*
6598	320-325	40	24	36	CL	<0.01	0.002	2.0	20.36
6605	355-360	30	20	50	C	0.04	0.001	2.2	21.93
6606	360-365	40	14	46	C	0.18	0.002	2.0	20.46
6607	365-370	54	12	34	SCL	0.14	0.001	4.1	40.73
6608	370-375	32	36	32	CL	0.04	0.001	1.6	16.03
6609	375-380	36	34	30	CL	0.04	0.002	1.9	19.06
6610	380-385	42	32	26	L	0.03	0.003	1.4	14.49
6611	385-390	40	38	22	L	0.03	0.002	1.8	18.46
6612	390-395	52	28	20	SCL/L/SL	0.02	0.002	1.8	17.96
6613	395-400	52	26	22	SCL	0.02	0.001	2.0	20.33
6659	400-405	56	20	24	SCL	<0.01	0.001	0.4	4.43
6660	405-410	40	26	34	CL	*	0.001	*	*
SUMMARY - ALL SAMPLES									
	Minimum	14.00	2.00	12.00		<0.01	<0.001	0.20	-3.72
	Maximum	80.00	50.00	60.00		0.45	0.02	5.20	51.34
	Mean	41.64	24.11	34.30		0.05	.00	1.69	15.18
	S. Deviation	15.96	11.64	9.84		0.07	.00	0.92	9.88
	N	84.00	84.00	84.00		85.00	83.00	85.00	83.00

APPENDIX D-3

OVERBURDEN/INTERBURDEN GEOCHEMICAL SUMMARY STATISTICS

LITH CODE : GR

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca	Mg	Na	K	SAR	Sat %	---AB-DTPA--- B	Se	2M KCl NO3-N
					--------meq/l--------						-----ppm-----		ppm
R4028	45-55	GR	8.1	0.4	1.27	0.59	1.6	0.10	1.6	23.2	0.18	<0.01	0.8
R4041	20-30	GR	8.4	0.5	1.42	0.50	3.7	0.08	3.7	20.5	0.25	<0.01	0.6
R4050	10-20	GR	7.8	0.5	1.06	0.36	3.2	0.19	3.7	27.1	0.19	<0.01	1.0
R4051	20-30	GR	7.7	0.7	1.57	1.31	3.4	0.58	2.8	23.7	0.20	<0.01	1.0
R4052	30-40	GR	7.1	0.8	2.77	2.34	2.7	0.97	1.7	35.2	0.50	<0.01	2.0
R4053	40-50	GR	7.3	0.6	1.35	1.17	2.7	0.71	2.4	28.6	0.34	<0.01	1.3
R4054	50-60	GR	7.0	1.0	1.48	1.69	4.2	0.81	3.3	43.0	0.39	<0.01	2.4
R4072	10-20	GR	7.7	0.3	0.50	0.33	2.5	0.09	3.9	22.6	0.15	<0.01	0.4
R4073	20-30	GR	7.6	0.3	0.48	0.25	1.9	0.05	3.2	23.0	0.10	<0.01	0.4
R4074	30-40	GR	7.9	0.3	0.59	0.31	2.0	0.08	3.0	28.4	0.17	<0.01	0.9
R4075	40-50	GR	8.2	0.3	0.67	0.38	2.6	0.06	3.5	21.3	0.11	<0.01	1.2
R4076	50-60	GR	8.2	0.3	0.69	0.39	2.3	0.02	3.1	21.7	0.16	<0.01	2.2
R4077	60-70	GR	8.1	0.3	0.50	0.25	2.0	0.02	3.3	32.4	0.06	<0.01	1.2
R4078	70-80	GR	8.2	0.4	0.41	0.22	2.3	0.08	4.1	24.2	0.26	<0.01	2.1
R4079	80-90	GR	8.2	0.5	0.38	0.20	3.3	0.08	6.2	18.2	0.26	<0.01	1.6
R4080	90-100	GR	8.2	0.5	0.78	0.42	4.2	0.19	5.5	22.4	0.24	<0.01	2.6
R3985	20-30	GR	7.8	0.9	1.89	0.69	3.6	2.33	3.2	26.4	0.12	<0.01	0.5
R3986	30-40	GR	7.8	1.6	1.53	0.82	15.0	0.57	13.9	24.2	0.34	<0.01	<0.1
R3987	40-50	GR	7.6	0.3	0.55	0.28	2.2	0.03	3.4	29.1	0.72	0.01	
R3988	50-60	GR	7.8	0.8	0.59	0.28	8.9	0.30	13.5	36.8	0.43	0.04	6.1
R4026	25-35	GR	8.2	0.3	0.69	0.33	2.4	0.06	3.4	26.7	0.13	<0.01	0.7
R4027	35-45	GR	7.9	0.3	0.48	0.26	2.2	0.05	3.6	29.3	0.10	<0.01	0.4

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potentia
		---------%--------				---------%---------			
R4028	45-55	87	4	9	LS	<0.01	<0.001	0.3	3.000
R4041	20-30	81	7	12	SL	0.02	<0.001	0.5	4.375
R4050	10-20					0.01	<0.001	0.2	1.688
R4051	20-30	84	2	14	LS/SL	0.04	<0.001	1.2	10.750
R4052	30-40					0.01	<0.001	0.2	1.688
R4053	40-50	78	2	20	SCL/SL	0.01	<0.001	0.2	1.688
R4054	50-60	84	2	14	LS/SL	<0.01	0.001	0.3	3.031
R4072	10-20	80	4	16	SL	<0.01	<0.001	0.2	2.000
R4073	20-30	86	2	12	LS	0.01	<0.001	0.2	1.688
R4074	30-40	82	2	16	SL	0.01	<0.001	0.2	1.688
R4075	40-50	80	4	16	SL	0.01	<0.001	0.2	1.688
R4076	50-60	80	2	18	SL	<0.01	<0.001	0.3	3.000
R4077	60-70	84	2	14	LS/SL	0.01	0.001	0.3	2.719
R4078	70-80	76	6	18	SL	0.01	<0.001	0.2	1.688
R4079	80-90	68	13	19	SL	0.01	<0.001	0.2	1.688
R4080	90-100	72	12	16	SL	0.01	<0.001	0.4	3.688
R3985	20-30	88	3	9	LS	0.02	<0.001	0.7	6.375
R3986	30-40	78	12	10	SL	0.08	0.003	0.3	0.594
R3987	40-50	90	2	8	S	0.07	<0.001	1.6	13.813
R3988	50-60	38	18	44	C	0.01	0.002	0.5	4.750
R4026	25-35	89	1	10	LS	0.01	<0.001	0.4	3.688
R4027	35-45	91	0	9	S	0.03	<0.001	0.5	4.063

LITH CODE : GR

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca	Mg	Na	K	SAR	Sat %	---AB-DTPA--- B	Se	2M KCl NO3-N
					--------meq/l--------						-----ppm-----		ppm
R 6505	0-5	GR	8.6	0.5	0.4	0.1	4.7	0.1	9.9	30.6			
6506	5-10	GR	8.2	1.4	0.6	0.3	13.7	0.2	20.3	59.4			
6507	10-15	GR	8.4	0.7	0.4	0.2	7.2	0.1	14.2	35.2			
6508	15-20	GR	8.5	0.2	0.1	<0.1	1.8	<0.1	6.0	32.6			
6509	20-25	GR	8.4	0.3	0.5	0.2	2.1	0.1	3.5	33.8			
6510	25-30	GR	8.6	0.3	0.4	0.6	1.7	0.1	2.4	34.2			
6511	30-35	GR	8.5	0.2	0.1	<0.1	2.3	<0.1	8.1	33.5			
6512	35-40	GR	8.5	0.3	0.1	0.1	2.8	0.1	8.8	33.7			
6644	0-5	GR	6.4	0.6	0.4	0.1	5.0	0.1	10.5	23.4			
6645	5-10	GR	6.5	1.5	5.6	1.9	4.2	1.4	2.1	14.8			
6646	10-15	GR	7.9	0.3	0.5	0.1	2.0	0.1	3.4	29.7			
6647	15-20	GR	8.0	0.2	0.2	0.1	1.6	<0.5	4.6	30.9			
6648	20-25	GR	8.0	0.2	0.2	0.1	2.1	<0.5	6.0	28.0			
6649	25-30	GR	8.3	0.3	0.2	0.1	1.9	0.1	5.2	31.9			
6650	30-35	GR	8.5	0.5	0.3	0.1	4.7	0.1	11.4	31.5			
6651	35-40	GR	8.4	0.4	0.3	0.1	3.3	0.1	7.4	25.9			
6652	40-45	GR	8.5	0.3	0.2	0.1	1.9	0.1	5.5	32.9			
6653	45-50	GR	8.7	0.4	0.2	0.1	3.3	0.1	9.3	30.6			
6654	55-60	GR	8.6	0.3	0.3	<0.5	2.6	0.1	7.2	31.8			
6655	60-65	GR	8.5	0.3	0.4	0.1	1.8	0.3	3.8	36.3			
6656	65-70	GR	8.4	0.3	0.2	<0.5	0.7	0.4	2.2	32.6			
6657	75-80	GR	8.4	0.3	0.3	0.1	1.9	0.2	4.0	33.8			
6658	80-85	GR	8.3	0.4	0.8	0.5	2.4	0.2	3.1	33.2			
SUMMARY - ALL SAMPLES													
	Minimum		6.40	0.20	0.10	<0.1	0.70	<0.1	1.61	14.80	0.06	<0.01	<0.01
	Maximum		8.70	1.60	5.60	2.34	15.04	2.33	20.30	59.40	0.72	0.04	6.10
	Mean		8.04	0.49	0.76	0.41	3.43	0.25	5.66	29.52	0.25	<0.01	1.40
	S. Deviation		0.52	0.32	0.91	0.51	2.78	0.42	3.96	7.16	0.15	<0.01	1.27
	N		44.00	44.00	44.00	44.00	44.00	44.00	44.00	44.00	22.00	22.00	21.00

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		---------%---------				----------%---------			
R	6505	0-5				*	*	*	*
	6506	5-10			*	0.06	*	0.7	*
	6507	10-15			*	<0.01	0.001	0.2	1.53
	6508	15-20			*	<0.01	<0.001	0.2	1.70
	6509	20-25			*	0.01	0.001	0.3	3.03
	6510	25-30			*	<0.01	<0.001	0.1	1.30
	6511	30-35			*	<0.01	<0.001	0.2	1.60
	6512	35-40	58	10	32	SCL	<0.01	0.001	0.2	1.83
	6644	0-5	86	4	10	LS	<0.01	0.002	*	0.06
	6645	5-10	88	4	8	LS	<0.01	<0.001	*	*
	6646	10-15			*	<0.01	<0.001	0.1	1.10
	6647	15-20			*	<0.01	<0.001	0.1	0.80
	6648	20-25			*	<0.01	<0.001	0.1	0.90
	6649	25-30			*	0.01	<0.001	0.1	0.69
	6650	30-35	98	2	0	S	0.01	<0.001	0.2	1.39
	6651	35-40			*	0.01	<0.001	0.2	1.89
	6652	40-45	98	0	2	S	0.01	<0.001	0.1	0.89
	6653	45-50			*	0.01	<0.001	*	*
	6654	55-60			*	0.01	<0.001	0.2	1.49
	6655	60-65	98	2	0	S	*	<0.001	*	*
	6656	65-70	98	2	0	S	0.01	<0.001	0.1	0.69
	6657	75-80			*	0.01	*	0.2	*
	6658	80-85			*	0.01	<0.001	0.2	1.59
SUMMARY - ALL SAMPLES									
	Minimum	38.00	0.00	0.00		<0.01	<0.001	0.10	0.060
	Maximum	98.00	18.00	44.00		0.08	0.003	1.60	13.813
	Mean	82.20	4.59	13.18		0.02	<0.001	0.28	2.263
	STD.	12.54	4.43	9.13		0.02	<0.001	0.29	2.584
	N	26.00	26.00	26.00		42.00	41.000	39.00	38.000

Tsdaka Overburden

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca	Mg	Na	K	SAR	Sat %	---AB-DTPA--- B	Se	2M KCl NO3-N
					--------meq/l--------						-----ppm-----		ppm
R4042	30-40	CN	8.5	0.6	1.04	0.37	5.8	0.09	6.9	19.1	0.15	<0.01	1.4
R4043	40-50	CN	8.9	0.4	0.20	0.08	4.9	0.03	13.2	19.5	0.16	<0.01	1.1
R4044	50-60	CN	8.9	0.7	0.64	0.25	8.4	0.04	12.6	27.9	0.25	<0.01	0.8
R4045	60-70	CN	8.8	1.1	0.84	0.33	12.3	0.05	16.0	28.4	0.20	<0.01	
R4046	70-80	CN	8.8	1.4	1.24	0.51	13.8	0.07	14.8	34.2	0.25	<0.01	0.5
R4047	80-90	CN	8.8	1.5	0.79	0.44	14.7	0.09	18.7	29.4	0.27	<0.01	0.7
SUMMARY -Tsdaka Overburden													
	Minimum		8.5	0.4	0.2	0.1	4.9	.0	6.9	19.1	0.15	<0.01	0.5
	Maximum		8.9	1.5	1.2	0.5	14.7	0.1	18.7	34.2	0.27	<0.01	1.4
	Mean		8.8	1.0	0.8	0.3	10.0	0.1	13.7	26.4	0.21	<0.01	0.9
	S. Deviation		0.1	0.4	0.3	0.1	3.8	.0	3.6	5.4	0.05	<0.01	0.3
	N		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.00	5.0

Tsdaka Overburden

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		---%---				---%---			
R4042	30-40	80	8	12	SL	0.01	<0.001	1.2	11.69
R4043	40-50	83	7	10	LS	<0.01	<0.001	0.6	6.00
R4044	50-60	71	12	17	SL	0.01	0.001	0.5	4.72
R4045	60-70	70	10	20	SCL/SL	0.01	0.002	1.2	11.75
R4046	70-80	66	14	20	SCL/SL	<0.01	0.003	2.8	28.09
R4047	80-90	74	11	15	SL	<0.01	0.002	5.5	55.06
SUMMARY - Tsdaka Overburden									
	Minimum	66.0	7.0	10.0		<0.01	<0.001	0.5	4.7
	Maximum	83.0	14.0	20.0		0.01	0.003	5.5	55.1
	Mean	74.0	10.3	15.7		0.01	0.001	2.0	19.6
	S. Deviation	5.9	2.4	3.8		0.01	0.001	1.7	17.6
	N	5.0	5.0	5.0		6.0	6.000	6.0	6.0

* - tons CaCO3/1000 tons material

Wishbone Overburden

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca	Mg	Na	K	SAR	Sat %	---AB-DTPA--- B	Se	2M KCl NO3-N ppm
					--------meq/l--------						-----ppm-----		
R3989	60-70	CN	8.4	1.1	0.32	0.16	11.7	0.19	23.8	36.2	0.53	0.12	11.0
R3990	70-80	CN	8.7	1.3	0.37	0.19	14.4	0.18	27.3	53.0	0.44	0.14	3.6
R3991	80-90	CN	8.7	1.3	0.35	0.20	14.6	0.16	27.9	36.7	0.49	0.10	1.5
R3992	90-100	CN	8.8	1.2	0.38	0.20	14.3	0.11	26.4	41.1	0.46	0.16	2.9
R3993	100-110	CN	8.7	1.3	0.11	0.12	14.9	0.14	43.7	41.2	0.51	0.10	0.6
R3994	110-120	CN	8.9	1.4	0.11	0.06	17.3	0.14	59.6	37.6	0.48	0.13	1.2
R3995	120-130	CN	8.8	1.3	0.10	0.06	15.3	0.12	55.0	34.5	0.49	0.15	2.0
R3996	130-140	CN	8.8	1.4	0.15	0.10	17.3	0.12	49.6	33.5	0.43	0.08	1.6
R3997	140-150	CN	8.6	1.6	0.13	0.07	18.8	0.14	59.2	31.4	0.66	0.17	2.2
SUMMARY -Wishbone LOverburden													
	Minimum		8.4	1.1	0.1	0.1	11.7	0.1	23.8	31.4	0.4	0.1	0.6
	Maximum		8.9	1.6	0.4	0.2	18.8	0.2	59.6	53.0	0.7	0.2	11.0
	Mean		8.7	1.3	0.2	0.1	15.4	0.1	41.4	38.4	0.5	0.1	3.0
	S. Deviation		0.1	0.1	0.1	0.1	2.0	.0	14.2	6.0	0.1	.0	3.0
	N		9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0

Wishbone Overburden

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		---%---				---%---			
R3989	60.0-70.0	10	34	56	C	0.01	0.001	1.1	10.72
R3990	70.0-80.0	10	31	59	C	0.01	0.001	1.0	9.72
R3991	80.0-90.0	5	42	53	SiC	0.01	0.002	0.7	6.75
R3992	90.0-100.0	10	34	56	C	0.01	0.001	0.9	8.72
R3993	100.0-110.0	16	27	57	C	<0.01	<0.001	1.0	10.00
R3994	110.0-120.0	7	37	56	C	0.02	0.001	0.8	7.41
R3995	120.0-130.0	10	31	59	C	0.01	<0.001	1.1	10.69
R3996	130.0-140.0	16	34	50	C	0.01	<0.001	1.6	15.69
R3997	140.0-150.0	30	38	32	CL	<0.01	0.001	2.3	23.03
SUMMARY -Wishbone Overburden									
	Minimum	5.0	27.0	32.0		<0.01	<0.001	0.7	6.8
	Maximum	30.0	42.0	59.0		0.02	0.002	2.3	23.0
	Mean	12.7	34.2	53.1		0.01	0.001	1.2	11.4
	S. Deviation	7.0	4.2	7.9		0.01	0.001	0.5	4.8
	N	9.0	9.0	9.0		9.00	9.000	9.0	9.0

* - tons CaCO3/1000 tons material

Jonesville Overburden

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca	Mg	Na	K	SAR	Sat %	---AB-DTPA--- B ppm	Se ppm	2M KCl NO3-N ppm
					--------meq/l--------								
R3954	29.8-38.7	SL	7.9	0.5	1.56	0.32	2.6	0.45	2.7	26.4	0.29	0.11	0.6
R3955	38.7-42.8	SS	7.8	0.9	2.46	0.59	4.1	1.42	3.4	26.7	0.26	0.34	0.9
R3956	42.8-51.3	SH	8.1	0.8	1.36	0.36	5.9	0.75	6.4	36.4	0.24	0.04	0.2
R3957	51.3-60.0	SS	8.1	0.7	1.56	0.42	4.7	0.56	4.7	32.7	0.24	0.05	0.4
R3958	60.0-70.0	SS	8.3	0.6	2.39	0.82	2.7	0.31	2.1	32.2	0.42	0.05	0.2
R3959	70.0-80.0	SS	7.9	0.8	2.51	0.71	5.0	0.58	4.0	29.5	0.24	0.05	0.1
R3960	80.0-82.8	SH	8.1	0.7	0.97	0.21	6.3	0.33	8.2	29.3	0.18	0.16	4.6
SUMMARY -Jonesville Overburden													
	Minimum		7.8	0.5	0.97	0.21	2.61	0.31	2.10	26.40	0.18	0.04	0.10
	Maximum		8.3	0.9	2.51	0.82	6.30	1.42	8.20	36.40	0.42	0.34	4.60
	Mean		8.0	0.7	1.83	0.49	4.47	0.63	4.48	30.46	0.27	0.11	1.00
	S. Deviation		0.2	0.1	0.57	0.21	1.34	0.35	2.00	3.30	0.07	0.10	1.49
	N		7.0	7.0	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00

Jonesville Overburden

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		---%---				---%---			
R3954	29.8-38.7	42	23	35	CL	<0.01	0.001	0.8	8.03
R3955	38.7-42.8	40	24	36	CL	0.03	0.003	1.8	17.16
R3956	42.8-51.3	42	19	39	CL	0.01	0.002	0.9	8.75
R3957	51.3-60.0	50	15	35	SC/SCL	0.01	0.002	6.9	68.75
R3958	60.0-70.0	73	9	18	SL	0.01	0.003	2.1	20.78
R3959	70.0-80.0	62	10	28	SCL	0.02	0.003	2.0	19.47
R3960	80.0-82.8	34	8	58	C	0.08	0.002	1.7	14.56
SUMMARY - Jonesville Overburden									
	Minimum	34.0	8.0	18.0		<0.01	0.001	0.8	8.0
	Maximum	73.0	24.0	58.0		0.08	0.003	6.9	68.8
	Mean	49.0	15.4	35.6		0.02	0.002	2.3	22.5
	S. Deviation	12.8	6.2	11.2		0.02	0.001	1.9	19.4
	N	7.0	7.0	7.0		7.00	7.000	7.0	7.0

* - tons CaCO3/1000 tons material

Premier Overburden

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca	Mg	Na	K	SAR	Sat %	---AB-DTPA--- B ppm	Se ppm	2M KCl NO3-N ppm
					--------meq/l--------								
R4056	70-80	SH	7.7	0.9	2.21	1.01	6.0	0.68	4.8	31.4	0.34	0.01	1.1
R4057	80-90	SS	7.5	1.6	7.98	3.78	6.8	1.49	2.8	33.8	0.32	0.01	0.4
R4058	90-100	SS	7.5	1.8	7.98	4.25	6.0	1.40	2.4	38.0	0.30	<0.01	0.5
R4059	100-110	SH72BO	7.7	1.0	3.23	2.19	3.7	0.95	2.3	37.6	0.21	0.02	0.1
R4029	55-65	SH	8.1	0.6	2.01	0.82	3.3	0.11	2.8	20.7	0.21	<0.01	0.4
R4030	65-75	SH	8.8	0.9	1.52	0.51	8.0	0.07	7.9	38.3	0.50	0.02	1.4
R4031	75-85	SH	8.7	0.8	0.79	0.18	7.3	0.05	10.5	29.7	0.43	0.02	1.0
R4032	85-95	SH	8.5	0.8	1.31	0.45	6.6	0.13	7.1	30.1	0.35	0.10	0.3
R4033	95-105	SH	8.3	1.1	2.81	0.95	8.1	0.20	5.9	37.8	0.36	0.01	1.1
R4034	105-115	SH	8.4	0.8	1.36	0.37	7.2	0.13	7.7	33.1	0.37	0.02	1.5
R4035	115-125	SH	8.3	1.2	1.46	0.34	10.8	0.18	11.4	38.9	0.42	0.18	0.4
R4036	125-135	SH	8.1	2.2	2.06	0.59	19.1	0.23	16.6	36.4	0.46	0.14	2.9
R4037	135-145	SH	8.4	1.2	0.98	0.34	11.9	0.12	14.6	27.8	0.40	0.06	2.5
R4038	145-155	SH	8.3	1.8	1.85	0.53	16.2	0.20	14.8	27.8	0.33	0.05	3.7
R4039	155-165	SH	8.5	1.0	1.13	0.38	10.6	0.08	12.2	35.8	0.21	0.06	1.8
R3961	162.3-172.3	SS	8.8	1.5	0.24	0.17	15.3	0.26	33.9	25.5	0.13	0.08	<0.1
R3974	76.1-86.0	SS	8.8	1.2	0.10	0.08	13.3	0.14	45.1	84.2	0.32	0.15	0.1
R3975	86.0-92.5	SS	8.8	1.5	0.35	0.29	15.0	0.54	26.5	93.4	0.40	0.08	0.1
R3976	92.5-100.5	SS	8.8	1.5	0.28	0.20	14.4	0.95	29.6	77.0	0.39	0.11	<0.1
R3977	100.5-106.1	SH	8.5	1.8	0.28	0.20	18.0	0.23	37.0	38.4	0.53	0.14	0.2
R3978	108.2-114.7	SL	8.1	1.9	0.84	0.54	17.4	0.95	20.9	29.4	0.40	0.05	5.2
R3979	114.7-121.1	SL	8.3	1.0	0.41	0.30	11.5	0.30	19.3	25.8	0.46	0.04	2.9
R3980	121.1-127.6	SS	7.7	1.5	2.33	1.94	12.8	0.62	8.8	25.4	0.47	0.03	0.1
R3981	127.6-131.5	SL	8.1	0.9	0.87	0.64	8.1	0.34	9.4	24.5	0.40	0.06	5.2
R3982	131.5-138.8	SS	7.9	1.9	6.59	4.78	9.7	0.91	4.1	25.8	0.38	0.07	<0.1
R3983	138.8-142.8	SL	7.7	1.3	3.46	2.06	8.1	0.55	4.9	30.6	0.30	0.26	6.4

Premier Overburden

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		---%---				---%---			
R4056	70-80	42	22	36	CL	<0.01	<0.001	3.0	30.00
R4057	80-90	58	12	30	SCL	<0.01	0.001	12.8	128.03
R4058	90-100	64	8	28	SCL	0.07	0.001	5.9	56.84
R4059	100-110	72	6	22	SCL	0.01	0.003	5.7	56.78
R4029	55-65	75	8	17	SL	0.02	0.002	0.6	5.44
R4030	65-75					0.03	0.002	1.2	11.13
R4031	75-85	64	14	22	SCL/LS	0.01	0.002	3.6	35.75
R4032	85-95	74	10	16	SCL	0.03	0.003	4.5	44.16
R4033	95-105	66	13	21	SL	0.02	0.003	2.4	23.47
R4034	105-115	62	14	24	SCL	0.01	0.003	2.0	19.78
R4035	115-125	32	21	47	SCL	0.05	0.008	0.9	7.69
R4036	125-135	31	32	37	C	0.04	0.009	2.5	24.03
R4037	135-145	28	28	44	CL	0.01	0.003	2.4	23.78
R4038	145-155	40	20	40	C/CL	0.03	0.006	2.6	25.25
R4039	155-165	58	12	30	SCL	0.02	0.002	3.1	30.44
R3961	162.3-172.3	63	13	24	SCL	0.02	0.004	1.3	12.50
R3974	76.1-86.0	29	38	33	CL	0.03	0.002	1.8	17.13
R3975	86.0-92.5	21	44	35	CL	0.03	0.001	1.6	15.09
R3976	92.5-100.5	30	38	32	CL	0.03	0.002	1.8	17.13
R3977	100.5-106.1	35	20	45	C	0.06	0.005	1.9	17.28
R3978	108.2-114.7	57	15	28	SCL	0.03	0.004	1.6	15.19
R3979	114.7-121.1	63	12	25	SCL	0.04	0.001	2.2	20.78
R3980	121.1-127.6	63	11	26	SCL	0.01	0.004	2.6	25.81
R3981	127.6-131.5	68	11	21	SCL	0.04	0.002	1.6	14.81
R3982	131.5-138.8	64	12	24	SCL	0.01	0.010	2.5	25.00
R3983	138.8-142.8	36	13	51	C	0.03	0.004	0.3	2.19

Premier Overburden

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca	Mg	Na	K	SAR	Sat %	---AB-DTPA--- B	Se	2M KCl NO3-N ppm
					--------meq/l--------						-----ppm-----		
6534	145-150	SL	8.3	2.8	0.6	0.3	26.4	0.7	39.8	19.8			
6535	150-155	SL	8.3	1.9	0.4	0.2	20.7	0.4	39.9	21.9			
6536	155-160	SL	8.5	2.1	0.5	0.2	24.3	0.1	40.1	22.4			
6537	160-165	SL	8.5	2.2	0.5	0.3	26.0	0.2	42.3	23.7			
6538	165-170	SL	8.3	1.9	0.8	1.1	26.5	0.2	27.3	20.3			
6539	170-175	SL	8.5	2.0	0.3	0.1	24.7	0.3	54.2	24.7			
6540	175-180	SL	8.6	2.1	0.4	0.3	48.7	0.7	83.3	23.6			
6541	180-185	SL	8.6	0.7	0.1	0.2	6.3	0.2	16.2	19.7			
6542	185-190	SL	8.6	1.5	0.4	0.6	15.7	0.4	22.6	21.6			
6543	190-195	SL	8.5	0.6	0.2	0.2	5.0	0.2	10.5	23.4			
6544	195-200	SL	9.1	1.8	0.4	0.1	19.1	0.3	36.8	15.9			
6545	200-210	SL	9.0	0.7	0.1	0.1	6.4	0.2	18.1	20.0			
6546	210-215	SL	8.6	2.3	0.4	0.3	25.2	0.4	43.3	19.1			
6547	215-220	SL	8.6	1.4	0.3	0.2	15.8	0.3	32.4	19.6			
6548	220-225	SL	8.5	1.2	0.7	0.4	11.6	0.5	15.2	25.1			

Premier Overburden

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		---%---				---%---			
6534	145-150	46	26	28	SCL	0.01	0.001	1.1	10.83
6535	150-155	36	32	32	CL	0.02	<0.001	1.2	11.60
6536	155-160	42	28	30	CL	0.02	0.001	1.8	17.83
6537	160-165	34	34	32	CL	0.01	0.001	1.5	14.63
6538	165-170	46	26	28	SCL	0.02	<0.001	1.8	18.40
6539	170-175	36	32	32	CL	0.02	0.001	1.2	12.33
6540	175-180	34	34	32	CL	0.02	0.002	1.3	13.16
6541	180-185	48	24	28	SCL	0.02	<0.001	5.6	56.30
6542	185-190	40	28	32	CL	0.03	0.001	1.6	16.23
6543	190-195	40	30	30	CL	0.01	0.001	3.7	37.23
6544	195-200	60	18	22	SCL	<0.01	0.001	18.1	181.03
6545	200-210	40	28	32	CL	<0.01	0.001	7.3	73.13
6546	210-215	48	24	28	SCL	0.01	0.001	*	*
6547	215-220	44	28	28	CL	0.02	0.001	5.4	53.83
6548	220-225	32	28	40	C/CL	*	0.002	2.6	*

Premier Overburden

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca	Mg	Na	K	SAR	Sat %	---AB-DTPA--- B	Se	2M KCl NO3-N
					--------meq/l--------						-----ppm-----		ppm
6548	215-220	CL	8.5	1.9	0.5	0.4	18.8	0.7	27.8	24.9			
6549	220-222	CL	8.3	1.9	0.6	0.5	19.6	0.8	27.0	34.5			
6550	222-225	CL	8.6	0.8	0.2	0.3	7.0	0.4	14.3	32.3			
6551	225-227	CL	8.4	0.7	0.4	0.2	3.6	0.3	6.8	17.6			
6552	227-230	CL	8.3	1.5	0.8	0.6	17.3	0.9	20.3	29.8			
6553	230-235	SH	8.3	1.6	0.3	0.3	28.5	0.4	53.8	18.7			
6554	235-240	SH	8.3	1.5	0.1	0.1	17.2	0.2	53.8	18.7			
6555	240-245	SH	8.2	1.5	0.2	<0.1	15.5	0.2	45.4	20.5			
6556	245-250	SH	8.2	1.7	0.2	0.1	18.3	0.5	46.1	21.0			
6582	240-245	SH	8.4	1.0	0.2	0.1	10.6	0.1	28.9	24.4			
6583	245-250	SH	8.6	1.9	0.2	0.1	20.2	0.2	52.3	24.2			
6593	295-300	SH	8.9	1.0	0.1	0.3	12.3	0.2	28.2	47.6			
6594	300-305	SH	8.8	2.1	0.2	0.2	28.1	0.2	63.8	44.1			
6595	305-310	SH	9.1	1.0	0.7	1.1	12.2	0.4	12.7	64.2			

Premier Overburden

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		--------%--------				----------%---------			
6548	215-220	32	28	40	C/CL	0.02	<0.001	2.2	22.10
6549	220-222	20	36	44	C	0.02	0.001	2.1	20.53
6550	222-225	20	36	44	C	0.02	*	3.1	*
6551	225-227	52	20	28	SCL	0.01	0.002	1.8	17.76
6552	227-230	28	28	44	C	0.03	0.001	2.5	24.53
6553	230-235	68	10	22	SCL	0.06	0.005	1.2	12.36
6554	235-240	68	8	28	SCL	0.09	0.003	0.9	9.39
6555	240-245	64	8	28	SCL	0.06	0.002	0.8	7.86
6556	245-250	60	10	30	SCL	0.06	0.001	0.8	7.53
6582	240-245	46	26	28	SCL	0.07	0.002	0.7	7.06
6583	245-250	56	20	24	SCL	0.08	0.005	2.2	22.06
6593	295-300	24	18	58	C	0.09	<0.001	1.0	10.00
6594	300-305	24	16	60	C	0.08	0.001	0.8	8.33
6595	305-310	36	24	40	C/CL	0.45	0.001	2.6	25.53

