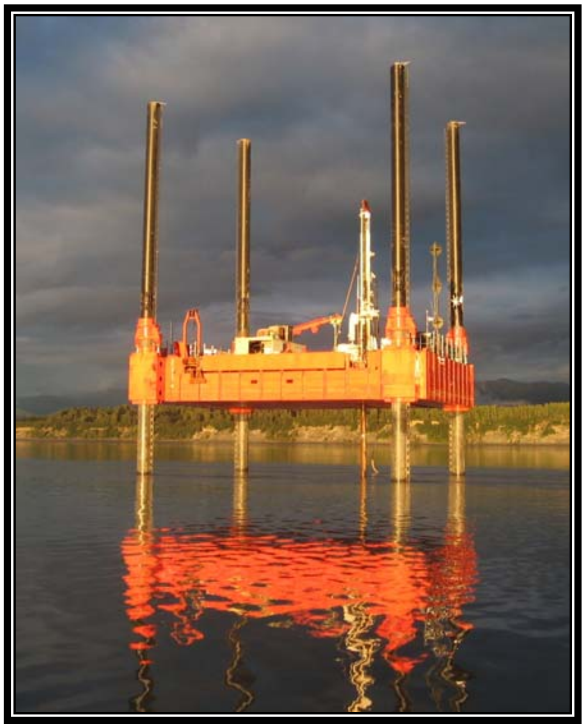
GEOTECHNICAL DATA REPORT
KNIK ARM CROSSING
KNIK ARM, ALASKA



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March 2007

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Project No.: 32-1-01536-004

EXECUTIVE SUMMARY

This report presents the results of field explorations, field testing, and laboratory testing for the Knik Arm Crossing Project, in Knik Arm, Alaska. The purpose of this work was to collect geotechnical data along the conceptual alignment for the Knik Arm Crossing structure and abutments.

A concept crossing location was developed following preliminary engineering and permitting studies. The east side of the concept crossing alignment is about one mile north of Cairn Point. The west side of the crossing transitions through the intertidal zone about one mile north of the existing Port MacKenzie Dock. The over-water distance along the concept alignment is about 2 ¼ miles (about 11,900 feet). Borings were located at 500-foot intervals along this alignment approximately between the minus 5 foot mean lower low water contours on the west and east sides of the crossing. Pertinent prior borings by Shannon & Wilson and others that are located within about 2,000 feet of the concept alignment were also compiled and are included in an appendix to this report.

The 2006 Knik Arm Crossing geotechnical explorations included nineteen over-water borings, five cone penetration tests, and shear wave velocity measurements and pressuremeter testing at two locations. Drill rod energy transfer studies were included to correlate penetration resistance values recorded during drilling with conventional standard penetration test methods. The over-water program involved using a barge and four-corner mooring for borings located near mid channel. Borings located in shallower water were drilled using a jack-up platform to support the drill rig. The logistics associated with water depth, tidal range, and current velocity were challenging and should not be underestimated regarding design or eventual construction of the Knik Arm Crossing.

Samples recovered during drilling were transported to Shannon & Wilson’s soils laboratory in Anchorage, Alaska for testing as appropriate to confirm field classifications and evaluate the engineering properties of the soils. Index testing typically included evaluating moisture contents, particle size gradations, and plasticity. Strength testing included unconfined compression and unconsolidated, undrained triaxial testing to supplement strength estimates based on standard penetration resistance and testing with field screening instruments including the pocket penetrometer and Torvane.

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ABBREVIATIONS & ACRONYMS

°F	Degrees Fahrenheit
AASHTO	American Association of State Highway and Transportation Officials
ADOT&PF	Alaska Department of Transportation & Public Facilities
API	American Petroleum Institute
bpf	Blows per foot
cm/yr	Centimeters per year
CPT	Cone Penetration Test
FS	Factor of safety
ft/sec	Feet per second
Golder	Golder Associates
H	Horizontal
HDR	HDR Alaska, Inc.
HLA	Harding Lawson Associates
km	Kilometer
ksi	Kips per square inch
LRFD	Load and resistance factor design
m	meter
Mat-Su	Matanuska-Susitna
MLLW	Mean Lower Low Water
mm/yr	Millimeters per year
M_s	Surface Wave Magnitude
MW	Moment Magnitude
NCEER	National Center for Earthquake Engineering Research
NOAA	National Oceanic and Atmospheric Administration
OD	Outside diameter
PB	Parsons Brinckerhoff Construction Services, Inc.
PDA	Pile Driving Analyzer
PSHA	Probabilistic Seismic Hazard Analyses
psi	Pounds per square inch
RMDT	Robert Miner Dynamic Testing, Inc.
SPT	Standard Penetration Test
tsf	Tons per square foot
UHS	Uniform Hazard Spectrum
USGS	United States Geological Survey
V	Vertical
ybp	Years before present

1.0 INTRODUCTION

This report presents the results of a geotechnical study conducted in Alaska across the Knik Arm where a bridge crossing is planned. The location of this alignment is shown on Figure 1. This geotechnical study was the seventh study in this area and was comprised of drilling nineteen borings across the roughly 12,000-foot wide channel. The off shore boring program was supported by five cone penetration tests (CPT), shear wave velocity measurements and pressuremeter testing at two locations and two on-shore borings to characterize the East and West shoreline soils.

The purpose of this work was to collect geotechnical data to be used in the design of the crossing.

1.1 Prior Studies

Four prior geotechnical studies of limited extent were performed north of Cairn Point in efforts aimed at evaluating various alignment crossings. These studies are listed in the references of this report and include Dames & Moore, 1970; Alaska Department of Highways, 1970; Shannon & Wilson, 1971; and, Harding Lawson Associates (HLA), 1984.

Geotechnical work on the Knik Arm Bridge project was started in the early 1970s. Dames & Moore performed an over-water geophysical survey of this area of the waterway while the Alaska Department of Highways and Shannon & Wilson, Inc., conducted limited over-water drilling and shoreline reconnaissance activities, respectively. The focus of these studies was an early attempt at identifying the most promising crossing locations rather than collecting data to establish foundation types or construction costs.

In 1984, HLA conducted off shore exploration studies at three potential crossing locations, one starting on the shoreline near downtown Anchorage and two alignments further north up the Knik Arm beyond Cairn Point. The closest crossing studied by HLA is referred to as the Elmendorf Crossing and is generally situated about ¼ mile north of the current alignment on the west side of Knik Arm and ¾ miles north of this alignment on the east shoreline. The location of the current crossing concept is shown on Figures 1 and 2. Three borings drilled by HLA (HLA 4, 5, and 6) in the Elmendorf Crossing corridor are included with this report to supplement more recent studies.

This 1984 information was then reviewed again by Parsons Brinckerhoff Construction Services, Inc./HDR Alaska, Inc., 2003, (PB/HDR, 2003) and revealed broad data gaps in the information when used for estimating the foundation requirements and construction costs. Each existing boring encountered different geologic units making it difficult to develop a subsurface cross section that could be used for estimating reasonable foundation costs. The intent of the follow-on study was to fill in these data gaps where the feasibility and construction costs could be revisited and would not have to rely so heavily on broad interpolations of limited subsurface data. At the time, the concept alignment was shifted south of the Elmendorf Crossing to shorten the access roads and be less costly. The follow-on 2003 study focused at this site and consisted of a field and laboratory program to collect site soils data followed by preliminary analysis of this information.

The 2003 study field work comprised drilling nineteen borings across the channel supplemented by CPTs at a few boring locations, shear wave velocity measurements at one location, and seven shallow borings along the east side tide flats south to the Port of Anchorage. Also rod energy transfer studies were conducted during Standard Penetration Testing (SPT) with various length drill rods. The bulk of the field effort was on drilling and sampling the seven over-water borings using a jack-up platform system. We have included pertinent boring logs from this study in Appendix G. Previous downhole geophysical data is included in Appendix H. The approximate locations of these borings are shown in Figure 2.

1.2 Current Scope

The current concept alignment is shown in Figures 1 and 2. The current work effort was focused at this site and consisted of a field and laboratory program to collect site soils data for design purposes. The actual field work comprised drilling nineteen borings across the channel following the concept alignment supplemented by CPTs at a few boring locations, shear wave velocity measurements and pressuremeter testing at two locations. Also rod energy transfer studies were conducted during SPT with various length drill rods. The bulk of the field effort was on drilling and sampling the over-water borings using a floating barge and jack-up platform system.

Soil samples recovered during the above drilling were returned to our Anchorage soils laboratory for selective index, strength, and consolidation testing, as appropriate. The combined field, laboratory and geophysical results were then summarized in this report.

1.3 Report Organization

This data report is organized into eight main sections. Section 1 is introductory in nature consisting of general information regarding the project, prior studies, the current scope of work and the authorization of our studies. Sections 2, 3, and 4 contain general descriptions of the site and project and a brief summary description of the field explorations and laboratory tests performed. Details of this work are provided in the appendices.

Section 5 is devoted to a summary discussion of the geology, tectonics, and seismicity of the area. This information is also discussed in PB/HDR, 2003. This section is followed by Section 6, which gives a description of the subsurface conditions based upon the exploration. Backup logs and test results for this latter section are contained in the appendices. Sections 7 and 8 summarize limitations and references. Figures follow main text.

Nine appendices accompany the main text and figures. Appendix A provides discussions of the major field drilling and sampling work including off-shore drilling and sampling equipment and procedures. Also included within this appendix are the results of current drilling efforts including 19 boring logs and the logs of Shelby Tube samples recovered during drilling. The CPT results, recent shear wave velocity measurements and pressuremeter testing are contained in Appendices B, C and D, respectively.

Appendix E summarizes the results of measured energy transfers from the surface SPT hammer to the sampler for various rod lengths. Appendix F describes the laboratory test procedures on the recovered soil samples and the results. The focus of this testing was on evaluating soil shear strengths, although basic index and a few consolidation tests were also performed.

Appendix G contains the logs of pertinent prior borings by Shannon & Wilson and others while Appendix H includes the results of a downhole seismic velocity survey conducted on the Knik Arm west shoreline. The last appendix, Appendix I, contains important information about this geotechnical report and is intended to aid the planners and users in understanding the use and limitations of our geotechnical work.

1.4 Authorization

This work was performed in general accordance with our Subconsultant Agreement with PND Engineers, with subsequent amendments aimed at completing an expanded work scope. The prime consultant, HDR Alaska, and the project representatives from the Knik Arm Bridge and Toll Authority approved the general scope of the geotechnical work at several meetings held at the start and as the work progressed.

2.0 SITE AND PROJECT DESCRIPTION

The Knik Arm Bridge Project is intended to provide a connection between the west and east shore of Knik Arm. The following narrative describes the site, the geographic and climatic setting and general nature of the bridge project.

2.1 Site Description

The Knik Arm Crossing will span Knik Arm, an extension of upper Cook Inlet to the north of Anchorage, Alaska as shown in Figure 1. A site map showing the tentative crossing area, the onland and off-shore topography, and the locations of borings drilled in the area is presented in Figure 2. Anchorage is located in Southcentral Alaska, is the largest city in the state, and accounts for nearly half of the state's population. The Port of Anchorage and the Ted Stevens Anchorage International Airport serve as major transportation hubs for goods entering Alaska and/or serving the Pacific Rim countries. The shorelines of Anchorage are characterized as large mudflats in the intertidal zones and 50 to 150 foot high bluffs above high tide. Similar conditions exist in Knik Arm and at the planned crossing area.

Knik Arm is an approximately 34 mile long, 1.6- to 5-mile wide water body that is orientated approximately northeast by southwest. It is characterized by strong currents, deep water, and large tides, as well as strong winds, winter storms, and sea ice. The water is also murky with glacial silt making visibility for divers and construction workers limited to a few feet or less. These potentially hazardous work conditions make construction of a highway bridge across this channel one of the more challenging projects in Alaska.

As shown in Figure 1, the east side of the concept crossing alignment is about one mile north of Cairn Point. The over-water distance along the concept alignment is about 2 ¼ miles (about 11,900 feet). On the west side of the crossing, the concept alignment transitions through the intertidal zone about one mile north of the existing Port MacKenzie Dock. New access roads will be needed to connect the crossing with the existing road systems east and west of Knik Arm.

Tides are large and range between Elevation +34.1 feet (MLLW Datum) at high tide and –6.1 feet at low tide for a total maximum change of 40.2 feet. MLLW has been taken as the project elevation datum and is used throughout most of the remainder of the report. The corresponding high and low elevations for Mean Sea Level Datum are +17.6 and –22.6 feet, respectively.

Currents created at tide changes vary with the location in the channel and when the measurements are made during the tide cycles. During our explorations, maximum currents of

8.5 knots (13.5 feet per second [ft/sec]) on the ebb tide were measured at the water surface at one location. At most other locations, more typical maximum values were in the 4 to 5 knot (6.8 to 8.4 ft/sec) range. When comparing project flow measurements with those found in the tide tables during 2006 explorations, we generally found that the published flows (Nobeltec Tides & Currents, Version 3.0 software) were about 1.5 knots (2.5 ft/sec) lower than our readings. These published currents are based on NOAA predictions from gages situated south of the study area.

2.2 Geographic and Climatic Setting

Knik Arm in part is a glacially scoured valley. The local topography above high tide consists of steeply sloping bluffs along much of the coast including both sides of Knik Arm with intertidal mudflats reaching about ¼ and ½ miles seaward on the west and east sides, respectively, at extremely low tides. Based on a 2003 reconnaissance survey, the east and west bluffs are roughly 70 and 100 feet high, respectively. These bluffs are both part of the Elmendorf Moraine or gravel deposits left as a result of prior glacier retreats.

From limited reconnaissance of both bluffs they appear to be in a state of marginal stability as erosion from tides and strong currents seem to be slowly cutting away at the toe of slopes on both sides of the Knik Arm. This toe erosion results in progressive slumping and/or sloughing of the bluffs, the tailings of which are eventually washed away at high tides or with wave action again exposing the toe to more erosion. Freeze thaw effects, infrequent strong earthquakes, and bank seepage also appear to contribute some to this erosion process. Bank regression studies of the Anchorage bluff at Point Woronzof indicate an average regression rate of about 2 feet per year. Similar regression rates probably occur here as the sea face exposure, slope heights and bank materials appear similar.

The climate is predominantly cool maritime with mild winters and cool summers. Average annual precipitation is about 15 inches. Strong winds are common especially in winter and cloud cover is persistent. Average annual temperature is about 36 degrees Fahrenheit (°F) with a mean January temperature of about 16°F and a mean August temperature of approximately 56°F.

2.3 Project Description

The purpose of the Knik Arm crossing project is to construct a transportation link from Anchorage northwest over the Knik Arm to the Matanuska-Susitna (Mat-Su) Borough where the road will interconnect with the existing roads. On the east side of the concept crossing an embankment fill is planned which transitions the intertidal zone and parallels the undeveloped shoreline south about 2 miles to the Port of Anchorage and existing roads in the area. For this report, only the water crossing of Knik Arm, and to a limited extent the embankment south to the Port of Anchorage were studied.

The location of the crossing, shown on Figure 1, was generally established far enough north to avoid the deep waters at Cairn Point and to avoid the future ferry or shipping traffic to the existing dock at Port MacKenzie.

3.0 FIELD EXPLORATIONS AND TESTING

The 2006 geotechnical evaluation involved the four specific field tasks listed below:

1. Drilling and sampling of nineteen soil borings,
2. Select CPT testing at five locations,
3. Downhole shear wave velocity measurements and pressuremeter testing at two locations, and
4. SPT energy transfer tests on drill rods in one boring.

The scope of each of these efforts is briefly described below while detailed procedures and the results are contained in Appendices A through E.

3.1 Borings

Nineteen borings, designated Borings B06-01 through B06-19, were advanced to characterize the typical subsurface conditions at the concept crossing alignment. Six of the borings were drilled from a floating barge and the remaining thirteen from jack-up platform using rotary and wireline drilling methods. Results of two additional on-shore borings drilled previously, designated Borings A03-7 and B05-1, are also included in this report. The on-shore borings were advanced using hollow stem auger methods.

The off-shore drilling work was performed between August and October, 2006. The borings advanced in the deepest water, B06-05 through B06-10, were drilled from the floating barge and the remaining thirteen borings were advanced from the jack-up platform. The two on-shore borings were advanced in October, 2003 and December, 2005 for Borings A03-7 and B05-01, respectively.

The locations of the 19 off-shore borings and 2 on-shore borings are shown on the boring location plan in Figure 2. The individual logs of the 19 off-shore borings are presented in Appendix A. Also presented in this appendix is a detailed description of drilling and sampling procedures for both on and off-shore work. The logs of the on-shore borings are presented in Appendix G with pertinent prior logs by Shannon & Wilson and others.

3.2 Cone Penetration Testing

Cone penetration tests (CPTs) were performed adjacent to five boring locations, Borings B06-11, B06-13, B06-15, B06-17, and B06-18, to further evaluate the properties of the soils, particularly the uniformity of the thick silty clays and fine sands and their relative strength or density properties. The CPT measurements were conducted by Gregg In Situ, Inc. In general, the upper layer (15 to 20 feet) of soil was drilled to create a cased hole to support the CPT rod as it was pushed beyond these depths into the underlying soils. The penetrometer tests were initiated after the casing was set and drilled out. The cone used for this study was a 2.3 in^2 (15-cm^2) standard electronic cone.

The tests consist of pushing an instrumented, a 20-ton capacity cone in the soil at a constant 0.8 inch per second rate. The resistance to continuous penetration encountered by the cone tip and a friction sleeve are transmitted electronically through the push rods into a portable data acquisition system at the surface. A pore pressure element is located within the cone. During the test, the data was graphically displayed in color on a computer screen showing tip stress, friction stress, dynamic pore pressure, and slope plotted against depth. Logs from the cone penetrometer tests and the measured piezometric data are included in Appendix B along with calculated friction ratios, relative strengths, and equivalent Standard Penetration Resistance (or uncorrected N) values and $N_{1(60)}$ values. The $N_{1(60)}$ values are equivalent corrected blow counts (for confining effects) and an assumed 60 percent energy transfer down the drill rods to the sampler.

3.3 Shear Wave Velocity Measurements and Pressuremeter Testing

While pushing the cone for the CPTs adjacent to Borings B06-11 and B06-18, the CPT cone advance was stopped every 5 feet for making shear wave velocity measurements. These measurements are made using conventional downhole procedures and provide useful velocity information for performing a follow on ground response analysis and developing a site specific response spectra. In this test, the energy source, an air gun, was provided and operated by Gregg In Situ, Inc. When cone advance was stopped at each interval, a blast of air in the water column above the borehole location induced compression and shear waves into the soil. These “waves” travel down through the soil column past a geophone attached near the cone tip. The interval travel times of both waves can be measured between the source and geophone at different depths enabling the interval shear wave velocities to be calculated every 5 feet. The results of the velocity changes with depth from these measurements for Boring B06-18 are presented in Appendix C.

Gregg In Situ, Inc. was unable to provide shear wave velocity calculations for Boring B06-11 as a result of poor data collection. Because the geophones are incorporated into the cone and there are no guides for it, aligning the geophones properly with the energy source is generally challenging. Additionally, the strong currents we observed may have, to some degree, caused an offset in the place where the air blast created compression wave actually impacted the soil creating an even more challenging condition to align the geophones. It is our opinion that a combination of these two factors caused the poor data collection observed in Boring B06-11. Although Gregg In Situ, Inc. conducted shear wave velocity testing in this boring they were not able to provide shear wave velocity calculations.

After CPT operations were completed and while drilling and sampling, we also conducted pressuremeter (PMT) testing. The PMT measurements were also conducted by Gregg In Situ, Inc. using a Menard-type pressuremeter and were conducted in approximately 10 foot intervals on the upper 100 feet of the boring. The test is conducted by inserting the probe into a pre-formed test cavity at the bottom of the boring. Water is then metered from the control unit to expand the probe against the walls of the test cavity. Pressure and volume measurements are taken as the probe is incrementally expanded over a range of low to high pressures. In order to successfully conduct this test, the test cavity must remain opened long enough for the probe to be inserted. Because Boring B06-11 encountered sand in the upper reaches, we were unable to keep the cavity open and the testing was for the most part unsuccessful. The results of the PMT testing for Boring B06-18, along with a brief description of methods and procedures used are presented in Appendix D.

3.4 Standard Penetration Test Rod Energy Transfer Measurements

The borings drilled for this study were typically in excess of 100 feet deep and, in many cases, sampling was conducted from a position 100 feet above the mud line. Therefore, standard penetration tests were performed with large diameter rods made of 3.5-inch outside diameter (OD) pipe with 0.188-inch walls (NWJ) compared to the smaller standard N-rod. Rod lengths reached over 300 feet in the deeper borings. Additionally, a Mobile automatic trip hammer was used in lieu of the conventional cathead/rope/safety hammer sampling method. These changes from the traditional SPT procedures, from which N-value empirical correlations are based, required rod energy transfer measurements in the field program to develop project-specific corrections appropriate for determining the relative density of cohesionless soils or the consistency (stiffness) of the cohesive soils.

To evaluate the auto hammer/rod energy transfer, Gregg In Situ, Inc. used a Pile Driving Analyzer (PDA) to acquire and process measurements of force and velocity with every impact of the automatic hammer on the sample rods. Two strain gauges mounted on a two foot section of

NWJ rod measured force, while two piezoresistive accelerometers mounted on the same rod measured acceleration. The gauges were mounted approximately 6 inches from the top of the rod. Analog signals from the gauges and accelerometers were collected, digitized, displayed in real-time, and stored by the PDA. Data recorded for soil sample intervals from 120 to 165 feet below mud line (169 to 214 feet of rods) were used to compute the average energy transfer to the rods. The results of these measurements are included as Appendix E.

4.0 LABORATORY TESTING

Laboratory tests were performed on select soil samples from the borings to determine the pertinent physical characteristics and engineering properties. The laboratory testing program on the soils was formulated with special emphasis on the determination of their strength properties for design of foundations. Additionally, index tests including moisture contents, gradation and Atterberg limits together with consolidation tests were conducted to better establish the behavior characteristics of these soils. The parameters from these tests, combined with visual examination of the sample consistency during drilling, the penetration resistance values from the standard penetration tests, and other field measurements provide the information needed for an engineering analysis of the soils. Results of the soil tests performed on samples from each boring are presented in Appendix F, together with a brief description of each test.

5.0 LOCAL GEOLOGY, TECTONICS AND SEISMICITY

5.1 Local Geology

Two major glaciation events have occurred in the upper Cook Inlet within the last 75,000 years. During the Knik Glaciation (30,000 to 75,000 years ago), thick sequences of sediment, known as the Knik Ground Moraine, were deposited as glaciers retreated. These deposits extend from the Eagle River Valley to Point Woronzof and can be observed in the Eagle River channel and south of Fort Richardson in the Anchorage Bowl area. During the time of deposition, fresh water lakes and ponds formed and were subsequently filled by peat and clay.

The Naptowne Glaciation (11,000 to 30,000 years ago) is responsible for the majority of glacial deposits currently encountered in the Anchorage area. At its maximum, the Naptowne Glaciation extended across the Anchorage Bowl area from the north and terminated at Point Woronzof and Point Campbell (Reger et al., 1995). The Bootlegger Cove Clay was formed during this time in the ice-free areas of the basin starting around 18,000 years ago. Thick units of this clay were deposited throughout the upper Cook Inlet region. Prior to and concurrent with the deposition of the Bootlegger Cove Clays, material was being shed out of the uplifting Chugach Mountains through alluvial processes (Hamilton, 1994). Wedges of sand and gravel interfinger with and underlie the clay in many areas.

Towards the end of the Naptowne Glaciation, meltwater from the Knik-Matanuska Glacier flowed across the Anchorage area towards the south as large braided stream channels containing sand and gravel. These sands and gravels were bound to the northeast portion of the Anchorage basin by the glacier lobe and deposited as the Mountain View Fan, which underlies parts of Government Hill, Mountain View, and downtown Anchorage. This deposit overlies much of the Bootlegger Cove Formation.

Approximately 14,000 years ago, the Knik-Matanuska lobe of the glacier retreated to roughly the location of the present day Eagle River and remained in that location for the next 2,000 years (Hamilton, 1994). During this time, large amounts of material were shed from the retreating glacier and subsequently formed the Elmendorf Moraine. The Elmendorf Moraine blocked drainage of the ancestral Eagle River creating a large lake within the lower part of the valley. Major deposition ended when ancestral Eagle River cut through the Elmendorf Moraine and drained the bound lake (Dilley, 2000).

By about 11,500 years ago, glacial ice had retreated approximately 30 miles up the Knik Arm and Anchorage was ice-free. By 10,000 years ago, many mountain passes were ice-free and glaciers were near their present locations (Hamilton, 1994). Since this time, glaciers have fluctuated slightly with small surges and retreats. The waters of Cook Inlet have risen in response to a worldwide sea level increase due to melting glaciers and have subsequently flooded the valley of the Knik-Matanuska River system creating Knik Arm.

5.2 Tectonics and Seismicity

The project region is one of the most seismically active areas in the U.S. and historically subjected to large earthquakes. More than 5,000 earthquakes have been reported in the Alaska region since 1899. A list of earthquakes according to depth was obtained from the Alaska Earthquake Information Center, the locations of which are plotted on Figure 3.

5.1.1 Tectonics

The tectonics and active seismicity of the region are the result of ongoing north-northwest movement of the Pacific Plate relative to the North American Plate. The relative movement results in a region of right lateral strike-slip faulting along the eastern margin of the Gulf of Alaska and subduction along the central and western margins of the gulf. The rate of movement between these plates, approximately 6 cm per year (DeMets et. al., 1990) is relatively rapid and results in Alaska being one of the most seismically active regions of the world and the location of some of the largest, instrumentally-recorded earthquakes, including the 1964 Prince William Sound (MW[1] 9.2) earthquake.

Along the eastern margin of the Gulf of Alaska (+ 600 kilometers (km) southeast of the Anchorage area) the relative right-lateral movement between the plates is accommodated primarily by northwest-striking high-angle strike-slip faults (i.e., Fairweather and Queen Charlotte Faults). The right-lateral movement is translated northwest of the gulf into the interior of Alaska along the right lateral Denali Fault system, which extends approximately 200 km north of Anchorage.

The transition from right-lateral to subduction plate boundary is accommodated across the Yakutat Terrane or micro-plate which is located between the Pacific and North American plates in the east-central portion of the Gulf of Alaska (about 300 to 600 km east-southeast of Cook Inlet).

Along the central and western margins of the Gulf of Alaska (~300 km south of the Anchorage area), the relative plate movement is accommodated by subduction of the Pacific Plate beneath the North American Plate in the Aleutian Subduction Zone. Typical subduction zone physical characteristics include:

- A trench

  The trench demarcates the plate boundaries and the line at which one plate descends (subducts) beneath the overriding plate.

- A deformation zone or forearc at the leading edge of the overriding plate

  The front of the forearc adjacent to the trench typically consists of a wedge of accreted sedimentary and volcanic rocks scraped from the top of the subducting plate. Accumulation of accreted sediment and rock and warping of the forearc often produce a series of topographic highs (e.g., outer-arc high) and basins (e.g., forearc basin) that parallel the trench. The trailing edge of the forearc is characterized by a volcanic arc, which is the result of partial melting of the subducted plate below.

- A plunging subducted plate

  The subducted plate dips beneath the overriding plate, sometimes reaching depths of hundreds of kilometers. Partial melting of this plate at depth gives rise to the volcanic arc in the overriding plate.

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[1] Moment Magnitude (MW) is proportional to the amount of total energy released during a seismic event. It is comparable to, but not equivalent to, the magnitude for other scales (e.g. Richter).

In the Aleutian Subduction Zone, the Aleutian trench demarcates the plate boundaries. It extends approximately 3,000 km from the Gulf of Alaska, southwest and west to the Kuril trench west of the Aleutian Islands.

At the trench, the Pacific Plate dips at about 7 to 10 degrees a horizontal distance of about 150 to 280 km to the northwest. The depth and location of Wadati-Benioff zone seismicity associated with the subduction indicates that the plate dip increases to about 40 degrees beneath the overlying forarc basin (e.g., Shelikof Strait, Cook Inlet). The depth of this dramatic change in plate dip is estimated to be about 40 to 50 km. The steeply dipping portion of the plate extends to depths between 100 and 200 km based on the depth of seismicity observed in the plate.

The Kenai-Chugach Mountains physiographic province corresponds to a forearc high in the accretionary wedge in this region of the subduction zone. The Cook Inlet-Susitna Lowland physiographic province located immediately to the west-northwest of the Kenai-Chugach Mountains physiographic province is a forearc basin in which is located the Anchorage area. Beyond (west-northwest of) the basin is the volcanic arc in the Central and South Alaska Range physiographic provinces. The forearc basin in which Cook Inlet is located is undergoing both horizontal compression and dextral shearing as collision of the Yakutat micro-plate and the Kenai-Chugach Mountains physiographic province drives the Kenai-Chugach Mountains west-northwest towards the Alaska Range (Bruhn and Haeussler, 2006; Haeussler et al., 2000), resulting in potentially active folding and faulting within the basin.

5.1.2 Seismogenic Sources and Seismicity

Within the present understanding of the regional tectonic framework and historical seismicity, three broad seismogenic sources of engineering significance have been identified. These include:

- A mega-thrust source at in interface between the North American and Pacific Plates in the Alaska-Aleutian Subduction Zone.
- A deep subcrustal zone (intraslab) in the subducted Pacific Plate in the Aleutian Subduction Zone.
- A shallow crustal zone within the North American Plate.

Cook Inlet is located within a forearc basin in the shallow crustal zone and above the mega-thrust and intraslab sources. Earthquakes from each source may cause significant ground shaking at the site. The following provides a brief description of these sources, including geometry, seismicity, and likely maximum earthquake magnitudes.

Alaska-Aleutian Subduction Zone Megathrust

Megathrust or interplate earthquakes occur on the relatively shallow northwest dipping (<10 degrees) interface between the North American and Pacific Plates. Nearly the entire length of this interface has ruptured in historic times, producing several large interplate earthquakes, including the 1964 Prince William Sound (MW 9.2), 1957 Andreanof (MW 9.1), 1938 (MW 8.2 near the end of the Alaska Peninsula), and 1965 Rat Island (MW 8.7) great earthquakes (Yeats et. al., 1997). Anchorage is situated about 40 km north of the seismogenic portion of the plate interface that ruptured during the 1964 Prince William Sound (MW 9.2) earthquake.

The updip (south) extent of the seismogenic portion of the interplate was estimated by Wesson et al., (1999) as the southern limit of well recorded seismicity and the slope break of the continental shelf on the north side of the trench and at a depth of 20 km. This updip extent is in general agreement with the rupture areas for interplate earthquakes shown by Plafker et al. (1992). The down-dip (west-northwest) extent is estimated to be where the dip of Pacific Plate increases dramatically to about 40 degrees, at a depth of about 40 to 50 km. Based on this geometry, the depth of the plate interface beneath the site is about 30 km, as illustrated on Figure 5.

The rate and magnitude of mega-thrust earthquakes vary along the subduction zone. The segment of the subduction zone that underlies Kodiak Island and ruptured in 1964 produced the MW 9.2 Prince William Sound earthquake, the second largest instrumentally-recorded earthquake in the world. It is likely that this magnitude is the maximum that is generated on this subduction zone. In the probabilistic ground motion hazard study by the U.S. Geological Survey (Wesson et al., 1999), a recurrence interval of 750 years was assumed for a magnitude 9.2 event, based on stratigraphic studies in the Copper River Delta by Plafker and Rubin (1994). Significant but smaller events (e.g., magnitude 7+) occur more frequently on this rupture area, particularly in the area below Kodiak Island (Dosier et al., 2002; Sauber et al., 2006).

Alaska-Aleutian Subduction Zone Intraslab

Intraslab or Wadati-Benioff Zone earthquakes occur within the subducted Pacific Plate. These are typically located near the transition or within the steeper dipping part of the plate at or beyond (northwest of) the down-dip edge of the seismogenic plate interface (see Figure 5). Consequently, these earthquakes occur at depths of 35 km and greater. Hansen and Ratchkovksi (2001) identify at least three historic events Wadati-Benioff Zone earthquakes (in the vicinity of

Kodiak Island) with magnitudes greater than 6.9, including the 1999 MW 7 Kodiak Island Earthquake. They indicate that this was a dip-slip event on a northwest dipping plane parallel to the subduction zone and was the result down-dip tensional forces in the more steeply dipping portion of the subducted plate.

Shallow Crustal Sources

While much of the shallow crustal seismicity within forearc is a result of convergence of the North American and Pacific Plates, much of the shallow crustal seismicity in the North American Plate has generally not been associated with specific faults or structures.

Haeussler et al. (2000) identify several faults and potentially fault-cored folds in upper Cook Inlet basin. Holocene scarps and recorded historical seismicity have been observed on the largest of these structures, the Castle Mountain Fault. The Castle Mountain Fault has been mapped over a total length of approximately 475 km. As shown in the upper map in Figure 6, the fault trends east-northeast/west-southwest approximately parallel to the northwest shore of the Cook Inlet. At its closest approach, it is about 40 km northwest of the site. Evidence of Holocene (11,000 years before present [ybp]) displacement has been observed along an 80 km long portion of the fault in the Susitna lowland north of Anchorage.

The fault displays evidence of both right-lateral strike-slip and reverse slip components. The north side is displaced upward relative to the south side along a steep, north-dipping fault plane. Slip during the Holocene Epoch on the Castle Mountain Fault has been predominately strike-slip with a component of dip-slip movement indicated by displacement of Holocene features and sediments. In the Susitna lowland, a Holocene sand ride is displaced 23 feet (7 meters [m]) in a right-lateral sense while near-surface sediments have been displaced vertically 7.5 feet (2.3 m).

Because there is no documented evidence for displacement along the Castle Mountain Fault during historical time, the maximum earthquake magnitude was estimated from available seismological and geological data. A magnitude Ms[2] 7.0 earthquake occurred in the vicinity of the Castle Mountain Fault west of Anchorage in 1933. Due to the poor accuracy of epicenter location at the time and a lack of surface displacement investigations, it is not known if the earthquake occurred on the Castle Mountain Fault.

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[2] Surface Wave Magnitude (M_s) relies on the amplitude of the surface waves with periods of 20 seconds, which are recorded at great distances.

Using Slemmons (1982) relationship between maximum earthquake magnitude and source parameters (maximum surface rupture length, total length, fault area, or displacement per event), Woodward-Clyde Consultants (1982) have estimated the maximum magnitude for the fault to be about 7.5. Assuming an average slip rate of approximately 5 millimeters per year (mm/yr), they also estimate the average recurrence interval for a maximum magnitude 7.5 on the Castle Mountain Fault to be approximately 235 years. Wesson, et al. (1999) in their probabilistic ground motion hazard study for the State of Alaska also determined that a likely maximum magnitude for this fault is about 7.5, but they used a slip rate of 0.5 mm/yr to estimate a recurrence rate of 1,300 years.

Another prominent crustal fault in the region is the Border Ranges Fault, which can be traced approximately 1,000 km northeastward from Kodiak Island, across the Kenai Peninsula, and along the northern front of the Chugach Mountains. At its closest approach, this fault is about 12 km southeast of the site (see upper map of Figure 6). The fault is mapped as a north-dipping reverse fault separating upper Paleozoic and lower Mesozoic rocks on the north from Upper Mesozoic and Tertiary rocks on the south and is interpreted to be an ancient subduction zone (suture zone) of Mesozoic to early Tertiary age. As the active subduction zone has since migrated southeastward to the Aleutian trench, it is generally believed that this fault is inactive. However, geologic mapping in the southern Kenai Peninsula by John Kelley (1981) suggests possible reactivation by more youthful faulting along a small portion of the ancient Border Ranges zone. This would be consistent with the faulted basin margins and fore-arc tectonic model of the area as proposed by Dickinson and Seeley (1979).

6.0 SUBSURFACE CONDITIONS

The following summary discussion is based upon the field and laboratory results from 19 new borings and two shoreline borings, five CPT soundings and shear wave velocity measurements, and pressuremeter testing at two locations. The detailed results of this work are presented in Appendices A through F.

6.1 Channel Crossing Soils

The soils across the channel and in the bluffs are of glacial or marine origin and, except for near surface deposits in the main channel bottom, are generally dense to very dense or very stiff to hard. The glacial geology in this area appears to be complex and has developed as a result of a number of glacier advances and retreats, scouring and redeposition as tills in both glacial lake and marine environments, and consolidation of deposits due to glacier over riding. Based on surface exposures, these depositional characteristics are not only present below the waters of Knik Arm and the mudflats, but also exist in the steep bluffs on both sides of the channel.

Four basic geologic units appear to have been penetrated with the deep borings and are summarized in descending order as follows:

1. Recent Channel Marine Deposits,
2. Glacial Till or Moraine Deposits,
3. Glacial Lake Clays or Marine/Alluvial Sands, and
4. Possible Knik Tills.

6.1.1 Recent Channel Marine Deposits

Up to 35 feet of loose to medium dense silty to clean fine sands are present in the center of the channel and were observed in Borings B06-06 through B06-13. A thinner layer of these recent deposits, approximately 10 feet thick, was also observed in the more easterly borings, B06-16 through B06-19. We believe these are recent marine deposits that are somewhat mobile and tend to shift over time as sand dunes with the changing currents and tides. The recent sand deposits were not observed on the west side, outside the channel, except for infill in the shallow water around the Port Mackenzie dock structure. This suggests that the west side of the channel may be subjected to stronger erosive forces.

6.1.2 Glacial Till or Moraine Deposits

This unit was observed in the west side, outside of the main channel and was absent in the main channel, where it appears to have been eroded, or on the east side. Its general lack of apparent bedding or well-defined structure suggests that it is a glacial till. In addition to its lack of structure, it is characterized as both a clayey gravel and gravelly sand because of its changing mixture of particle sizes noted on the grain size plots in Appendix F. In general, its fine contents are relatively low when compared to the coarse grained components. It is also consistently very dense or hard with Standard Penetration Resistances generally in excess of 50 blows per foot (bpf) and frequently in excess of 100 bpf.

Our borings generally encountered a layer of coarse gravel and cobbles covering the till deposit. We believe that this layer of coarse material is the result of erosion forces on the west side mudflat. The layer was thinner closer to the shore, approximately 15 feet and became increasingly thicker towards the main channel. Blow counts in these deposits were generally higher than 50 bpf, this combined with the presence of cobbles slowed down the advancing of our borings and in Boring B06-03 forced us to terminate the boring at approximately 20 feet below seafloor.

Water contents range widely between approximately 10 and 25 percent, and where it was cohesive, Atterberg limit tests show that it is a CL according to the Unified Soil Classification System (Appendix F, Table F-2) or has low plasticity characteristics.

More detailed soil descriptions and test results on this unit can be obtained from the boring logs in Appendix A and the laboratory test results on select samples in Appendix F.

6.1.3 Glacial Lake Clays or Marine/Alluvial Sands

Once the upper till-like unit or the loose marine deposits are penetrated, the borings encountered a thick clay/sand deposit, probably the most dominant geologic unit beneath the channel. This unit is distinguished from the till-like soils by its general lack of gravel particles with the exception of a few gravelly zones.

a. Alluvial Sands

The sand is classified as a dense to very dense, gray, clean to silty fine sand generally grading into a sandy silt to the east. From gradation results in Appendix F, the Unified Soil Classification symbol of the fine sand is largely an SP or SP-SM and the silty sand to sandy silt an SM or ML. Locally the fine sand appears to be deposited as a glacial rock flour, and seldom exceeds 20 percent fines, has little apparent cohesion, and is nonplastic in many cases.

Cone data were taken adjacent to Boring B06-11 in the sand deposit from 10 to 20 feet in depth. Measured CPT tip resistances generally increased with depth from approximately 40 tons per square foot (tsf) at the top of the CPT record to 160 or more tsf at the bottom of the record. Friction ratios values are about 1 percent (non-normalized) and 2 percent or slightly more (normalized) which is typical of a granular soil. The inferred soil behavior classification, based on the CPT data, is silty sand and sand using non-normalized data and silt mixtures using normalized data.

The average density properties of this granular unit are best taken from Borings B06-06 through B06-11 as each penetrates a thick part of this unit. Uncorrected N values correlated with elevation are plotted on Figure 5. Figure 5 reflects substantial scatter although there appears to be a consistent increase in relative density or consistency with depth.

b. Glacial Lake Clays

The clay beneath the eastern part of the channel is classified as a stiff to hard, gray, clay with generally low plasticity characteristics. Typical shear strengths versus elevation for the fine-grained soils encountered during drilling are summarized on Figure 6. This figure provides a summary plot of the laboratory shear strength results including unconfined compression tests, triaxial tests, and pocket penetrometer measurements and generally shows consistent strengths with depth with most values falling in or above the 2 to 5 tons per square foot (very stiff to hard) range.

A summary of the Mohr Circles from numerous unconfined compression tests and unconsolidated, undrained triaxial compression tests is presented on Figure 7. Unconfined compression test results for individual samples are presented in Appendix F, Figure F-3. The triaxial tests are presented in Appendix F, Figure F-4, and were conducted with a confining pressure close to the in situ effective confining pressure.

Limited cone data were taken adjacent to Borings B06-17 and B06-18 to check the strength and uniformity of the clays. Measured CPT tip resistances in the 7 to 140-foot depth range were generally consistent around 40 tsf, and had friction properties that are typical of a competent cohesive soil as opposed to a granular unit. Low calculated friction ratios of between 2 and 2.5 percent and an inferred soil behavior classification suggests that, based on CPT data in the 7 to 140-foot depth range, the clays may have silt, sandy silt and silt mixture properties. As noted above, the friction ratios for the sands in CPT B06-11 had slightly lower friction ratios of 1 percent (non-normalized) and 2 percent (normalized) and silty sand and sand using non-normalized data and silt mixtures using normalized data. This suggests that the behavior differences between the glacial lake clays and alluvial sands are small and reflective of a larger unit deposited under a similar geologic environment, only one has slightly more fines than the other.

The average shear velocities were about 1,050 ft/sec in the clayey soils found at Boring B06-18.

More detailed soil descriptions and test results on this sand/clay unit can be obtained from the boring and cone logs in Appendices A and B, the shear wave velocity and drill rod energy transfer results in Appendices C and D, and the laboratory test results on select samples in Appendix F.

6.1.4 Possible Knik Tills

This is the deepest unit encountered in the borings. Instead of being the typical very dense sands and gravels found in deep borings throughout the Port of Anchorage and downtown Anchorage areas, it is classified as a very dense, gray clean to silty granular formation grading from sand to coarse gravel and cobbles. Average N values were generally over 50 bpf and often in excess of 100 bpf. We believe that four of our borings, B06-04, B06-06, B06-07 and B06-11, penetrated this deposit, at elevations ranging from approximately -180-ft to -225-ft. It is noted that borings adjacent to the ones that penetrated the Knik Till were often advanced below the aforementioned elevations suggesting that the till depth is variable within the area. This deposit was also generally associated with artesian pressures encountered on the borings that penetrated it.

6.2 East Shoreline Soils

The soils along the east shoreline of Knik Arm are characterized by Boring A03-7. Boring A03-7 drilled approximately 2,000 feet south of the concept alignment, encountered conditions similar to those in the east side of the channel, but with generally higher blow counts. Like the nearest off-shore borings, Boring A03-7 encountered a soil profile comprised mostly of hard Glacial Lake clays. A layer, approximately 70 feet thick, of till like material was noted from 50 to approximately 120 foot below ground surface. Beneath this layer of till, the boring again encountered hard clay to approximately 193 feet below ground surface where till material was noted again. Blow counts through the boring were in general above 50 bpf and often over 100 bpf and shear strength values from pocket penetrometer readings were above 4.5 tsf. One unconfined test was performed on a sample from this boring with a result of 9.5 tsf.

More detailed soil descriptions and test results on this sand/clay unit can be obtained from the boring log in Appendix G.

6.3 West Shoreline Soils

The soils along the west shoreline are characterized by Boring B05-1. Based on information available from Boring B05-1, the west shoreline has a similar profile to that encountered on the off-shore borings performed on that side of the channel.

A glacial till deposit overlaying hard clay was observed in the boring. The blow counts in this unit were, in general, above 50 bpf. Following this unit, the boring encountered hard silty clay overlying dense to very dense silty sands that we believe to be part of the alluvial sands/ glacial lake clays deposits. The blow counts on these units ranged between 30 and more than 50 bpf. Pocket penetrometer readings on samples taken from the clay unit show strengths in general higher than 4.5 tsf. Readings from a sample taken approximately at the transition from clay to sand showed slightly lower values.

7.0 CLOSURE AND LIMITATIONS

The analyses and subsurface interpretations contained in this report are based on site conditions as they existed during our 2006 explorations. It is assumed that the existing data is representative of the subsurface conditions throughout the site, i.e., the subsurface conditions everywhere are not significantly different from those disclosed by the existing data.

Unanticipated soil conditions are commonly encountered and cannot fully be determined by taking soil samples or advancing borings. Such unexpected conditions frequently require that additional expenditures be made to attain a properly constructed project. Therefore, some contingency fund is recommended to accommodate such potential extra costs. Shannon & Wilson has prepared the attachment in Appendix I "Important Information About Your Geotechnical/Environmental Report" to assist you and others in understanding the use and limitations of the reports.

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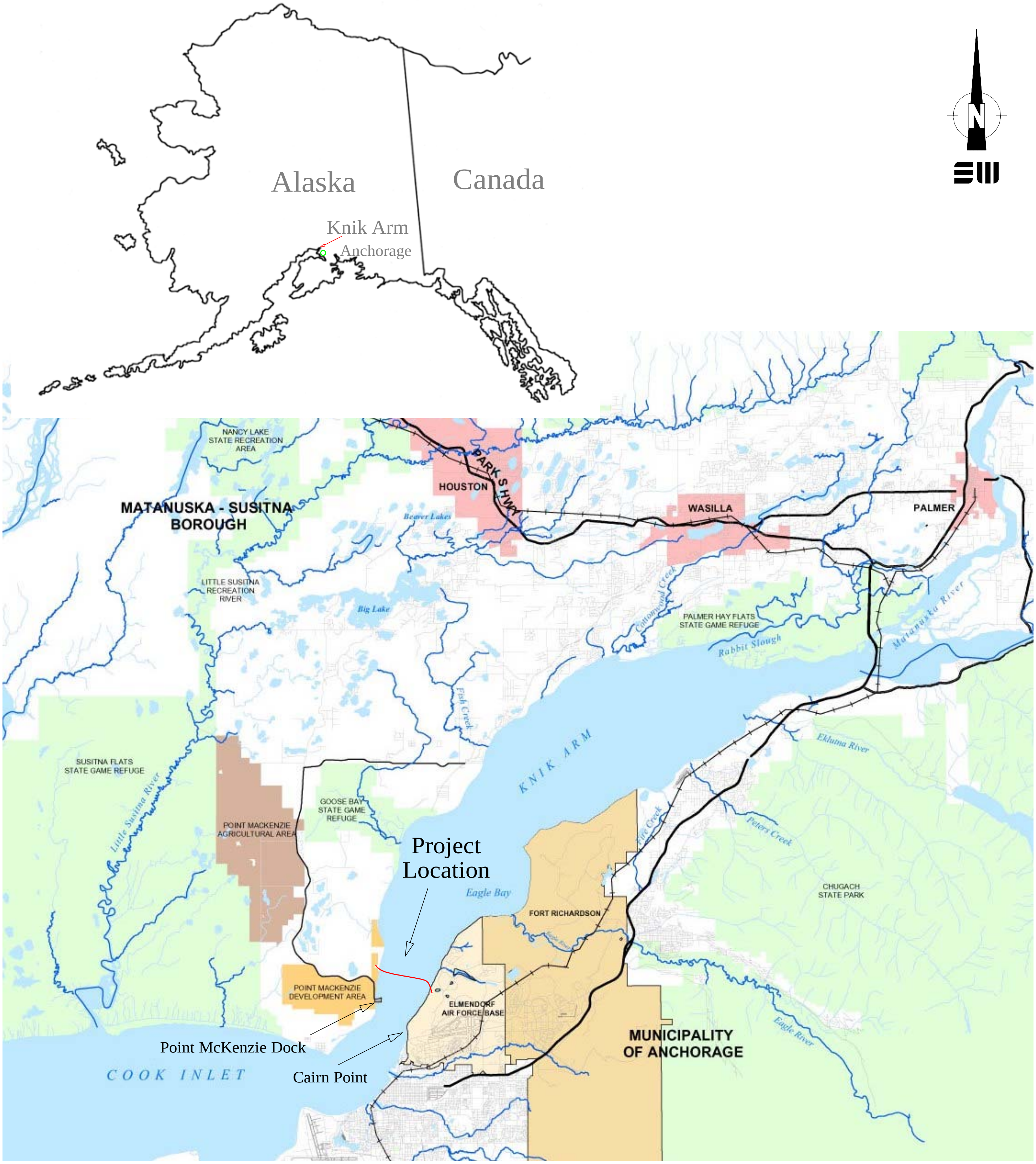

Drawing adapted from http://www.knikarmbridge.com/project.html

Knik Arm Crossing
Knik Arm, Alaska

VICINITY MAP

March 2007
32-1-01536-004

DRAWING NOT TO SCALE

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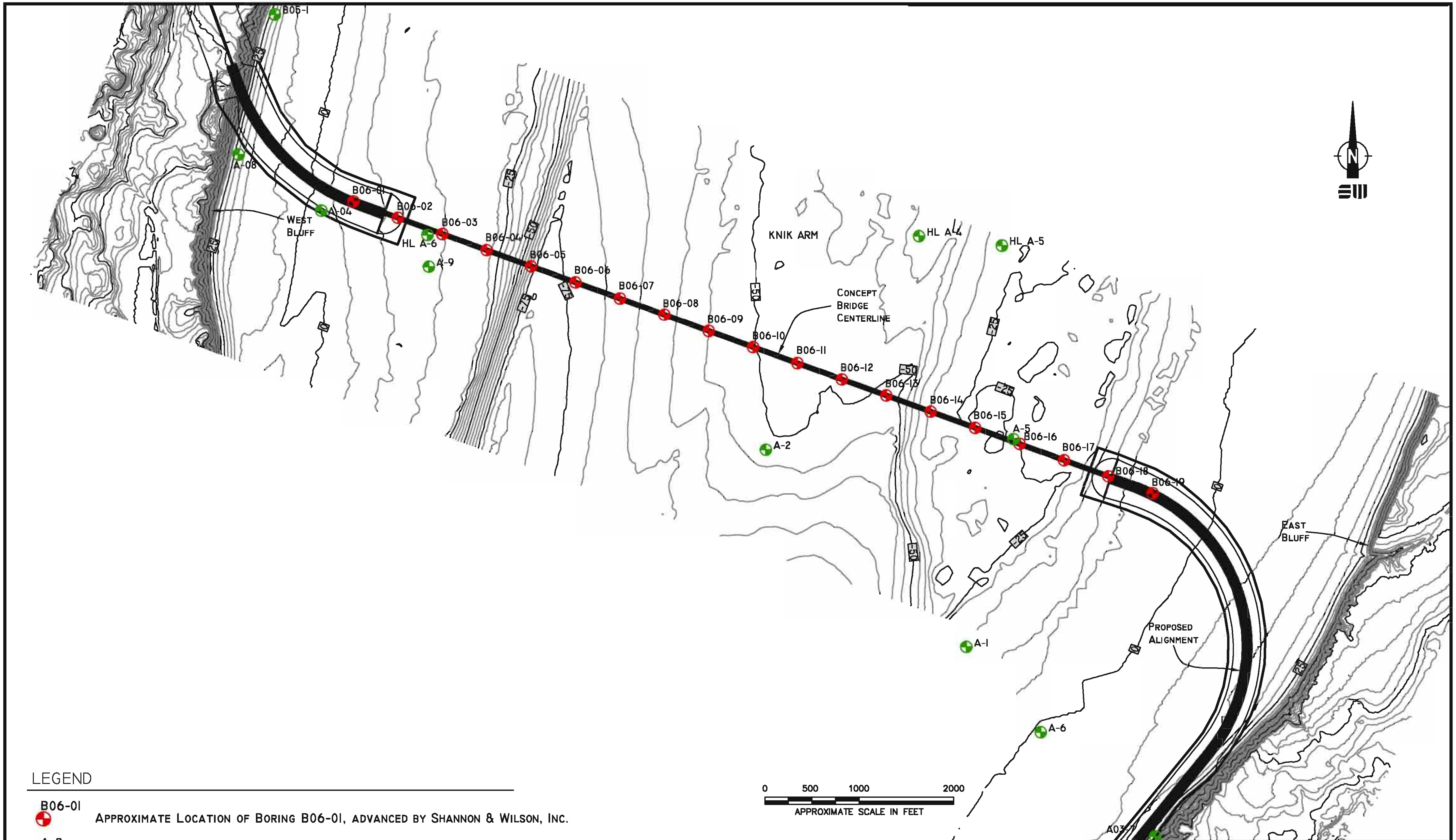
Fig. 1



LEGEND

B06-01 Approximate Location of Boring B06-01, advanced by Shannon & Wilson, Inc.

A-2 Approximate Location of Prior Exploration Borings by Shannon & Wilson and others.

0 Approximate Elevation in Feet MLLW (Mean Lower Low Water)

Drawing Adapted from PND 2006 Concept Alignment Studies

Knik Arm Crossing
Knik Arm, Alaska

BORING LOCATION PLAN

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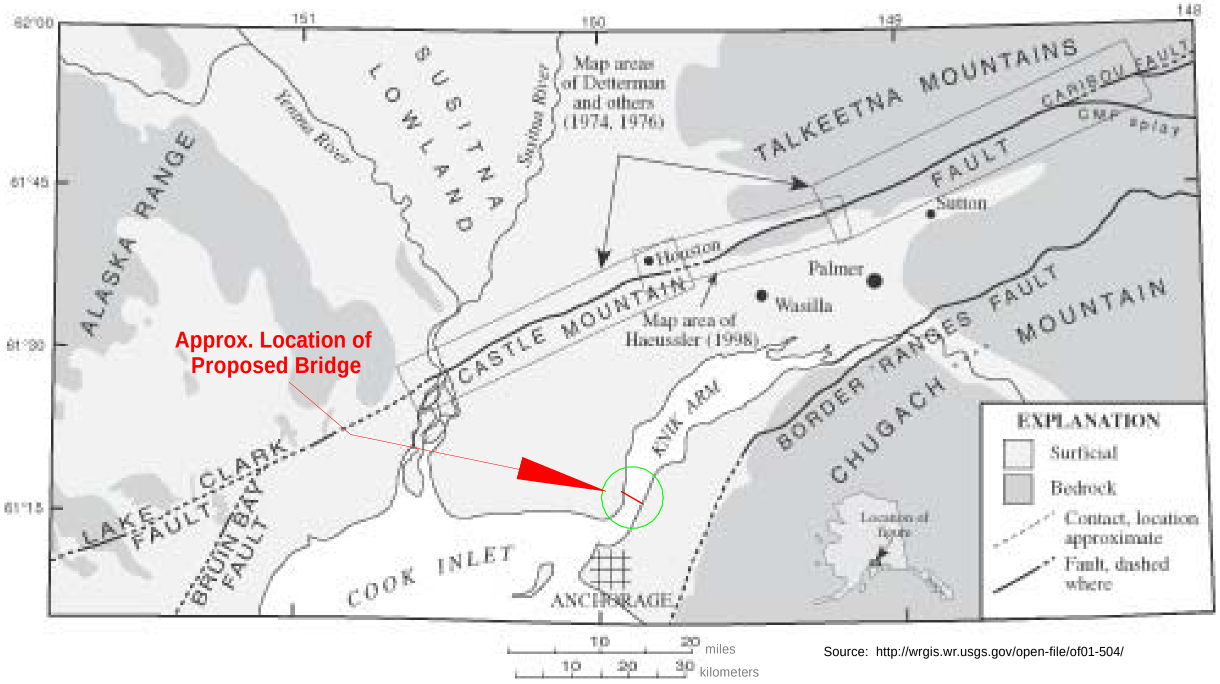
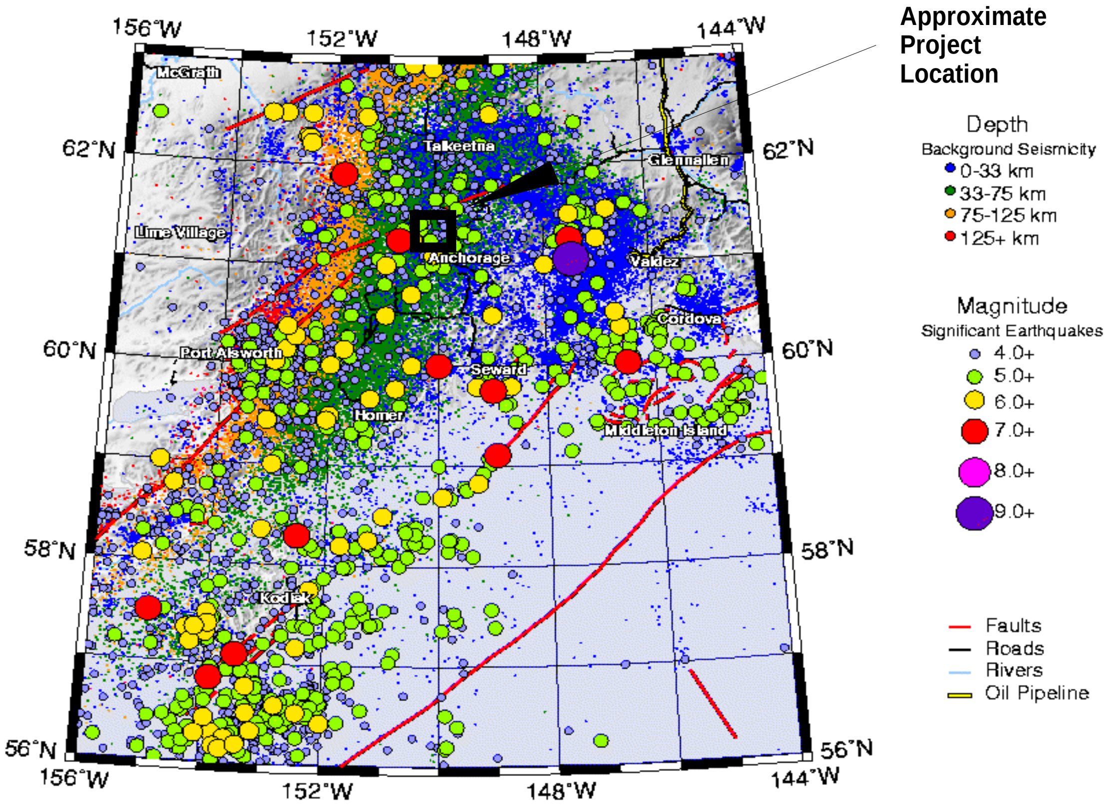
Fig. 2

Castle Mountain and Border Ranges Faults, Alaska



Source: http://wrgis.wr.usgs.gov/open-file/of01-504/

South Central Alaska Seismicity, 1899 - 2004



Source: http://www.aeic.alaska.edu/maps/southcentral_seismicity_map.html

Knik Arm Crossing
Knik Arm, Alaska

FAULTING AND EARTHQUAKE MAP

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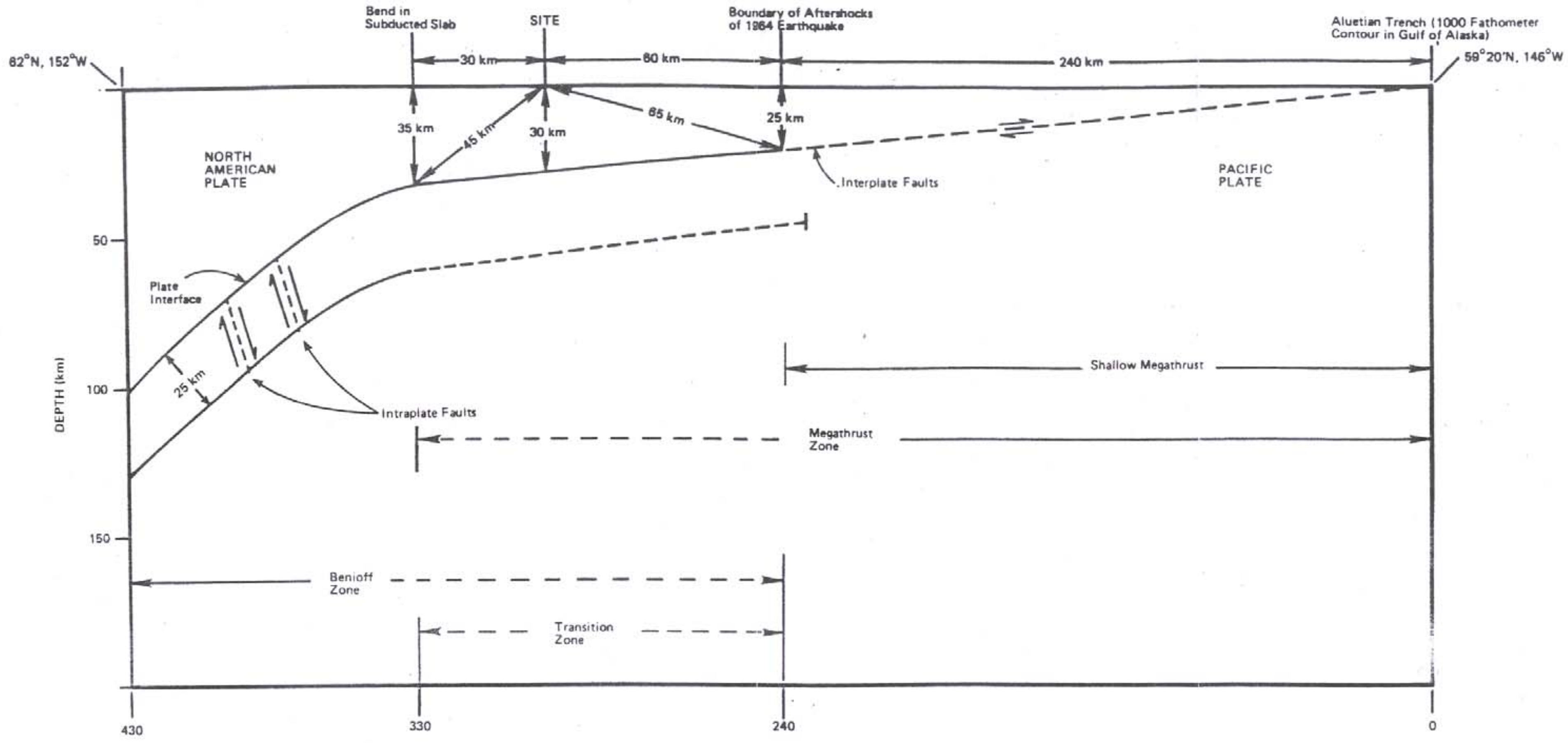
Fig. 3



Taken from Harding Lawson Associates, 1984

Knik Arm Crossing
Knik Arm, Alaska

SEISMIC PROFILE IN
KNIK ARM AREA

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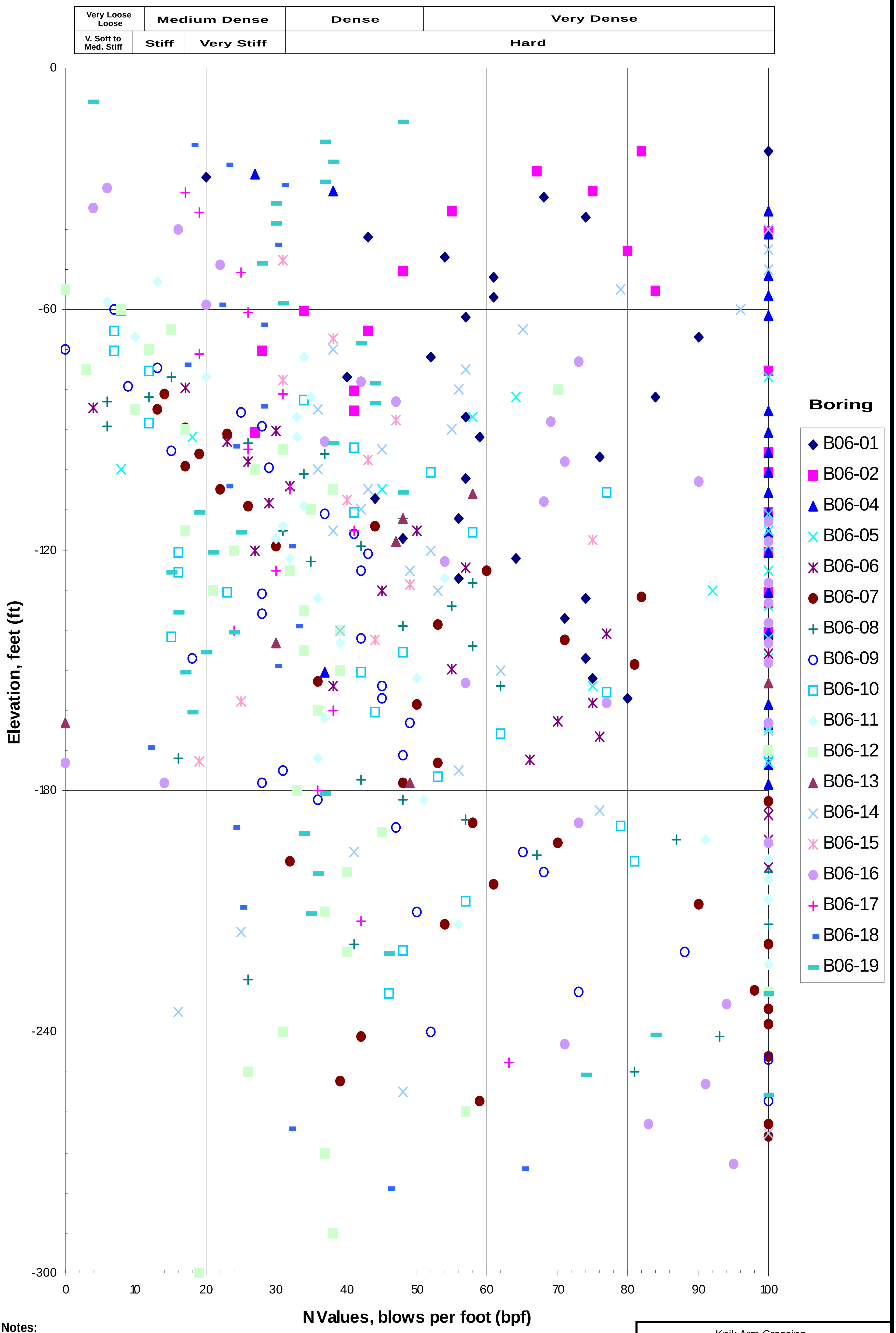
Fig. 4



Notes:

1. N values are Standard Penetration Test Results
2. N values are uncorrected for energy loss and confining pressure effects
3. All N values greater than max (50 blows for 6 inches or 10 blows for 0 inches) are plotted as 100
4. Elevation data: MLLW
5. See Appendix A for boring log details and recorded N values

Knik Arm Crossing
Knik Arm, Alaska

PENETRATION RESISTANCE VS. ELEVATION

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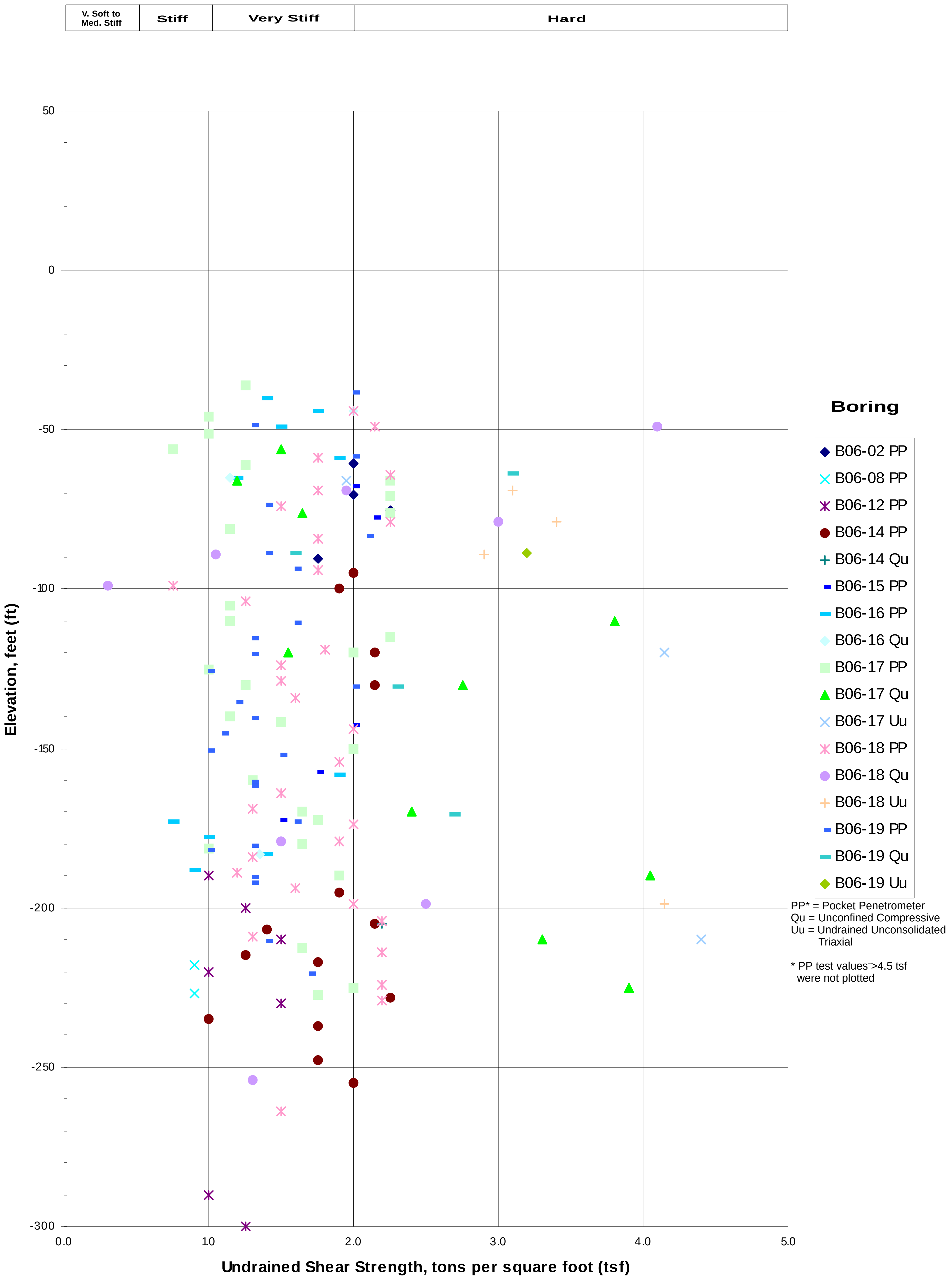
Fig. 5



PP* = Pocket Penetrometer
Qu = Unconfined Compressive
Uu = Undrained Unconsolidated
Triaxial

* PP test values >4.5 tsf
were not plotted

NOTES:
1. **Undrained Shear Strength can be approximated as ½ of unconfined compressive strength from PP and Qu tests.**
2. **The above plotted values for PP and Qu tests represent ½ of the measured values.**
3. **The above plotted values for Uu represent ½ of the deviator stress from triaxial tests.**
4. **Elevation datum: MLLW**
5. **See Appendix F for laboratory test procedures and results.**

Knik Arm Crossing
Knik Arm, Alaska

TYPICAL CLAY STRENGTHS

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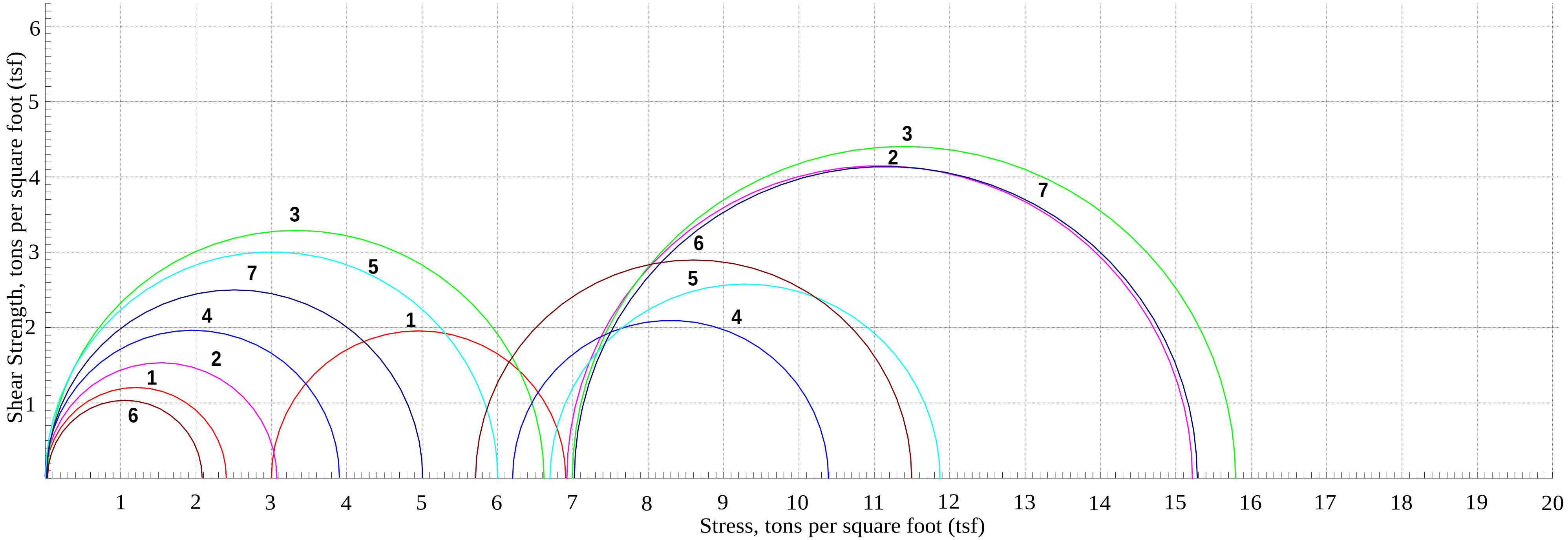
Fig. 6



		Unconfined Compressive Test (Qu)			Undrained Unconsolidated Triaxial Test (Uu)					
	Boring No. Sample No.	Depth bgs (ft)	Applied Vertical Stress (tsf)	Calculated Shear Strength (tsf)	Depth bgs (ft)	Applied Vertical Stress (tsf)	Normal Stress (tsf)	Deviator Stress (tsf)	Calculated Shear Strength (tsf)	
			σ_1	τ		σ_1	σ_3	σ_1-σ_3	τ	
1	B06-17 S8	43	2.4	1.2	44	6.9	3.0	3.9	1.95	Very stiff to hard CLAY (CL)
2	B06-17 S18	97	3.1	1.6	96	15.2	6.9	8.3	4.15	Very stiff to hard CLAY (CL)
3	B06-17 S36	187	6.6	3.3	188	15.8	7.0	8.8	4.4	Hard CLAY (CL)
4	B06-18 S9	59	3.9	2.0	60.5	10.4	4.2	6.2	3.1	Hard CLAY (CL)
5	B06-18 S11*	69	6.0	3.0	70.5	11.8	5.0	6.8	3.4	Hard CLAY (CL)
6	B06-18 S13	80	2.1	1.1	80.5	11.5	5.7	5.8	2.9	Very stiff to hard CLAY (CL)
7	B06-18 S35	190.5	5.0	2.5	189.5	15.3	7.0	8.3	4.15	Hard CLAY (CL)

* Lower calculated shear strength yielded by the test on B06-18 S11(relative to calculated shear strength yielded by Qu test on the same sample) may be the result of isolated variations in the soil sample.

NOTES:
1. See Appendix F for laboratory test procedures and results.
2. Unconfined Compressive tests and Undrained Unconsolidated Triaxial tests run on the same sample at different intervals.

Knik Arm Crossing
Knik Arm, Alaska

MOHR CIRCLE DIAGRAMS

March 2007
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Fig. 7

APPENDIX A

DRILLING AND SAMPLING PROCEDURES AND RESULTS

TABLE OF CONTENTS

LIST OF FIGURES

APPENDIX A
DRILLING AND SAMPLING PROCEDURES AND RESULTS

A-1 Over-water Drilling

Nineteen over-water borings, designated Borings B06-01 through B06-19, were accomplished to depths ranging from 20 to 275 feet below the mudline at the locations shown on Figure 2. The log of each boring is presented in Figures A-2 through A-20. The over-water borings were drilled by Gregg Drilling from Signal Hill, California, using a Mobile B80-22 drilling rig with a 22-foot stroke. Support equipment included 24-inch, 18-inch and 12-inch outer starter casing, 6-inch inner drill casing, mud rotary drilling tools with a wireline system of rods and samplers, a floating barge with four anchor mooring system for deep water locations, and a jack-up platform for locations with less water depth and/or less current. The drilling operations were continuously monitored by field engineers or geologists from Shannon & Wilson, Inc.

Mid-channel water depths were beyond the operational limits of the jack-up platform mobilized by Gregg Drilling; therefore, the over-water drilling was performed in two separate programs. On the first program, six borings, Borings B06-05, B06-06, B06-07, B06-08, B06-09 and B06-10, were drilled from a floating barge provided by Cook Inlet Tug and Barge of Anchorage, Alaska. The barge had a flat deck with plan dimensions of approximately 160 feet by 40 feet. The barge was equipped with a 24-inch diameter moon pool, work and emergency skiffs, and covered work space. The barge was positioned for each boring with a tug and anchored with four 8,000 pound anchors. The anchors were set on each of the corners and operated by Gregg Drilling personnel. The anchors were typically able to hold the barge in position in currents up to 6 knots; however, lateral displacements of up to 10 feet were experienced with changing currents and tide levels. Drilling was carried out on a 24-hour basis.

The drilling work was completed over three work periods to take advantage of the more favorable tide conditions in August of 2006. The first period started on August 3 and ended on August 11, 2006, during which time two borings, B06-06 and B06-09, were completed. Boring B06-10 was started during this period, but could not be completed because of a broken drill casing. During the first days, the tides were within a 20-foot range reaching a 30-foot range at the end of this period.

The second work period started on August 16 and finished on August 22, 2006, and resulted in three additional borings, B06-05, B06-07 and B06-08. From tide tables, the tide range for this period was 20 to 25 feet. On the third period, August 25 to 28, 2006, we completed Boring B06-10.

Location control over-water was established by Shannon & Wilson representatives and the barge/platform supervisor using a Thales MobileMaper CE Onboard Differential Global Positioning System (GPS) survey instrument. The instrument is accurate to within 1 meter (3 feet); considering the relative difficulty of positioning the barge within the Knik Arm currents, the accuracy for most drill locations is estimated to be within about 10 feet of the planned location. Vertical depths or mudline elevations were checked by direct measurements from the deck using a digital depth finder/eco sounder. The elevation datum for these measurements and the project datum were taken as MLLW.

After the barge was towed nearby the proposed boring location and the anchors were dropped approximately 500 feet away from each corner, the final position was adjusted by means of the winches. Once the barge was secured into position, each boring was initiated by setting 24-inch and 12-inch casings through the water. The boring was then advanced using mud rotary methods, and a third 4.5-inch diameter drill rod/casing with drill bits and three different wireline and/or drive samplers. The third drill rod/casing was carried down with the hole as drilling advanced to control caving of the borehole walls.

Due to the extreme tidal range, often in excess of 25 feet, the cables had some slack to accommodate the variable water depths, which resulted in the aforementioned small displacements of the platform bending the drill string. Gregg Drilling selected a drill pipe that would tolerate high bending angles to accommodate this condition. However, the bending, combined with the effects of the strong currents associated with the tides, pressed the inner drill string against the outer casing, often impeding the advancement of the boring.

Additionally, because of the variable water depth, it was necessary to add and remove segments of both outer casing and drill string as the tides changed, further slowing down the drill process. In the first two borings, in order to minimize this, the 12-inch casing was not lowered into the soil, but kept approximately 30 feet above seafloor. This set up was found to increase the pressure applied to the 4.5-inch drill string and, because the casing would remain relatively straight through the water column, exaggerated the bending angle on the 4.5-inch drill string beyond acceptable parameters resulting in damage to the drill string. After observing this, the other four borings were advanced with the 12-inch casing advanced into the seafloor. We observed an improvement with this method; however, as currents exceeded 4 to 5 knots the combination of bending angle and pressure still resulted in enough binding pressure that we were unable to continue drilling operations.

The remaining 13 borings were drilled from a 50-foot by 50-foot jack-up platform with four 115-foot long legs equipped with a center moon pool, a small crane, work and emergency skiffs, a flow meter and a covered work space. This jack-up platform, owned by Seacore, LTD from Gweek, England, is a modular unit, which for this project consisted of 7 floats pinned together. The platform is raised and lowered using jacks with a 10-foot stroke operating at a rate of roughly 5 feet per minute. The legs are 30-inches in diameter by 1-inch thick wall steel pipes and were rigged to work in up to 85 feet of water and accommodate 4 to 6 knot currents, depending on water depth. Cook Inlet Tug and Barge provided the tug to move the platform to each drill location.

The drilling work was completed over two work periods to take advantage of the more favorable tide conditions in September and October 2006. The first period started on September 2 and ended on September 6, 2006, during which time two borings, B06-03 and B06-16, were completed. Boring B06-19 was started during this period but was not completed, as observed currents exceeded the operational safety limits of the platform.

The second work period started on September 13 and finished on October 4, 2006, and resulted in 10 additional borings, five CPT soundings and down-hole shear wave velocity measurements and pressuremeter testing in Borings B06-11 and B06-18.

Drilling progressed smoothly except for drilling time that was lost during moves and casing setups when strong current and adverse tide conditions forced delays, and in Borings B06-03 and B06-04, where the presence of cobbles and boulders at seafloor impeded the advance of the boring. In most cases the platform base was jacked to about Elevation +30 feet for drilling with minor height adjustments to accommodate tide conditions that were estimated from local tide tables. Drilling was carried out on a 24-hour basis.

Once the platform was jacked up on its four legs to the elevation needed for stability, each boring was initiated by setting 12-inch and 6-inch casings through the water and seating it into the soil below. The boring was then advanced using mud rotary methods, and a third 4.5-inch diameter HWT drill rod/casing with drill bits and three different wireline and/or drive samplers. The third drill rod/casing was carried down with the hole as drilling advanced to control caving of the borehole walls.

A-2 Over-water Sampling

As a boring was advanced, sampling was generally accomplished at 5-, 7.5-, 10- and 15-foot depth intervals using both disturbed and undisturbed sampling procedures. Samples were visually classified according to the Unified Soil Classification System (USCS) included as Figure A-1.

The three samplers generally used for the off-shore work were as follows:

Disturbed Samplers

1. Two-inch OD split spoon sampler using standard penetration test (SPT) procedures,
2. Push core wireline 5-foot core barrel with a rugged 3-inch inner tube designed to recover large gravelly samples, and

Undisturbed Samplers

3. Three inch diameter by 36 inches long thin wall tubes (Shelby Tubes) advanced with wireline spring loaded core barrel (similar design to Pitcher Barrel) and with conventional push rod system.

With the SPT method, a 2-inch OD split-spoon sampler is advanced 18 inches into the undisturbed soil at the bottom of the advancing boring, with blows of a 140-pound auto-hammer falling 30 inches on the drill rods. The number of blows required to produce the final 12 inches of an 18-inch penetration of the hammer, defined as the Standard Penetration Resistance, was recorded for each sample by our representative. When hard or very dense soils or coarse gravels were encountered, the sampler often could not be driven the full 18 inches, or in some cases even 12 inches. The blow counts, or N values, which are noted on the logs, are uncorrected values and provide a means of evaluating the consistency (stiffness) for cohesive soils and relative density (compactness) for cohesionless soils. When a full 18 inches penetration was not achieved, blows and the penetration achieved are recorded on the logs. To aid in evaluating the above uncorrected N values, particularly for sandy soils, energy transfer studies were conducted to measure the energy losses between the hammer and the top of the rods and between the hammer to the bottom of the rods (or near sampler) for various lengths. The results of these measurements are presented in Appendix E.

The push core wireline sampler was used sparingly or only when recovery of material by other methods was poor. It has a catcher at the bottom and allows recovery of up to a three inch diameter by four foot long disturbed sample. Because this sampler recovers disturbed material and provides no driving resistance or estimate of soil density or consistency, it was used as a final choice when sample recovery was not possible using the other two methods.

The final sampler is the thin walled tube that was advanced with conventional push rod techniques or with a modified Pitcher Barrel sampler. With the modified Pitch Barrel sampler, the wireline barrel advances the thin wall tube by a spring loaded piston inside a coring barrel. As the coil spring compresses, the rotating outer barrel cuts away the soil around the outside of the tube, reducing side friction and allowing the spring to direct its load to forcing the tube into the undisturbed soil at the bottom of the advancing boring. The barrel’s carbide cutting teeth can usually cut to within an inch or less of the lower tube end in hard soils permitting good recovery of a near full tube of soil. However, we observed that occasionally, in hard cohesive soils, the recovery with this kind of sampler was not optimal. For this situation, we used conventional push rod methods, on which the sampler tube is attached to the end of the drill rod. Samples are recovered by pushing the tube into the soil at the bottom of the advancing boring using hydraulic ram pressure from the rig. The sampling device was allowed to stay in the hole for approximately 5 minutes, to allow the sample to adhere to the tube. The sampling tube was then removed from the bottom of the boring. Samples recovered in these tubes were sealed at the ends with plastic caps then placed and fixed in an upright position for transporting to our Anchorage laboratory. Classifications of Shelby tube samples that were extruded are included as Figure A-21 (29 sheets).

Cone penetrometer test (CPT) soundings were performed at five boring locations to further evaluate the properties of the soils, particularly the uniformity of the thick silty clays and fine sands and their relative strength or density properties. The CPT measurements were conducted by Gregg In Situ, Inc. The results of these soundings are presented in Appendix B. In addition to the CPT soundings, on two of the borings, we also conducted shear wave velocity measurements by means of a seismic CPT system and pressuremeter testing (PMT) with a Menard-type pressuremeter. The results of these tests are presented in Appendix C and Appendix D, respectively.

Unified Soil Classification System

GROUP NAME **Criteria for Assigning Group Names and Group Symbols**				**Soil Classification Group Symbol with Generalized Group Descriptions**	
COARSE-GRAINED SOILS more than 50% retained on No. 200 sieve	GRAVELS 50% or more of coarse fraction retained on No. 4 sieve	Clean GRAVELS Less than 5% fines	▨	GW	Well-graded Gravels
			▨	GP	Poorly-graded Gravels
		GRAVELS with fines More than 12% fines	▨	GM	Gravel & Silt Mixtures
			▨	GC	Gravel & Clay Mixtures
	SANDS More than 50% of coarse fraction passes No. 4 sieve	Clean SANDS Less than 5% fines	▨	SW	Well-graded Sands
			▨	SP	Poorly-graded Sands
		SANDS with fines More than 12% fines	▨	SM	Sand & Silt Mixtures
			▨	SC	Sand & Clay Mixtures
FINE-GRAINED SOILS 50% or more passes the No. 200 sieve	SILTS AND CLAYS Liquid limit 50% or less	INORGANIC	▨	ML	Non-plastic & Low-plasticity Silts
			▨	CL	Low-plasticity Clays
		ORGANIC	▨	OL	Non-plastic and Low-plasticity Organic Clays Non-plastic and Low-plasticity Organic Silts
	SILTS AND CLAYS Liquid limit greater than 50%	INORGANIC	▨	CH	High-plasticity Clays
			▨	MH	High-plasticity Silts
		ORGANIC	▨	OH	High-plasticity Organic Clays High-plasticity Organic Silts
HIGHLY ORGANIC SOILS	Primarily organic matter, dark in color, and organic odor		▨	PT	Peat

Organic Content

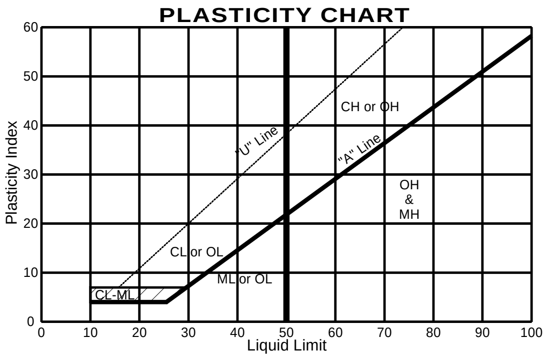
Adjective	Percent by Volume
Occasional	0-1
Scattered	1-10
Numerous	10-30
Organic	30-50, minor constituent
Peat	50-100, MAJOR constituent

Descriptive Terminology Denoting Component Proportions

Description	Range of Proportion
Add the adjective "slightly"	5 - 12%
Add soil adjective[(a)]	12 - 50%
Major proportion in upper case, (e.g., SAND)	>50%

(a) Use gravelly, sandy, or silty as appropriate

NOTE: The soil descriptions used in the boring logs lists constituents from smallest percentage to largest percentage.



Knik Arm Crossing
Knik Arm, Alaska

UNIFIED SOIL CLASSIFICATION SYSTEM

March 2007

32-1-01536-004

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Fig. A-1

MATERIAL DESCRIPTION Approx. Elevation: -7 Ft. (MLLW Datum)	Depth, Ft.
Cobbles and coarse gravels as logged by drill action	
Very dense, gray, sandy, silty GRAVEL; wet S1: 33% Gravel, 31% Sand, 36% Fines	10.0
Medium dense to very dense, gray, slightly silty, gravelly SAND; wet S3: 12% Gravel, 79% Sand, 9% Fines	17.0
Very dense, gray GRAVEL; wet logged by drill action	33.0
Dense to very dense, gray, clayey, gravelly SAND; moist S7: 19% Gravel, 67% Sand, 14% Fines	37.0

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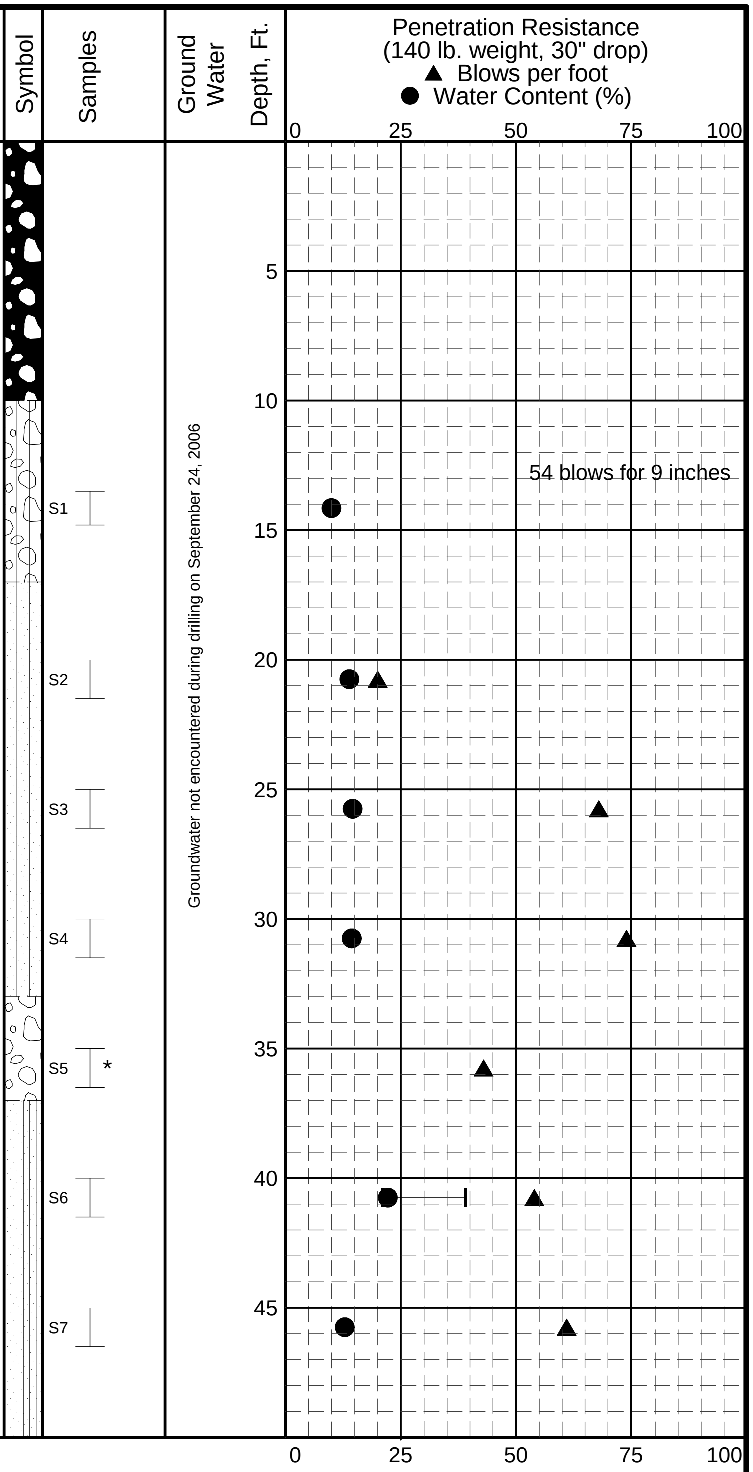

LEGEND

* Sample Not Recovered
⌶ 2" O.D. Split Spoon Sample
■ Shelby Tube
▮▮ Soil Core Barrel
⊻ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit |—●—| Liquid Limit
Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-01
Location: N 61°17'04.77" W 149°54'46.56"

March 2007
32-1-01536-004

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Fig. A-2
Sheet 1 of 4

MATERIAL DESCRIPTION

Approx. Elevation: -7 Ft. (MLLW Datum)

Dense to very dense, gray, clayey, gravelly SAND; moist

63.0

Hard, gray, clayey SILT; moist

68.0

Hard, gray, slightly gravelly to gravelly CLAY; moist

76.0

Very dense, gray, sandy, silty GRAVEL; moist

S14: 43% Fines

84.0

Hard, gray, slightly gravelly to gravelly CLAY; moist

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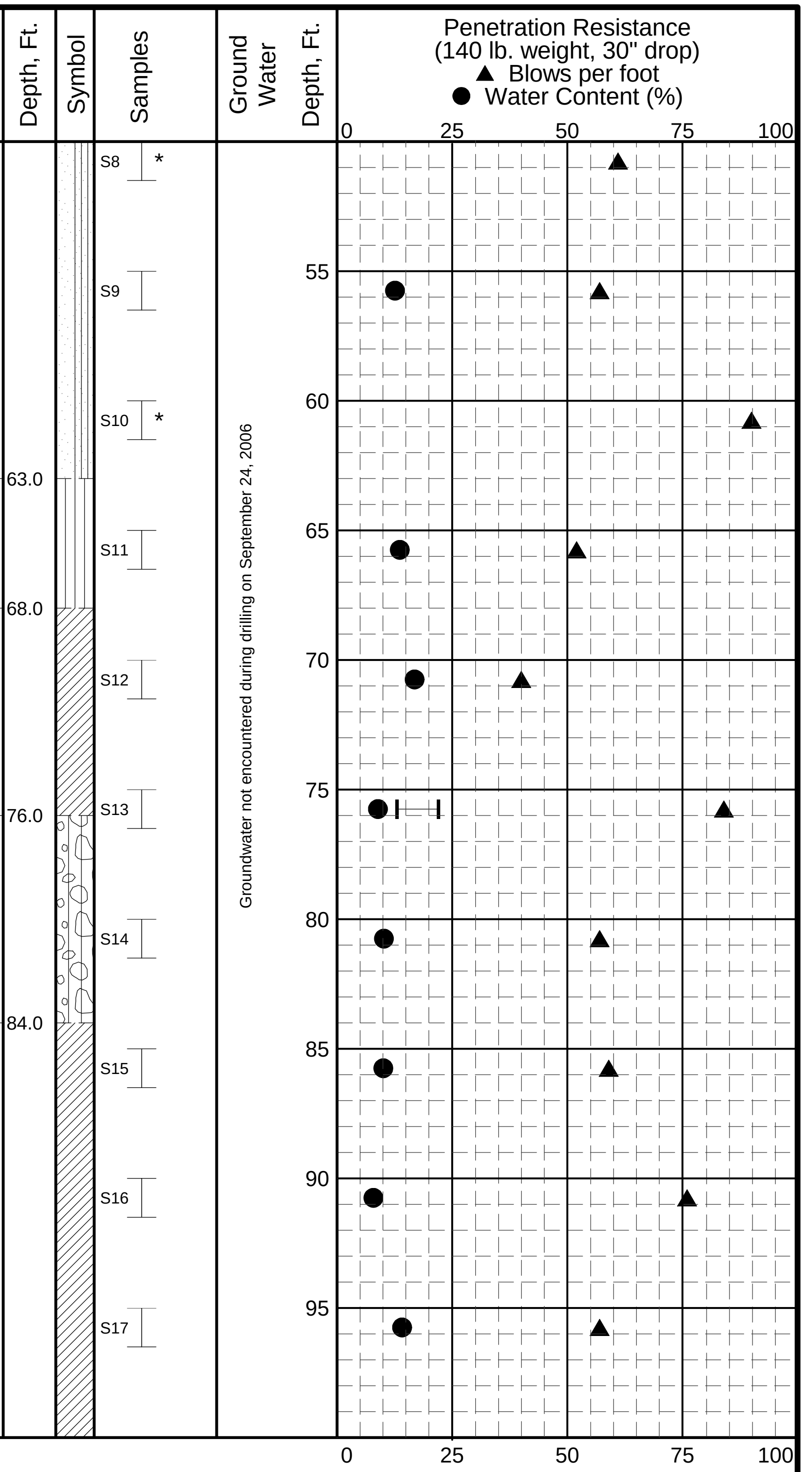

LEGEND

- * Sample Not Recovered
- ⌶ 2" O.D. Split Spoon Sample
- ■ Shelby Tube
- ▮▮ Soil Core Barrel
- ▽ Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

NOTES

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Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-01
Location: N 61°17'04.77" W 149°54'46.56"

March 2007 32-1-01536-004

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Fig. A-2
Sheet 2 of 4

MATERIAL DESCRIPTION

Approx. Elevation: -7 Ft. (MLLW Datum)

Hard, gray, slightly gravelly to gravelly CLAY; moist

S21: 73% Fines

1/16 to 1/4 inch sand seams at 120 feet bgs

Dense, gray, sandy, silty GRAVEL; moist to wet
Occasional silt layers at 125 feet bgs

S24: 31% Gravel, 28% Sand, 41% Fines

Hard, gray CLAY; moist

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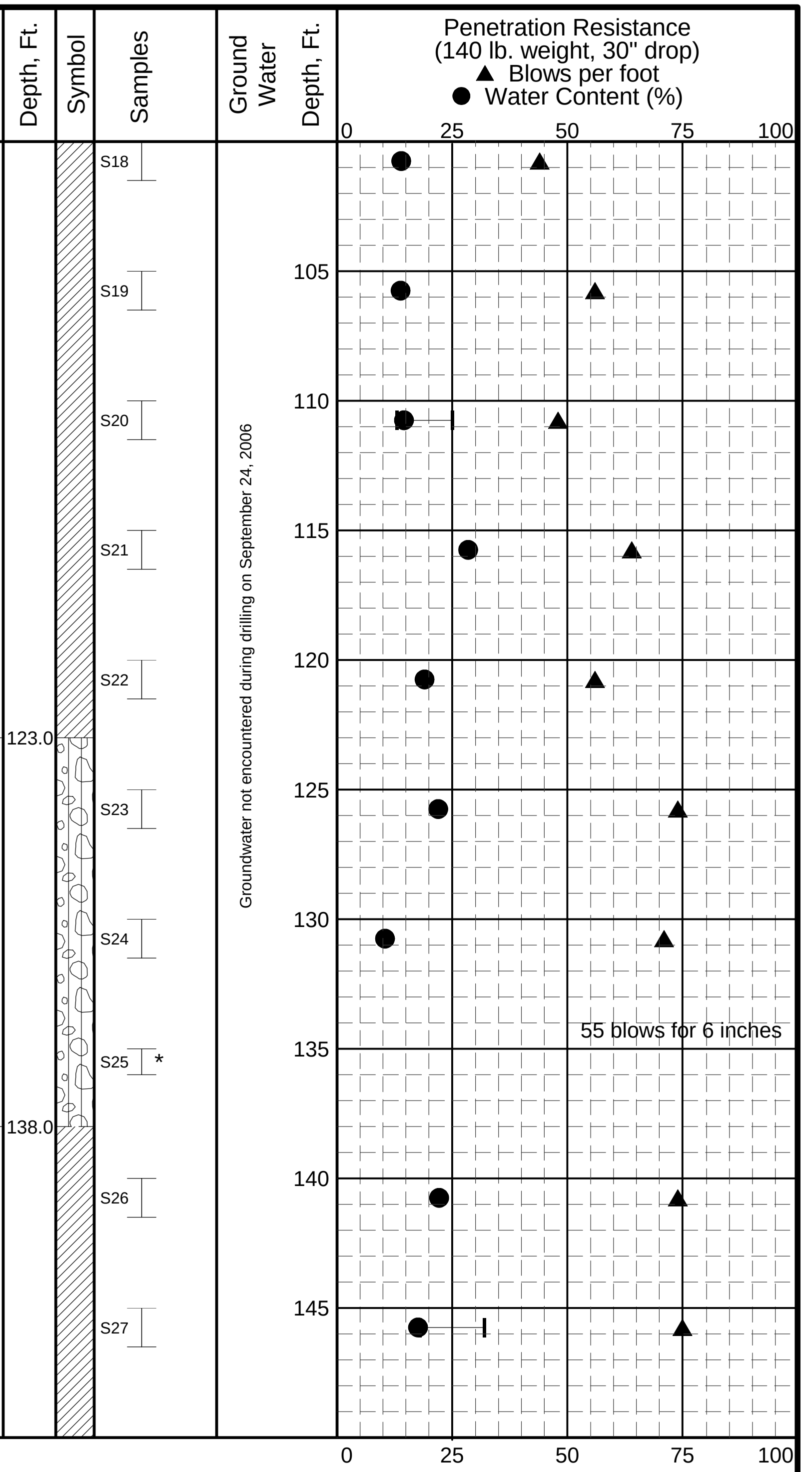

LEGEND

- * Sample Not Recovered
- ⌶ 2" O.D. Split Spoon Sample
- ■ Shelby Tube
- ▌▌ Soil Core Barrel

▽ Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit |—●—| Liquid Limit

Natural Water Content

NOTES

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Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-01
Location: N 61°17'04.77" W 149°54'46.56"

March 2007 32-1-01536-004

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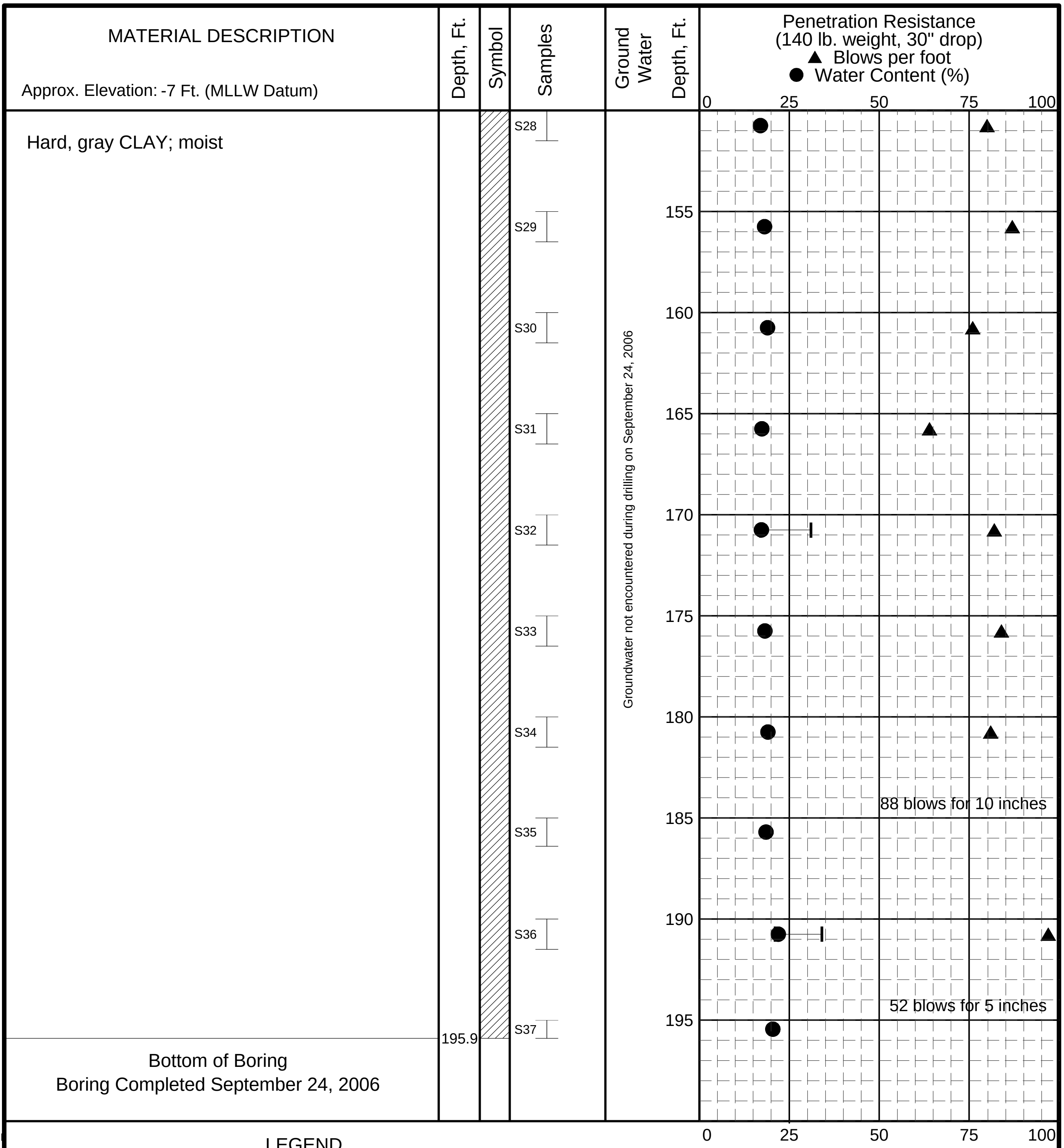
Fig. A-2
Sheet 3 of 4

MATERIAL DESCRIPTION

Approx. Elevation: -7 Ft. (MLLW Datum)

Hard, gray CLAY; moist

Bottom of Boring
Boring Completed September 24, 2006



LEGEND

* Sample Not Recovered
⌶ 2" O.D. Split Spoon Sample
■ Shelby Tube
▮▮ Soil Core Barrel

⊻ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit |—●—| Liquid Limit
Natural Water Content

NOTES

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Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-01
Location: N 61°17'04.77" W 149°54'46.56"

March 2007 32-1-01536-004

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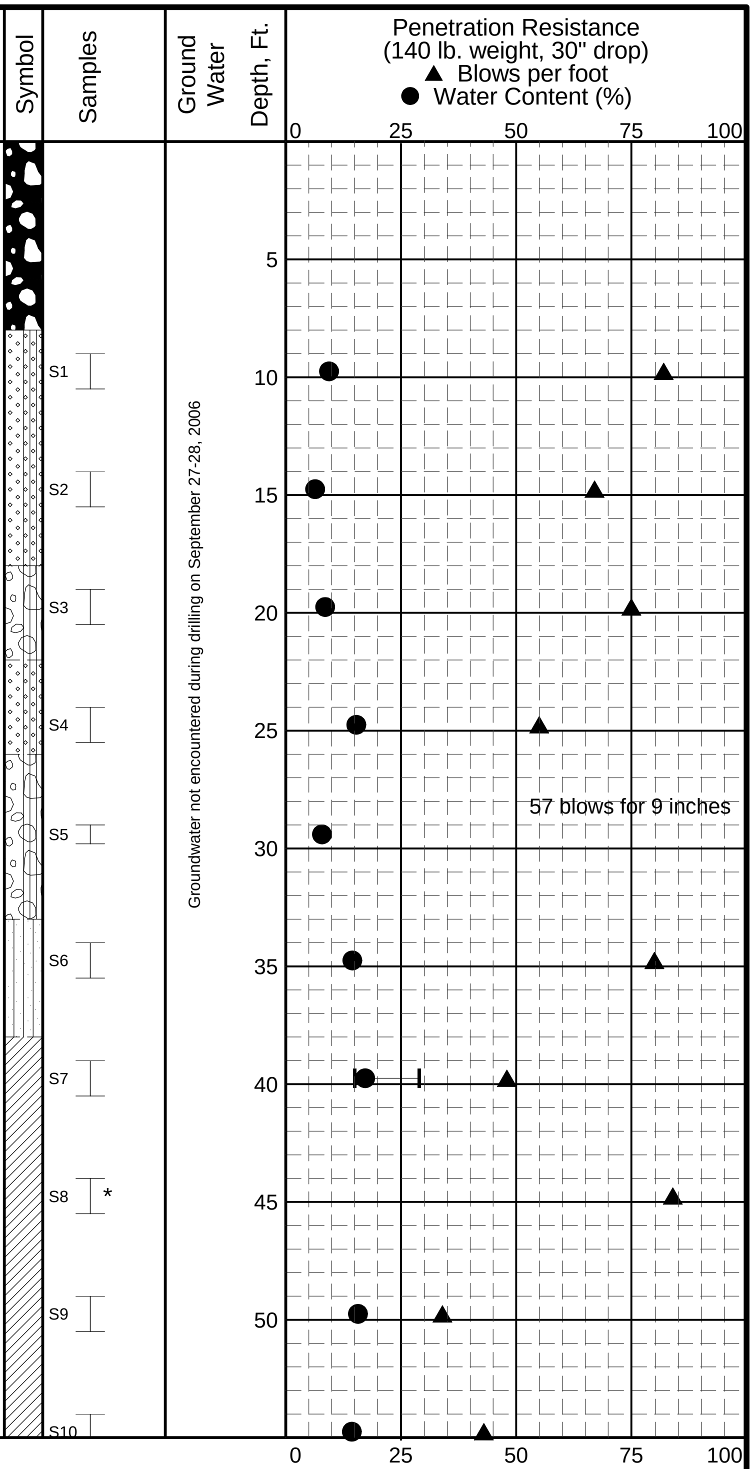
Fig. A-2
Sheet 4 of 4

MATERIAL DESCRIPTION Approx. Elevation: -11.5 Ft. (MLLW Datum)	Depth, Ft.
Cobbles and coarse gravels as logged by drill action	
Very dense, gray, slightly gravelly to gravelly, silty SAND; wet	8.0
Very dense, gray, slightly silty, sandy GRAVEL to gravelly SAND; wet	18.0
Very dense, gray, slightly silty to silty SAND; wet S4: 5.7% Fines	22.0
Very dense, gray, slightly silty, sandy GRAVEL; wet	26.0
Hard, greenish gray, sandy SILT; moist S6: 52% Fines	33.0
Hard, gray CLAY; moist S9: PP = 4.0; TV = 1.6H	38.0



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LEGEND

* Sample Not Recovered

⌶ 2" O.D. Split Spoon Sample

■ Shelby Tube

▮▮ Soil Core Barrel

▽ Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit |—●—| Liquid Limit

Natural Water Content

NOTES

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3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-02
Location: N 61°17'03.47" W 149°54'37.13"

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Fig. A-3
Sheet 1 of 3

MATERIAL DESCRIPTION

Approx. Elevation: -11.5 Ft. (MLLW Datum)

Hard, gray CLAY; moist

S11: PP = 4.0; TV = 1.5H

S12: PP = 4.5

S12, tube bent, unable to extrude sample

Sand partings at 79 feet bgs

S15: PP = 3.5; TV = 1.8H 1.4V

Very dense, gray, silty, sandy GRAVEL; wet

S16: 40% Gravel, 35% Sand, 25% Fines

Very dense, gray, sandy GRAVEL; moist with cobbles 3 to 12 inches based on drill action

S19: 83% Gravel, 15% Sand, 2% Fines

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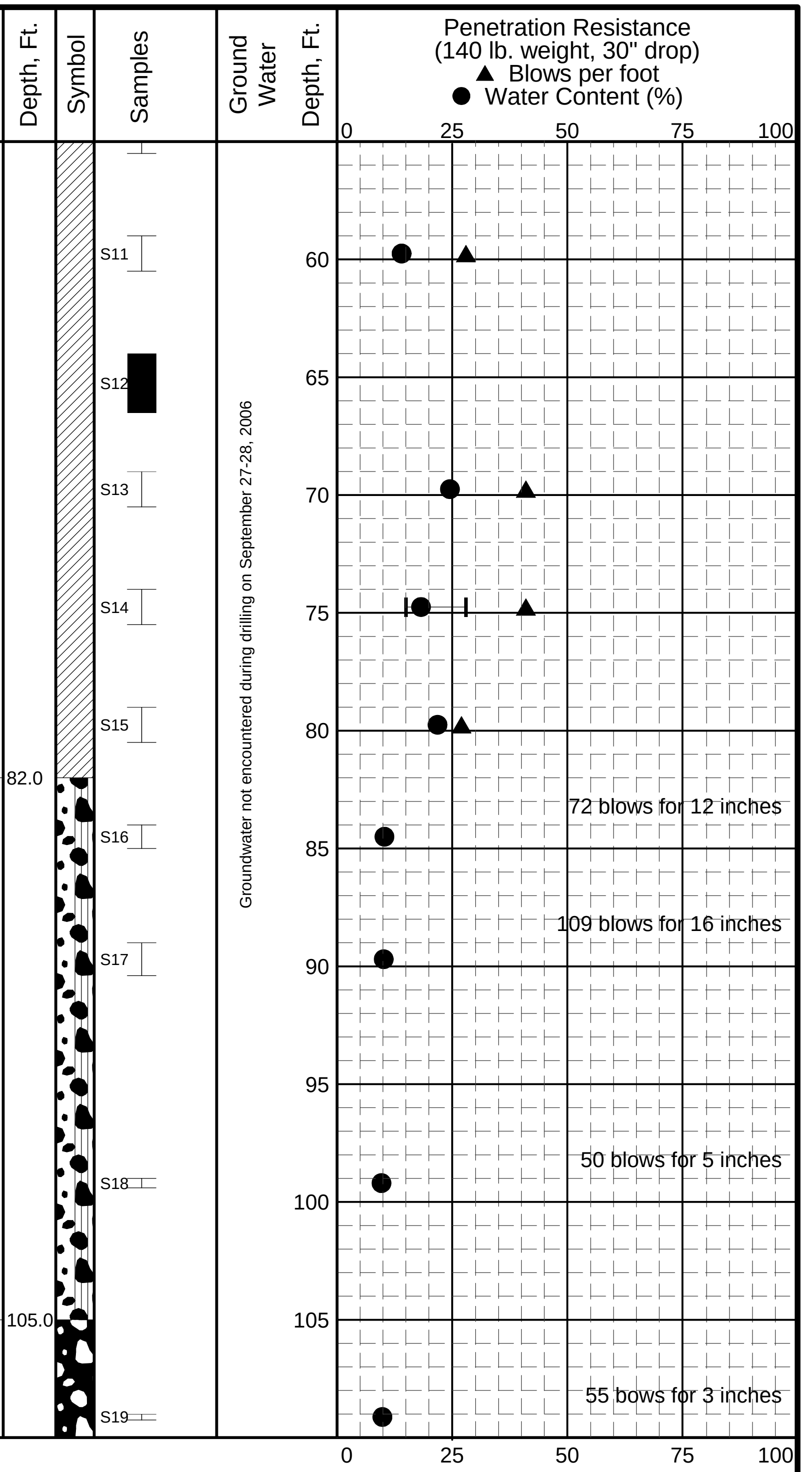

LEGEND

*	Sample Not Recovered	⊻	Ground Water Level At Time Of Drilling
⌶	2" O.D. Split Spoon Sample		
■	Shelby Tube		
▌▌	Soil Core Barrel		

● Water Content (%)

Plastic Limit |——●——| Liquid Limit

Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
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Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-02
Location: N 61°17'03.47" W 149°54'37.13"

March 2007 32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. A-3
Sheet 2 of 3

MATERIAL DESCRIPTION

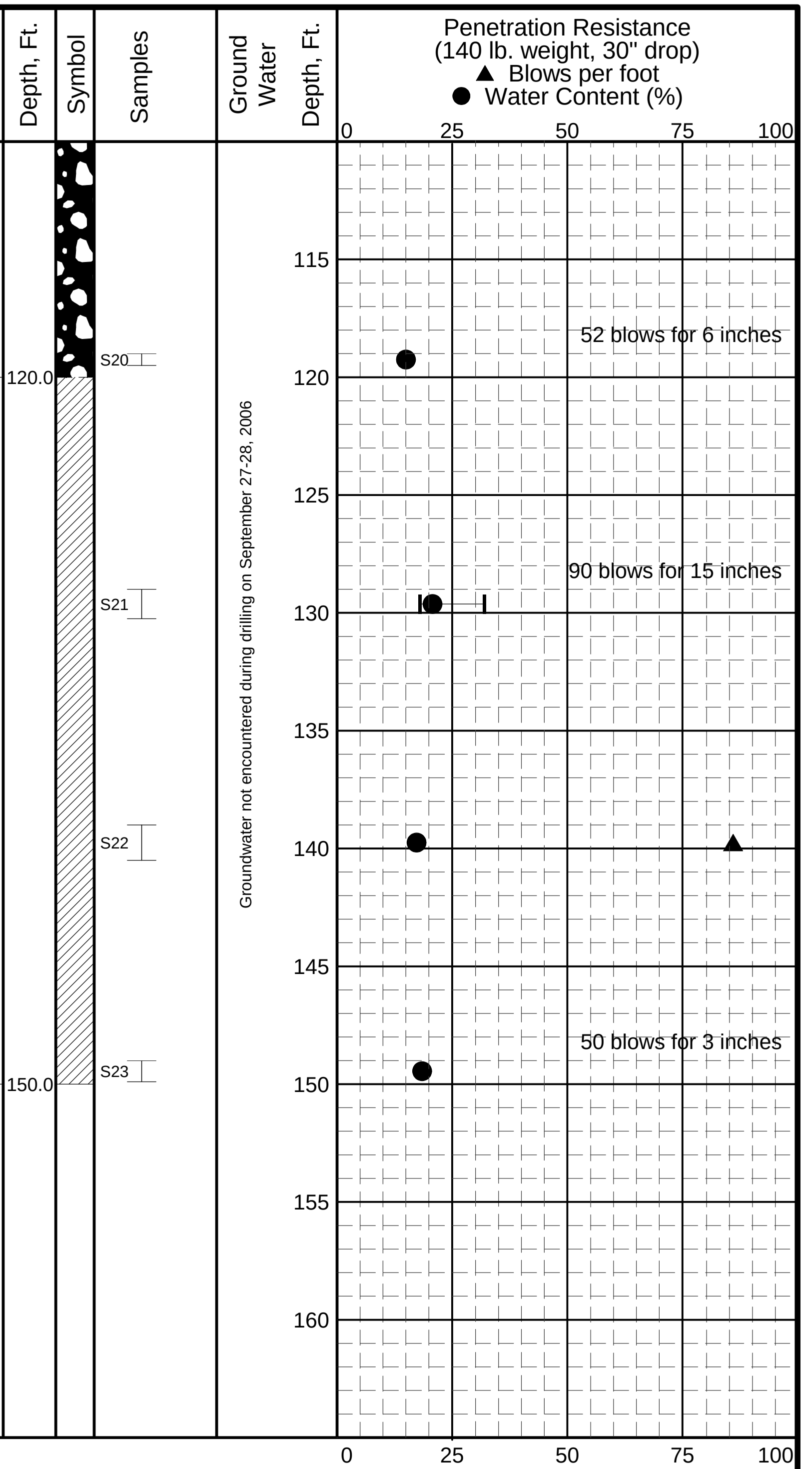
Approx. Elevation: -11.5 Ft. (MLLW Datum)

Very dense, gray, sandy GRAVEL; moist with cobbles 3 to 12 inches based on drill action

Hard, gray CLAY; moist

Bottom of Boring

Boring Completed September 27-28, 2006



LEGEND

* Sample Not Recovered

⌶ 2" O.D. Split Spoon Sample

■ Shelby Tube

▮▮ Soil Core Barrel

▽ Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

NOTES

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Knik Arm Crossing

Knik Arm, Alaska

LOG OF BORING B06-02

Location: N 61°17'03.47" W 149°54'37.13"

March 2007 32-1-01536-004

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Fig. A-3

Sheet 3 of 3

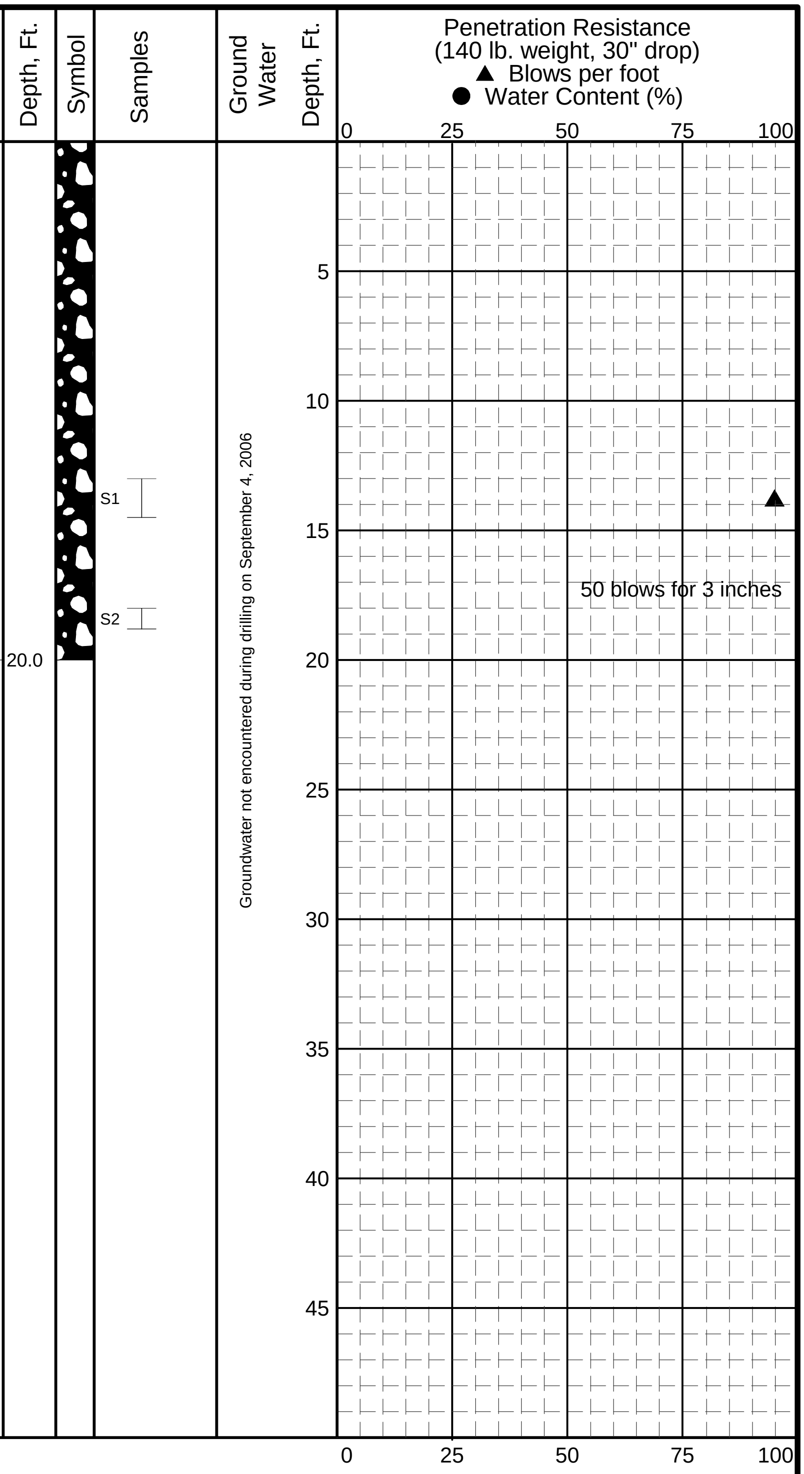
MATERIAL DESCRIPTION

Approx. Elevation: -13.5 Ft. (MLLW Datum)

Very dense, gray, coarse GRAVEL to COBBLES; wet

Unable to maintain boring open for sampling and achieve target depth within a reasonable timeframe; boring terminated at 20 feet below seafloor.

Bottom of Boring
Boring Completed September 4, 2006



LEGEND

* Sample Not Recovered
⌶ 2" O.D. Split Spoon Sample
■ Shelby Tube
▮▮ Soil Core Barrel
▽ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit ├──●──┤ Liquid Limit
Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-03
Location: N 61°12'01.07" W 149°54'27.50"

March 2007
32-1-01536-004

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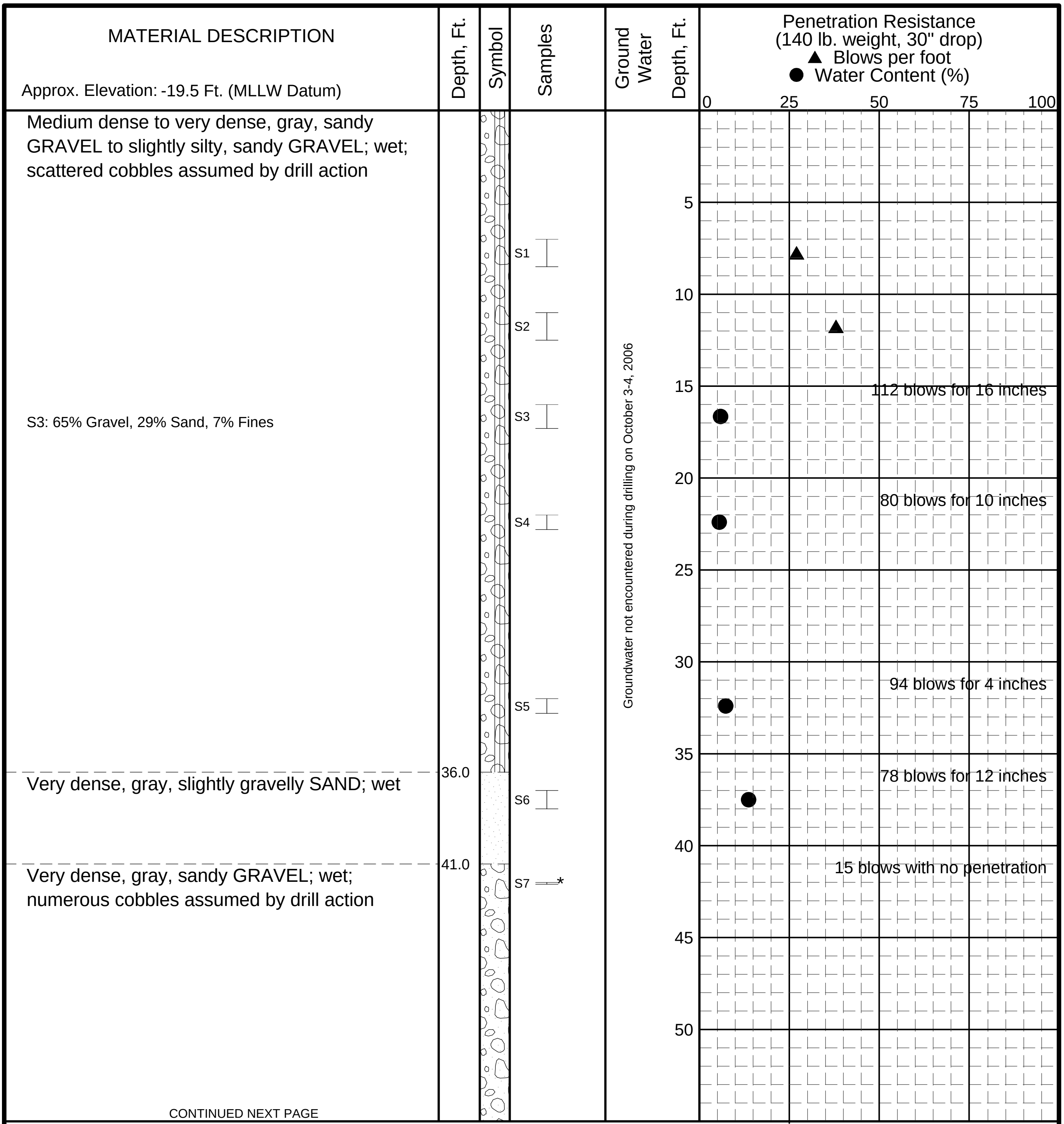
Fig. A-4



Approx. Elevation: -19.5 Ft. (MLLW Datum)

Medium dense to very dense, gray, sandy GRAVEL to slightly silty, sandy GRAVEL; wet; scattered cobbles assumed by drill action

S3: 65% Gravel, 29% Sand, 7% Fines

Very dense, gray, slightly gravelly SAND; wet

Very dense, gray, sandy GRAVEL; wet; numerous cobbles assumed by drill action

CONTINUED NEXT PAGE

LEGEND

- * Sample Not Recovered
- ⌶ 2" O.D. Split Spoon Sample
- ■ Shelby Tube
- ▮▮ Soil Core Barrel
- ▽ Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-04
Location: N 61°17'00.44" W 149°54'17.56"

March 2007 32-1-01536-004

SHANNON & WILSON, INC.
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Fig. A-5
Sheet 1 of 3

MATERIAL DESCRIPTION

Approx. Elevation: -19.5 Ft. (MLLW Datum)

Very dense, gray, sandy GRAVEL; wet; numerous cobbles assumed by drill action

Note: Sample S8 skipped due to the presence of cobbles

Very dense, gray, silty SAND; wet

Very dense, gray, silty, sand GRAVEL; wet

Hard, gray, gravelly SILT; moist

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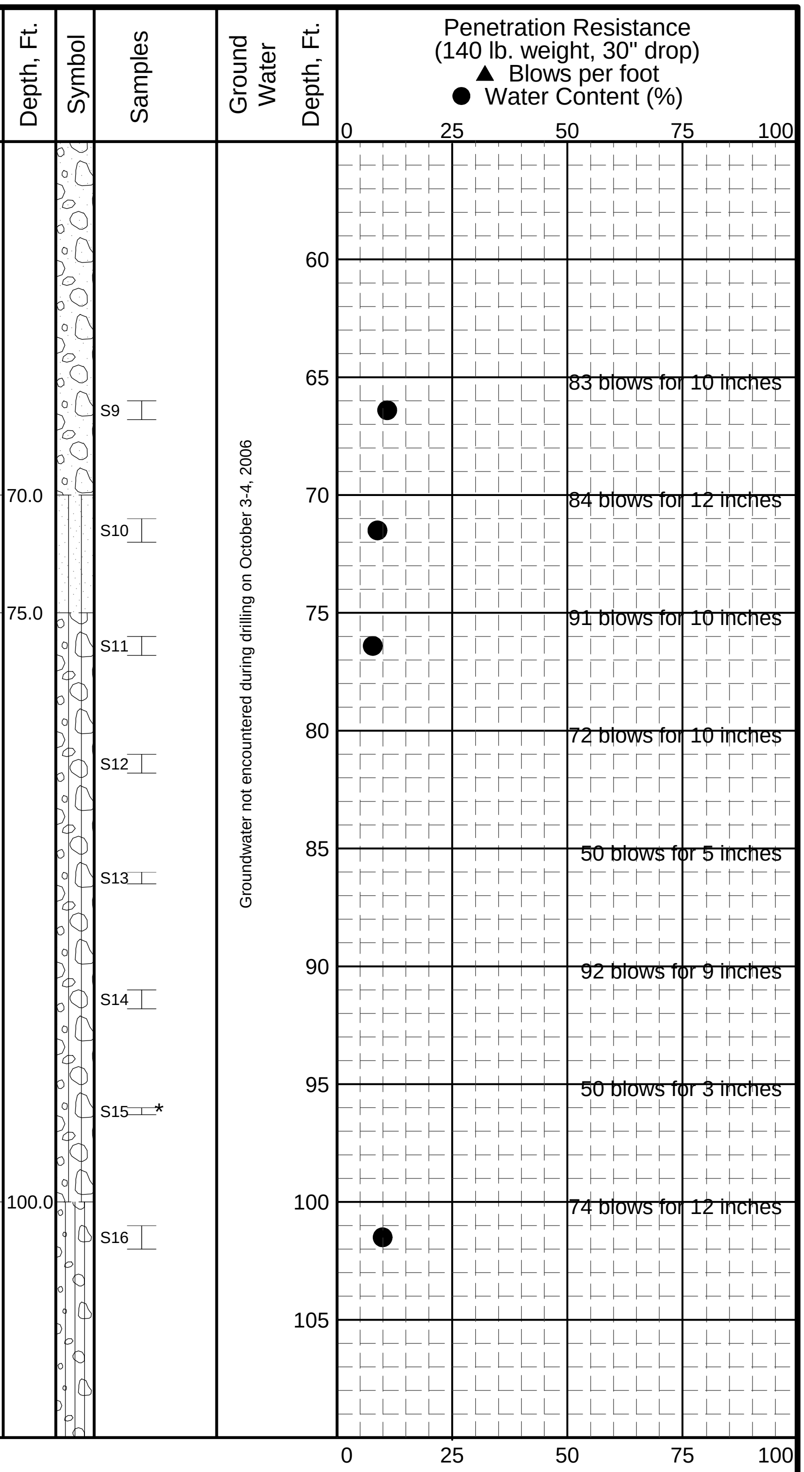

LEGEND

- * Sample Not Recovered
- ⌶ 2" O.D. Split Spoon Sample
- ■ Shelby Tube
- ▮▮ Soil Core Barrel
- ∇ Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit ├──●──┤ Liquid Limit

Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-04
Location: N 61°17'00.44" W 149°54'17.56"

March 2007 32-1-01536-004

SHANNON & WILSON, INC.
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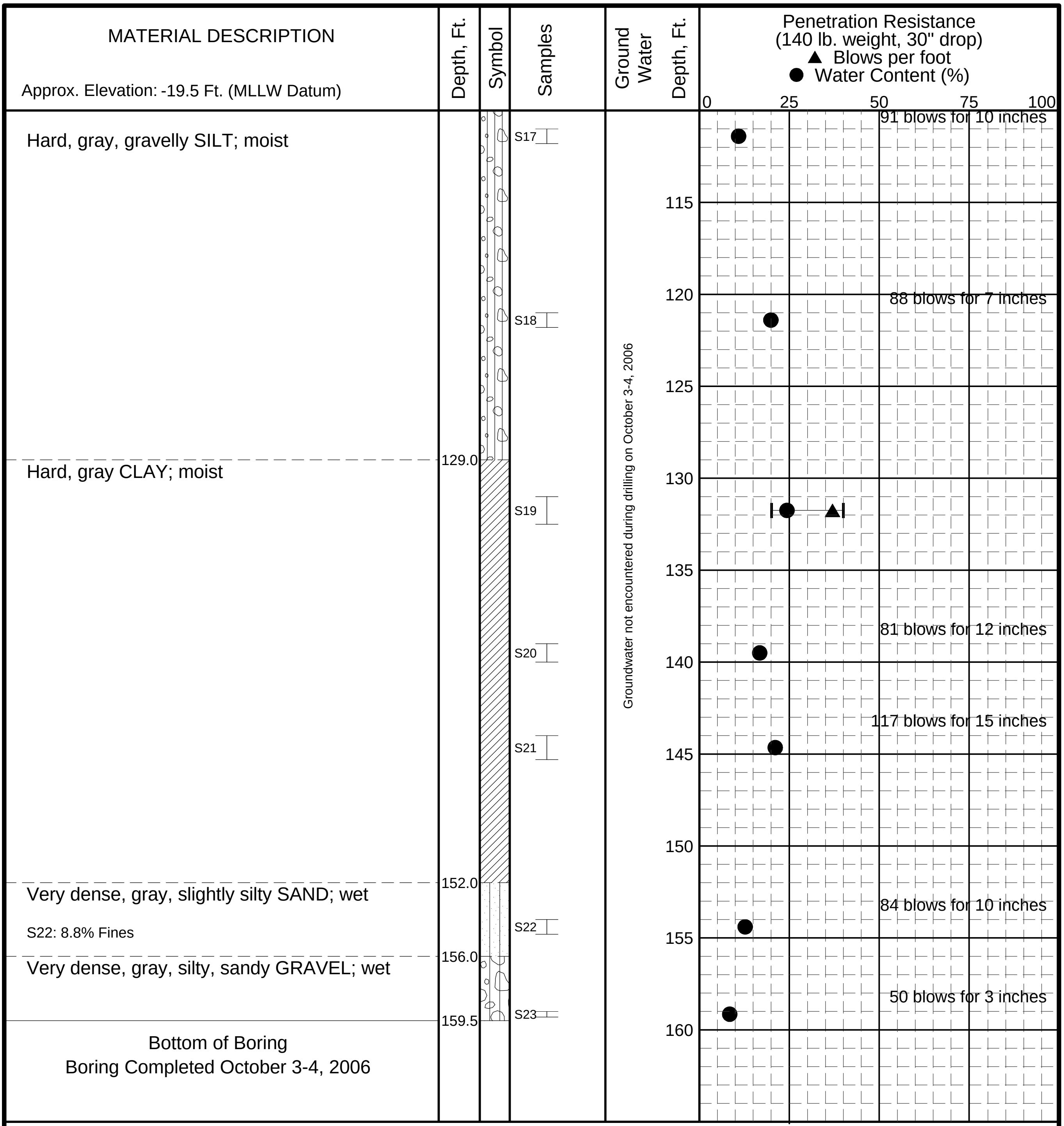
Fig. A-5
Sheet 2 of 3

GEOTECHNICAL LOG 01536-004 OFFSHORE LOGS.GPJ S&W GEO1.GDT 3/6/07



Hard, gray, gravelly SILT; moist

Hard, gray CLAY; moist

Very dense, gray, slightly silty SAND; wet

S22: 8.8% Fines

Very dense, gray, silty, sandy GRAVEL; wet

Bottom of Boring
Boring Completed October 3-4, 2006

LEGEND

- * Sample Not Recovered
- ⌶ 2" O.D. Split Spoon Sample
- ■ Shelby Tube
- ▮▮ Soil Core Barrel

▽ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit |——●——| Liquid Limit
Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-04
Location: N 61°17'00.44" W 149°54'17.56"

March 2007 32-1-01536-004

SHANNON & WILSON, INC.
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Fig. A-5
Sheet 3 of 3

MATERIAL DESCRIPTION

Approx. Elevation: -70 Ft. (MLLW Datum)

Very dense, gray, fine to coarse, clean to silty GRAVEL; wet

40.0 Hard, gray CLAY; moist

44.0 Hard, gray, trace to slightly sandy SILT; moist

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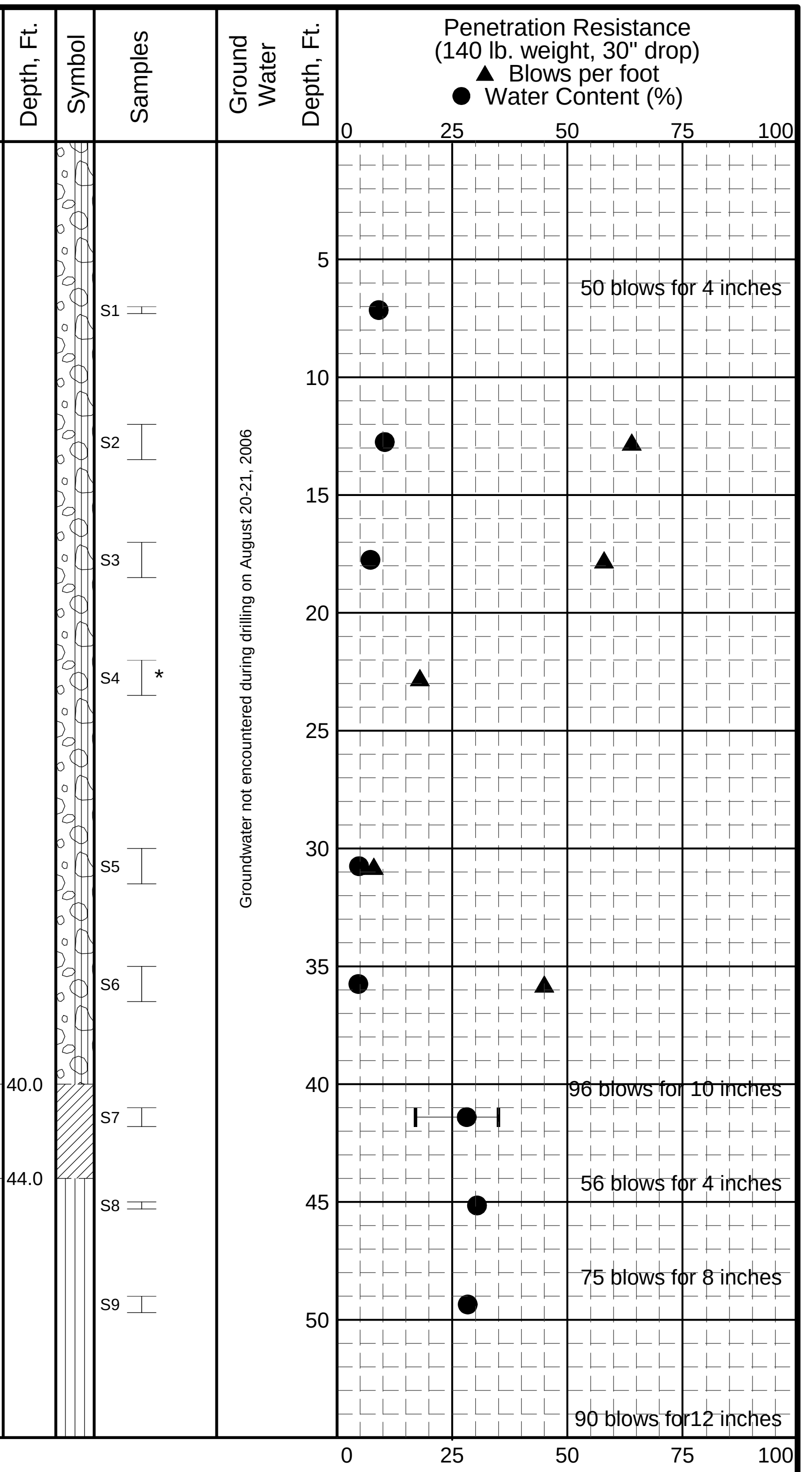

LEGEND

- * Sample Not Recovered
- ⌶ 2" O.D. Split Spoon Sample
- ■ Shelby Tube
- ▮▮ Soil Core Barrel
- ⊽ Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit |—●—| Liquid Limit

Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-05
Location: N 61°16'58.36" W 149°54'08.05"

March 2007 32-1-01536-004

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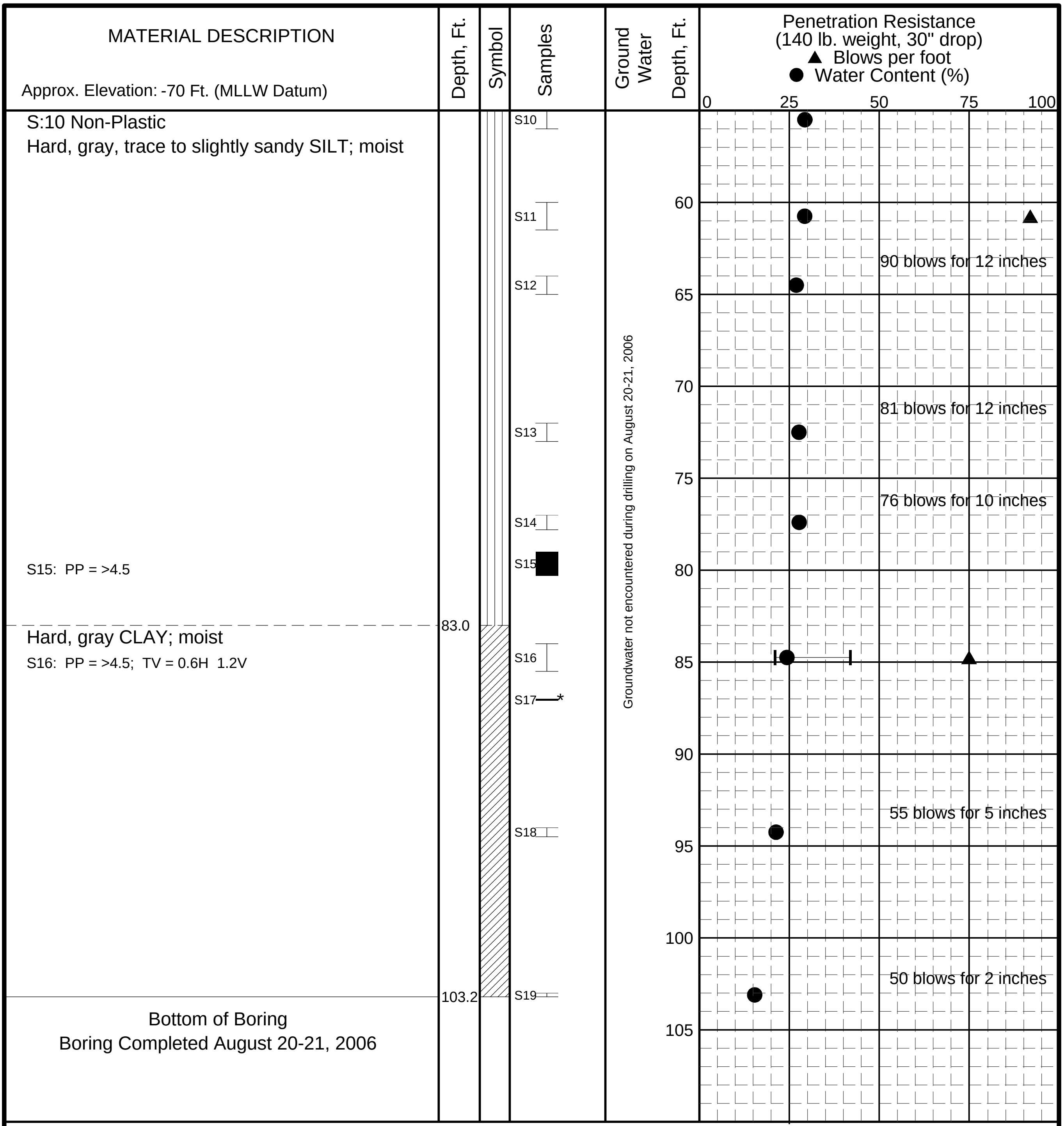
Fig. A-6
Sheet 1 of 2



Approx. Elevation: -70 Ft. (MLLW Datum)

S:10 Non-Plastic

Hard, gray, trace to slightly sandy SILT; moist

S15: PP = >4.5

Hard, gray CLAY; moist

S16: PP = >4.5; TV = 0.6H 1.2V

Bottom of Boring

Boring Completed August 20-21, 2006

LEGEND

*	Sample Not Recovered
⌶	2" O.D. Split Spoon Sample
■	Shelby Tube
▌▌	Soil Core Barrel
▽	Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-05
Location: N 61°16'58.36" W 149°54'08.05"

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
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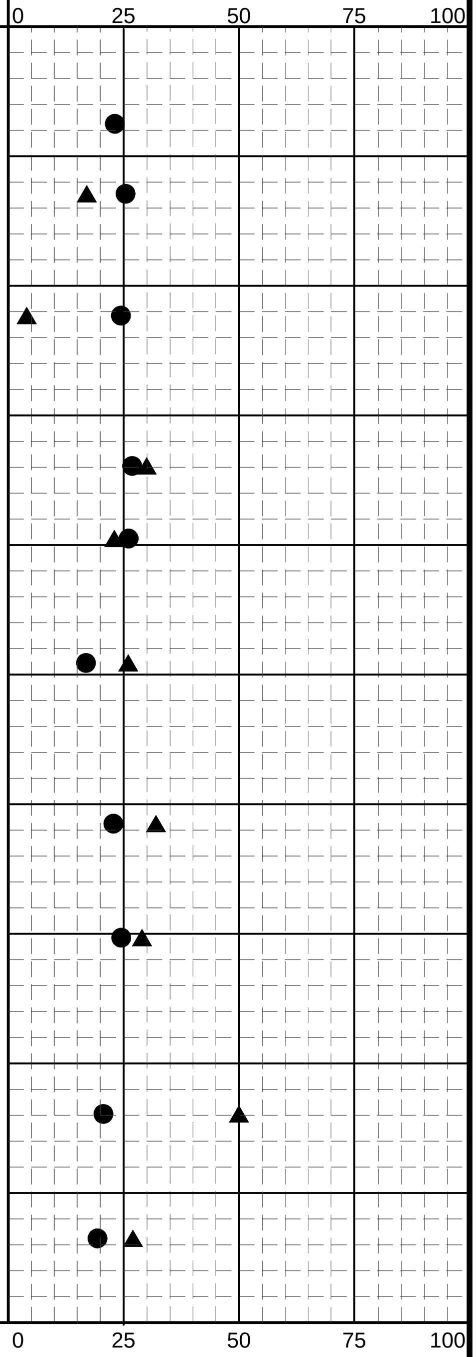
Fig. A-6
Sheet 2 of 2

MATERIAL DESCRIPTION Approx. Elevation: -74 Ft. (MLLW Datum)	Depth, Ft.	Symbol	Samples	Ground Water
Loose to dense, gray, trace to slightly silty SAND; wet Note: Sample S1, no representative blow count due to heaving sands S1: 5.8% Fines			S1	Groundwater not encountered during drilling on August 3-5, 2006
			S2	
			S3	
S4: 3.8% Fines			S4	
			S5	
	23.0			
S6: 9% Gravel, 84% Sand, 7% Fines			S6	
Medium to very dense, gray, slightly silty, slightly gravelly, coarse to fine SAND; wet				
			S7	
			S8	
S9: 9.5% Fines			S9	
			S10	

Penetration Resistance
(140 lb. weight, 30" drop)
▲ Blows per foot
● Water Content (%)



CONTINUED NEXT PAGE

LEGEND

- * Sample Not Recovered
- Ⅲ 3" O.D. Split Spoon Sample
- ■ Shelby Tube
- ▌▌ Soil Core Barrel
- ▽ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit ├──●──┤ Liquid Limit
Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-06
Location: N 61°16'57.09" W 149°53'58.13"

March 2007
32-1-01536-004

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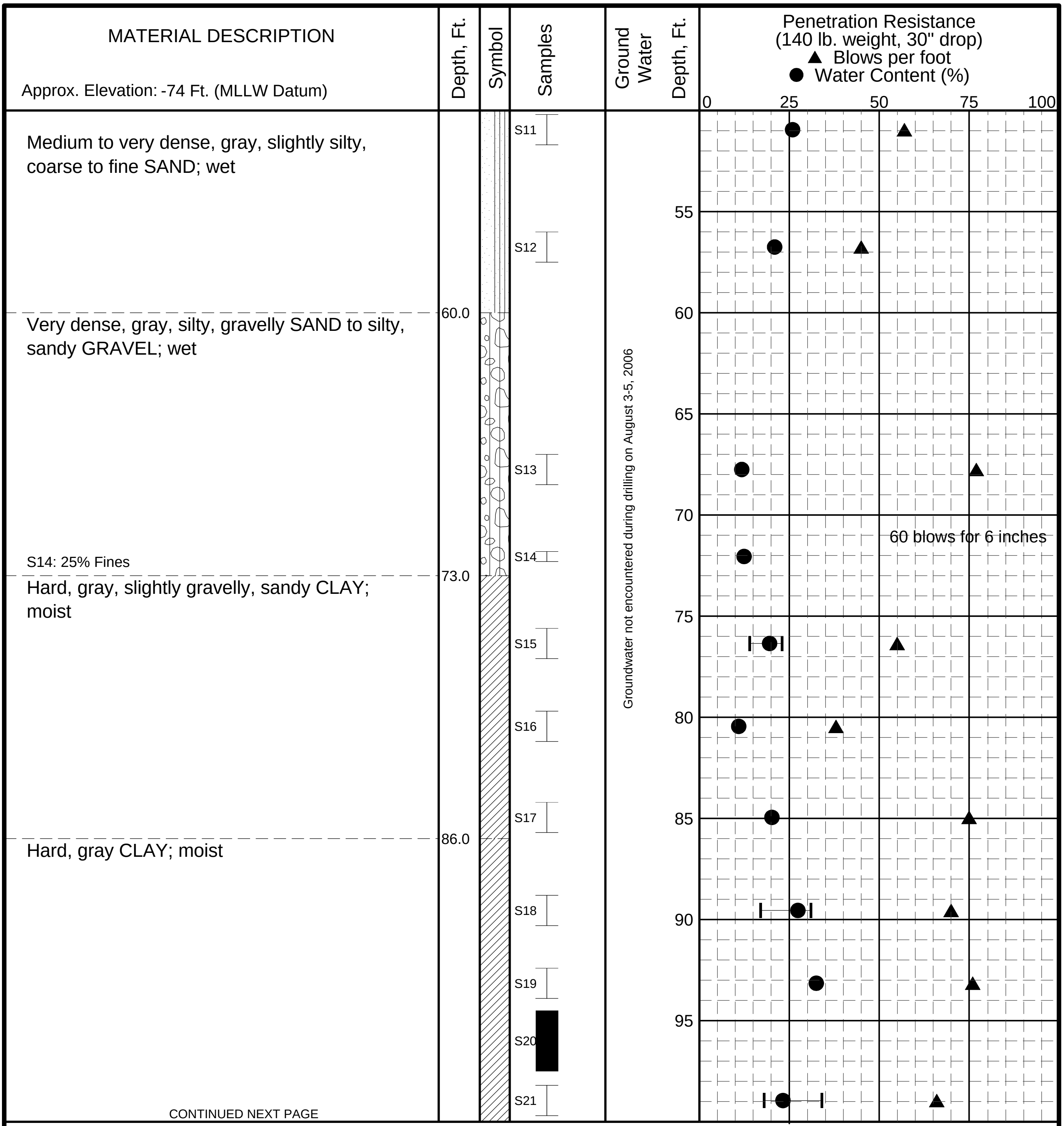
Fig. A-7
Sheet 1 of 4



Medium to very dense, gray, slightly silty, coarse to fine SAND; wet

Very dense, gray, silty, gravelly SAND to silty, sandy GRAVEL; wet

S14: 25% Fines

Hard, gray, slightly gravelly, sandy CLAY; moist

Hard, gray CLAY; moist

CONTINUED NEXT PAGE

LEGEND

*	Sample Not Recovered
⫼	3" O.D. Split Spoon Sample
■	Shelby Tube
▮ ▮	Soil Core Barrel
▽	Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit ├──●──┤ Liquid Limit

Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

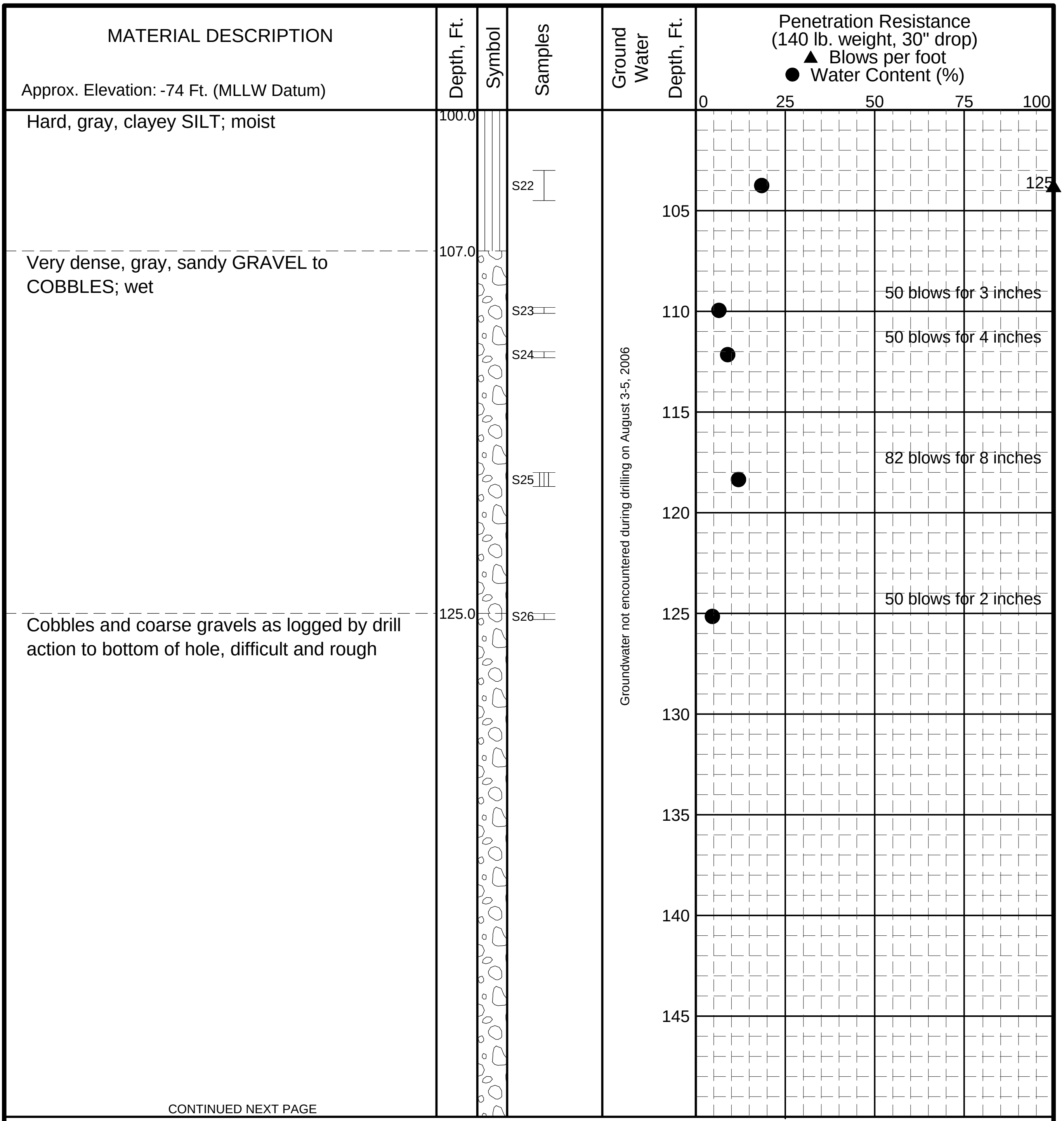
Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-06
Location: N 61°16'57.09" W 149°53'58.13"

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. A-7
Sheet 2 of 4



Hard, gray, clayey SILT; moist

Very dense, gray, sandy GRAVEL to COBBLES; wet

Cobbles and coarse gravels as logged by drill action to bottom of hole, difficult and rough

LEGEND

- * Sample Not Recovered
- Ⅲ 3" O.D. Split Spoon Sample
- ■ Shelby Tube
- ▮▮ Soil Core Barrel
- ▽ Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-06
Location: N 61°16'57.09" W 149°53'58.13"

March 2007 32-1-01536-004

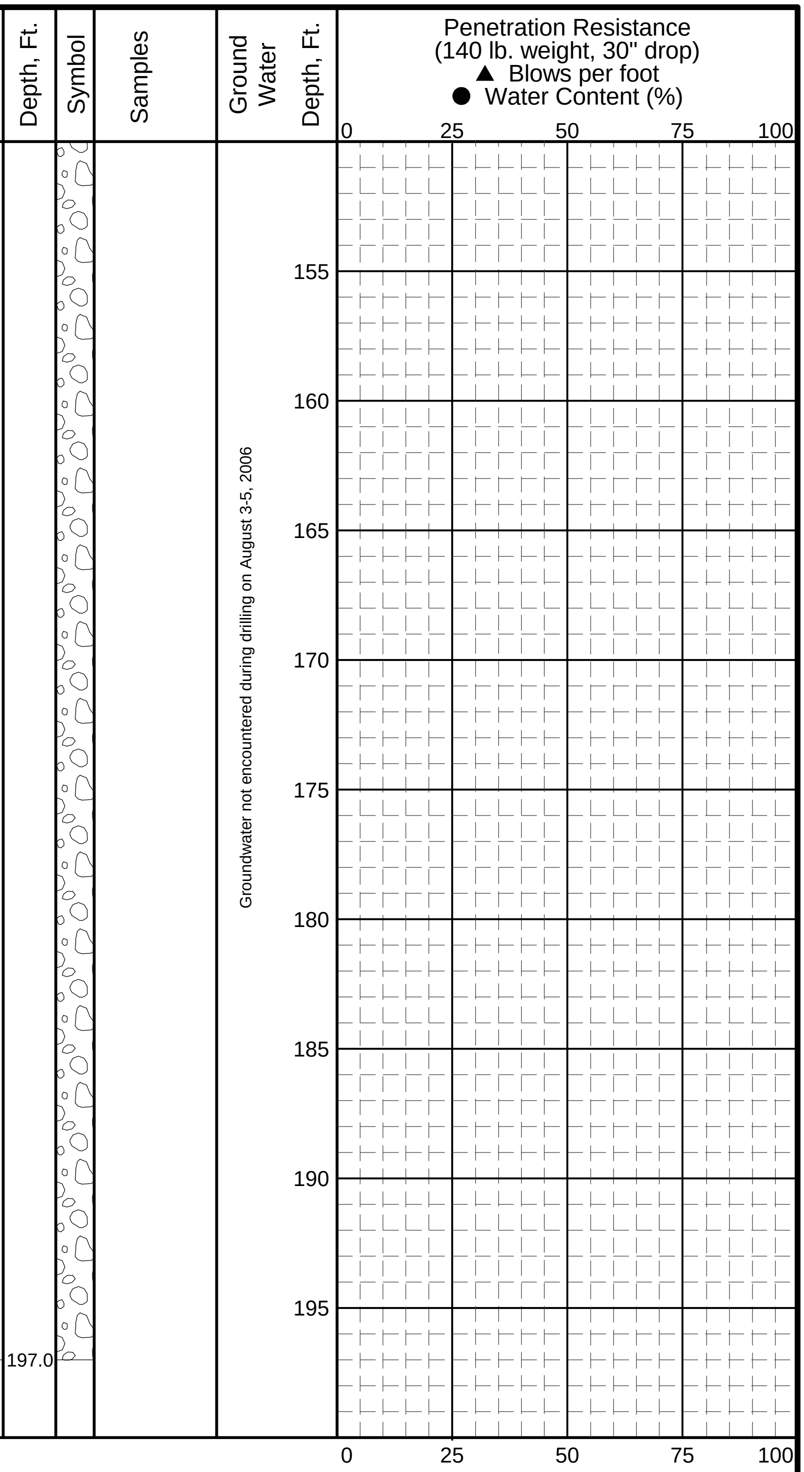
SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. A-7
Sheet 3 of 4