Premier Overburden

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca	Mg	Na	K	SAR	Sat %	---AB-DTPA--- B	Se	2M KCl NO3-N ppm
					--------meq/l--------						-----ppm-----		
6596	310-315	SH	9.1	1.6	0.1	0.1	21.2	0.1	70.1	94.0			
6597	315-320	SH	9.0	3.0	0.4	1.0	43.4	0.4	51.3	96.2			
6598	320-325	SH	9.1	2.0	0.2	0.2	22.7	0.2	48.2	111.0			
6605	355-360	SH	9.1	1.5	0.3	0.3	15.3	0.2	26.6	60.9			
6606	360-365	SH	9.0	0.9	0.6	0.6	8.8	0.3	11.3	46.3			
6607	365-370	SH	8.9	1.6	0.4	0.4	15.5	0.3	24.0	39.2			
6608	370-375	SH	9.2	1.2	0.4	0.2	12.2	0.1	23.9	70.0			
6609	375-380	SH	9.1	1.0	0.6	1.4	9.6	0.3	9.6	108.7			
6610	380-385	SH	9.1	1.3	0.1	0.2	13.3	0.1	34.1	126.2			
6611	385-390	SH	9.2	1.8	0.2	0.2	19.5	0.1	44.1	88.4			
6612	390-395	SH	9.1	1.6	0.2	0.1	17.0	0.1	46.1	83.5			
6613	395-400	SH	9.1	1.3	0.2	0.2	14.5	0.1	32.0	84.5			
6659	400-405	CL	8.2	0.5	0.6	0.2	3.3	0.2	5.2	21.9			
6660	405-410	CL	8.6	0.6	0.9	0.2	4.7	0.2	6.4	30.2			

Premier Overburden

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		---------%---------				----------%----------			
6596	310-315				*	0.09	*	2.3	*
6597	315-320	38	30	32	CL	<0.01	*	2.5	*
6598	320-325	40	24	36	CL	<0.01	0.002	2.0	20.36
6605	355-360	30	20	50	C	0.04	0.001	2.2	21.93
6606	360-365	40	14	46	C	0.18	0.002	2.0	20.46
6607	365-370	54	12	34	SCL	0.14	0.001	4.1	40.73
6608	370-375	32	36	32	CL	0.04	0.001	1.6	16.03
6609	375-380	36	34	30	CL	0.04	0.002	1.9	19.06
6610	380-385	42	32	26	L	0.03	0.003	1.4	14.49
6611	385-390	40	38	22	L	0.03	0.002	1.8	18.46
6612	390-395	52	28	20	SCL/L/SL	0.02	0.002	1.8	17.96
6613	395-400	52	26	22	SCL	0.02	0.001	2.0	20.33
6659	400-405	56	20	24	SCL	<0.01	0.001	0.4	4.43
6660	405-410	40	26	34	CL	*	0.001	*	*

Premier Overburden

Lab #	Sample ID#	Lith	pH	E.C. mmhos/cm	Ca meq/l	Mg meq/l	Na meq/l	K meq/l	SAR	Sat %	AB-DTPA B ppm	AB-DTPA Se ppm	2M KCl NO3-N ppm
6513	40-45	SL	8.9	0.9	0.3	0.1	8.3	0.1	20.3	61.4			
6514	45-50	SL	8.4	0.4	1.1	0.4	2.0	0.3	2.3	48.5			
6515	50-55	SL	8.4	0.6	1.1	0.9	3.8	0.5	3.9	21.6			
6516	55-60	SL	8.3	0.7	1.2	0.8	3.9	0.5	3.9	34.6			
6517	60-65	SL	8.3	0.5	0.8	0.5	3.1	0.4	3.8	30.9			
6518	65-70	SL	8.3	0.6	0.9	0.5	3.4	0.4	4.0	32.1			
6519	70-75	SL	8.3	0.5	0.6	0.3	3.2	0.3	4.8	32.4			
6520	75-80	SL	8.4	0.7	0.7	0.5	5.6	0.4	6.9	25.5			
6521	80-85	SL	8.4	0.7	0.7	0.5	5.0	0.4	6.7	29.0			
6522	85-90	SL	8.4	0.8	0.5	0.3	9.6	0.4	14.7	27.1			
6523	90-95	SL	8.4	0.9	0.5	0.3	7.2	0.4	11.7	26.9			
6524	95-100	SL	8.4	0.8	0.3	0.1	7.3	0.3	16.1	23.3			
6525	100-105	SL	8.3	1.2	0.4	0.2	11.4	0.3	22.0	23.8			
6526	105-110	SL	8.1	2.0	0.7	0.5	18.0	0.6	22.9	21.2			
6527	110-115	SL	8.5	1.3	0.4	0.3	13.3	0.3	22.1	22.5			
6528	115-120	SL	8.4	1.8	0.4	0.2	20.3	0.3	39.3	26.2			
6529	120-125	SL	8.4	2.0	0.3	0.1	21.7	0.4	45.6	21.7			
6530	125-130	SL	8.3	2.5	0.5	0.3	25.1	0.5	41.3	21.6			
6531	130-135	SL	8.4	1.5	0.5	0.2	17.0	0.3	29.4	24.3			
6532	135-140	SL	8.5	1.3	0.3	0.1	13.7	0.2	31.5	23.5			
6533	140-145	SL	8.4	1.6	0.3	0.1	17.6	0.3	36.9	20.2			

Premier Overburden

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		---------%---------				----------%---------			
6513	40-45				*	<0.01	*	0.5	*
6514	45-50	10	38	52	C	0.03	0.002	0.8	8.26
6515	50-55	50	18	32	SCL	<0.01	0.001	14.0	140.13
6516	55-60	18	38	44	C	0.01	0.001	3.3	32.53
6517	60-65	26	34	40	C/CL	0.01	<0.001	1.6	16.20
6518	65-70	18	38	44	C	0.02	<0.001	1.4	14.00
6519	70-75	18	38	44	C	0.02	<0.001	1.2	11.60
6520	75-80	38	26	36	CL	0.01	0.001	15.5	155.23
6521	80-85	24	36	40	C/CL	0.01	0.001	1.6	16.43
6522	85-90	22	34	44	C	0.02	0.001	1.4	14.13
6523	90-95	30	30	40	C/CL	0.02	0.001	1.6	15.53
6524	95-100	36	34	30	CL	0.01	0.001	1.2	12.33
6525	100-105	42	30	28	CL	0.01	0.001	1.3	12.73
6526	105-110	48	28	24	SCL/L	<0.01	<0.001	6.2	62.00
6527	110-115	34	34	32	CL	<0.01	0.001	1.6	15.73
6528	115-120	38	30	32	CL	0.02	<0.001	1.3	13.00
6529	120-125	38	32	30	CL	0.02	<0.001	2.7	27.00
6530	125-130	38	32	30	CL	0.02	0.001	1.1	10.63
6531	130-135	38	34	28	CL	0.01	0.001	1.3	12.32
6532	135-140	38	32	30	CL	0.01	<0.001	1.2	11.50
6533	140-145	44	28	28	CL	0.01	0.001	1.0	9.93

Premier Overburden

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca meq/l	Mg meq/l	Na meq/l	K meq/l	SAR	Sat %	---AB-DTPA--- B ppm	Se ppm	2M KCl NO3-N ppm
6590	280-285	SS	9.1	1.3	0.2	0.1	13.8	0.1	32.1	98.6			
6591	285-290	SS	8.9	2.6	0.3	0.1	28.6	0.1	67.1	37.6			
6599	325-330	SS	9.0	1.4	0.1	0.1	14.7	0.1	43.0	115.1			
6600	330-335	SS	9.0	1.0	0.2	0.5	10.7	0.2	18.0	101.9			
6601	335-340	SS	9.1	1.3	0.3	0.4	12.9	0.1	22.0	116.3			
6602	340-345	SS	9.2	1.3	0.3	0.6	15.0	0.3	22.9	132.9			
6603	345-350	SS	9.2	1.3	0.3	0.4	13.6	0.2	22.9	121.3			
6614	400-405	SS	9.0	1.4	0.1	0.1	14.7	0.1	43.0	115.1			
6615	405-410	SS	9.0	1.0	0.2	0.5	10.7	0.2	18.0	101.9			
6616	410-415	SS	9.1	1.3	0.3	0.4	12.9	0.1	22.0	116.3			
6617	415-420	SS	9.2	1.3	0.3	0.6	15.0	0.3	22.9	132.9			
6618	420-425	SS	9.2	1.3	0.3	0.4	13.6	0.2	22.9	121.3			
6614	400-405	SS	9.2	1.3	0.1	0.4	14.2	0.1	27.8	70.0			
6615	405-410	SS	9.3	1.2	0.2	0.5	12.1	0.1	21.4	82.4			
6616	410-415	SS	9.2	1.2	0.1	0.1	13.1	0.1	39.8	75.5			
6617	415-420	SS	9.3	0.9	0.1	0.2	9.5	0.1	24.0	89.8			
6618	420-425	SS	9.2	1.1	0.1	0.1	16.1	0.1	47.2	66.2			
6619	425-430	SS	9.3	1.1	0.1	0.2	12.9	0.1	33.1	129.1			
6620	430-435	SS	9.3	0.8	0.2	0.2	9.0	0.2	20.5	116.9			
6621	435-440	SS	9.2	0.7	0.2	0.3	7.3	0.2	14.5	108.0			
6622	440-445	SS	9.4	0.9	0.2	0.4	10.2	0.1	18.6	125.1			

Premier Overburden

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		---------%---------				----------%---------			
6590	280-285	46	26	28	SCL	*	*	*	*
6591	285-290	64	16	20	SCL/SL	<0.01	0.005	15.1	150.86
6599	325-330	36	32	32	CL	0.02	*	*	*
6600	330-335	36	34	30	CL	0.01	*	*	*
6601	335-340	32	36	32	CL	0.01	*	*	*
6602	340-345	20	44	36	SiCL/CL	0.05	*	1.9	*
6603	345-350	30	38	32	CL	0.06	0.001	2.0	20.03
6614	400-405	36	32	32	CL	0.02	*	*	*
6615	405-410	36	34	30	CL	0.01	*	*	*
6616	410-415	32	36	32	CL	0.01	*	*	*
6617	415-420	20	44	36	SiCL/CL	0.05	*	1.9	*
6618	420-425	30	38	32	CL	0.06	0.001	2.0	20.03
6614	400-405	54	28	18	SL	0.03	0.001	1.8	17.63
6615	405-410	56	26	18	SL	<0.01	0.001	1.6	16.03
6616	410-415	64	22	14	SL	<0.01	0.001	5.7	56.83
6617	415-420	58	20	22	SCL	0.01	0.001	1.9	19.23
6618	420-425	60	22	18	SL	<0.01	0.001	5.6	56.23
6619	425-430	62	16	22	SCL	0.01	0.001	2.9	28.53
6620	430-435	64	18	18	SL	<0.01	0.001	1.8	18.23
6621	435-440	64	14	22	SCL	<0.01	0.001	2.3	23.03
6622	440-445	60	18	22	SCL	0.01	0.001	1.6	15.63

Premier Overburden

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca meq/l	Mg meq/l	Na meq/l	K meq/l	SAR	Sat %	---AB-DTPA--- B ppm	Se ppm	2M KCl NO3-N ppm
6623	445-450	SS	9.4	0.7	0.2	0.3	7.6	0.2	14.2	139.1			
6624	450-455	SS	9.3	0.6	0.3	0.3	5.9	0.1	10.5	115.9			
6625	455-460	SS	9.5	0.7	0.3	0.8	7.9	0.2	10.4	144.3			
6626	460-465	SS	9.4	0.7	0.4	0.8	7.3	0.2	9.3	150.5			
6627	465-470	SS	9.4	0.9	0.8	1.7	11.1	0.4	9.8	125.4			
6628	470-475	SS	9.4	0.9	0.2	0.3	9.7	0.1	20.0	124.7			
6629	475-480	SS	9.4	1.1	0.2	0.5	12.1	0.2	20.4	130.2			
6630	480-485	SS	9.4	0.9	0.1	0.2	9.5	0.1	23.3	139.7			
6617	415-420	SS	9.4	0.9	0.1	0.1	10.3	0.1	31.5	122.7			
6618	420-425	SS	9.3	1.0	0.1	0.2	9.8	<0.5	26.5	96.4			
6619	425-430	SS	9.4	1.2	0.2	0.1	13.9	0.3	37.9	60.3			
6620	430-435	SS	9.3	1.4	0.1	0.1	15.3	0.5	45.8	56.8			
6621	435-440	SS	9.2	0.9	0.3	0.5	8.6	0.3	14.2	55.4			
6622	440-445	SS	9.3	0.9	0.2	0.4	12.8	0.1	23.5	70.6			
6623	445-450	SS	9.4	0.9	0.2	0.3	13.0	0.1	26.0	83.4			
6624	450-455	SS	9.2	1.2	0.3	0.7	19.3	0.2	26.5	60.3			
6625	455-460	SS	9.1	1.2	0.3	0.1	12.9	0.1	25.9	40.3			
6640	530-535	SS	9.2	1.3	0.2	0.2	14.6	0.1	31.4	48.9			
6641	535-540	SS	9.0	1.1	0.4	0.2	12.3	0.1	23.7	31.1			
6642	540-545	SS	9.0	1.0	0.4	0.3	10.1	0.2	17.4	37.8			
6643	545-550	SS	9.1	1.1	0.1	0.1	11.9	0.1	36.4	60.2			
6667	115-120	SS	8.5	0.7	0.8	0.3	5.9	0.3	8.1	20.2			
6668	120-125	SS	8.5	0.6	0.6	0.2	4.5	0.2	7.2	19.9			
6669	125-130	SS	8.4	0.6	0.2	4.5	0.2	5.6	7.1	22.9			
6670	130-135	SS	8.5	0.9	0.9	0.4	6.2	0.3	7.7	18.6			
6671	135-140	SS	8.1	0.9	0.5	0.3	9.1	0.3	14.8	21.8			
6672	140-145	SS	8.1	0.7	0.3	0.1	6.3	0.2	14.3	20.5			

Premier Overburden

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		---%---				---%---			
6623	445-450	60	14	26	SCL	<0.01	0.001	1.6	16.33
6624	450-455	60	14	26	SCL	<0.01	0.001	1.9	18.53
6625	455-460	60	14	26	SCL	<0.01	0.001	1.9	19.13
6626	460-465	60	14	26	SCL	<0.01	0.001	1.7	17.03
6627	465-470	64	12	24	SCL	<0.01	0.001	3.9	39.13
6628	470-475	68	10	22	SCL	<0.01	<0.001	1.7	16.60
6629	475-480	66	12	22	SCL	<0.01	0.001	2.4	24.33
6630	480-485	64	12	24	SCL	<0.01	0.001	1.6	15.73
6617	415-420	64	12	24	SCL	<0.01	<0.001	2.0	19.70
6618	420-425	72	8	20	SCL/SL	<0.01	0.001	3.2	31.93
6619	425-430	72	2	26	SCL	<0.01	0.001	10.7	106.63
6620	430-435	76	8	16	SL	<0.01	0.001	11.1	111.43
6621	435-440	64	14	22	SCL	0.01	0.001	3.3	32.93
6622	440-445	66	14	20	SCL/SL	<0.01	0.001	2.6	26.33
6623	445-450	64	12	24	SCL	<0.01	0.001	3.2	31.53
6624	450-455	74	8	18	SL	<0.01	0.001	6.9	68.73
6625	455-460	68	12	20	SCL/SL	<0.01	0.003	14.7	146.69
6640	530-535	72	8	20	SCL/SL	<0.01	0.001	12.5	125.03
6641	535-540	68	12	20	SCL/SL	<0.01	0.002	8.6	85.86
6642	540-545	64	16	20	SCL/SL	<0.01	0.002	6.3	62.96
6643	545-550	62	22	16	SL	*	*	*	*
6667	115-120	56	20	24	SCL	0.01	0.001	1.8	17.42
6668	120-125	48	24	28	SCL	0.01	0.001	1.2	12.12
6669	125-130	42	28	30	CL	0.02	0.001	1.1	10.51
6670	130-135	40	30	30	CL	0.02	0.001	1.3	12.01
6671	135-140	42	24	34	CL	0.01	0.001	1.3	12.62
6672	140-145	42	28	30	CL	0.02	0.001	1.3	11.91

Premier Overburden

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca	Mg	Na	K	SAR	Sat %	---AB-DTPA--- B	Se	2M KCl NO3-N ppm
					--------meq/l--------						-----ppm-----		
6549	220-222	SL	8.4	0.7	0.5	0.4	6.3	0.4	9.8	17.1			
6550	245-250	SL	8.1	2.0	0.8	0.6	23.3	0.5	27.5	22.1			
6568	300-305	SL	8.3	2.9	0.6	0.6	30.4	0.1	38.3	18.0			
6570	310-315	SL	8.3	2.6	0.5	0.3	32.8	0.4	51.9	19.8			
6584	250-255	SL	8.6	1.4	0.2	0.1	14.9	0.1	40.7	24.4			
6585	255-260	SL	8.7	1.5	0.2	0.1	17.3	0.1	46.8	35.8			
6586	260-265	SL	8.6	1.4	0.2	0.2	14.8	0.2	34.0	34.2			
6587	265-270	SL	8.9	1.4	0.2	0.1	15.0	0.1	43.4	59.2			
6588	270-275	SL	9.1	1.8	0.2	<0.1	21.9	0.1	70.7	56.6			
6589	275-280	SL	9.1	2.0	0.2	0.1	23.3	0.1	61.3	91.4			
6592	290-295	SL	9.0	2.8	0.3	0.1	31.6	0.2	72.5	43.7			
6604	350-355	SL	9.2	1.4	0.2	0.2	14.4	0.1	32.3	84.6			
SUMMARY - Premier Overburden													
	Minimum		6.40	0.20	0.10	<0.1	0.20	<0.1	2.10	14.80	0.13	<0.01	<0.01
	Maximum		9.50	3.00	7.98	4.78	48.70	5.60	83.30	151	0.53	0.26	6.40
	Mean		8.59	1.22	0.60	0.41	12.67	0.30	24.64	44.16	0.36	0.07	1.51
	S. Deviation		0.47	0.62	1.05	0.65	7.95	0.44	16.94	33.47	0.09	0.06	1.80
	N		204.0	204.0	204	204.0	204.0	204.0	204.0	204.0	26.0	26.0	26.0

Premier Overburden

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		---------%---------				----------%---------			
6549	220-222	56	20	24	SCL	0.02	0.002	1.9	19.06
6556	245-250	62	20	18	SL	<0.01	0.001	2.7	27.13
6568	300-305	68	14	18	SL	0.22	0.009	2.0	20.08
6570	310-315	62	14	24	SCL	0.07	0.008	1.1	10.85
6584	250-255	56	20	24	SCL	0.08	0.004	3.3	33.03
6585	255-260	54	20	26	SCL	0.04	0.002	6.6	65.66
6586	260-265	44	24	32	CL	0.04	0.001	1.9	18.93
6587	265-270	28	30	42	C	0.05	0.002	1.2	12.26
6588	270-275	34	34	32	CL	0.04	0.002	2.1	21.06
6589	275-280	42	30	28	CL	<0.01	0.002	2.9	28.66
6592	290-295	46	18	36	SC	0.09	0.002	2.7	27.06
6604	350-355	38	36	26	L	0.03	*	1.9	*
SUMMARY - Premier Overburden									
	Minimum	10.00	0.00	0.00		<0.01	<0.001	0.10	0.06
	Maximum	98.00	44.00	60.00		0.40	0.010	10.10	101.03
	Mean	49.98	20.30	27.34		0.03	0.001	2.59	23.67
	S. Deviation	18.69	10.13	10.24		0.05	0.002	2.97	30.22
	N	183.0	183.0	183.0		196.0	185.0	191.0	177.0

Midway Overburden

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca	Mg	Na	K	SAR	Sat %	---AB-DTPA--- B ppm	Se ppm	2M KCl NO3-N ppm
R3962	190.4-200.0	SH	8.4	1.0	0.05	0.03	11.0	0.13	51.9	34.3	0.19	0.07	0.1
R3963	200.0-210.0	SH	8.8	1.5	0.12	0.08	16.9	0.18	52.6	33.3	0.22	0.05	0.3
R3964	210.0-214.5	SH	8.6	1.5	0.11	0.07	15.8	0.18	51.6	29.2	0.26	0.03	0.6
R3965	214.5-224.2	SL	8.5	2.1	0.31	0.20	21.3	0.39	42.0	30.9	0.33	0.10	0.6
R3966	224.2-225.9	SH	8.5	1.5	0.13	0.09	17.1	0.22	51.8	39.1	0.29	0.04	0.7
R3967	225.9-226.9	CL	9.1	2.5	0.35	0.63	24.1	1.39	34.5	26.0	0.34	<0.01	0.4
R3968	226.9-227.3	IR	8.6	2.1	0.45	0.51	23.1	0.40	33.5	20.4	0.85	<0.01	0.4
R3969	227.3-236.7	SH	8.4	1.3	0.08	0.05	15.1	0.16	58.1	27.3	0.38	0.02	0.2
R3970	236.7-245.0	SS	8.7	1.4	0.19	0.13	15.7	0.22	39.3	23.6	0.32	0.05	0.1
R3971	245.0-253.2	SS	8.4	2.0	0.27	0.16	20.7	1.39	44.3	21.7	0.43	0.04	0.1
R3972	253.2-260.0	SH	7.9	3.2	0.60	0.42	26.4	3.66	36.9	30.6	0.35	0.19	<0.1
R3973	260.0-267.6	SH	8.7	1.8	0.09	0.07	18.6	0.39	66.0	33.8	0.33	0.10	<0.1
R3998	50-60	CL60SH	7.5	1.5	7.53	2.80	6.8	0.81	3.0	27.2	0.41	0.04	0.1
R3999	60-70	SH	7.8	0.9	2.67	1.76	5.5	0.45	3.7	32.5	0.46	0.07	0.4
R4000	70-80	CD55SH	7.6	0.5	0.94	0.68	2.6	0.75	2.9	43.9	0.14	<0.01	0.4
R4060	205-215	SH	8.4	0.5	0.49	0.26	4.1	0.20	6.7	51.6	0.15	<0.01	0.2
R4061	215-225	SH	8.6	0.7	0.38	0.19	7.0	0.15	13.1	51.0	0.17	0.02	0.4
SUMMARY - Midway Overburden													
	Minimum		7.50	0.50	0.05	0.03	2.57	0.13	2.86	20.40	0.14	<0.01	<0.01
	Maximum		9.10	3.20	7.53	2.80	26.39	3.66	65.98	51.60	0.85	0.19	0.70
	Mean		8.38	1.53	0.87	0.48	14.81	0.65	34.81	32.73	0.33	0.05	0.29
	S. Deviation		0.42	0.70	1.77	0.71	7.21	0.85	20.46	8.88	0.16	0.05	0.21
	N		18.00	18.00	18.0	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00

Midway Overburden

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		---%---				---%---			
R3962	190.4-200.0	63	8	29	SCL	0.09	0.001	1.1	8.22
R3963	200.0-210.0	57	9	34	SCL	0.04	<0.001	1.7	15.75
R3964	210.0-214.5	53	13	34	SCL	0.02	0.001	1.9	18.41
R3965	214.5-224.2	46	12	42	SL	0.04	0.005	1.9	17.91
R3966	224.2-225.9	45	9	46	C/SC	0.02	<0.001	1.5	14.38
R3967	225.9-226.9	78	6	16	SL	0.01	0.003	18.7	186.78
R3968	226.9-227.3	76	9	15	SL	<0.01	0.002	7.3	73.06
R3969	227.3-236.7	48	20	32	SCL	0.03	<0.001	1.6	15.06
R3970	236.7-245.0	54	17	29	SCL	0.01	0.001	1.1	10.72
R3971	245.0-253.2	50	19	31	SCL	0.02	0.005	1.0	9.53
R3972	253.2-260.0	27	42	31	CL	0.18	0.005	0.2	-3.47
R3973	260.0-267.6	34	19	47	C	0.06	0.002	1.1	9.19
R3998	50.0-60.0	56	19	25	SCL	0.01	0.010	0.5	5.00
R3999	60.0-70.0	40	22	38	CL	0.04	0.004	0.6	4.88
R4000	70.0-80.0	85	5	10	LS	0.36	0.001	0.1	-10.22
R4060	205-215	80	2	18	SL	0.28	0.001	0.5	-3.72
R4061	215-225	34	42	24	L	0.16	0.001	1.2	7.03
SUMMARY - Midway OVerburden									
	Minimum	27.00	2.00	10.00		<0.01	<0.001	0.10	-10.22
	Maximum	85.00	42.00	47.00		0.36	0.010	18.70	186.78
	Mean	54.47	16.06	29.47		0.08	0.002	2.47	22.26
	S. Deviation	16.65	11.07	10.33		0.10	0.003	4.35	44.54
	N	18.00	18.00	18.00		18.00	18.00	18.00	18.00

* - tons CaCO3/1000 tons material

Eska Overburden

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca	Mg	Na	K	SAR	Sat %	---AB-DTPA--- B	Se	2M KCl NO3-N
					--------meq/l--------						-----ppm-----		ppm
R4020	270-280SH		9.3	1.9	0.28	0.29	19.6	0.15	36.8	34.9	0.37	0.12	1.7
R4021	280-290SH		9.1	2.3	0.53	0.43	22.8	0.18	32.9	36.0	0.34	0.20	2.6
R4022	290-300SH		9.1	2.2	0.31	0.56	21.4	0.29	32.5	35.9	0.27	0.14	0.7
R4023	300-310SS		9.0	2.1	0.37	0.56	22.6	0.13	33.1	40.2	0.37	0.15	1.1
R4024	310-320SS80CD		9.0	2.7	0.33	0.60	26.5	0.21	38.9	36.4	0.41	0.13	1.8
R4067	285-295SH		8.1	2.2	1.28	0.72	24.7	0.34	24.7	44.7	0.39	0.02	2.7
R4068	295-305SH		8.2	1.0	0.42	0.29	12.7	0.18	21.5	39.0	0.39	<0.01	0.6
R4069	305-315SH90BO		8.4	0.7	0.28	0.16	8.7	0.08	18.5	52.5	0.36	<0.01	0.2
R4070	325-335SH		8.7	2.1	1.64	0.74	24.3	0.24	22.2	47.1	0.44	0.02	1.1
R4071	335-345SH		9.0	2.7	1.17	0.64	30.4	0.33	31.9	44.6	0.46	0.04	6.4
R4082	110-120SH		9.2	1.2	0.13	0.09	16.7	0.14	50.3	43.0	0.40	0.05	2.2
R4083	120-130SH		9.6	1.2	0.07	0.03	12.7	0.06	56.9	59.8	0.23	0.06	3.9
R4084	130-140SH		9.9	1.5	0.06	0.04	13.1	0.06	59.2	74.4	0.20	0.09	1.8
R4085	140-150SH		9.7	1.5	0.90	0.35	16.8	0.05	21.3	63.9	0.26	0.15	4.0
R4086	150-160SH		9.8	1.2	0.39	0.20	17.0	0.07	31.2	55.7	0.34	0.10	3.4
R4087	160-170SH		10.0	1.4	0.04	0.02	13.9	0.04	82.2	91.2	0.28	0.16	1.8
R4088	170-180SH		10.0	1.7	0.36	0.17	15.5	0.05	30.0	88.9	0.27	0.13	5.1
R4089	180-190SH		9.9	1.6	0.34	0.17	17.3	0.07	34.4	87.4	0.34	0.17	2.5
R4090	190-200SH		10.0	1.7	0.05	0.02	17.9	0.05	94.9	107.0	0.33	0.22	4.7
R4091	200-210SH		10.0	1.5	0.06	0.02	18.6	0.05	91.2	96.6	0.36	0.21	6.1
R4092	210-220SH		9.9	1.5	0.04	0.01	16.6	0.04	105.4	72.2	0.25	0.19	1.4
SUMMARY - Eska Overburden													
	Minimum		8.10	0.70	0.40	0.01	8.65	0.04	11.74	21.90	0.20	<0.01	0.20
	Maximum		10.00	3.50	2.21	1.69	32.87	0.42	105.43	187.60	0.46	0.31	6.80
	Mean		9.24	1.77	0.38	0.27	18.56	0.14	48.89	58.16	0.34	0.12	2.67
	S. Deviation		0.50	0.52	0.47	0.31	4.79	0.09	25.81	30.16	0.06	0.07	1.95
	N		40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	39.00

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		---%---				---%---			
R4020	270.0-280	34	32	34	CL	0.01	0.003	2.1	20.78
R4021	280.0-290	18	39	43	C	0.03	0.006	0.7	6.25
R4022	290.0-300	39	19	42	C	0.04	0.002	0.8	6.81
R4023	300.0-310	41	22	37	CL	0.04	0.003	1.8	16.84
R4024	310.0-320	31	36	33	CL	0.01	0.006	1.7	16.88
R4067	285-295	28	24	48	C	0.07	<0.001	1.0	7.81
R4068	295-305	52	12	36	SC	0.02	0.001	1.9	18.41
R4069	305-315	56	12	32	SCL	0.07	<0.001	2.0	17.81
R4070	325-335	20	30	50	C	0.08	<0.001	1.1	8.50
R4071	335-345	20	34	46	C	0.02	<0.001	1.4	13.38
R4082	110-120	38	29	33	CL	0.01	0.005	2.5	24.84
R4083	120-130	32	37	31	CL	<0.01	0.002	3.1	31.06
R4084	130-140	28	41	31	CL	<0.01	0.012	1.4	14.38
R4085	140-150	25	44	31	CL	0.01	0.019	2.1	21.28
R4086	150-160	36	34	30	CL	0.01	0.002	1.8	17.75
R4087	160-170	26	44	30	CL	0.01	0.002	2.0	19.75
R4088	170-180	22	47	31	CL	0.01	0.002	1.2	11.75
R4089	180-190	14	50	36	SiCL	0.01	0.003	1.2	11.78
R4090	190-200	18	46	36	SiCL	0.01	0.006	1.3	12.88
R4091	200-210	22	44	34	CL	0.01	0.009	1.4	13.97
R4092	210-220	16	48	36	SiCL	0.03	0.003	1.3	12.16

* - tons CaCO3/1000 tons material

SUMMARY - Eska Overburden

Minimum	14.00	9.00	12.00		<0.01	<0.001	0.60	5.25
Maximum	79.00	50.00	55.00		0.22	0.019	5.20	51.34
Mean	38.25	29.58	31.18		0.03	0.005	1.73	16.53
STD.	16.80	11.37	9.27		0.04	0.004	0.76	7.87
N	40.00	40.00	40.00		40.00	40.000	40.00	40.00

Subeska Overburden

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca	Mg	Na	K	SAR	Sat %	---AB-DTPA--- B	Se	2M KCl NO3-N
					--------meq/l--------						-----ppm-----		ppm
R5327	320-330	SH	8.7	3.2	0.36	0.11	30.4	0.22	62.9	35.6	0.14	0.25	1.4
R5328	330-340	SH	8.6	2.7	0.36	0.10	24.3	0.20	50.7	33.8	0.16	0.26	1.9
R5329	340-350	SH	8.7	2.3	0.20	0.08	21.3	0.16	56.1	32.2	< 0.01	0.14	1.8
R5330	350-360	SH	8.7	2.3	0.31	0.12	21.7	0.18	46.4	28.8	0.02	0.17	4.1
R5331	360-370	SH	8.7	3.6	0.39	0.16	34.6	0.23	65.9	42.0	0.04	0.19	1.9
R5332	370-380	SH	8.8	2.3	0.13	0.06	25.4	0.01	82.8	39.8	0.05	0.21	2.7
R5333	250-260	SH	8.9	3.1	0.15	0.06	33.3	0.11	103.3	14.3	0.06	0.27	2.1
R5334	260-270	SH	9.0	1.9	0.05	0.02	20.7	<0.01	107.4	91.7	0.08	0.27	2.0
R5335	270-280	SH	8.8	3.0	0.16	0.07	34.7	0.01	103.3	42.6	0.04	0.20	1.4
R5336	280-290	SH	8.6	1.8	0.11	0.04	17.9	0.06	65.2	33.3	< 0.01	0.11	0.9
R5337	290-300	SH	8.8	2.1	0.23	0.07	20.7	0.09	53.9	47.3	0.03	0.21	1.0
R5338	300-310	SH	8.9	2.0	0.13	0.04	19.0	0.07	65.0	102.0	0.05	0.28	1.0
R5339	310-320	SS	9.0	2.2	0.27	0.07	21.7	0.06	52.4	153.3	0.07	0.31	0.8
R5340	320-330	SS	9.1	1.6	0.16	0.07	17.0	0.05	49.3	141.1	0.22	0.14	1.8
R5341	330-340	SS	9.1	2.2	0.26	0.07	23.0	0.05	56.4	127.7	0.36	0.09	4.3
R5342	340-350	SS	9.1	1.8	0.19	0.05	17.7	0.04	51.2	117.3	0.36	0.09	4.4
R5343	350-360	SS	9.1	3.5	0.48	0.12	37.9	0.10	69.5	128.8	0.39	0.13	3.2
R5344	360-370	SS	9.2	1.8	0.17	0.04	18.0	0.03	54.9	118.9	0.39	0.11	5.2
R5345	370-380	SH	9.2	1.7	0.10	0.10	17.8	<0.01	56.4	130.5	0.36	0.16	6.0
R5346	380-390	SH	9.1	1.2	0.08	0.03	12.2	<0.01	51.5	158.8	0.23	0.13	3.3
R5347	390-400	SH	9.0	1.4	0.13	0.05	15.0	<0.01	50.3	121.7	0.17	0.12	3.0
SUMMARY - Subeska Overburden													
	Minimum		8.6	1.2	0.05	0.02	12.2	<0.01	46.4	14.3	<0.01	0.09	0.8
	Maximum		9.2	3.6	0.48	0.16	37.9	0.23	107.4	158.8	0.39	0.31	6.0
	Mean		8.9	2.3	0.21	0.07	23.1	0.08	64.5	82.9	0.15	0.18	2.6
	S. Deviation		0.2	0.7	0.11	0.03	6.9	0.07	18.3	48.1	0.14	0.07	1.5
	N		21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0