MATERIAL DESCRIPTION

Approx. Elevation: -74 Ft. (MLLW Datum)

Cobbles and coarse gravels as logged by drill action to bottom of hole, difficult and rough



Bottom of Boring
Boring Completed August 3-5, 2006

LEGEND

- * Sample Not Recovered
- ⫼ 3" O.D. Split Spoon Sample
- ■ Shelby Tube
- ▮▮ Soil Core Barrel
- ▽ Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
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3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-06
Location: N 61°16'57.09" W 149°53'58.13"

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
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Fig. A-7
Sheet 4 of 4

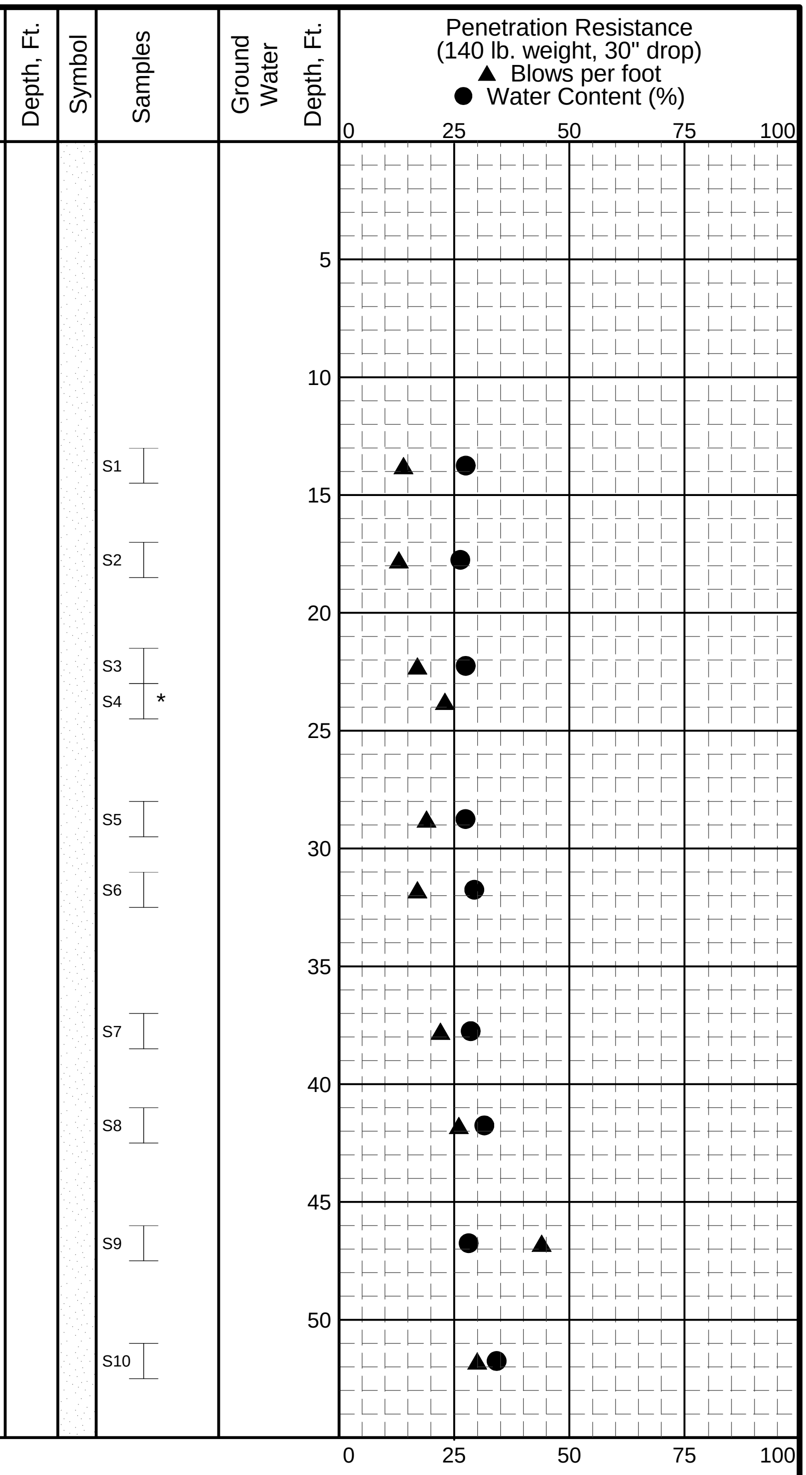
MATERIAL DESCRIPTION

Approx. Elevation: -68 Ft. (MLLW Datum)

Medium dense to dense, silty SAND; wet

Sample S4 contained heave material, not representative

S5: 14% Fines



CONTINUED NEXT PAGE

LEGEND

- * Sample Not Recovered
- ⌶ 2" O.D. Split Spoon Sample
- ■ Shelby Tube
- ▮▮ Soil Core Barrel

∇ Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit |—●—| Liquid Limit

Natural Water Content

NOTES

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2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
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Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-07
Location: N 61°16'54.95" W 149°53'49.65"

March 2007 32-1-01536-004

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Geotechnical and Environmental Consultants

Fig. A-8
Sheet 1 of 4

MATERIAL DESCRIPTION

Approx. Elevation: -68 Ft. (MLLW Datum)

Depth, Ft.	Material Description
	Medium dense to dense, silty SAND; wet
58.0	Very dense, gray, slightly gravelly to gravelly SAND; wet
66.0	Very dense, gray, slightly silty SAND; wet S13: 5.2% Fines
83.0	Very dense, gray, slightly gravelly SAND; wet
83.5	Dense, gray, clean to slightly silty SAND; wet; 1-inch layer of organics at 91.5 feet bgs
92.0	Soft, brown PEAT; wet (logged by drill action and organics coming up in cuttings)
103.0	Very dense, gray, clean to slightly silty SAND; wet; scattered organics from 114-115 feet bgs

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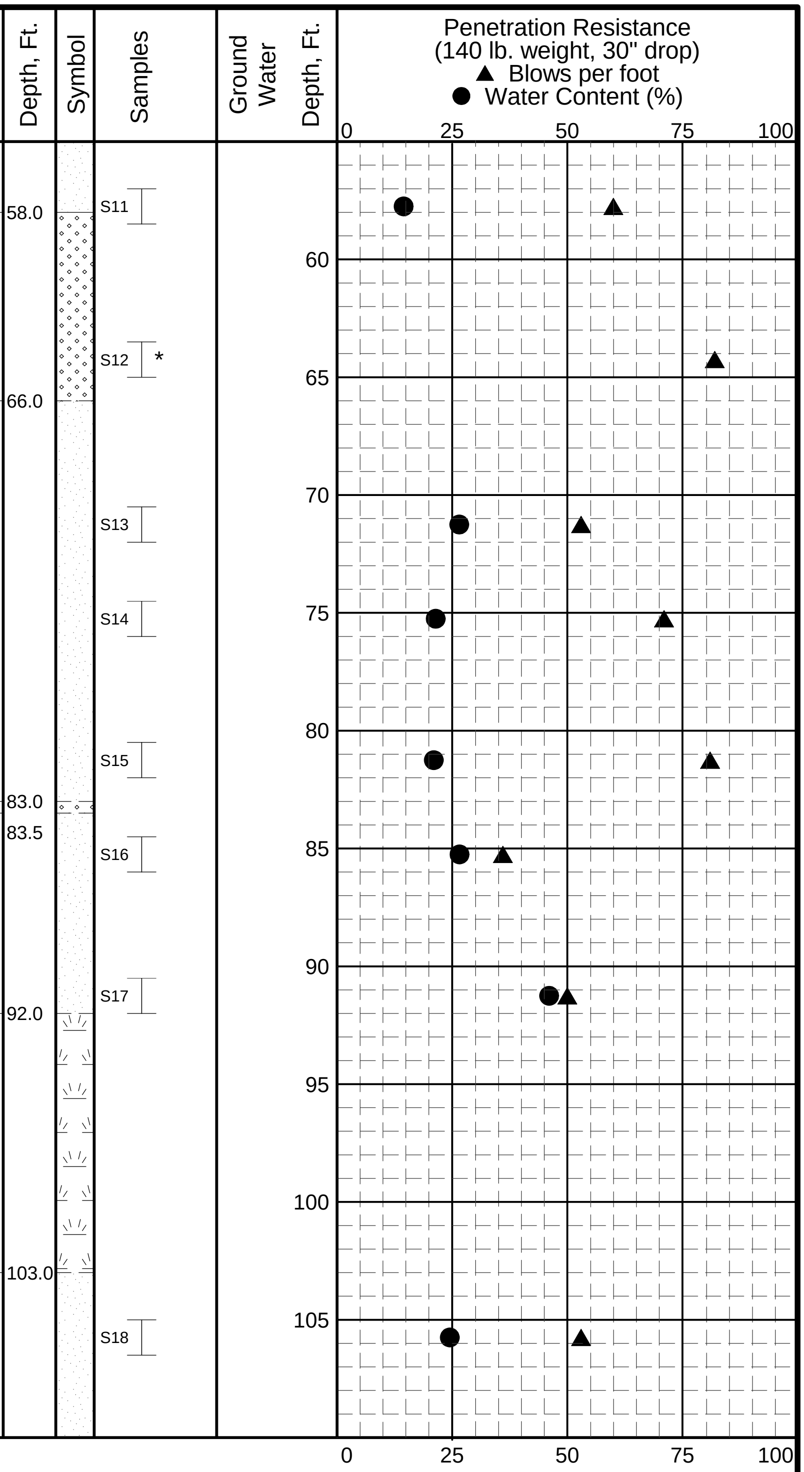

LEGEND

* Sample Not Recovered
⌶ 2" O.D. Split Spoon Sample
■ Shelby Tube
▌▌ Soil Core Barrel
⊻ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit |—●—| Liquid Limit
Natural Water Content

NOTES

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2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Knik Arm, Alaska

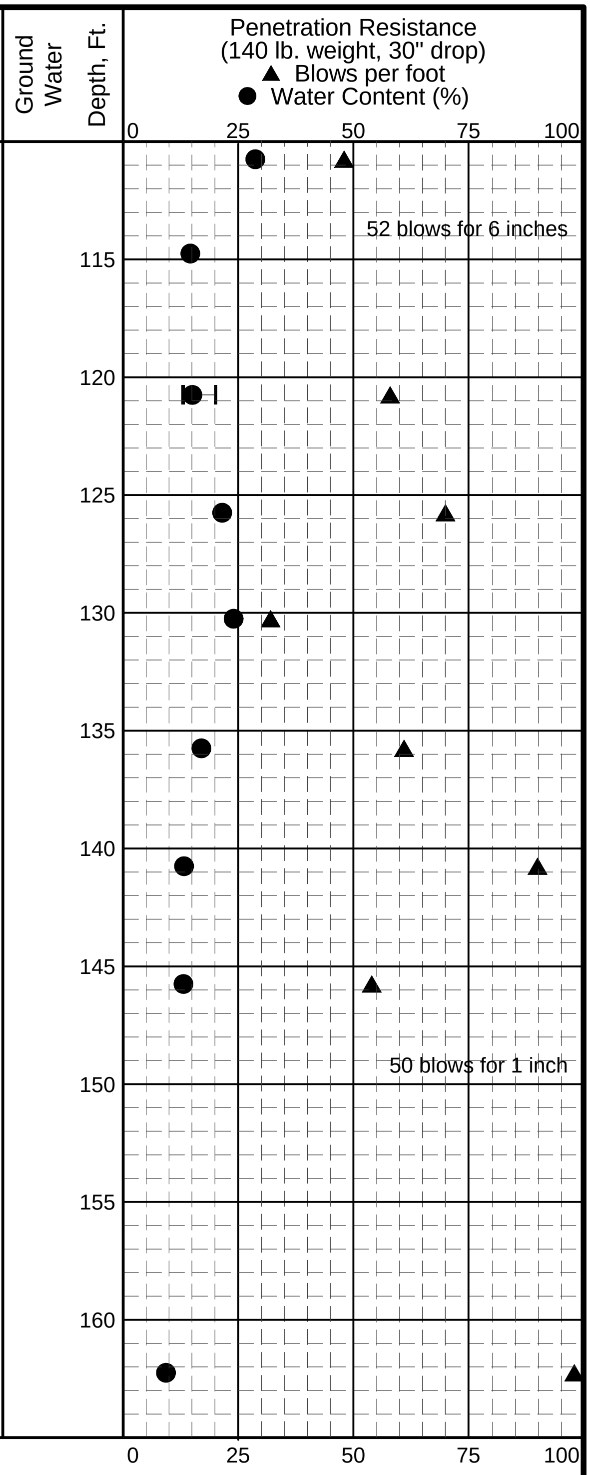
LOG OF BORING B06-07
Location: N 61°16'54.95" W 149°53'49.65"

March 2007 32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. A-8
Sheet 2 of 4

MATERIAL DESCRIPTION Approx. Elevation: -68 Ft. (MLLW Datum)	Depth, Ft.	Samples
Very dense, gray, clean to slightly silty SAND; wet; scattered organics from 114-115 feet bgs		S19 S20
Hard, light gray, silty, sandy CLAY; moist S21: PP = >4.5	118.0	S21 S22
Hard, gray, silty CLAY; moist S23: PP = >4.5	128.0	S23
Hard, gray sandy, silty CLAY; moist	135.5	S24
Hard, gray, gravelly, sandy CLAY; moist S25: 17% Gravel, 28% Sand, 56% Fines	138.0	S25 S26 S27*
Very dense, gray, slightly silty to silty, sandy GRAVEL; wet Moderate artisan pressure encountered at 155 feet bgs and continues to bottom of boring	155.0	S28



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LEGEND

* Sample Not Recovered
⌶ 2" O.D. Split Spoon Sample
■ Shelby Tube
▌▌ Soil Core Barrel
▽ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-07
Location: N 61°16'54.95" W 149°53'49.65"

March 2007 32-1-01536-004

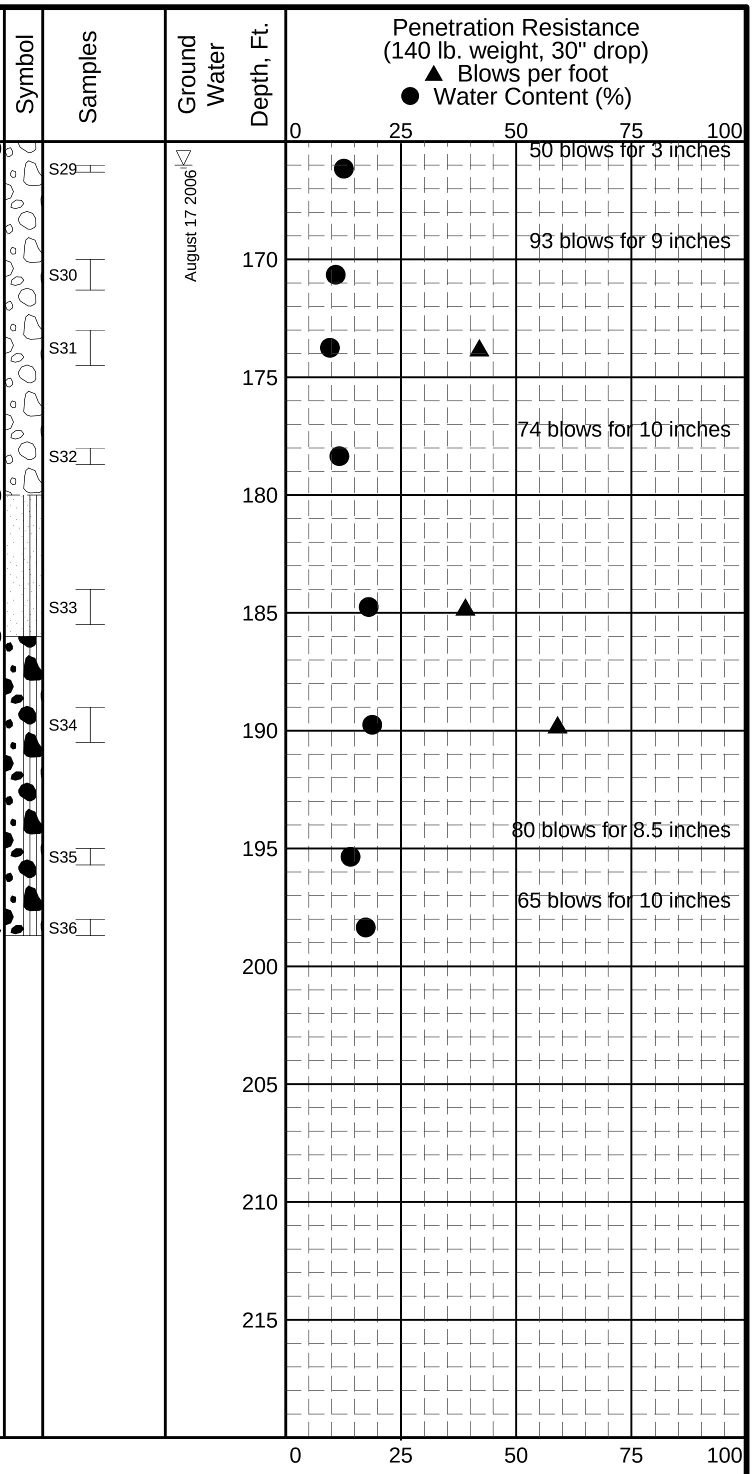
SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. A-8
Sheet 3 of 4

MATERIAL DESCRIPTION

Approx. Elevation: -68 Ft. (MLLW Datum)

MATERIAL DESCRIPTION	Depth, Ft.
Very dense, gray, sandy GRAVEL; wet S30: 70% Gravel, 30% Sand,	165.0
Dense, gray, slightly silty SAND; wet; occasional silt and gravelly silt layers (1-inch thick)	180.0
Very dense, gray, slightly silty to silty, sandy GRAVEL; wet Moderate artisan pressure encountered at 155 feet bgs and continues to bottom of boring	186.0
Bottom of Boring Boring Completed August 16-18, 2006	198.7



LEGEND

* Sample Not Recovered
⌶ 2" O.D. Split Spoon Sample
■ Shelby Tube
▮▮ Soil Core Barrel
▽ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-07
Location: N 61°16'54.95" W 149°53'49.65"

March 2007 32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. A-8
Sheet 4 of 4

MATERIAL DESCRIPTION

Approx. Elevation: -62 Ft. (MLLW Datum)

Loose to very dense, gray, silty SAND; moist to wet

1-foot heave at 20 feet bgs
Sample S2 contained heave material, not representative

S6: 15% Fines

Drill string sank under it's own weight from 41-50 feet bgs

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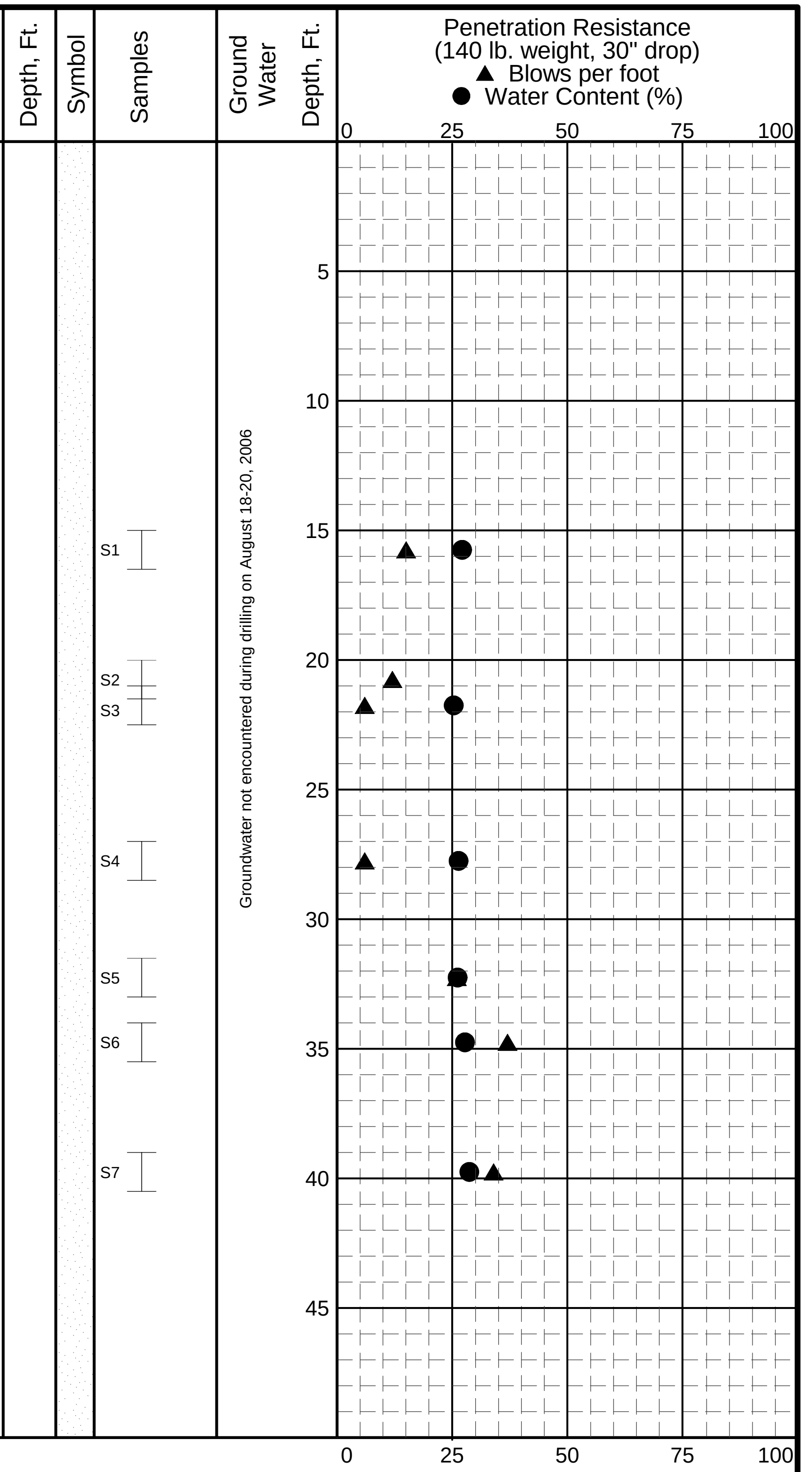

LEGEND

- * Sample Not Recovered
- ⌶ 2" O.D. Split Spoon Sample
- ■ Shelby Tube
- ▮▮ Soil Core Barrel
- ⊽ Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-08
Location: N 61°16'53.16" W 149°53'39.21"

March 2007 32-1-01536-004

SHANNON & WILSON, INC.
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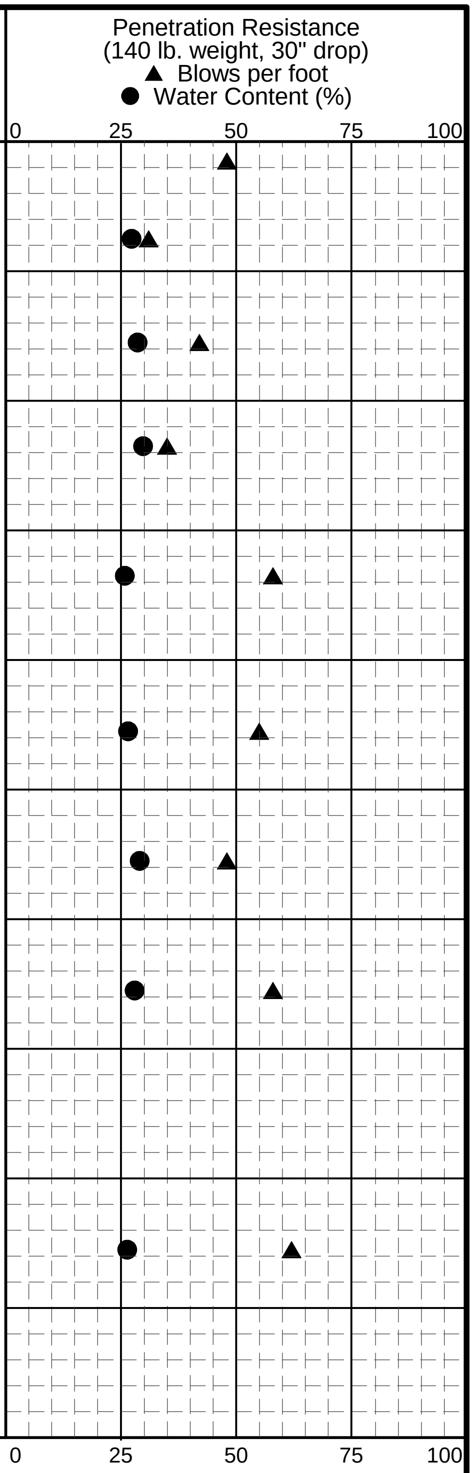
Fig. A-9
Sheet 1 of 4

MATERIAL DESCRIPTION Approx. Elevation: -62 Ft. (MLLW Datum)	Depth, Ft.	Symbol	Samples	Ground Water
Loose to very dense, gray, silty SAND; moist to wet			S8 *	Groundwater not encountered during drilling on August 18-20, 2006
			S9	
			S10	
			S11	
			S12	
			S13	
S14: 13% Fines			S14	
			S15	
			S16	



CONTINUED NEXT PAGE

LEGEND

*	Sample Not Recovered
⌶	2" O.D. Split Spoon Sample
■	Shelby Tube
▌▌	Soil Core Barrel
⊽	Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit ├──●──┤ Liquid Limit

Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-08
Location: N 61°16'53.16" W 149°53'39.21"

March 2007 32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. A-9
Sheet 2 of 4

MATERIAL DESCRIPTION

Approx. Elevation: -62 Ft. (MLLW Datum)

Loose to very dense, gray, silty SAND; moist to wet

S20: 26% Fines

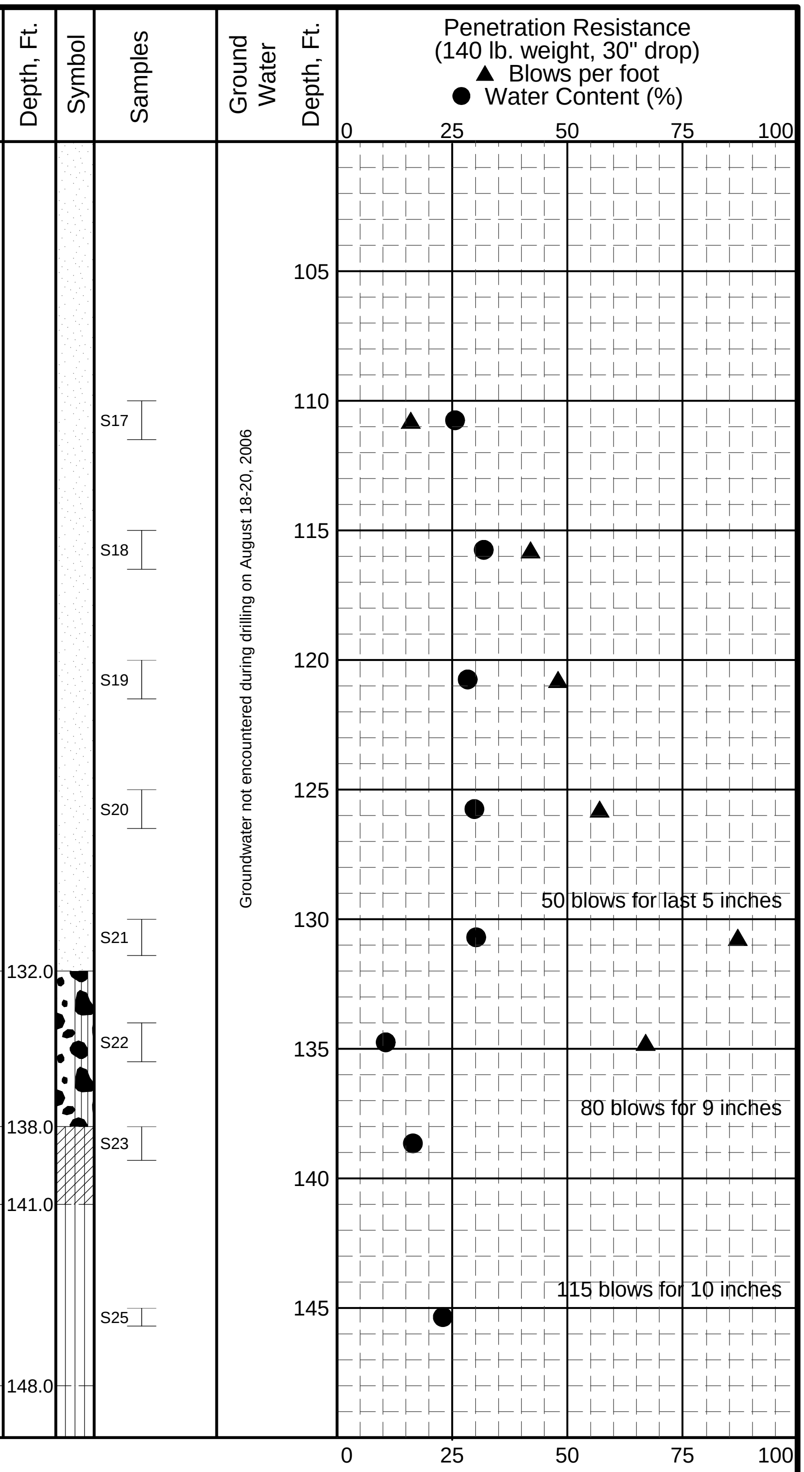
Very dense, gray, silty, sandy GRAVEL; wet

S23: 6% Gravel, 22% Sand, 72% Fines

Hard, gray, slightly gravelly, sandy, silty CLAY; moist

Hard, gray, sandy SILT; moist

Note: Sample S24 interval skipped



CONTINUED NEXT PAGE

LEGEND

* Sample Not Recovered

⌶ 2" O.D. Split Spoon Sample

■ Shelby Tube

▮▮ Soil Core Barrel

▽ Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-08
Location: N 61°16'53.16" W 149°53'39.21"

March 2007 32-1-01536-004

SHANNON & WILSON, INC.
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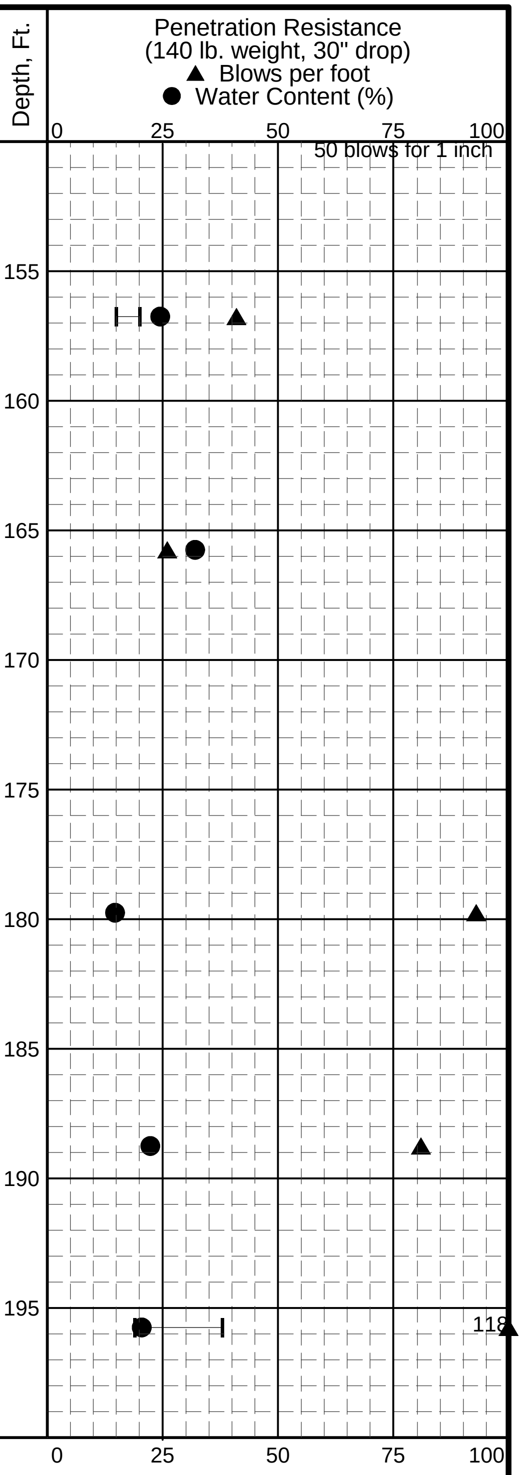
Fig. A-9
Sheet 3 of 4

MATERIAL DESCRIPTION Approx. Elevation: -62 Ft. (MLLW Datum)	Depth, Ft.	Samples
Hard, gray, sandy, gravelly SILT; moist inferred by drilling action		S26 *
Very stiff to hard, gray, silty CLAY; moist drilling action indicates occasional gravelly seams S27: PP = 1.8; TV = 0.9H 8V S28: PP = 1.8; TV = 0.95H 0.85V	153.0	S27 S28 S29 *
Very dense, gray, gravelly, silty SAND; wet S30: 31% Gravel, 37% Sand, 32% Fines	176.0	S30
Hard, gray, sandy CLAY; moist to wet	185.0	S31 S32
Bottom of Boring Boring Completed August 18-20, 2006	196.5	

Ground Water: Groundwater not encountered during drilling on August 18-20, 2006



LEGEND

* Sample Not Recovered

⌶ 2" O.D. Split Spoon Sample

■ Shelby Tube

▮▮ Soil Core Barrel

⊽ Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-08
Location: N 61°16'53.16" W 149°53'39.21"

March 2007 32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. A-9
Sheet 4 of 4

MATERIAL DESCRIPTION Approx. Elevation: -55 Ft. (MLLW Datum)	Depth, Ft.	Symbol	Samples	Ground Water
Loose to dense, gray, slightly silty to silty SAND; wet				Groundwater not encountered during drilling on August 7-9, 2006
S1: 5.7% Fines			S1	
			S2 *	
			S3	
S4: 0% Gravel, 91% Sand, 9% Fines			S4	
			S5	
S6: 0% Gravel, 87% Sand, 13% Fines			S6	
			S7	
S8: 6.7% Fines			S8	

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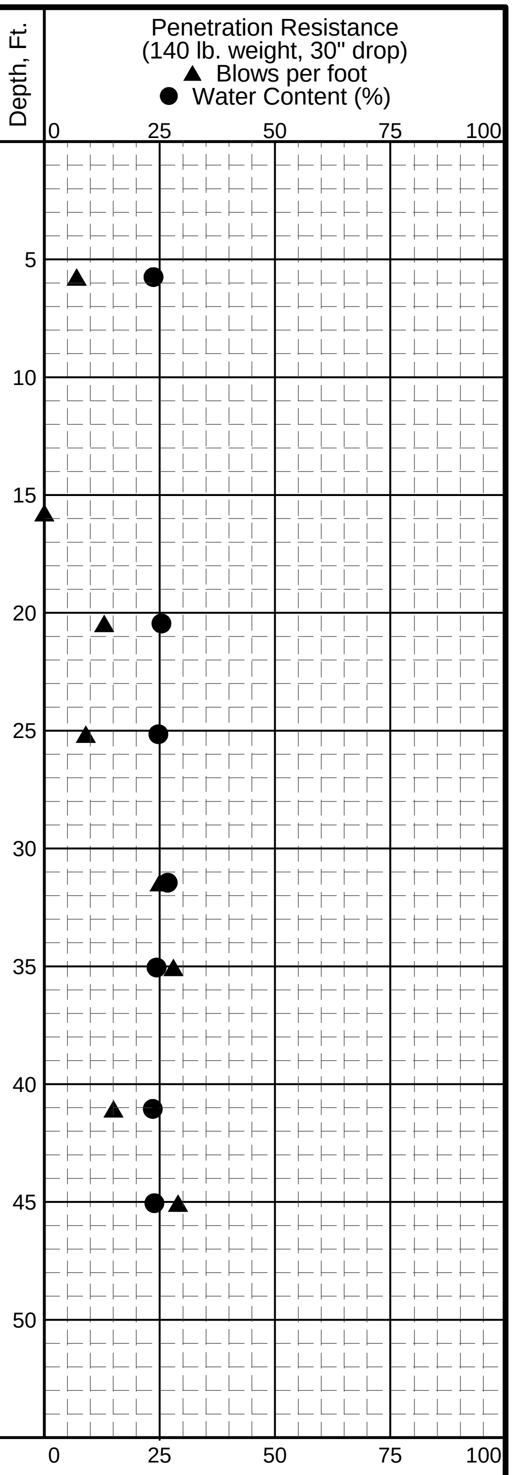

LEGEND

- * Sample Not Recovered
- ⌶ 2" O.D. Split Spoon Sample
- ▬ Shelby Tube
- ▮▮ Soil Core Barrel
- ⊽ Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-09
Location: N 61°16'51.56" W 149°53'29.69"

March 2007 32-1-01536-004

SHANNON & WILSON, INC.
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Fig. A-10
Sheet 1 of 4

MATERIAL DESCRIPTION

Approx. Elevation: -55 Ft. (MLLW Datum)

Depth, Ft. | Symbol | Samples | Ground Water | Depth, Ft.

Loose to dense, gray, slightly silty to silty SAND; wet

S14: 93% Sand, 7% Fines

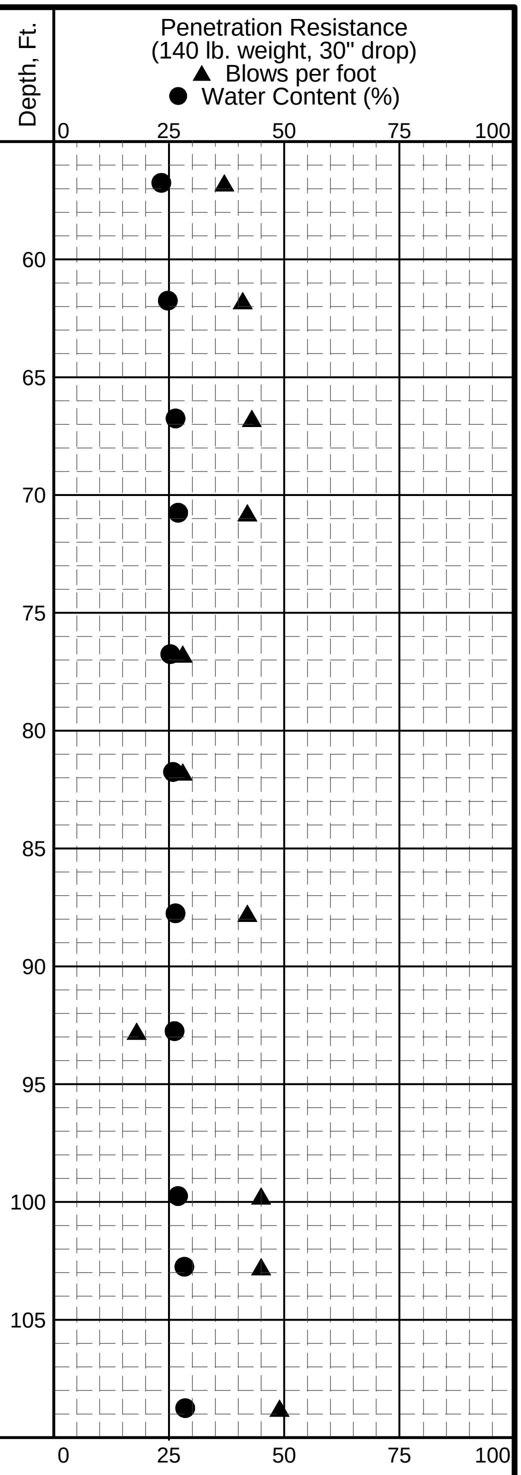
Wood fragments at 87 feet bgs

Note: Sample S17 skipped due to heaving sands

CONTINUED NEXT PAGE

S9
S10
S11
S12
S13
S14
S15
S16
S18
S19
S20

Groundwater not encountered during drilling on August 7-9, 2006



LEGEND

* Sample Not Recovered
⌶ 2" O.D. Split Spoon Sample
▬ Shelby Tube
▌▌ Soil Core Barrel
⊽ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit |—●—| Liquid Limit
Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

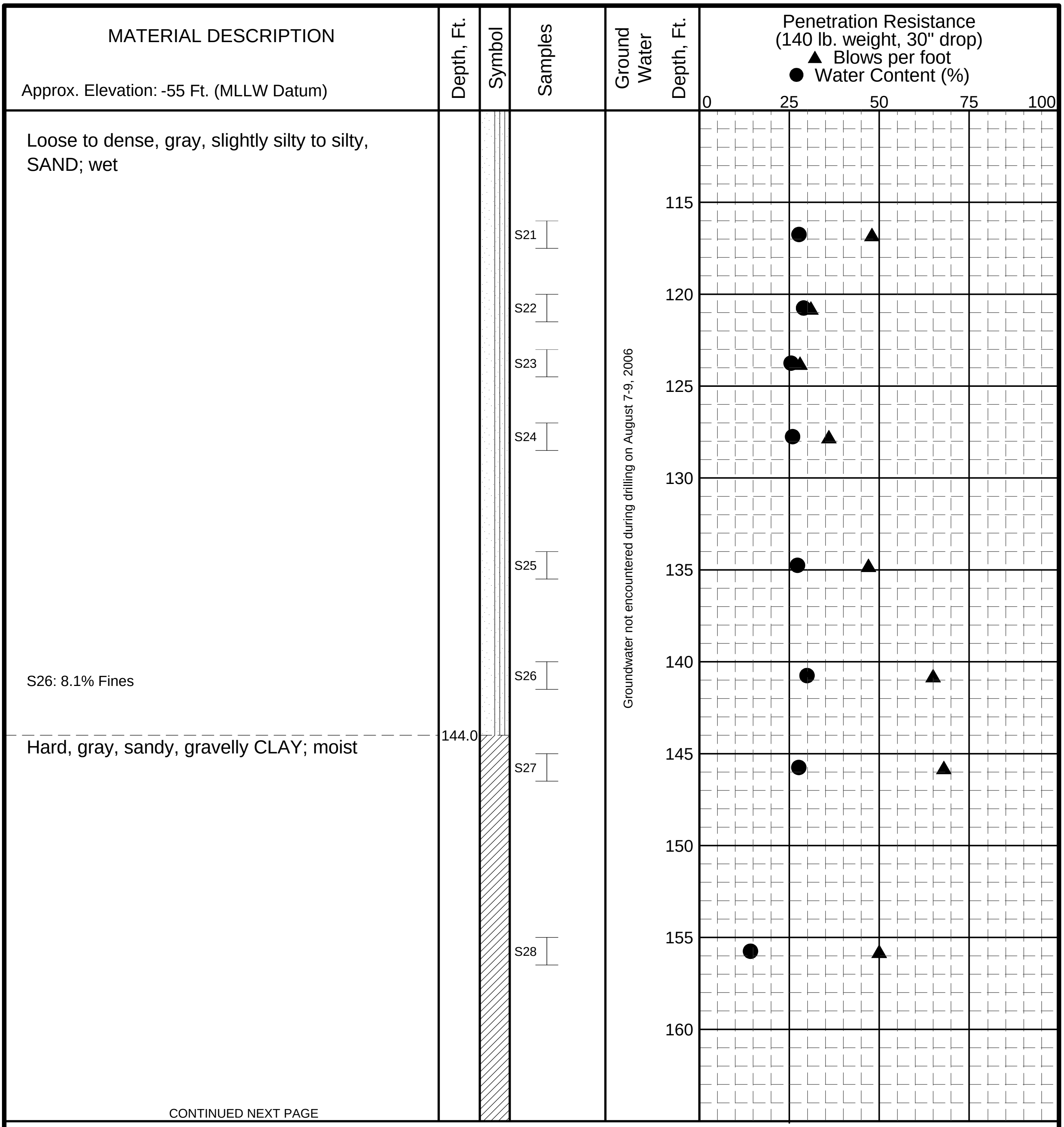
Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-09
Location: N 61°16'51.56" W 149°53'29.69"

March 2007 32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. A-10
Sheet 2 of 4



Loose to dense, gray, slightly silty to silty, SAND; wet

S26: 8.1% Fines

Hard, gray, sandy, gravelly CLAY; moist

CONTINUED NEXT PAGE

LEGEND

* Sample Not Recovered

⌶ 2" O.D. Split Spoon Sample

■ Shelby Tube

▮▮ Soil Core Barrel

▽ Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit |—●—| Liquid Limit

Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-09
Location: N 61°16'51.56" W 149°53'29.69"

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

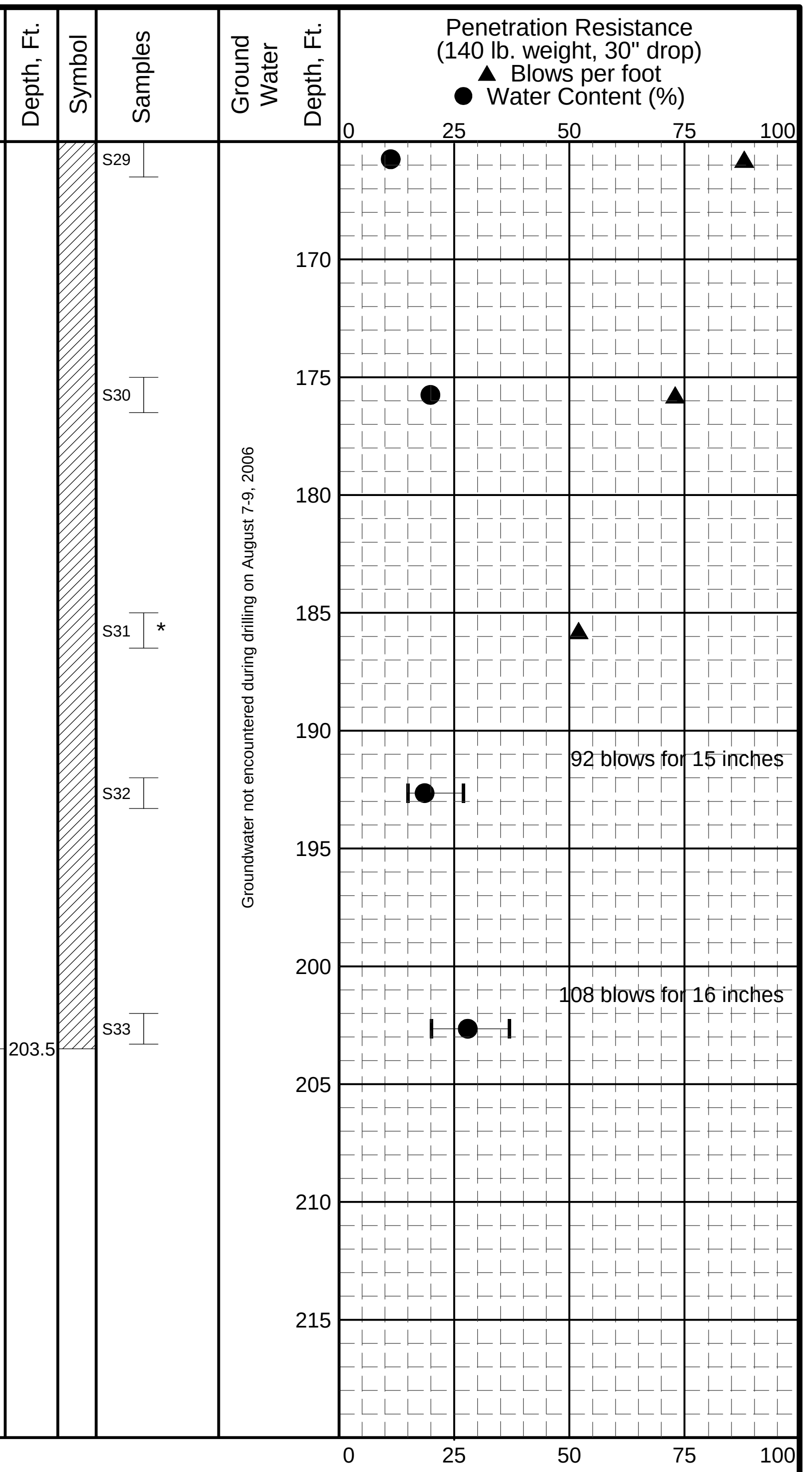
Fig. A-10
Sheet 3 of 4

MATERIAL DESCRIPTION

Approx. Elevation: -55 Ft. (MLLW Datum)

Hard, gray, sandy, gravelly CLAY; moist

Bottom of Boring
Boring Completed August 7-9, 2006



LEGEND

- * Sample Not Recovered
- ⌶ 2" O.D. Split Spoon Sample
- ■ Shelby Tube
- ▮▮ Soil Core Barrel
- ▽ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit |—●—| Liquid Limit
Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-09
Location: N 61°16'51.56" W 149°53'29.69"

March 2007 32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. A-10
Sheet 4 of 4

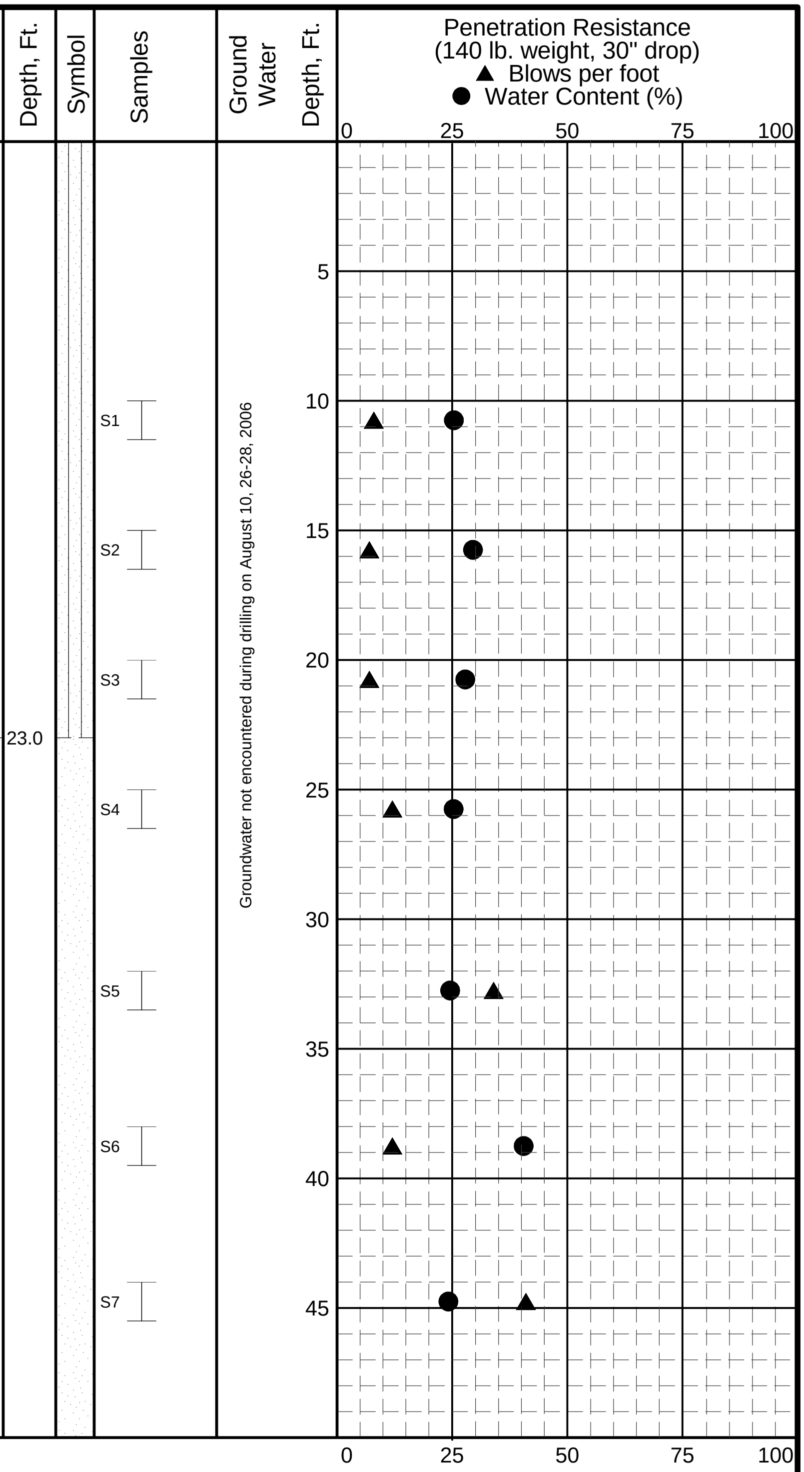
MATERIAL DESCRIPTION

Approx. Elevation: -50.5 Ft. (MLLW Datum)

Loose, gray, slightly silty, fine SAND; wet

Medium dense to very dense, gray, slightly silty to silty, fine SAND; wet

Note: Drilling interrupted on 8/10/2006. Sample numbers S8 and S9 skipped when drilling resumed at later date.



CONTINUED NEXT PAGE

LEGEND

* Sample Not Recovered

⌶ 2" O.D. Split Spoon Sample

■ Shelby Tube

▮▮ Soil Core Barrel

▽ Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-10
Location: N 61°16'49.901" W 149°53'20.08"

March 2007 32-1-01536-004

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Fig. A-11
Sheet 1 of 4

MATERIAL DESCRIPTION

Approx. Elevation: -50.5 Ft. (MLLW Datum)

S10: 4.6% Fines

New Location: N 61°16'50.07" W 149°53'20.21"

Medium dense to very dense, gray, slightly silty to silty, fine SAND; wet

S16: 13% Fines

2 inch peat layer at 95.5 feet bgs

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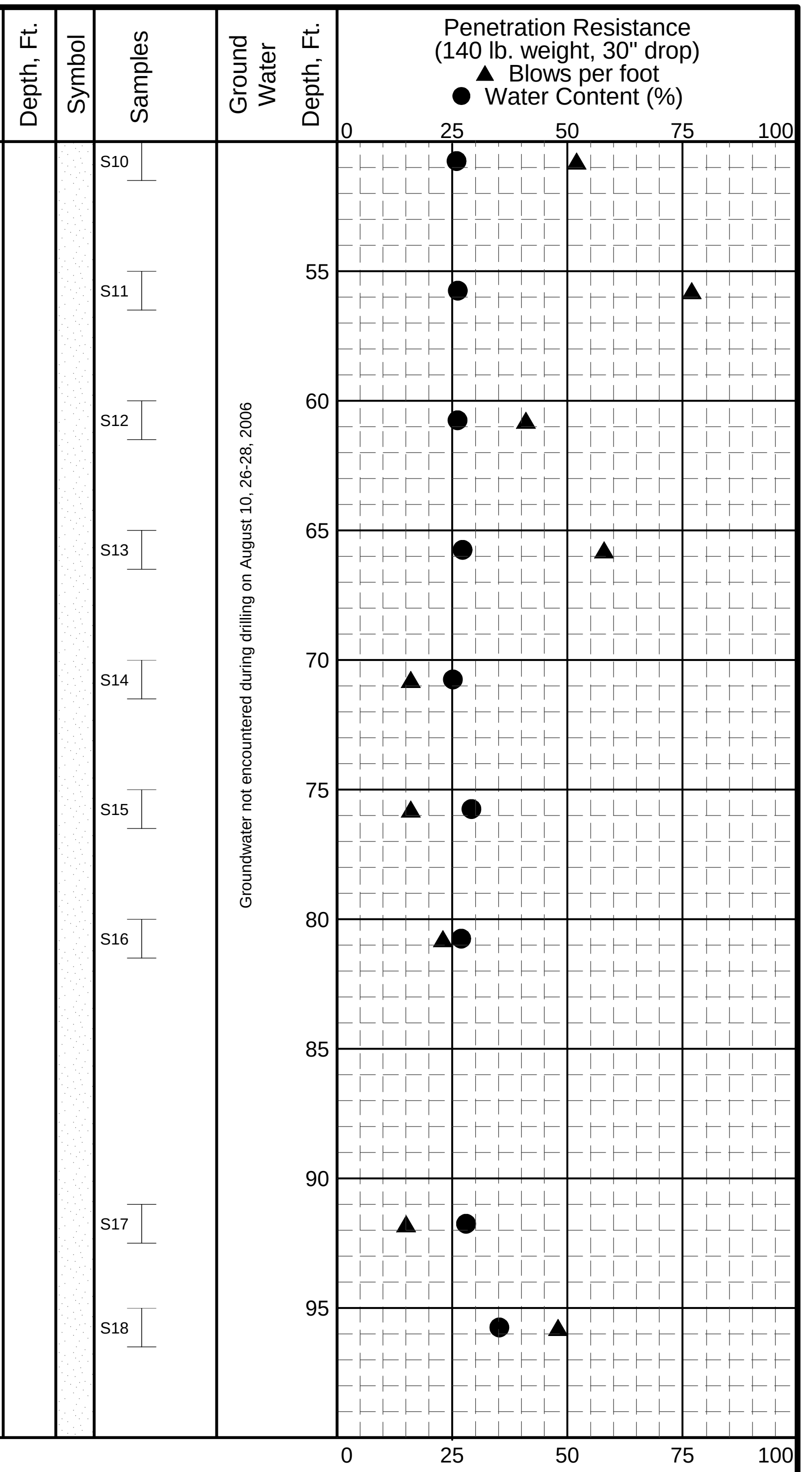

LEGEND

- * Sample Not Recovered
- ⌶ 2" O.D. Split Spoon Sample
- ■ Shelby Tube
- ▮▮ Soil Core Barrel
- ⊽ Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-10
Location: N 61°16'49.901" W 149°53'20.08"

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. A-11
Sheet 2 of 4

MATERIAL DESCRIPTION

Approx. Elevation: -50.5 Ft. (MLLW Datum)

Medium dense to very dense, gray, slightly silty to silty, fine SAND; wet

S20: 15% Fines

0.5-inch peat layer at 116 feet bgs

S24: 28% Fines

2-inch peat layer and two, 0.1-inch peat seams at 139 feet bgs

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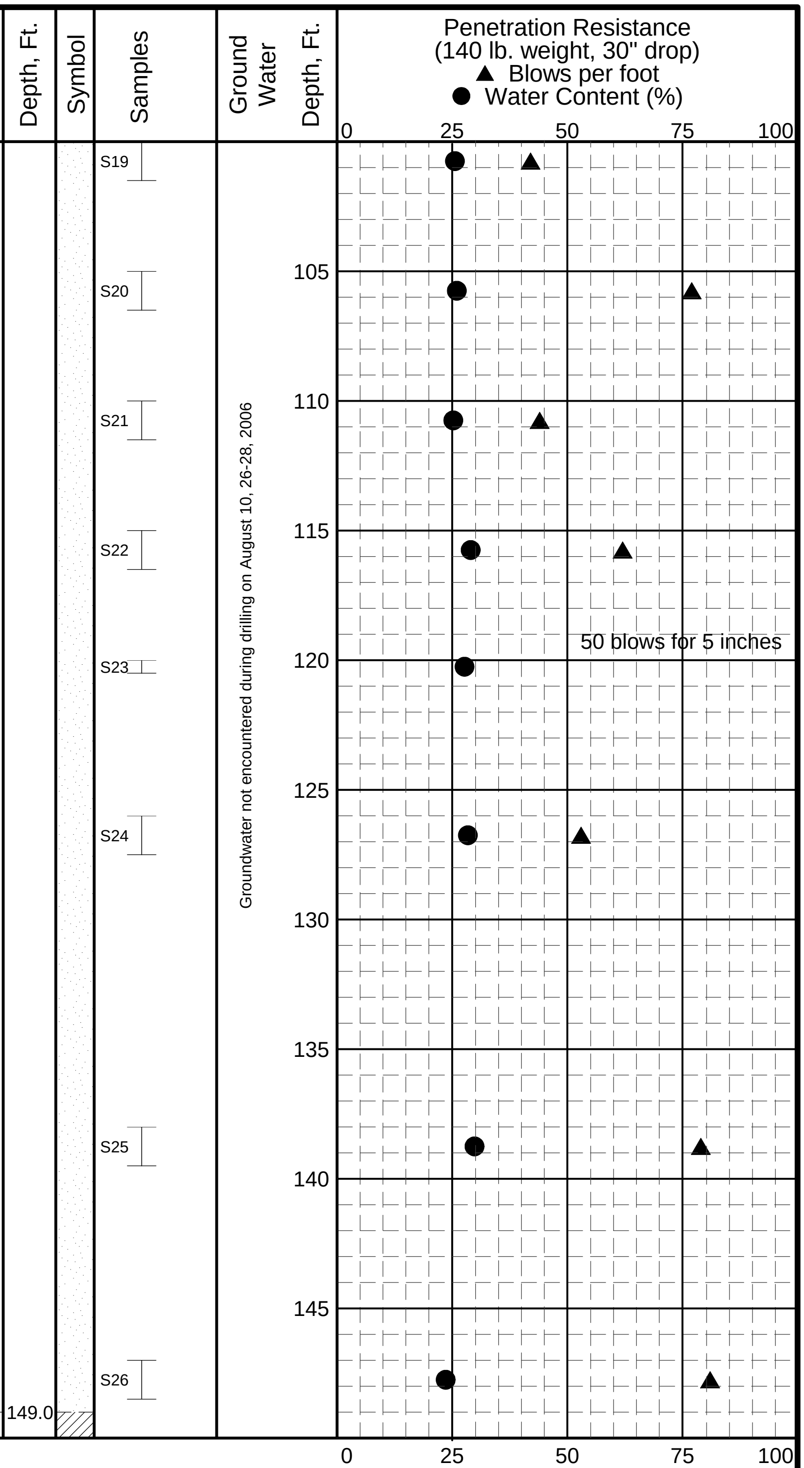


LEGEND

- * Sample Not Recovered
- ⌶ 2" O.D. Split Spoon Sample
- ■ Shelby Tube
- ▮▮ Soil Core Barrel
- ▽ Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit ├──●──┤ Liquid Limit

Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-10
Location: N 61°16'49.901" W 149°53'20.08"

March 2007 32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. A-11
Sheet 3 of 4

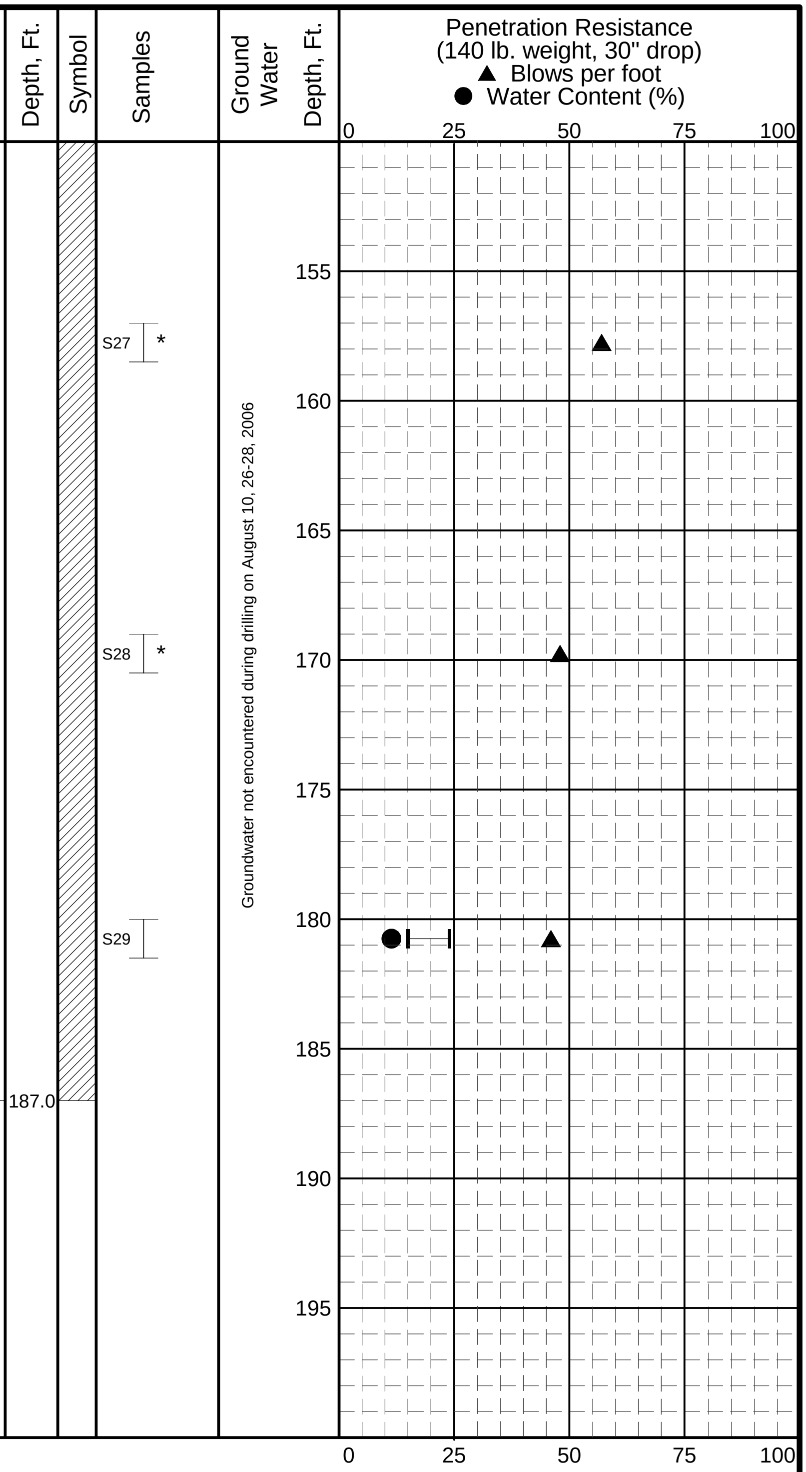
MATERIAL DESCRIPTION

Approx. Elevation: -50.5 Ft. (MLLW Datum)

Hard, gray, slightly gravelly to gravelly CLAY; wet

Note: Possible change in soil type, bottom of boring sloughed prior to sampling, no sample was attempted.

Bottom of Boring
Boring Completed August 10, 26-28, 2006



LEGEND

* Sample Not Recovered
⌶ 2" O.D. Split Spoon Sample
■ Shelby Tube
▮▮ Soil Core Barrel
▽ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Knik Arm, Alaska

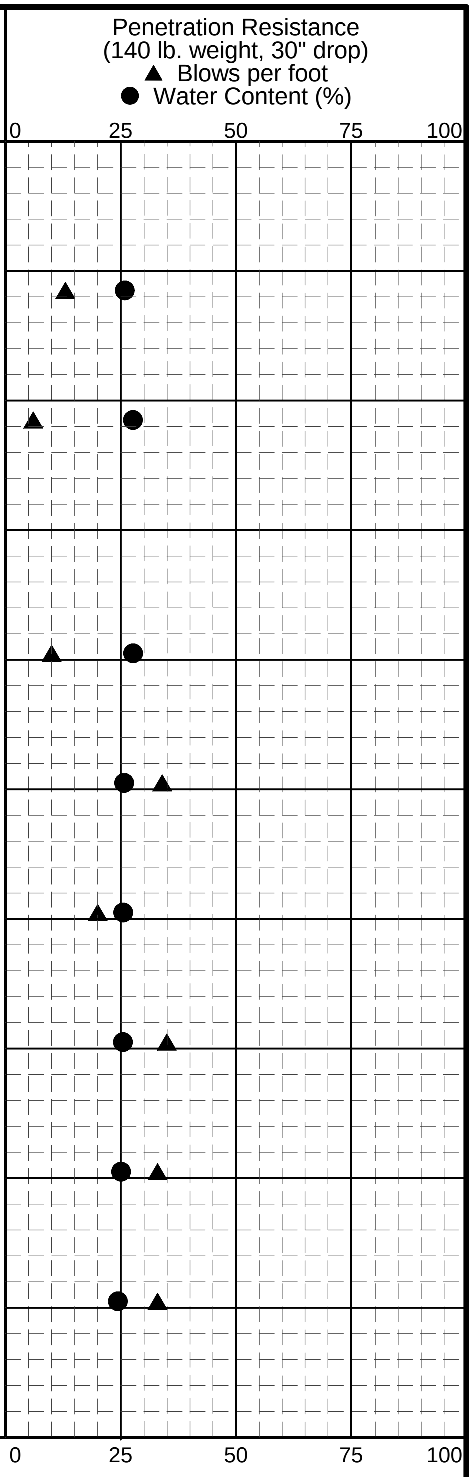
LOG OF BORING B06-10
Location: N 61°16'49.901" W 149°53'20.08"

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. A-11
Sheet 4 of 4

MATERIAL DESCRIPTION Approx. Elevation: -48 Ft. (MLLW Datum)	Depth, Ft.	Symbol	Samples	Ground Water	Depth, Ft.
Note: CPT advanced at Location N 61°16'48.28" W 149°53'10.17" See log of CPT-11 in Appendix B for further data on Boring B06-11				Groundwater not encountered during drilling on September 17-18, 2006	
Loose to dense, gray, slightly silty to silty SAND; wet			S1 ⌶		5
			S2 ⌶		10
					15
S3: 93% Sand, 7% Fines			S3 ⌶		20
			S4 ⌶		25
S5: 11% Fines			S5 ⌶		30
			S6 ⌶		35
			S7 ⌶		40
			S8 ⌶		45



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LEGEND

- * Sample Not Recovered
- ⌶ 2" O.D. Split Spoon Sample
- ▬ Shelby Tube
- ▌▌ Soil Core Barrel
- ⊻ Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit ├──●──┤ Liquid Limit

Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-11
Location: N 61°16'48.47" W 149°53'09.86"

March 2007 32-1-01536-004

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Fig. A-12
Sheet 1 of 4

MATERIAL DESCRIPTION

Approx. Elevation: -48 Ft. (MLLW Datum)

Loose to dense, gray, slightly silty to silty SAND; wet

S11: 9.6% Fines

S15: 14% Fines

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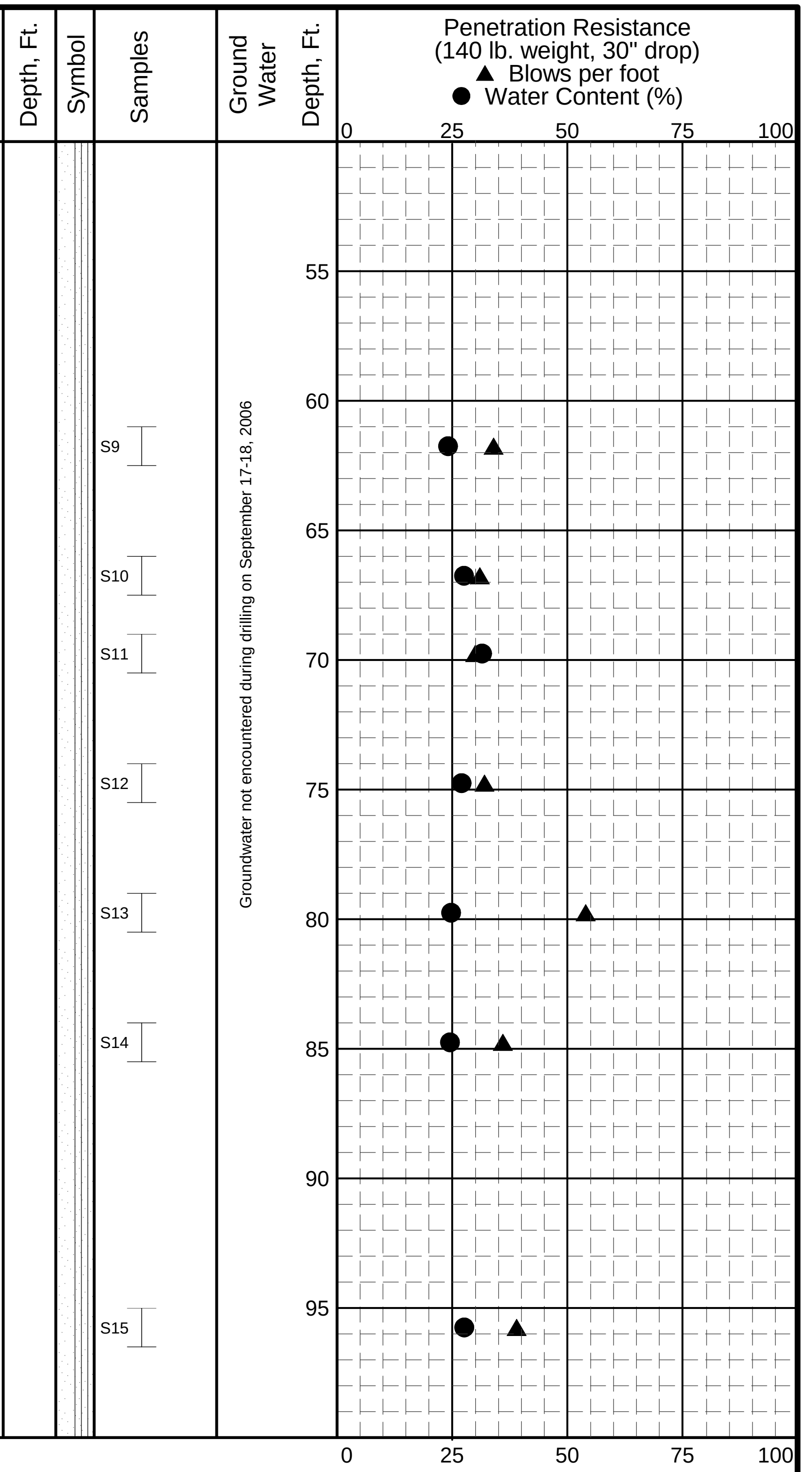

LEGEND

*	Sample Not Recovered	⊻	Ground Water Level At Time Of Drilling
⌶	2" O.D. Split Spoon Sample		
■	Shelby Tube		
▮▮	Soil Core Barrel		

● Water Content (%)

Plastic Limit ├──●──┤ Liquid Limit

Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-11
Location: N 61°16'48.47" W 149°53'09.86"

March 2007 32-1-01536-004

SHANNON & WILSON, INC.
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Fig. A-12
Sheet 2 of 4

MATERIAL DESCRIPTION

Approx. Elevation: -48 Ft. (MLLW Datum)

Loose to dense, gray, slightly silty to silty SAND; wet

Note: CPT "refusal" reached at maximum depth 145.83 feet bgs on 8/16/2006. Split spoon sampled to 160 feet bgs prior to moving to new location N 61°16'48.67 W 149°53'09.86 and redrilling boring.

145.0

S20: 30% Gravel, 63% Sand, 7% Fines

Very dense, gray, slightly silty, gravelly SAND; wet

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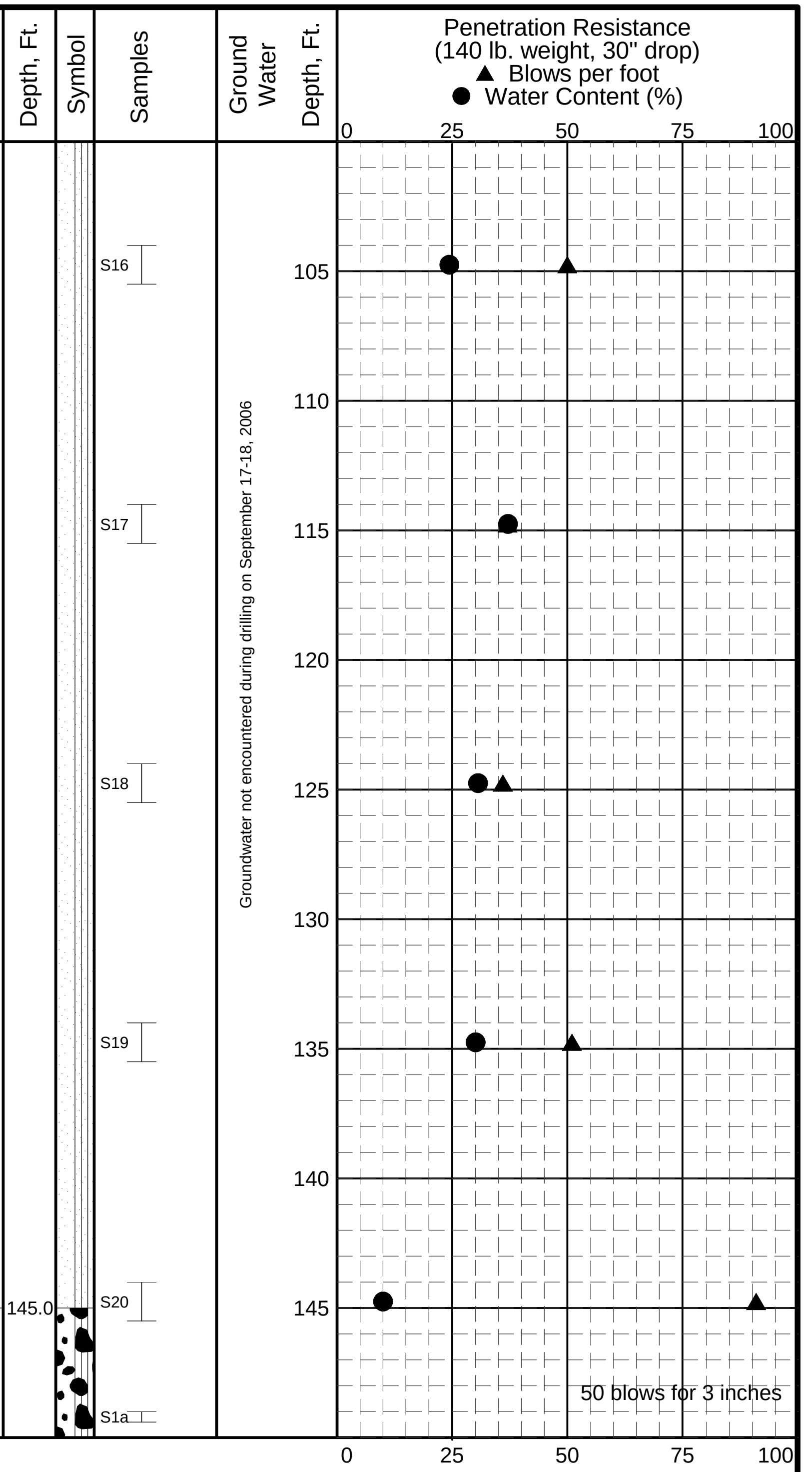


LEGEND

*	Sample Not Recovered
⌶	2" O.D. Split Spoon Sample
■	Shelby Tube
▮▮	Soil Core Barrel
⊻	Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit ├──●──┤ Liquid Limit

Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-11
Location: N 61°16'48.47" W 149°53'09.86"

March 2007 32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. A-12
Sheet 3 of 4

MATERIAL DESCRIPTION

Approx. Elevation: -48 Ft. (MLLW Datum)

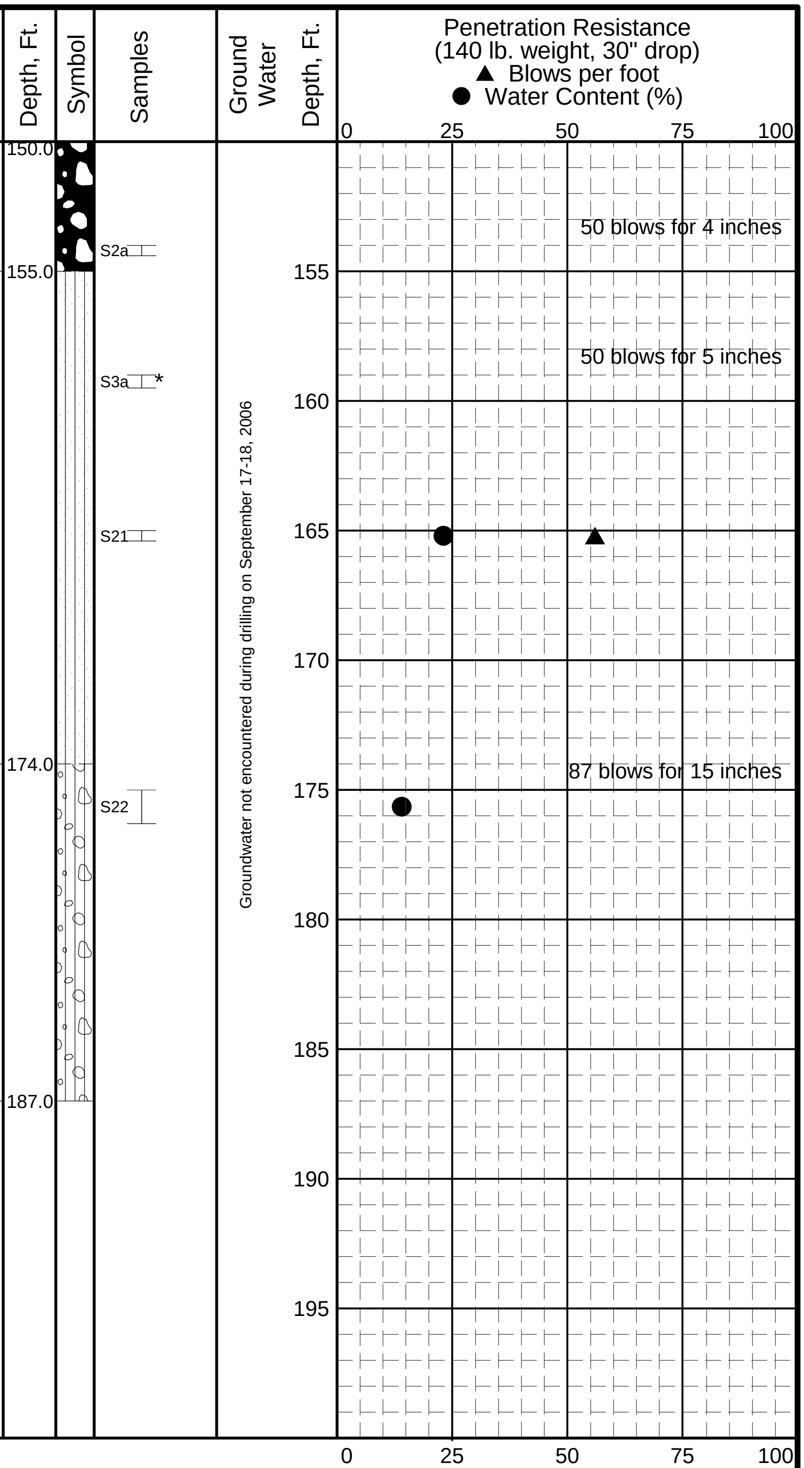
Cobbles and coarse gravels as logged by drill action

Hard, gray, slightly sandy to sandy SILT; moist

Hard, gray, gravelly SILT; moist

Note: Possible change in soil type. Bottom of boring sloughed prior to sampling, no sample attempted.

Bottom of Boring
Boring Completed September 17-18, 2006



LEGEND

*	Sample Not Recovered
⌶	2" O.D. Split Spoon Sample
■	Shelby Tube
▮▮	Soil Core Barrel
⊽	Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-11
Location: N 61°16'48.47" W 149°53'09.86"

March 2007 32-1-01536-004

SHANNON & WILSON, INC.
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Fig. A-12
Sheet 4 of 4

MATERIAL DESCRIPTION

Approx. Elevation: -49 Ft. (MLLW Datum)

Depth, Ft. | Symbol | Samples | Ground Water | Depth, Ft.

Very loose to loose, gray, clean to slightly silty SAND; wet

S1 *

S2: 11% Fines

S2

S3: 9.5% Fines

S3

S4

S5: 99% Sand, 1% Fines

S5

30.0

Medium dense to dense, gray, slightly silty to silty SAND; wet

S6

S7

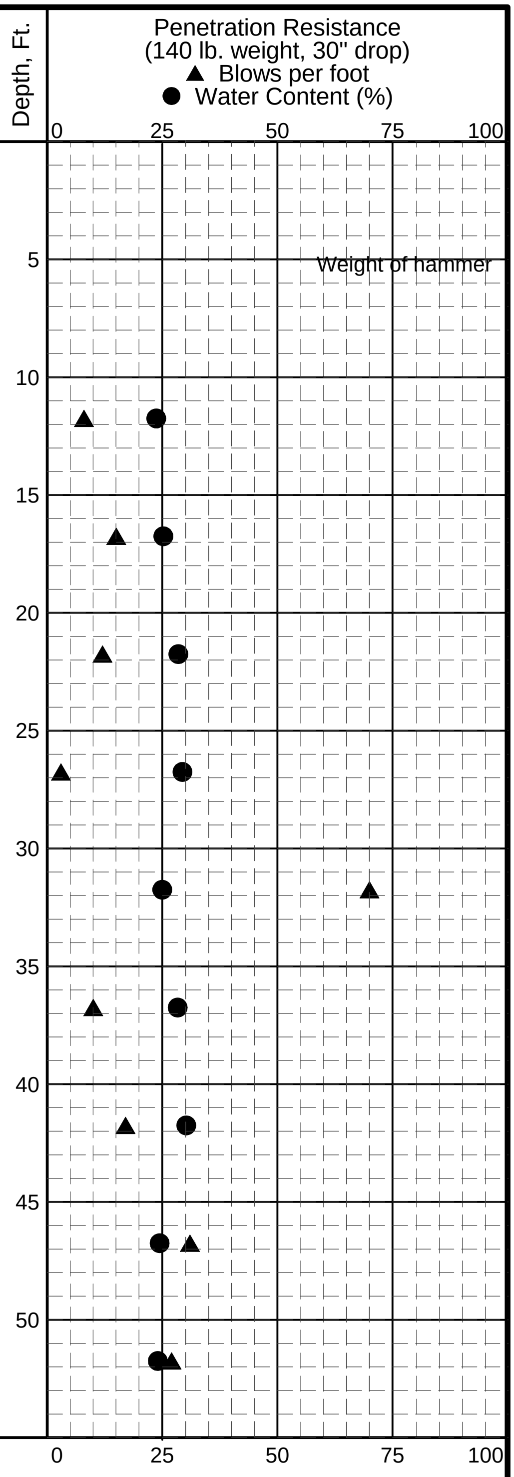
S8: 8.2% Fines

S8

S9

S10

Groundwater not encountered during drilling on September 30-October 1, 2006



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LEGEND

* Sample Not Recovered
⌶ 2" O.D. Split Spoon Sample
▬ Shelby Tube
▮▮ Soil Core Barrel
▽ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-12
Location: N 61°16'46.44" W 149°53'00.61"

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
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Fig. A-13
Sheet 1 of 5

MATERIAL DESCRIPTION

Approx. Elevation: -49 Ft. (MLLW Datum)

S11: 73% Sand, 27% Fines

Medium dense to dense, gray, slightly silty to silty SAND; wet

S15: 8.6% Fines

Dense, gray, trace to slightly silty SAND; wet

S20: 4.1% Fines

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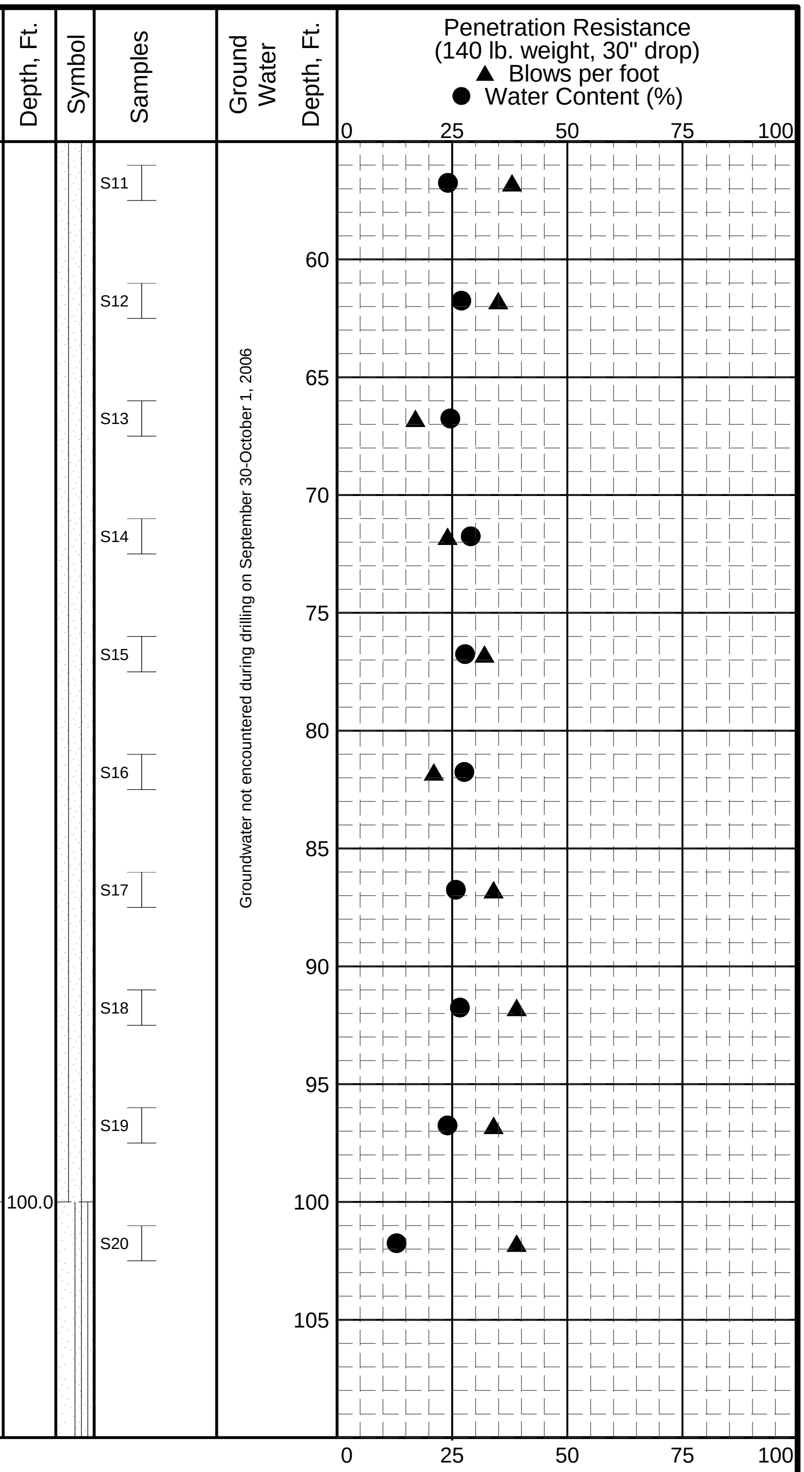

LEGEND

* Sample Not Recovered

⌶ 2" O.D. Split Spoon Sample

■ Shelby Tube

▮▮ Soil Core Barrel

▽ Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-12
Location: N 61°16'46.44" W 149°53'00.61"

March 2007 32-1-01536-004

SHANNON & WILSON, INC.
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Fig. A-13
Sheet 2 of 5

MATERIAL DESCRIPTION

Approx. Elevation: -49 Ft. (MLLW Datum)

Dense, gray, slightly silty SAND; wet
Gravel layer, 2 ft thick, at 107 feet bgs
(Inferred by drill action)

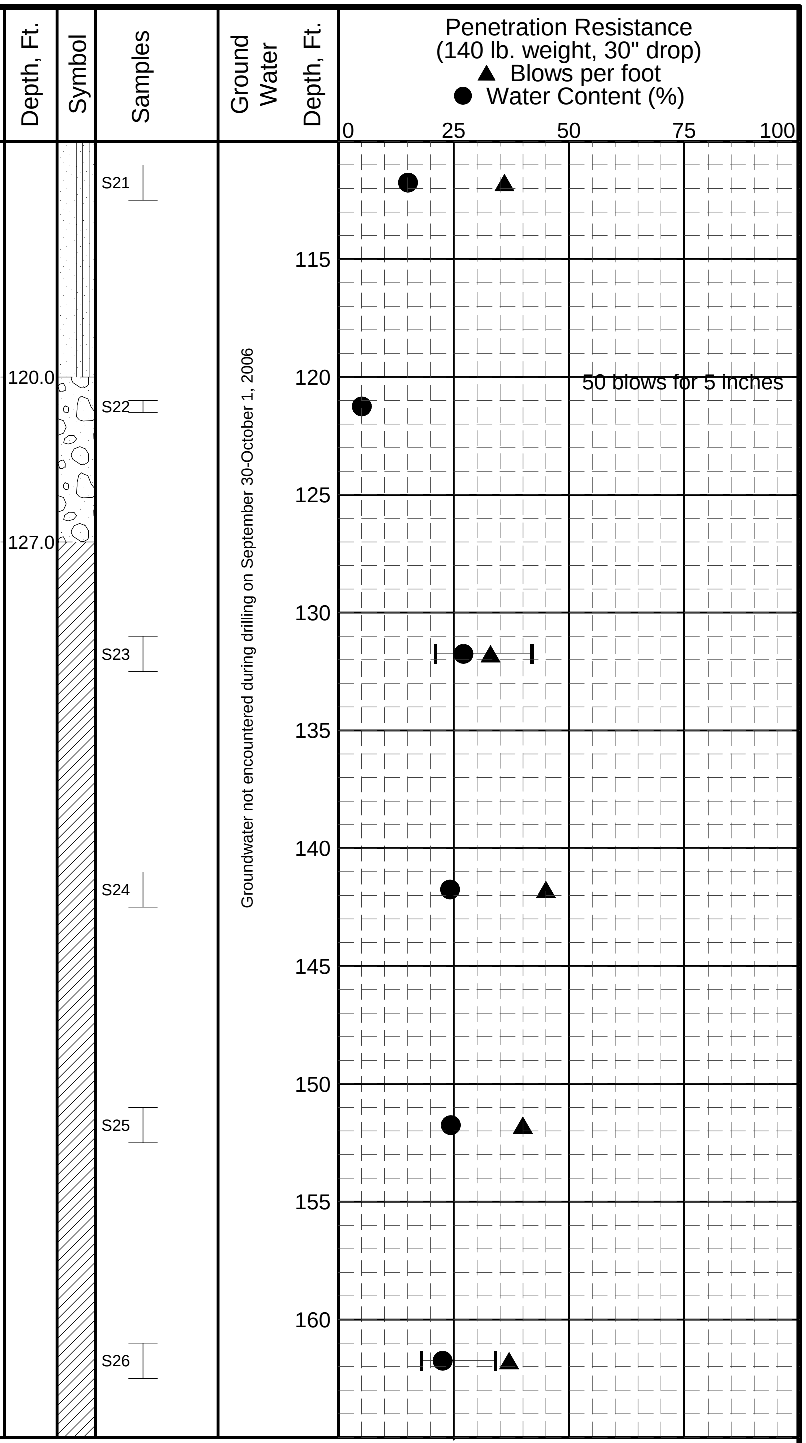
Dense, gray, sandy GRAVEL to COBBLES; wet

Very stiff to hard, gray CLAY; moist

S24: PP = 2.0

S25: PP = 2.5

S26: PP = 3.0



CONTINUED NEXT PAGE

LEGEND

- * Sample Not Recovered
- ⌶ 2" O.D. Split Spoon Sample
- ■ Shelby Tube
- ❚❚ Soil Core Barrel
- ∇ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-12
Location: N 61°16'46.44" W 149°53'00.61"

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
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Fig. A-13
Sheet 3 of 5

MATERIAL DESCRIPTION

Approx. Elevation: -49 Ft. (MLLW Datum)

Very stiff to hard, gray, silty CLAY; moist

S27: PP = 2.0

S28: PP = 3.0; TV = 0.8H

Medium dense to dense, gray, silty SAND to hard, gray, sandy SILT; moist to wet

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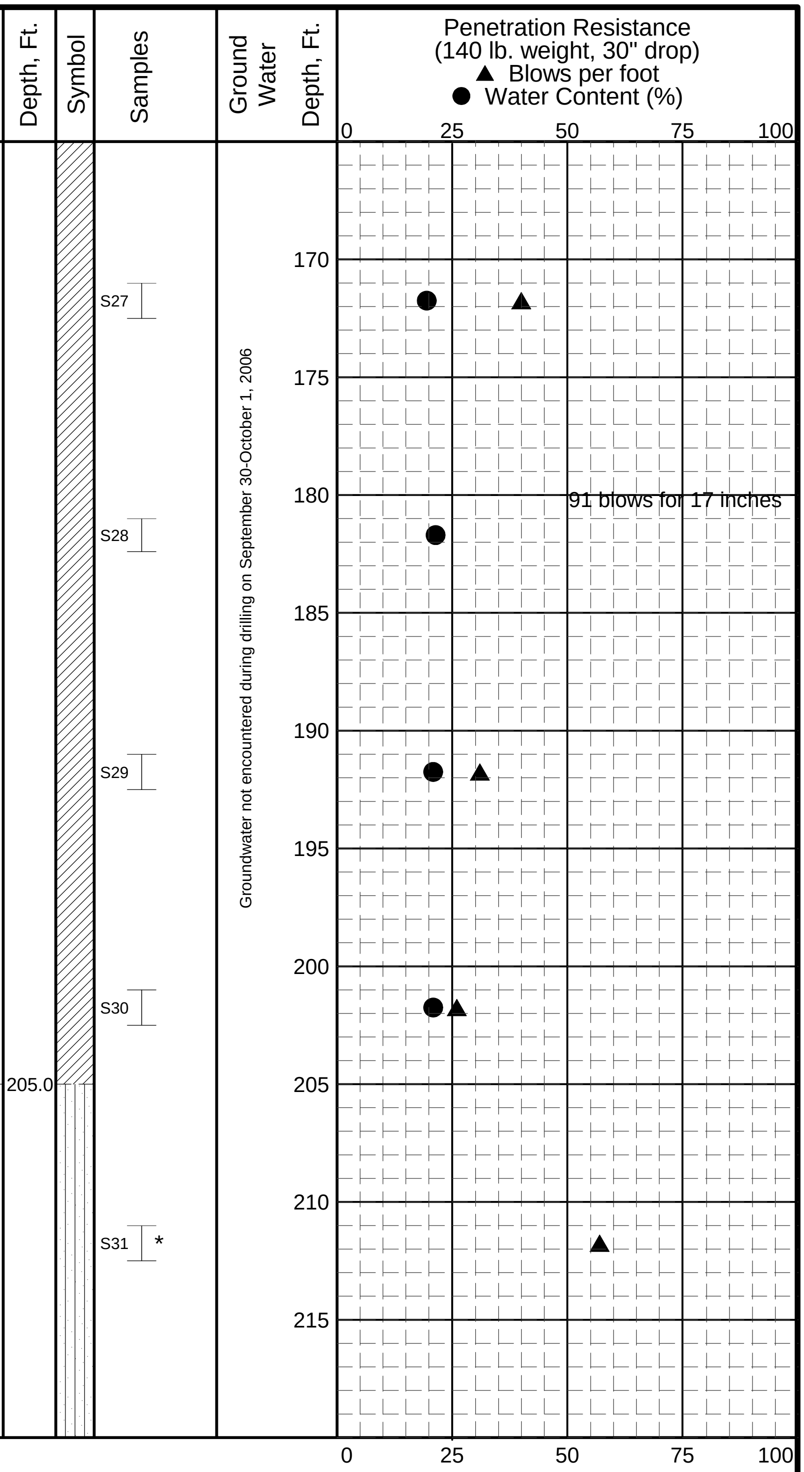

LEGEND

*	Sample Not Recovered
⌶	2" O.D. Split Spoon Sample
■	Shelby Tube
▮▮	Soil Core Barrel
▽	Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-12
Location: N 61°16'46.44" W 149°53'00.61"

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
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Fig. A-13
Sheet 4 of 5

MATERIAL DESCRIPTION

Approx. Elevation: -49 Ft. (MLLW Datum)

Depth, Ft.

Medium dense to dense, gray, silty SAND to hard, gray, sandy SILT; moist to wet

230.0

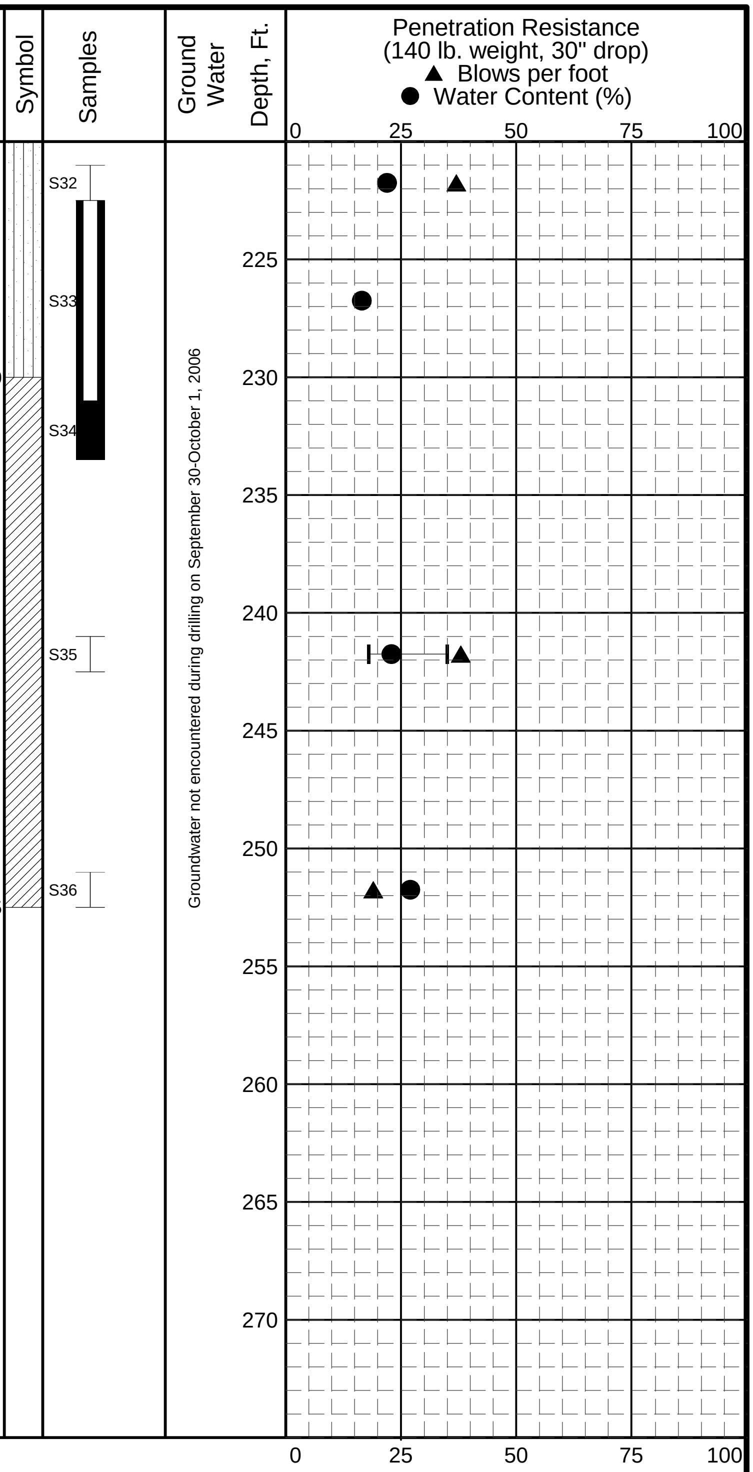
Very stiff to hard, gray CLAY; moist
Note: Sample S34, tube bent unable to extrude sample.

S35: PP = 2.0; TV = 1.3H 1.4V

S36: PP = 2.5; TV = 1.1H 1.3V

252.5

Bottom of Boring
Boring Completed September 30-October 1, 2006



LEGEND

* Sample Not Recovered
⌶ 2" O.D. Split Spoon Sample
■ Shelby Tube
▌▌ Soil Core Barrel
▽ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit |—●—| Liquid Limit
Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Knik Arm, Alaska

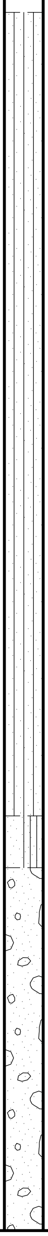
LOG OF BORING B06-12
Location: N 61°16'46.44" W 149°53'00.61"

March 2007 32-1-01536-004

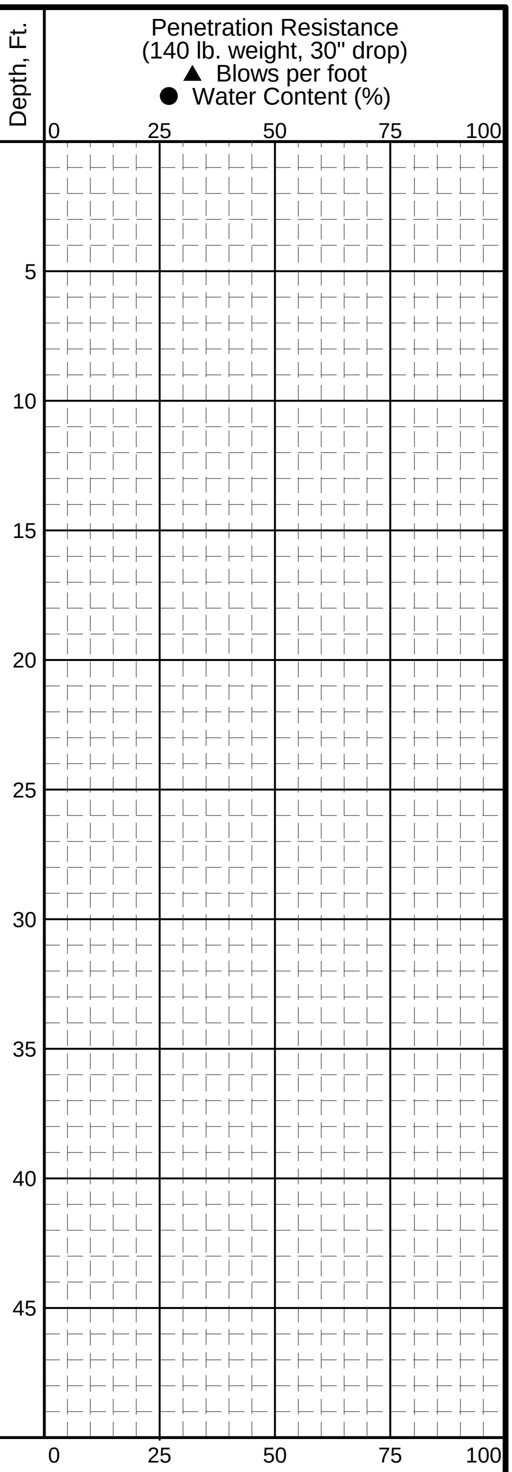
SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. A-13
Sheet 5 of 5

MATERIAL DESCRIPTION Approx. Elevation: -51 Ft. (MLLW Datum)	Depth, Ft.	Ground Water
Top 3 feet disturbed by drilling, no indication of soil type or consistency		Groundwater not encountered during drilling on September 29-30, 2006
Soft to medium stiff, sandy SILT to medium dense, silty SAND (based on CPT DATA)	3.0	
Medium dense to dense SAND (based on CPT DATA)	34.0	
Dense, gravelly SAND (based on CPT DATA) Note: CPT "refusal" reached at maximum depth of 42 feet bgs on 9/29/2006. Boring continued by drilling/sampling at same location.	36.0	



Samples



CONTINUED NEXT PAGE

LEGEND

- * Sample Not Recovered
- ⌶ 2" O.D. Split Spoon Sample
- ■ Shelby Tube
- ▮▮ Soil Core Barrel
- ▽ Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit ├──●──┤ Liquid Limit

Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-13
Location: N 61°16'44.835" W 149°52'51.451"

March 2007 32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. A-14
Sheet 1 of 3

MATERIAL DESCRIPTION

Approx. Elevation: -51 Ft. (MLLW Datum)

Drilling action suggests dense, gravelly SAND (interpreted from CPT and extends to 55 feet bgs)

Hard, gray CLAY; moist

Dense to very dense, gravelly, silty SAND; wet

S5: 14% Gravel, 37% Sand, 49% Fines

Dense to very dense, gray, silty SAND; wet

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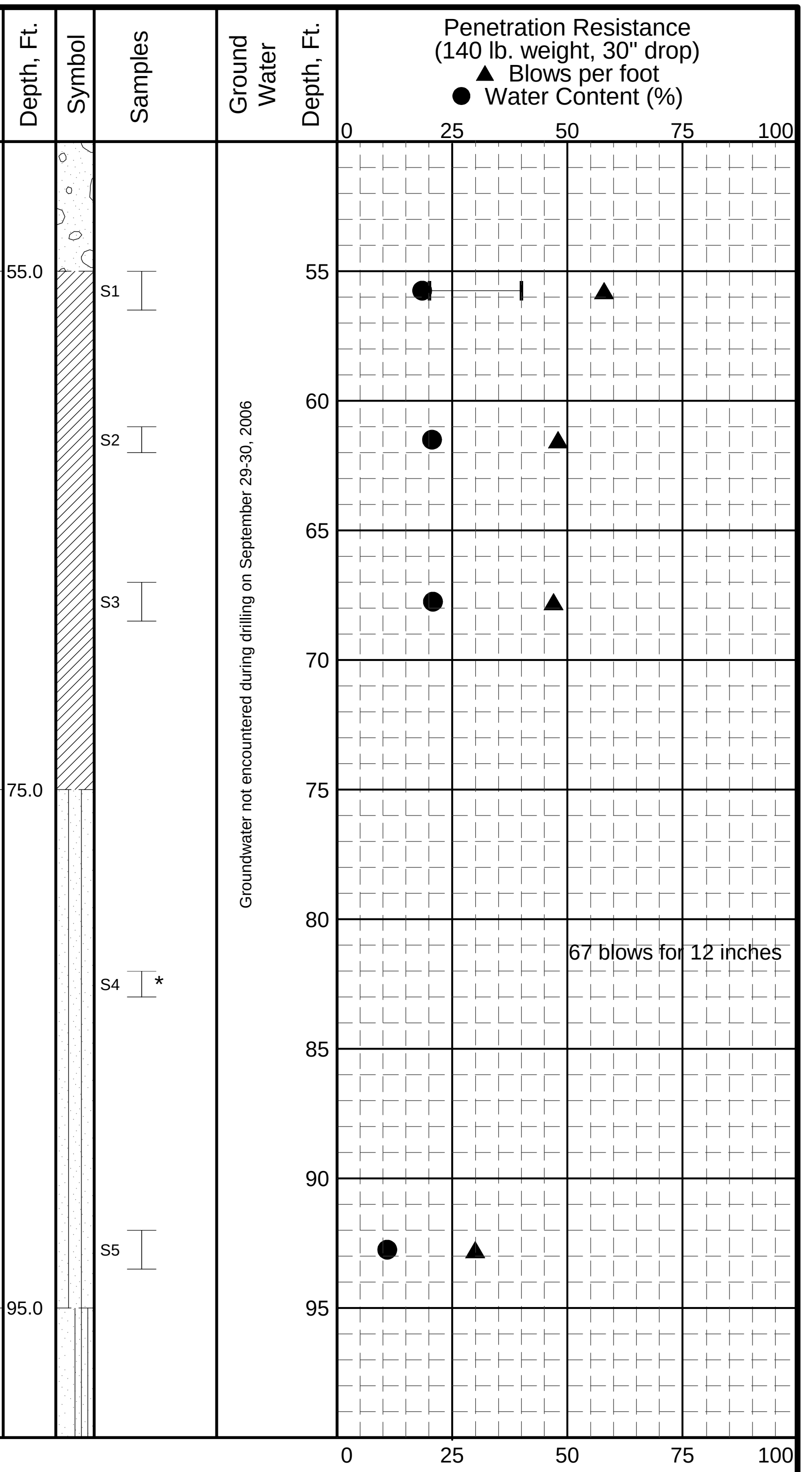


LEGEND

*	Sample Not Recovered
⌶	2" O.D. Split Spoon Sample
■	Shelby Tube
▮▮	Soil Core Barrel
⊽	Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit |—●—| Liquid Limit

Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

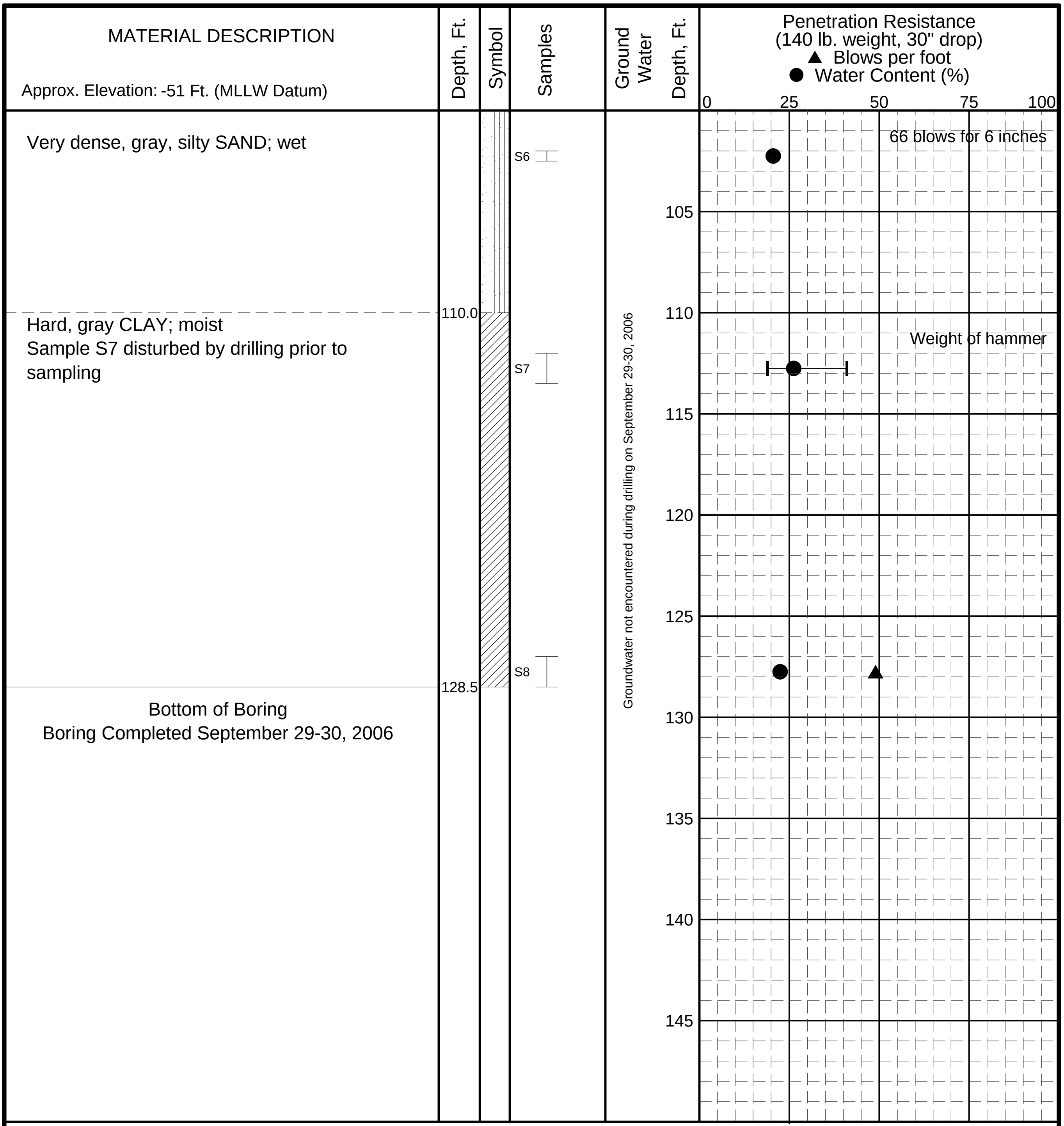
Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-13
Location: N 61°16'44.835" W 149°52'51.451"

March 2007 32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. A-14
Sheet 2 of 3



Very dense, gray, silty SAND; wet

Hard, gray CLAY; moist
Sample S7 disturbed by drilling prior to sampling

Bottom of Boring
Boring Completed September 29-30, 2006

LEGEND

- * Sample Not Recovered
- ⌶ 2" O.D. Split Spoon Sample
- ■ Shelby Tube
- ▮▮ Soil Core Barrel
- ▽ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-13
Location: N 61°16'44.835" W 149°52'51.451"

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
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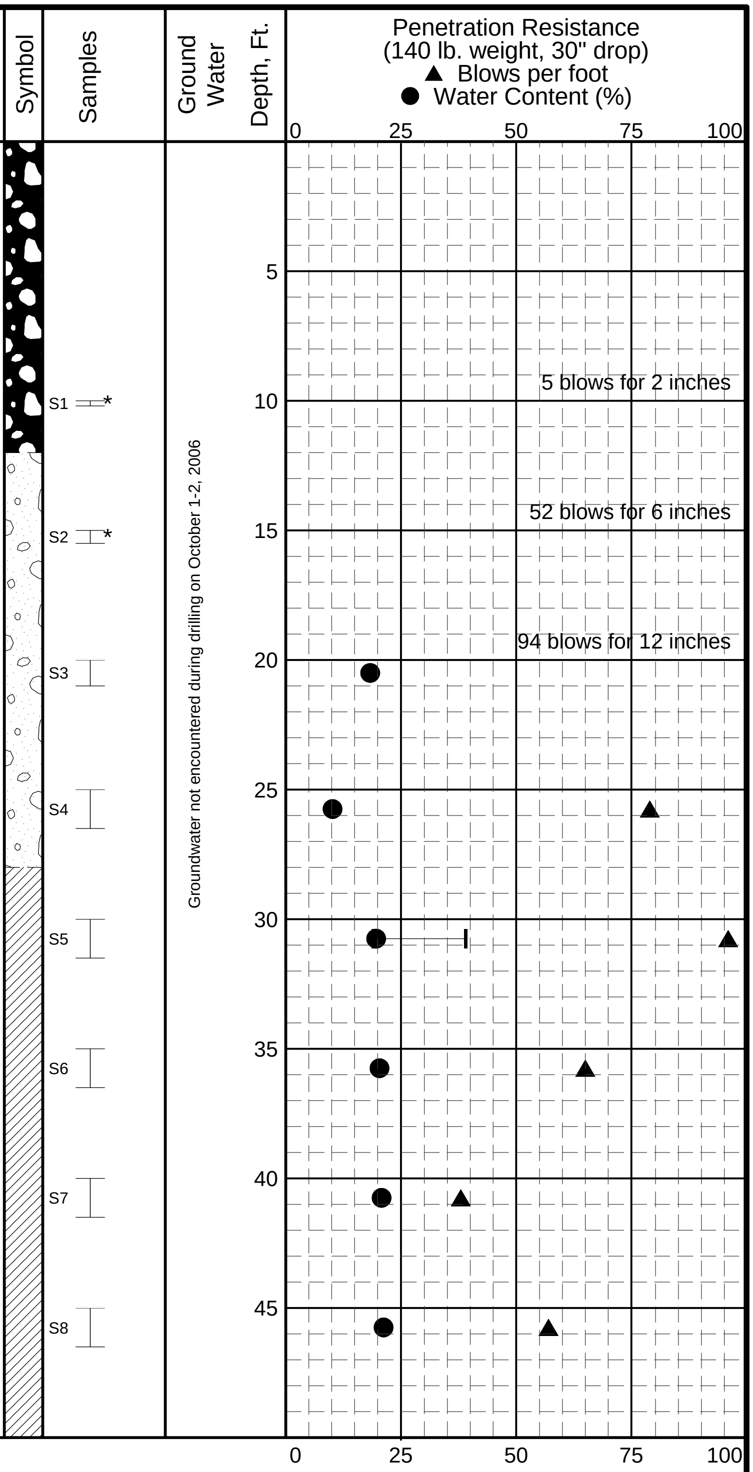
Fig. A-14
Sheet 3 of 3

MATERIAL DESCRIPTION

Approx. Elevation: -30 Ft. (MLLW Datum)

Depth, Ft.	MATERIAL DESCRIPTION
	Cobbles and coarse gravels as logged by drill action
12.0	Very dense, gray, gravelly, silty SAND; wet
28.0	Hard, gray CLAY; moist S5: PP = >4.5 S7: PP = >4.5



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LEGEND

- * Sample Not Recovered
- ⌶ 2" O.D. Split Spoon Sample
- ■ Shelby Tube
- ▮▮ Soil Core Barrel
- ▽ Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit |——●——| Liquid Limit

Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-14
Location: N 61°16'42.98" W 149°52'41.60"

March 2007 32-1-01536-004

SHANNON & WILSON, INC.
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Fig. A-15
Sheet 1 of 5

MATERIAL DESCRIPTION

Approx. Elevation: -30 Ft. (MLLW Datum)

S9: PP = >4.5; TV = 1.9H

Hard, gray CLAY; moist

S11: PP = >4.5

S12: PP = 4.0; TV = 1.6H

S13: PP = 3.8; TV = 1.5H

S14: PP = >4.5

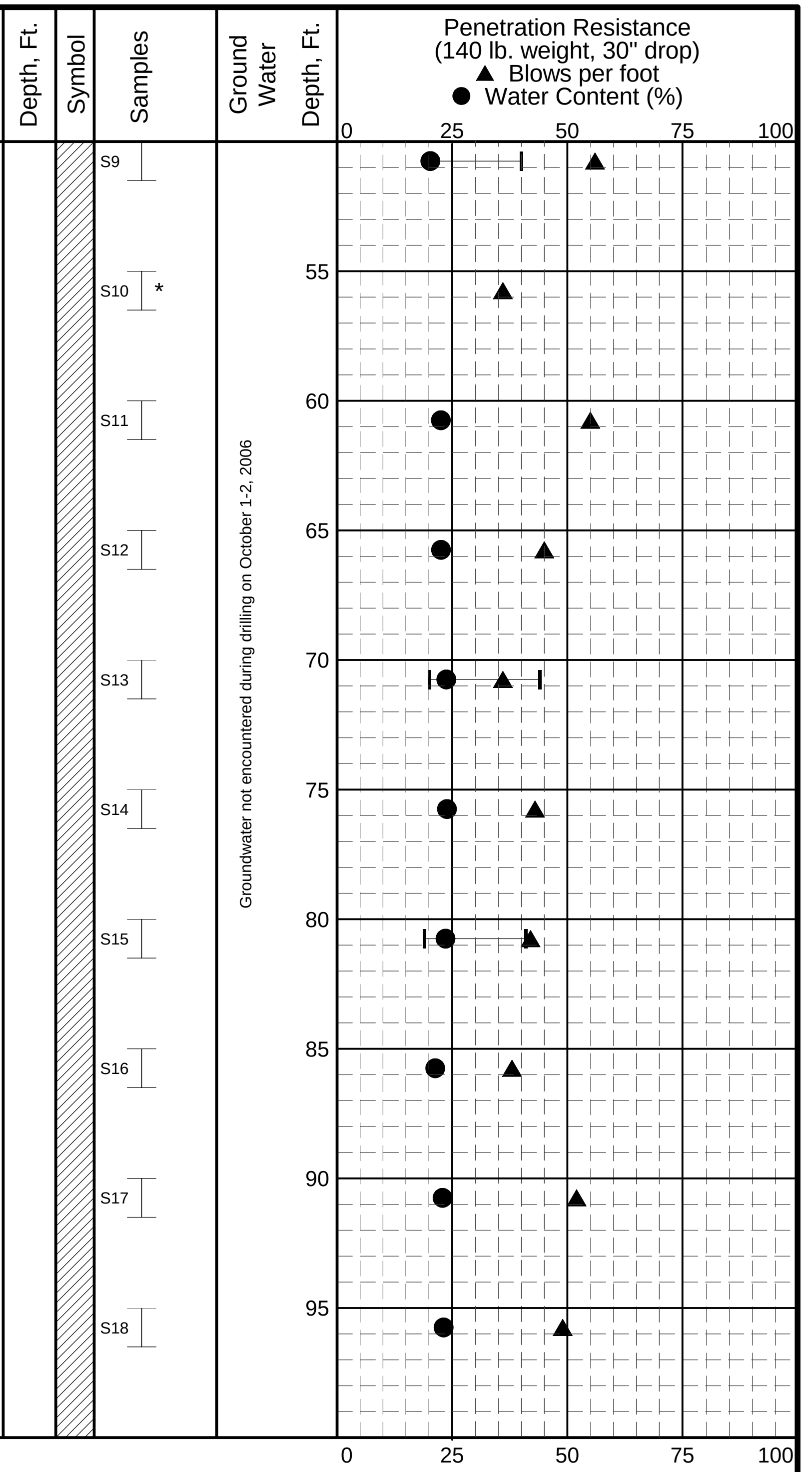
S15: PP = >4.5

S16: PP = >4.5

S17: PP = 4.3

S18: PP = >4.5

CONTINUED NEXT PAGE



LEGEND

- * Sample Not Recovered
- ⌶ 2" O.D. Split Spoon Sample
- ■ Shelby Tube
- ▌▌ Soil Core Barrel
- ∇ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-14
Location: N 61°16'42.98" W 149°52'41.60"

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
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Fig. A-15
Sheet 2 of 5

MATERIAL DESCRIPTION

Approx. Elevation: -30 Ft. (MLLW Datum)

S19: PP = 4.3

Hard, gray CLAY; moist

S21: PP = >4.5

Possible sand layer as logged by drill action

Very stiff to hard, gray CLAY; moist

S23: PP = >4.5; TV = 1.9H 1.6V

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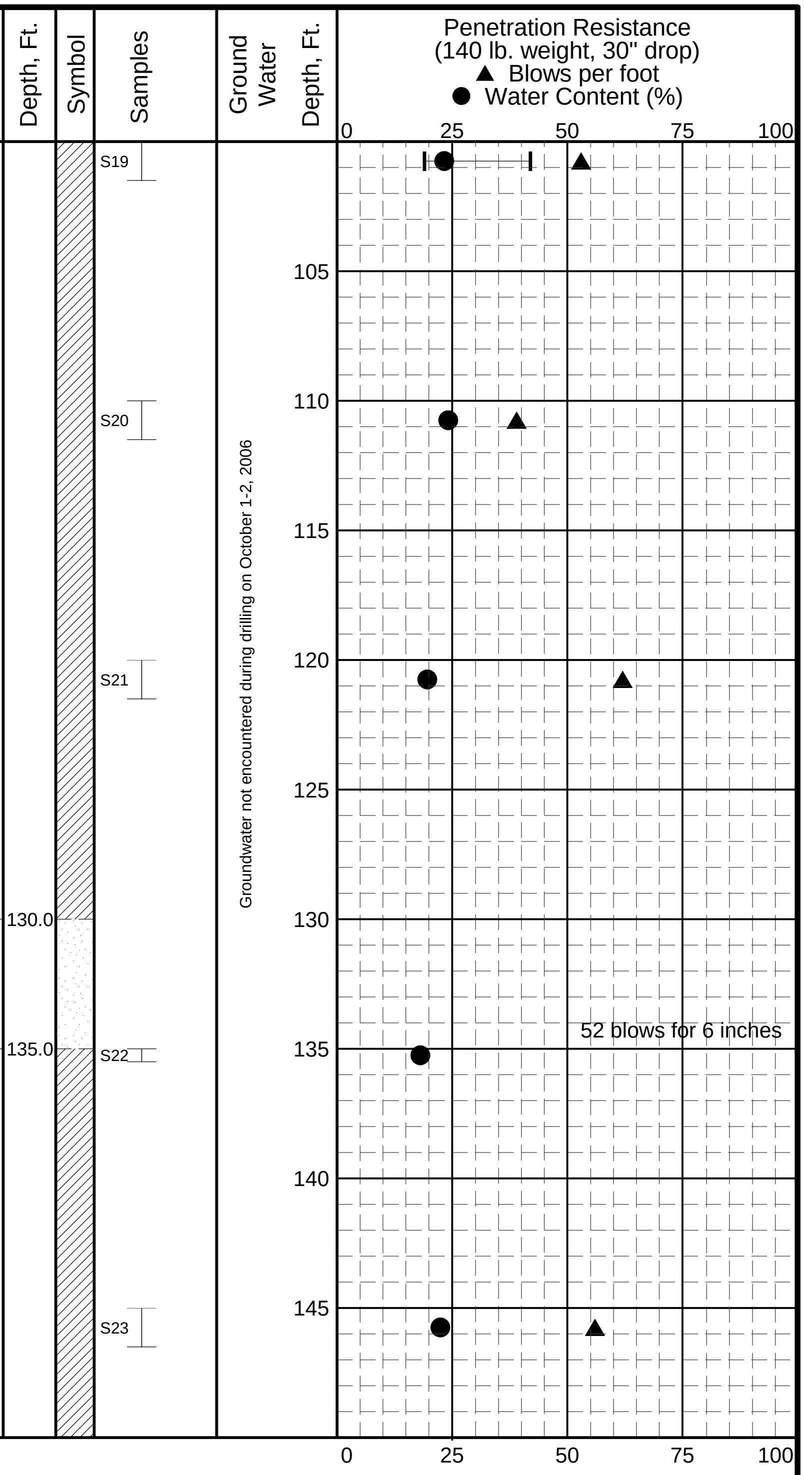

LEGEND

*	Sample Not Recovered	⊽	Ground Water Level At Time Of Drilling
⌶	2" O.D. Split Spoon Sample		
■	Shelby Tube		
▮▮	Soil Core Barrel		

● Water Content (%)

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
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4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-14
Location: N 61°16'42.98" W 149°52'41.60"

March 2007 32-1-01536-004

SHANNON & WILSON, INC.
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Fig. A-15
Sheet 3 of 5

MATERIAL DESCRIPTION

Approx. Elevation: -30 Ft. (MLLW Datum)

Very stiff to hard, gray CLAY; moist

S24: PP = >4.5; TV = 1.6H 1.4V

S25: PP = 3.8; TV = 1.6H

S26: PP = 4.3; TV = 1.5H
Qu = >4.4 tsf

S27: PP = 2.8; TV = 1.0H 1.4V

S28: PP = 2.5; TV = 1.0H 1.1V

S29: PP = 3.5; TV = 1.1H 1.3V

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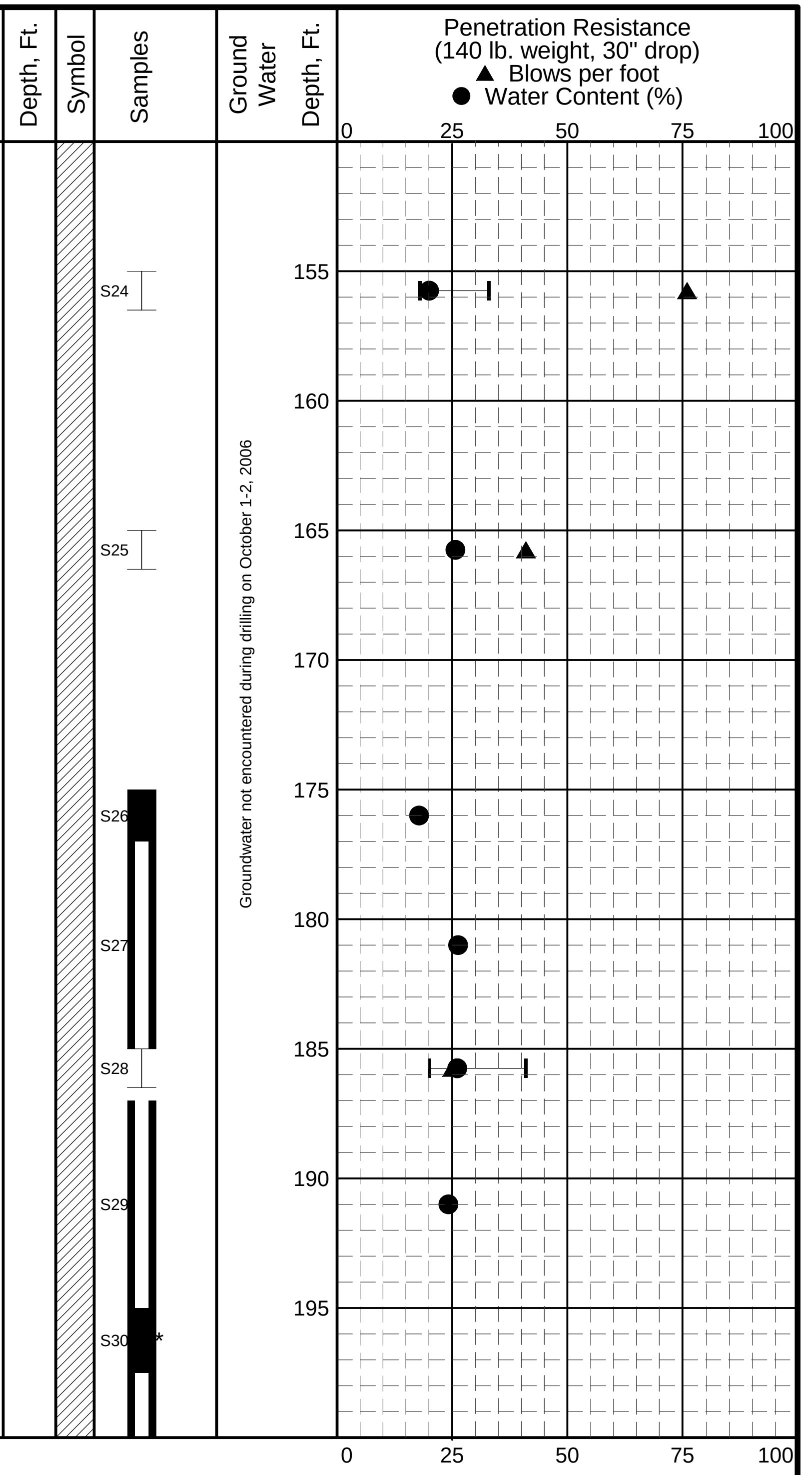

LEGEND

- * Sample Not Recovered
- ⌶ 2" O.D. Split Spoon Sample
- ■ Shelby Tube
- ▌▌ Soil Core Barrel
- ⊻ Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit |——●——| Liquid Limit
Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
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Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-14
Location: N 61°16'42.98" W 149°52'41.60"

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
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Fig. A-15
Sheet 4 of 5

MATERIAL DESCRIPTION

Approx. Elevation: -30 Ft. (MLLW Datum)

S31: PP = 4.5; TV = 1.3H

Very stiff to hard, gray CLAY; moist

S32: PP = 2.0; TV = 0.9H 0.9V

S33: PP = 3.5; TV = 1.0H 1.0V

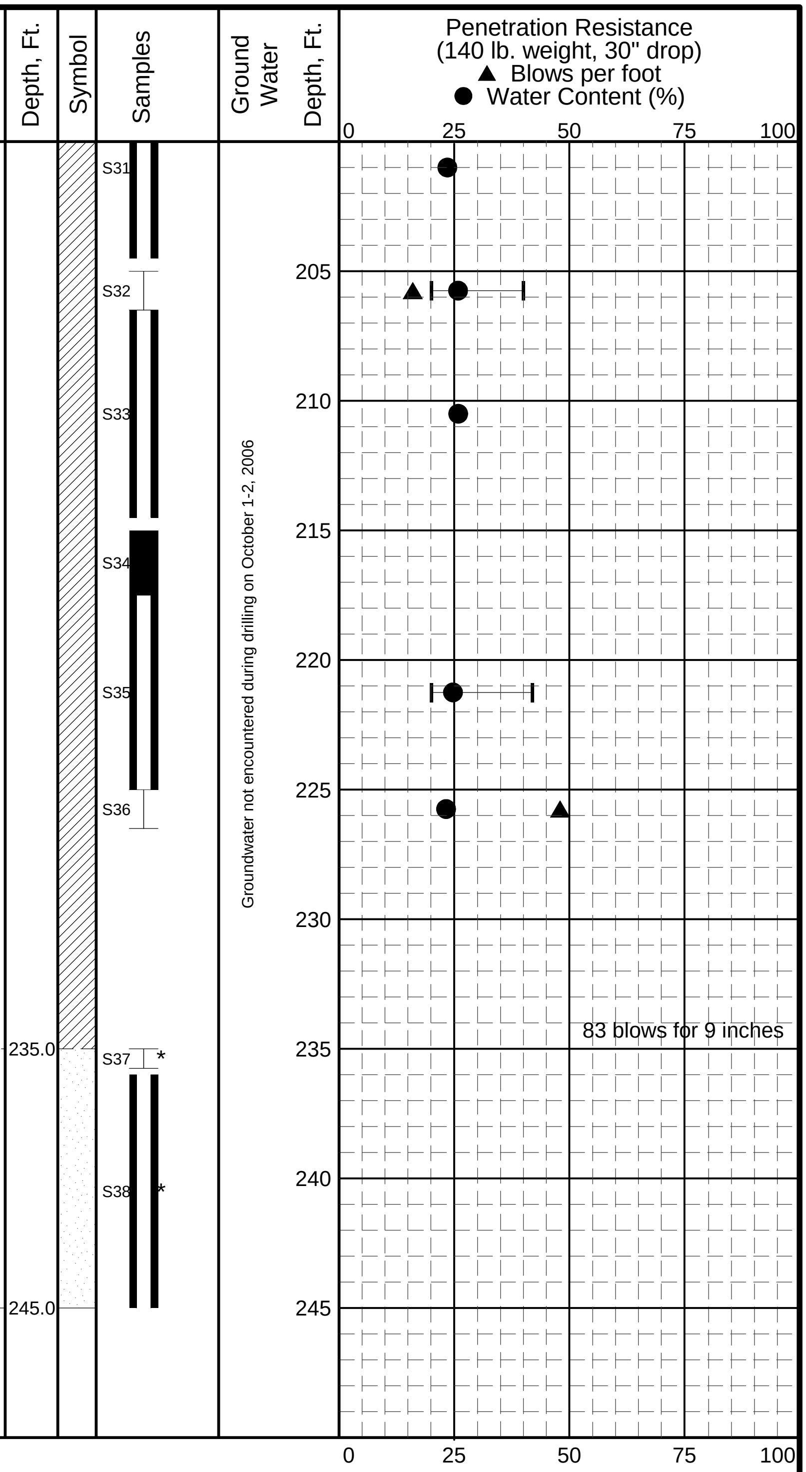
S34: PP = >4.5; TV = 1.0H

S35: PP = 3.5; TV = 0.9H

S36: PP = 4.0; TV = 1.5H

Gravelly sand or sandy gravel as logged by drill action.

Bottom of Boring
Boring Completed October 1-2, 2006



LEGEND

- * Sample Not Recovered
- ⌶ 2" O.D. Split Spoon Sample
- ▬ Shelby Tube
- ▮▮ Soil Core Barrel
- ▽ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit |——●——| Liquid Limit
Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-14
Location: N 61°16'42.98" W 149°52'41.60"

March 2007 32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. A-15
Sheet 5 of 5

GEOTECHNICAL LOG 01536-004 OFFSHORE LOGS.GPJ S&W GEO1.GDT 3/6/07

MATERIAL DESCRIPTION

Approx. Elevation: -25.5 Ft. (MLLW Datum)

Depth, Ft. | Symbol | Samples | Ground Water | Depth, Ft.

Note: See log of CPT-15 in Appendix B for further data on Boring B06-15

Very stiff to hard, gray SILT grading to CLAY; moist

Groundwater not encountered during drilling on September 28-29, 2006

S1: PP = >4.5; TV = 1.4H 1.8V

Note: CPT reached "refusal" repeatedly requiring drilling out hole prior to advancing probe. CPT push terminated at 39.3 feet bgs on 9/28/2006. Boring continued by drilling/sampling at same location.

S2: PP = 4.0; TV = 2.1H 1.1V

S3: PP = 4.25; TV = 1.6H

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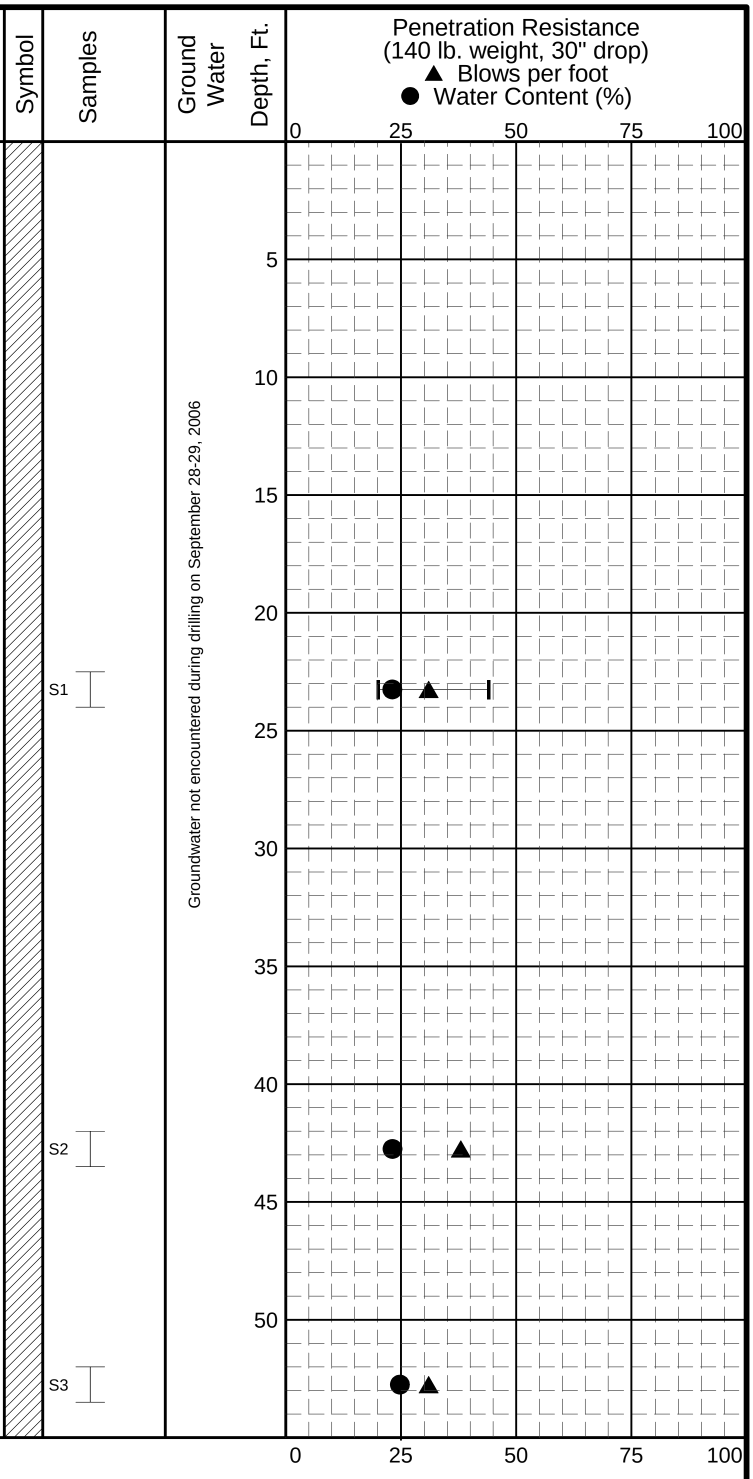

LEGEND

- * Sample Not Recovered
- ⌶ 2" O.D. Split Spoon Sample
- ▬ Shelby Tube
- ▌▌ Soil Core Barrel
- ⊽ Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-15
Location: N 61°16'41.61" W 149°52'32.19"

March 2007
32-1-01536-004

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Geotechnical and Environmental Consultants

Fig. A-16
Sheet 1 of 3

MATERIAL DESCRIPTION

Approx. Elevation: -25.5 Ft. (MLLW Datum)

Very stiff to hard, gray CLAY; moist

S4: PP = >4.5

S5: PP = >4.5

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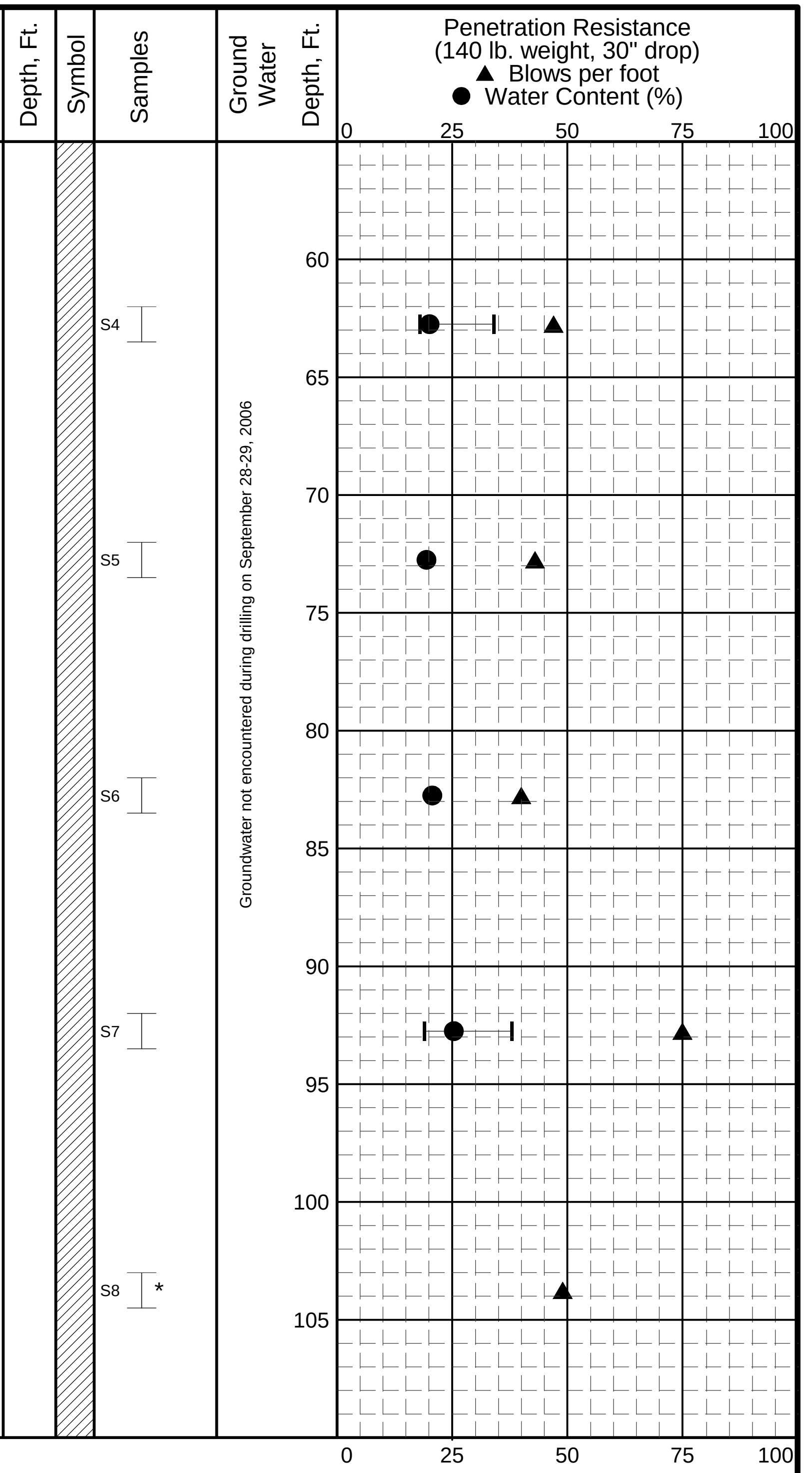


LEGEND

- * Sample Not Recovered
- ⌶ 2" O.D. Split Spoon Sample
- ■ Shelby Tube
- ▌▌ Soil Core Barrel
- ⊽ Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit ├──●──┤ Liquid Limit

Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-15
Location: N 61°16'41.61" W 149°52'32.19"

March 2007 32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. A-16
Sheet 2 of 3

MATERIAL DESCRIPTION

Approx. Elevation: -25.5 Ft. (MLLW Datum)

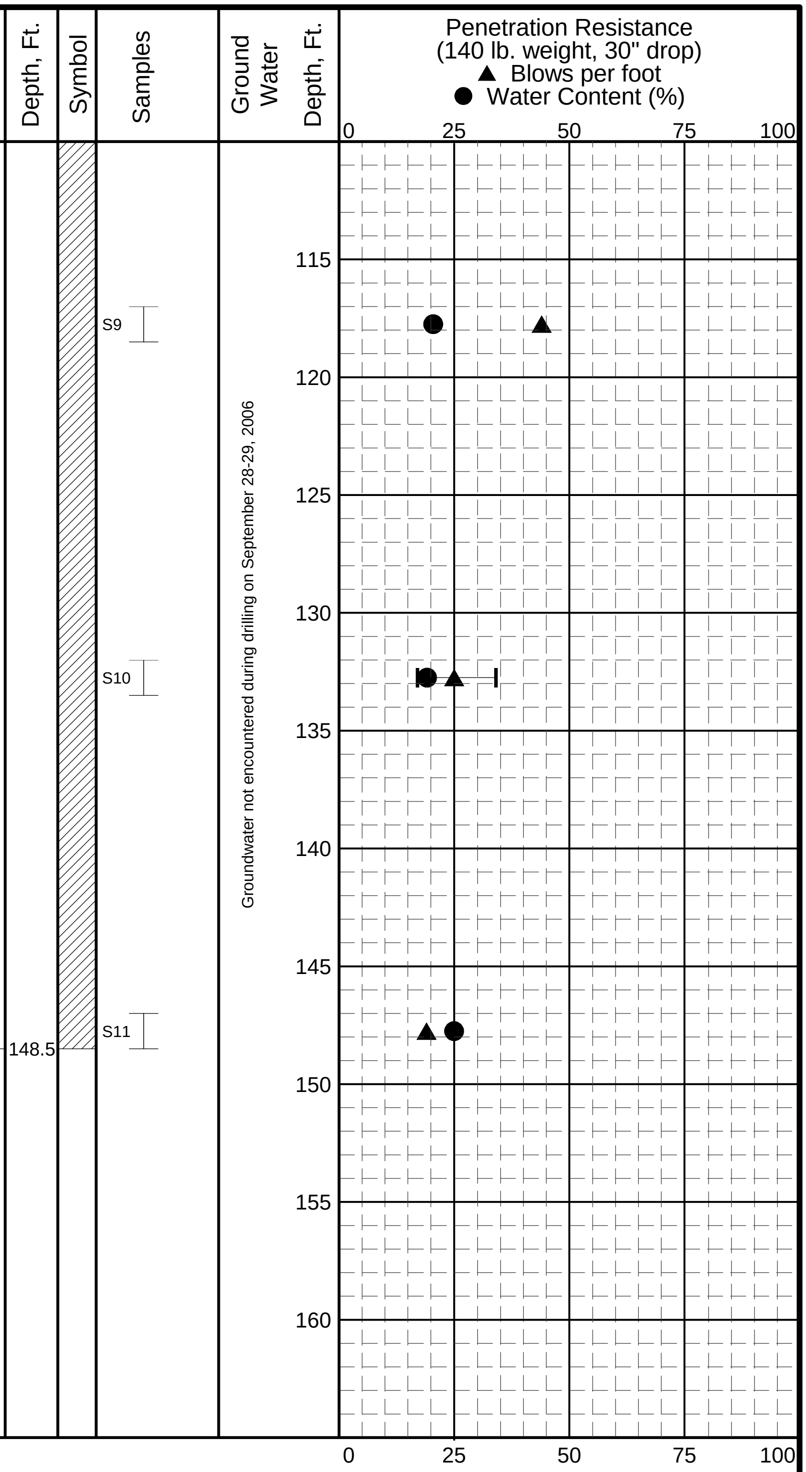
Very stiff to hard, gray CLAY; moist

S9: PP = 4.0

S10: PP = 3.5

S11: PP = 3.0

Bottom of Boring
Boring Completed September 28-29, 2006



LEGEND

- * Sample Not Recovered
- ⌶ 2" O.D. Split Spoon Sample
- ■ Shelby Tube
- ▮▮ Soil Core Barrel
- ⊻ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

NOTES

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Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-15
Location: N 61°16'41.61" W 149°52'32.19"

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. A-16
Sheet 3 of 3

MATERIAL DESCRIPTION

Approx. Elevation: -25 Ft. (MLLW Datum)

Loose, gray SAND; wet

S2: 2.3% Fines

Very stiff, gray CLAY; moist to wet

S3: PP = 2.7; TV = 0.9H 1.5V

S4: PP = 3.5; TV = 1.4H
Qu = 4.0 tsf

S5: PP = 3.0; TV = 0.8H 1.3V

Medium dense, gray, clayey SAND; wet

S6: 36% Fines

Very stiff, gray, silty CLAY; moist

S7: PP = 3.75

S8: PP = 2.5
Qu = >2.3 tsf

Very dense, gray, silty SAND to hard, sandy SILT; moist to wet

Dense, gray, silty SAND; moist to wet; occasional clay seams/layers (to 1 inch thick)

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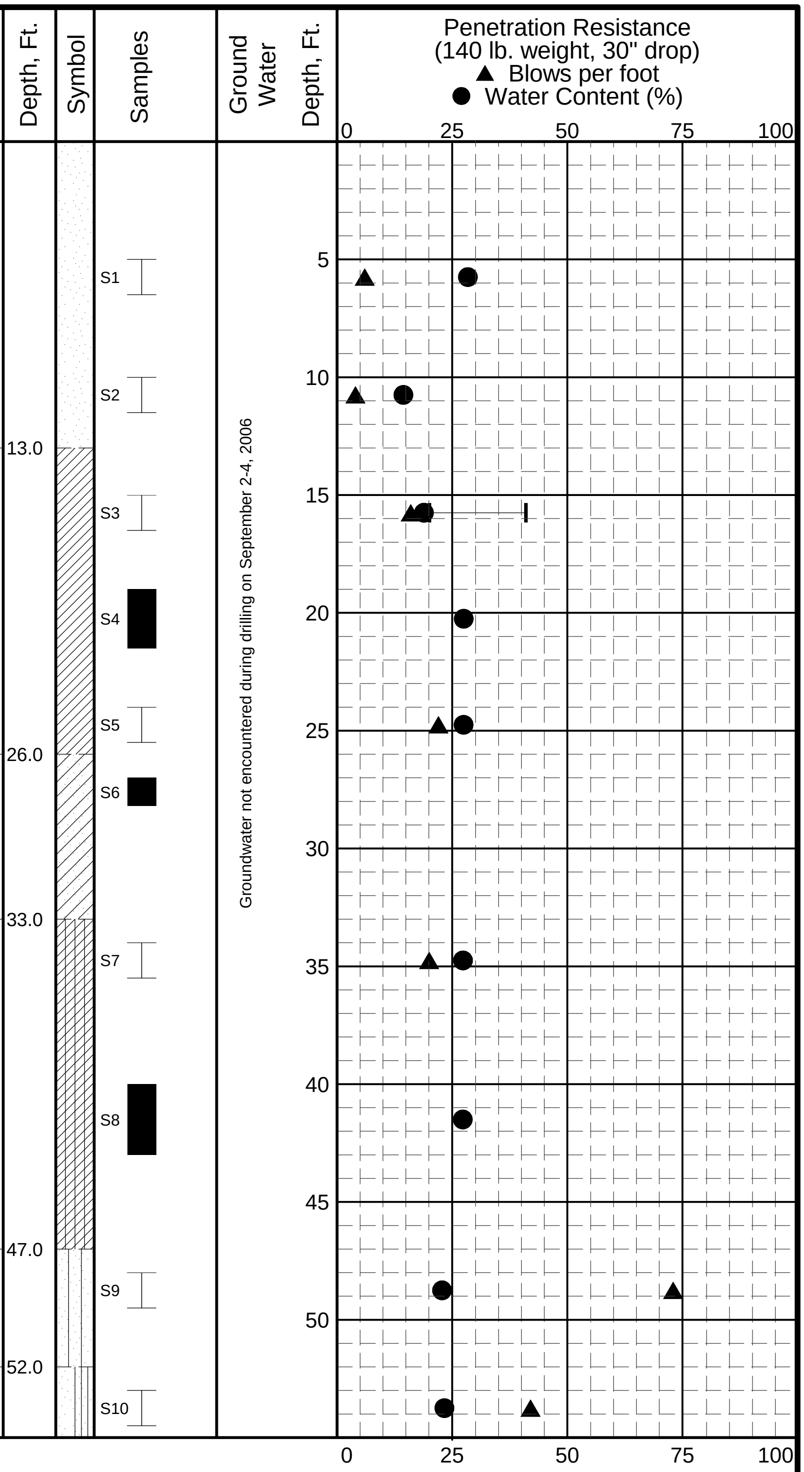

LEGEND

*	Sample Not Recovered
⌶	2" O.D. Split Spoon Sample
▬	Shelby Tube
▌▌	Soil Core Barrel
▽	Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit ├──●──┤ Liquid Limit

Natural Water Content

NOTES

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Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-16
Location: N 61°16'39.73" W 149°52'22.51"

March 2007 32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. A-17
Sheet 1 of 5

MATERIAL DESCRIPTION

Approx. Elevation: -25 Ft. (MLLW Datum)

Depth, Ft. | Symbol | Samples | Ground Water

Dense, gray, silty SAND; moist to wet; occasional clay seams/layers (to 1 inch thick)

62.0

Very dense, slightly silty to silty SAND; wet

S12: 91% Sand, 8% Fines

S16: 8.0% Fines

S20: 80% Sand, 20% Fines

CONTINUED NEXT PAGE

S11

S12

S13

S14

S15

S16

S17

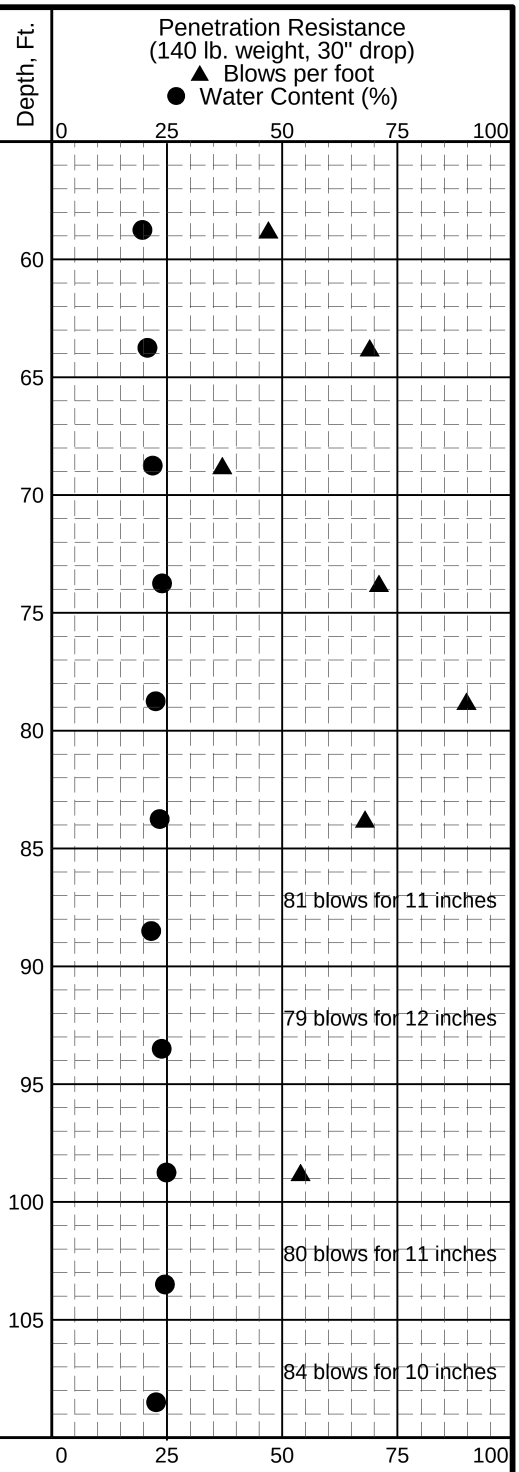
S18

S19

S20

S21

Groundwater not encountered during drilling on September 2-4, 2006



LEGEND

- * Sample Not Recovered
- ⌶ 2" O.D. Split Spoon Sample
- ▬ Shelby Tube
- ▌▌ Soil Core Barrel
- ⊽ Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

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Knik Arm Crossing

Knik Arm, Alaska

LOG OF BORING B06-16

Location: N 61°16'39.73" W 149°52'22.51"

March 2007

32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. A-17
Sheet 2 of 5

MATERIAL DESCRIPTION

Approx. Elevation: -25 Ft. (MLLW Datum)

Material Description	Depth, Ft.
Very dense, slightly silty to silty SAND; wet S24: 18% Fines	125.0
Very dense, gray, silty SAND; wet; occasional clay layers (1 to 12 inches thick) S26: PP = 3.75; TV = 0.8H 1.3V S27: 24% Fines	146.0
Soft to very stiff, gray CLAY; moist S29: PP = 1.5; TV = 0.7H 0.8V S30: PP = 2.0; TV = 1.0H 0.85V S31: PP = 2.75; TV = 1.0H Qu = 2.7 tsf S32: PP = 1.75; TV = 0.6H	164.0

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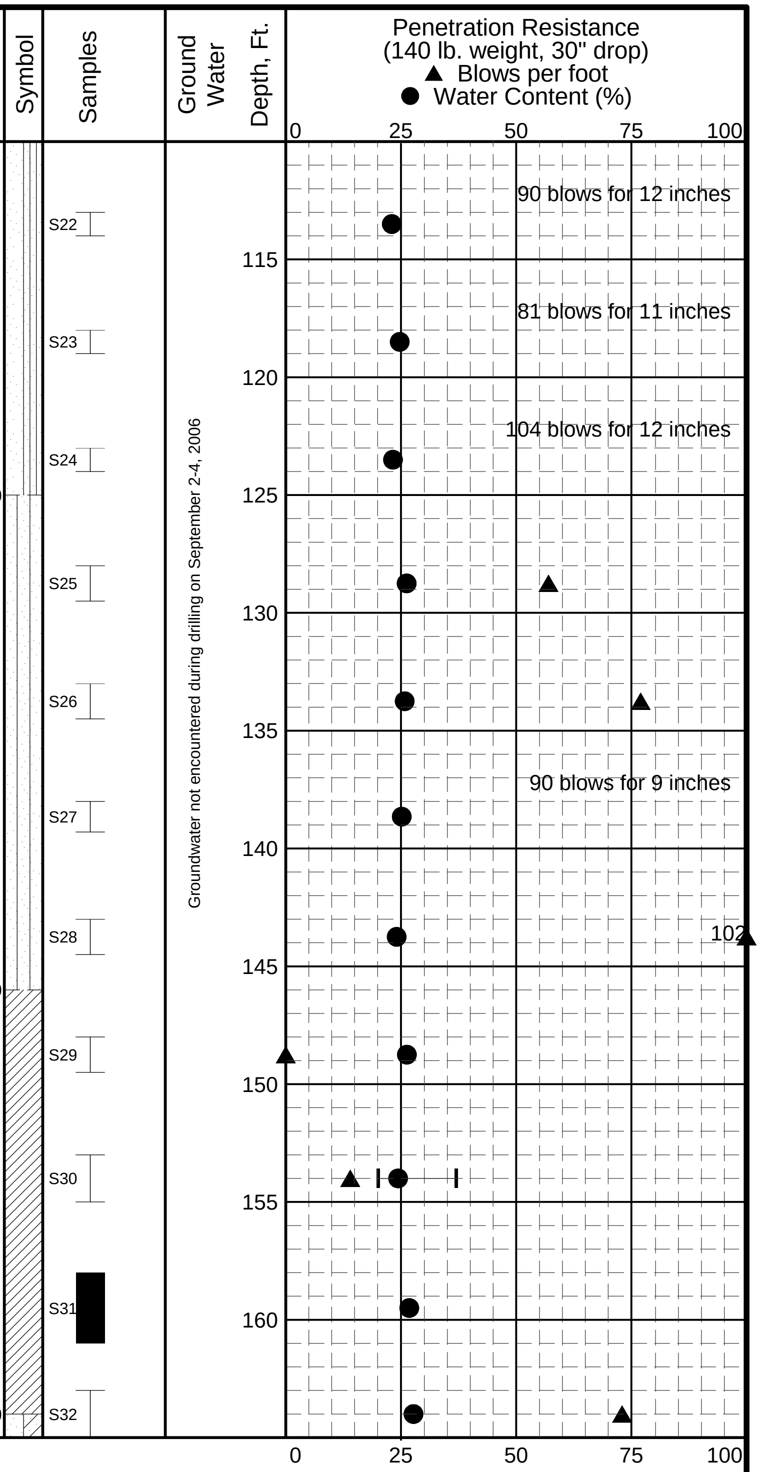

LEGEND

* Sample Not Recovered
⌶ 2" O.D. Split Spoon Sample
■ Shelby Tube
▌▌ Soil Core Barrel
▽ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit ├──●──┤ Liquid Limit
Natural Water Content

NOTES

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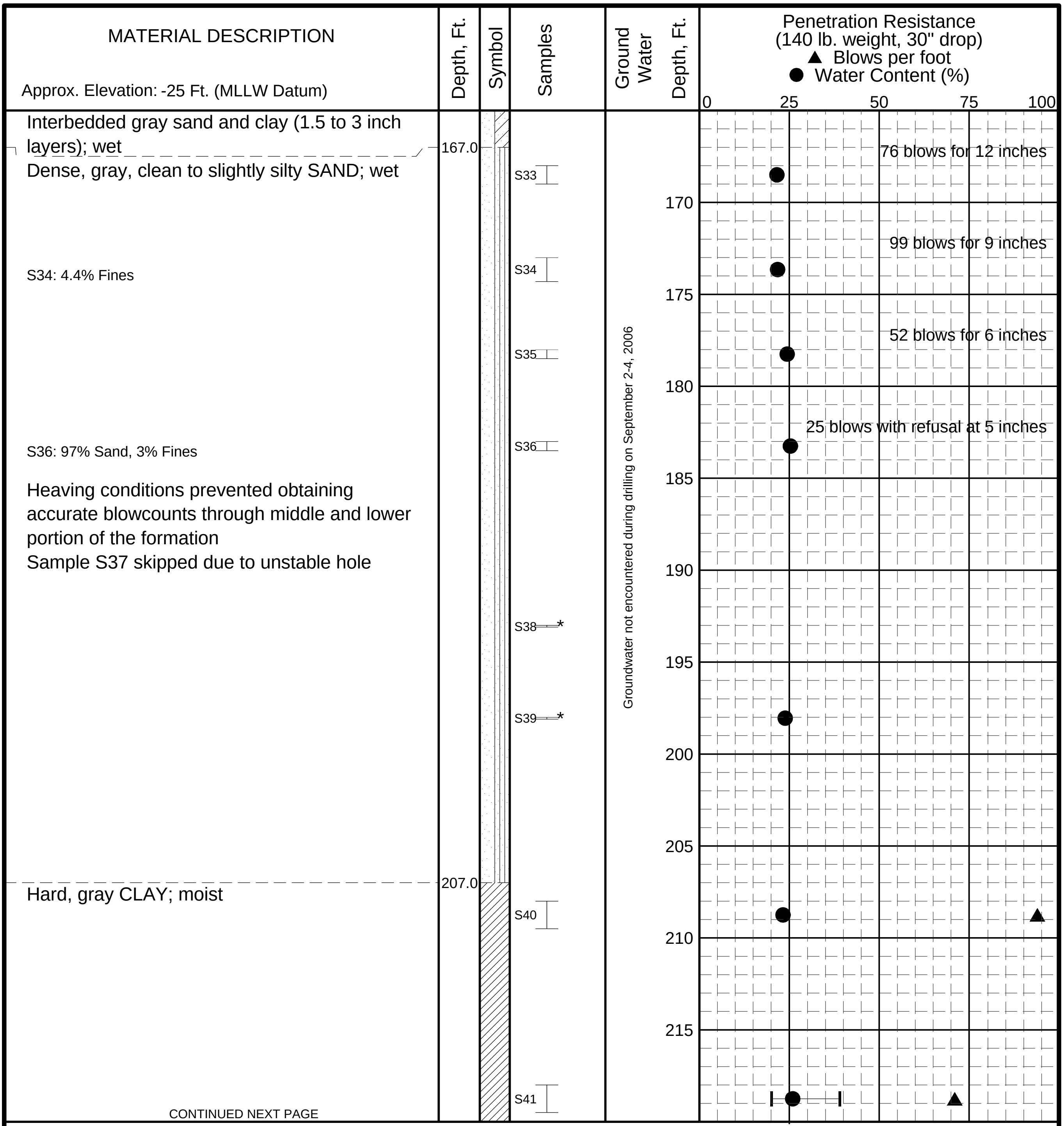
Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-16
Location: N 61°16'39.73" W 149°52'22.51"

March 2007 32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. A-17
Sheet 3 of 5



Interbedded gray sand and clay (1.5 to 3 inch layers); wet

Dense, gray, clean to slightly silty SAND; wet

S34: 4.4% Fines

S36: 97% Sand, 3% Fines

Heaving conditions prevented obtaining accurate blowcounts through middle and lower portion of the formation

Sample S37 skipped due to unstable hole

Hard, gray CLAY; moist

CONTINUED NEXT PAGE

LEGEND

*	Sample Not Recovered
⌶	2" O.D. Split Spoon Sample
■	Shelby Tube
▮▮	Soil Core Barrel
⊽	Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit ├──●──┤ Liquid Limit

Natural Water Content

NOTES

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Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-16
Location: N 61°16'39.73" W 149°52'22.51"

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. A-17
Sheet 4 of 5

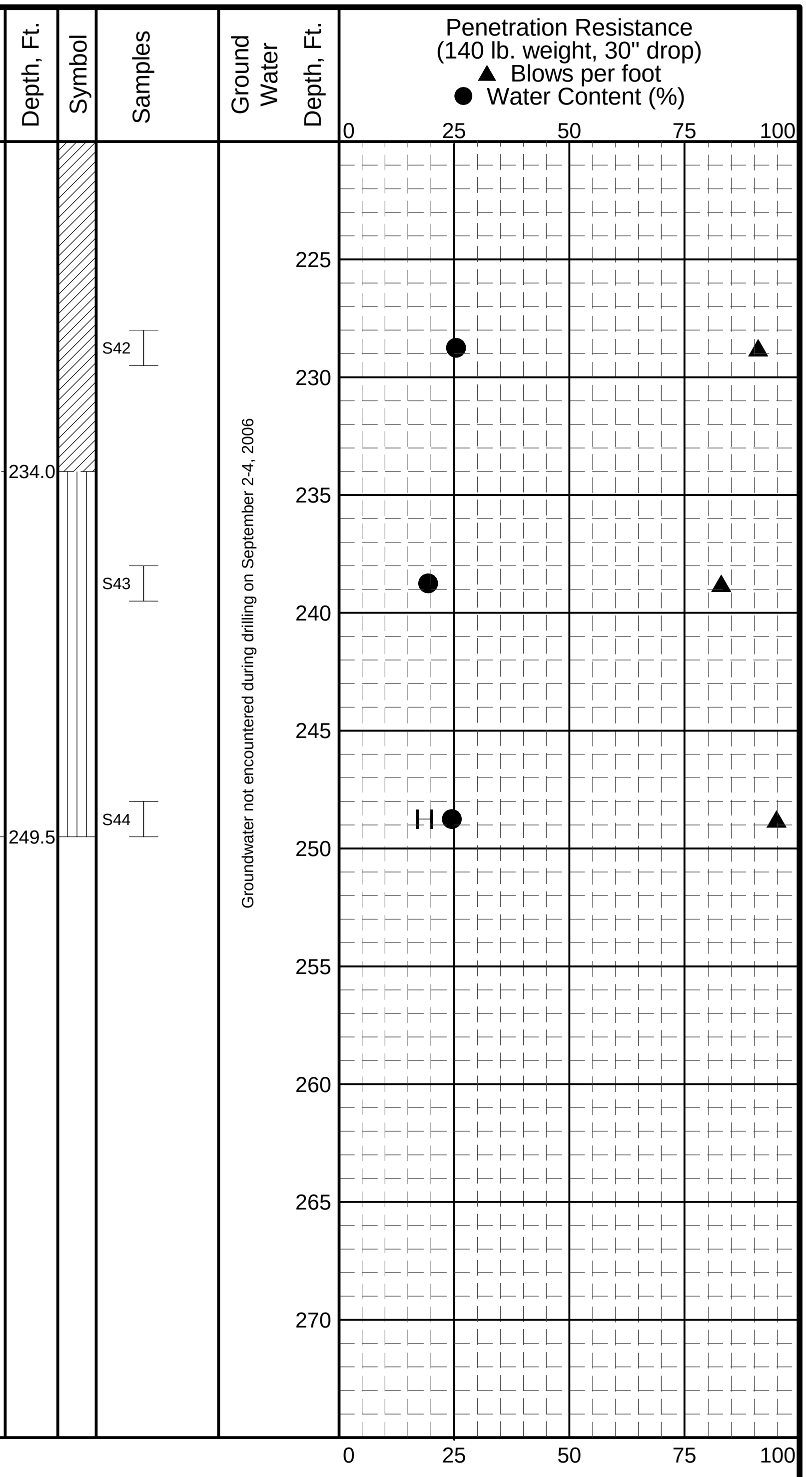
MATERIAL DESCRIPTION

Approx. Elevation: -25 Ft. (MLLW Datum)

Hard, gray CLAY; moist

Hard, gray SILT; moist

Bottom of Boring
Boring Completed September 2-4, 2006



LEGEND

*	Sample Not Recovered
⌶	2" O.D. Split Spoon Sample
■	Shelby Tube
▌▌	Soil Core Barrel
⊽	Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit ├──●──┤ Liquid Limit
Natural Water Content

NOTES

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Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-16
Location: N 61°16'39.73" W 149°52'22.51"

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. A-17
Sheet 5 of 5

MATERIAL DESCRIPTION

Approx. Elevation: -24 Ft. (MLLW Datum)

Medium dense, gray, silty GRAVEL; wet

Very stiff, gray CLAY; moist

S2: PP = 2.5; TV = 1.4H 1.5V

S4: PP = 2.0; TV = 0.9H

S5: PP = 2.0; TV = 1.3H 1.3V

S6: PP = 1.5; TV = 0.6H
Qu = 3.0 tsf

S7: PP = 2.5; TV = 1.3H 1.1V

S8: PP = 2.5
Qu = 2.4 tsf
Uu = 3.9 tsf

S9: PP = 2.5; TV = 1.3H 1.1V

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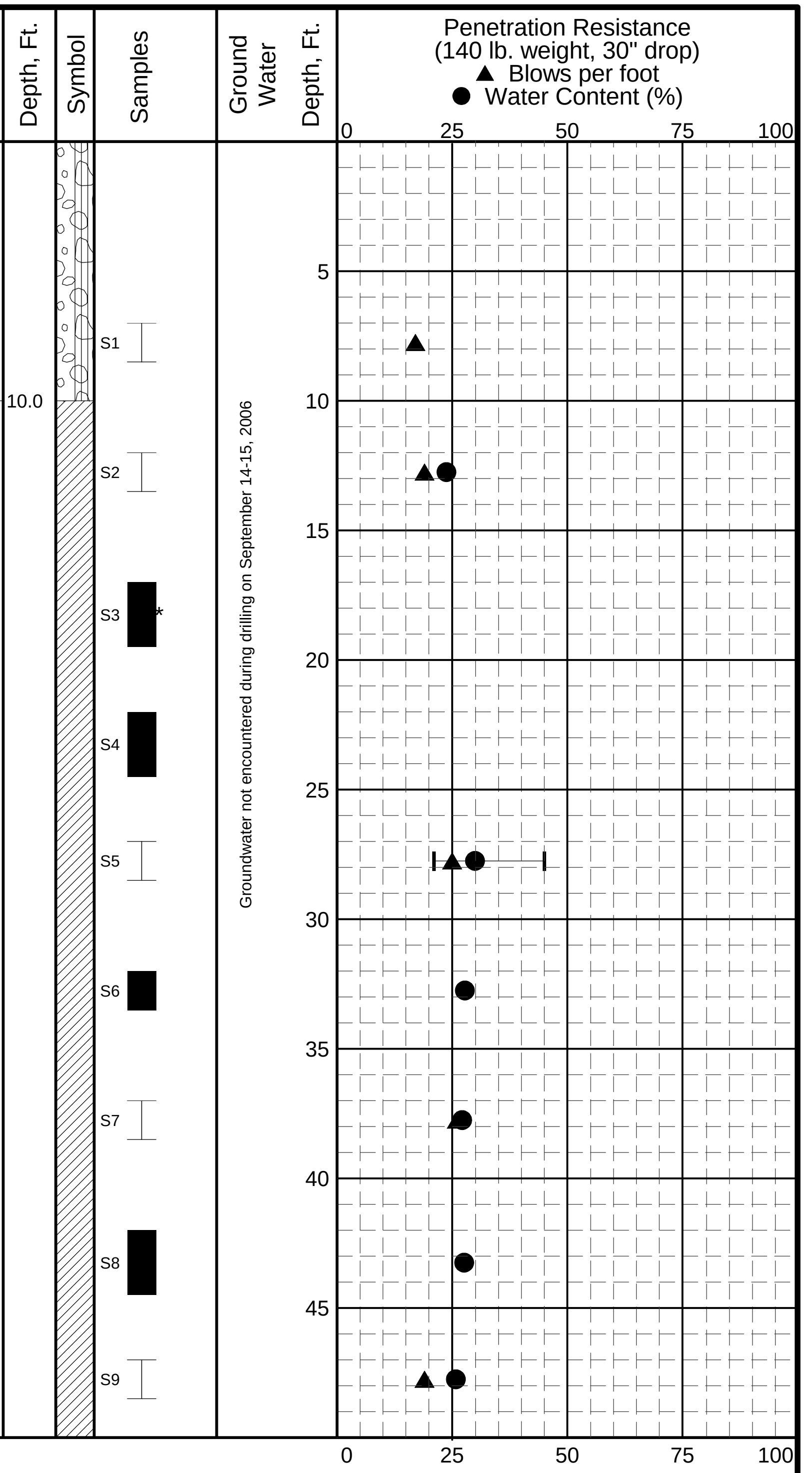

LEGEND

* Sample Not Recovered
⌶ 2" O.D. Split Spoon Sample
▬ Shelby Tube
▮▮ Soil Core Barrel
▽ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

NOTES

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Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-17
Location: N 61°16'38.10" W 149°52'12.30"

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. A-18
Sheet 1 of 5

MATERIAL DESCRIPTION Approx. Elevation: -24 Ft. (MLLW Datum)	Depth, Ft.	Symbol	Samples	Ground Water
Very stiff, gray CLAY; moist S10: PP = 4.5; TV = 1.4H Qu = 3.3 tsf			S10	
Very stiff to hard, gray CLAY; moist S11: PP = 3.3; TV = 1.8H 1.3V	55.0		S11	Groundwater not encountered during drilling on September 14-15, 2006
			S12	
			S13	
			S14	
S15: PP = 2.3; TV = 1.0H			S15	
S16: PP = 2.3; TV = 0.9H Qu = 7.6 tsf			S16	
S17: PP = >4.5; TV = 1.6H			S17	
S18: PP = 4.0; TV = 1.0H Qu = 3.1 tsf Uu = 8.3 tsf			S18	

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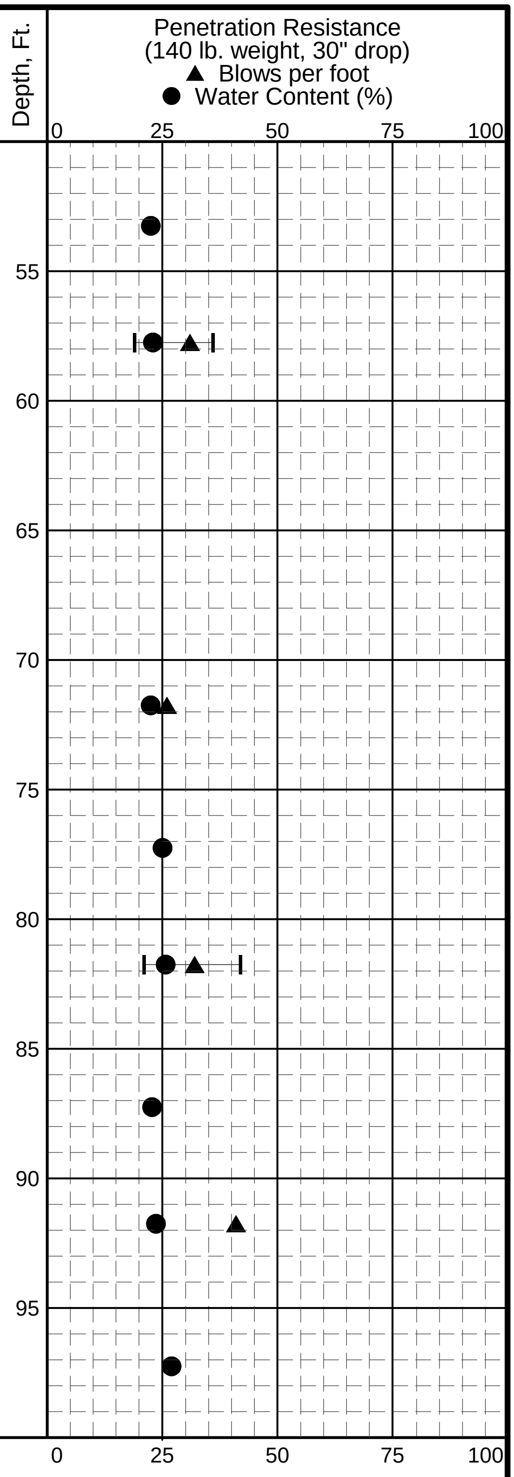

LEGEND

- * Sample Not Recovered
- ⌶ 2" O.D. Split Spoon Sample
- ■ Shelby Tube
- ▌▌ Soil Core Barrel
- ∇ Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit |—●—| Liquid Limit

Natural Water Content

NOTES

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Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-17
Location: N 61°16'38.10" W 149°52'12.30"

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. A-18
Sheet 2 of 5

MATERIAL DESCRIPTION

Approx. Elevation: -24 Ft. (MLLW Datum)

Very stiff to hard, gray CLAY; moist

S19: PP = 2.0; TV = 0.8H

S20: PP = 2.5; TV = 0.9H
Qu = 5.5 tsf

S21: PP = 2.3; TV = 1.1H 1.1V

S22: PP = 3.0

S23: PP = 4.0; TV = 1.5H

S25: PP = 2.5; TV = 1.4H 1.3V

S26: PP = >4.5

S27: PP = 3.3
Qu = 4.8 tsf

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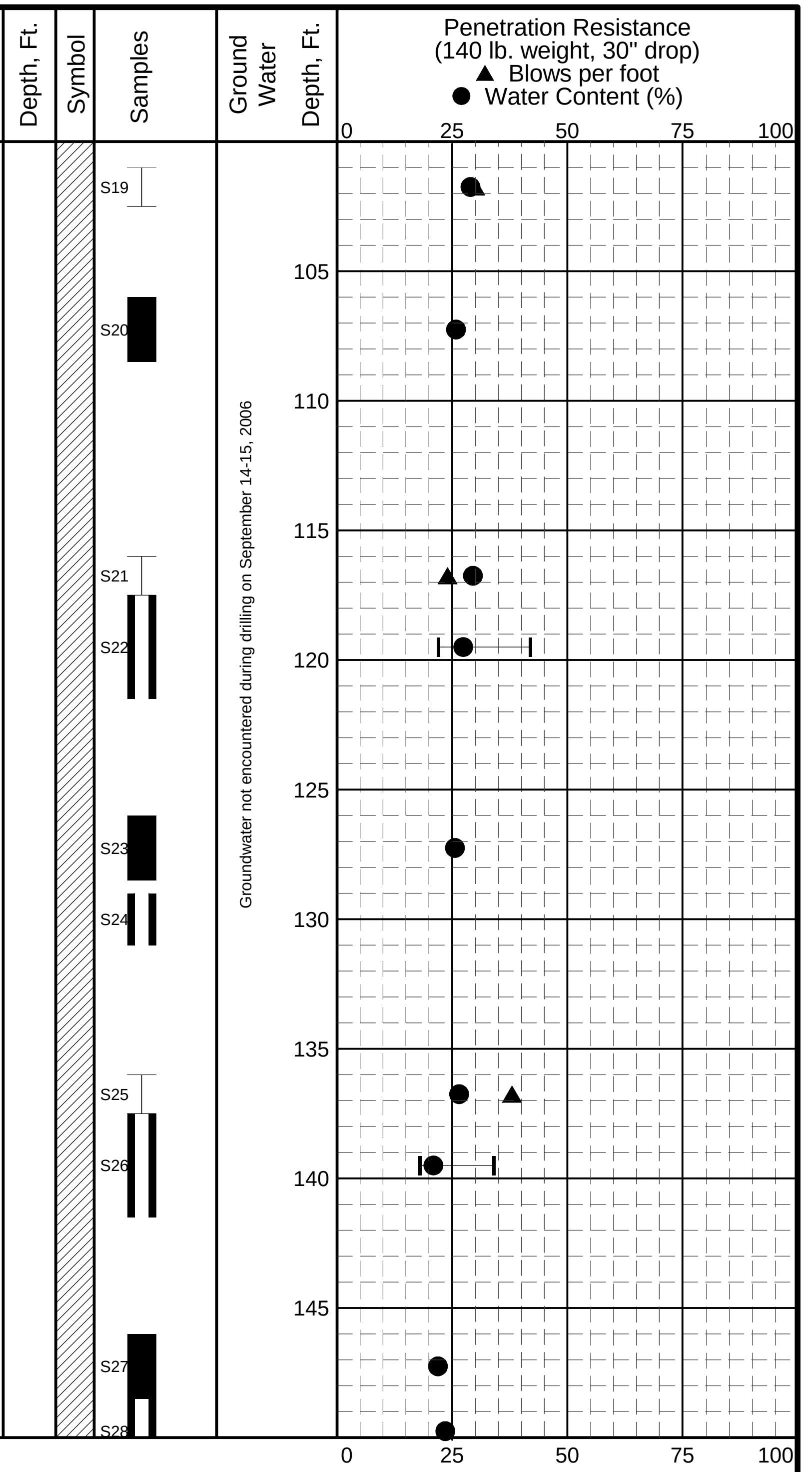

LEGEND

* Sample Not Recovered
⌶ 2" O.D. Split Spoon Sample
■ Shelby Tube
▮▮ Soil Core Barrel
▽ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

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Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-17
Location: N 61°16'38.10" W 149°52'12.30"

March 2007 32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. A-18
Sheet 3 of 5

MATERIAL DESCRIPTION

Approx. Elevation: -24 Ft. (MLLW Datum)

S28: PP = 3.5; TV = 1.4H

Very stiff to hard, gray CLAY; moist

S29: PP = 3.3; TV = 1.5H 1.5V

S30: PP = 2.0; TV = 1.9H

S31: PP = 3.8; TV = 1.7H
Qu = 8.1 tsf

S32: PP = >4.5; TV = 2.0H 2.0V
97% Fines

S33: PP = >4.5; TV = 2.1H 2.5V

S34: PP = >4.5; TV = 2.3H 2.0V

S35: PP = >4.5; TV = 2.1H 2.0V

S36: PP = >4.5; TV = 2.0H
Qu = 6.6 tsf
Uu = 8.8 tsf
S37: PP = 3.3; TV = 1.6H 1.5V

S38: 98% Fines

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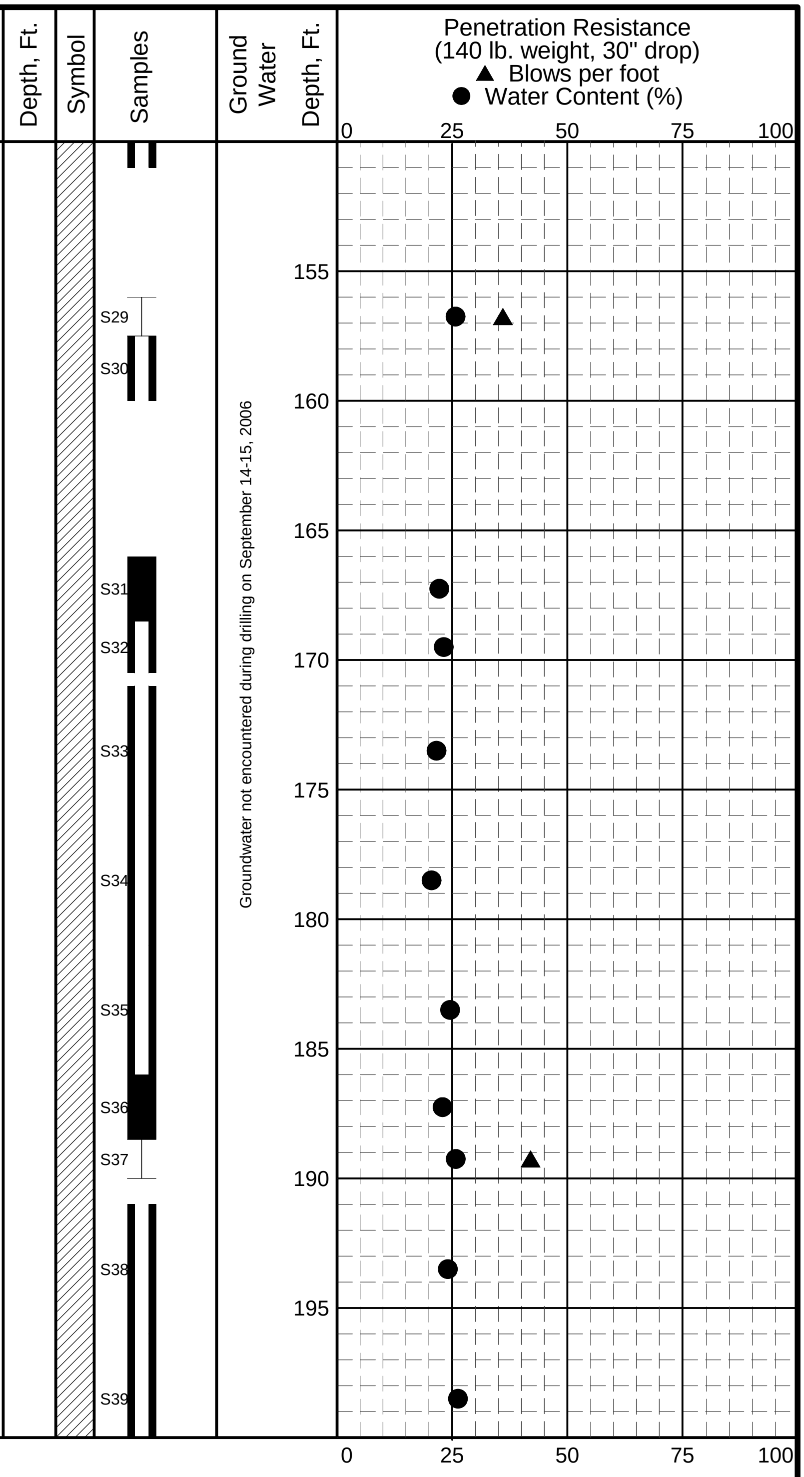

LEGEND

* Sample Not Recovered
⌶ 2" O.D. Split Spoon Sample
■ Shelby Tube
▌▌ Soil Core Barrel

⊻ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

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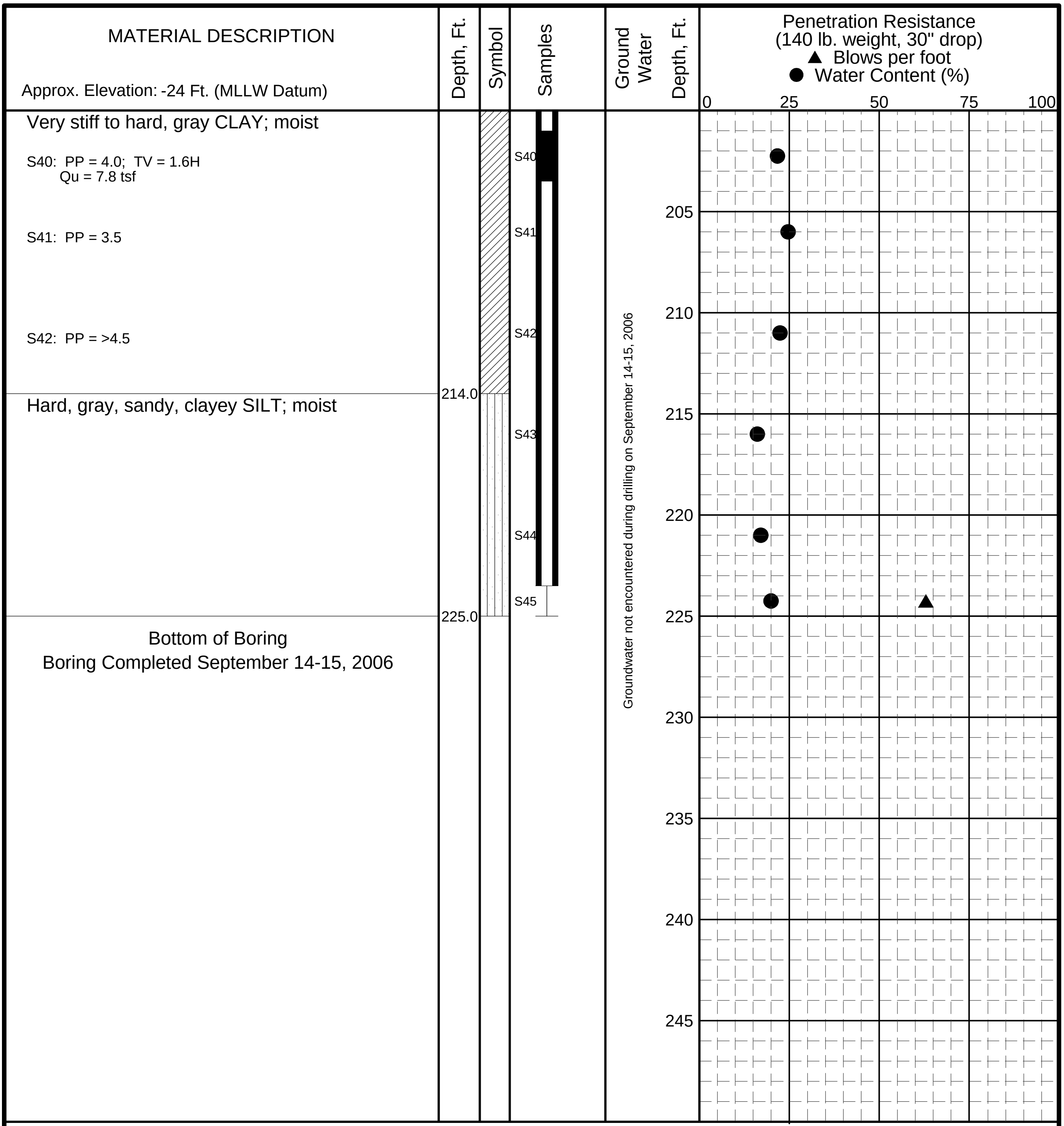
Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-17
Location: N 61°16'38.10" W 149°52'12.30"

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. A-18
Sheet 4 of 5



Approx. Elevation: -24 Ft. (MLLW Datum)

Very stiff to hard, gray CLAY; moist

S40: PP = 4.0; TV = 1.6H
Qu = 7.8 tsf

S41: PP = 3.5

S42: PP = >4.5

Hard, gray, sandy, clayey SILT; moist

Bottom of Boring
Boring Completed September 14-15, 2006

LEGEND

*	Sample Not Recovered
⌶	2" O.D. Split Spoon Sample
■	Shelby Tube
▌▌	Soil Core Barrel
⊽	Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit ├──●──┤ Liquid Limit
Natural Water Content

NOTES

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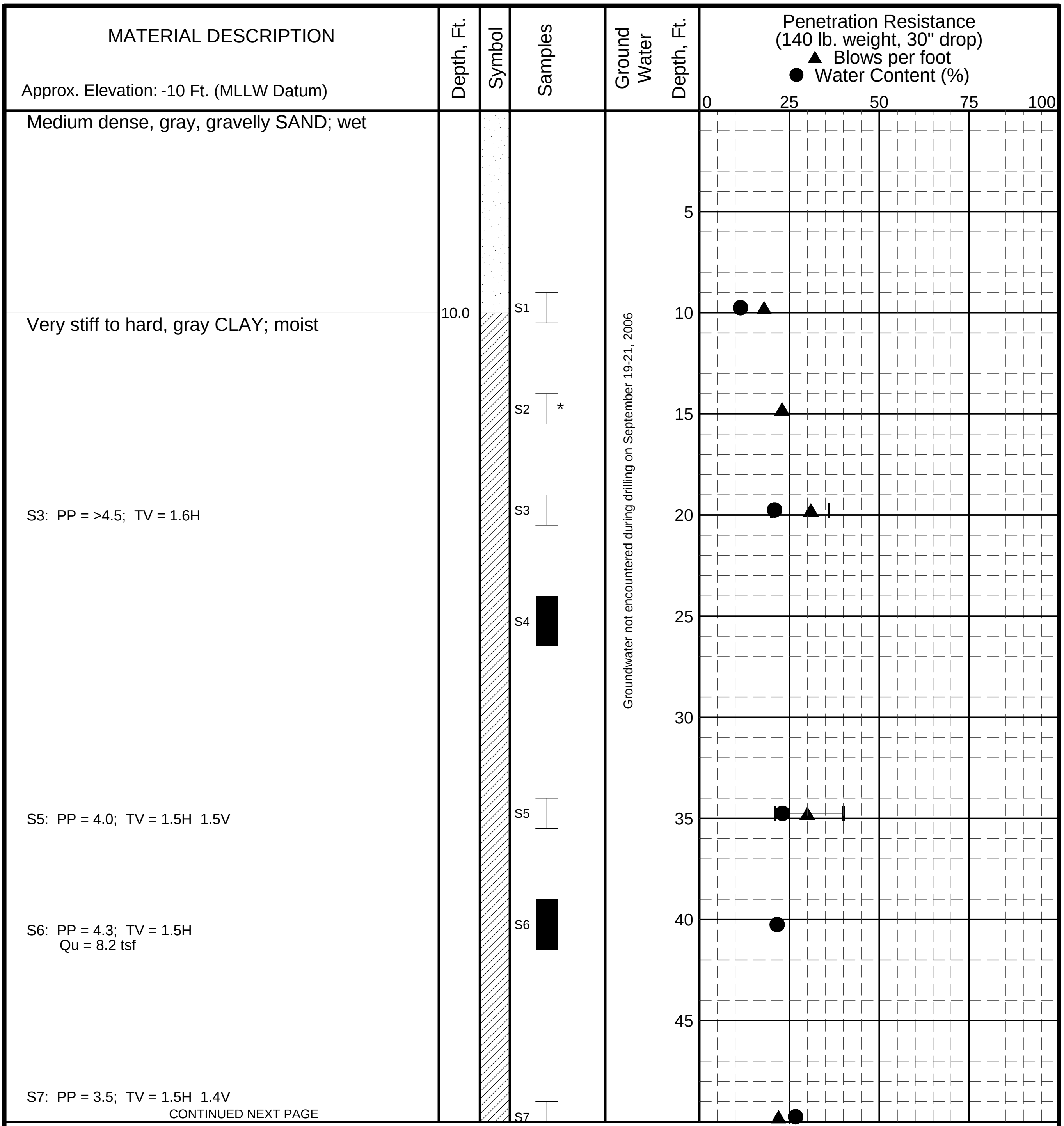
Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-17
Location: N 61°16'38.10" W 149°52'12.30"

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. A-18
Sheet 5 of 5



LEGEND

* Sample Not Recovered

⌶ 2" O.D. Split Spoon Sample

■ Shelby Tube

▌▌ Soil Core Barrel

⊻ Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit |—●—| Liquid Limit

Natural Water Content

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Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-18
Location: N 61°16'36.43" W 149°52'00.18"

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. A-19
Sheet 1 of 6

MATERIAL DESCRIPTION

Approx. Elevation: -10 Ft. (MLLW Datum)

Very stiff to hard, gray CLAY; moist

S8: PP = 4.5; TV = 1.6H 1.3V

S9: PP = 3.5; TV = 1.6H
Qu = 3.9 tsf
Uu = 6.2 tsf

S10: PP = 3.0; TV = 1.5H 1.3V

S11: PP = 4.5; TV = 1.3H
Qu = 6.0 tsf
Uu = 6.8 tsf

S12: PP = 3.5; TV = 1.6H 1.3V

S13: PP = 2.3; TV = 1.3H
Qu = 2.1 tsf
Uu = 5.8 tsf

82.0

Very stiff to hard, slightly gravelly, slightly sandy CLAY; moist

S14: PP = 3.5; TV = 1.5H 1.3V

S15: PP = 3.0; TV = 1.1H
Qu = 0.6 tsf

S16: PP = 2.5; TV = 0.8H 1.1V

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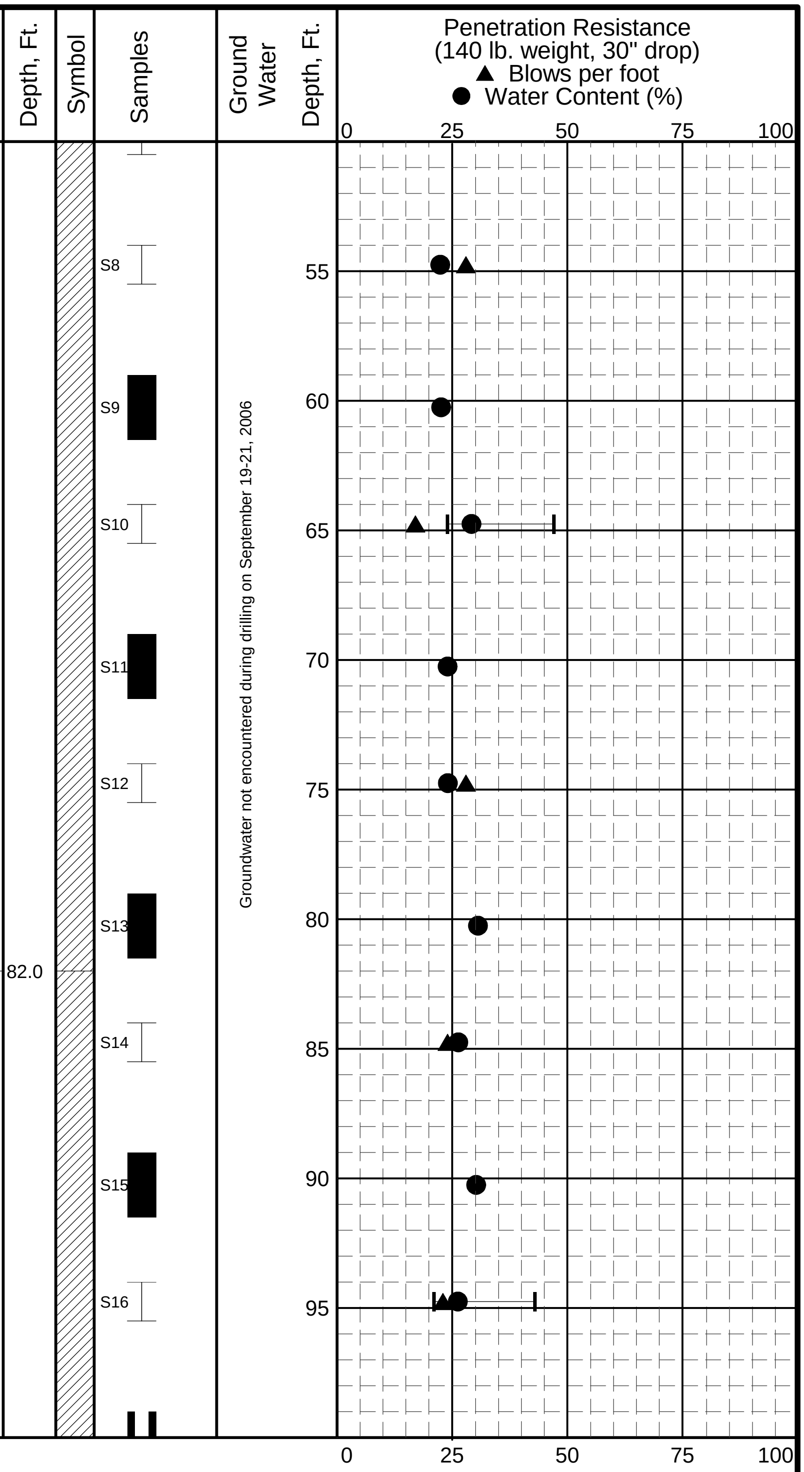

LEGEND

- * Sample Not Recovered
- ⌶ 2" O.D. Split Spoon Sample
- ■ Shelby Tube
- ▌▌ Soil Core Barrel
- ▽ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit |—●—| Liquid Limit
Natural Water Content

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Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-18
Location: N 61°16'36.43" W 149°52'00.18"

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. A-19
Sheet 2 of 6

MATERIAL DESCRIPTION

Approx. Elevation: -10 Ft. (MLLW Datum)

Very stiff to hard, gray, slightly gravelly, slightly sandy CLAY; moist

S17: PP = >4.5

S19: PP = 3.5; TV = 1.5H

S20: PP = 3.0; TV = 0.9H

S21: PP = 3.0

S22: PP = 3.3; TV = 0.75H

S24: PP = 4.0; TV = 1.0H

S26: PP = 3.75; TV = 0.9H

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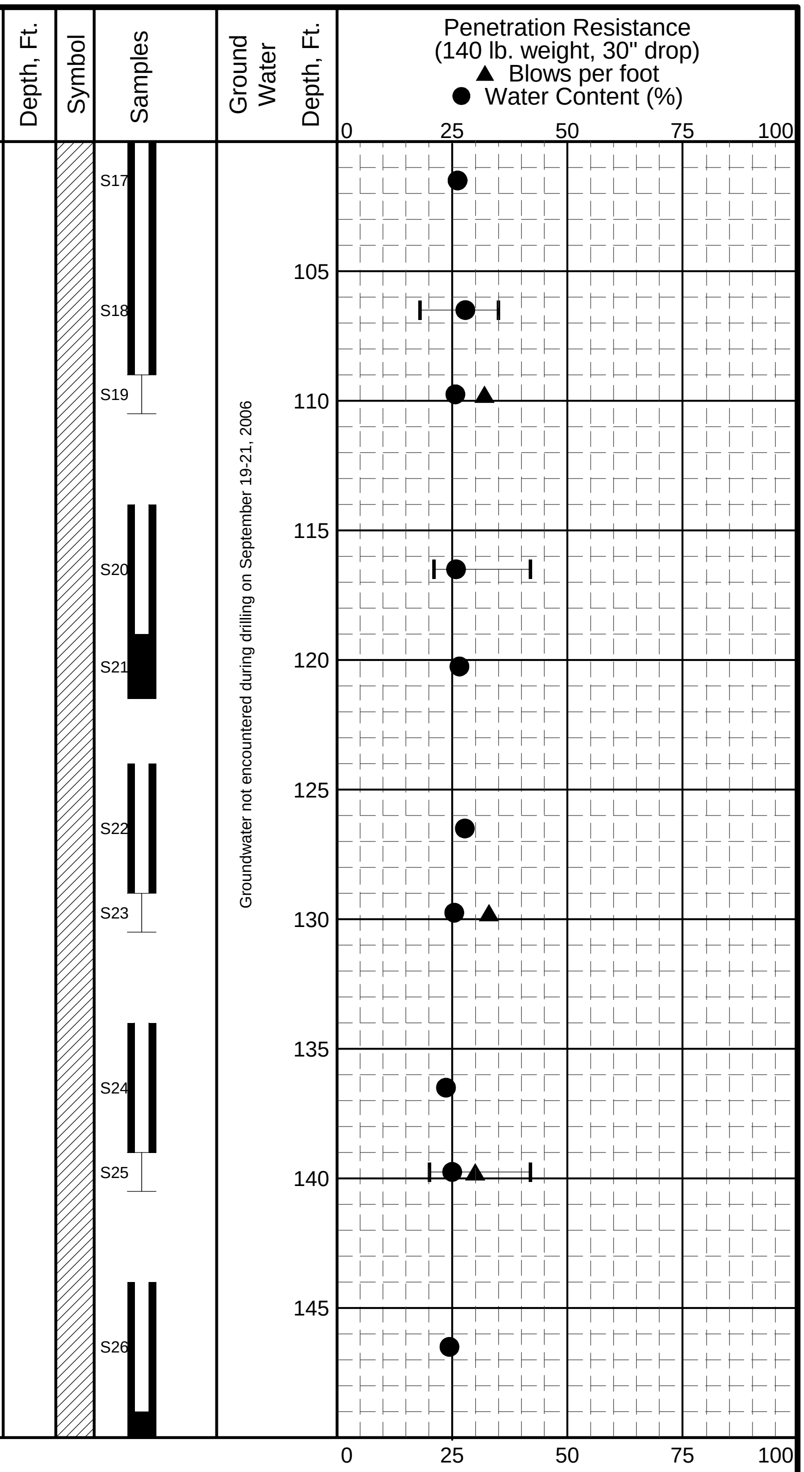

LEGEND

* Sample Not Recovered
⌶ 2" O.D. Split Spoon Sample
■ Shelby Tube
▮▮ Soil Core Barrel

∇ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-18
Location: N 61°16'36.43" W 149°52'00.18"

March 2007 32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. A-19
Sheet 3 of 6

MATERIAL DESCRIPTION

Approx. Elevation: -10 Ft. (MLLW Datum)

Very stiff to hard, gray, slightly gravelly, slightly sandy CLAY; moist

S28: PP = 3.0

S29: PP = 2.5

S30: PP = 4.0; TV = 1.5H 1.3V

S31: PP = 3.8; TV = 1.0H
Qu = 3.0 tsf

S32: PP = 2.5; TV = 1.0H 1.4V

S33: PP = 2.5; TV = 1.1H 1.3V

S34: PP = 3.3; TV = 1.3H 1.5V

S35: PP = 4.0; TV = 1.4H
Qu = 5.0 tsf
Uu = 8.3 tsf

S36: PP = 4.5; TV = 1.3H 1.3V

S37: PP = 2.5; TV = 1.3H 1.3V

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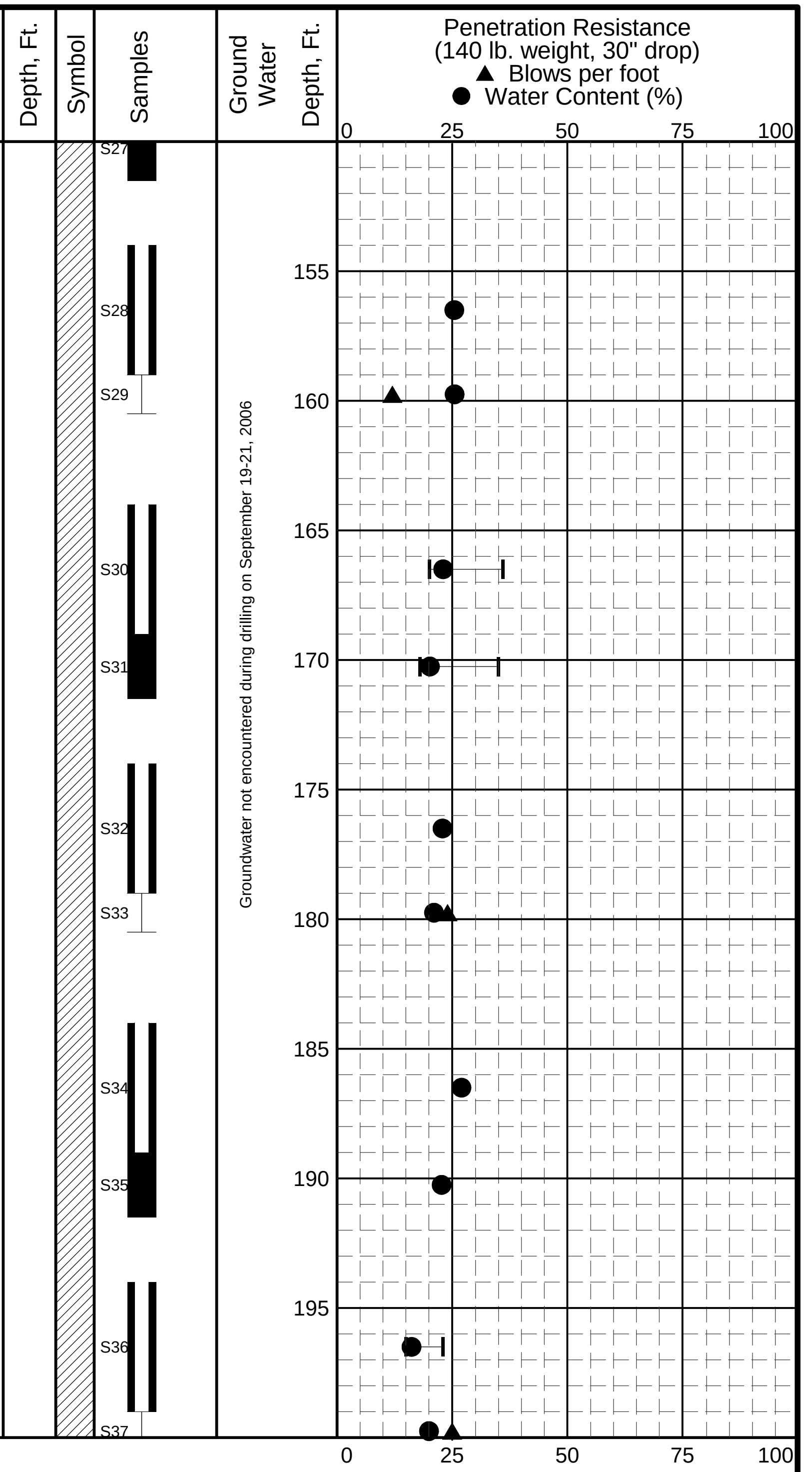

Groundwater not encountered during drilling on September 19-21, 2006

LEGEND

- * Sample Not Recovered
- ⌶ 2" O.D. Split Spoon Sample
- ■ Shelby Tube
- ▮▮ Soil Core Barrel
- ▽ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit |—●—| Liquid Limit
Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
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Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-18
Location: N 61°16'36.43" W 149°52'00.18"

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. A-19
Sheet 4 of 6

MATERIAL DESCRIPTION

Approx. Elevation: -10 Ft. (MLLW Datum)

Very stiff to hard, gray, slightly gravelly, slightly sandy CLAY; moist

S38: PP = 4.5; TV = 1.5H 1.6V

S39: PP = >4.5; TV = 1.6H 1.8V
7% Gravel, 10% Sand, 83% Fines

S40: PP = 4.5; TV = 1.6H 1.8V

S41: PP = 4.5; TV = 1.8H 1.8V

Hard, gray, gravelly SILT; moist

Very stiff to hard, gray, sandy CLAY; moist

S43: PP = >4.5; TV = 1.9H 1.9V

S44: PP = >4.5; TV = 1.5H 1.6V

S45: PP = >4.5; TV = 1.1H 1.3V

S46: PP = >4.5
Qu = 2.6 tsf

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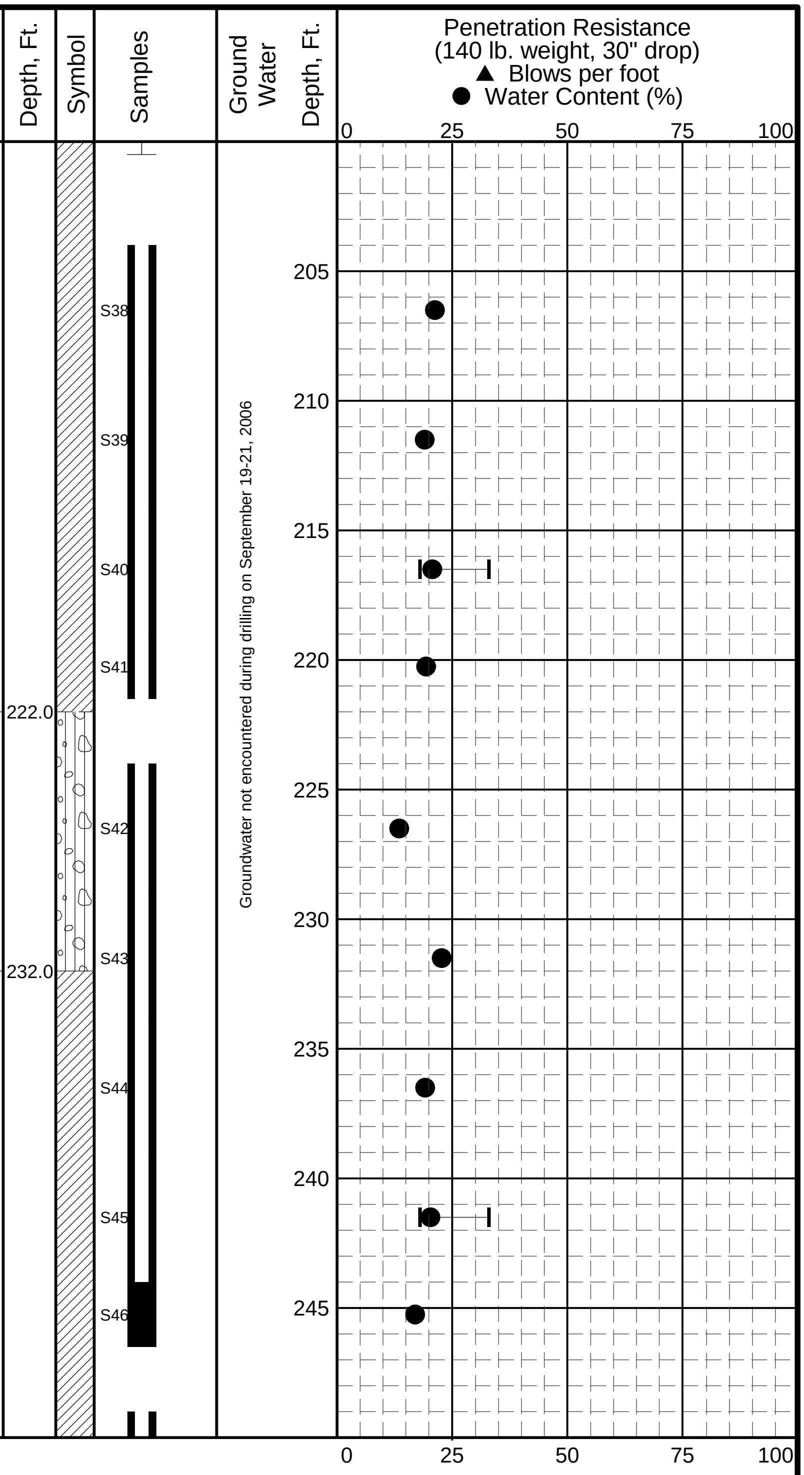


LEGEND

* Sample Not Recovered
⌶ 2" O.D. Split Spoon Sample
■ Shelby Tube
▮▮ Soil Core Barrel

▽ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit |—●—| Liquid Limit
Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-18
Location: N 61°16'36.43" W 149°52'00.18"

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. A-19
Sheet 5 of 6

MATERIAL DESCRIPTION

Approx. Elevation: -10 Ft. (MLLW Datum)

Very stiff to hard, gray, sandy CLAY; moist

S47: TV = 1.6H 1.8V

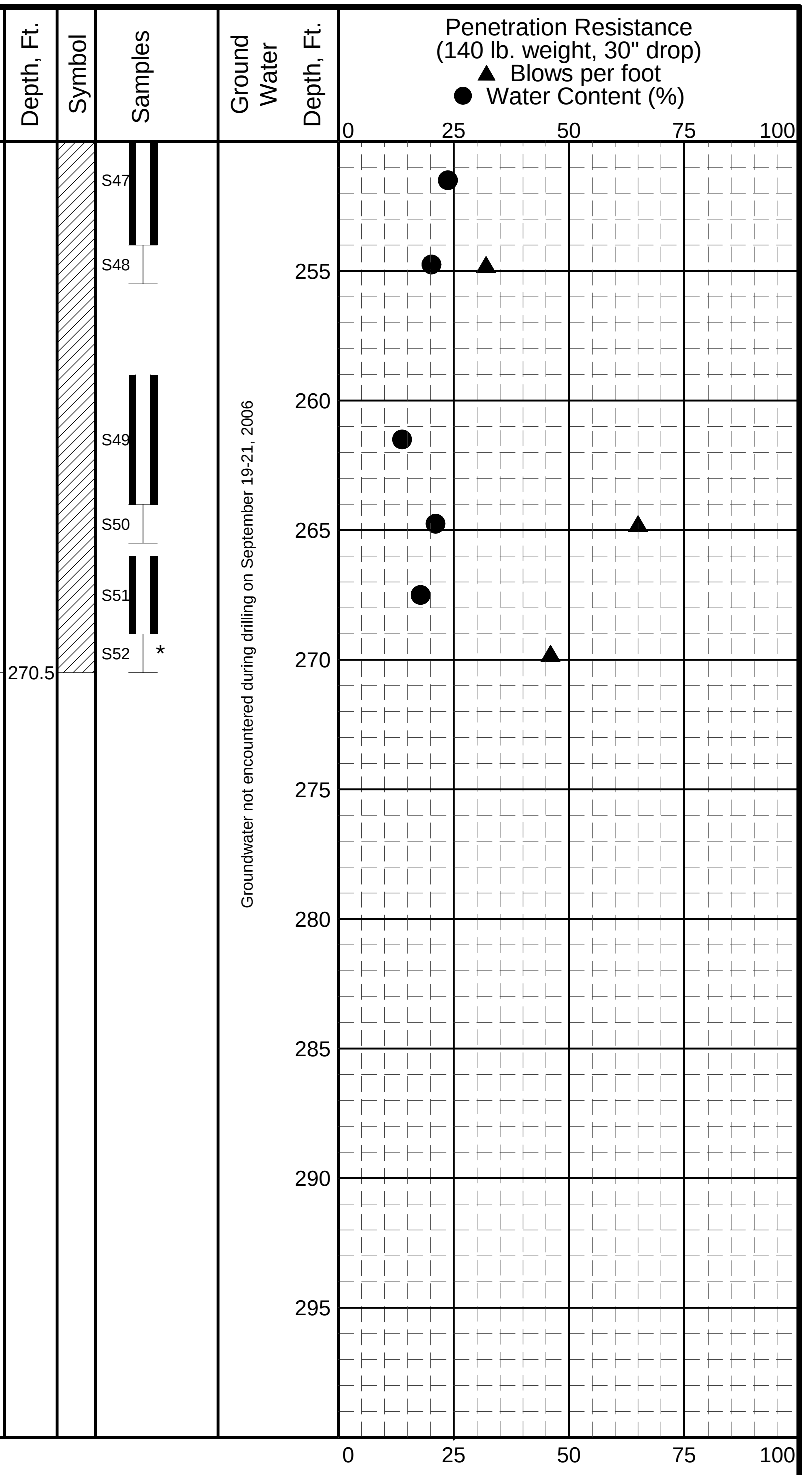
S48: PP = 3.0; TV = 1.5H 1.5V

S49: PP = >4.5

S51: 0% Gravel, 37% Sand, 63% Fines

Possible change in soil type at 269.0 ft

Bottom of Boring
Boring Completed September 19-21, 2006



LEGEND

* Sample Not Recovered

⌶ 2" O.D. Split Spoon Sample

■ Shelby Tube

▮▮ Soil Core Barrel

▽ Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
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Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-18
Location: N 61°16'36.43" W 149°52'00.18"

March 2007 32-1-01536-004

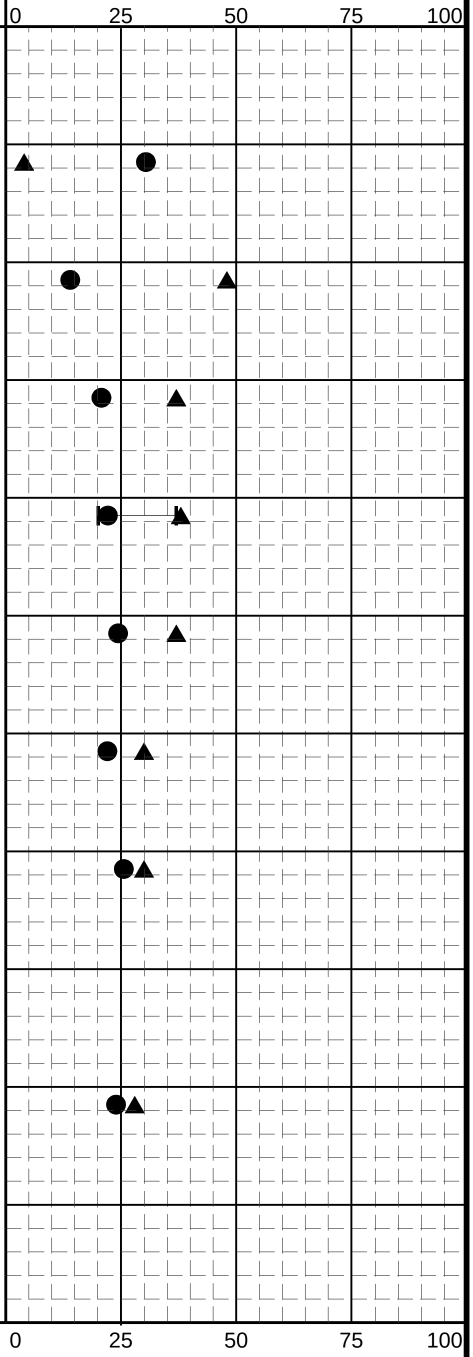
SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. A-19
Sheet 6 of 6

MATERIAL DESCRIPTION Approx. Elevation: -3.5 Ft. (MLLW Datum)	Depth, Ft.	Samples
Loose, gray, slightly silty SAND; wet		S1
Dense, gray, silty, gravelly SAND; wet S2: 33% Gravel, 55% Sand, 12% Fines	7.5	S2
Very stiff to hard, gray CLAY; moist S3: PP = >4.5 S4: PP = >4.5 S5: PP = >4.5 S6: PP = >4.5; TV = 0.9V	12.5	S3 S4 S5 S6
Very stiff to hard, gray CLAY; moist S7: PP = 4.0; TV = 0.9H 0.8V S9: PP = 2.5; TV = 1.6H 1V	32.5	S7 S8 * S9 S10 *

Ground Water: Groundwater not encountered during drilling on September 5-6, 25-26, 2006

Penetration Resistance
(140 lb. weight, 30" drop)
▲ Blows per foot
● Water Content (%)



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LEGEND

- * Sample Not Recovered
- ⌶ 2" O.D. Split Spoon Sample
- ■ Shelby Tube
- ▮▮ Soil Core Barrel
- ⊻ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
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Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-19
Location: N 61°16'34.47" W 149°51'53.90"

March 2007 32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. A-20
Sheet 1 of 5

MATERIAL DESCRIPTION

Approx. Elevation: -3.5 Ft. (MLLW Datum)

S11: PP = 4; TV = 2.1H 1.5V

Very stiff to hard, gray CLAY; moist

S12: PP = >4.5; TV = 1.8H
Qu = 6.2 tsf

S13: PP = >4.5; TV = 1.9H 1.6V

S14: PP = 2.75; TV = 1H 1.1V

S15: PP = 4.5; TV = 1.8H 1.5V

S16: PP = 4.25; TV = 1.75H 1.5V

S17: PP = 2.75; TV = 1.1H
Qu = 3.2 tsf

S18: PP = 3.25; TV = 1.25H 1.1V

New Location: N 61°6'34.805 W 149°51'53.908"

S51: PP = 3.25; TV = 1.3H 1.4V

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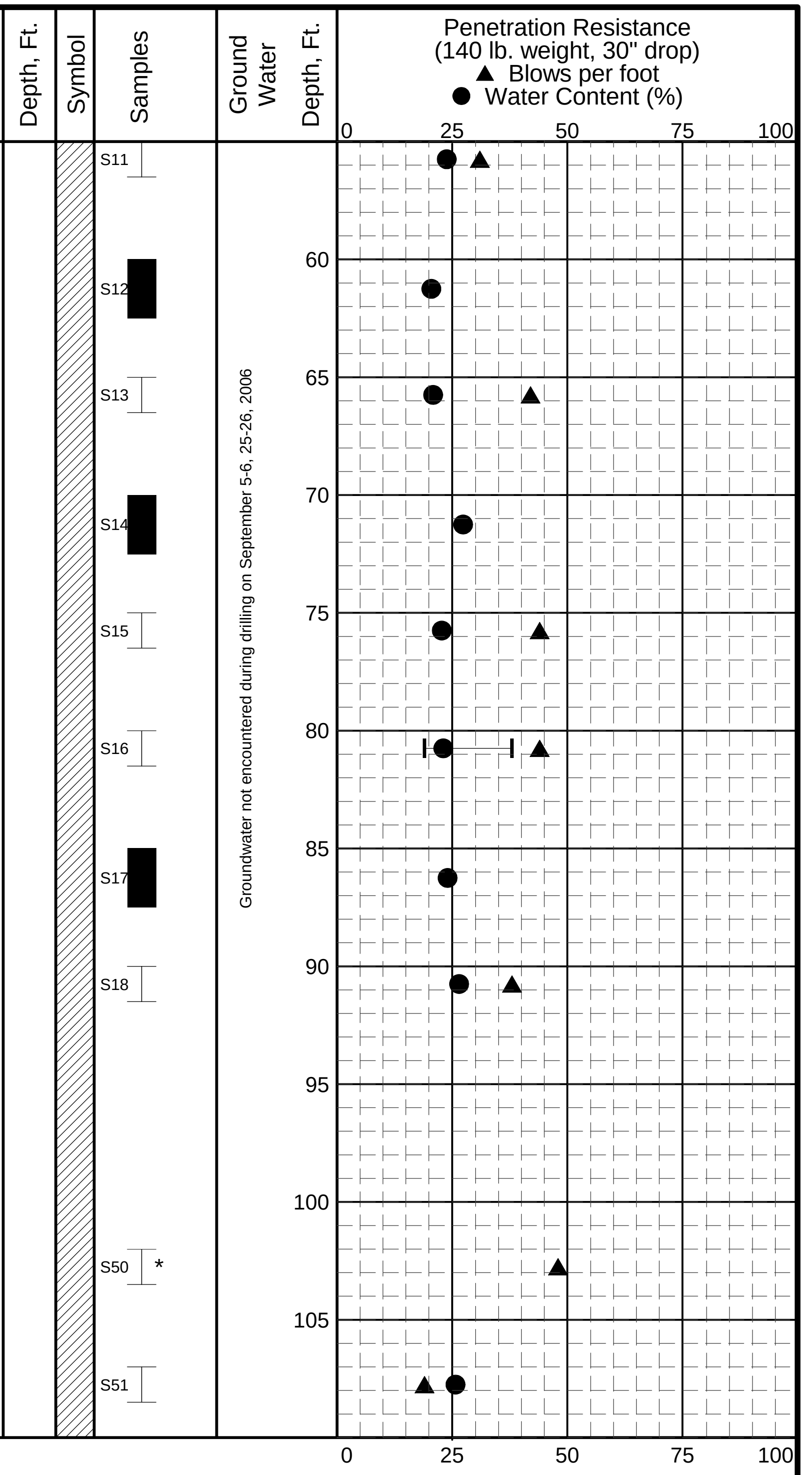

LEGEND

* Sample Not Recovered
⌶ 2" O.D. Split Spoon Sample
■ Shelby Tube
▮▮ Soil Core Barrel

▽ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

NOTES

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Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-19
Location: N 61°16'34.47" W 149°51'53.90"

March 2007 32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. A-20
Sheet 2 of 5

MATERIAL DESCRIPTION

Approx. Elevation: -3.5 Ft. (MLLW Datum)

Very stiff to hard, gray CLAY; moist

S52: PP = 2.5; TV = 1.3H 1.1V

S53: PP = 2.5; TV = 1.0H 1.3V

S54: PP = 2.0; TV = 1.0H 1.0V

S55: PP = 4.0
Qu = 4.6 tsf

S56: PP = 2.3; TV = 0.9H 1.13V

S57: PP = 2.5; TV = 1.13H 1.25V

S58: PP = 2.25; TV = 1.13H 0.9V

Stiff, gray, slightly clayey, slightly sandy SILT; moist; frequent layers of silty, fine SAND (1 to 6 inches thick)

S59: PP = 2.0; TV = 1.13H 1.25V

S60: PP = 3.0; TV = 1.25H 1.25V

Stiff to hard, gray, slightly gravelly to gravelly CLAY; moist

S61: PP = 2.5; TV = 1.13H 1.13V

S62: PP = 2.5; TV = 1.13H

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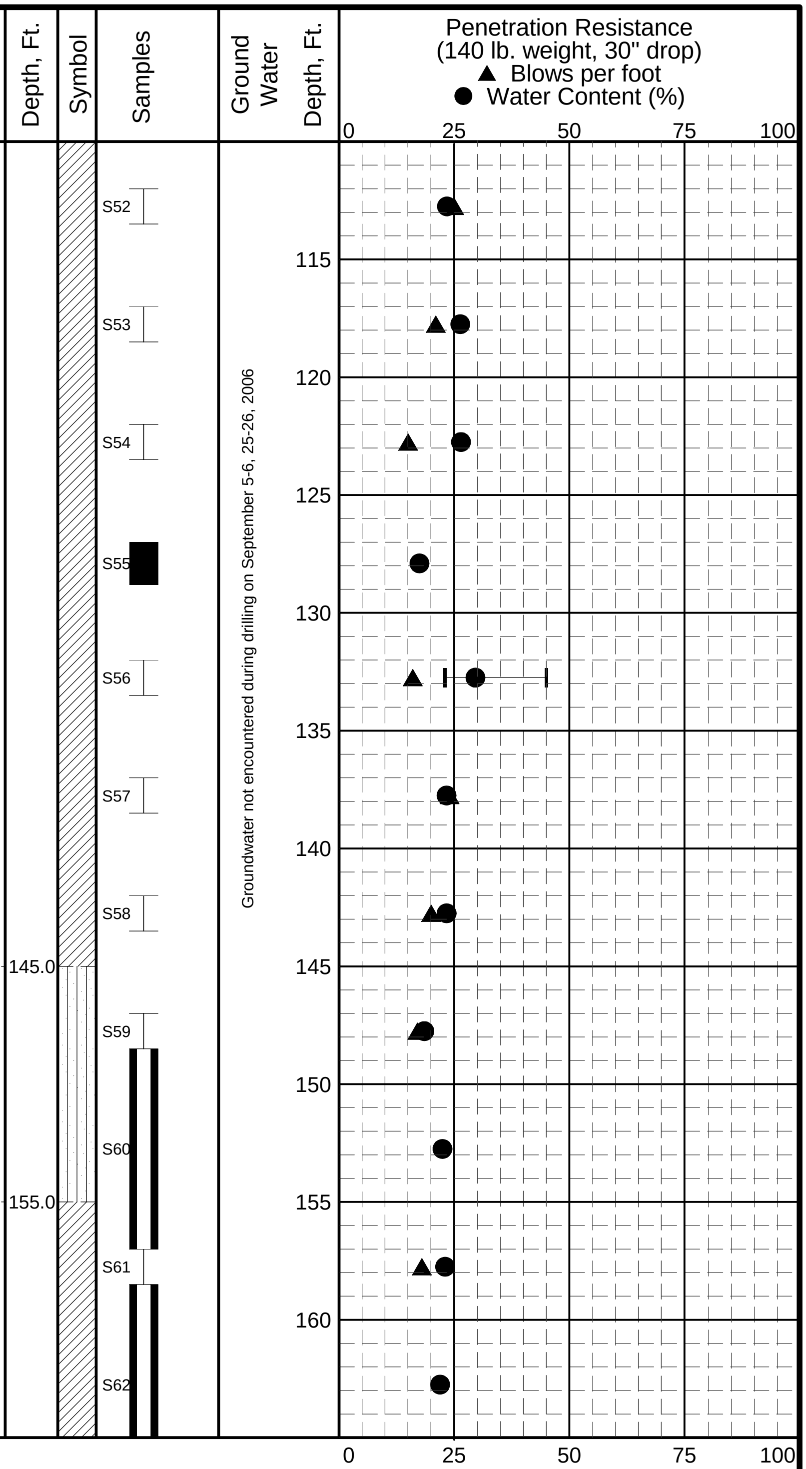

LEGEND

* Sample Not Recovered
⌶ 2" O.D. Split Spoon Sample
■ Shelby Tube
▌▌ Soil Core Barrel
▽ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
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Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-19
Location: N 61°16'34.47" W 149°51'53.90"

March 2007 32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. A-20
Sheet 3 of 5

MATERIAL DESCRIPTION

Approx. Elevation: -3.5 Ft. (MLLW Datum)

Depth, Ft.

Stiff to hard, gray, slightly gravelly to gravelly CLAY; moist

S63: PP = >4.5
Qu = 5.4 tsf

S64: PP = 3.25; TV = 1.25H 1.38V

S65: PP = 2.5

S66: PP = 2.0; TV = 0.9H 0.9V

185.0

Hard, gray CLAY; moist

S67: PP = 2.0/3.0; TV = 1.0H 1.0V

S68: PP = 2.5; TV = 0.9H 0.9V

S70: PP = 2.75; TV = 0.45H

S71: PP = 3.5; TV = 0.25H

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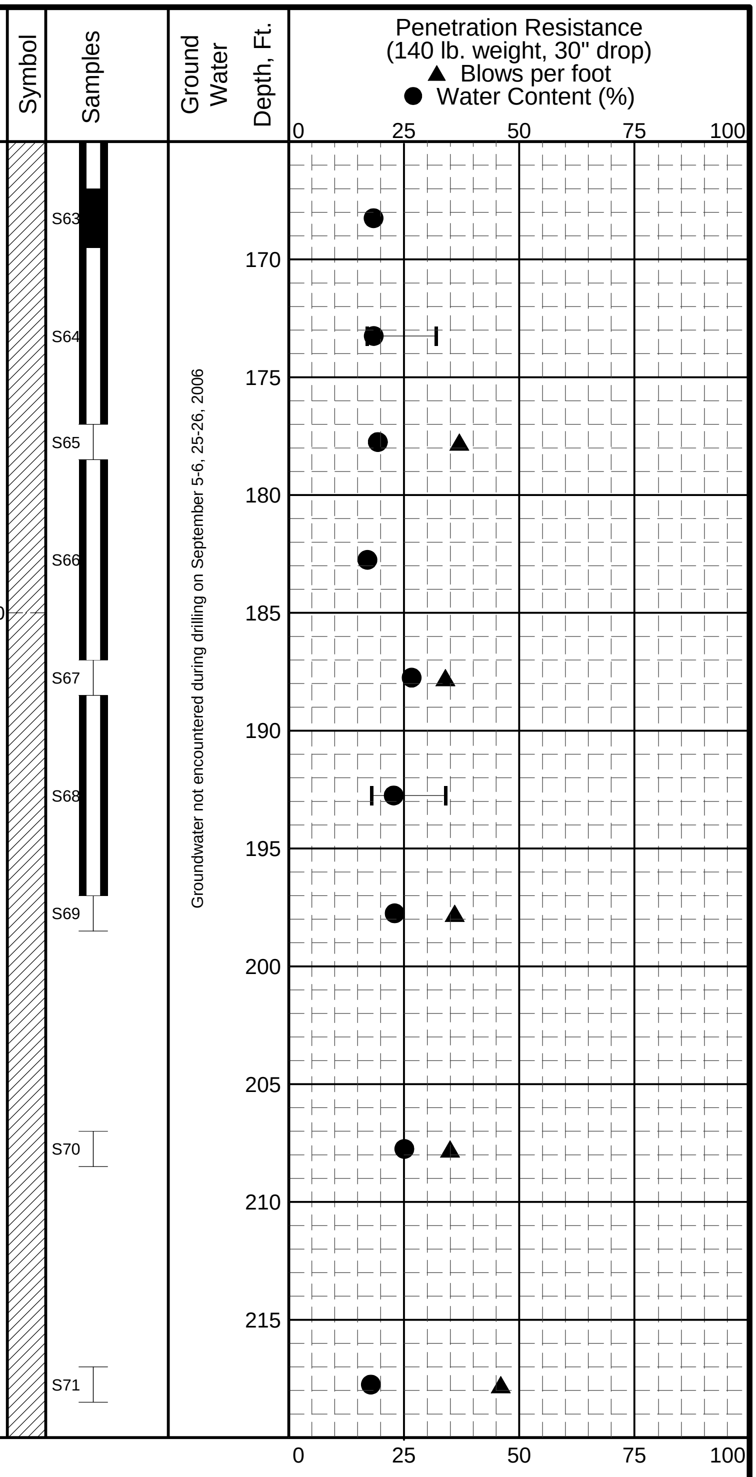

LEGEND

- * Sample Not Recovered
- ⌶ 2" O.D. Split Spoon Sample
- ■ Shelby Tube
- ▮▮ Soil Core Barrel
- ∇ Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

NOTES

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Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-19
Location: N 61°16'34.47" W 149°51'53.90"

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. A-20
Sheet 4 of 5

MATERIAL DESCRIPTION

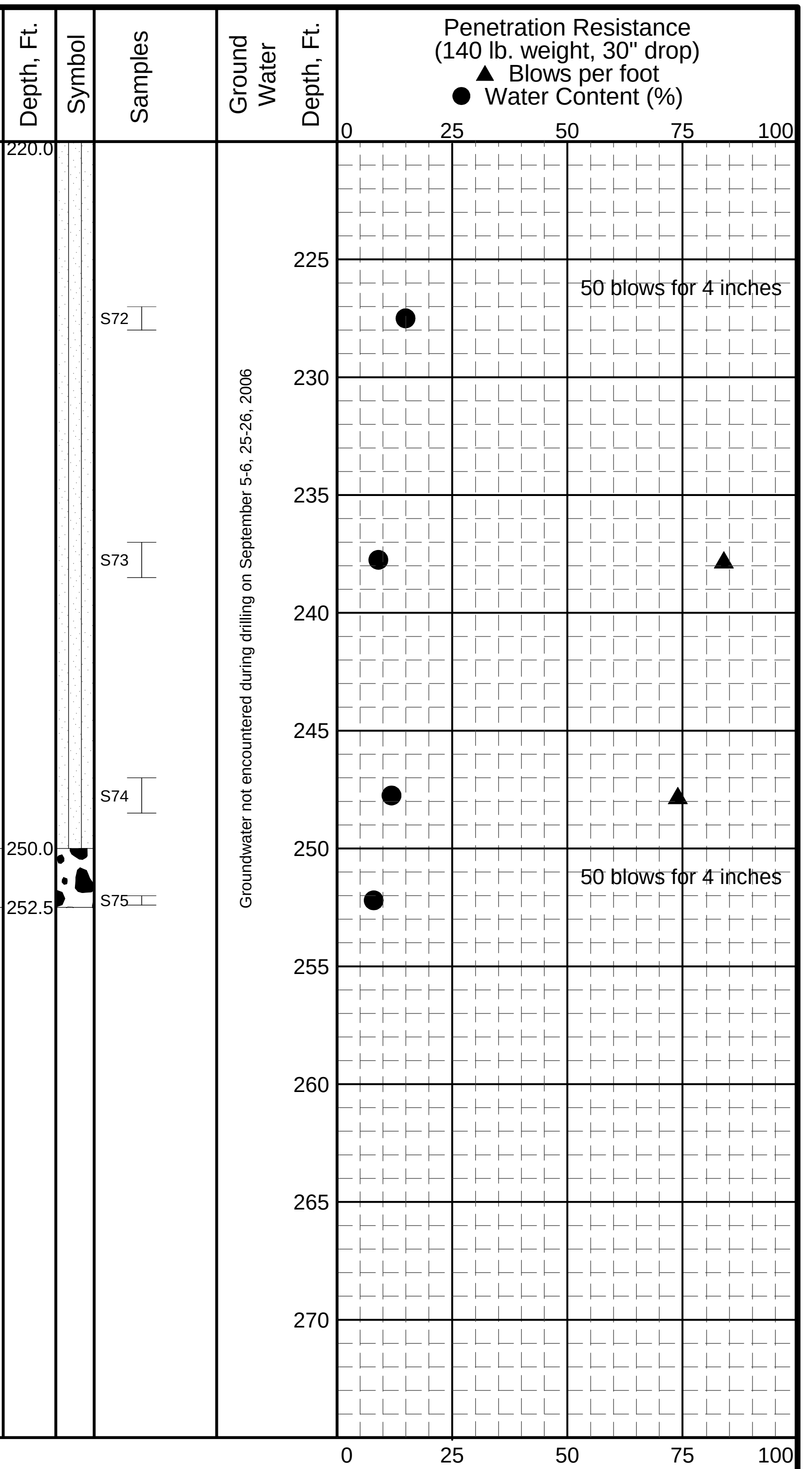
Approx. Elevation: -3.5 Ft. (MLLW Datum)

Very dense, gray, slightly gravelly to gravelly, silty SAND; wet

S73: 14% Fines

Very dense, gray, slightly silty, sandy GRAVEL; wet

Bottom of Boring
Boring Completed September 5-6, 25-26, 2006



LEGEND

* Sample Not Recovered
⌶ 2" O.D. Split Spoon Sample
■ Shelby Tube
▮▮ Soil Core Barrel
▽ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit ├──●──┤ Liquid Limit
Natural Water Content

NOTES

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Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING B06-19
Location: N 61°16'34.47" W 149°51'53.90"

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. A-20
Sheet 5 of 5

CLASSIFICATION OF SHELBY TUBE SAMPLES

Boring: B06-14
Sample: S26

Depth: 176 to 177 ft below ground surface
Sample Quality: Good

			Torvane			Pocket Pen				
Depth (ft)	Depth	Length	V	H	R		S	%M	Top	Description
176	176' to 176.5'	6"		2.2		>4.5		22.1%	▨	Gray CLAY, moist
176.5	176.5' to 177'	6"						17.8%	▨	Gray CLAY, moist Unconfined Compression test run.
177									Bottom of Sample	

NOTES:

- > V, H, and R represent Vertical, Horizontal, and Remolded Torvane and Pocket Penetrometer readings respectively.
- > Clay sensitivity is shown in the column labeled "S".
- > Torvane and Pocket Pen readings in tons per square foot (tsf).
- > Reported Pocket Pen values are average values representing each 6-inch section of the sample.
- > %M is moisture content for each interval.

Knik Arm Crossing
Knik Arm, Alaska

CLASSIFICATION OF SHELBY TUBE SAMPLES
(Boring B06-14 Sample S26)

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical & Environmental Consultants

Fig. A-21
Sheet 1 of 29

CLASSIFICATION OF SHELBY TUBE SAMPLES

Boring: B06-16
Sample: S4

Depth: 19.5 to 20.5 ft below ground surface
Sample Quality: Good

Depth (ft)			Torvane			Pocket Pen				
	Depth	Length	V	H	R		S	%M	Top	Description
19.5	19.5' to 20'	6"				4.3		20.6%	▨	Gray CLAY, moist
20	20' to 20.5'	6"						21.3%	▨	Gray CLAY, moist Unconfined Compression test run.
20.5									Bottom of Sample	

NOTES:

> V, H, and R represent Vertical, Horizontal, and Remolded Torvane and Pocket Penetrometer readings respectively.
> Clay sensitivity is shown in the column labeled "S".
> Torvane and Pocket Pen readings in tons per square foot (tsf).
> Reported Pocket Pen values are average values representing each 6-inch section of the sample.
> %M is moisture content for each interval.

Knik Arm Crossing
Knik Arm, Alaska

CLASSIFICATION OF SHELBY TUBE SAMPLES
(Boring B06-16 Sample S4)

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical & Environmental Consultants

Fig. A-21
Sheet 2 of 29

CLASSIFICATION OF SHELBY TUBE SAMPLES

Boring: B06-16
Sample: S8

Depth: 40 to 41 ft below ground surface
Sample Quality: Good

Depth (ft)			Torvane			Pocket Pen				
	Depth	Length	V	H	R		S	%M	Top	Description
40	40' to 40.5'	6"	0.9	0.6	0.3	2.5	4.67	25.0%	▨	Gray CLAY, moist
40.5	40.5' to 41'	6"						24.7%	▨	Gray CLAY, moist Unconfined Compression test run.
41									Bottom of Sample	

NOTES:

> V, H, and R represent Vertical, Horizontal, and Remolded Torvane and Pocket Penetrometer readings respectively.
> Clay sensitivity is shown in the column labeled "S".
> Torvane and Pocket Pen readings in tons per square foot (tsf).
> Reported Pocket Pen values are average values representing each 6-inch section of the sample.
> %M is moisture content for each interval.

Knik Arm Crossing
Knik Arm, Alaska

CLASSIFICATION OF SHELBY TUBE SAMPLES
(Boring B06-16 Sample S8)

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical & Environmental Consultants

Fig. A-21
Sheet 3 of 29

CLASSIFICATION OF SHELBY TUBE SAMPLES

Boring: B06-16
Sample: S31

Depth: 159.5 to 160.5 ft below ground surface
Sample Quality: Good

Depth (ft)			Torvane			Pocket Pen				
	Depth	Length	V	H	R		S	%M	Top	Description
159.5	159.5' to 160'	6"				2.8		26.4%	▨	Gray CLAY, moist
160	160' to 160.5'	6"						27.2%	▨	Gray CLAY, moist Unconfined Compression test run.
160.5									Bottom of Sample	

NOTES:

> V, H, and R represent Vertical, Horizontal, and Remolded Torvane and Pocket Penetrometer readings respectively.
> Clay sensitivity is shown in the column labeled "S".
> Torvane and Pocket Pen readings in tons per square foot (tsf).
> Reported Pocket Pen values are average values representing each 6-inch section of the sample.
> %M is moisture content for each interval.

Knik Arm Crossing
Knik Arm, Alaska

CLASSIFICATION OF SHELBY TUBE SAMPLES
(Boring B06-16 Sample S31)

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical & Environmental Consultants

Fig. A-21
Sheet 4 of 29

CLASSIFICATION OF SHELBY TUBE SAMPLES

Boring: B06-17
Sample: S6

Depth:33 to 34.5 ft below ground surface
Sample Quality: Good

Depth (ft)			Torvane			Pocket Pen				
	Depth	Length	V	H	R		S	%M	Top	Description
33	33' to 33.5'	6"	2.0	1.0	0.4	2.7	5	28.6%	▨	Gray CLAY, moist
33.5	33.5' to 34'	6"							▨	Gray CLAY, moist Unconfined Compression test run
34	34' to 34.5'	6"	1.5	0.5	0.5	1.3	3	26.9%	▨	Gray CLAY, moist
34.5									Bottom of Sample	

NOTES:

> V, H, and R represent Vertical, Horizontal, and Remolded Torvane and Pocket Penetrometer readings respectively.
> Clay sensitivity is shown in the column labeled "S".
> Torvane and Pocket Pen readings in tons per square foot (tsf).
> Reported Pocket Pen values are average values representing each 6-inch section of the sample.
> %M is moisture content for each interval.

Knik Arm Crossing
Knik Arm, Alaska

CLASSIFICATION OF SHELBY TUBE SAMPLES
(Boring B06-17 Sample S6)

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical & Environmental Consultants

Fig. A-21
Sheet 5 of 29

CLASSIFICATION OF SHELBY TUBE SAMPLES

Boring: B06-17
Sample: S8

Depth: 42 to 44.5 ft below ground surface
Sample Quality: Fair

Depth (ft)
42
42.5
43
43.5
44
44.5

		Torvane			Pocket Pen				
Depth	Length	V	H	R		S	%M	Top	Description
42' to 42.5'	6"				1.8		26.5%		Gray CLAY, moist
42.5' to 43'	6"								Gray CLAY, moist
43' to 43.5'	6"								Gray CLAY, moist Unconfined Compression Test run
43.5' to 44'	6"								Gray CLAY, moist
44' to 44.5'	6"				3.3		27.1%	Bottom of Sample	Gray CLAY, moist Unconsolidated Undrained Triaxial Test run

NOTES:

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- > Clay sensitivity is shown in the column labeled "S".
- > Torvane and Pocket Pen readings in tons per square foot (tsf).
- > Reported Pocket Pen values are average values representing each 6-inch section of the sample.
- > %M is moisture content for each interval.

Knik Arm Crossing
Knik Arm, Alaska

CLASSIFICATION OF SHELBY TUBE SAMPLES
(Boring B06-17 Sample S8)

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical & Environmental Consultants

Fig. A-21
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CLASSIFICATION OF SHELBY TUBE SAMPLES

Boring: B06-17
Sample: S10

Depth: 52.5 to 54.5 ft below ground surface
Sample Quality: Good

Depth (ft)			Torvane			Pocket Pen				
	Depth	Length	V	H	R		S	%M	Top	Description
52.5	52.5' to 53'	6"	1.3	1.3		3.8		23.6%	▨	Gray CLAY, moist
53	53' to 53.5'	6"							▨	
53.5	53.5' to 54'	6"						23.2%	▨	Gray CLAY, moist Unconfined Compression test run.
54	54' to 54.5'	6"	1.9	1.6		4.3		20.7%	▨	Gray CLAY, moist
54.5									Bottom of Sample	

NOTES:

> V, H, and R represent Vertical, Horizontal, and Remolded Torvane and Pocket Penetrometer readings respectively.
> Clay sensitivity is shown in the column labeled "S".
> Torvane and Pocket Pen readings in tons per square foot (tsf).
> Reported Pocket Pen values are average values representing each 6-inch section of the sample.
> %M is moisture content for each interval.

Knik Arm Crossing
Knik Arm, Alaska

CLASSIFICATION OF SHELBY TUBE SAMPLES
(Boring B06-17 Sample S10)

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CLASSIFICATION OF SHELBY TUBE SAMPLES

Boring: B06-17
Sample: S14

Depth: 76.5 to 77.5 ft below ground surface
Sample Quality: Fair

Depth (ft)			Torvane			Pocket Pen				
	Depth	Length	V	H	R		S	%M	Top	Description
76.5	76.5' to 77'	6"						24.6%	▨	Gray, CLAY, moist
77	77' to 77.5'	6"	0.6	0.8		1.5		25.5%	▨	Gray CLAY, moist
77.5									Bottom of Sample	

NOTES:

- > V, H, and R represent Vertical, Horizontal, and Remolded Torvane and Pocket Penetrometer readings respectively.
- > Clay sensitivity is shown in the column labeled "S".
- > Torvane and Pocket Pen readings in tons per square foot (tsf).
- > Reported Pocket Pen values are average values representing each 6-inch section of the sample.
- > %M is moisture content for each interval.

Knik Arm Crossing
Knik Arm, Alaska

CLASSIFICATION OF SHELBY TUBE SAMPLES
(Boring B06-17 Sample S14)

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CLASSIFICATION OF SHELBY TUBE SAMPLES

Boring: B06-17
Sample: S16

Depth: 86 to 88 ft below ground surface
Sample Quality: Good

Depth (ft)	Depth	Length	Torvane			Pocket Pen	S	%M	Top	Description
			V	H	R					
86	86' to 86.5'	6"						21.4%	▨	Gray CLAY, moist Unconfined Compression test run.
86.5	86.5' to 87'	6"	1.4	1.7		4.5		25.5%	▨	Gray CLAY, scattered silt seams, moist
87	87' to 87.5'	6"	1.3	1.3		>4.5		20.5%	▨	Gray CLAY, moist
87.5	87.5' to 88'	6"	1.5	1.2		3.9		23.7%	▨	Gray CLAY, moist
88									Bottom of Sample	

NOTES:

> V, H, and R represent Vertical, Horizontal, and Remolded Torvane and Pocket Penetrometer readings respectively.
> Clay sensitivity is shown in the column labeled "S".
> Torvane and Pocket Pen readings in tons per square foot (tsf).
> Reported Pocket Pen values are average values representing each 6-inch section of the sample.
> %M is moisture content for each interval.

Knik Arm Crossing
Knik Arm, Alaska

CLASSIFICATION OF SHELBY TUBE SAMPLES
(Boring B06-17 Sample S16)

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CLASSIFICATION OF SHELBY TUBE SAMPLES

Boring: B06-17
Sample: S18

Depth: 96 to 98.5 ft below ground surface
Sample Quality: Fair

Depth (ft)	Depth	Length	Torvane V	Torvane H	Torvane R	Pocket Pen	S	%M	Top	Description
96	96' to 96.5'	6"				3.3		27.0%	▨	Gray CLAY, moist Unconsolidated Undrained Triaxial Test run
96.5	96.5' to 97'	6"							▨	Gray CLAY, moist
97	97' to 97.5'	6"							▨	Gray CLAY, moist Unconfined Compression Test run
97.5	97.5' to 98'	6"							▨	Gray CLAY, moist
98	98' to 98.5'	6"				4.3		20.9%	▨	Gray CLAY, moist
98.5									Bottom of Sample	

NOTES:

- > V, H, and R represent Vertical, Horizontal, and Remolded Torvane and Pocket Penetrometer readings respectively.
- > Clay sensitivity is shown in the column labeled "S".
- > Torvane and Pocket Pen readings in tons per square foot (tsf).
- > Reported Pocket Pen values are average values representing each 6-inch section of the sample.
- > %M is moisture content for each interval.

Knik Arm Crossing
Knik Arm, Alaska

CLASSIFICATION OF SHELBY TUBE SAMPLES
(Boring B06-17 Sample S18)

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CLASSIFICATION OF SHELBY TUBE SAMPLES

Boring: B06-17
Sample: S20

Depth: 106 to 108 ft below ground surface
Sample Quality: Good

Depth (ft)			Torvane			Pocket Pen				
	Depth	Length	V	H	R		S	%M	Top	Description
106	106' to 106.5'	6"						24.7%	▨	Gray CLAY, moist Unconfined Compression test run.
106.5	106.5' to 107'	6"	1.7	1.3		4.0		26.4%	▨	Gray CLAY, moist
107	107' to 107.5'	6"	1.4	1.6		>4.5		25.6%	▨	Gray CLAY, moist
107.5	107.5' to 108'	6"	0.9	1.7		3.9		26.6%	▨	Gray CLAY, moist
108									Bottom of Sample	

NOTES:

> V, H, and R represent Vertical, Horizontal, and Remolded Torvane and Pocket Penetrometer readings respectively.
> Clay sensitivity is shown in the column labeled "S".
> Torvane and Pocket Pen readings in tons per square foot (tsf).
> Reported Pocket Pen values are average values representing each 6-inch section of the sample.
> %M is moisture content for each interval.

Knik Arm Crossing
Knik Arm, Alaska

CLASSIFICATION OF SHELBY TUBE SAMPLES
(Boring B06-17 Sample S20)

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CLASSIFICATION OF SHELBY TUBE SAMPLES

Boring: B06-17
Sample: S23

Depth:126.5 to 128.0 ft below ground surface
Sample Quality: Fair

Depth (ft)			Torvane			Pocket Pen				
	Depth	Length	V	H	R		S	%M	Top	Description
126.5	126.5' to 127'	6"							▨	Gray CLAY, moist, scattered fine gravel
127	127' to 127.5'	6"	1.3	1.6		4.0		25.6%	▨	Gray CLAY, moist, scattered fine gravel
127.5	127.5' to 128'	6"							▨	Gray CLAY, moist, with trace sand
128									Bottom of Sample	

NOTES:

> V, H, and R represent Vertical, Horizontal, and Remolded Torvane and Pocket Penetrometer readings respectively.
> Clay sensitivity is shown in the column labeled "S".
> Torvane and Pocket Pen readings in tons per square foot (tsf).
> Reported Pocket Pen values are average values representing each 6-inch section of the sample.
> %M is moisture content for each interval.

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Knik Arm, Alaska

CLASSIFICATION OF SHELBY TUBE SAMPLES
(Boring B06-17 Sample S23)

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CLASSIFICATION OF SHELBY TUBE SAMPLES

Boring: B06-17
Sample: S27

Depth: 146 to 148 ft below ground surface
Sample Quality: Good

Depth (ft)			Torvane			Pocket Pen				
	Depth	Length	V	H	R		S	%M	Top	Description
146	146' to 146.5'	6"	2.0	1.25		3.5		21.8%		Gray CLAY, moist
146.5	146.5' to 147'	6"						18.5%		Gray CLAY, moist Unconfined Compression test run.
147	147' to 147.5'	6"								Gray CLAY, moist, with silt partings
147.5	147.5' to 148'	6"	1.5	1.5		2.5		25.4%		Gray CLAY, moist, with scattered silt pockets
148									Bottom of Sample	

NOTES:

- > V, H, and R represent Vertical, Horizontal, and Remolded Torvane and Pocket Penetrometer readings respectively.
- > Clay sensitivity is shown in the column labeled "S".
- > Torvane and Pocket Pen readings in tons per square foot (tsf).
- > Reported Pocket Pen values are average values representing each 6-inch section of the sample.
- > %M is moisture content for each interval.

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CLASSIFICATION OF SHELBY TUBE SAMPLES
(Boring B06-17 Sample S27)

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CLASSIFICATION OF SHELBY TUBE SAMPLES

Boring: B06-17
Sample: S31

Depth: 166 to 168 ft below ground surface
Sample Quality: Good

			Torvane			Pocket Pen				
Depth (ft)	Depth	Length	V	H	R		S	%M	Top	Description
166	166' to 166.5'	6"						20.9%	▨	Gray CLAY, moist, with silt seams Unconfined Compression test run.
166.5	166.5' to 167'	6"	2.0	1.8		>4.5		21.3%	▨	Gray CLAY, moist, with silt seams
167	167' to 167.5'	6"	1.6	1.4		>4.5		22.3%	▨	Gray CLAY, moist, with silt seams
167.5	167.5' to 168'	6"	1.1	1.6		3.9		24.3%	▨	Gray CLAY, moist, occasional shells
168									Bottom of Sample	

NOTES:

> V, H, and R represent Vertical, Horizontal, and Remolded Torvane and Pocket Penetrometer readings respectively.
> Clay sensitivity is shown in the column labeled "S".
> Torvane and Pocket Pen readings in tons per square foot (tsf).
> Reported Pocket Pen values are average values representing each 6-inch section of the sample.
> %M is moisture content for each interval.

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CLASSIFICATION OF SHELBY TUBE SAMPLES
(Boring B06-17 Sample S31)

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CLASSIFICATION OF SHELBY TUBE SAMPLES

Boring: B06-17
Sample: S36

Depth: 186 to 188.5 ft below ground surface
Sample Quality: Fair

Depth (ft)			Torvane			Pocket Pen				
	Depth	Length	V	H	R		S	%M	Top	Description
186	186' to 186.5'	6"				3.5		22.6%		Gray CLAY, moist
186.5	186.5' to 187'	6"								Gray CLAY, moist
187	187' to 187.5'	6"								Gray CLAY, moist Unconfined Compression Test run
187.5	187.5' to 188'	6"								Gray CLAY, moist
188	188' to 188.5'	6"				1.0		23.9%		Gray CLAY, moist Unconsolidated Undrained Triaxial Test run
188.5									Bottom of Sample	

NOTES:

> V, H, and R represent Vertical, Horizontal, and Remolded Torvane and Pocket Penetrometer readings respectively.
> Clay sensitivity is shown in the column labeled "S".
> Torvane and Pocket Pen readings in tons per square foot (tsf).
> Reported Pocket Pen values are average values representing each 6-inch section of the sample.
> %M is moisture content for each interval.

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CLASSIFICATION OF SHELBY TUBE SAMPLES
(Boring B06-17 Sample S36)

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CLASSIFICATION OF SHELBY TUBE SAMPLES

Boring: B06-17
Sample: S40

Depth: 201 to 203.5 ft below ground surface
Sample Quality: Good

Depth (ft)
201
201.5
202
202.5
203
203.5

		Torvane			Pocket Pen				
Depth	Length	V	H	R		S	%M	Top	Description
201' to 201.5'	6"	0.7	0.9		4.5		21.4%		Gray CLAY, moist
201.5' to 202'	6"								Gray, slightly sandy CLAY, moist Unconfined Compression test run.
202' to 202.5'	6"	1.6	1.8		>4.5		20.8%		Gray CLAY, moist
202.5' to 203'	6"	1.6	1.6		>4.5		20.3%		Gray CLAY, moist
203' to 203.5'	6"	1.2	1.4		4.1		24.3%		Gray, slightly sandy CLAY, moist

Bottom of Sample

NOTES:

- > V, H, and R represent Vertical, Horizontal, and Remolded Torvane and Pocket Penetrometer readings respectively.
- > Clay sensitivity is shown in the column labeled "S".
- > Torvane and Pocket Pen readings in tons per square foot (tsf).
- > Reported Pocket Pen values are average values representing each 6-inch section of the sample.
- > %M is moisture content for each interval.

Knik Arm Crossing
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CLASSIFICATION OF SHELBY TUBE SAMPLES
(Boring B06-17 Sample S40)

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CLASSIFICATION OF SHELBY TUBE SAMPLES

Boring: B06-18
Sample: S6

Depth: 39 to 41 ft below ground surface
Sample Quality: Good

Depth (ft)			Torvane			Pocket Pen				
	Depth	Length	V	H	R		S	%M	Top	Description
39	39' to 39.5'	6"						21.4%	▨	Gray CLAY, moist Unconfined Compression test run.
39.5	39.5' to 40'	6"	1.5	1.6		>4.5		22.6%	▨	Gray CLAY, moist
40	40' to 40.5'	6"	1.4	1.5		4.0		21.6%	▨	Gray CLAY, moist
40.5	40.5' to 41'	6"	1.6	1.3		4.3		20.9%	▨	Gray CLAY, moist
41									Bottom of Sample	

NOTES:

> V, H, and R represent Vertical, Horizontal, and Remolded Torvane and Pocket Penetrometer readings respectively.
> Clay sensitivity is shown in the column labeled "S".
> Torvane and Pocket Pen readings in tons per square foot (tsf).
> Reported Pocket Pen values are average values representing each 6-inch section of the sample.
> %M is moisture content for each interval.

Knik Arm Crossing
Knik Arm, Alaska

CLASSIFICATION OF SHELBY TUBE SAMPLES
(Boring B06-18 Sample S6)

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Fig. A-21

CLASSIFICATION OF SHELBY TUBE SAMPLES

Boring: B06-18
Sample: S9

Depth: 59 to 61.5 ft below ground surface
Sample Quality: Fair

Depth (ft)
59
59.5
60
60.5
61
61.5

		Torvane			Pocket Pen				
Depth	Length	V	H	R		S	%M	Top	Description
59' to 59.5'	6"				3.0		20.5%		Gray CLAY, moist Unconfined Compression Test run
59.5' to 60'	6"								Gray CLAY, moist
60' to 60.5'	6"								Gray CLAY, moist
60.5' to 61'	6"						22.6%		Gray CLAY, moist, trace gravel Unconsolidated Undrained Triaxial Test run
61' to 61.5'	6"				3.3		23.2%	Bottom of Sample	Gray CLAY, moist, trace gravel

NOTES:

> V, H, and R represent Vertical, Horizontal, and Remolded Torvane and Pocket Penetrometer readings respectively.
> Clay sensitivity is shown in the column labeled "S".
> Torvane and Pocket Pen readings in tons per square foot (tsf).
> Reported Pocket Pen values are average values representing each 6-inch section of the sample.
> %M is moisture content for each interval.

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CLASSIFICATION OF SHELBY TUBE SAMPLES
(Boring B06-18 Sample S9)

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CLASSIFICATION OF SHELBY TUBE SAMPLES

Boring: B06-18
Sample: S11

Depth: 69 to 71.5 ft below ground surface
Sample Quality: Fair

Depth (ft)			Torvane			Pocket Pen				
	Depth	Length	V	H	R		S	%M	Top	Description
69	69' to 69.5'	6"				2.0		21.5%	▨	Gray CLAY, moist Unconfined Compression Test run
69.5	69.5' to 70'	6"							▨	Gray CLAY, moist
70	70' to 70.5'	6"							▨	Gray CLAY, moist
70.5	70.5' to 71'	6"						24.0%	▨	Gray CLAY, moist Unconsolidated Undrained Triaxial Test run
71	71' to 71.5'	6"				2.3		24.2%	▨	Gray CLAY, moist
71.5									Bottom of Sample	

NOTES:

> V, H, and R represent Vertical, Horizontal, and Remolded Torvane and Pocket Penetrometer readings respectively.
> Clay sensitivity is shown in the column labeled "S".
> Torvane and Pocket Pen readings in tons per square foot (tsf).
> Reported Pocket Pen values are average values representing each 6-inch section of the sample.
> %M is moisture content for each interval.

Knik Arm Crossing
Knik Arm, Alaska

CLASSIFICATION OF SHELBY TUBE SAMPLES
(Boring B06-18 Sample S11)

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CLASSIFICATION OF SHELBY TUBE SAMPLES

Boring: B06-18
Sample: S13

Depth: 79 to 81.5 ft below ground surface
Sample Quality: Fair

Depth (ft)			Torvane			Pocket Pen				
	Depth	Length	V	H	R		S	%M	Top	Description
79	79' to 79.5'	6"				1.3		27.9%		Gray CLAY, moist
79.5	79.5' to 80'	6"								Gray CLAY, moist
80	80' to 80.5'	6"								Gray CLAY, moist Unconfined Test run
80.5	80.5' to 81'	6"						30.6%		Gray CLAY, moist Unconsolidated Undrained Triaxial Test run
81	81' to 81.5'	6"				2.3		24.2%		Gray CLAY, moist
81.5									Bottom of Sample	

NOTES:

- > V, H, and R represent Vertical, Horizontal, and Remolded Torvane and Pocket Penetrometer readings respectively.
- > Clay sensitivity is shown in the column labeled "S".
- > Torvane and Pocket Pen readings in tons per square foot (tsf).
- > Reported Pocket Pen values are average values representing each 6-inch section of the sample.
- > %M is moisture content for each interval.

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Knik Arm, Alaska

CLASSIFICATION OF SHELBY TUBE SAMPLES
(Boring B06-18 Sample S13)

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CLASSIFICATION OF SHELBY TUBE SAMPLES

Boring: B06-18
Sample: S15

Depth: 89 to 91 ft below ground surface
Sample Quality: Fair

Depth (ft)			Torvane			Pocket Pen				
	Depth	Length	V	H	R		S	%M	Top	Description
89	89' to 89.5'	6"	0.5	0.4	0.2	0.8	5.1	31.2%		Gray CLAY, moist
89.5	89.5' to 90'	6"								
90	90' to 90.5'	6"						33.9%		Gray CLAY, moist Unconfined Compression test run.
90.5	90.5' to 91'	6"	0.6	0.7	0.6	1.8		25.5%		Gray CLAY, moist
91									Bottom of Sample	

NOTES:

> V, H, and R represent Vertical, Horizontal, and Remolded Torvane and Pocket Penetrometer readings respectively.
> Clay sensitivity is shown in the column labeled "S".
> Torvane and Pocket Pen readings in tons per square foot (tsf).
> Reported Pocket Pen values are average values representing each 6-inch section of the sample.
> %M is moisture content for each interval.

Knik Arm Crossing
Knik Arm, Alaska

CLASSIFICATION OF SHELBY TUBE SAMPLES
(Boring B06-18 Sample S15)

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CLASSIFICATION OF SHELBY TUBE SAMPLES

Boring: B06-18
Sample: S21

Depth:119.5 to 121.5 ft below ground surface
Sample Quality: Good

Depth (ft)			Torvane			Pocket Pen				
	Depth	Length	V	H	R		S	%M	Top	Description
119.5	119.5' to 120'	6"	1.1	1.6	1.0	4.0	2.75	25.6%	▨	Gray CLAY, moist
120	120.0' to 120.5'	6"							▨	Gray CLAY, moist
120.5	120.5' to 121'	6"	1.1	1.4		3.3		26.4%	▨	Gray CLAY, moist
121	121.0' to 121.5'	6"	1.5	1.3		3.3		27.7%	▨	Gray CLAY, moist
121.5									Bottom of Sample	

NOTES:

> V, H, and R represent Vertical, Horizontal, and Remolded Torvane and Pocket Penetrometer readings respectively.
> Clay sensitivity is shown in the column labeled "S".
> Torvane and Pocket Pen readings in tons per square foot (tsf).
> Reported Pocket Pen values are average values representing each 6-inch section of the sample.
> %M is moisture content for each interval.

Knik Arm Crossing
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CLASSIFICATION OF SHELBY TUBE SAMPLES
(Boring B06-18 Sample S21)

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CLASSIFICATION OF SHELBY TUBE SAMPLES

Boring: B06-18
Sample: S31

Depth: 170 to 171 ft below ground surface
Sample Quality: Disturbed

Depth (ft)			Torvane			Pocket Pen				
	Depth	Length	V	H	R		S	%M	Top	Description
170	170' to 170.5'	6"	0.4	0.7	0.3	1.8	3.7	22.3%	▨	Gray CLAY, moist
170.5	170.5' to 171'	6"						20.2%	▨	Gray CLAY, moist Unconfined Compression test run.
171									Bottom of Sample	

NOTES:

- > V, H, and R represent Vertical, Horizontal, and Remolded Torvane and Pocket Penetrometer readings respectively.
- > Clay sensitivity is shown in the column labeled "S".
- > Torvane and Pocket Pen readings in tons per square foot (tsf).
- > Reported Pocket Pen values are average values representing each 6-inch section of the sample.
- > %M is moisture content for each interval.

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CLASSIFICATION OF SHELBY TUBE SAMPLES
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CLASSIFICATION OF SHELBY TUBE SAMPLES

Boring: B06-18
Sample: S35

Depth: 189 to 191.5 ft below ground surface
Sample Quality: Fair

Depth (ft)			Torvane			Pocket Pen				
	Depth	Length	V	H	R		S	%M	Top	Description
189	189' to 189.5'	6"				1.5		21.7%	▨	Gray CLAY, moist, trace gravel
189.5	189.5' to 190'	6"						22.7%	▨	Gray CLAY, moist, trace gravel Unconsolidated Undrained Triaxial Test run
190	190' to 190.5'	6"							▨	Gray CLAY, moist, trace gravel
190.5	190.5' to 191'	6"							▨	Gray CLAY, moist, trace gravel Unconfined Compression test run
191	191' to 191.5'	6"				2.0		26.6%	▨	Gray CLAY, moist, trace gravel
191.5									Bottom of Sample	

NOTES:

- > V, H, and R represent Vertical, Horizontal, and Remolded Torvane and Pocket Penetrometer readings respectively.
- > Clay sensitivity is shown in the column labeled "S".
- > Torvane and Pocket Pen readings in tons per square foot (tsf).
- > Reported Pocket Pen values are average values representing each 6-inch section of the sample.
- > %M is moisture content for each interval.

Knik Arm Crossing
Knik Arm, Alaska

CLASSIFICATION OF SHELBY TUBE SAMPLES
(Boring B06-18 Sample S35)

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CLASSIFICATION OF SHELBY TUBE SAMPLES

Boring: B06-18
Sample: S46

Depth: 244 to 246 ft below ground surface
Sample Quality: Good

			Torvane			Pocket Pen				
Depth (ft)	Depth	Length	V	H	R		S	%M	Top	Description
244	244' to 244.5'	6"	0.4	0.7	0.4	1.8	3.0	11.3%		Gray CLAY, moist
244.5	244.5' to 245'	6"						23.7%		Gray CLAY, moist, with silt seams Unconfined Compression test run.
245	245' to 245.5'	6"	1.6	1.6		>4.5		16.3%		Gray CLAY, moist, with silt seams
245.5	245.5' to 246'	6"	1.7	1.8		>4.5		16.5%		Gray CLAY, moist, with silt seams
246									Bottom of Sample	

NOTES:

- > V, H, and R represent Vertical, Horizontal, and Remolded Torvane and Pocket Penetrometer readings respectively.
- > Clay sensitivity is shown in the column labeled "S".
- > Torvane and Pocket Pen readings in tons per square foot (tsf).
- > Reported Pocket Pen values are average values representing each 6-inch section of the sample.
- > %M is moisture content for each interval.

Knik Arm Crossing
Knik Arm, Alaska

CLASSIFICATION OF SHELBY TUBE SAMPLES
(Boring B06-18 Sample S46)

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical & Environmental Consultants

Fig. A-21
Sheet 25 of 29

CLASSIFICATION OF SHELBY TUBE SAMPLES

Boring: B06-19
Sample: S12

Depth: 60 to 61.5 ft below ground surface
Sample Quality: Good

Depth (ft)			Torvane			Pocket Pen				
	Depth	Length	V	H	R		S	%M	Top	Description
60	60' to 60.5'	6"	1.6	1.8		>4.5		22.0%	▨	Gray CLAY, moist
60.5	60.5' to 61'	6"						19.9%	▨	Gray, slightly gravelly CLAY, moist Unconfined Compression test run.
61	61' to 61.5'	6"	1.4	1.8		>4.5		19.5%	▨	Gray, slightly gravelly CLAY, moist
61.5									Bottom of Sample	

NOTES:

> V, H, and R represent Vertical, Horizontal, and Remolded Torvane and Pocket Penetrometer readings respectively.
> Clay sensitivity is shown in the column labeled "S".
> Torvane and Pocket Pen readings in tons per square foot (tsf).
> Reported Pocket Pen values are average values representing each 6-inch section of the sample.
> %M is moisture content for each interval.

Knik Arm Crossing
Knik Arm, Alaska

CLASSIFICATION OF SHELBY TUBE SAMPLES
(Boring B06-19 Sample S12)

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical & Environmental Consultants

Fig. A-21
Sheet 26 of 29

CLASSIFICATION OF SHELBY TUBE SAMPLES

Boring: B06-19
Sample: S17

Depth: 85 to 87.5 ft below ground surface
Sample Quality: Fair

Depth (ft)			Torvane			Pocket Pen				
	Depth	Length	V	H	R		S	%M	Top	Description
85	85' to 85.5'	6"				3.0		23.9%		Gray CLAY, moist
85.5	85.5' to 86'	6"								Gray CLAY, moist
86	86' to 86.5'	6"								Gray CLAY, moist
86.5	86.5' to 87'	6"								Gray CLAY, moist Unconfined Compression test run
87	86' to 87.5'	6"				2.0		22.2%		Gray CLAY, moist
87.5									Bottom of Sample	

NOTES:

> V, H, and R represent Vertical, Horizontal, and Remolded Torvane and Pocket Penetrometer readings respectively.
> Clay sensitivity is shown in the column labeled "S".
> Torvane and Pocket Pen readings in tons per square foot (tsf).
> Reported Pocket Pen values are average values representing each 6-inch section of the sample.
> %M is moisture content for each interval.

Knik Arm Crossing
Knik Arm, Alaska

CLASSIFICATION OF SHELBY TUBE SAMPLES
(Boring B06-19 Sample S17)

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical & Environmental Consultants

Fig. A-21
Sheet 27 of 29

CLASSIFICATION OF SHELBY TUBE SAMPLES

Boring: B06-19
Sample: S55

Depth:127 to 128 ft below ground surface
Sample Quality: Good

Depth (ft)			Torvane			Pocket Pen				
	Depth	Length	V	H	R		S	%M	Top	Description
127	127' to 127.5'	6"						20.5%	▨	Gray CLAY, moist Unconfined Compression test run.
127.5	127.5' to 128'	6"	1.3	1.0		3.2		14.4%	▨	Gray CLAY, moist
128									Bottom of Sample	

NOTES:

> V, H, and R represent Vertical, Horizontal, and Remolded Torvane and Pocket Penetrometer readings respectively.
> Clay sensitivity is shown in the column labeled "S".
> Torvane and Pocket Pen readings in tons per square foot (tsf).
> Reported Pocket Pen values are average values representing each 6-inch section of the sample.
> %M is moisture content for each interval.

Knik Arm Crossing
Knik Arm, Alaska

CLASSIFICATION OF SHELBY TUBE SAMPLES
(Boring B06-19 Sample S55)

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical & Environmental Consultants

Fig. A-21
Sheet 28 of 29

CLASSIFICATION OF SHELBY TUBE SAMPLES

Boring: B06-19
Sample: S63

Depth:167 to 168 ft below ground surface
Sample Quality: Good

Depth (ft)			Torvane			Pocket Pen				
	Depth	Length	V	H	R		S	%M	Top	Description
167	167' to 167.5'	6"	1.5	1.4		>4.5		15.7%	▨	Gray CLAY, moist
167.5	167.5' to 168'	6"						18.4%	▨	Gray CLAY, moist Unconfined Compression test run.
168									Bottom of Sample	

NOTES:

- > V, H, and R represent Vertical, Horizontal, and Remolded Torvane and Pocket Penetrometer readings respectively.
- > Clay sensitivity is shown in the column labeled "S".
- > Torvane and Pocket Pen readings in tons per square foot (tsf).
- > Reported Pocket Pen values are average values representing each 6-inch section of the sample.
- > %M is moisture content for each interval.

Knik Arm Crossing
Knik Arm, Alaska

CLASSIFICATION OF SHELBY TUBE SAMPLES
(Boring B06-19 Sample S63)

March 2007 | 32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical & Environmental Consultants

Fig. A-21
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APPENDIX B

CONE PENETRATION TEST RESULTS

TABLE OF CONTENTS

Report prepared by Gregg In Situ, Inc.

LIST OF PLOTS

Cone Penetration Testing Procedure (CPT)

Gregg Drilling & Testing, Inc. carries out all Cone Penetration Tests (CPT) using an integrated electronic cone system, *Figure CPT*. The soundings were conducted using a 20 ton capacity cone with a tip area of 15 cm^2 and a friction sleeve area of 225 cm^2. The cone is designed with an equal end area friction sleeve and a tip end area ratio of 0.85.

The cone takes measurements of cone bearing (q_c), sleeve friction (f_s) and penetration pore water pressure (u_2) at 5-cm intervals during penetration to provide a nearly continuous hydrogeologic log. CPT data reduction and interpretation is performed in real time facilitating on-site decision making. The above mentioned parameters are stored on disk for further analysis and reference. All CPT soundings are performed in accordance with revised (2002) ASTM standards (D 5778-95).

The cone also contains a porous filter element located directly behind the cone tip (u_2), *Figure CPT*. It consists of porous plastic and is 5.0mm thick. The filter element is used to obtain penetration pore pressure as the cone is advanced as well as Pore Pressure Dissipation Tests (PPDT's) during appropriate pauses in penetration. It should be noted that prior to penetration, the element is fully saturated with silicon oil under vacuum pressure to ensure accurate and fast dissipation.

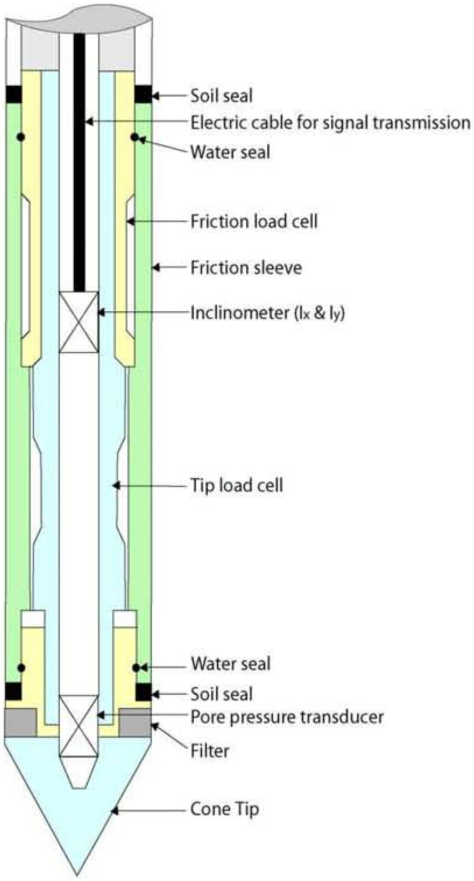


Figure CPT

When the soundings are complete, the test holes are grouted using a Gregg In Situ support rig. The grouting procedures generally consist of pushing a hollow CPT rod with a "knock out" plug to the termination depth of the test hole. Grout is then pumped under pressure as the tremie pipe is pulled from the hole. Disruption or further contamination to the site is therefore minimized.

GREGG IN SITU
Digital File Formats

CPT Data Files

Unless otherwise requested by the client, Gregg CPT data files are named such that the first 3 characters contain Gregg In-Situ, Inc. job number, the next character is typically C for CPT (S if shear waves were collected, R if Resistivity was used, U for UVIF or M for ‘Mini-Cone’) followed by two or three characters indicating the sounding number. The last character position is reserved for the letters a, b, c, d etc to uniquely identify multiple soundings at the same location. The CPT sounding file has the extension COR and pore pressure dissipation files have the extension PPD. As an example, for job number 05-127 (Job Number 127 in the year 2005) the first sounding will have file names 127C01.COR and 127C01.PPC.

The CPT (COR) file consists of the following components:
1. Two lines of header information
2. Data records
3. End of data marker
4. Units information

Header Lines
Line 1: Columns 1-6 are blank (future use)
Columns 7-21 contain the sounding Date and Time
Columns 22-36 contain the sounding Operator
Line 2: Columns 1-16 contain the sounding ID
Columns 17-31 Field representative
Columns 32-47 contain the project name

Data Records
The data records contain 4 or more columns of data in floating point format. A comma (and spaces) separates each data item:
Column 1: Sounding Depth (m)
Column 2: Tip (q_c) data uncorrected for pore pressure effects. Recorded in units selected by the CPT operator.
Column 3: Sleeve (f_s) data. Recorded in units selected by the operator
Column 4: Dynamic pore pressure readings (u_2). Recorded in units selected by the operator
Column 5: Exists only if specialty modules (Resistivity and/or UVIF) have been used

End of Data Marker
After the last line of data a line containing ASCII 26 (CTL-Z) and a new line (carriage return/ line feed) character. This is used to mark the end of data.

Units Information
The last section of the file contains information about the units that were selected for the sounding. A separator bar makes up the first line. The second line contains the type of units used for depth, q_c, f_s and u_2. The third line contains the conversion values required for Gregg’s software to convert the recorded data to an internal set of base units (bar for q_c, bar for f_s and meters for u_2).

January 4, 2005

CPT Dissipation Files

CPT Dissipation files have the same naming convention as the CPT sounding files and have the extension PPC. PPC files consist of the following components:

1. Two lines of header information
2. Data records

Header Lines (same as COR file):
Line 1: Columns 1-6 are blank (future use)
Columns 7-21 contain the sounding Date and Time
Columns 22-36 contain the sounding Operator
Line 2: Columns 1-16 Sounding or Location ID
Columns 17-31 Field Representative
Columns 32-47 Project Name

Data Records
The data records immediately follow the header lines. Each data record can occupy several lines in the file and is a complete record of a dissipation test at a particular depth. Each data record starts with a line containing two values separated by spaces; the first value being an index number and the second being the dissipation test depth in meters. Following this line are the dissipation pore pressure values stored at 5 second intervals with a maximum of 12 entries per line. The last line of the dissipation record may not contain a full 12 entries. The data record is terminated with an ASCII 30 character (appears as a triangle in some editors). This sequence is repeated for every dissipation test in the sounding. No marker is used to indicate end of file. Unit information is not stored in this file. Users would have to check the CPT file for the units that were used.

Cone Penetration Test Data & Interpretation

Soil behavior type and stratigraphic interpretation is based on relationships between cone bearing (q_c), sleeve friction (f_s), and pore water pressure (u_2). The friction ratio (R_f) is a calculated parameter defined by $100f_s/q_c$ and is used to infer soil behavior type. Generally:

Cohesive soils (clays)

- High friction ratio (R_f) due to small cone bearing (q_c)
- Generate large excess pore water pressures (u_2)

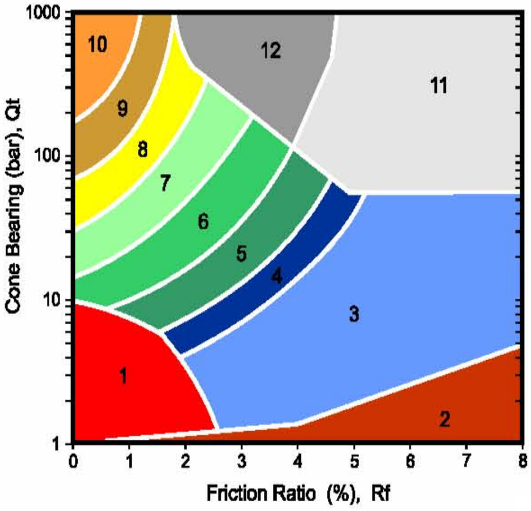
Cohesionless soils (sands)

- Low friction ratio (R_f) due to large cone bearing (q_c)
- Generate very little excess pore water pressures (u_2)

A complete set of baseline readings are taken prior to and at the completion of each sounding to determine temperature shifts and any zero load offsets. Corrections for temperature shifts and zero load offsets can be extremely important, especially when the recorded loads are relatively small. In sandy soils, however, these corrections are generally negligible.

The cone penetration test data collected from your site is presented in graphical form in Appendix CPT. The data includes CPT logs of measured soil parameters, computer calculations of interpreted soil behavior types (SBT), and additional geotechnical parameters. A summary of locations and depths is available in Table 1. Note that all penetration depths referenced in the data are with respect to the existing ground surface.

Soil interpretation for this project was conducted using recent correlations developed by Robertson et al, 1990, *Figure SBT*. Note that it is not always possible to clearly identify a soil type based solely on q_c, f_s, and u_2. In these situations, experience, judgment, and an assessment of the pore pressure dissipation data should be used to infer the soil behavior type.



ZONE	Qt/N	SBT
1	2	🟥 Sensitive, fine grained
2	1	🟫 Organic materials
3	1	🟦 Clay
4	1.5	🟦 Silty clay to clay
5	2	🟩 Clayey silt to silty clay
6	2.5	🟩 Sandy silt to clayey silt
7	3	🟩 Silty sand to sandy silt
8	4	🟨 Sand to silty sand
9	5	🟫 Sand
10	6	🟧 Gravely sand to sand
11	1	⬜ Very stiff fine grained*
12	2	⬛ Sand to clayey sand*

*over consolidated or cemented

Figure SBT

Gregg In Situ
Environmental and Geotechnical Site Investigation Contractors

Gregg In Situ Interpretations as of June 30, 2004 (Release 1.22A)

Gregg In Situ's interpretation routine provides a tabular output of geotechnical parameters based on current published CPT correlations and is subject to change to reflect the current state of practice. The interpreted values are not considered valid for all soil types. The interpretations are presented only as a guide for geotechnical use and should be carefully scrutinized for consideration in any geotechnical design. Reference to current literature is strongly recommended. Gregg In Situ does not warranty the correctness or the applicability of any of the geotechnical parameters interpreted by the program and does not assume liability for any use of the results in any design or review. Representative hand calculations should be made for any parameter that is critical for design purposes. The end user of the interpreted output should also be fully aware of the techniques and the limitations of any method used in this program. The purpose of this document is to inform the user as to which methods were used and what the appropriate papers and/or publications are for further reference.

The CPT interpretations are based on values of tip, sleeve friction and pore pressure averaged over a user specified interval (e.g. 0.20m). Note that q_t is the tip resistance corrected for pore pressure effects and q_c is the recorded tip resistance. Since all Gregg In Situ cones have equal end area friction sleeves, pore pressure corrections to sleeve friction, f_S, are not required.

The tip correction is: $q_t = q_c + (1-a) \bullet u_2$

where: q_t is the corrected tip resistance
q_c is the recorded tip resistance
u_2 is the recorded dynamic pore pressure behind the tip (u_2 position)
a is the Net Area Ratio for the cone (typically 0.85 for Gregg In Situ cones)

The total stress calculations are based on soil unit weights that have been assigned to the Soil Behavior Type zones, from a user defined unit weight profile or by using a single value throughout the profile. Effective vertical overburden stresses are calculated based on a hydrostatic distribution of equilibrium pore pressures below the water table or from a user defined equilibrium pore pressure profile (this can be obtained from CPT dissipation tests). For over water projects the effects of the column of water have been taken into account as has the appropriate unit weight of water. How this is done depends on where the instruments were zeroed (i.e. on deck or at mud line).

Details regarding the interpretation methods for all of the interpreted parameters are provided in Table 1. The appropriate references cited in Table 1 are listed in Table 2. Where methods are based on charts or techniques that are too complex to describe in this summary the user should refer to the cited material.

The estimated Soil Behavior Types (normalized and non-normalized) are based on the charts developed by Robertson and Campanella shown in Figures 1 and 2. The Bq classification charts are not reproduced in this document but can be reviewed in Lunne, Robertson and Powell (1997) or Robertson (1990).

Where the results of a calculation/interpretation are declared *'invalid'* the value will be represented by the text strings "-9999" or "-9999.0". In some cases the value 0 will be used. Invalid results will occur because of (and not limited to) one or a combination of:

1. Invalid or undefined CPT data (e.g. drilled out section or data gap).
2. Where the interpretation method is inappropriate, for example, drained parameters in an undrained material (and vice versa). The user must evaluate the site specific soil conditions and characteristics to properly apply the appropriate interpretation method.

3. Where interpretation input values are beyond the range of the referenced charts or specified limitations of the interpretation method.

4. Where pre-requisite or intermediate interpretation calculations are invalid.

The parameters selected for output from the program are often specific to a particular project. As such, not all of the interpreted parameters listed in Table 1 may be included in the output files delivered with this report.

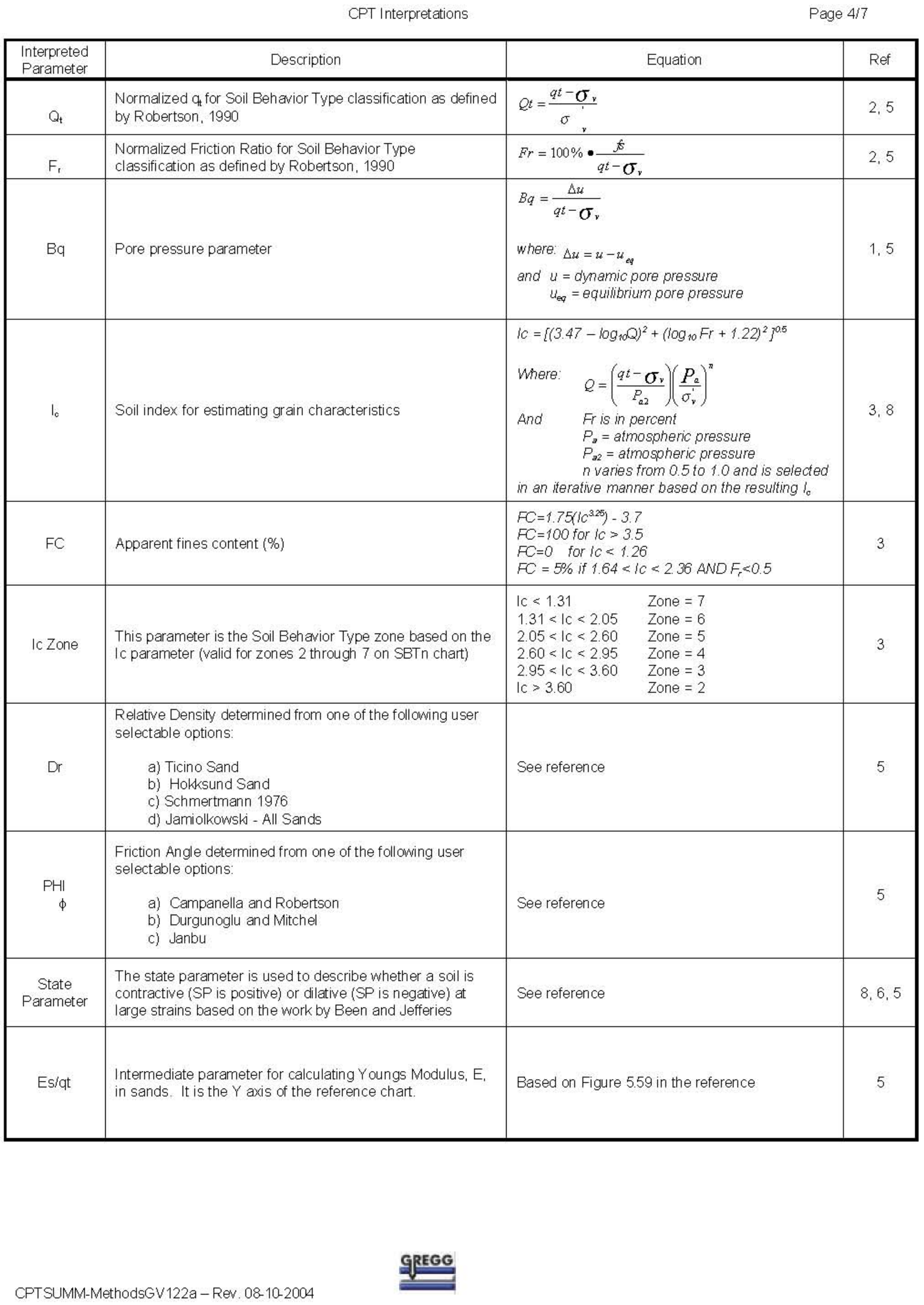
The output files are in one format:

File Type	Typical Extensions	Description
Spreadsheet	**XLS**	**IFI, NLI files exported directly to Excel format. Column and cell formatting has been done. Header information is exported to start in Column C allowing the depth columns A and/or B to be duplicated on each printed page without repetition of part of the header information.**

Table 1
CPT Interpretation Methods

Interpreted Parameter	Description	Equation	Ref
Depth	Mid Layer Depth *(where interpretations are done at each point then Mid Layer Depth = Recorded Depth)*	*Depth (Layer Top) + Depth (Layer Bottom) / 2.0*	
Elevation	Elevation of Mid Layer based on sounding collar elevation supplied by client	Elevation = Collar Elevation – Depth	
Avgqc	Averaged recorded tip value (q_c)	$Avgqc = \frac{1}{n}\sum_{i=1}^{n} q_c$ *n=1 when interpretations are done at each point*	
Avgqt	Averaged corrected tip (q_t) where: $q_t = q_c + (1 - a) \bullet u$	$Avgqt = \frac{1}{n}\sum_{i=1}^{n} q_t$ *n=1 when interpretations are done at each point*	
Avgfs	Averaged sleeve friction (f_s)	$Avgfs = \frac{1}{n}\sum_{i=1}^{n} fs$ *n=1 when interpretations are done at each point*	
AvgRf	Averaged friction ratio (Rf) where friction ratio is defined as: $Rf = 100\% \bullet \frac{fs}{qt}$	$AvgRf = 100\% \bullet \frac{Avgfs}{Avgqt}$ *n=1 when interpretations are done at each point*	
Avgu	Averaged dynamic pore pressure *(u)*	$Avgu = \frac{1}{n}\sum_{i=1}^{n} u_i$ *n=1 when interpretations are done at each point*	
AvgRes	Averaged Resistivity (this data is not always available since it is a specialized test requiring an additional module)	$Avgu = \frac{1}{n}\sum_{i=1}^{n} RESISTIVITY_i$ *n=1 when interpretations are done at each point*	
AvgUVIF	Averaged UVIF ultra-violet induced fluorescence (this data is not always available since it is a specialized test requiring an additional module)	$Avgu = \frac{1}{n}\sum_{i=1}^{n} UVIF_i$ *n=1 when interpretations are done at each point*	
AvgTemp	Averaged Temperature (this data is not always available since it is a specialized test)	$Avgu = \frac{1}{n}\sum_{i=1}^{n} TEMPERATURE_i$ *n=1 when interpretations are done at each point*	

Interpreted Parameter	Description	Equation	Ref
AvgGamma	Averaged Gamma Counts (this data is not always available since it is a specialized test requiring an additional module)	$Avgu = \frac{1}{n}\sum_{i=1}^{n} GAMMA$ *n=1 when interpretations are done at each point*	
SBT	Soil Behavior Type as defined by Robertson and Campanella	See Figure 1	2, 5
SBTn	Normalized Soil Behavior Type as defined by Robertson and Campanella	See Figure 2	2, 5
SBT-BQ	Non-normalized soil behavior type based on the Bq parameter	See Figure 5.7 (reference 5)	2, 5
SBT-BQn	Normalized Soil Behavior base on the Bq parameter	See Figure 5.8 (reference 5) or Figure 3 (reference 2)	2, 5
k	Coefficient of permeability (assigned to each SBT zone)		5
U.Wt.	Unit Weight of soil determined from one of the following user selectable options: 1) uniform value 2) value assigned to each SBT zone 3) user supplied unit weight profile	See references	5
T. Stress σ_v	Total vertical overburden stress at Mid Layer Depth. *A layer is defined as the averaging interval specified by the user. For data interpreted at each point the Mid Layer Depth is the same as the recorded depth.*	$TStress = \sum_{i=1}^{n} \gamma_i h_i$ *where* γ_i is layer unit weight h_i is layer thickness	
Ueq	Equilibrium pore pressure determined from one of the following user selectable options: 1) hydrostatic from water table depth 2) user supplied profile	For hydrostatic option: $u_{eq} = \gamma_w \bullet (D - D_{wt})$ where u_{eq} is equilibrium pore pressure γ_w is unit weight of water D is the current depth D_{wt} is the depth to the water table	
E. Stress σ_v'	Effective vertical overburden stress at Mid Layer Depth	$Estress = Tstress - u_{eq}$	
Cn	SPT N_{60} overburden correction factor	$Cn=(\sigma_v')^{-0.5}$ where σ_v' *is in tsf* $0.5 < C_n < 2.0$	
N_{60}	SPT N value at 60% energy calculated from qt/N ratios assigned to each SBT zone. This method has abrupt N value changes at zone boundaries.	*See Figure 1*	4, 5
$(N_1)_{60}$	SPT N_{60} value corrected for overburden pressure	$(N_1)_{60} = Cn \bullet N_{60}$	4
$N_{60}I_c$	SPT N_{60} values based on the Ic parameter	$(qt/pa)/ N_{60} = 8.5 (1 – Ic/4.6)$	5
$(N_1)_{60}Ic$	SPT N_{60} value corrected for overburden pressure (using N_{60} I_c). User has 2 options.	1) $(N_1)_{60}Ic = Cn \bullet (N_{60}Ic)$ 2) $q_{c1n}/ (N_1)_{60}Ic = 8.5 (1 – Ic/4.6)$	4 5
$(N_1)_{60cs}Ic$	Clean sand equivalent SPT $(N_1)_{60}Ic$. User has 3 options.	1) $(N_1)_{60cs}Ic = a + ß((N_1)_{60}Ic)$ 2) $(N_1)_{60cs}Ic = K_{SPT} * ((N_1)_{60}Ic)$ 3) $q_{c1ncs})/ (N_1)_{60cs}Ic = 8.5 (1 – Ic/4.6)$ FC = 5%: a = 0, ß=1.0 FC = 35% a = 5.0, ß=1.2 5% < FC < 35% a = exp[1.76 – (190/FC^2)] ß = [0.99 + (FC$^{1.5}$/1000)]	10 10 5



Interpreted Parameter	Description	Equation	Ref
Q_t	Normalized q_t for Soil Behavior Type classification as defined by Robertson, 1990	$Qt = \frac{qt - \sigma_v}{\sigma'_v}$	2, 5
F_r	Normalized Friction Ratio for Soil Behavior Type classification as defined by Robertson, 1990	$Fr = 100\% \bullet \frac{fs}{qt - \sigma_v}$	2, 5
Bq	Pore pressure parameter	$Bq = \frac{\Delta u}{qt - \sigma_v}$ where: $\Delta u = u - u_{eq}$ and u = dynamic pore pressure u_{eq} = equilibrium pore pressure	1, 5
I_c	Soil index for estimating grain characteristics	$Ic = [(3.47 - \log_{10} Q)^2 + (\log_{10} Fr + 1.22)^2]^{0.5}$ Where: $Q = \left(\frac{qt - \sigma_v}{P_{a2}}\right)\left(\frac{P_a}{\sigma'_v}\right)^n$ And Fr is in percent P_a = atmospheric pressure P_{a2} = atmospheric pressure n varies from 0.5 to 1.0 and is selected in an iterative manner based on the resulting I_c	3, 8
FC	Apparent fines content (%)	$FC=1.75(Ic^{3.25}) - 3.7$ FC=100 for Ic > 3.5 FC=0 for Ic < 1.26 FC = 5% if 1.64 < Ic < 2.36 AND F_r<0.5	3
Ic Zone	This parameter is the Soil Behavior Type zone based on the Ic parameter (valid for zones 2 through 7 on SBTn chart)	Ic < 1.31 Zone = 7 1.31 < Ic < 2.05 Zone = 6 2.05 < Ic < 2.60 Zone = 5 2.60 < Ic < 2.95 Zone = 4 2.95 < Ic < 3.60 Zone = 3 Ic > 3.60 Zone = 2	3
Dr	Relative Density determined from one of the following user selectable options: a) Ticino Sand b) Hokksund Sand c) Schmertmann 1976 d) Jamiolkowski - All Sands	See reference	5
PHI ϕ	Friction Angle determined from one of the following user selectable options: a) Campanella and Robertson b) Durgunoglu and Mitchel c) Janbu	See reference	5
State Parameter	The state parameter is used to describe whether a soil is contractive (SP is positive) or dilative (SP is negative) at large strains based on the work by Been and Jefferies	See reference	8, 6, 5
Es/qt	Intermediate parameter for calculating Youngs Modulus, E, in sands. It is the Y axis of the reference chart.	Based on Figure 5.59 in the reference	5

Interpreted Parameter	Description	Equation	Ref
Youngs Modulus E	Youngs Modulus based on the work by Baldi. There are three types of sands considered in this technique. The user selects the appropriate type for the site from: a) OC Sands b) Aged NC Sands c) Recent NC Sands Each sand type has a family of curves that depend on mean normal stress. The program calculates mean normal stress and linearly interpolates between the two extremes provided in Baldi's chart.	Mean normal stress is evaluated from: $\sigma'_m = \frac{1}{3} \bullet \left(\sigma'_v + \sigma'_h + \sigma'_h\right)^3$ where σ_v'= vertical effective stress σ_h'= horizontal effective stress and σ_h = K_o * σ'_v with Ko assumed to be 0.5	5
Su	Undrained shear strength - N_{kt} is user selectable	$Su = \frac{qt - \sigma_v}{N_{kt}}$	1, 5
OCR	Over Consolidation Ratio	a) Based on Schmertmann's method involving a plot of S_u/σ_v' /(S_u/σ_v')$_{NC}$ and OCR where the Su/p' ratio for NC clay is user selectable	9

The following parameters are not presented but may be interpreted for use in liquefaction analysis. Further detailed interpretation may be completed by using the Liquefaction Spreadsheet following the committee recommendations of the NCEER. This Spreadsheet is available for purchase. A promotional document is presented in the Interpretations directory on the Data Disk with this report.

Interpreted Parameter	Description	Equation	Ref
q_{c1}	q_t normalized for overburden stress used for seismic analysis	$q_{c1} = q_t \bullet (Pa/\sigma_v')^{0.5}$ where: Pa = atm. Pressure q_t is in Mpa	3
q_{c1n}	q_{c1} in dimensionless form used for seismic analysis	$q_{c1n} = (q_{c1} / Pa)(Pa/\sigma_v')$ where: Pa = atm. Pressure and n ranges from 0.5 to 0.75 based on Ic.	3
K_{SPT}	Equivalent clean sand factor for $(N_1)60$	$K_{SPT} = 1 + ((0.75/30) * (FC - 5))$	10
K_{CPT}	Equivalent clean sand correction for q_{c1N}	$K_{cpt} = 1.0$ for $I_c \leq 1.64$ $K_{cpt} = f(I_c)$ for $I_c > 1.64$ (see reference)	10
q_{c1ncs}	Clean sand equivalent q_{c1n}	$q_{c1ncs} = q_{c1n} \bullet K_{cpt}$	3
CRR	Cyclic Resistance Ratio (for Magnitude 7.5)	$q_{c1ncs} < 50$: $CRR_{7.5} = 0.833 [(q_{c1ncs}/1000] + 0.05$ $50 \leq q_{c1ncs} < 160$: $CRR_{7.5} = 93 [(q_{c1ncs}/1000]^3 + 0.08$	10
CSR	Cyclic Stress Ratio	$CSR = (\tau_{av}/\sigma_v') = 0.65 (a_{max} / g) (\sigma_v/ \sigma_v') r_d$ $r_d = 1.0 - 0.00765 z$ $z \leq 9.15m$ $r_d = 1.174 - 0.0267 z$ $9.15 < z \leq 23m$ $r_d = 0.744 - 0.008 z$ $23 < z \leq 30m$ $r_d = 0.50$ $z > 30m$	10
MSF	Magnitude Scaling Factor	See Reference	10
FofS	Factor of Safety against Liquefaction	$FS = (CRR_{7.5} / CSR) MSF$	10
Liquefaction Status	Statement indicating possible liquefaction	Takes into account FofS and limitations based I_c and q_{c1ncs}.	10

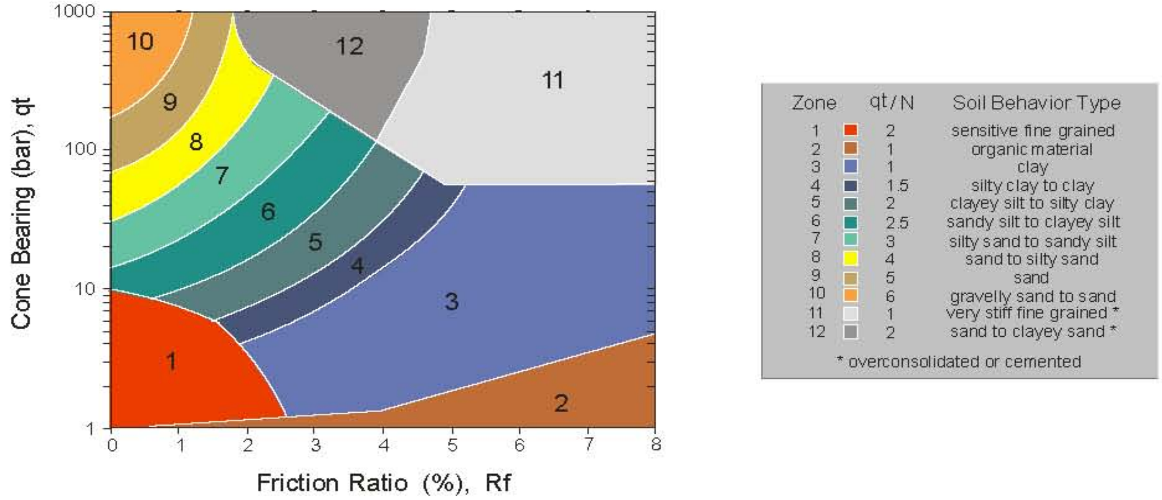


Figure 1 Non-Normalized Behavior Type Classification Chart

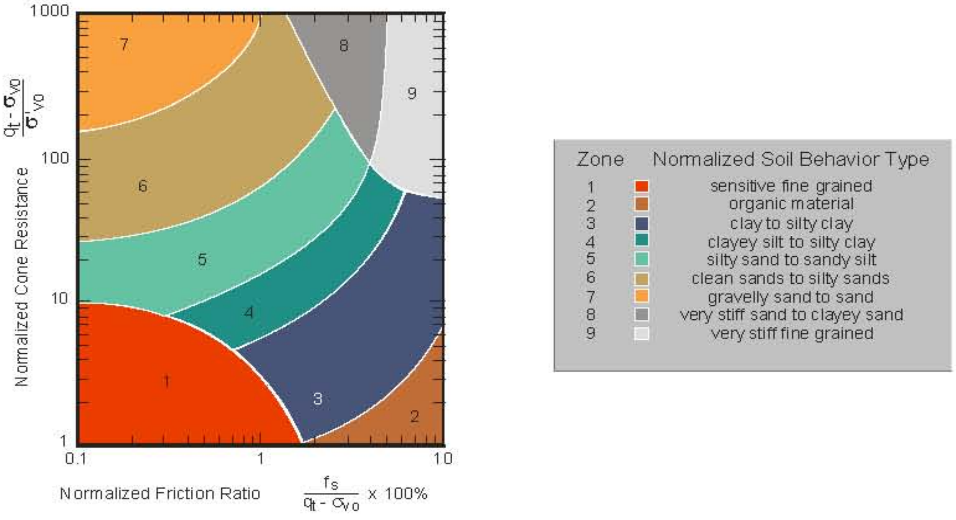


Figure 2 Normalized Behavior Type Classification Chart

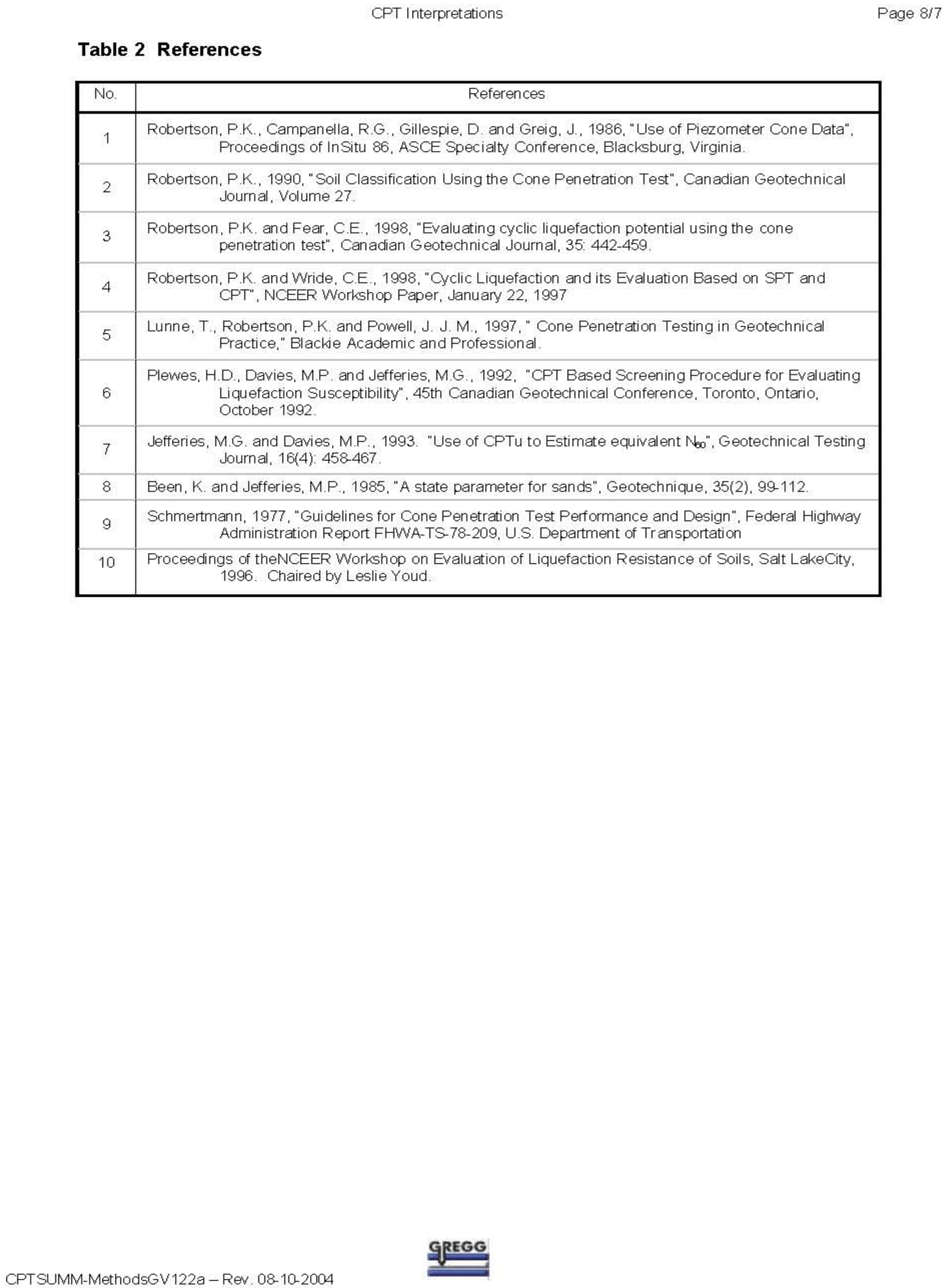


Table 2 References

No.	References
1	Robertson, P.K., Campanella, R.G., Gillespie, D. and Greig, J., 1986, "Use of Piezometer Cone Data", Proceedings of InSitu 86, ASCE Specialty Conference, Blacksburg, Virginia.
2	Robertson, P.K., 1990, "Soil Classification Using the Cone Penetration Test", Canadian Geotechnical Journal, Volume 27.
3	Robertson, P.K. and Fear, C.E., 1998, "Evaluating cyclic liquefaction potential using the cone penetration test", Canadian Geotechnical Journal, 35: 442-459.
4	Robertson, P.K. and Wride, C.E., 1998, "Cyclic Liquefaction and its Evaluation Based on SPT and CPT", NCEER Workshop Paper, January 22, 1997
5	Lunne, T., Robertson, P.K. and Powell, J. J. M., 1997, " Cone Penetration Testing in Geotechnical Practice," Blackie Academic and Professional.
6	Plewes, H.D., Davies, M.P. and Jefferies, M.G., 1992, "CPT Based Screening Procedure for Evaluating Liquefaction Susceptibility", 45th Canadian Geotechnical Conference, Toronto, Ontario, October 1992.
7	Jefferies, M.G. and Davies, M.P., 1993. "Use of CPTu to Estimate equivalent N_{60}", Geotechnical Testing Journal, 16(4): 458-467.
8	Been, K. and Jefferies, M.P., 1985, "A state parameter for sands", Geotechnique, 35(2), 99-112.
9	Schmertmann, 1977, "Guidelines for Cone Penetration Test Performance and Design", Federal Highway Administration Report FHWA-TS-78-209, U.S. Department of Transportation
10	Proceedings of theNCEER Workshop on Evaluation of Liquefaction Resistance of Soils, Salt LakeCity, 1996. Chaired by Leslie Youd.