Subeska Overburden

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		---------%---------				----------%---------			
R5327	320-330	52	22	26	SCL	0.14	0.002	1.1	6.69
R5328	330-340	34	30	36	CL	0.07	0.004	1.8	15.94
R5329	340-350	46	24	30	SCL	0.04	<0.001	4.3	41.75
R5330	350-360	47	25	28	SCL	<0.01	0.002	5.7	57.06
R5331	360-370	32	24	44	C	0.07	0.008	2.7	25.06
R5332	370-380	30	34	36	CL	0.01	0.006	4.5	44.88
R5333	250-260	34	36	30	CL	<0.01	0.002	3.2	32.06
R5334	260-270	38	29	33	CL	<0.01	0.002	5.3	53.06
R5335	270-280	49	24	27	SCL	0.01	0.002	4.9	48.75
R5336	280-290	64	9	27	SCL	0.12	0.003	1.1	7.34
R5337	290-300	38	34	28	CL	0.10	0.003	2.2	18.97
R5338	300-310	40	36	24	L	0.01	0.005	2.9	28.84
R5339	310-320	36	38	26	L	0.03	0.014	1.8	17.50
R5340	320-330	58	18	24	SCL	<0.01	0.007	8.7	87.22
R5341	330-340	61	17	22	SCL	<0.01	0.002	6.2	62.06
R5342	340-350	62	14	24	SCL	<0.01	0.002	7.9	79.06
R5343	350-360	60	18	22	SCL	<0.01	0.002	4.6	46.06
R5344	360-370	54	22	24	SCL	<0.01	0.002	18.5	185.06
R5345	370-380	54	24	22	SCL	<0.01	0.002	7.9	79.06
R5346	380-390	62	16	22	SCL	<0.01	0.002	4.4	44.06
R5347	390-400	61	19	20	SCL/SL	<0.01	0.002	5.9	59.06

SUMMARY - Subeska Overburden

Minimum	30	9	20	<0.01	<0.001	1.1	6.69
Maximum	64	38	44	0.14	0.014	18.5	185.06
Mean	48	24	27	0.03	0.004	5.0	49.50
S. Deviation	11	8	6	0.04	0.003	3.7	37.80
N	21	21	21	21.00	21.00	21.00	21.00

Burning Bed Overburden

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca	Mg	Na	K	SAR	Sat %	---AB-DTPA--- B ppm	Se ppm	2M KCl NO3-N ppm
					--------meq/l--------								
R3940	170.0-174.0	C050B0	9.2	0.6	0.04	0.04	7.3	0.05	35.4	40.6	0.26	0.08	0.3
R3941	174.0-179.5	SS	9.3	1.6	0.07	0.03	17.1	0.07	75.8	51.3	0.67	0.08	0.3
R3942	179.5-187.5	SS	9.0	1.4	0.03	0.02	15.0	0.10	91.4	81.8	0.27	0.18	0.4
R3943	187.5-196.6	SS	9.4	1.3	0.05	0.02	13.4	0.08	70.7	111.9	0.23	0.37	0.4
R3944	196.6-204.4	SS	9.3	1.0	0.03	0.02	11.7	0.06	76.7	113.7	0.30	0.37	0.3
R3945	204.4-212.5	SS	9.4	1.0	0.05	0.03	11.7	0.05	58.6	125.6	0.22	0.35	0.2
R3946	212.5-220.2	SS	9.4	1.0	0.06	0.03	11.2	0.04	52.6	129.1	0.27	0.10	0.1
R3947	220.2-227.8	SS	9.5	1.3	0.03	0.02	14.2	0.04	85.5	121.3	0.20	0.39	0.3
R3948	227.8-233.8	SS	9.4	1.1	0.04	0.02	12.0	0.05	69.6	107.5	0.23	0.13	0.3
R3949	233.8-237.0	SL	9.0	1.2	0.04	0.02	12.4	0.04	68.3	92.8	0.23	0.09	0.3
R3950	237.0-244.6	SL	9.3	1.2	0.04	0.02	12.7	0.05	71.2	94.0	0.23	0.13	0.3
R3951	244.6-252.9	SL	9.2	1.6	0.05	0.04	17.2	0.10	82.1	40.7	0.74	0.35	0.1
R3952	252.9-261.0	SL	9.0	1.7	0.09	0.05	18.4	0.12	71.7	33.1	0.26	0.20	0.3
R3953	261.0-268.5	SL	9.0	1.7	0.10	0.05	18.1	0.13	67.0	30.6	0.31	0.10	0.3
R3928	81.4-88.9	SS	8.8	1.2	0.07	0.07	12.1	0.14	44.7	40.6	0.33	0.24	0.1
R3929	88.9-97.4	SS	9.1	1.2	0.04	0.05	13.8	0.10	67.0	36.4	0.28	0.21	0.3
R3930	97.4-105.5	SS	9.0	1.5	0.04	0.03	16.3	0.14	85.4	33.1	0.31	0.14	0.4
R3931	105.5-113.8	SS	9.1	2.1	0.12	0.08	22.7	0.18	71.9	34.7	0.30	0.12	0.3
R3932	113.8-121.2	SS	8.9	2.1	0.17	0.09	22.7	0.19	63.7	32.1	0.31	0.13	0.3
R3933	121.2-129.6	SL	8.9	1.5	0.08	0.05	16.7	0.19	65.4	28.6	0.36	0.09	0.4
R3934	129.6-137.3	SL	8.6	2.3	0.19	0.10	25.1	0.27	65.8	26.4	0.37	0.12	0.3
R3935	137.3-139.7	SS	9.1	1.3	0.06	0.05	14.9	0.14	64.7	28.6	0.32	0.09	0.3
R3936	139.7-146.7	SL	8.9	1.4	0.04	0.04	17.0	0.20	82.1	34.8	0.36	0.16	0.3
R3937	146.7-154.5	SL	8.9	2.0	0.10	0.09	22.0	0.27	70.8	28.3	0.35	0.30	0.4
R3938	154.5-162.2	SL	8.7	1.9	0.06	0.05	21.0	0.16	93.0	31.9	0.33	0.13	0.5
R3939	162.2-170.0	SL	8.9	1.4	0.04	0.04	17.3	0.14	87.7	31.2	0.27	0.13	0.3
R3940	170.0-174.0	C050B0	9.2	0.6	0.04	0.04	7.3	0.05	35.4	40.6	0.26	0.08	0.3
R3941	174.0-179.5	SS	9.3	1.6	0.07	0.03	17.1	0.07	75.8	51.3	0.67	0.08	0.3

Burning Bed Overburden

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		---%---				---%---			
R3940	170.0-174.0	82	6	12	LS/SL	0.43	<0.001	1.1	-2.44
R3941	174.0-179.5	61	18	21	SCL	0.03	0.001	1.7	16.09
R3942	179.5-187.5	34	32	34	CL	0.06	0.001	0.9	7.16
R3943	187.5-196.6	42	31	27	CL/L	0.06	0.001	1.9	17.16
R3944	196.6-204.4	43	23	34	CL	0.04	<0.001	1.7	15.75
R3945	204.4-212.5	42	28	30	CL	0.01	<0.001	1.9	18.69
R3946	212.5-220.2	47	25	28	SCL	<0.01	0.001	2.1	21.03
R3947	220.2-227.8	39	31	30	CL	0.01	0.001	2.1	20.72
R3948	227.8-233.8	41	29	30	CL	0.02	0.001	2.0	19.41
R3949	233.8-237.0	19	44	37	SiCL	0.08	0.001	1.0	7.53
R3950	237.0-244.6	67	12	21	SCL	0.02	0.001	1.8	17.41
R3951	244.6-252.9	56	15	29	SCL	<0.01	0.009	2.1	21.28
R3952	252.9-261.0	61	9	30	SCL	0.07	0.003	2.0	17.91
R3953	261.0-268.5	22	32	46	C	0.20	0.002	2.1	14.81
R3928	81.4-88.9	33	33	34	CL	0.04	0.003	0.9	7.84
R3929	88.9-97.4	48	24	28	SCL	<0.01	0.001	1.8	18.03
R3930	97.4-105.5	28	28	44	C	0.03	0.001	1.1	10.09
R3931	105.5-113.8	45	25	30	CL/SCL	0.01	0.002	1.9	18.75
R3932	113.8-121.2	29	31	40	C/CL	0.03	0.002	1.3	12.13
R3933	121.2-129.6	34	26	40	C/CL	0.04	0.001	1.2	10.78
R3934	129.6-137.3	36	22	42	C	0.04	0.004	1.0	8.88
R3935	137.3-139.7	52	9	39	SC	<0.01	0.001	17.3	173.03
R3936	139.7-146.7	43	20	37	CL	0.02	0.001	1.2	11.41
R3937	146.7-154.5	46	10	44	SC	0.07	0.009	1.4	12.09
R3938	154.5-162.2	43	12	45	C	0.09	0.007	1.2	9.41
R3939	162.2-170.0	62	6	32	SCL	0.20	0.001	0.6	-0.22
R3940	170.0-174.0	82	6	12	LS/SL	0.43	<0.001	1.1	-2.44
R3941	174.0-179.5	61	18	21	SCL	0.03	0.001	1.7	16.09

Burning Bed Overburden

Lab #	Sample ID#	Lith	-----paste----- pH	E.C. mmhos/cm	Ca	Mg	Na	K	SAR	Sat %	---AB-DTPA--- B	Se	2M KCl NO3-N
					--------meq/l--------						-----ppm-----		ppm
R3942	179.5-187.5	SS	9.0	1.4	0.03	0.02	15.0	0.10	91.4	81.8	0.27	0.18	0.4
R3943	187.5-196.6	SS	9.4	1.3	0.05	0.02	13.4	0.08	70.7	111.9	0.23	0.37	0.4
R3944	196.6-204.4	SS	9.3	1.0	0.03	0.02	11.7	0.06	76.7	113.7	0.30	0.37	0.3
R3945	204.4-212.5	SS	9.4	1.0	0.05	0.03	11.7	0.05	58.6	125.6	0.22	0.35	0.2
R3946	212.5-220.2	SS	9.4	1.0	0.06	0.03	11.2	0.04	52.6	129.1	0.27	0.10	0.1
R3947	220.2-227.8	SS	9.5	1.3	0.03	0.02	14.2	0.04	85.5	121.3	0.20	0.39	0.3
R3948	227.8-233.8	SS	9.4	1.1	0.04	0.02	12.0	0.05	69.6	107.5	0.23	0.13	0.3
R3949	233.8-237.0	SL	9.0	1.2	0.04	0.02	12.4	0.04	68.3	92.8	0.23	0.09	0.3
R3950	237.0-244.6	SL	9.3	1.2	0.04	0.02	12.7	0.05	71.2	94.0	0.23	0.13	0.3
R3951	244.6-252.9	SL	9.2	1.6	0.05	0.04	17.2	0.10	82.1	40.7	0.74	0.35	0.1
R3952	252.9-261.0	SL	9.0	1.7	0.09	0.05	18.4	0.12	71.7	33.1	0.26	0.20	0.3
R3953	261.0-268.5	SL	9.0	1.7	0.10	0.05	18.1	0.13	67.0	30.6	0.31	0.10	0.3
SUMMARY - Burning Bed Overburden													
	Minimum		8.6	0.6	0.03	0.02	7.26	0.04	35.37	26.4	0.20	0.08	0.10
	Maximum		9.5	2.3	0.19	0.10	25.09	0.27	93.01	129.1	0.74	0.39	0.50
	Mean		9.1	1.4	0.06	0.04	15.16	0.10	70.39	68.4	0.32	0.19	0.29
	S. Deviation		0.2	0.4	0.03	0.02	3.96	0.06	13.35	38.1	0.14	0.11	0.09
	N		40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0

Burning Bed Overburden

Lab #	Sample ID#	Sand	Silt	Clay	Texture	Total S	SO4-S	CaCO3	Acid-Base Potential *
		---------%---------				----------%----------			
R3942	179.5-187.5	34	32	34	CL	0.06	0.001	0.9	7.16
R3943	187.5-196.6	42	31	27	CL/L	0.06	0.001	1.9	17.16
R3944	196.6-204.4	43	23	34	CL	0.04	<0.001	1.7	15.75
R3945	204.4-212.5	42	28	30	CL	0.01	<0.001	1.9	18.69
R3946	212.5-220.2	47	25	28	SCL	<0.01	0.001	2.1	21.03
R3947	220.2-227.8	39	31	30	CL	0.01	0.001	2.1	20.72
R3948	227.8-233.8	41	29	30	CL	0.02	0.001	2.0	19.41
R3949	233.8-237.0	19	44	37	SiCL	0.08	0.001	1.0	7.53
R3950	237.0-244.6	67	12	21	SCL	0.02	0.001	1.8	17.41
R3951	244.6-252.9	56	15	29	SCL	<0.01	0.009	2.1	21.28
R3952	252.9-261.0	61	9	30	SCL	0.07	0.003	2.0	17.91
R3953	261.0-268.5	22	32	46	C	0.20	0.002	2.1	14.81
						* - tons CaCO3/1000 tons material			
SUMMARY - Burning Bed Overburden									
	Minimum	19.00	6.00	12.00		<0.01	<0.001	0.60	-2.44
	Maximum	82.00	44.00	46.00		0.43	0.009	17.30	173.03
	Mean	45.28	22.90	31.83		0.07	0.002	1.99	17.93
	S. Deviation	15.02	9.96	8.15		0.10	0.002	2.49	25.61
	N	40.0	40.0	40.0		40.0	40.0	40.0	40.0

APPENDIX E
GEOPHYSICAL LOGS

Geophysical logs are included for the following boreholes:

PB-60	PB-108
PB-69A	PB-1
PB-74	PB-13rd
PB-80	PB-19
PB-84	PB-48
PB-85	PB-70
PB-92	PB-73A
PB-101	PB-86
PB-107	PB-100

NOTE: Geophysical logs were not completed for boreholes PB-87, PB-105 and PB-109; however, hole sample logs are included for PB-87 and PB-109. A core description is included for PB-105.

BPB

COAL LITHOLOGY LOG

LOG SUITE
GAMMA RAY
L.S. DENSITY
CALIPER

COAL COMBINATION SONDE

SONDE TYPE
COAL COMBINATION SONDE

BOREHOLE
CLIENT C.C. Hawley — FB-1

AREA Wishbone Hill
COUNTRY Alaska
DATE LOGGED 6-30-83

DRILLER'S DEPTH 1205'
LOGGER'S DEPTH 1205'

1 PRT 3 LOGS

BOREHOLE DATA

PERMANENT DATUM: Ground Level
ELEVATION OF P.D.: 0
MEASUREMENTS FROM: Ground
DEPTH DRILLER: 1205'
DEPTH LOGGER: 1205'
BTM LOG INTERVAL: 1205'
TOP LOG INTERVAL: Ground
CASING SIZES: 1: 6" TO 56' | 2: TO | 3: 6" TO 1205' | 4: TO
DRILLING FLUID: Water
DENSITY: 8.9
VISCOSITY: 40
PH: 7
FLUID LOSS: 8
SOURCE OF SAMPLE: Circ
RM @ MEAS. TEMP.: .241 @ 65°F
RMF @ MEAS. TEMP.: .241 @ 65°F
RMC @ MEAS. TEMP.: .241 @ 65°F
SOURCE RMF & RMC: Calc
RM @ BHT: .241 @ 65°F
TIME SINCE CIRC.: 24 hrs
MAX. REC. TEMP.: 65°F
EQUIP. LOCATION: Wishbone Hill

OPERATION DATA

RECORDED BY: M.J. Bielski
WITNESSED BY: C.C. Hawley

RUN	BIT FROM	BIT TO	CASING SIZE	CASING WEIGHT	CASING FROM	CASING TO
1	0	56'	6"	28#	0	56'
2						
3	56'	1205'	6"	28#	0	1205'
4						

FIRST READING: 2134'
LAST READING: 0'
DEPTH DRILLER: 1205'
DEPTH LOGGER: 1205'
BTM LOG INTERVAL: 1205'
TOP LOG INTERVAL: 0'
OPEN HOLE: Full
TYPE FLUID IN HOLE: Water
MAX. REC. TEMP.: 65°F
EST. CEMENT TOP: 0'
EQUIP. LOCATION: Wishbone Hill
RECORDED BY: M.J. Bielski
WITNESSED BY: C.C. Hawley

EQUIPMENT AND RECORDING DATA

COAL COMBINATION SONDE

LOG	EQUIPMENT: SONDE	EQUIPMENT: SOURCE	CALIBRATOR	TAPING: LOG TAPED	TAPING: RECORD SPEED	TAPING: DIRECT/REPLAY	PANEL: SPEED	PANEL: TC SECS	PANEL: NORM	CAL. COEFF.	DEPTHS: FROM	DEPTHS: TO	DEPTHS: INTERVAL	SEAM LOG RUN
GAMMA RAY	208D		G4	Yes	30	D	30	1	-	1.6	210	0'	210'	Yes
L.S. DENSITY			D4	Yes	30	D	30	.3	5.6	-	219	9	210'	Yes
CALIPER	SIDEWALL POSITION	B418	C1	Yes	30	D	30	.3	-	-	218	8	210'	Yes

COAL QUALITY/SEAM THICKNESS LOG INTERVALS (Refer to relevant log)

FROM	215'	90'	INTERVAL TOTAL
TO	185'	55'	
INTERVAL	30'	35'	65'

ADDITIONAL SONDES RUN

SONDE	LOG	GENERAL SCALE	DETAIL LOG/SCALE

REFER TO ADDITIONAL HEADINGS

REMARKS

4" PVC pipe from 66' to TD

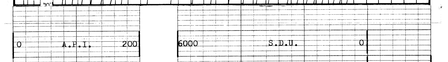
BPB COAL LITHOLOGY LOG

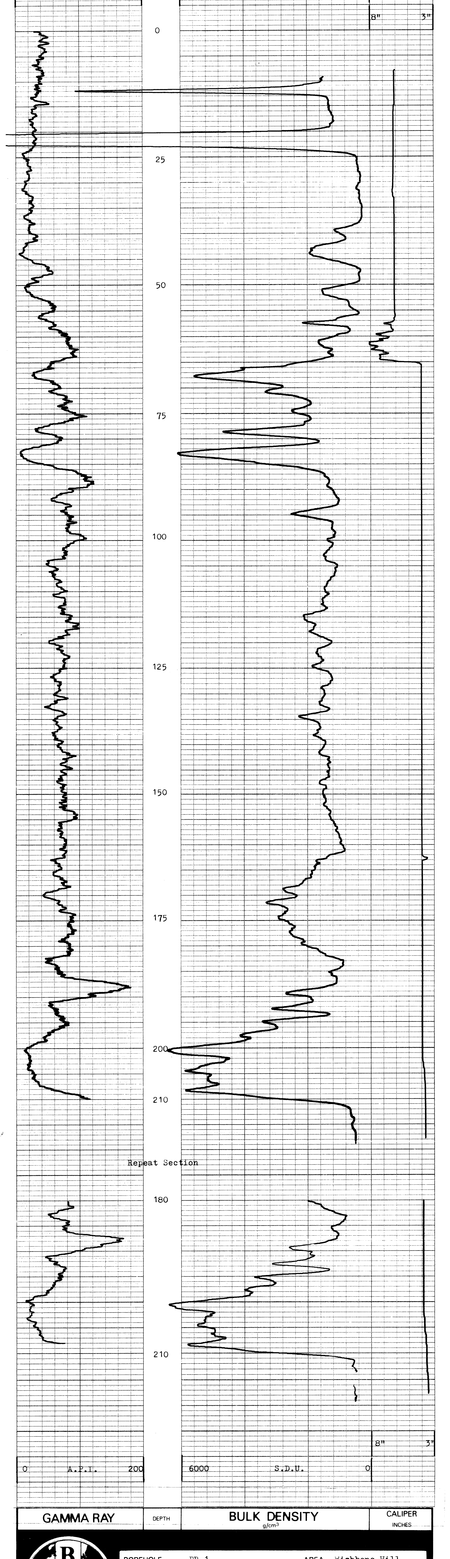
CALIBRATION DATA

JIG No. G4	VALUE 436	2" DIAM	JIG CAL DATE 6-8-83	JIG VALUE 3400	SCU @ g/cm³	3 ins 512	ups
JIG MARK SHOWN AT ABOVE VALUE -			JIG No D4	SPAN 6000	NORM 5.65	8 ins 802	ups

GAMMA RAY | DEPTH | BULK DENSITY g/cm³ | CALIPER INCHES

HOLE SIZE CORRECTION DATA





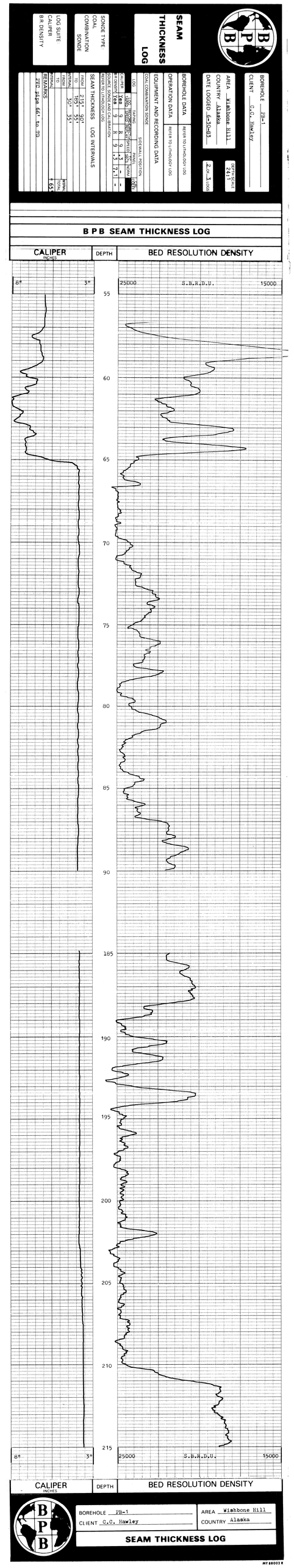
GAMMA RAY | DEPTH | BULK DENSITY g/cm³ | CALIPER INCHES

BPB

BOREHOLE FB-1 AREA Wishbone Hill
CLIENT C.C. Hawley COUNTRY Alaska

COAL LITHOLOGY LOG

MY A50241 B


SEAM THICKNESS LOG
BPB
SONDE TYPE
COAL COMBINATION SONDE
LOG SUITE
CALIPER
BR DENSITY
BOREHOLE FB-1
CLIENT C.C. Hawley
AREA Wishbone Hill
COUNTRY Alaska
DATE LOGGED 6-30-83
DEPTH SCALE 2&5"
2 OF 3 LOGS
BOREHOLE DATA
OPERATION DATA
REFER TO LITHOLOGY LOG
EQUIPMENT AND RECORDING DATA
COAL COMBINATION SONDE
SIDEWALL POSITION
SEAM THICKNESS LOG INTERVALS
REMARKS
FOC pipe 66' to 70
B P B SEAM THICKNESS LOG
CALIPER
INCHES
DEPTH
BED RESOLUTION DENSITY
8"
3"
25000
S.B.R.D.U.
15000
55
60
65
70
75
80
85
90
185
190
195
200
205
210
215
BOREHOLE FB-1
CLIENT C.C. Hawley
AREA Wishbone Hill
COUNTRY Alaska
SEAM THICKNESS LOG
MY 88002 R

COAL LITHOLOGY LOG

LOG SUITE: GAMMA RAY L.S. DENSITY CALIPER

LOG COMBINATION SONDE:

SONDE TYPE:

BOREHOLE: PB=138D
CLIENT: Idemitsu Koman

AREA: WinHonne West
COUNTRY: USA
DATE LOGGED: Apr25=88

LOG TIME: 1200 hrs

1 = 3 mm

BOREHOLE DATA

	DRILLER	LOGGER
DEPTH	374.24	374.24
CASING SIZE	7	7
CASING WEIGHT	23	23
CASING DEPTH	370	370
FLUID LEVEL	0	0
FLUID TYPE	WATER	WATER
FLUID DENSITY	1.0	1.0
FLUID VISCOSITY	1	1
MAX. TEMP.	21°	
TIME SINCE CIRC.	1 hr	

PRODUCTION DATA: Ground Level

ELEVATION: 0 m

WITNESS: Mr. Tokuda

RECORDED BY: Mr. Ishikawa

OPERATION DATA

DEPTH DRILLED	370'
SECTION LOGGED	370'
LOG MEASURED FROM	KB
DRILLING MEASURED FROM	KB
KB ELEVATION	0 m
GL ELEVATION	0 m
PERMANENT DATUM	Ground Level
ELEVATION	0 m

EQUIPMENT DATA

LOGGING UNIT NO.	2
TRUCK No.	3
RECORDER No.	3
RECORDER TYPE	MR-62

EQUIPMENT AND RECORDING DATA

COAL COMBINATION SONDE

LOG	EQUIPMENT			TAPPING			PANEL			CAL. CORR.	DEPTHS			SEAM LOG RUN
	SONDE	SOURCE	CALIBRATOR	LOG SPEED	RECORD SPEED	DIRECT OR PLAYBACK	SPEED	T.C. SECS.	NORM		FROM	TO	INTERVAL	
GAMMA RAY & DENSITY & CALIPER	121B		G6	Yes	30	D	30	1	-	1.4	370	0	370	
		SIDEWALL POSITION	D6	Yes	30	D	30	1	5.4	-				
			--	Yes	30	D	30	3	-	-				

COAL QUALITY/SEAM THICKNESS LOG INTERVALS (Refer to relevant log)

FROM	350'	200'	INTERVAL TOTAL
TO	350'	100'	
INTERVAL	20'	20'	40'

ADDITIONAL SONDES RUN

SONDE	LOG	GENERAL SCALE	LOG	DETAIL SCALE	LOG
8	SP/Res	120	1		

REFER TO ADDITIONAL HEADINGS

REMARKS

BPB COAL LITHOLOGY LOG

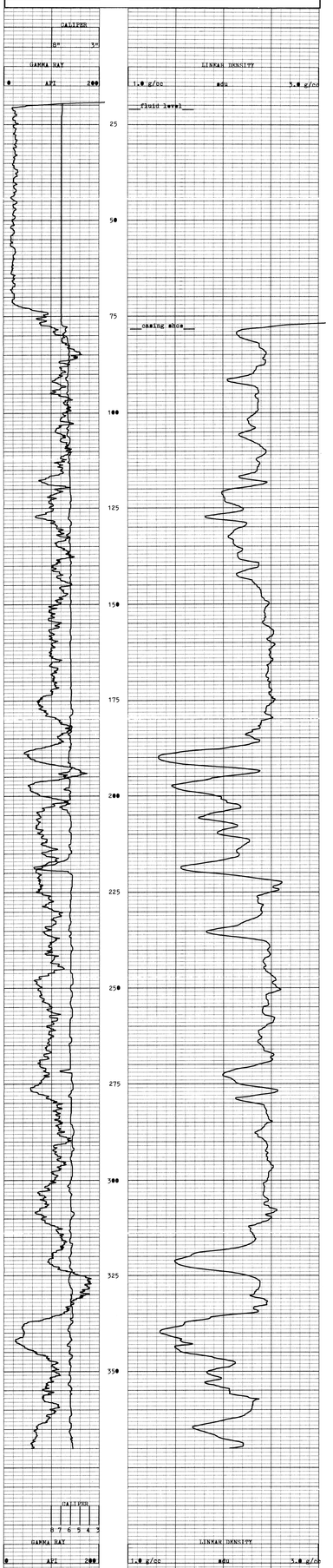
CALIBRATION DATA

JG No: G6 VALUE 3915 @ 5 DIAM

JG MARK SHOWN AT ABOVE VALUE 3

JG CAL DATE 6-88 JG VALUE 2899 SOLU @ gl/cm³ 3 in 537 cps

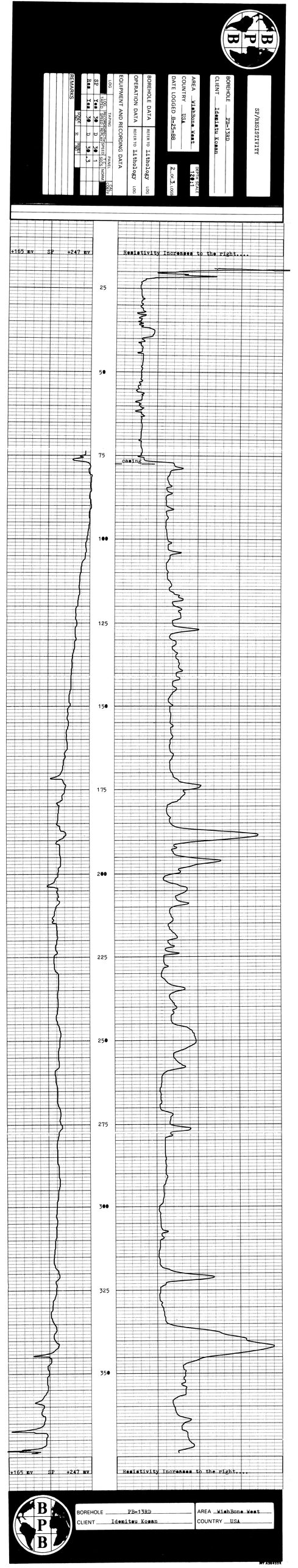
JG No: D6 SPAN NORM 5.45 8 in 827 cps



BOREHOLE PB=138D AREA WinHonne West

CLIENT Idemitsu Koman COUNTRY USA

COAL LITHOLOGY LOG


SP/RESISTIVITY
BOREHOLE PB-13RD
CLIENT Idemitsu Kosan
AREA WishBone West
COUNTRY USA
DATE LOGGED 8-25-88
RUN ONE
2 of 3 LOGS
BOREHOLE DATA
OPERATION DATA
EQUIPMENT AND RECORDING DATA
REFER TO Lithology LOG
REMARKS
SP
Res
Yes 30
Yes 30
No 30
No 30
+165 mv SP +247 mv
Resistivity Increases to the right....
25
50
75
casing
100
125
150
175
200
225
250
275
300
325
350
+165 mv SP +247 mv
Resistivity Increases to the right....
BOREHOLE PB-13RD
CLIENT Idemitsu Kosan
AREA WishBone West
COUNTRY USA

BPB

COAL LITHOLOGY LOG

LOG SUITE: GAMMA RAY, L.S. DENSITY, CALIPER

SONDE TYPE: COAL COMBINATION SONDE

BOREHOLE: BB-39
AREA: Wishbone Hill
CLIENT: C.O. Hawley
COUNTRY: Alaska
DATE LOGGED: 25-3-83
DEPTH DRILLER: 301'
DEPTH LOGGER: 301'
BOTTOM LOG INTERVAL: 301'
CASING: 2" @ 300'
CASING DRILLER: 2" @ 300'
CASING LOGGER: 300'
BIT: 3 7/8" @ 301'
TYPE OF FLUID IN HOLE: WATER
DENSITY / VISCOSITY: -
PH / FLUID LOSS: -
SOURCE OF SAMPLE: CIRCULATED
RM @ MEAS. TEMP.: -
RMF @ MEAS. TEMP.: -
RMC @ MEAS. TEMP.: -
SOURCE OF RMF / RMC: -
RM @ BHT: -
TIME SINCE CIRC.: 24 HRS
MAX. REC. TEMP.: 70°F
EQUIP. LOCATION: 3614
RECORDED BY: D. SMITH
WITNESSED BY: -

RUN	BIT	FROM	TO
1	3 7/8"	SURFACE	301'

CASING RECORD

SIZE	WGT.	GRADE	FROM	TO
2"	-	-	SURFACE	300'

BOREHOLE RECORD

BIT	FROM	TO
3 7/8"	SURFACE	301'

TUBING RECORD

SIZE	WGT.	GRADE	FROM	TO
-	-	-	-	-

PERMANENT DATUM: Ground Level
ELEV.: 2432'
LOG MEASURED FROM: BOREHOLE RECORD
DRILLING MEASURED FROM: DRILLER

EQUIPMENT AND RECORDING DATA

COAL COMBINATION SONDE

LOG	EQUIPMENT: SONDE	SOURCE	CALIBRATION	TAPING: LOG TAPED	RECORD SPEED	DIRECT or REPLAY	PANEL: SPEED	TC DECS.	NORM	CAL. DET.	DEPTHS: FROM	TO	BEHIND	SEAM LOG RUN
GAMMA RAY	2081			Yes	30	D	30	1	-	1.6	291'	0	291'	Yes
DENSITY		84B	04	Yes	30	D	30	.5	5.5	-	300	9	291	Yes
CALIPER	SIDEWALL POSITION		04	Yes	30	D	30	.5	-	-	299	8	291	Yes

COAL QUALITY/SEAM THICKNESS LOG INTERVALS (Refer to relevant log)

FROM	160'	INTERVAL
TO	60'	TOTAL
INTERVAL	100'	100'

ADDITIONAL SONDES RUN

SONDE	LOG	GENERAL SCALE LOG	DETAIL SCALE LOG
6810D	Res.	120	-

REFER TO ADDITIONAL HEADINGS

REMARKS

BPB COAL LITHOLOGY LOG

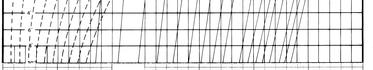
CALIBRATION DATA

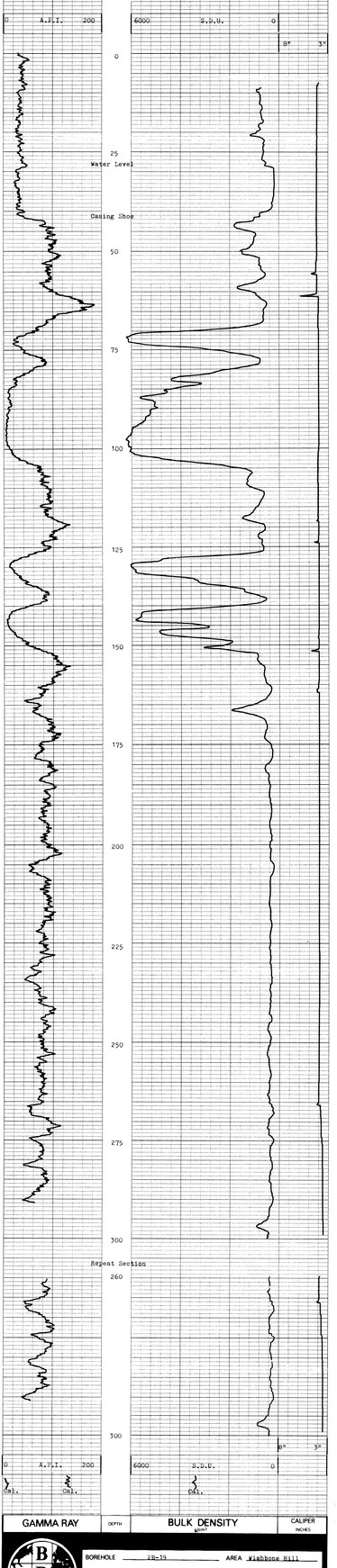
JIG No. 04 VALUE 4.96 @ 2 DIAM
JIG MARK SHOWN AT ABOVE VALUE - 3

JIG CAL SHIFT -25-83 JIG VALUE 3364 SDU @ g/cm³ 3 in 526 cps
JIG No. 04 SPAN 6000 NORM 2.5 g/cm³ 5.51 8 in 808 cps

GAMMA RAY	DEPTH	BULK DENSITY g/cm³	CALIPER INCHES

HOLE SIZE CORRECTION DATA





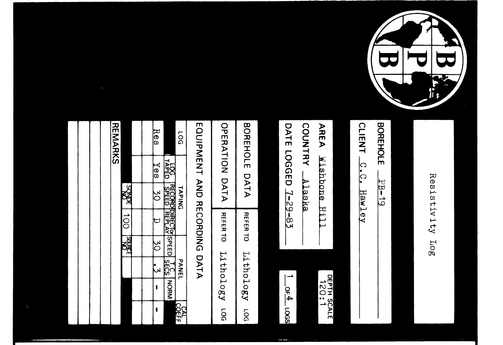
GAMMA RAY	DEPTH	BULK DENSITY g/cm³	CALIPER INCHES

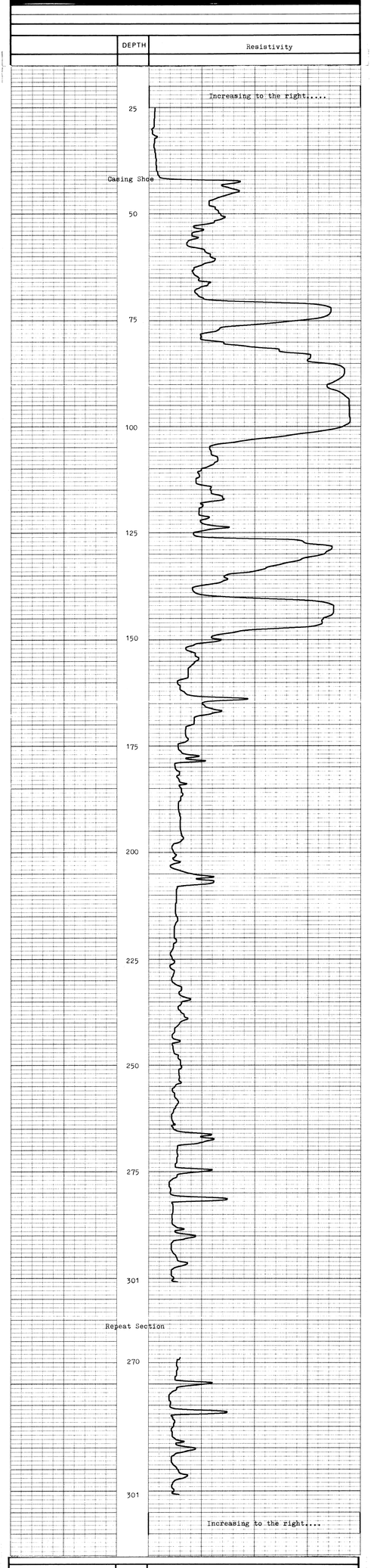
BPB

BOREHOLE BB-39 AREA Wishbone Hill
CLIENT C.O. Hawley COUNTRY Alaska

COAL LITHOLOGY LOG

MT A39585 E





DEPTH
Resistivity

BOREHOLE PB-19
CLIENT C.C. Hawley
AREA Wishbone Hill
COUNTRY Alaska

MY A384339

COAL LITHOLOGY LOG

BOREHOLE PB-48
CLIENT Rocky Mountain Energy

AREA Wishbone Hill
COUNTRY Alaska
DATE LOGGED 7-11-84

DEPTH SCALE 120:1

2 OF 4 LOGS

SONDE TYPE:
COAL
COMBINATION
SONDE

LOG SUITE:
GAMMA RAY
L.S. DENSITY
CALIPER

BOREHOLE DATA

PERMANENT DATUM	Ground Level	
ELEVATION OF P.D.		
	BPB	DRILLER
MEASUREMENTS FROM	Ground	Ground
DEPTH REACHED	364'	365'
CASING SHOE	--	--
BIT SIZES	1 5.12" TO 15'	2 4.75" TO 60'
	3 4.5" TO TD	4 -- TO --
CASING SIZES	1 -- TO --	2 -- TO --

FLUID DATA

NATURE	Quick-Gel
S.G.	--
LEVEL	00'
VISCOSITY	--
Rm at meas. temp	--
BHT	--

OPERATION DATA

FIRST READING	364'
LAST READING	0
INTERVAL LOGGED	364'
UNIT-TRUCK No.	75/V853
ENGINEER	M. Beals
WITNESS	D. Germer

EQUIPMENT AND RECORDING DATA

COAL COMBINATION SONDE

LOG	EQUIPMENT			TAPING			PANEL			CAL COEFF	DEPTHS			SEAM LOG RUN
	SONDE	SOURCE	CALIBRATOR	LOG TAPED	RECORD SPEED	DIRECT or REPLAY	SPEED	T.C. SECS	NORM		FROM	TO	INTERVAL	
GAMMA RAY	192B		G5	Yes	30	D	30	1	-	1.4	359'	0	359'	Yes
L.S. DENSITY	SIDEWALL POSITION	B489	D5	Yes	30	D	30	.3	4.7	-	363	4	359	Yes
CALIPER			C1	Yes	30	D	30	.3	-	-	362	3	359	Yes

COAL QUALITY/SEAM THICKNESS LOG INTERVALS (Refer to relevant log)

FROM	355'	INTERVAL TOTAL
TO	135	
INTERVAL	220'	= 220'

ADDITIONAL SONDES RUN

SONDE	LOG	GENERAL SCALE LOG	DETAIL SCALE LOG
ES100	Res.	120:1	--

REFER TO ADDITIONAL HEADINGS

REMARKS

BPB COAL LITHOLOGY LOG

CALIBRATION DATA

JIG No. G5 VALUE 392 @ 5" DIAM
JIG MARK SHOWN AT ABOVE VALUE - 3

JIG CAL. DATE 5-84 JIG VALUE 3700 SDU @ g/cm³ | 3 ins. 582 cps.
JIG No D5 SPAN 6000 NORM $\frac{SDU}{CPS}$ = 4.71 | 8 ins. 828 cps.

GAMMA RAY	DEPTH	BULK DENSITY g/cm³	CALIPER INCHES

HOLE SIZE CORRECTION DATA

GAMMA RAY	DEPTH	BULK DENSITY g/cm³	CALIPER INCHES

BOREHOLE PB-48 AREA Wishbone Hill
CLIENT Rocky Mountain Energy COUNTRY Alaska

COAL LITHOLOGY LOG

MY (1)137483 R

Resistivity Log

BOREHOLE PB-4B
CLIENT Rocky Mountain Energy

AREA Wishbone Hill
COUNTRY Alaska
DATE LOGGED 12-11-84

1 of 4 LOGS

RUN 1
DEPTH 359

BOREHOLE DATA
Metric to Lithology

OPERATION DATA
Metric to Lithology

EQUIPMENT AND RECORDING DATA

LOG	RATING	RUN	NORM	SCALE
Res.	1500	1	-	-
Res.	1500	1	-	-
SP	1500	1	-	-

REMARKS

DEPTH

Resistivity

Increasing to the right...

0
25
50
75
100
125
150
175
200
225
250
275
300
325
350
359

Repeat Section

335
359

Increasing to the right...

DEPTH

Resistivity

BOREHOLE PB-4B
CLIENT Rocky Mountain Energy

AREA Wishbone Hill
COUNTRY Alaska

COAL LITHOLOGY LOG

BPB

SCALE TYPE: COAL DENSITY SONDE

SCALE: GAMMA RAY 1" = 100 API, L.S. DENSITY 1" = 1 g/cc, CALIPER 1" = 10"

BOREHOLE DATA

	DRILLER'S	LOGGER'S
DEPTH	475'	475'
CASING SIZE	7"	
CASING DEPTH	45'	
BIT SIZE	6 1/4"	
MUD TYPE	AIR	
MUD WEIGHT		
MUD VISCOSITY		
MUD PH		
MUD RESISTIVITY		
MUD TEMPERATURE		
MUD SOURCE		
RM @ MEAS. TEMP.		
RMF @ MEAS. TEMP.		
RMC @ MEAS. TEMP.		
SOURCE OF RMF & RMC		
RM @ BHT		
TIME SINCE CIRC.		
MAX. REC. TEMP.		
EQUIP. LOCATION		
RECORDED BY		
WITNESSED BY		

BOREHOLE RECORD

BIT	FROM	TO	SIZE
1	0	45'	7"
2	45'	475'	6 1/4"

REMARKS

RIG: [illegible]

DATE: 4-[illegible]-[illegible]

LOCATION: [illegible]

BOREHOLE

CLIENT: [illegible]

EQUIPMENT AND RECORDING DATA

COAL COMBINATION SONDE

LOG	EQUIPMENT			TAPING			PANEL		LOG SCALE	DEPTHS		SEAM LOG RUN
	SONDE	SOURCE	CALIBRATOR	LOG NAME	RECORDING SPEED	TAPE NO.	AMPLIFIER	SPEED	NORM	FROM	TO	
GAMMA RAY	1608											
DENSITY		66	Yes	30	5	30	1	1.5	484	0	484	
CALIPER	1608	56	Yes	30	5	30	5	9.6	"			
	SONDE POSITION	56	Yes	30	5	30	5	9.6	"			

COAL QUALITY/SEAM THICKNESS LOG INTERVALS (Refer to relevant log)

FROM		INTERVAL TOTAL
TO	475'	
INTERVAL	320'	
	155'	155'

ADDITIONAL SONDES RUN

SONDE	LOG	GENERAL SCALE LOG/RUN	DETAIL
S	37/Aee	1201	

REMARKS

REFER TO ADDITIONAL HEADINGS

BPB COAL LITHOLOGY LOG

CALIBRATION DATA

JIG No 16	VALUE 5.2	2 DAMP	
JIG MARK SHOWN AT ABOVE VALUE = 3			
JIG CAL DATE 6-88	JIG VALUE 5.2	SENSOR 398mm	1 in 617 cps
JIG No 56	SPAN	NORM 9.6	8 in 800 cps

CALIPER

GR

GAMMA RAY

0 API 200

TERRAIN DENSITY

1.0 g/cc MDU 3.0 g/cc

0 25 50 75 100 125 150 175 200 225 250 275 300 325 350 375 400 425 450 475

CALIPER

0 1 2 3 4 5 6

GAMMA RAY

0 API 200

TERRAIN DENSITY

1.0 g/cc 3.0 g/cc

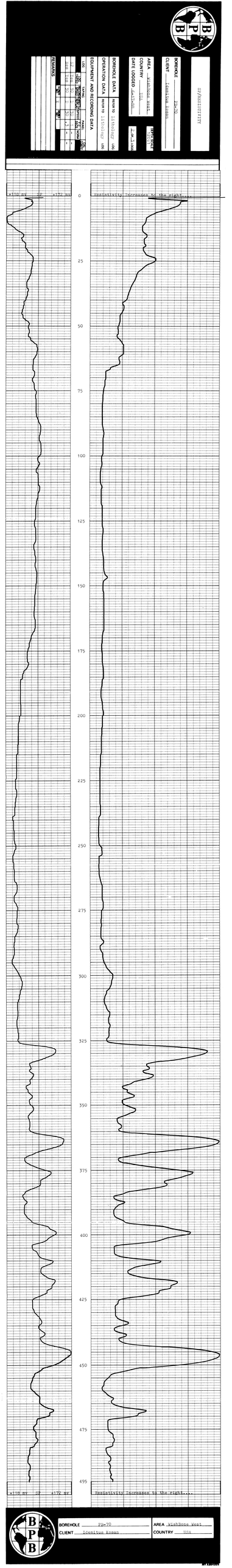
BPB

BOREHOLE: [illegible] AREA: [illegible]

CLIENT: [illegible] COUNTRY: [illegible]

COAL LITHOLOGY LOG

API A3888 B


BOREHOLE FP-70
CLIENT Idemitsu Kosan
AREA Wishbone West
COUNTRY USA
DATE LOGGED 24-Feb-00
OPERATOR
SURFACE LOCATION
BOREHOLE DATA
EQUIPMENT AND RECORDING DATA
OPERATION DATA
REMARKS
Resistivity Increases to the right...
Resistivity Increases to the right...
0
25
50
75
100
125
150
175
200
225
250
275
300
325
350
375
400
425
450
475
495

COAL LITHOLOGY LOG

BPB

BOREHOLE PB-73A
CLIENT Idemitsu Kosan
AREA WishBone West
COUNTRY USA
DATE LOGGED 6-21-88
1 OF 3 LOGS
DEPTH SCALE 120:1

BOREHOLE DATA
PERMANENT DATUM Ground Level
ELEVATION OF P.D.
MEASUREMENTS FROM: G.L. (BPB) / P.D. (DRILLER)
DEPTH REACHED 165'
CASING SHOE 165'
BIT SIZES 1) 1 1/2 TO 165 2) TO 3) TO 4) TO
CASING SIZES 1) TO 2) TO 3) TO 4) TO

FLUID DATA
NATURE
SOURCE
LEVEL Ground Level
VISCOSITY 1.32
Rm at meas. temp.
Rmf at meas. temp.
Rmc at meas. temp.
BHT

OPERATION DATA
FIRST READING 156'
LAST READING 0
INTERVAL LOGGED 156'
UNIT/TRUCK No. 87/V8851
ENGINEER J.C.Wisner
WITNESS D.Gerner

LOG SUITE
GAMMA RAY
L.S. DENSITY
CALIPER

SONDE TYPE
COAL COMBINATION SONDE

EQUIPMENT AND RECORDING DATA

COAL COMBINATION SONDE

LOG	EQUIPMENT: SONDE	SOURCE	CALIBRATOR	TAPING: LOG TAPED	RECORD SPEED	DIRECT or REPLAY	PANEL: SPEED	TC SECS	NORM	CAL COEFF	DEPTHS: FROM	TO	INTERVAL	SEAM LOG RUN
	121B													
GAMMA RAY			G6	Yes	30	D	30	1	-	1.4	158	0	158	
L.S. DENSITY		B470	D6	Yes	30	D	30	1	5.4	-				
CALIPER	SIDEWALL POSITION		--	Yes	30	D	30	.3	-	-				

COAL QUALITY/SEAM THICKNESS LOG INTERVALS (Refer to relevant log)

FROM	125'	INTERVAL TOTAL
TO	60'	
INTERVAL	65'	= 65'

ADDITIONAL SONDES RUN

SONDE	LOG	GENERAL SCALE LOG	DETAIL SCALE LOG
E	SP/Res	120:1	

REFER TO ADDITIONAL HEADINGS

REMARKS

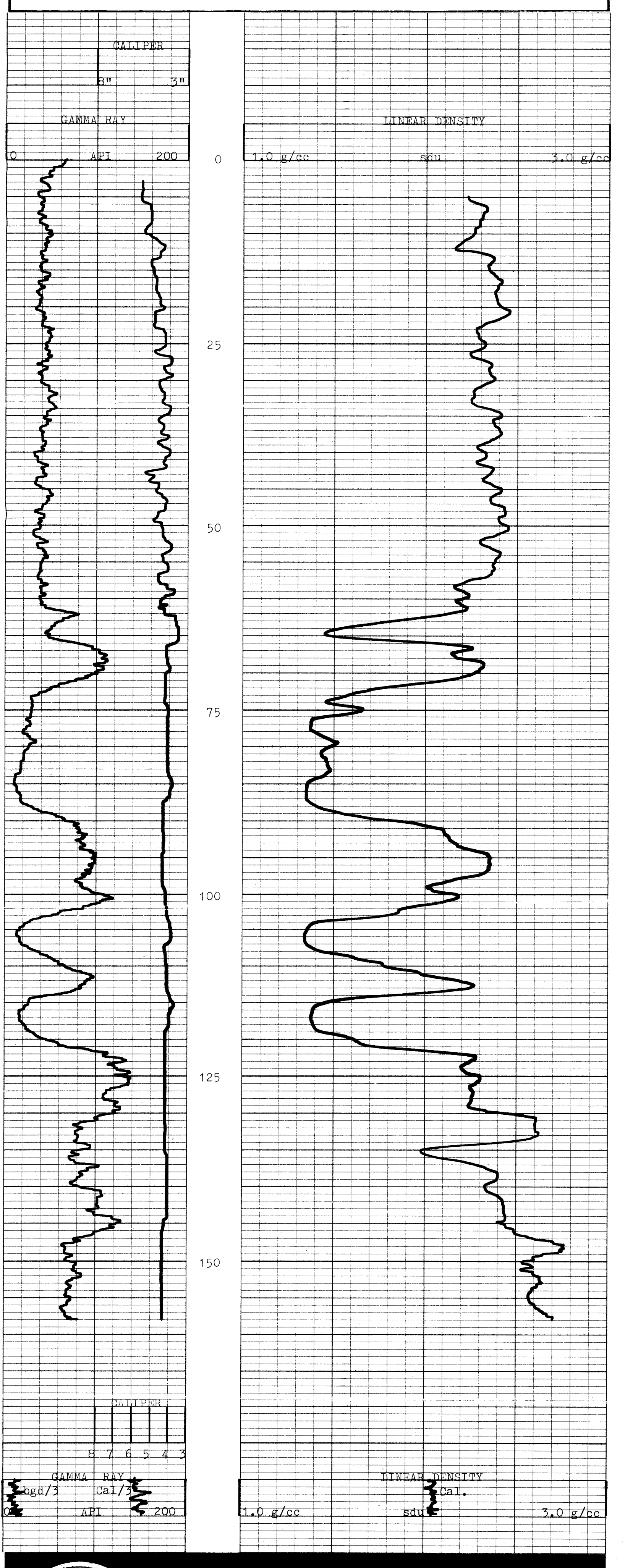
BPB COAL LITHOLOGY LOG

CALIBRATION DATA

JIG No G6 VALUE 396 @ 2' DIAM
JIG MARK SHOWN AT ABOVE VALUE - 3

JIG CAL DATE 6-88 JIG VALUE 2899 SDU @ g/cm³
JIG No D6 SPAN NORM SDU = CPS 5.45

3 ins 537 cps
8 ins 827 cps



BPB

BOREHOLE PB-73A AREA WishBone West
CLIENT Idemitsu Kosan COUNTRY USA

COAL LITHOLOGY LOG

MY A30261 R

SP/RESISTIVITY

BOREHOLE PB-73A

CLIENT Idemitus Kosan

AREA WishBone West

COUNTRY USA

DATE LOGGED 6-21-88

DEPTH SCALE 120:1

2 OF 3 LOGS

BOREHOLE DATA REFER TO Lithology LOG

OPERATION DATA REFER TO Lithology LOG

EQUIPMENT AND RECORDING DATA

LOG	TAPING			PANEL		CAL COEFF
	LOG TAPED	RECORD SPEED	DIRECT or REPLAY	SPEED	T.C SECS	NORM
SP	Yes	30	D	30	1	-
Res	Yes	30	D	30	.3	-
		SONDE NO	F	SONDE NO		

REMARKS

+208 mv SP +246 mv

Resistivity Increases to the right....

0

25

50

75

100

125

150

+208 mv SP +246 mv

Resistivity Increases to the right....

BOREHOLE PB-73A

CLIENT Idemitus Kosan

AREA WishBone West

COUNTRY USA

MY A58452R

COAL LITHOLOGY LOG

LOG SUITE
GAMMA RAY
L.S. DENSITY
CALIPER

LOG SUITE
COAL COMBINATION SONDE

SONDE TYPE
COAL COMBINATION SONDE

BPB

BOREHOLE PB=86
CLIENT Idemitsu Kosan

AREA Wishbone West
COUNTRY USA
DATE LOGGED 7-30-88

LAT 37°25'30"N
LONG 102°57'00"W

BOREHOLE DATA

CASING SIZE	FROM	0	DRILLER'S DEPTH	355	TEMPERATURE (°F)	60	DENSITY	1.60	VISCOSITY	40	
	TO	355	LOGGER'S DEPTH	355	DURATION OF CIRC.	24 hrs					
BIT SIZES	1	14 3/4"	TIME SINCE CIRC.	2 hrs	TIME ON BOTTOM	2 hrs					
	2	7 7/8"	MAX. REC. TEMP.	60	EQUIPMENT LOCATION	Denver					

FLUID DATA

SOURCE	Water										
CASING	Glass										
DENSITY	1.0	VISCOSITY	1	PH	7	FLUID LOSS		RESISTIVITY		TEMPERATURE	

OPERATION DATA

UNIT NUMBER	3470										
RECORDED BY	Mike Hess										
WITNESSED BY											
RUN NUMBER	1										
DEPTH-DRILLER	355										
DEPTH-LOGGER	355										
BTM. LOG INTERVAL	355										
TOP LOG INTERVAL	0										
CASING-DRILLER	355										
CASING-LOGGER	355										
BIT SIZE	7 7/8"										
TYPE FLUID IN HOLE	Water										
DENSITY / VISCOSITY	1.0	1									
PH / FLUID LOSS	7										
SOURCE OF SAMPLE	Flow Line										
RM @ MEAS. TEMP.	1.4 @ 60°F										
RMF @ MEAS. TEMP.	1.3 @ 60°F										
RMC @ MEAS. TEMP.	1.5 @ 60°F										
SOURCE RMF / RMC	Calc										
RM @ BHT	1.4 @ 60°F										
TIME SINCE CIRC.	2 hrs										
MAX. REC. TEMP.	60°F										
EQUIP. LOCATION	Denver										
RECORDED BY	Mike Hess										
WITNESSED BY											

EQUIPMENT AND RECORDING DATA

COAL COMBINATION SONDE

LOG	EQUIPMENT			TAPING		PANEL			CAL OUT	DEPTHS			SEAM LOG RUN
	SONDE	SOURCE	CALIBRATOR	LOG TAPED	RECORD DIRECT= REPLAY	SPEED	TC SECS.	NORM		FROM	TO	INTERVAL	
GAMMA RAY	1211												
		G6		Yes	30	D	30	1	=	1.4	348	0	348
DENSITY	3470	D6		Yes	30	D	30	1		5.4	=		
CALIPER	SIDEWALL POSITION	---		Yes	30	D	30	.3	=	=			

COAL QUALITY/SEAM THICKNESS LOG INTERVALS (Refer to relevant log)

FROM	185'	INTERVAL
TO	80'	TOTAL
INTERVAL	105'	= 105'

ADDITIONAL SONDES RUN

SONDE	LOG	GENERAL SCALE	DETAIL LOG SCALE
D	92/1mm	120ft	

REFER TO ADDITIONAL HEADINGS

REMARKS

BPB COAL LITHOLOGY LOG

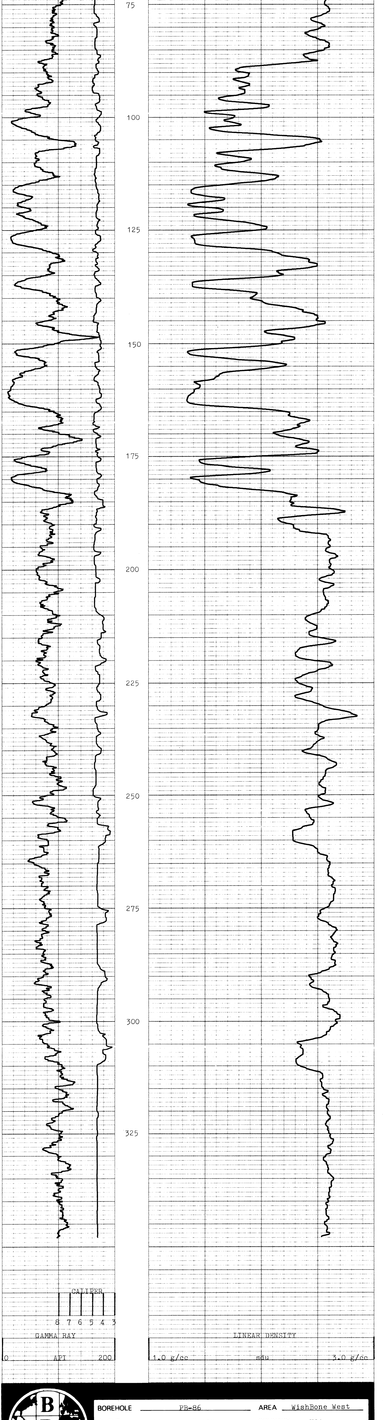
CALIBRATION DATA

JG No. G6 VALUE 595 S'DIAM

JG MARK SHOWN AT ABOVE VALUE - 3

JG CAL DATE 6-88 JG VALUE 2899 ROU@ gm/cm³ 3 cts 537 cps

JG No. D6 SPAN NORM 2.5 - 5.45 8 cts 827 cps



BPB

BOREHOLE PB=86 AREA Wishbone West

CLIENT Idemitsu Kosan COUNTRY USA

COAL LITHOLOGY LOG

MT (11137483)

BOREHOLE PB-86
CLIENT Idemitsu Kosan
AREA WishBone West
COUNTRY USA
DATE LOGGED 7-30-86
2 OF 3 LOGS
DEPTH SCALE 1:20:1
SP/RESISTIVITY
BOREHOLE DATA
REFER TO Lithology LOG
OPERATION DATA
REFER TO Lithology LOG
EQUIPMENT AND RECORDING DATA
LOG
TAPING
PANEL
REMARKS
SP
Res
Res
SP
Res
Res
+162 mv
SP
+237 mv
Resistivity Increases to the right....
25
50
75
100
125
150
175
200
225
250
275
300
325
350
+162 mv
SP
+237 mv
Resistivity Increases to the right....
BOREHOLE PB-86
CLIENT Idemitsu Kosan
AREA WishBone West
COUNTRY USA
AV A384338

COAL LITHOLOGY LOG

LOG SUITE: GAMMA RAY, L.S. DENSITY, CALIPER

SONDE TYPE: COAL COMBINATION SONDE

BOREHOLE: PB#100
CLIENT: Idemitsu Kosan

AREA: Wishbone West
COUNTRY: USA
DATE LOGGED: 7-13-88

RUN NO.: 1
DEPTH DRILLER: 1209'
LOG TD: 1206'

DRILLING DATA: DRILLER: Ingersoll Rand; RIG NO.: 7; DRILLER: Tom Stevens; WITNESS: Tom Stevens

OPERATION DATA: DIRECT READING: 396'; MATERIAL LOGGED: 396'; DEPTH TRACK No.: 1; OPERATOR: Jim Hall

FLUID DATA: SALINITY: 1.10; LEVEL: FULL; MUD TYPE: Water; MUD WEIGHT: 8.4 lbs/gal

BOREHOLE DATA: CASING SIZES: 1) 4" 1420-574'; 2) 4" 574'-0'; BIT SIZES: 1) 3 7/8" 1420'-601'; 2) 3 7/8" 601'-0'; MEASUREMENTS FROM: Ground Level; ELEVATION OF F.D.: 0'; DEPTH RECKONED: 401.4'; DEPTH LOGGED: 401.4'; PERMANENT DATUM: Ground Level; ELEVATION: 0'; DATUM: GPD

EQUIPMENT AND RECORDING DATA

COAL COMBINATION SONDE

LOG	EQUIPMENT			TAPING			PANEL		CAL COEFF	DEPTHS			SEAM LOG RUN
	SONDE	SOURCE	CALIBRATOR	LOG TAPED	RECORD SPEED	DIRECT'N REPLAY	TC SECS	SPEED	NORM	FROM	TO	INTERVAL	
GAMMA RAY	1213		06	Yes	30	D	30	1	= 1.4	396	0	396	
L.S. DENSITY	8420	26		Yes	30	D	30	5.4	=				
CALIPER	SIDEWALL POSITION		--	Yes	30	D	30	5.3	=				

COAL QUALITY/SEAM THICKNESS LOG INTERVALS (Refer to relevant log)

FROM	205'	INTERVAL
TO	135'	TOTAL
INTERVAL	70'	70'