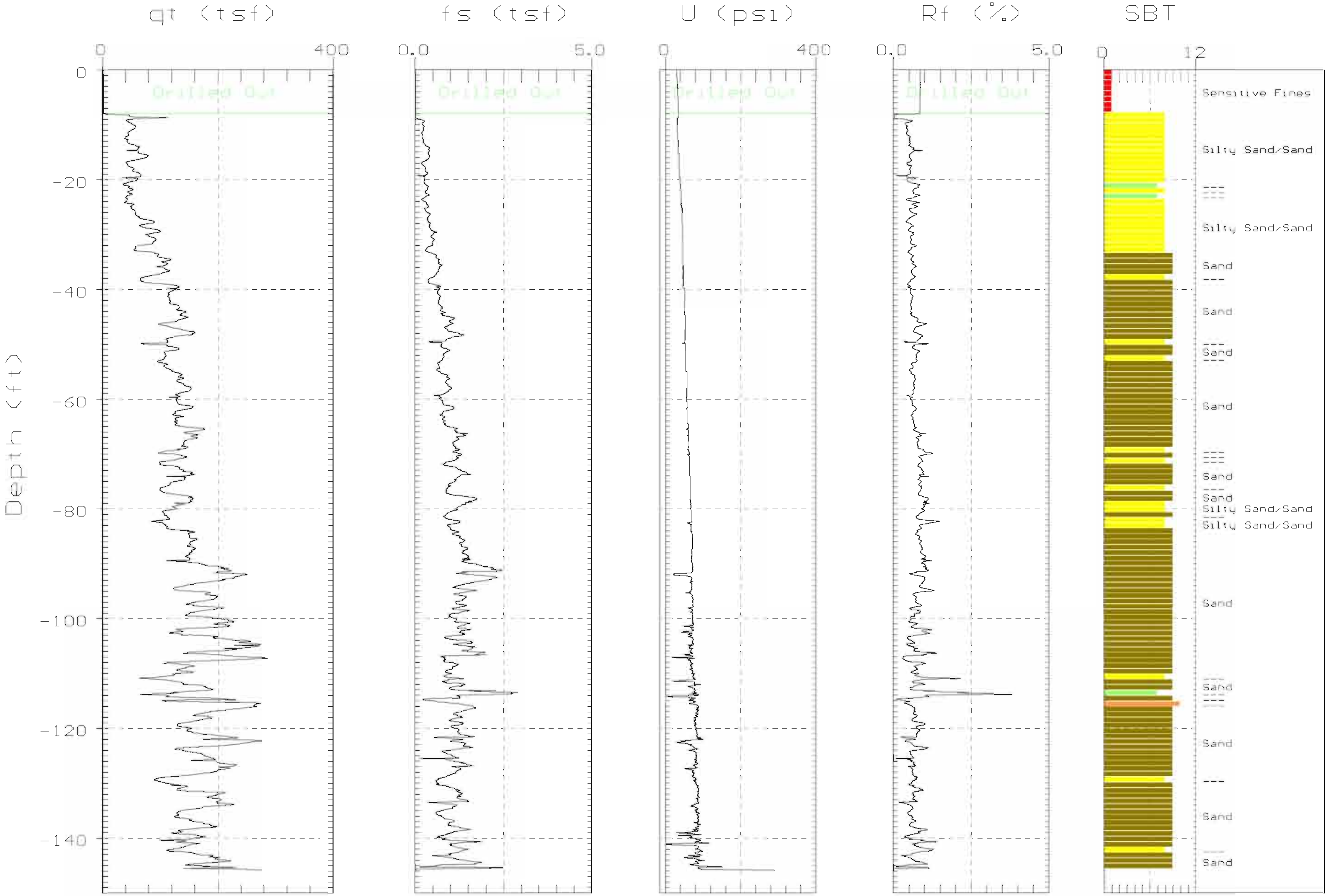
CPT Plots Based on
Non-Normalized Soil Behavior Type

GREGG

SHANNON WILSON

Site:KNIK ARM CROSSING
Location:CPT-11

Engineer:R.COLLINS
Date:09/16/06 14:05



Max. Depth: 145.83 (ft)
Depth Inc.: 0.082 (ft)

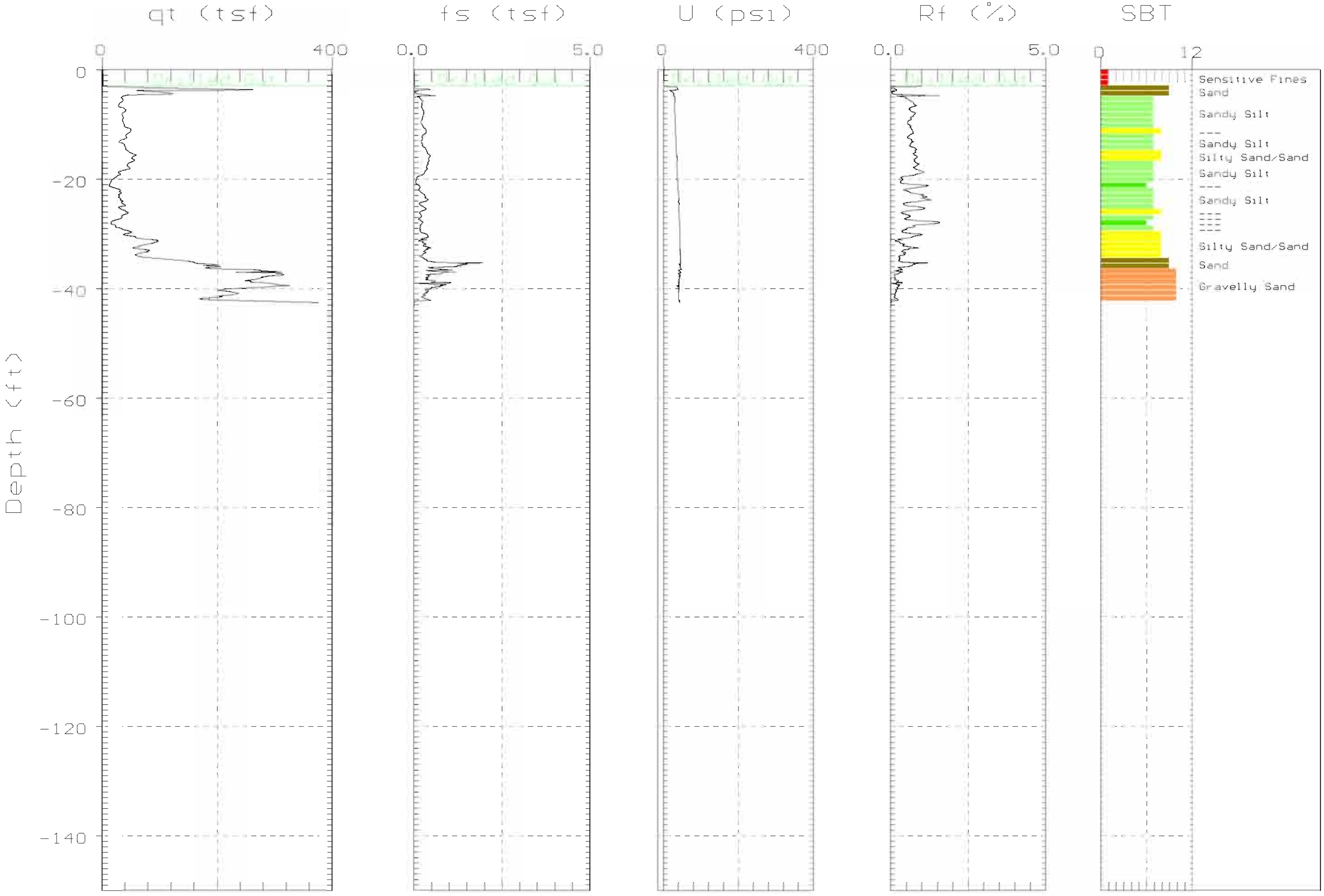
SBT: Soil Behavior Type (Robertson 1990)

GREGG

SHANNON WILSON

Site:KNIK ARM CROSSING
Location:CPT-13

Engineer:R.COLLINS
Date:09/29/06 13:30



Max. Depth: 42.57 (ft)
Depth Inc.: 0.082 (ft)

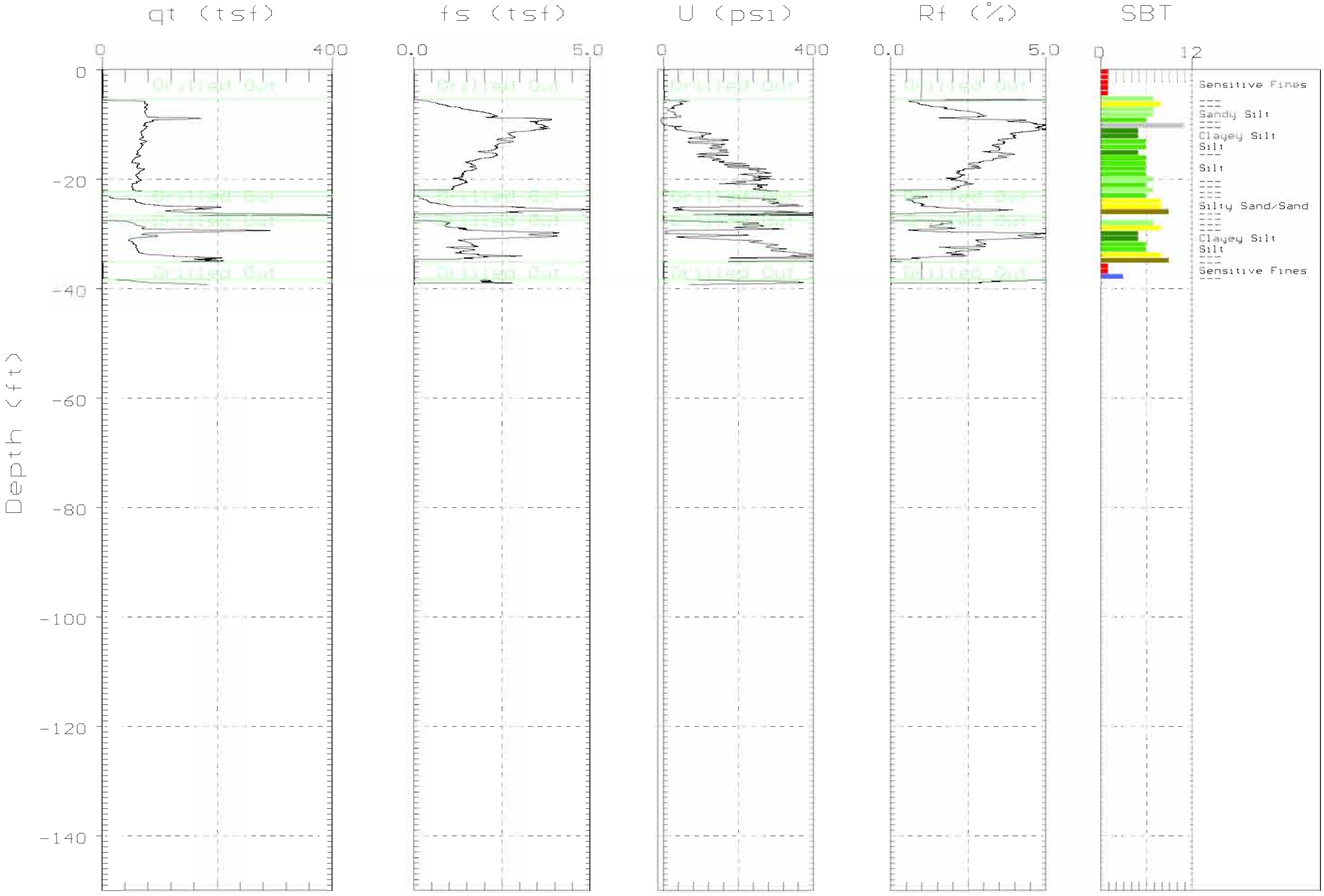
SBT: Soil Behavior Type (Robertson 1990)

GREGG

SHANNON WILSON

Site:KNIK ARM CROSSING
Location:CPT-15

Engineer:R.COLLINS
Date:09/28/06 12:35



Max. Depth: 39.29 (ft)
Depth Inc.: 0.082 (ft)

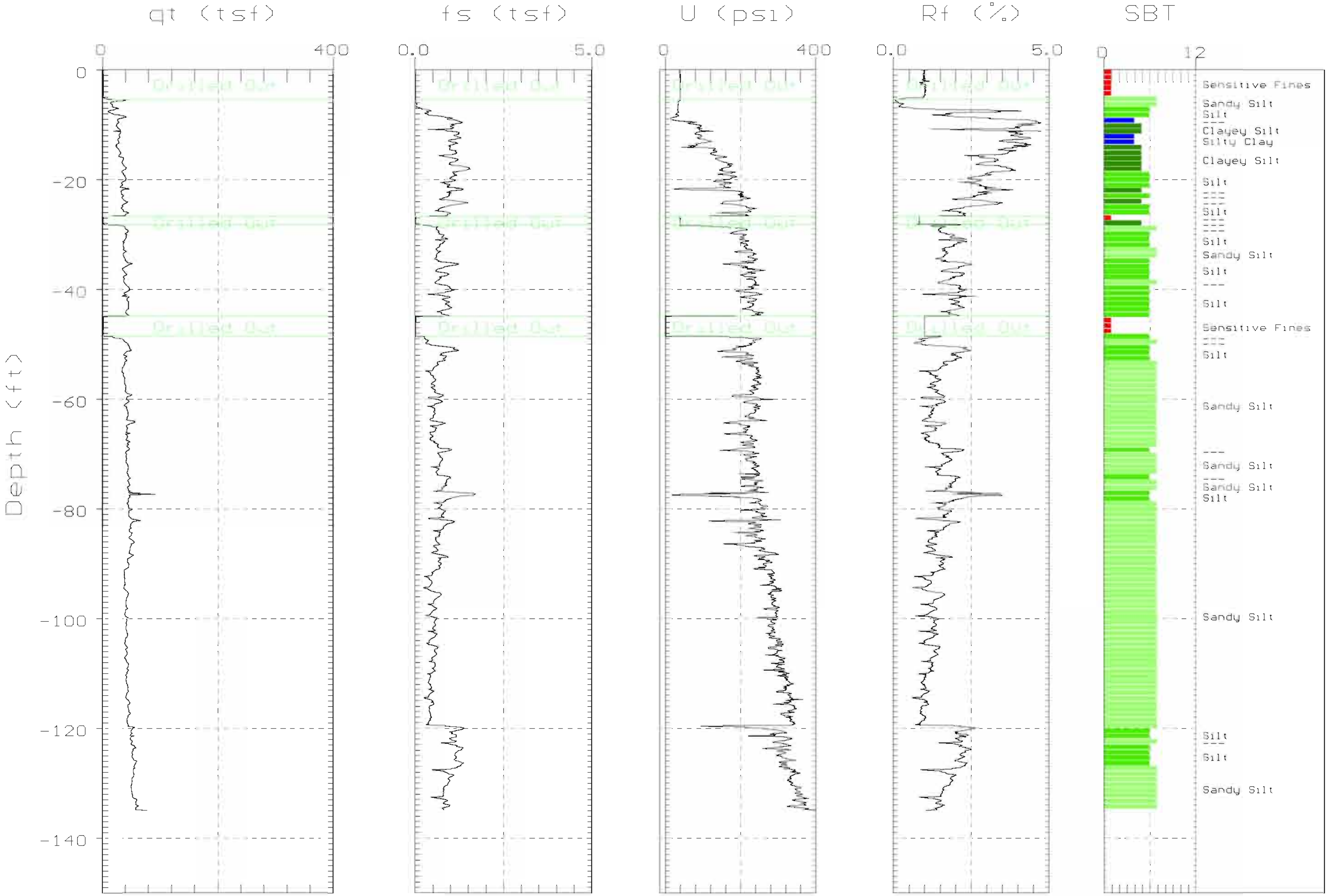
SBT: Soil Behavior Type (Robertson 1990)

GREGG

SHANNON WILSON

Site: KNIK ARM CROSSING
Location: CPT-17

Engineer: R.COLLINS
Date: 09/13/06 13:36



Max. Depth: 134.92 (ft)
Depth Inc.: 0.082 (ft)

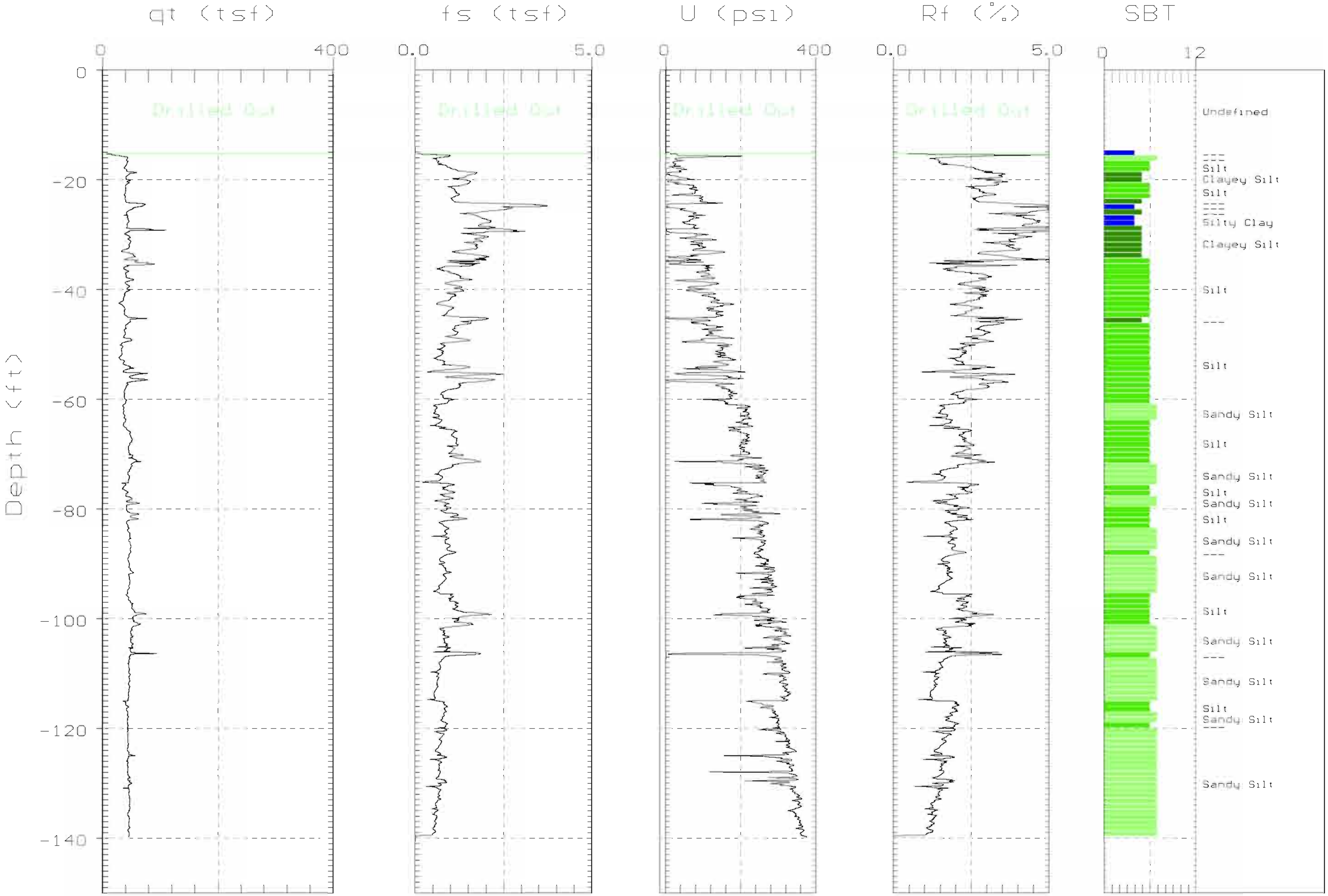
SBT: Soil Behavior Type (Robertson 1990)

GREGG

SHANNON WILSON

Site:KNIK ARM CROSSING
Location:CPT-18

Engineer:R.COLLINS
Date:09/18/06 20:21



Max. Depth: 139.84 (ft)
Depth Inc.: 0.082 (ft)

SBT: Soil Behavior Type (Robertson 1990)

CPT Plots Based on
Normalized Soil Behavior Type

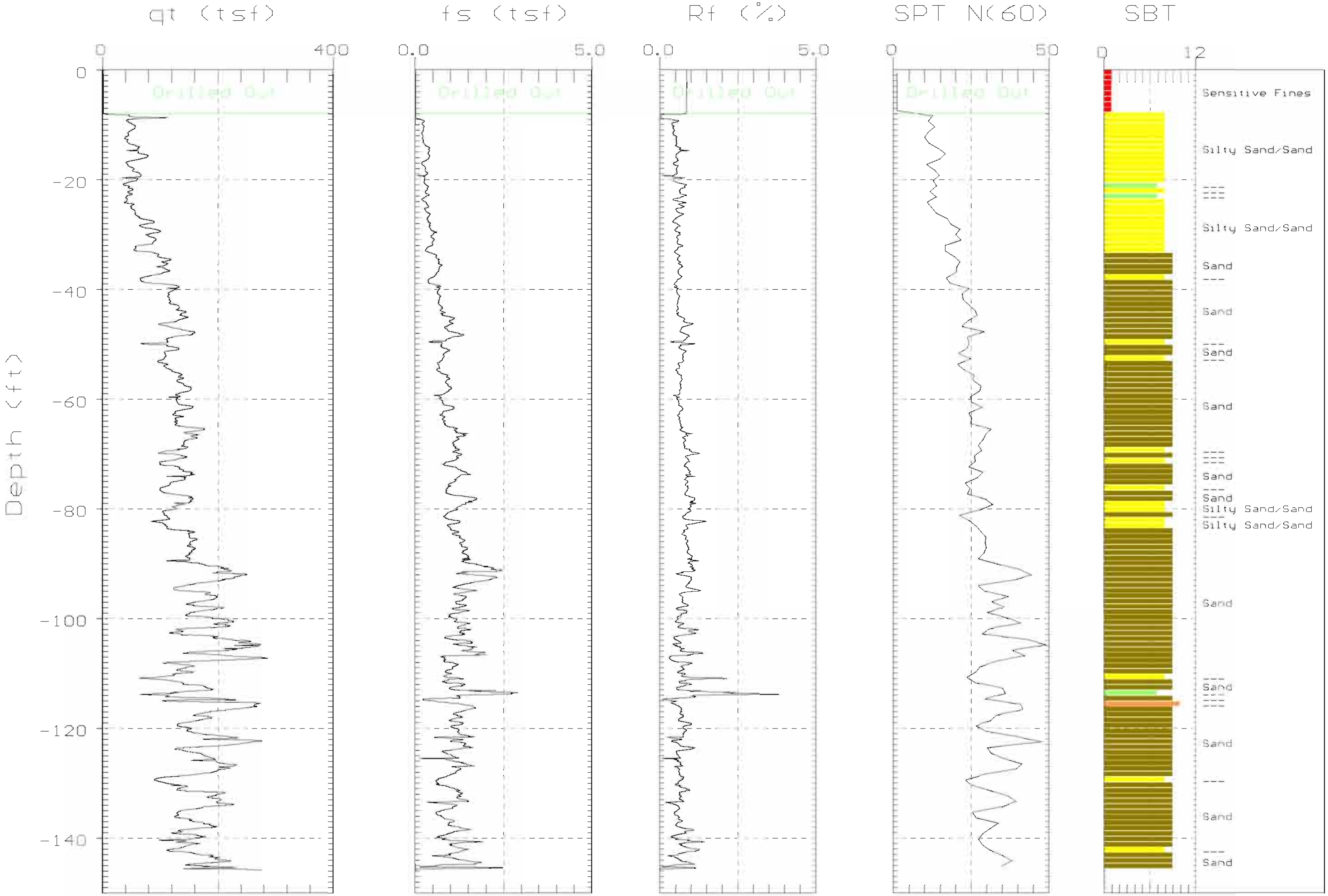
GREGG

GREGG

SHANNON WILSON

Site:KNIK ARM CROSSING
Location:CPT-11

Engineer:R.COLLINS
Date:09/16/06 14:05



Max. Depth: 145.83 (ft)
Depth Inc.: 0.082 (ft)

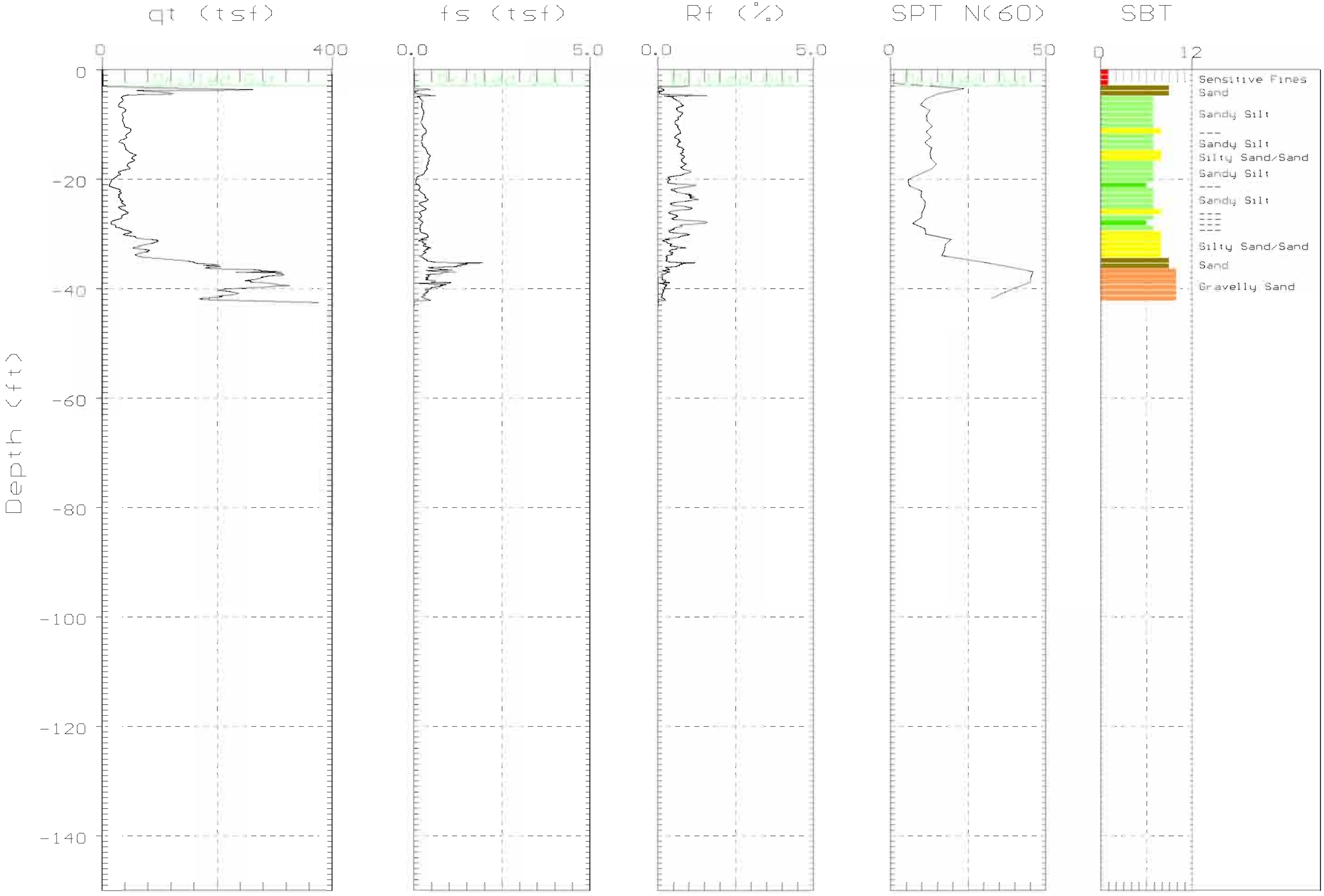
SBT: Soil Behavior Type (Robertson 1990)

GREGG

SHANNON WILSON

Site:KNIK ARM CROSSING
Location:CPT-13

Engineer:R.COLLINS
Date:09/29/06 13:30



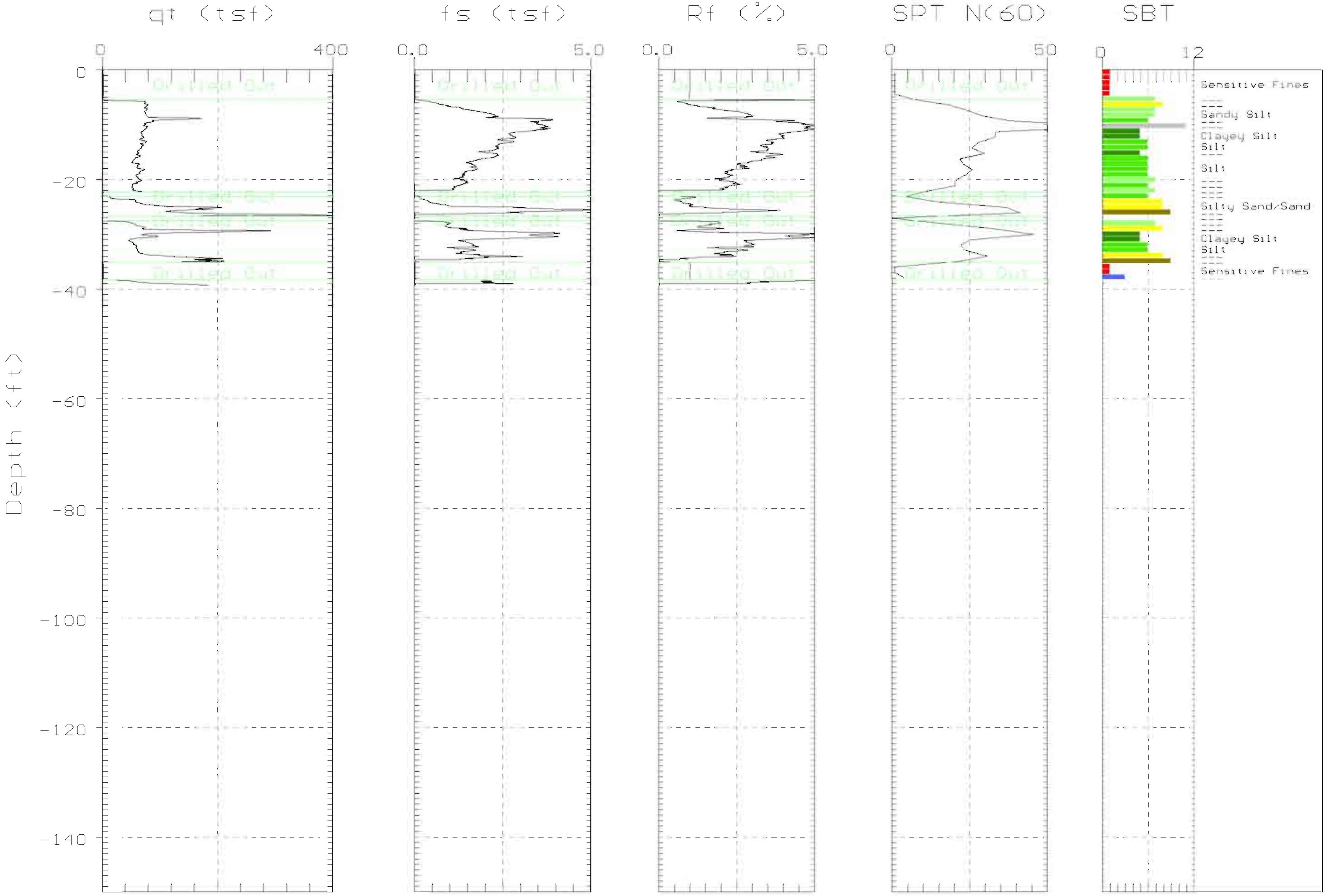
Max. Depth: 42.57 (ft)
Depth Inc.: 0.082 (ft)

SBT: Soil Behavior Type (Robertson 1990)

SHANNON WILSON

Site:KNIK ARM CROSSING
Location:CPT-15

Engineer:R.COLLINS
Date:09/28/06 12:35



Max. Depth: 39.29 (ft)
Depth Inc.: 0.082 (ft)

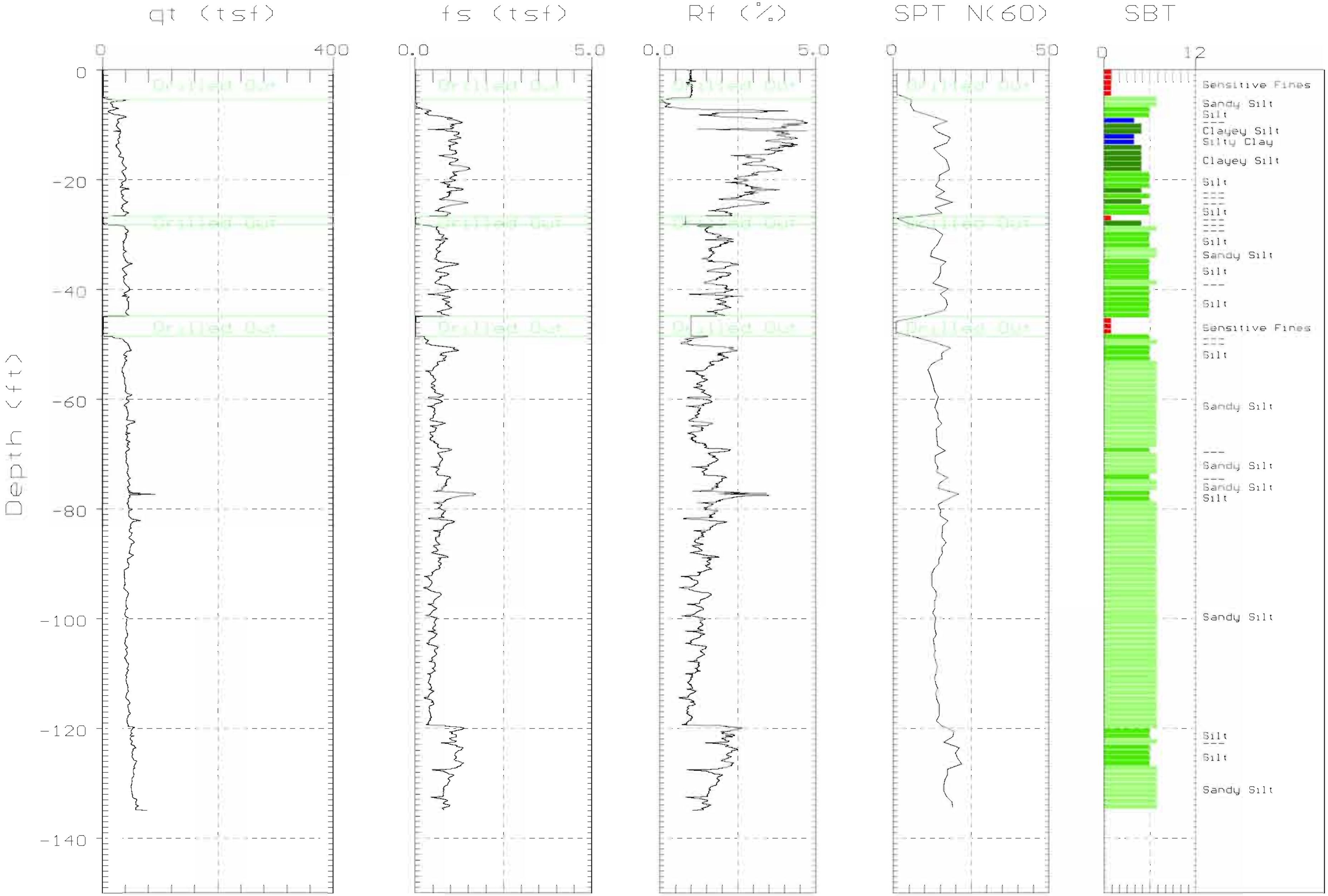
SBT: Soil Behavior Type (Robertson 1990)

GREGG

SHANNON WILSON

Site:KNIK ARM CROSSING
Location:CPT-17

Engineer:R.COLLINS
Date:09/13/06 13:36



Max. Depth: 134.92 (ft)
Depth Inc.: 0.082 (ft)

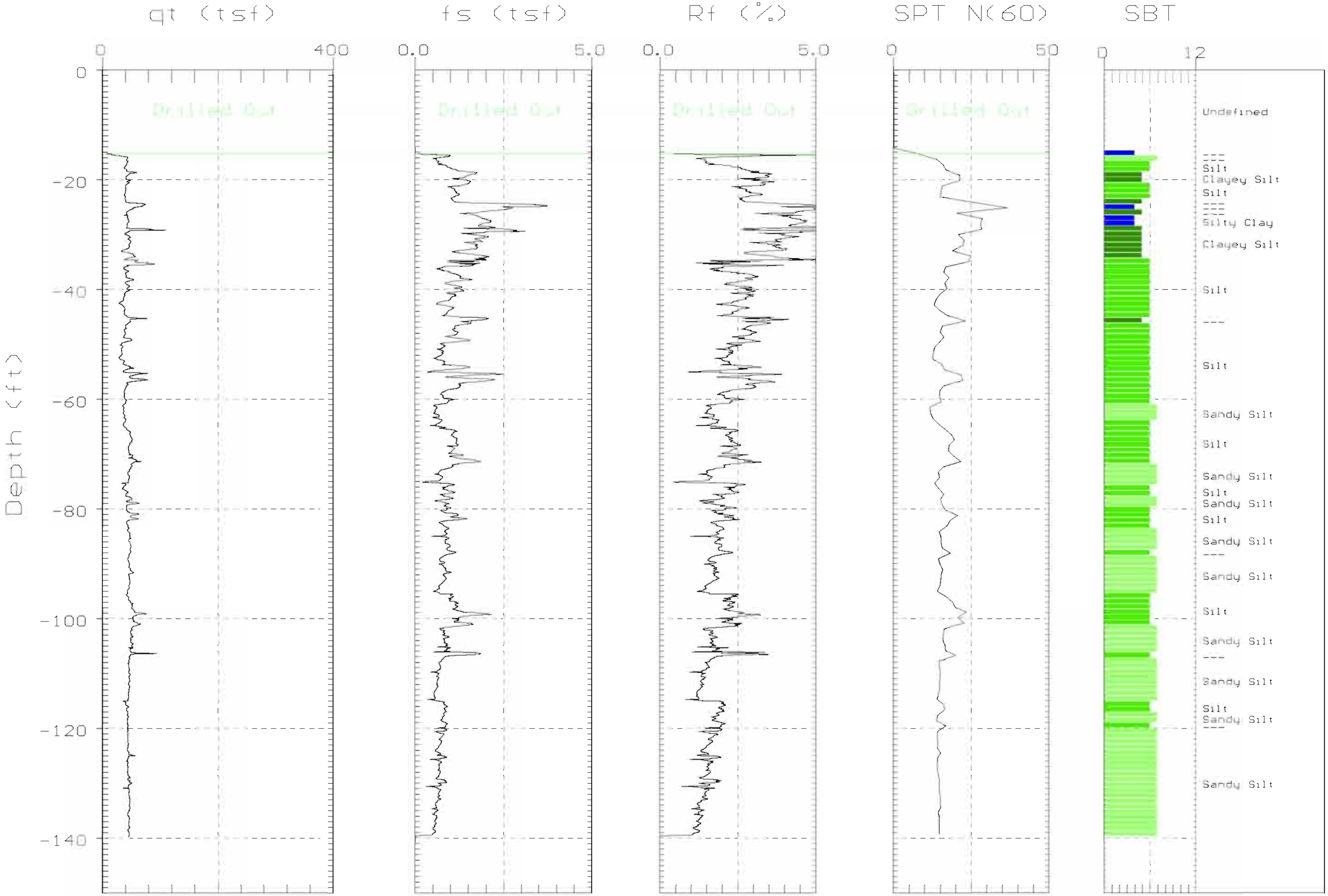
SBT: Soil Behavior Type (Robertson 1990)

GREGG

SHANNON WILSON

Site:KNIK ARM CROSSING
Location:CPT-18

Engineer:R.COLLINS
Date:09/18/06 20:21



Max. Depth: 139.84 (ft)
Depth Inc.: 0.082 (ft)

SBT: Soil Behavior Type (Robertson 1990)

Pore Pressure Dissipation Tests

GREGG

Pore Pressure Dissipation Tests (PPDT)

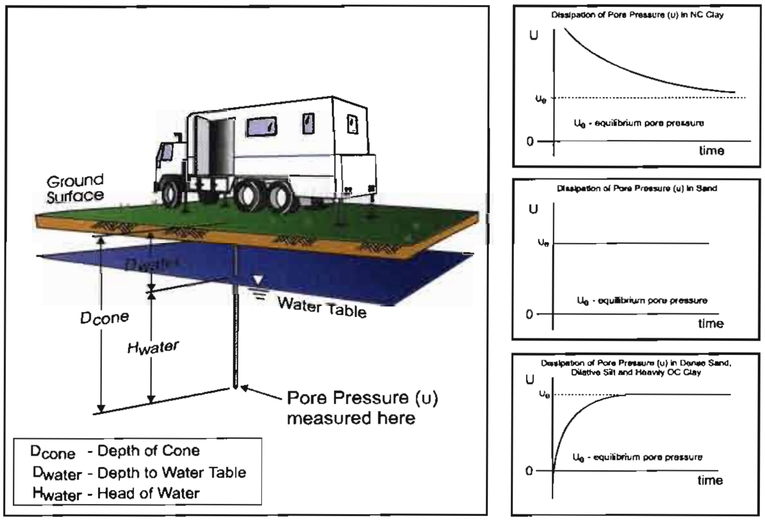
Pore Pressure Dissipation Tests (PPDT's) conducted at various intervals measured hydrostatic water pressures and determined the approximate depth of the ground water table. A PPDT is conducted when the cone is halted at specific intervals determined by the field representative. The variation of the penetration pore pressure (u) with time is measured behind the tip of the cone and recorded by a computer system.
Pore pressure dissipation data can be interpreted to provide estimates of:

- Equilibrium piezometric pressure
- Phreatic Surface
- In situ horizontal coefficient of consolidation (c_h)
- In situ horizontal coefficient of permeability (k_h)

In order to correctly interpret the equilibrium piezometric pressure and/or the phreatic surface, the pore pressure must be monitored until such time as there is no variation in pore pressure with time, *Figure PPDT*. This time is commonly referred to as t_{100}, the point at which 100% of the excess pore pressure has dissipated.

A complete reference on pore pressure dissipation tests is presented by Robertson et al. 1992.

A summary of the pore pressure dissipation tests is summarized in Table 1.



Water Table Calculation

$$D_{water} = D_{cone} - H_{water}$$

where $H_{water} = U_e$ (depth units)

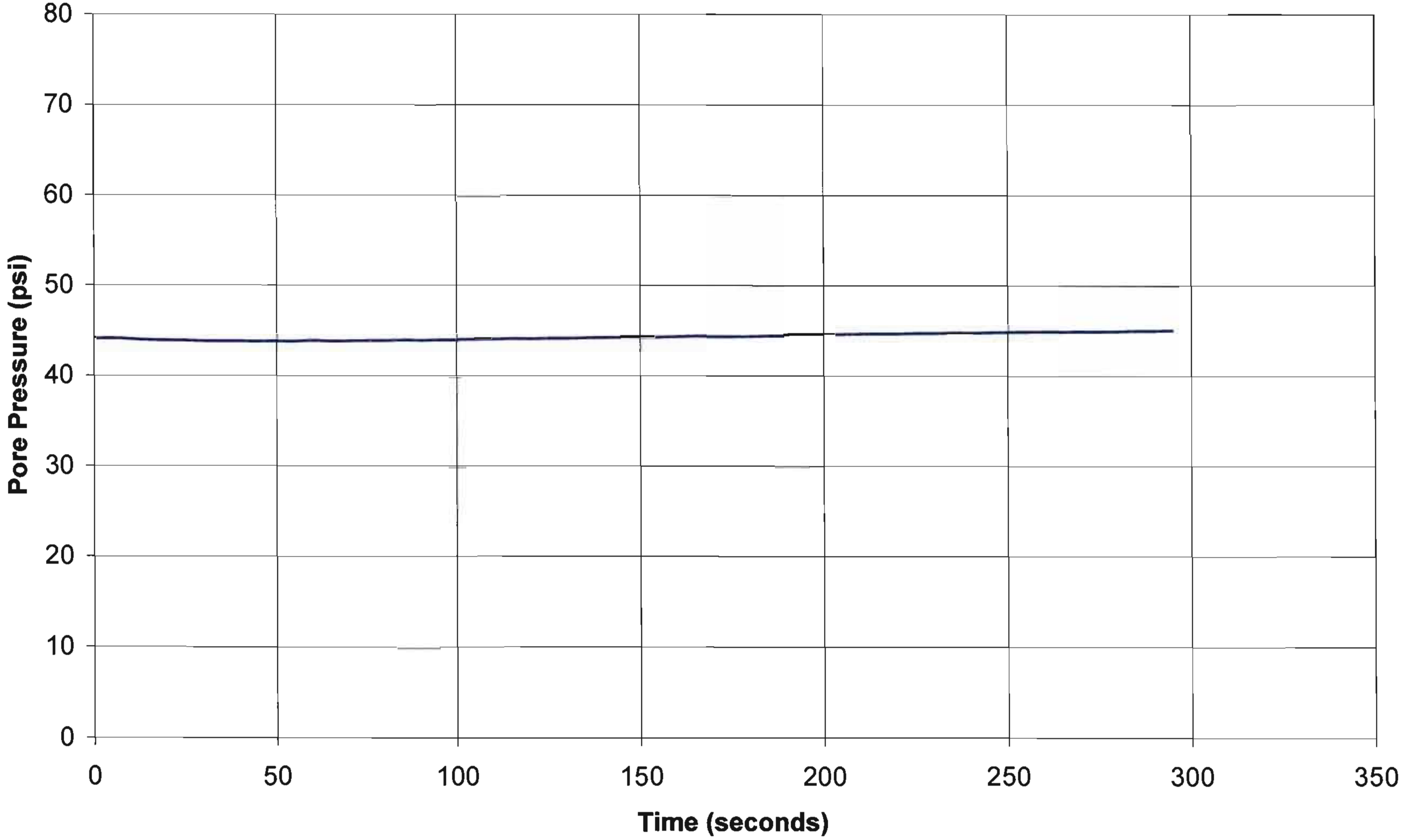
Useful Conversion Factors:
1psi = 0.704m = 2.31 feet (water)
1tsf = 0.958 bar = 13.9 psi
1m = 3.28 feet

Figure PPDT

GREGG DRILLING & TESTING

Pore Pressure Dissipation Test

Sounding: CPT-11
Depth: 27.887
Site: ALASKA
Engineer: R.COLLINS



APPENDIX C

SEISMIC CONE PENETRATION TESTING

TABLE OF CONTENTS

Report prepared by Gregg In Situ, Inc.

LIST OF FIGURES

LIST OF PLOTS

Seismic Cone Penetrometer Testing
(SCPTu)

Gregg In Situ, Inc. uses a modified CPT cone that contains a built in seismometer to measure compression and shear wave velocities in addition to the standard piezocone parameters (q_c, f_s, and u_2). Therefore, four independent readings are compiled with depth in a single sounding. The standard CPT parameters are recorded continuously while the seismic test is usually performed at 5-foot intervals.

When working over water, Gregg generates shear waves by lowering a seismic source into the water near the casing containing the cone. The seismic source can be triggered to release an air-gun therefore creating a compression and shear wave that travels through the water and into the soil where the cone can record the arrival. The air-gun acts as a trigger, initiating the recording of the seismic wave trace.

Geophones in the body of the piezocone recognize the arriving waves propagating through the soil. Any waves received by the geophones on the cone penetrometer are sent back to the operator on deck to be displayed on an oscilloscope. On site software then plots the wave amplitude versus time to calculate wave velocities.

At least two waves are recorded for each test depth so the operator can check consistency of the waveforms. Shear wave data is sampled at a frequency of 20 kHz (20,000 samples per second) and compression wave data is sampled at 50 kHz (50,000 samples per second). To maintain a desired signal resolution, the input sensitivity (gain) is increased with depth.

Offset distances of the seismic source from the cone and the location of the geophone are all taken into account in calculations.

The shear wave velocity (V_s) provides information about small-strain stiffness while the penetration data provides information about large-strain strength. From interval shear wave velocity (V_s) and the mass density (ρ) of a soil layer, the dynamic shear modulus (G_o) of the soil can be calculated in a specific depth interval. The dynamic shear modulus (G_0) is a key parameter for the analysis of soil behavior in response to dynamic loading from earthquakes, vibrating machine foundations, waves and wind.

A summary of the data collected including the depth and location identification is displayed in tabular format and graphical formats and can be found with the corresponding CPT plot.

For a detailed reference on seismic CPT, refer to Robertson et. al., 1986.

Seismic Cone Penetrometer Testing
(SCPTu)

Gregg Drilling & Testing, Inc. uses a modified CPT cone that contains a built in seismometer to measure compression and shear wave velocities in addition to the standard piezocone parameters (q_c, f_s, and u_2). Therefore, four independent readings are compiled with depth in a single sounding. The standard CPT parameters are recorded continuously while the seismic test is usually performed at 5-foot intervals.

Gregg generates shear waves by striking a seismic beam coupled to the ground surface by a hydraulic cylinder under the CPT rig, *Figure SCPTu*. Compression waves are generated by striking an auger in the ground. The sledgehammer that strikes the beam/auger acts as a trigger, initiating the recording of the seismic wave trace. Before measurements are taken, the rods are decoupled from the CPT rig to prevent energy transmission down the rods.

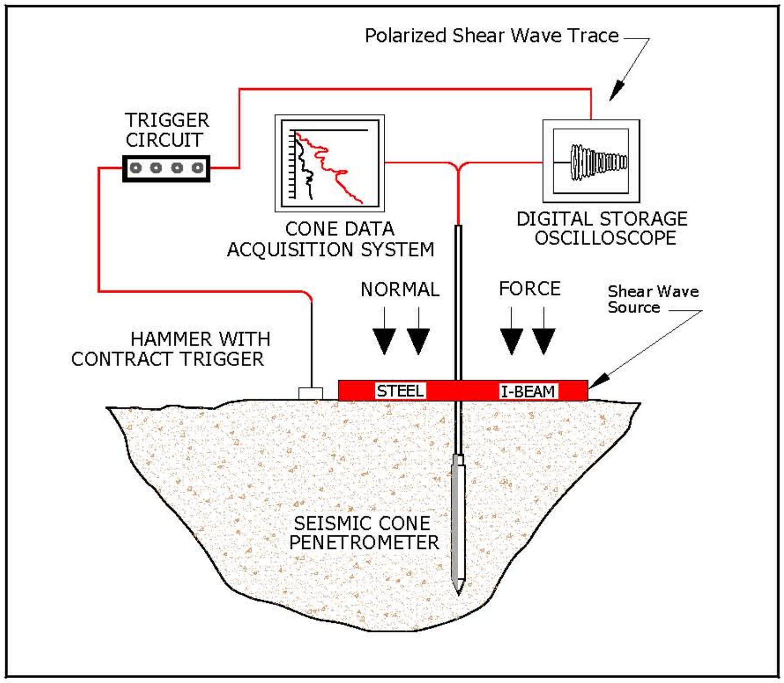


Figure SCPTu

Geophones in the body of the piezocone recognize the arriving waves generated at the ground surface, *Figure Seismic*. Any waves received by the geophones on the cone penetrometer are sent back up to the truck to be displayed on an oscilloscope. On site software then plots the wave amplitude versus time to calculate wave velocities.

At least two waves are recorded for each test depth so the operator can check consistency of the waveforms. Shear wave data is sampled at a frequency of 20 kHz (20,000 samples per second) and compression wave data is sampled at 50 kHz (50,000 samples per second). To maintain a desired signal resolution, the input sensitivity (gain) is increased with depth.

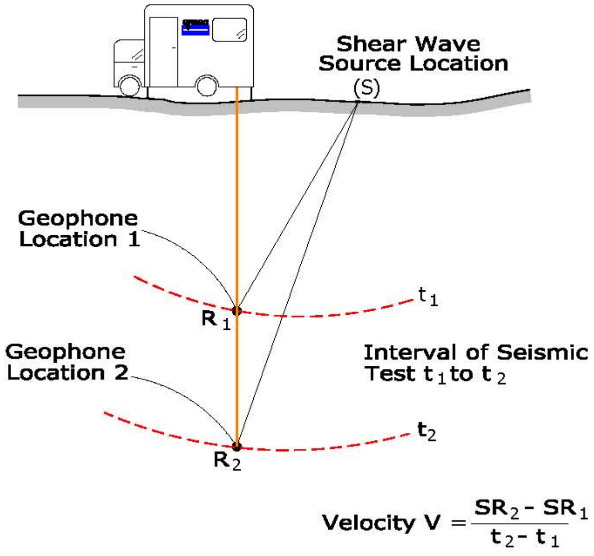


Figure Seismic

Offset distances of the beam from the cone and the location of the geophone are all taken into account in calculations.

The shear wave velocity (V_s) provides information about small-strain stiffness while the penetration data provides information about large-strain strength. From interval shear wave velocity (V_s) and the mass density (ρ) of a soil layer, the dynamic shear modulus (G_o) of the soil can be calculated in a specific depth interval. The dynamic shear modulus (G_0) is a key parameter for the analysis of soil behavior in response to dynamic loading from earthquakes, vibrating machine foundations, waves and wind.

A summary of the data collected including the depth and location identification is displayed in Table 1 and graphical formats and can be found with the corresponding CPT plot.

For a detailed reference on seismic CPT, refer to Robertson et. al., 1986.

GREGG

Shear Wave Velocity Calculations

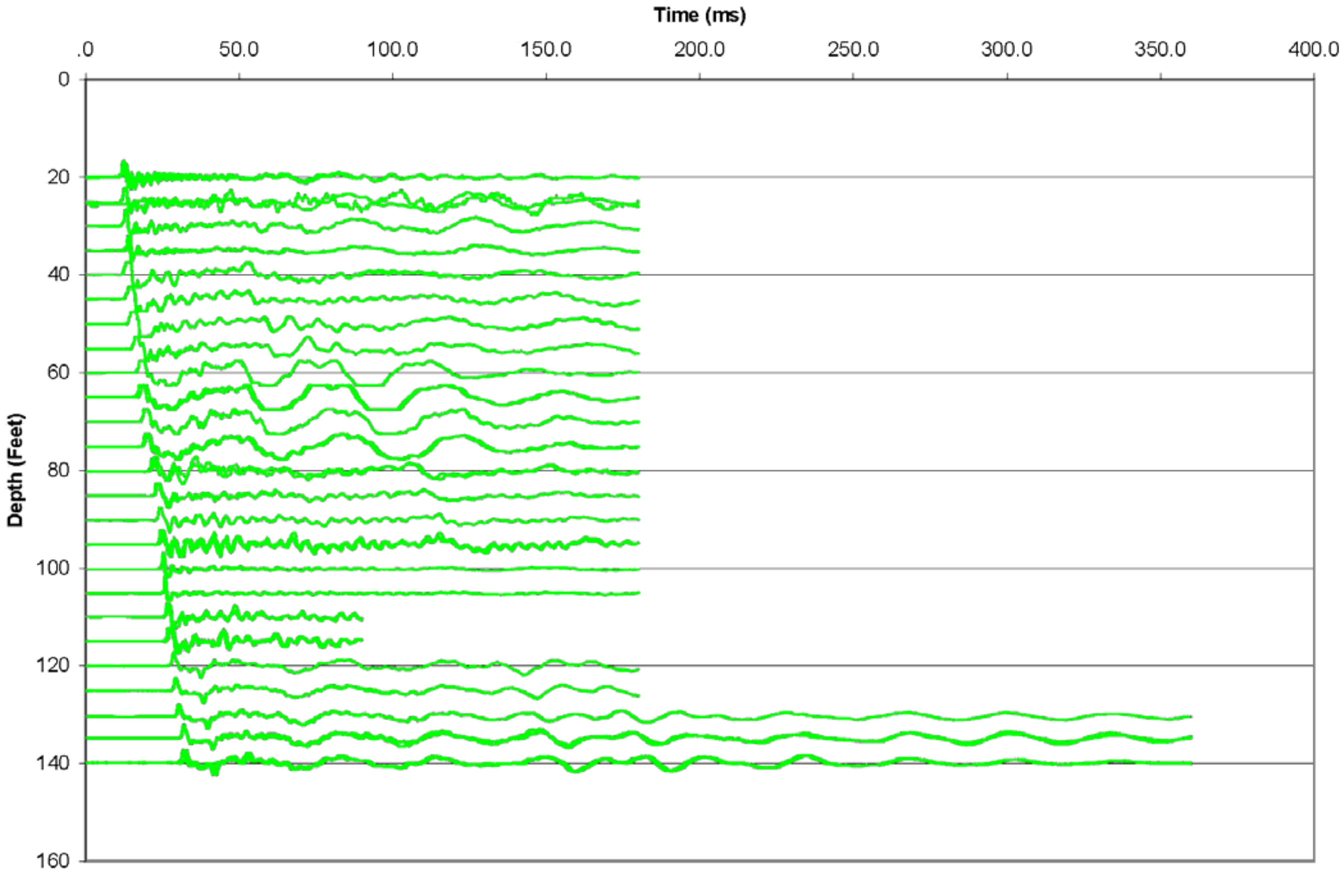
KNIK ARM CROSSING
ALASKA

Geophone Offset: 0.66 Feet
Source Offset: 30.00 Feet

UNKNOWN
C18

Test Depth (Feet)	Geophone Depth (Feet)	Waveform Ray Path (Feet)	Incremental Distance (Feet)	Characteristic Arrival Time (ms)	Incremental Time Interval (ms)	Interval Velocity (Ft/Sec)	Interval Depth (Feet)
20.01	19.35	35.70	35.70	36.3500			
25.18	24.52	38.75	3.05	43.8000	7.4500	408.8	21.94
30.02	29.36	41.98	3.23	47.5000	3.7000	873.0	26.94
35.02	34.36	45.62	3.64	51.6500	4.1500	877.1	31.86
40.03	39.37	49.49	3.88	57.7000	6.0500	641.1	36.86
45.03	44.37	53.56	4.07	66.9000	9.2000	441.9	41.87
50.11	49.45	57.84	4.28	75.5500	8.6500	495.1	46.91
55.12	54.46	62.17	4.33	81.5500	6.0000	722.0	51.96
60.04	59.38	66.53	4.35	88.7000	7.1500	608.8	56.92
65.04	64.38	71.03	4.50	94.2500	5.5500	811.1	61.88
70.05	69.39	75.59	4.56	98.8500	4.6000	992.3	66.88
75.21	74.55	80.36	4.77	104.2000	5.3500	891.4	71.97
80.22	79.56	85.02	4.66	111.8000	7.6000	613.4	77.05
85.22	84.56	89.72	4.70	117.5000	5.7000	824.4	82.06
90.22	89.56	94.45	4.73	122.5000	5.0000	946.0	87.06
95.23	94.57	99.21	4.76	126.8000	4.3000	1106.3	92.06
100.23	99.57	103.99	4.78	131.4500	4.6500	1028.0	97.07
105.23	104.57	108.79	4.80	135.3500	3.9000	1230.8	102.07
110.01	109.35	113.39	4.60				106.96
115.01	114.35	118.22	4.83				111.85
120.08	119.42	123.13	4.91	143.0000			116.88
125.09	124.43	128.00	4.87	146.6000	3.6000	1352.2	121.92
130.41	129.75	133.18	5.18	150.4500	3.8500	1345.2	127.09
134.86	134.20	137.51	4.34	154.9500	4.5000	964.0	131.98
139.86	139.20	142.40	4.88	159.5500	4.6000	1061.7	136.70

Waveforms for sounding C18



Knik Arm Crossing
Knik Arm, Alaska

Waveforms for Sounding C18

March 2007

32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical & Environmental Consultants

Figure C-1

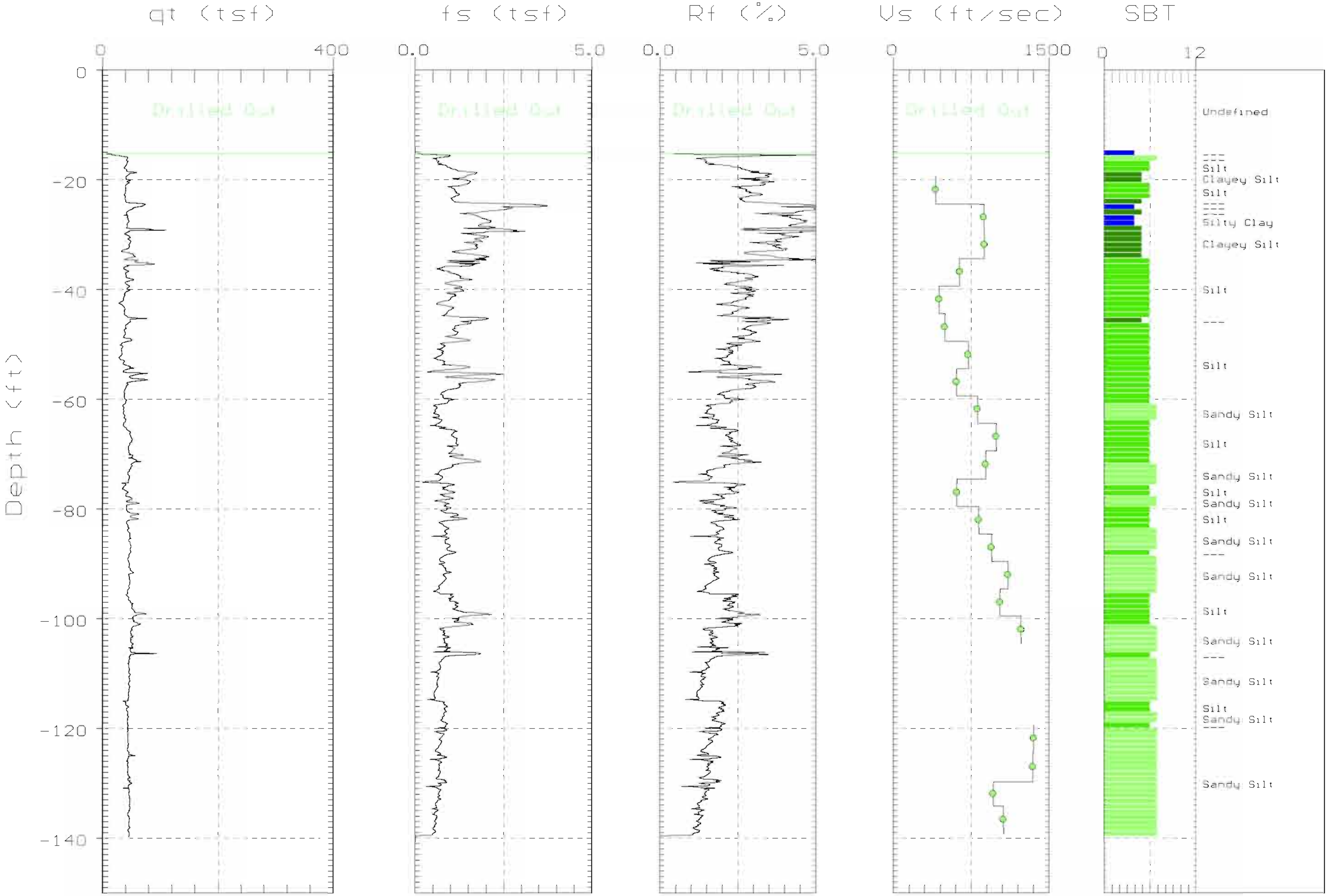
CPT Plots of Shear Wave Velocities and Non-normalized Parameters

GREGG

SHANNON WILSON

Site:KNIK ARM CROSSING
Location:CPT-18

Engineer:R.COLLINS
Date:09/18/06 20:21



Max. Depth: 139.84 (ft)
Depth Inc.: 0.082 (ft)

SBT: Soil Behavior Type (Robertson 1990)

APPENDIX D

PRESSUREMETER TEST RESULTS

Report prepared by Gregg In Situ, Inc.

GREGG

GREGG DRILLING AND TESTING, INC.
GREGG IN SITU, INC.
ENVIRONMENTAL AND GEOTECHNICAL INVESTIGATION SERVICES

October 31, 2006

Shannon & Wilson
Attn: Mr. Stafford Glashan
5430 Fairbanks Street, Suite 3
Ancgorage, AK 99518

Subject: Pressuremeter Test Results (Revised)
Knik Arm Bridge
Anchorage, Alaska

Dear Mr. Glashan:

The following report presents the results of GREGG IN SITU's Pressuremeter Testing Program for the above referenced site. The following testing services were performed:

1	Cone Penetration Tests	(CPTU)	☐
2	Pore Pressure Dissipation Tests	(PPD)	☐
3	Seismic Cone Penetration Tests	(SCPTU)	☐
4	Resistivity Cone Penetration Tests	(RCPTU)	☐
5	Pressuremeter Tests	(PMT)	X
6	Groundwater Sampling	(GWS)	☐
7	Soil Sampling	(SS)	☐
8	Vapor Sampling	(VS)	☐
9	Vane Shear Testing	(VST)	☐
10	SPT Energy Calibration	(SPTE)	☐

A summary of the pressuremeter testing results is presented in Table 1. Conditions such as borehole instability or broken pressuremeter sheaths which resulted in uncertain data quality have been denoted, where appropriate, in this data report.

A list of reference papers providing additional background on the specific tests conducted is provided in the bibliography following the text of the report. If you would like a copy of any of these publications or should you have any questions or comments regarding the contents of this report, please do not hesitate to contact our office at (925) 313-5800.

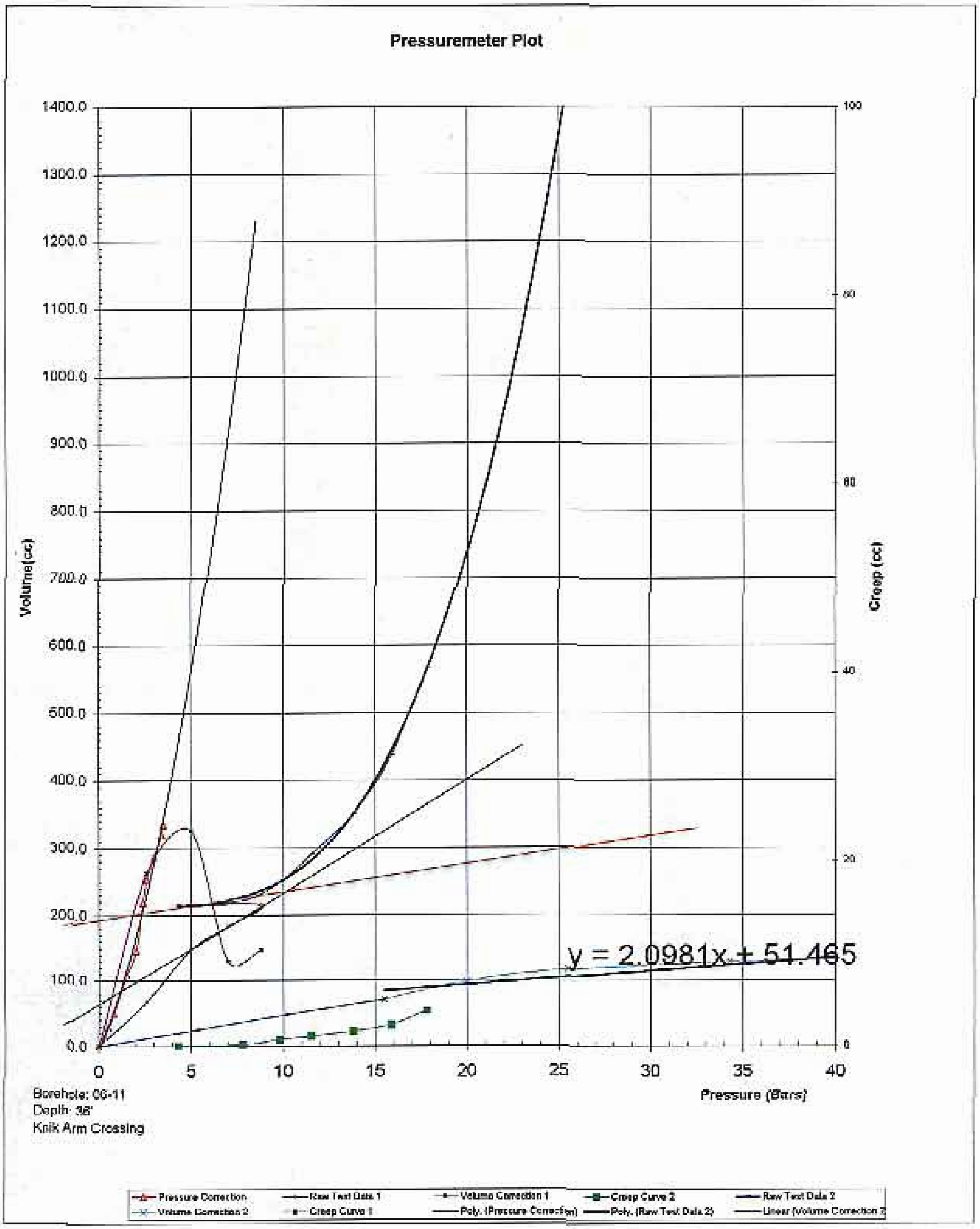
Sincerely,
GREGG IN SITU, Inc.

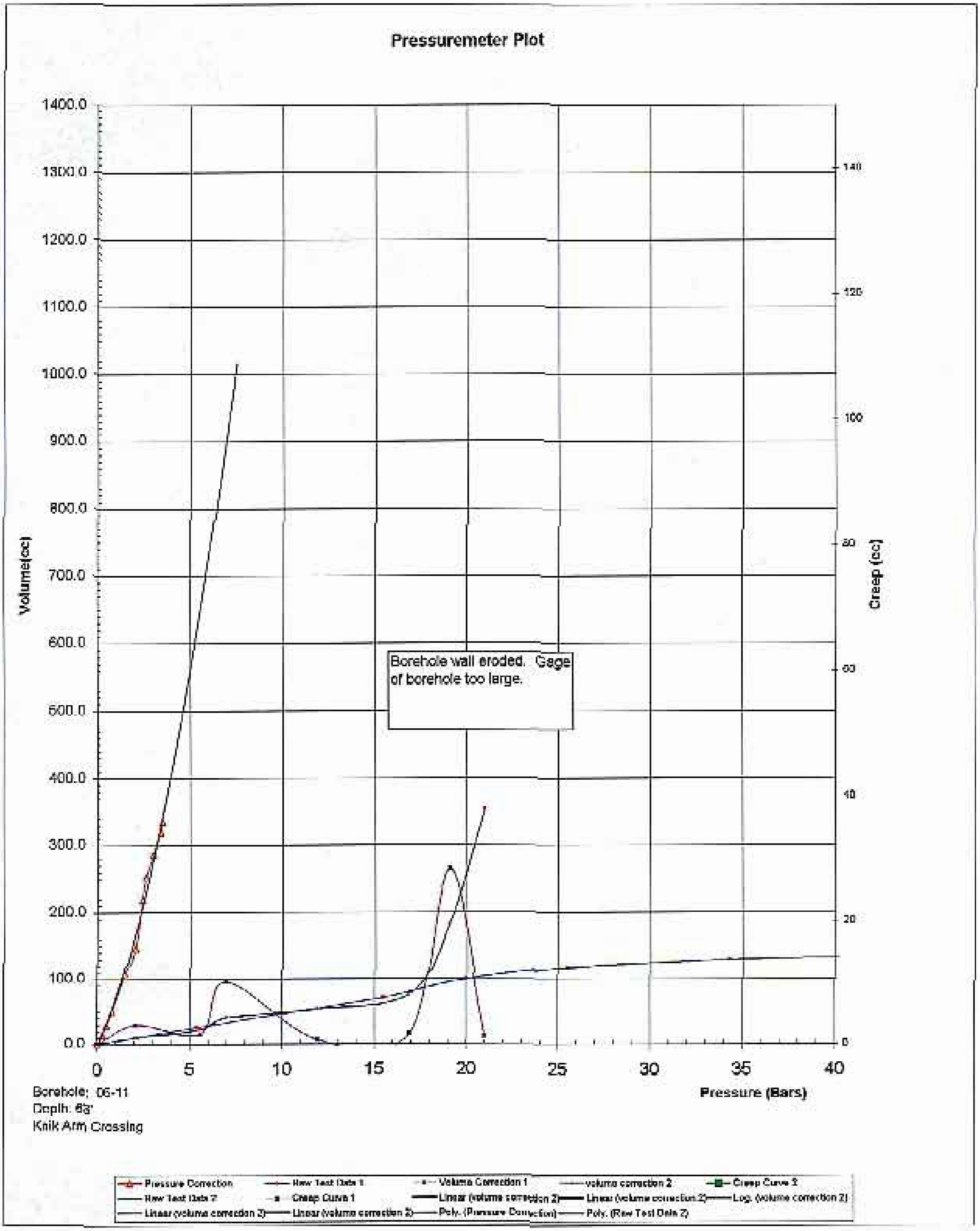
Virgil Baker
Geotechnical Manager

Pressuremeter Testing Summary

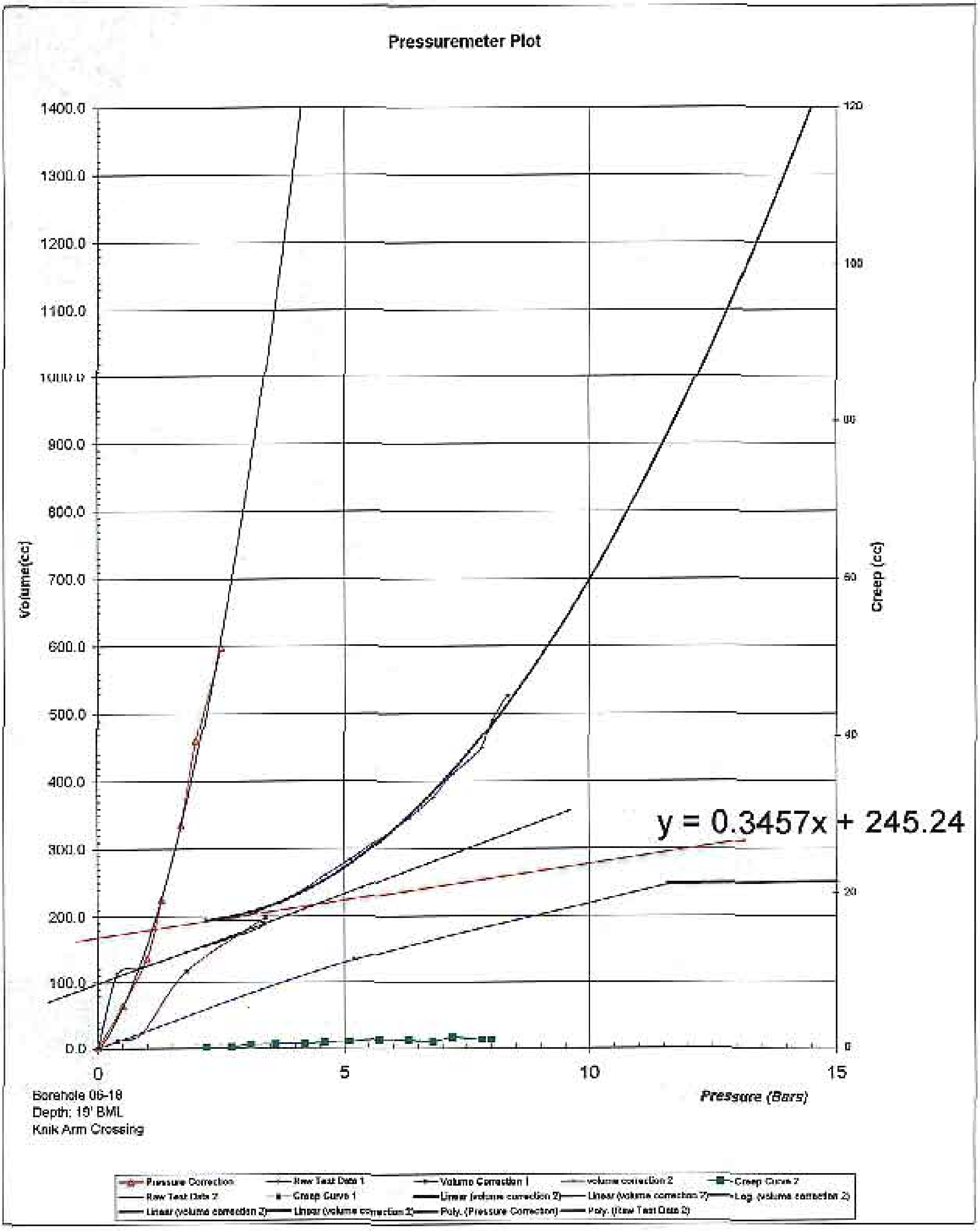
-Table 1-

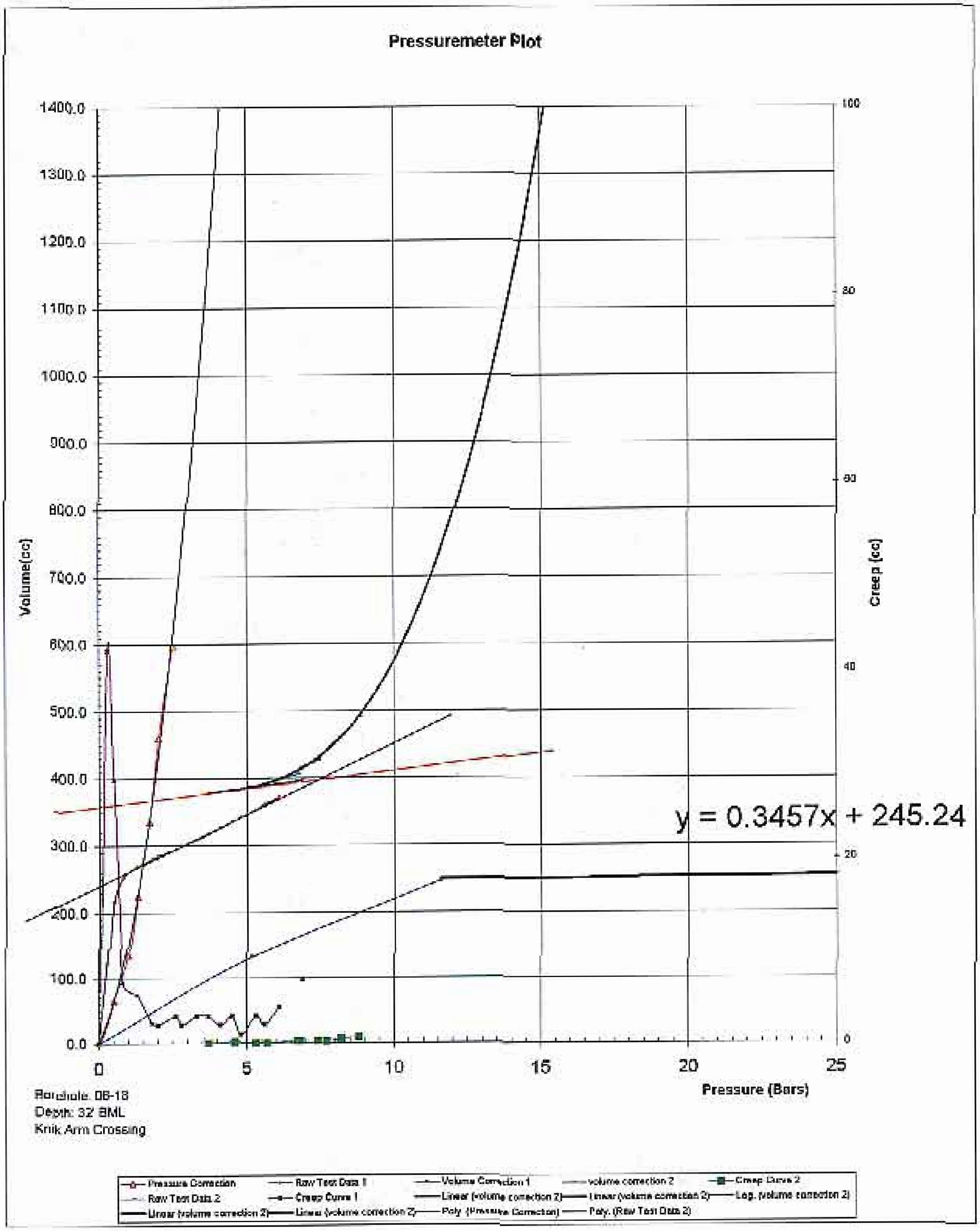
Boring Number/ Test #	Probe Depth Below Mud Line (Feet)	Date	Initial Menard Pressuremeter Modulus (Bars)	Menard *Pressuremeter* Reload Modulus (Bars)	Limit Pressure (Bars)	Comments
06-11/1	36	9/17/06	150	583	25	Some squeezing of borehole occurred. Probe had to be pushed into place.
06-11/2	63	9/17/06	----	----	----	Borehole wall eroded. Gage of borehole too large to complete test. Loose Sand?
06-11/3	75	9/17/06	----	----	----	Loose sand. Borehole caved-in at test depth. Could not insert probe.
06-18/1	19	9/19/06	103	153	10.6	
06-18/2	32	9/19/06	132	379	13.0	
06-18/3	45	9/20/06	81	242	12.4	
06-18/4	59	9/20/06	41	179	13.0	Squeezing borehole. Probe pushed into place.
06-18/5	69	9/20/06	86	192	13.5	Squeezing borehole. Probe pushed into place.
06-18/6	79	9/20/06	----	----	---	Disturbed borehole wall.- Bad test.
06-18/7	89	9/20/06	350*	75*	14.1	Squeezing borehole. Probe pushed into place. * Unload reload loop appears to have been performed before elastic deformation was reached.
06-18/8	99	9/20/06	86	68	17.5	Squeezing borehole. Probe pushed into place. Some borehole disturbance observed.

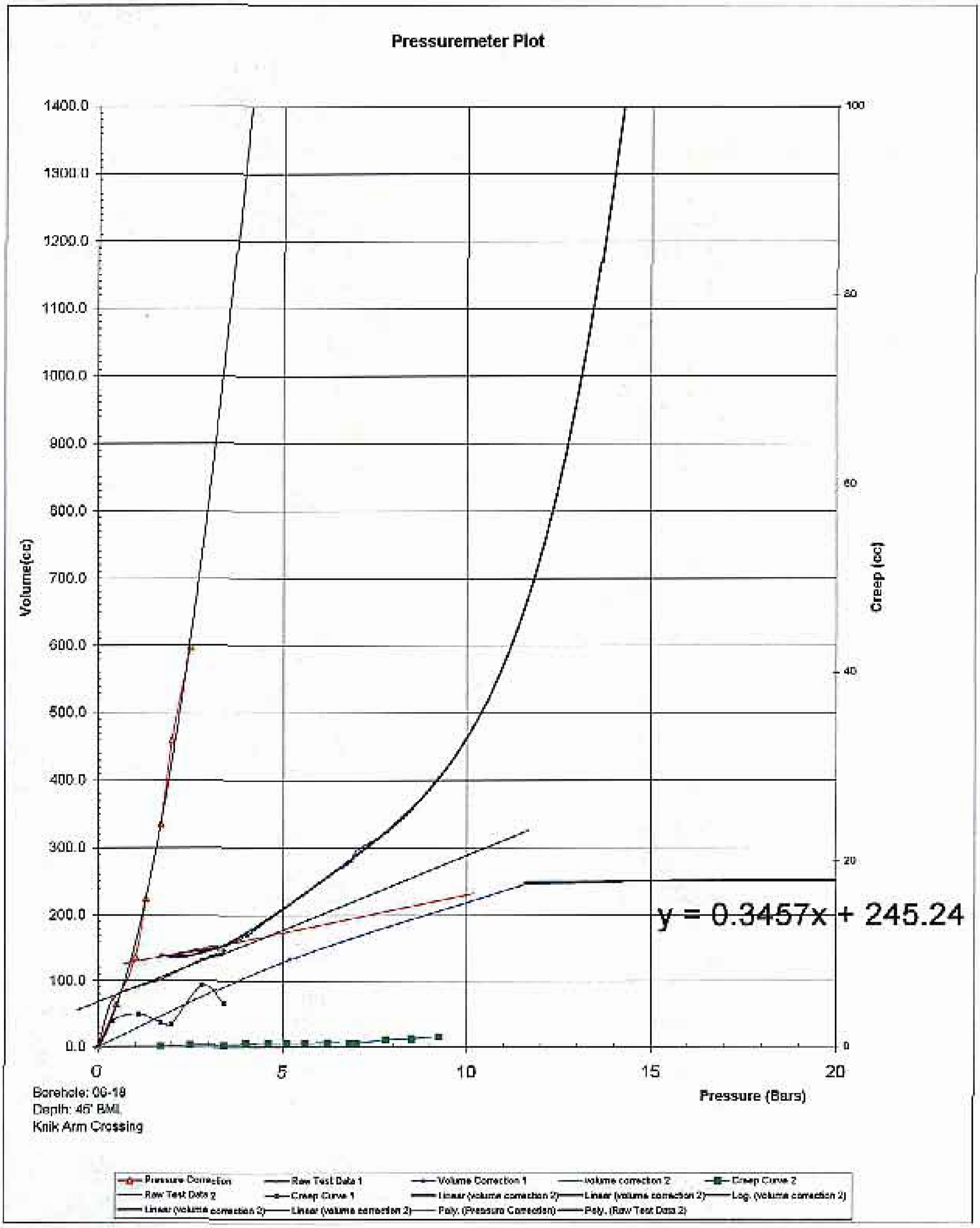

Pressuremeter Plot
1400.0
1300.0
1200.0
1100.0
1000.0
900.0
800.0
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
Volume(cc)
100
80
60
40
20
0
Creep (cc)
0
5
10
15
20
25
30
35
40
Pressure (Bars)
y = 2.0981x + 51.465
Borehole: 06-11
Depth: 38'
Knik Arm Crossing
Pressure Correction
Raw Test Data 1
Volume Correction 1
Creep Curve 2
Raw Test Data 2
Volume Correction 2
Creep Curve 1
Poly. (Pressure Correction)
Poly. (Raw Test Data 2)
Linear (Volume Correction 2



Borehole wall eroded. Gage of borehole too large.


Pressuremeter Plot
Volume(cc)
1400.0
1300.0
1200.0
1100.0
1000.0
900.0
800.0
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
Creep (cc)
120
100
80
60
40
20
0
0
5
10
15
Pressure (Bars)
y = 0.3457x + 245.24
Borehole 06-18
Depth: 19' BML
Knik Arm Crossing
Pressure Correction
Raw Test Data 1
Volume Correction 1
volume correction 2
Creep Curve 2
Raw Test Data 2
Creep Curve 1
Linear (volume correction 2)
Linear (volume correction 2)
Log. (volume correction 2)
Linear (volume correction 2)
Linear (volume correction 2)
Poly. (Pressure Correction)
Poly. (Raw Test Data 2)


Pressuremeter Plot
Volume(cc)
1400.0
1300.0
1200.0
1100.0
1000.0
900.0
800.0
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
Creep (cc)
100
80
60
40
20
0
0
5
10
15
20
25
Pressure (Bars)
y = 0.3457x + 245.24
Borehole: 08-18
Depth: 32 BML
Knik Arm Crossing
Pressure Correction
Raw Test Data 1
Volume Correction 1
volume correction 2
Creep Curve 2
Raw Test Data 2
Creep Curve 1
Linear (volume correction 2)
Linear (volume correction 2)
Log. (volume correction 2)
Linear (volume correction 2)
Linear (volume correction 2)
Poly. (Pressure Correction)
Poly. (Raw Test Data 2)

Pressuremeter Plot
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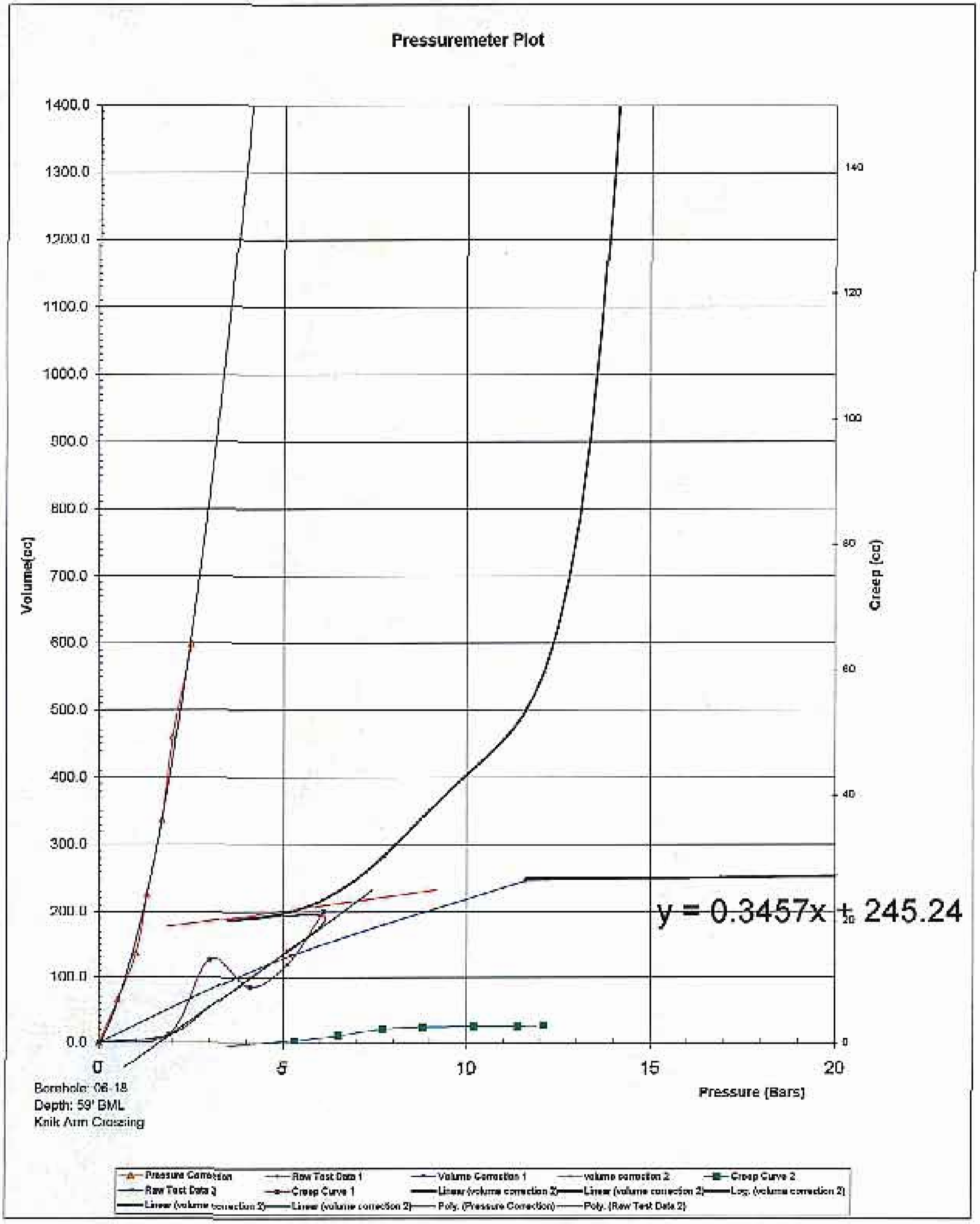
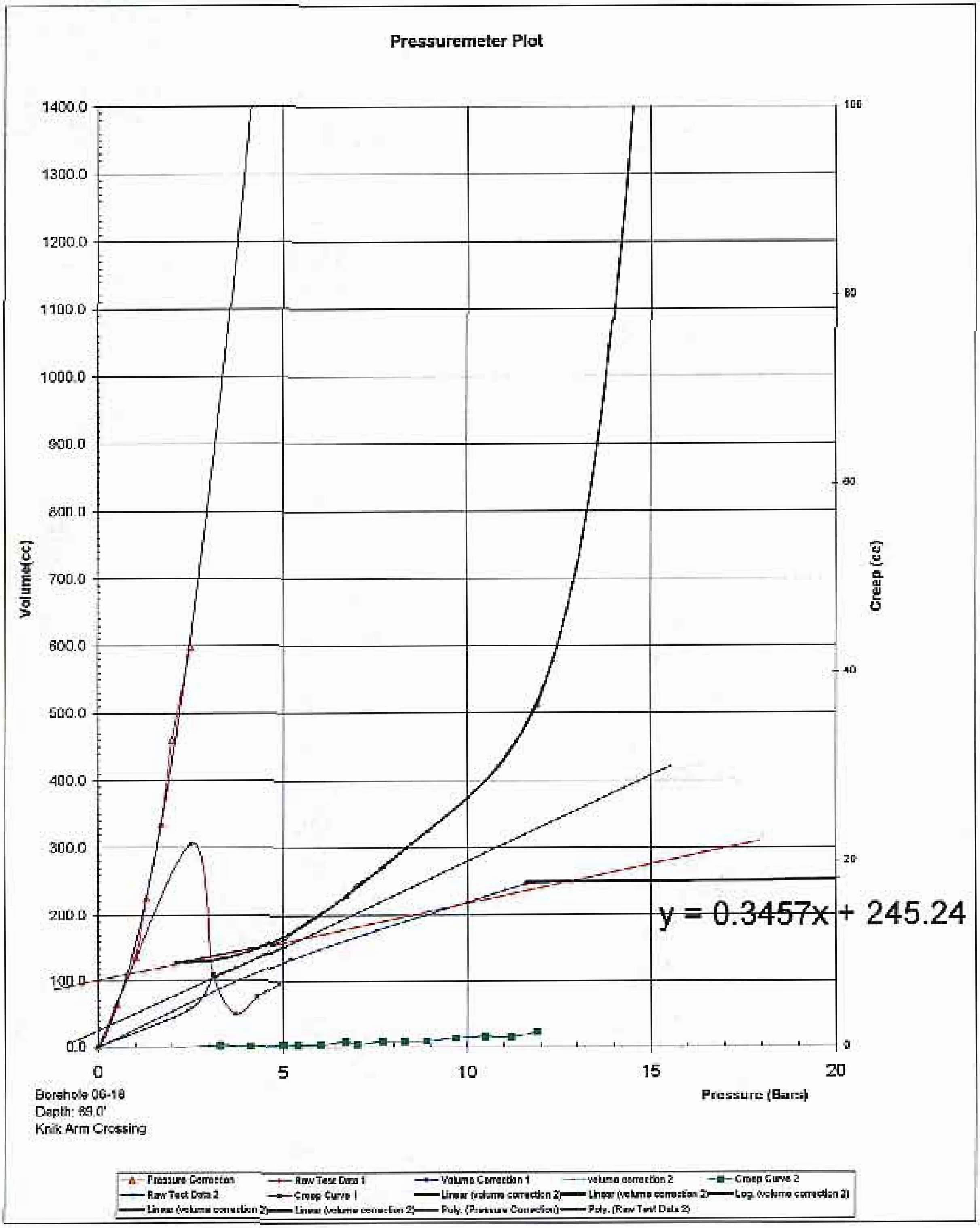
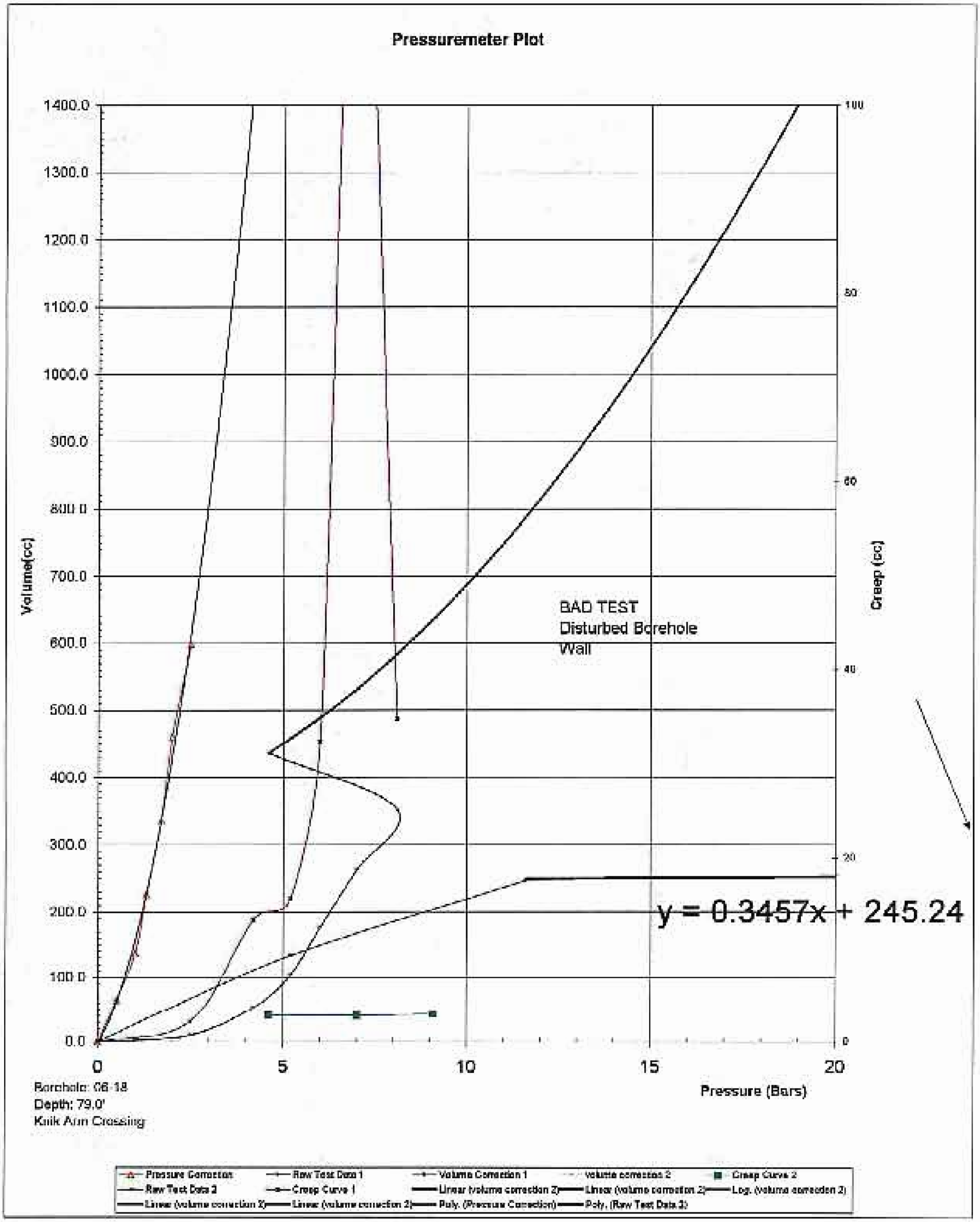
1300.0
1200.0
1100.0
1000.0
900.0
800.0
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
Volume(cc)
100
80
60
40
20
0
Creep (cc)
0
5
10
15
20
Pressure (Bars)
y = 0.3457x + 245.24
Borehole: 06-19
Depth: 45' BML
Knik Arm Crossing
Pressure Correction
Raw Test Data 1
Volume Correction 1
volume correction 2
Creep Curve 2
Raw Test Data 2
Creep Curve 1
Linear (volume correction 2)
Linear (volume correction 2)
Log. (volume correction 2)
Linear (volume correction 2)
Linear (volume correction 2)
Poly. (Pressure Correction)
Poly. (Raw Test Data 2)

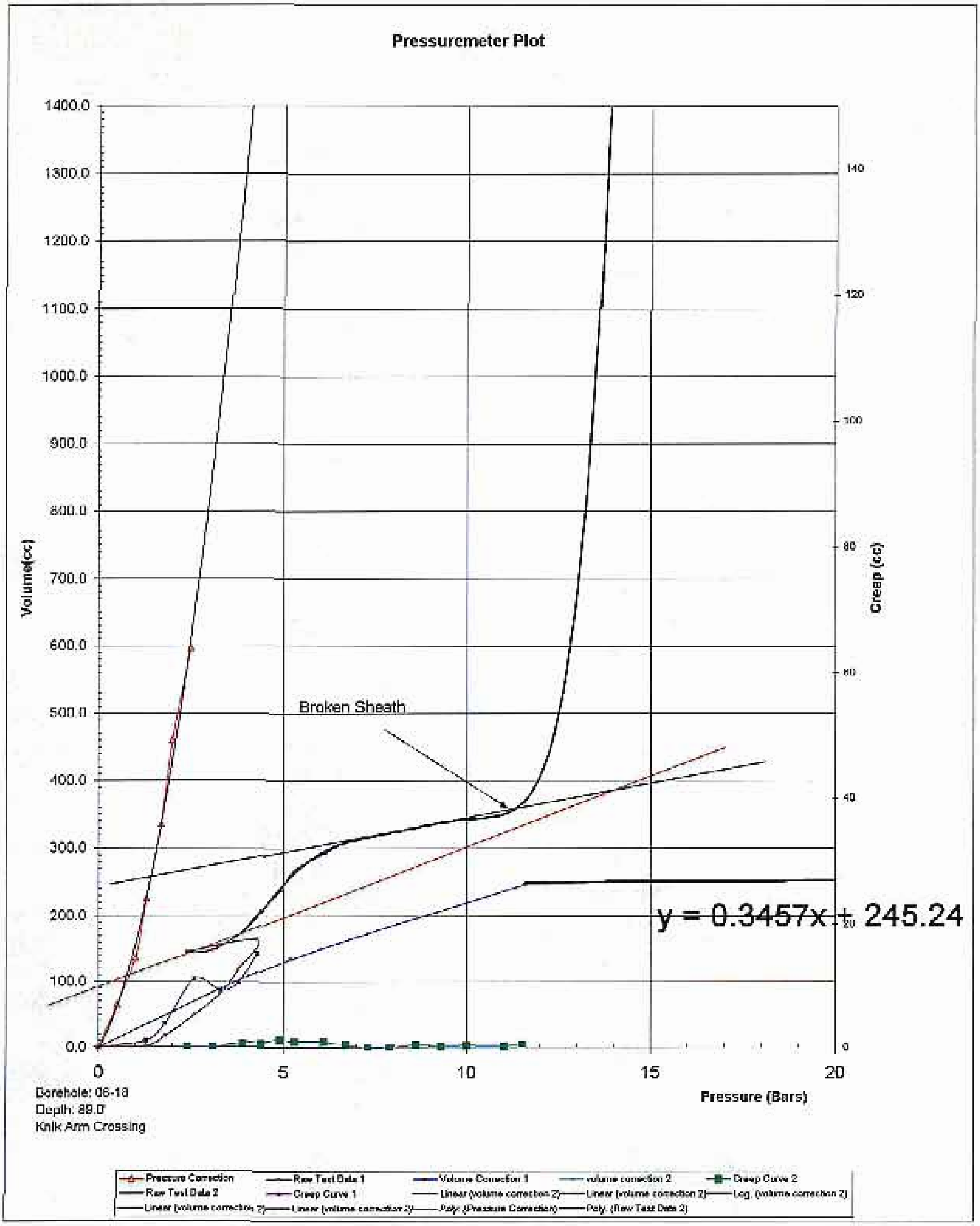

Pressuremeter Plot
1400.0
1300.0
1200.0
1100.0
1000.0
900.0
800.0
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
Volume(cc)
140
120
100
80
60
40
20
0
Creep (cc)
y = 0.3457x + 245.24
0
5
10
15
20
Pressure (Bars)
Borehole: 06-18
Depth: 59' BML
Knik Arm Crossing
Pressure Correction
Raw Test Data 1
Volume Correction 1
volume correction 2
Creep Curve 2
Raw Test Data 2
Creep Curve 1
Linear (volume correction 2)
Linear (volume correction 2)
Log. (volume correction 2)
Linear (volume correction 2)
Linear (volume correction 2)
Poly. (Pressure Correction)
Poly. (Raw Test Data 2)

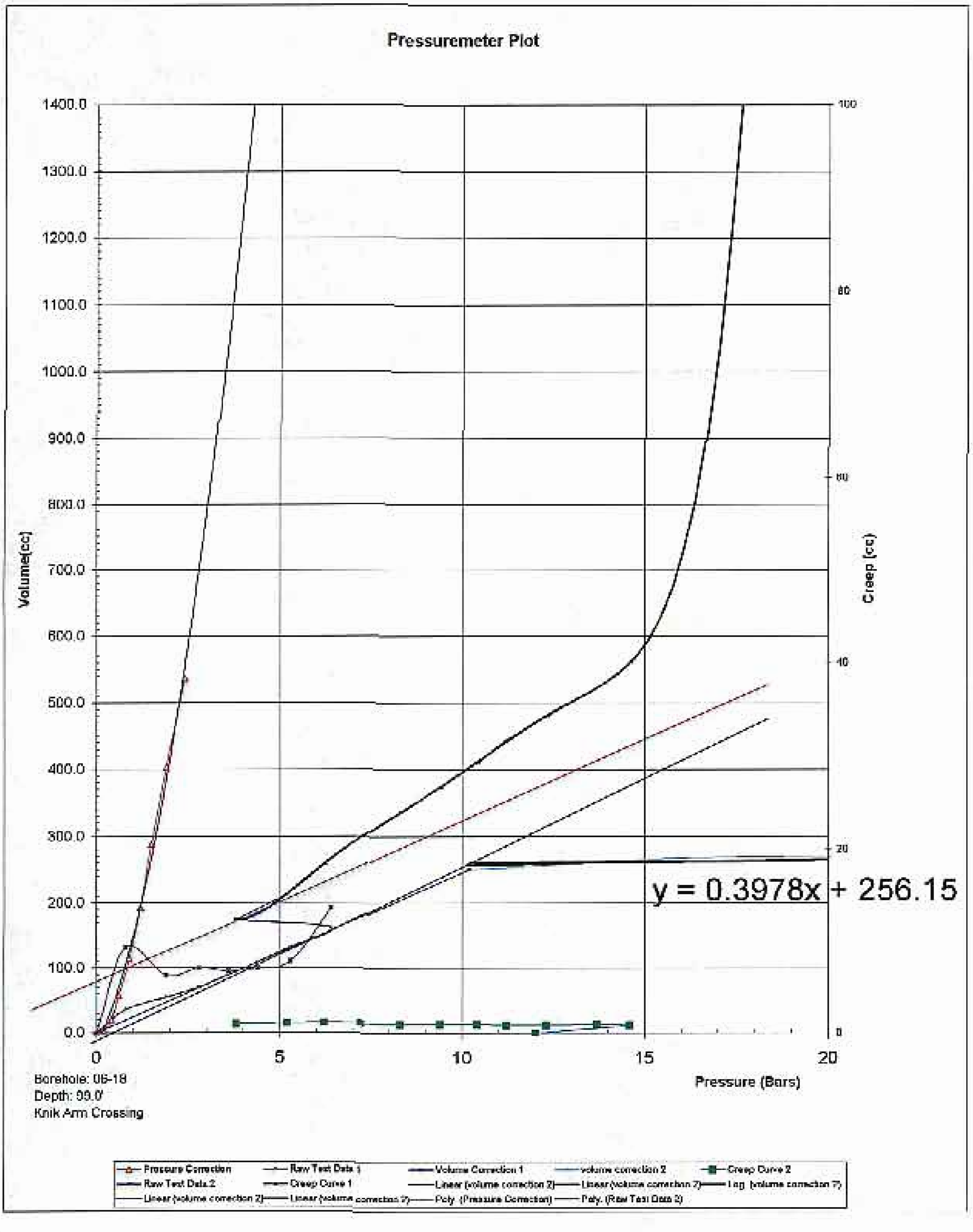

Pressuremeter Plot
Volume(cc)
1400.0
1300.0
1200.0
1100.0
1000.0
900.0
800.0
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
Creep (cc)
100
80
60
40
20
0
0
5
10
15
20
Pressure (Bars)
y = 0.3457x + 245.24
Borehole 06-18
Depth: 89.0'
Knik Arm Crossing
Pressure Correction
Raw Test Data 1
Volume Correction 1
volume correction 2
Creep Curve 2
Raw Test Data 2
Creep Curve 1
Linear (volume correction 2)
Linear (volume correction 2)
Log. (volume correction 2)
Linear (volume correction 2)
Linear (volume correction 2)
Poly. (Pressure Correction)
Poly. (Raw Test Data 2)



BAD TEST
Disturbed Borehole
Wall

Borehole: 06-18
Depth: 79.0'
Knik Arm Crossing


Pressuremeter Plot
Volume(cc)
1400.0
1300.0
1200.0
1100.0
1000.0
900.0
800.0
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
Creep (cc)
140
120
100
80
60
40
20
0
Broken Sheath
y = 0.3457x + 245.24
0
5
10
15
20
Pressure (Bars)
Borehole: 06-18
Depth: 89.0'
Knik Arm Crossing
Pressure Correction
Raw Test Data 1
Volume Correction 1
volume correction 2
Creep Curve 2
Raw Test Data 2
Creep Curve 1
Linear (volume correction 2)
Linear (volume correction 2)
Log. (volume correction 2)
Linear (volume correction 2)
Linear (volume correction 2)
Poly. (Pressure Correction)
Poly. (Raw Test Data 2)


Pressuremeter Plot
1400.0
1300.0
1200.0
1100.0
1000.0
900.0
800.0
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
Volume(cc)
100
80
60
40
20
0
Creep (cc)
0
5
10
15
20
Pressure (Bars)
y = 0.3978x + 256.15
Borehole: 06-18
Depth: 99.0'
Knik Arm Crossing
Pressure Correction
Raw Test Data 1
Volume Correction 1
volume correction 2
Creep Curve 2
Raw Test Data 2
Creep Curve 1
Linear (volume correction 2)
Linear (volume correction 2)
Log (volume correction 2)
Linear (volume correction 2)
Linear (volume correction 2)
Poly. (Pressure Correction)
Poly. (Raw Test Data 2)

GREGG

Pressuremeter

Gregg In Situ, Inc. uses a model G-Type MENARD pressuremeter to measure in situ strength and deformation properties of all types of soil and soft rock as well as ice and permafrost. Well established interpretation methods can be used to determine the following:

- Bearing capacity of shallow and deep foundations
- Settlement of all foundations
- Deformation of all laterally loaded piles and sheet piles
- Resistance of anchors

The pressuremeter consists of a probe, a control unit, and tubing used to connect the probe with the control unit. The probe is a cylindrical metal casing with an inner rubber membrane and outer protective sheath constructed to form three independent cells. When in use the central cell is inflated with water and the guard cells with gas. The control unit houses all regulators, valves, and pressure gages to reduce and control the pressure applied to the probe cells. The control unit also supplies the flow of water to the measuring cell.

The test is accomplished by placing the probe at a test depth in a pre-drilled borehole. The probe can also be driven to a test depth within a slotted casing. Equal increments of pressure are then applied to the probe and held constant. Volume changes are noted at select time intervals after each pressure increment. By plotting the injected volume versus pressure (*figure Volume vs Pressure*), one can obtain an in situ pressure volume curve. The "limit pressure" (P_L) is the pressure at which failure occurs and through well established correlations, can be directly related to bearing capacity. The *slope of the* pressure volume curve is called the Menard modulus and can be used to calculate settlements.

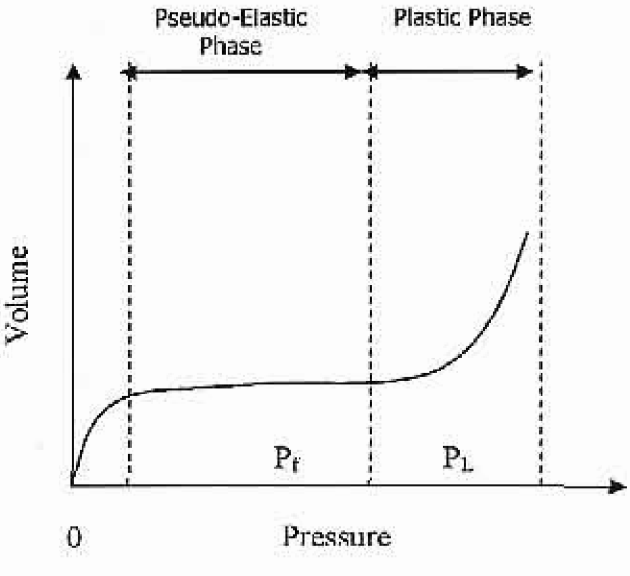


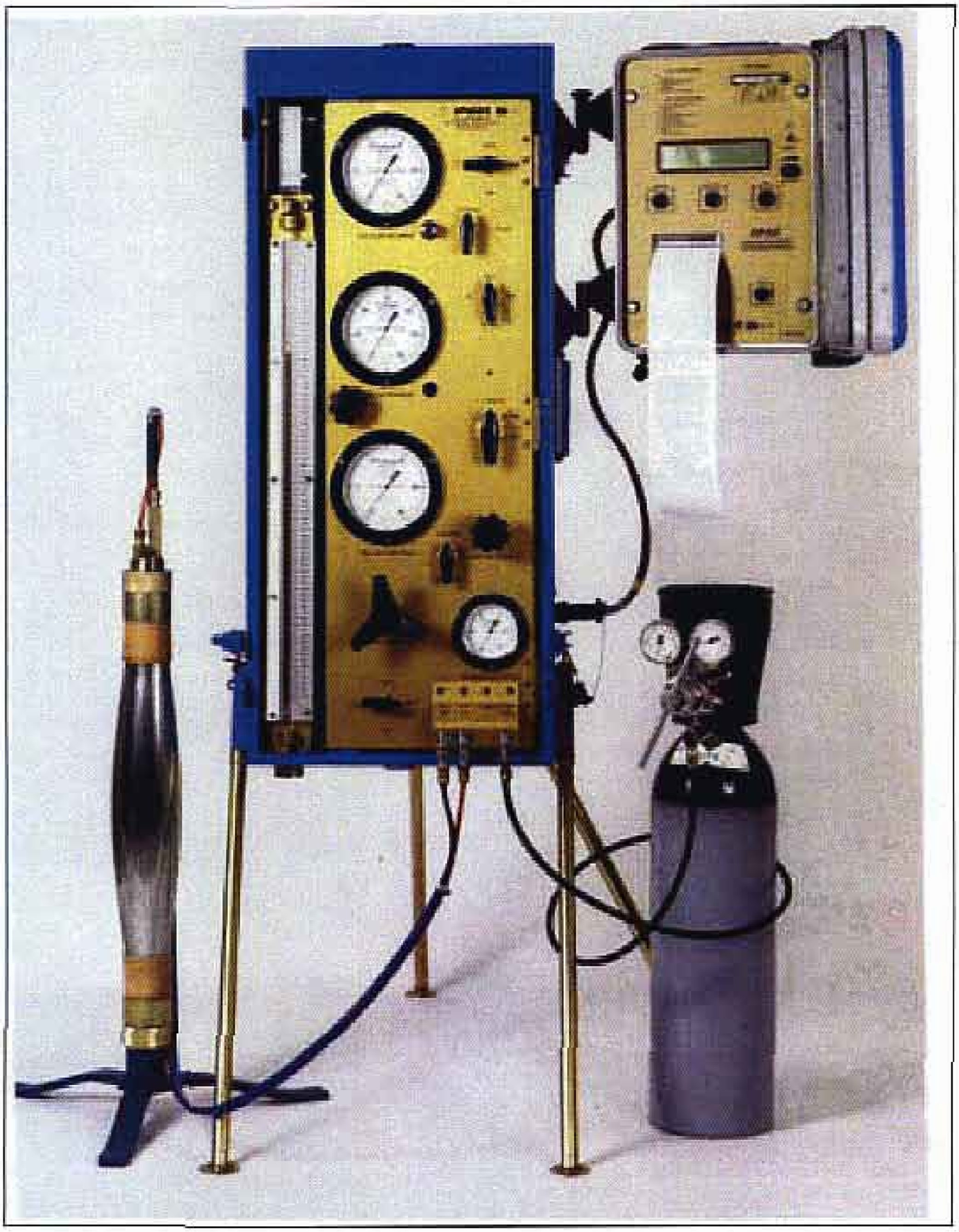
Figure Volume vs. Pressure Plot

APAGEO

Tout le Matériel pour la Géotechnique
Le Forage et le Laboratoire

Menard matériels

MENARD PRESSUREMETER WITH SPAD DATA LOGGER



sn APAGEO sas - ZA de Gomberville - 78114 Magny Les Hameaux France – internet : www.apageo.com

MENARD PRESSUREMETER ®

Monitoring box, hydraulic probe and lines conform to the ASTM Standard Method for Pressuremeter Testing in Soils D-4719-00 and AFNOR Standard NF P 94-110

TEST DESCRIPTION

A pressuremeter test is an in-situ stress controlled loading test performed on the wall of a borehole using a cylindrical probe which can expand radially.

From the test readings, a stress-strain curve can be obtained which yields :

- the Menard pressuremeter modulus
- the creep pressure
- the Menard limit pressure

once the volume and pressure calibrations have been performed to allow data reduction.

EQUIPMENT

The pressuremeter consists of :

- **A MONITORING UNIT**

With devices to precisely regulate the pressure applied to the probe and to read its volume changes with pressure increments and time. A gas cylinder provides the pressure source. The box can stand on a tripod which can be knocked down for transport.

It includes :

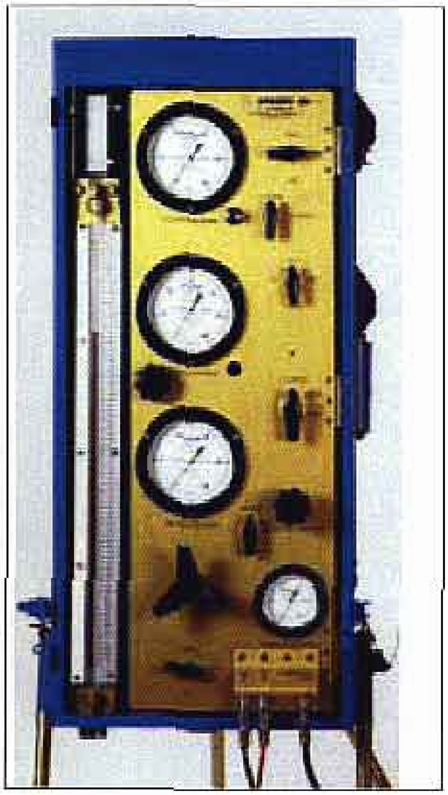
- a 800 cm^3 volumeter with a sight tube and ruler in cm^3
- a main pressure regulator
- a differential pressure regulator
- 2 pressure gauges 0-2.5 and 0-6 MPa for the measuring cell
- 1 pressure gauge 0-6 MPa for the guard cells
- the necessary valves and couplings

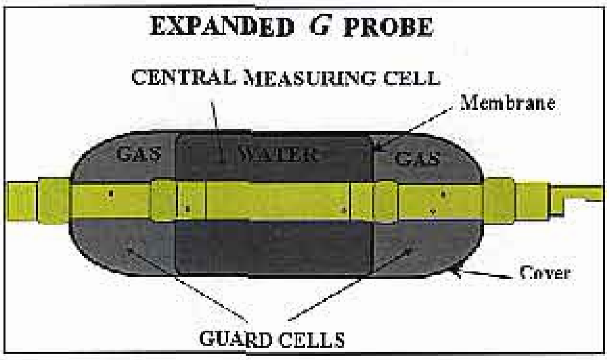
For very soft soils and for weak rock testing, the monitoring box can respectively receive 0-0.06 or 0-10 MPa gauges.

- **THE PLASTIC TUBING**

Coaxial or twin tubing, which connects the probe to the monitoring box. This tubing, flexible and of high resistance, is designed to minimize volume reading corrections.

Menard Pressuremeter Monitoring Unit (PVC)





Tricellular Pressuremeter probe

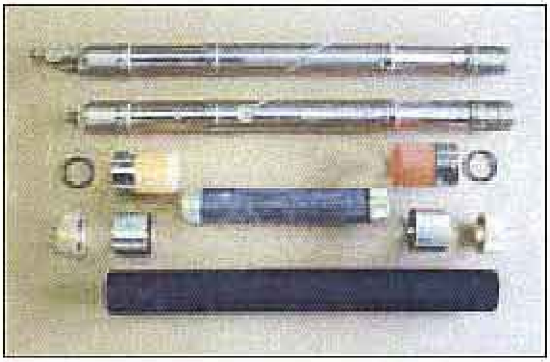
Main features :

- Monitoring box : 85 x 41 x 22 cm
  Weight : 30 kg
- Probes : 44, 60, 76 mm O.D. (AX, BX and NX sizes)
- A slotted tube
- A variety of rubber covers to suit all types of soil

- **THE 3-CELL PROBE**

Which includes a central measuring cell, filled with water. Its volume changes are read on the monitoring box volumeter.

The probe is totally protected by a rubber cover which is inflated by the gas to form the 2 guard cells. Pressure applied to the borehole walls are kept constant along the 3 cells through the differential pressure regulator to ensure a true cylindrical deformation along the measuring cell.



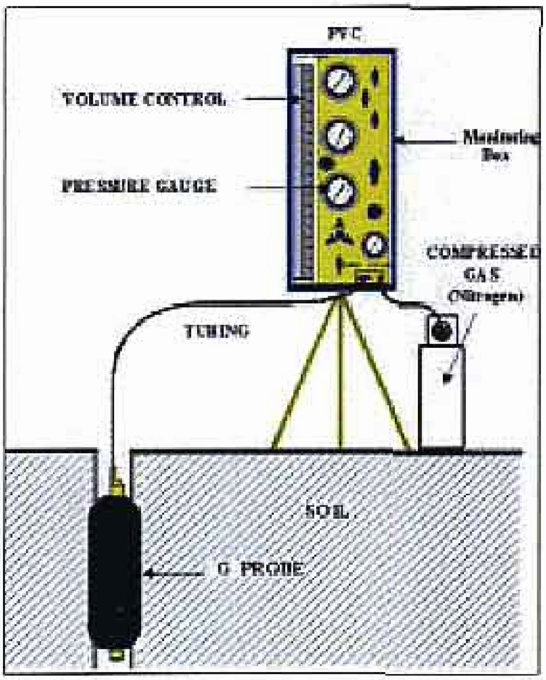
Pressuremeter probe with its components

TEST PROCEDURE

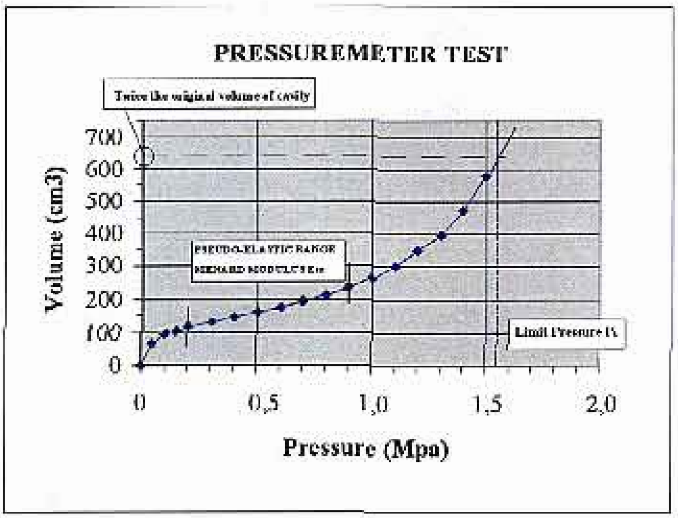
The borehole is drilled so as to minimize wall disturbance and keep a cavity diameter compatible with the probe size. The probe is lowered into the borehole to the required test depth and the pressure is applied by equal increments. Volumeter readings are taken 30 seconds and 1 minute after pressure application on the monitoring box.

In gravely soils under water table where the borehole would cave-in, the probe can be inserted in a specially designed **slotted tube** which is driven or vibrodriven into the soil to be tested.

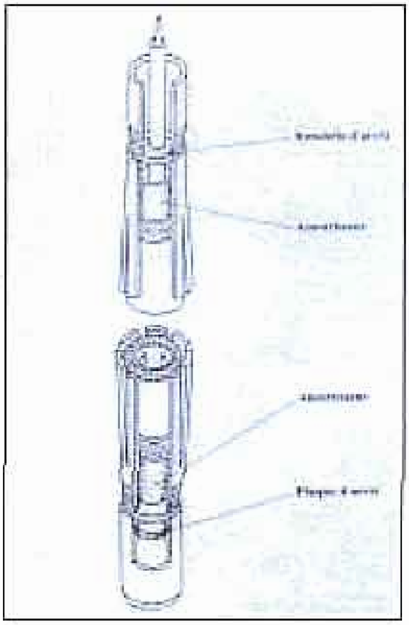
Specially fitted probes can also be part of a string of pipes to be forced into soft soils, sometimes simultaneously with a static cone penetration device.



Test Procedure



Standard Pressuremeter test curve



Slotted tube

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Copies of ASTM Standards are available through www.astm.org

APPENDIX E

DRILL ROD ENERGY TRANSFER RESULTS

TABLE OF CONTENTS

Report prepared by Gregg In Situ, Inc.

LIST OF FIGURES

LIST OF PLOTS

GREGG DRILLING AND TESTING, INC.
GREGG IN SITU, INC.
ENVIRONMENTAL AND GEOTECHNICAL INVESTIGATION SERVICES

October 19, 2006

Mr. Stafford Glashan
Shannon Wilson
5430 Fairbanks St., Suite 3
Anchorage, Alaska 99518

Re: Standard Penetration Energy Measurements
Automatic Hammer on Mud Rotary Drill Rig
Knik Arm Crossing Project
Anchorage, Alaska

Dear Mr. Glashan

This report offers results of energy measurements and related calculations made on September 23, 2006 during Standard Penetration Testing (SPT) on Gregg Drilling's mud rotary drill rig. Dynamic tests were performed on an instrumented section of NWJ drill rod attached to the sampler rod string. All dynamic measurements were obtained and recorded using a Pile Driving Analyzer®.

Equipment:

SPT energy measurements were made on SPT samplers driven by the hammer/anvil system on the Gregg Drilling drill rig on September 23, 2006. The rig was tested on the Skate III jack-up barge in the Knik Arm Crossing Project area. In total, 10 energy measurements were collected corresponding to 10 different samples at increasing depth.

Gregg used a Model PAK Pile Driving Analyzer (PDA) to acquire and process measurements of force and velocity with every impact of the automatic hammer on the sample rods. Two strain gauges mounted on a two foot section of NWJ rod measured force, while two piezoresistive accelerometers bolted on the same rod measured acceleration. The gauges were mounted approximately 6" from the top of the rod.
Analog signals from the gauges and accelerometers were collected, digitized, displayed in real-time, and stored by the PDA. Selected output from the PDA for each recorded impact of the hammer included:

- Maximum force in the rod (FMX)
- Maximum velocity in the rod (VMX)
- Maximum calculated transferred energy (EMX)
- Blows per minute (BPM)
- Energy transferred to the rods (ETR)

Data and Calculations:

The purpose of testing was to measure the energy transferred from the hammer to the drill rod and to calculate the energy efficiency of the hammer. The PDA measurements of force and velocity were reviewed after field testing and analyzed to calculate the transferred energy (EMX).

The maximum energy transferred past the gauge location, EMX, is computed by the PDA using force (F) and velocity (V) records as follows:

$$\mathrm{EMX} = \int_a^b F(t)\, V(t)\, dt$$

The time "a" corresponds to the start of the record when the energy transfer begins and "b" is the time at which energy transferred to the rod reaches a maximum value. The energy transferred is defined as ETR, and is usually used to define the efficiency of the hammer/anvil system.

Results:

Table 1 summarizes the average calculated energies for each sample tested as well as the type of sample and depth. It is shown that the overall average (ETR) energy for this system is 91%. Appendix A provides plots and tables of PDA results for all hammer blows at each sampling depth. The plots and tables present selected measured and calculated results as a function of blow number. The results include:

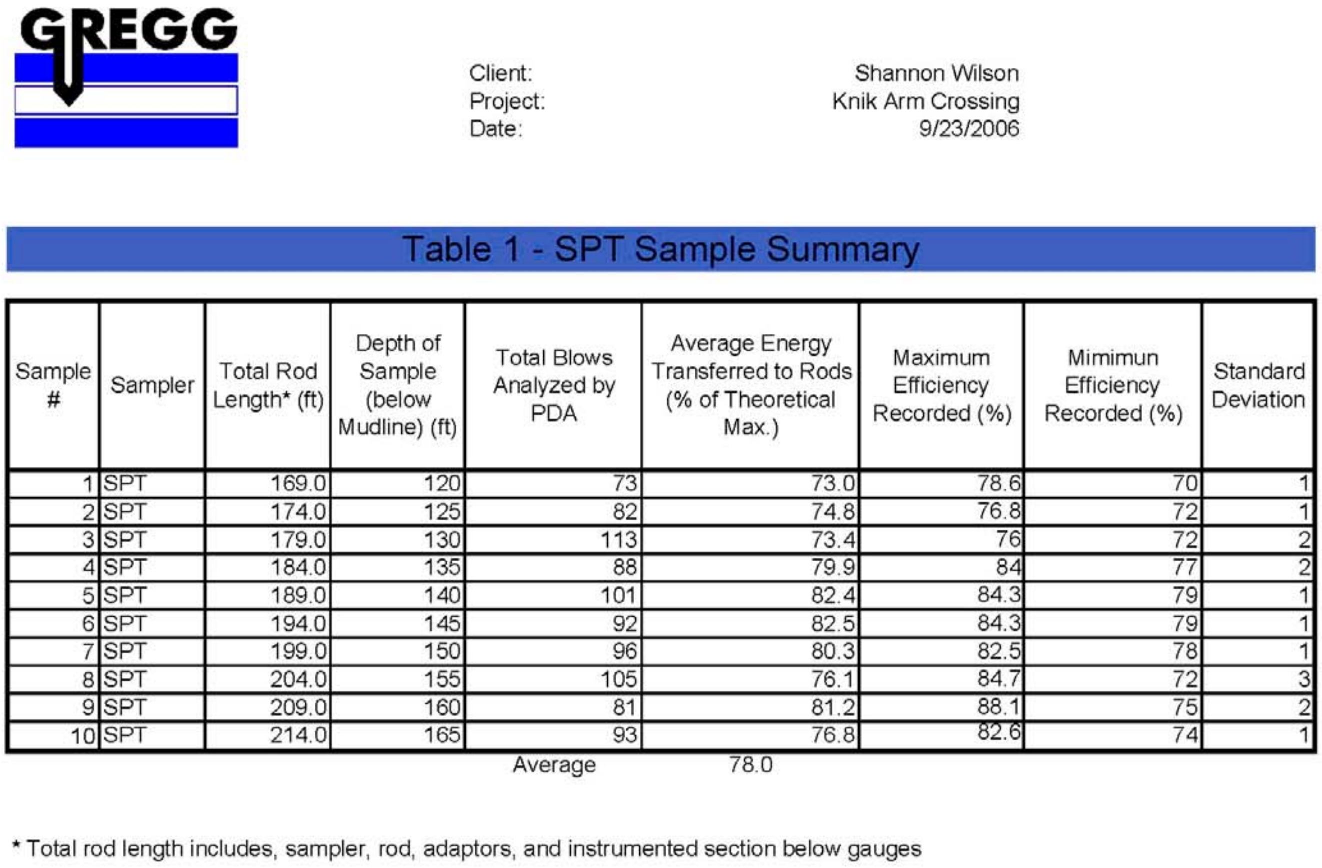
- the blow number
- depth
- BLC (blow count in blows per foot)
- FMX (maximum rod force)
- VMX (maximum rod velocity)
- EMX (maximum transferred energy)
- BPM (blows per minute)
- ETR (energy transferred in percent of maximum)

At the end of each table is a statistical evaluation of the results for each variable including the average, standard deviation, maximum, and what blow number this maximum occurred.

If you have any questions or comments on this report, please do not hesitate to call our office at (562) 427-6899.

Sincerely,

Kelly Cabal
Engineer



GREGG

Client: Shannon Wilson
Project: Knik Arm Crossing
Date: 9/23/2006

Table 1 - SPT Sample Summary

Sample #	Sampler	Total Rod Length* (ft)	Depth of Sample (below Mudline) (ft)	Total Blows Analyzed by PDA	Average Energy Transferred to Rods (% of Theoretical Max.)	Maximum Efficiency Recorded (%)	Mimimun Efficiency Recorded (%)	Standard Deviation
1	SPT	169.0	120	73	73.0	78.6	70	1
2	SPT	174.0	125	82	74.8	76.8	72	1
3	SPT	179.0	130	113	73.4	76	72	2
4	SPT	184.0	135	88	79.9	84	77	2
5	SPT	189.0	140	101	82.4	84.3	79	1
6	SPT	194.0	145	92	82.5	84.3	79	1
7	SPT	199.0	150	96	80.3	82.5	78	1
8	SPT	204.0	155	105	76.1	84.7	72	3
9	SPT	209.0	160	81	81.2	88.1	75	2
10	SPT	214.0	165	93	76.8	82.6	74	1
				Average	78.0			

* Total rod length includes, sampler, rod, adaptors, and instrumented section below gauges

Knik Arm Crossing
Knik Arm, Alaska

SPT Sample Summary

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical & Environmental Consultants

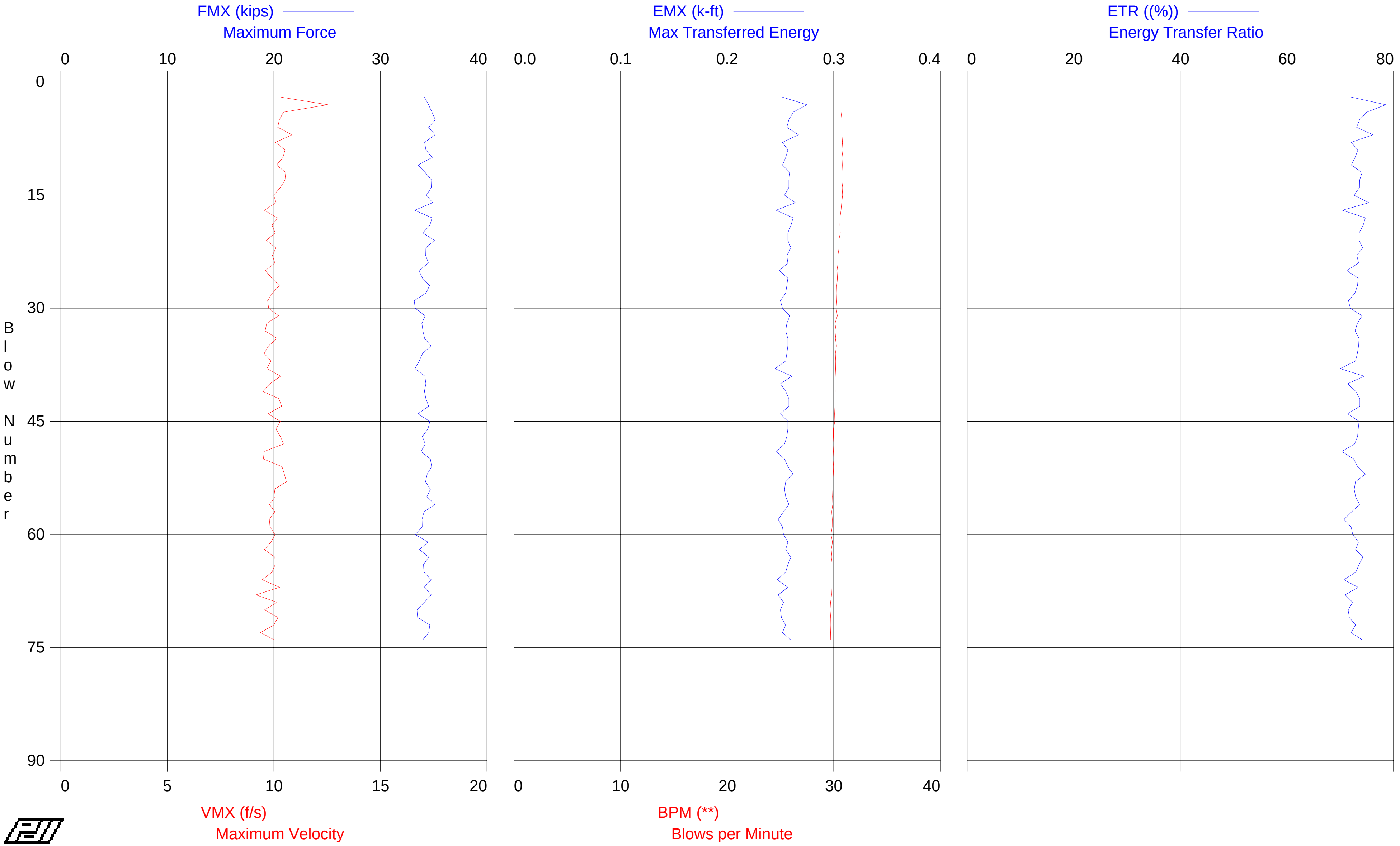
Figure E-1

Gregg Drilling & Testing - Case Method Results

PDIPLOT Ver. 2005.2 - Printed: 28-Sep-2006

Test date: 23-Sep-2006

Knik Arm Crossing - Boring# 06-01



Knik Arm Crossing - Boring# 06-01
OP: V Baker
140# Auto Hammer
Test date: 23-Sep-2006

AR: 1.43 in^2
LE: 169.00 ft
WS: 16,807.9 f/s
SP: 0.492 k/ft3
EM: 30,000 ksi
JC: 0.35

FMX: Maximum Force
VMX: Maximum Velocity
EMX: Max Transferred Energy
BPM: Blows per Minute
ETR: Energy Transfer Ratio

BL#	FMX kips	VMX f/s	EMX k-ft	BPM **	ETR (%)
2	34	10.3	0.25	0.0	72.1
3	35	12.5	0.28	0.0	78.6
4	35	10.5	0.26	30.7	75.0
5	35	10.3	0.26	30.8	73.7
6	35	10.2	0.26	30.8	73.1
7	35	10.9	0.27	30.8	76.2
8	34	10.1	0.25	30.8	72.1
9	34	10.5	0.26	30.8	73.3
10	35	10.4	0.26	30.9	72.8
11	34	10.1	0.25	30.8	72.1
12	34	10.6	0.26	30.9	74.1
13	35	10.5	0.26	30.9	73.6
14	35	10.3	0.26	30.8	73.6
15	34	10.0	0.25	30.8	72.6
16	35	10.1	0.26	30.8	75.4
17	33	9.6	0.25	30.7	70.4
18	35	10.2	0.26	30.6	74.7
19	35	9.9	0.26	30.6	74.3
20	34	10.1	0.26	30.6	73.6
21	35	9.7	0.26	30.5	73.5
22	34	10.1	0.26	30.5	74.2
23	34	9.9	0.26	30.4	73.1
24	35	10.0	0.26	30.4	73.5
25	34	9.6	0.25	30.3	71.3
26	34	9.9	0.26	30.4	73.4
27	35	10.3	0.26	30.3	73.2
28	34	9.9	0.26	30.3	72.8
29	33	9.7	0.25	30.3	71.6
30	33	9.8	0.25	30.2	71.9
31	34	10.2	0.26	30.3	74.1
32	34	9.7	0.26	30.1	73.2
33	34	9.6	0.26	30.2	72.8
34	34	10.2	0.26	30.2	73.5
35	35	9.8	0.26	30.3	73.5
36	34	9.6	0.26	30.2	73.2
37	34	9.9	0.26	30.2	72.9
38	33	9.7	0.25	30.2	70.0
39	34	10.3	0.26	30.2	74.5
40	34	9.8	0.25	30.1	71.4
41	34	9.5	0.26	30.2	72.9
42	34	10.2	0.26	30.1	73.7
43	35	10.4	0.26	30.1	73.7
44	34	9.7	0.25	30.1	71.4
45	35	10.3	0.26	30.1	73.5
46	34	10.1	0.26	30.0	73.4
47	34	10.3	0.26	30.0	73.3
48	34	10.5	0.25	30.0	72.7
49	34	9.5	0.25	30.0	70.3
50	35	9.5	0.25	29.9	72.5
51	35	10.4	0.26	30.0	73.3
52	34	10.5	0.26	30.0	74.7
53	34	10.6	0.26	29.9	72.9
54	35	10.0	0.25	29.9	72.6
55	34	10.1	0.26	29.9	72.9
56	35	9.8	0.26	29.9	73.7
57	34	10.1	0.25	29.8	72.2
58	34	9.8	0.25	29.9	70.7
59	34	9.8	0.25	29.9	72.1
60	33	10.1	0.25	29.8	72.4
61	34	9.9	0.26	29.9	73.4
62	34	9.6	0.26	29.8	72.9
63	35	10.0	0.26	29.8	74.3
64	34	10.1	0.26	29.8	73.5
65	34	9.9	0.26	29.8	72.9
66	35	9.5	0.25	29.7	70.7
67	34	10.3	0.26	29.8	73.4
68	35	9.2	0.25	29.8	70.9

Knik Arm Crossing - Boring# 06-01
OP: V Baker

140# Auto Hammer
Test date: 23-Sep-2006

BL#	FMX kips	VMX f/s	EMX k-ft	BPM **	ETR (%)
69	34	10.2	0.25	29.7	72.4
70	33	9.6	0.25	29.7	71.5
71	33	10.2	0.25	29.7	71.7
72	35	10.0	0.26	29.7	72.9
73	35	9.4	0.25	29.7	72.1
74	34	10.0	0.26	29.7	74.2
Average	34	10.0	0.26	30.2	73.0
Std. Dev.	0	0.4	0.00	0.4	1.3

Total number of blows analyzed: 73

Time Summary

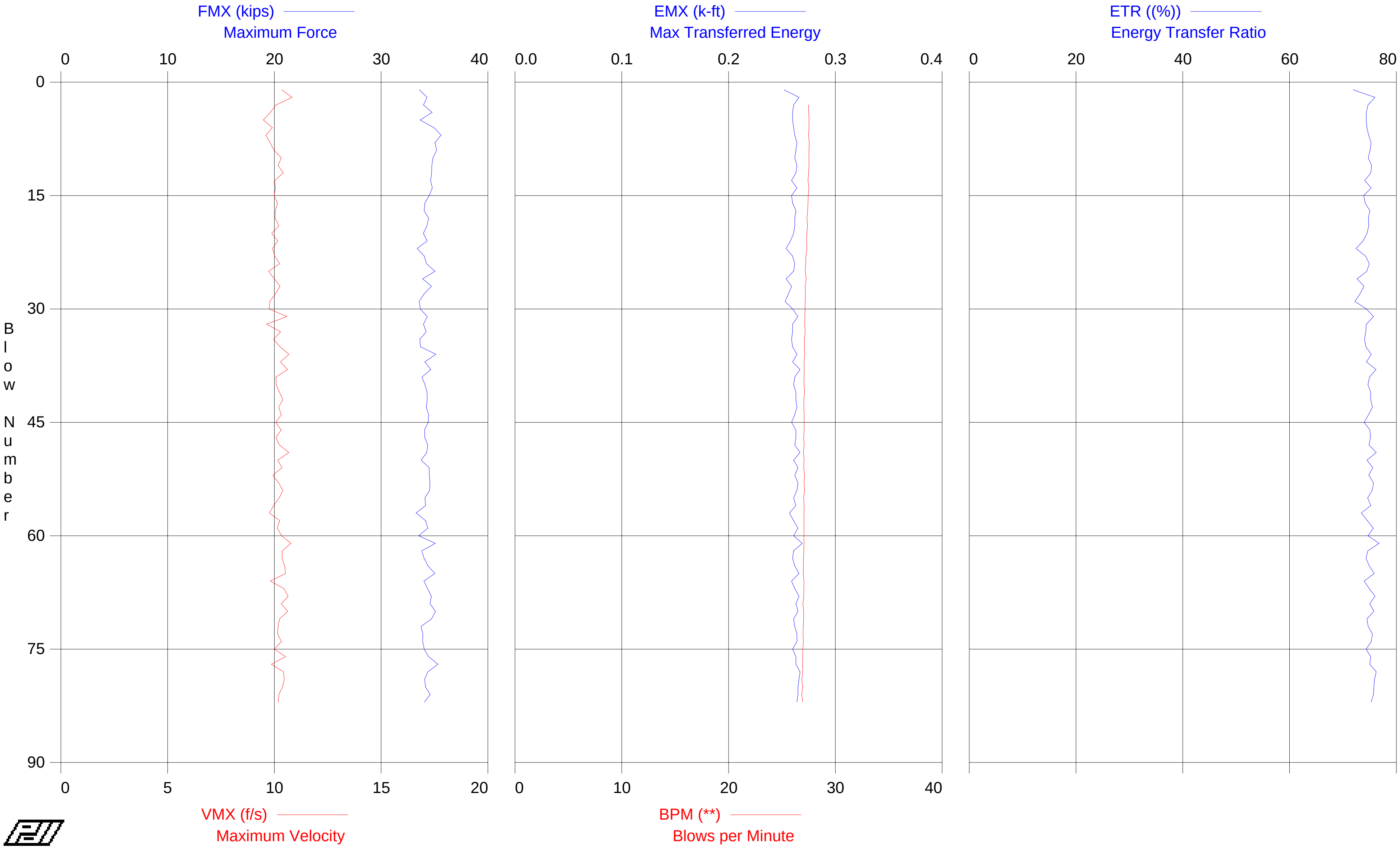
Drive 2 minutes 27 seconds 10:57:06 AM - 10:59:33 AM (9/23/2006) BN 2 - 74

Gregg Drilling & Testing - Case Method Results

PDIPLOT Ver. 2005.2 - Printed: 28-Sep-2006

Test date: 23-Sep-2006

Knik Arm Crossing - Boring# 06-01



Knik Arm Crossing - Boring# 06-01
OP: V Baker

140# Auto Hammer
Test date: 23-Sep-2006

AR: 1.43 in^2
LE: 174.00 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft3
EM: 30,000 ksi
JC: 0.35

FMX: Maximum Force
VMX: Maximum Velocity
EMX: Max Transferred Energy

BPM: Blows per Minute
ETR: Energy Transfer Ratio

BL#	FMX kips	VMX f/s	EMX k-ft	BPM **	ETR (%)
1	34	10.3	0.25	0.0	71.9
2	34	10.8	0.27	0.0	76.0
3	34	10.1	0.26	27.5	74.7
4	35	9.8	0.26	27.5	74.4
5	34	9.5	0.26	27.5	74.4
6	35	9.9	0.26	27.5	74.5
7	36	9.6	0.26	27.5	74.8
8	35	9.8	0.26	27.6	75.3
9	35	10.0	0.26	27.5	75.1
10	35	10.3	0.26	27.5	74.7
11	35	10.2	0.26	27.5	75.4
12	35	10.4	0.26	27.5	75.2
13	35	10.0	0.26	27.4	74.1
14	35	10.1	0.26	27.5	75.3
15	35	10.0	0.26	27.5	73.9
16	34	10.2	0.26	27.4	74.2
17	34	10.0	0.26	27.4	75.0
18	34	10.0	0.26	27.3	74.8
19	34	10.2	0.26	27.4	74.8
20	34	9.9	0.26	27.3	74.5
21	34	10.2	0.26	27.3	73.8
22	33	9.9	0.25	27.3	72.4
23	34	10.0	0.26	27.2	74.2
24	34	10.2	0.26	27.2	74.9
25	35	9.7	0.26	27.2	74.5
26	34	10.0	0.25	27.3	72.7
27	35	10.3	0.26	27.2	74.0
28	34	10.0	0.26	27.2	73.2
29	34	9.8	0.25	27.2	72.2
30	34	9.8	0.26	27.2	74.4
31	34	10.6	0.27	27.1	75.8
32	34	9.6	0.26	27.1	74.4
33	34	10.3	0.26	27.2	74.3
34	34	10.0	0.26	27.1	74.0
35	34	10.3	0.26	27.1	74.3
36	35	10.7	0.26	27.1	75.3
37	34	10.3	0.26	27.1	74.4
38	35	10.6	0.27	27.1	76.2
39	34	10.1	0.26	27.1	75.0
40	34	10.1	0.26	27.1	74.7
41	34	10.2	0.26	27.1	75.2
42	34	10.4	0.26	27.1	75.2
43	34	10.2	0.26	27.1	75.5
44	34	10.3	0.26	27.1	74.8
45	34	10.1	0.26	27.1	74.0
46	34	10.3	0.26	27.1	75.1
47	34	10.1	0.26	27.0	75.1
48	34	10.2	0.26	27.1	74.9
49	34	10.7	0.27	27.0	76.3
50	34	10.2	0.26	27.1	74.5
51	35	10.4	0.27	27.0	75.6
52	35	9.9	0.26	27.1	74.8
53	35	10.2	0.27	27.1	75.8
54	35	10.4	0.26	27.1	75.5
55	34	10.2	0.26	27.0	74.6
56	34	10.0	0.26	27.1	75.2
57	33	9.8	0.26	27.1	73.4
58	34	10.2	0.26	27.1	74.6
59	34	10.1	0.27	27.1	75.7
60	34	10.3	0.26	27.1	74.7
61	35	10.8	0.27	27.1	76.8
62	34	10.4	0.26	27.1	74.7
63	34	10.4	0.26	27.0	74.3
64	34	10.5	0.26	27.0	74.9
65	35	10.5	0.27	27.0	75.9
66	34	9.8	0.26	27.1	74.0
67	34	10.5	0.26	27.1	75.0

Knik Arm Crossing - Boring# 06-01
OP: V Baker

140# Auto Hammer
Test date: 23-Sep-2006

BL#	FMX kips	VMX f/s	EMX k-ft	BPM **	ETR (%)
68	35	10.6	0.27	27.0	76.0
69	35	10.3	0.26	27.0	75.0
70	35	10.6	0.27	27.0	75.8
71	35	10.2	0.26	27.0	74.5
72	34	10.2	0.26	27.0	74.7
73	34	10.1	0.26	27.0	75.5
74	34	10.3	0.26	27.0	75.3
75	34	10.0	0.26	27.0	74.3
76	34	10.5	0.26	26.9	75.2
77	35	9.9	0.26	26.9	75.0
78	34	10.4	0.27	26.9	76.2
79	34	10.5	0.27	26.9	75.9
80	34	10.4	0.27	26.9	75.8
81	35	10.2	0.27	26.8	75.7
82	34	10.2	0.26	27.0	75.3
Average	34	10.2	0.26	27.2	74.8
Std. Dev.	0	0.3	0.00	0.2	0.9

Total number of blows analyzed: 82

Time Summary

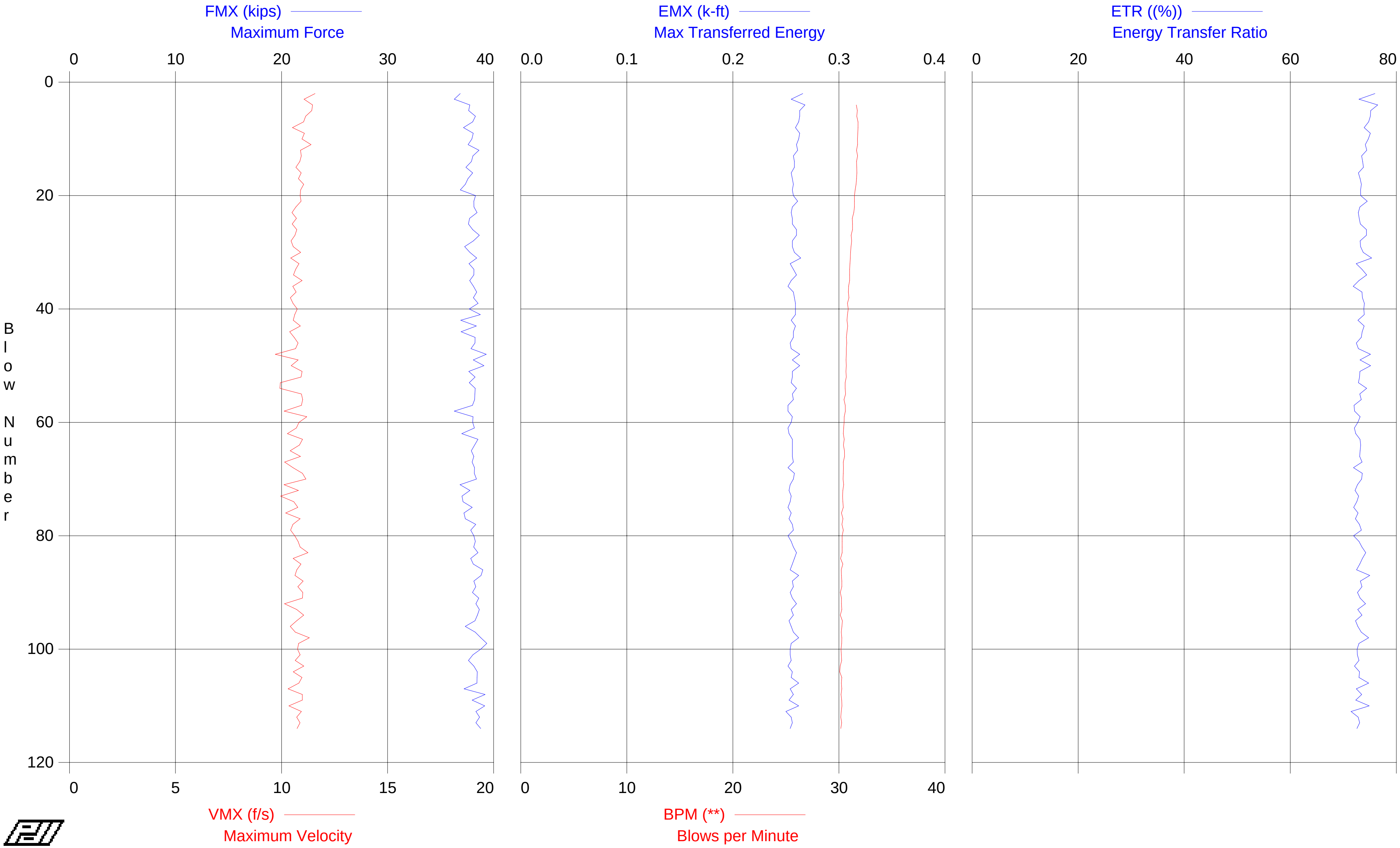
Drive 3 minutes 4 seconds 11:38:43 AM - 11:41:47 AM (9/23/2006) BN 1 - 82

Gregg Drilling & Testing - Case Method Results

PDIPLOT Ver. 2005.2 - Printed: 28-Sep-2006

Test date: 23-Sep-2006

Knik Arm Crossing - Boring# 06-01



Knik Arm Crossing - Boring# 06-01
OP: V Baker

140# Auto Hammer
Test date: 23-Sep-2006

AR: 1.43 in^2
LE: 179.00 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft3
EM: 30,000 ksi
JC: 0.35

FMX: Maximum Force
VMX: Maximum Velocity
EMX: Max Transferred Energy

BPM: Blows per Minute
ETR: Energy Transfer Ratio

BL#	FMX kips	VMX f/s	EMX k-ft	BPM **	ETR (%)
2	37	11.6	0.27	0.0	76.0
3	36	11.1	0.26	0.0	72.9
4	38	11.5	0.27	31.6	76.5
5	38	11.4	0.26	31.7	75.2
6	38	11.1	0.26	31.7	75.1
7	38	11.0	0.26	31.8	74.8
8	37	10.5	0.26	31.8	74.0
9	38	11.1	0.26	31.8	75.1
10	38	11.0	0.26	31.7	74.7
11	38	11.4	0.26	31.8	74.2
12	39	10.9	0.26	31.7	74.4
13	38	10.9	0.26	31.8	73.5
14	38	10.9	0.26	31.7	73.7
15	37	10.7	0.26	31.7	73.8
16	38	10.9	0.26	31.7	72.8
17	38	10.8	0.26	31.7	73.2
18	37	11.0	0.26	31.6	73.4
19	37	10.9	0.26	31.5	73.3
20	38	10.9	0.26	31.5	73.3
21	38	10.9	0.26	31.5	74.5
22	38	10.7	0.26	31.5	73.1
23	38	10.5	0.26	31.4	72.8
24	38	10.7	0.26	31.3	73.0
25	38	10.5	0.26	31.3	73.2
26	38	10.7	0.26	31.3	74.4
27	39	10.6	0.26	31.2	74.4
28	38	10.5	0.26	31.2	73.2
29	37	10.5	0.26	31.1	73.3
30	38	10.9	0.26	31.1	73.8
31	38	10.4	0.26	31.1	75.3
32	38	10.8	0.25	31.0	72.4
33	38	10.7	0.26	31.0	73.5
34	38	10.6	0.26	31.0	74.4
35	38	11.0	0.26	31.0	73.0
36	38	10.5	0.25	30.9	71.9
37	38	10.7	0.26	30.9	73.5
38	38	10.4	0.26	30.9	73.6
39	39	10.5	0.26	30.8	74.0
40	38	10.7	0.26	30.9	73.9
41	39	10.6	0.26	30.8	74.0
42	37	10.6	0.26	30.8	72.8
43	38	10.9	0.26	30.8	74.0
44	37	10.4	0.26	30.8	73.6
45	38	10.6	0.26	30.7	73.4
46	38	10.8	0.25	30.7	72.5
47	38	10.7	0.26	30.7	72.8
48	39	9.7	0.26	30.7	75.1
49	38	10.8	0.26	30.7	73.1
50	39	10.5	0.26	30.7	75.2
51	38	11.0	0.26	30.7	73.1
52	38	10.9	0.26	30.7	73.1
53	38	9.9	0.26	30.6	72.9
54	38	9.9	0.26	30.6	74.4
55	38	10.9	0.26	30.6	73.1
56	38	11.0	0.26	30.5	73.4
57	38	10.9	0.25	30.6	72.0
58	36	10.1	0.25	30.6	72.1
59	38	11.2	0.26	30.5	73.2
60	38	10.8	0.26	30.5	72.8
61	38	10.7	0.25	30.4	72.1
62	37	10.3	0.25	30.4	72.4
63	39	11.0	0.26	30.5	73.1
64	38	10.8	0.26	30.4	73.3
65	38	10.4	0.26	30.5	73.2
66	38	10.9	0.26	30.5	73.1
67	38	10.1	0.26	30.4	73.5
68	38	10.5	0.25	30.4	71.9

Knik Arm Crossing - Boring# 06-01
OP: V Baker
140# Auto Hammer
Test date: 23-Sep-2006

BL#	FMX kips	VMX f/s	EMX k-ft	BPM **	ETR (%)
69	38	11.0	0.26	30.4	73.6
70	38	11.2	0.26	30.4	73.5
71	37	10.1	0.25	30.4	72.7
72	38	10.8	0.25	30.4	72.2
73	37	10.0	0.26	30.3	72.9
74	37	10.6	0.25	30.4	72.6
75	38	10.8	0.25	30.4	71.9
76	37	10.2	0.26	30.2	72.8
77	37	10.9	0.25	30.4	72.3
78	38	10.5	0.26	30.3	73.0
79	38	10.4	0.26	30.4	73.4
80	38	10.6	0.25	30.3	71.9
81	38	10.8	0.26	30.3	73.0
82	38	10.9	0.26	30.3	73.5
83	39	11.2	0.26	30.3	74.2
84	38	10.5	0.26	30.2	73.6
85	38	10.9	0.26	30.4	73.1
86	39	10.7	0.25	30.2	72.5
87	39	10.6	0.26	30.2	75.0
88	38	11.0	0.26	30.3	73.2
89	38	10.8	0.26	30.3	73.5
90	38	11.0	0.25	30.1	72.7
91	39	11.0	0.26	30.2	73.2
92	38	10.1	0.26	30.2	74.2
93	39	10.7	0.26	30.3	72.7
94	38	11.0	0.26	30.1	73.5
95	38	10.7	0.25	30.3	72.3
96	37	10.4	0.26	30.3	72.7
97	38	10.7	0.26	30.2	73.4
98	39	11.3	0.26	30.3	74.8
99	39	10.8	0.26	30.3	73.0
100	39	10.8	0.25	30.2	72.6
101	38	10.9	0.25	30.2	72.7
102	38	10.6	0.26	30.3	72.9
103	38	11.1	0.25	30.1	72.1
104	38	10.6	0.26	30.1	73.1
105	38	11.0	0.26	30.3	73.0
106	38	10.8	0.26	30.2	74.8
107	37	10.3	0.25	30.3	72.5
108	39	11.0	0.26	30.2	73.5
109	38	11.0	0.25	30.3	72.4
110	39	10.3	0.26	30.3	74.9
111	38	10.9	0.25	30.2	71.5
112	39	10.7	0.26	30.2	72.8
113	38	10.9	0.26	30.3	73.1
114	39	10.7	0.25	30.2	72.6
Average	38	10.7	0.26	30.7	73.4
Std. Dev.	1	0.3	0.00	0.5	0.9

Total number of blows analyzed: 113

Time Summary

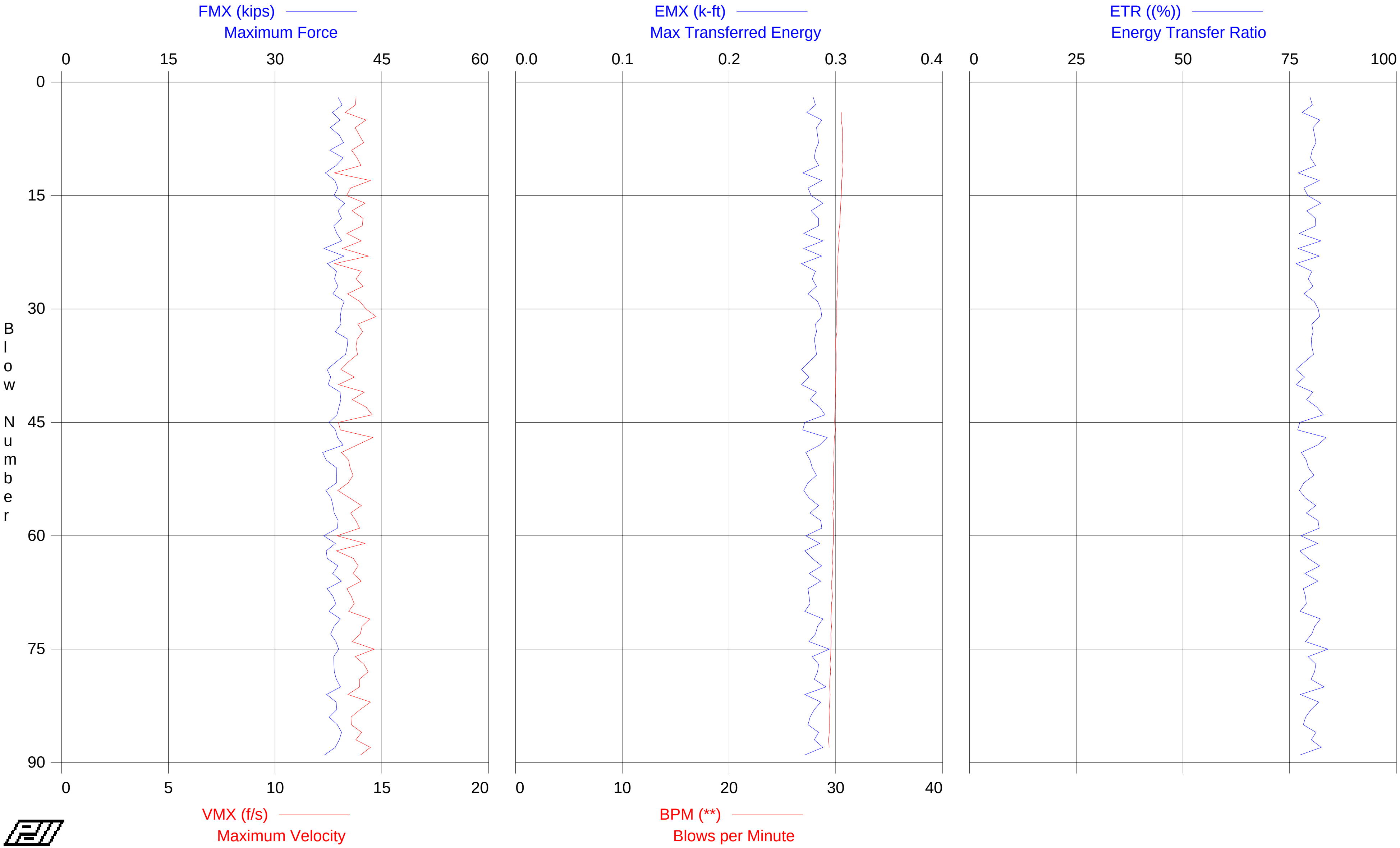
Drive 3 minutes 59 seconds 12:27:21 PM - 12:31:20 PM (9/23/2006) BN 2 - 114

Gregg Drilling & Testing - Case Method Results

PDIPLOT Ver. 2005.2 - Printed: 28-Sep-2006

Test date: 23-Sep-2006

Knik Arm Crossing - Boring# 06-01



Knik Arm Crossing - Boring# 06-01
OP: V Baker

140# Auto Hammer
Test date: 23-Sep-2006

AR: 1.43 in^2
LE: 184.00 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft3
EM: 30,000 ksi
JC: 0.35

FMX: Maximum Force
VMX: Maximum Velocity
EMX: Max Transferred Energy

BPM: Blows per Minute
ETR: Energy Transfer Ratio

BL#	FMX kips	VMX f/s	EMX k-ft	BPM **	ETR (%)
2	39	13.8	0.28	0.0	79.8
3	39	13.8	0.28	0.0	80.3
4	38	13.3	0.27	30.5	77.9
5	39	14.3	0.29	30.5	82.1
6	38	13.8	0.28	30.6	80.5
7	39	13.9	0.28	30.6	80.9
8	40	14.2	0.28	30.6	81.2
9	38	13.6	0.28	30.6	80.3
10	40	13.8	0.28	30.7	79.9
11	39	14.0	0.28	30.6	81.1
12	37	12.8	0.27	30.7	77.0
13	38	14.5	0.29	30.6	81.9
14	39	13.5	0.27	30.6	78.3
15	38	13.4	0.28	30.5	79.3
16	40	14.2	0.29	30.5	82.3
17	39	13.6	0.28	30.4	79.0
18	39	14.1	0.28	30.4	81.0
19	38	14.1	0.28	30.4	81.1
20	39	13.4	0.27	30.3	77.3
21	39	14.0	0.29	30.3	82.4
22	37	13.2	0.27	30.3	77.0
23	40	14.4	0.29	30.2	82.0
24	37	12.8	0.27	30.2	76.5
25	39	14.0	0.28	30.2	80.2
26	38	13.8	0.28	30.2	79.4
27	39	14.1	0.28	30.1	80.5
28	38	13.4	0.27	30.2	78.4
29	40	14.0	0.28	30.1	80.7
30	39	14.3	0.29	30.1	81.7
31	39	14.7	0.29	30.1	82.0
32	39	13.9	0.28	30.1	80.2
33	38	14.1	0.28	30.1	80.5
34	40	13.8	0.28	30.0	80.1
35	40	13.8	0.28	30.0	80.2
36	40	13.9	0.28	30.0	80.6
37	39	13.4	0.28	30.0	78.5
38	37	13.1	0.27	30.0	76.5
39	38	13.7	0.28	30.0	78.5
40	37	13.0	0.27	30.0	76.5
41	39	14.2	0.28	30.0	80.5
42	39	13.6	0.28	30.0	79.0
43	39	14.3	0.29	30.0	81.4
44	39	14.6	0.29	29.9	82.9
45	38	13.0	0.27	29.9	77.4
46	38	13.1	0.27	30.0	76.9
47	39	14.6	0.29	29.9	83.6
48	40	13.8	0.29	29.9	81.6
49	37	13.1	0.27	29.8	77.7
50	37	13.4	0.28	29.9	78.9
51	39	13.5	0.28	29.8	79.4
52	39	13.7	0.28	29.8	80.7
53	39	13.4	0.27	29.8	78.4
54	37	12.9	0.27	29.8	77.3
55	38	13.5	0.28	29.7	78.7
56	38	14.0	0.28	29.8	81.1
57	38	13.5	0.28	29.7	78.9
58	39	13.8	0.29	29.8	81.7
59	39	14.0	0.29	29.8	81.9
60	37	12.9	0.27	29.8	77.6
61	38	14.2	0.29	29.8	81.6
62	37	12.9	0.27	29.7	77.4
63	37	13.7	0.28	29.7	79.4
64	39	13.9	0.29	29.7	82.1
65	38	13.7	0.28	29.7	78.5
66	39	14.0	0.29	29.6	81.7
67	37	13.4	0.27	29.6	78.2
68	38	13.6	0.28	29.7	78.7

Knik Arm Crossing - Boring# 06-01
OP: V Baker

140# Auto Hammer
Test date: 23-Sep-2006

BL#	FMX kips	VMX f/s	EMX k-ft	BPM **	ETR (%)
69	39	13.7	0.28	29.6	78.9
70	38	13.4	0.27	29.6	77.5
71	39	14.4	0.29	29.5	82.2
72	38	14.1	0.28	29.6	80.9
73	38	14.0	0.28	29.5	80.2
74	39	13.6	0.28	29.6	78.7
75	39	14.7	0.29	29.5	84.0
76	38	13.7	0.28	29.5	79.3
77	38	14.2	0.28	29.5	81.1
78	38	14.4	0.28	29.5	80.8
79	39	14.0	0.28	29.5	80.0
80	39	14.0	0.29	29.4	83.1
81	37	13.4	0.27	29.5	77.5
82	39	14.5	0.29	29.4	81.9
83	39	14.0	0.28	29.4	80.0
84	38	13.6	0.28	29.4	78.8
85	39	13.6	0.27	29.4	78.2
86	39	14.1	0.28	29.4	81.2
87	39	13.8	0.28	29.3	80.1
88	38	14.5	0.29	29.4	82.4
89	37	14.0	0.27	0.0	77.4
Average	38	13.8	0.28	29.9	79.9
Std. Dev.	1	0.5	0.01	0.4	1.8

Total number of blows analyzed: 88

Time Summary

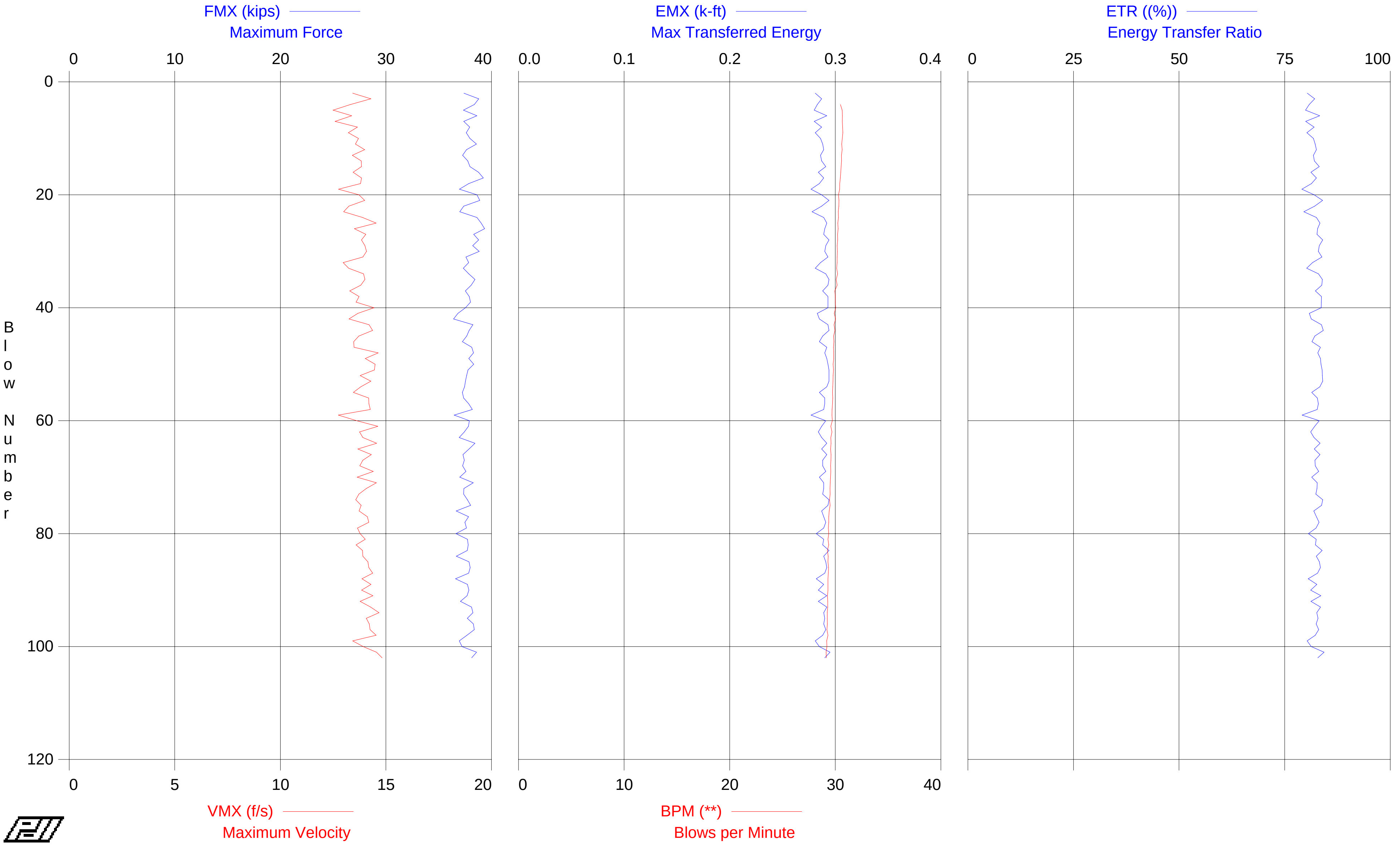
Drive 3 minutes 3 seconds 1:31:50 PM - 1:34:53 PM (9/23/2006) BN 2 - 89

Gregg Drilling & Testing - Case Method Results

PDIPLOT Ver. 2005.2 - Printed: 28-Sep-2006

Test date: 23-Sep-2006

Knik Arm Crossing - Boring# 06-01



Knik Arm Crossing - Boring# 06-01
OP: V Baker

140# Auto Hammer
Test date: 23-Sep-2006

AR: 1.43 in^2
LE: 189.00 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft3
EM: 30,000 ksi
JC: 0.35

FMX: Maximum Force
VMX: Maximum Velocity
EMX: Max Transferred Energy

BPM: Blows per Minute
ETR: Energy Transfer Ratio

BL#	FMX kips	VMX f/s	EMX k-ft	BPM **	ETR (%)
2	37	13.4	0.28	0.0	80.4
3	39	14.3	0.29	0.0	82.1
4	38	13.3	0.28	30.5	80.8
5	37	12.5	0.28	30.6	80.0
6	39	13.4	0.29	30.7	83.3
7	37	12.6	0.28	30.7	80.0
8	38	13.7	0.29	30.7	82.0
9	38	13.2	0.28	30.7	80.3
10	38	13.7	0.29	30.7	81.8
11	39	13.6	0.29	30.6	82.2
12	38	14.0	0.29	30.6	82.5
13	37	13.4	0.29	30.6	81.8
14	38	13.8	0.29	30.6	82.0
15	38	13.8	0.29	30.6	83.2
16	39	13.4	0.28	30.5	81.2
17	39	13.8	0.29	30.5	82.5
18	38	13.8	0.29	30.4	81.4
19	37	12.8	0.28	30.4	79.1
20	39	13.7	0.29	30.3	82.0
21	39	14.0	0.29	30.3	84.0
22	37	13.2	0.29	30.3	82.1
23	37	13.0	0.28	30.3	79.5
24	39	13.9	0.29	30.3	82.5
25	39	14.5	0.29	30.2	83.4
26	39	13.5	0.29	30.3	82.8
27	38	14.1	0.29	30.2	82.7
28	39	13.8	0.29	30.2	84.0
29	38	14.0	0.29	30.2	83.2
30	39	14.1	0.29	30.2	83.0
31	38	13.9	0.29	30.2	83.8
32	38	13.0	0.29	30.2	81.6
33	37	13.2	0.28	30.1	80.2
34	38	13.9	0.29	30.2	83.0
35	38	14.0	0.29	30.1	83.9
36	38	13.8	0.29	30.2	83.8
37	38	13.3	0.29	30.0	82.3
38	38	13.7	0.29	30.0	83.7
39	38	13.6	0.29	30.0	83.7
40	38	14.4	0.29	30.0	83.7
41	37	13.7	0.28	29.9	80.8
42	36	13.2	0.29	30.0	81.3
43	38	14.2	0.29	29.9	83.7
44	38	14.4	0.29	30.0	84.1
45	38	13.7	0.29	29.8	82.1
46	37	13.5	0.29	29.9	81.5
47	38	13.5	0.29	29.8	83.5
48	38	14.6	0.29	29.9	82.9
49	38	14.0	0.29	29.9	83.5
50	38	14.5	0.29	29.8	83.6
51	38	14.5	0.29	29.8	83.9
52	38	13.8	0.29	29.8	83.9
53	38	14.3	0.29	29.8	84.0
54	37	13.8	0.29	29.8	83.3
55	37	13.5	0.29	29.7	81.4
56	37	14.2	0.29	29.8	82.7
57	38	14.2	0.29	29.7	83.0
58	38	14.3	0.29	29.7	82.7
59	36	12.8	0.28	29.7	79.1
60	38	13.6	0.29	29.7	83.2
61	38	14.6	0.29	29.6	82.1
62	37	13.7	0.28	29.7	81.1
63	37	13.9	0.29	29.6	82.0
64	38	14.6	0.29	29.6	83.4
65	38	13.7	0.29	29.6	82.0
66	37	14.3	0.29	29.6	83.4
67	37	13.9	0.29	29.6	82.2
68	37	13.8	0.29	29.6	82.3

Knik Arm Crossing - Boring# 06-01
OP: V Baker

140# Auto Hammer
Test date: 23-Sep-2006

BL#	FMX kips	VMX f/s	EMX k-ft	BPM **	ETR (%)
69	38	14.4	0.29	29.6	83.1
70	37	13.6	0.29	29.5	81.4
71	38	14.6	0.29	29.5	82.7
72	37	14.1	0.29	29.5	82.7
73	37	13.7	0.29	29.5	82.4
74	38	13.6	0.29	29.5	84.0
75	38	13.8	0.29	29.5	83.7
76	37	13.7	0.29	29.4	81.9
77	38	14.1	0.29	29.4	82.5
78	37	14.2	0.29	29.4	83.1
79	38	13.7	0.29	29.3	82.4
80	37	13.8	0.28	29.4	80.6
81	38	14.0	0.29	29.3	82.5
82	38	13.6	0.29	29.4	82.3
83	38	13.9	0.29	29.3	83.9
84	37	13.9	0.29	29.3	82.5
85	38	14.1	0.29	29.3	83.2
86	38	14.2	0.29	29.4	83.5
87	38	14.4	0.29	29.3	82.8
88	37	13.9	0.28	29.3	80.6
89	38	14.3	0.29	29.3	82.6
90	38	13.8	0.28	29.3	81.1
91	38	14.4	0.29	29.3	83.6
92	37	13.8	0.28	29.3	81.2
93	38	14.3	0.29	29.3	83.5
94	38	14.7	0.29	29.2	82.6
95	38	14.1	0.29	29.2	82.9
96	38	14.2	0.29	29.3	82.5
97	38	14.2	0.29	29.2	83.1
98	38	14.5	0.29	29.3	82.2
99	37	13.4	0.28	29.2	80.3
100	37	13.9	0.29	29.2	81.3
101	39	14.6	0.30	29.1	84.3
102	38	14.8	0.29	29.2	82.8
Average	38	13.9	0.29	29.8	82.4
Std. Dev.	1	0.5	0.00	0.5	1.2

Total number of blows analyzed: 101

Time Summary

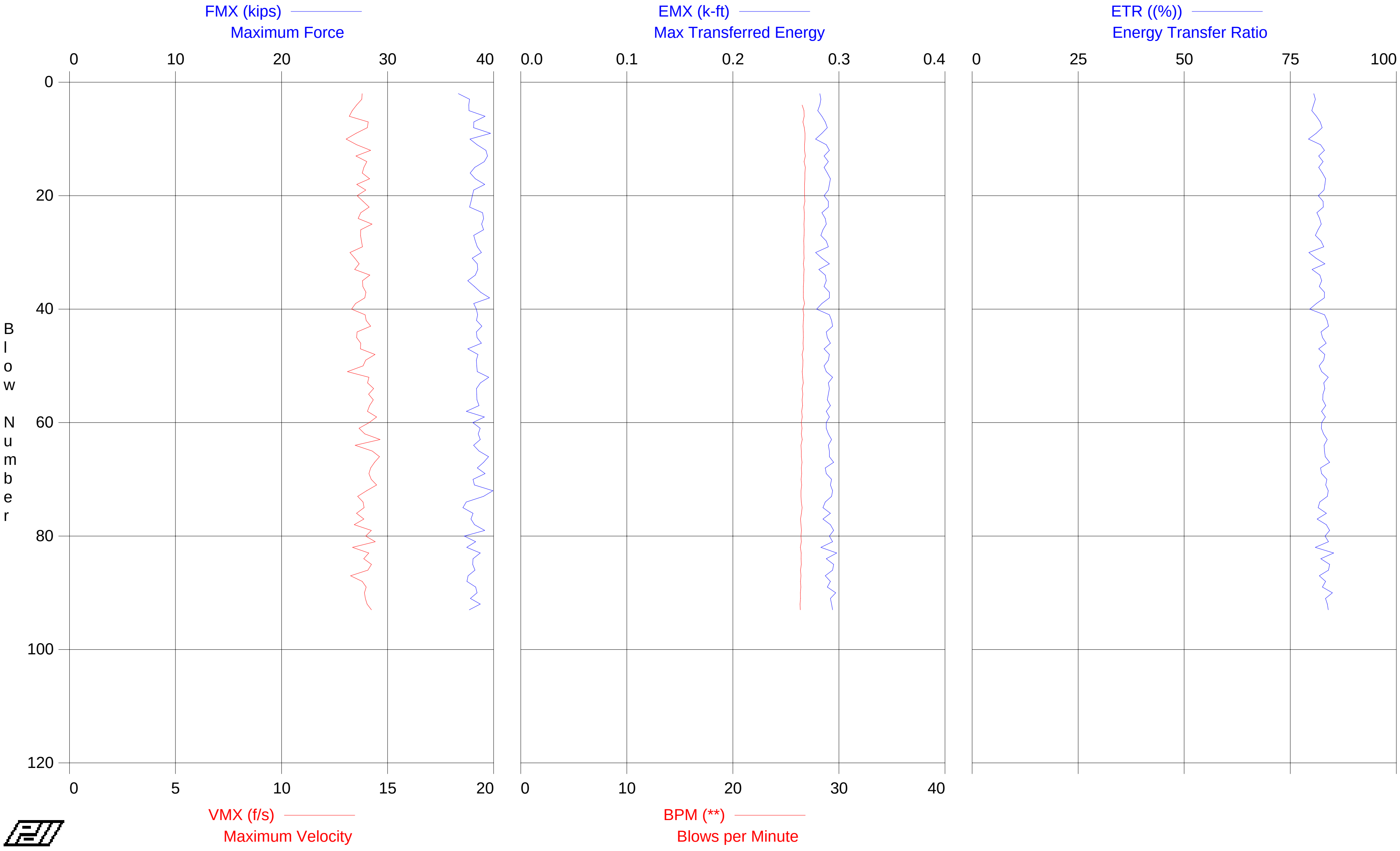
Drive 3 minutes 25 seconds 2:25:53 PM - 2:29:18 PM (9/23/2006) BN 2 - 102

Gregg Drilling & Testing - Case Method Results

PDIPLOT Ver. 2005.2 - Printed: 28-Sep-2006

Test date: 23-Sep-2006

Knik Arm Crossing - Boring# 06-01



Knik Arm Crossing - Boring# 06-01
OP: V Baker

140# Auto Hammer
Test date: 23-Sep-2006

AR: 1.43 in^2
LE: 194.00 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft3
EM: 30,000 ksi
JC: 0.35

FMX: Maximum Force
VMX: Maximum Velocity
EMX: Max Transferred Energy

BPM: Blows per Minute
ETR: Energy Transfer Ratio

BL#	FMX kips	VMX f/s	EMX k-ft	BPM **	ETR (%)
2	37	13.8	0.28	0.0	80.5
3	38	13.8	0.28	0.0	80.9
4	38	13.5	0.28	26.5	80.5
5	38	13.3	0.28	26.7	80.1
6	39	13.2	0.28	26.7	81.2
7	38	14.1	0.29	26.6	82.1
8	38	14.0	0.29	26.7	82.5
9	40	13.5	0.28	26.8	81.1
10	38	13.0	0.28	26.8	79.3
11	38	13.5	0.29	26.8	82.1
12	39	14.2	0.29	26.8	83.1
13	39	13.5	0.29	26.8	81.7
14	39	14.0	0.29	26.7	82.7
15	38	13.9	0.29	26.8	81.7
16	38	13.8	0.29	26.8	82.6
17	38	14.2	0.29	26.8	83.3
18	39	13.5	0.29	26.8	83.2
19	38	14.0	0.29	26.8	83.0
20	38	13.6	0.29	26.8	81.6
21	38	13.8	0.29	26.8	82.7
22	38	14.1	0.29	26.7	82.8
23	39	13.7	0.28	26.7	81.3
24	39	13.6	0.29	26.7	81.9
25	39	14.3	0.29	26.7	82.3
26	39	13.7	0.29	26.7	81.5
27	38	13.7	0.28	26.7	80.9
28	38	13.8	0.29	26.7	82.3
29	38	13.8	0.29	26.7	82.9
30	39	13.2	0.28	26.7	79.4
31	38	13.4	0.28	26.7	81.1
32	38	13.7	0.29	26.7	83.2
33	38	13.4	0.28	26.7	80.1
34	38	14.2	0.29	26.7	82.0
35	38	13.8	0.29	26.7	82.4
36	38	13.8	0.29	26.6	81.8
37	39	14.0	0.29	26.7	83.1
38	40	13.9	0.29	26.6	83.0
39	38	13.5	0.28	26.8	81.2
40	38	13.3	0.28	26.6	79.6
41	38	13.9	0.29	26.7	83.1
42	38	14.0	0.29	26.6	83.7
43	39	14.2	0.29	26.6	84.0
44	38	13.6	0.29	26.6	82.3
45	38	13.5	0.29	26.6	82.6
46	39	13.7	0.29	26.6	83.5
47	38	13.7	0.29	26.6	81.7
48	39	14.4	0.29	26.5	83.1
49	38	14.0	0.29	26.6	82.9
50	38	13.8	0.29	26.6	81.8
51	38	13.1	0.29	26.5	82.4
52	40	14.1	0.29	26.6	84.0
53	39	14.1	0.29	26.6	82.9
54	38	14.3	0.29	26.5	83.1
55	38	14.1	0.29	26.6	82.7
56	38	14.3	0.29	26.5	82.7
57	39	14.1	0.29	26.6	83.4
58	37	14.1	0.29	26.5	82.4
59	39	14.5	0.29	26.5	83.3
60	38	14.1	0.29	26.5	82.4
61	39	13.7	0.29	26.5	82.3
62	39	13.9	0.29	26.5	82.9
63	39	14.6	0.29	26.5	83.7
64	38	13.5	0.29	26.4	83.0
65	39	14.3	0.29	26.5	83.0
66	40	14.6	0.29	26.5	83.2
67	39	14.4	0.30	26.5	84.3
68	38	14.2	0.29	26.5	82.1

Knik Arm Crossing - Boring# 06-01
OP: V Baker

140# Auto Hammer
Test date: 23-Sep-2006

BL#	FMX kips	VMX f/s	EMX k-ft	BPM **	ETR (%)
69	39	14.1	0.29	26.5	82.4
70	38	14.2	0.29	26.4	83.6
71	38	14.5	0.29	26.5	83.4
72	40	14.0	0.29	26.4	84.0
73	39	13.6	0.29	26.4	83.7
74	37	13.8	0.29	26.5	81.9
75	37	13.9	0.29	26.5	81.6
76	38	13.5	0.29	26.5	83.5
77	38	13.9	0.29	26.4	81.3
78	38	13.4	0.29	26.4	83.5
79	39	14.2	0.30	26.5	84.3
80	37	14.0	0.29	26.4	83.2
81	38	14.4	0.29	26.5	84.0
82	37	13.3	0.28	26.4	80.9
83	39	14.1	0.30	26.4	85.2
84	38	13.9	0.29	26.4	82.2
85	38	14.2	0.30	26.5	84.3
86	38	14.1	0.29	26.4	84.0
87	38	13.3	0.29	26.4	81.9
88	37	13.8	0.29	26.4	83.3
89	38	14.0	0.29	26.4	82.6
90	38	13.9	0.30	26.4	84.9
91	38	14.0	0.29	26.4	83.3
92	39	14.0	0.29	26.3	83.7
93	38	14.2	0.29	26.4	83.9
Average	38	13.9	0.29	26.6	82.5
Std. Dev.	1	0.3	0.00	0.1	1.2

Total number of blows analyzed: 92

Time Summary

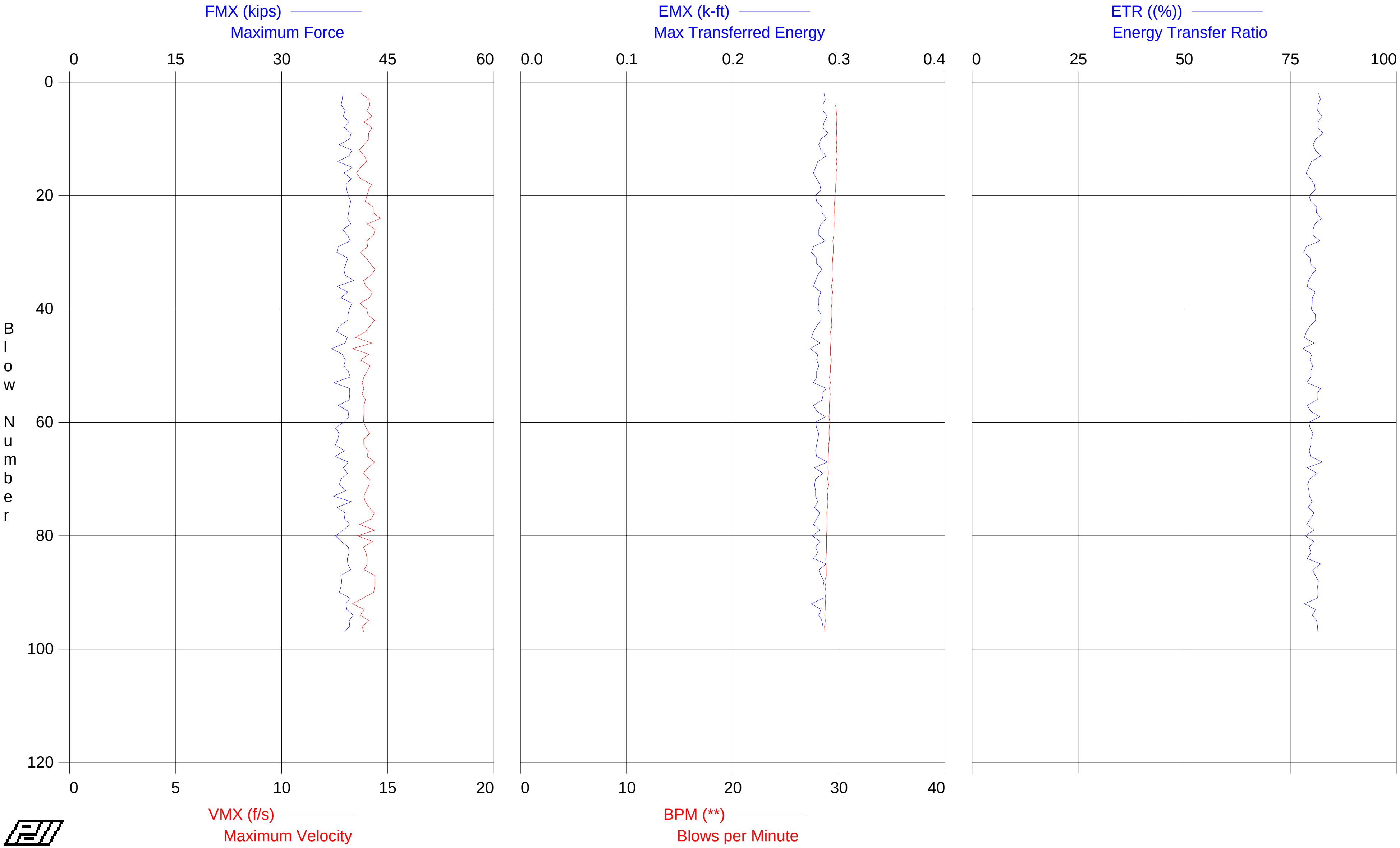
Drive	3 minutes 30 seconds	3:48:07 PM - 3:51:37 PM (9/23/2006) BN 2 - 93

Gregg Drilling & Testing - Case Method Results

PDIPLOT Ver. 2005.2 - Printed: 28-Sep-2006

Test date: 23-Sep-2006

Knik Arm Crossing - Boring# 06-01



Knik Arm Crossing - Boring# 06-01
OP: V Baker

140# Auto Hammer
Test date: 23-Sep-2006

AR: 1.43 in^2
LE: 199.00 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft3
EM: 30,000 ksi
JC: 0.35

FMX: Maximum Force
VMX: Maximum Velocity
EMX: Max Transferred Energy

BPM: Blows per Minute
ETR: Energy Transfer Ratio

BL#	FMX kips	VMX f/s	EMX k-ft	BPM **	ETR (%)
2	39	13.7	0.29	0.0	81.7
3	39	14.1	0.29	0.0	82.1
4	38	14.2	0.29	29.7	81.5
5	39	14.0	0.29	29.7	81.5
6	39	14.3	0.29	29.8	82.5
7	40	13.9	0.29	29.8	81.6
8	39	14.3	0.29	29.8	81.5
9	40	14.1	0.29	29.8	82.8
10	40	14.1	0.28	29.7	81.0
11	38	13.9	0.28	29.8	80.4
12	40	13.7	0.28	29.8	80.9
13	40	13.9	0.29	29.9	82.2
14	38	14.0	0.28	29.7	80.0
15	40	13.7	0.28	29.8	79.4
16	39	13.5	0.28	29.7	78.7
17	40	13.7	0.28	29.7	79.8
18	39	14.2	0.28	29.7	80.7
19	39	14.1	0.28	29.7	80.9
20	39	14.0	0.28	29.6	79.4
21	40	13.9	0.28	29.6	79.8
22	40	14.3	0.28	29.5	81.3
23	39	14.3	0.28	29.6	81.1
24	39	14.7	0.29	29.5	82.4
25	40	14.0	0.28	29.5	80.8
26	39	14.4	0.28	29.5	80.4
27	39	14.3	0.28	29.5	80.4
28	40	14.0	0.29	29.4	82.0
29	38	14.1	0.28	29.5	78.8
30	38	13.7	0.27	29.5	78.2
31	39	14.0	0.28	29.4	79.8
32	39	14.2	0.28	29.4	79.6
33	39	14.4	0.28	29.4	81.1
34	39	14.2	0.28	29.4	80.0
35	40	13.9	0.28	29.4	79.3
36	38	14.0	0.28	29.3	79.0
37	39	14.3	0.28	29.4	80.9
38	38	14.2	0.28	29.3	80.2
39	40	13.7	0.28	29.3	80.2
40	40	14.0	0.28	29.3	79.9
41	39	14.1	0.28	29.3	80.9
42	39	14.4	0.28	29.3	81.0
43	38	14.2	0.28	29.3	79.6
44	38	14.0	0.28	29.2	78.8
45	39	13.5	0.27	29.3	78.3
46	39	14.3	0.28	29.2	80.6
47	37	13.3	0.27	29.2	78.0
48	39	14.1	0.28	29.2	80.1
49	39	13.7	0.28	29.3	79.6
50	39	14.2	0.28	29.2	80.3
51	39	14.0	0.28	29.2	79.8
52	40	13.9	0.28	29.1	79.8
53	37	13.8	0.28	29.2	78.9
54	40	13.9	0.29	29.1	82.2
55	40	13.8	0.28	29.2	81.3
56	40	14.0	0.29	29.1	81.4
57	38	13.9	0.28	29.1	79.0
58	39	13.9	0.28	29.1	79.8
59	40	13.9	0.29	29.1	81.9
60	39	13.9	0.28	29.1	79.4
61	38	14.0	0.28	29.1	79.7
62	38	14.2	0.28	29.1	80.3
63	38	13.9	0.28	29.1	79.9
64	38	13.9	0.28	29.0	79.8
65	39	14.1	0.28	29.0	79.5
66	38	14.0	0.28	29.0	79.8
67	39	14.4	0.29	29.0	82.6
68	39	14.1	0.28	29.0	79.0

Knik Arm Crossing - Boring# 06-01
OP: V Baker

140# Auto Hammer
Test date: 23-Sep-2006

BL#	FMX kips	VMX f/s	EMX k-ft	BPM **	ETR (%)
69	39	13.8	0.29	29.0	81.4
70	38	14.1	0.28	28.9	79.5
71	38	14.1	0.28	29.0	79.1
72	39	14.0	0.28	28.9	79.4
73	37	13.9	0.28	28.9	79.5
74	40	13.9	0.28	28.9	80.1
75	38	14.1	0.28	28.9	79.2
76	39	14.4	0.28	28.8	80.6
77	39	14.2	0.28	28.9	79.7
78	40	13.7	0.28	28.9	78.8
79	39	14.4	0.28	28.9	80.6
80	38	13.6	0.28	28.8	78.5
81	38	14.3	0.28	28.8	80.5
82	39	13.9	0.28	28.8	79.4
83	40	14.0	0.28	28.8	79.9
84	39	14.0	0.28	28.7	79.0
85	39	14.0	0.29	28.8	82.2
86	40	13.9	0.28	28.8	80.2
87	38	14.4	0.28	28.8	80.9
88	39	14.4	0.29	28.7	81.6
89	38	14.4	0.29	28.8	81.4
90	38	14.3	0.29	28.7	81.5
91	40	13.8	0.29	28.7	81.4
92	39	13.3	0.27	28.7	78.3
93	39	13.9	0.28	28.7	81.0
94	40	13.7	0.28	28.7	80.2
95	40	14.1	0.28	28.7	81.2
96	40	13.8	0.29	28.6	81.4
97	39	13.9	0.29	28.7	81.3
Average	39	14.0	0.28	29.2	80.3
Std. Dev.	1	0.2	0.00	0.4	1.1

Total number of blows analyzed: 96

Time Summary

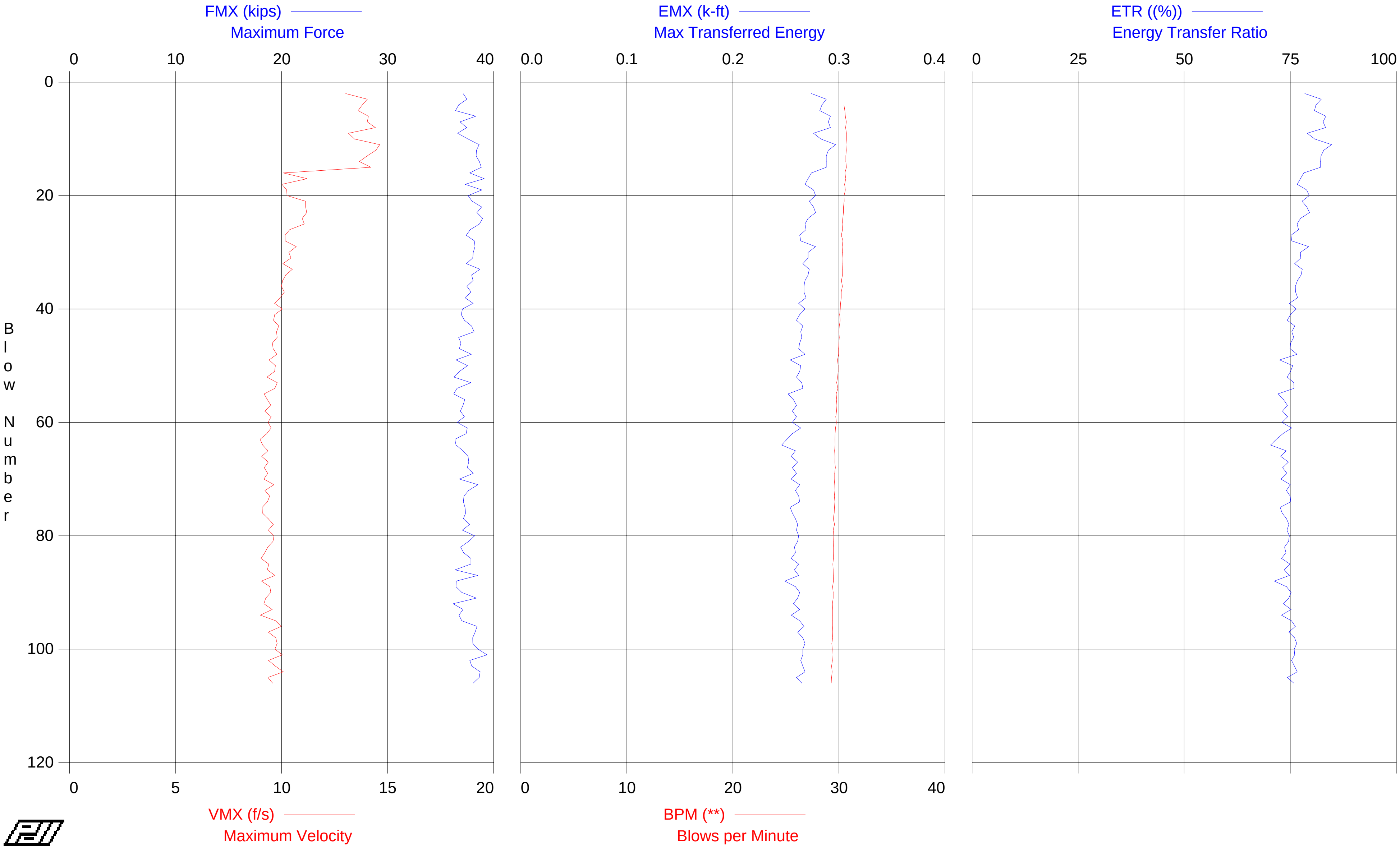
Drive 3 minutes 17 seconds 4:36:46 PM - 4:40:03 PM (9/23/2006) BN 2 - 97

Gregg Drilling & Testing - Case Method Results

PDIPLOT Ver. 2005.2 - Printed: 28-Sep-2006

Test date: 23-Sep-2006

Knik Arm Crossing - Boring# 06-01



Gregg Drilling & Testing
Case Method Results
PDIPLOT Ver. 2005.2 - Printed: 28-Sep-2006

Knik Arm Crossing - Boring# 06-01
OP: V Baker
140# Auto Hammer
Test date: 23-Sep-2006

AR: 1.43 in^2
LE: 204.00 ft
WS: 16,807.9 f/s
SP: 0.492 k/ft3
EM: 30,000 ksi
JC: 0.35

FMX: Maximum Force
VMX: Maximum Velocity
EMX: Max Transferred Energy
BPM: Blows per Minute
ETR: Energy Transfer Ratio

BL#	FMX kips	VMX f/s	EMX k-ft	BPM **	ETR (%)
2	37	13.0	0.27	0.0	78.4
3	37	14.0	0.29	0.0	82.3
4	37	13.8	0.28	30.5	81.1
5	36	13.6	0.28	30.6	80.7
6	38	14.1	0.29	30.6	83.4
7	37	14.0	0.29	30.7	82.7
8	37	14.4	0.29	30.6	83.3
9	37	13.2	0.28	30.7	79.0
10	38	13.4	0.28	30.7	80.8
11	39	14.6	0.30	30.7	84.7
12	38	14.4	0.29	30.7	82.9
13	38	14.0	0.29	30.6	82.2
14	39	13.7	0.29	30.6	82.2
15	39	14.2	0.29	30.7	82.1
16	38	10.1	0.27	30.6	78.2
17	39	11.2	0.27	30.6	77.4
18	37	10.0	0.27	30.5	76.6
19	39	10.2	0.28	30.6	78.9
20	38	10.3	0.28	30.5	79.5
21	38	11.1	0.27	30.5	77.8
22	39	11.1	0.28	30.4	78.9
23	38	11.2	0.28	30.4	79.6
24	39	11.0	0.27	30.4	77.4
25	39	11.1	0.27	30.3	76.6
26	38	10.4	0.27	30.3	76.9
27	37	10.2	0.26	30.2	75.2
28	38	10.2	0.26	30.4	75.4
29	38	10.7	0.28	30.3	79.4
30	38	10.3	0.27	30.3	77.4
31	38	10.4	0.27	30.4	77.5
32	37	10.1	0.27	30.4	76.0
33	39	10.5	0.27	30.3	77.8
34	38	10.2	0.27	30.3	77.6
35	38	10.1	0.27	30.2	76.7
36	37	10.0	0.27	30.3	76.2
37	38	10.1	0.27	30.2	76.3
38	37	9.9	0.27	30.2	76.7
39	38	9.7	0.26	30.2	74.8
40	37	10.0	0.27	30.1	76.4
41	37	9.7	0.26	30.1	75.1
42	37	9.6	0.26	30.1	74.3
43	38	9.9	0.27	30.0	76.1
44	38	9.8	0.26	30.0	75.4
45	37	9.8	0.27	30.0	75.8
46	37	9.6	0.26	30.0	75.1
47	37	9.6	0.26	30.0	75.0
48	38	9.8	0.27	30.0	76.6
49	36	9.4	0.25	29.9	72.5
50	38	9.7	0.26	29.9	75.6
51	37	9.7	0.26	29.9	75.1
52	36	9.3	0.26	29.9	74.3
53	38	9.8	0.27	29.8	75.9
54	37	9.7	0.27	29.9	75.9
55	36	9.2	0.25	29.7	72.0
56	37	9.3	0.26	29.8	73.4
57	37	9.5	0.26	29.7	74.3
58	37	9.2	0.26	29.8	73.2
59	37	9.5	0.26	29.7	74.4
60	37	9.4	0.26	29.8	73.1
61	38	9.5	0.26	29.7	75.3
62	37	9.3	0.26	29.6	73.3
63	36	9.0	0.25	29.6	71.7
64	36	9.1	0.25	29.6	70.4
65	37	9.4	0.26	29.6	74.0
66	38	9.1	0.26	29.6	72.8
67	38	9.4	0.26	29.6	74.6
68	38	9.2	0.26	29.7	73.2

Knik Arm Crossing - Boring# 06-01
OP: V Baker

140# Auto Hammer
Test date: 23-Sep-2006

BL#	FMX kips	VMX f/s	EMX k-ft	BPM **	ETR (%)
69	38	9.3	0.26	29.6	74.2
70	37	9.2	0.26	29.6	72.8
71	39	9.6	0.26	29.6	75.0
72	38	9.2	0.26	29.5	74.1
73	37	9.4	0.26	29.6	75.0
74	37	9.3	0.26	29.5	75.1
75	37	9.1	0.25	29.6	72.6
76	37	9.1	0.26	29.6	73.1
77	37	9.4	0.26	29.5	74.1
78	38	9.6	0.26	29.6	74.7
79	37	9.4	0.26	29.5	74.2
80	38	9.6	0.26	29.5	74.8
81	38	9.6	0.26	29.5	74.6
82	37	9.4	0.26	29.5	73.6
83	37	9.2	0.26	29.5	74.0
84	38	9.0	0.26	29.5	72.9
85	38	9.4	0.26	29.4	74.9
86	36	9.3	0.26	29.5	73.6
87	38	9.7	0.26	29.5	74.8
88	36	9.1	0.25	29.5	71.2
89	36	9.4	0.26	29.4	74.1
90	37	9.5	0.26	29.5	75.2
91	38	9.3	0.26	29.5	74.7
92	36	9.2	0.26	29.4	73.4
93	37	9.6	0.26	29.4	75.2
94	37	9.0	0.26	29.4	72.9
95	37	9.7	0.26	29.4	75.3
96	38	10.0	0.27	29.4	76.2
97	38	9.4	0.26	29.4	74.6
98	38	9.7	0.27	29.4	76.0
99	38	9.8	0.27	29.3	76.5
100	39	9.7	0.27	29.4	75.9
101	39	10.0	0.27	29.3	76.1
102	38	9.4	0.26	29.4	75.3
103	38	9.7	0.27	29.3	76.0
104	39	10.1	0.27	29.4	76.6
105	39	9.4	0.26	29.3	74.3
106	38	9.6	0.27	29.3	75.8
Average	38	10.3	0.27	29.9	76.1
Std. Dev.	1	1.5	0.01	0.5	2.9

Total number of blows analyzed: 105

Time Summary

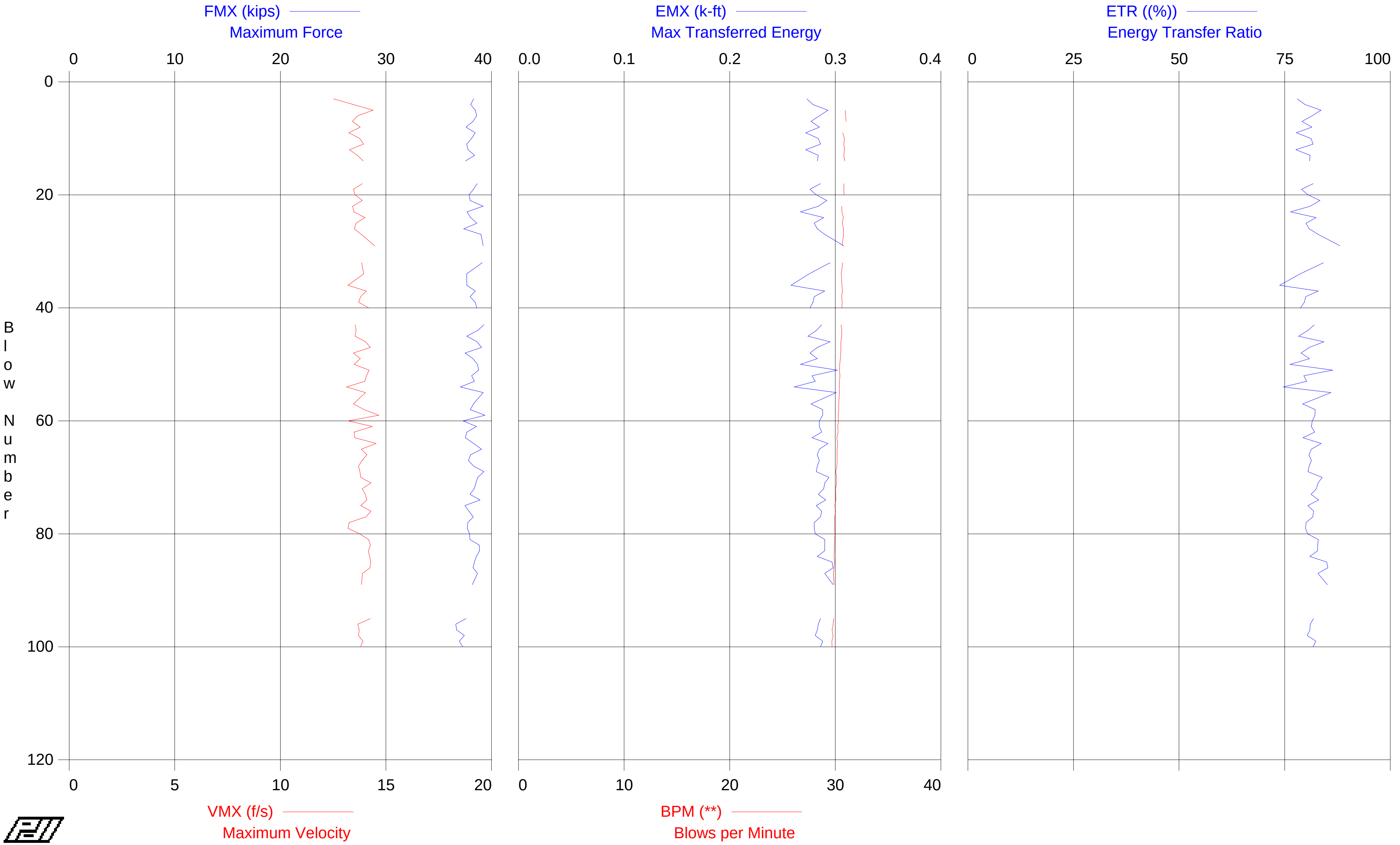
Drive 6 minutes 23 seconds 5:56:53 PM - 6:03:16 PM (9/23/2006) BN 2 - 106

Gregg Drilling & Testing - Case Method Results

PDIPLOT Ver. 2005.2 - Printed: 28-Sep-2006

Test date: 23-Sep-2006

Knik Arm Crossing - Boring# 06-01



Gregg Drilling & Testing
Case Method Results

PDIPLOT Ver. 2005.2 - Printed: 28-Sep-2006

Knik Arm Crossing - Boring# 06-01
OP: V Baker

140# Auto Hammer
Test date: 23-Sep-2006

AR: 1.43 in^2
LE: 209.00 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft3
EM: 30,000 ksi
JC: 0.35

FMX: Maximum Force
VMX: Maximum Velocity
EMX: Max Transferred Energy

BPM: Blows per Minute
ETR: Energy Transfer Ratio

BL#	FMX kips	VMX f/s	EMX k-ft	BPM **	ETR (%)
3	38	12.5	0.27	0.0	78.0
4	38	13.5	0.28	0.0	79.8
5	38	14.4	0.29	30.9	83.6
6	39	13.7	0.29	31.0	81.5
7	38	13.4	0.28	31.0	79.1
8	38	13.8	0.29	0.0	81.5
9	38	13.2	0.27	30.7	77.8
10	38	13.8	0.28	30.9	81.3
11	38	13.9	0.29	30.8	81.7
12	38	13.3	0.27	30.9	77.7
13	38	13.7	0.28	30.8	81.0
14	38	13.9	0.28	30.9	80.9
18	39	13.9	0.29	30.8	81.8
19	38	13.5	0.28	30.8	79.0
20	38	13.5	0.28	30.8	80.5
21	38	13.9	0.29	0.0	83.4
22	39	13.4	0.28	30.6	81.0
23	38	13.5	0.27	30.6	76.4
24	38	14.0	0.29	30.8	82.4
25	39	13.6	0.28	30.7	80.0
26	37	13.5	0.28	30.8	80.8
27	39	13.8	0.29	30.8	83.0
29	39	14.5	0.31	30.6	88.1
32	39	13.8	0.30	30.7	84.2
34	38	13.9	0.28	30.6	78.6
36	38	13.2	0.26	30.6	73.8
37	38	14.1	0.29	30.7	83.0
38	38	13.8	0.28	30.6	80.0
39	38	13.7	0.28	30.6	79.7
40	39	14.2	0.28	30.6	78.8
43	39	13.5	0.29	30.6	82.0
44	39	13.6	0.28	30.6	80.5
45	38	13.5	0.27	30.6	78.3
46	39	14.0	0.30	30.5	84.3
47	39	14.3	0.28	30.5	80.8
48	37	13.5	0.28	30.5	78.9
49	38	13.8	0.28	30.5	80.9
50	39	13.5	0.27	30.4	76.2
51	39	14.2	0.30	30.4	86.4
52	38	14.1	0.28	30.4	79.5
53	38	14.0	0.28	30.4	80.2
54	37	13.1	0.26	30.4	74.6
55	39	14.0	0.30	30.4	86.0
57	38	13.5	0.28	30.3	79.2
58	38	14.0	0.29	30.3	82.2
59	39	14.7	0.29	30.3	82.2
60	37	13.2	0.29	30.3	81.5
61	39	14.4	0.29	30.2	81.3
62	38	13.5	0.29	30.3	82.1
63	38	13.5	0.28	30.2	79.3
64	38	14.5	0.29	30.2	83.7
65	39	13.8	0.29	30.2	81.3
66	38	14.1	0.28	30.2	80.7
67	38	13.9	0.29	30.2	81.3
68	38	13.7	0.28	30.2	80.8
69	39	13.8	0.28	30.0	80.5
70	39	13.8	0.29	30.1	83.9
71	39	14.3	0.29	30.1	82.9
72	38	13.9	0.29	30.0	82.5
73	38	14.0	0.28	30.0	81.3
74	39	14.1	0.29	30.1	83.1
75	37	13.8	0.28	30.0	80.5
76	38	14.3	0.29	30.0	81.9
77	38	14.1	0.29	29.9	81.6
78	38	13.3	0.28	30.0	80.1
79	38	13.2	0.28	29.9	80.0
80	38	13.7	0.28	30.0	80.4

Knik Arm Crossing - Boring# 06-01
OP: V Baker

140# Auto Hammer
Test date: 23-Sep-2006

BL#	FMX kips	VMX f/s	EMX k-ft	BPM **	ETR (%)
81	38	14.2	0.29	29.9	83.0
82	39	14.3	0.29	29.9	82.8
83	39	14.2	0.29	29.9	82.8
84	39	14.2	0.28	29.9	81.0
85	38	14.3	0.30	29.9	84.9
86	38	14.2	0.30	29.9	85.2
87	39	13.9	0.29	29.8	82.9
89	38	13.8	0.30	29.9	85.1
95	38	14.3	0.29	29.8	81.8
96	37	13.7	0.28	29.8	81.1
97	37	13.7	0.28	29.7	81.0
98	37	13.7	0.28	29.8	80.3
99	37	13.9	0.29	29.7	82.4
100	37	13.8	0.29	29.7	81.7
Average	38	13.8	0.28	30.3	81.2
Std. Dev.	1	0.4	0.01	0.4	2.4

Total number of blows analyzed: 81

Time Summary

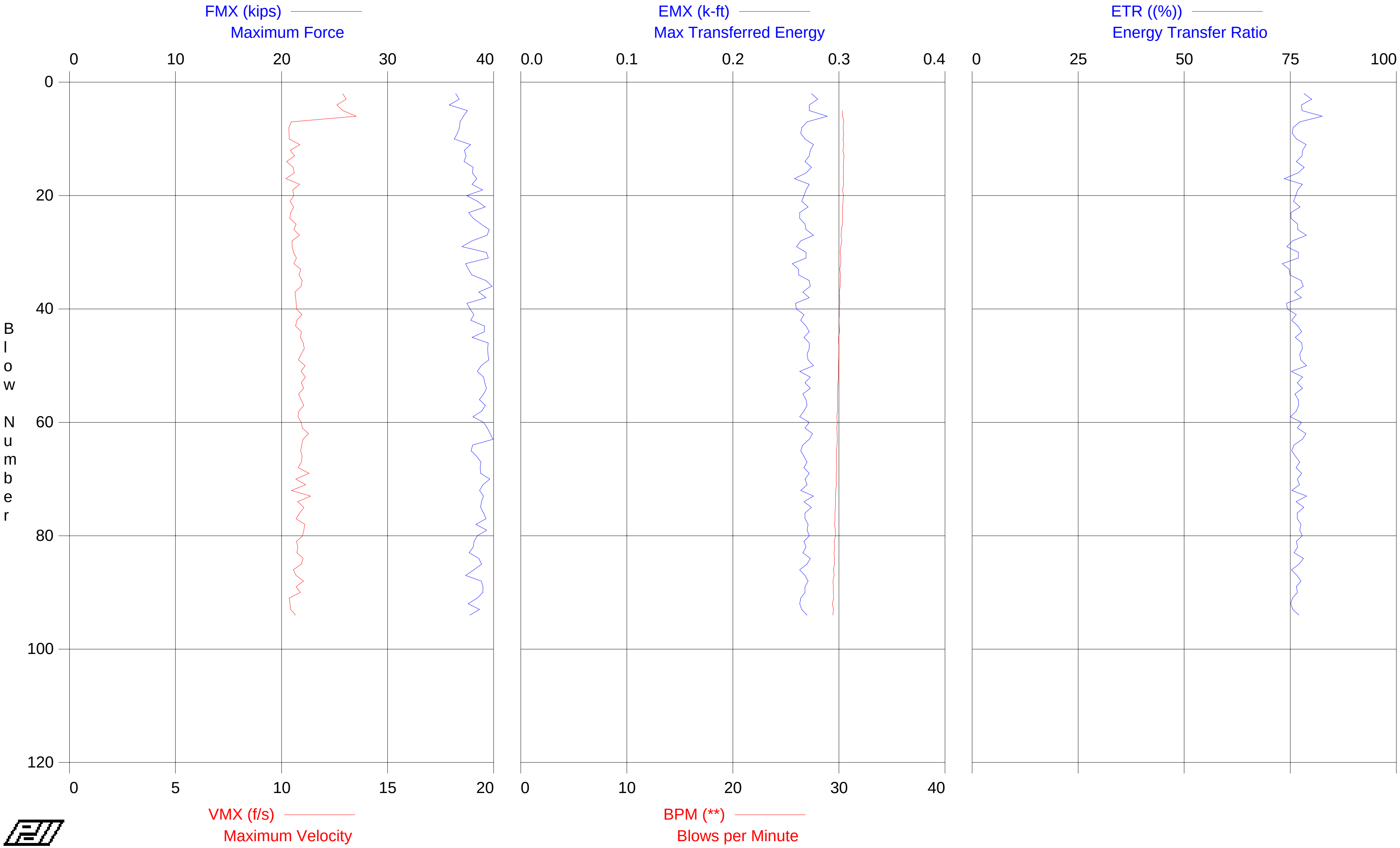
Drive 4 minutes 27 seconds 7:09:33 PM - 7:14:00 PM (9/23/2006) BN 3 - 100

Gregg Drilling & Testing - Case Method Results

PDIPLOT Ver. 2005.2 - Printed: 28-Sep-2006

Test date: 23-Sep-2006

Knik Arm Crossing - Boring# 06-01



Knik Arm Crossing - Boring# 06-01
OP: V Baker
140# Auto Hammer
Test date: 23-Sep-2006

AR: 1.43 in^2
LE: 214.00 ft
WS: 16,807.9 f/s
SP: 0.492 k/ft3
EM: 30,000 ksi
JC: 0.35

FMX: Maximum Force
VMX: Maximum Velocity
EMX: Max Transferred Energy
BPM: Blows per Minute
ETR: Energy Transfer Ratio

BL#	FMX	VMX	EMX	BPM	ETR
	kips	f/s	k-ft	**	(%)
2	36	12.9	0.27	0.0	78.2
3	37	13.0	0.28	0.0	80.0
4	36	12.6	0.27	0.0	77.7
5	38	12.9	0.27	30.3	77.8
6	37	13.5	0.29	30.3	82.6
7	37	10.5	0.27	30.5	77.3
8	37	10.3	0.27	30.4	75.7
9	37	10.4	0.26	30.4	75.4
10	36	10.4	0.27	30.4	76.5
11	38	10.9	0.28	30.5	78.8
12	37	10.4	0.27	30.4	77.9
13	37	10.6	0.27	30.5	77.8
14	37	10.2	0.27	30.4	76.4
15	38	10.5	0.27	30.4	78.3
16	38	10.6	0.27	30.4	76.8
17	38	10.2	0.26	30.4	73.6
18	38	10.8	0.27	30.4	77.8
19	39	10.5	0.27	30.3	76.7
20	37	10.6	0.27	30.4	76.3
21	38	10.4	0.27	30.4	75.8
22	39	10.6	0.27	30.3	77.3
23	38	10.4	0.26	30.3	75.2
24	38	10.4	0.26	30.3	75.2
25	39	10.7	0.27	30.3	76.7
26	40	10.6	0.27	30.2	76.8
27	39	10.8	0.28	30.2	78.8
28	38	10.5	0.26	30.3	75.5
29	37	10.5	0.26	30.2	74.2
30	39	10.6	0.27	30.1	76.9
31	39	10.7	0.27	30.2	76.9
32	37	10.6	0.26	30.2	73.1
33	38	10.9	0.26	30.1	74.7
34	38	10.8	0.26	30.2	75.0
35	39	11.0	0.27	30.1	77.6
36	40	10.9	0.27	30.1	78.1
37	39	10.6	0.27	30.0	76.0
38	39	10.7	0.27	30.1	77.6
39	37	10.7	0.26	30.1	74.1
40	38	10.7	0.26	30.0	74.3
41	38	11.0	0.27	30.0	76.4
42	38	10.7	0.26	30.0	75.3
43	39	10.7	0.27	30.0	76.8
44	39	10.9	0.27	30.1	77.7
45	38	10.9	0.27	30.0	76.2
46	39	11.0	0.27	30.0	77.7
47	39	11.1	0.27	30.0	77.9
48	39	10.9	0.27	30.0	77.2
49	40	10.8	0.27	30.0	77.5
50	39	11.1	0.28	29.9	78.9
51	38	10.9	0.26	29.9	75.3
52	39	11.1	0.27	30.0	78.0
53	39	10.9	0.27	29.9	76.6
54	39	11.0	0.27	29.9	77.9
55	39	10.8	0.27	29.9	76.1
56	39	10.9	0.27	29.9	76.9
57	39	11.0	0.27	29.9	77.0
58	39	10.8	0.27	29.9	76.4
59	38	10.8	0.26	29.8	75.0
60	39	10.9	0.27	29.9	77.6
61	39	11.0	0.27	29.8	76.7
62	40	11.3	0.28	29.8	78.7
63	40	11.0	0.27	29.9	77.9
64	38	10.9	0.27	29.8	75.9
65	38	10.9	0.26	29.8	75.3
66	38	11.0	0.27	29.8	76.2
67	39	10.9	0.27	29.8	77.2
68	39	10.8	0.27	29.8	76.4

Knik Arm Crossing - Boring# 06-01
OP: V Baker

140# Auto Hammer
Test date: 23-Sep-2006

BL#	FMX kips	VMX f/s	EMX k-ft	BPM **	ETR (%)
69	39	11.3	0.27	29.8	77.7
70	40	10.7	0.27	29.7	76.6
71	39	11.1	0.27	29.8	77.2
72	39	10.5	0.26	29.7	75.4
73	39	11.4	0.28	29.7	78.8
74	39	10.8	0.27	29.7	76.4
75	39	11.1	0.27	29.7	78.2
76	39	10.9	0.27	29.6	76.6
77	39	10.7	0.27	29.6	76.7
78	38	11.1	0.27	29.6	77.5
79	39	11.1	0.27	29.7	77.2
80	38	11.0	0.27	29.7	77.8
81	38	10.7	0.27	29.6	76.4
82	38	10.8	0.27	29.6	76.8
83	38	10.7	0.27	29.5	75.9
84	39	11.0	0.27	29.6	78.1
85	39	10.9	0.27	29.6	77.1
86	38	10.6	0.26	29.5	75.3
87	37	10.7	0.27	29.6	76.6
88	39	11.0	0.27	29.4	77.5
89	39	10.7	0.27	29.5	76.5
90	39	10.9	0.27	29.5	76.7
91	38	10.4	0.26	29.5	75.5
92	38	10.4	0.26	29.4	75.1
93	39	10.4	0.27	29.5	75.6
94	38	10.7	0.27	29.4	77.0
Average	38	10.9	0.27	30.0	76.8
Std. Dev.	1	0.6	0.00	0.3	1.4

Total number of blows analyzed: 93

Time Summary

Drive	3 minutes 30 seconds	8:12:59 PM - 8:16:29 PM (9/23/2006) BN 2 - 94

APPENDIX F

LABORATORY TEST PROCEDURES AND RESULTS

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LIST OF FIGURES

APPENDIX F
LABORATORY TEST PROCEDURES AND RESULTS

Laboratory tests were performed on select soil samples recovered from the Knik Arm crossing borings to verify visual classifications and to determine those engineering characteristics pertinent to the civil design of the project. The following sections discuss each of the tests performed for the various properties required.

F-1 Classification Tests

Soil samples shipped to our laboratory were carefully examined and classified in the laboratory and their descriptions were checked against those in the field. These descriptions were used in the preparation of our boring logs, Figures A-2 through A-20 in Appendix A. A summary of the soil test results is presented in Table F-1. The Unified Soil Classification System (ASTM D-2488 & 2487-90) was used for this study and is included as Table F-2.

Water Content Determinations

Following the visual classification of each soil sample, a portion of the material was taken, weighed, and oven dried to determine the natural water content of the soil. The water contents, based on ASTM D-2216, are tabulated in Table F-1 and on the boring logs.

Density Determinations

Since a number of soil specimen were prepared for uniaxial and triaxial compression testing, density determinations were automatically obtained as a by product from these tests. In the preparation procedure, the ends of approximately 6-inch high cylindrical specimens are squared off, the height and diameter are measured, and the volume calculated. The specimens are then weighed to determine the wet unit weight. The results of these determinations are indicated in Figures F-3 and F-4.

Grain Size Analyses

Grain size analyses were conducted on 35 selected soil samples. The specimens were primarily granular in nature and were tested to obtain estimates of the material’s fines content. The 35 grain size tests were performed in accordance with the mechanical sieve procedures described in ASTM D-422 or wet sieving procedures in ASTM D-1140 for percent finer than the U.S. Number 200 sieve size. The results of these measurements are presented in the soil testing summary on Table F-1 and in detail as grain size plots in nine sheets in Figure F-1.

Atterberg Limits

To aid in classifying and correlating the properties of the potentially cohesive soils, Atterberg limit tests (liquid and plastic limits) were performed on 75 samples, which typically represented the various fine grained materials encountered in the borings. Liquid limit tests were performed in accordance with ASTM D-423. Plastic limit tests followed ASTM D-424.

F-2 Shear Strength Tests

The focus of the shear strength testing was the various fine-grained soil units encountered in the borings. The procedures used to estimate the strength of the silt and/or clay soils included pocket penetrometer and Torvane tests, unconfined compression tests, and unconsolidated undrained triaxial compression tests.

Pocket Penetrometer and Torvane Tests

These simple tests were performed on most of the fine-grained soil specimens in both disturbed and undisturbed samples unless penetration resistance sampling results suggested that the soil strength likely exceeded the upper limit of these field screening instruments. The pocket penetrometer (PP) is a small hand-held spring-calibrated ¼-inch cylindrical probe, which is slowly pushed into the soil specimen until ¼-inch penetration is achieved. The maximum reading is then taken and provides a quick estimate of the unconfined compressive strength; which, if divided by 2, becomes comparable with the undrained shear strength. The results are presented on the boring logs in Appendix A and summarized on the Soils Testing Report on Table F-1. They are also selectively presented in Figure 6. The limit of this test is 4.5 tons per foot (tsf). Thus when the limit was exceeded the results are reported as > 4.5 tsf.

The Torvane (Tv) is likewise a simple hand-held spring calibrated torsional device with small steel vanes on the end. In this test the vanes are pushed into the specimen and then torqued against the spring tension until failure by shearing results. The highest reading is then read and recorded as a direct estimate of the materials undrained shear strength. Similar to the pocket penetrometer, the higher readings usually occur on undisturbed samples and often low bound strengths are recorded if the sample being tested is silty or sandy clay. Torvane testing in stiff to hard silts and clays has typically been found to provide lower readings than actual soil strengths, and are misleading.

The results of the PP and Tv measurements are presented on the boring logs (Figures A-2 through A-20) and on the classification of Shelby tubes (Figure A-21, 29 sheets), both in Appendix A. PP and Tv measurements on Shelby tube samples were taken on the ends of the samples in the field and recorded on the boring logs. After extrusion of the soil from the tube in the laboratory, PP and Tv measurements were again taken on the Shelby tube samples and may not match the field measurements because they were logged at different times.

Unconfined Compression Tests

Unconfined compression tests were performed on fine-grained soil specimens to generally estimate the intact compressive or undrained shear strength. The tests were performed in accordance with ASTM D-2166. In this test, the approximately 6-inch long by 2.8 inch diameter cylindrical specimens are squared off at the ends, placed in a compression machine, and loaded axially to failure. The results of these tests are summarized on Table F-1 and selectively on Figure 6. The actual stress strain curves for each test and a sketch depicting the mode of failure for each test are presented as Figure F-3, pages 1 through 26.

Triaxial Compression Tests

Unconsolidated, undrained triaxial compression tests were performed on representative samples of the more silty and/or clayey specimens to estimate intact strength under the existing approximate overburden pressure. After preparation, each cylindrical specimen was encased in a rubber membrane and placed in a triaxial chamber. With the drain valve closed, each specimen was subjected to a predetermined confining pressure, generally a value estimated as the effective overburden pressure. With the confining pressure kept constant, the specimen was then loaded axially to failure with no drainage from the specimen allowed. The results of these tests are summarized in Table F-1. Plots of deviator stress (total stresses) versus axial strain, and pertinent specimen and test data are included as Figure F-4. In a number of cases, two specimen from a given sample were often prepared and then tested, one as an unconfined compression test specimen and one for triaxial testing. Mohr circles for the triaxial specimens and their matching unconfined compression test, where performed, are summarized in Figure 7.

F-3 Consolidation Tests

One dimensional consolidation tests were performed on undisturbed samples of the fine-grained soils in the east abutment area to estimate preconsolidation pressures on these soils. In this test, performed in a consolidometer, samples extruded from Shelby Tubes were first trimmed and fitted into a rigid ring. Porous stones were then placed on the top and bottom of the specimen to allow drainage. The specimen is then loaded in increments and the axial deflection is monitored over time. The deflection at 100 percent primary consolidation was then taken from each time-settlement curve and used to plot void ratio versus log of the actual pressure. The results of this test are presented on Figure F-5.

SOILS TESTING REPORT

Table F-1
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Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			13.5	20	25	30	35	40
Test Hole No.			B06-01	B06-01	B06-01	B06-01	B06-01	B06-01
Field Sample No.			S1	S2	S3	S4	S5	S6
Date Sampled			September 22, 2006	September 22, 2006	September 22, 2006	September 22, 2006	September 22, 2006	September 22, 2006
Lab No.			B06-01S1	B06-01S2	B06-01S3	B06-01S4	B06-01S5	B06-01S6
Percent Passing Sieve Size	3"	75mm					NO RECOVERY	
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm	100.0%		100.0%			
	0.5"	12.5mm	77.4%		98.1%			
	0.375"	9.5mm	74.5%		94.1%			
	0.25"	6.3mm						
	#4	4.75mm	66.7%		88.2%			
	#8	2.36mm	61.8%		80.7%			
	#10	2mm						
	#16	1.18mm	58.0%		72.4%			
	#30	0.6mm	54.9%		24.0%			
	#40	0.425mm						
	#50	0.3mm	50.5%		12.5%			
	#100	0.15mm	44.7%		10.1%			
	#200	0.075mm	36.0%		8.7%			
DOTTSD								
Liquid Limit								39
Plastic Index								18
Moisture Content %			10.0%	13.9%	14.6%	14.4%		22.2%
Organic Content %								
% Gravel			33%		12%			
% Sand			31%		79%			
% Silt & Clay			36%		8.7%			
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			45	50	55	60	65	70
Test Hole No.			B06-01	B06-01	B06-01	B06-01	B06-01	B06-01
Field Sample No.			S7	S8	S9	S10	S11	S12
Date Sampled			September 22, 2006	September 22, 2006	September 22, 2006	September 22, 2006	September 22, 2006	September 23, 2006
Lab No.			B06-01S7	B06-01S8	B06-01S9	B06-01S10	B06-01S11	B06-01S12
Percent Passing Sieve Size	3"	75mm		NO RECOVERY		NO RECOVERY		
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm	100.0%					
	0.5"	12.5mm	91.7%					
	0.375"	9.5mm	88.6%					
	0.25"	6.3mm						
	#4	4.75mm	80.7%					
	#8	2.36mm	74.5%					
	#10	2mm						
	#16	1.18mm	69.7%					
	#30	0.6mm	65.3%					
	#40	0.425mm						
	#50	0.3mm	59.2%					
	#100	0.15mm	54.5%					
	#200	0.075mm	13.8%					
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %			12.9%		12.6%		13.6%	16.8%
Organic Content %								
% Gravel			19%					
% Sand			67%					
% Silt & Clay			14%					
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			75	80	85	90	95	100
Test Hole No.			B06-01	B06-01	B06-01	B06-01	B06-01	B06-01
Field Sample No.			S13	S14	S15	S16	S17	S18
Date Sampled			September 23, 2006	September 23, 2006	September 23, 2006	September 23, 2006	September 23, 2006	September 23, 2006
Lab No.			B06-01S13	B06-01S14	B06-01S15	B06-01S16	B06-01S17	B06-01S18
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm		43.0%				
DOTTSD								
Liquid Limit			22					
Plastic Index			9					
Moisture Content %			8.9%	10.2%	10.0%	7.9%	14.1%	13.9%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay				43%				
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Table F-1

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			105	110	115	120	125	130
Test Hole No.			B06-01	B06-01	B06-01	B06-01	B06-01	B06-01
Field Sample No.			S19	S20	S21	S22	S23	S24
Date Sampled			September 23, 2006	September 23, 2006	September 23, 2006	September 23, 2006	September 23, 2006	September 23, 2006
Lab No.			B06-01S19	B06-01S20	B06-01S21	B06-01S22	B06-01S23	B06-01S24
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						100.0%
	1"	25mm						94.4%
	0.75"	19mm						82.2%
	0.5"	12.5mm						76.2%
	0.375"	9.5mm						74.2%
	0.25"	6.3mm						
	#4	4.75mm						68.9%
	#8	2.36mm						64.6%
	#10	2mm						
	#16	1.18mm						60.9%
	#30	0.6mm						57.3%
	#40	0.425mm						
	#50	0.3mm						52.6%
	#100	0.15mm						47.0%
	#200	0.075mm			73.2%			41.0%
DOTTSD								
Liquid Limit				25				
Plastic Index				12				
Moisture Content %			13.8%	14.5%	28.5%	19.0%	22.0%	10.4%
Organic Content %								
% Gravel								31%
% Sand								28%
% Silt & Clay					73%			41%
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			135	140	145	150	155	160
Test Hole No.			B06-01	B06-01	B06-01	B06-01	B06-01	B06-01
Field Sample No.			S25	S26	S27	S28	S29	S30
Date Sampled			September 23, 2006	September 23, 2006	September 23, 2006	September 23, 2006	September 23, 2006	September 23, 2006
Lab No.			B06-01S25	B06-01S26	B06-01S27	B06-01S28	B06-01S29	B06-01S30
Percent Passing Sieve Size	3"	75mm	NO RECOVERY					
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit					32			
Plastic Index					14			
Moisture Content %				22.2%	17.6%	16.9%	18.1%	19.0%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Table F-1
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Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			165	170	175	180	185	190
Test Hole No.			B06-01	B06-01	B06-01	B06-01	B06-01	B06-01
Field Sample No.			S31	S32	S33	S34	S35	S36
Date Sampled			September 23, 2006	September 23, 2006	September 23, 2006	September 24, 2006	September 24, 2006	September 24, 2006
Lab No.			B06-01S31	B06-01S32	B06-01S33	B06-01S34	B06-01S35	B06-01S36
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit				31				34
Plastic Index				14				13
Moisture Content %			17.4%	17.2%	18.2%	19.1%	18.5%	21.9%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			195					
Test Hole No.			B06-01					
Field Sample No.			S37					
Date Sampled			September 24, 2006					
Lab No.			B06-01S37					
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %			20.4%					
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Table F-1

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			9	14	19	24	29	34
Test Hole No.			B06-02	B06-02	B06-02	B06-02	B06-02	B06-02
Field Sample No.			S1	S2	S3	S4	S5	S6
Date Sampled			September 27, 2006	September 27, 2006	September 27, 2006	September 27, 2006	September 27, 2006	September 27, 2006
Lab No.			B06-02S1	B06-02S2	B06-02S3	B06-02S4	B06-02S5	B06-02S6
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm				5.7%		52.2%
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %			9.4%	6.4%	8.6%	15.3%	7.9%	14.4%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay						5.7%		52%
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			39	44	49	54	59	64
Test Hole No.			B06-02	B06-02	B06-02	B06-02	B06-02	B06-02
Field Sample No.			S7	S8	S9	S10	S11	S12
Date Sampled			September 27, 2006	September 22, 2006	September 22, 2006	September 22, 2006	September 22, 2006	September 23, 2006
Lab No.			B06-02S7	B06-02S8	B06-02S9	B06-02S10	B06-02S11	B06-02S12
Percent Passing Sieve Size	3"	75mm		NO RECOVERY				TUBE BENT, UNABLE TO EXTRUDE
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit			29					
Plastic Index			14					
Moisture Content %			17.2%		16.7%	14.3%	14.0%	
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)					4.0		4.0	4.5

SOILS TESTING REPORT

Table F-1
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Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			69	74	79	84	89	99
Test Hole No.			B06-02	B06-02	B06-02	B06-02	B06-02	B06-02
Field Sample No.			S13	S14	S15	S16	S17	S18
Date Sampled			September 27, 2006	September 27, 2006	September 27, 2006	September 27, 2006	September 27, 2006	September 27, 2006
Lab No.			B06-02S13	B06-02S14	B06-02S15	B06-02S16	B06-02S17	B06-02S18
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm				100.0%		
	1"	25mm				95.0%		
	0.75"	19mm				89.8%		
	0.5"	12.5mm				81.7%		
	0.375"	9.5mm				74.5%		
	0.25"	6.3mm						
	#4	4.75mm				49.9%		
	#8	2.36mm				43.4%		
	#10	2mm						
	#16	1.18mm				39.1%		
	#30	0.6mm				33.6%		
	#40	0.425mm						
	#50	0.3mm				33.6%		
	#100	0.15mm				28.3%		
	#200	0.075mm				24.7%		
DOTTSD								
Liquid Limit				28				
Plastic Index				13				
Moisture Content %			24.5%	18.2%	21.8%	10.3%	10.1%	9.6%
Organic Content %								
% Gravel						40%		
% Sand						35%		
% Silt & Clay						25%		
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)					3.5			

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			109	119	129	139	149	
Test Hole No.			B06-02	B06-02	B06-02	B06-02	B06-02	
Field Sample No.			S19	S20	S21	S22	S23	
Date Sampled			September 27, 2006	September 27, 2006	September 28, 2006	September 28, 2006	September 28, 2006	
Lab No.			B06-02S19	B06-02S20	B06-02S21	B06-02S22	B06-02S23	
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm	100.0%					
	1"	25mm	81.4%					
	0.75"	19mm	81.4%					
	0.5"	12.5mm	58.4%					
	0.375"	9.5mm	37.3%					
	0.25"	6.3mm						
	#4	4.75mm	17.0%					
	#8	2.36mm	10.0%					
	#10	2mm						
	#16	1.18mm	5.9%					
	#30	0.6mm	4.2%					
	#40	0.425mm						
	#50	0.3mm	3.0%					
	#100	0.15mm	2.0%					
	#200	0.075mm	1.6%					
DOTTSD								
Liquid Limit					32			
Plastic Index					14			
Moisture Content %			9.8%	15.0%	20.7%	17.3%	18.5%	
Organic Content %								
% Gravel			83%					
% Sand			15%					
% Silt & Clay			1.6%					
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			7	11	16	22	32	37
Test Hole No.			B06-04	B06-04	B06-04	B06-04	B06-04	B06-04
Field Sample No.			S1	S2	S3	S4	S5	S6
Date Sampled			October 3, 2006	October 3, 2006	October 3, 2006	October 3, 2006	October 3, 2006	October 3, 2006
Lab No.			B06-04S1	B06-04S2	B06-04S3	B06-04S4	B06-04S5	B06-04S6
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm			100.0%			
	1"	25mm			68.8%			
	0.75"	19mm			65.2%			
	0.5"	12.5mm			62.3%			
	0.375"	9.5mm			50.3%			
	0.25"	6.3mm						
	#4	4.75mm			35.5%			
	#8	2.36mm			26.0%			
	#10	2mm						
	#16	1.18mm			20.0%			
	#30	0.6mm			15.8%			
	#40	0.425mm						
	#50	0.3mm			10.4%			
	#100	0.15mm			8.2%			
	#200	0.075mm			6.7%			
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %					5.9%	5.5%	7.3%	13.7%
Organic Content %								
% Gravel					65%			
% Sand					29%			
% Silt & Clay					6.7%			
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			42	57	66	71	76	81
Test Hole No.			B06-04	B06-04	B06-04	B06-04	B06-04	B06-04
Field Sample No.			S7	S8	S9	S10	S11	S12
Date Sampled			October 3, 2006	October 3, 2006	October 3, 2006	October 4, 2006	October 4, 2006	October 4, 2006
Lab No.			B06-04S7	B06-04S8	B06-04S9	B06-04S10	B06-04S11	B06-04S12
Percent Passing Sieve Size	3"	75mm	**NO RECOVERY**	**SKIPPED DUE TO COBBLES**				
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %					10.9%	8.8%	7.8%	
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			86	91	96	101	111	121
Test Hole No.			B06-04	B06-04	B06-04	B06-04	B06-04	B06-04
Field Sample No.			S13	S14	S15	S16	S17	S18
Date Sampled			October 4, 2006	October 4, 2006	October 4, 2006	October 4, 2006	October 4, 2006	October 4, 2006
Lab No.			B06-04S13	B06-04S14	B06-04S15	B06-04S16	B06-04S17	B06-04S18
Percent Passing Sieve Size	3"	75mm			NO RECOVERY			
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %						9.9%	10.9%	19.9%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			131	139	144	154	159	
Test Hole No.			B06-04	B06-04	B06-04	B06-04	B06-04	
Field Sample No.			S19	S20	S21	S22	S23	
Date Sampled			October 4, 2006	October 4, 2006	October 4, 2006	October 4, 2006	October 4, 2006	
Lab No.			B06-04S19	B06-04S20	B06-04S21	B06-04S22	B06-04S23	
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm				8.8%		
DOTTSD								
Liquid Limit			40					
Plastic Index			20					
Moisture Content %			24.4%	16.8%	21.1%	12.7%	8.4%	
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay						8.8%		
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Table F-1
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Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			7	12	17	22	30	35
Test Hole No.			B06-05	B06-05	B06-05	B06-05	B06-05	B06-05
Field Sample No.			S1	S2	S3	S4	S5	S6
Date Sampled			August 20, 2006	August 20, 2006	August 20, 2006	August 20, 2006	August 20, 2006	August 20, 2006
Lab No.			B06-05S1	B06-05S2	B06-05S3	B06-05S4	B06-05S5	B06-05S6
Percent Passing Sieve Size	3"	75mm				NO RECOVERY		
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %			9.0%	10.4%	7.2%		4.8%	4.6%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Table F-1
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Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			41	45	49	55	60	64
Test Hole No.			B06-05	B06-05	B06-05	B06-05	B06-05	B06-05
Field Sample No.			S7	S8	S9	S10	S11	S12
Date Sampled			August 20, 2006	August 20, 2006	August 20, 2006	August 21, 2006	August 21, 2006	August 21, 2006
Lab No.			B06-05S7	B06-05S8	B06-05S9	B06-05S10	B06-05S11	B06-05S12
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit			35					
Plastic Index			18			Non-Plastic		
Moisture Content %			28.2%	30.4%	28.4%	29.3%	29.3%	26.9%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			72	77	79	84	87	94
Test Hole No.			B06-05	B06-05	B06-05	B06-05	B06-05	B06-05
Field Sample No.			S13	S14	S15	S16	S17	S18
Date Sampled			August 21, 2006	August 21, 2006	August 21, 2006	August 21, 2006	August 21, 2006	August 21, 2006
Lab No.			B06-05S13	B06-05S14	B06-05S15	B06-05S16	B06-05S17	B06-05S18
Percent Passing Sieve Size	3"	75mm					NO RECOVERY	
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit						42		
Plastic Index						21		
Moisture Content %			27.7%	27.8%		24.4%		21.3%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)					>4.5	>4.5		

SOILS TESTING REPORT

Table F-1
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Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			103					
Test Hole No.			B06-05					
Field Sample No.			S19					
Date Sampled			August 21, 2006					
Lab No.			B06-05S19					
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %			15.4%					
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Table F-1

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			3	5.7	10.4	16.2	19	23.8
Test Hole No.			B06-06	B06-06	B06-06	B06-06	B06-06	B06-06
Field Sample No.			S1	S2	S3	S4	S5	S6
Date Sampled			August 3, 2006	August 3, 2006	August 4, 2006	August 4, 2006	August 4, 2006	August 4, 2006
Lab No.			B06-06S1	B06-06S2	B06-06S3	B06-06S4	B06-06S5	B06-06S6
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						100.0%
	0.5"	12.5mm						99.3%
	0.375"	9.5mm						99.1%
	0.25"	6.3mm						
	#4	4.75mm						90.8%
	#8	2.36mm						79.4%
	#10	2mm						
	#16	1.18mm						67.8%
	#30	0.6mm						58.8%
	#40	0.425mm						
	#50	0.3mm						44.2%
	#100	0.15mm						15.4%
	#200	0.075mm	5.8%			3.8%		7.0%
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %			23.1%	25.4%	24.4%	26.9%	26.1%	16.8%
Organic Content %								
% Gravel								9%
% Sand								84%
% Silt & Clay			5.8%			3.8%		7.0%
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			30	34.4	41.2	46	50.2	56
Test Hole No.			B06-06	B06-06	B06-06	B06-06	B06-06	B06-06
Field Sample No.			S7	S8	S9	S10	S11	S12
Date Sampled			August 4, 2006	August 4, 2006	August 4, 2006	August 4, 2006	August 4, 2006	August 4, 2006
Lab No.			B06-06S7	B06-06S8	B06-06S9	B06-06S10	B06-06S11	B06-06S12
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm			9.5%			
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %			22.8%	24.5%	20.6%	19.3%	25.9%	20.9%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay					9.5%			
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			67	71.8	75.6	79.7	84.2	88.8
Test Hole No.			B06-06	B06-06	B06-06	B06-06	B06-06	B06-06
Field Sample No.			S13	S14	S15	S16	S17	S18
Date Sampled			August 4, 2006	August 4, 2006	August 4, 2006	August 4, 2006	August 4, 2006	August 5, 2006
Lab No.			B06-06S13	B06-06S14	B06-06S15	B06-06S16	B06-06S17	B06-06S18
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm		24.7%				
DOTTSD								
Liquid Limit					23			31
Plastic Index					9			14
Moisture Content %			11.8%	12.4%	19.5%	10.9%	20.2%	27.4%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay				25%				
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			92.4	94.5	98.2	103	109.8	112
Test Hole No.			B06-06	B06-06	B06-06	B06-06	B06-06	B06-06
Field Sample No.			S19	S20	S21	S22	S23	S24
Date Sampled			August 5, 2006	August 5, 2006	August 5, 2006	August 5, 2006	August 5, 2006	August 5, 2006
Lab No.			B06-06S19	B06-06S20	B06-06S21	B06-06S22	B06-06S23	B06-06S24
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit					34			
Plastic Index					16			
Moisture Content %			32.5%		23.2%	18.4%	6.4%	8.9%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			118	125				
Test Hole No.			B06-06	B06-06				
Field Sample No.			S25	S26				
Date Sampled			August 5, 2006	August 5, 2006				
Lab No.			B06-06S25	B06-06S26				
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %			11.9%	4.6%				
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			13	17	21.5	23	28	31
Test Hole No.			B06-07	B06-07	B06-07	B06-07	B06-07	B06-07
Field Sample No.			S1	S2	S3	S4	S5	S6
Date Sampled			August 16, 2006	August 16, 2006	August 16, 2006	August 16, 2006	August 16, 2006	August 17, 2006
Lab No.			B06-07S1	B06-07S2	B06-07S3	B06-07S4	B06-07S5	B06-07S6
Percent Passing Sieve Size	3"	75mm				**SAMPLE CONTAINED HEAVE MATERIAL, NOT REPRESENTATIVE**		
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm					14.3%	
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %			27.5%	26.3%	27.5%		27.4%	29.4%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay							14%	
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

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Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			37	41	46	51	57	63.5
Test Hole No.			B06-07	B06-07	B06-07	B06-07	B06-07	B06-07
Field Sample No.			S7	S8	S9	S10	S11	S12
Date Sampled			August 17, 2006	August 17, 2006	August 17, 2006	August 17, 2006	August 17, 2006	August 17, 2006
Lab No.			B06-07S7	B06-07S8	B06-07S9	B06-07S10	B06-07S11	B06-07S12
Percent Passing Sieve Size	3"	75mm						NO RECOVERY
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %			28.6%	31.5%	28.1%	34.2%	14.5%	
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Table F-1
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Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			70.5	74.5	80.5	84.5	90.5	105
Test Hole No.			B06-07	B06-07	B06-07	B06-07	B06-07	B06-07
Field Sample No.			S13	S14	S15	S16	S17	S18
Date Sampled			August 17, 2006	August 17, 2006	August 17, 2006	August 17, 2006	August 17, 2006	August 17, 2006
Lab No.			B06-07S13	B06-07S14	B06-07S15	B06-07S16	B06-07S17	B06-07S18
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm	5.2%					
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %			26.5%	21.4%	21.0%	26.6%	46.1%	24.5%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay			5.2%					
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			110	114.5	120	125	129.5	135
Test Hole No.			B06-07	B06-07	B06-07	B06-07	B06-07	B06-07
Field Sample No.			S19	S20	S21	S22	S23	S24
Date Sampled			August 17, 2006	August 17, 2006	August 17, 2006	August 17, 2006	August 17, 2006	August 17, 2006
Lab No.			B06-07S19	B06-07S20	B06-07S21	B06-07S22	B06-07S23	B06-07S24
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit					20			
Plastic Index					7			
Moisture Content %			28.7%	14.6%	15.0%	21.5%	24.0%	17.0%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)					>4.5		>4.5	

SOILS TESTING REPORT

Table F-1
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Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			140	145	150	161.5	166	170
Test Hole No.			B06-07	B06-07	B06-07	B06-07	B06-07	B06-07
Field Sample No.			S25	S26	S27	S28	S29	S30
Date Sampled			August 17, 2006	August 17, 2006	August 17, 2006	August 17, 2006	August 17, 2006	August 17, 2006
Lab No.			B06-07S25	B06-07S26	B06-07S27	B06-07S28	B06-07S29	B06-07S30
Percent Passing Sieve Size	3"	75mm			NO RECOVERY			
	2"	50mm						
	1.5"	37.5mm						100.0%
	1"	25mm	100.0%					88.7%
	0.75"	19mm	95.0%					72.5%
	0.5"	12.5mm	90.6%					55.6%
	0.375"	9.5mm	88.4%					49.2%
	0.25"	6.3mm						
	#4	4.75mm	83.4%					29.7%
	#8	2.36mm	80.3%					10.4%
	#10	2mm						
	#16	1.18mm	77.6%					4.0%
	#30	0.6mm	74.5%					1.8%
	#40	0.425mm						
	#50	0.3mm	69.2%					0.7%
	#100	0.15mm	62.8%					0.3%
	#200	0.075mm	55.8%					0.1%
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %			13.2%	13.1%		9.3%	12.6%	10.8%
Organic Content %								
% Gravel			17%					70%
% Sand			28%					30%
% Silt & Clay			56%					0.1%
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			173	178	184	189	195	198
Test Hole No.			B06-07	B06-07	B06-07	B06-07	B06-07	B06-07
Field Sample No.			S31	S32	S33	S34	S35	S36
Date Sampled			August 17, 2006	August 17, 2006	August 18, 2006	August 18, 2006	August 18, 2006	August 18, 2006
Lab No.			B06-07S31	B06-07S32	B06-07S33	B06-07S34	B06-07S35	B06-07S36
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %			9.6%	11.6%	18.0%	18.8%	14.1%	17.4%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			15	20	21	27	31.5	34
Test Hole No.			B06-08	B06-08	B06-08	B06-08	B06-08	B06-08
Field Sample No.			S1	S2	S3	S4	S5	S6
Date Sampled			August 18, 2006	August 19, 2006	August 19, 2006	August 19, 2006	August 19, 2006	August 19, 2006
Lab No.			B06-08S1	B06-08S2	B06-08S3	B06-08S4	B06-08S5	B06-08S6
Percent Passing Sieve Size	3"	75mm		SAMPLE CONTAINED HEAVE MATERIAL, NOT REPRESENTATIVE				
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						14.7%
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %			27.2%		25.3%	26.4%	26.2%	27.8%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								15%
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Project Name:	Knik Arm Crossing
Project No.:	32-1-01536-004
Sampled By:	Ryan Collins/Oscar Lage

Depth (feet)			39	50	53	57	61	66
Test Hole No.			B06-08	B06-08	B06-08	B06-08	B06-08	B06-08
Field Sample No.			S7	S8	S9	S10	S11	S12
Date Sampled			August 19, 2006	August 19, 2006	August 19, 2006	August 19, 2006	August 19, 2006	August 19, 2006
Lab No.			B06-08S7	B06-08S8	B06-08S9	B06-08S10	B06-08S11	B06-08S12
Percent Passing Sieve Size	3"	75mm		NO RECOVERY				
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %			28.7%		27.3%	28.6%	29.8%	25.8%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			72	77	82	92	110	115
Test Hole No.			B06-08	B06-08	B06-08	B06-08	B06-08	B06-08
Field Sample No.			S13	S14	S15	S16	S17	S18
Date Sampled			August 19, 2006	August 19, 2006	August 19, 2006	August 19, 2006	August 19, 2006	August 19, 2006
Lab No.			B06-08S13	B06-08S14	B06-08S15	B06-08S16	B06-08S17	B06-08S18
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm		13.3%				
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %			26.5%	29.1%	27.9%	26.4%	25.6%	31.8%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay				13%				
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Table F-1
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Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			120	125	130	134	138	
Test Hole No.			B06-08	B06-08	B06-08	B06-08	B06-08	B06-08
Field Sample No.			S19	S20	S21	S22	S23	S24
Date Sampled			August 19, 2006	August 19, 2006	August 19, 2006	August 19, 2006	August 19, 2006	August 19, 2006
Lab No.			B06-08S19	B06-08S20	B06-08S21	B06-08S22	B06-08S23	B06-08S24
Percent Passing Sieve Size	3"	75mm						SAMPLE S24 INTERVAL SKIPPED
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm					100.0%	
	0.75"	19mm					98.0%	
	0.5"	12.5mm					95.9%	
	0.375"	9.5mm					94.9%	
	0.25"	6.3mm						
	#4	4.75mm					93.7%	
	#8	2.36mm					92.6%	
	#10	2mm						
	#16	1.18mm					91.7%	
	#30	0.6mm					90.3%	
	#40	0.425mm						
	#50	0.3mm					87.7%	
	#100	0.15mm					82.5%	
	#200	0.075mm		25.6%			72.1%	
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %			28.4%	29.8%	30.2%	10.6%	16.5%	
Organic Content %								
% Gravel							6%	
% Sand							22%	
% Silt & Clay				26%			72%	
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Table F-1

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			145	151	156	165	173	179
Test Hole No.			B06-08	B06-08	B06-08	B06-08	B06-08	B06-08
Field Sample No.			S25	S26	S27	S28	S29	S30
Date Sampled			August 19, 2006	August 19, 2006	August 19, 2006	August 19, 2006	August 19, 2006	August 19, 2006
Lab No.			B06-08S25	B06-08S26	B06-08S27	B06-08S28	B06-08S29	B06-08S30
Percent Passing Sieve Size	3"	75mm		NO RECOVERY			NO RECOVERY	
	2"	50mm						
	1.5"	37.5mm						100.0%
	1"	25mm						94.9%
	0.75"	19mm						89.2%
	0.5"	12.5mm						84.7%
	0.375"	9.5mm						80.1%
	0.25"	6.3mm						
	#4	4.75mm						68.8%
	#8	2.36mm						59.7%
	#10	2mm						
	#16	1.18mm						52.8%
	#30	0.6mm						47.4%
	#40	0.425mm						
	#50	0.3mm						41.8%
	#100	0.15mm						37.4%
	#200	0.075mm						32.0%
DOTTSD								
Liquid Limit					20			
Plastic Index					5			
Moisture Content %			23.0%		24.5%	32.0%		14.7%
Organic Content %								
% Gravel								31%
% Sand								37%
% Silt & Clay								32%
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)					1.8	1.8		

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			188	195				
Test Hole No.			B06-08	B06-08				
Field Sample No.			S31	S32				
Date Sampled			August 20, 2006	August 20, 2006				
Lab No.			B06-08S31	B06-08S32				
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit				38				
Plastic Index				19				
Moisture Content %			22.3%	20.5%				
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Table F-1
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Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			5	15	19.7	24.4	30.7	34.3
Test Hole No.			B06-09	B06-09	B06-09	B06-09	B06-09	B06-09
Field Sample No.			S1	S2	S3	S4	S5	S6
Date Sampled			August 7, 2006	August 7, 2006	August 7, 2006	August 7, 2006	August 7, 2006	August 7, 2006
Lab No.			B06-09S1	B06-09S2	B06-09S3	B06-09S4	B06-09S5	B06-09S6
Percent Passing Sieve Size	3"	75mm		NO RECOVERY				
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm				100.0%		100.0%
	#10	2mm						
	#16	1.18mm				100.0%		99.9%
	#30	0.6mm				99.9%		99.7%
	#40	0.425mm						
	#50	0.3mm				95.7%		86.6%
	#100	0.15mm				40.2%		43.4%
	#200	0.075mm	5.7%			9.3%		13.2%
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %			23.7%		25.4%	24.7%	26.8%	24.3%
Organic Content %								
% Gravel						0%		0%
% Sand						91%		87%
% Silt & Clay			5.7%			9.3%		13%
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Table F-1

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			40.3	44.3	56	61	66	70
Test Hole No.			B06-09	B06-09	B06-09	B06-09	B06-09	B06-09
Field Sample No.			S7	S8	S9	S10	S11	S12
Date Sampled			August 7, 2006	August 7, 2006	August 7, 2006	August 7, 2006	August 7, 2006	August 8, 2006
Lab No.			B06-09S7	B06-09S8	B06-09S9	B06-09S10	B06-09S11	B06-09S12
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm		6.7%				
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %			23.5%	23.9%	23.3%	24.7%	26.4%	27.0%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay				6.7%				
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Table F-1
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Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			76	81	87	92		99
Test Hole No.			B06-09	B06-09	B06-09	B06-09	B06-09	B06-09
Field Sample No.			S13	S14	S15	S16	S17	S18
Date Sampled			August 8, 2006	August 8, 2006	August 8, 2006	August 8, 2006	August 8, 2006	August 8, 2006
Lab No.			B06-09S13	B06-09S14	B06-09S15	B06-09S16	B06-09S17	B06-09S18
Percent Passing Sieve Size	3"	75mm					**SAMPLE SKIPPED DUE TO HEAVING SANDS**	
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm		100.0%				
	#30	0.6mm		99.6%				
	#40	0.425mm						
	#50	0.3mm		74.1%				
	#100	0.15mm		17.3%				
	#200	0.075mm		6.7%				
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %			25.3%	25.9%	26.4%	26.2%		27.0%
Organic Content %								
% Gravel				0%				
% Sand				93%				
% Silt & Clay				7%				
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			102	108	116	120	123	127
Test Hole No.			B06-09	B06-09	B06-09	B06-09	B06-09	B06-09
Field Sample No.			S19	S20	S21	S22	S23	S24
Date Sampled			August 8, 2006	August 8, 2006	August 9, 2006	August 9, 2006	August 9, 2006	August 9, 2006
Lab No.			B06-09S19	B06-09S20	B06-09S21	B06-09S22	B06-09S23	B06-09S24
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %			28.3%	28.5%	27.7%	29.0%	25.5%	25.9%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			134	140	145	155	165	175
Test Hole No.			B06-09	B06-09	B06-09	B06-09	B06-09	B06-09
Field Sample No.			S25	S26	S27	S28	S29	S30
Date Sampled			August 9, 2006	August 9, 2006	August 9, 2006	August 9, 2006	August 9, 2006	August 9, 2006
Lab No.			B06-09S25	B06-09S26	B06-09S27	B06-09S28	B06-09S29	B06-09S30
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm		8.1%				
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %			27.3%	29.9%	27.6%	14.2%	11.2%	19.8%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay				8.1%				
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Table F-1
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Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			185	192	202			
Test Hole No.			B06-09	B06-09	B06-09			
Field Sample No.			S31	S32	S33			
Date Sampled			August 9, 2006	August 9, 2006	August 9, 2006			
Lab No.			B06-09S31	B06-09S32	B06-09S33			
Percent Passing Sieve Size	3"	75mm	NO RECOVERY					
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit				27	37			
Plastic Index				12	17			
Moisture Content %				18.6%	27.9%			
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Table F-1

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004
Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			10	15	20	25	32	38
Test Hole No.			B06-10	B06-10	B06-10	B06-10	B06-10	B06-10
Field Sample No.			S1	S2	S3	S4	S5	S6
Date Sampled			August 10, 2006	August 10, 2006	August 10, 2006	August 10, 2006	August 10, 2006	August 10, 2006
Lab No.			B06-10S1	B06-10S2	B06-10S3	B06-10S4	B06-10S5	B06-10S6
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %			25.4%	29.5%	27.8%	25.3%	24.6%	40.5%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			44			50	55	60
Test Hole No.			B06-10	B06-10	B06-10	B06-10	B06-10	B06-10
Field Sample No.			S7	S8	S9	S10	S11	S12
Date Sampled			August 10, 2006			August 27, 2006	August 27, 2006	August 27, 2006
Lab No.			B06-10S7			B06-10S10	B06-10S11	B06-10S12
Percent Passing Sieve Size	3"	75mm		SAMPLES SKIPPED UPON RESUMING DRILLING AT LATER DATE				
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm				4.6%		
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %			24.2%			26.0%	26.2%	26.2%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay						4.6%		
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			65	70	75	80	91	95
Test Hole No.			B06-10	B06-10	B06-10	B06-10	B06-10	B06-10
Field Sample No.			S13	S14	S15	S16	S17	S18
Date Sampled			August 27, 2006	August 27, 2006	August 27, 2006	August 27, 2006	August 27, 2006	August 27, 2006
Lab No.			B06-10S13	B06-10S14	B06-10S15	B06-10S16	B06-10S17	B06-10S18
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm				12.8%		
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %			27.3%	25.1%	29.2%	27.0%	28.0%	35.2%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay						13%		
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Project Name:	Knik Arm Crossing
Project No.:	32-1-01536-004
Sampled By:	Ryan Collins/Oscar Lage

Depth (feet)			100	105	110	115	120	126
Test Hole No.			B06-10	B06-10	B06-10	B06-10	B06-10	B06-10
Field Sample No.			S19	S20	S21	S22	S23	S24
Date Sampled			August 27, 2006	August 27, 2006	August 27, 2006	August 27, 2006	August 27, 2006	August 28, 2006
Lab No.			B06-10S19	B06-10S20	B06-10S21	B06-10S22	B06-10S23	B06-10S24
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm		15.0%				27.6%
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %			25.6%	26.0%	25.2%	29.0%	27.7%	28.4%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay				15%				28%
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			138	147	157	169	180	187
Test Hole No.			B06-10	B06-10	B06-10	B06-10	B06-10	B06-10
Field Sample No.			S25	S26	S27	S28	S29	S30
Date Sampled			August 28, 2006	August 28, 2006	August 28, 2006	August 28, 2006	August 28, 2006	August 28, 2006
Lab No.			B06-10S25	B06-10S26	B06-10S27	B06-10S28	B06-10S29	B06-10S30
Percent Passing Sieve Size	3"	75mm			NO RECOVERY	NO RECOVERY		UNABLE TO SAMPLE DUE TO CAVE-IN
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit							24	
Plastic Index							9	
Moisture Content %			29.8%	23.6%			11.4%	
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			5	10	19	24	29	34
Test Hole No.			B06-11	B06-11	B06-11	B06-11	B06-11	B06-11
Field Sample No.			S1	S2	S3	S4	S5	S6
Date Sampled			September 17, 2006	September 17, 2006	September 17, 2006	September 17, 2006	September 17, 2006	September 17, 2006
Lab No.			B06-11S1	B06-11S2	B06-11S3	B06-11S4	B06-11S5	B06-11S6
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm			100.0%			
	#30	0.6mm			99.9%			
	#40	0.425mm						
	#50	0.3mm			91.7%			
	#100	0.15mm			26.3%			
	#200	0.075mm			7.4%		10.6%	
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %			25.9%	27.6%	27.7%	25.7%	25.5%	25.5%
Organic Content %								
% Gravel					0%			
% Sand					93%			
% Silt & Clay					7.4%		11%	
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			39	44	61	66	69	74
Test Hole No.			B06-11	B06-11	B06-11	B06-11	B06-11	B06-11
Field Sample No.			S7	S8	S9	S10	S11	S12
Date Sampled			September 17, 2006	September 17, 2006	September 17, 2006	September 18, 2006	September 18, 2006	September 18, 2006
Lab No.			B06-11S7	B06-11S8	B06-11S9	B06-11S10	B06-11S11	B06-11S12
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm					9.6%	
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %			25.1%	24.4%	24.1%	27.6%	31.5%	27.0%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay							10%	
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			79	84	95	104	114	124
Test Hole No.			B06-11	B06-11	B06-11	B06-11	B06-11	B06-11
Field Sample No.			S13	S14	S15	S16	S17	S18
Date Sampled			September 18, 2006	September 18, 2006	September 18, 2006	September 18, 2006	September 18, 2006	September 18, 2006
Lab No.			B06-11S13	B06-11S14	B06-11S15	B06-11S16	B06-11S17	B06-11S18
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm			14.0%			
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %			24.7%	24.5%	27.6%	24.4%	37.1%	30.6%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay					14%			
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			134	144	149	154	159	165
Test Hole No.			B06-11	B06-11	B06-11	B06-11	B06-11	B06-11
Field Sample No.			S19	S20	S1-A	S2-A	S3-A	S21
Date Sampled			September 18, 2006	September 18, 2006	September 18, 2006	September 18, 2006	September 18, 2006	September 18, 2006
Lab No.			B06-11S19	B06-11S20	B06-11S1-A	B06-11S2-A	B06-11S3-A	B06-11S21
Percent Passing Sieve Size	3"	75mm					NO RECOVERY	
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm		100.0%				
	0.5"	12.5mm		93.9%				
	0.375"	9.5mm		87.1%				
	0.25"	6.3mm						
	#4	4.75mm		70.5%				
	#8	2.36mm		53.8%				
	#10	2mm						
	#16	1.18mm		41.5%				
	#30	0.6mm		34.2%				
	#40	0.425mm						
	#50	0.3mm		22.1%				
	#100	0.15mm		13.1%				
	#200	0.075mm		7.2%				
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %			30.1%	10.0%				23.1%
Organic Content %								
% Gravel				30%				
% Sand				63%				
% Silt & Clay				7.2%				
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			175	187				
Test Hole No.			B06-11	B06-11				
Field Sample No.			S22	S23				
Date Sampled			September 18, 2006	September 18, 2006				
Lab No.			B06-11S22	B06-11S23				
Percent Passing Sieve Size	3"	75mm		UNABLE TO SAMPLE DUE TO CAVE-IN				
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %			14.0%					
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			6	11	16	21	26	31
Test Hole No.			B06-12	B06-12	B06-12	B06-12	B06-12	B06-12
Field Sample No.			S1	S2	S3	S4	S5	S6
Date Sampled			September 30, 2006	September 30, 2006	September 30, 2006	September 30, 2006	September 30, 2006	September 30, 2006
Lab No.			B06-12S1	B06-12S2	B06-12S3	B06-12S4	B06-12S5	B06-12S6
Percent Passing Sieve Size	3"	75mm	**NO RECOVERY**					
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm					100.0%	
	0.25"	6.3mm						
	#4	4.75mm					99.8%	
	#8	2.36mm					99.7%	
	#10	2mm						
	#16	1.18mm					99.6%	
	#30	0.6mm					99.4%	
	#40	0.425mm						
	#50	0.3mm					94.0%	
	#100	0.15mm					9.2%	
	#200	0.075mm		10.7%	9.5%		0.6%	
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %				23.7%	25.2%	28.5%	29.4%	25.0%
Organic Content %								
% Gravel							0%	
% Sand							99%	
% Silt & Clay				11%	9.5%		0.6%	
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			36	41	46	51	56	61
Test Hole No.			B06-12	B06-12	B06-12	B06-12	B06-12	B06-12
Field Sample No.			S7	S8	S9	S10	S11	S12
Date Sampled			September 30, 2006	September 30, 2006	September 30, 2006	September 30, 2006	September 30, 2006	September 30, 2006
Lab No.			B06-12S7	B06-12S8	B06-12S9	B06-12S10	B06-12S11	B06-12S12
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm					100.0%	
	#10	2mm						
	#16	1.18mm					100.0%	
	#30	0.6mm					99.9%	
	#40	0.425mm						
	#50	0.3mm					92.3%	
	#100	0.15mm					51.1%	
	#200	0.075mm		8.2%			26.7%	
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %			28.3%	30.2%	24.4%	24.0%	24.1%	27.0%
Organic Content %								
% Gravel							0%	
% Sand							73%	
% Silt & Clay				8.2%			27%	
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			66	71	76	81	86	91
Test Hole No.			B06-12	B06-12	B06-12	B06-12	B06-12	B06-12
Field Sample No.			S13	S14	S15	S16	S17	S18
Date Sampled			September 30, 2006	September 30, 2006	September 30, 2006	September 30, 2006	September 30, 2006	September 30, 2006
Lab No.			B06-12S13	B06-12S14	B06-12S15	B06-12S16	B06-12S17	B06-12S18
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm			8.6%			
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %			24.6%	29.0%	27.8%	27.6%	25.8%	26.7%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay					8.6%			
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			96	101	111	121	131	141
Test Hole No.			B06-12	B06-12	B06-12	B06-12	B06-12	B06-12
Field Sample No.			S19	S20	S21	S22	S23	S24
Date Sampled			September 30, 2006	September 30, 2006	September 30, 2006	September 30, 2006	September 30, 2006	October 1, 2006
Lab No.			B06-12S19	B06-12S20	B06-12S21	B06-12S22	B06-12S23	B06-12S24
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm		4.1%				
DOTTSD								
Liquid Limit							42	
Plastic Index							21	
Moisture Content %			24.0%	12.9%	15.1%	5.0%	27.1%	24.2%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay				4.1%				
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								2.0

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			151	161	171	181	191	201
Test Hole No.			B06-12	B06-12	B06-12	B06-12	B06-12	B06-12
Field Sample No.			S25	S26	S27	S28	S29	S30
Date Sampled			October 1, 2006	October 1, 2006	October 1, 2006	October 1, 2006	October 1, 2006	October 1, 2006
Lab No.			B06-12S25	B06-12S26	B06-12S27	B06-12S28	B06-12S29	B06-12S30
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit				34				
Plastic Index				16				
Moisture Content %			24.4%	22.6%	19.5%	21.4%	20.9%	20.9%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)			2.5	3.0	2.0	3.0		

SOILS TESTING REPORT

Table F-1

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			211	221	222.5	231	241	251
Test Hole No.			B06-12	B06-12	B06-12	B06-12	B06-12	B06-12
Field Sample No.			S31	S32	S33	S34	S35	S36
Date Sampled			October 1, 2006	October 1, 2006	October 1, 2006	October 1, 2006	October 1, 2006	October 1, 2006
Lab No.			B06-12S31	B06-12S32	B06-12S33	B06-12S34	B06-12S35	B06-12S36
Percent Passing Sieve Size	3"	75mm	NO RECOVERY			TUBE BENT, UNABLE TO EXTRUDE		
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit							35	
Plastic Index							17	
Moisture Content %				22.0%	16.5%		22.9%	27.0%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)							2.0	2.5

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004   Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			55	61	67	82	92	102
Test Hole No.			B06-13	B06-13	B06-13	B06-13	B06-13	B06-13
Field Sample No.			S1	S2	S3	S4	S5	S6
Date Sampled			September 29, 2006	September 29, 2006	September 30, 2006	September 30, 2006	September 30, 2006	September 30, 2006
Lab No.			B06-13S1	B06-13S2	B06-13S3	B06-13S4	B06-13S5	B06-13S6
Percent Passing Sieve Size	3"	75mm				NO RECOVERY		
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm					100.0%	
	0.75"	19mm					97.6%	
	0.5"	12.5mm					96.8%	
	0.375"	9.5mm					92.9%	
	0.25"	6.3mm						
	#4	4.75mm					86.3%	
	#8	2.36mm					82.3%	
	#10	2mm						
	#16	1.18mm					78.6%	
	#30	0.6mm					74.6%	
	#40	0.425mm						
	#50	0.3mm					67.4%	
	#100	0.15mm					57.7%	
	#200	0.075mm					49.2%	
DOTTSD								
Liquid Limit			40					
Plastic Index			20					
Moisture Content %			18.5%	20.6%	20.8%		10.9%	20.5%
Organic Content %								
% Gravel							14%	
% Sand							37%	
% Silt & Clay							49%	
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			112	127				
Test Hole No.			B06-13	B06-13				
Field Sample No.			S7	S8				
Date Sampled			September 30, 2006	September 30, 2006				
Lab No.			B06-13S7	B06-13S8				
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit			41					
Plastic Index			22					
Moisture Content %			26.2%	22.5%				
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			10	15	20	25	30	35
Test Hole No.			B06-14	B06-14	B06-14	B06-14	B06-14	B06-14
Field Sample No.			S1	S2	S3	S4	S5	S6
Date Sampled			October 1, 2006	October 1, 2006	October 1, 2006	October 1, 2006	October 1, 2006	October 1, 2006
Lab No.			B06-14S1	B06-14S2	B06-14S3	B06-14S4	B06-14S5	B06-14S6
Percent Passing Sieve Size	3"	75mm	**NO RECOVERY**	**NO RECOVERY**				
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit							39	
Plastic Index							20	
Moisture Content %					18.3%	10.1%	19.6%	20.3%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)							>4.5	

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			40	45	50	55	60	65
Test Hole No.			B06-14	B06-14	B06-14	B06-14	B06-14	B06-14
Field Sample No.			S7	S8	S9	S10	S11	S12
Date Sampled			October 1, 2006	October 1, 2006	October 1, 2006	October 1, 2006	October 1, 2006	October 1, 2006
Lab No.			B06-14S7	B06-14S8	B06-14S9	B06-14S10	B06-14S11	B06-14S12
Percent Passing Sieve Size	3"	75mm				NO RECOVERY		
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit					40			
Plastic Index					20			
Moisture Content %			20.8%	21.2%	20.3%		22.5%	22.6%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)			>4.5		>4.5		>4.5	4.0

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			70	75	80	85	90	95
Test Hole No.			B06-14	B06-14	B06-14	B06-14	B06-14	B06-14
Field Sample No.			S13	S14	S15	S16	S17	S18
Date Sampled			October 2, 2006	October 2, 2006	October 2, 2006	October 2, 2006	October 2, 2006	October 2, 2006
Lab No.			B06-14S13	B06-14S14	B06-14S15	B06-14S16	B06-14S17	B06-14S18
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit			44		41			
Plastic Index			24		22			
Moisture Content %			23.7%	23.9%	23.6%	21.3%	22.9%	23.1%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)			3.8	>4.5	>4.5	>4.5	4.3	>4.5

SOILS TESTING REPORT

Table F-1

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			100	110	120	135	145	155
Test Hole No.			B06-14	B06-14	B06-14	B06-14	B06-14	B06-14
Field Sample No.			S19	S20	S21	S22	S23	S24
Date Sampled			October 2, 2006	October 2, 2006	October 2, 2006	October 2, 2006	October 2, 2006	October 2, 2006
Lab No.			B06-14S19	B06-14S20	B06-14S21	B06-14S22	B06-14S23	B06-14S24
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit			42					33
Plastic Index			23					15
Moisture Content %			23.3%	24.1%	19.6%	18.1%	22.4%	20.0%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)			4.3		>4.5		>4.5	>4.5

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			165	175	177	185	186.5	195
Test Hole No.			B06-14	B06-14	B06-14	B06-14	B06-14	B06-14
Field Sample No.			S25	S26	S27	S28	S29	S30
Date Sampled			October 2, 2006	October 2, 2006	October 2, 2006	October 2, 2006	October 2, 2006	October 2, 2006
Lab No.			B06-14S25	B06-14S26	B06-14S27	B06-14S28	B06-14S29	B06-14S30
Percent Passing Sieve Size	3"	75mm		SEE FIGURE A-21 IN APPENDIX A FOR LOG OF SHELBY TUBE SAMPLE				NO RECOVERY
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit						41		
Plastic Index						21		
Moisture Content %			26.7%	17.8%	26.3%	26.1%	24.2%	
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)				>4.4				
Pocket Pen Value (tsf)			3.8	4.3	2.8	2.5	3.5	

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			197.5	205	206.5	215	217.5	225
Test Hole No.			B06-14	B06-14	B06-14	B06-14	B06-14	B06-14
Field Sample No.			S31	S32	S33	S34	S35	S36
Date Sampled			October 2, 2006	October 2, 2006	October 2, 2006	October 2, 2006	October 2, 2006	October 2, 2006
Lab No.			B06-14S31	B06-14S32	B06-14S33	B06-14S34	B06-14S35	B06-14S36
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit				40			42	
Plastic Index				20			22	
Moisture Content %			23.5%	25.8%	25.9%		24.7%	23.2%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)			4.5	2.0	3.5	>4.5	3.5	4.0

SOILS TESTING REPORT

Table F-1

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004

Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			235	236				
Test Hole No.			B06-14	B06-14				
Field Sample No.			S37	S38				
Date Sampled			October 2, 2006	October 2, 2006				
Lab No.			B06-14S37	B06-14S38				
Percent Passing Sieve Size	3"	75mm	NO RECOVERY	NO RECOVERY				
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %								
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			22.5	42	52	62	72	82
Test Hole No.			B06-15	B06-15	B06-15	B06-15	B06-15	B06-15
Field Sample No.			S1	S2	S3	S4	S5	S6
Date Sampled			September 28, 2006	September 28, 2006	September 29, 2006	September 29, 2006	September 29, 2006	September 29, 2006
Lab No.			B06-15S1	B06-15S2	B06-15S3	B06-15S4	B06-15S5	B06-15S6
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit			44			34		
Plastic Index			24			16		
Moisture Content %			23.1%	23.2%	24.8%	20.1%	19.4%	20.7%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)			>4.5	4.0	4.3	>4.5	>4.5	

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004

Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			92	103	117	132	147	
Test Hole No.			B06-15	B06-15	B06-15	B06-15	B06-15	
Field Sample No.			S7	S8	S9	S10	S11	
Date Sampled			September 29, 2006	September 29, 2006	September 29, 2006	September 29, 2006	September 29, 2006	
Lab No.			B06-15S7	B06-15S8	B06-15S9	B06-15S10	B06-15S11	
Percent Passing Sieve Size	3"	75mm		**NO RECOVERY**				
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit			38			34		
Plastic Index			19			17		
Moisture Content %			25.4%		20.4%	19.1%	25.0%	
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)					4.0	3.5	3.0	

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			5	10	15	19	24	27
Test Hole No.			B06-16	B06-16	B06-16	B06-16	B06-16	B06-16
Field Sample No.			S1	S2	S3	S4	S5	S6
Date Sampled			September 2, 2006	September 2, 2006	September 2, 2006	September 2, 2006	September 2, 2006	September 2, 2006
Lab No.			B06-16S1	B06-16S2	B06-16S3	B06-16S4	B06-16S5	B06-16S6
Percent Passing Sieve Size	3"	75mm				SEE FIGURE A-21 IN APPENDIX A FOR LOG OF SHELBY TUBE SAMPLE		
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm		2.3%				35.3%
DOTTSD								
Liquid Limit					41			
Plastic Index					21			
Moisture Content %			28.4%	14.4%	18.9%	27.5%	27.3%	
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay				2.3%				35%
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)						4.0		
Pocket Pen Value (tsf)					2.7	3.5	3.0	

SOILS TESTING REPORT

Table F-1

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			34	40	48	53	58	63
Test Hole No.			B06-16	B06-16	B06-16	B06-16	B06-16	B06-16
Field Sample No.			S7	S8	S9	S10	S11	S12
Date Sampled			September 2, 2006	September 2, 2006	September 2, 2006	September 2, 2006	September 2, 2006	September 3, 2006
Lab No.			B06-16S7	B06-16S8	B06-16S9	B06-16S10	B06-16S11	B06-16S12
Percent Passing Sieve Size	3"	75mm		SEE FIGURE A-21 IN APPENDIX A FOR LOG OF SHELBY TUBE SAMPLE				
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						100.0%
	0.25"	6.3mm						
	#4	4.75mm						99.6%
	#8	2.36mm						99.2%
	#10	2mm						
	#16	1.18mm						97.8%
	#30	0.6mm						90.7%
	#40	0.425mm						71.9%
	#50	0.3mm						43.0%
	#100	0.15mm						14.9%
	#200	0.075mm						8.5%
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %			27.3%	27.3%	22.8%	23.3%	19.7%	20.7%
Organic Content %								
% Gravel								0%
% Sand								91%
% Silt & Clay								8.0%
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)				>2.3				
Pocket Pen Value (tsf)			3.8	2.5				

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			68	73	78	83	88	93
Test Hole No.			B06-16	B06-16	B06-16	B06-16	B06-16	B06-16
Field Sample No.			S13	S14	S15	S16	S17	S18
Date Sampled			September 3, 2006	September 3, 2006	September 3, 2006	September 3, 2006	September 3, 2006	September 3, 2006
Lab No.			B06-16S13	B06-16S14	B06-16S15	B06-16S16	B06-16S17	B06-16S18
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm				8.0%		
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %			21.9%	23.9%	22.5%	23.4%	21.6%	23.9%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay						8.0%		
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Table F-1
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Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			98	103	108	113	118	123
Test Hole No.			B06-16	B06-16	B06-16	B06-16	B06-16	B06-16
Field Sample No.			S19	S20	S21	S22	S23	S24
Date Sampled			September 3, 2006	September 3, 2006	September 3, 2006	September 3, 2006	September 3, 2006	September 3, 2006
Lab No.			B06-16S19	B06-16S20	B06-16S21	B06-16S22	B06-16S23	B06-16S24
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm		100.0%				
	#10	2mm						
	#16	1.18mm		100.0%				
	#30	0.6mm		99.8%				
	#40	0.425mm						
	#50	0.3mm		88.8%				
	#100	0.15mm		47.9%				
	#200	0.075mm		20.4%				17.7%
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %			24.9%	24.6%	22.6%	23.0%	24.7%	23.3%
Organic Content %								
% Gravel				0%				
% Sand				80%				
% Silt & Clay				20%				18%
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			128	133	138	143	148	153
Test Hole No.			B06-16	B06-16	B06-16	B06-16	B06-16	B06-16
Field Sample No.			S25	S26	S27	S28	S29	S30
Date Sampled			September 3, 2006	September 3, 2006	September 3, 2006	September 3, 2006	September 3, 2006	September 3, 2006
Lab No.			B06-16S25	B06-16S26	B06-16S27	B06-16S28	B06-16S29	B06-16S30
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm			24.0%			
DOTTSD								
Liquid Limit								37
Plastic Index								17
Moisture Content %			26.2%	25.8%	25.2%	24.1%	26.8%	24.4%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay					24%			
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)				3.8			1.5	2.0

SOILS TESTING REPORT

Table F-1

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			158	163	168	173	178	183
Test Hole No.			B06-16	B06-16	B06-16	B06-16	B06-16	B06-16
Field Sample No.			S31	S32	S33	S34	S35	S36
Date Sampled			September 3, 2006	September 3, 2006	September 3, 2006	September 3, 2006	September 3, 2006	September 3, 2006
Lab No.			B06-16S31	B06-16S32	B06-16S33	B06-16S34	B06-16S35	B06-16S36
Percent Passing Sieve Size	3"	75mm	SEE FIGURE A-21 IN APPENDIX A FOR LOG OF SHELBY TUBE SAMPLE					
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						100.0%
	#8	2.36mm						100.0%
	#10	2mm						
	#16	1.18mm						100.0%
	#30	0.6mm						99.5%
	#40	0.425mm						96.4%
	#50	0.3mm						79.6%
	#100	0.15mm						9.1%
	#200	0.075mm				4.4%		3.0%
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %			26.8%	27.7%	21.6%	21.7%	24.4%	25.3%
Organic Content %								
% Gravel								0%
% Sand								97%
% Silt & Clay						4.4%		3.0%
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)			2.7					
Pocket Pen Value (tsf)			2.8	1.8				

SOILS TESTING REPORT

Table F-1

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			188	193	198	208	218	228
Test Hole No.			B06-16	B06-16	B06-16	B06-16	B06-16	B06-16
Field Sample No.			S37	S38	S39	S40	S41	S42
Date Sampled			September 3, 2006	September 3, 2006	September 3, 2006	September 3, 2006	September 3, 2006	September 4, 2006
Lab No.			B06-16S37	B06-16S38	B06-16S39	B06-16S40	B06-16S41	B06-16S42
Percent Passing Sieve Size	3"	75mm	SKIPPED SAMPLE DUE TO HEAVING SANDS	SAMPLE S38 CONTAINED HEAVE MATERIAL, NOT REPRESENTATIVE	SAMPLE S39 CONTAINED HEAVE MATERIAL, NOT REPRESENTATIVE			
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit							39	
Plastic Index							19	
Moisture Content %						23.3%	25.9%	25.4%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Table F-1

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004

Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			238	248				
Test Hole No.			B06-16	B06-16				
Field Sample No.			S43	S44				
Date Sampled			September 4, 2006	September 4, 2006				
Lab No.			B06-16S43	B06-16S44				
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit				20				
Plastic Index				3				
Moisture Content %			19.3%	24.5%				
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			7	12	17	22	27	32
Test Hole No.			B06-17	B06-17	B06-17	B06-17	B06-17	B06-17
Field Sample No.			S1	S2	S3	S4	S5	S6
Date Sampled			September 14, 2006	September 14, 2006	September 14, 2006	September 14, 2006	September 14, 2006	September 14, 2006
Lab No.			B06-17S1	B06-17S2	B06-17S3	B06-17S4	B06-17S5	B06-17S6
Percent Passing Sieve Size	3"	75mm			NO RECOVERY			SEE FIGURE A-21 IN APPENDIX A FOR LOG OF SHELBY TUBE SAMPLE
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit							45	
Plastic Index							24	
Moisture Content %				23.7%			30.0%	27.8%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								3.0
Pocket Pen Value (tsf)				2.5		2.0	2.0	1.5

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			37	42	47	52	57	62
Test Hole No.			B06-17	B06-17	B06-17	B06-17	B06-17	B06-17
Field Sample No.			S7	S8	S9	S10	S11	S12
Date Sampled			September 14, 2006	September 14, 2006	September 14, 2006	September 14, 2006	September 14, 2006	September 14, 2006
Lab No.			B06-17S7	B06-17S8	B06-17S9	B06-17S10	B06-17S11	B06-17S12
Percent Passing Sieve Size	3"	75mm		SEE FIGURE A-21 IN APPENDIX A FOR LOG OF SHELBY TUBE SAMPLE		SEE FIGURE A-21 IN APPENDIX A FOR LOG OF SHELBY TUBE SAMPLE		NO RECOVERY
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit							36	
Plastic Index							17	
Moisture Content %			27.2%	27.6%	25.8%	22.5%	23.0%	
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)				3.9				
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)				2.4		3.3		
Pocket Pen Value (tsf)			2.5	2.5	2.5	4.5	3.3	

SOILS TESTING REPORT

Table F-1
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Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			71	76	81	86	91	96
Test Hole No.			B06-17	B06-17	B06-17	B06-17	B06-17	B06-17
Field Sample No.			S13	S14	S15	S16	S17	S18
Date Sampled			September 15, 2006	September 15, 2006	September 15, 2006	September 15, 2006	September 15, 2006	September 15, 2006
Lab No.			B06-17S13	B06-17S14	B06-17S15	B06-17S16	B06-17S17	B06-17S18
Percent Passing Sieve Size	3"	75mm		SEE FIGURE A-21 IN APPENDIX A FOR LOG OF SHELBY TUBE SAMPLE		SEE FIGURE A-21 IN APPENDIX A FOR LOG OF SHELBY TUBE SAMPLE		SEE FIGURE A-21 IN APPENDIX A FOR LOG OF SHELBY TUBE SAMPLE
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit					42			
Plastic Index					21			
Moisture Content %			44.5%	25.1%	25.7%	22.8%	23.6%	27.0%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								8.3
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)						7.6		3.1
Pocket Pen Value (tsf)					2.3	2.3	>4.5	4.0

SOILS TESTING REPORT

Table F-1
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Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			101	106	116	117	126	129
Test Hole No.			B06-17	B06-17	B06-17	B06-17	B06-17	B06-17
Field Sample No.			S19	S20	S21	S22	S23	S24
Date Sampled			September 15, 2006	September 15, 2006	September 15, 2006	September 15, 2006	September 15, 2006	September 15, 2006
Lab No.			B06-17S19	B06-17S20	B06-17S21	B06-17S22	B06-17S23	B06-17S24
Percent Passing Sieve Size	3"	75mm		SEE FIGURE A-21 IN APPENDIX A FOR LOG OF SHELBY TUBE SAMPLE			SEE FIGURE A-21 IN APPENDIX A FOR LOG OF SHELBY TUBE SAMPLE	
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit						42		
Plastic Index						20		
Moisture Content %			29.0%	25.8%	29.5%	27.4%	25.6%	
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)				5.5				
Pocket Pen Value (tsf)			2.0	2.5	2.3	3.0	4.0	

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			136	137.5	146	148.5	156	157.5
Test Hole No.			B06-17	B06-17	B06-17	B06-17	B06-17	B06-17
Field Sample No.			S25	S26	S27	S28	S29	S30
Date Sampled			September 15, 2006	September 15, 2006	September 15, 2006	September 15, 2006	September 15, 2006	September 15, 2006
Lab No.			B06-17S25	B06-17S26	B06-17S27	B06-17S28	B06-17S29	B06-17S30
Percent Passing Sieve Size	3"	75mm			SEE FIGURE A-21 IN APPENDIX A FOR LOG OF SHELBY TUBE SAMPLE			
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit				34				
Plastic Index				16				
Moisture Content %			26.5%	20.9%	21.9%	23.5%	25.7%	
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)					4.8			
Pocket Pen Value (tsf)			2.5	>4.5	3.3	3.5	3.3	2.0

SOILS TESTING REPORT

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Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			166	168.5	171	176	181	186
Test Hole No.			B06-17	B06-17	B06-17	B06-17	B06-17	B06-17
Field Sample No.			S31	S32	S33	S34	S35	S36
Date Sampled			September 15, 2006	September 15, 2006	September 15, 2006	September 15, 2006	September 15, 2006	September 15, 2006
Lab No.			B06-17S31	B06-17S32	B06-17S33	B06-17S34	B06-17S35	B06-17S36
Percent Passing Sieve Size	3"	75mm	SEE FIGURE A-21 IN APPENDIX A FOR LOG OF SHELBY TUBE SAMPLE					SEE FIGURE A-21 IN APPENDIX A FOR LOG OF SHELBY TUBE SAMPLE
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm		97.2%				
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %			22.2%	23.2%	21.6%	20.5%	24.6%	22.9%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay				97%				
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								8.8
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)			8.1					6.6
Pocket Pen Value (tsf)			3.8	>4.5	>4.5	>4.5	>4.5	>4.5

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			188.5	191	196	201	203.5	208.5
Test Hole No.			B06-17	B06-17	B06-17	B06-17	B06-17	B06-17
Field Sample No.			S37	S38	S39	S40	S41	S42
Date Sampled			September 15, 2006	September 15, 2006	September 15, 2006	September 15, 2006	September 15, 2006	September 15, 2006
Lab No.			B06-17S37	B06-17S38	B06-17S39	B06-17S40	B06-17S41	B06-17S42
Percent Passing Sieve Size	3"	75mm				SEE FIGURE A-21 IN APPENDIX A FOR LOG OF SHELBY TUBE SAMPLE		
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm		97.9%				
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %			25.8%	24.1%	26.3%	21.7%	24.7%	22.4%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay				98%				
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)						7.8		
Pocket Pen Value (tsf)			3.3			4.0	3.5	>4.5

SOILS TESTING REPORT

Table F-1
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Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			213.5	218.5	223.5			
Test Hole No.			B06-17	B06-17	B06-17			
Field Sample No.			S43	S44	S45			
Date Sampled			September 15, 2006	September 15, 2006	September 15, 2006			
Lab No.			B06-17S43	B06-17S44	B06-17S45			
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %			16.1%	17.1%	19.9%			
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

SOILS TESTING REPORT

Table F-1

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			9	14	19	24	34	39
Test Hole No.			B06-18	B06-18	B06-18	B06-18	B06-18	B06-18
Field Sample No.			S1	S2	S3	S4	S5	S6
Date Sampled			September 19, 2006	September 19, 2006	September 19, 2006	September 20, 2006	September 20, 2006	September 20, 2006
Lab No.			B06-18S1	B06-18S2	B06-18S3	B06-18S4	B06-18S5	B06-18S6
Percent Passing Sieve Size	3"	75mm		**NO RECOVERY**				**SEE FIGURE A-21 IN APPENDIX A FOR LOG OF SHELBY TUBE SAMPLE**
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit					36		40	
Plastic Index					16		19	
Moisture Content %			11.4%		20.9%		23.1%	21.6%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								8.2
Pocket Pen Value (tsf)					>4.5		4.0	4.3

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			49	54	59	64	69	74
Test Hole No.			B06-18	B06-18	B06-18	B06-18	B06-18	B06-18
Field Sample No.			S7	S8	S9	S10	S11	S12
Date Sampled			September 20, 2006	September 20, 2006	September 20, 2006	September 20, 2006	September 20, 2006	September 20, 2006
Lab No.			B06-18S7	B06-18S8	B06-18S9	B06-18S10	B06-18S11	B06-18S12
Percent Passing Sieve Size	3"	75mm			SEE FIGURE A-21 IN APPENDIX A FOR LOG OF SHELBY TUBE SAMPLE		SEE FIGURE A-21 IN APPENDIX A FOR LOG OF SHELBY TUBE SAMPLE	
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit						47		
Plastic Index						23		
Moisture Content %			26.8%	22.4%	22.6%	29.2%	24.0%	24.1%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)					6.2		6.8	
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)					3.9		6.0	
Pocket Pen Value (tsf)			3.5	4.5	3.5	3.0	4.5	3.5

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004   Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			79	84	89	94	99	104
Test Hole No.			B06-18	B06-18	B06-18	B06-18	B06-18	B06-18
Field Sample No.			S13	S14	S15	S16	S17	S18
Date Sampled			September 20, 2006	September 20, 2006	September 20, 2006	September 20, 2006	September 20, 2006	September 20, 2006
Lab No.			B06-18S13	B06-18S14	B06-18S15	B06-18S16	B06-18S17	B06-18S18
Percent Passing Sieve Size	3"	75mm	SEE FIGURE A-21 IN APPENDIX A FOR LOG OF SHELBY TUBE SAMPLE		SEE FIGURE A-21 IN APPENDIX A FOR LOG OF SHELBY TUBE SAMPLE			
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit						43		35
Plastic Index						22		17
Moisture Content %			30.6%	26.3%	30.2%	26.2%	26.2%	27.9%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)			5.8					
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)			2.1		0.6			
Pocket Pen Value (tsf)			2.3	3.5	3.0	2.5	>4.5	

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			109	114	119	124	129	134
Test Hole No.			B06-18	B06-18	B06-18	B06-18	B06-18	B06-18
Field Sample No.			S19	S20	S21	S22	S23	S24
Date Sampled			September 20, 2006	September 20, 2006	September 20, 2006	September 21, 2006	September 21, 2006	September 21, 2006
Lab No.			B06-18S19	B06-18S20	B06-18S21	B06-18S22	B06-18S23	B06-18S24
Percent Passing Sieve Size	3"	75mm			SEE FIGURE A-21 IN APPENDIX A FOR LOG OF SHELBY TUBE SAMPLE			
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit				42				
Plastic Index				21				
Moisture Content %			25.7%	25.8%	26.6%	27.7%	25.4%	23.7%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)			3.5	3.0	3.0	3.3		4.0

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			139	144	149	154	159	164
Test Hole No.			B06-18	B06-18	B06-18	B06-18	B06-18	B06-18
Field Sample No.			S25	S26	S27	S28	S29	S30
Date Sampled			September 21, 2006	September 21, 2006	September 21, 2006	September 21, 2006	September 21, 2006	September 21, 2006
Lab No.			B06-18S25	B06-18S26	B06-18S27	B06-18S28	B06-18S29	B06-18S30
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit			42					36
Plastic Index			22					16
Moisture Content %			25.0%	24.4%		25.5%	25.5%	23.0%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)				3.8		3.0	2.5	4.0

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			169	174	179	184	189	194
Test Hole No.			B06-18	B06-18	B06-18	B06-18	B06-18	B06-18
Field Sample No.			S31	S32	S33	S34	S35	S36
Date Sampled			September 21, 2006	September 21, 2006	September 21, 2006	September 21, 2006	September 21, 2006	September 21, 2006
Lab No.			B06-18S31	B06-18S32	B06-18S33	B06-18S34	B06-18S35	B06-18S36
Percent Passing Sieve Size	3"	75mm	SEE FIGURE A-21 IN APPENDIX A FOR LOG OF SHELBY TUBE SAMPLE				SEE FIGURE A-21 IN APPENDIX A FOR LOG OF SHELBY TUBE SAMPLE	
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit			35					23
Plastic Index			17					8
Moisture Content %			20.2%	22.9%	21.0%	27.0%	22.7%	16.2%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)							8.3	
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)			3.0				5.0	
Pocket Pen Value (tsf)			3.8	2.5	2.5	3.3	4.0	4.5

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			199	204	209	214	219	224
Test Hole No.			B06-18	B06-18	B06-18	B06-18	B06-18	B06-18
Field Sample No.			S37	S38	S39	S40	S41	S42
Date Sampled			September 21, 2006	September 21, 2006	September 21, 2006	September 21, 2006	September 21, 2006	September 21, 2006
Lab No.			B06-18S37	B06-18S38	B06-18S39	B06-18S40	B06-18S41	B06-18S42
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm			100.0%			
	1"	25mm			96.7%			
	0.75"	19mm			95.4%			
	0.5"	12.5mm			94.7%			
	0.375"	9.5mm			94.3%			
	0.25"	6.3mm						
	#4	4.75mm			93.1%			
	#8	2.36mm			92.1%			
	#10	2mm						
	#16	1.18mm			91.4%			
	#30	0.6mm			90.6%			
	#40	0.425mm						
	#50	0.3mm			88.9%			
	#100	0.15mm			86.4%			
	#200	0.075mm			83.0%			
DOTTSD								
Liquid Limit						33		
Plastic Index						15		
Moisture Content %			20.0%	21.2%	19.0%	20.7%	19.3%	13.5%
Organic Content %								
% Gravel					7%			
% Sand					10%			
% Silt & Clay					83%			
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)			2.5	4.5	>4.5	4.5	4.5	

SOILS TESTING REPORT

Table F-1

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			229	234	239	244	249	254
Test Hole No.			B06-18	B06-18	B06-18	B06-18	B06-18	B06-18
Field Sample No.			S43	S44	S45	S46	S47	S48
Date Sampled			September 21, 2006	September 21, 2006	September 21, 2006	September 21, 2006	September 21, 2006	September 21, 2006
Lab No.			B06-18S43	B06-18S44	B06-18S45	B06-18S46	B06-18S47	B06-18S48
Percent Passing Sieve Size	3"	75mm				SEE FIGURE A-21 IN APPENDIX A FOR LOG OF SHELBY TUBE SAMPLE		
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit					33			
Plastic Index					15			
Moisture Content %			22.7%	19.1%	20.3%	17.0%	23.7%	20.2%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)						2.6		
Pocket Pen Value (tsf)			>4.5	>4.5	>4.5	>4.5		3.0

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			259	264	266	269		
Test Hole No.			B06-18	B06-18	B06-18	B06-18		
Field Sample No.			S49	S50	S51	S52		
Date Sampled			September 21, 2006	September 21, 2006	September 21, 2006	September 21, 2006		
Lab No.			B06-18S49	B06-18S50	B06-18S51	B06-18S52		
Percent Passing Sieve Size	3"	75mm				NO RECOVERY		
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm			100.0%			
	0.25"	6.3mm						
	#4	4.75mm			99.8%			
	#8	2.36mm			99.5%			
	#10	2mm						
	#16	1.18mm			98.7%			
	#30	0.6mm			95.0%			
	#40	0.425mm						
	#50	0.3mm			79.9%			
	#100	0.15mm			66.2%			
	#200	0.075mm			62.9%			
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %			13.8%	21.0%	17.8%			
Organic Content %								
% Gravel					0%			
% Sand					37%			
% Silt & Clay					63%			
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)			>4.5					

SOILS TESTING REPORT

Table F-1

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			5	10	15	20	25	30
Test Hole No.			B06-19	B06-19	B06-19	B06-19	B06-19	B06-19
Field Sample No.			S1	S2	S3	S4	S5	S6
Date Sampled			September 5, 2006	September 5, 2006	September 5, 2006	September 5, 2006	September 5, 2006	September 5, 2006
Lab No.			B06-19S1	B06-19S2	B06-19S3	B06-19S4	B06-19S5	B06-19S6
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm		100.0%				
	0.75"	19mm		96.9%				
	0.5"	12.5mm		87.7%				
	0.375"	9.5mm		81.7%				
	0.25"	6.3mm						
	#4	4.75mm		66.9%				
	#8	2.36mm		55.6%				
	#10	2mm						
	#16	1.18mm		46.0%				
	#30	0.6mm		37.0%				
	#40	0.425mm						
	#50	0.3mm		29.5%				
	#100	0.15mm		21.1%				
	#200	0.075mm		12.0%				
DOTTSD								
Liquid Limit						37		
Plastic Index						17		
Moisture Content %			30.4%	14.0%	20.7%	22.2%	24.4%	22.0%
Organic Content %								
% Gravel				33%				
% Sand				55%				
% Silt & Clay				12%				
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)					>4.5	>4.5	>4.5	>4.5

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			35	40	45	50	55	60
Test Hole No.			B06-19	B06-19	B06-19	B06-19	B06-19	B06-19
Field Sample No.			S7	S8	S9	S10	S11	S12
Date Sampled			September 5, 2006	September 5, 2006	September 5, 2006	September 5, 2006	September 5, 2006	September 5, 2006
Lab No.			B06-19S7	B06-19S8	B06-19S9	B06-19S10	B06-19S11	B06-19S12
Percent Passing Sieve Size	3"	75mm		NO RECOVERY		NO RECOVERY		SEE FIGURE A-21 IN APPENDIX A FOR LOG OF SHELBY TUBE SAMPLE
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %			25.6%		23.8%		23.8%	20.5%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								6.2
Pocket Pen Value (tsf)			4.0		2.5		4.0	>4.5

SOILS TESTING REPORT

Table F-1

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			65	70	75	80	85	90
Test Hole No.			B06-19	B06-19	B06-19	B06-19	B06-19	B06-19
Field Sample No.			S13	S14	S15	S16	S17	S18
Date Sampled			September 5, 2006	September 5, 2006	September 5, 2006	September 5, 2006	September 5, 2006	September 5, 2006
Lab No.			B06-19S13	B06-19S14	B06-19S15	B06-19S16	B06-19S17	B06-19S18
Percent Passing Sieve Size	3"	75mm					SEE FIGURE A-21 IN APPENDIX A FOR LOG OF SHELBY TUBE SAMPLE	
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit						38		
Plastic Index						19		
Moisture Content %			20.9%	27.4%	22.7%	23.1%	24.0%	26.5%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)							3.2	
Pocket Pen Value (tsf)			>4.5	2.8	4.5	4.3	2.8	3.3

SOILS TESTING REPORT

Table F-1

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)				102	107	112	117	122
Test Hole No.				B06-19	B06-19	B06-19	B06-19	B06-19
Field Sample No.				S50	S51	S52	S53	S54
Date Sampled				September 25, 2006	September 25, 2006	September 25, 2006	September 25, 2006	September 25, 2006
Lab No.				B06-19S50	B06-19S51	B06-19S52	B06-19S53	B06-19S54
Percent Passing Sieve Size	3"	75mm	SAMPLE NUMBERING SEQUENCE OUT OF ORDER DUE TO RELOCATION OF BORING (NO SAMPLES S19 - S49)	NO RECOVERY				
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %					25.7%	23.4%	26.3%	26.5%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)					3.3	2.5	2.5	2.0

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			127	132	137	142	147	148.5
Test Hole No.			B06-19	B06-19	B06-19	B06-19	B06-19	B06-19
Field Sample No.			S55	S56	S57	S58	S59	S60
Date Sampled			September 25, 2006	September 25, 2006	September 25, 2006	September 25, 2006	September 25, 2006	September 25, 2006
Lab No.			B06-19S55	B06-19S56	B06-19S57	B06-19S58	B06-19S59	B06-19S60
Percent Passing Sieve Size	3"	75mm	**SEE FIGURE A-21 IN APPENDIX A FOR LOG OF SHELBY TUBE SAMPLE**					
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit				45				
Plastic Index				22				
Moisture Content %			17.5%	29.6%	23.3%	23.4%	18.5%	22.4%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)			4.6					
Pocket Pen Value (tsf)			4.0	2.3	2.5	2.3	2.0	3.0

SOILS TESTING REPORT

Table F-1

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			157	158.5	167	169.5	177	178.5
Test Hole No.			B06-19	B06-19	B06-19	B06-19	B06-19	B06-19
Field Sample No.			S61	S62	S63	S64	S65	S66
Date Sampled			September 25, 2006	September 25, 2006	September 25, 2006	September 25, 2006	September 25, 2006	September 25, 2006
Lab No.			B06-19S61	B06-19S62	B06-19S63	B06-19S64	B06-19S65	B06-19S66
Percent Passing Sieve Size	3"	75mm			**SEE FIGURE A-21 IN APPENDIX A FOR LOG OF SHELBY TUBE SAMPLE**			
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit						32		
Plastic Index						15		
Moisture Content %			23.0%	21.9%	18.4%	18.4%	19.3%	17.1%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)					5.4			
Pocket Pen Value (tsf)			2.5	2.5	>4.5	3.3	2.5	2.0

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			187	188.5	197	207	217	227
Test Hole No.			B06-19	B06-19	B06-19	B06-19	B06-19	B06-19
Field Sample No.			S67	S68	S69	S70	S71	S72
Date Sampled			September 25, 2006	September 25, 2006	September 25, 2006	September 25, 2006	September 26, 2006	September 26, 2006
Lab No.			B06-19S67	B06-19S68	B06-19S69	B06-19S70	B06-19S71	B06-19S72
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm						
DOTTSD								
Liquid Limit				34				
Plastic Index				16				
Moisture Content %			26.7%	22.8%	23.0%	25.1%	17.8%	14.9%
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay								
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)			2.5	2.5		2.8	3.5	

SOILS TESTING REPORT

Project Name: Knik Arm Crossing

Project No.: 32-1-01536-004 Sampled By: Ryan Collins/Oscar Lage

Depth (feet)			237	247	252			
Test Hole No.			B06-19	B06-19	B06-19			
Field Sample No.			S73	S74	S75			
Date Sampled			September 26, 2006	September 26, 2006	September 26, 2006			
Lab No.			B06-19S73	B06-19S74	B06-19S75			
Percent Passing Sieve Size	3"	75mm						
	2"	50mm						
	1.5"	37.5mm						
	1"	25mm						
	0.75"	19mm						
	0.5"	12.5mm						
	0.375"	9.5mm						
	0.25"	6.3mm						
	#4	4.75mm						
	#8	2.36mm						
	#10	2mm						
	#16	1.18mm						
	#30	0.6mm						
	#40	0.425mm						
	#50	0.3mm						
	#100	0.15mm						
	#200	0.075mm	14.0%					
DOTTSD								
Liquid Limit								
Plastic Index								
Moisture Content %			9.0%	11.8%	8.0%			
Organic Content %								
% Gravel								
% Sand								
% Silt & Clay			14%					
Max. Dry Density								
Opt. Moisture %								
Unconsol. Uncon. Triaxial U_u (tsf)								
Coeff. Of Consolidation C_v								
Unc. Comp. Strength Q_u (tsf)								
Pocket Pen Value (tsf)								

Unified Soil Classification System

GROUP NAME Criteria for Assigning Group Names and Group Symbols				Soil Classification Group Symbol with Generalized Group Descriptions	
COARSE-GRAINED SOILS more than 50% retained on No. 200 sieve	GRAVELS 50% or more of coarse fraction retained on No. 4 sieve	Clean GRAVELS Less than 5% fines	▨	GW	Well-graded Gravels
			▨	GP	Poorly-graded Gravels
		GRAVELS with fines More than 12% fines	▨	GM	Gravel & Silt Mixtures
			▨	GC	Gravel & Clay Mixtures
	SANDS More than 50% of coarse fraction passes No. 4 sieve	Clean SANDS Less than 5% fines	▨	SW	Well-graded Sands
			▨	SP	Poorly-graded Sands
		SANDS with fines More than 12% fines	▨	SM	Sand & Silt Mixtures
			▨	SC	Sand & Clay Mixtures
FINE-GRAINED SOILS 50% or more passes the No. 200 sieve	SILTS AND CLAYS Liquid limit 50% or less	INORGANIC	▨	ML	Non-plastic & Low-plasticity Silts
			▨	CL	Low-plasticity Clays
		ORGANIC	▨	OL	Non-plastic and Low-plasticity Organic Clays Non-plastic and Low-plasticity Organic Silts
	SILTS AND CLAYS Liquid limit greater than 50%	INORGANIC	▨	CH	High-plasticity Clays
			▨	MH	High-plasticity Silts
		ORGANIC	▨	OH	High-plasticity Organic Clays High-plasticity Organic Silts
HIGHLY ORGANIC SOILS	Primarily organic matter, dark in color, and organic odor		▨	PT	Peat

Organic Content

Adjective	Percent by Volume
Occasional	0-1
Scattered	1-10
Numerous	10-30
Organic	30-50, minor constituent
Peat	50-100, MAJOR constituent

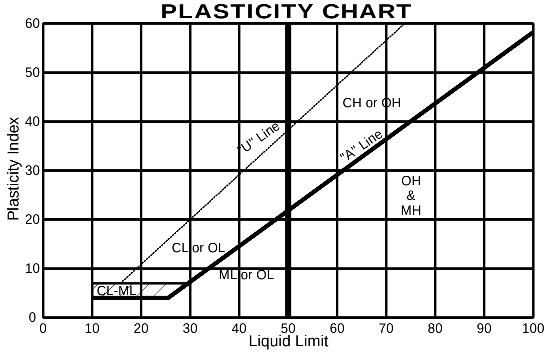
Descriptive Terminology Denoting Component Proportions

Description	Range of Proportion
Add the adjective "slightly"	5 - 12%
Add soil adjective$^{(a)}$	12 - 50%
Major proportion in upper case, (e.g., SAND)	>50%

(a) Use gravelly, sandy, or silty as appropriate

NOTE: The soil descriptions used in the boring logs lists constituents from smallest percentage to largest percentage.