ADDITIONAL SONDES RUN

SONDE	LOG	GENERAL SCALE LOG	DETAIL SCALE LOG
R	82/Dec 120:1		

REFER TO ADDITIONAL HEADINGS

REMARKS

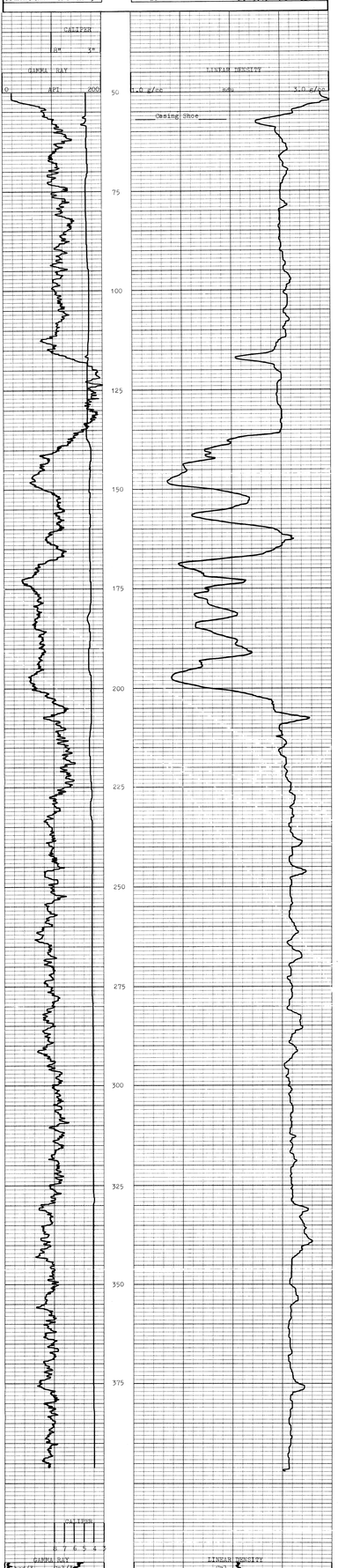
BPB COAL LITHOLOGY LOG

CALIBRATION DATA

JG No. 06 VALUE 9.8 2 DAM
JG MARK SHOWN AT ABOVE VALUE = 5

JG CAL DATE 6-88 JG VALUE 2899 SDU'S
JG No. 06 SPAN NORM 99 = 5.45

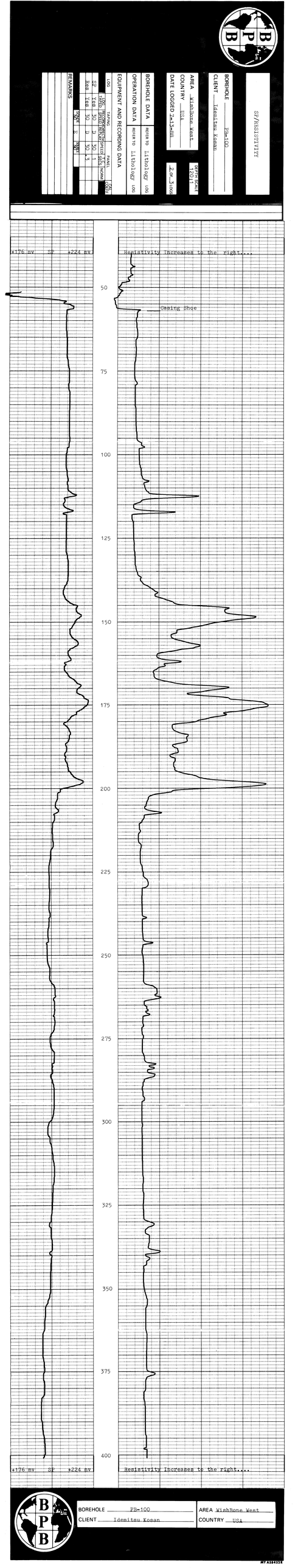
5 cps 537 cps
8 cps 827 cps



BOREHOLE PB#100 AREA Wishbone West
CLIENT Idemitsu Kosan COUNTRY USA

COAL LITHOLOGY LOG

MY A30561 9


SP/RESISTIVITY
BOREHOLE PB-100
CLIENT Idemitsu Kosan
AREA WishBone West
COUNTRY USA
DATE LOGGED 2-13-88
RUN 1
DEPTH SCALE 1:200
2 or 3 100
BOREHOLE DATA REFER TO Lithology 100
OPERATION DATA REFER TO Lithology 100
EQUIPMENT AND RECORDING DATA
LOG
PANEL
REMARKS
SP
RES 1
RES 2
RES 3
±176 mv
SP
±224 mv
Resistivity Increases to the right....
Casing Shoe
50
75
100
125
150
175
200
225
250
275
300
325
350
375
400
Resistivity Increases to the right....
BOREHOLE PB-100
CLIENT Idemitsu Kosan
AREA WishBone West
COUNTRY USA
MY A5843SR

COAL LITHOLOGY LOG

BPB

LOG SUITE	SONDE TYPE
GAMMA RAY	COAL COMBINATION SONDE
L.S. DENSITY	
CALIPER	

BOREHOLE: PB-60
CLIENT: Idemitsu Kosan
AREA: Wishbone West
COUNTRY: USA
DATE LOGGED: 8-13-88
LOG No. 3 of 3 LOGS
SCALE 1" = 40' 120:1

BOREHOLE DATA

PERMANENT DATUM	Ground Level
ELEVATION OF P.D.	
LOG MEASURED FROM	Pipe Stab.
DEPTH RECORDED	Pipe Stab.
DRILLER'S DEPTH	321.75
LOGGER'S DEPTH	321.5

CASING SIZES	BIT SIZES	CASING SHOE
1 4 1/2"	1 3 3/4	321.75
2	2	217
3	3	
4	4	
TO	TO	

FLUID DATA	
NATURE	Water
LEVEL	Wtn the casing
SALINITY	
Rm @ °Mes. temp.	
Bht	

OPERATION DATA

FIRST READING	212'
LAST READING	
INTERVAL LOGGED	212'
LOGGING SPEED	
UNIT/TRUCK No.	87/3651
ENGINEER	J.G.Misner
WITNESS	

EQUIPMENT AND RECORDING DATA

COAL COMBINATION SONDE

LOG	EQUIPMENT: SONDE	EQUIPMENT: SOURCE	EQUIPMENT: CALIBRATOR	TAPING: LOG TAPED	TAPING: RECORD SPEED	TAPING: DIRECT or REPLAY	PANEL: SPEED	PANEL: T.C. SECS	PANEL: NORM	CAL COEFF	DEPTHS: FROM	DEPTHS: TO	DEPTHS: INTERVAL	SEAM LOG RUN
	121B													
GAMMA RAY			G6	Yes	30	D	30	1	-	1.4	212	0	212	
L.S. DENSITY	SIDEWALL POSITION	B470	D6	Yes	30	D	30	1	5.4	-				
CALIPER			--	Yes	30	D	30	.3	-	-				

COAL QUALITY/SEAM THICKNESS LOG INTERVALS (Refer to relevant log)

FROM	165'	INTERVAL TOTAL
TO	75'	
INTERVAL	90'	90'

ADDITIONAL SONDES RUN

SONDE	LOG	GENERAL SCALE LOG	DETAIL SCALE LOG
E	SP/Res	120:1	

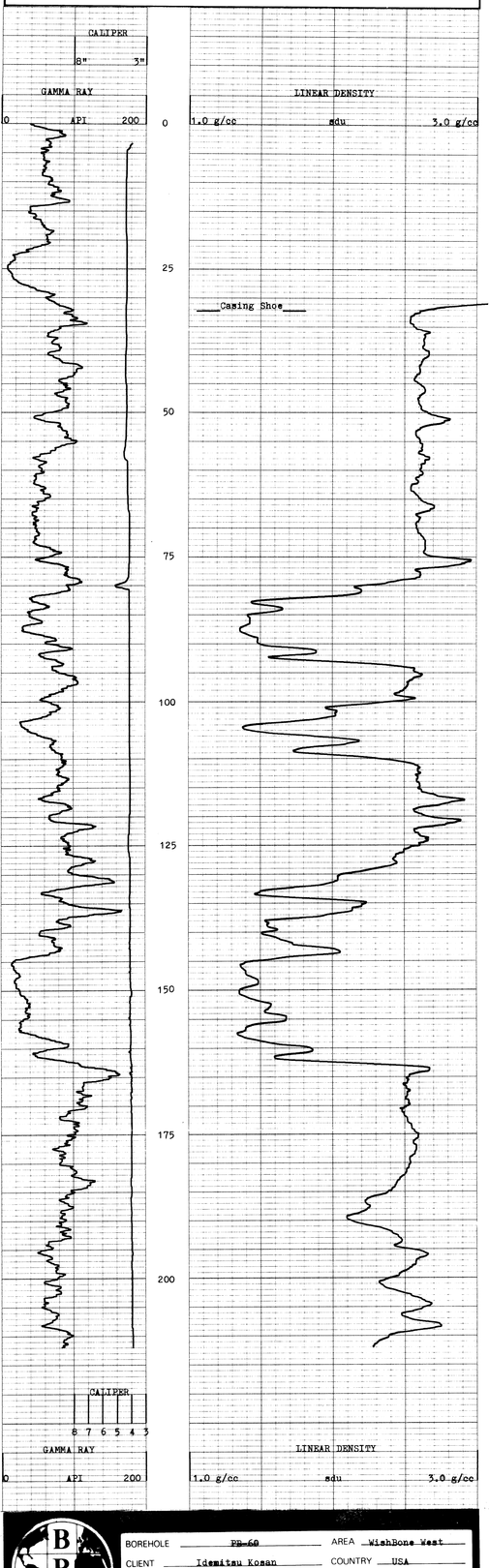
REFER TO ADDITIONAL HEADINGS

REMARKS

BPB COAL LITHOLOGY LOG

CALIBRATION DATA

JIG No G6	VALUE 391 @ 5" DIAM	JIG CAL DATE 6-88	JIG VALUE 2899 SDU@	g/cm³	3	ins	537 cps
JIG MARK SHOWN AT ABOVE VALUE - 3		JIG No D6	SPAN	NORM SDU CPS 5.45	8	ins	827 cps



BPB

BOREHOLE PB-60 AREA WishBone West
CLIENT Idemitsu Kosan COUNTRY USA

COAL LITHOLOGY LOG

MY 1311574819

SP/RESISTIVITY

BOREHOLE PB-60

CLIENT Idemitsu Kosan

AREA WishBone West

COUNTRY USA

DATE LOGGED 8-13-88

DEPTH SCALE 120:1

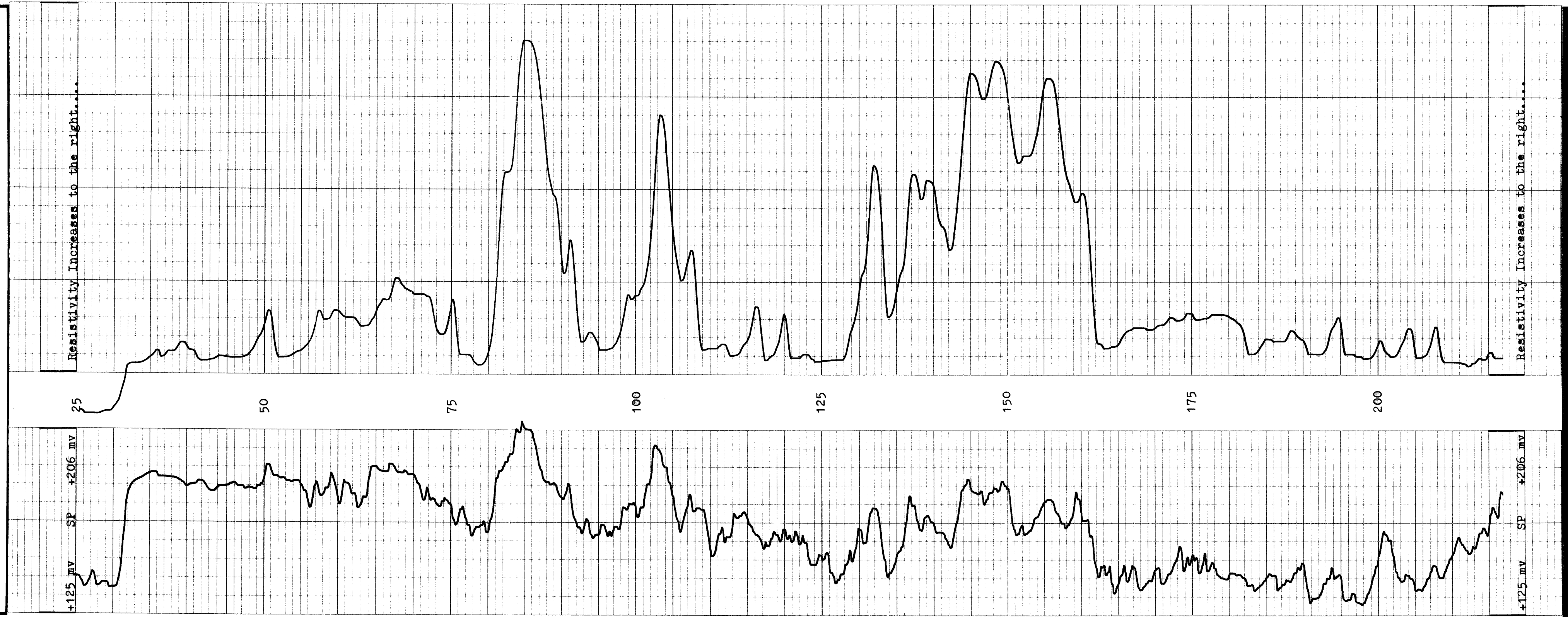
2 OF 3 LOGS

BOREHOLE DATA	REFER TO Lithology LOG
OPERATION DATA	REFER TO Lithology LOG

EQUIPMENT AND RECORDING DATA

LOG	TAPING			PANEL			CAL COEFF
	LOG TAPED	RECORD SPEED	DIRECT or REPLAY	SPEED	T.C. SECS	NORM	
SP	Yes	30	D	30	1		
Res	Yes	30	D	30	.3		
		SONDE NO	E	SOURCE NO			

REMARKS



AREA WishBone West

COUNTRY USA

BOREHOLE PB-60

CLIENT Idemitsu Kosan

BPB

COAL LITHOLOGY LOG

BOREHOLE: PH-601
CLIENT: Idemitsu Kosan
AREA: Wishbone West
COUNTRY: USA
DATE LOGGED: 3-Jan-2001
RUN NO.: 1
DEPTH DRILLER: 405'
DEPTH LOGGER: 405'
CASING DRILLER: 0-0'
CASING LOGGER: 0'
BIT SIZE: 7 7/8"
TYPE FLUID: Air
DENSITY: -
VISCOSITY: -
PH: -
FLUID LOSS: -
SOURCE OF SAMPLE: -
RM @ MEAS TEMP: -
RMF @ MEAS TEMP: -
RMC @ MEAS TEMP: -
SOURCE RMF: -
SOURCE RMC: -
RM @ BHT: -
TIME CIRC STOPPED: -
TIME LOGGER ON BOTTOM: -
MAX REC TEMP: -
EQUIP LOCATION: Kemmerer
RECORDED BY: Jeff Hansen
WITNESSED BY: Mr. Kent

LDL SUITE
GAMMA RAY
LITHO DENSITY
CALIPER

COAL DENSITY SONDE

SONDE TYPE
SONDE SERIAL NO.

BOREHOLE DATA

RUN NO.	BIT SIZE	FROM	TO
1	7 7/8"	0'	405'

CASING	SIZE	WEIGHT	GRADE	FROM	TO
DRILLER	7"	17 lb/ft	J55	0'	405'
LOGGER					

PERMANENT DATUM: GL
ELEVATION: 6552ft
LOG MEAS. FROM: KB
DRILLING MEAS. FROM: KB

OPERATION DATA

	RUN 1	RUN 2	RUN 3
DATE	3-Jan-01		
TIME	1545		
MAX. RECORDED TEMP.	77°F		
EQUIPMENT NUMBER	1215		
LOCATION	Kemmerer		
RECORDED BY	Jeff Hansen		
WITNESSED BY	Mr. Kent		

EQUIPMENT AND RECORDING DATA

COAL COMBINATION SONDE

LOG	SONDE	SOURCE	CALIBRATOR	LOG TAPED	TAPING: RECORD/DIRECT/REPLAY	TAPING: RECORD SPEED	PANEL: SPEED	PANEL: TC	PANEL: SENS	CAL. OUTPUT: NORM	DEPTHS: FROM	DEPTHS: TO	DEPTHS: INTERVAL	SEAM LOG RUN
GAMMA RAY	1215			Yes	D	30	D	30	1	-	1.4	405	n	405
DENSITY		1670	36	Yes	D	30	D	30	1	5.4	-			
CALIPER	HORIZONTAL POSITION		--	Yes	D	30	D	30	1	-	-			

COAL QUALITY/SEAM THICKNESS LOG INTERVALS (Refer to relevant log)

FROM	80'
TO	65'
INTERVAL	15'

INTERVAL	
TOTAL	
	15'

ADDITIONAL SONDES RUN

SONDE	LOG	GENERAL SCALE LOG	DETAIL SCALE LOG
S 32/Res 1201			

REFER TO ADDITIONAL HEADINGS

REMARKS

BPB COAL LITHOLOGY LOG

CALIBRATION DATA

JG No. 96 VALUE 5918 2 DIAM
JG MARK SHOWN AT ABOVE VALUE - 3

JG CAL DATE 6-08 JG VALUE 2899.50 kN/m³ 3 in 557 GR
JG No. 36 SPAN NORM 2.45 8 in 827 GR

CALIPER
8" 22"

GAMMA RAY
0 API 200

LINEAR DENSITY
1.0 g/cc 3.0 g/cc

0 25 50 75 100 125 150 175 200 225 250 275 300 325 350 375 400

CALIPER
8 7 6 5 4 3

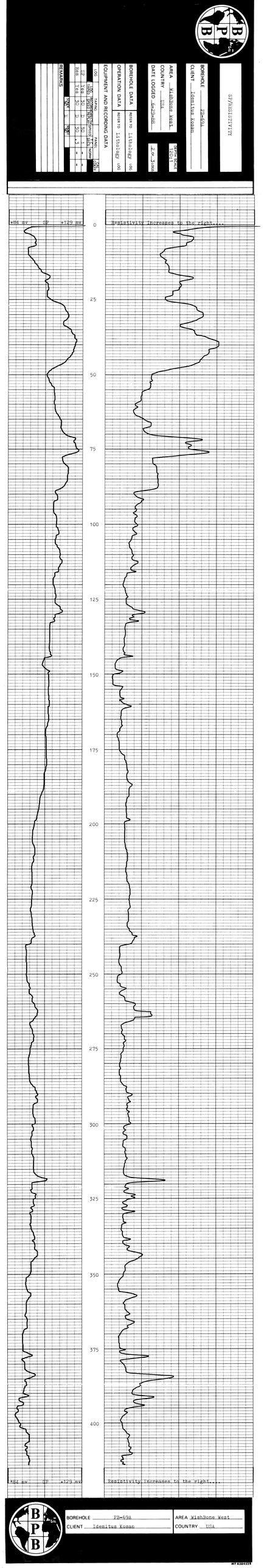
GAMMA RAY
0 API 200

LINEAR DENSITY
1.0 g/cc 3.0 g/cc

BPB

BOREHOLE PH-601 AREA Wishbone West
CLIENT Idemitsu Kosan COUNTRY USA

COAL LITHOLOGY LOG


B P B
SPONTANEOUS POTENTIAL
BOREHOLE PB-69A
CLIENT Idemitsu Kosan
AREA WishBone West
COUNTRY USA
DATE LOGGED 6-29-98
2nd Log
LOG
TAPING
PANEL
REMARKS
BOREHOLE DATA
OPERATION DATA
EQUIPMENT AND RECORDING DATA
-84 mv SP +129 mv
Resistivity Increases to the right....
0
25
50
75
100
125
150
175
200
225
250
275
300
325
350
375
400
-84 mv SP +129 mv
Resistivity Increases to the right....
BOREHOLE PB-69A
CLIENT Idemitsu Kosan
AREA WishBone West
COUNTRY USA
MY A3245338

BOREHOLE PB-74
CLIENT Idemitus Kosan

AREA WishBone West
COUNTRY USA
DATE LOGGED 6-30-88

DEPTH SCALE 120:1

1 OF 2 LOGS

COAL LITHOLOGY LOG

SONDE TYPE:
COAL
COMBINATION
SONDE

LOG SUITE:
GAMMA RAY
L.S. DENSITY
CALIPER

BOREHOLE DATA

PERMANENT DATUM	Ground Level			
ELEVATION OF P.D.				
	BPB		DRILLER	
MEASUREMENTS FROM	G.L.		G.L.	
DEPTH REACHED	399.68		400	
CASING SHOE				
BIT SIZES	1	4 3/4 TO 115	2	4 1/2 TO 400
	3	TO	4	TO
CASING SIZES	1	TO	2	TO

FLUID DATA

NATURE	Quik-Gel
S.G.	1.15
LEVEL	
VISCOSITY	
Rm at meas. temp.	
B.H.T.	

OPERATION DATA

FIRST READING	395'
LAST READING	0
INTERVAL LOGGED	395'
UNIT-TRUCK No.	87/V851
ENGINEER	J.C.Wisner
WITNESS	D.Germer

EQUIPMENT AND RECORDING DATA

COAL COMBINATION SONDE

LOG	EQUIPMENT			TAPING			PANEL			CAL. COEFF	DEPTHS			SEAM LOG RUN
	SONDE	SOURCE	CALIBRATOR	LOG TAPED	RECORD SPEED	DIRECT or REPLAY	SPEED	T.C. SECS	NORM		FROM	TO	INTERVAL	
	121B													
GAMMA RAY			G6	Yes	30	D	30	1	-	1.4	395	0	395	
L.S. DENSITY	SIDEWALL POSITION	B470	D6	Yes	30	D	30	.3	5.4	-				
CALIPER			--	Yes	30	D	30	.3	-	-				

COAL QUALITY/SEAM THICKNESS LOG INTERVALS (Refer to relevant log)

FROM		INTERVAL
TO		TOTAL
INTERVAL		=

ADDITIONAL SONDES RUN

SONDE	LOG	GENERAL SCALE LOG	DETAIL SCALE LOG
E	SP/Res	120:1	

REFER
TO
ADDITIONAL
HEADINGS

REMARKS

BPB COAL LITHOLOGY LOG

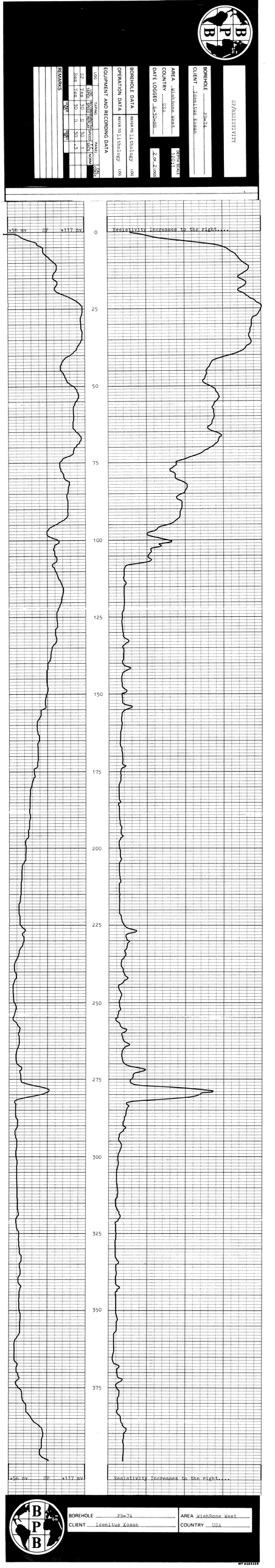
CALIBRATION DATA

JIG No G6 VALUE 391 @ 2" DIAM	JIG CAL DATE 6-88	JIG VALUE 2899 SDU @ g/cm³	3 ins. 537 cps.
JIG MARK SHOWN AT ABOVE VALUE -3	JIG No. D6 SPAN	NORM $\frac{SDU}{CPS}$ = 5.45	8 ins. 827 cps.

BOREHOLE PB-74
CLIENT Idemitus Kosan
AREA WishBone West
COUNTRY USA

COAL LITHOLOGY LOG

MY A50261 R


SP/RESISTIVITY
BOREHOLE PH-74
CLIENT Idemitsu Kosan
AREA WishBone West
COUNTRY USA
DATE LOGGED 6-30-88
2.0 m 2.0 OHM
BOREHOLE DATA
OPERATION DATA
EQUIPMENT AND RECORDING DATA
REMARKS
+56 mv SP +117 mv
Resistivity Increases to the right....
0
25
50
75
100
125
150
175
200
225
250
275
300
325
350
375
BOREHOLE PH-74
CLIENT Idemitsu Kosan
AREA WishBone West
COUNTRY USA

COAL LITHOLOGY LOG

BPB

BOREHOLE: PH-80
CLIENT: Idemitsu Kosan
AREA: Wimborne West
COUNTRY: USA
DATE LOGGED: 4-Jan-88
RUN NO: 3
DEPTH SCALE: 1:200

LOG SUITE: GAMMA RAY, L.S. DENSITY, CALIPER
COAL COMBINATION SONDE
SONDE TYPE: COAL

BOREHOLE DATA

PERMANENT DATUM: GROUND LEVEL
ELEVATION OF P.D.: 0
LOG MEASURED FROM: RT
DRILLING MEASURED FROM: RT
DEPTH REACHED: 292.84
CASING SHOE: 295
CASING SIZES: 1: 6 1/4 TO 295; 2: TO; 3: TO
BIT SIZES: 1: 6 1/4 TO 295; 2: TO; 3: TO
MATRIX: Coal-Lst
FLUID DATA: DENSITY: 1.0 g/cc; VISCOSITY: 1.0 cp; LEVEL: Full; PH: FRESH WATER

OPERATION DATA

RECORDED BY: D.Forrest
WITNESS:
ENGINEER: S.Wilson
MATERIAL LOGGED: 288'
LOGGED INTERVAL: 288'
RUN NO.: 1
DATE: 6/7/1988
TIME: 10:30

EQUIPMENT AND RECORDING DATA

COAL COMBINATION SONDE

LOG	EQUIPMENT SONDE	EQUIPMENT SOURCE	EQUIPMENT CALIBRATOR	TAPING LOG TAPED	TAPING RECORD SPEED	TAPING DIRECT or REPLAY	PANEL SPEED	PANEL TC SECS	PANEL NORM	CAL. CURVE	DEPTHS FROM	DEPTHS TO	DEPTHS INTERVAL	SEAM LOG RUN
GAMMA RAY	1213		G6	Yes	30	D	30	1	-	1.4	288	0	288	
L.S. DENSITY	8470	D6		Yes	30	D	30	1	5.4	-				
CALIPER	SIDEWALL POSITION	--		Yes	30	D	30	.3	-	-				

COAL QUALITY/SEAM THICKNESS LOG INTERVALS (Refer to relevant log)

FROM	250'	195'	INTERVAL TOTAL
TO	220'	160'	
INTERVAL	30'	35'	65'

ADDITIONAL SONDES RUN

SONDE	LOG	GENERAL SCALE	DETAIL SCALE
X	SP/Res	120:1	

REFER TO ADDITIONAL HEADINGS

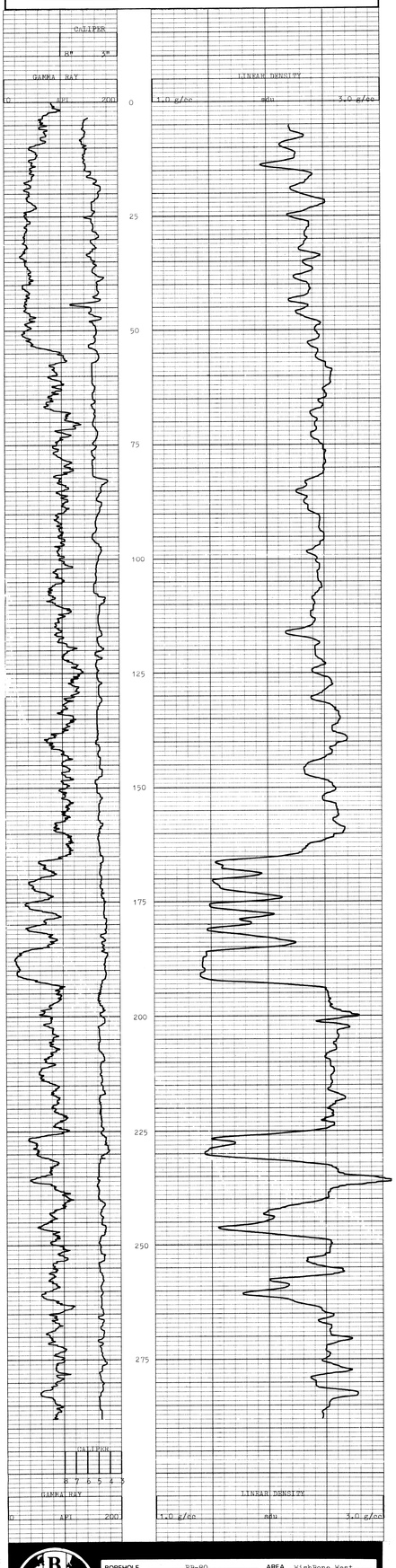
REMARKS

BPB COAL LITHOLOGY LOG

CALIBRATION DATA

JG No: 96 VALUE 3980 2" DIAM
JG MARK SHOWN AT ABOVE VALUE - 3

JG CAL DATE 6-88 JG VALUE 2899 SDU@ gm/cm³ 3 cms 537 cps
JG No: J6 SPAN NORM 5.45 8 cms 827 cps

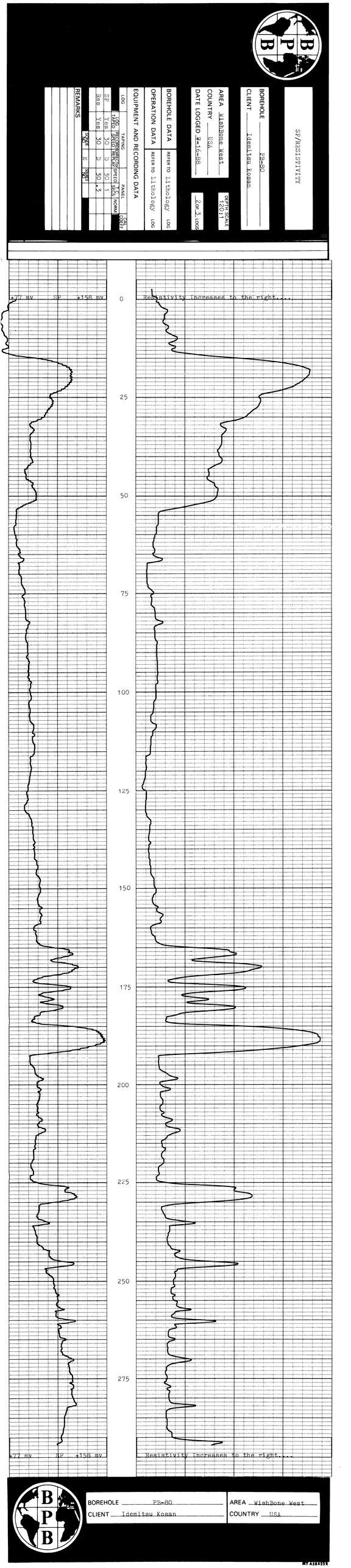


BPB

BOREHOLE: PH-80
CLIENT: Idemitsu Kosan
AREA: Wimborne West
COUNTRY: USA

COAL LITHOLOGY LOG

MY A50361 B


SP/RESISTIVITY
BOREHOLE PB-80
CLIENT Idemitsu Kosan
AREA WishBone West
COUNTRY USA
DATE LOGGED 2-16-88
DEPTH SCALE 1:20
2 OF 2 LOGS
BOREHOLE DATA
REFER TO lithology LOG
OPERATION DATA
REFER TO lithology LOG
EQUIPMENT AND RECORDING DATA
LOG
TAPING
PANEL
CODE
SP Yes 30 D 30 1
Res Yes 30 D 30 .3
REMARKS
SOURCE
R
RMF
RMC
-77 mv
SP
+158 mv
Resistivity Increases to the right....
0
25
50
75
100
125
150
175
200
225
250
275
BOREHOLE PB-80
CLIENT Idemitsu Kosan
AREA WishBone West
COUNTRY USA

MY A84455R

BPB

BOREHOLE PB-84
CLIENT Idemitsu Kosan
AREA WishBone West
COUNTRY USA
DATE LOGGED 7-26-88
DEPTH SCALE 120:1
1 OF 2 LOGS

COAL LITHOLOGY LOG

SONDE TYPE: COAL COMBINATION SONDE

LOG SUITE: GAMMA RAY, L.S. DENSITY, CALIPER

BOREHOLE DATA

PERMANENT DATUM	Ground Level	
ELEVATION OF P D		
	BPB	DRILLER
MEASUREMENTS FROM	G.L.	G.L.
DEPTH REACHED	394.07	395
CASING SHOE		
BIT SIZES 1	4 3/4 TO 80	2 4 ½ TO 395
3	TO	4 TO
CASING SIZES 1	TO	2 TO

FLUID DATA

NATURE	Quik-Gel
SG	
LEVEL	
VISCOSITY	
Rm at meas temp	
BHT	

OPERATION DATA

FIRST READING	388'
LAST READING	297'
INTERVAL LOGGED	97'
UNIT-TRUCK No.	87/V851
ENGINEER	J.C. Wisner
WITNESS	

EQUIPMENT AND RECORDING DATA

COAL COMBINATION SONDE

LOG	EQUIPMENT			TAPING			PANEL			CAL COEFF	DEPTHS			SEAM LOG RUN
	SONDE	SOURCE	CALIBRATOR	LOG TAPED	RECORD SPEED	DIRECT or REPLAY	SPEED	TC SECS	NORM		FROM	TO	INTERVAL	
	121B													
GAMMA RAY	SIDEWALL POSITION		G6	Yes	30	D	30	1	-	1.4	388	297	97	
L.S DENSITY		B470	D6	Yes	30	D	30	1	5.4	-				
CALIPER			--	Yes	30	D	30	.3	-	-				

COAL QUALITY/SEAM THICKNESS LOG INTERVALS (Refer to relevant log)

FROM		INTERVAL TOTAL
TO		
INTERVAL		=

ADDITIONAL SONDES RUN

SONDE	LOG	GENERAL SCALE LOG	DETAIL SCALE LOG
E	SP/Res	120:1	

REFER TO ADDITIONAL HEADINGS

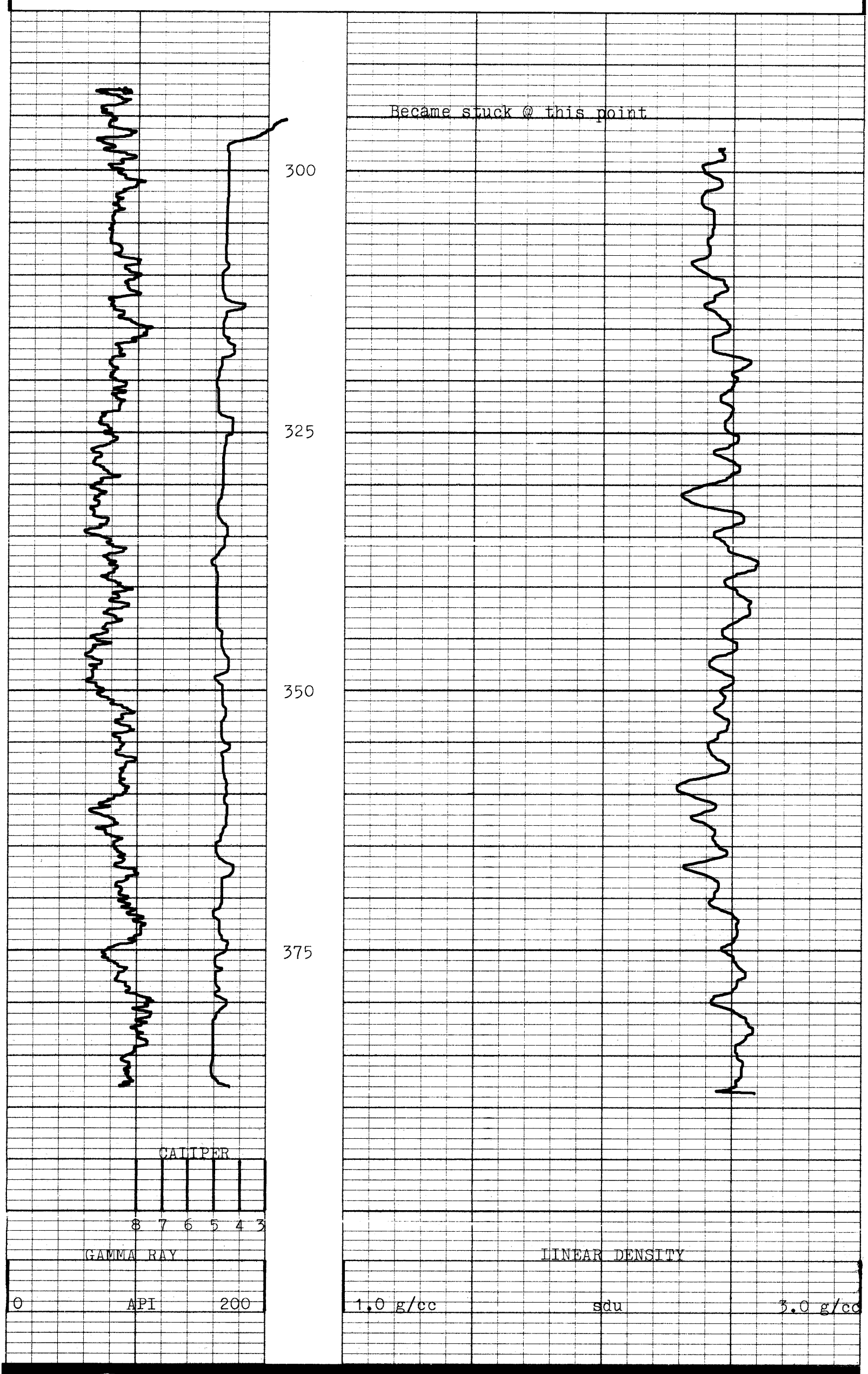
REMARKS

Sonde became stuck @ 297', after becoming free, discontinued logging.