PLASTICITY CHART



Knik Arm Crossing
Knik Arm, Alaska

UNIFIED SOIL CLASSIFICATION SYSTEM

December 2006

32-1-01536-004

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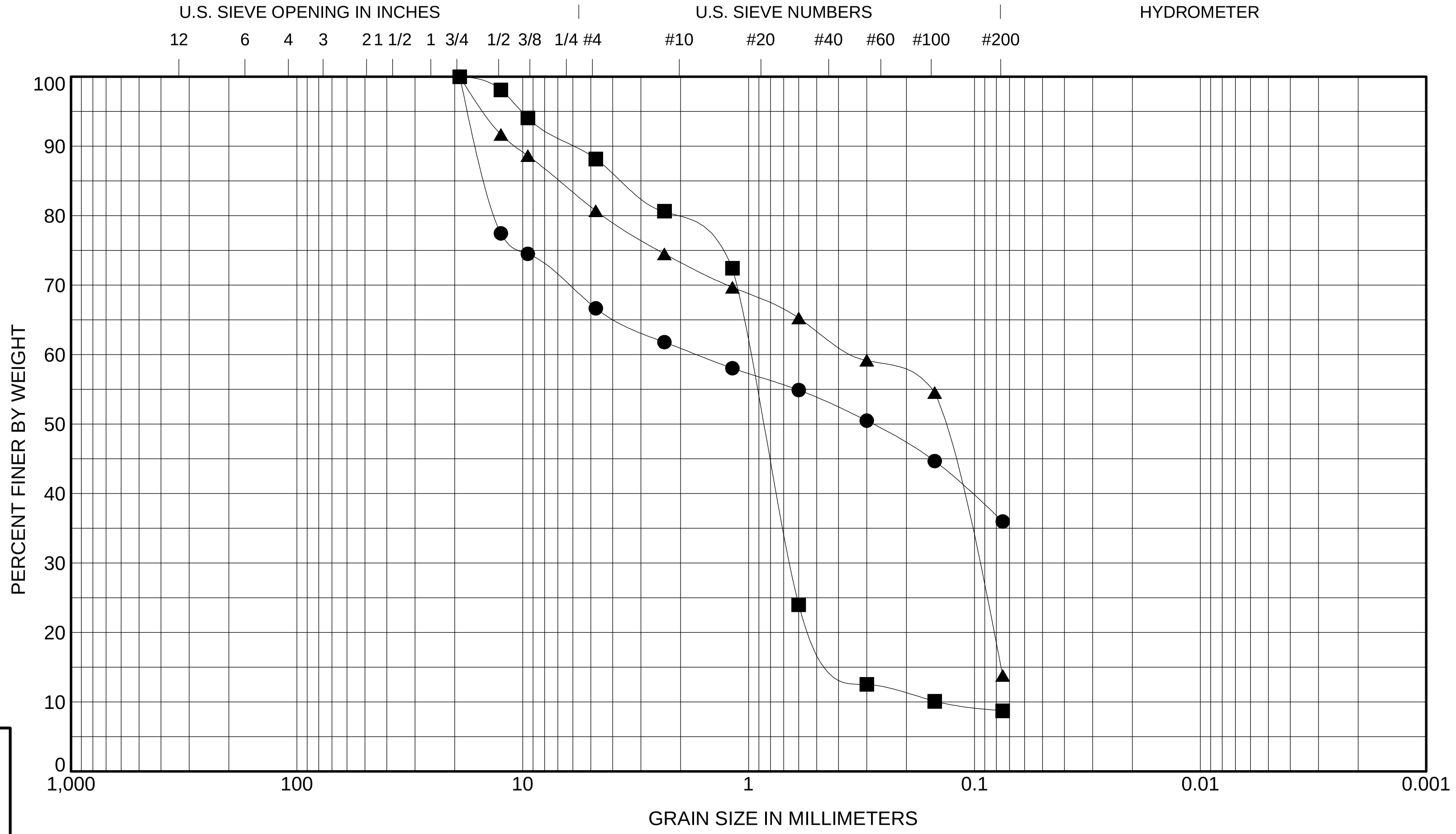
Table F-2



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample	Depth, Ft	Classification	LL	PL	PI	Cc	Cu
●	**B06-01 S1**	**13.5 - 14.8**	**Sandy, silty GRAVEL [GM]**					
■	**B06-01 S3**	**25.0 - 26.5**	**Slightly silty, gravelly SAND [SP]**				**3.0**	**7.0**
▲	**B06-01 S7**	**45.0 - 46.5**	**Clayey, gravelly SAND [SM]**					

	Sample	Depth, Ft	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B06-01 S1**	**13.5 - 14.8**	**19**	**1.7**			**33**	**31**	**36**	
■	**B06-01 S3**	**25.0 - 26.5**	**19**	**0.99**	**0.65**	**0.14**	**12**	**79**	**9**	
▲	**B06-01 S7**	**45.0 - 46.5**	**19**	**0.33**	**0.1**		**19**	**67**	**14**	

Knik Arm Crossing
Knik Arm, Alaska

GRAIN SIZE CLASSIFICATION

March 2007
32-1-01536-004

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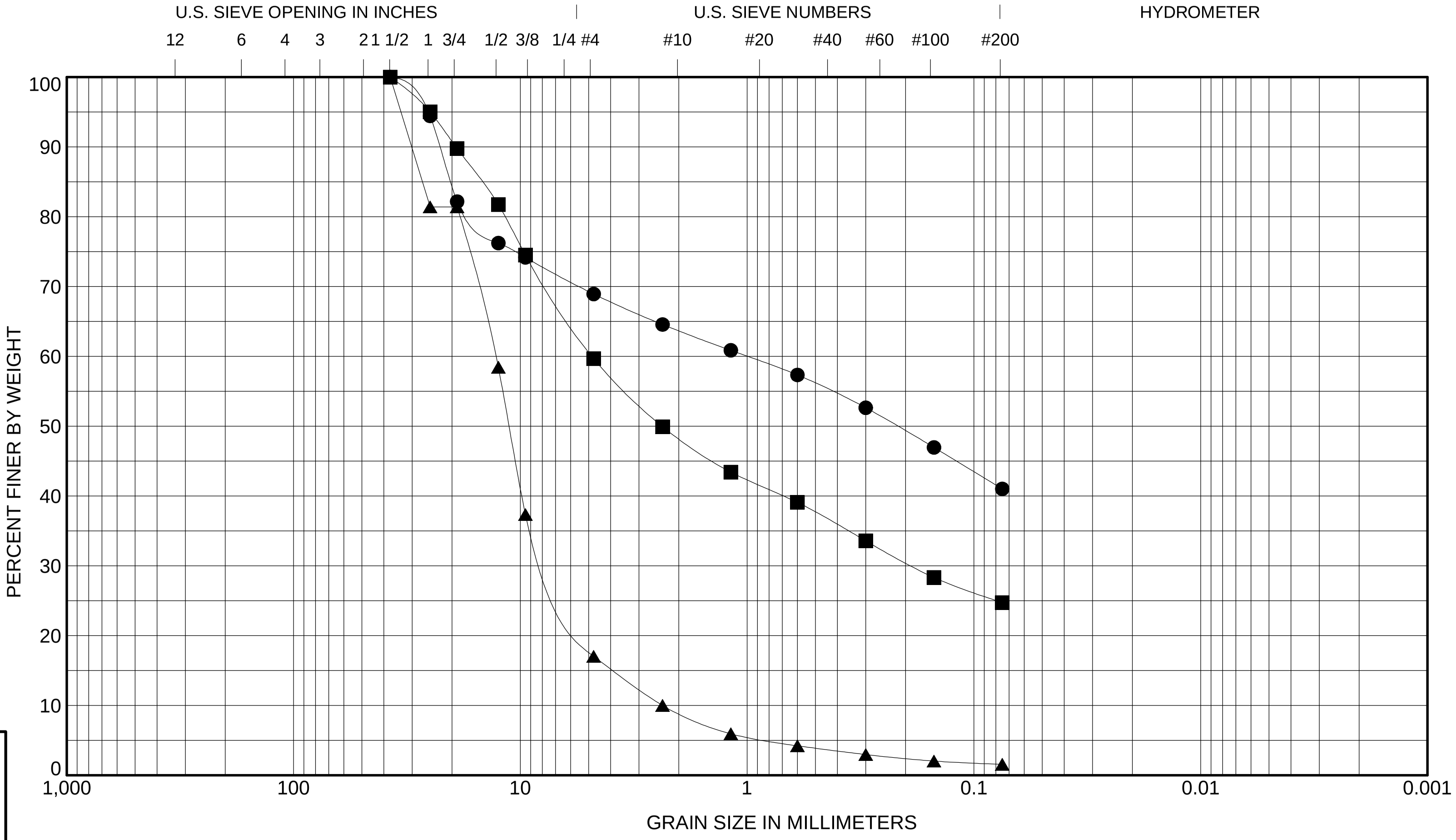
Fig. F-1
Sheet 1 of 9



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample	Depth, Ft	Classification	LL	PL	PI	Cc	Cu
●	**B06-01 S24**	**130.0 - 131.5**	**Sandy, silty GRAVEL [GM]**					
■	**B06-02 S16**	**84.0 - 85.0**	**Silty, sandy GRAVEL [GM]**					
▲	**B06-02 S19**	**109.0 - 109.3**	**Sandy GRAVEL [GW]**				**1.8**	**5.4**

	Sample	Depth, Ft	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B06-01 S24**	**130.0 - 131.5**	**37.5**	**1**			**31**	**28**	**41**	
■	**B06-02 S16**	**84.0 - 85.0**	**37.5**	**4.82**	**0.19**		**40**	**35**	**25**	
▲	**B06-02 S19**	**109.0 - 109.3**	**37.5**	**12.86**	**7.39**	**2.36**	**83**	**15**	**2**	

Knik Arm Crossing
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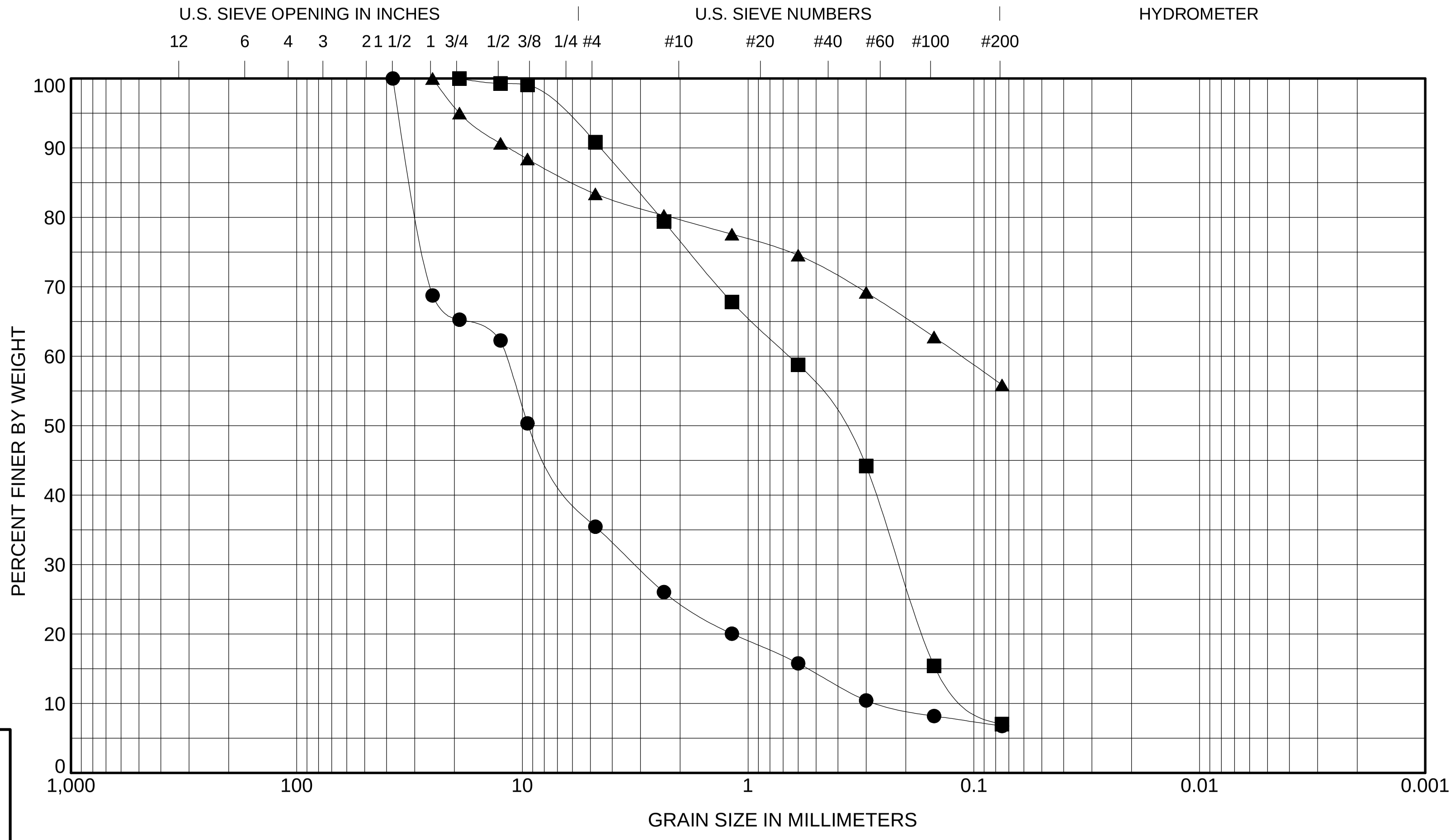
Fig. F-1
Sheet 2 of 9



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample		Depth, Ft	Classification	LL	PL	PI	Cc	Cu
●	**B06-04 S3**	**16.0 - 17.4**	**Slightly silty, sandy GRAVEL [GP-GM]**				**3.2**	**45.2**
■	**B06-06 S6**	**23.8 - 25.3**	**Slightly silty, slightly gravelly SAND [SP-SM]**				**0.7**	**6.9**
▲	**B06-07 S25**	**140.0 - 141.5**	**Gravelly, sandy CLAY [CL]**					

Sample		Depth, Ft	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B06-04 S3**	**16.0 - 17.4**	**37.5**	**11.86**	**3.17**	**0.26**	**65**	**29**	**7**	
■	**B06-06 S6**	**23.8 - 25.3**	**19**	**0.66**	**0.21**	**0.1**	**9**	**84**	**7**	
▲	**B06-07 S25**	**140.0 - 141.5**	**25**	**0.11**			**17**	**28**	**56**	

Knik Arm Crossing
Knik Arm, Alaska

GRAIN SIZE CLASSIFICATION

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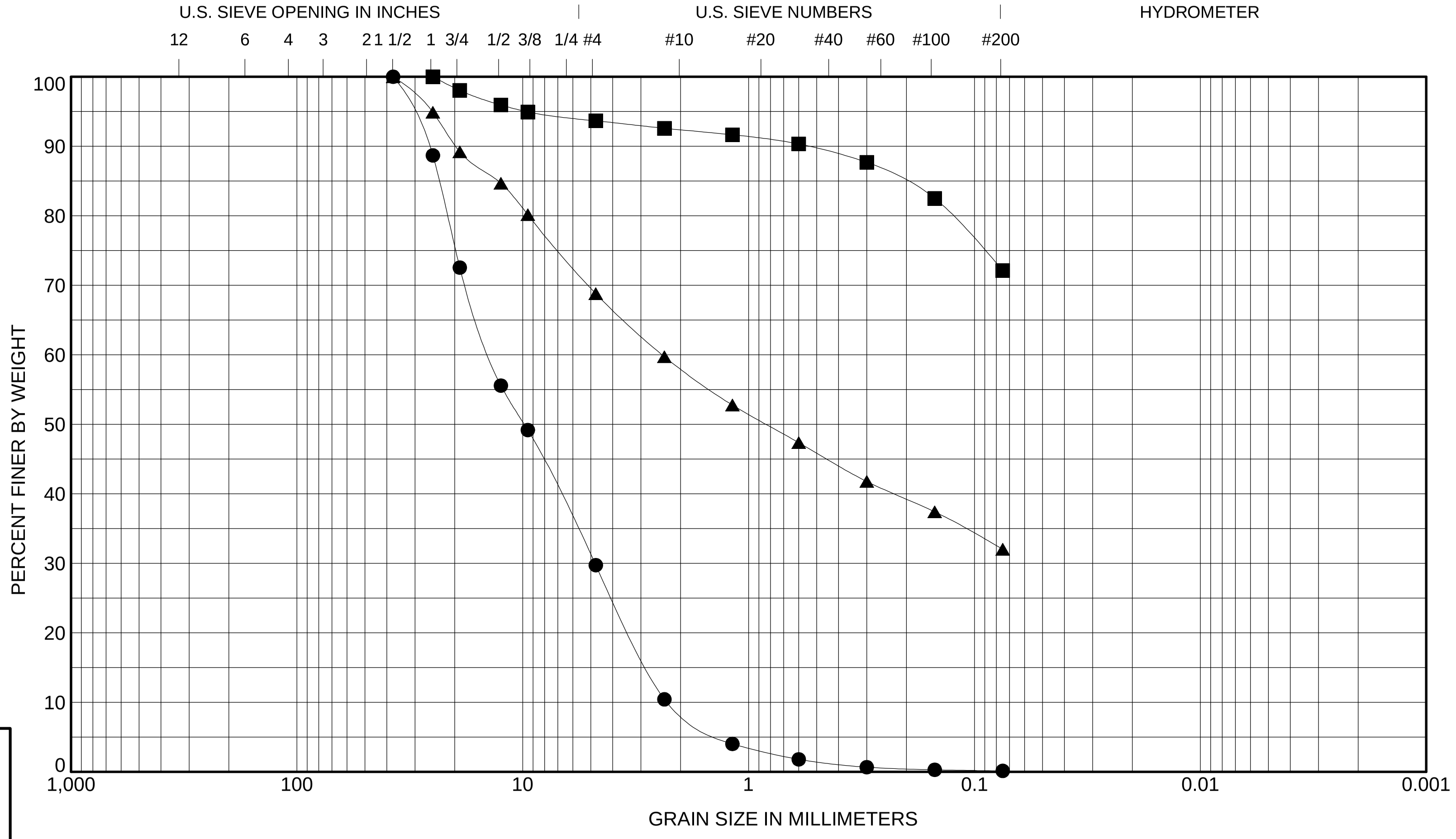
Fig. F-1
Sheet 3 of 9



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample		Depth, Ft	Classification	LL	PL	PI	Cc	Cu
●	**B06-07 S30**	**170.0 - 171.3**	**Sandy GRAVEL [GP]**				**0.7**	**6.2**
■	**B06-08 S23**	**138.0 - 139.3**	**Slightly gravelly, sandy, silty CLAY [CL-ML]**					
▲	**B06-08 S30**	**179.0 - 180.5**	**Gravelly, silty SAND [SM]**					

Sample		Depth, Ft	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B06-07 S30**	**170.0 - 171.3**	**37.5**	**13.94**	**4.8**	**2.25**	**70**	**30**	**0**	
■	**B06-08 S23**	**138.0 - 139.3**	**25**				**6**	**22**	**72**	
▲	**B06-08 S30**	**179.0 - 180.5**	**37.5**	**2.41**			**31**	**37**	**32**	

Knik Arm Crossing
Knik Arm, Alaska

GRAIN SIZE CLASSIFICATION

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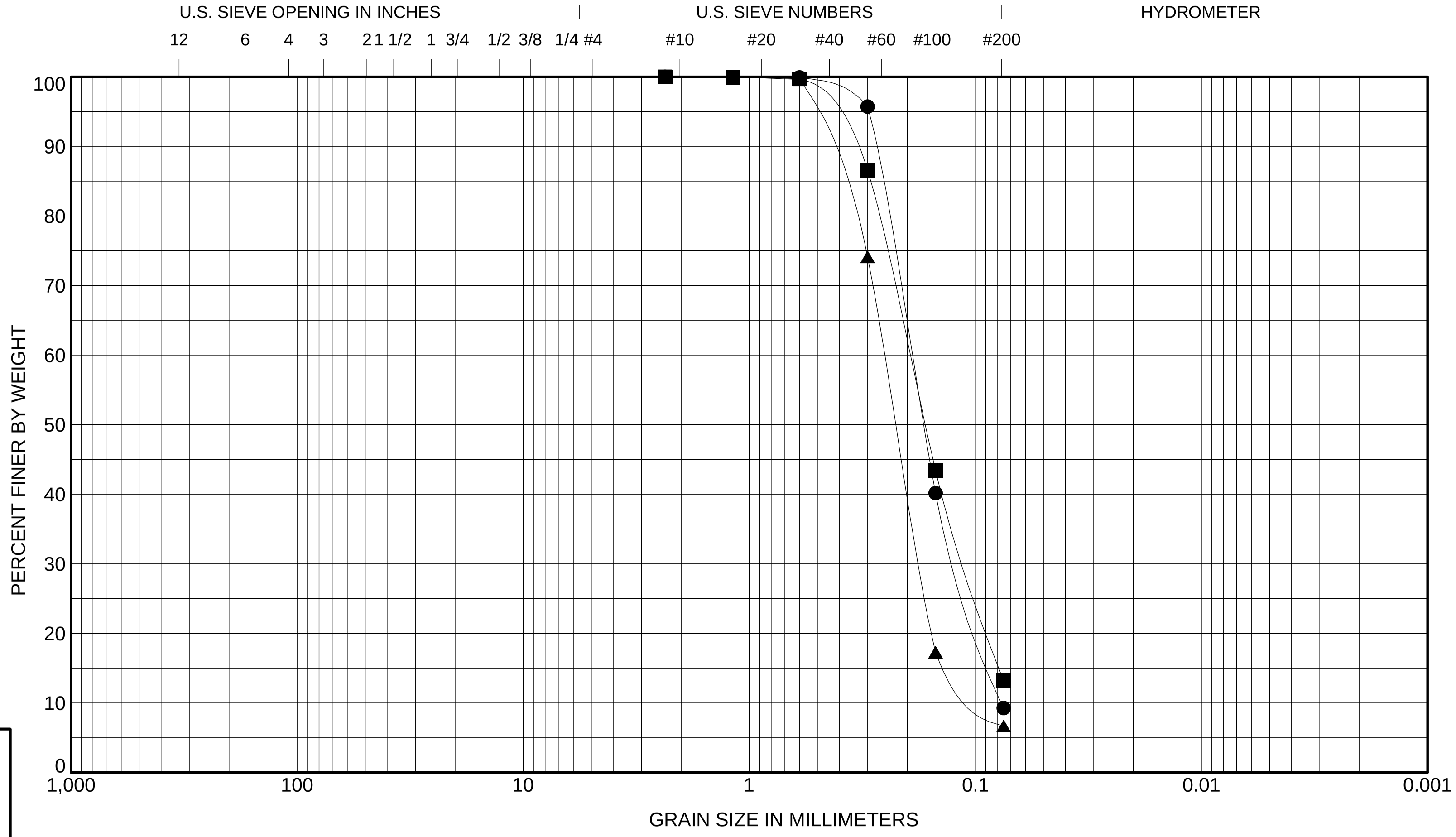
Fig. F-1
Sheet 4 of 9



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample	Depth, Ft	Classification	LL	PL	PI	Cc	Cu
●	**B06-09 S4**	**24.4 - 25.9**	**Slightly silty SAND [SP-SM]**				**1.0**	**2.5**
■	**B06-09 S6**	**34.3 - 35.8**	**Silty SAND [SM]**					
▲	**B06-09 S14**	**81.0 - 82.5**	**Slightly silty SAND [SP-SM]**				**1.3**	**2.7**

	Sample	Depth, Ft	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B06-09 S4**	**24.4 - 25.9**	**2.36**	**0.19**	**0.12**	**0.08**	**0**	**91**	**9**	
■	**B06-09 S6**	**34.3 - 35.8**	**2.36**	**0.2**	**0.11**		**0**	**87**	**13**	
▲	**B06-09 S14**	**81.0 - 82.5**	**1.18**	**0.25**	**0.18**	**0.09**	**0**	**93**	**7**	

Knik Arm Crossing
Knik Arm, Alaska

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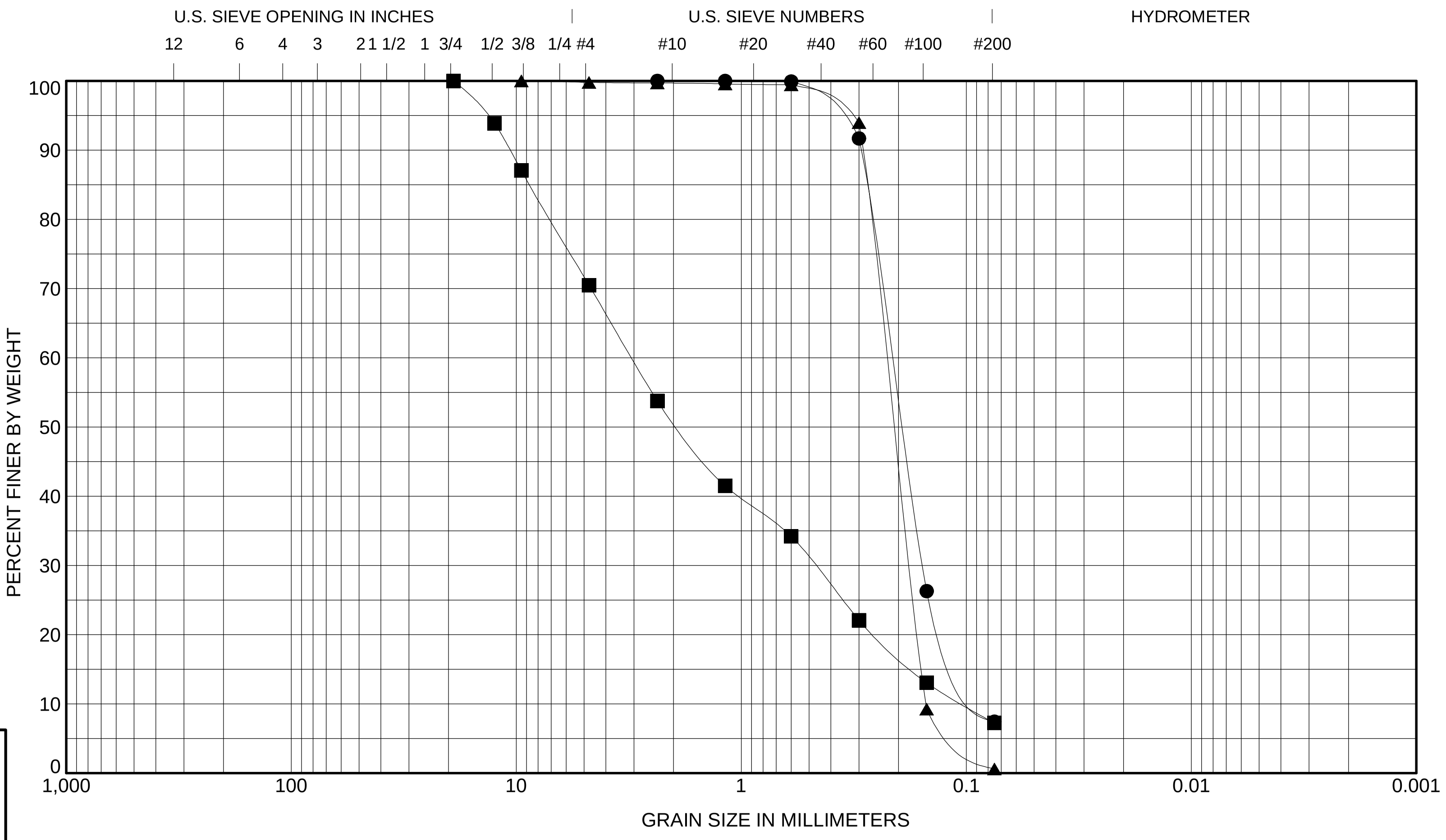

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample	Depth, Ft	Classification	LL	PL	PI	Cc	Cu
●	**B06-11 S3**	**19.0 - 20.5**	**Slightly silty SAND [SP-SM]**				**1.4**	**2.6**
■	**B06-11 S20**	**144.0 - 145.5**	**Slightly silty, gravelly SAND [SP-SM]**				**0.7**	**29.4**
▲	**B06-12 S5**	**26.0 - 27.5**	**SAND [SP]**				**0.9**	**1.5**

	Sample	Depth, Ft	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B06-11 S3**	**19.0 - 20.5**	**2.36**	**0.21**	**0.16**	**0.08**	**0**	**93**	**7**	
■	**B06-11 S20**	**144.0 - 145.5**	**19**	**3.06**	**0.47**	**0.1**	**30**	**63**	**7**	
▲	**B06-12 S5**	**26.0 - 27.5**	**9.5**	**0.23**	**0.18**	**0.15**	**0**	**99**	**1**	

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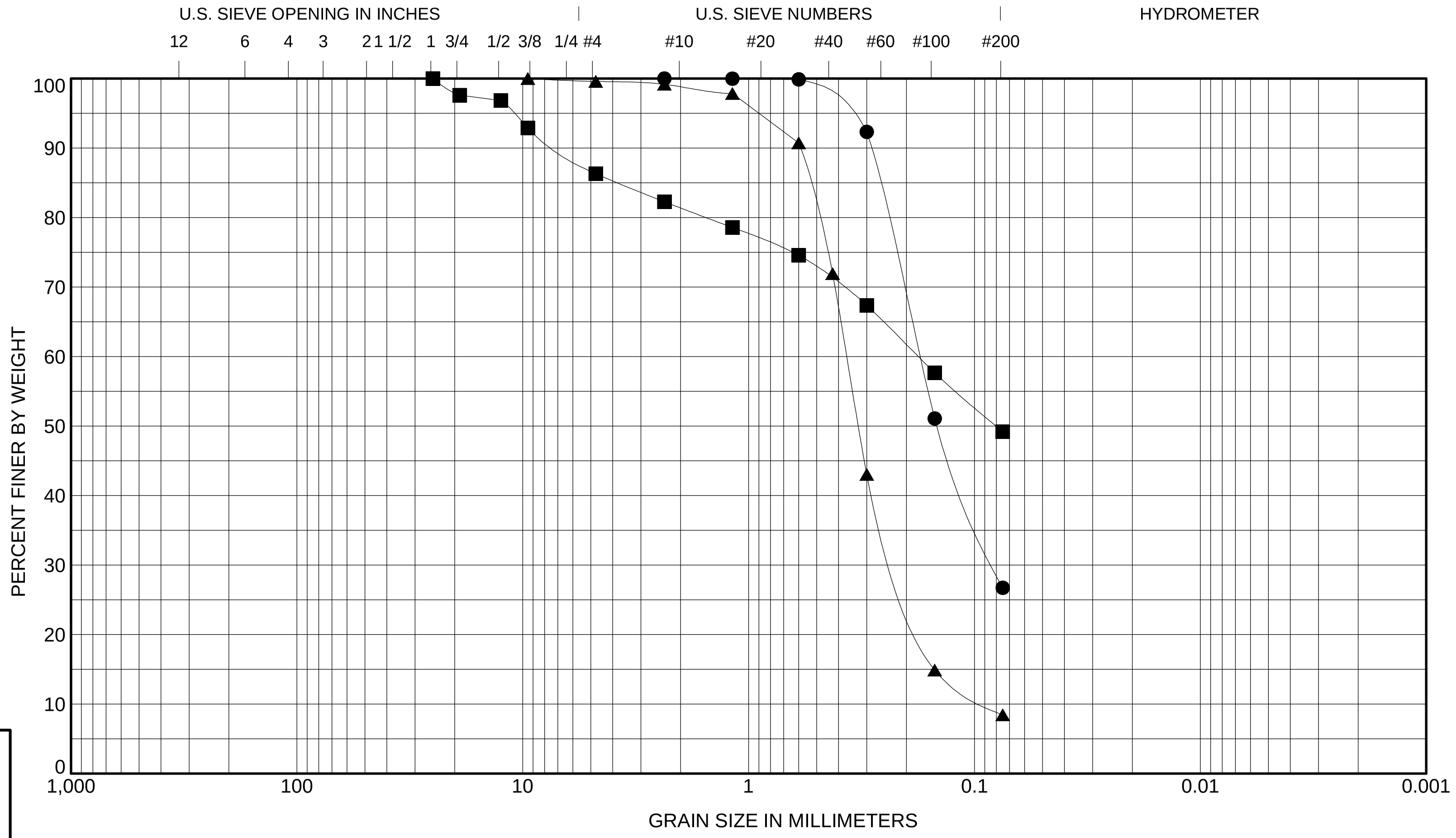

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample		Depth, Ft	Classification	LL	PL	PI	Cc	Cu
●	**B06-12 S11**	**56.0 - 57.5**	**Silty SAND [SM]**					
■	**B06-13 S5**	**92.0 - 93.5**	**Gravelly, silty SAND [SM]**					
▲	**B06-16 S12**	**63.0 - 64.5**	**Slightly silty SAND [SW-SM]**				**1.5**	**4.2**

Sample		Depth, Ft	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B06-12 S11**	**56.0 - 57.5**	**2.36**	**0.17**	**0.08**		**0**	**73**	**27**	
■	**B06-13 S5**	**92.0 - 93.5**	**25**	**0.18**			**14**	**37**	**49**	
▲	**B06-16 S12**	**63.0 - 64.5**	**9.5**	**0.37**	**0.22**	**0.09**	**0**	**91**	**8**	

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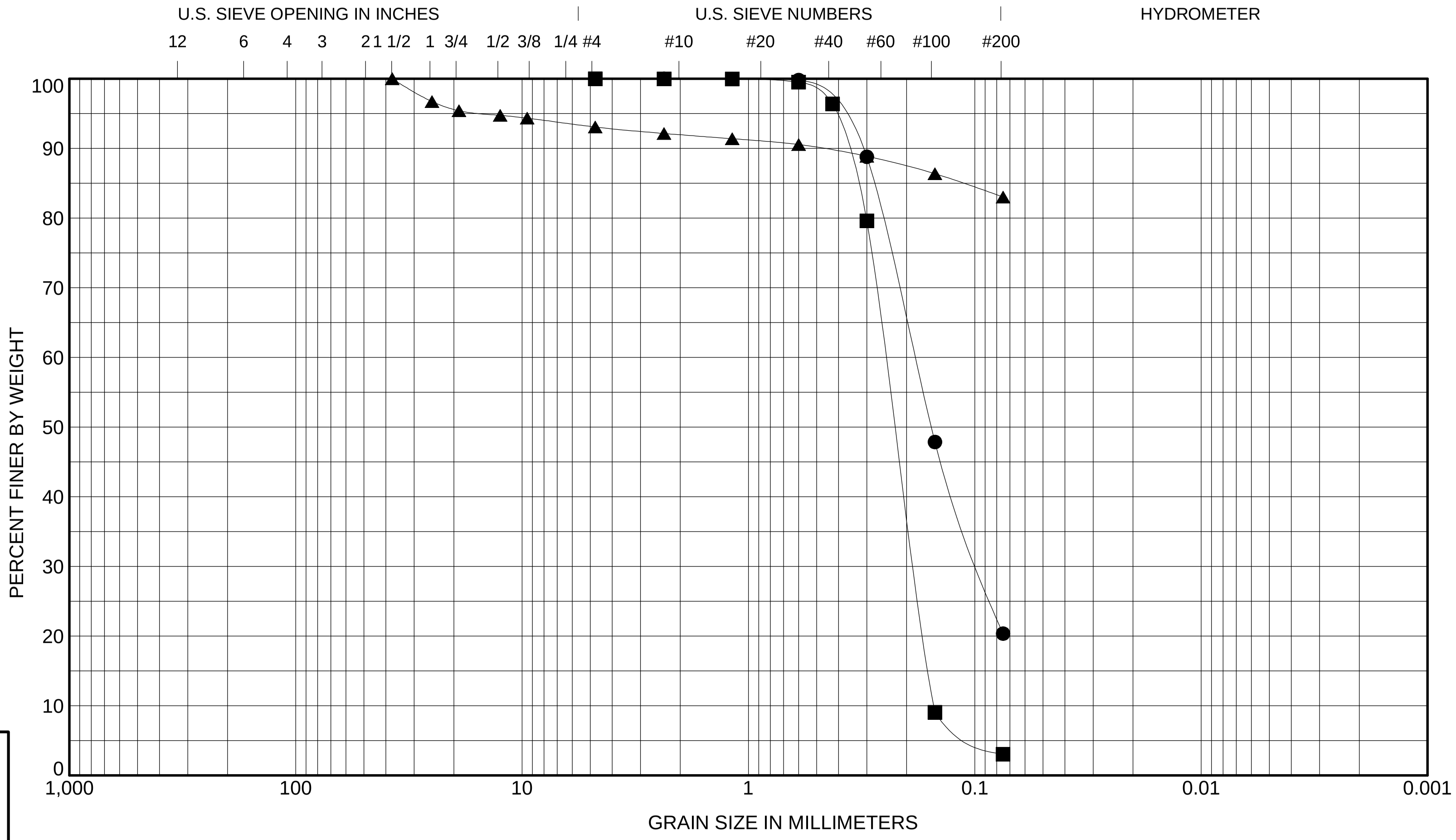

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample	Depth, Ft	Classification	LL	PL	PI	Cc	Cu
●	**B06-16 S20**	**103.0 - 104.5**	**Silty SAND [SM]**					
■	**B06-16 S36**	**183.0 - 184.5**	**SAND [SP]**				**0.9**	**1.6**
▲	**B06-18 S39**	**209.0 - 214.0**	**Slightly gravelly, slightly sandy CLAY [CL]**					

	Sample	Depth, Ft	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B06-16 S20**	**103.0 - 104.5**	**2.36**	**0.18**	**0.1**		**0**	**80**	**20**	
■	**B06-16 S36**	**183.0 - 184.5**	**4.75**	**0.25**	**0.18**	**0.15**	**0**	**97**	**3**	
▲	**B06-18 S39**	**209.0 - 214.0**	**37.5**				**7**	**10**	**83**	

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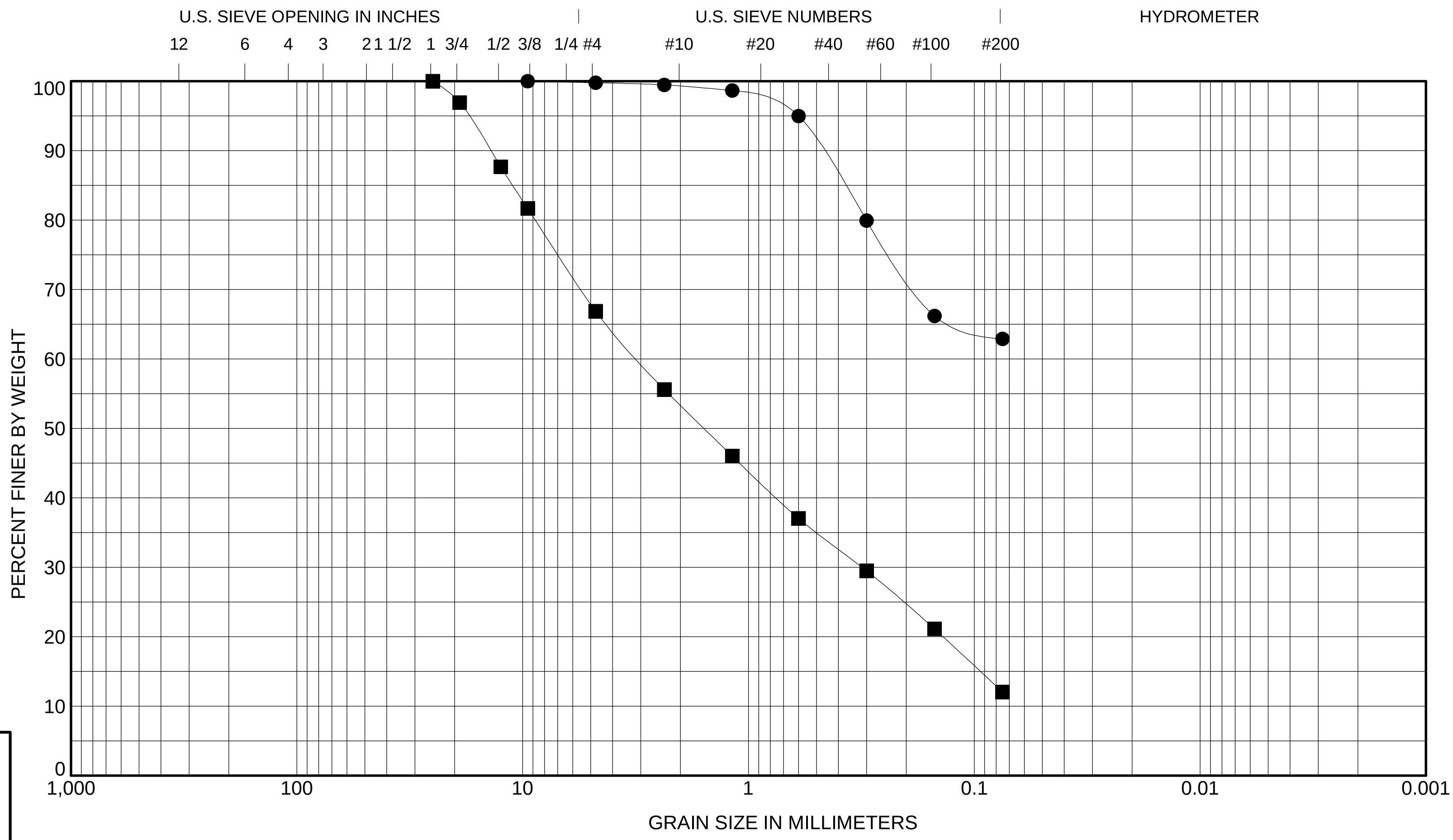

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample	Depth, Ft	Classification	LL	PL	PI	Cc	Cu
●	**B06-18 S51**	**266.0 - 269.0**	**Sandy CLAY [CL]**					
■	**B06-19 S2**	**10.0 - 11.5**	**Silty, gravelly SAND [SM]**				**0.5**	**48.3**

	Sample	Depth, Ft	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B06-18 S51**	**266.0 - 269.0**	**9.5**				**0**	**37**	**63**	
■	**B06-19 S2**	**10.0 - 11.5**	**25**	**3.1**	**0.31**		**33**	**55**	**12**	

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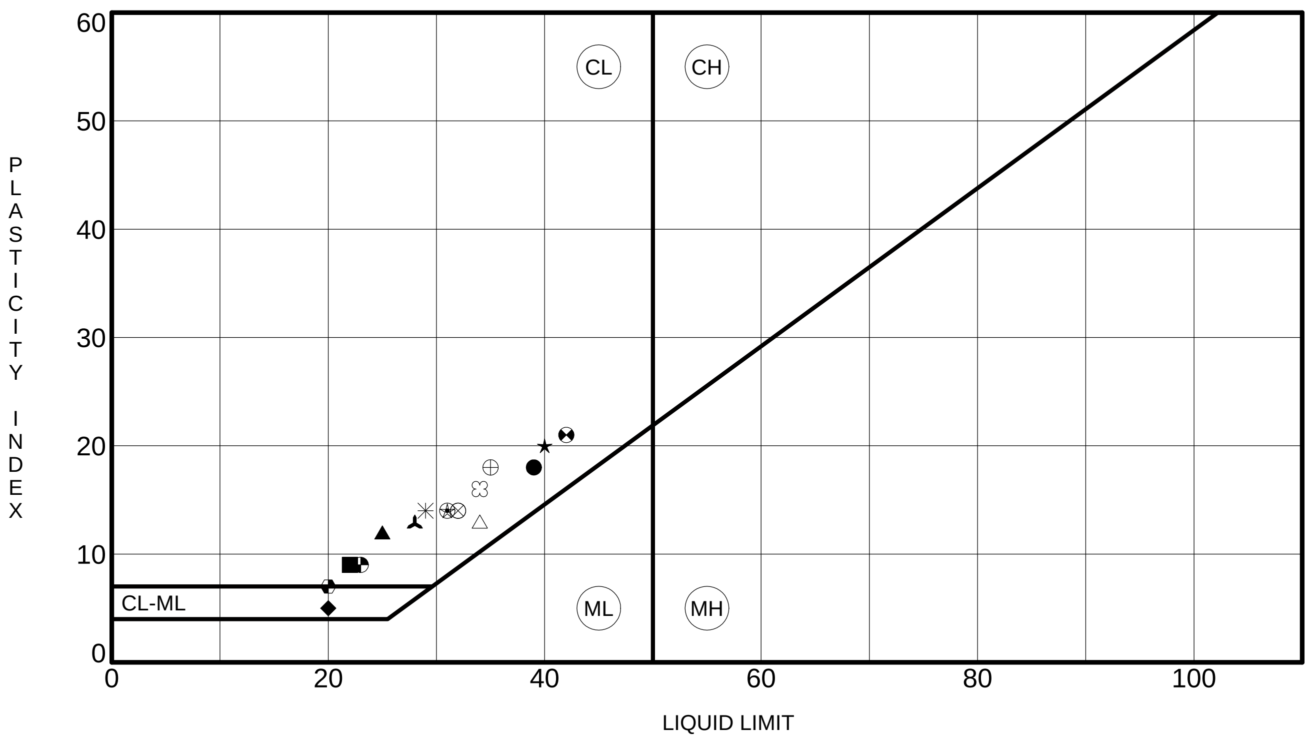

Boring	Depth, Ft	LL	PL	PI	Fines	Classification
● **B06-01 S6**	**40.0 - 41.5**	**39**	**21**	**18**		**CL**
■ **B06-01 S13**	**75.0 - 76.5**	**22**	**13**	**9**		**CL**
▲ **B06-01 S20**	**110.0 - 111.5**	**25**	**13**	**12**		**CL**
○ **B06-01 S27**	**145.0 - 146.5**	**32**	**18**	**14**		**CL**
⊙ **B06-01 S32**	**170.0 - 171.5**	**31**	**17**	**14**		**CL**
△ **B06-01 S36**	**190.0 - 191.5**	**34**	**21**	**13**		**CL**
✳ **B06-02 S7**	**39.0 - 40.5**	**29**	**15**	**14**		**CL**
⅄ **B06-02 S14**	**74.0 - 75.5**	**28**	**15**	**13**		**CL**
⊗ **B06-02 S21**	**129.0 - 130.5**	**32**	**18**	**14**		**CL**
★ **B06-04 S19**	**131.0 - 132.5**	**40**	**20**	**20**		**CL**
⊕ **B06-05 S7**	**41.0 - 42.5**	**35**	**17**	**18**		**CL**
◍ **B06-05 S16**	**84.0 - 85.5**	**42**	**21**	**21**		**CL**
◑ **B06-06 S15**	**75.6 - 77.1**	**23**	**14**	**9**		**CL**
☆ **B06-06 S18**	**88.8 - 90.3**	**31**	**17**	**14**		**CL**
✤ **B06-06 S21**	**98.2 - 99.7**	**34**	**18**	**16**		**CL**
◕ **B06-07 S21**	**120.0 - 121.5**	**20**	**13**	**7**		**CL-ML**
◆ **B06-08 S27**	**156.0 - 157.5**	**20**	**15**	**5**		**CL-ML**

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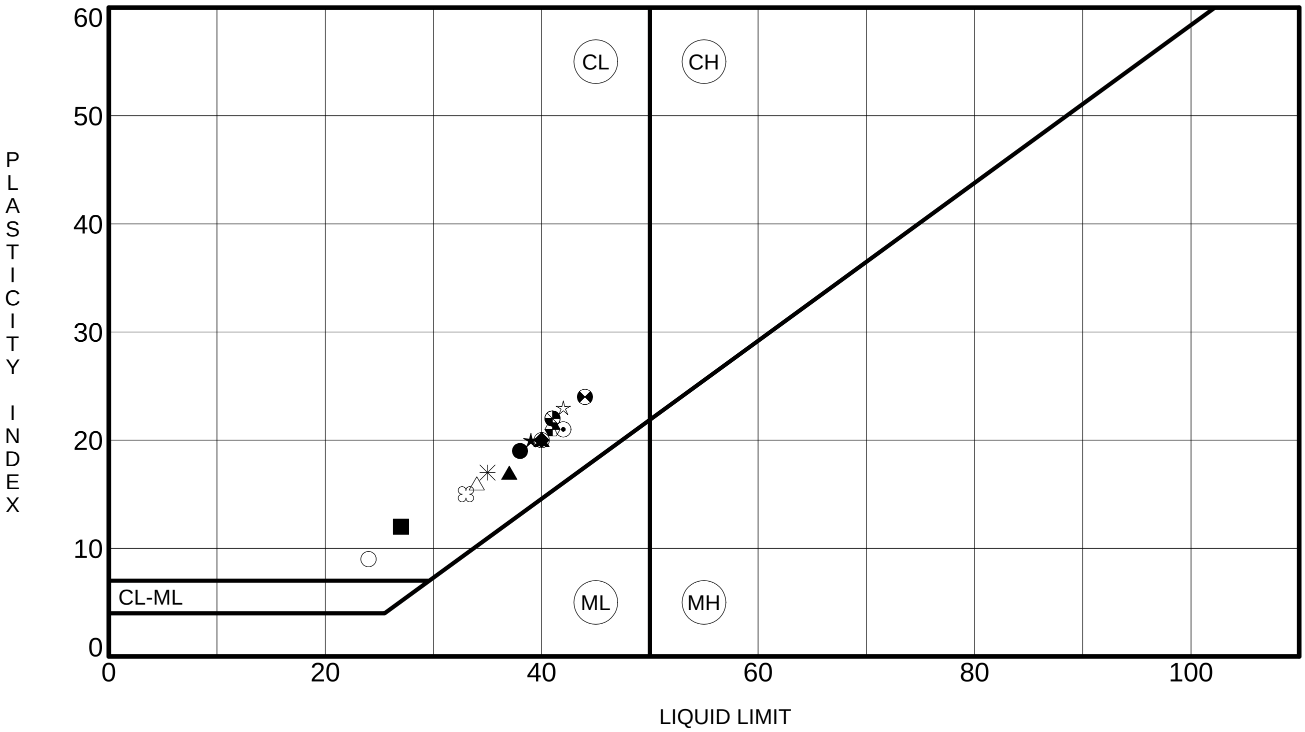

Boring	Depth, Ft	LL	PL	PI	Fines	Classification
● **B06-08 S32**	**195.0 - 196.5**	**38**	**19**	**19**		**CL**
■ **B06-09 S32**	**192.0 - 193.5**	**27**	**15**	**12**		**CL**
▲ **B06-09 S33**	**202.0 - 203.5**	**37**	**20**	**17**		**CL**
○ **B06-10 S29**	**180.0 - 181.5**	**24**	**15**	**9**		**CL**
⊙ **B06-12 S23**	**131.0 - 132.5**	**42**	**21**	**21**		**CL**
△ **B06-12 S26**	**161.0 - 162.5**	**34**	**18**	**16**		**CL**
✳ **B06-12 S35**	**241.0 - 242.5**	**35**	**18**	**17**		**CL**
⅄ **B06-13 S1**	**55.0 - 56.5**	**40**	**20**	**20**		**CL**
⊗ **B06-13 S7**	**112.0 - 113.5**	**41**	**19**	**22**		**CL**
★ **B06-14 S5**	**30.0 - 31.5**	**39**	**19**	**20**		**CL**
⊕ **B06-14 S9**	**50.0 - 51.5**	**40**	**20**	**20**		**CL**
⧓ **B06-14 S13**	**70.0 - 71.5**	**44**	**20**	**24**		**CL**
◕ **B06-14 S15**	**80.0 - 81.5**	**41**	**19**	**22**		**CL**
☆ **B06-14 S19**	**100.0 - 101.5**	**42**	**19**	**23**		**CL**
⌘ **B06-14 S24**	**155.0 - 156.5**	**33**	**18**	**15**		**CL**
◓ **B06-14 S28**	**185.0 - 186.5**	**41**	**20**	**21**		**CL**
◆ **B06-14 S32**	**205.0 - 206.5**	**40**	**20**	**20**		**CL**

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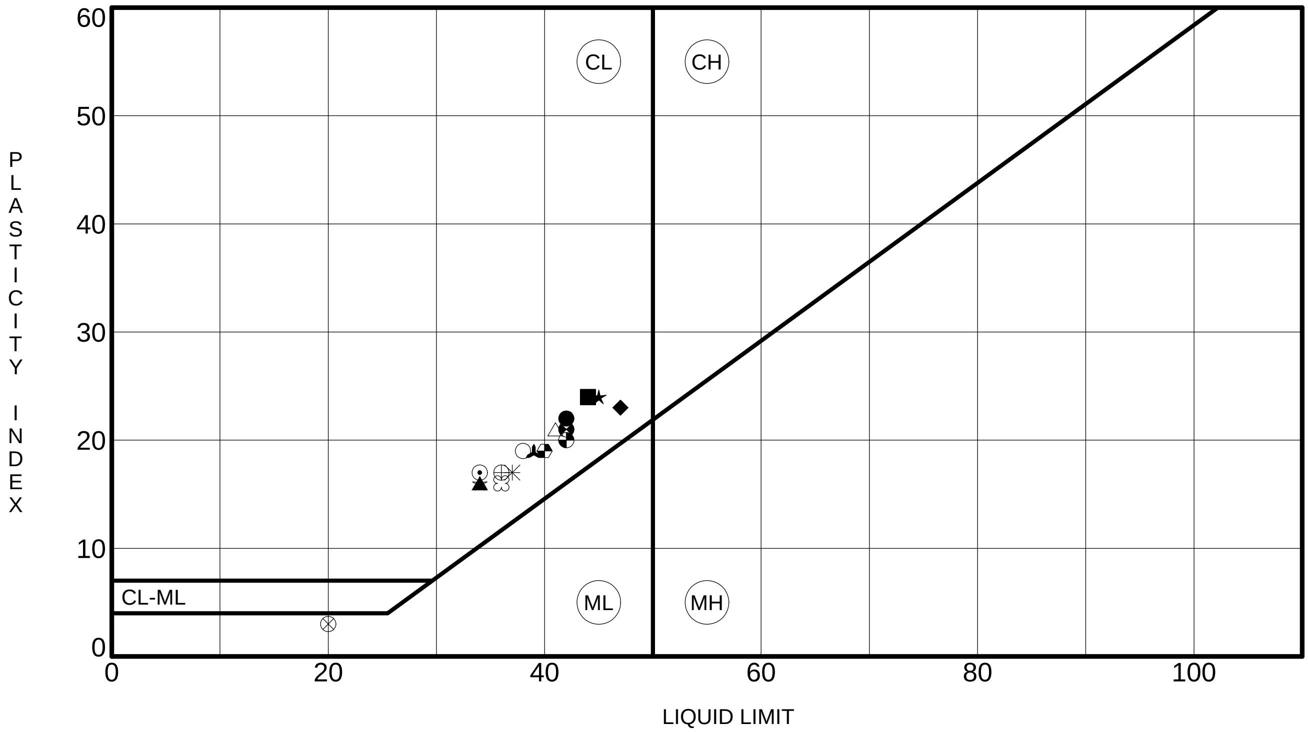

Boring		Depth, Ft	LL	PL	PI	Fines	Classification
●	**B06-14 S35**	**217.5 - 219.0**	**42**	**20**	**22**		**CL**
■	**B06-15 S1**	**22.5 - 24.0**	**44**	**20**	**24**		**CL**
▲	**B06-15 S4**	**62.0 - 63.5**	**34**	**18**	**16**		**CL**
○	**B06-15 S7**	**92.0 - 93.5**	**38**	**19**	**19**		**CL**
⊙	**B06-15 S10**	**132.0 - 133.5**	**34**	**17**	**17**		**CL**
△	**B06-16 S3**	**15.0 - 16.5**	**41**	**20**	**21**		**CL**
✳	**B06-16 S30**	**153.0 - 154.5**	**37**	**20**	**17**		**CL**
⅄	**B06-16 S41**	**218.0 - 219.5**	**39**	**20**	**19**		**CL**
⊗	**B06-16 S44**	**248.0 - 249.5**	**20**	**17**	**3**		**ML**
★	**B06-17 S5**	**27.0 - 28.5**	**45**	**21**	**24**		**CL**
⊕	**B06-17 S11**	**57.0 - 58.5**	**36**	**19**	**17**		**CL**
◑	**B06-17 S15**	**81.0 - 82.5**	**42**	**21**	**21**		**CL**
◕	**B06-17 S22**	**117.5 - 119.0**	**42**	**22**	**20**		**CL**
☆	**B06-17 S26**	**137.5 - 139.0**	**34**	**18**	**16**		**CL**
⌘	**B06-18 S3**	**19.0 - 20.5**	**36**	**20**	**16**		**CL**
◔	**B06-18 S5**	**34.0 - 35.5**	**40**	**21**	**19**		**CL**
◆	**B06-18 S10**	**64.0 - 65.5**	**47**	**24**	**23**		**CL**

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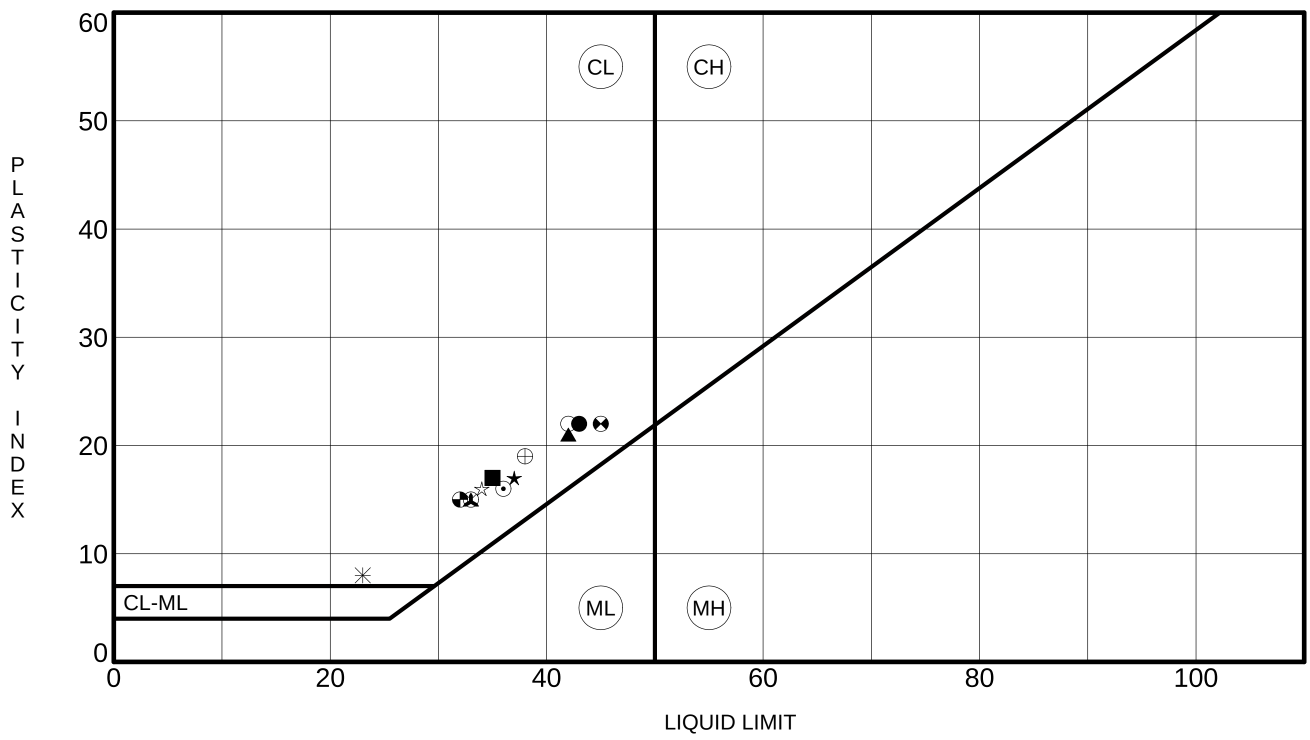

Boring	Depth, Ft	LL	PL	PI	Fines	Classification
● **B06-18 S16**	**94.0 - 95.5**	**43**	**21**	**22**		**CL**
■ **B06-18 S18**	**104.0 - 105.5**	**35**	**18**	**17**		**CL**
▲ **B06-18 S20**	**114.0 - 115.5**	**42**	**21**	**21**		**CL**
○ **B06-18 S25**	**139.0 - 140.5**	**42**	**20**	**22**		**CL**
⊙ **B06-18 S30**	**164.0 - 165.5**	**36**	**20**	**16**		**CL**
△ **B06-18 S31**	**169.0 - 170.5**	**35**	**18**	**17**		**CL**
✳ **B06-18 S36**	**194.0 - 195.5**	**23**	**15**	**8**		**CL**
⅄ **B06-18 S40**	**214.0 - 215.5**	**33**	**18**	**15**		**CL**
⊗ **B06-18 S45**	**239.0 - 240.5**	**33**	**18**	**15**		**CL**
★ **B06-19 S4**	**20.0 - 21.5**	**37**	**20**	**17**		**CL**
⊕ **B06-19 S16**	**80.0 - 81.5**	**38**	**19**	**19**		**CL**
⧓ **B06-19 S56**	**132.0 - 133.5**	**45**	**23**	**22**		**CL**
◐ **B06-19 S64**	**169.5 - 171.0**	**32**	**17**	**15**		**CL**
☆ **B06-19 S68**	**188.5 - 190.0**	**34**	**18**	**16**		**CL**

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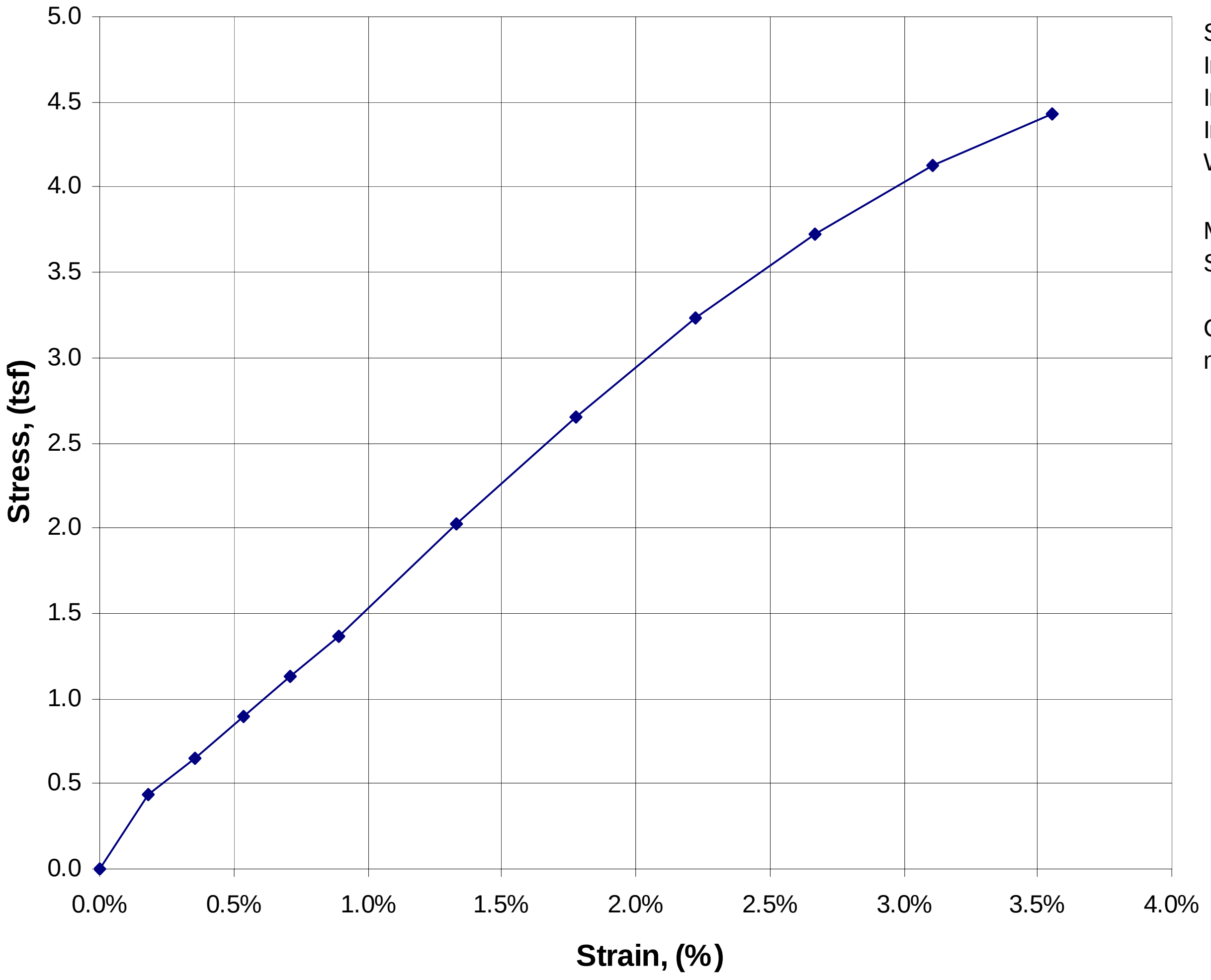
Boring B06-14 Sample S26



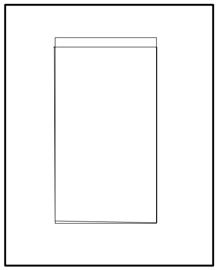
Sample Data

Sample Depth: 176.5-177 ft
Initial Diameter: 2.828 in.
Initial Height: 5.625 in.
Initial Moisture Content: 17.8%
Wet Density: 130.4 lb/ft³

Maximum Stress: >4.4 tons/ft^2 (tsf)
Strain at Maximum Stress: >3.6%

Classification: Hard, gray CLAY, moist. (CL)

Failure Sketch



Knik Arm Crossing
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UNCONFINED COMPRESSION TEST RESULTS
(Boring B06-14 Sample S26)

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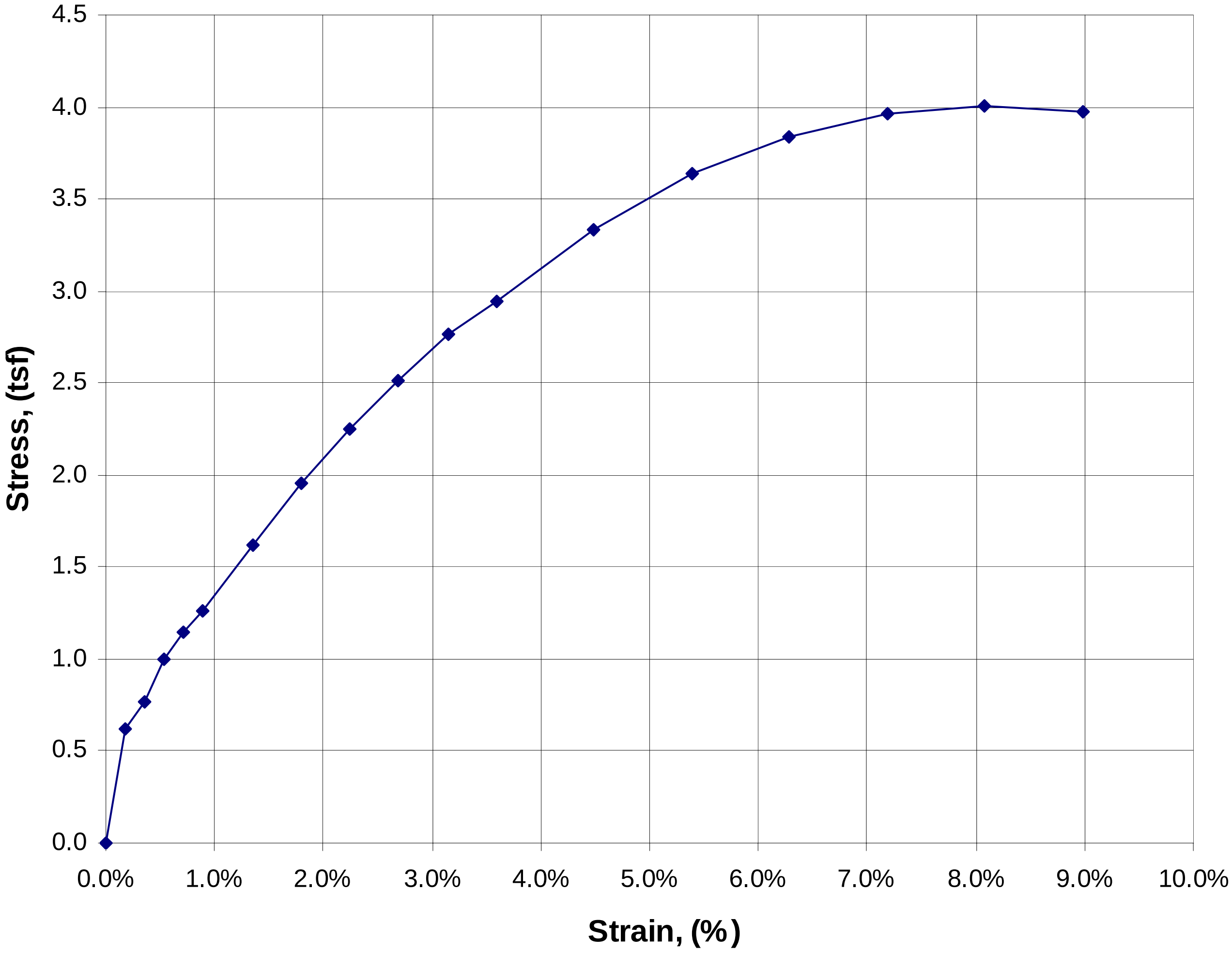
Boring B06-16 Sample S4



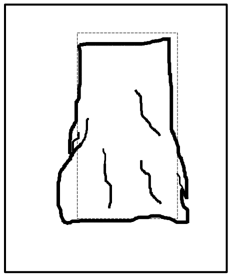
Sample Data

Sample Depth: 20.0-20.5 ft
Initial Diameter: 2.838 in.
Initial Height: 5.567 in.
Initial Moisture Content: 21.3%
Wet Density: NA lb/ft³

Maximum Stress: 4.0 tons/ft^2 (tsf)
Strain at Maximum Stress: 9.0%

Classification: Hard, gray CLAY, moist. (CL)

Failure Sketch



Knik Arm Crossing
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UNCONFINED COMPRESSION TEST RESULTS
(Boring B06-16 Sample S4)

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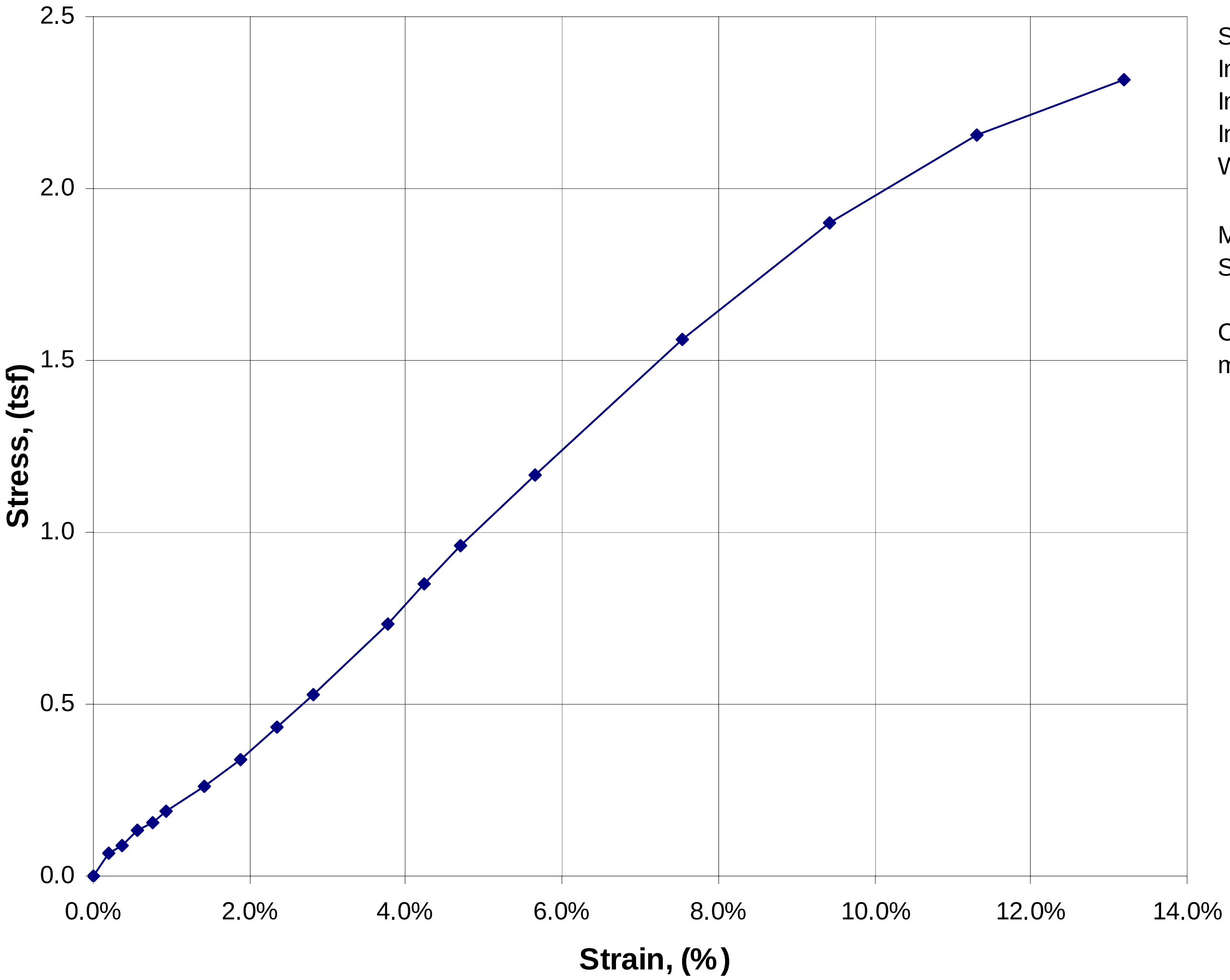
Boring B06-16 Sample S8



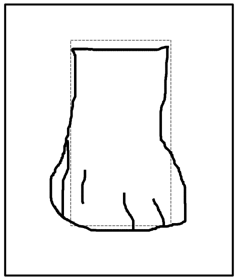
Sample Data

Sample Depth: 40.5-41 ft
Initial Diameter: 2.816 in.
Initial Height: 5.310 in.
Initial Moisture Content: 24.7%
Wet Density: 130.6 lb/ft³

Maximum Stress: 2.3 tons/ft^2 (tsf)
Strain at Maximum Stress: 13.2%

Classification: Very stiff, gray CLAY, moist. (CL)

Failure Sketch



Knik Arm Crossing
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UNCONFINED COMPRESSION TEST RESULTS
(Boring B06-16 Sample S8)

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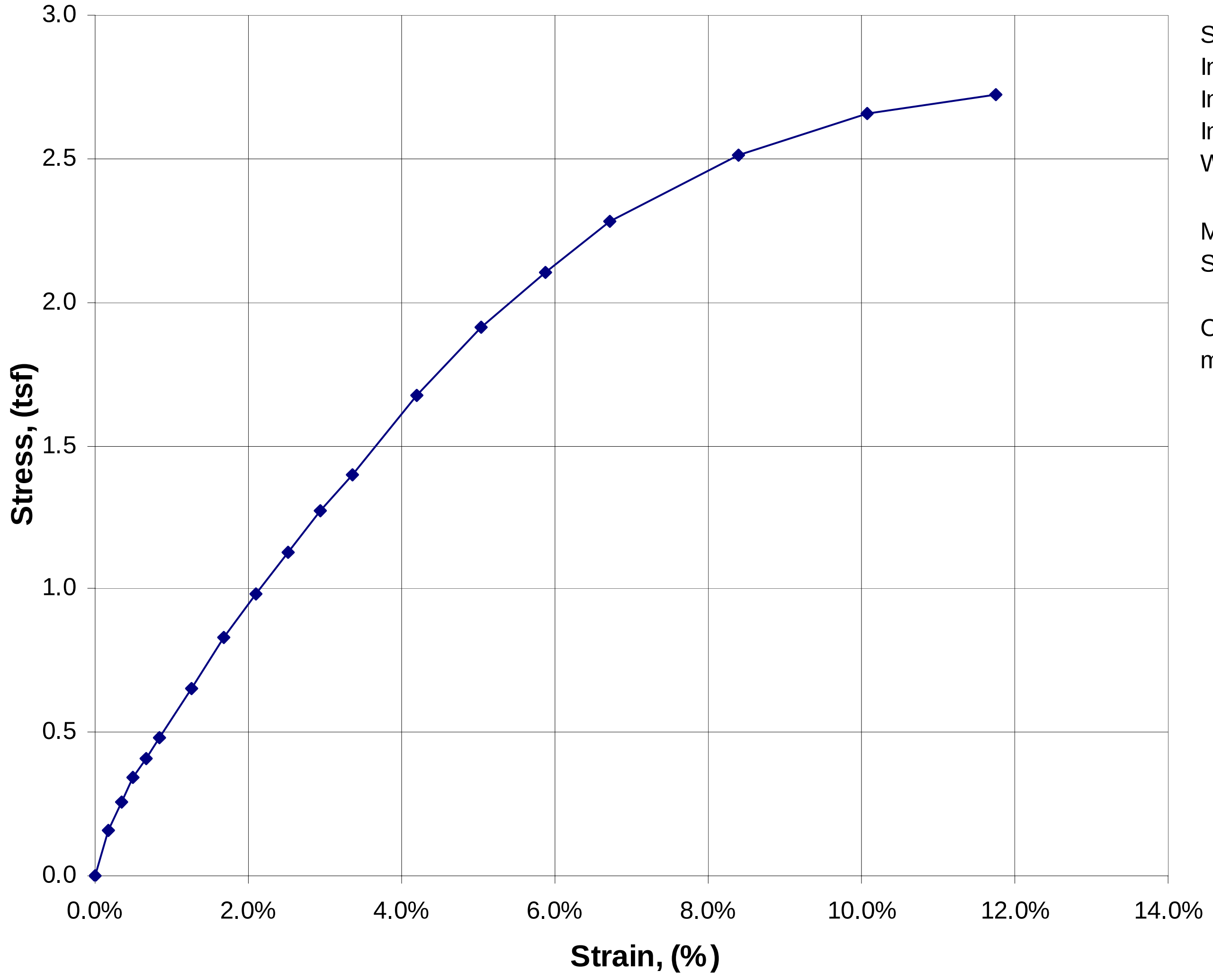
Boring B06-16 Sample S31



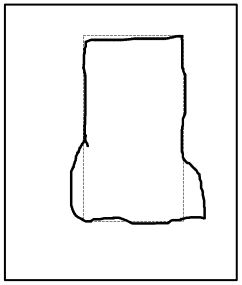
Sample Data

Sample Depth: 160-160.5 ft
Initial Diameter: 2.758 in.
Initial Height: 5.962 in.
Initial Moisture Content: 27.2%
Wet Density: 115.5 lb/ft³

Maximum Stress: 2.7 tons/ft^2 (tsf)
Strain at Maximum Stress: 11.7%

Classification: Hard, gray CLAY, moist. (CL)

Failure Sketch



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UNCONFINED COMPRESSION TEST RESULTS
(Boring B06-16 Sample S31)

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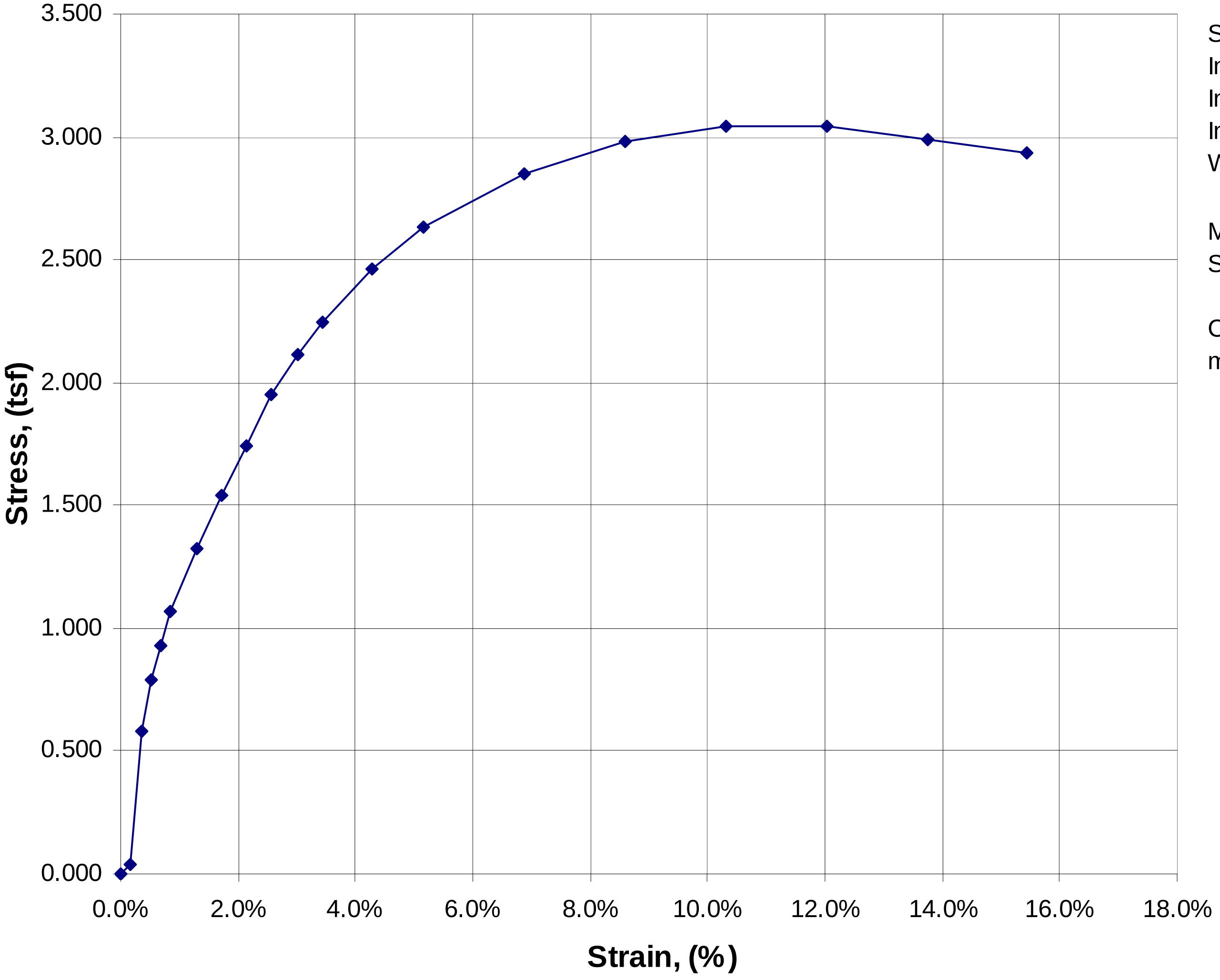
Boring B06-17 Sample S6



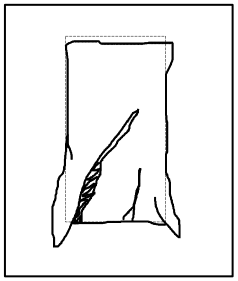
Sample Data

Sample Depth: 33.5 - 34 ft
Initial Diameter: 2.830 in.
Initial Height: 5.824 in.
Initial Moisture Content: not measured
Wet Density: 126.4 lb/ft³

Maximum Stress: 3.0 tons/ft^2 (tsf)
Strain at Maximum Stress: 15.5%

Classification: Very stiff, gray CLAY, moist. (CL)

Failure Sketch



Knik Arm Crossing
Knik Arm, Alaska

UNCONFINED COMPRESSION TEST RESULTS
(Boring B06-17 Sample S6)

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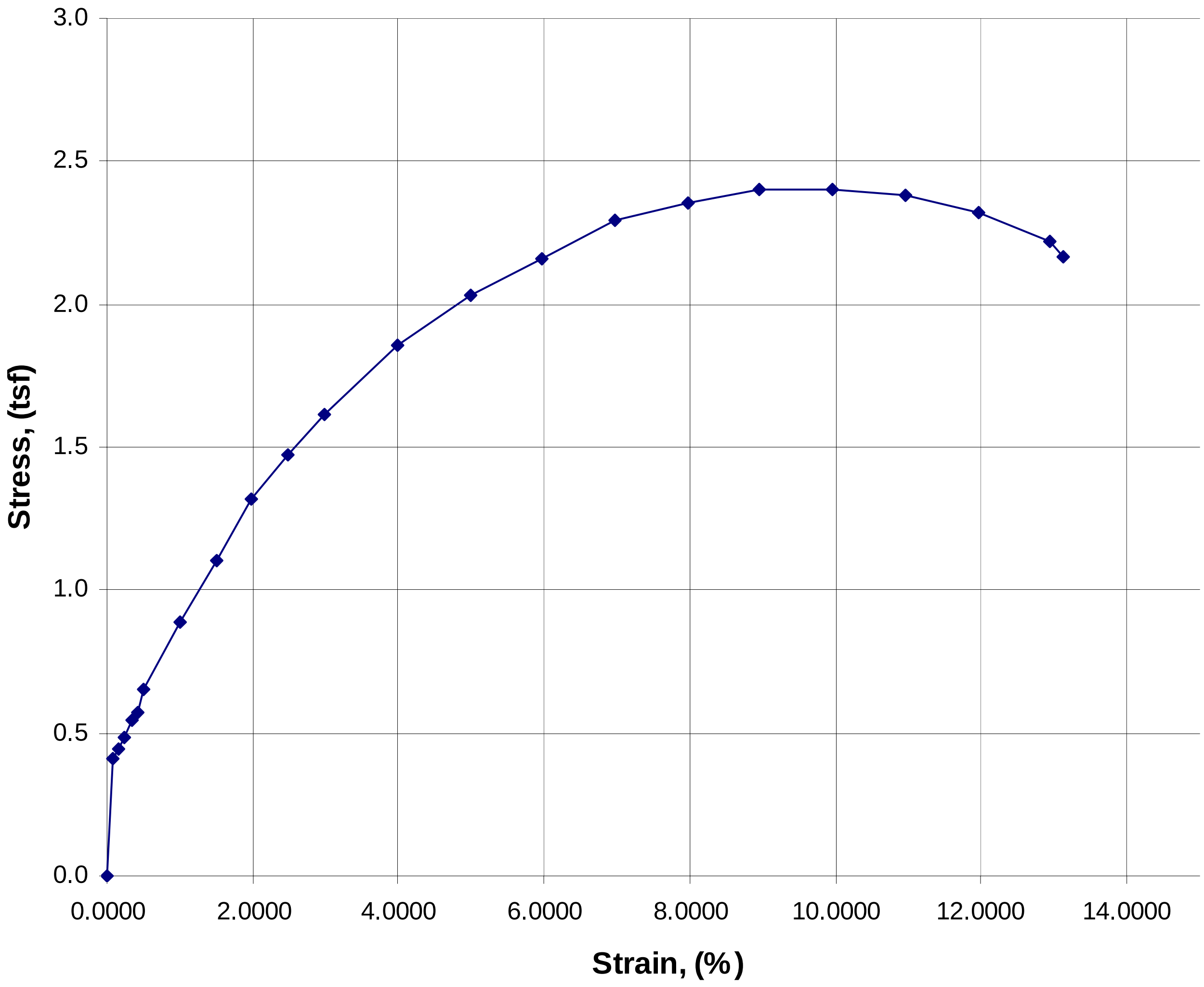
Boring B06-17 Sample S8



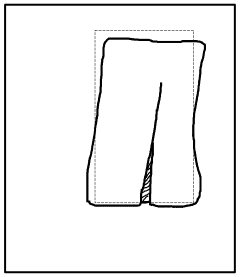
Sample Data

Sample Depth: 43- 43.5 ft
Initial Diameter: 2.875 in.
Initial Height: 6.023 in.
Initial Moisture Content: 26.0%
Wet Density: 122.0 lb/ft³

Maximum Stress: 2.4 tons/ft^2 (tsf)
Strain at Maximum Stress: 10.0%

Classification: Very stiff, gray CLAY, moist. (CL)

Failure Sketch



Knik Arm Crossing
Knik Arm, Alaska

UNCONFINED COMPRESSION TEST RESULTS
(Boring B06-17 Sample S8)

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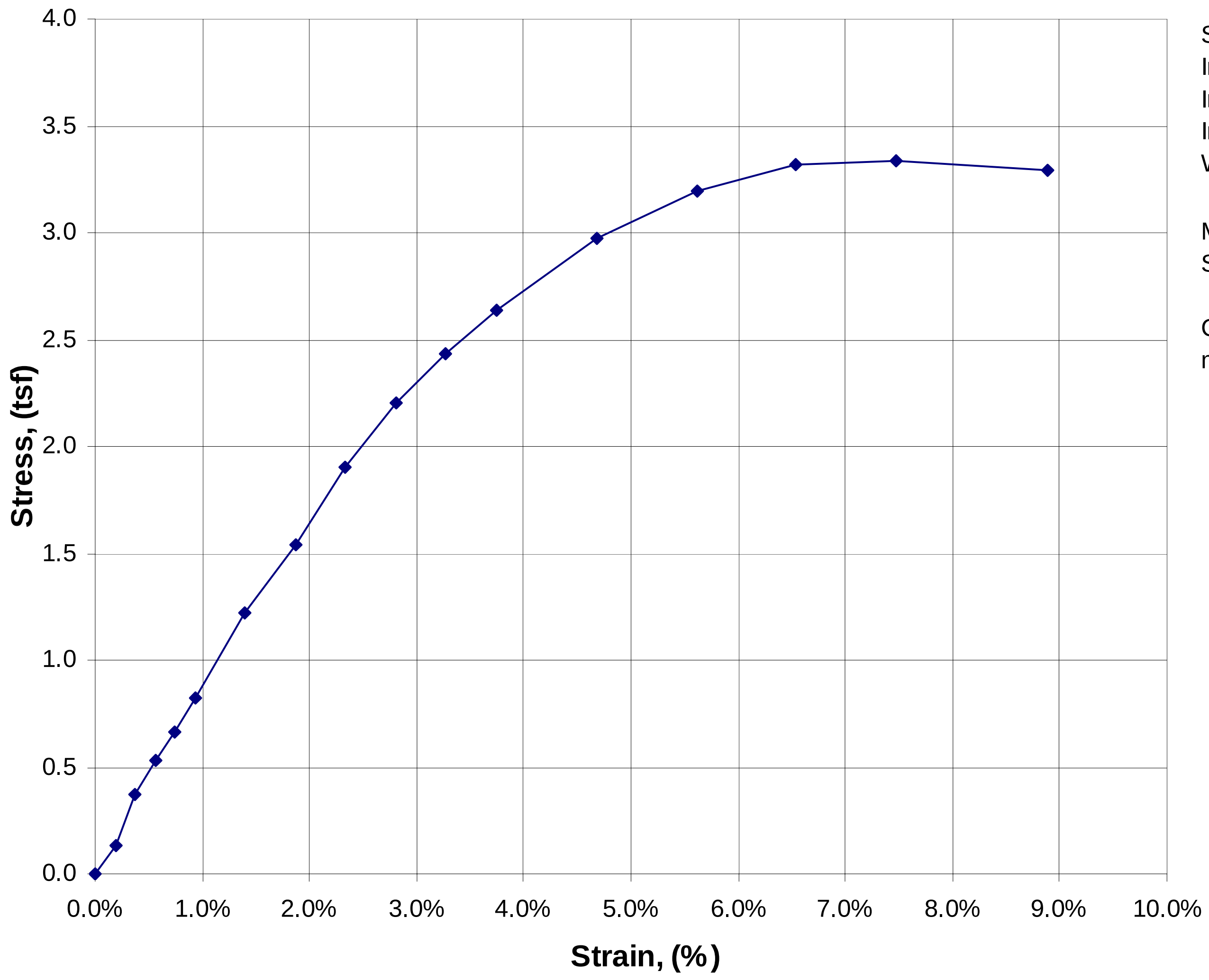
Boring B06-17 Sample S10



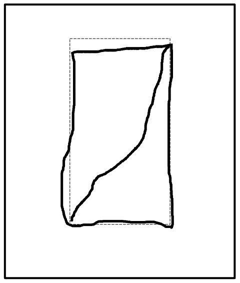
Sample Data

Sample Depth: 53.5-54 ft
Initial Diameter: 2.846 in.
Initial Height: 5.348 in.
Initial Moisture Content: 23.2%
Wet Density: 132.2 lb/ft³

Maximum Stress: 3.3 tons/ft^2 (tsf)
Strain at Maximum Stress: 8.9%

Classification: Very stiff, gray CLAY, moist. (CL)

Failure Sketch



Knik Arm Crossing
Knik Arm, Alaska

UNCONFINED COMPRESSION TEST RESULTS
(Boring B06-17 Sample S10)

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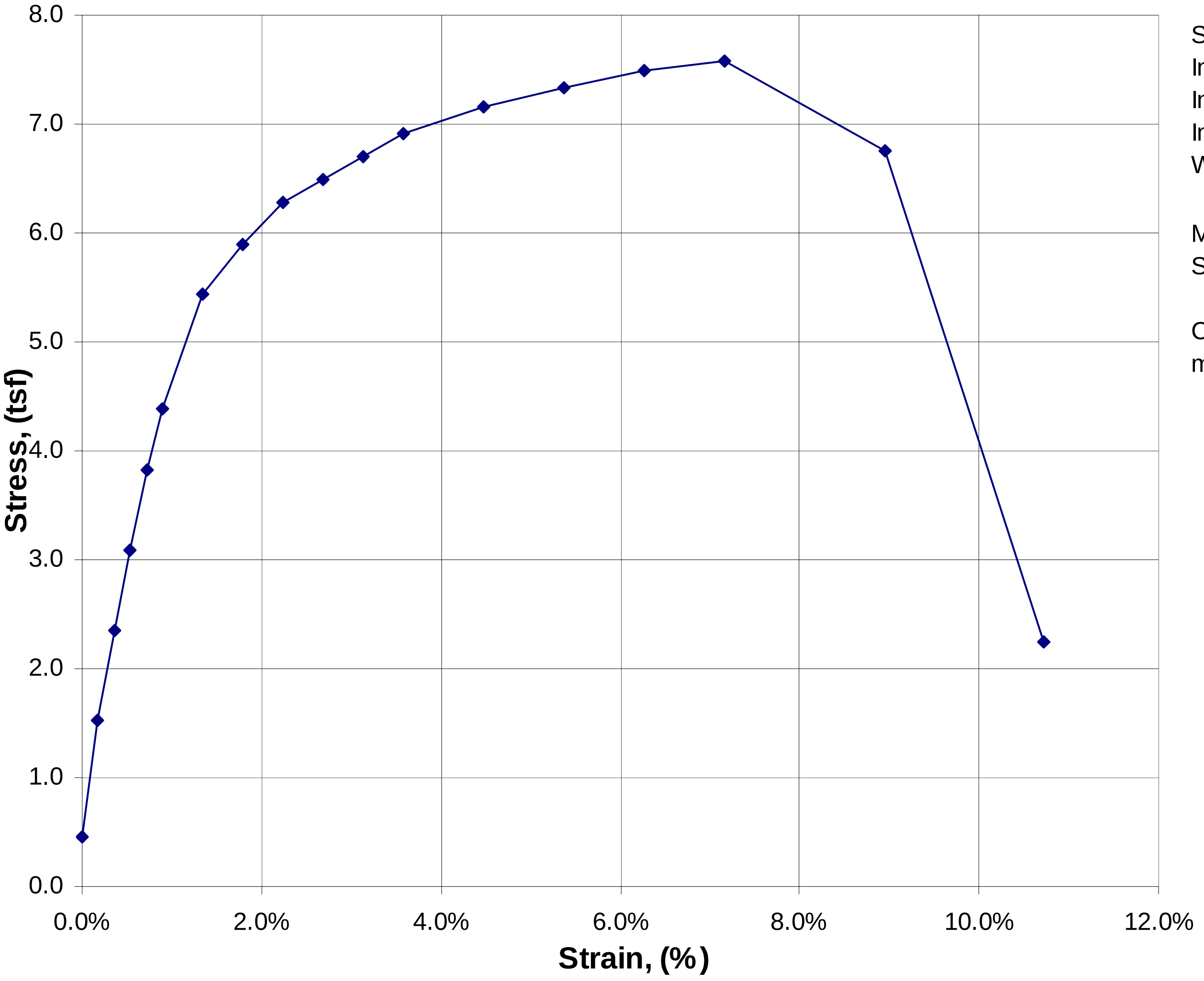
Boring B06-17 Sample S16



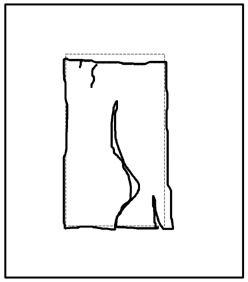
Sample Data

Sample Depth: 86-86.5 ft
Initial Diameter: 2.862 in.
Initial Height: 5.591 in.
Initial Moisture Content: 21.4%
Wet Density: 131.1 lb/ft³

Maximum Stress: 7.6 tons/ft^2 (tsf)
Strain at Maximum Stress: 7.2%

Classification: Hard, gray CLAY, moist, scattered silt seams (CL)

Failure Sketch



Knik Arm Crossing
Knik Arm, Alaska

UNCONFINED COMPRESSION TEST RESULTS
(Boring B06-17 Sample S16)

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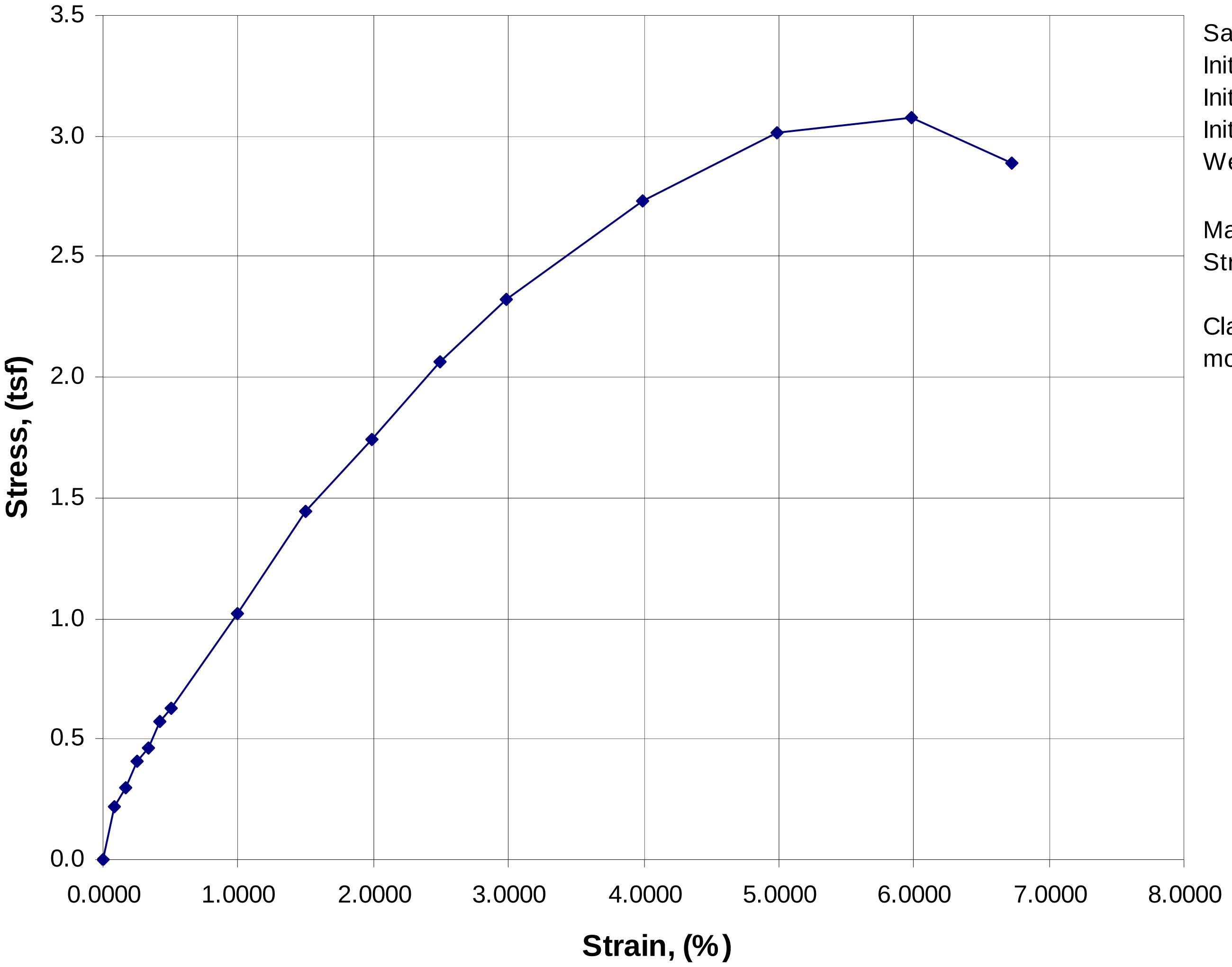
Boring B06-17 Sample S18



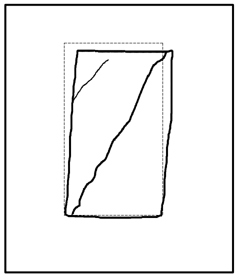
Sample Data

Sample Depth: 97 - 97.5 ft
Initial Diameter: 2.875 in.
Initial Height: 6.019 in.
Initial Moisture Content: 27.0%
Wet Density: 122.8 lb/ft³

Maximum Stress: 3.1 tons/ft^2 (tsf)
Strain at Maximum Stress: 6.0%

Classification: Very stiff, gray CLAY, moist. (CL)

Failure Sketch



Knik Arm Crossing
Knik Arm, Alaska

UNCONFINED COMPRESSION TEST RESULTS
(Boring B06-17 Sample S18)

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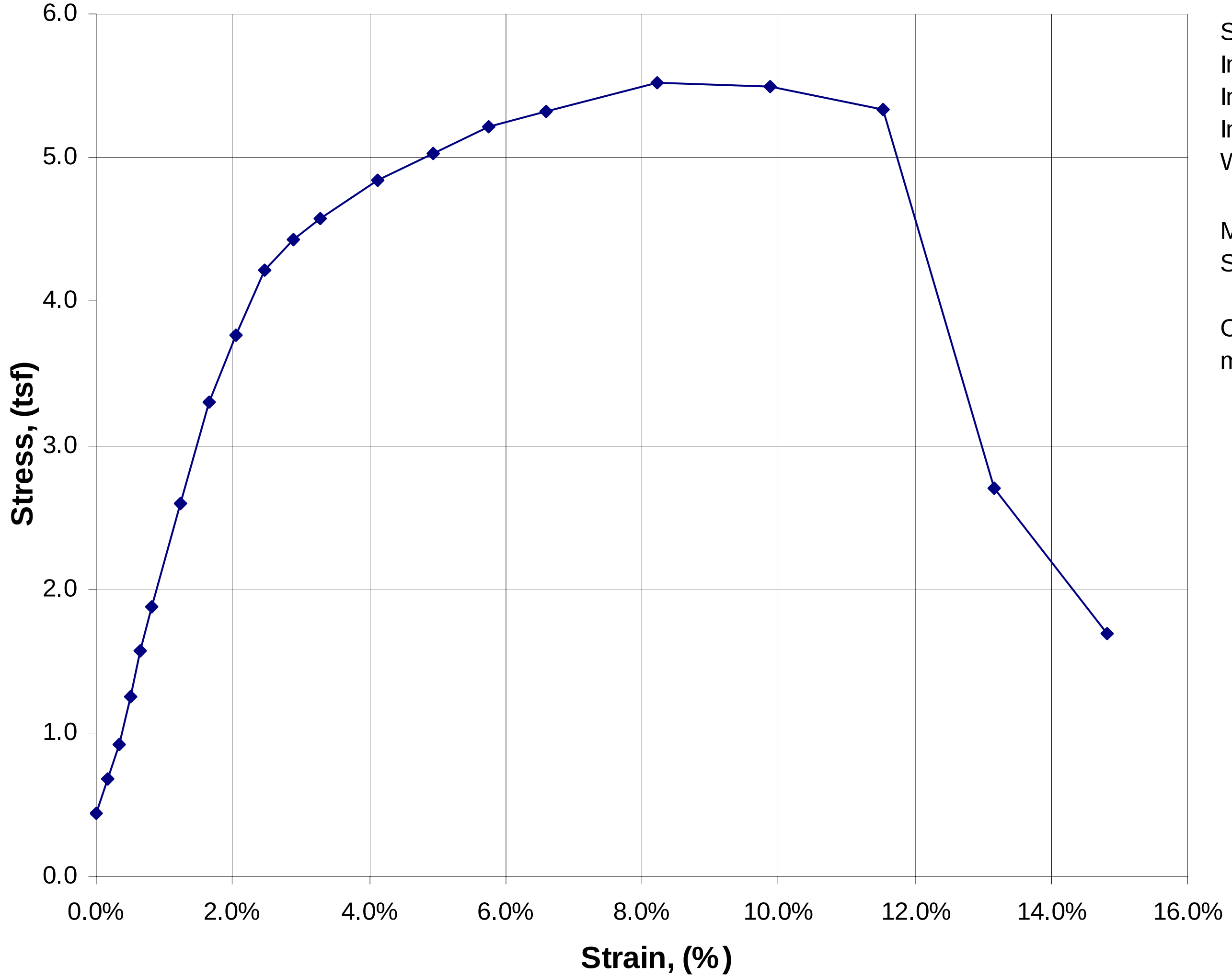
Boring B06-17 Sample S20



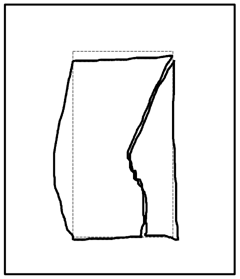
Sample Data

Sample Depth: 106 - 106.5 ft
Initial Diameter: 2.897 in.
Initial Height: 6.074 in.
Initial Moisture Content: 24.7%
Wet Density: 131.1 lb/ft^3

Maximum Stress: 5.5 tons/ft^2 (tsf)
Strain at Maximum Stress: 9.9%

Classification: Hard, gray CLAY, moist. (CL)

Failure Sketch



Knik Arm Crossing
Knik Arm, Alaska

UNCONFINED COMPRESSION TEST RESULTS
(Boring B06-17 Sample S20)

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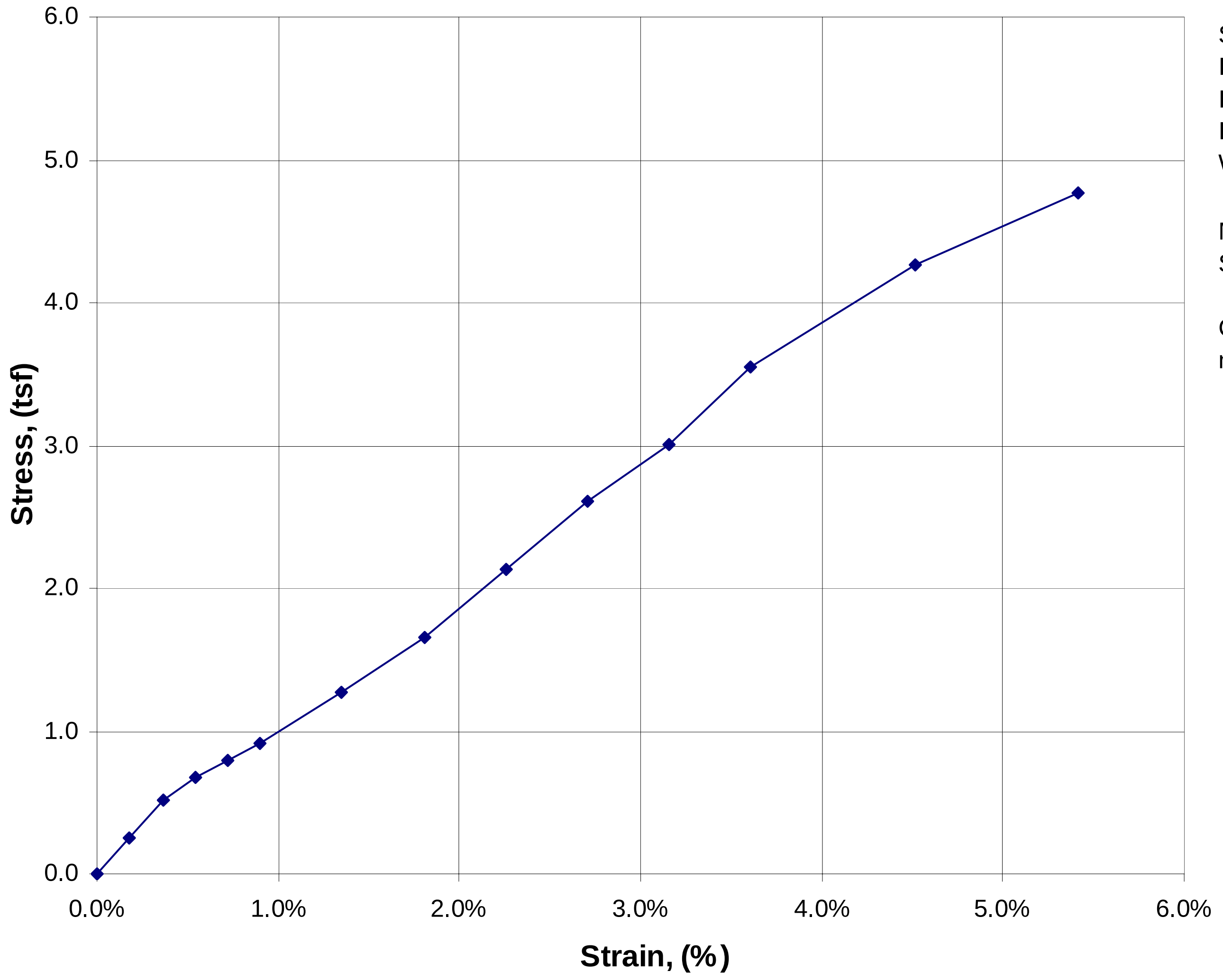
Boring B06-17 Sample S27



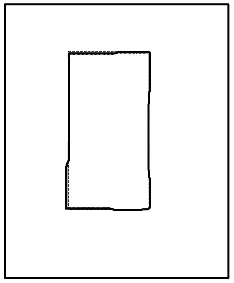
Sample Data

Sample Depth: 146.5-147 ft
Initial Diameter: 2.851 in.
Initial Height: 5.542 in.
Initial Moisture Content: 21.8%
Wet Density: 133.2 lb/ft³

Maximum Stress: 4.8 tons/ft^2 (tsf)
Strain at Maximum Stress: 5.4%

Classification: Hard, gray CLAY, moist. (CL)

Failure Sketch



Knik Arm Crossing
Knik Arm, Alaska

UNCONFINED COMPRESSION TEST RESULTS
(Boring B06-17 Sample S27)

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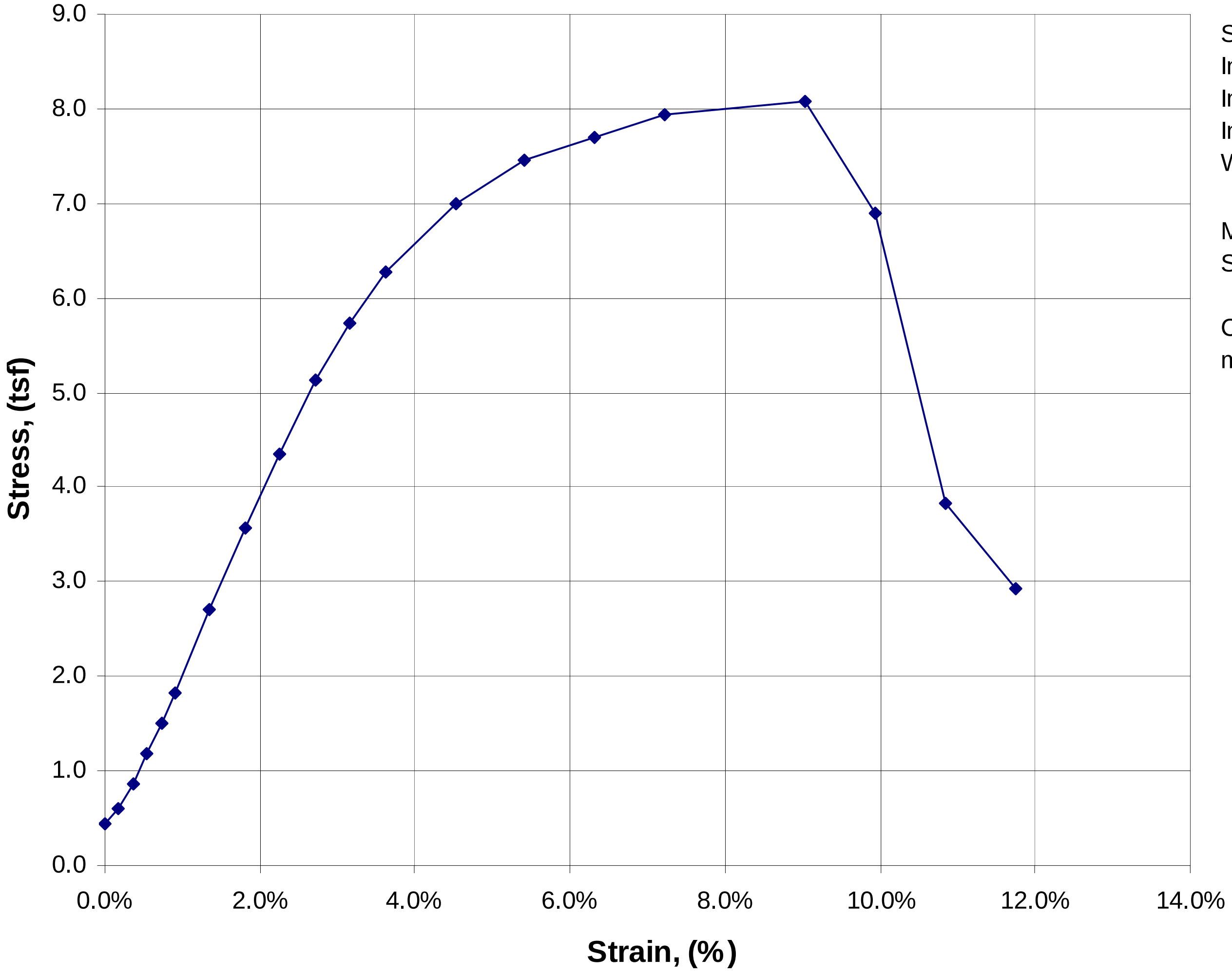
Boring B06-17 Sample S31



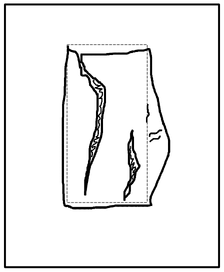
Sample Data

Sample Depth: 166-16.5 ft
Initial Diameter: 2.88 in.
Initial Height: 5.535 in.
Initial Moisture Content: 20.9%
Wet Density: 131.8 lb/ft³

Maximum Stress: 8.1 tons/ft^2 (tsf)
Strain at Maximum Stress: 9.0%

Classification: Hard, gray CLAY, moist, with silt seams. (CL)

Failure Sketch



Knik Arm Crossing
Knik Arm, Alaska

UNCONFINED COMPRESSION TEST RESULTS
(Boring B06-17 Sample S31)

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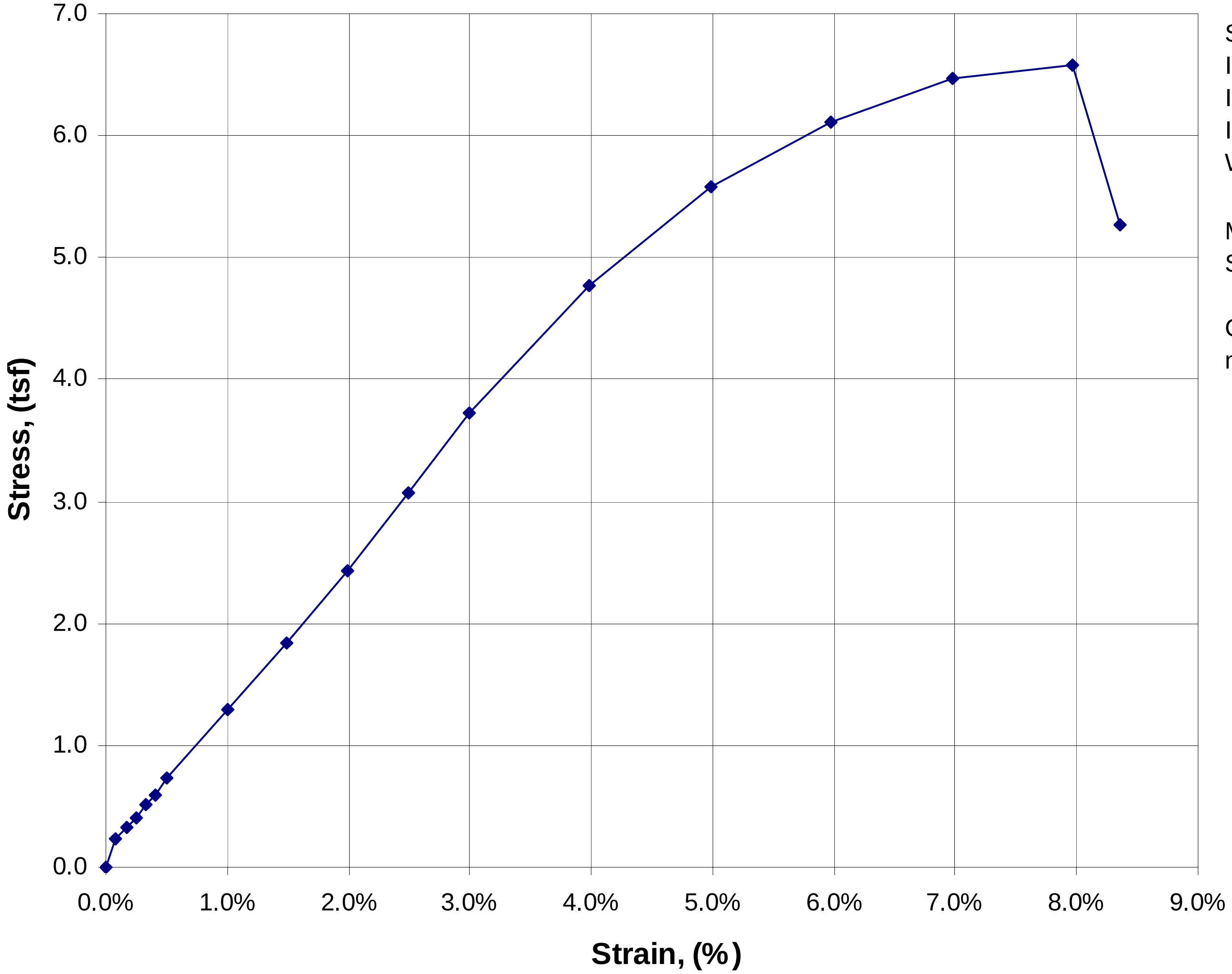
Boring B06-17 Sample S36



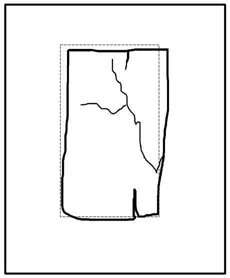
Sample Data

Sample Depth: 187 - 187.5 ft
Initial Diameter: 2.875 in.
Initial Height: 6.026 in.
Initial Moisture Content: 27.0%
Wet Density: 132.2 lb/ft³

Maximum Stress: 6.6 tons/ft^2 (tsf)
Strain at Maximum Stress: 8.0%

Classification: Hard, gray CLAY, moist. (CL)

Failure Sketch



Knik Arm Crossing
Knik Arm, Alaska

UNCONFINED COMPRESSION TEST RESULTS
(Boring B06-17 Sample S36)

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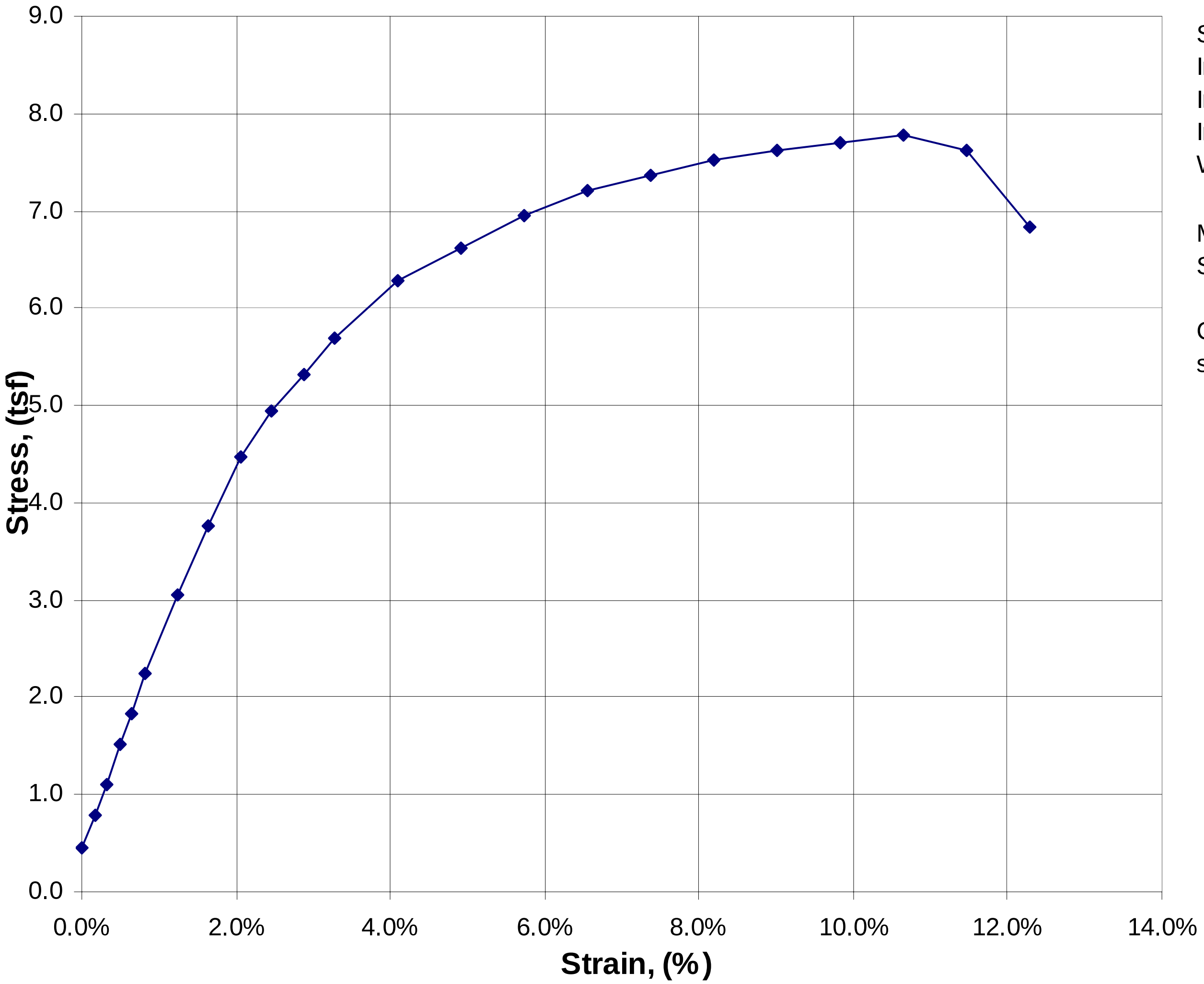
Boring B06-17 Sample S40



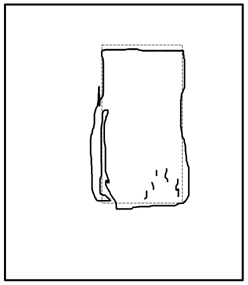
Sample Data

Sample Depth: 201.5-202 ft
Initial Diameter: 2.869 in.
Initial Height: 6.102 in.
Initial Moisture Content: 20.7%
Wet Density: 136.4 lb/ft^3

Maximum Stress: 7.8 tons/ft^2 (tsf)
Strain at Maximum Stress: 10.7%

Classification: Hard, gray, slightly sandy CLAY, moist (CL)

Failure Sketch



Knik Arm Crossing
Knik Arm, Alaska

UNCONFINED COMPRESSION TEST RESULTS
(Boring B06-17 Sample S40)

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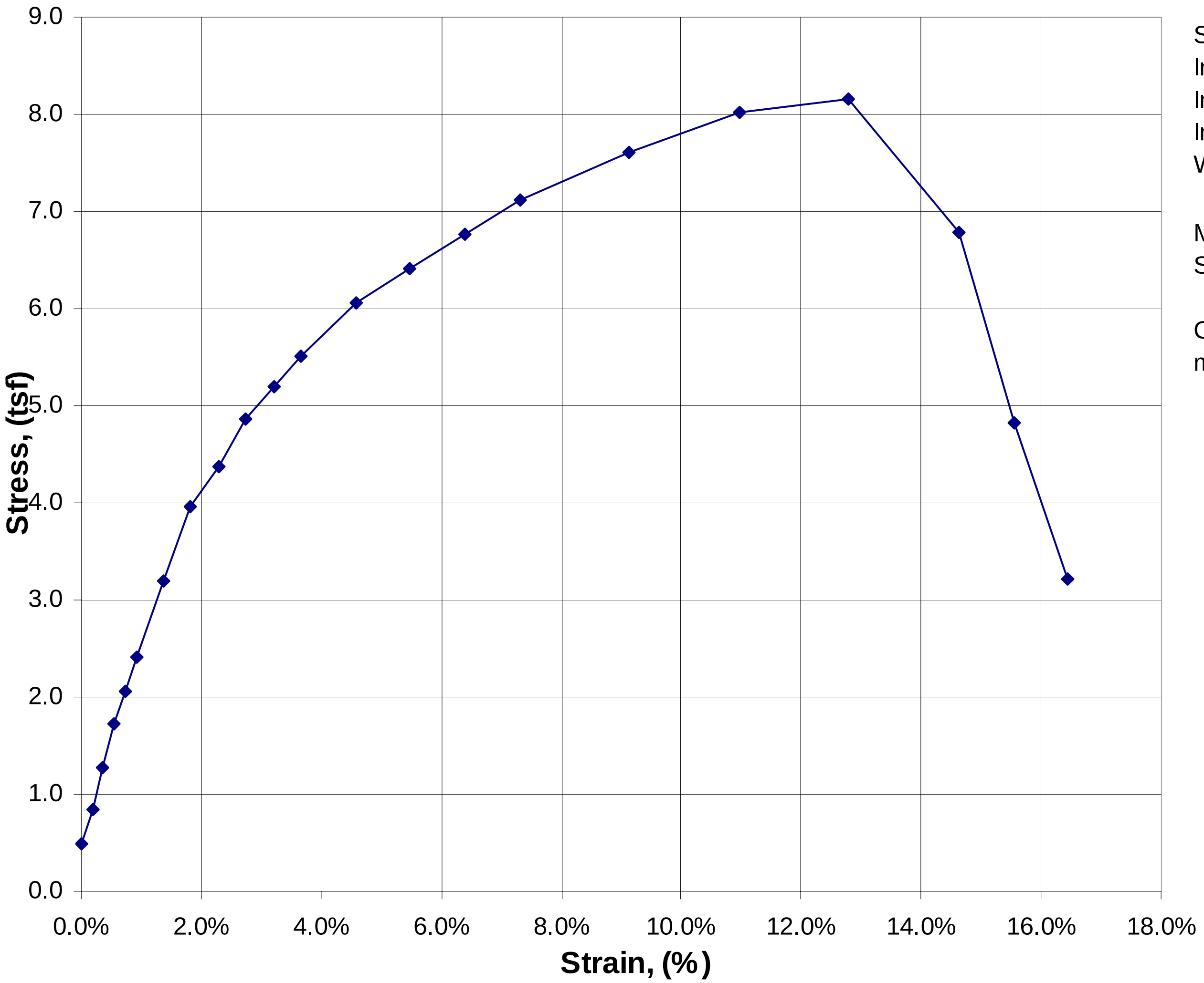
Boring B06-18 Sample S6



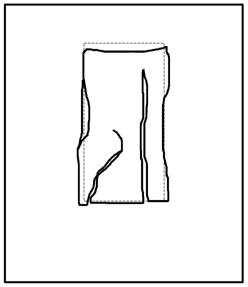
Sample Data

Sample Depth: 39-39.5 ft
Initial Diameter: 2.766 in.
Initial Height: 5.470 in.
Initial Moisture Content: 21.4%
Wet Density: 128.1 lb/ft³

Maximum Stress: 8.2 tons/ft^2 (tsf)
Strain at Maximum Stress: 12.8%

Classification: Hard, gray CLAY, moist. (CL)

Failure Sketch



Knik Arm Crossing
Knik Arm, Alaska

UNCONFINED COMPRESSION TEST RESULTS
(Boring B06-18 Sample S6)

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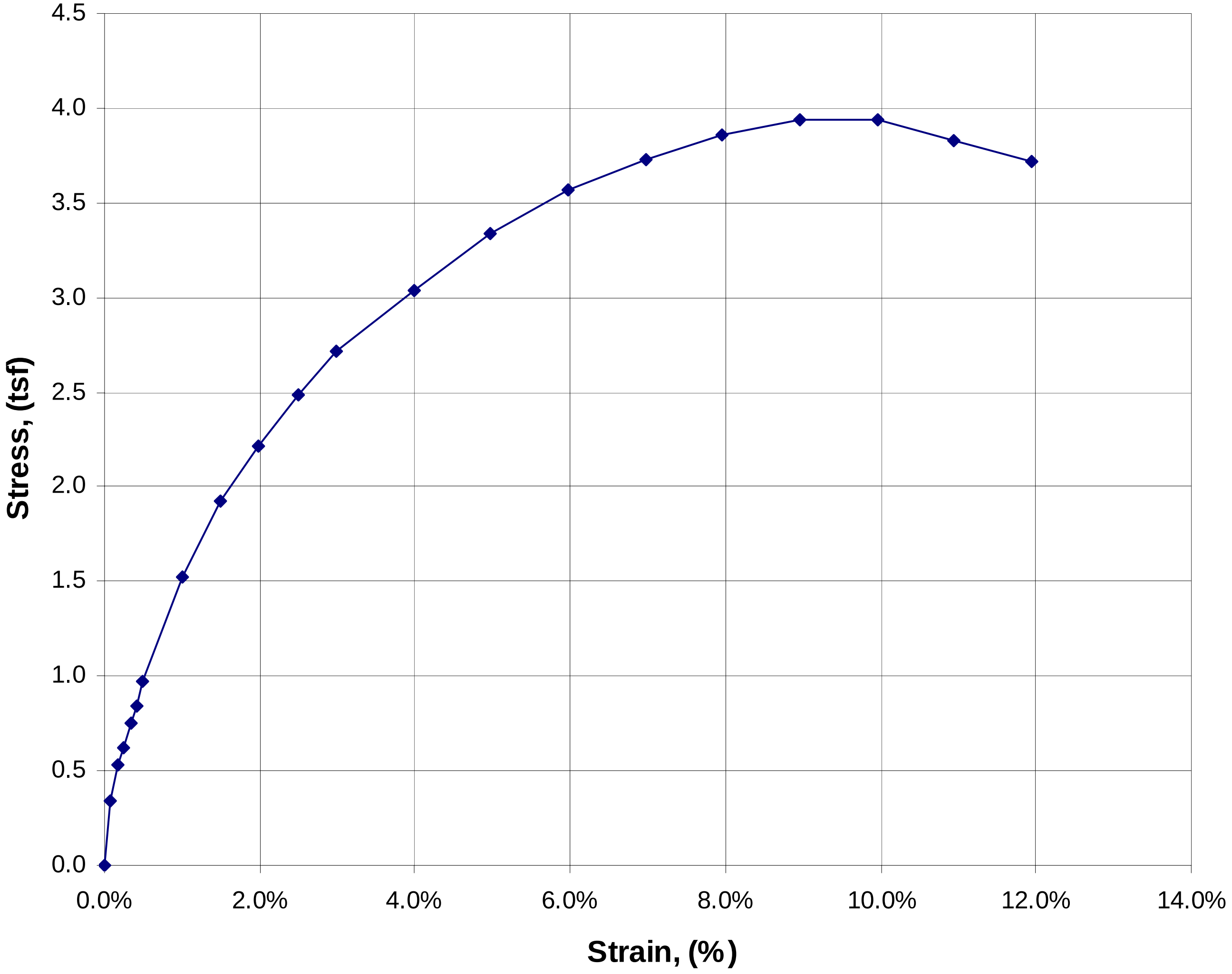
Boring B06-18 Sample S9



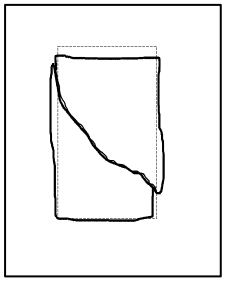
Sample Data

Sample Depth: 59 - 59.5 ft
Initial Diameter: 2.875 in.
Initial Height: 6.029 in.
Initial Moisture Content: 21.0%
Wet Density: 129.0 lb/ft³

Maximum Stress: 3.9 tons/ft^2 (tsf)
Strain at Maximum Stress: 10.0%

Classification: Hard, gray, CLAY, moist, trace gravel (CL)

Failure Sketch



Knik Arm Crossing
Knik Arm, Alaska

UNCONFINED COMPRESSION TEST RESULTS
(Boring B06-18 Sample S9)

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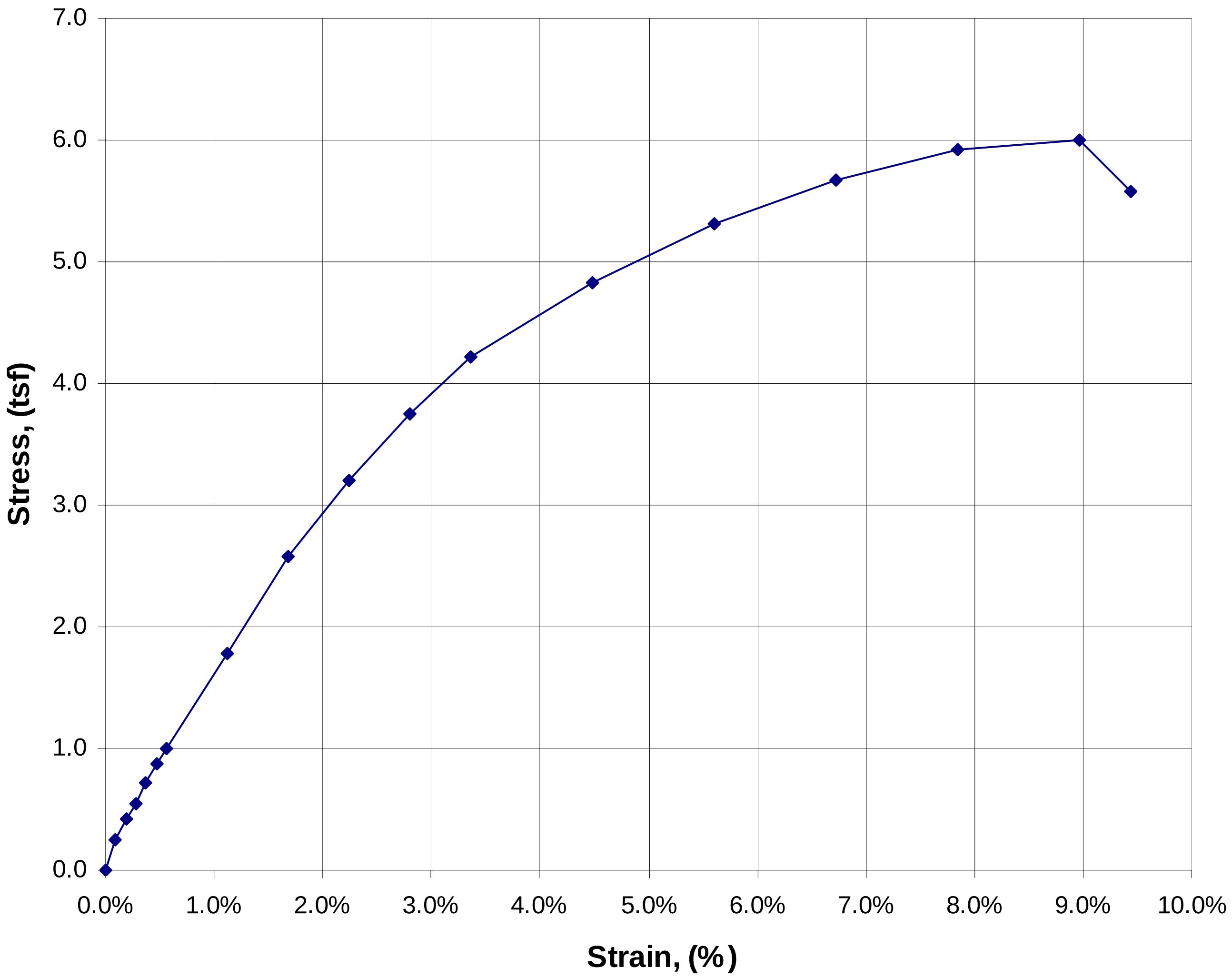
Boring B06-18 Sample S11



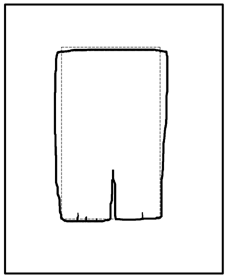
Sample Data

Sample Depth: 69 - 69.5 ft
Initial Diameter: 2.875 in.
Initial Height: 5.352 in.
Initial Moisture Content: 20.0%
Wet Density: 131.7 lb/ft³

Maximum Stress: 6.0 tons/ft^2 (tsf)
Strain at Maximum Stress: 9.0%

Classification: Hard, gray CLAY, moist. (CL)

Failure Sketch



Knik Arm Crossing
Knik Arm, Alaska

UNCONFINED COMPRESSION TEST RESULTS
(Boring B06-18 Sample S11)

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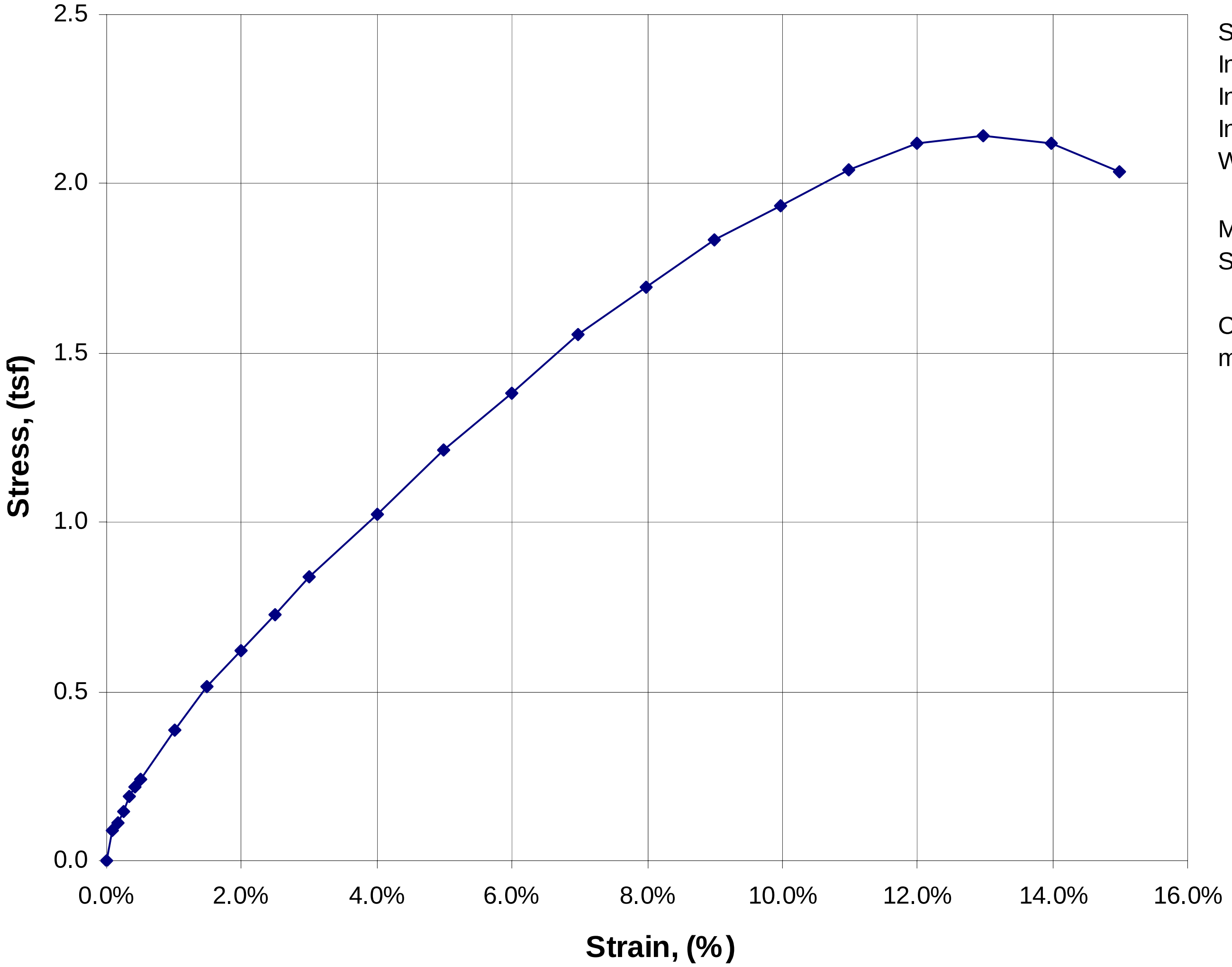
Boring B06-18 Sample S13



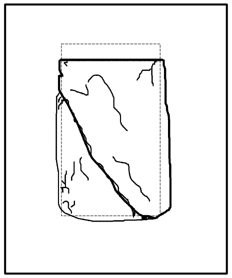
Sample Data

Sample Depth: 80 - 80.5 ft
Initial Diameter: 2.875 in.
Initial Height: 6.009 in.
Initial Moisture Content: 27.0%
Wet Density: 118.9 lb/ft³

Maximum Stress: 2.1 tons/ft^2 (tsf)
Strain at Maximum Stress: 13.0%

Classification: Very stiff, gray CLAY, moist. (CL)

Failure Sketch



Knik Arm Crossing
Knik Arm, Alaska

UNCONFINED COMPRESSION TEST RESULTS
(Boring B06-18 Sample S13)

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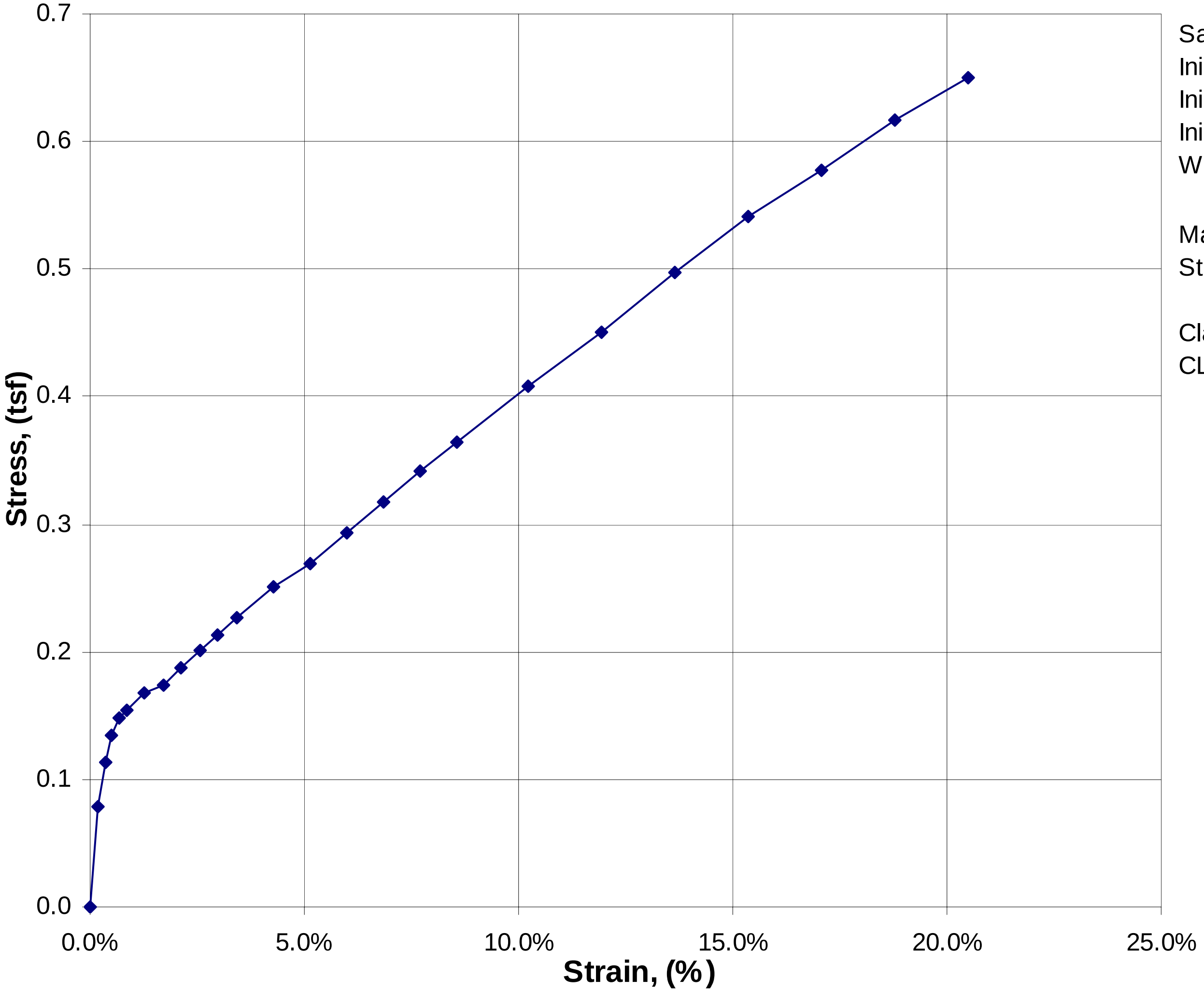
Boring B06-18 Sample S15



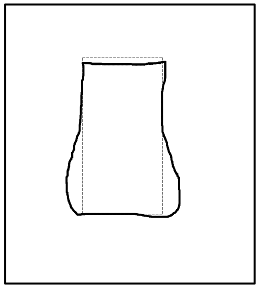
Sample Data

Sample Depth: 90-90.5 ft
Initial Diameter: 2.901 in.
Initial Height: 5.856 in.
Initial Moisture Content: 33.9%
Wet Density: 128.5 lb/ft³

Maximum Stress: 0.6 tons/ft^2 (tsf)
Strain at Maximum Stress: >20.5%

Classification: Medium stiff, gray CLAY, moist. (CL)

Failure Sketch



Knik Arm Crossing
Knik Arm, Alaska

UNCONFINED COMPRESSION TEST RESULTS
(Boring B06-18 Sample S15)

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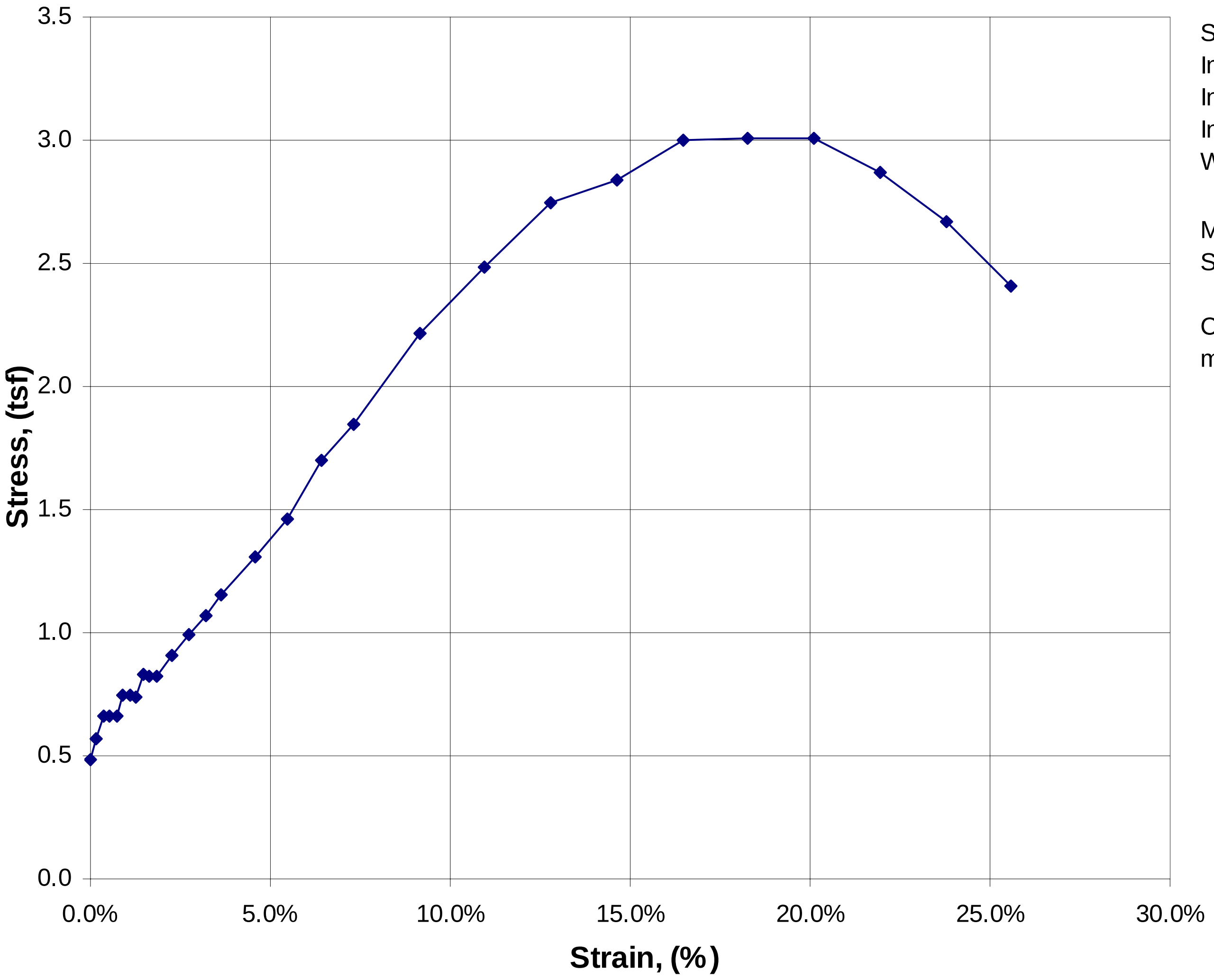
Boring B06-18 Sample S31



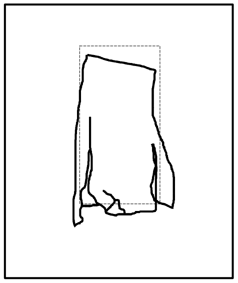
Sample Data

Sample Depth: 170.5-171 ft
Initial Diameter: 2.85 in.
Initial Height: 55.82 in.
Initial Moisture Content: 20.2%
Wet Density: 127.1 lb/ft³

Maximum Stress: 3.0 tons/ft^2 (tsf)
Strain at Maximum Stress: 20.1%

Classification: Very stiff, gray CLAY, moist. (CL)

Failure Sketch



Knik Arm Crossing
Knik Arm, Alaska

UNCONFINED COMPRESSION TEST RESULTS
(Boring B06-18 Sample S31)

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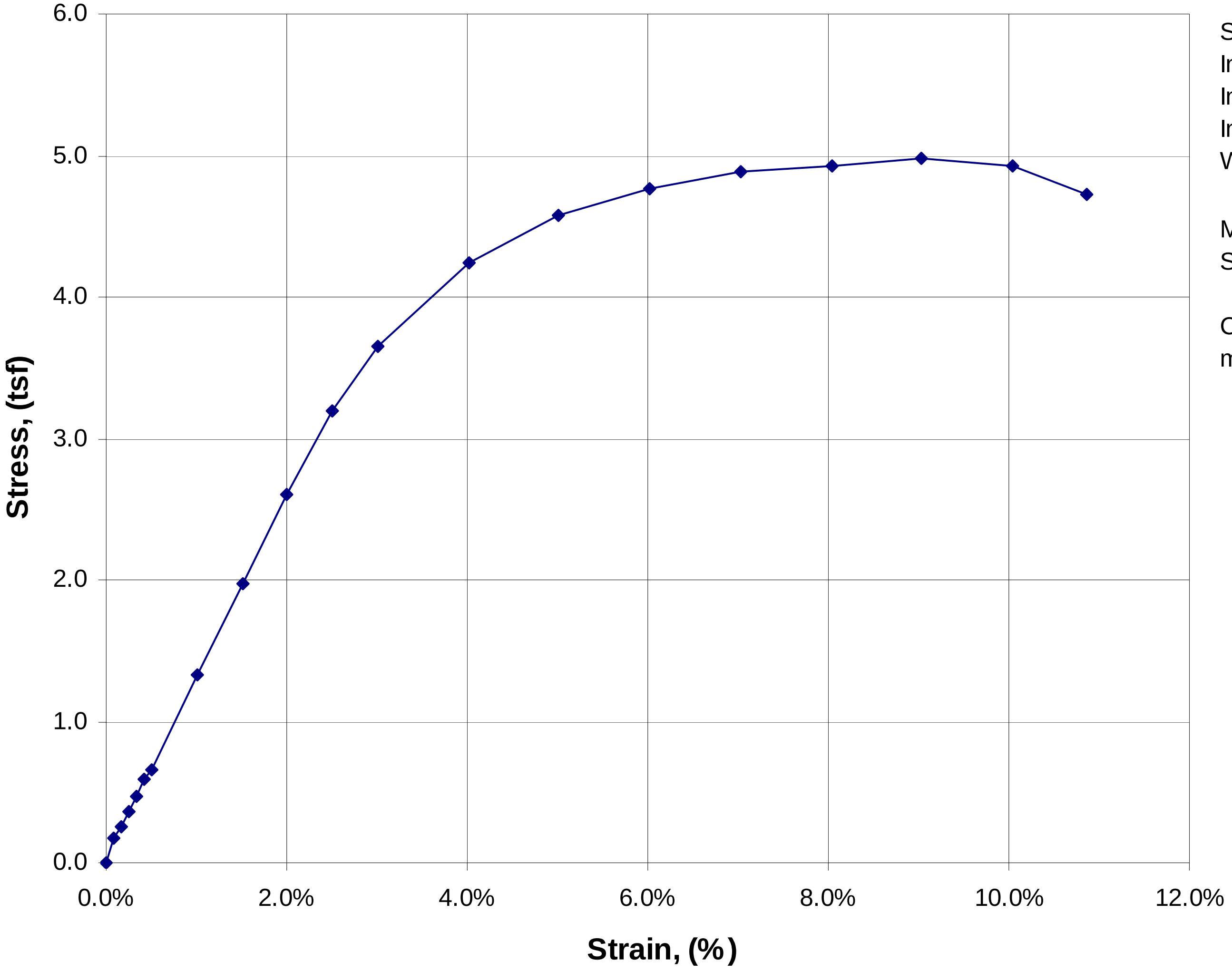
Boring B06-18 Sample S35



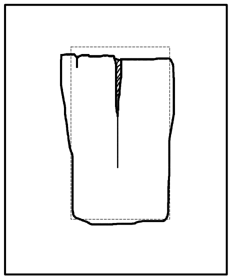
Sample Data

Sample Depth: 190.5 - 191 ft
Initial Diameter: 2.875 in.
Initial Height: 5.976 in.
Initial Moisture Content: 21.0%
Wet Density: 130.6 lb/ft³

Maximum Stress: 5.0 tons/ft^2 (tsf)
Strain at Maximum Stress: 9.0%

Classification: Hard, gray CLAY, moist. (CL)

Failure Sketch



Knik Arm Crossing
Knik Arm, Alaska

UNCONFINED COMPRESSION TEST RESULTS
(Boring B06-18 Sample S35)

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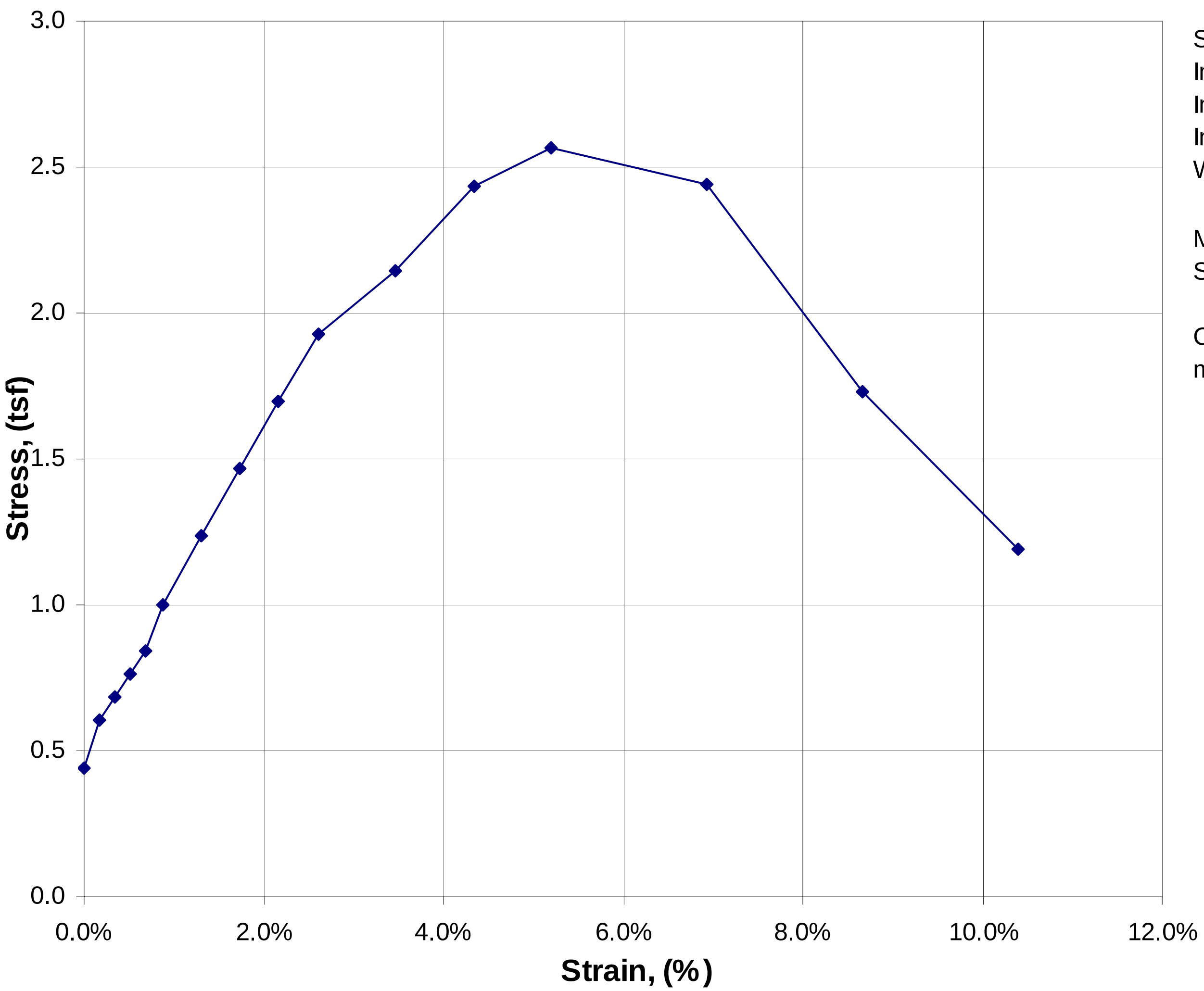
Boring B06-18 Sample S46



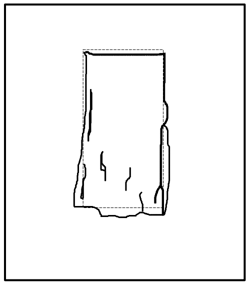
Sample Data

Sample Depth: 244.5-245 ft
Initial Diameter: 2.898 in.
Initial Height: 5.769 in.
Initial Moisture Content: 23.7%
Wet Density: 126.9 lb/ft³

Maximum Stress: 2.6 tons/ft^2 (tsf)
Strain at Maximum Stress: 5.2%

Classification: Very stiff, gray CLAY, moist with silt seams. (CL)

Failure Sketch



Knik Arm Crossing
Knik Arm, Alaska

UNCONFINED COMPRESSION TEST RESULTS
(Boring B06-18 Sample S46)

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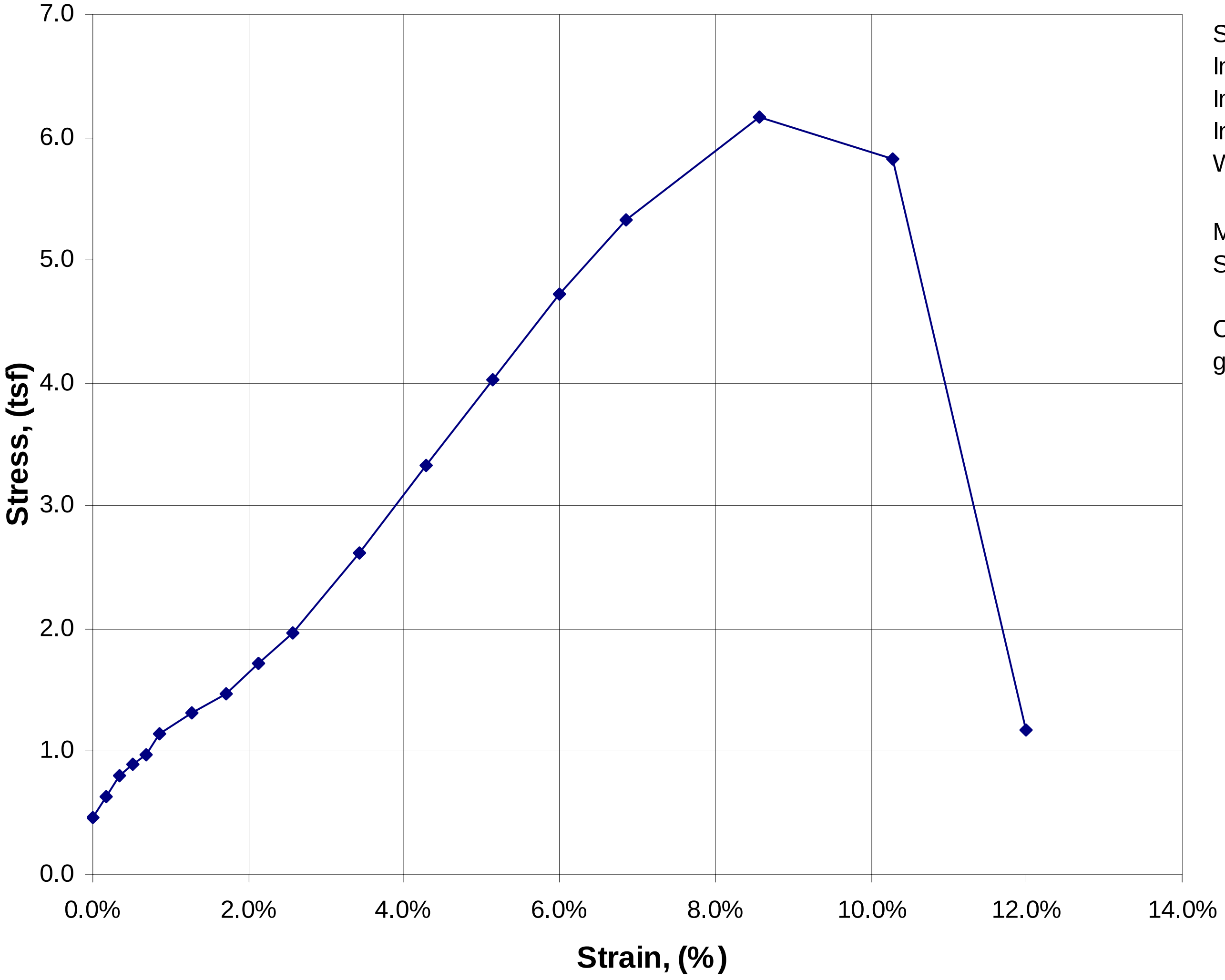
Boring B06-19 Sample S12



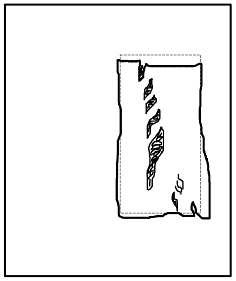
Sample Data

Sample Depth: 60.5-61 ft
Initial Diameter: 2.81 in.
Initial Height: 5.84 in.
Initial Moisture Content: 18.4%
Wet Density: 131.6 lb/ft³

Maximum Stress: 6.2 tons/ft² (tsf)
Strain at Maximum Stress: 8.6%

Classification: Hard, gray, slightly gravelly CLAY, moist. (CL)

Failure Sketch



Knik Arm Crossing
Knik Arm, Alaska

UNCONFINED COMPRESSION TEST RESULTS
(Boring B06-19 Sample S12)

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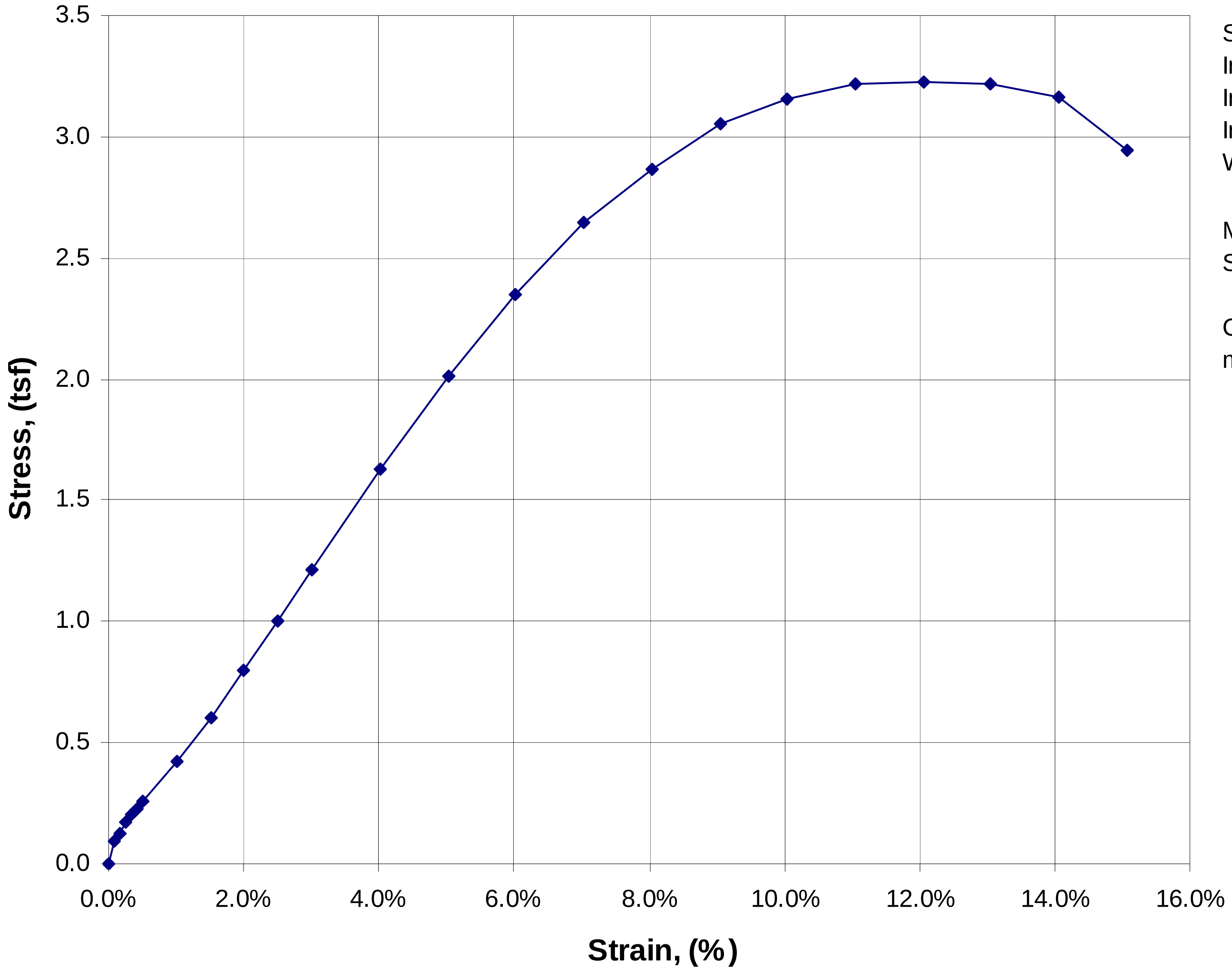
Boring B06-19 Sample S17



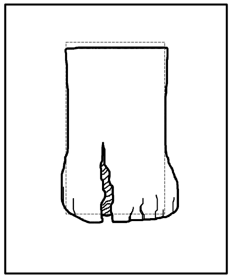
Sample Data

Sample Depth: 86.5 - 87 ft
Initial Diameter: 2.85 in.
Initial Height: 5.973 in.
Initial Moisture Content: 24.0%
Wet Density: 136.6 lb/ft³

Maximum Stress: 3.2 tons/ft^2 (tsf)
Strain at Maximum Stress: 13.1%

Classification: Very stiff, gray CLAY, moist. (CL)

Failure Sketch



Knik Arm Crossing
Knik Arm, Alaska

UNCONFINED COMPRESSION TEST RESULTS
(Boring B06-19 Sample S17)

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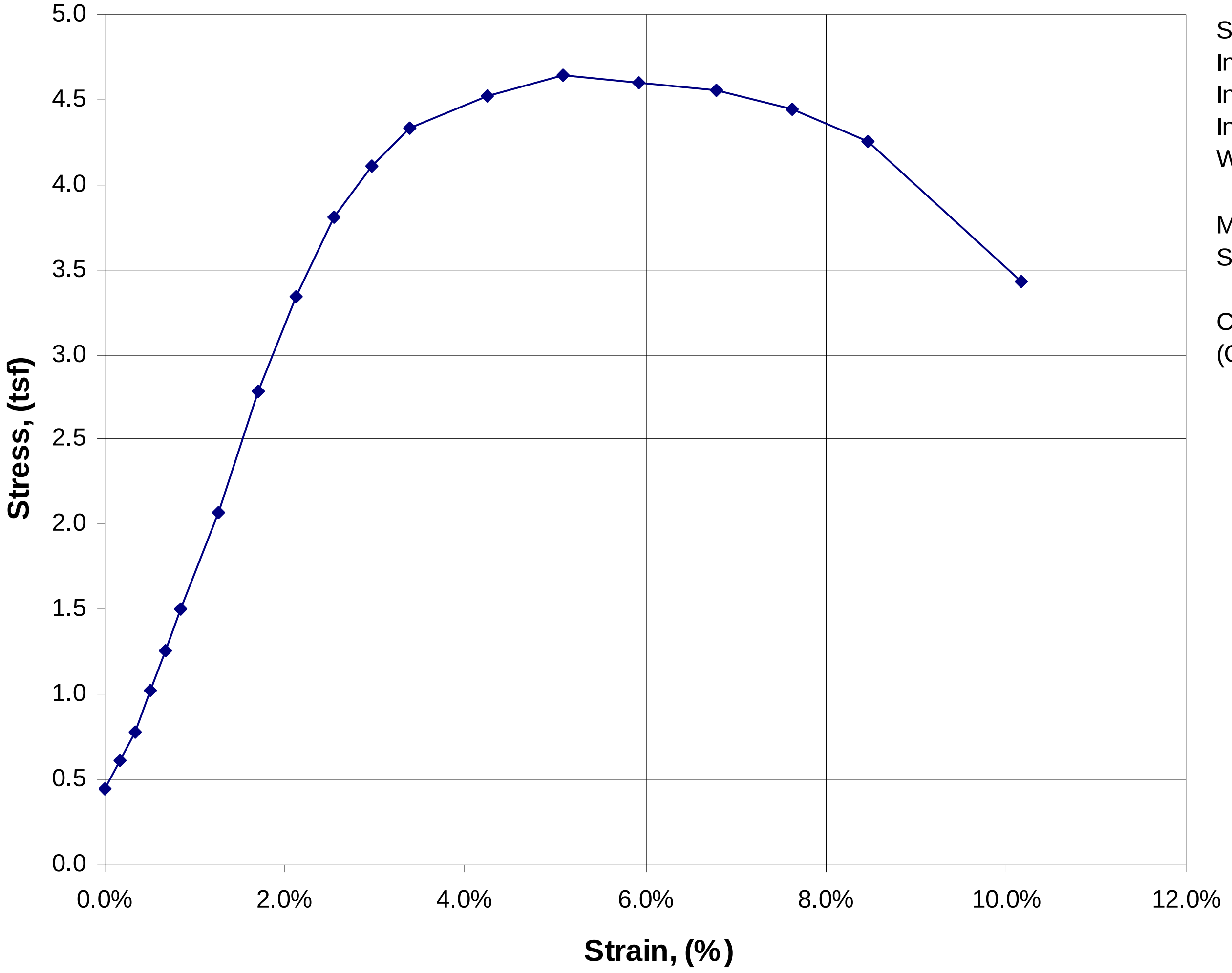
Boring B06-19 Sample S55



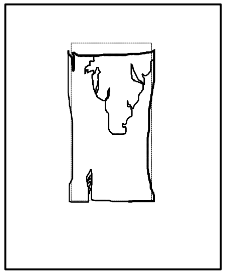
Sample Data

Sample Depth: 127-127.5 ft
Initial Diameter: 2.873 in.
Initial Height: 5.90 in.
Initial Moisture Content: 20.5%
Wet Density: 129.9 lb/ft³

Maximum Stress: 4.6 tons/ft² (tsf)
Strain at Maximum Stress: 6.8%

Classification: Hard, gray CLAY, moist. (CL)

Failure Sketch



Knik Arm Crossing
Knik Arm, Alaska

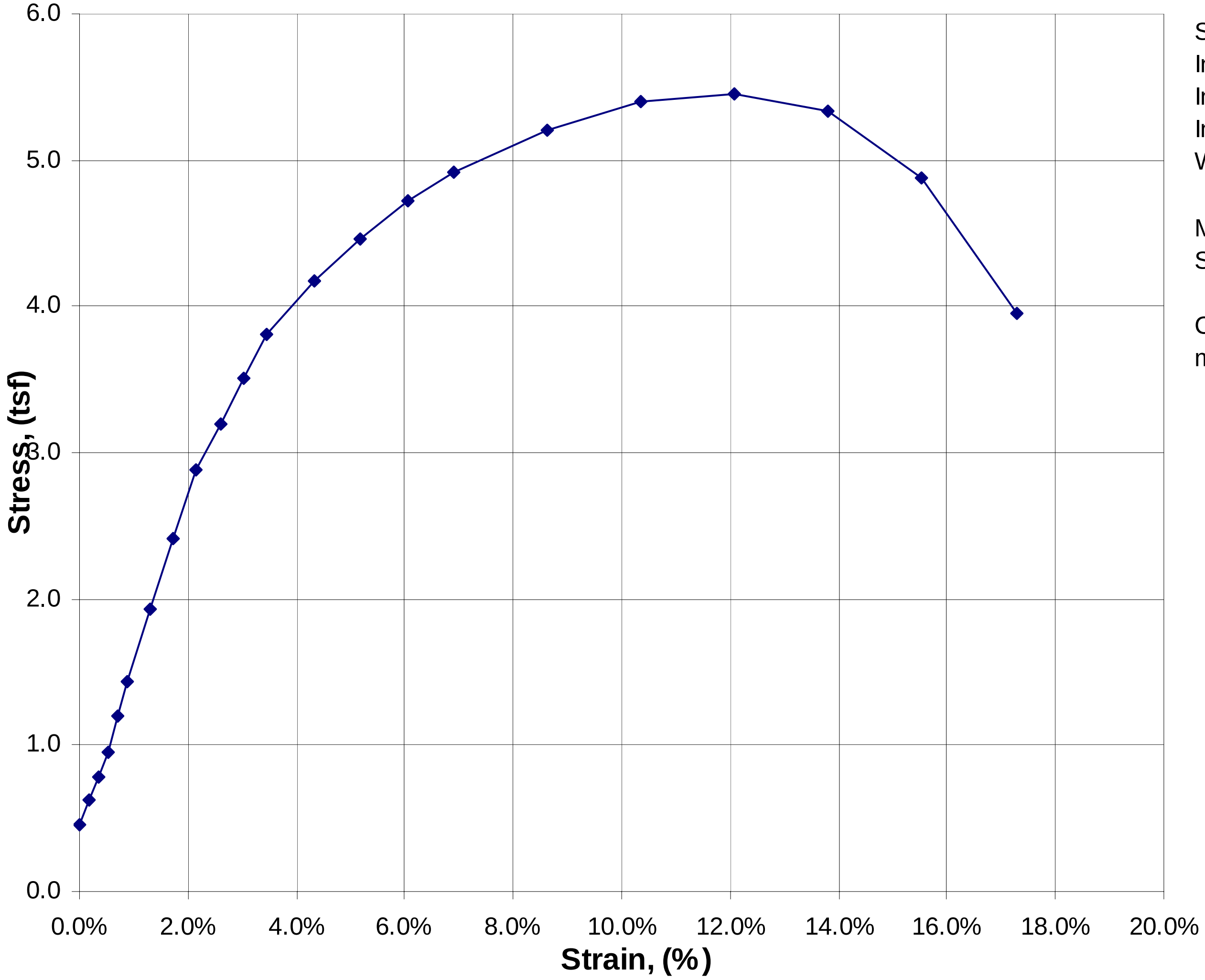
UNCONFINED COMPRESSION TEST RESULTS
(Boring B06-19 Sample S55)

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical & Environmental Consultants

Fig. F-3
Sheet 25 of 26

Boring B06-19 Sample S63



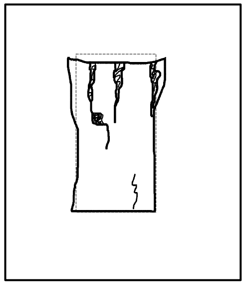
Sample Data

Sample Depth: 167.5-168 ft
Initial Diameter: 2.85 in.
Initial Height: 55.82 in.
Initial Moisture Content: 18.4%
Wet Density: 130.2 lb/ft³

Maximum Stress: 5.4 tons/ft² (tsf)
Strain at Maximum Stress: 13.8%

Classification: Hard, gray CLAY, moist. (CL)

Failure Sketch



Knik Arm Crossing
Knik Arm, Alaska

UNCONFINED COMPRESSION TEST RESULTS
(Boring B06-19 Sample S63)

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
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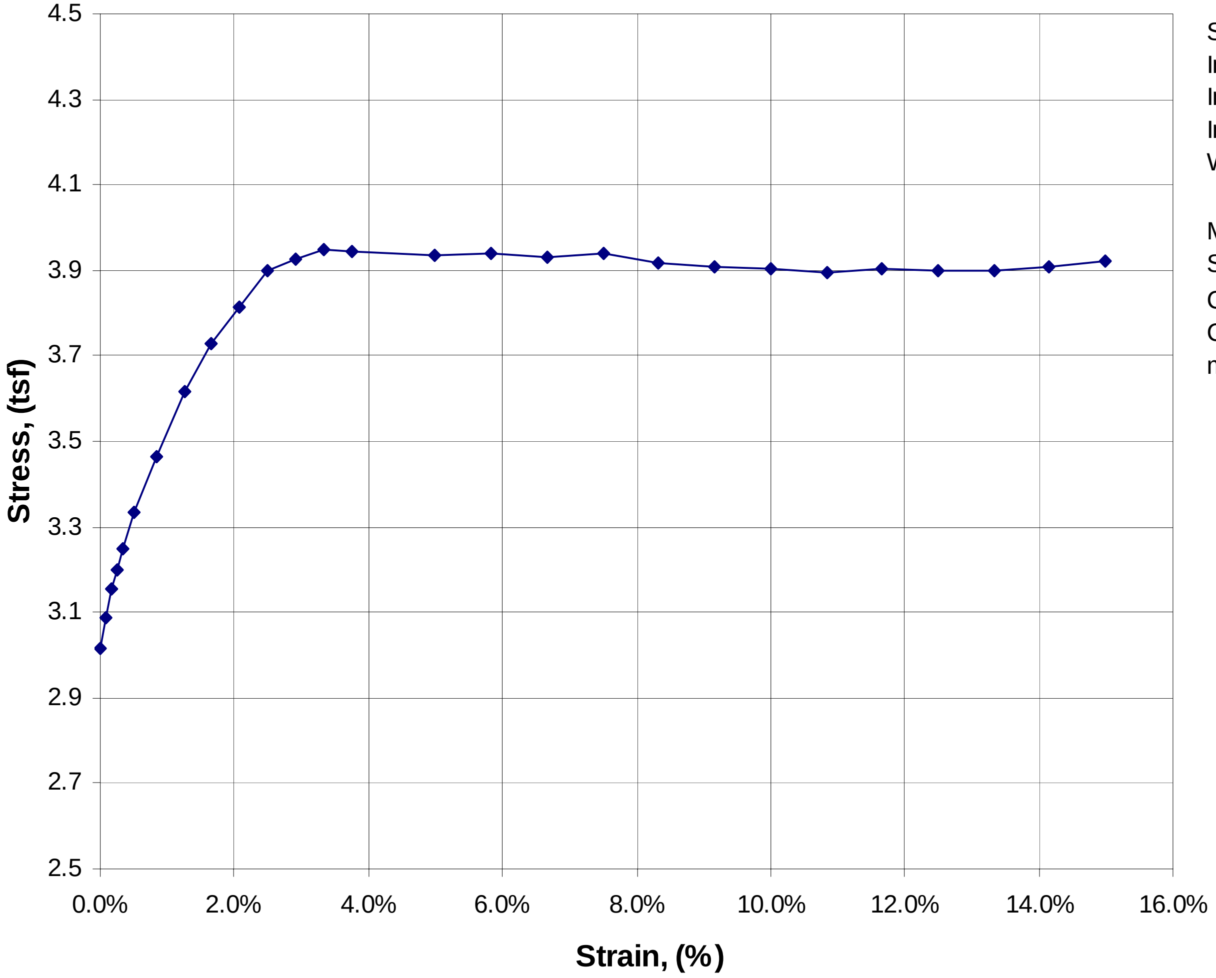
Fig. F-3
Sheet 26 of 26

Boring B06-17 Sample S8

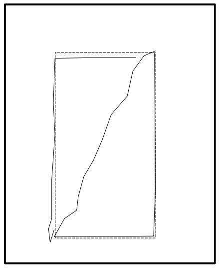


Sample Data

Sample Depth: 44-44.5 ft
Initial Diameter: 2.869 in.
Initial Height: 6.001 in.
Initial Moisture Content: 27.1%
Wet Density: 123.8 lb/ft³

Maximum Deviator Stress: 3.9 tons/ft^{2} (tsf)
Strain at Maximum Stress: 3.3%
Confining Pressure: 3.9 tons/ft^{2} (tsf)
Classification: Very stiff, gray CLAY, moist. (CL)

Failure Sketch



Knik Arm Crossing
Knik Arm, Alaska

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS (Boring B06-17 Sample S8)

March 2007
32-1-01536-004

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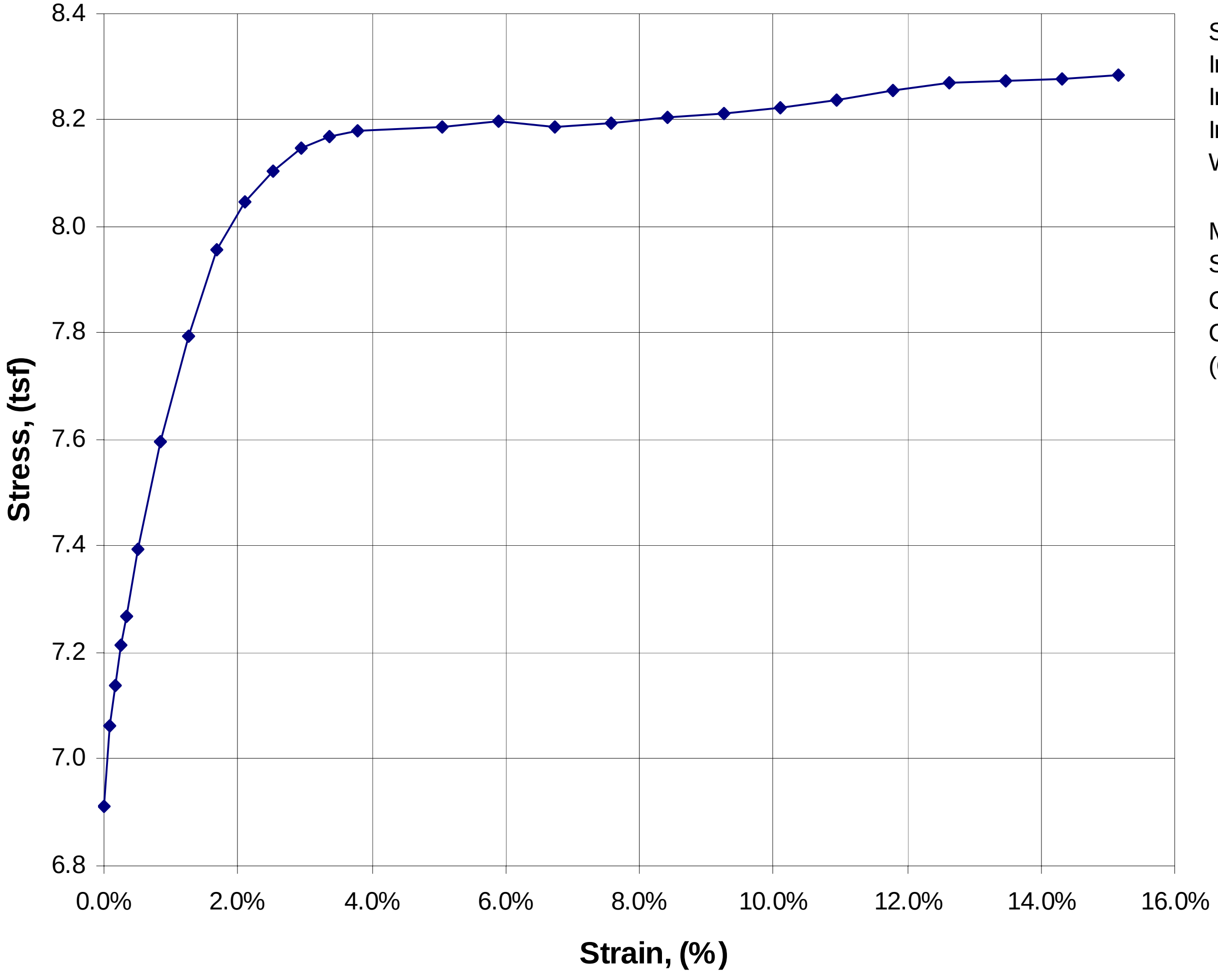
Fig. F-4
Sheet 1 of 7

Boring B06-17 Sample S18

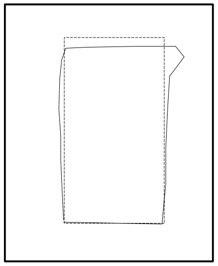


Sample Data

Sample Depth: 96-96.5 ft
Initial Diameter: 2.969 in.
Initial Height: 5.938 in.
Initial Moisture Content: 27.0%
Wet Density: 117.1 lb/ft³

Maximum Deviator Stress: 8.3 tons/ft^2 (tsf)
Strain at Maximum Stress: 15.0%
Comfining Pressure: 6.9 tons/ft^2 (tsf)
Classification: Hard, gray CLAY, moist.
(CL)

Failure Sketch



Knik Arm Crossing
Knik Arm, Alaska

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS (Boring B06-17 Sample S18)

March 2007
32-1-01536-004

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Fig. F-4
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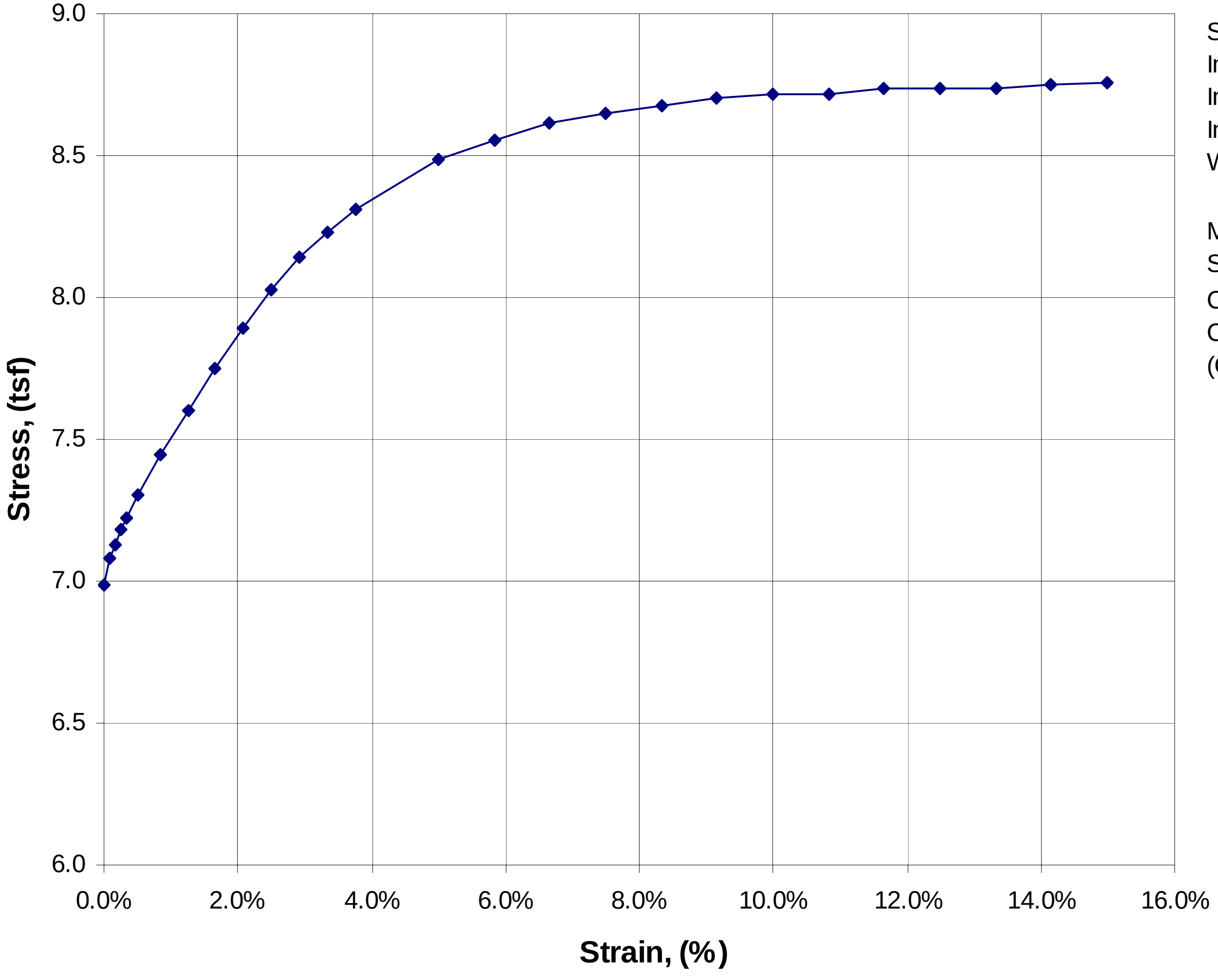
Boring B06-17 Sample S36

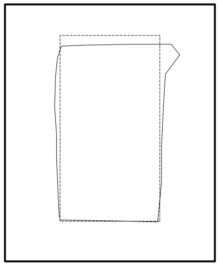


Sample Data

Sample Depth: 188-188.5 ft
Initial Diameter: 2.865 in.
Initial Height: 6.004 in.
Initial Moisture Content: 23.9%
Wet Density: 128.4 lb/ft³

Maximum Deviator Stress: 8.8 tons/ft^2 (tsf)
Strain at Maximum Stress: 15.8%
Comfining Pressure: 7.0 tons/ft^2 (tsf)
Classification: Hard, gray CLAY, moist.
(CL)

Failure Sketch



Knik Arm Crossing
Knik Arm, Alaska

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS (Boring B06-17 Sample S36)

March 2007 32-1-01536-004

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Fig. F-4
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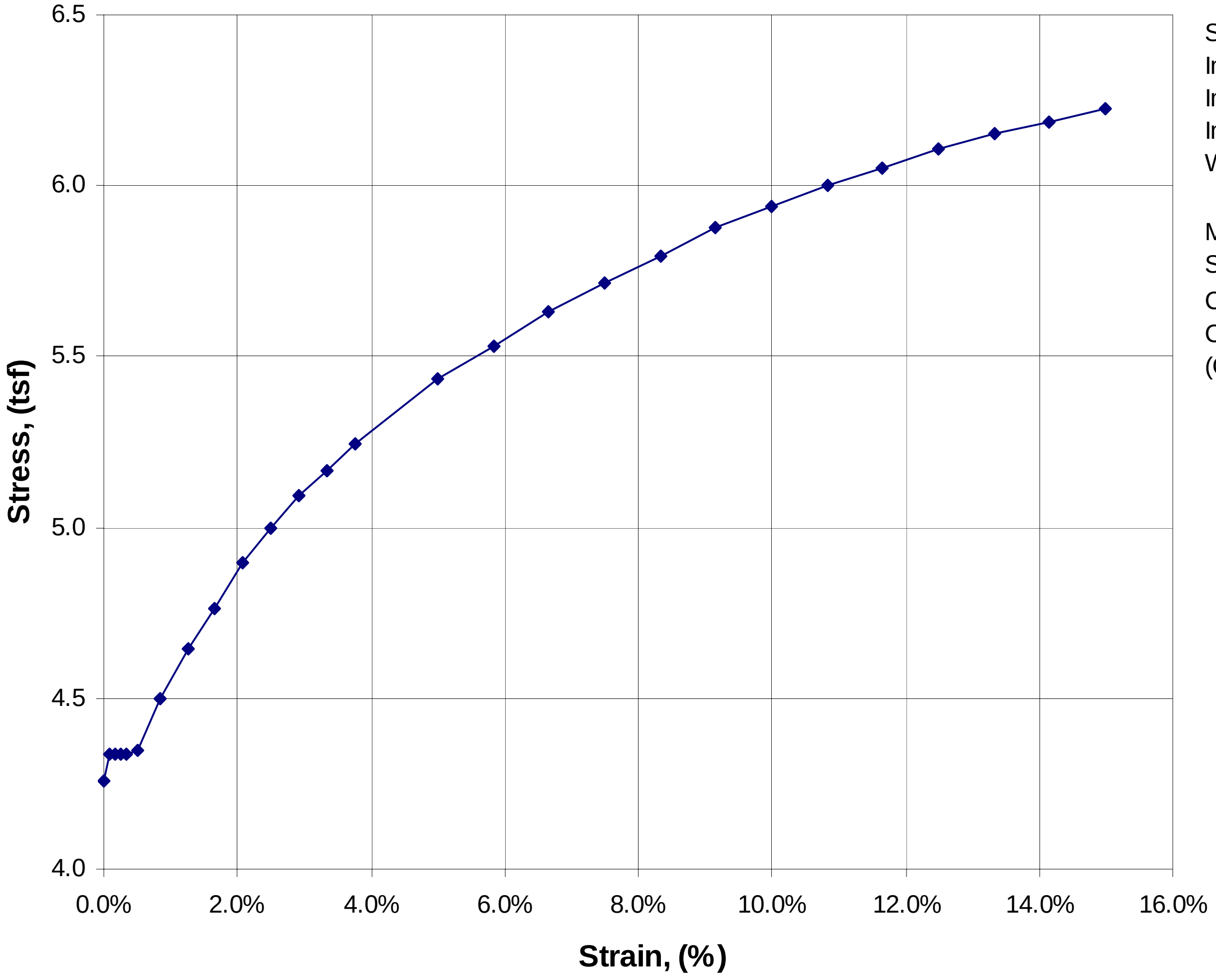
Boring B06-18 Sample S9

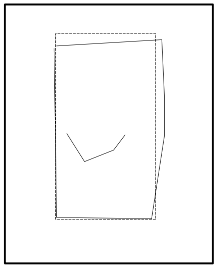


Sample Data

Sample Depth: 60.5-61 ft
Initial Diameter: 2.875 in.
Initial Height: 6.003 in.
Initial Moisture Content: 22.6%
Wet Density: 129.2 lb/ft³

Maximum Deviator Stress: 6.2 tons/ft^2 (tsf)
Strain at Maximum Stress: 15.0%
Comfining Pressure: 4.2 tons/ft^2 (tsf)
Classification: Hard, gray CLAY, moist. (CL)

Failure Sketch



Knik Arm Crossing
Knik Arm, Alaska

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS (Boring B06-18 Sample S9)

March 2007 32-1-01536-004

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Fig. F-4
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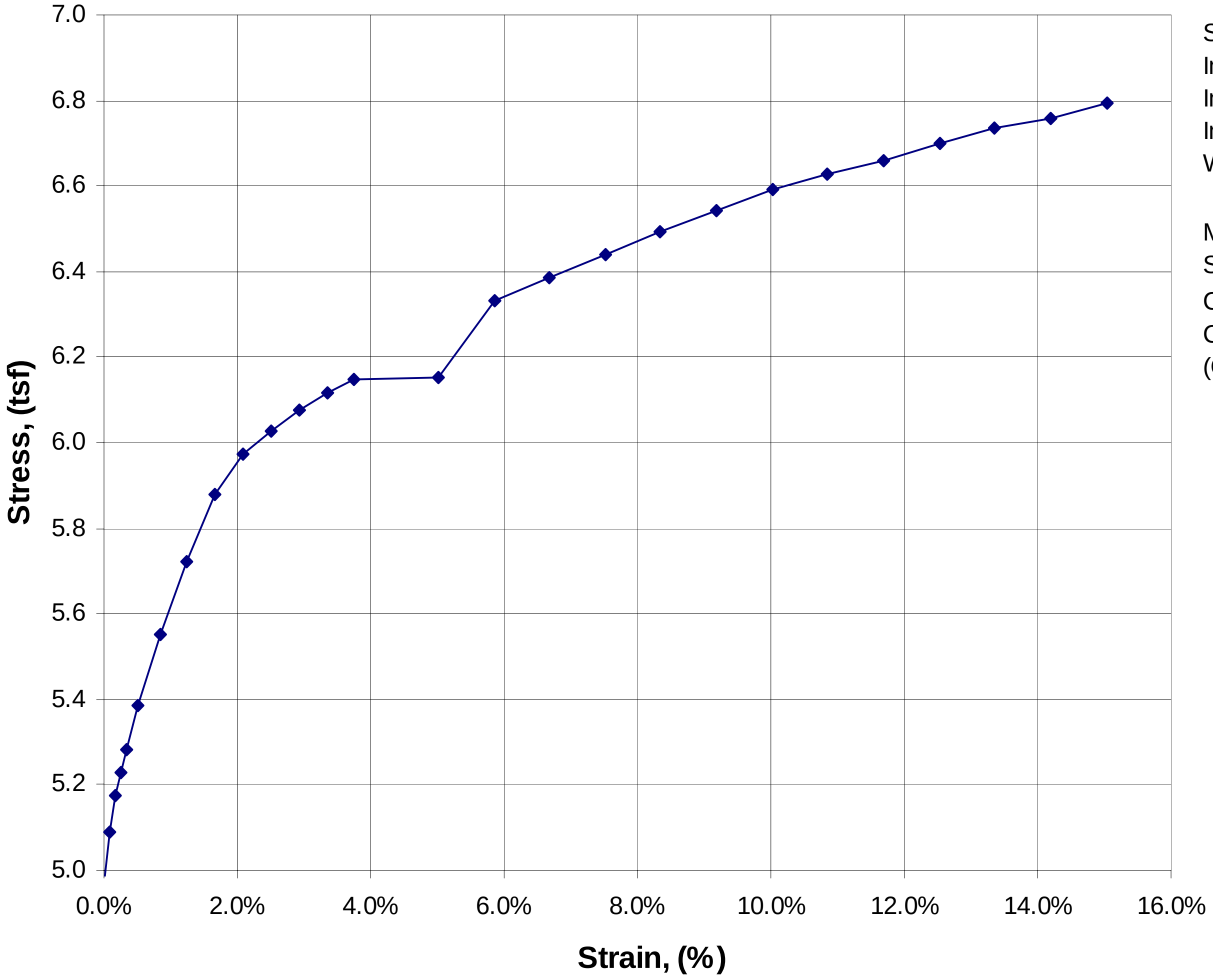
Boring B06-18 Sample S11

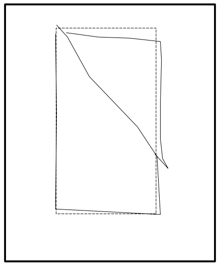


Sample Data

Sample Depth: 70.5-71 ft
Initial Diameter: 2.875 in.
Initial Height: 5.987 in.
Initial Moisture Content: 24.0%
Wet Density: 127.4 lb/ft³

Maximum Deviator Stress: 6.8 tons/ft^{2} (tsf)
Strain at Maximum Stress: 15%
Comfining Pressure: 5.0 tons/ft^{2} (tsf)
Classification: Hard, gray CLAY, moist.
(CL)

Failure Sketch



Knik Arm Crossing
Knik Arm, Alaska

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS (Boring B06-18 Sample S11)

March 2007
32-1-01536-004

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Fig. F-4
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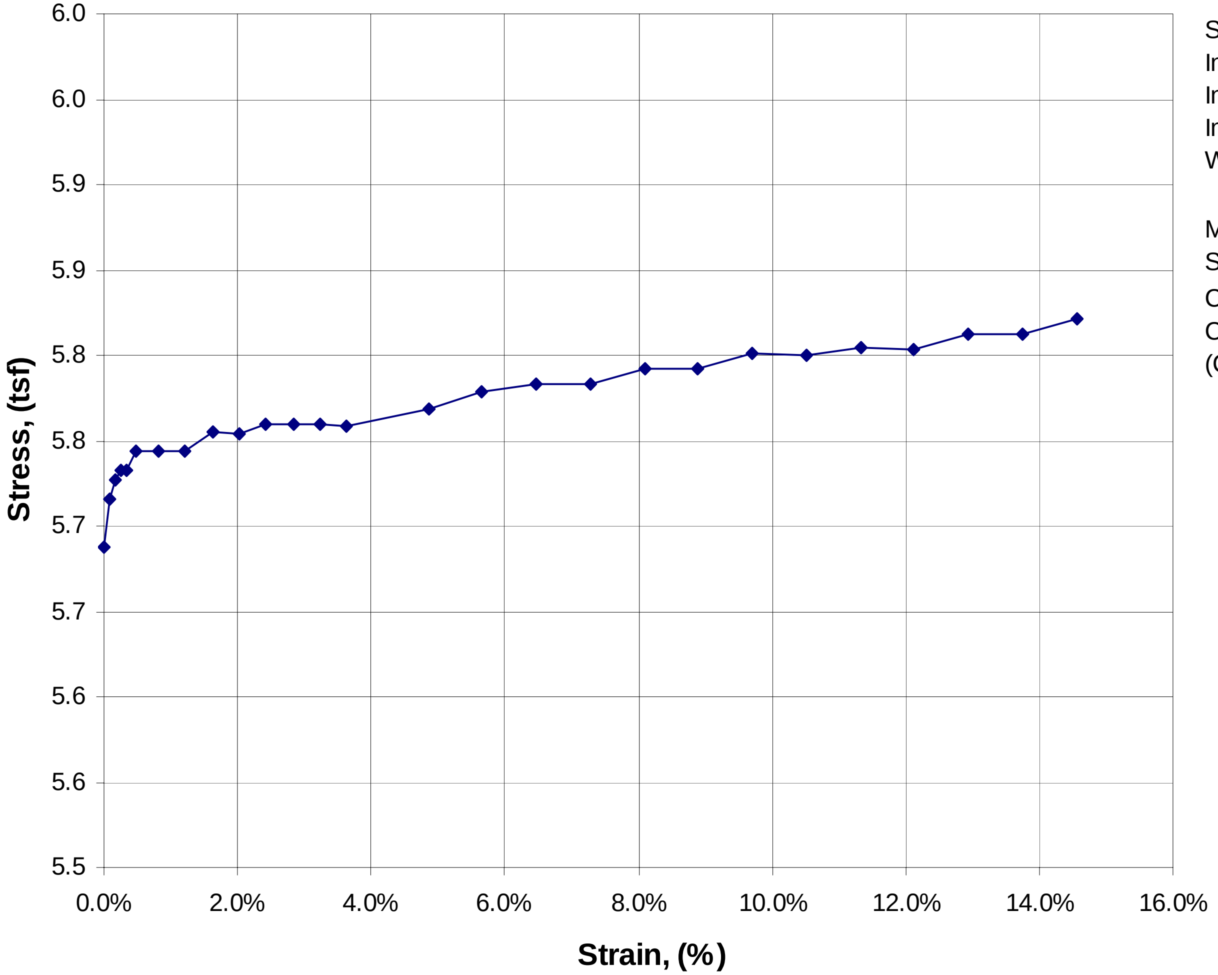
Boring B06-18 Sample S13

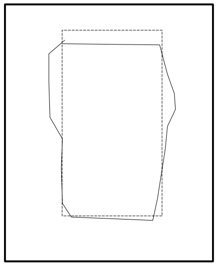


Sample Data

Sample Depth: 80.5-81 ft
Initial Diameter: 2.850 in.
Initial Height: 6.182 in.
Initial Moisture Content: 30.6%
Wet Density: 118.7 lb/ft³

Maximum Deviator Stress: 5.8 tons/ft^2 (tsf)
Strain at Maximum Stress: 14.6%
Comfining Pressure: 5.7 tons/ft^2 (tsf)
Classification: Hard, gray CLAY, moist.
(CL)

Failure Sketch



Knik Arm Crossing
Knik Arm, Alaska

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS (Boring B06-18 Sample S13)

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Fig. F-4
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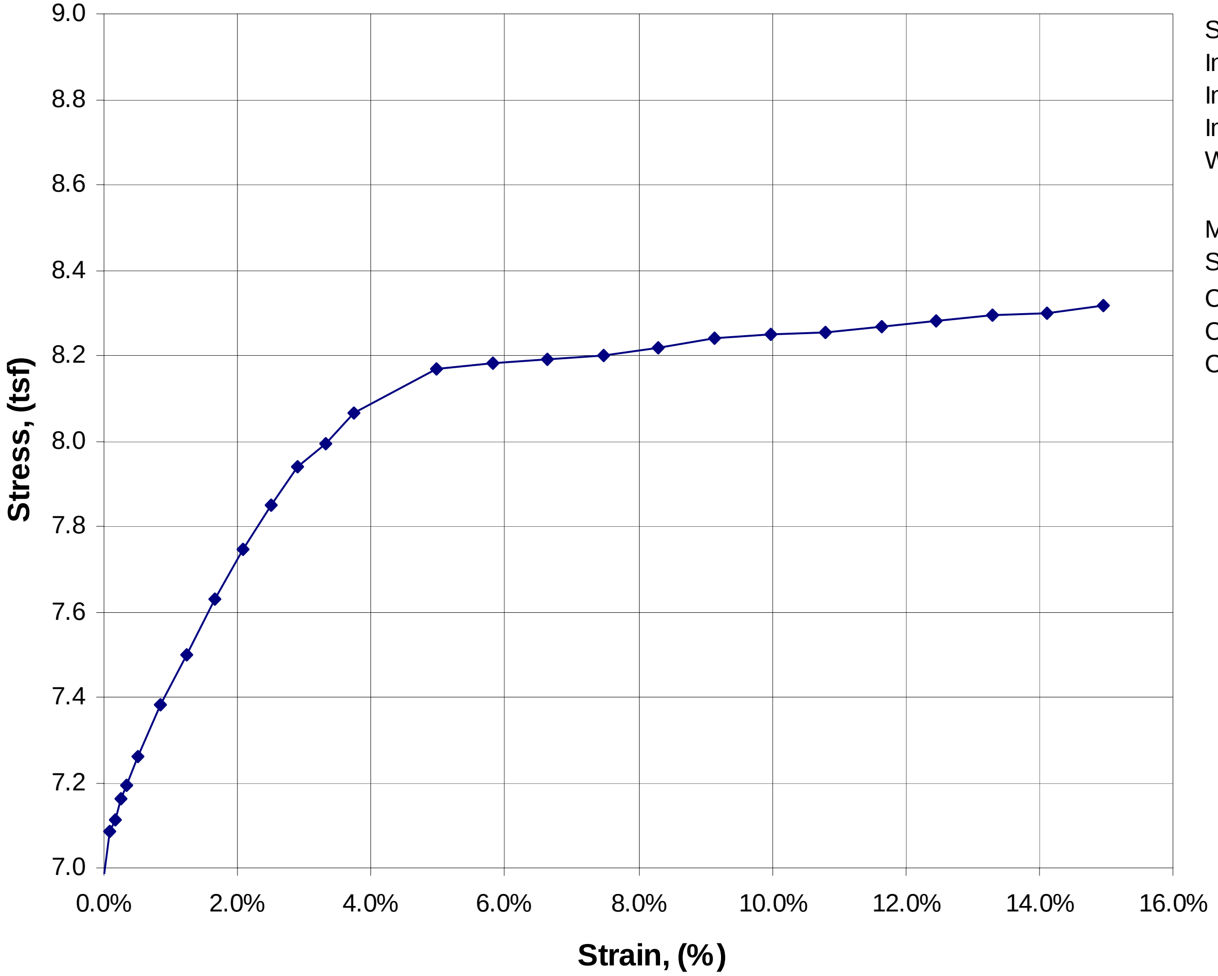
Boring B06-18 Sample S35

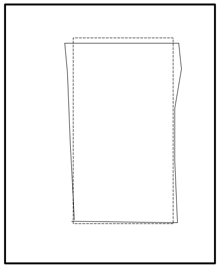


Sample Data

Sample Depth: 189.5-190 ft
Initial Diameter: 2.875 in.
Initial Height: 6.019 in.
Initial Moisture Content: 22.7%
Wet Density: 129.1 lb/ft³

Maximum Deviator Stress: 8.3 tons/ft^2 (tsf)
Strain at Maximum Stress: 15%
Comfining Pressure: 7.0 tons/ft^2 (tsf)
Classification: Hard, gray, slightly gravelly CLAY, moist. (CL)

Failure Sketch



Knik Arm Crossing
Knik Arm, Alaska

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS (Boring B06-18 Sample S35)

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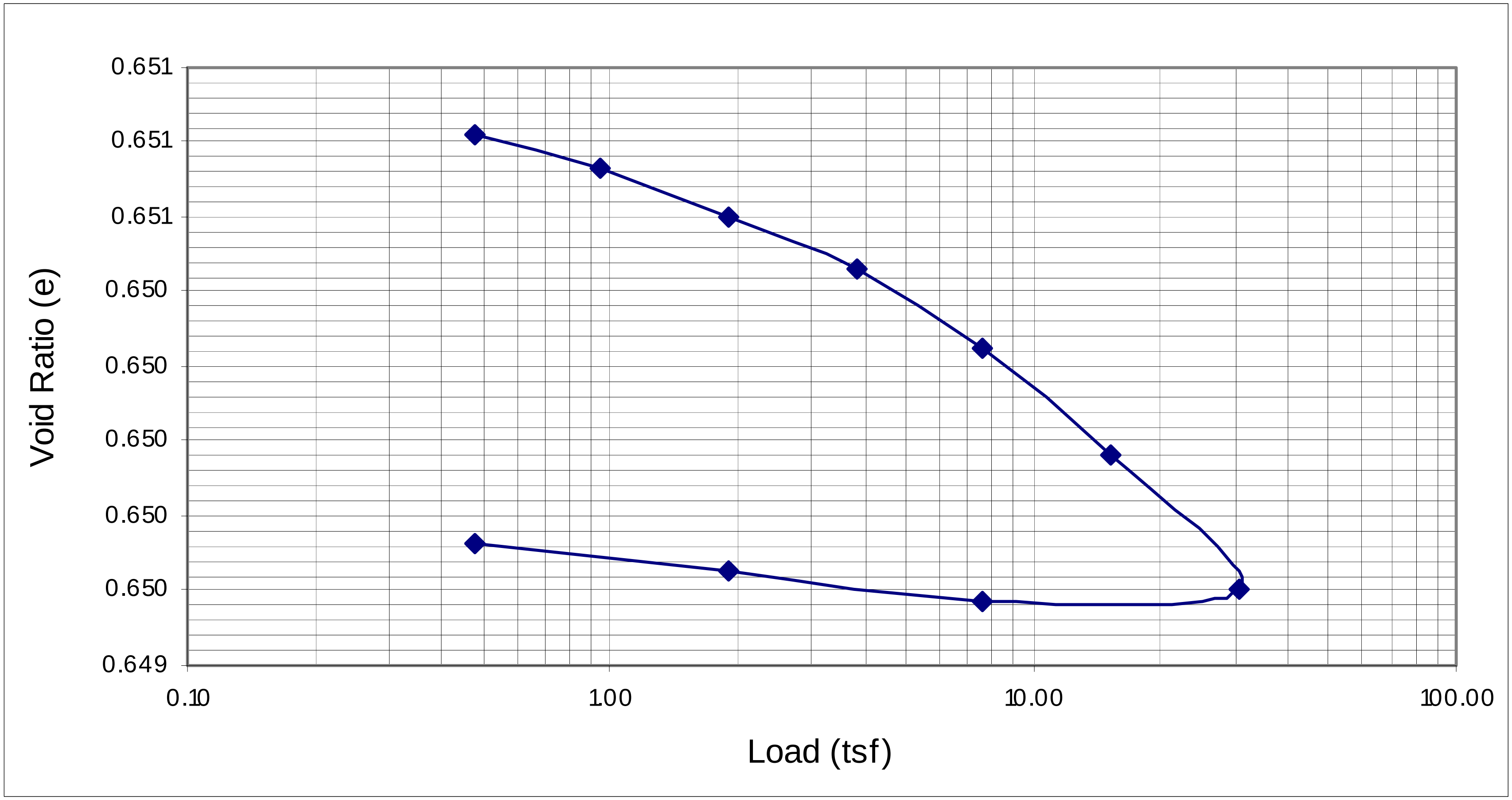
Fig. F-4
Sheet 7 of 7



Specimen Data

Boring =	B06-18
Sample =	S9
Depth (feet bgs) =	59
Specimen Diameter (in.) =	2.595
Specimen Thickness (in.) =	1
Water Content Before (%) =	21.7
Water Content After (%) =	19.8
Dry Unit Weight (pcf) =	93.0
USC =	CL
General Consistency =	Hard

Knik Arm Crossing
Knik Arm, Alaska

CONSOLIDATION TEST RESULTS

March 2007
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SHANNON & WILSON, INC.
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Fig. F-5
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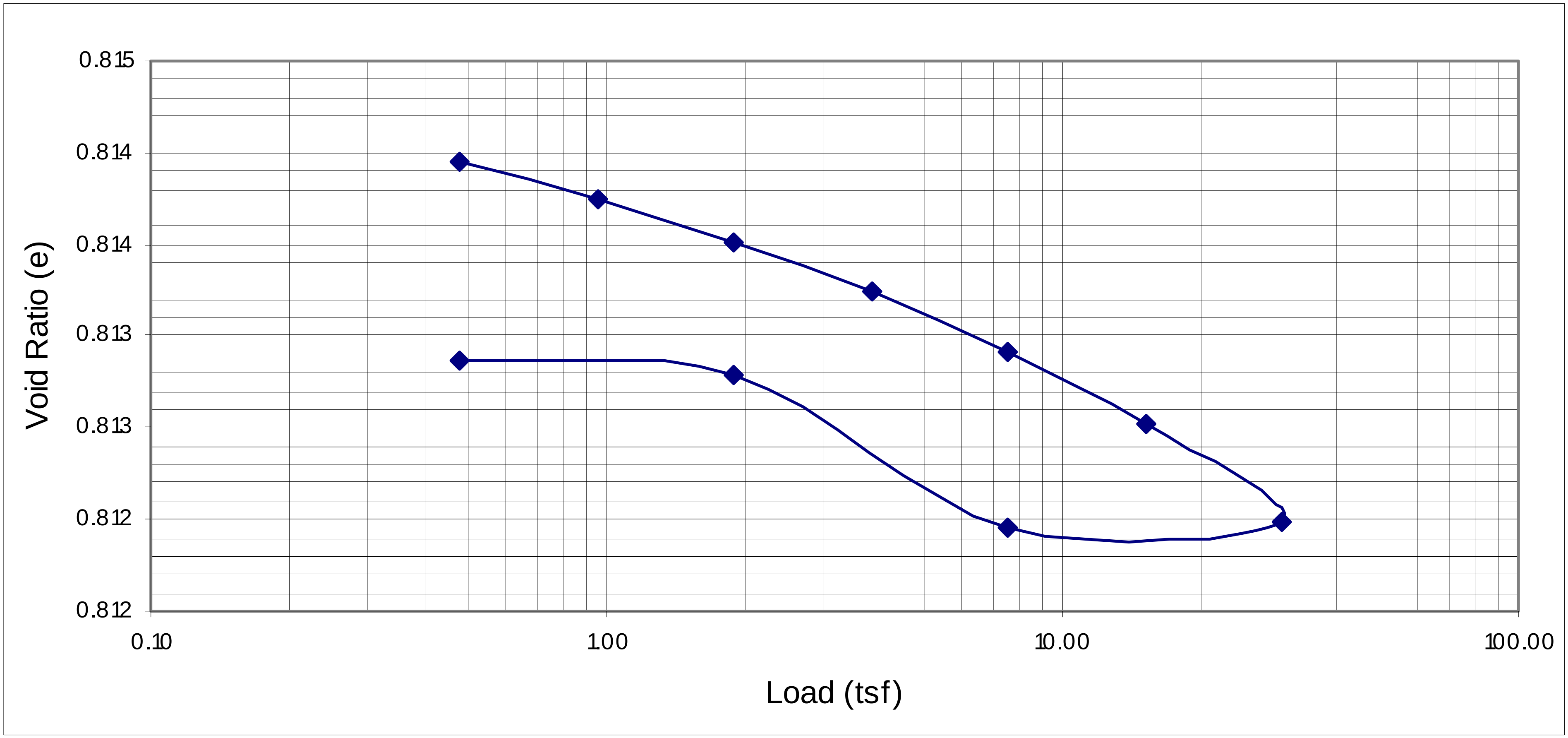

Specimen Data

Boring = B06-18
Sample = S-11
Depth (feet bgs) = 69
Specimen Diameter (in.) = 2.499
Specimen Thickness (in.) = 1
Water Content Before (%) = 24.4
Water Content After (%) = 22.1
Dry Unit Weight (pcf) = 93.7
USC = CL
General Consistency = Hard

Knik Arm Crossing
Knik Arm, Alaska

CONSOLIDATION TEST RESULTS

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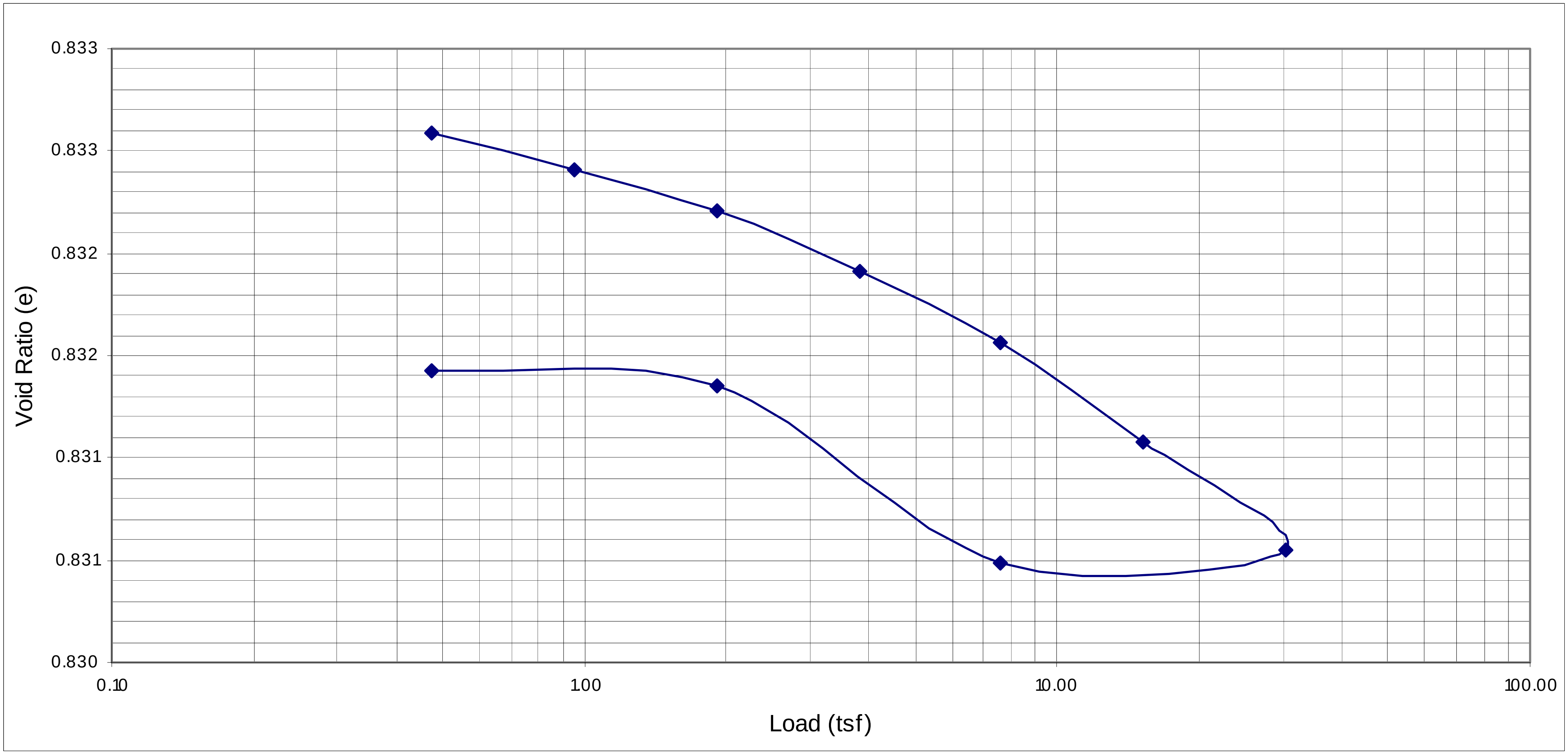
SHANNON & WILSON, INC.
Geotechnical & Environmental Consultants

Fig. F-5
Sheet 2 of 3



Specimen Data

Boring =	B06-19
Sample =	S17
Depth (feet bgs) =	85
Specimen Diameter (in.) =	2.499
Specimen Thickness (in.) =	1
Water Content Before (%) =	25.7
Water Content After (%) =	22.4
Dry Unit Weight (pcf) =	74.4
USC =	CL
General Consistency =	Hard

Knik Arm Crossing
Knik Arm, Alaska

CONSOLIDATION TEST RESULTS

March 2007
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SHANNON & WILSON, INC.
Geotechnical & Environmental Consultants

Fig. F-5
Sheet 3 of 3

APPENDIX G

PREVIOUS BORINGS BY SHANNON & WILSON AND OTHERS

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LIST OF FIGURES

APPENDIX G
PREVIOUS BORINGS BY SHANNON & WILSON AND OTHERS

G-1 On-Shore Borings by Shannon & Wilson

Shannon & Wilson, Inc. conducted field explorations in 2003 and 2005 that provide information pertinent to the Knik Arm Crossing. Boring A-7 was located in the beach to bluff transition area on the east shoreline of the crossing area. Boring B05-1 was located in the beach/bluff transition area on the west shoreline of the crossing. These borings were extended to depths of 196.5 and 226.7 feet, respectively, and provide a means for correlating the conditions encountered in the over-water borings with the conditions exposed in the bluffs bordering the east and west sides of Knik Arm. Boring A-8 advanced on the west bluff is also included. The approximate locations of these borings are shown on Figure 2. Logs of these borings are included in Figure G-1, Figure G-7, and Figure G-8.

Drilling services for the shoreline borings were provided by Discovery Drilling of Anchorage, Alaska, using a track-mounted CME 75 drill rig. The borings were advanced with 8-inch outside diameter, 3-1/4 inch inside diameter hollow-stem augers. Pumps were also supplied to add water or drilling mud to the borings to control heave when necessary. An experienced geologist from Shannon & Wilson was present continuously during drilling to locate the borings, observe drill action, collect samples, log subsurface conditions, and monitor groundwater encountered.

As the borings were advanced, both disturbed and undisturbed samples were recovered at 5 or 10-foot depth intervals. Disturbed samples were taken with a split-spoon sampler using SPT procedures, as described previously. The uncorrected N values are shown graphically on the boring logs adjacent to the sample depth, and give a measure of the relative compactness or consistency (stiffness) of the cohesionless and cohesive soils at the site, respectively.

Undisturbed samples were taken by fixing a 3-inch diameter by 30-inch thin wall tube on the end of the drill rods and advancing it with the hydraulic ram into the undisturbed soil at the bottom of the boring as drilling progressed. The recovered tubes were sealed at the ends with plastic caps and returned to Shannon & Wilson’s Anchorage laboratory for testing, as necessary.

At the end of drilling, an indexed PVC casing was installed in a soft setting grout on Boring B05-1 to facilitate down-hole shear wave velocity measurements. Seismic profiling was subsequently conducted by Northland Geophysical with the results presented in Appendix H.

G-2 Off-Shore Borings by Shannon & Wilson

As part of the 2003 explorations, Shannon & Wilson conducted seven off-shore borings, designated A-1, A-2, A-4 through A-6, A-9, and A-10. These borings were advanced to depths ranging from 183 to 337 feet below the mudline. The locations of these borings are shown on Figure 2. Logs of these borings, with the exception of Boring A-10, are presented in Figures G-2 through G-6 and Figure G-9. Boring A-10 has been omitted from this study because it is deemed too far north from the concept alignment to be representative. These borings were drilled by Gregg Drilling from Signal Hill, California, using a Mobile B80-22 drilling rig with a 22-foot stroke. Support equipment included 12-inch outer starter casing, 6-inch inner drill casing, mud rotary drilling tools with a wireline system of rods and samplers and a jack up platform. The drilling operations were continuously monitored by field engineers or geologists from Shannon & Wilson, Inc.

The over-water drilling was performed from a 50-foot by 50-foot platform with four 100-foot long legs equipped with a center moon pool, a small crane, work and emergency skiffs, a digital global positioning system, a flow meter and a covered work space. This jack up platform, owned by Seacore, LTD from Gweek, England, is a modular unit, which for this project consisted of 6 floats pinned together. The platform is raised and lowered using jacks with a 10-foot stroke operating at a rate of roughly 5 feet per minute. The legs are 30-inches in diameter by 1-inch thick wall steel pipes and were rigged to work in 30 to 70 feet of water and accommodate 3 to 6 knot currents. The operators of the platform indicated that they noted no evidence of scour around the legs, but the feet often sank 1 to 4 feet into the mud during setup. Carl Anderson at the Port of Anchorage provided the tug to move the platform to each drill location.

G-3 Borings by others

Three prior over-water borings, designated Harding Lawson Boring A-4 (HLA 4), Harding Lawson Boring A-5 (HLA 5), and Harding Lawson Boring A-6 (HLA 6), were drilled in the crossing vicinity by Harding Lawson and Associates in 1984 as part of the early Knik Arm Crossing studies (HLA, 1984). The approximate locations of these borings are shown on Figure . This drilling work was performed from a floating barge held in place with heavy anchors. Logs of these borings are presented in Figures G-10 through G-12.

MATERIAL DESCRIPTION

Approx. Elevation: 30 Ft. (MLLW Datum)

Loose, gray, slightly silty, gravelly SAND; moist

3.0

Hard, gray, slightly gravelly to gravelly, sandy SILT; moist to wet

18.0

Very dense, gray, slightly silty, gravelly SAND; wet

S6: 38% Gravel, 56% Sand, 6% Fines

29.0

Hard, gray, gravelly, sandy, silty CLAY; wet

S9: Atterberg, Non-Plastic

S9: PP = 3.25

S10: PP = >4.5

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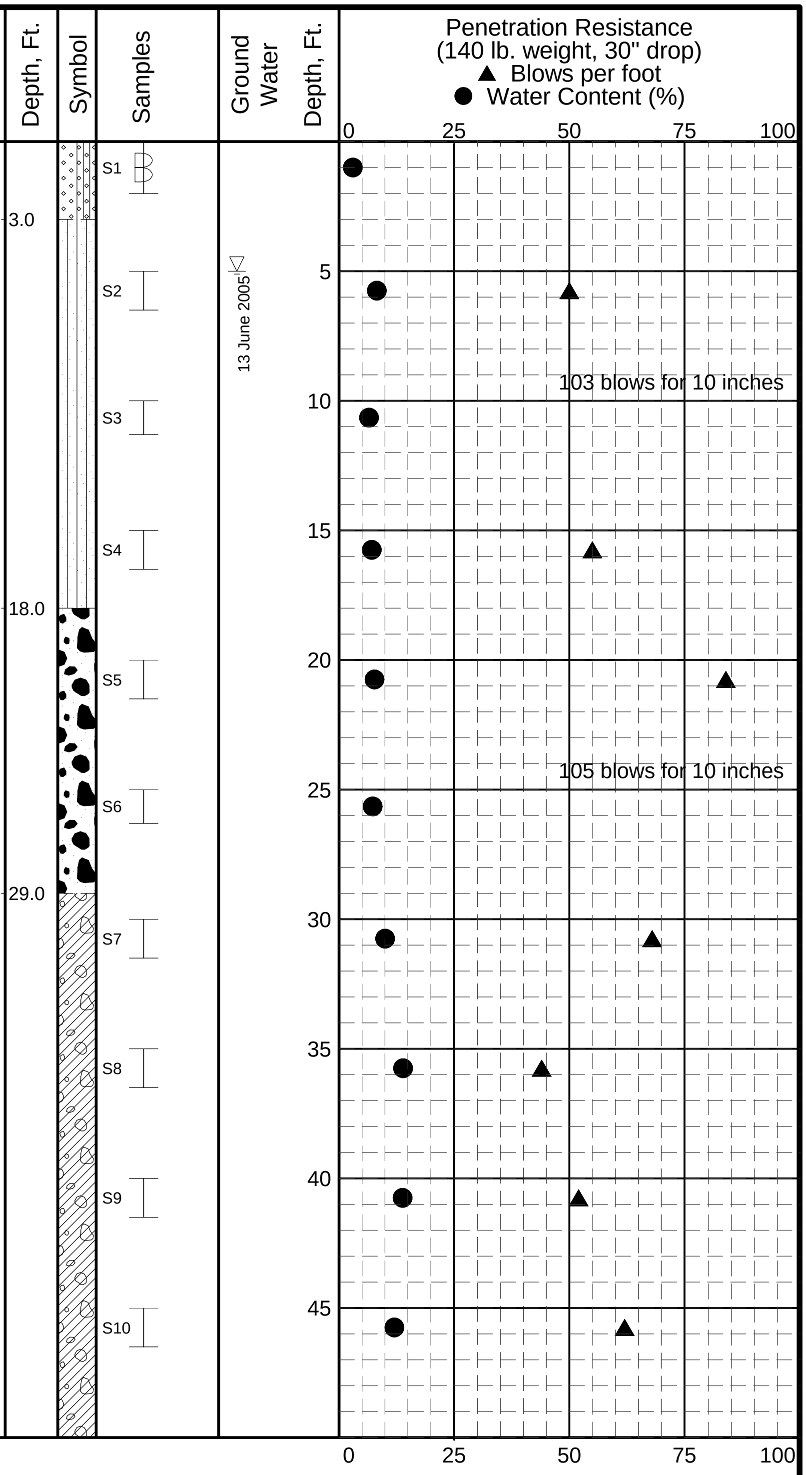

LEGEND

*	Sample Not Recovered	⊻	Ground Water Level At Time Of Drilling
⌶	2" O.D. Split Spoon Sample		
⌶	Grab Sample		

● Water Content (%)

Plastic Limit ├──●──┤ Liquid Limit

Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Point MacKenzie, Alaska

LOG OF BORING B05-1 (West Shoreline)
Location: N 61°17'23.9" W 149°55'05.3"

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SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. G-1
Sheet 1 of 5

MATERIAL DESCRIPTION Approx. Elevation: 30 Ft. (MLLW Datum)	Depth, Ft.	Samples
S11: PP = >4.5 Hard, gray, gravelly, sandy, silty CLAY; wet		S11
S12: PP = >4.5		S12
S13: PP = >4.5		S13
Hard, gray, sandy, silty CLAY; moist S14: Atterberg, Non-Plastic	63.0	S14
Hard, gray, gravelly, sandy, silty CLAY; wet; interbedded with dense, gray, silty SAND; wet	68.0	S15
S16: PP = >4.5		S16
S17: PP = >4.5		S17
S18a: PP = >4.5 52% Fines 6-inch gray, silty SAND layer at 86 feet		S18a S18b
S19: PP = >4.5 4-inch gray, silty SAND layer at 91 feet		S19
3-inch gray, silty SAND layer at 95 feet S20: PP = >4.5		S20

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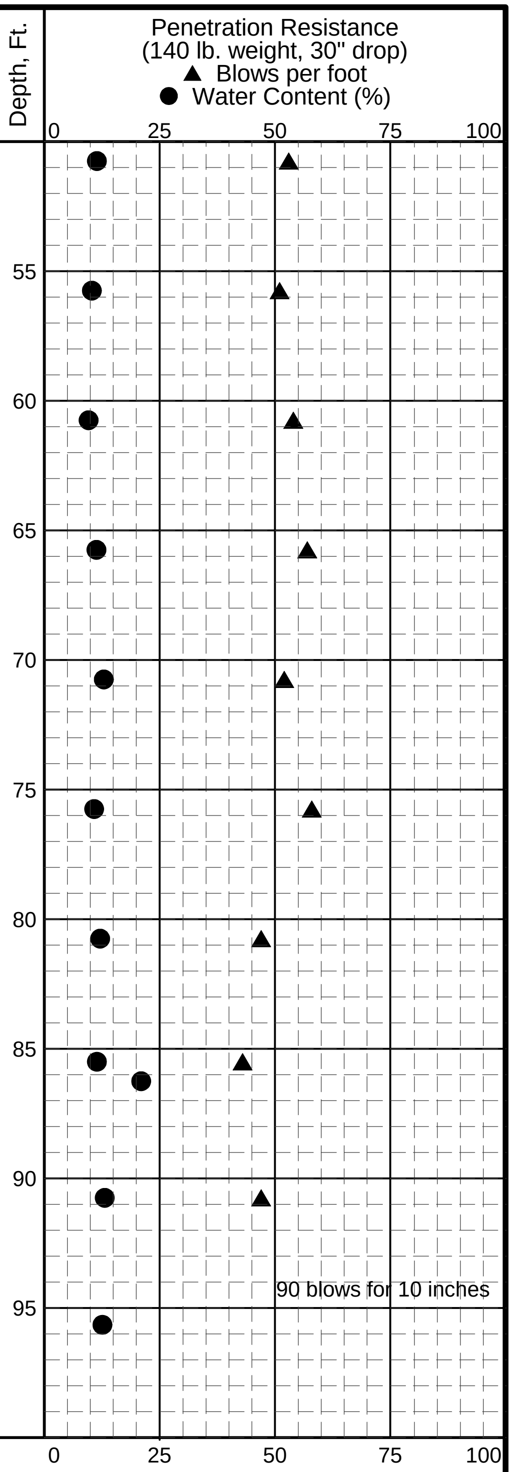

LEGEND

* Sample Not Recovered
⌶ 2" O.D. Split Spoon Sample
Ⓑ Grab Sample
∇ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit |—●—| Liquid Limit
Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Point MacKenzie, Alaska

LOG OF BORING B05-1 (West Shoreline)
Location: N 61°17'23.9" W 149°55'05.3"

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Geotechnical and Environmental Consultants

Fig. G-1
Sheet 2 of 5

GEOTECHNICAL LOG 01536-004 WEST SHORELINE.GPJ S&W GEO1.GDT 3/7/07

MATERIAL DESCRIPTION

Approx. Elevation: 30 Ft. (MLLW Datum)

Hard, gray, gravelly, sandy, silty CLAY; wet; interbedded with dense, gray, silty SAND; wet

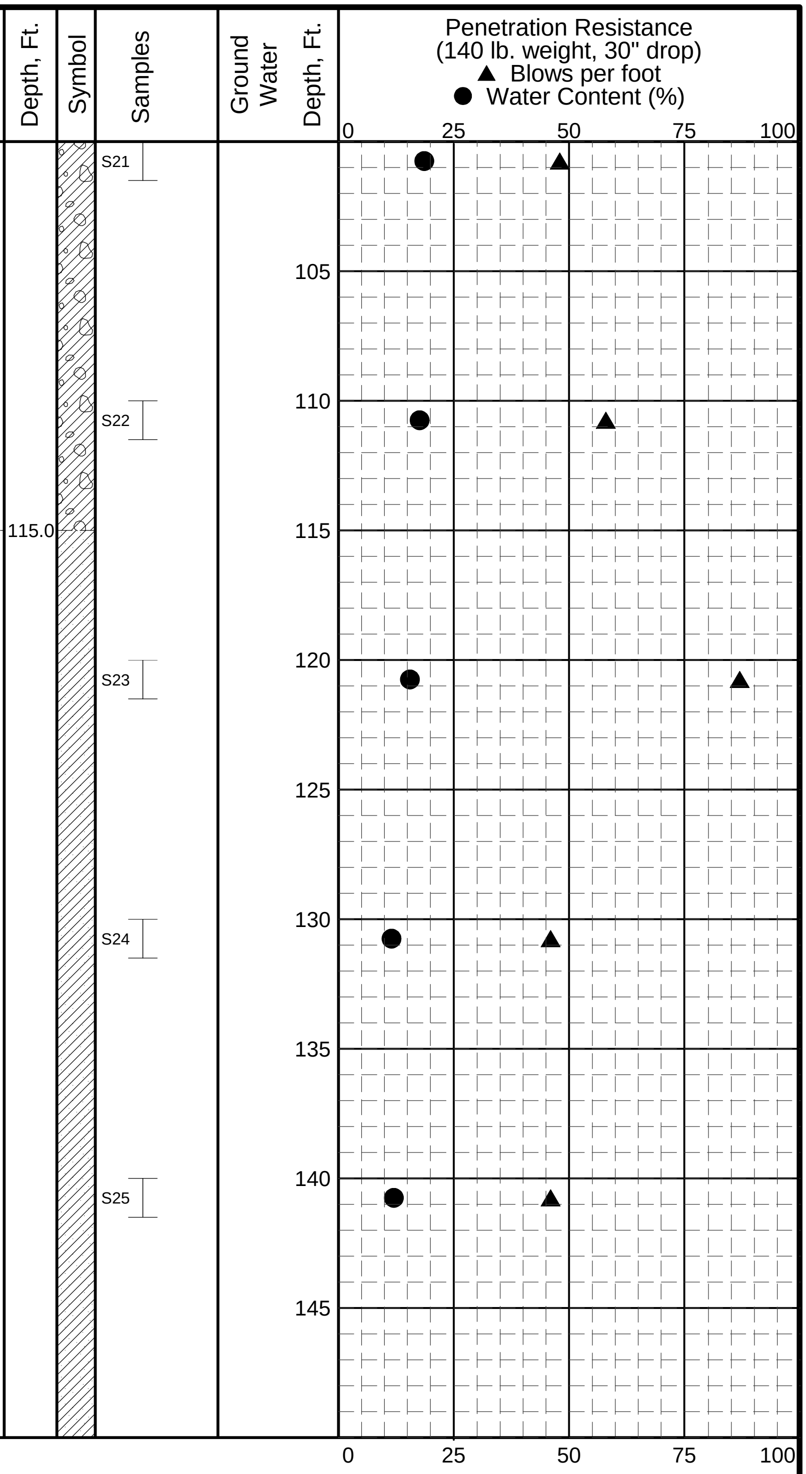
Small wood chip in Sample S22, at 110.5 feet

Hard, gray, slightly gravelly, sandy, silty CLAY; wet

S23: PP = >4.5

S24: PP = >4.5

S25: PP = >4.5



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LEGEND

* Sample Not Recovered

⌶ 2" O.D. Split Spoon Sample

⌶ Grab Sample

▽ Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit |—●—| Liquid Limit

Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Point MacKenzie, Alaska

LOG OF BORING B05-1 (West Shoreline)
Location: N 61°17'23.9" W 149°55'05.3"

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SHANNON & WILSON, INC.
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Fig. G-1
Sheet 3 of 5

MATERIAL DESCRIPTION

Approx. Elevation: 30 Ft. (MLLW Datum)

S26: PP = >4.5

Hard, gray, slightly gravelly, sandy, silty CLAY; wet

S27: PP = 3.25; TV = 1.25H 1.5V

Dense to very dense, gray, silty SAND; wet; stringers and layers of gray, silty CLAY; wet

S29a: PP = 3.0

5-inch gray, sandy, silty CLAY layer at 180.4 feet

S30: 23% Fines

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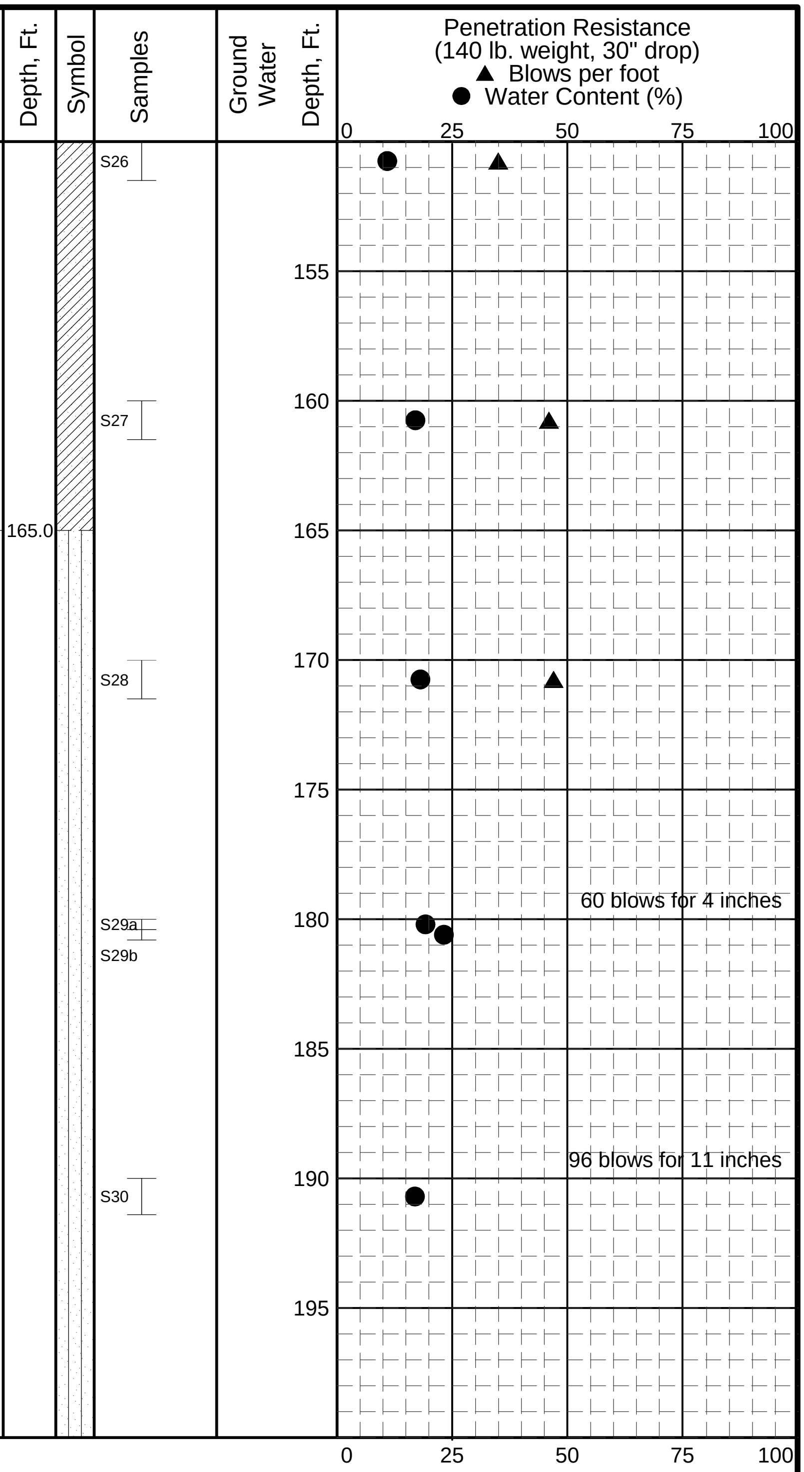


LEGEND

* Sample Not Recovered

2" O.D. Split Spoon Sample

Grab Sample

Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit ├──●──┤ Liquid Limit

Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Crossing
Point MacKenzie, Alaska

LOG OF BORING B05-1 (West Shoreline)
Location: N 61°17'23.9" W 149°55'05.3"

March 2007 32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. G-1
Sheet 4 of 5

MATERIAL DESCRIPTION

Approx. Elevation: 30 Ft. (MLLW Datum)

S31: PP = 2.0; TV = 1.0H 1.2V

Dense to very dense, gray, silty SAND; wet; stringers and layers of gray, silty CLAY; wet

S33: PP = 3.0; TV = n/aH 0.85V

S34: PP = >4.5

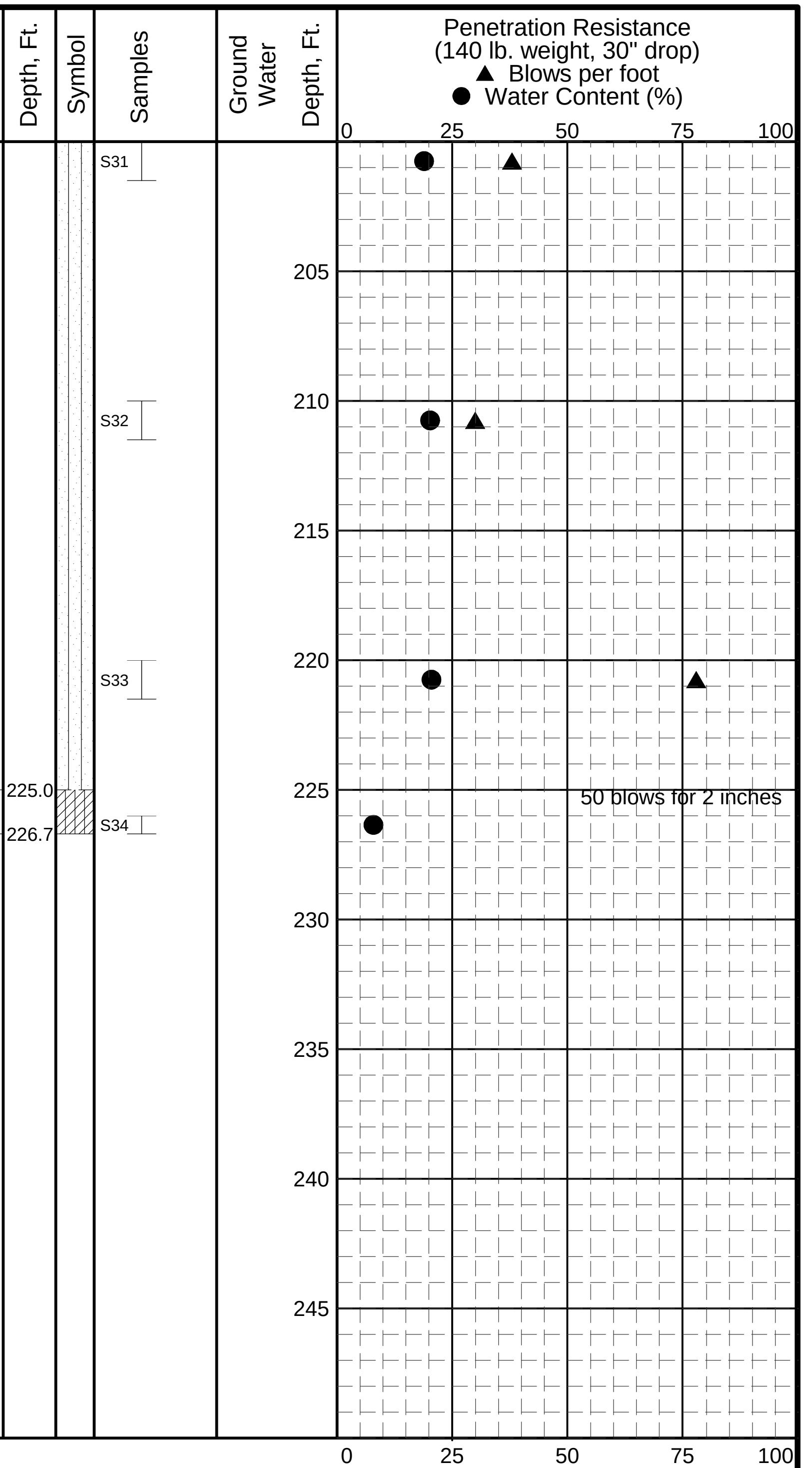
225.0

Hard, gray, slightly gravelly, sandy, silty CLAY; moist

226.7

Bottom of Boring

Boring Completed June 17, 2005



LEGEND

*	Sample Not Recovered
⌶	2" O.D. Split Spoon Sample
⌶	Grab Sample
⊻	Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit |—●—| Liquid Limit

Natural Water Content

NOTES

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2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

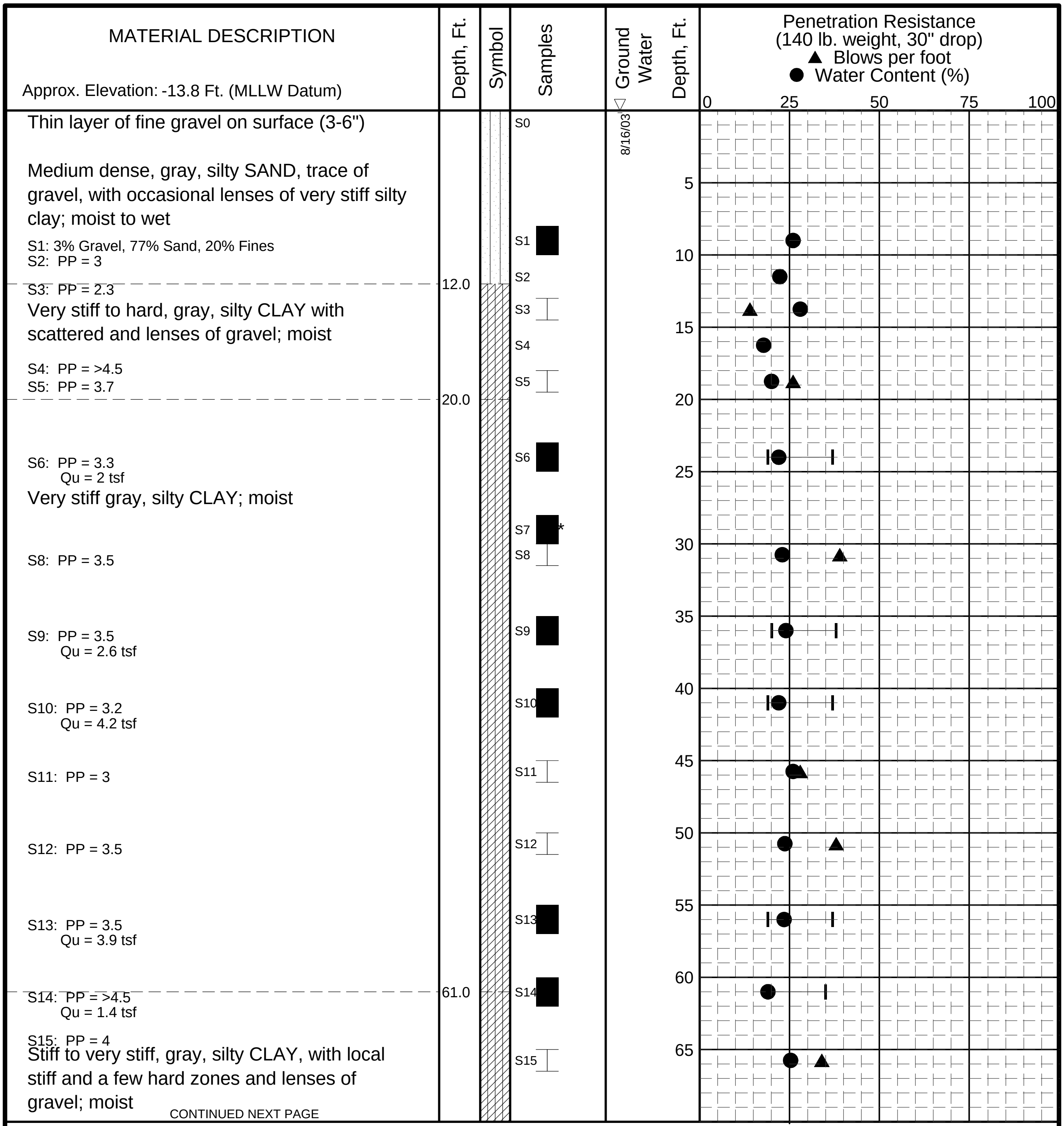
Knik Arm Crossing
Point MacKenzie, Alaska

LOG OF BORING B05-1 (West Shoreline)
Location: N 61°17'23.9" W 149°55'05.3"

March 2007 32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. G-1
Sheet 5 of 5



Thin layer of fine gravel on surface (3-6")

Medium dense, gray, silty SAND, trace of gravel, with occasional lenses of very stiff silty clay; moist to wet

S1: 3% Gravel, 77% Sand, 20% Fines
S2: PP = 3
S3: PP = 2.3

Very stiff to hard, gray, silty CLAY with scattered and lenses of gravel; moist

S4: PP = >4.5
S5: PP = 3.7

S6: PP = 3.3
Qu = 2 tsf

Very stiff gray, silty CLAY; moist

S8: PP = 3.5

S9: PP = 3.5
Qu = 2.6 tsf

S10: PP = 3.2
Qu = 4.2 tsf

S11: PP = 3

S12: PP = 3.5

S13: PP = 3.5
Qu = 3.9 tsf

S14: PP = >4.5
Qu = 1.4 tsf

S15: PP = 4

Stiff to very stiff, gray, silty CLAY, with local stiff and a few hard zones and lenses of gravel; moist

CONTINUED NEXT PAGE

LEGEND

- * Sample Not Recovered
- ■ Shelby Tube
- ⌶ 2" O.D. Split Spoon Sample
- ⌶ Rock Core Sample
- ▽ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit |—●—| Liquid Limit
Natural Water Content

NOTES

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2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Bridge
Anchorage, Alaska

LOG OF BORING A-1
Location: N 61°16.314' W 149°52.57

March 2007 32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. G-2
Sheet 1 of 5

MATERIAL DESCRIPTION

Approx. Elevation: -13.8 Ft. (MLLW Datum)

S16: PP = 3

Stiff to very stiff, gray, silty CLAY, with local stiff and a few hard zones and lenses of gravel; moist

S18: PP = 2.75

S19: PP = 1.7
Uu = 1.8 tsf

S20: PP = 2.5
Uu = 4 tsf

S21: PP = 2.5

S22: PP = 2.5
Qu = 1.5 tsf

Depth, Ft. 104.0

S23: PP = 2.25

S24: PP = 2

Very stiff, gray, silty CLAY, with a few scattered gravel; moist

S25: PP = 2.25
Qu = 2.8 tsf

S26: PP = 3.7
Uu = 3.9 tsf

S27a: PP = 2.5

S28: PP = 2.3
Qu = 2.8 tsf

S29: PP = 2.5
Qu = 2.4 tsf
Uu = 2.6 tsf

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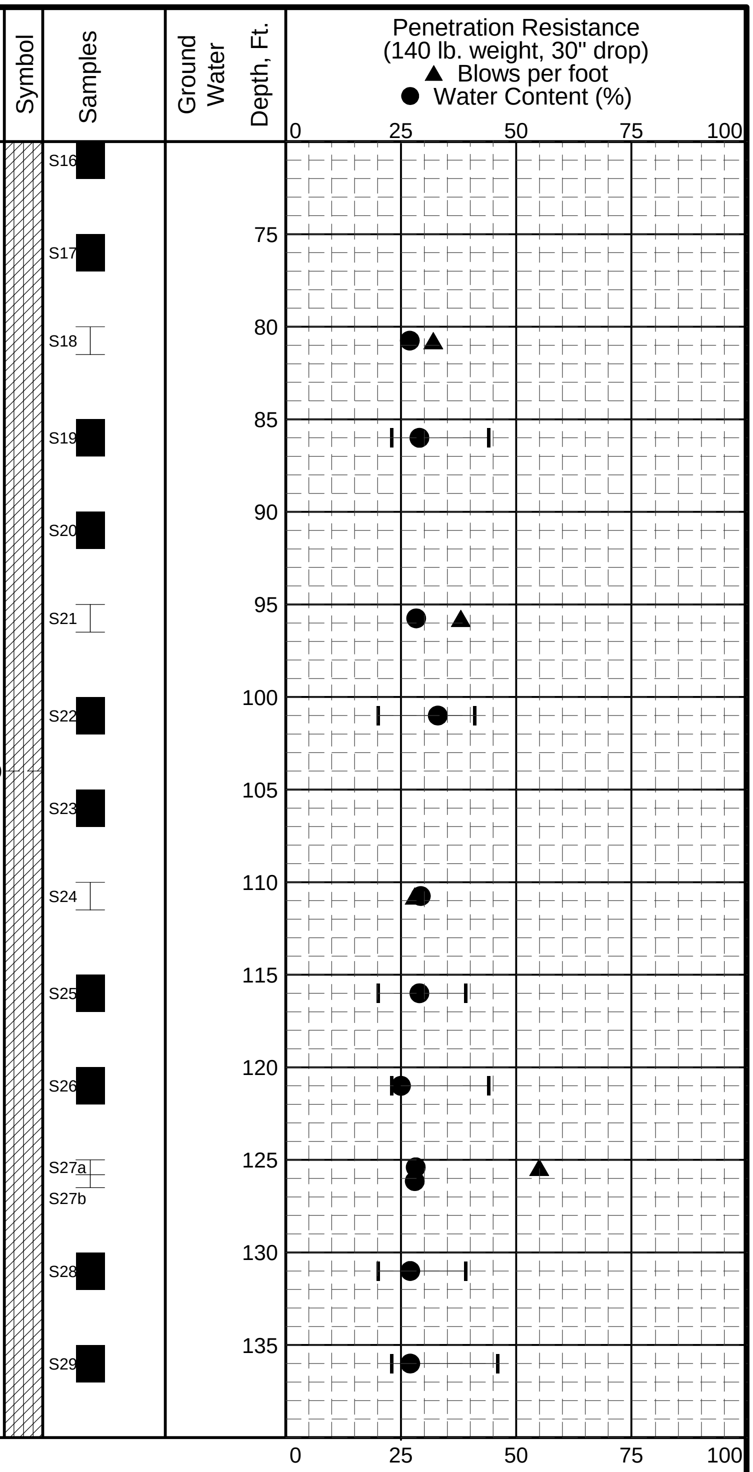

LEGEND

- * Sample Not Recovered
- ■ Shelby Tube
- ⌶ 2" O.D. Split Spoon Sample
- ⌶ Rock Core Sample
- ∇ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit |—●—| Liquid Limit
Natural Water Content

NOTES

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Knik Arm Bridge
Anchorage, Alaska

LOG OF BORING A-1
Location: N 61°16.314' W 149°52.57

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. G-2
Sheet 2 of 5

MATERIAL DESCRIPTION

Approx. Elevation: -13.8 Ft. (MLLW Datum)

S30: PP = 2

145.0

S31: PP = 2.5

Very stiff to hard, gray, silty CLAY, with scattered gravel; moist

S32: PP = 2.75
Qu = 4.4 tsf

S33: PP = 2.5

159.0

S34: PP = 2.75

Very stiff, gray, silty CLAY, with a few stiff layers and several 1 foot ± lenses of gravel; moist

S35: PP = 1.75
Qu = 1.6 tsf

S36: PP = 2.5

S37: PP = 2.75
Qu = 2.4 tsf

S38: PP = 2.75

S39: PP = 2.25

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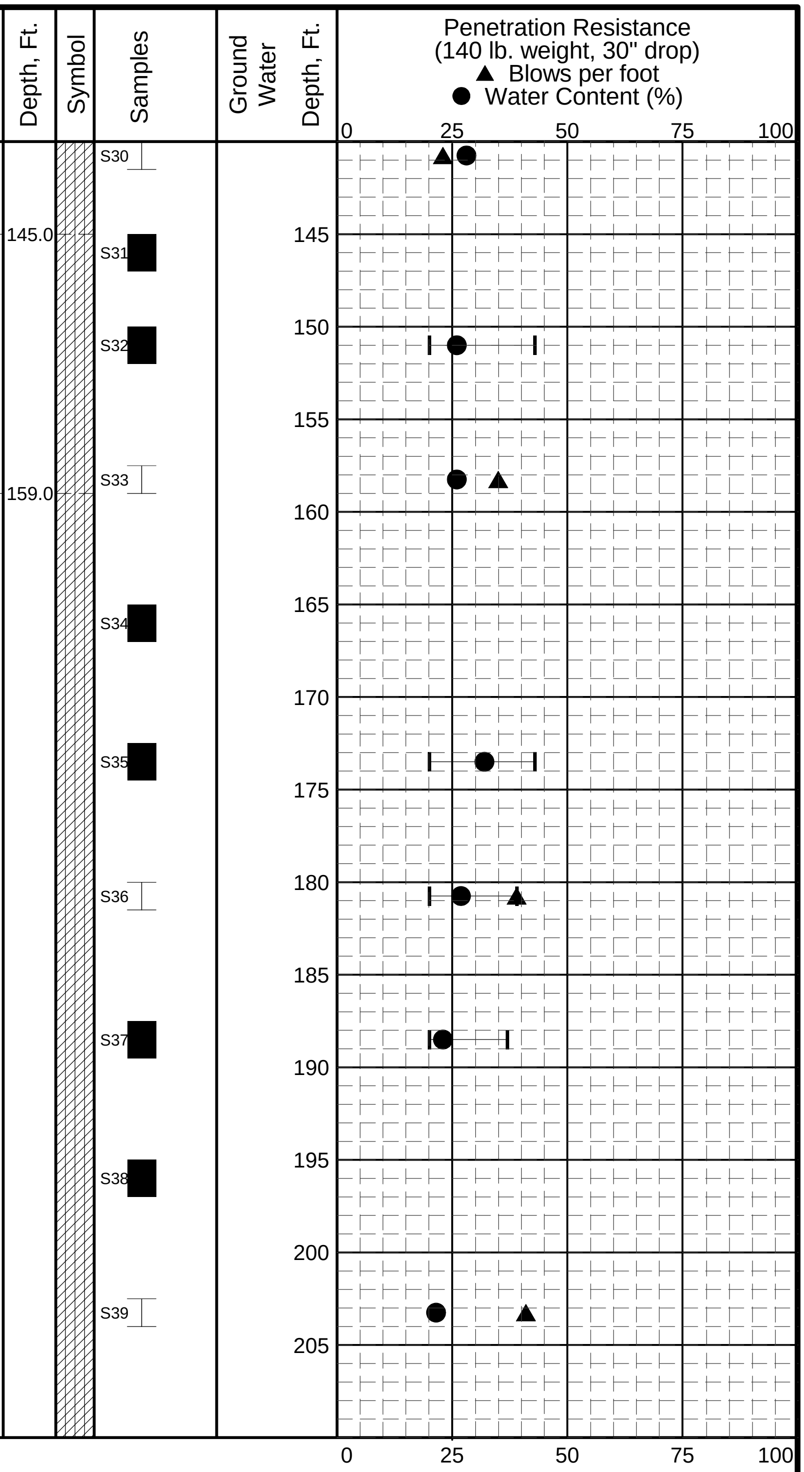

LEGEND

* Sample Not Recovered
■ Shelby Tube
⌶ 2" O.D. Split Spoon Sample
⌶ Rock Core Sample

⊻ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit |—●—| Liquid Limit
Natural Water Content

NOTES

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Knik Arm Bridge
Anchorage, Alaska

LOG OF BORING A-1
Location: N 61°16.314' W 149°52.57

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. G-2
Sheet 3 of 5

MATERIAL DESCRIPTION

Approx. Elevation: -13.8 Ft. (MLLW Datum)

S40: PP = 2
Uu = 2.2 tsf

Very stiff, gray, silty CLAY, with a few stiff layers and several 1 foot ± lenses of gravel; moist

S42: PP = 2.5

226.0

Stiff, gray, silty CLAY, with a few medium stiff layers; moist

S43: PP = 1.2
Qu = 0.6 tsf

240.0

S44: PP = 2.25

Very stiff to hard, gray, silty CLAY; moist

S45: PP = 3.5

S46: PP = 3.5
Qu = 4.4 tsf

270.0

Stiff to very stiff, gray, silty CLAY, with lenses of gravel and thin hard layers; moist

S47: PP = 1.7
Qu = 1.2 tsf

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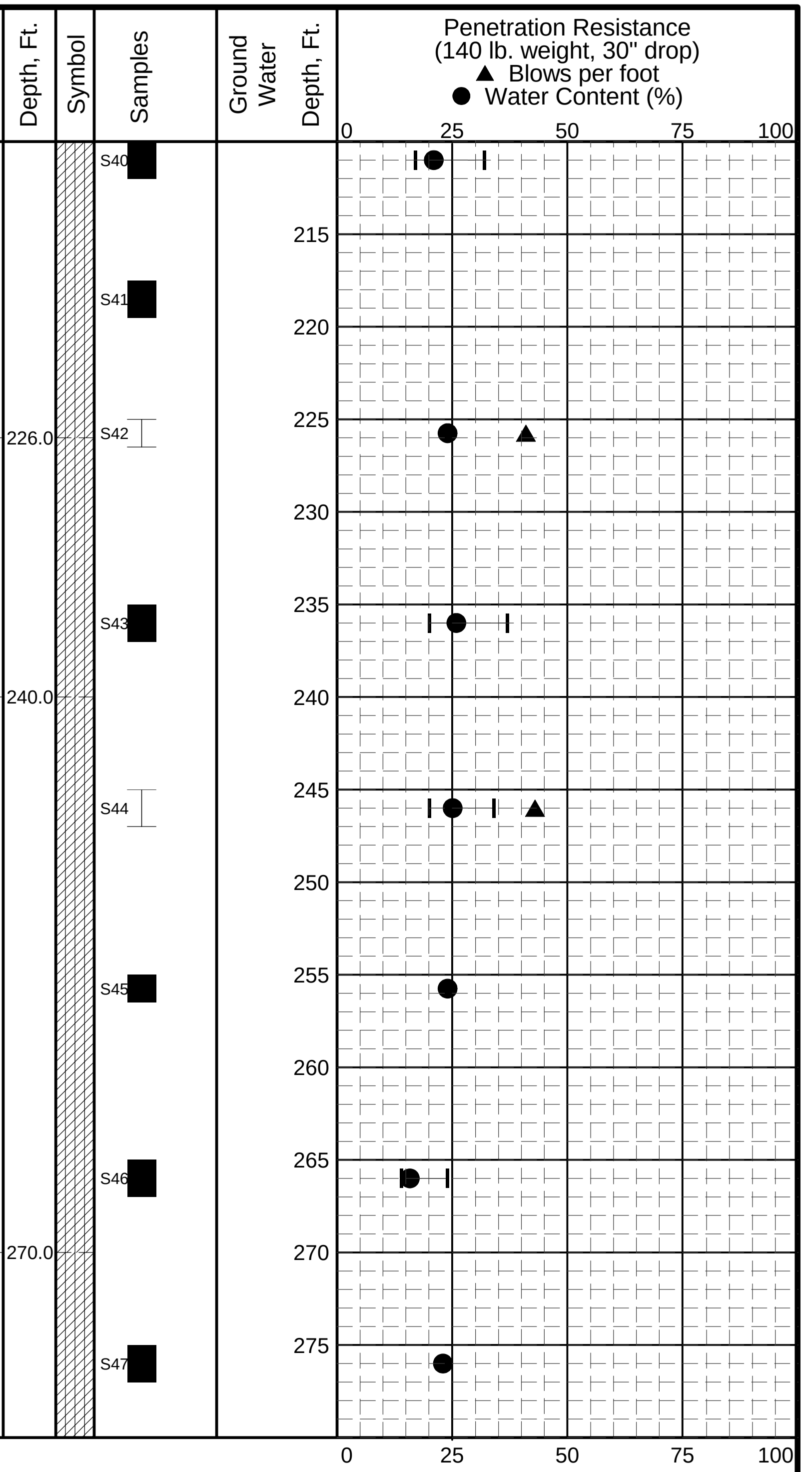

LEGEND

* Sample Not Recovered
▀ Shelby Tube
⌶ 2" O.D. Split Spoon Sample
⌶ Rock Core Sample
⊻ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit |—●—| Liquid Limit
Natural Water Content

NOTES

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Knik Arm Bridge
Anchorage, Alaska

LOG OF BORING A-1
Location: N 61°16.314' W 149°52.57

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. G-2
Sheet 4 of 5

MATERIAL DESCRIPTION

Approx. Elevation: -13.8 Ft. (MLLW Datum)

S48: PP = 2.5

Stiff to very stiff, gray, silty CLAY, with lenses of gravel and thin hard layers; moist

S49: PP = >4.5

S50: PP = 3.75
Qu = 3.5 tsf
Uu = 3.3 tsf

312.0

Hard, gray, gravelly, silty CLAY; moist

319.0

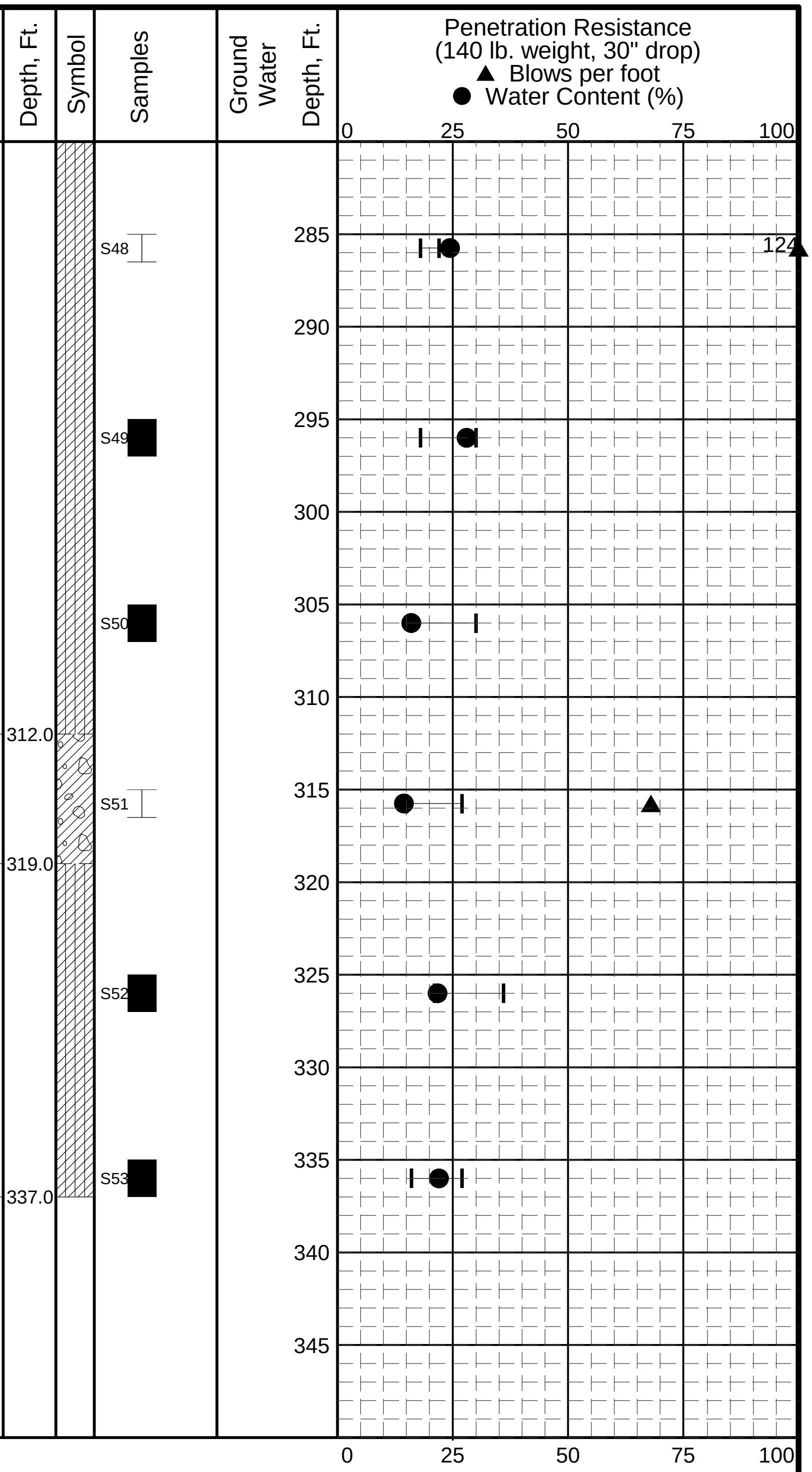
Hard, gray, silty CLAY; moist

S52: PP = >4.5
Qu = 1.0 tsf

S53: PP = 3.3
Qu = 4.7 tsf

337.0

Bottom of Boring
Boring Completed 8/16/03



LEGEND

- * Sample Not Recovered
- ■ Shelby Tube
- ⌶ 2" O.D. Split Spoon Sample
- ⌶ Rock Core Sample
- ▽ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit |—●—| Liquid Limit
Natural Water Content

NOTES

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Knik Arm Bridge
Anchorage, Alaska

LOG OF BORING A-1
Location: N 61°16.314' W 149°52.57

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. G-2
Sheet 5 of 5

MATERIAL DESCRIPTION

Approx. Elevation: -60.9 Ft. (MLLW Datum)

Loose, gray, SAND; wet

S4a: 0% Gravel, 89% Sand, 11% Fines

S4b: 10.8% Fines

Medium dense, gray, slightly silty, fine SAND; wet

S7: 0% Gravel, 92% Sand, 8% Fines

Medium dense to very dense, gray, clean to silty fine SAND, with layers of gray sand; wet

S12: 0% Gravel, 84% Sand, 16% Fines

S14: 0% Gravel, 84% Sand, 16% Fines

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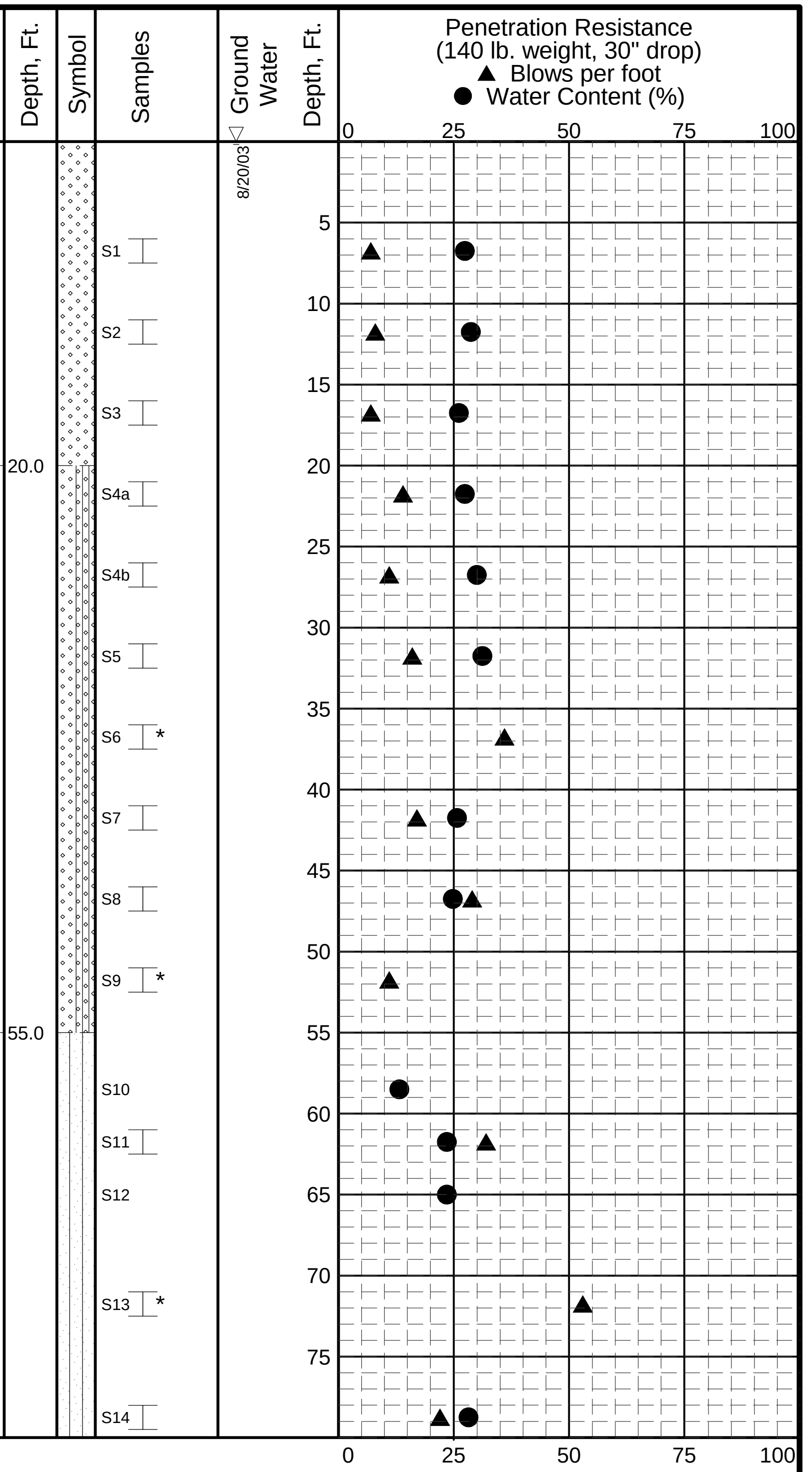

LEGEND

* Sample Not Recovered
■ Shelby Tube
⌶ 2" O.D. Split Spoon Sample
⌶ Rock Core Sample
▽ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit ├──●──┤ Liquid Limit
Natural Water Content

NOTES

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Knik Arm Bridge
Anchorage, Alaska

LOG OF BORING A-2
Location: N 61°16.661' W 149°53.273'

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. G-3
Sheet 1 of 3

MATERIAL DESCRIPTION

Approx. Elevation: -60.9 Ft. (MLLW Datum)

Medium dense to very dense, gray, clean to silty fine SAND, with layers of gray sand; wet

S15: 0.3% Fines

Dense, gray, slightly silty to clean fine SAND; wet

S18: 1% Gravel, 92% Sand, 7% Fines

S19: 0.8% Fines

S20: 0% Gravel, 58% Sand, 42% Fines

Very dense, gray, silty fine SAND, with trace of gravel; wet

Dense to very dense, gray, GRAVEL; wet

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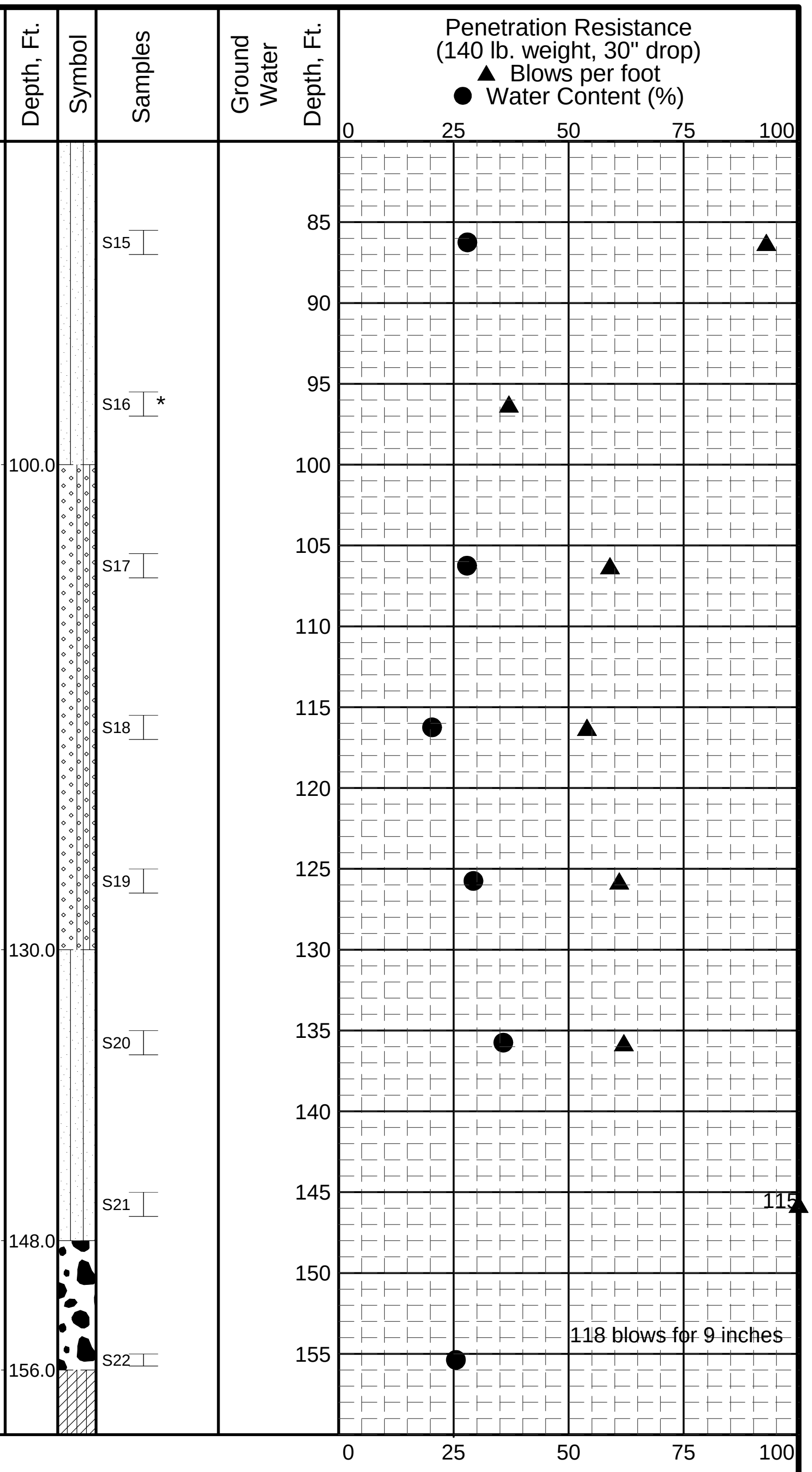

LEGEND

- * Sample Not Recovered
- ■ Shelby Tube
- ⌶ 2" O.D. Split Spoon Sample
- ⌶ Rock Core Sample
- ⊽ Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

NOTES

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Knik Arm Bridge
Anchorage, Alaska

LOG OF BORING A-2
Location: N 61°16.661' W 149°53.273'

March 2007 32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. G-3
Sheet 2 of 3

MATERIAL DESCRIPTION

Approx. Elevation: -60.9 Ft. (MLLW Datum)

S23: PP = 3.5

Very stiff to hard, gray, silty CLAY, with trace of gravel; moist

S25: PP = 3.5

S26: PP = 4
Qu = 2.5 tsf

182.0

Hard, gray, slightly sandy, silty CLAY; moist

S27: 94.4% Fines

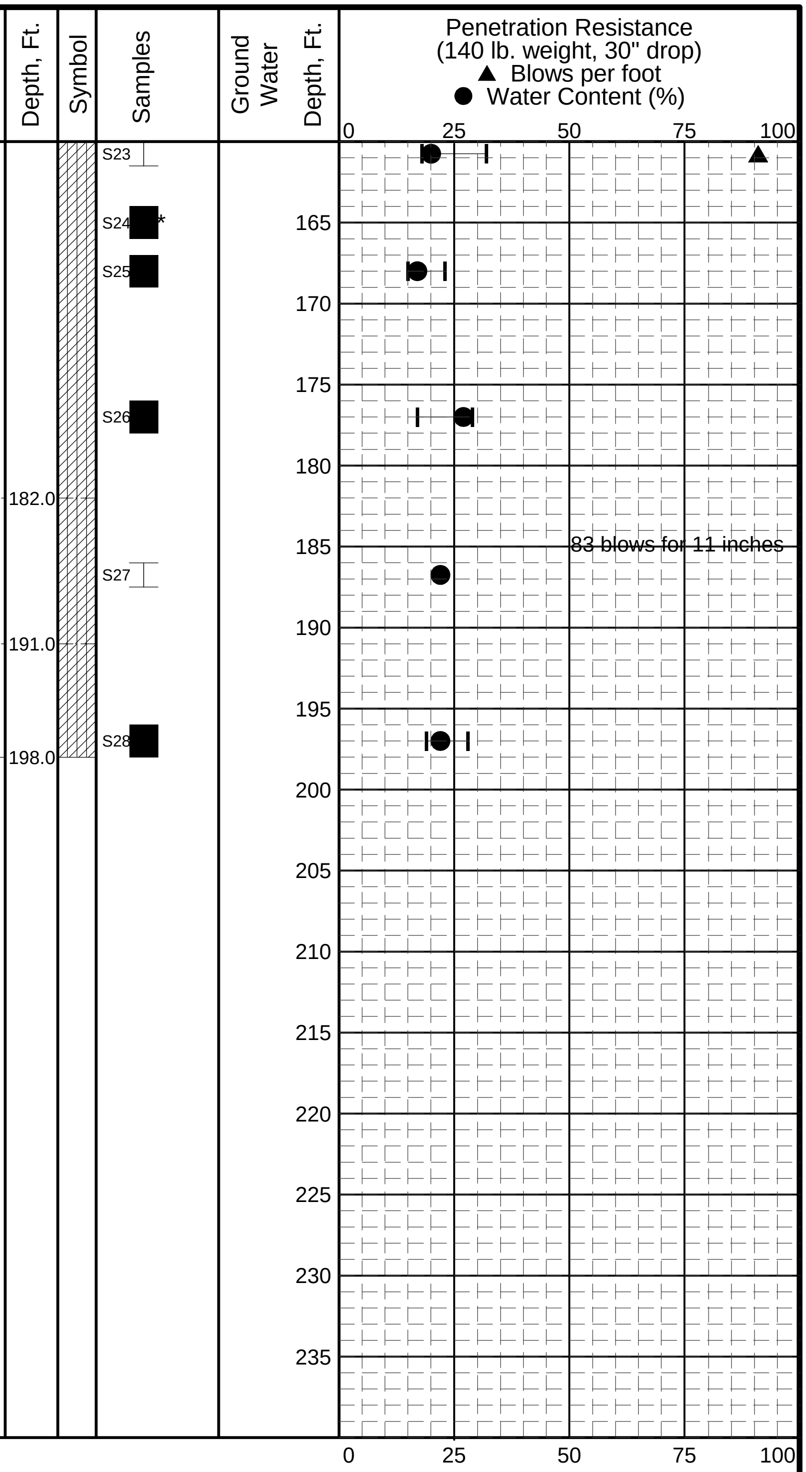
191.0

Very stiff, gray, silty CLAY; moist

S28: PP = 2.5

198.0

Bottom of Boring
Boring Completed 8/20/03



LEGEND

* Sample Not Recovered
■ Shelby Tube
⌶ 2" O.D. Split Spoon Sample
I Rock Core Sample

▽ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit |—●—| Liquid Limit
Natural Water Content

NOTES

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Knik Arm Bridge
Anchorage, Alaska

LOG OF BORING A-2
Location: N 61°16.661' W 149°53.273'

March 2007 32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. G-3
Sheet 3 of 3

MATERIAL DESCRIPTION

Approx. Elevation: -2.9 Ft. (MLLW Datum)

Boulder

Very dense, gray, silty, gravelly SAND; moist and non plastic

S3: 33% Gravel, 36% Sand, 31% Fines

S6: 36% Gravel, 40% Sand, 24% Fines

Dense to very dense, gray, interbedded, silty, gravelly SAND and slightly silty GRAVEL; moist

S8: 92% Gravel,

Hard, gray, slightly sandy, gravelly, silty CLAY with few stiff clay lenses; dry, crumbly and low plasticity, locally non plastic

S13: PP = >4.5

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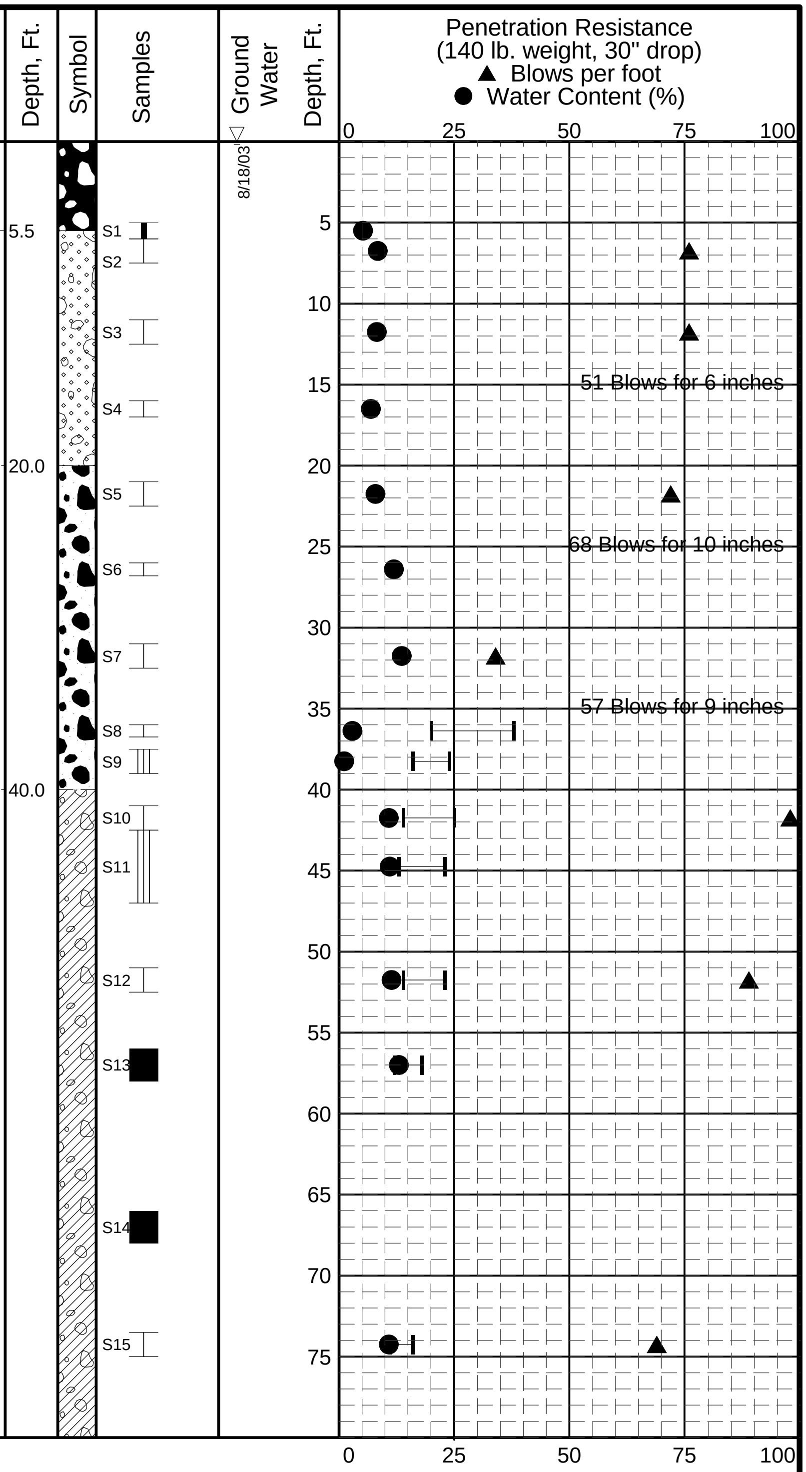

LEGEND

* Sample Not Recovered

▬ Shelby Tube

⌶ 2" O.D. Split Spoon Sample

⌶ Rock Core Sample

▽ Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit ┣━●━┫ Liquid Limit

Natural Water Content

NOTES

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Knik Arm Bridge
Anchorage, Alaska

LOG OF BORING A-4
Location: N 61°17.063' W 149°54.890'

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. G-4
Sheet 1 of 3

MATERIAL DESCRIPTION

Approx. Elevation: -2.9 Ft. (MLLW Datum)

S16: PP = 4.5
Qu = .84 tsf

Hard, gray, slightly sandy, gravelly, silty CLAY with few stiff clay lenses; dry, crumbly and low plasticity, locally non plastic

S19: PP = >4.5

S20: PP = 1.25

S21: PP = >4.5

Very dense, gray, silty SAND; wet and non plastic

S23: PP = >4.5

Hard, gray, sandy, silty CLAY, most with isolated lenses of gravel 6"- to 1'-thick, spaced randomly; moist with low plasticity

S24: PP = >4.5

S25: PP = >4.5

Hard, gray, slightly gravelly, silty CLAY; moist with low plasticity

S26: PP = >4.5

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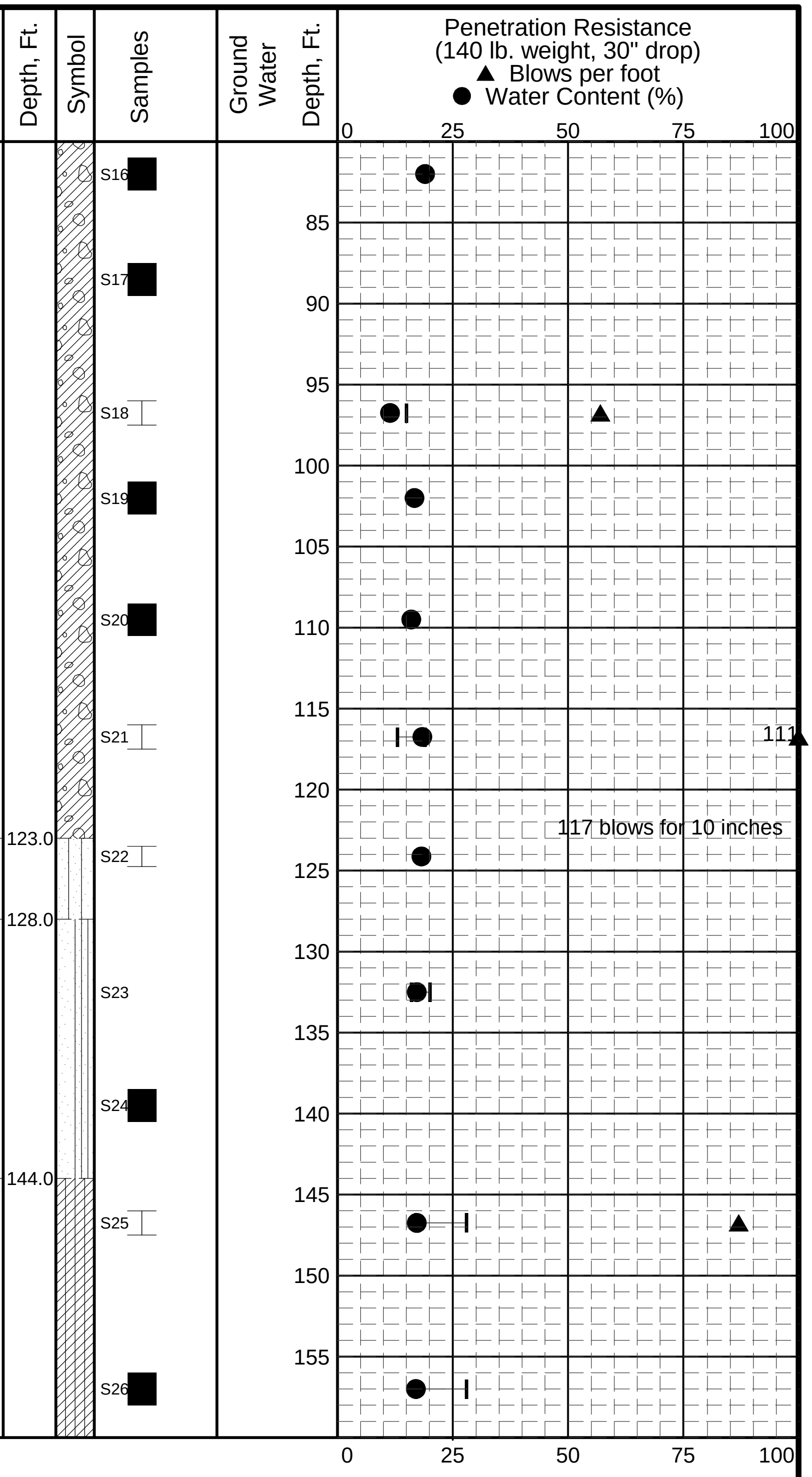

LEGEND

- * Sample Not Recovered
- ■ Shelby Tube
- ⌶ 2" O.D. Split Spoon Sample
- ⌶ Rock Core Sample
- ▽ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit |—●—| Liquid Limit
Natural Water Content

NOTES

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Knik Arm Bridge
Anchorage, Alaska

LOG OF BORING A-4
Location: N 61°17.063' W 149°54.890'

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. G-4
Sheet 2 of 3

MATERIAL DESCRIPTION

Approx. Elevation: -2.9 Ft. (MLLW Datum)

Depth, Ft. | Symbol | Samples | Ground Water | Depth, Ft.

S27: PP = >4.5

Hard, gray, slightly gravelly, silty CLAY; moist with low plasticity

S28: PP = >4.5

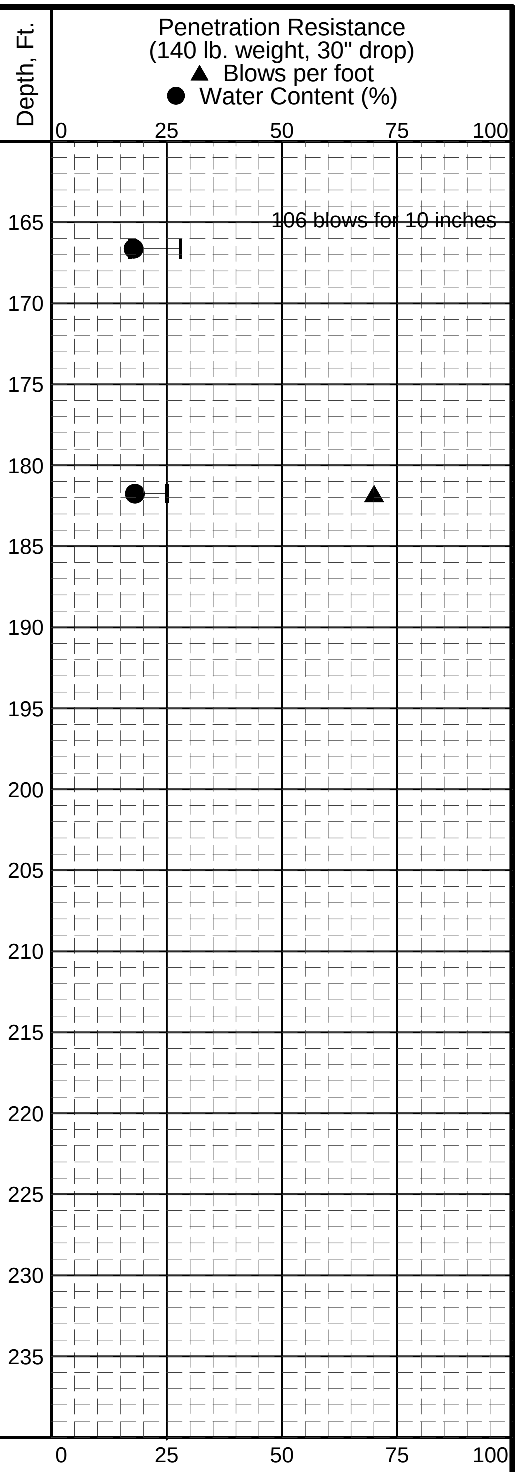
182.5

Bottom of Boring

Boring Completed 8/18/03

S27

S28



LEGEND

* Sample Not Recovered

■ Shelby Tube

⌶ 2" O.D. Split Spoon Sample

⌶ Rock Core Sample

▽ Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

NOTES

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Knik Arm Bridge
Anchorage, Alaska

LOG OF BORING A-4
Location: N 61°17.063' W 149°54.890'

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. G-4
Sheet 3 of 3

MATERIAL DESCRIPTION

Approx. Elevation: -30.1 Ft. (MLLW Datum)

S1: PP = 2.75

Very stiff to hard, gray, slightly gravelly, slightly sandy CLAY, interbedded with layers of dense, clayey SAND; wet

S2: PP = 4.5

S3: PP = 3.5

S5: PP = 2.5
Qu = .54 tsf

S6: PP = >4.5

S7: PP = 3.5

Very stiff to hard, gray, sandy CLAY to medium dense to dense, clayey fine SAND; wet

S8: PP = 2.5
Qu = 2.3 tsf
S9: PP = 2

S10: PP = 3.5

S11: PP = 4

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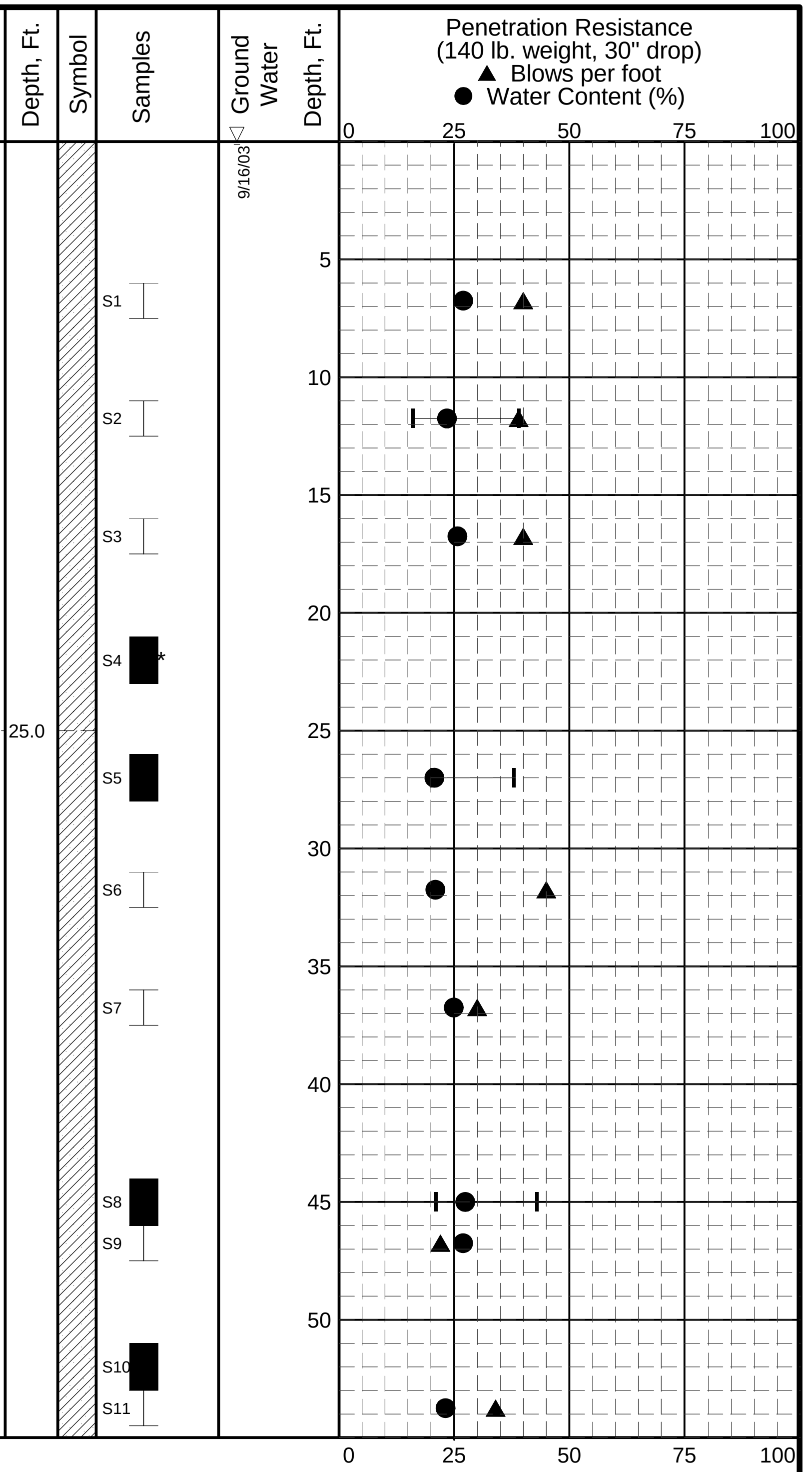

LEGEND

* Sample Not Recovered
■ Shelby Tube
⌶ 2" O.D. Split Spoon Sample

⌶ Rock Core Sample

▽ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit |—●—| Liquid Limit
Natural Water Content

NOTES

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Knik Arm Bridge
Anchorage, Alaska

LOG OF BORING A-5
Location: N 61°16.674' W 149°52.395'

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. G-5
Sheet 1 of 5

GEOTECHNICAL LOG 1536NOPP.GPJ S&W_GEO1.GDT 3/7/07

MATERIAL DESCRIPTION

Approx. Elevation: -30.1 Ft. (MLLW Datum)

S12: PP = 2.5
Qu = 2.4 tsf

S14a: PP = 3
Qu = 1.4 tsf

S15: PP = 3.5

S16: PP = 2.75

S17: PP = 1
Qu = 1.4 tsf
Uu = 2.3 tsf
S18: PP = 3

S19: PP = 2.5

Very stiff, gray, sandy CLAY to medium dense to dense, clayey fine SAND; wet, local stiff layers

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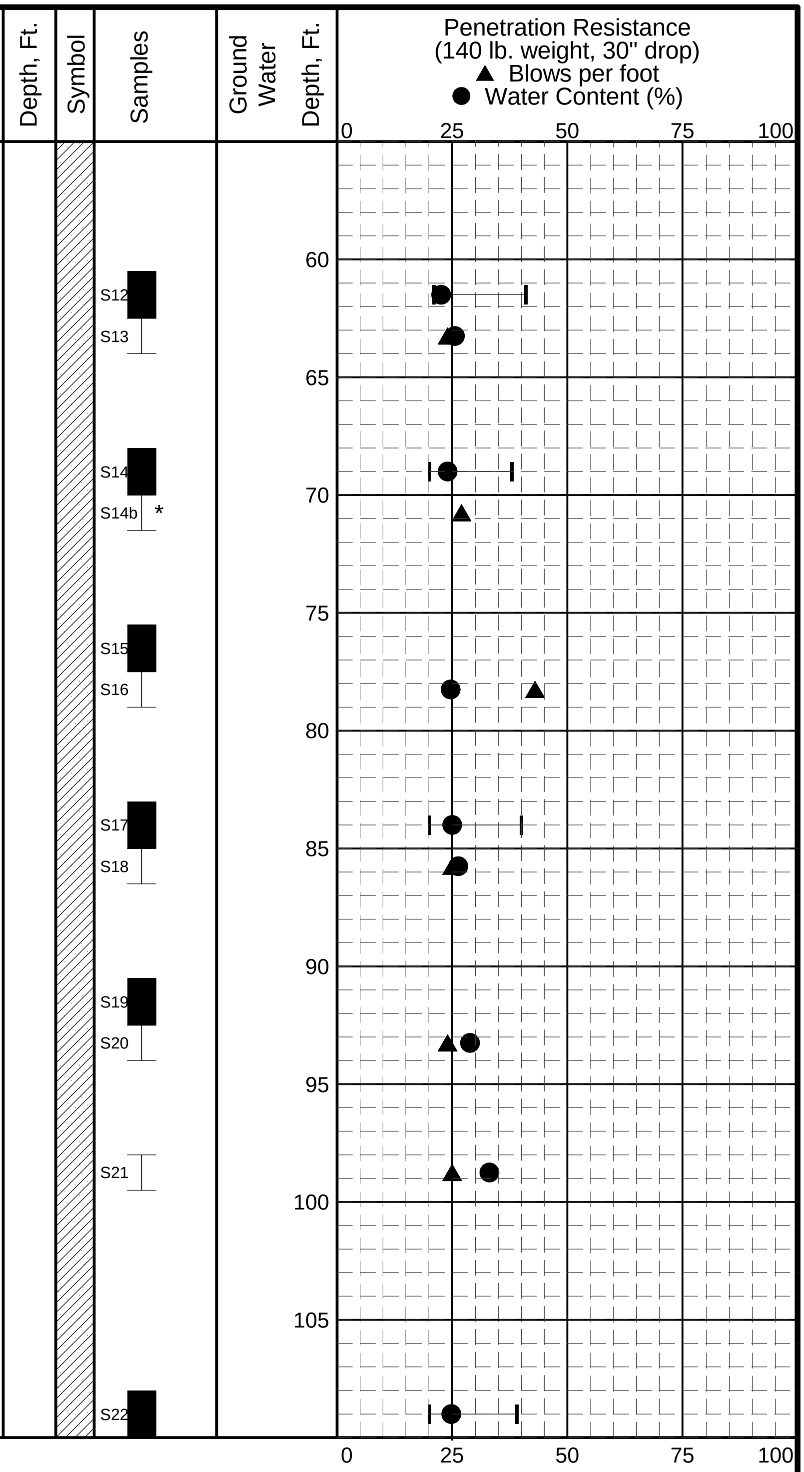

LEGEND

* Sample Not Recovered
▬ Shelby Tube
⌶ 2" O.D. Split Spoon Sample
⌶ Rock Core Sample
▽ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Bridge
Anchorage, Alaska

LOG OF BORING A-5
Location: N 61°16.674' W 149°52.395'

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. G-5
Sheet 2 of 5

MATERIAL DESCRIPTION

Approx. Elevation: -30.1 Ft. (MLLW Datum)

S22: PP = 2
Qu = 2.0 tsf

S23: PP = 3.5

125.0

S24: 0% Gravel, 88% Sand, 12% Fines

Very dense, gray, silty fine SAND, and interbedded with gray, very stiff to hard, silty CLAY; wet

S26: PP = 2.25

S27: PP = 4.25
Qu = 3.2 tsf
Uu = 6.5 tsf

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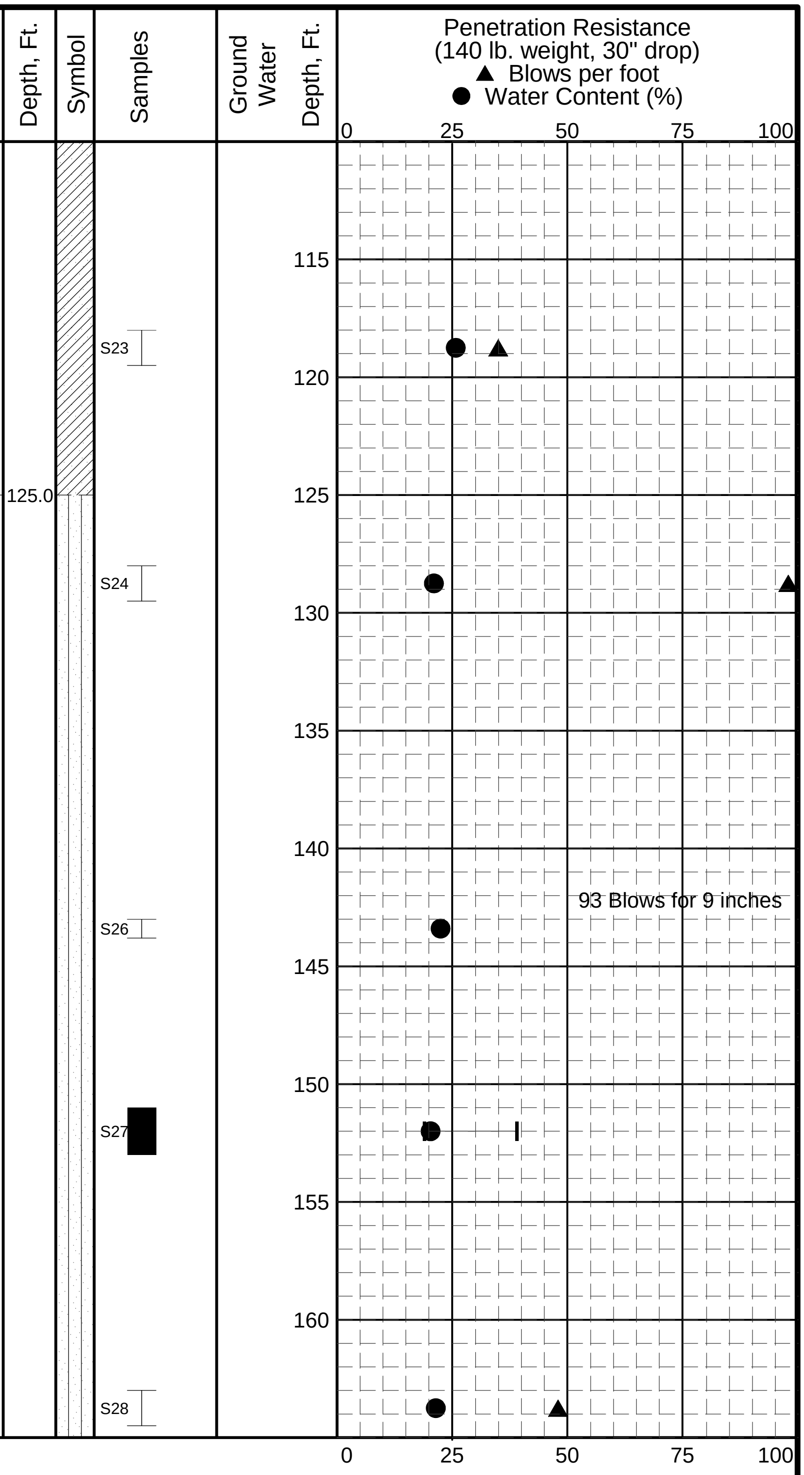

LEGEND

* Sample Not Recovered
■ Shelby Tube
⌶ 2" O.D. Split Spoon Sample

⌶ Rock Core Sample

▽ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
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Knik Arm Bridge
Anchorage, Alaska

LOG OF BORING A-5
Location: N 61°16.674' W 149°52.395'

March 2007 32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. G-5
Sheet 3 of 5

GEOTECHNICAL LOG 1536NOPP.GPJ S&W_GEO1.GDT 3/7/07

MATERIAL DESCRIPTION

Approx. Elevation: -30.1 Ft. (MLLW Datum)

S28: PP = 3.5
0% Gravel, 4% Sand, 96% Fines

Very dense, gray, silty fine SAND, and interbedded with gray, very stiff to hard, silty CLAY; wet

S29: PP = 3

S30: PP = <1
Qu = 3.0 tsf
Uu = 4.2 tsf

S31: PP = 2.5
2% Gravel, 5% Sand, 93% Fines

S32: PP = 3

S33: PP = 4.5
0% Gravel, 97% Sand, 3% Fines

Very dense, gray, silty fine SAND, and interbedded with gray, very stiff to hard, silty

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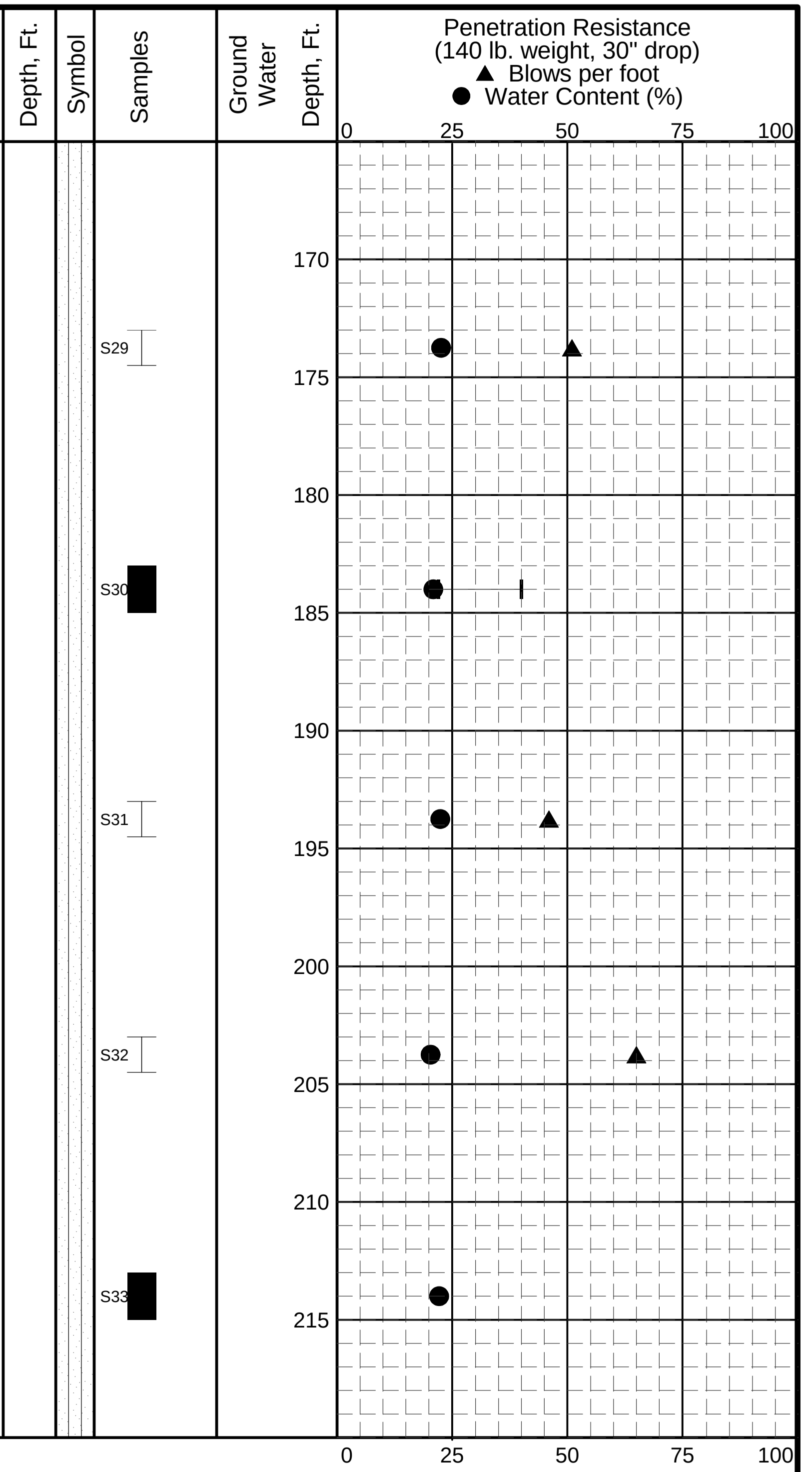


LEGEND

* Sample Not Recovered
▬ Shelby Tube
⌶ 2" O.D. Split Spoon Sample
I Rock Core Sample

⊻ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit |—●—| Liquid Limit
Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Bridge
Anchorage, Alaska

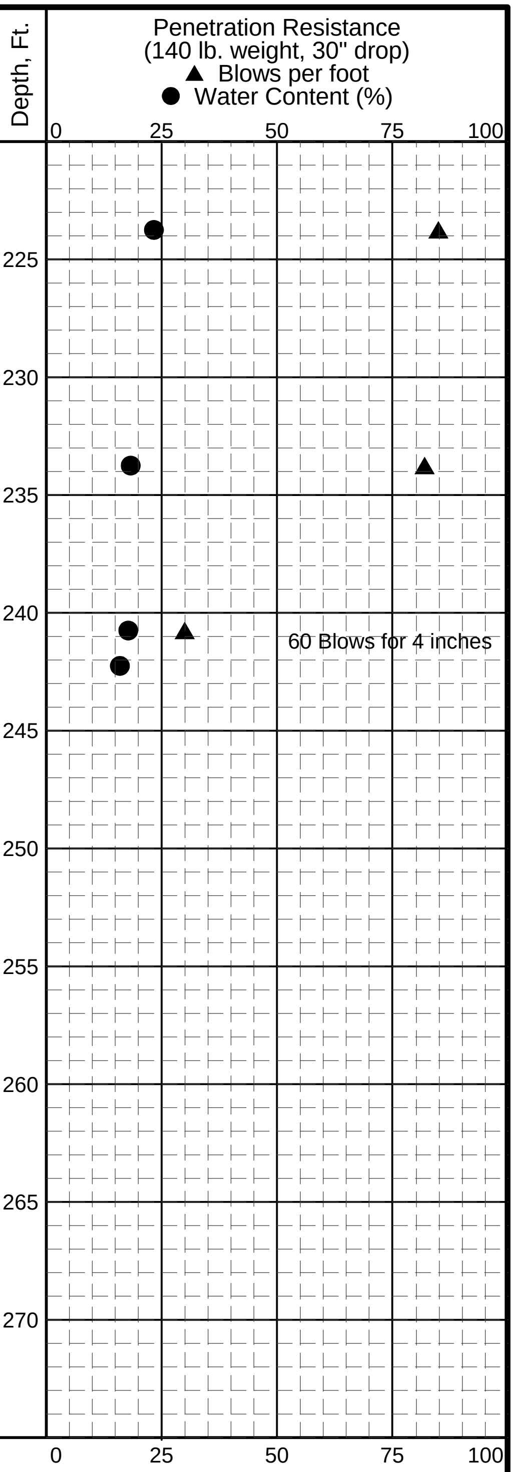
LOG OF BORING A-5
Location: N 61°16.674' W 149°52.395'

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. G-5
Sheet 4 of 5

MATERIAL DESCRIPTION Approx. Elevation: -30.1 Ft. (MLLW Datum)	Depth, Ft.	Symbol	Samples	Ground Water
CLAY; wet S34: PP = 3.5			S34 S35 S36 S37	
Bottom of Boring Boring Completed 9/16/03	242.5			



LEGEND

* Sample Not Recovered
■ Shelby Tube
⌶ 2" O.D. Split Spoon Sample
▽ Ground Water Level At Time Of Drilling
Ⅰ Rock Core Sample

● Water Content (%)
Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
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Knik Arm Bridge
Anchorage, Alaska

LOG OF BORING A-5
Location: N 61°16.674' W 149°52.395'

March 2007 32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. G-5
Sheet 5 of 5

Approx. Elevation: 4.47 Ft. (MLLW Datum)

MATERIAL DESCRIPTION	Depth, Ft.
Gravelly mudline	
Very stiff, gray, sandy, silty CLAY; moist S2: PP = 3 S3: PP = 4.25 S4: PP = 2	3.0
Medium dense, gray, silty GRAVEL; moist	27.3
Very stiff, gray, gravelly, silty CLAY; moist with sand partings and seams	29.0
Dense, gray, gravelly CLAY to clayey GRAVEL; moist	46.0
Very dense, gray-black, gravelly COBBLES; wet	50.0
Very dense, gray, slightly silty, sandy GRAVEL; wet	56.0
Very dense, gray, gravelly, silty fine SAND; wet S12: 17% Gravel, 63% Sand, 20% Fines	65.0

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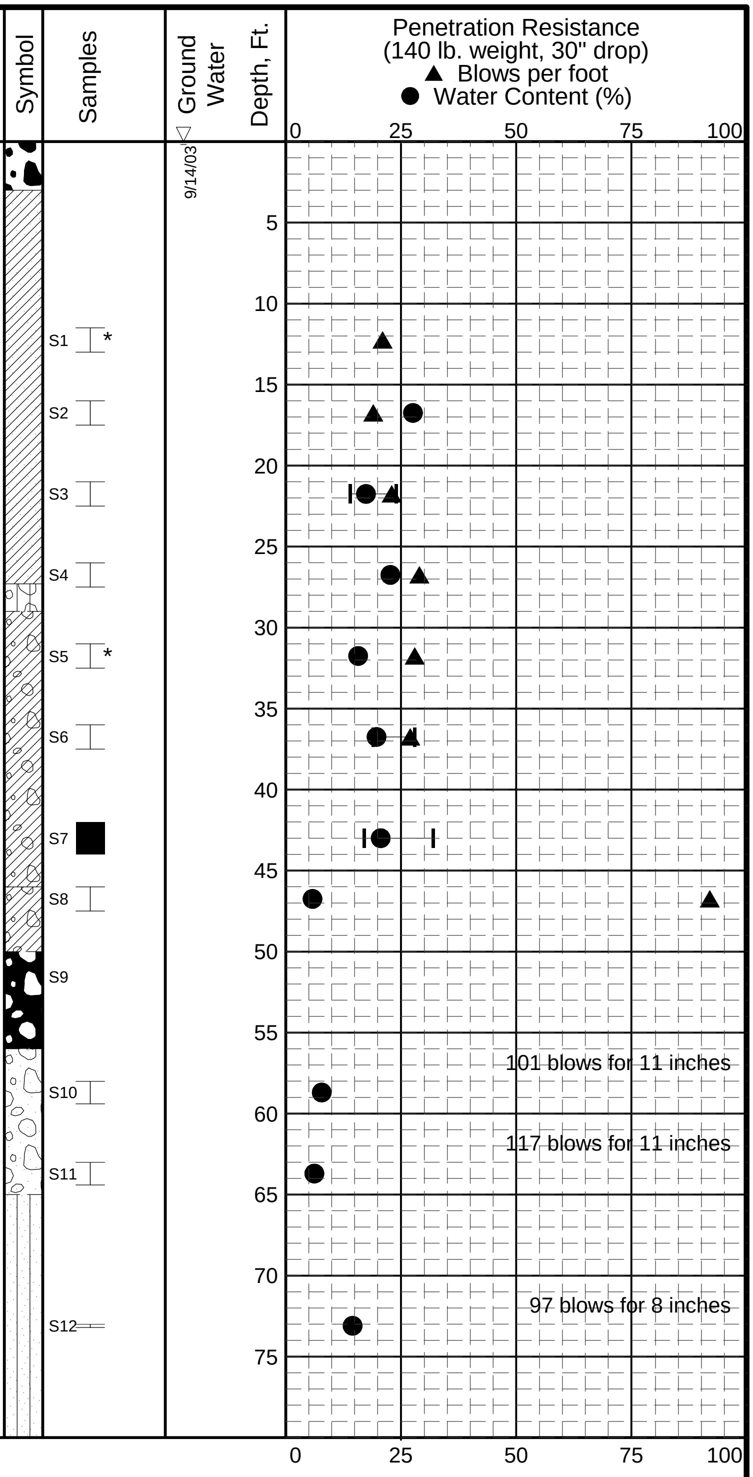

LEGEND

* Sample Not Recovered

■ Shelby Tube

⌶ 2" O.D. Split Spoon Sample

⌶ Rock Core Sample

▽ Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit |—●—| Liquid Limit

Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Bridge
Anchorage, Alaska

LOG OF BORING A-6
Location: N 61°16.159' W 149°52.139'

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. G-6
Sheet 1 of 3

GEOTECHNICAL LOG 1536NOPP.GPJ S&W_GEO1.GDT 3/7/07

MATERIAL DESCRIPTION

Approx. Elevation: 4.47 Ft. (MLLW Datum)

Very stiff to hard, gray, sandy, silty CLAY; moist

Dense to very dense, gray, slightly gravelly, silty SAND; moist
S14: PP = >4.5
S15: 11% Gravel, 46% Sand, 43% Fines

S18: PP = 1.75
Qu = 10 tsf
Uu = 9 tsf
S19: PP = >4.5
S20: PP = >4.5

Very stiff to hard, gray, slightly sandy, silty CLAY, with sand seams and partings increasing thickness with depth; moist
S21: PP = >4.5

S22: PP = >4.5

S23: PP = 2

S24: PP = 2.25
0% Gravel, 10% Sand, 90% Fines

Very stiff to hard, gray, slightly sandy, silty CLAY; wet

S25: PP = 2.75

S27: PP = 3.5

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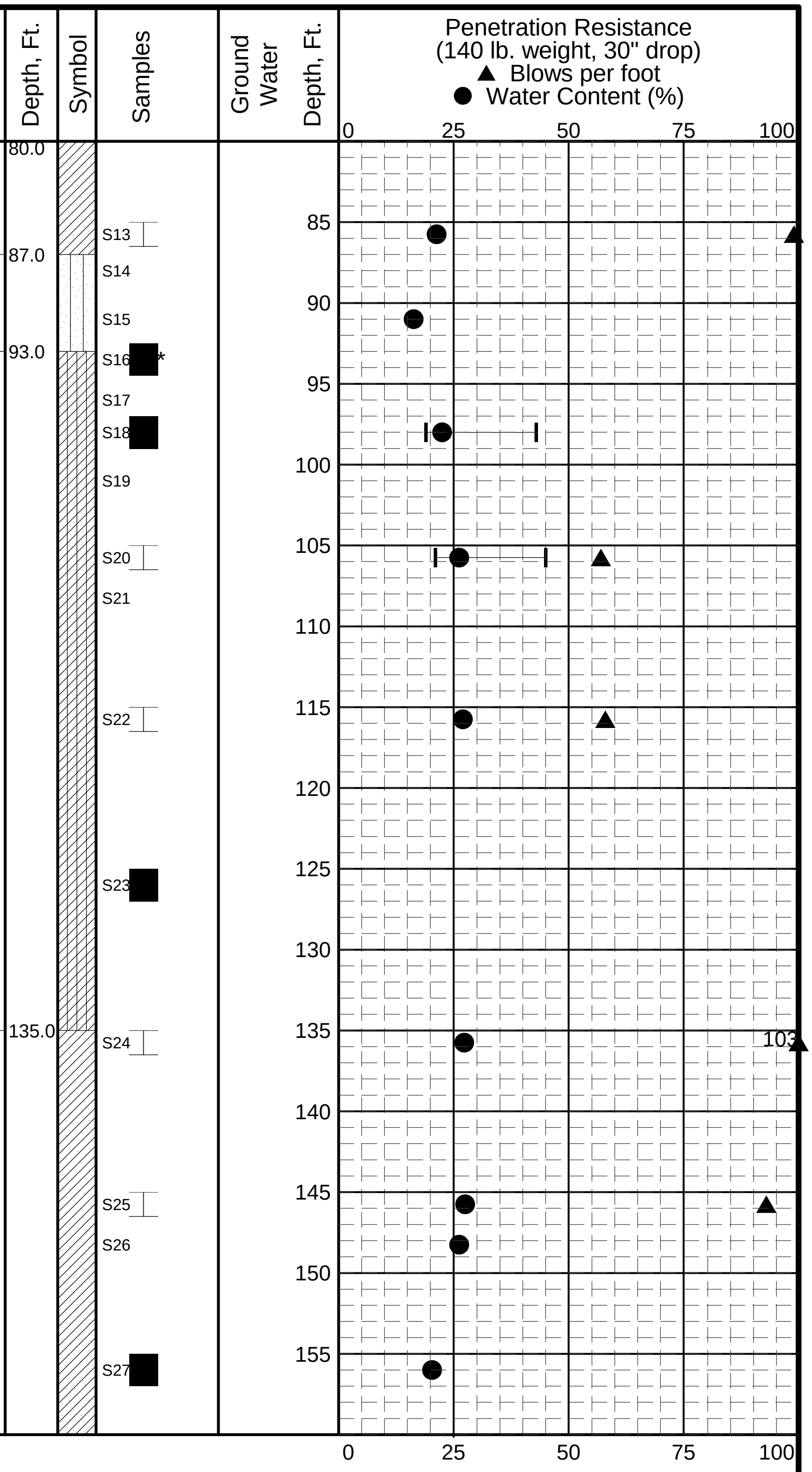


LEGEND

* Sample Not Recovered
■ Shelby Tube
⌶ 2" O.D. Split Spoon Sample
⌶ Rock Core Sample
▽ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit |—●—| Liquid Limit
Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

Knik Arm Bridge
Anchorage, Alaska

LOG OF BORING A-6
Location: N 61°16.159' W 149°52.139'

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. G-6
Sheet 2 of 3

MATERIAL DESCRIPTION

Approx. Elevation: 4.47 Ft. (MLLW Datum)

Very stiff to hard, gray, slightly sandy, silty CLAY; wet

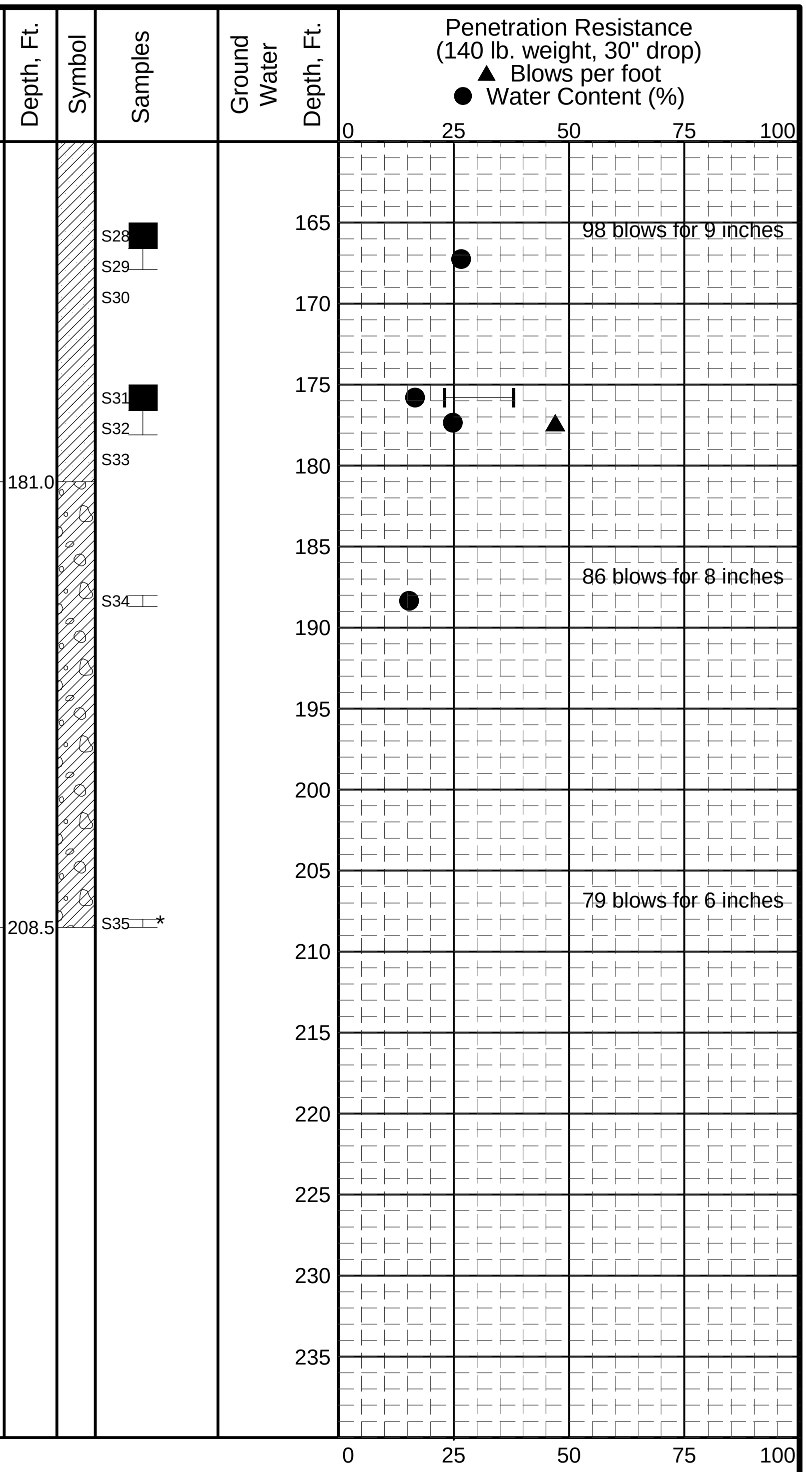
S28: PP = >4

S30: PP = 2.75

S31: PP = >4.5
Qu = 3 tsf
Uu = 3 tsf

Hard, gray, gravelly, silty CLAY; moist

Bottom of Boring
Boring Completed 9/14/03



LEGEND

* Sample Not Recovered
■ Shelby Tube
⌶ 2" O.D. Split Spoon Sample
⌶ Rock Core Sample

▽ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
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Knik Arm Bridge
Anchorage, Alaska

LOG OF BORING A-6
Location: N 61°16.159' W 149°52.139'

March 2007 32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. G-6
Sheet 3 of 3

MATERIAL DESCRIPTION Approx. Elevation: 30.5 Ft. (MLLW Datum)	Depth, Ft.
Hard, gray, gravelly, sandy, silty CLAY; moist S5: 17% Gravel, 25% Sand, 58% Fines	
S10: 29% Fines Very dense, gray, silty SAND; wet	50.5
Very dense, gray, silty, gravelly SAND; wet Gravel content decreases with depth	58.0
Very dense, gray, slighty gravelly, silty fine SAND; wet	73.0

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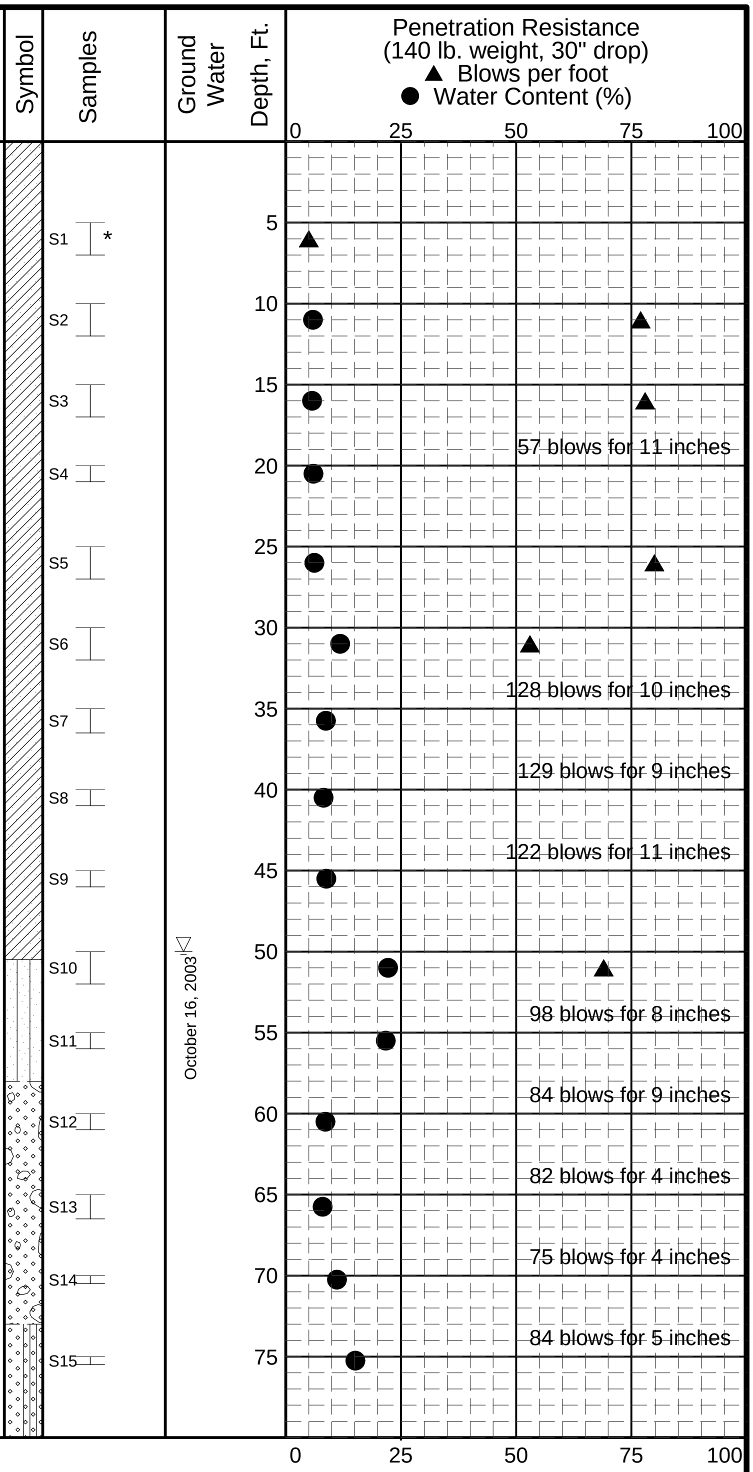

LEGEND

* Sample Not Recovered
▬ Shelby Tube
⌶ 2" O.D. Split Spoon Sample
⌶ Rock Core Sample

▽ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit ├──●──┤ Liquid Limit
Natural Water Content

NOTES

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Knik Arm Crossing
Anchorage, Alaska

LOG OF BORING A-7 (East Shoreline)
Location: N 61°15'57.96" W 149°51'52.98"

March 2007 32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. G-7
Sheet 1 of 3

MATERIAL DESCRIPTION

Approx. Elevation: 30.5 Ft. (MLLW Datum)

Very dense, gray, slighty gravelly, silty fine SAND; wet

Very dense, gray, silty, sandy, gravelly COBBLES; wet

S21: PP = >4.5

Hard, gray, silty, CLAY with sand seams increasing in thickness to interbedded clay and clayey sands; moist

S22: PP = >4.5

S24: PP = >4.5

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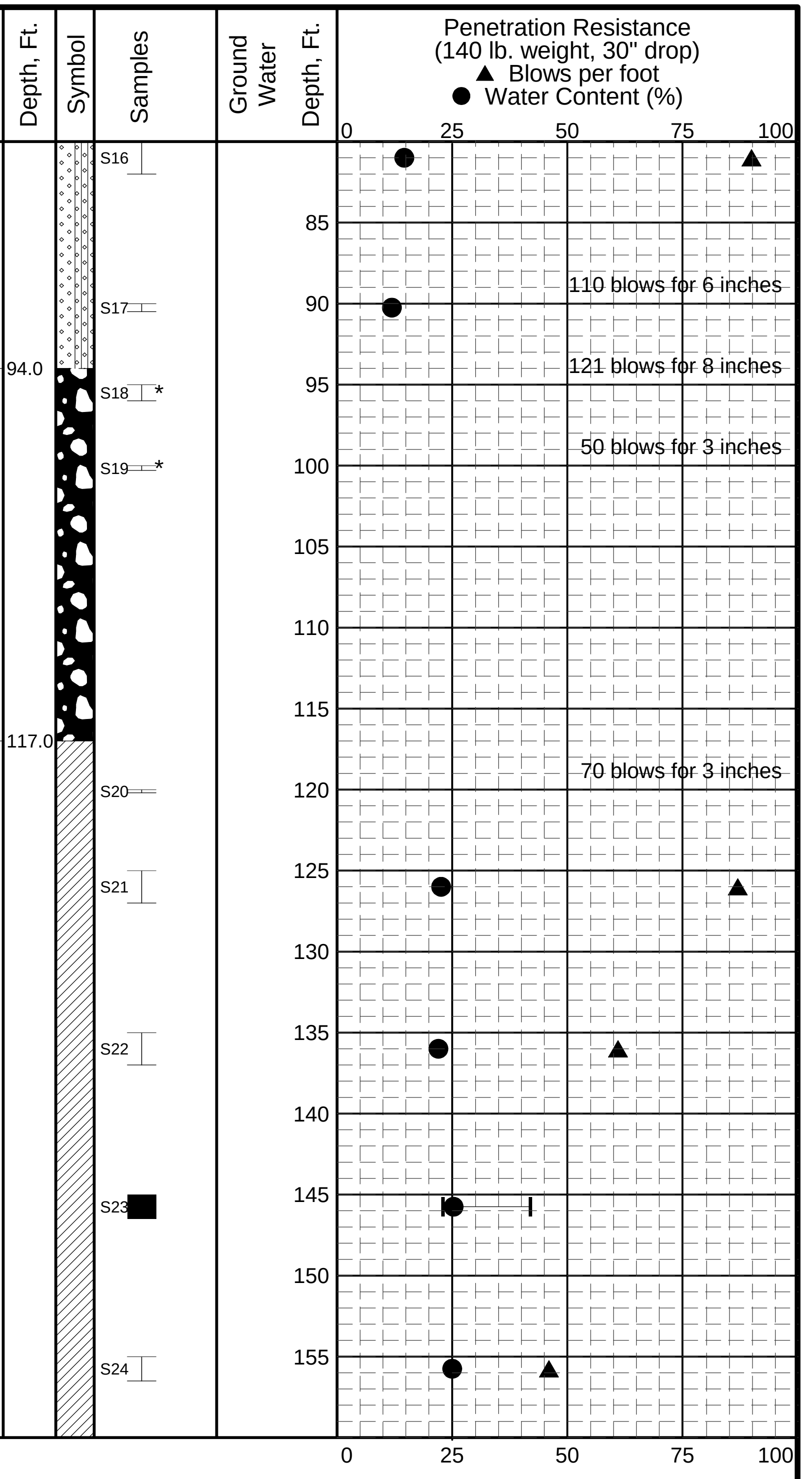