BPB COAL LITHOLOGY LOG

CALIBRATION DATA

JIG No G6 VALUE 391 @ 5" DIAM	JIG CAL DATE 6-88 JIG VALUE 2899 SDU @ g/cm³	3 ins 537 cps
JIG MARK SHOWN AT ABOVE VALUE - 3	JIG No D6 SPAN NORM SDU/CPS = 5.45	8 ins 827 cps

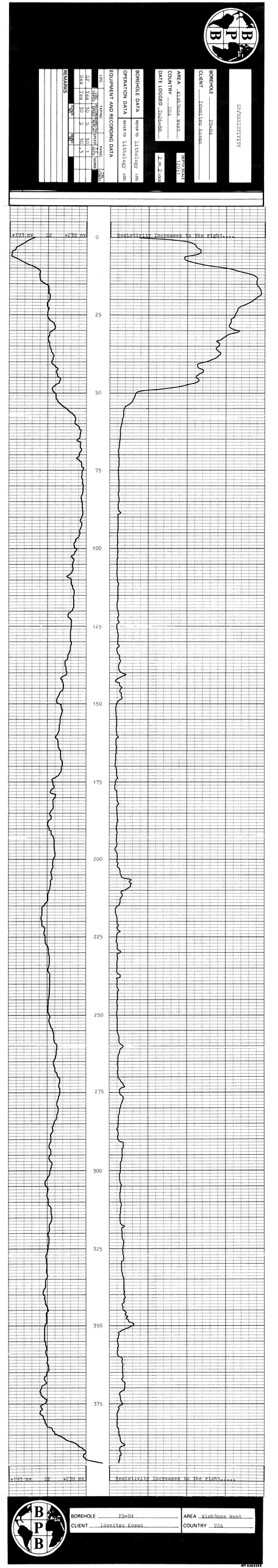


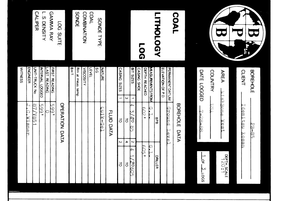
BPB

BOREHOLE PB-84 AREA WishBone West
CLIENT Idemitsu Kosan COUNTRY USA

COAL LITHOLOGY LOG

MY (1)137483 B


SP/RESISTIVITY
BOREHOLE PB-84
CLIENT Idemitsu Kosan
AREA WishBone West
COUNTRY USA
DATE LOGGED 12-26-88
DEPTH SCALE 1"=25'
BOREHOLE DATA
OPERATION DATA
EQUIPMENT AND RECORDING DATA
REMARKS
+195 mv SP +238 mv
Resistivity Increases to the right....
0
25
50
75
100
125
150
175
200
225
250
275
300
325
350
375
BOREHOLE PB-84
CLIENT Idemitsu Kosan
AREA WishBone West
COUNTRY USA



EQUIPMENT AND RECORDING DATA

COAL COMBINATION SONDE

LOG	EQUIPMENT: SONDE	SOURCE	S-SPACING	LOG CONDITIONS: LOG SPEED	TAPING: CASING SIZE	CASING DEPTH	MUD LEVEL	FLUID: MUD TYPE	MUD DENSITY	MUD VISCOSITY	LOG: TOP	BOTTOM	BASE LOG RUN
COARSE GAMMA	1213												
DENSITY		1ms	26	1ms	30	0	30	1	m	1.490	0	590	
CALIPER	SIDEWALL POSITION		26	1ms	30	0	30	1.245	"	"			
		"	"	1ms	30	0	30	1.5	"	"			

COAL QUALITY/BEAM THICKNESS LOG INTERVALS (Refer to relevant log)

FROM					INTERVAL TOTAL
TO	310'	205'	100'		
INTERVAL	15'	105'			120'

ADDITIONAL SONDES RUN

SONDE	LOG	CENTRE / DETAIL (DUAL OR BACK LOG)
S	27/8/88	1201

REMARKS

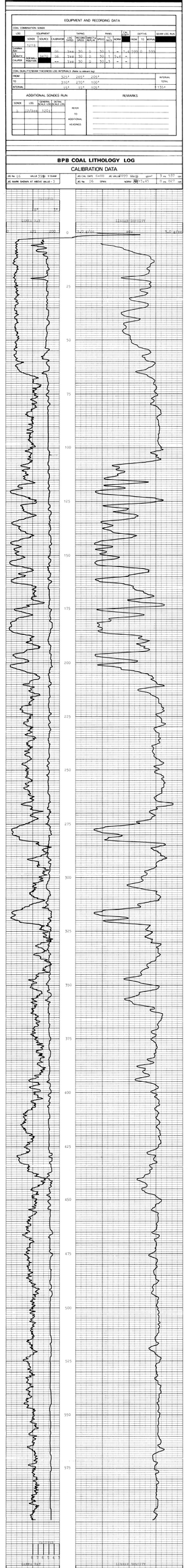
REFER TO ADDITIONAL HEADINGS

BPB COAL LITHOLOGY LOG

CALIBRATION DATA

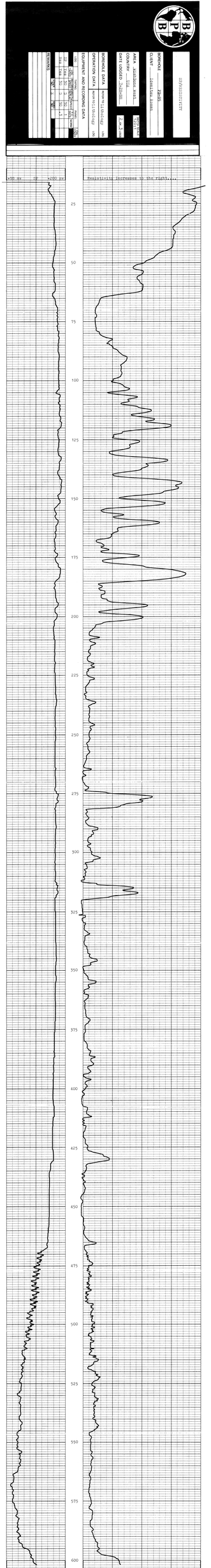
AC No. 01 VALUE 310 TO 0.049 | AC CAL DATE 6-88 | AC VALUE 0.099 SENSE quad | 1 m 537 us

AC MARK SHOWN AT INDICATED 1 | AC No. 16 | SPAN NORM 80 % of 1.49 | 1 m 507 us



BOREHOLE 2Dm2 | AREA Kielhow East

EVENT Logging Event | COUNTRY USA


BPB
BOREHOLE FS-05
CLIENT Idemitsu Kosan
AREA Kashima West
COUNTRY Japan
DATE LOGGED 24-Dec-96
BOREHOLE DATA
EQUIPMENT AND RECORDING DATA
OPERATION DATA
REMARKS
Resistivity Increases to the right...
Resistivity Increases to the right...

HOLE SAMPLE LOG

Hole PB-87 Logged By F.J. Mrkonjich Date Aug 1-2 88 Page 1 Of 2
Driller Mark Hlpr - Mike TD ~~2~~335 Date 8-2-88
Probe ~~BPB - John~~ NO LOG TD Date
Est. Mud Wt. Hole Size 4 1/2" Log Types Collar Elev.
Project Name Wishbone Hill - Western Lease Area Sec. T 19 R 2
County Mat-Su State AK Collar Coor. N E
Remarks

Depth	Log	P	C	Description
				Glacial Gravel
30				Tzudaka Conglomerate
				* Note - 8-1-88 drilled to 75' lost circulation at top of hole, mud pit drained, next morning pit had filled itself with water made from the hole
90				Shale; gray very clayey
110				~~Shale~~ ~~Sandstone~~; silty; gray some sand

Hole PB-87
Page 1 Of 2

320 Form 124

BPB

COAL LITHOLOGY LOG

SONDE TYPE

COAL COMBINATION SONDE

LOG SUITE

L. DENSITY CALIPER

BOREHOLE
CLIENT Idaaitsu Kosan
AREA Wiehbone West
COUNTRY USA
DATE LOGGED 8-25-88
RUN NO. ONE
DEPTH DRILLER 1215'
DEPTH LOGGER 1215'
BTM. LOG INTERVAL 1215'
TOP LOG INTERVAL 400'
CASING DRILLER 5 1/2" @ 475'
CASING LOGGER 475'
BIT SIZE 7 7/8"
TYPE FLUID IN HOLE Gel-Chem
DENSITY 9.2
VISCOSITY 40
PH 9.5
FLUID LOSS 6.8
SOURCE OF SAMPLE Flowline
RM @ MEAS. TEMP. .85@68°
RMF @ MEAS. TEMP. .75@68°
RMC @ MEAS. TEMP. 1.1@68°
SOURCE OF RMF & RMC Measured
RM @ BHT .55@120°
TIME SINCE CIRC. 12 hrs.
MAX. REC. TEMP. 120°
EQUIP. LOCATION 1215'
RECORDED BY Stabler
WITNESSED BY Mr. Jones

PERMANENT DATUM Ground Level
ELEV. K.B. 1230'
D.F. 1229'
G.L. 1215'
ELEV. 1215'

EQUIPMENT AND RECORDING DATA

COAL COMBINATION SONDE

LOG	EQUIPMENT SONDE	SOURCE	CALIBRATOR	LOG SPEED	TAPING RECORD SPEED	TAPING DIRECT. REPLAY	PANEL SPEED	L/S SECS	NORM	CAL LOCK	DEPTHS FROM	DEPTHS TO	DEPTHS REPEAT	SEAM LOG RUN
GAMMA RAY & DENSITY CALIPER	1218													
	SIDEWALL POSITION	G6	Yes	50	D	30	1	–	1.4	472	0	472		
		D6	Yes	50	D	30	1	5.4	–					
		--	Yes	50	D	30	3	–	–					

COAL QUALITY/SEAM THICKNESS LOG INTERVALS (Refer to remarks log)

FROM	400'	108'
TO	265'	165'
INTERVAL	135'	15'
INTERVAL TOTAL		150'

ADDITIONAL SONDES RUN

SONDE	LOG	GENERAL FIELD LOG	DETAIL FIELD LOG
S	S2/Dss	12@13	

REFER TO ADDITIONAL HEADINGS

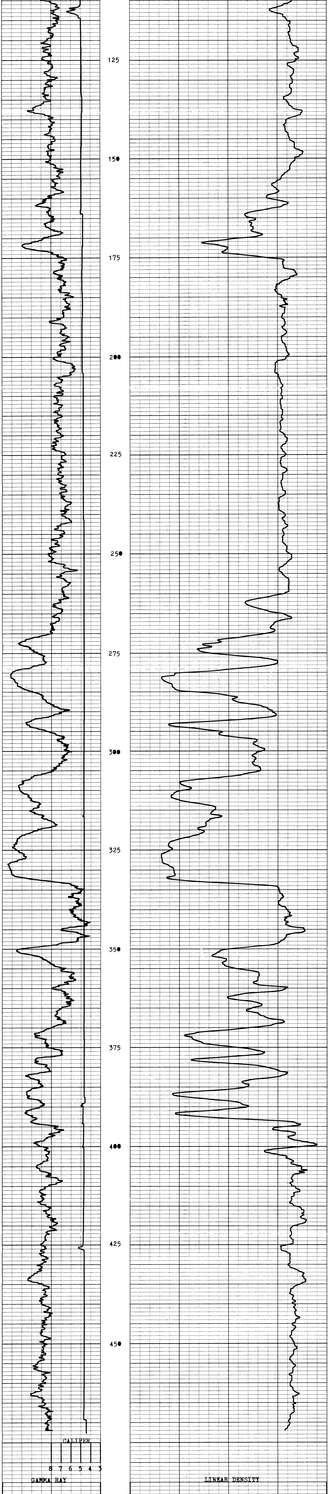
REMARKS

Sonde's zeroed @ the pipe stabilizer.

BPB COAL LITHOLOGY LOG

CALIBRATION DATA

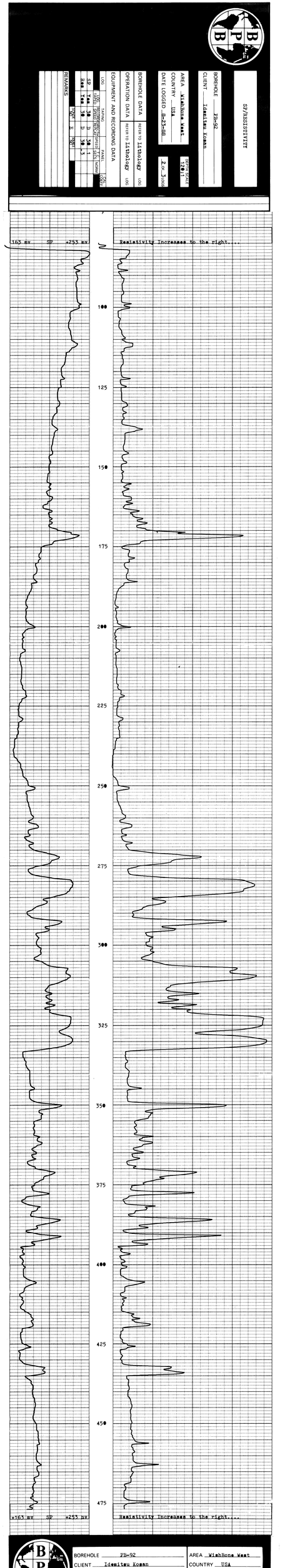
JG No. G6	VALUE 3960 S GAM	JG CAL DATE 6-88	JG VALUE 2899 SOLID gm/cc	3 = 537 cps
JG MARK SHOWN AT ABOVE VALUE = 3		JG No. D6	SPAN NORM 2.5 - 5.45	8 = 827 cps



BPB

BOREHOLE Fb-92 AREA Wiehbone West
CLIENT Idaaitsu Kosan COUNTRY USA

COAL LITHOLOGY LOG


SP/RESISTIVITY
BOREHOLE PB-92
CLIENT Idemitsu Kosan
AREA WishBone West
COUNTRY USA
DATE LOGGED 8-23-88
DEPTH SCALE 1:240 ft
2 in = 100ft
BOREHOLE DATA RETURN TO Lithology LOG
OPERATION DATA RETURN TO Lithology LOG
EQUIPMENT AND RECORDING DATA
LOG RECORDED FROM TO PASS DIRECTION SPEED CODE
SP 0 500 1 D 30 1
RES 0 500 1 D 30 1-3
REMARKS
163 mv SP +253 mv
Resistivity Increases to the right....
100
125
150
175
200
225
250
275
300
325
350
375
400
425
450
475
+163 mv SP +253 mv
Resistivity Increases to the right....
BOREHOLE PB-92
CLIENT Idemitsu Kosan
AREA WishBone West
COUNTRY USA

BPB

COAL LITHOLOGY LOG

BOREHOLE Ph-101
CLIENT Idamitsu Kosan
AREA Widbone West
COUNTRY USA
DATE LOGGED 15-Feb-88
RUN No. 1
DEPTH DRILLER 1281'
DEPTH LOGGER 1281'
BOTTOM LOGGED INTERVAL 1278'
TOP LOGGED INTERVAL 0'
CASING DRILLER 0' @ 0'
CASING LOGGER 0' @ 0'
BIT SIZE 8 1/2"
TYPE FLUID IN HOLE Air
DENSITY / VISCOSITY
PH / FLUID LOSS
SOURCE OF SAMPLE
RM @ MEAS. TEMP.
RMF @ MEAS. TEMP.
RMC @ MEAS. TEMP.
SOURCE: RMF / RMC
RM @ BHT
TIME SINCE CIRC.
MAX. REC. TEMP.
EQUIP. LOCATION
RECORDED BY
WITNESSED BY

REMARKS

LOG SUITE: GAMMA RAY, S.S. DENSITY, CALIPER
COAL COMBINATION SONDE
SONDE TYPE

EQUIPMENT AND RECORDING DATA

COAL COMBINATION SONDE

LOG	EQUIPMENT: SONDE	SOURCE	CALIBRATOR	LOG TAPED	TAPING: RECORD SPEED	RECORD DIRECTION	REPLAY	PANEL: SPEED	TC SECS	NORM	CAL. DEPTH: FROM	TO	DEPTHS: FROM	TO	SEAM LOG RUN
	1213														
GAMMA RAY			G6	Yes	30	D	30	1	-	1.4	368		0	368	
S.S. DENSITY		8470	D6	Yes	30	D	30	1		5.4	-				
CALIPER	SIDEWALL POSITION		--	Yes	30	D	30	.5		-	-				

COAL QUALITY/SEAM THICKNESS LOG INTERVALS (Refer to relevant log)

					INTERVAL TOTAL
FROM	365'	320'			
TO	345'	305'			
INTERVAL	20'	15'			35'

ADDITIONAL SONDES RUN

SONDE	LOG	GENERAL SCALE LOG	DETAIL SCALE LOG

REFER TO ADDITIONAL HEADINGS

REMARKS

Density: scale change 0260';

BPB COAL LITHOLOGY LOG

CALIBRATION DATA

JG No. G6 VALUE 5910 S DIAM
JG MARK SHOWN AT ABOVE VALUE 3

JG CAL DATE 6-88 JG VALUE 2899 SOLID GRAIN
JG No. D6 SPAN NORM AT 5.45
3 in 537 cps
8 in 827 cps

CALIPER
6" 3"
GAMMA RAY
0 API 200
BULK DENSITY
3000 0
0 25 50 75 100 125 150 175 200 225 250 275 300 325 350
Casing Shoe
BULK DENSITY
3000 0
LINEAR DENSITY
1.0 g/cc acu 3.0 g/cc
CALIPER
8 7 6 5 4 3
GAMMA RAY
0 API 200
LINEAR DENSITY
1.0 g/cc acu 3.0 g/cc

BPB

BOREHOLE Ph-101 AREA Widbone West
CLIENT Idamitsu Kosan COUNTRY USA

COAL LITHOLOGY LOG

BPB

COAL LITHOLOGY LOG

COAL COMBINATION LOG

COAL PLOT GAMMA RAY & DENSITY

GAMMA RAY & DENSITY

BPB WELL No. PB-107

CLIENT ARCO ALASKA

FIELD Wishbone West

COUNTY U.S.A.

DATE LOGGED 8.12.89

DATE PLOTTED 8.13.89

RUN No. 1

COMPANY ARCO ALASKA

WELL PB-107

FIELD Wishbone West

COUNTY U.S.A.

STATE ALASKA

LOCATION

PERMANENT DATUM: Ground Level

LOG MEASURED FROM: K.B.

DRILLING MEASURED FROM: K.B.

Date	8.12.89		
Run No.	1		
Depth Driller	509		
Depth Logger	509		
Bottom Logged Interval	509		
Top Logged Interval	0		
Type Fluid in Hole	Water		
Salinity ppm Cl			
Density lb/gal			
Level	Full		
Max Rec Temp °F			
Equip. Location			
Recorded By	J.C.Webster		
Witnessed By			

BOREHOLE DATA

Bit No.	1		
Type			
Size	6.125		
From	0		
To	509		

CASING DATA

Size	4.1/2		
Wgt	9.5		
Grade			
From	0		
To	509		

TUBING DATA

Size			
Wgt			
Grade			
From			
To			

EQUIPMENT AND RECORDING DATA

COAL COMBINATION SONDE

LOG RUN	EQUIPMENT SONDE	EQUIPMENT SOURCE	CALIBRATION	TAPING RECORD DIRECT (INCHES)	TAPING RECORD DIRECT (METRES)	PANEL T.C. (SECS)	PANEL SPEED	CAL. LOG RUN	DEPTHS FROM	DEPTHS TO	SCANNING LOG RUN
							NORM				NORM
FOCUSED ARRAY	2026										
DIRECT COUPLED	2432	06	Yes	30	D	30	1	-	14	509	0	509
		06	Yes	30	D	30	3	7.4	-	-	
		-	Yes	30	D	30	3	-	-	-	

COAL QUALITY/SEAM THICKNESS LOG INTERVALS (Refer to relevant log)

FROM		INTERVAL THICKNESS
TO		
MATERIAL		

ADDITIONAL SONDES RUN

SONDE	LOG	GENERAL & DETAILED CALIBRATION DATA
202/223 Dip. E	SP/Res 12011	

REFER TO ADDITIONAL HEADINGS

REMARKS

BPB COAL LITHOLOGY LOG

CALIBRATION DATA

JIG No. 06	VALUE 398 S-GAMM	JIG No. 06	SPAN NORM 7.4
JIG MARK SHOWN AT ABOUT VALUE - 3			

JIG CAL DATE 4.89 JIG VALUE 3376 SPAN @ 1.8 g/cc² 3 — 546 cps

8 — 826 cps

CALIPER

8" 18"

GAMMA RAY

0 API 200

LINEAR DENSITY

1.0 g/cc ACDL 3.0 g/cc

0 25 50 75 100 125 150 175 200 225 250 275 300 325 350 375 400 425 450 475 500

EXTRA SECTION

475 500

CALIPER

8 14.5 4 3

GAMMA RAY

0 API 200

LINEAR DENSITY

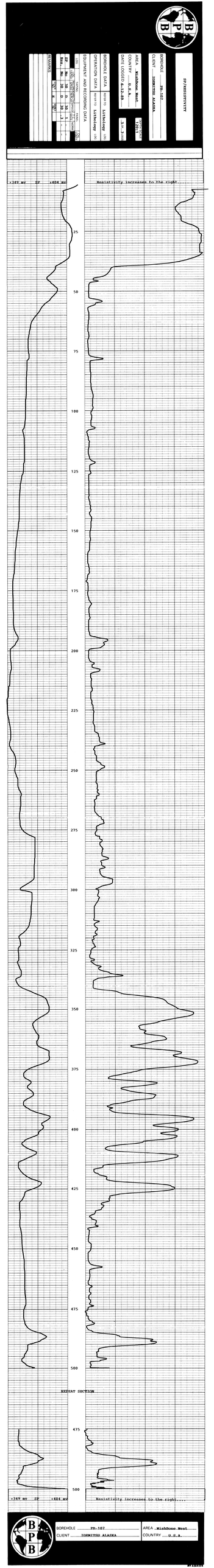
1.0 g/cc ACDL 3.0 g/cc

BPB

BOREHOLE PB-107 AREA Wishbone West

CLIENT TIDEWTER ALASKA COUNTRY U.S.A.

COAL LITHOLOGY LOG


BPB
RESISTIVITY
SONDE PR-107
CLIENT TOKMITSU ALASKA
WELL PR-107
AREA Wishbone West
COUNTRY U.S.A.
DATE LOGGED 6-12-89
3.5" 3.5"
RUN 1
BOREHOLE DATA
OPERATION DATA
EQUIPMENT AND RECORDING DATA
REMARKS
+349 mv SP +404 mv
Resistivity increases to the right
25
50
75
100
125
150
175
200
225
250
275
300
325
350
375
400
425
450
475
500
REPEAT SECTION
475
500
+349 mv SP +404 mv
Resistivity increases to the right
BPB
BOREHOLE PR-107
CLIENT TOKMITSU ALASKA
AREA Wishbone West
COUNTRY U.S.A.

BPB

COAL LITHOLOGY LOG

LOG SUITE & DENSITY SOURCE

LOG SUITE & NEUTRON COMBINATION SONDE

SONDE TYPE

BOREHOLE / CLIENT

PIN 108

RIG

Mackintosh Rotary

DATE LOGGED

6.9.89

RUN

ONE

DRILLER'S DEPTH

524

LOGGER'S DEPTH

524

CASING

DRILLER'S DEPTH

0

LOGGER'S DEPTH

0

BIT SIZE

DRILLER'S DEPTH

524

LOGGER'S DEPTH

524

FLUID LEVEL

DRILLER'S DEPTH

LOGGER'S DEPTH

MAX. RECORDED TEMP.

DEGREES C

MAX. RECORDED TEMP.

DEGREES F

TIME SINCE CIRCULATION

HOURS

TIME SINCE CIRCULATION

HOURS

OPERATING DATA

RECORDED DATA

BOREHOLE FLUID

TYPE

CLAY

DENSITY

VISCOSITY

PH

FLUID LOSS

SOURCE OF SAMPLE

RM @ MEAS. TEMP.

RMF @ MEAS. TEMP.

RMC @ MEAS. TEMP.

SOURCE OF RMF

SOURCE OF RMC

RM @ BHT

RMF @ BHT

RMC @ BHT

BHT

TIME

MAX. RECORDED TEMP.

DEGREES C

MAX. RECORDED TEMP.

DEGREES F

EQUIPMENT AND RECORDING DATA

COAL COMBINATION SONDE

EQUIPMENT				TAPPING			PANEL			LOG OFFSET		DEPTH CONTROL	
SONDE	SONDE SERIAL NO.	CALIBRATOR	LOG VALUES	RECORDING SPEED	RECORDING DEPTH	DEPTH CONTROL	NORM	NORM	NORM	NORM	TO	DEPTH CONTROL	TO
COMBO 40	2020												
DENSITY		CG	Yes	30	0	30	1	-	1.4	524	0	524	
NEUTRON	8720	CG	Yes	30	0	30	3	7.4	-	-			
CALIPER		-	Yes	30	0	30	3	-	-	-			

COAL QUALITY/SEAM THICKNESS LOG INTERVALS (Refer to relevant log)

FROM	TO	INTERVAL	TOPIC

ADDITIONAL SONDES RUN

SONDE	LOG	CENTRE DETAIL	TOTAL DETAIL
202/223 Dip			
E	Off/Geo	120:1	

REFER TO ADDITIONAL HEADING

REMARKS

BPB COAL LITHOLOGY LOG

CALIBRATION DATA

PU No.	06	VALUE	3931	S DUW	AD CAL DATE	6-89	AD VALUE 3376 SD/CD
AC MAIN SHOES AT ABOVE VALUE		7			AD No.	06	SPANS NORM 201 7.4

CALIPER

8" 24"

GAMMA RAY

0 API 200

LINEAR DENSITY

1.0 g/cc

1.0 g/cc

0

25

50

75

100

125

150

175

200

225

250

275

300

325

350

375

400

425

450

475

500

525

BOTTOM

475

500

525

CALIPER

8 16 24

GAMMA RAY

0 API 200

LINEAR DENSITY

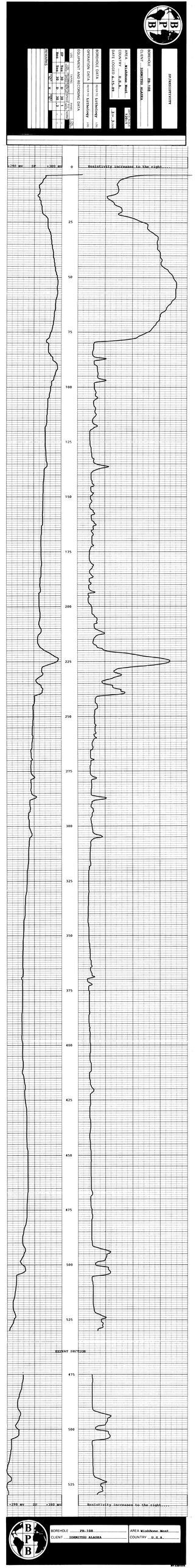
1.0 g/cc

1.0 g/cc

BPB

BOREHOLE PIN-108

AREA Blindshoe West


BPB
GEOLOGISTAYE
BOREHOLE PB.10B
CLIENT IDEMITSU ALASKA
AREA Wishbone West
COUNTRY U.S.A.
DATE LOGGED 6.5.85
DATE RUN 1-2-3-4-5-6
DATUM
LOG MEASURED FROM
DRILLING MEASURED FROM
BOREHOLE DATA
OPERATION DATA
EQUIPMENT AND RECORDING DATA
REMARKS
RM
RMF
RMC
BHT
Time
Date
Recorded By
Witnessed By
Run No.
Type Log
Depth-Driller
Depth-Logger
Bottom Logged Interval
Top Logged Interval
Casing-Driller
Casing-Logger
Bit Size
Type Fluid in Hole
Density
Viscosity
pH
Fluid Loss
Source of Sample
Rm @ Meas. Temp.
Rmf @ Meas. Temp.
Rmc @ Meas. Temp.
Source of Rmf and Rmc
Rm @ BHT
Time Since Circ.
Max. Rec. Temp.
Equip. Location
Recorded By
Witnessed By
+250 MV
SP
+300 MV
0
25
50
75
100
125
150
175
200
225
250
275
300
325
350
375
400
425
450
475
500
525
Resistivity increases to the right
RUNWAY SECTION
475
500
525
+250 MV
SP
+300 MV
Resistivity increases to the right
BPB
BOREHOLE PB.10B
CLIENT IDEMITSU ALASKA
AREA Wishbone West
COUNTRY U.S.A.

Core Hole Description

Project Area WISHBONE HILL – WEST Hole PB-60 Date 12-1-88

Interval Cored: 22.9 – 30.0

Interval Recovered: 7.1 Described by: F.J. Mrkonjich

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls.	Box No.	Bag No.	Core Description
21								
22								
23		22.9						Top of Coring
24	Run #1 22.9 – 27.5'			CORE LOSS 1.8'	%ASH	BOX 1		
		24.7						24.7
25			1.5'		80.62	BOX 1	BAG 1	CARB-SHALE / SHALE
26								26.2
27			1.3'		8.45		BAG 2	COAL
		27.5						27.5
28			1.8'		12.71		BAG 3	COAL
29		29.3						29.3
		29.8	0.5'		87.29	BOX 2	BAG 4	SHALE
30								29.8
31								

Comments:

Core Hole Description

Project Area WISHBONE HILL - WEST Hole PB-60 Date 12-1-88

Interval Cored: 82.5 - 92.0

Interval Recovered: 9.5' Described by: F. J. Mrkonjich

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft. 82	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls.	Box No.	Bag No.	Core Description
					%ASH			
			0.3		42.26	Box 8	BAG 4	82.5 BONE COAL 82.8
83			1.2		10.89	Box 8	BAG 5	COAL
84								84.0
85			2.0		33.72		BAG 6	COAL
86								86.0
			1.0		19.80		BAG 7	COAL
87								87.0
88			1.8		8.82		BAG 8	COAL
								88.8
89			1.2		20.10		BAG 9	COAL
90								90.0
			0.3		42.44	Box 9	BAG 10	90.3 BONE COAL
91			1.4		22.70		BAG 11	COAL
								91.7
92			0.8				BAG 12	

Comments:

Core Hole Description

Project Area WISHBONE HILL - WEST Hole PB-60 Date 12-1-88

Interval Cored: 92.0 - 94.0

Interval Recovered: 2.0 Described by: F. J. Mrkonjich

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls.	Box No.	Bag No.	Core Description
92					% ASH	BOX 9	BAG 12	92.5
93			0.8		9.59	BOX 9	BAG 13	COAL
								93.3
			0.7		59.39	BOX 9	BAG 14	CARB - SHALE
94								94.0
								94.2 - 100.3 Shale & silty sandstone
95								

Comments:

Core Hole Description

Project Area WISHBONE HILL - WEST Hole PB-60 Date 12-1-88

Interval Cored: 100.0 - 110.3

Interval Recovered: 10.3 Described by: F. J. Mrkonjich

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls. % ASH	Box No.	Bag No.	Core Description
100								100.2
						BOX 11	BAG 15	
101			1.3		55.39			CARB-SHALE
								101.5
102			2.0		66.09		BAG 16	CARB - SHALE
103								103.5
104			1.6		11.91		BAG 17	COAL
105								105.1
106			1.4		35.22		BAG 18	BONE COAL
								106.5
107			1.2		71.60		BAG 19	CARB - SHALE
								107.7
108			1.8		NOT ANALYZED	BOX 12	BAG 20	CARB - SHALE
109								109.5
110							BAG 21	SHALE & SILTY SANDSTONE

Comments:

Core Hole Description

Project Area WISHBONE HILL - WEST Hole PB-60 Date 12-1-88

Interval Cored: 130.0 - 140.0

Interval Recovered: 10.0 Described by: F. J. Mrkonjich

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls. % ASH	Box No.	Bag No.	Core Description
130				NOT AVALIZED	NOT AVALIZED			130.5 SHALE
131			1.1		73.26	BOX 15	BAG 22	SHALE 131.6
132			1.9		31.13		BAG 23	COAL
133								133.5
134			0.7		5.63		BAG 24	COAL 134.2
135			1.5		75.33		BAG 25	SHALE 135.7
136			0.9		75.37		BAG 26	SHALE 136.6
137			0.9		68.67		BAG 27	SHALE 137.5
138			0.4		21.49	BOX 16	BAG 28	COAL 137.9
			1.0		51.49	BOX 16	BAG 29	BONE COAL 138.9
139			0.6		16.43		BAG 30	COAL 139.5
140			0.4		40.64		BAG 31	BONE COAL 139.9

Comments:

Core Hole Description

Project Area WISHBONE HILL WEST Hole PB-60 Date 12-1-88

Interval Cored: 140.0 - 150.0

Interval Recovered: 10.0 Described by: F. J. Mrkonjich

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls. %ASH	Box No.	Bag No.	Core Description
140			0.7		20.10	BOX 16	BAG 32	COAL
								140.6
			0.4		18.76		BAG 33	COAL
141								141.0
			1.0		13.81		BAG 34	COAL
142								142.0
			0.6		55.68		BAG 35	SHALE
								142.6
143			1.0		11.99		BAG 36	COAL
								143.6
			0.6		61.69		BAG 37	SHALE
144								144.2
			1.0		5.72	BOX 17	BAG 38	COAL
145								145.2
			1.3		49.35		BAG 39	BONE COAL
146								146.5
			1.2		68.48		BAG 40	SHALE
147								147.7
			1.7		5.77		BAG 41	COAL
148								
								149.4
149			1.6		8.10		BAG 42	COAL
150								

Comments:

Core Hole Description

Project Area WISHBONE HILL - WEST Hole PB-60 Date 12-1-88

Interval Cored: 150.0 - 160.0

Interval Recovered: 10.0 Described by: F. J. Mrkonjich

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls. % ASH	Box No.	Bag No.	Core Description
150	150							
			1.6		8.10	BOX 17	BAG 42	COAL
151								151.0
						BOX 18	BAG 43	
			1.5		39.49			BONE COAL
152								152.5
			0.8		27.74		BAG 44	COAL
153								153.3
							BAG 45	
154			1.6		41.69			BONE COAL
								154.9
155								
							BAG 46	
			2.0		8.91			COAL
156								
								156.9
157			0.6	CORE LOSS				157.6
							BAG 47	
			0.9		22.57		BAG 48	COAL
158								158.4
						BOX 19	BAG 49	
159			1.6		48.86			BONE COAL
160								160.0

Comments:

Core Hole Description

Project Area WISHBONE HILL - WEST Hole PB-60 Date 12-1-88

Interval Cored: 160.0 - 162.5

Interval Recovered: 2.5 Described by: F. J. Markonjich

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls. % ASH	Box No.	Bag No.	Core Description
160								160.0
			1.2		20.56	BOX 19	BAG 50	COAL
161								161.2
			1.1		49.57	BOX 19	BAG 51	BONE COAL
162								162.3
					NOT ANALIZED			↓ silty sandstone
163								

Comments:

Core Hole Description

Project Area WISHBONE HILL - WEST Hole PB-92 Date

Interval Cored: 276.0 - 286.0

Interval Recovered: 10.0 Described by: F. J. Mrkonjich

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls.	Box No.	Bag No.	Core Description
276					%/ASH			
277								277.0
			0.5		88.65	BOX 25	BAG 5A	SHALE 277.5
278							BAG 5	
			1.7		7.70			COAL
279								279.2
280			1.8		6.42		BAG 6	COAL
281								281.0
							BAG 7	
282			1.5		17.05			COAL
								282.5
283			0.9		24.61		BAG 8	COAL
								283.4
			0.3		28.28		BAG 9	283.7 COAL
284			0.5		79.36	BOX 26	BAG 10A	284.2 SHALE/SILTSTONE
285					NOT ANALIZED			
286								

Comments:

Core Hole Description

Project Area WISHBONE HILL - WEST Hole PB-92 Date 12-1-88

Interval Cored: 286.0 - 296.0

Interval Recovered: 10' Described by: F. J. Mrkonjich

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed / Type Anls. % ASH	Box No.	Bag No.	Core Description
286								SHALE / SILTSTONE
					NOT ANALIZED	BOX 26	NOT BAGGED	
287								
288								
289								
290								290.1
			0.5		79.36	BOX 26	BAG 10A	SHALE / SILTSTONE
								290.6
			0.3		23.21	26	16	290.9 COAL
291								
						BOX	BAG	COAL
			1.3		5.93	26	11	
292								292.2
						BOX 27	~~BAG~~ ~~BAGGED~~ BAG	~~SHALE~~
					53.54			BONE COAL / CARB-SHALE
293							12	
294								294.4
					NOT ANALIZED			SHALE
295								
296								

Comments:

Core Hole Description

Project Area WISHBONE HILL - WEST Hole PB-92 Date 12-1-88

Interval Cored: 296.0 - 306.0

Interval Recovered: 10.0 Described by: F. J. Mrkonjich

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls. %ASH	Box No.	Bag No.	Core Description
296						BOX	NOT	SHALE/SILTSTONE
						27	BAGGED	
297								
					NOT			
298					ANALIZED			
299								
300								
301								
						BOX 28	NOT BAGGED	
302								
303								
304								304.2
			0.5		74.38	BOX 28	BAG 13A	SHALE 304.7
305			0.8		67.69	BOX 28	BAG 13	SHALE 305.5
			2.0		26.39	BOX 28	14	COAL
306								

Comments:

Core Hole Description

Project Area WISHBONE HILL - WEST Hole PB-92 Date 12-1-88

Interval Cored: 306.0 - 316.0

Interval Recovered: 10.0 Described by: F. J. Mrkonjich

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls. % / ASH	Box No.	Bag No.	Core Description
306						BOX	BAG	
			2.0		24.39	28	14	COAL
307								
								307.5
308						BOX	BAG	
			2.0		16.30	28	15	COAL
309								
								309.5
310						BOX	BAG	
			1.3		13.39	29	16	COAL
								310.8
311							BAG	
			0.7		47.51		17	BONE COAL
								311.5
312							BAG 18	
			1.9		59.80			SHALE
313								
								313.4
314			0.9		35.38		BAG 19	BONE COAL
								314.3
			0.3		25.44		20	COAL 314.6
315							BAG	
			0.9		52.22		21	BONE COAL
								315.5
316			2.0		43.28	BOX 30	BAG 22	BONE COAL

Comments:

Core Hole Description

Project Area WISHBONE HILL - WEST Hole PB-92 Date 12-1-88

Interval Cored: 316.0 - 326.0

Interval Recovered: 10.0 Described by: F. J. Markonjich

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls. % Ash	Box No.	Bag No.	Core Description
316								
						BOX	BAG	
						30	22	BONE COAL
317			2.0		43.28			
								317.5
							BAG 23	
318			2.0		60.98			SHALE
319								
								319.5
			0.8		40.82		BAG 24	BONE COAL
320								320.3
							BAG 25	
321			1.7		12.04			COAL
322								322.0
							BAG 26	
			1.5		5.28			COAL
323								
								323.5
324						BOX	BAG	
			1.4		5.04	31	27	COAL
								324.9
325								
			1.6		6.56	BOX 31	BAG 28	COAL
326								

Comments:

Core Hole Description

Project Area WISHBONE HILL - WEST Hole PB-92 Date 12-1-88

Interval Cored: 326.0 - 336.0

Interval Recovered: 10.0 Described by: F. J. Mrkonjich

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls. % Ash	Box No.	Bag No.	Core Description
326			1.6		6.56	BOX 31	BAG 28	326.5 COAL
327			0.7		14.06		BAG 29	COAL
			0.3		5.23		30	327.2 327.5 COAL
328			1.5		6.72		BAG 31	COAL
329								329.0
							BAG 32	
330			2.0		15.03			COAL
331								331.0
			0.5		18.5	BOX 32	BAG 33	331.5 COAL
332					NOT ANALIZED			SILTSTONE
333								
334								
335								
336								

Comments:

Core Hole Description

Project Area WISHBONE HILL - WEST Hole PB-92 Date 12-1-88

Interval Cored: 347 - 357.0

Interval Recovered: 10.0 Described by: F. J. Mrkonjich

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls. %ASH	Box No.	Bag No.	Core Description
347					NOT ANALYZED	BOX 34	NOT BAGGED	SILTSTONE
								347.5
			0.5		87.00		BAG 34	SHALE
348								348.0
			1.5		52.85		BAG 35	BONE COAL
349								
								349.5
			0.5		34.27		BAG 36	BONE COAL
350								350.0
					58.51		BAG	SHALE
			1.2				37	
351								
								351.2
			0.3		50.88		BAG 38	BONE COAL
								351.5
352								
			1.5		62.06		BAG 39	SHALE
353								353.0
			0.5		74.95		BAG 39A	SILTSTONE / SHALE
								353.5
354					NOT ANALYZED			
355								
356								
357								

Comments:

Core Hole Description

Project Area WISHBONE HILL - WEST Hole PB-92 Date 12-1-88

Interval Cored: 367.0 - 377.0

Interval Recovered: 10.0 Described by: F. J. Mrkonjich

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls. %ASH	Box No.	Bag No.	Core Description
367								
					NOT ANALIZED			SILTSTONE
368								368.0
			0.5		84.22	BOX 36	BAG 40A	SILTSTONE 368.5
			0.5		57.88		BAG 40	SHALE
369								369.0
							BAG	
			2.0		31.52		41	COAL
370								
371								371.0
			0.5		30.16	BOX 37	BAG 42	COAL 371.5
			0.8		45.82		BAG 43	BONE COAL
372								372.3
							BAG	
			1.7		62.37		44	SHALE
373								
374								374.0
							NOT BAGGED	
			1.5		87.72			SHALE
375								
								375.5
			0.3		67.97		46	SHALE 375.8
376								
							BAG	
			1.1		13.78		46	COAL
								376.9
377					77.1		47	SHALE

Comments:

Core Hole Description

Project Area WISHBONE HILL - WEST Hole PB-92 Date 12-1-88

Interval Cored: 377.0 - 387.0

Interval Recovered: 10.0 Described by: F. J. Mrkonjich

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed / Type Anls. % ASH	Box No.	Bag No.	Core Description
377			1.0		77.1	BOX 37	BAG 47	SHALE
								377.9
378					NOT ANALYZED	BOX 37	NOT BAGGED	SILTSTONE
						BOX 38	NOT BAGGED	
379								
380								
381								
382								
383					81.70	BOX 38	BAG 48 A	
								383.5
384			0.7		37.30	BOX 38	BAG 48	BONE COAL
								384.2
			0.8		6.22		BAG 49	COAL
385								385.0
			0.7		30.64		BAG 50	COAL
								385.7
386					73.18	BOX 39	[illegible]	SHALE
			1.8			BOX 39	BAG 51	386.2
387								

Comments:

Core Hole Description

Project Area WISHBONE HILL - WEST Hole PB-92 Date 12-1-88

Interval Cored: 387.0 - 391.5

Interval Recovered: 4.5 Described by: F.J. Mrkonjich

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls. %ASH	Box No.	Bag No.	Core Description
387			1.0		73.18	BOX 39	BAG 51	387.5 SHALE
388			2.0		76.34		BAG 52	SHALE
389								389.5
390			1.5		17.48		BAG 53	COAL
391								391.0
			0.5		67.79		BAG 54	391.5 SHALE
			0.5		74.17		BAG 55A	392.0 SHALE
392								
393								
394								

Comments:

Core Hole Description

Project Area WISHBONE HILL - WEST Hole PB-101 Date 12-2-88

Interval Cored: 140.0 - 150.0

Interval Recovered: 8.7 Described by: F.J. Mrkonjich

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls. %ASH	Box No.	Bag No.	Core Description
140								
								141.0
141						BOX 8	NOT	
			1.8				BAGGED	SILTSTONE
142								
								142.8
143			1.3	CORE LOSS				
								144.1
144			0.7					SILTSTONE
								144.8
145			0.7		68.58	BOX 9	BAG 1	SHALE
								145.5
146			1.1		51.47		BAG 2	BONE COAL
								146.6
147			1.5		55.95		BAG 3	SHALE
148								148.1
			0.9		54.21		BAG 4	SHALE
149								149.0
			1.5		70.19		BAG 5	SHALE
150								

Comments:

Core Hole Description

Project Area WISHBONE HILL - WEST Hole PB-101 Date 12-2-88

Interval Cored: 150.0 - 160.0

Interval Recovered: 7.3 Described by: F.J. Mrkonjich

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls. %o ASH	Box No.	Bag No.	Core Description
150								150.5
			1.5		70.19	BOX 9	BAG 5	SHALE
151			1.0		57.47		BAG 5A	SHALE
								151.5
152			1.1	CORE LOSS	NOT ANALIZED			
								152.6
153			1.3		16.59		BAG 6	COAL
								153.9
154			0.3		61.72		7	154.2 SHALE
			0.4		62.53		8	SHALE 154.6
155			0.8		56.57		BAG 9	SHALE
								155.4
156			2.0		47.14	BOX 10	BAG 1	BONE COAL
157								157.4
158			0.8		66.51		BAG 2	SHALE
								158.2
159			1.6	CORE LOSS				
								159.8
160			0.6		35.89	10	3	BONE COAL

Comments:

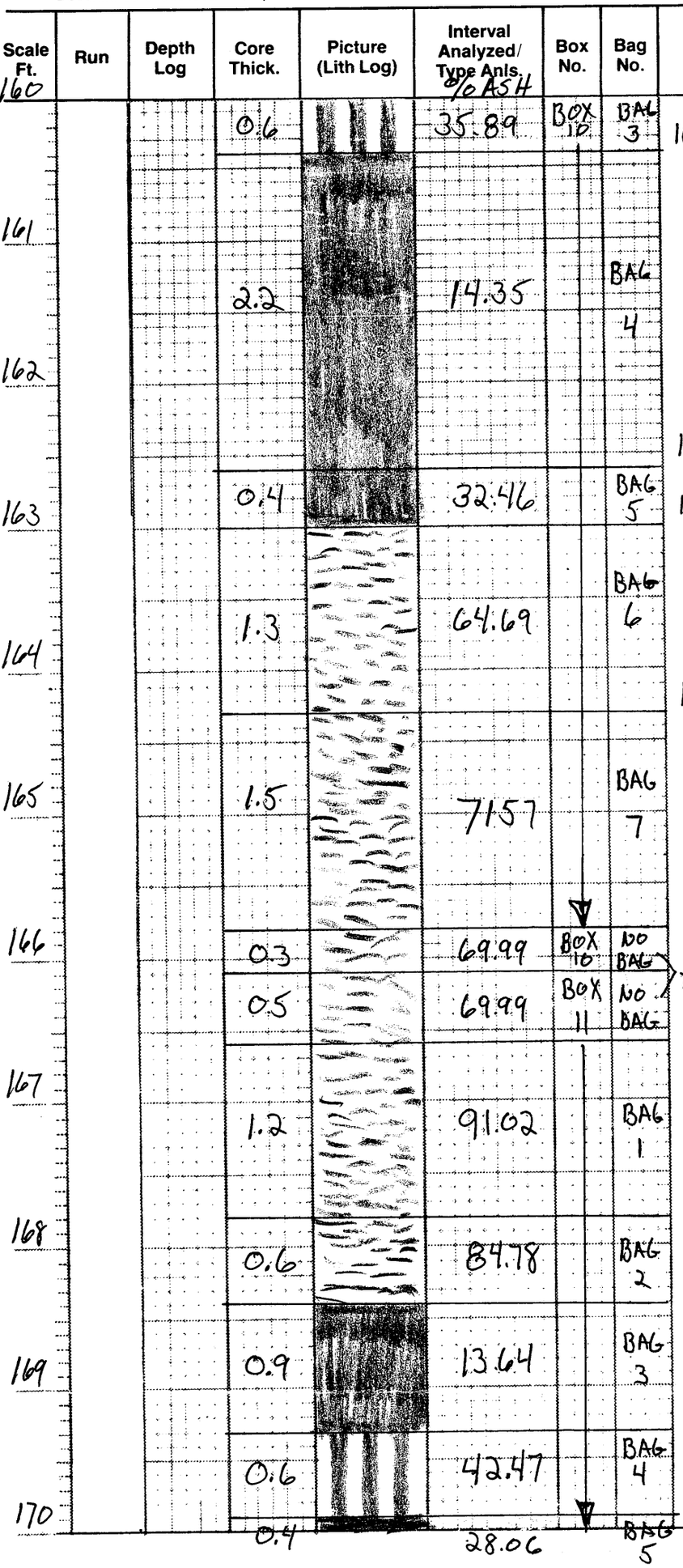
Core Hole Description

Project Area WISHBONE HILL - WEST Hole PB-101 Date 12-2-88

Interval Cored: 160.0 - 170.0

Interval Recovered: 10.0 Described by: F. J. Markonjich

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.



Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls. % ASH	Box No.	Bag No.	Core Description
160								
			0.6		35.89	BOX 10	BAG 3	160.4 BONE COAL
161			2.2		14.35		BAG 4	COAL
162								162.6
			0.4		32.46		BAG 5	163.0 COAL
163			1.3		64.69		BAG 6	SHALE
164								164.3
			1.5		71.57		BAG 7	SHALE
165								165.8
			0.3		69.99	BOX 10	NO BAG	166.1 SHALE
166			0.5		69.99	BOX 11	NO BAG 7A	166.6 SHALE
			1.2		91.02		BAG 1	SHALE
167								167.8
			0.6		84.78		BAG 2	168.4 SHALE
168			0.9		13.64		BAG 3	COAL
								169.3
169			0.6		42.47		BAG 4	169.9 BONE COAL
170			0.4		28.06		BAG 5	COAL

Comments:

Core Hole Description

Project Area WISHBONE HILL -WEST Hole PB-101 Date 12-2-88

Interval Cored: 170.0 -180.0

Interval Recovered: 8.6 Described by: F.J. Mrkonjich

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls.	Box No.	Bag No.	Core Description
170					% ASH			
			0.4		28.06	BOX 11	BAG 5	170.3 COAL
171			1.4		58.02		BAG 6	SHALE
								171.7
172			0.8		63.06		BAG 7	SHALE
								172.5
			0.8		25.76		BAG 8	COAL
173								173.3
			1.4	CORE LOSS	NOT AUALIZED			?
174								174.7
175			2.0		74.29		BAG 9	SHALE
176								176.7
177			0.7		68.29	BOX 12	BAG 1	SHALE 177.4
178			1.0		62.72		BAG 2	SHALE 178.4
179			1.8		5.12		BAG 3	COAL
180								

Comments:

Core Hole Description

Project Area WISHBONE HILL - WEST Hole PB-101 Date 12-2-88

Interval Cored: 180.0 - 190.0

Interval Recovered: 5.4 Described by: F.J. Mrkonjich

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls. %/ASH	Box No.	Bag No.	Core Description
180			1.8		5.12	12	3	180.2 COAL
			1.2	CORE LOSS	NOT AVALIZED			
181								181.4
			0.8		32.17		BAG 4	COAL
182								182.2
							BAG 4	
183			2.4	VOID	NOT AVALIZED			?
184								184.6
			0.4		32.17		BAG 4	185.0 COAL
185			1.0	CORE LOSS	NOT AVALIZED			?
186								186.0
			0.3		56.54	BOX 12	5	186.3 SHALE
187			2.0		11.98		BAG 6	COAL
188								188.3
			0.8		49.10		BAG 7	BONE COAL
189								189.1
			0.7		66.34	BOX 12	NOT BAGGED	SHALE/SANDSTONE
								189.8
190			3.5		66.24			SHALE/SANDSTONE

Comments:

Core Hole Description

Project Area WISHBONE HILL - WEST Hole PB-101 Date 12-2-88

Interval Cored: 190.00 - 200.0

Interval Recovered: 5.5 Described by: F.J. Mrkonjich

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls. %ASH	Box No.	Bag No.	Core Description
190								
			3.5	VOID	NOT ANALIZED			?
191								
192								
193								193.3
			1.5		34.22	BOX 13	BAG 1	COAL
194								194.8
			1.0	CORE LOSS	NOT ANALIZED		BAG	?
195								195.8
			1.1		23.73		BAG 2	COAL
196								196.9
			2.7		80.56		BAG 2A	SHALE
197								
198								
199								199.8
			0.8	CORELOSS	NOT ANALIZED			?
200								

Comments:

Core Hole Description

Project Area WISHBONE HILL - WEST Hole PB-101 Date 12-2-88

Interval Cored: 200.0 - 210.0

Interval Recovered: 8.2 Described by: F.J. Mrkonjich

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls. % ASH	Box No.	Bag No.	Core Description
200			0.8	CORE LOSS	NOT ANALIZED			?
								200.6
			0.5		45.16	BOX 13	BAG 3	BONE COAL
201								201.1
			1.7		61.07	BOX 13	BAG 4	SHALE
202								
								202.8
203			1.8		7.24	BOX 14	BAG 1	COAL
204								204.6
205			1.2	CORE LOSS	NOT ANALIZED			?
								205.8
206			0.8		18.08		BAG 2	COAL
								206.6
			0.4		65.62		BAG 2A	SHALE
207								207.0
			0.5		68.50		BAG 3	SHALE
								207.5
208			1.2		76.11		BAG 4	SHALE
								208.7
208			0.7		75.30		BAG 4A	SHALE
								209.4
			1.8		NOT ANALIZED		NOT BAGGED	SHALE
210								

Comments:

Core Hole Description

Project Area WISHBONE HILL - WEST Hole PB-101 Date 12-2-88

Interval Cored: 210.0 - 220.0

Interval Recovered: 5.6 Described by: F.J. Mrkonjich

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls. %ASH	Box No.	Bag No.	Core Description
210								
			1.8		NOT ANALIZED	BOX 14	NOT BAGGED	SHALE
211								211.2
			1.8		NOT ANALIZED	BOX 14	NOT BAGGED	SHALE
212								
213								213.0
			1.9	CORE LOSS	NOT ANALIZED			?
214								
215								214.9
			1.2			BOX 15	NOT BAGGED	SHALE
216								216.1
			1.3			BOX 15	N. B.	SHALE
217								217.4
218			1.8	CORE LOSS	NOT ANALIZED			?
219								219.2
			0.7	ADVANCED CASING NO CORE	NOT ANALIZED			?
220								219.9 COAL
			1.0		7.99	15	1	

Comments:

Core Hole Description

Project Area WISHBONE HILL - WEST Hole PB-101 Date 12-2-88

Interval Cored: 220.0 - 230.0

Interval Recovered: 8.9 Described by: F.J. Mrkonjich

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls. %ASH	Box No.	Bag No.	Core Description
220			1.0		7.99	BOX 15	BAG 1	COAL
								220.9
221			1.0		4.75	BOX 15	BAG 2	COAL
								221.9
222			0.3	CORE LOSS	NOT ANALIZED			?
								222.2
			0.5		69.42	BOX 15	BAG 3	SHALE
								222.7
			0.3		63.69	15	BAG 4	SHALE
223								223.0
224			2.0		84.83	BOX 15	BAG 4A	SHALE
225								225.0
226			2.0		17.60	BOX 15	BAG 5	COAL
227								227.0
228			2.2		43.06	BOX 16	BAG 1	BONE COAL
229								229.2
			0.8	VOID	NOT ANALIZED			?
230								230.0

Comments:

Core Hole Description

Project Area WISHBONE HILL - WEST Hole PB-101 Date 12-2-88

Interval Cored: 230.0 - 240.0

Interval Recovered: 9.0 Described by: F. J. Mrkonjich

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls. %o Ash	Box No.	Bag No.	Core Description
230								
			1.1		79.86	BOX 16	BAG 2	SHALE
231								231.1
			0.4		83.08		BAG 3	SHALE 231.5
					60.45		BAG 4	
232			1.8					SHALE
233								
								233.3
			0.7		84.74		BAG 5	SHALE
234								234.0
			1.0		46.21		BAG 6	BONE COAL
235								235.0
			0.8	TEST SAMPLE GEOTECH	NOT ANALIZED		N.B.	SILTSTONE
								235.8
236			1.1			BOX 16	N.B.	SILTSTONE
								236.9
237			1.1		75.46	BOX 17	BAG 1A	SHALE
238								238.0
			1.0	CORE LOSS	NOT ANALIZED			?
239								239.0
			0.2		21.75	17	1	239.2 COAL
						BOX	BAG	
			2.0		22.34	17	2	COAL
240								

Comments:

Core Hole Description

Project Area WISHBONE HILL - WEST Hole PB-101 Date 12-2-88

Interval Cored: 240.0 - 250.0

Interval Recovered: 10.0 Described by: F.J. Mrkonjich

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls. % ASH	Box No.	Bag No.	Core Description
240						BOX	BAG	
			2.0		22.34	17	2	COAL
241								241.2
			0.2		18.19	17	3	241.4 COAL
						BOX	BAG	
242			1.2		58.41	17	4	SHALE
								242.6
243							BAG	
			1.5		82.23		4A	SHALE
244								244.1
							BAG	
			1.2		16.83		5	COAL
245								245.3
			0.3		52.44	BOX 17	5A	245.6 BONE COAL
						BOX	BAG	
246			1.0		21.75	18	1	COAL
								246.6
247			0.8		69.41		BAG 2	SHALE
								247.4
			1.0		58.98		BAG 3	SHALE
248								248.4
249			1.5		88.58		BAG 3A	SHALE
250								249.9

Comments:

Core Hole Description

Project Area WISHBONE HILL - WEST Hole PB-101 Date 12-2-88

Interval Cored: 307.0 - 317.0

Interval Recovered: 10.0 Described by: F. J. Mrkonjich

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls. %ASH	Box No.	Bag No.	Core Description
307								
			1.2		80.09	BOX 24	BAG 1A	SHALE
308								308.2
			1.1		9.31	BOX 24	BAG 1	COAL
309								309.3
			0.8		12.14	BOX 24	BAG 2	COAL
310								310.1
			0.7		61.51	BOX 25	BAG 1	SHALE 310.8
311			1.5		3.57		BAG 2	COAL
312								312.3
			0.4		19.08		BAG 3	COAL 312.7
B13			1.2		52.26		BAG 4	BONE COAL
314								313.9
			1.7		13.67		BAG 5	COAL
315								315.6
			0.2		71.22	25	5A	315.8 SHALE
316								
317								

Comments:

Core Hole Description

Project Area WISHBONE HILL - WEST Hole PB-101 Date 12-2-88

Interval Cored: 345.0 - 355.0

Interval Recovered: 7.2 Described by: F.J. Mrkonjich

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed / Type Anls. %ASH	Box No.	Bag No.	Core Description
345			0.8	CORE LOSS	NOT AVALIZED	BOX 28		?
								345.8
346			1.0		NOT AVALIZED	BOX 28	N.B	SHALE
								346.8
347			0.8		NOT AVALIZED	BOX 29	N.B	SHALE
								247.6
348			1.2	CORE LOSS	NOT AVALIZED			?
								248.8
349			0.7		NOT AVALIZED	BOX 29	N.B	SHALE
								249.5
350			0.8	CORE LOSS	NOT ANALIZED			?
								350.3
351			2.6		67.32	BOX 29	BAG 1	SHALE
352								
								352.9
353			1.4		32.19	BOX 29	BAG 2	COAL
354								
								354.3
355			2.0		70.61	BOX 29	BAG 3	SHALE

Comments:

Core Hole Description

Project Area WISHBONE HILL ~ WEST Hole PB-101 Date 12-2-88

Interval Cored: 355.0 - 365.0

Interval Recovered: 10.0 Described by: F.J. Mrkonjich

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls. % Ash	Box No.	Bag No.	Core Description
355								
						BOX	BAG	
			2.0		70.61	29	3	SHALE
356								
								356.3
						BOX	BAG	SHALE
			0.7		77.71	29	4	
357								357.0 SHALE
			0.3		87.61	BOX 29	BAG 5	357.3
								SHALE
			0.7		87.46	BOX 30	BAG 1	
358								358.0
			1.0		14.35		BAG 2	COAL
359								359.0
							BAG 3	
			1.7		19.89			COAL
360								
								360.7
361			0.4		82.50		BAG 4	SHALE
								361.1
					NOT AVALIZED	BOX 30	N.R	SANDSTONE
362								
			3.9					
363								
364								
365								365.0

Comments:

Core Hole Description

Project Area Wishbone Hill Hole PB-105 Date Oct. 11/88

Interval Cored:

Interval Recovered: Described by: Rem # 1 D. Germer

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls.	Box No.	Bag No.	Core Description
	Casing							
	Run # 1 57.5 - 60.0	57.5						
		58.0	1.8			Box 1	Bag 1 57.5 - 59.3	coal, fractured
		59.0						
			2.2	-c-c- -c- -c-c-		Box 1	59.3 - 59.8	carb. shale
		60.0				Box 2	bag 1	

Comments:

Start Coring 9:50 Oct. 11, 1988

Core Hole Description

Project Area Wishbone Hill Hole PB-105 Date Oct. 11/88

Interval Cored:

Interval Recovered: Described by: Roen #2 & #19 Y. Endoh

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls.	Box No.	Bag No.	Core Description
	#1 57.5 ~ 62.5	60.0	2.2	c		Box 1	59.8 ~ 61.4 Bag 1	carb. sh. many coal streaks
		61.0		c-c				
				c				
				c-c				
		62.0		c		Box 2	61.4 ~ 62.5 Bag 2	siltstone lt. gray
	#2 62.5 ~ 67.5	63.0	3.0				62.5 ~ 64.4 Bag 3	siltstone lt. gray
		64.0				Box 2		
			1.1	B		Box 2	64.4 ~ 65.5 Bag 4	carb. sh with bone
		65.0		B-B				
				B				
				B-B				
				B				
		66.0	0.7	c		Box 2	65.5 ~ 66.2 Bag 5	carb. sh with 3" coal at BT'M
				c-c				
				c				
			0.2					
		67.0		c		Box 3	66.2 ~ 67.5 Bag 1	carb. sh siderite BT'M half
				c-c				
				c				
				c-c				
	#3 67.5 ~ 72.5	68.0	2.3	c		Box 3	67.5 ~ 69.8 Bag 2	carb. sh Coal at BT'M 5"
				c-c				
				c				
				c-c				
		69.0	0.4					
				c		Box 3	69.8 ~ 70.3 Bag 3	carb. sh with many coal streaks bedding 10 dgrees ACA
			2.3	c-c				
				c				
		70.0						

Comments:

Core Hole Description

Project Area Wishbone Hill Hole PB-105 Date Oct. 11/88

Interval Cored:

Interval Recovered: Described by:

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls.	Box No.	Bag No.	Core Description
	#3 74.7 ~ 77.4	70.0		c			70.2 ~ 71.0	carb. sh brownish gray
		71.0		c c		Box 3	Bag 4	
				c				
		72.0		c c			71.4 ~ 72.7	carb. sh brownish gray
				c			4	
				c c				
	#4 77.4 ~ 78.2	73.0	8.3	c			72.7 ~ 74.0	Carb. sh fractured top half many coal streaks
				c c			Bag 1	
				c				
		74.0		c c		Box 4	74.0 ~ 74.8	Carb. sh many coal streaks 35 degrees ACA
				c			4	
				c c				
		75.0		c				
				c c				
				c				
		76.0		c c			74.8 ~ 75.7	Carb. sh with many coal streaks at BT'M fairly sticky
				c			6	
				c c				
		77.0		c			75.7	
	#5 77.4 ~ 80.2	78.0				Box 1	77.2 ~ 78.2	Bone
		79.0	3.4				Bag 3	
							78.2 ~ 80.1	Bone
		80.0					4	

Comments:

Core Hole Description

Project Area Wishbone Hill Hole PB-105 Date Oct. 11/88

Interval Cored:

Interval Recovered: Described by:

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls.	Box No.	Bag No.	Core Description
	Run #7 82.2 ~ 89.2	82.0	3.4			Box 1	Bag 4	Bone
		84.0	1.3	-c-c- B -c-c- B -c-c-			Bag 5	Carb. Sh. Bony many coal streaks sticky
		85.0	1.0				Bag 6	Bone
		86.0	0.8				Bag 7	Siltstone lt. gray hard
		86.8	0.7				Bag 8	Bone
		87.5	2.5			Box 7	Bag 9	Coal solid
		90.0	0.7	-c-c- -c-			Bag 10	Carb. Sh.
	Run #8 89.2 ~ 92.2	90.7	2.0				Bag 11	Coal solid
		92.0				Box 8	Bag 12	Coal solid

Comments:

Core Hole Description

Project Area Wishbone Hill Hole PB-105 Date Oct. 11/88

Interval Cored:

Interval Recovered: Described by:

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls.	Box No.	Bag No.	Core Description
	#7 90.2 ~ 92.2	90.0	3.0			Box 6	Bag 1 90.7 ~ 91.0	coal solid
		91.0					91.0 ~ 92.2	Carb. sh
		92.0						
	#8 92.2 ~ 94.7	93.0	3.7			Box 7	92.2 ~ 93.8 Bag 4	Carb. sh brownish gray few coaly streaks
		94.0					93.8 ~ 94.7 Bag 5	
	#9 94.7 ~ 99.6	95.0	0.4	S			94.7 ~ 95.3 Bag 1	siderite very hard lt. brownish gray
		96.0	2.3				95.3 ~ 97.6 Bag 2	siltstone lt. gray
		97.0	0.2					Bone
			0.5			Box 8	97.6 ~ 98.0 Bag 3	coal solid BTM 7/10' broken
		98.0	1.6	CORE LOSS				
		99.0						
	#10	100.0	3.0			Box 9	98.6 ~ 100.0 Bag 4	

Comments:

94.5' { Oct. 11 17:30 end
Oct 12 9:20 began coring

Core Hole Description

Project Area Wishbone Hill Hole PB-10t Date Oct. 12/88

Interval Cored:

Interval Recovered: Described by:

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls.	Box No.	Bag No.	Core Description
	#10 99.5~101.5	100.0	3.0	c		Box 7	99.5~100.1 Bag 3	Carb. sh few coal streaks brownish gray
		101.0		c c			100.1~100.5	
				c			100.5~101.5 4	
		102.0		c c				
				c				
				c c				
				c				
				c c				
				c				
	#11 101.5~107.5		0.7	CORE LOSS			101.5~102.5 Bag 4	coal bouy BT'M half
		103.0	0.7			Box 6	102.5~103.3 3	
				c			103.3~104.8 4	Carb. sh many coal streaks brownish black
		104.0		c c				
				c				
				c c				
				c				
				c c				
		105.0	4.2	c			104.8~106.2 Bag 5	Carb. sh few coal streaks fairly soft sticky shaved swelled → pulled pipes
				c c		Box 7		
				c				
		106.0		c c			106.2~107.5 Bag 1	
				c		Box 8		
				c c				
		107.0		c				
	#12 107.5~112.5						107.5~108.5 Bag 6	Bone shaved sticky → pulled pipes clear 75 degrees ACA fairly carb. core lost top of BT'M recovered 3.5' in 5' run
		108.0				Box 6		
		109.0						
			3.5			Box 9	108.5~111.0 Bag 1	
		110.0						

Comments:

Core Hole Description

Project Area Wishbone Hill Hole PB-105 Date Oct. 12/88

Interval Cored: _____

Interval Recovered: _____ Described by: _____

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls.	Box No.	Bag No.	Core Description
	#12 110.5 ~ 111.4	110.0	3.4				109.5~111.0 Bag 1	
		111.0						
		111.5						
		112.0	1.3	CORE LOSS				
		112.5						
		113.0	0.3				112.2~112.5 Bore	
	#13 111.4 ~ 114.5	113.5				Box 9	112.5~113.2 2	carb. sh many coal streaks
		114.0	1.7				113.2~114.5 3	carb. sh many coal streaks
		114.5						coal
	#14 114.5 ~ 119.4	115.0					114.5~116.1 4	coal solid vitrious
		115.5						
		116.0	3.1				116.1~116.8 5	
		116.5					116.8~117.5 6	
		117.0						
		117.5					117.5~118.2 Bag 1	Carb. sh brownish gray
		118.0	1.3					
		118.5				Box 10	118.2~118.9 7	Coal solid vitrious
		119.0						
		119.5	1.9				118.9~119.4 8	
	#15	120.0					119.4~120.0 9	Coal solid

Comments: _____

Core Hole Description

Project Area Wishbone Hill Hole PB-10E Date Oct. 12 '88

Interval Cored: _____

Interval Recovered: _____ Described by: _____

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls.	Box No.	Bag No.	Core Description
	#14 119.7 ~ 121.4	120.0	1.7				Bag 4	Carb. sh many coal streaks
		121.0	0.6	C–C–C			120.0 ~ 120.6	
				C–C			120.6 ~ 121.4	Coal solid vitrious
		122.0	1.7	C–C–C		Box 10	121.4 ~ 122.4	5
				C–C			122.4 ~ 123.4	Carb. sh many coal streaks
		123.0		C–C				6
				C–C				
		124.0	3.2	C				
				C–C				
	#15 124.7 ~ 127.9	125.0		C–C			124.5 ~ 125.6	Carb. sh bouy BTM 0.2'
				C			Bag 1	
				C–C				
				C				
				B–B				
		126.0	3.9				125.6 ~ 127.5	Coal solid vitrious
		127.0				Box 11		2
		128.0					127.5 ~ 129.4	3
		129.0						
	#16 129.9 ~ 130.4	130.0	0.2	LOST				coal

129.9 ~ 130.4

Comments: _____

Core Hole Description

Project Area Wishbone Hill Hole PB-105 Date Oct. 12/88

Interval Cored: _____

Interval Recovered: _____ Described by: _____

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls.	Box No.	Bag No.	Core Description
	#17 129.5 ~ 133.7	130.0				Box 11	bag 4	
							bag 2	Carb. sh with few coal streaks
		131.0	1.5					
		132.0						Siltstone lt. gray slightly shaved
		133.0	2.6			Box 9	w	
	#18 133.7 ~ 138.7	134.0					x	Siltstone with coaly wisps sideritic very hard
								Carb. sh many coal streaks friable
		135.0						
		136.0	3.8				y	Carb. sh with few coal band less than 2" many fractures 60° ACA
		137.0				Box 12	bag 1	
		138.0						
			0.4	CORE LOSS				
	#19	139.0	1.4			Box 11	bag 5	
		140.0						

Comments: _____

Core Hole Description

Project Area Wishbone Hill Hole PB-105 Date Oct. 12/88

Interval Cored: _____

Interval Recovered: _____ Described by: Run #20~#22 F. Markonjich

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls.	Box No.	Bag No.	Core Description
	#19 138.7 ~ 143.7	140.0				Box 11	138.7 ~ 142.1 bag 6	Coal solid vitrious
		141.0						
			4.4					
		142.0				Box 13	142.1 ~ 143.7 bag 1	Bony BTM 6" fractures 60 degrees ACA
		143.0						
		144.0					143.7 ~ 144.1 4	Coal
	#20 143.7 ~ 148.7						144.1 ~ 144.6 5	Carb. Sh
		145.0						Carb. Sh
							144.6 ~ 146.3 bag 2	
		146.0	4.3			Box 12		
		147.0					146.3 ~ 148.4 6	Carb. Sh
		148.0						
			0.4				148.4 ~ 148.8 7	Siltstone very dry
	#21	149.0					148.8 ~ 150.1 8	Shale lt. gray very sticky
			3.4					
		150.0						

Comments: Quit coring 17:30 Oct. 12 at 148.7'
Began coring 9:45 Oct. 13

Run #21 drilled on Oct 12. out of hole on Oct 13 Core barrell stuck in casing

320-130

Core Hole Description

Project Area Wishbone Hill Hole PB-105 Date Oct. 13/88

Interval Cored:

Interval Recovered: Described by:

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls.	Box No.	Bag No.	Core Description
	#21	142.0	3.4			Box 12	Bag 6	Sh lt. gray very sticky
	142.1 ~ 145.7	144.0						
		145.0						
		146.0	1.6			Box 13	Bag 1	carb. sh with thin coal streaks
	#22	154.0				Box 14	2	Sh slightly carb.
	153.7 ~ 158.7	155.0						
		156.0					3	
		157.0	1.0					
		158.0					4	
	#23	159.0	0.8			Box 15	Bag 5	Siltstone slightly carb. at BTM
	158.7 ~ 160.2	160.0	1.7					

Comments:

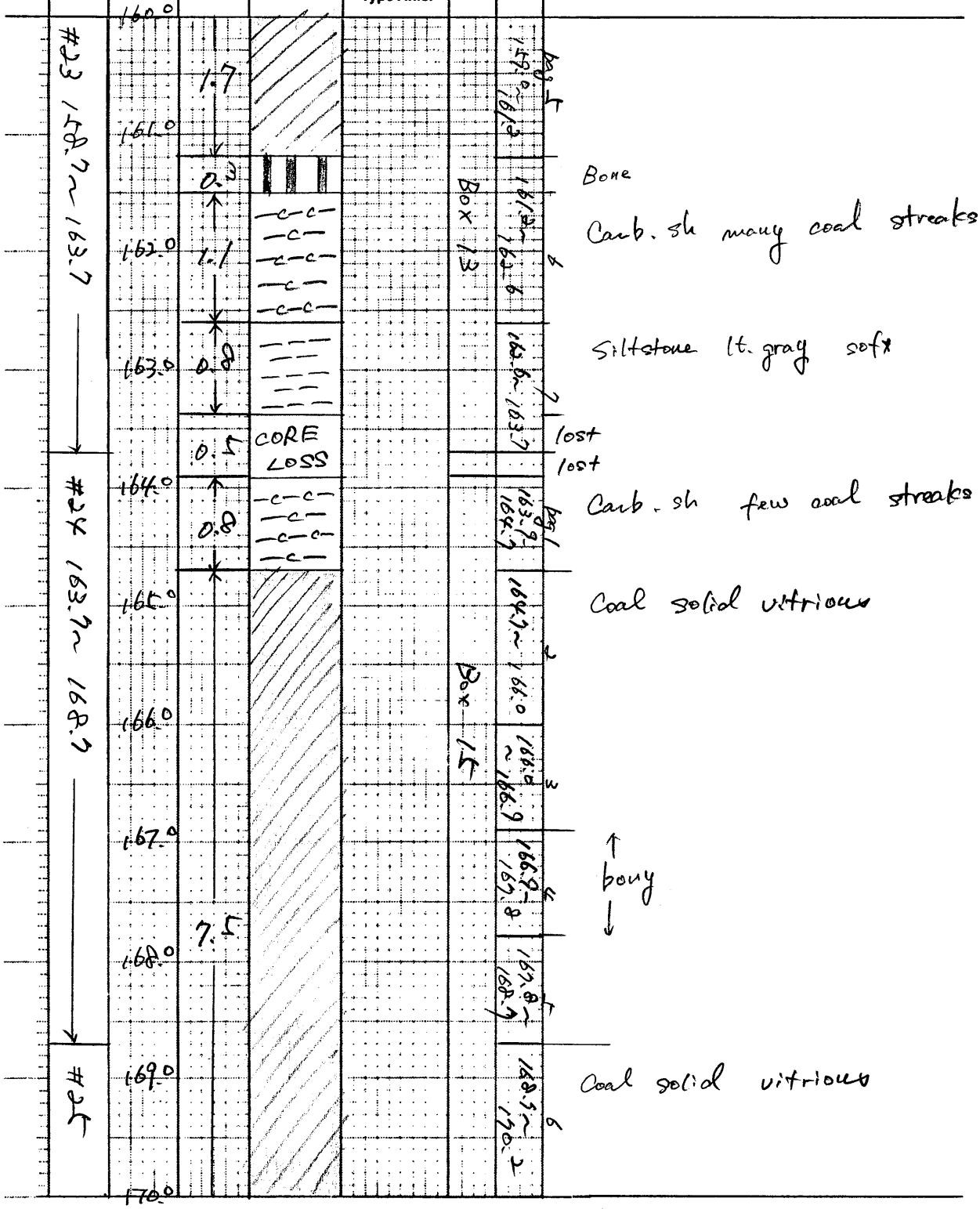
Core Hole Description

Project Area Wishbone Hill Hole PB-105 Date Oct. 13/88

Interval Cored: _____

Interval Recovered: _____ Described by: Run #23~#30 Y. Endoh

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.



Comments: _____

Core Hole Description

Project Area Wishbone Hill Hole PB-10t Date Oct. 13/88

Interval Cored:

Interval Recovered: Described by:

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls.	Box No.	Bag No.	Core Description
	#25 168.7 ~ 173.7	170.0	5.0			Box 15	168.7 ~ 173.7 Bag 7	
		171.0						
		172.0						
		173.0	1.5			Box 16	173.7 ~ 175.2 Bag 1	Carb. sh brownish black bony at Top
	#26 173.7 ~ 178.7	174.0				Box 17	173.7 ~ 174.4 Bag 5	Sh lt. gray shaleal with some coal band less than ½" sticky containing a lot of moisture ~ pulled piles
		175.0						
		176.0	4.0				174.4 ~ 178.7 Bag 1	
		177.0						
		178.0				Box 17	178.7 ~ 179.0 Bag 4	
	#27 178.7 ~ 180.0	179.0	4.0				179.0 ~ 179.7 Bag 4	Siltstone lt gray mod. hard w plant fossil on fractured plane 40 degrees ACA
		180.0						

Comments:

Core Hole Description

Project Area Wishbone Hill Hole PB-105 Date Oct 13/88

Interval Cored:

Interval Recovered: Described by:

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls.	Box No.	Bag No.	Core Description
	#27 178.6 ~ 182.6	180.0	4.0			Box 17	Bag 5	Siltstone lt gray sideritic top 6" – with coaly wisps
	#28 182.6 ~ 183.6	182.0	0.5	-c-c- -c- -c-c-			Bag 6	Carb. sh
		183.0						Coal solid vitrious
		184.0	1.0					
	#29 183.6 ~ 189.2	184.0	LOST	LOST				Siderite
		185.0	1.8			Box 18		Coal solid vitrious
		186.0						Sh lt gray carb. sticky. friable
		187.0	2.0					
		188.0						Coal solid vitrious
		189.0	2.4			Box 19		
	#30 189.2 ~ 190.4	190.0					Bag 7	Coal solid vitrious

Comments:

Core Hole Description

Project Area Wishbone Hill Hole PB-105 Date Oct. 13/88

Interval Cored:

Interval Recovered: Described by: #31~32 F. Mrkonjich

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls.	Box No.	Bag No.	Core Description
	#30 ~191.2 ~199.2	190.0	2.4			Box 1/1	186.4~190.9	Sh: carb. lt. gray some coal band less than 3"
		191.0					190.9~194.2	
		192.0	3.8					
		193.0					194.2~196.2	
		194.0						
			0.4				196.2~196.6	carb. Sh
	#31 ~191.2 ~199.6	195.0				Box 1/2	196.6~197.4	Shale gray very hard.
		196.0					197.4~198.3	
		197.0	6.8				198.3~199.6	
		198.0						
		199.0						
	#32	200.0				Box 2/2	199.6~200.0	

Comments: End of Oct 13/88 @ 194.2 began 2:45 pm Oct. 14/88

Core Hole Description

Project Area Wishbone Hill Hole PB-10-5 Date Oct. 14/88

Interval Cored: _____

Interval Recovered: _____ Described by: #33~38 D. Germer

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls.	Box No.	Bag No.	Core Description
	#32 199.6~204.6	200.0	6.8				199.6~200.4 bag 1	Shale gray
		201.0					200.4~200.8 2	Carb. sh
		202.0	1.3				200.8~201.6 2	Shale gray
		203.0				Box 2.0		
		204.0					201.6~204.6 2	
	#33 204.6~206.0	205.0					204.6~206.0 4	Shale; lt gray; very fractured calcite or silica on fractures; mod hard
		206.0	11.7				206.0~207.7 4	Shale: med gray; competent slightly rooted; slightly silty
	#34 206.0~210.4	207.0						
		208.0					207.7~209.4 bag 1	
		209.0				Box #1		
		210.0					209.4~210.4 2	

Comments: Quick drilling 6:00pm Oct. 14/88 @ 204.6'

Core Hole Description

Project Area Wishbone Hill Hole PB-105 Date Oct. 15/88

Interval Cored:

Interval Recovered: Described by:

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls.	Box No.	Bag No.	Core Description
	#34	210.0					5'10" to 6'10"	Sh; md. gray; slightly rooted slightly silty
		211.0					6'10" to 7'10"	
		212.0	11.7			Box 21	7'10" to 8'10"	Sh: md gray; slightly rooted slightly silty; competent
		213.0					8'10" to 9'10"	
		214.0					9'10" to 10'10"	
	#35	215.0					10'10" to 11'10"	Siltstone: md. gray; thin shaley + sandy zones <3" thick fractured
		216.0					11'10" to 12'10"	
		217.0	5.5			Box 22	12'10" to 13'10"	
		218.0					13'10" to 14'10"	
		219.0					14'10" to 15'10"	
	#36	220.0					15'10" to 16'10"	Siltstone; dk gray; rooted slightly carb.

Comments:

Core Hole Description

Project Area Wishbone Hill Hole PB-105 Date Oct. 15/88

Interval Cored:

Interval Recovered: Described by: #39 ~ 40 F. Mrkajich

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls.	Box No.	Bag No.	Core Description
	#37 221.2 ~ 224.2	220.0				Box 22	bag 5	Claystone / Shale ; lt gray very fractured + soft
		221.0					220.0 ~ 222.0	
		222.0	4.2				bag 6	
		223.0					222.0 ~ 224.0	
		224.0						~ 224.0 ~ 224.2
	#38 224.2 ~ 226.9	225.0	1.7			Box 23	224.2 ~ 225.9	Sh : med to dk gray ; mod hard clayey section (<2") siderite cemented @ base 3" fractured
		226.0	1.0				225.9 ~ 226.9	claystone ; v. hard ; siderite cemented . lt gray
		227.0	0.4	S			bag 7 226.9 ~ 227.3	Siderite
	#39 226.9 ~ 230.9	228.0	2.6				227.3 ~ 229.9	Shale / claystone mod gray Carb. sh 228.1 ~ 228.6
		229.0						
		230.0				Box 24	bag 8 229.9 ~ 230.9	Shale / claystone Med gray

Comments: End Oct 15/88 @ 226.9 begin Oct 16/88 9:15 am

Core Hole Description

Project Area Wishbone Hill Hole PB-10t Date Oct. 16/88

Interval Cored: _____

Interval Recovered: _____ Described by: Run # 41 ~ 44 D. Germer

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls.	Box No.	Bag No.	Core Description
	Run #39	230.0	0.4				229.9~230.3	Carb. shale 229.9~230.3
			0.6				230.3~231.0	
	Run #40 231.0~233.3	231.0					231.0~232.0	Shale md to dark gray
		232.0					2	
		233.0				Box 24	232.0~233.0	
		234.0	1.7				3	
			0.8				233.0~234.7	
		234.7					4	
	Run #41 234.7~236.7	235.0					234.7~235.7	sh; dk gray to blk: carbonaceous fractured; soft thin coal laminations
		236.0					5	
		236.7					235.7~236.7	
		237.0					6	ss; lt gray: fg to vfg
							236.7~238.0	wild coal: silty layers < 3" thick
		238.0	3.3			Box 25	7	
		239.0					238.0~239.3	
		240.0					8	

Comments: _____

Core Hole Description

Project Area Wishbone Hill Hole PB-105 Date Oct 16 '88

Interval Cored:

Interval Recovered: Described by:

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls.	Box No.	Bag No.	Core Description
	Run #4	240.0						ss: lt to md. gray ; fg; sh layers (max. 2") + laminations wkd coal common
		241.0						
		242.0						
		243.0						
		244.0						
		245.0						
	Run #5	246.0						Interbedded ss + sh ; gray sh is very silty ss is fg dip approx 28° 5" siderite band @ 246.0'~246.4' mod hd. few fractures (silty shale in btm 6")
		247.0						
		248.0						
		249.0						
		250.0						

Comments:

Core Hole Description

Project Area Wishbone Hill Hole PB-105 Date Oct. 16/88

Interval Cored:

Interval Recovered: Described by: Run #45~54 E. BJORKMAN

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls.	Box No.	Bag No.	Core Description
	Run #44 240.0~253.0	240.0	3.2			Box 34	240.0~243.2	Interbedded ss and sh wavy laminations ; rooted wild coal fragments 4" siderite band @ 240.2~240.6 bedding ∠ 20°
		245.0					243.2~244.0	
		250.0					244.0~245.0	sh ; gray to dk gray ; slightly carbonaceous 2" bone strk @ 244.2'
	Run #45 253.0~263.0	255.0	1.8				245.0~247.0	
		260.0				Box 35	247.0~249.0	Fresh to moderatelly weathered with weak zone in Friable shale or claystone mechanical vs. natural Fissility difficult to distinguish as material is removed w/ difficulty from tube. Predominantly light gray to light olive gray Siltstone and Shale medium strong to weak weak zones to 0.6' Last 0.5' carbonaceous
		265.0	8.4				249.0~250.0	
		270.0					250.0~251.0	
	Run #46 263.0~273.0	275.0					251.0~253.0	
		280.0						

Comments: Start coring @ 255' on Oct 17/88

Core Hole Description

Project Area Wishbone Hill Hole PB-10C Date Oct 16, 1988

Interval Cored:

Interval Recovered: Described by:

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls.	Box No.	Bag No.	Core Description
	#46 259.5 ~ 263.0	260.0				Box 27	259.5 ~ 260.0	
		261.0	3.5				260.0 ~ 263.7	bag 4
		262.0						bag 1
		263.0				Box 28	262.7	262.7
	#47 263.0 ~ 267.5	264.0	1.8				263.0	263.0
		265.0					263.4 ~ 264.3	3
		266.0	1.4				264.3 ~ 266.2	4
		267.0	0.9				266.2 ~ 267.4	5
							267.4 ~ 267.6	bag 1
	#48 267.5 ~ 272.0	268.0				Box 29	267.6 ~ 269.4	2
		269.0	2.9				269.4 ~ 271.1	3
		270.0						

Light olive gray, Friable shale and/or claystone w/ carbonaceous 1~3 mm coaly partings
very weak to weak mechanically destroyed when removed from tube

medium light gray, unstratified siltstone, solid medium strong (SILTSTONE) (400)

Light olive gray
Friable 1~5 mm carbonaceous Partings very weak

Coal, black, hard, vitrious conchoidal massive w/ coal cleats @ 60 and 50 degrees ACA

Comments:

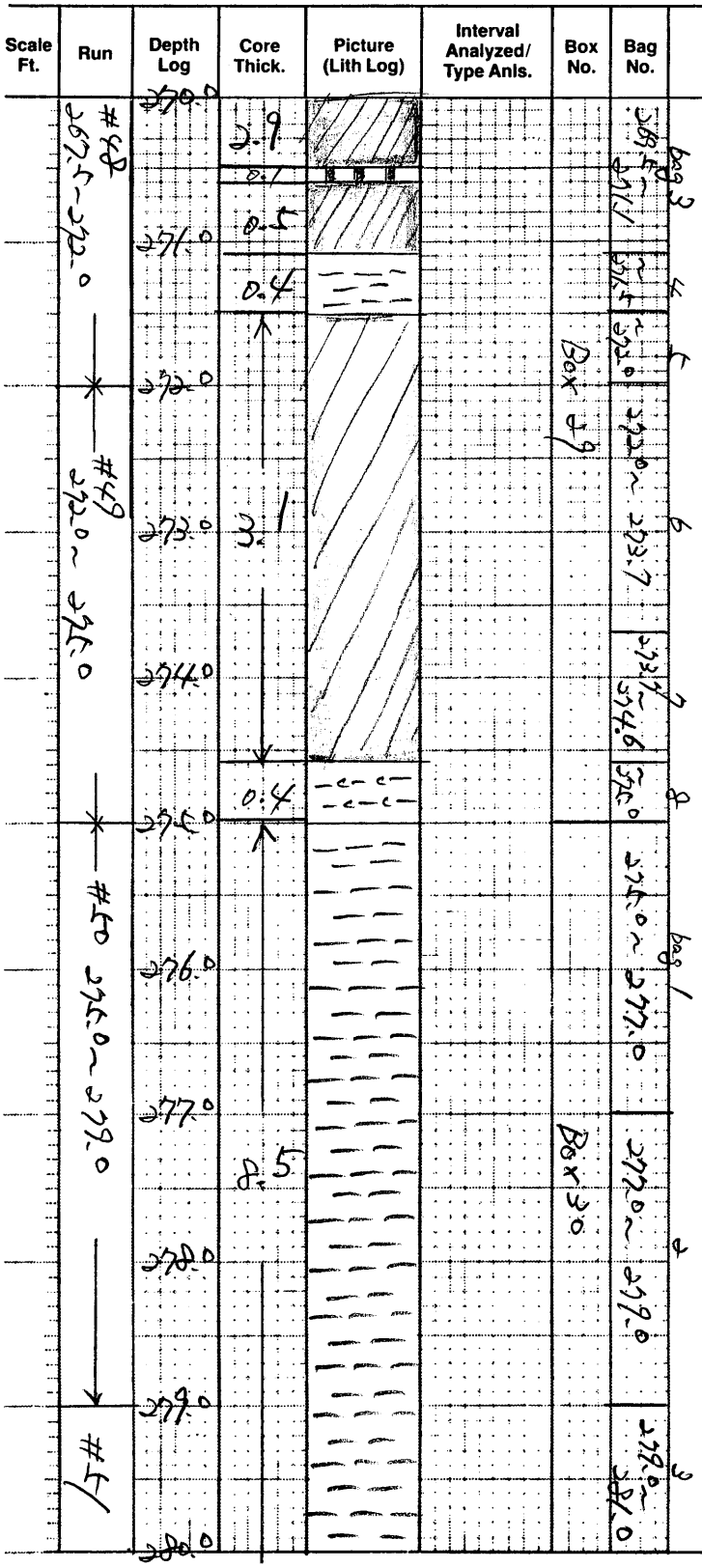
Core Hole Description

Project Area Wiseboue Hill Hole PB-105 Date Oct. 17/88

Interval Cored:

Interval Recovered: Described by:

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.



Comments:

Core Hole Description

Project Area Wishbone Hill Hole PB-105 Date Oct. 17/88

Interval Cored:

Interval Recovered: Described by:

Describe core loss location, if possible. Describe color, bedding, fractures, fossils, gradations, grains and mineralization, where applicable.

Scale Ft.	Run	Depth Log	Core Thick.	Picture (Lith Log)	Interval Analyzed/ Type Anls.	Box No.	Bag No.	Core Description
	#5 279.0 ~ 289.5	280.0	9.5				bag 3 279.0 ~ 281.0	281.3 ~ 281.5 Wild coal medium gray to olive black locally broken + fractured weak (SHALE)
		281.0					281.0 ~ 283.7	
		282.0						
		283.0					283.7 ~ 289.5	289.5 T.D.
		284.0						
		285.0						

Comments:

Hole PB-109 Logged By E. E. BJORKMAN Date 6-16-82 Page 1 Of 1

Driller 3 LEGS INUEL / EXCO TD 200' Date 6-16-82

Probe ____ TD ____ Date ____

Est. Mud Wt. ____ Hole Size 4 3/4 Log Types ____ Collar Elev. 1036

Project Name NOSE WISEMAN HILL Sec. ____ T ____ R ____

County MAT-SU BOROUGH State ALASKA Collar Coor. N ____ E ____

Remarks TARGET: INNER BOREHOLE FOR GEOCHEMICAL ANALYSIS JU/PR

Depth	Log	P	C	Description
1305				0-2' DK. YELLOWISH BROWN SILT(50) AND SAND(50) TOPSOIL
				5' MOD. YELLOWISH BROWN (10YR 5/4) TO GREENISH GRAY (5GY 6/1) V. LT GRAY (N8) (GLACIAL GRAVEL)
				10' BECOMING LESS YELLOWISH BROWN, GREENISH GRAY (5GY 6/1), DK. GR. GRAY SCHIST (GLACIAL GR)
				15' AS ABOVE (GLACIAL GRAVEL) MAFICS, GRANITICS, QUARTZ
1400				20' AS ABOVE (GLACIAL GRAVEL)
				25' AS ABOVE (GLACIAL GRAVEL) F-C GRAVEL (55) AND F-C SAND (35) WITH SILT (10) ABOUT 15% COBBLES, 1-5% BOULDERS — 26' DRILL BOULDER
				30' AS ABOVE (GLACIAL GRAVEL) — 32' BOULDER
1515				35' AS ABOVE (GLACIAL GRAVEL)
				40' AS ABOVE (GLACIAL GRAVEL)
				45' MAFICS, QUARTZ, GRANITICS, AND FELSOPHYRES (GLACIAL GRAVEL)
1620				50' AS ABOVE (GLACIAL GRAVELS) COBBLES 15-20%, 5-10% BOULDERS
				55' AS ABOVE (GLACIAL GRAVELS)
				60' AS ABOVE (GLACIAL GRAVELS)
				65' AS ABOVE (GLACIAL GRAVELS)
				70' AS ABOVE (GLACIAL GRAVELS)
1755				75' AS ABOVE (GLACIAL GRAVELS) 76' BR. TO GRAYISH OLIVE GREEN (5GY 3/2)
				80' COMPLETELY TO HIGHLY WSA. OLIVE GRAY (5Y 3/2) TO MOD DK GRAY
				85' BECOMING LESS GREEN, MORE MOD DK GRAY (N4) COMPL. DECOMPOSED SANDSTONE — 94' SOFT, SMALL HARD
				90' MED DK GRAY (N4) TO DK GRAY (N3) V.FN.GR (SANDSTONE)
				95' AS ABOVE (SANDSTONE)
				100' AS ABOVE (SANDSTONE)
				105' AS ABOVE (SANDSTONE)
				110' AS ABOVE (SANDSTONE)
				115' DK. GRAY (N3) V. FN. GR. (SANDSTONE)
				120' MOD DK GRAY (5Y4) TO DK GR (N3) (SILTSTONE) SOME PLANED FRAGMENTS
				125' DK GRAY (N3) TO OLIVE BLACK 5Y 2/1 (SILTSTONE) SL. SANDY
				130' AS ABOVE (SILTSTONE) FEW LEAF FOSSILS
				135' AS ABOVE (SILTSTONE)
1910				140' AS ABOVE (SILTSTONE)
				145' OLIVE BLACK (5Y 2/1) (SILTSTONE)
				150' AS ABOVE (SILTSTONE)
				155' AS ABOVE (SILTSTONE)
				160' BECOMING SLIGHTLY SANDY AND LESS OLIVE MORE GRAY (N3) (SILTSTONE)
				165' OLIVE BLACK (5Y 2/1) (SILTSTONE)
1925				170' AS ABOVE (SILTSTONE)
				175' AS ABOVE (SILTSTONE)
				180' AS ABOVE (SILTSTONE)
				185' AS ABOVE (SILTSTONE)
				190' AS ABOVE (SILTSTONE)
				195' AS ABOVE (SILTSTONE)
1940				200' AS ABOVE (SILTSTONE)
				BAGGED SAMPLES
				BAG 1 OF 2 0' - 100'
				BAG 2 OF 2 100' - 200' TD

Hole PB-109 Page 1 Of 1

320 Form 124