LEGEND

* Sample Not Recovered

■ Shelby Tube

⌶ 2" O.D. Split Spoon Sample

⌶ Rock Core Sample

▽ Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit ├──●──┤ Liquid Limit

Natural Water Content

NOTES

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3. Water level, if indicated above, is for the date specified and may vary.
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Knik Arm Crossing
Anchorage, Alaska

LOG OF BORING A-7 (East Shoreline)
Location: N 61°15'57.96" W 149°51'52.98"

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. G-7
Sheet 2 of 3

MATERIAL DESCRIPTION

Approx. Elevation: 30.5 Ft. (MLLW Datum)

Hard, gray, silty, CLAY with sand seams increasing in thickness to interbedded clay and clayey sands; moist

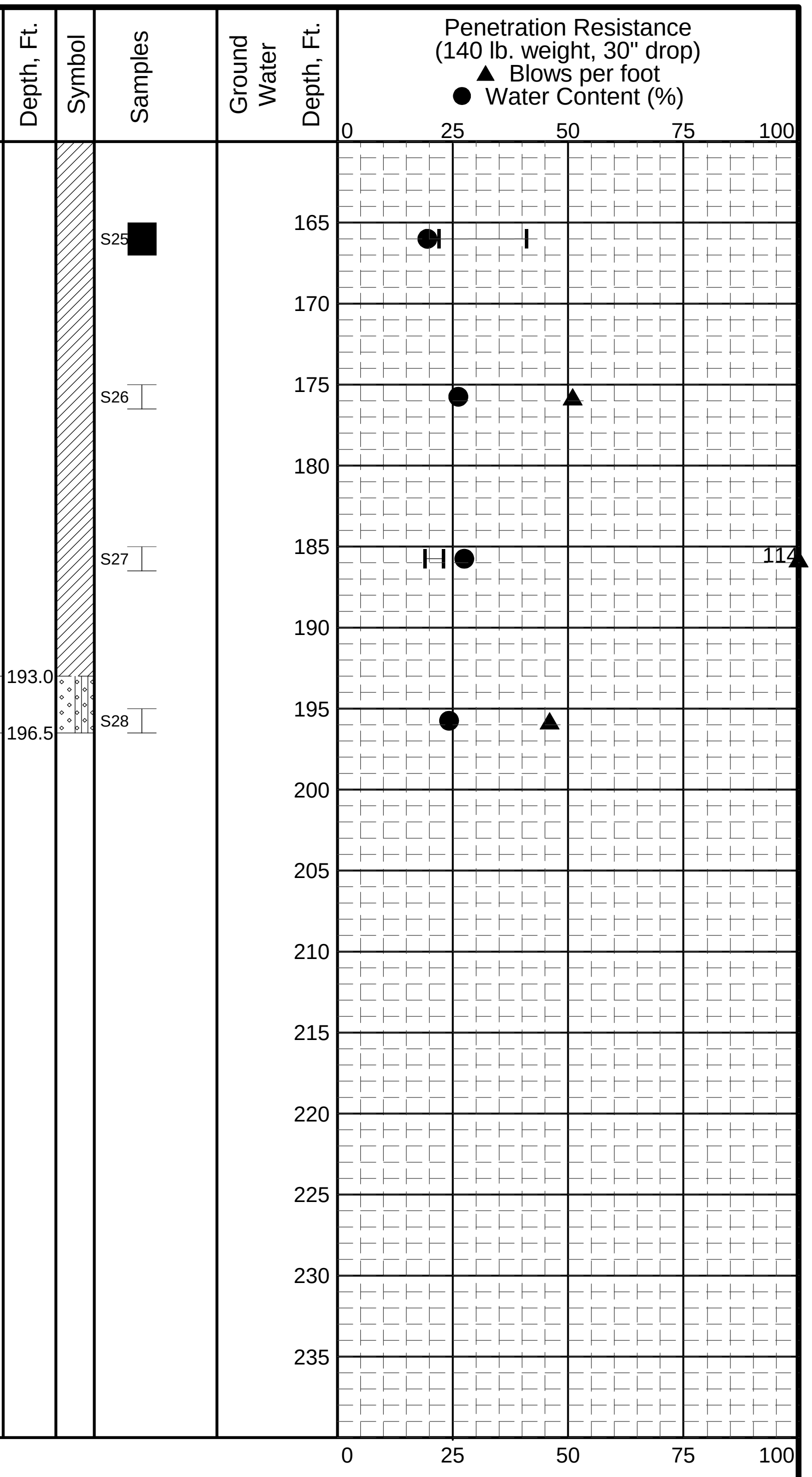
S25: PP = >4.5
Qu = 9.5 tsf

S26: 93.3% Fines

S28: 88.7% Fines

Dense, gray, silty fine SAND with sand seams and layers of gray clay; moist

Bottom of Boring
Boring Completed October 16, 2003



LEGEND

*	Sample Not Recovered
■	Shelby Tube
⌶	2" O.D. Split Spoon Sample
⌶	Rock Core Sample
⊽	Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

NOTES

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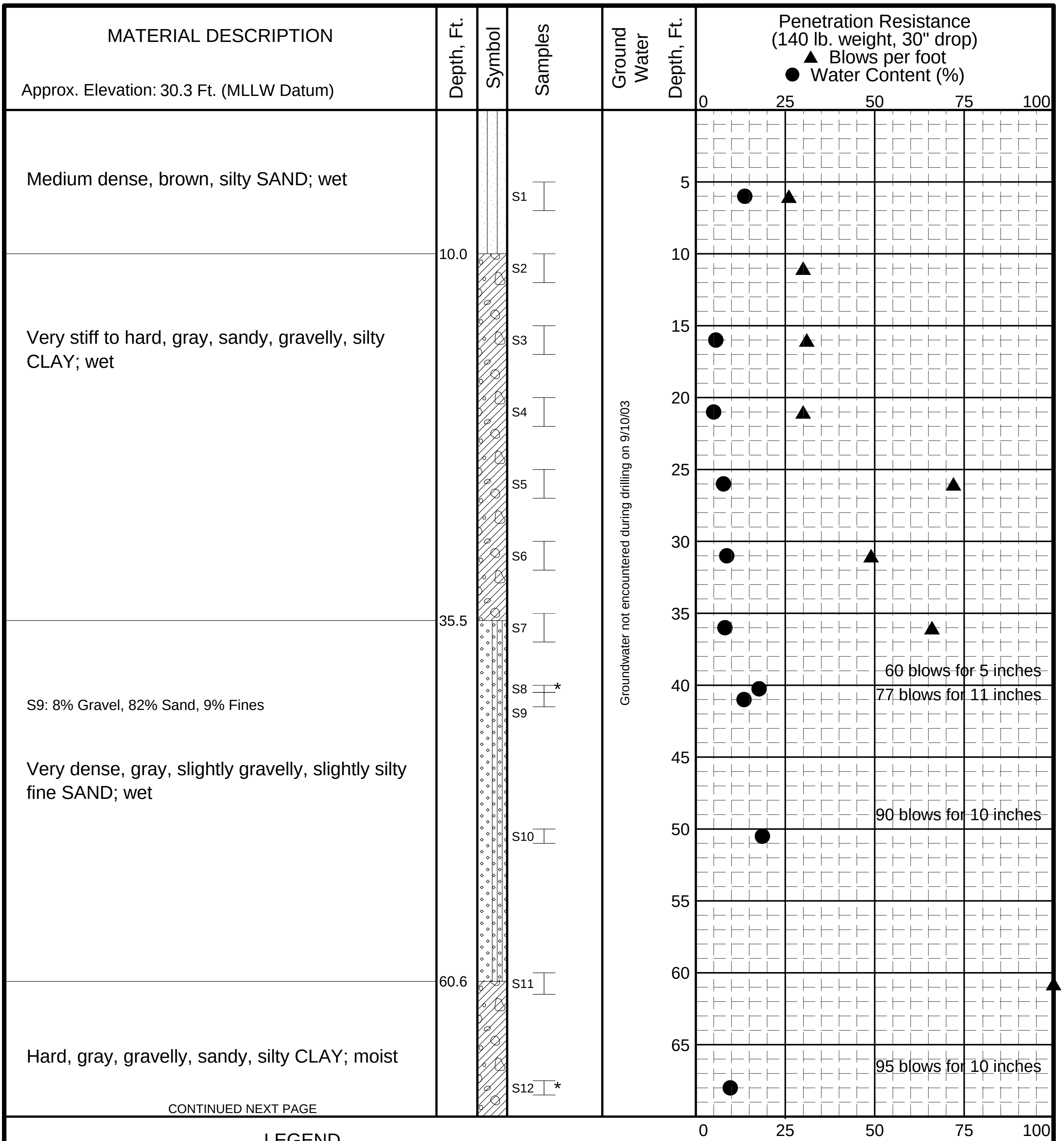
Knik Arm Crossing
Anchorage, Alaska

LOG OF BORING A-7 (East Shoreline)
Location: N 61°15'57.96" W 149°51'52.98"

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. G-7
Sheet 3 of 3



Approx. Elevation: 30.3 Ft. (MLLW Datum)

Medium dense, brown, silty SAND; wet

Very stiff to hard, gray, sandy, gravelly, silty CLAY; wet

S9: 8% Gravel, 82% Sand, 9% Fines

Very dense, gray, slightly gravelly, slightly silty fine SAND; wet

Hard, gray, gravelly, sandy, silty CLAY; moist

Groundwater not encountered during drilling on 9/10/03

LEGEND

- * Sample Not Recovered
- ■ Shelby Tube
- ⌶ 2" O.D. Split Spoon Sample
- ⌶ Rock Core Sample
- ▽ Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit |—●—| Liquid Limit

Natural Water Content

NOTES

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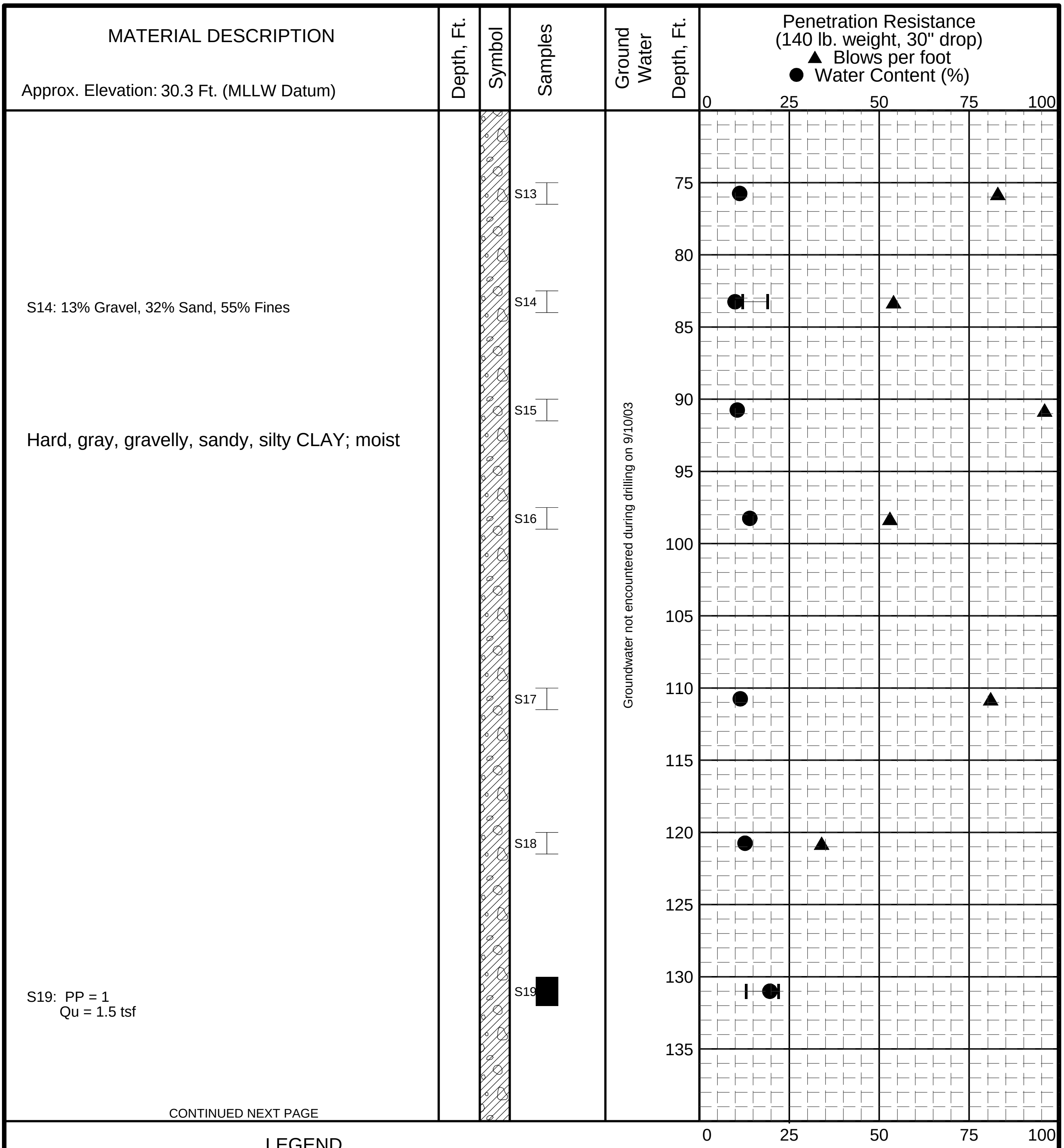
Knik Arm Bridge
Anchorage, Alaska

LOG OF BORING A-8
Location: N 61°17.142' W 149°55.095'

March 2007 32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. G-8
Sheet 1 of 3



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LEGEND

*	Sample Not Recovered
▬	Shelby Tube
⌶	2" O.D. Split Spoon Sample
⌶	Rock Core Sample
▽	Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit ├──●──┤ Liquid Limit

Natural Water Content

NOTES

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Knik Arm Bridge
Anchorage, Alaska

LOG OF BORING A-8
Location: N 61°17.142' W 149°55.095'

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. G-8
Sheet 2 of 3

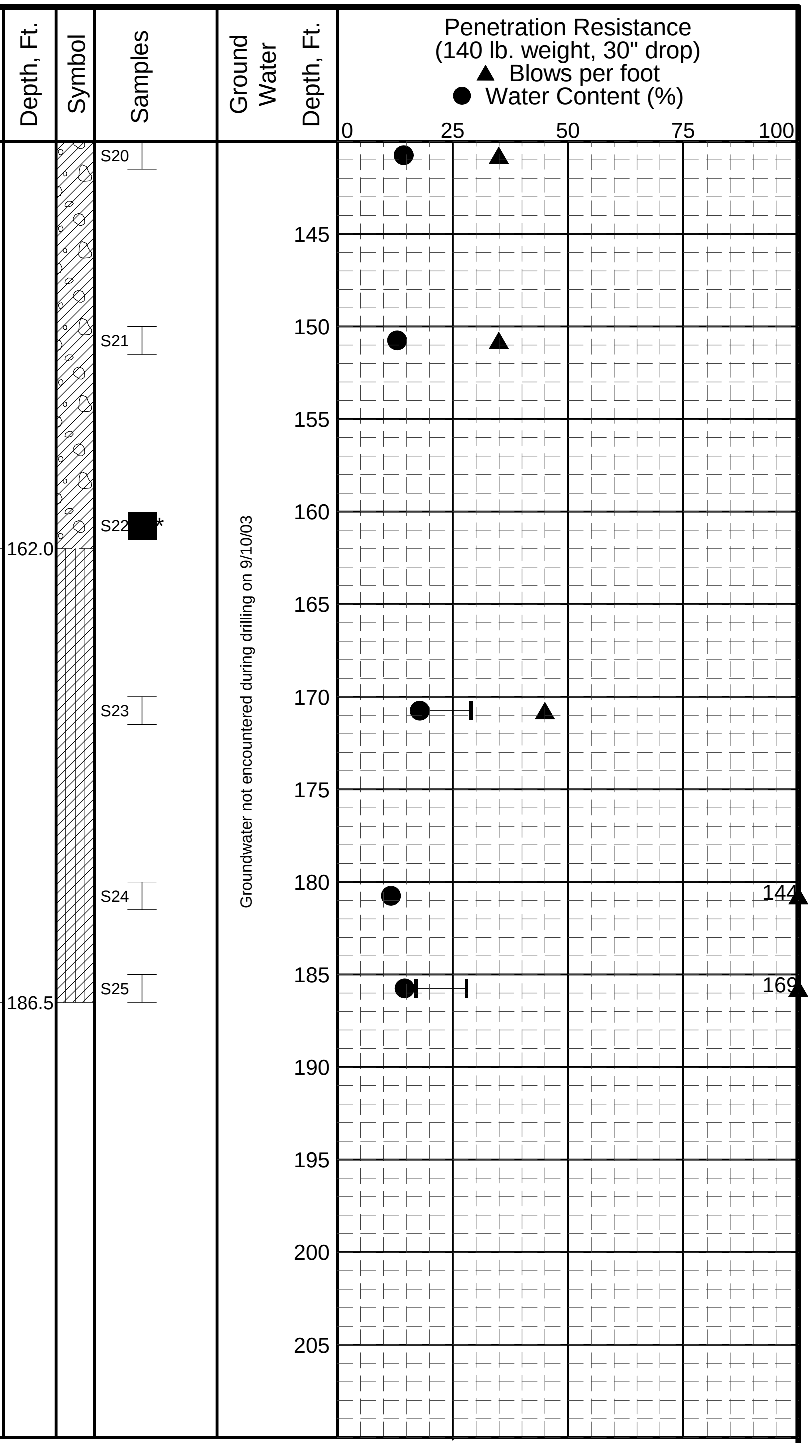
MATERIAL DESCRIPTION

Approx. Elevation: 30.3 Ft. (MLLW Datum)

Hard, gray, gravelly, sandy, silty CLAY; moist

Hard, gray, slightly sandy, silty CLAY; wet

Bottom of Boring
Boring Completed 9/10/03



LEGEND

- * Sample Not Recovered
- ■ Shelby Tube
- ⌶ 2" O.D. Split Spoon Sample
- ⌶ Rock Core Sample
- ∇ Ground Water Level At Time Of Drilling

● Water Content (%)
Plastic Limit |—●—| Liquid Limit
Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
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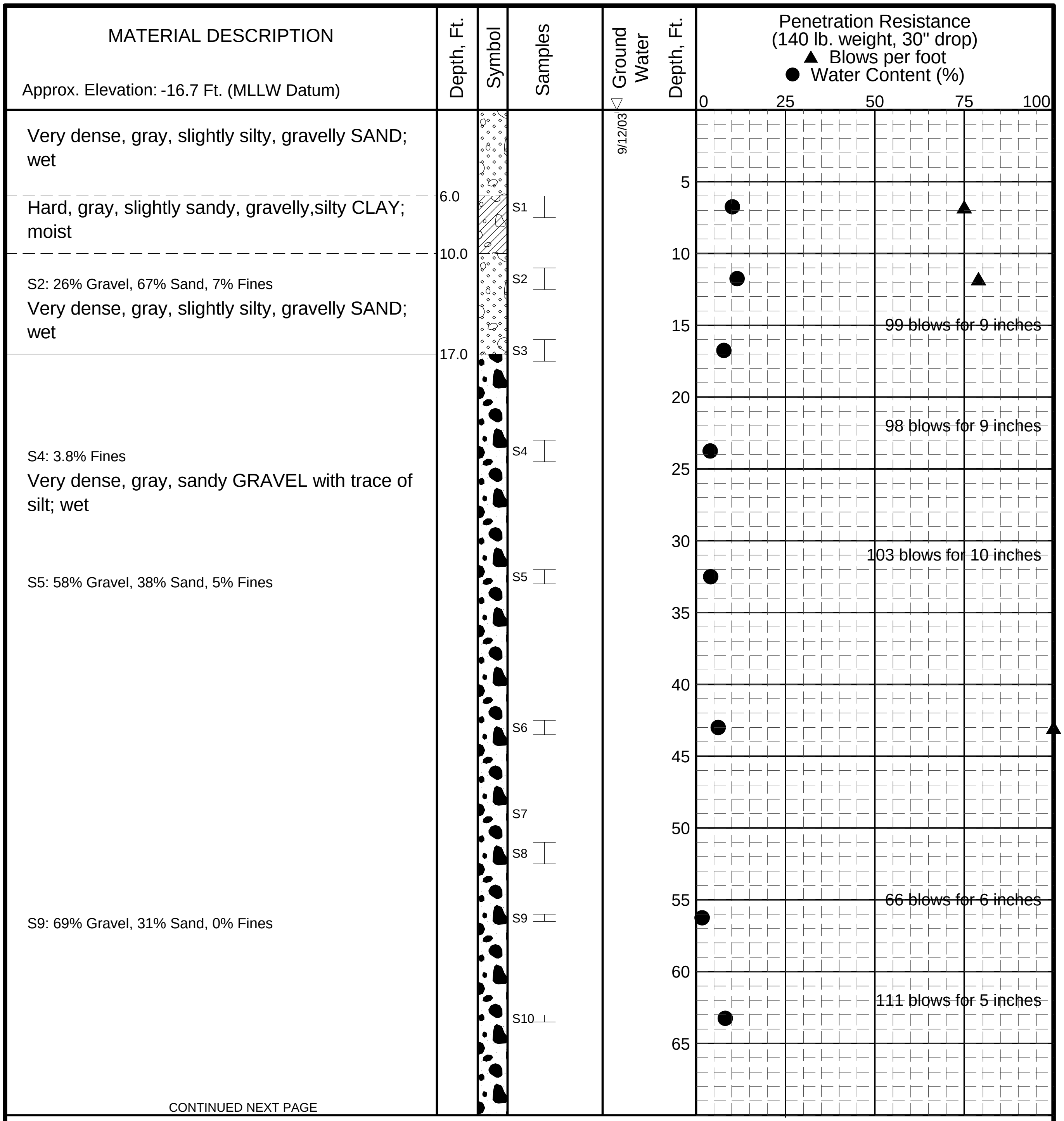
Knik Arm Bridge
Anchorage, Alaska

LOG OF BORING A-8
Location: N 61°17.142' W 149°55.095'

March 2007 32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. G-8
Sheet 3 of 3



MATERIAL DESCRIPTION

Approx. Elevation: -16.7 Ft. (MLLW Datum)

Very dense, gray, slightly silty, gravelly SAND; wet

6.0

Hard, gray, slightly sandy, gravelly,silty CLAY; moist

10.0

S2: 26% Gravel, 67% Sand, 7% Fines

Very dense, gray, slightly silty, gravelly SAND; wet

17.0

S4: 3.8% Fines

Very dense, gray, sandy GRAVEL with trace of silt; wet

S5: 58% Gravel, 38% Sand, 5% Fines

S9: 69% Gravel, 31% Sand, 0% Fines

CONTINUED NEXT PAGE

LEGEND

* Sample Not Recovered

■ Shelby Tube

⌶ 2" O.D. Split Spoon Sample

⌶ Rock Core Sample

▽ Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit ├─●─┤ Liquid Limit

Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
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3. Water level, if indicated above, is for the date specified and may vary.
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Knik Arm Bridge
Anchorage, Alaska

LOG OF BORING A-9
Loation: N 61°16.967' W 149°54.502

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. G-9
Sheet 1 of 2

MATERIAL DESCRIPTION

Approx. Elevation: -16.7 Ft. (MLLW Datum)

S11: 4.5% Fines

Very dense, gray, sandy GRAVEL with trace of silt; wet

80.0

Very dense, gray, silty, gravelly SAND; wet

95.0

Hard, gray, slightly gravelly, sandy, silty CLAY; moist

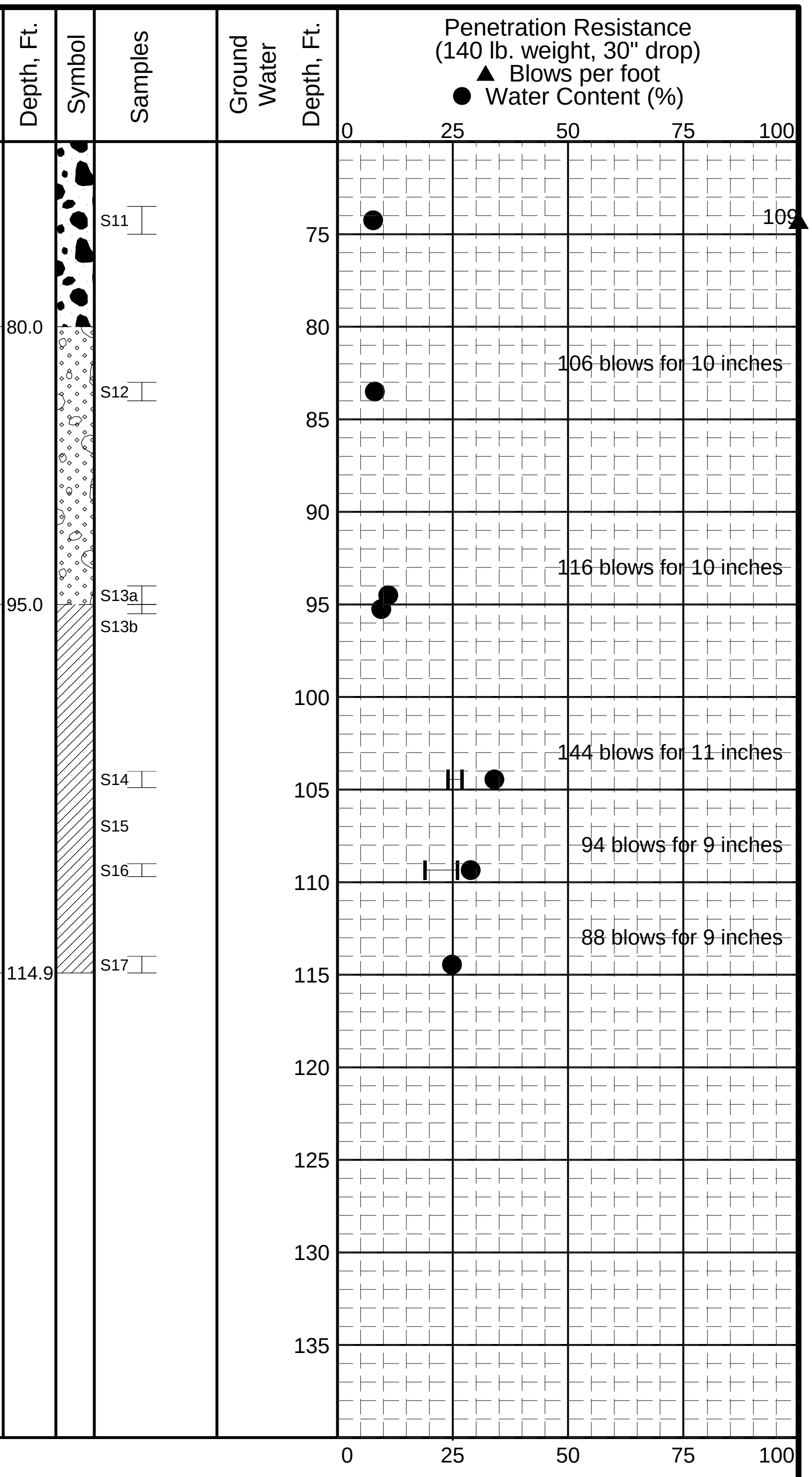
S15: PP = 2.25

S16: PP = 2.3

S17: 9% Gravel, 22% Sand, 70% Fines

114.9

Bottom of Boring
Boring Completed 9/12/03



LEGEND

*	Sample Not Recovered
▬	Shelby Tube
⌶	2" O.D. Split Spoon Sample
⌶	Rock Core Sample
▽	Ground Water Level At Time Of Drilling

● Water Content (%)

Plastic Limit ├─●─┤ Liquid Limit
Natural Water Content

NOTES

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2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. PP (Pocket Penetrometer) tests estimate Unconfined Compressive Strength of Cohesive Soils. TV (Torvane) tests estimate the Undrained Shear Strength of Cohesive Soils. All measurements in tons per square foot.

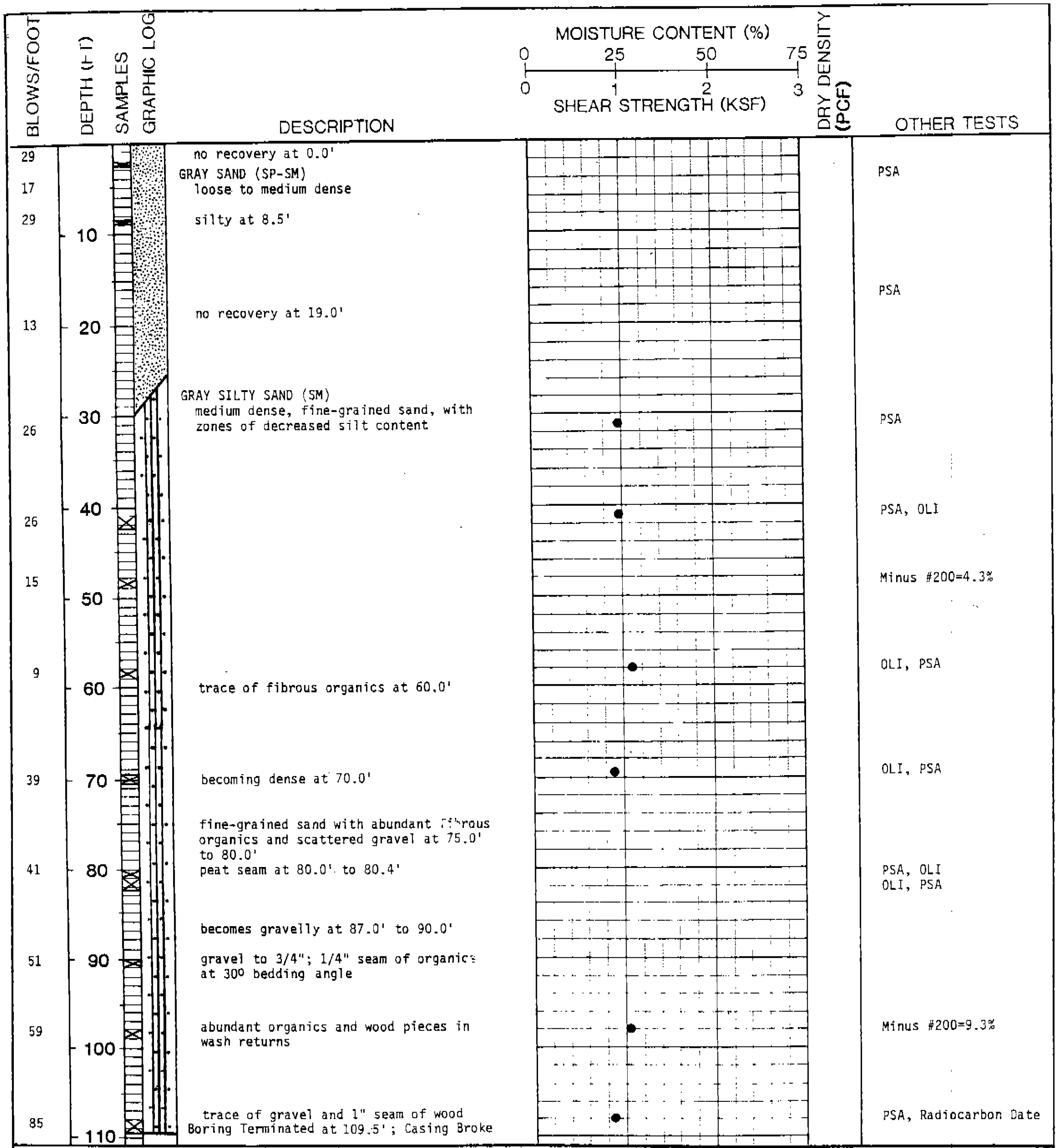
Knik Arm Bridge
Anchorage, Alaska

LOG OF BORING A-9
Loation: N 61°16.967' W 149°54.502

March 2007
32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. G-9
Sheet 2 of 2



BLOWS/FOOT	DEPTH (FT)	DESCRIPTION	OTHER TESTS
29		no recovery at 0.0'	
		GRAY SAND (SP-SM)	PSA
17		loose to medium dense	
29		silty at 8.5'	
	10		
			PSA
		no recovery at 19.0'	
13	20		
		GRAY SILTY SAND (SM) medium dense, fine-grained sand, with zones of decreased silt content	
26	30		PSA
26	40		PSA, OLI
15			Minus #200=4.3%
	50		
9			OLI, PSA
	60	trace of fibrous organics at 60.0'	
39	70	becoming dense at 70.0'	OLI, PSA
		fine-grained sand with abundant fibrous organics and scattered gravel at 75.0' to 80.0'	
41	80	peat seam at 80.0' to 80.4'	PSA, OLI OLI, PSA
		becomes gravelly at 87.0' to 90.0'	
51	90	gravel to 3/4"; 1/4" seam of organics at 30º bedding angle	
59		abundant organics and wood pieces in wash returns	Minus #200=9.3%
	100		
85		trace of gravel and 1" seam of wood	PSA, Radiocarbon Date
	110	Boring Terminated at 109.5'; Casing Broke	

DATE DRILLED 7/21/84 **WATER DEPTH (MLLW)** 56 **FT.**

EQUIPMENT Failing 750 Drill Rig **BORING COORDINATES** x=521 236 y=2 661 291

SHEAR STRENGTH

▲ Torvane △ Triaxial Test ■ Lab Vane

MOISTURE CONTENT

Plastic Limit ├──●──┤ **Liquid Limit**
Natural

NOTE: Blow counts marked with an asterisk were determined using a 300 lb hammer free falling 30 inches onto a 2.5 inch I.D. (3.0 inch O.D.) split spoon sampler. Unmarked blow counts were determined using standard penetration test methods.

Harding Lawson Associates
Engineers, Geologists
& Geophysicists

Log of Boring 4

Knik Arm Crossing
Anchorage, Alaska

PLATE
A4

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
	9620,016.08		8/84		

Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING:
Harding Lawson Boring A-4

March 2007 32-1-01536-004

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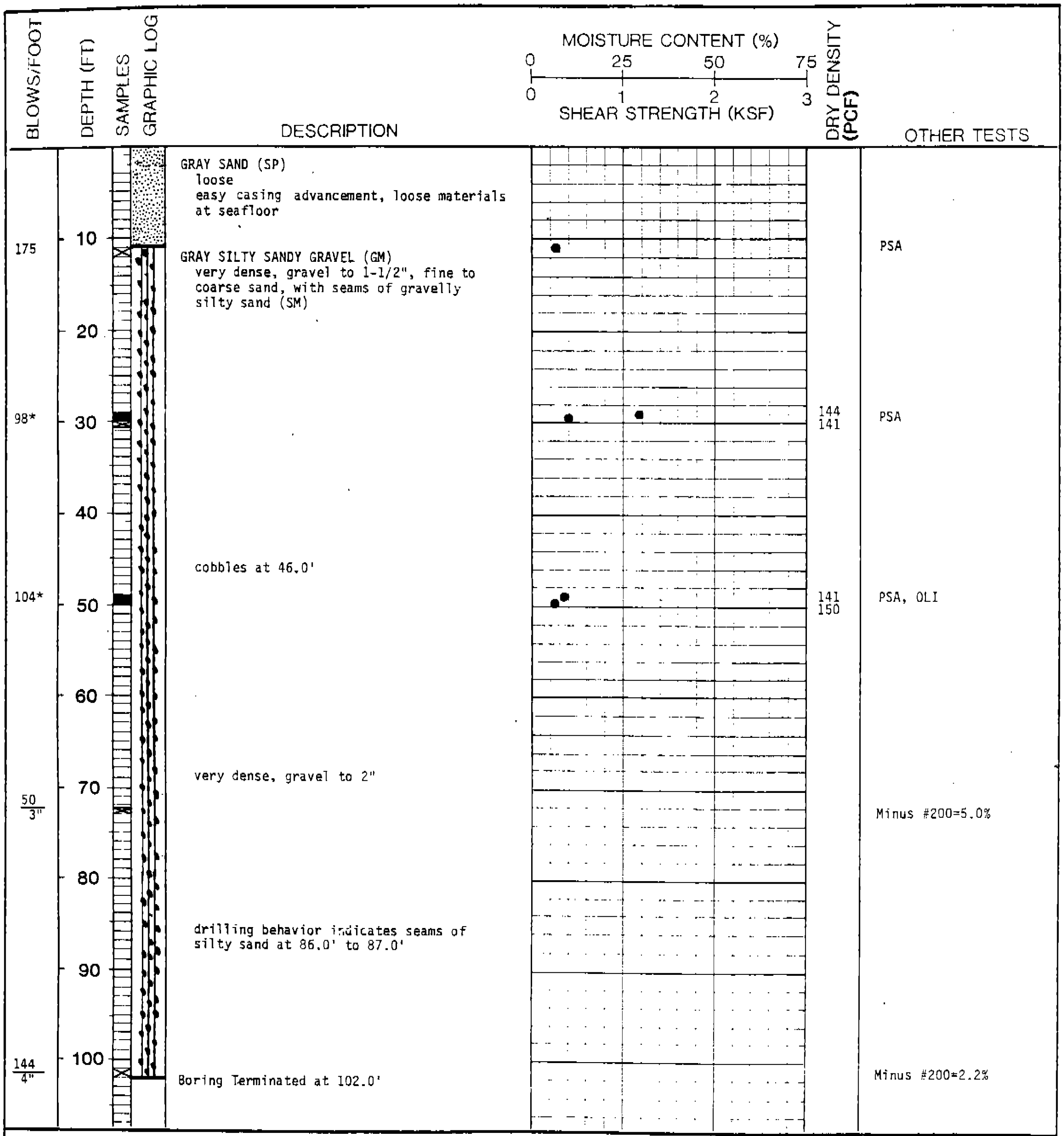
Fig. G-10



BLOWS/FOOT	DEPTH (FT)	DESCRIPTION	DRY DENSITY (PCF)	OTHER TESTS
		GRAY SAND (SP) loose easy casing advancement, loose materials at seafloor		
175	10	GRAY SILTY SANDY GRAVEL (GM) very dense, gravel to 1-1/2", fine to coarse sand, with seams of gravelly silty sand (SM)		PSA
	20			
98*	30		144 141	PSA
	40	cobbles at 46.0'		
104*	50		141 150	PSA, OLI
	60			
	70	very dense, gravel to 2"		
50/3"				Minus #200=5.0%
	80	drilling behavior indicates seams of silty sand at 86.0' to 87.0'		
	90			
144/4"	100	Boring Terminated at 102.0'		Minus #200=2.2%

DATE DRILLED 7/23/84-7/25/84 WATER DEPTH (MLLW) 46 FT.

EQUIPMENT Failing 750 Drill Rig BORING COORDINATES x=522 072 y=2 661 197

SHEAR STRENGTH

▲ Torvane △ Triaxial Test ■ Lab Vane

MOISTURE CONTENT

Plastic Limit |——●——| Liquid Limit (Natural)

NOTE: Blow counts marked with an asterisk were determined using a 300 lb hammer free falling 30 inches onto a 2.5 inch I.D. (3.0 inch O.D.) split spoon sampler. Unmarked blow counts were determined using standard penetration test methods.

Harding Lawson Associates
Engineers, Geologists
& Geophysicists

Log of Boring 5

Knik Arm Crossing
Anchorage, Alaska

PLATE
A5

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
	9620,016.08		8/84		

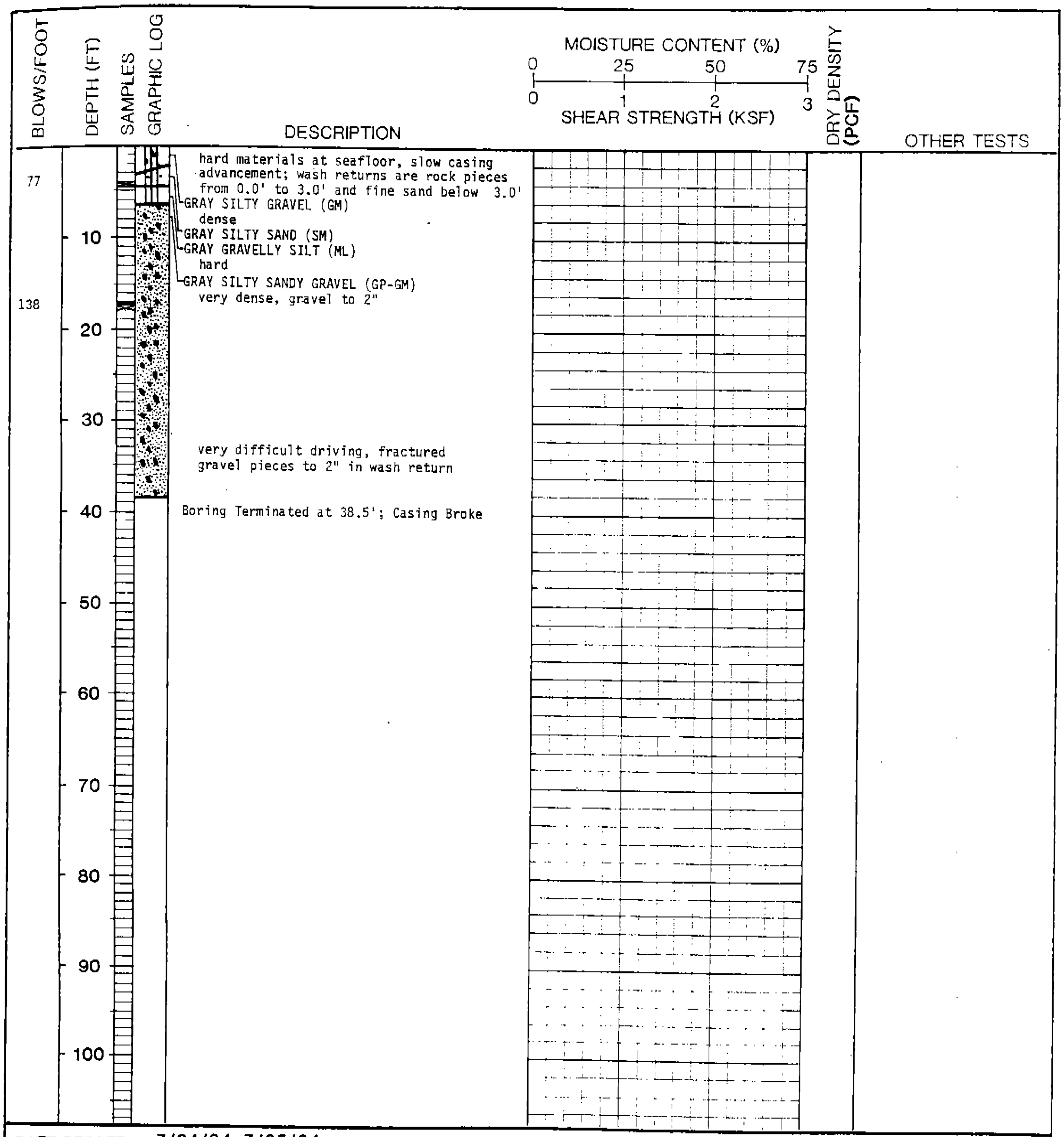
Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING:
Harding Lawson Boring A-5

March 2007 32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical & Environmental Consultants

Fig. G-11



hard materials at seafloor, slow casing advancement; wash returns are rock pieces from 0.0' to 3.0' and fine sand below 3.0'

GRAY SILTY GRAVEL (GM)
dense

GRAY SILTY SAND (SM)

GRAY GRAVELLY SILT (ML)
hard

GRAY SILTY SANDY GRAVEL (GP-GM)
very dense, gravel to 2"

very difficult driving, fractured gravel pieces to 2" in wash return

Boring Terminated at 38.5'; Casing Broke

DATE DRILLED 7/24/84-7/25/84 **WATER DEPTH (MLLW)** 36 **FT.**

EQUIPMENT Failing 750 Drill Rig **BORING COORDINATES** x=516 152 y=2 661 157

SHEAR STRENGTH

▲ Torvane **△ Triaxial Test** **■ Lab Vane**

MOISTURE CONTENT

Plastic Limit ├──●──┤ **Liquid Limit**
Natural

NOTE: **Blow counts marked with an asterisk were determined using a 300 lb hammer free falling 30 inches onto a 2.5 inch I.D. (3.0 inch O.D.) split spoon sampler. Unmarked blow counts were determined using standard penetration test methods.**

Harding Lawson Associates
Engineers, Geologists
& Geophysicists

Log of Boring 6
Knik Arm Crossing
Anchorage, Alaska

PLATE
A6

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
	9620,016.08		8/84		

Knik Arm Crossing
Knik Arm, Alaska

LOG OF BORING:
Harding Lawson Boring A-6

March 2007 32-1-01536-004

SHANNON & WILSON, INC.
Geotechnical & Environmental Consultants

Fig. G-12

APPENDIX H

RESULTS OF DOWNHOLE SEISMIC VELOCITY SURVEY

Report prepared by Northland Geophysical

NORTHLAND GEOPHYSICAL, PLLC
Geotechnical & Environmental Geophysics

PO Box 310 • Snohomish, WA 98291-0310
425.347.4559 phone • 425.513.0835 fax

August 15, 2005

Mr. William S. Burgess, P.E.
Shannon & Wilson, Inc.
5430 Fairbanks Street, Suite 3
Anchorage, Alaska 99518

SUBJECT: **Results of Downhole Seismic Velocity Survey**
Knik Arm Crossing Boring B-1
Point MacKenzie, Alaska

Dear Mr. Burgess:

This report presents the results of a downhole seismic velocity survey conducted by Northland Geophysical, PLLC, for Shannon & Wilson, Inc., during the second week of July 2005. This survey was performed as part of a geotechnical investigation in the Point MacKenzie area for the proposed Knik Arm Crossing from Anchorage to the Matanuska-Susitna Borough. The purpose of the geophysical survey was to determine *in-situ* shear-wave velocities of the subsurface soils to a depth of approximately 150 feet below ground surface (bgs) in the west abutment area of the proposed bridge. The shear-wave velocity information will be used to help evaluate earthquake site response characteristics for this area.

The seismic results are presented graphically in Figures 2-5 and in tabular form in Tables 1 and 2. The measured downhole seismic travel times are tabulated in Appendix A, and the recorded seismic waveforms are documented in Appendix B.

FIELD PROCEDURES

Test Boring B-1 was prepared for the downhole seismic testing by Discovery Drilling, Inc., of Anchorage using a track-mounted hollowstem-auger drilling rig. The borehole was advanced to a total depth of 150 feet bgs and then cased with Slope Indicator standard inclinometer casing. As the auger was withdrawn, the casing was grouted in place to ensure adequate seismic coupling with the surrounding soils.

The downhole velocity measurements were conducted following the procedures described in the reference paper entitled "Shear-Wave Velocities from Down-Hole Measurements" published in 1977 by H.E. Beeston and T.V. McEvilly in *Earthquake Engineering and Structural Dynamics* (Vol. 5, No. 2, pages 181-190). A diagram of the standard survey field configuration is provided in Figure 1 in both plan and profile views. The shear-wave energy source consists of a horizontal wood beam offset a distance of 8-10 feet from the borehole. Horizontal sledgehammer blows to steel-alloy end plates affixed to both ends of the beam create lateral shearing motion in the soil that propagates in the earth as a horizontally-polarized shear wave. The front tires of the field vehicle are driven onto the wood beam to firmly couple the beam with the soil using the vehicle's weight.

Shear-wave logging was conducted in Boring B-1 using standard downhole seismic logging procedures. The seismic energy sources were located at the surface, and the seismic receivers were located down the borehole. Recordings of downhole travel times were made at 2.5-foot intervals from a depth of 1.2 feet bgs to 143.7 feet bgs. Due to the 3-foot length of the seismic transducer, as well as accumulated sand and silt in the bottom of the casing, measurements could not be made to the total depth of the inclinometer casing.

All seismic data were recorded on a Geometrics R24 StrataView 24-channel digital seismograph. During the course of the field survey, digital computer files of the waveforms were written to an internal hard drive in the seismograph. A digital sampling rate of 1/8 millisecond (0.125 ms) was used throughout the recording sequence. Paper seismograms were also recorded during the survey to monitor data quality. At the conclusion of the field survey, backup electronic copies of the downhole seismic data were created by writing the data to diskettes using the seismograph's floppy disk drive.

The downhole seismic wave arrivals were detected using a Model BHG-2 slimhole triaxial geophone transducer manufactured by Geostuff of Grass Valley, California. The transducer assembly houses one vertical and two horizontal 14-Hz velocity geophones in an X-Y-Z configuration. The transducer uses a motor-driven steel spring clamp to lock the sensors in position at each recording level in the borehole. For downhole surveys, shear-wave arrivals are recorded using the two horizontal geophones, whereas compression-wave arrivals are recorded using the vertical geophone.

For this survey, a guide rod was attached to the BHG-2 transducer that is designed to track in one of the internal vertical grooves in the Slope Inclinometer casing installed in the seismic borehole. By this mechanism, the orientation of the transducer is consistently maintained throughout the logging operation. Furthermore, when the shear-wave source at the ground surface is oriented so that it is parallel to the set of inclinometer grooves to which the BHG-2 guide rod is keyed, the longitudinal horizontal geophone in the triaxial geophone assembly remains parallel to the S-wave source throughout the downhole survey. This optimization of coupling between source and receiver has been found to be beneficial for maintaining a consistent S-waveform throughout the survey, thus ensuring that the recorded shear-wave signal is always the optimum.

The physical location of Boring B-1 was near the high-tide line on the beach along the western shoreline of Knik Arm. The two orthogonal sets of inclinometer grooves in the Slope Indicator casing were oriented so that one set was approximately parallel to the beach, and the other set was perpendicular to the beach. So that the shear-wave beam would be level, the beam was aligned with the set of casing grooves parallel to the beach. Due to a high steep embankment just a few feet west of the casing, the beam had to be located on the east side of the borehole between the casing and Cook Inlet. The front wheels of the support truck were driven onto the S-wave beam as diagrammed in Figure 1, with the back wheels toward the Inlet. Shannon & Wilson purposely selected a time of moderate tides in mid-July for the downhole survey, so that we were able to proceed with data acquisition through the midday high-tide cycle with no impact on our survey configuration or access to the borehole.

When the cap on the Slope Indicator casing was first removed, the casing was found to be water-filled nearly to the top. Using a hand bailer, we lowered the water level in the casing to a depth of about 50' bgs to eliminate the possibility of generating so-called "tube waves" in the borehole that can closely resemble soil shear waves in both velocity and frequency content. We found that the hand bailer did not work well below a depth of 50' due to high sand/silt content in the water standing in the casing, but removing the casing water to a depth of 50' was sufficient for our purposes.

When we first lowered the BHG-2 seismic transducer in the borehole, we had trouble achieving total depth in the casing because of a deposit of sandy silty "sludge" in the bottom 25-30' of the boring. A leadweight "dummy" was lowered and raised several times to try to break this deposit loose. Then by attaching a custom-built weighted point to the seismic transducer and making several down-and-up runs, we were finally able to nearly achieve total depth in the hole with the BHG-2. We were not able to orient the transducer in the deepest 25' of the borehole because of sand/silt in the casing grooves; consequently, we were resigned to having to work with un-oriented data for the lower portion of the borehole. After a partial logging run with the weighted point attached to the BHG-2, we were finally able to run to total depth with the transducer locked into the casing grooves. Thus, we were ultimately able to achieve oriented shear-wave data from the bottom of the casing to the top.

The shear-wave survey was initiated by first recording S-wave arrivals at broad 25-foot increments over the length of the borehole. This test was conducted in order to determine the characteristic shear waveform at the site and to examine the full wavetrain for possible sources of interference. Following this test run, the seismic transducer was carefully lowered to the bottom of the casing (with the guide rod keyed to the selected inclinometer groove) and the steel spring clamp was expanded to the locked position. By sliding the entire assembly along the inside casing wall with the spring clamp remaining in the locked position, the transducer was subsequently raised up the borehole in 2.5-foot increments to each successive recording position.

At each measurement level, the shear-wave survey was conducted by sequentially recording sledgehammer impacts to opposite ends of the shear-wave beam on alternate seismograph channels in order to observe S-wave arrivals of both "positive" and "negative" polarity on the longitudinal horizontal geophone. Triggering of the seismograph at the time of hammer impact was accomplished by attaching a Geometrics impact switch to the sledgehammer.

The "positive" and "negative" shear-wave signals at a given recording level are, ideally, mirror images of one another. When the signals are superimposed and viewed as a pair, the time of polarity reversal greatly assists in identification of the arrival of the shear-wave energy. The technique of reversing the polarity of the shear-wave signal is especially important for positive identification of S-wave arrivals at shallower depths in the borehole where latter portions of the wavetrain from higher-velocity compression-wave (P-wave) energy commonly interfere with the shear-wave arrivals. The technique is also useful for differentiating shear-wave arrivals from other types of secondary vibrations that can appear at any depth in the borehole. For each polarity at each 2.5-foot recording level, three to twelve sledgehammer blows were "stacked" using the signal enhancement capability of the seismograph to improve the signal-to-noise ratio of the recorded waveforms.

Following completion of the shear-wave survey, a downhole P-wave survey was also conducted in Boring B-1. The P-wave energy source consisted of vertical sledgehammer impacts to an aluminum striker plate placed on the ground surface at a distance of 8.25 feet from the borehole. Using the vertical geophone of the BHG-2 triaxial geophone assembly, the compression waveforms were recorded at the same 2.5-foot measurement intervals as the S-wave recordings. While P-wave velocity information is not directly utilized for earthquake site response modeling, the compression-wave travel-time curve is often useful for interpretation of the seismic stratigraphy of the site. In addition, P-wave velocity information can be combined with the S-wave velocity determinations to evaluate other elastic parameters of the subsurface materials such as Poisson's ratio.

DATA PROCESSING AND INTERPRETATION

Preliminary estimates of average downhole seismic velocities were made in the field as the data were acquired in order to be certain that the seismic results were reasonable and consistent. Preliminary processing of the downhole seismic data was conducted in Anchorage by transferring the Geometrics digital data files to a laptop computer for visual examination of the traces. This step was undertaken to be certain that the data set was complete before demobilizing the downhole seismic equipment from the Anchorage area.

Detailed data processing was carried out at my home office in Snohomish County, Washington. Using the digital filtering capabilities of the Geometrics R24 seismograph, the shear-wave data were filtered with a 100-Hz low-pass filter to enhance the downhole S-wave signal (usually centered around 50-60 Hz) and to remove higher frequency P-wave interference from the wavetrain. On relatively uniform ground, the "positive" and "negative" S-wave signals from opposite ends of the shear-wave beam are nearly mirror images of one another. However, on the sloping beach deposits at this site, the signals from the south end of the beam were more uniform than those from the north end. The reversal in polarity between the north and the south end signals were used to confirm the shear-wave arrival, but timing of the shear-wave arrivals and the subsequent velocity analysis were focused on the signals generated at the south end of the beam.

The onset ("first break") of a shear-wave pulse may be reasonably clear at the shallowest recording depths, but it rapidly becomes vague and indistinct ("emergent") as depth increases. Therefore, a later portion of the shear waveform consistent throughout the vertical stack of traces (the first major peak/trough of the shear wave) was timed to determine *relative* arrival times. These relative arrival times were then adjusted back to the approximate time of the "first break" by subtracting an average phase difference estimated by examination of the recorded traces in the uppermost 10-30 feet of the borehole. An adjustment was also made for the phase shift (time delay) that is inherent in the 100-Hz low-pass display filter in the R24 seismograph.

The adjusted shear-wave arrival times were corrected for the offset of the S-wave beam from the borehole by converting slant-path travel times to vertical travel times by multiplying by the cosine of the angle formed by the slant path and the well bore. A vertical travel-time curve was then constructed from these corrected times (Figure 2). By close examination of this vertical travel-time curve, linear segments were selected that were interpreted to represent the major units in the seismic stratigraphy. Least-squares fits were applied to these linear segments to derive the average shear-wave velocities indicated to the right of the travel-time curve on Figure 2. These same average velocity segments were used to construct the "best fit" shear-wave velocity profile in Figure 3. The segments of the interpreted shear-wave velocity model are also tabulated in Table 1.

In addition to the broader average velocity segments, interval velocities were also computed over 2.5-, 5-, 7.5-, and 10-foot intervals throughout the length of the borehole. It is generally not possible to accurately measure shear-wave velocity over very short intervals due to the broad (non-impulsive) nature of the shear waveform as well as imperfections in generation, transmission, and measurement of the shear-wave pulse. Also, interval velocities computed over short intervals are more adversely affected by imperfections in geometry of the borehole construction than are the broader average velocity determinations. Nevertheless, interval velocity plots can provide insight regarding minor variations in seismic stratigraphy as well as the interpretation of major transitions between sedimentary units.

In addition to the "best fit" average velocity profile (solid bold line) in Figure 3, a profile of "differential" velocity is provided (dashed line). The differential velocity is a smoothed version of 5-foot interval velocities derived by averaging 5-foot interval velocities over a 2.5-foot "smoothing" window. While the differential plot tends to smooth across stratigraphic boundaries because of the 5-foot length of the measurement interval, it nevertheless provides an indication of the variation in seismic velocity within the broader average-velocity segments. The smoothing function of the differential computation results in a profile that is graphically representative of variations in stiffness of the subsurface materials, providing somewhat more detail regarding variations in the seismic stratigraphy than the broader average-velocity computations.

Processing of the P-wave data followed processing steps similar to those of the S-wave data. On the Geometrics R24 seismograph, these data were filtered with a 400-Hz low-pass display filter to remove high-frequency noise. Using a cursor on the seismograph screen, both the "first breaks" (first arrivals) and the first peaks of the P-waveforms were then timed and recorded. These data were corrected for the phase shift in the R24 filter, and the first-peak data were also corrected for the time delay between the first break and the first peak. As with the S-wave data, the P-wave data were then corrected to the vertical by multiplying by the cosine of the angle formed by the slant path and the well bore. A vertical P-wave travel-time curve was constructed (Figure 4), and least-square fits were applied to major segments of the travel-time curve to derive the average P-wave velocity profile (Figure 5). As with the shear-wave data, detailed interval velocities were computed over 2.5-, 5-, 7.5-, and 10-foot intervals to assist with interpretation of the seismic stratigraphy and selection of average interval-velocity segments. Due to greater scatter in the P-wave interval velocities than with the S-wave interval velocities, a "differential" plot is not presented for the P-wave.

DOWNHOLE SURVEY RESULTS

Figures 2 and 4 are vertical travel-time plots for the shear wave and the compression wave, respectively, and Figures 3 and 5 are the corresponding average velocity profiles derived from the travel-time data. Tables 1 and 2 present a summary of the "best fit" average velocities determined for the S wave and the P wave, respectively.

There is a higher degree of variation in the shear-wave velocities in Boring B-1 than is normally observed in S-wave profiles, particularly in fine-grained sediments. More typically, the shear-wave travel-time plot exhibits a relatively steady increase in slope (velocity) with depth. When examining the S-wave travel-time curve in Figure 2, it is seen that while there is an overall increase in slope (velocity) with depth, there are a number of alternating increases and decreases in gradient on the curve. This results in the relatively high degree of variation in the average velocity profile in Figure 3. This high degree of variation is also seen in the "differential" velocity profile derived from computation of 5-foot interval velocities. There is some scatter in the S-wave data through a few intervals, but because the data were optimized using the Slope Indicator inclinometer casing, I believe that for the most part the shear-wave variations are truly representative of variations in the seismic stratigraphy and not just a result of "noise" in the data. Returning to the travel-time plot in Figure 2, the major "breaks" (velocity increases) exhibited by the overall plot occur at depths of 23-29' bgs and 54' bgs.

In contrast, the P-wave travel-time plot in Figure 5 is relatively smooth, particularly when considering that the vertical travel times are much smaller than those for the shear wave. There is a major offset in the travel-time plot at a depth below 26' bgs that may be related to a change in the borehole annulus at that depth. The unsaturated material above a depth of 20' exhibits an average velocity of 2130 ft/sec, whereas from 26' to 44' bgs there is a velocity segment with a surprisingly high P-wave velocity of 8215 ft/sec. (The two data points at depths of 21.2' and 23.7' appeared to be anomalously delayed and were not used in the velocity computations.) A P-wave velocity greater than 8000 ft/sec would be considered to be too high for near-surface alluvial deposits, but it is plausible for saturated glacial drift. Since the ground-surface elevation of the borehole is about 28', the higher downhole velocities begin at an elevation approximately equivalent to the mean tide level of Cook Inlet. The P-wave velocity appears to decrease somewhat with greater depth in the borehole, exhibiting an average velocity of 7360 ft/sec from 44' to 81', and 6230 ft/sec from 81' to 141'. These are typical compression-wave velocities for glacial drift.

CLOSURE

I have appreciated the opportunity to determine *in-situ* downhole seismic velocities for Shannon & Wilson, Inc., for the purpose of site characterization in the west abutment area of the proposed Knik Arm Crossing. Please contact me if there are any questions regarding field procedures or my interpretation of the seismic velocity profiles.

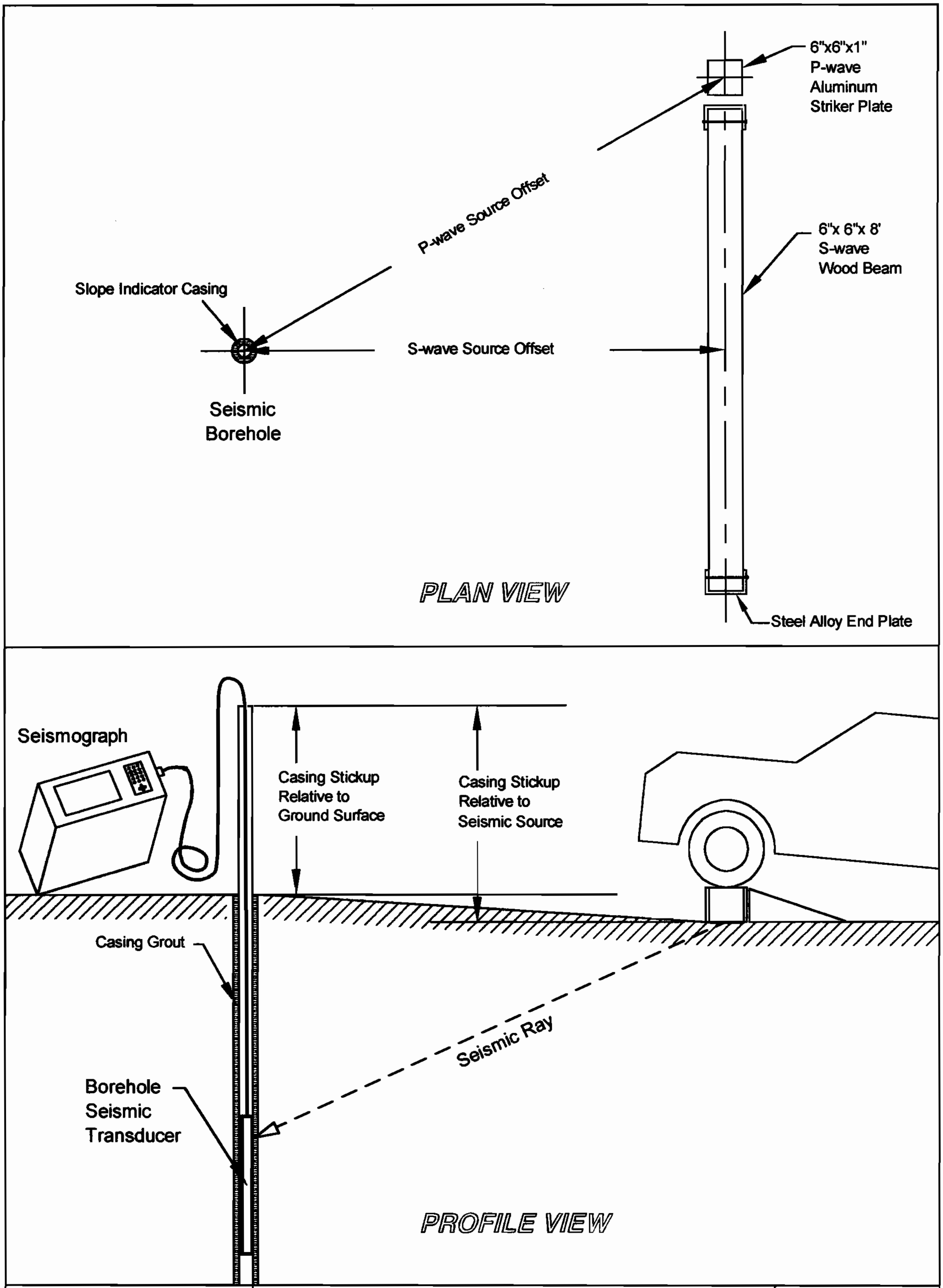
Sincerely yours,

NORTHLAND GEOPHYSICAL, PLLC

Thomas R. Williams

Thomas R. Williams, President
Washington State Licensed Geologist No. 147

147
Thomas R. Williams



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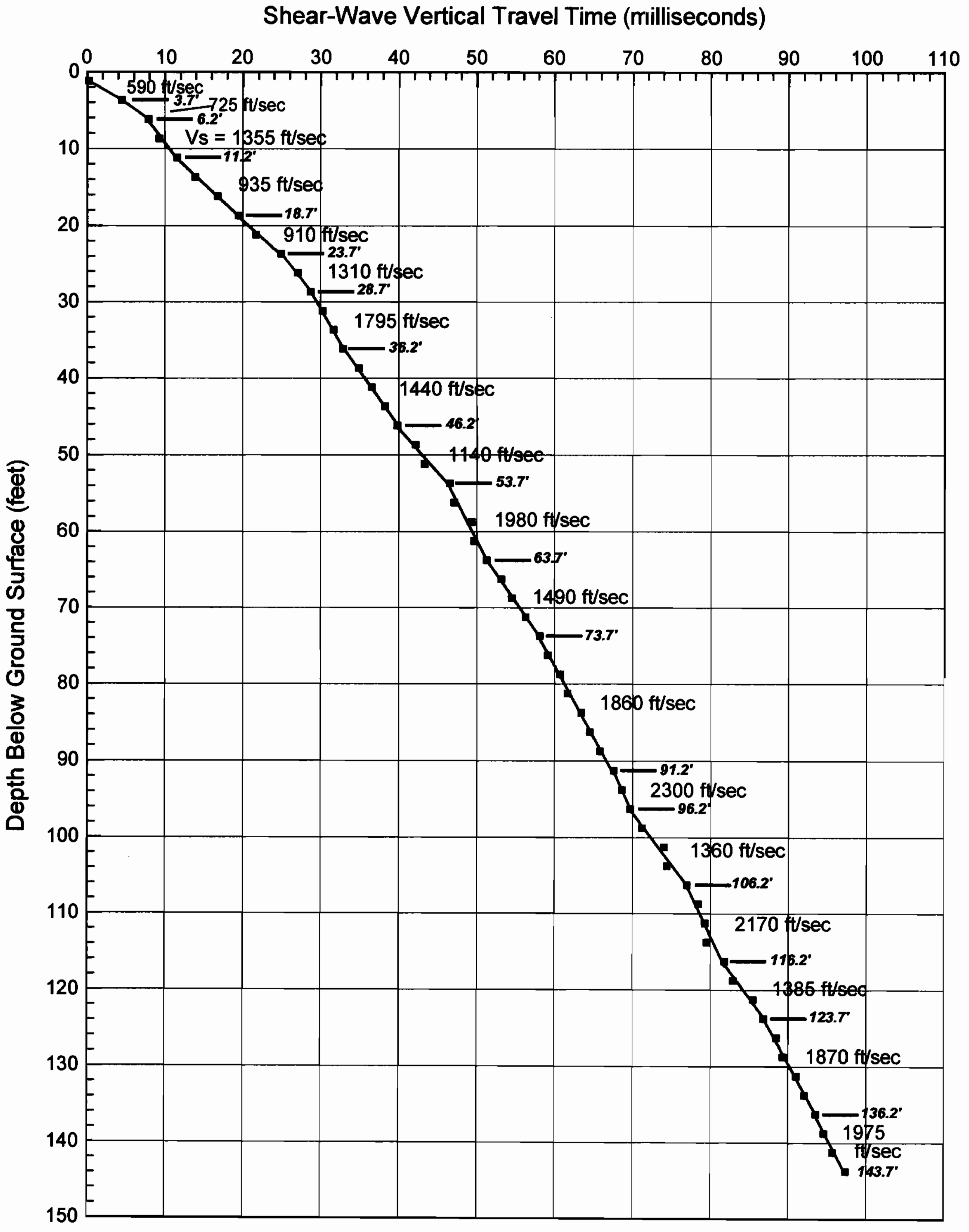
DOWNHOLE SEISMIC VELOCITY SURVEY FIELD CONFIGURATION

August 2005

FIGURE 1



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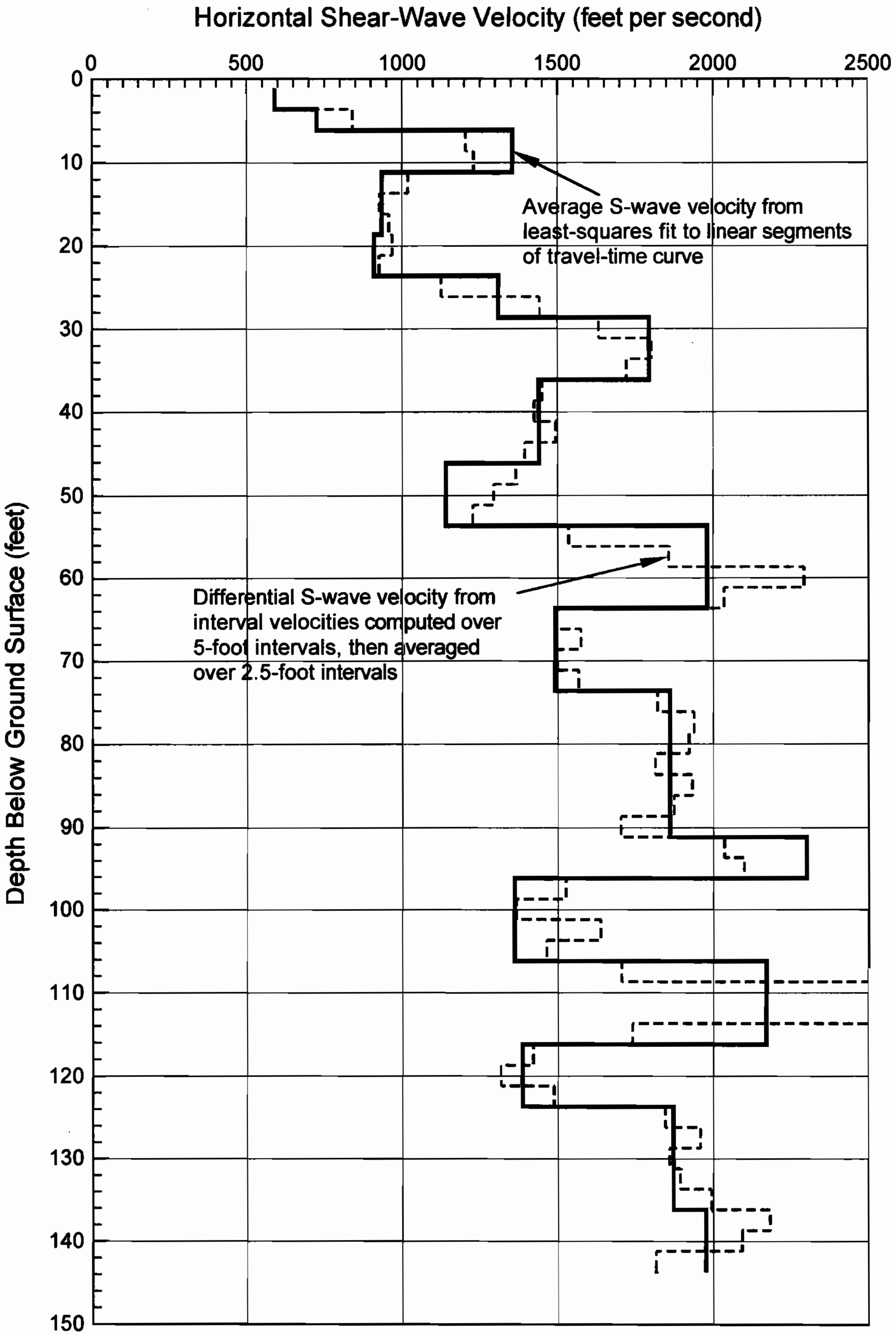
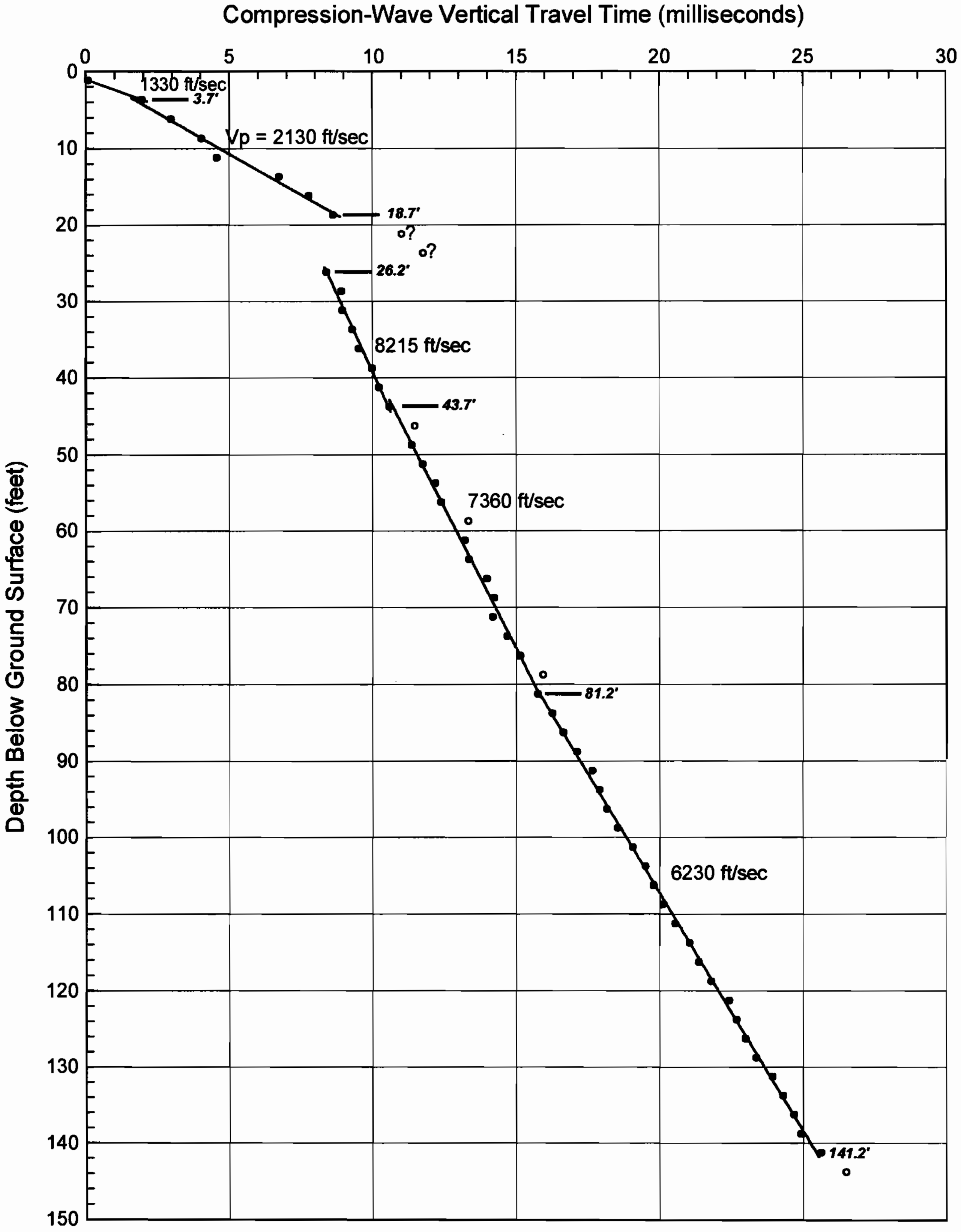
SHEAR-WAVE TRAVEL TIMES and AVERAGE VELOCITIES
Boring B-1
Knik Arm Crossing, Point MacKenzie, Alaska

August 2005

FIGURE 2



NORTHLAND GEOPHYSICAL, PLLC PO Box 310 Snohomish, WA 98291-0310	SHEAR-WAVE VELOCITY PROFILE Boring B-1 Knik Arm Crossing, Point MacKenzie, Alaska	August 2005 FIGURE 3



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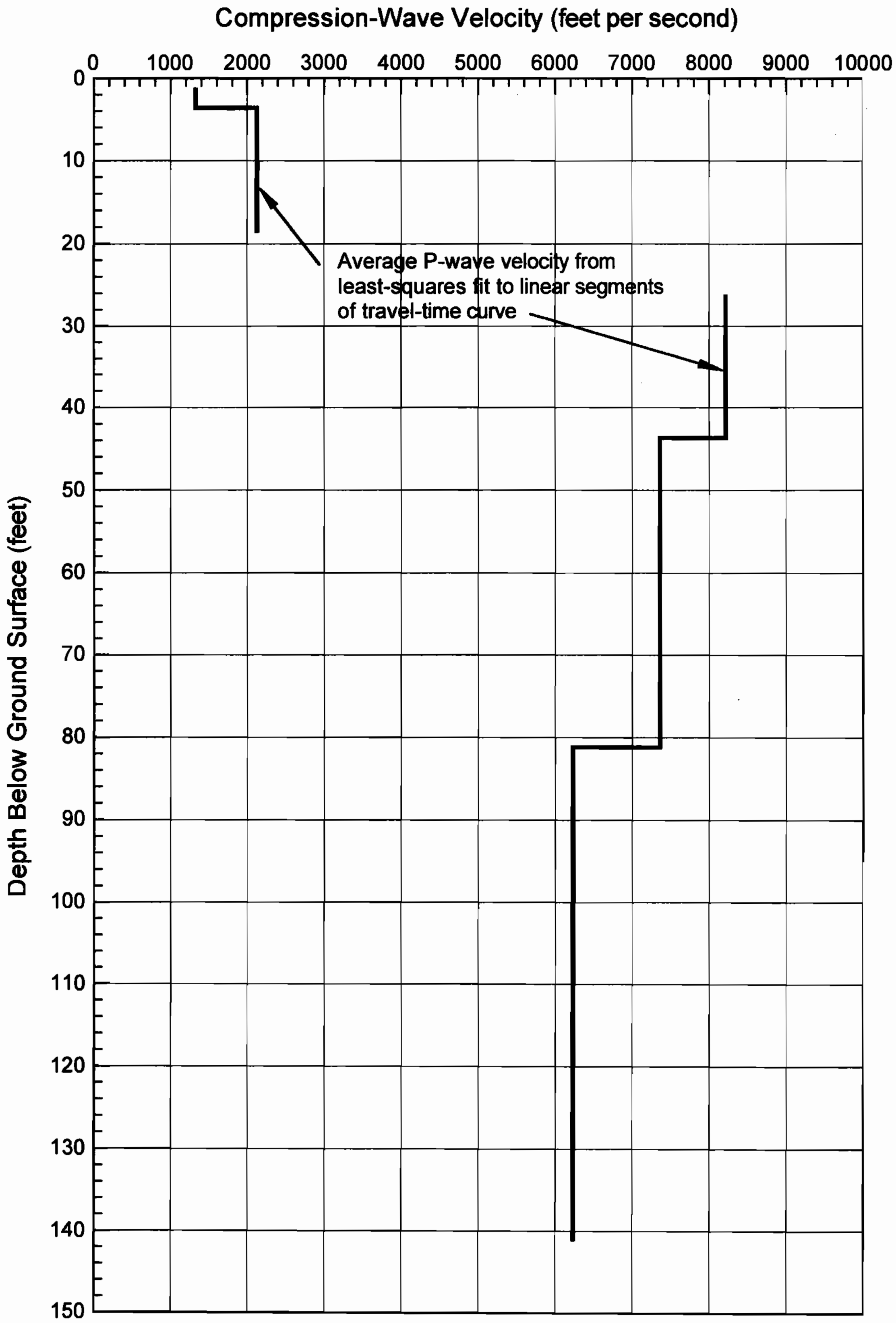
Snohomish, WA 98291-0310

P-WAVE TRAVEL TIMES and AVERAGE VELOCITIES
Boring B-1
Knik Arm Crossing, Point MacKenzie, Alaska

August 2005

FIGURE 4



NORTHLAND GEOPHYSICAL, PLLC
PO Box 310
Snohomish, WA 98291-0310

COMPRESSION-WAVE VELOCITY PROFILE
Boring B-1
Knik Arm Crossing, Point MacKenzie, Alaska

August 2005

FIGURE 5

Table 1

Average Shear-Wave Velocity

Boring B-1

Knik Arm Crossing, Pt. MacKenzie, AK

Depth Interval (feet bgs)	S-Wave Velocity (feet / sec)
1.2 - 3.7	590
3.7 - 6.2	725
6.2 - 11.2	1355
11.2 - 18.7	935
18.7 - 23.7	910
23.7 - 28.7	1310
28.7 - 36.2	1795
36.2 - 46.2	1440
46.2 - 53.7	1140
53.7 - 63.7	1980
63.7 - 73.7	1490
73.7 - 91.2	1860
91.2 - 96.2	2300
96.2 - 106.2	1360
106.2 - 116.2	2170
116.2 - 123.7	1385
123.7 - 136.2	1870
136.2 - 143.7	1975

Table 2

Average Compression-Wave Velocity

Boring B-1

Knik Arm Crossing, Pt. MacKenzie, AK

Depth Interval (feet bgs)	P-Wave Velocity (feet / sec)
1.2 - 3.7	1330
3.7 - 18.7	2130
26.2 - 43.7	8215
43.7 - 81.2	7360
81.2 - 141.2	6230

APPENDIX A

Travel-Time Data Sheets
Downhole Seismic Velocity Survey
July 14, 2005

Boring B-1
Knik Arm Crossing
Point MacKenzie, Alaska

Knik Arm Crossing Boring B-1
S-Wave Travel-Time Data

Borehole No.	Knik B-1
Seismic Mode	S-Wave (1st Peak)
Source Offset (ft)	8.25
Casing Stickup rt/gs	2.5
Casing Stickup rt/ss	3.6
Onset-to-Peak (ms)	3.5
Digital Filter	R24 100 Hz LP
Filter Delay (ms)	3.7

Depth bgs (ft)	Slant TT (ms)	Slant TT - OP - FD	Cosine Factor	**Vertical Travel Time (ms)**
1.2	22.93	15.73	0.012120322	**0.19**
3.7	21.96	14.76	0.300578035	**4.44**
6.2	22.18	14.98	0.525822098	**7.88**
8.7	20.90	13.70	0.677539216	**9.28**
11.2	22.06	14.86	0.774469512	**11.51**
13.7	23.81	16.61	0.836618529	**13.90**
16.2	26.28	19.08	0.877562207	**16.74**
18.7	28.68	21.48	0.905458936	**19.45**
21.2	30.62	23.42	0.925106445	**21.67**
23.7	33.68	26.48	0.939367946	**24.87**
26.2	35.65	28.45	0.949999675	**27.03**
28.7	37.12	29.92	0.958112440	**28.67**
31.2	38.53	31.33	0.964430318	**30.22**
33.7	39.81	32.61	0.969438760	**31.61**
36.2	40.93	33.73	0.973471700	**32.84**
38.7	42.90	35.70	0.976764242	**34.87**
41.2	44.46	37.26	0.979485412	**36.50**
43.7	46.15	38.95	0.981759041	**38.24**
46.2	47.68	40.48	0.983677407	**39.82**
48.7	49.96	42.76	0.985310343	**42.13**
51.2	51.06	43.86	0.986711438	**43.28**
53.7	54.28	47.08	0.987922345	**46.51**
56.2	54.81	47.61	0.988975814	**47.09**
58.7	57.06	49.86	0.989897871	**49.36**
61.2	57.31	50.11	0.990709402	**49.64**
63.7	58.90	51.70	0.991427322	**51.26**
66.2	60.75	53.55	0.992065438	**53.13**
68.7	62.09	54.89	0.992635115	**54.49**
71.2	63.84	56.64	0.993145768	**56.25**
73.7	65.65	58.45	0.993605255	**58.08**
76.2	66.68	59.48	0.994020170	**59.12**
78.7	68.25	61.05	0.994396081	**60.71**
81.2	69.18	61.98	0.994737717	**61.65**
83.7	70.90	63.70	0.995049110	**63.38**
86.2	72.00	64.80	0.995333721	**64.50**
88.7	73.25	66.05	0.995594529	**65.76**
91.2	75.03	67.83	0.995834109	**67.55**
93.7	76.06	68.86	0.996054702	**68.59**
96.2	77.18	69.98	0.996258257	**69.72**

Knik Arm Crossing Boring B-1
S-Wave Travel-Time Data

98.7	78.68	71.48	0.996446482	**71.23**
101.2	81.50	74.30	0.996620876	**74.05**
103.7	81.84	74.64	0.996782760	**74.40**
106.2	84.43	77.23	0.996933301	**76.99**
108.7	85.90	78.70	0.997073533	**78.47**
111.2	86.71	79.51	0.997204374	**79.29**
113.7	86.93	79.73	0.997326644	**79.52**
116.2	89.21	82.01	0.997441074	**81.80**
118.7	90.28	83.08	0.997548320	**82.88**
121.2	92.90	85.70	0.997648970	**85.50**
123.7	94.18	86.98	0.997743553	**86.78**
126.2	95.84	88.64	0.997832548	**88.45**
128.7	96.68	89.48	0.997916385	**89.29**
131.2	98.43	91.23	0.997995454	**91.05**
133.7	99.46	92.26	0.998070111	**92.08**
136.2	100.93	93.73	0.998140678	**93.56**
138.7	101.96	94.76	0.998207447	**94.59**
141.2	103.03	95.83	0.998270686	**95.66**
143.7	104.71	97.51	0.998330639	**97.35**

Knik Arm Crossing Boring B-1
P-Wave Travel-Time Data

Borehole No.	Knik B-1
Seismic Mode	P-Wave (1st Peak)
Source Offset (ft)	8.25
Casing Stickup rt/gs	2.5
Casing Stickup rt/ss	3.6
Onset-to-Peak (ms)	2.5
Digital Filter	R24 400 Hz LP
Filter Delay (ms)	1.1

Depth bgs (ft)	Slant TT (ms)	Slant TT - OP - FD	Cosine Factor	**Vertical Travel Time (ms)**
1.2	10.31	6.71	0.012120322	**0.08**
3.7	10.12	6.52	0.300578035	**1.96**
6.2	9.25	5.65	0.525822098	**2.97**
8.7	9.56	5.96	0.677539216	**4.04**
11.2	9.50	5.90	0.774469512	**4.57**
13.7	11.65	8.05	0.836618529	**6.73**
16.2	12.46	8.86	0.877562207	**7.78**
18.7	13.12	9.52	0.905458936	**8.62**
21.2	15.50	11.90	0.925106445	**11.01**
23.7	16.12	12.52	0.939367946	**11.76**
26.2	12.43	8.83	0.949999675	**8.39**
28.7	12.90	9.30	0.958112440	**8.91**
31.2	12.87	9.27	0.964430318	**8.94**
33.7	13.18	9.58	0.969438760	**9.29**
36.2	13.37	9.77	0.973471700	**9.51**
38.7	13.81	10.21	0.976764242	**9.97**
41.2	14.03	10.43	0.979485412	**10.22**
43.7	14.37	10.77	0.981759041	**10.57**
46.2	15.25	11.65	0.983677407	**11.46**
48.7	15.12	11.52	0.985310343	**11.35**
51.2	15.50	11.90	0.986711438	**11.74**
53.7	15.93	12.33	0.987922345	**12.18**
56.2	16.12	12.52	0.988975814	**12.38**
58.7	17.06	13.46	0.989897871	**13.32**
61.2	16.93	13.33	0.990709402	**13.21**
63.7	17.06	13.46	0.991427322	**13.34**
66.2	17.68	14.08	0.992065438	**13.97**
68.7	17.93	14.33	0.992635115	**14.22**
71.2	17.87	14.27	0.993145768	**14.17**
73.7	18.37	14.77	0.993605255	**14.68**
76.2	18.81	15.21	0.994020170	**15.12**
78.7	19.62	16.02	0.994396081	**15.93**
81.2	19.43	15.83	0.994737717	**15.75**
83.7	19.93	16.33	0.995049110	**16.25**
86.2	20.31	16.71	0.995333721	**16.63**
88.7	20.78	17.18	0.995594529	**17.10**
91.2	21.31	17.71	0.995834109	**17.64**
93.7	21.56	17.96	0.996054702	**17.89**
96.2	21.81	18.21	0.996258257	**18.14**

Knik Arm Crossing Boring B-1
P-Wave Travel-Time Data

98.7	22.18	18.58	0.996446482	**18.51**
101.2	22.70	19.10	0.996620876	**19.04**
103.7	23.15	19.55	0.996782760	**19.49**
106.2	23.43	19.83	0.996933301	**19.77**
108.7	23.75	20.15	0.997073533	**20.09**
111.2	24.18	20.58	0.997204374	**20.52**
113.7	24.68	21.08	0.997326644	**21.02**
116.2	25.00	21.40	0.997441074	**21.35**
118.7	25.43	21.83	0.997548320	**21.78**
121.2	26.06	22.46	0.997648970	**22.41**
123.7	26.31	22.71	0.997743553	**22.66**
126.2	26.62	23.02	0.997832548	**22.97**
128.7	27.00	23.40	0.997916385	**23.35**
131.2	27.56	23.96	0.997995454	**23.91**
133.7	27.93	24.33	0.998070111	**24.28**
136.2	28.31	24.71	0.998140678	**24.66**
138.7	28.56	24.96	0.998207447	**24.92**
141.2	29.25	25.65	0.998270686	**25.61**
143.7	30.12	26.52	0.998330639	**26.48**

APPENDIX B

Seismograph Records
Downhole Seismic Velocity Survey
July 14, 2005

Boring B-1
Knik Arm Crossing
Point MacKenzie, Alaska

Downhole Seismic Field Data
Boring B-1
Knik Arm Crossing
Point MacKenzie, Alaska

Following are photocopies of the field seismograms recorded during the downhole seismic velocity survey at Boring B-1 on July 14, 2005.

The data files for the shear-wave survey are numbered KNIK-04.DAT through KNIK-13.DAT, beginning at total depth and progressing to the top of the borehole. In the field, each recording level in the borehole is represented by four channels in the seismograph files, so that six measurement levels are recorded in each 24-channel Geometrics R24 StrataView file. In each group of four traces, the first two are from the longitudinal horizontal geophone and the second two are from the transverse horizontal geophone. Because the downhole shear-wave survey was optimized for the longitudinal geophone by orienting the shear-wave source parallel to the set of Slope Inclinometer casing grooves to which the longitudinal geophone was keyed, the traces for the transverse geophone are not reproduced here. The odd-numbered channels were used to record sledgehammer blows to the south end of the shear-wave beam; the even-numbered channels were used for hammer blows to the north end of the beam. For each end of the beam at each 2.5-foot measurement level, 3 to 12 hammer blows were stacked (summed using the signal enhancement feature of the seismograph) to increase the signal-to-noise ratio of the recorded waveforms.

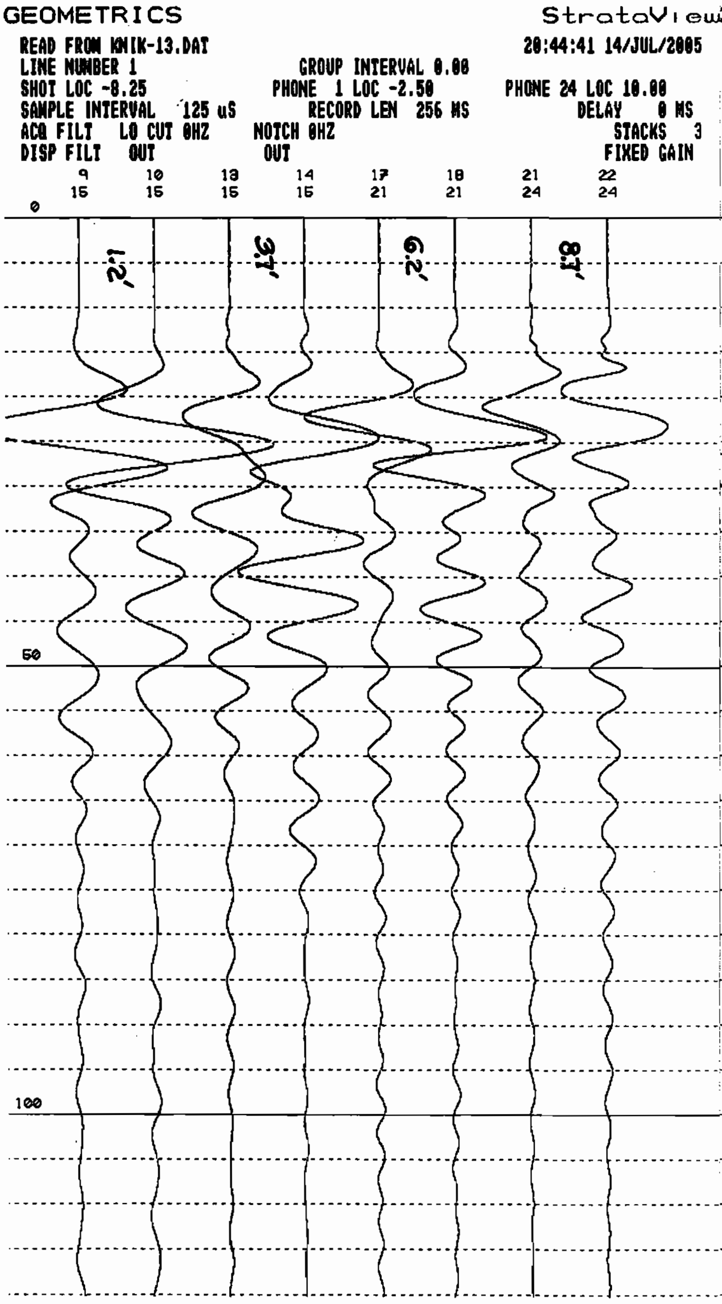
The data files for the compression-wave survey are labeled KNIK-14.DAT through KNIK-16.DAT. One seismograph channel was used for each 2.5-foot measurement level in the P-wave survey.

On the following photocopies of the seismograms, the raw field data are reproduced on the left side of each data sheet. The record on the right is the same data filtered using a 100-Hz low-pass digital display filter in the R24 seismograph for the shear-wave data, and a 400-Hz low-pass filter for the compression-wave data. The vertical time scale on the seismograms is given in milliseconds.

Knik Arm Crossing
Point MacKenzie, Alaska
Boring B-1
July 14, 2005

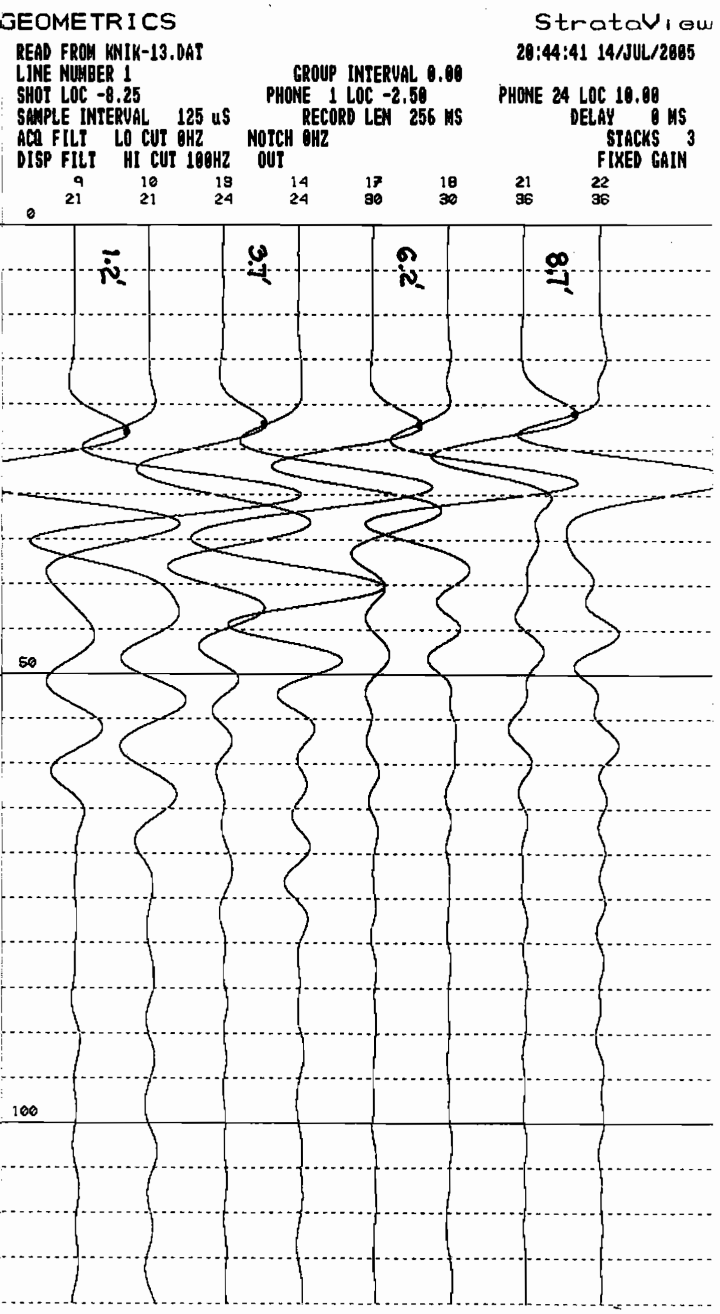
Downhole Shear-Wave Field Data
(1.2' – 8.7' bgs)

Raw Data



```
GEOMETRICS                                                    StrataView
READ FROM KNIK-13.DAT                                   20:44:41 14/JUL/2005
LINE NUMBER 1                  GROUP INTERVAL 0.00
SHOT LOC -8.25             PHONE  1 LOC -2.50      PHONE 24 LOC 10.00
SAMPLE INTERVAL  125 uS        RECORD LEN  256 MS           DELAY    0 MS
ACQ FILT   LO CUT 0HZ     NOTCH 0HZ                            STACKS   3
DISP FILT   OUT            OUT                              FIXED GAIN
```

Filtered Data

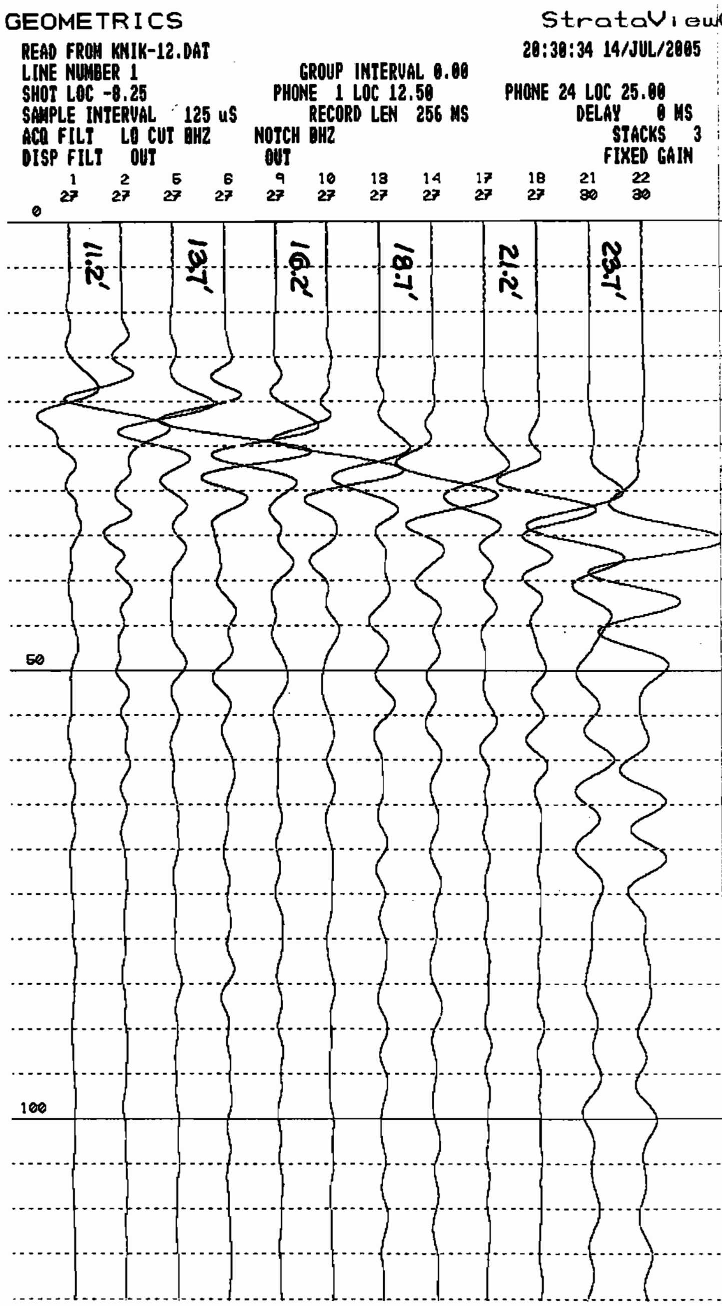


```
GEOMETRICS                                                    StrataView
READ FROM KNIK-13.DAT                                   20:44:41 14/JUL/2005
LINE NUMBER 1                  GROUP INTERVAL 0.00
SHOT LOC -8.25             PHONE  1 LOC -2.50      PHONE 24 LOC 10.00
SAMPLE INTERVAL   125 uS       RECORD LEN  256 MS           DELAY    0 MS
ACQ FILT   LO CUT 0HZ     NOTCH 0HZ                            STACKS   3
DISP FILT   HI CUT 100HZ   OUT                              FIXED GAIN
```

Knik Arm Crossing
Point MacKenzie, Alaska
Boring B-1
July 14, 2005

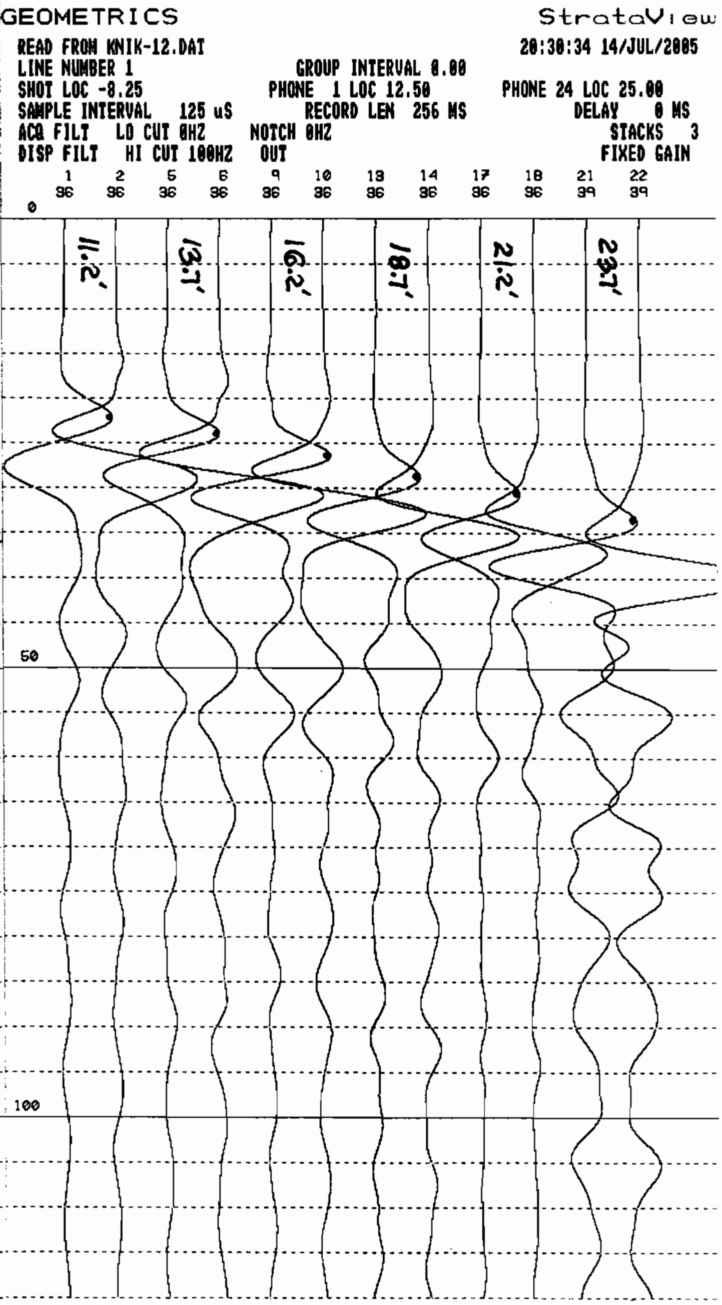
Downhole Shear-Wave Field Data
(11.2' – 23.7' bgs)

Raw Data



```
GEOMETRICS                                              StrataView
 READ FROM KNIK-12.DAT                                20:30:34 14/JUL/2005
 LINE NUMBER 1                   GROUP INTERVAL 0.00
 SHOT LOC -0.25               PHONE  1 LOC 12.50      PHONE 24 LOC 25.00
 SAMPLE INTERVAL   125 uS        RECORD LEN  256 MS            DELAY    0 MS
 ACQ FILT   LO CUT 0HZ    NOTCH 0HZ                             STACKS   3
 DISP FILT   OUT           OUT                                 FIXED GAIN
```

Filtered Data

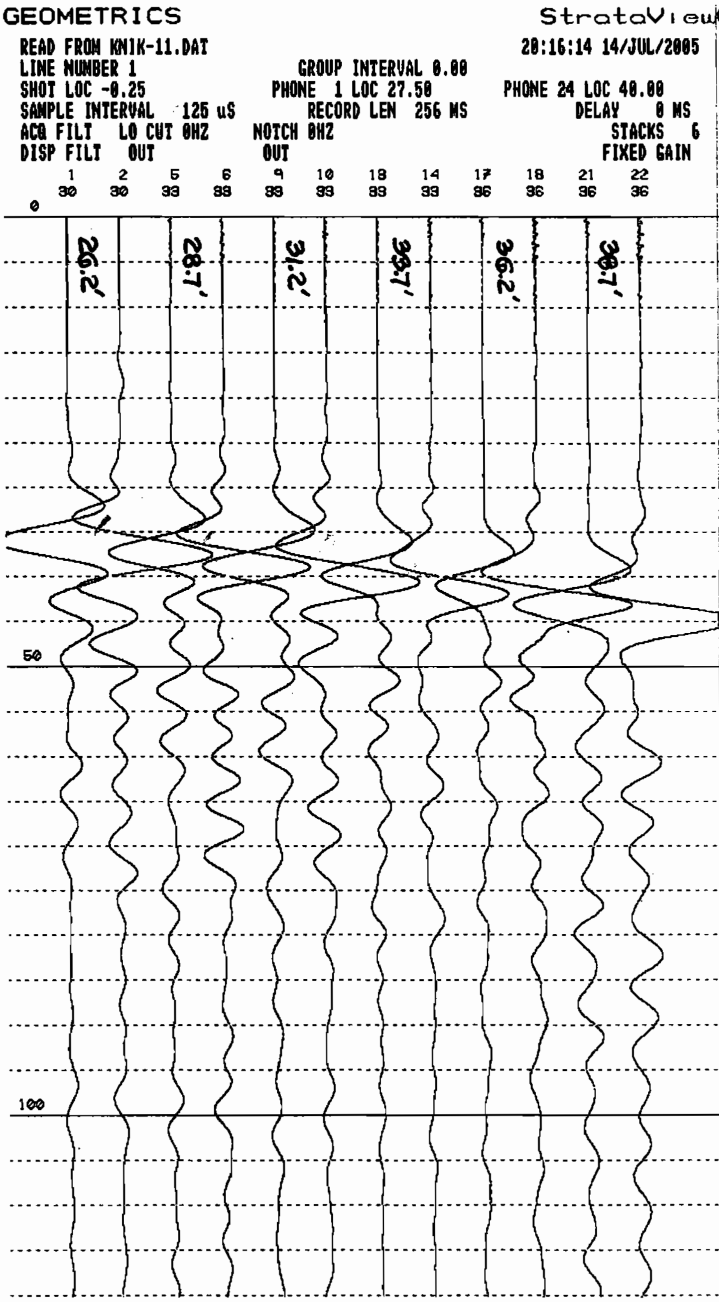


```
GEOMETRICS                                              StrataView
 READ FROM KNIK-12.DAT                                20:30:34 14/JUL/2005
 LINE NUMBER 1                   GROUP INTERVAL 0.00
 SHOT LOC -0.25               PHONE  1 LOC 12.50      PHONE 24 LOC 25.00
 SAMPLE INTERVAL   125 uS        RECORD LEN  256 MS            DELAY    0 MS
 ACQ FILT   LO CUT 0HZ    NOTCH 0HZ                             STACKS   3
 DISP FILT   HI CUT 100HZ   OUT                                FIXED GAIN
```

Knik Arm Crossing
Point MacKenzie, Alaska
Boring B-1
July 14, 2005

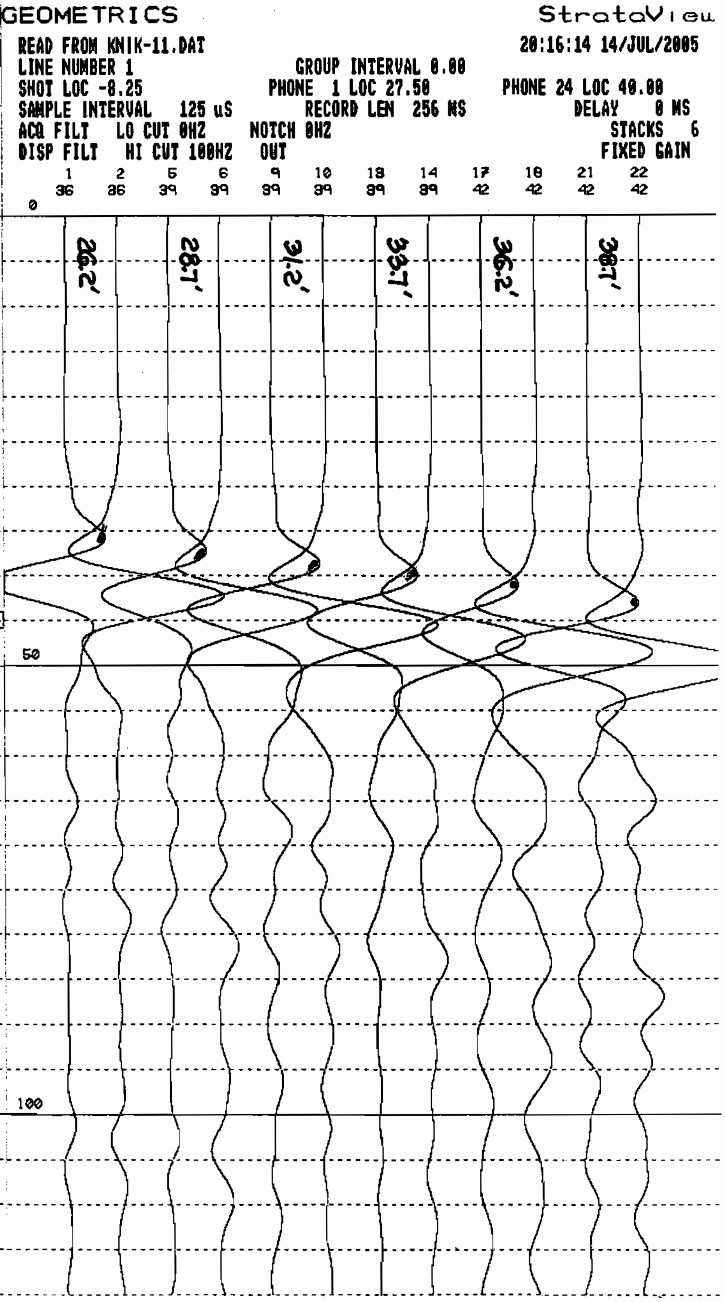
Downhole Shear-Wave Field Data
(26.2' – 38.7' bgs)

Raw Data



```
GEOMETRICS                                              StrataView
READ FROM KNIK-11.DAT                            20:16:14 14/JUL/2005
LINE NUMBER 1                 GROUP INTERVAL 0.00
SHOT LOC -0.25              PHONE  1 LOC 27.50      PHONE 24 LOC 40.00
SAMPLE INTERVAL  125 uS         RECORD LEN  256 MS           DELAY    0 MS
ACQ FILT   LO CUT 0HZ     NOTCH 0HZ                             STACKS   6
DISP FILT   OUT             OUT                                FIXED GAIN
```

Filtered Data

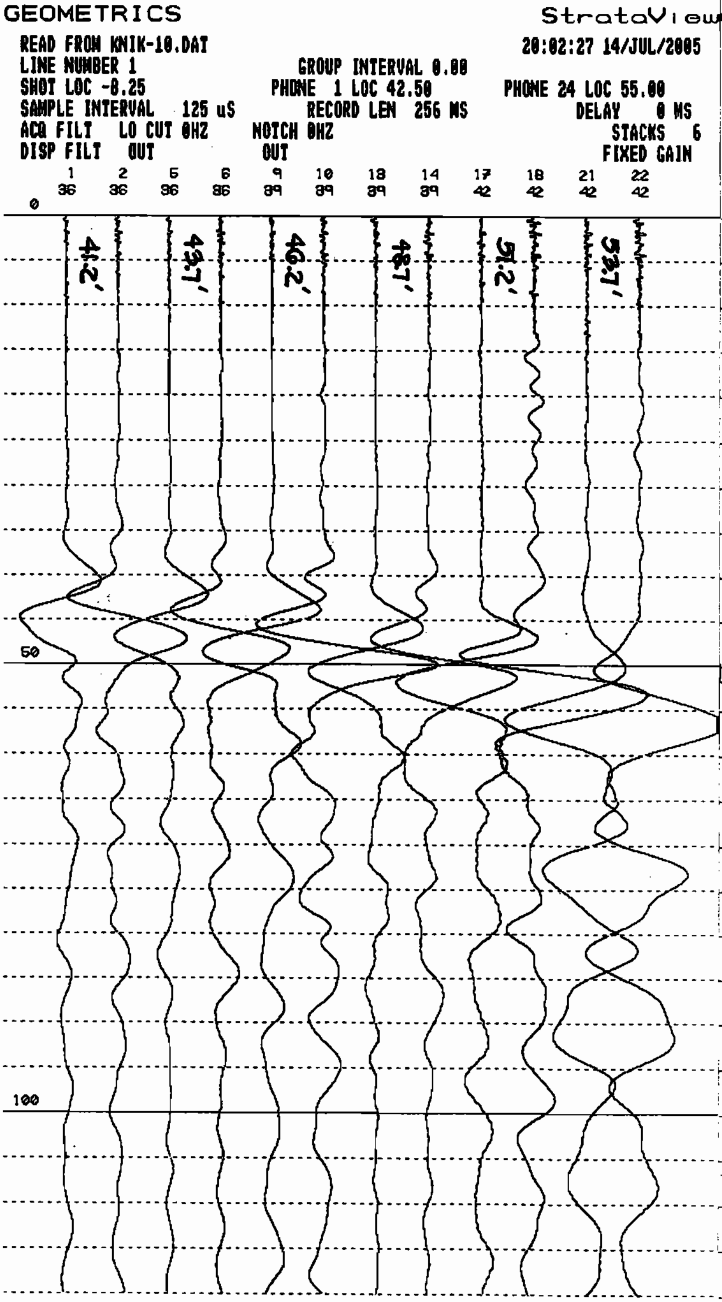


```
GEOMETRICS                                              StrataView
READ FROM KNIK-11.DAT                            20:16:14 14/JUL/2005
LINE NUMBER 1                 GROUP INTERVAL 0.00
SHOT LOC -0.25              PHONE  1 LOC 27.50      PHONE 24 LOC 40.00
SAMPLE INTERVAL   125 uS        RECORD LEN  256 MS           DELAY    0 MS
ACQ FILT   LO CUT 0HZ     NOTCH 0HZ                             STACKS   6
DISP FILT   HI CUT 100HZ   OUT                                 FIXED GAIN
```

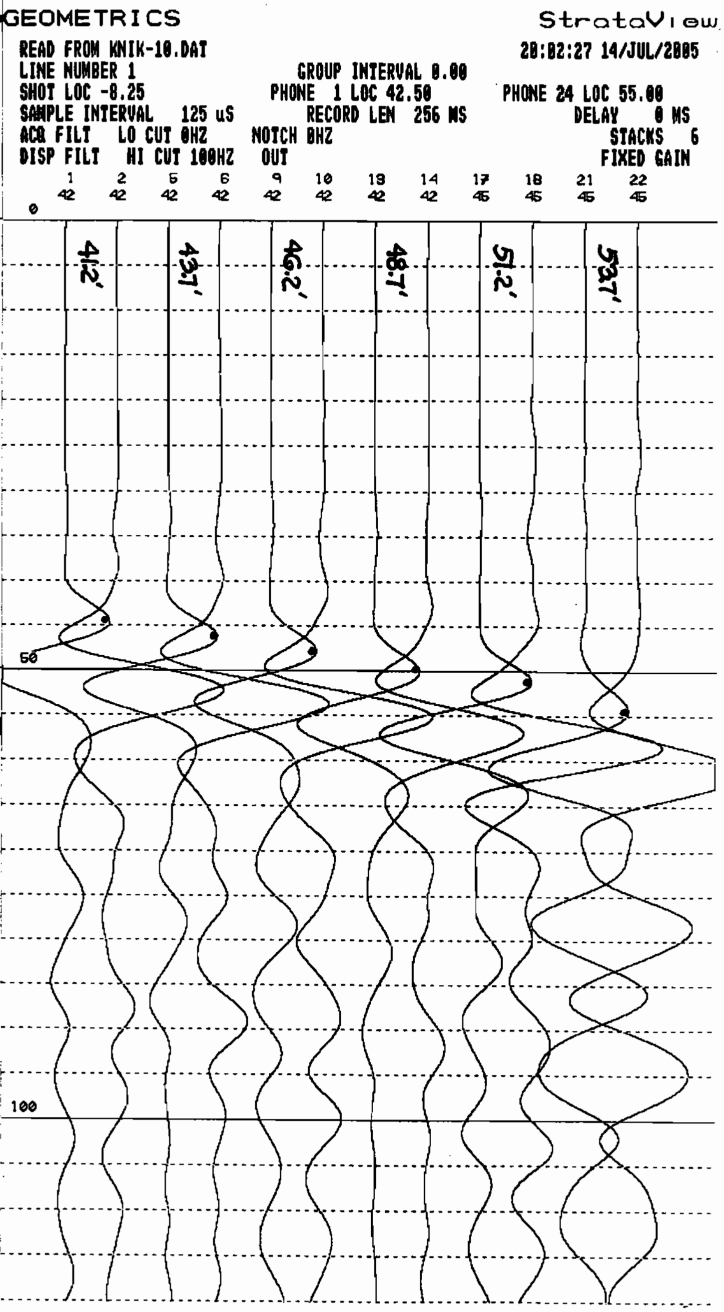
Knik Arm Crossing
Point MacKenzie, Alaska
Boring B-1
July 14, 2005

Downhole Shear-Wave Field Data
(41.2' – 53.7' bgs)

Raw Data



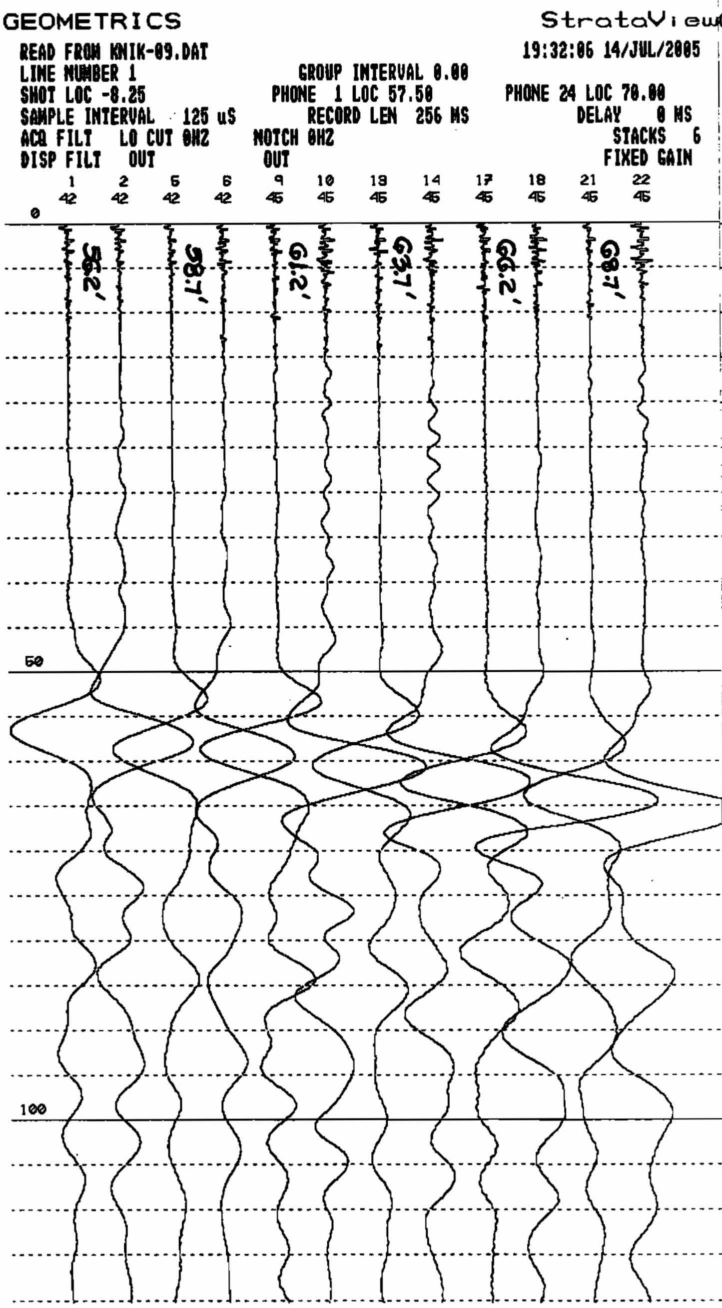
Filtered Data



Knik Arm Crossing
Point MacKenzie, Alaska
Boring B-1
July 14, 2005

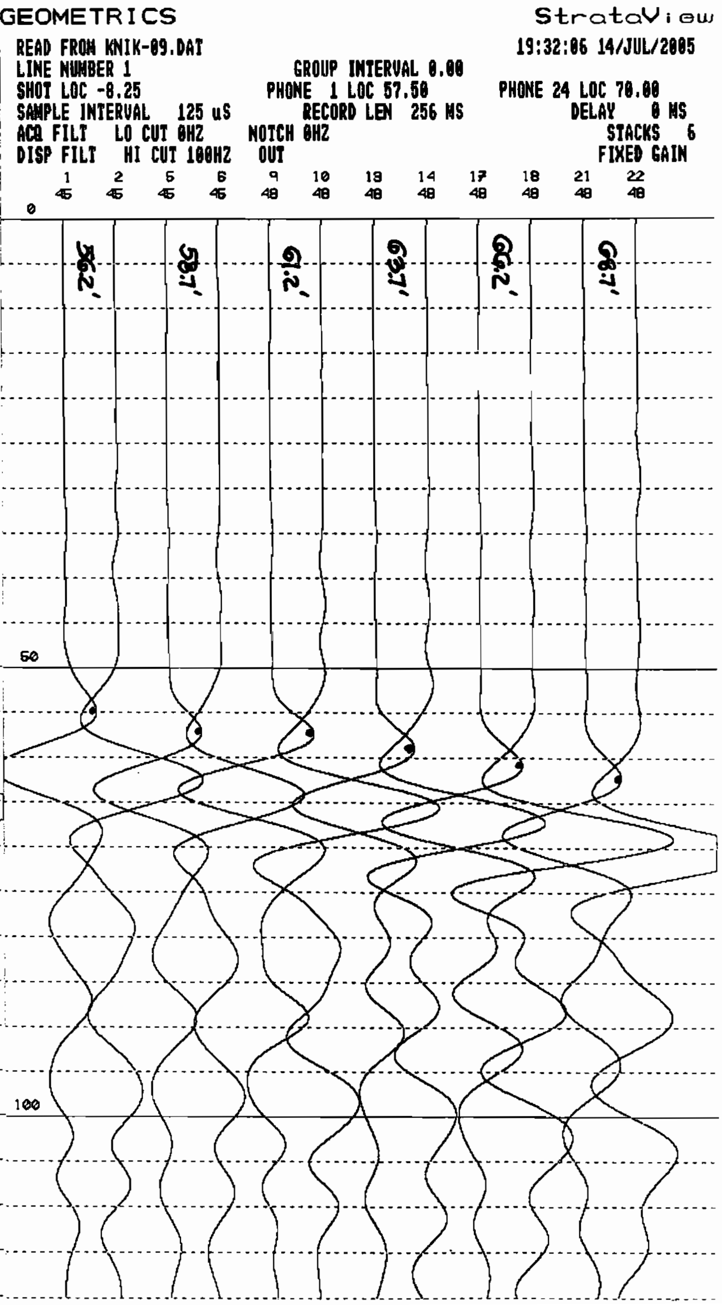
Downhole Shear-Wave Field Data
(56.2' – 68.7' bgs)

Raw Data



```
GEOMETRICS                                                     StrataView
READ FROM KNIK-09.DAT                                 19:32:06 14/JUL/2005
LINE NUMBER 1                   GROUP INTERVAL 0.00
SHOT LOC -8.25              PHONE  1 LOC 57.50         PHONE 24 LOC 70.00
SAMPLE INTERVAL   125 uS        RECORD LEN  256 MS            DELAY    0 MS
ACQ FILT   LO CUT 0HZ     NOTCH 0HZ                               STACKS   6
DISP FILT   OUT            OUT                                FIXED GAIN
```

Filtered Data

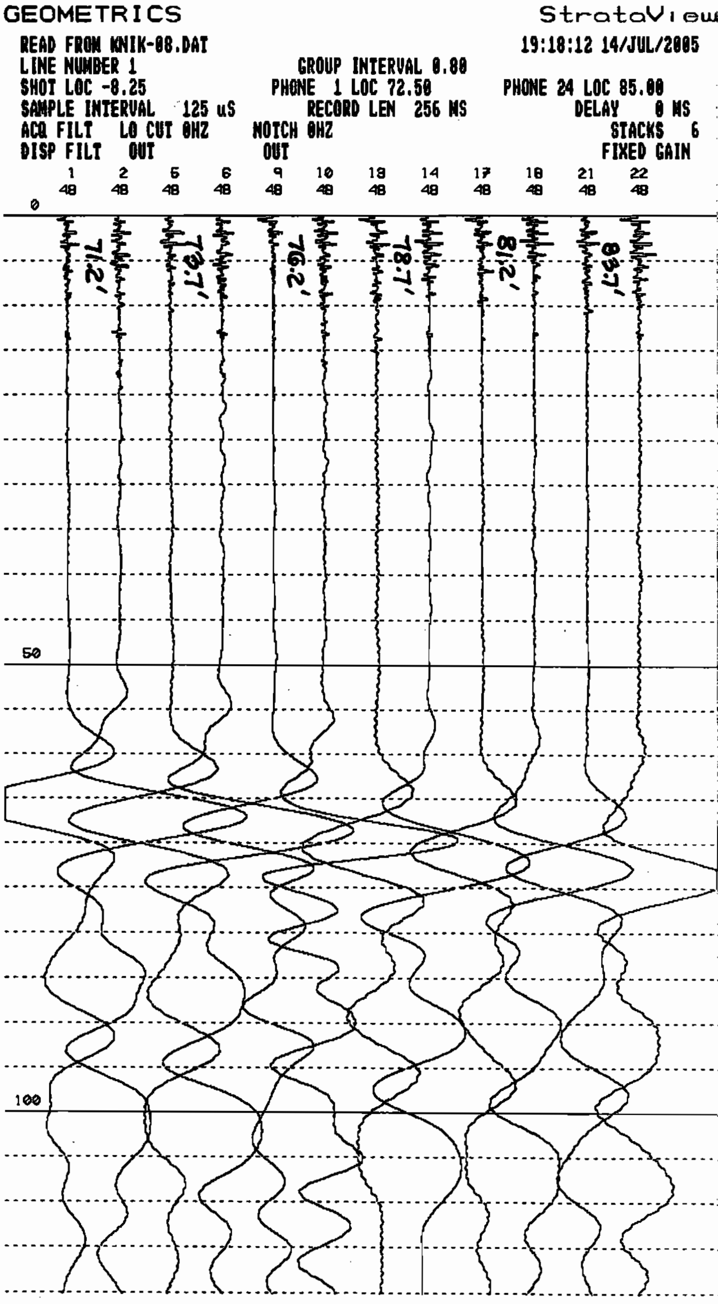


```
GEOMETRICS                                                     StrataView
READ FROM KNIK-09.DAT                                 19:32:06 14/JUL/2005
LINE NUMBER 1                   GROUP INTERVAL 0.00
SHOT LOC -8.25              PHONE  1 LOC 57.50         PHONE 24 LOC 70.00
SAMPLE INTERVAL   125 uS        RECORD LEN  256 MS            DELAY    0 MS
ACQ FILT   LO CUT 0HZ     NOTCH 0HZ                               STACKS   6
DISP FILT   HI CUT 100HZ   OUT                                FIXED GAIN
```

Knik Arm Crossing
Point MacKenzie, Alaska
Boring B-1
July 14, 2005

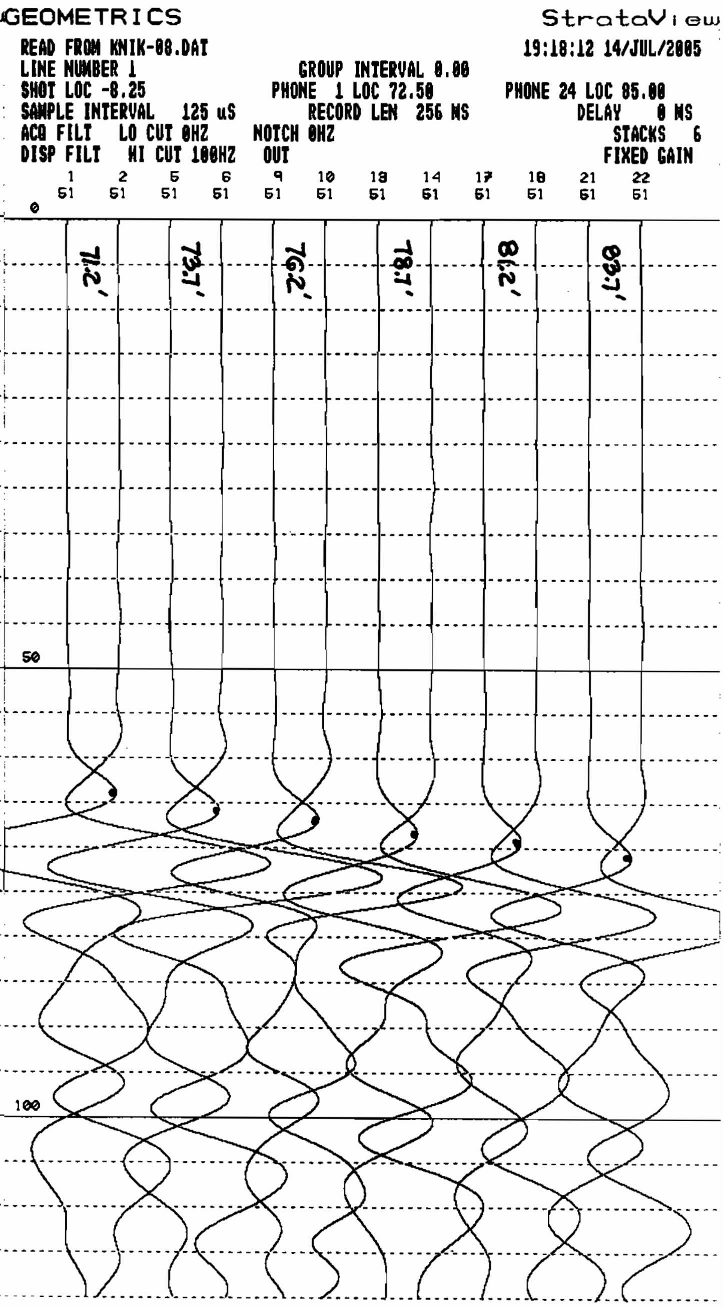
Downhole Shear-Wave Field Data
(71.2' – 83.7' bgs)

Raw Data



```
GEOMETRICS                                              StrataView
 READ FROM KNIK-08.DAT                                  19:18:12 14/JUL/2005
 LINE NUMBER 1                    GROUP INTERVAL 0.00
 SHOT LOC -8.25                PHONE  1 LOC 72.50      PHONE 24 LOC 85.00
 SAMPLE INTERVAL   125 uS         RECORD LEN  256 MS             DELAY    0 MS
 ACQ FILT   LO CUT 0HZ     NOTCH 0HZ                               STACKS   6
 DISP FILT   OUT            OUT                                    FIXED GAIN
```

Filtered Data

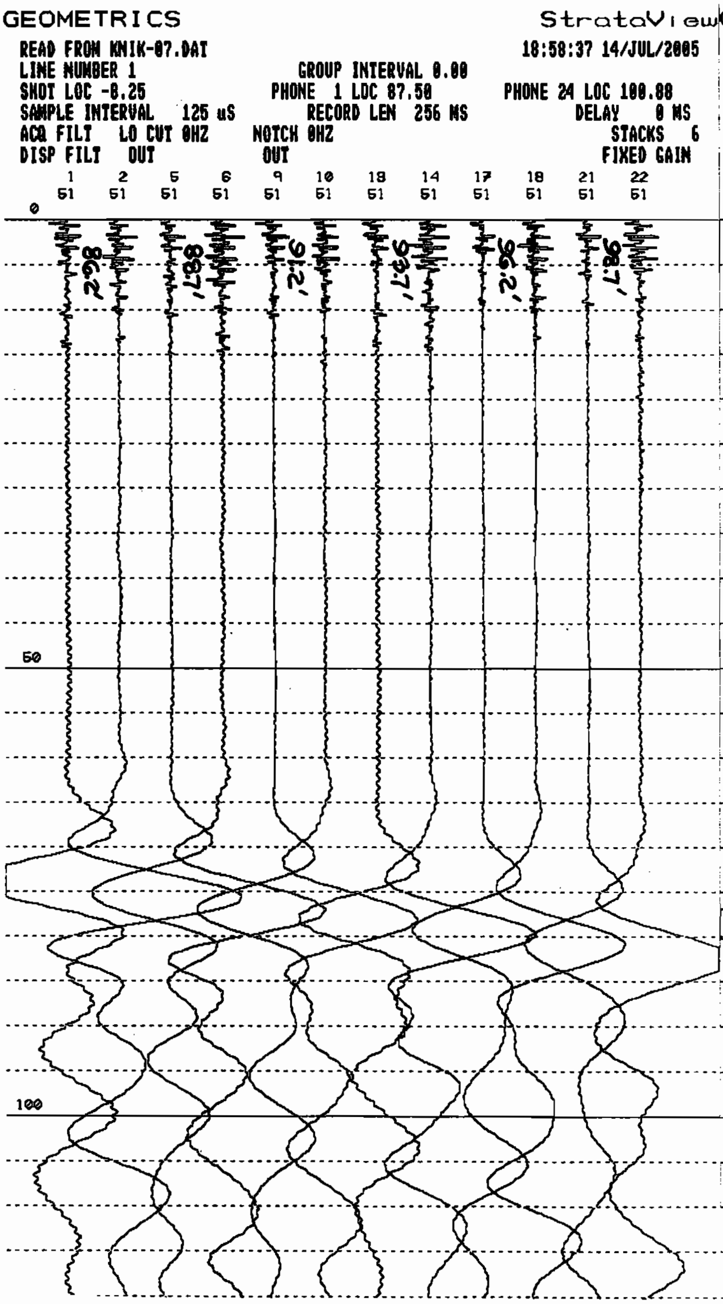


```
GEOMETRICS                                              StrataView
 READ FROM KNIK-08.DAT                                  19:18:12 14/JUL/2005
 LINE NUMBER 1                    GROUP INTERVAL 0.00
 SHOT LOC -8.25                PHONE  1 LOC 72.50      PHONE 24 LOC 85.00
 SAMPLE INTERVAL   125 uS         RECORD LEN  256 MS             DELAY    0 MS
 ACQ FILT   LO CUT 0HZ     NOTCH 0HZ                               STACKS   6
 DISP FILT   HI CUT 100HZ   OUT                                    FIXED GAIN
```

Knik Arm Crossing
Point MacKenzie, Alaska
Boring B-1
July 14, 2005

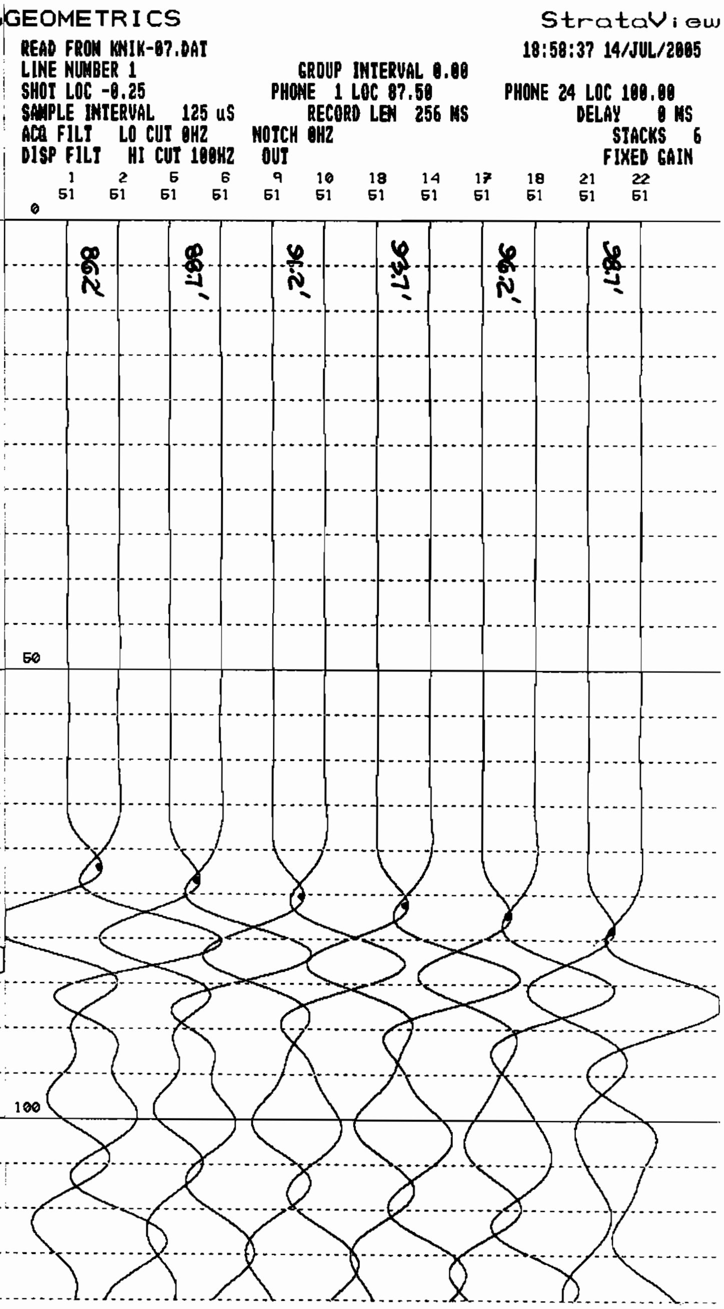
Downhole Shear-Wave Field Data
(86.2' – 98.7' bgs)

Raw Data



```
GEOMETRICS                                                StrataView
 READ FROM KNIK-07.DAT                                18:58:37 14/JUL/2005
 LINE NUMBER 1                GROUP INTERVAL 0.00
 SHOT LOC -0.25            PHONE  1 LOC 87.50          PHONE 24 LOC 100.00
 SAMPLE INTERVAL   125 uS      RECORD LEN  256 MS              DELAY    0 MS
 ACQ FILT   LO CUT 0HZ    NOTCH 0HZ                               STACKS   6
 DISP FILT   OUT           OUT                                  FIXED GAIN
     1    2    5    6    9    10   13   14   17   18   21   22
     51   51   51   51   51   51   51   51   51   51   51   51
```

Filtered Data

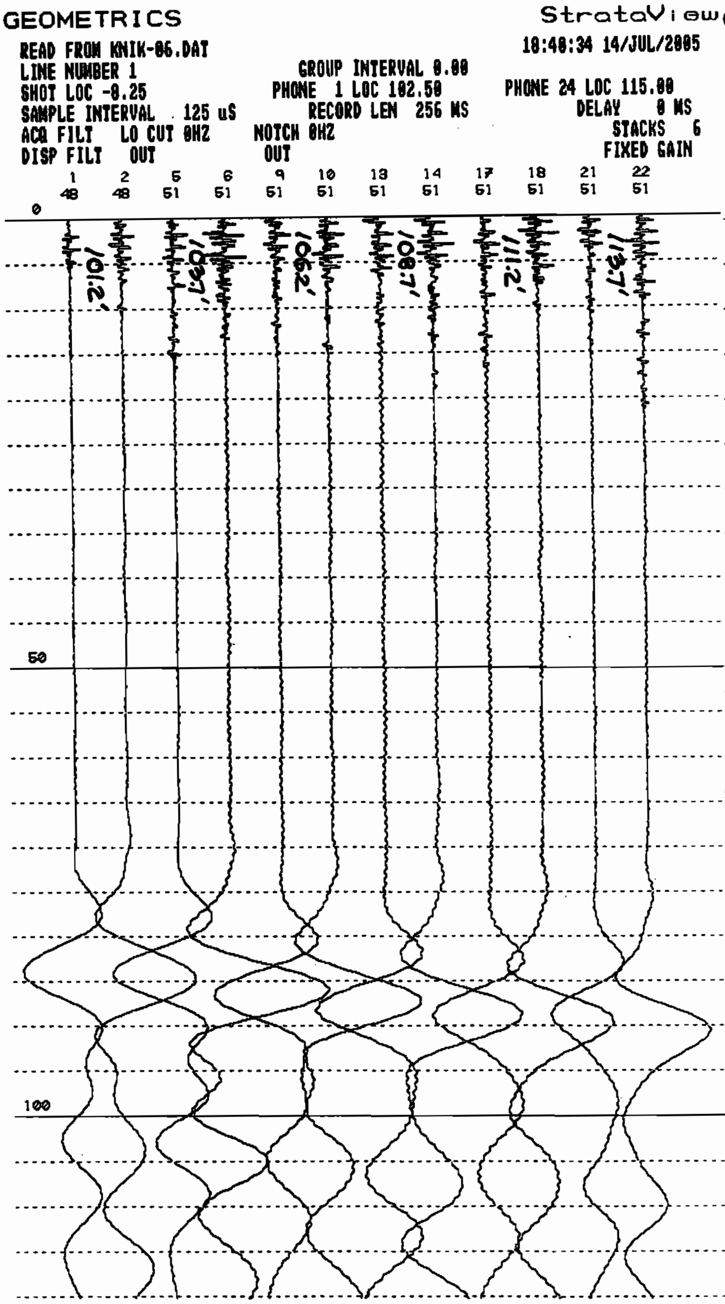


```
GEOMETRICS                                                StrataView
 READ FROM KNIK-07.DAT                                18:58:37 14/JUL/2005
 LINE NUMBER 1                GROUP INTERVAL 0.00
 SHOT LOC -0.25            PHONE  1 LOC 87.50          PHONE 24 LOC 100.00
 SAMPLE INTERVAL   125 uS      RECORD LEN  256 MS              DELAY    0 MS
 ACQ FILT   LO CUT 0HZ    NOTCH 0HZ                               STACKS   6
 DISP FILT   HI CUT 100HZ   OUT                                 FIXED GAIN
     1    2    5    6    9    10   13   14   17   18   21   22
     51   51   51   51   51   51   51   51   51   51   51   51
```

Knik Arm Crossing
Point MacKenzie, Alaska
Boring B-1
July 14, 2005

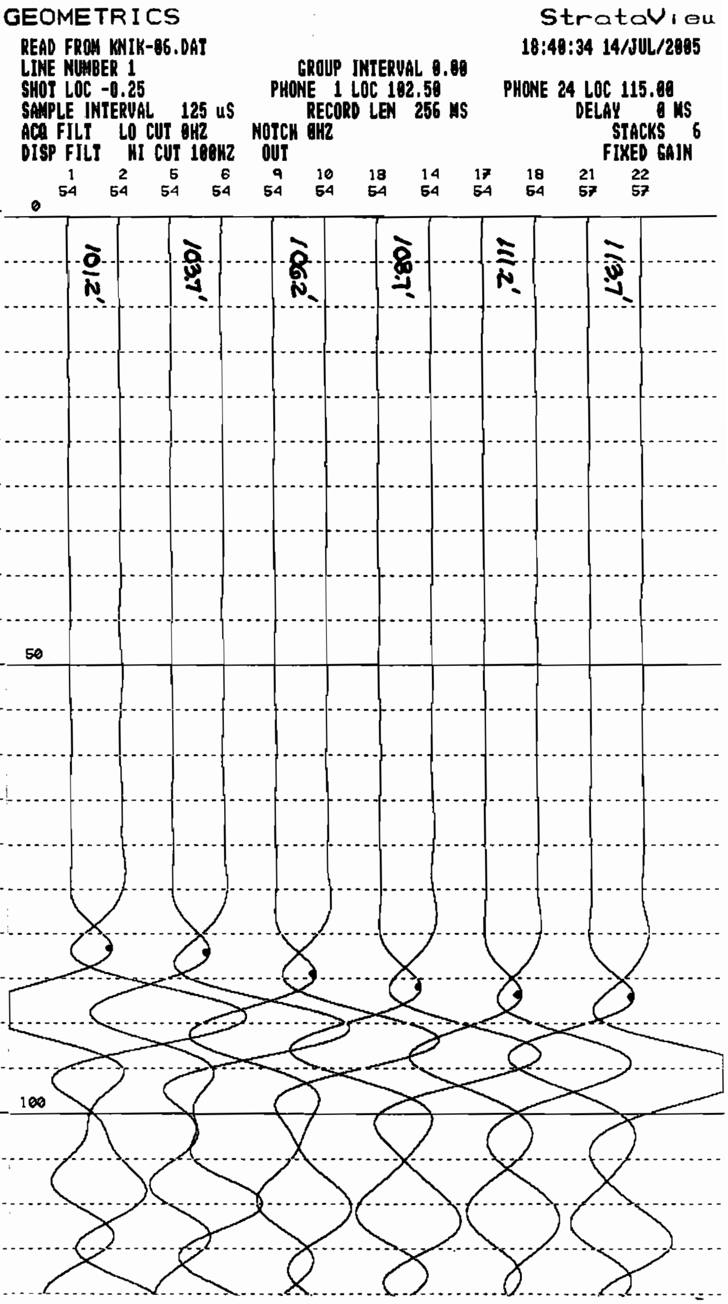
Downhole Shear-Wave Field Data
(101.2' – 113.7' bgs)

Raw Data



```
GEOMETRICS                                                    StrataView
  READ FROM KNIK-06.DAT                                 10:40:34 14/JUL/2005
  LINE NUMBER 1                      GROUP INTERVAL 0.00
  SHOT LOC -0.25                PHONE  1 LOC 102.50       PHONE 24 LOC 115.00
  SAMPLE INTERVAL   125 uS           RECORD LEN  256 MS          DELAY    0 MS
  ACQ FILT   LO CUT 0HZ       NOTCH 0HZ                           STACKS   6
  DISP FILT   OUT              OUT                                FIXED GAIN
```

Filtered Data

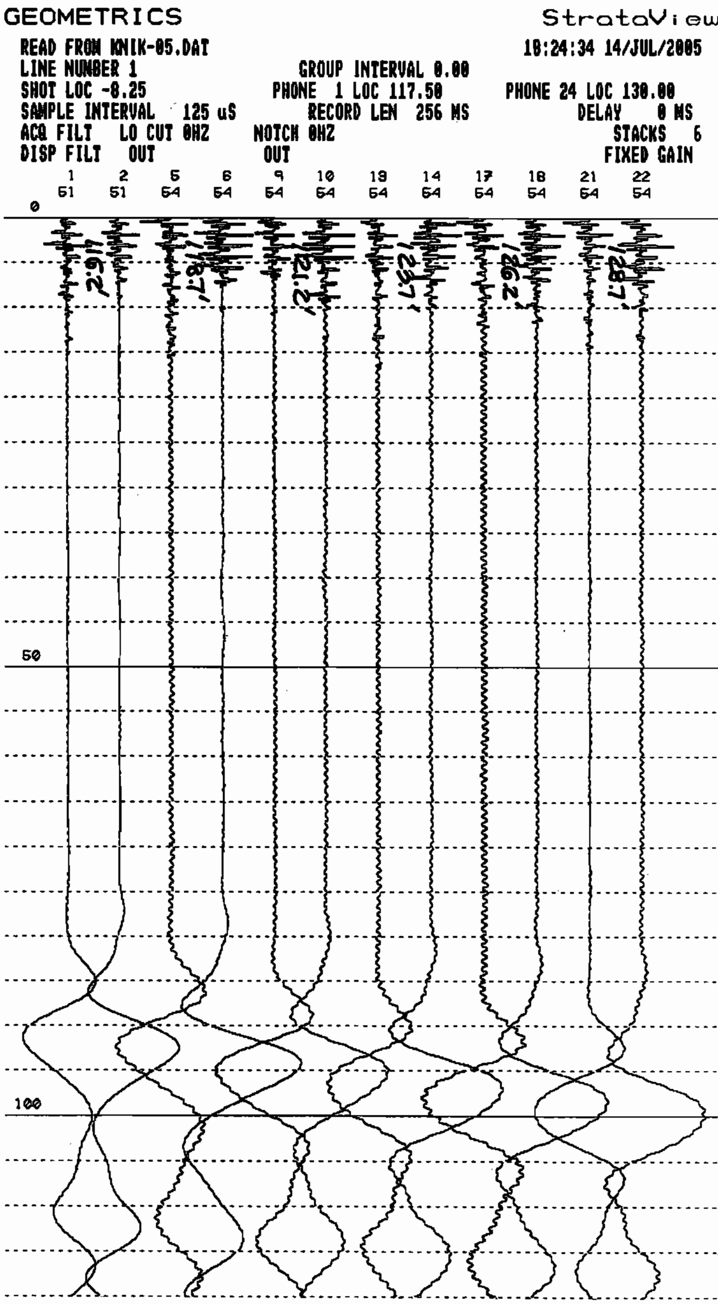


```
GEOMETRICS                                                    StrataView
  READ FROM KNIK-06.DAT                                 10:40:34 14/JUL/2005
  LINE NUMBER 1                      GROUP INTERVAL 0.00
  SHOT LOC -0.25                PHONE  1 LOC 102.50       PHONE 24 LOC 115.00
  SAMPLE INTERVAL   125 uS           RECORD LEN  256 MS          DELAY    0 MS
  ACQ FILT   LO CUT 0HZ       NOTCH 0HZ                           STACKS   6
  DISP FILT   HI CUT 100HZ   OUT                                  FIXED GAIN
```

Knik Arm Crossing
Point MacKenzie, Alaska
Boring B-1
July 14, 2005

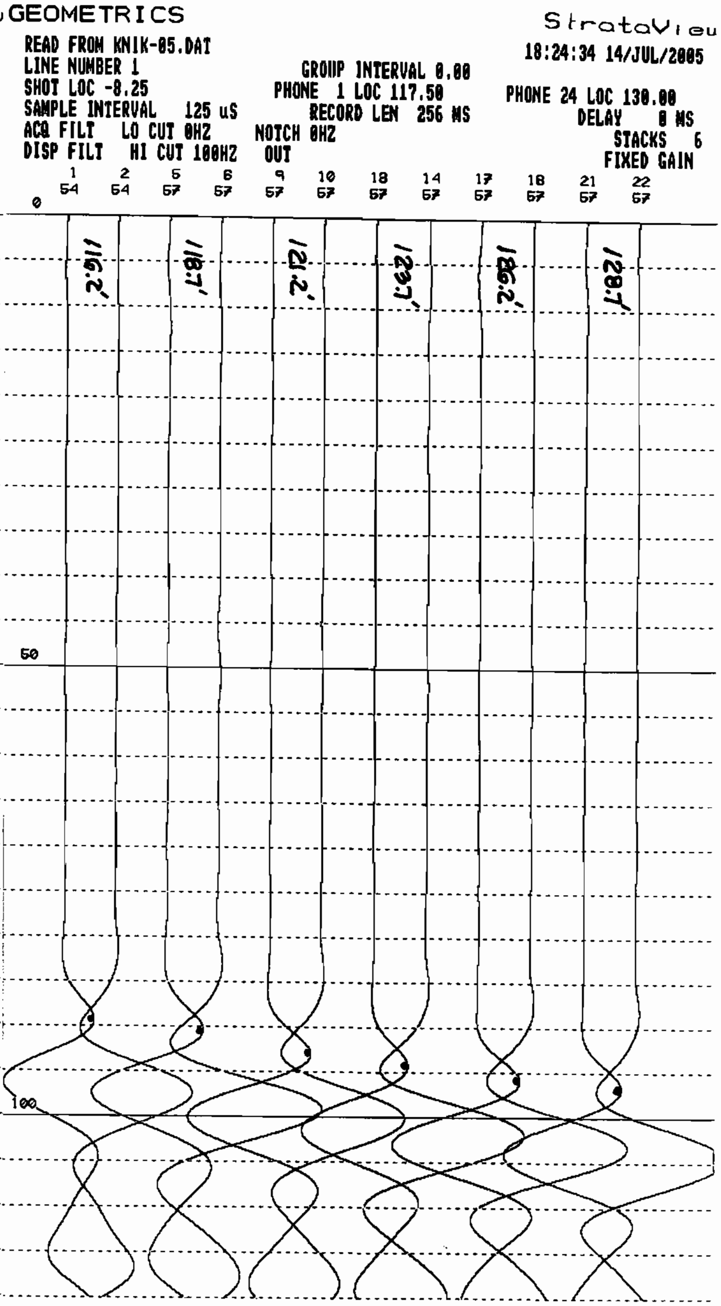
Downhole Shear-Wave Field Data
(116.2' – 128.7' bgs)

Raw Data



```
GEOMETRICS                                                          StrataView
 READ FROM KNIK-05.DAT                                        18:24:34 14/JUL/2005
 LINE NUMBER 1                    GROUP INTERVAL 0.00
 SHOT LOC -8.25                 PHONE  1 LOC 117.50        PHONE 24 LOC 130.00
 SAMPLE INTERVAL   125 uS         RECORD LEN  256 MS              DELAY    0 MS
 ACQ FILT   LO CUT 0HZ     NOTCH 0HZ                                 STACKS   6
 DISP FILT   OUT            OUT                                     FIXED GAIN
```

Filtered Data

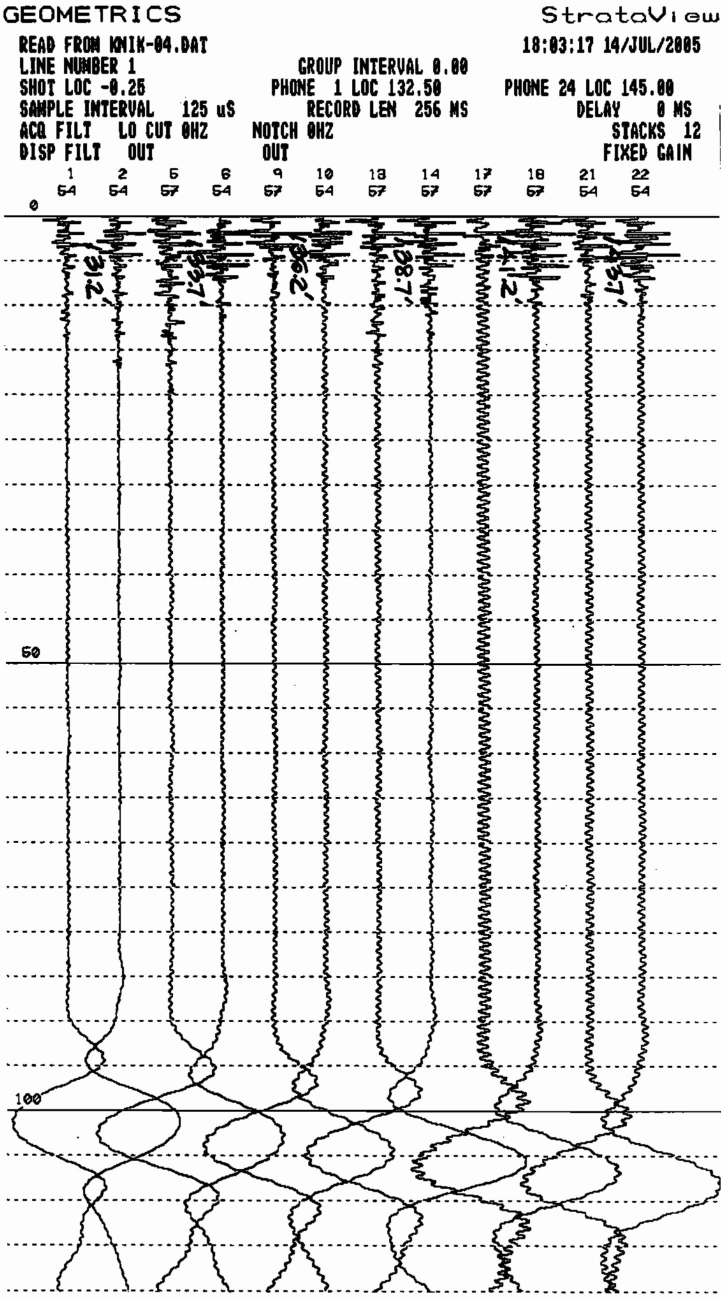


```
GEOMETRICS                                                          StrataView
 READ FROM KNIK-05.DAT                                        18:24:34 14/JUL/2005
 LINE NUMBER 1                    GROUP INTERVAL 0.00
 SHOT LOC -8.25                 PHONE  1 LOC 117.50        PHONE 24 LOC 130.00
 SAMPLE INTERVAL   125 uS         RECORD LEN  256 MS              DELAY    0 MS
 ACQ FILT   LO CUT 0HZ     NOTCH 0HZ                                 STACKS   6
 DISP FILT   HI CUT 100HZ   OUT                                     FIXED GAIN
```

Knik Arm Crossing
Point MacKenzie, Alaska
Boring B-1
July 14, 2005

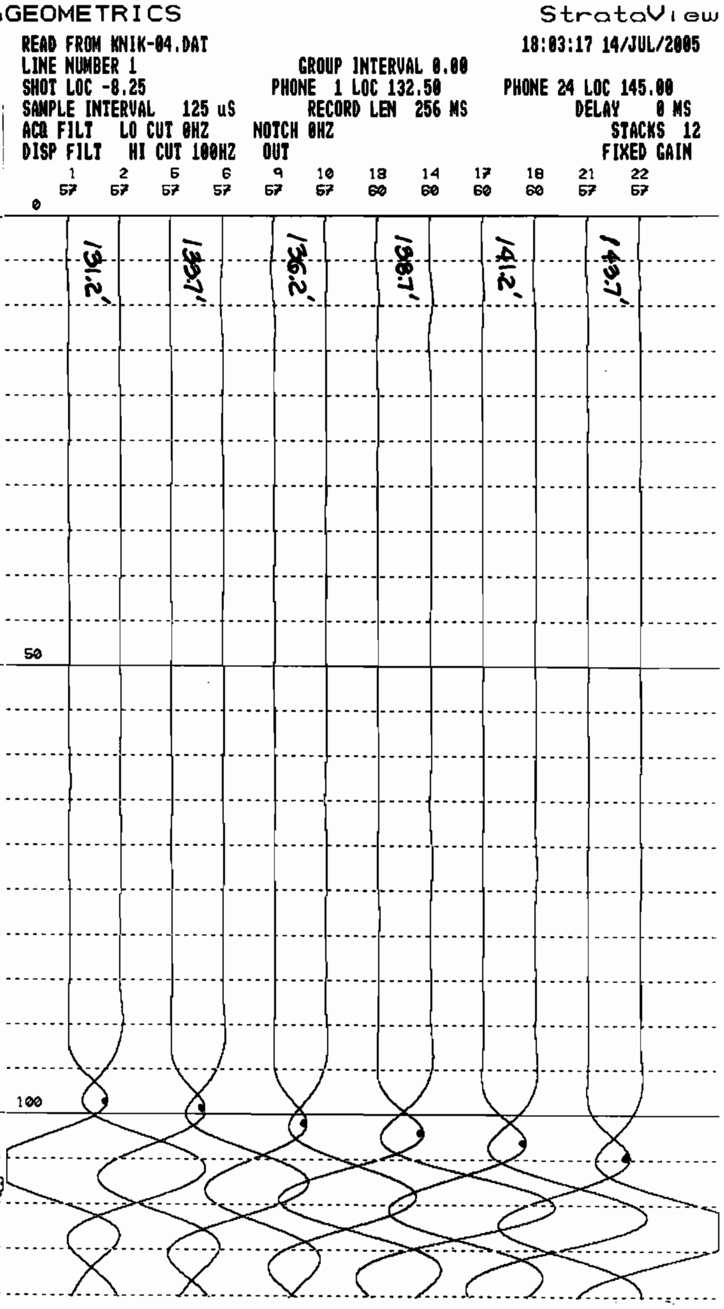
Downhole Shear-Wave Field Data
(131.2' – 143.7' bgs)

Raw Data



```
GEOMETRICS                                                  StrataView
 READ FROM KNIK-04.DAT                                 18:03:17 14/JUL/2005
 LINE NUMBER 1                 GROUP INTERVAL 0.00
 SHOT LOC -0.25              PHONE  1 LOC 132.50     PHONE 24 LOC 145.00
 SAMPLE INTERVAL   125 uS      RECORD LEN  256 MS              DELAY    0 MS
 ACQ FILT   LO CUT 0HZ     NOTCH 0HZ                           STACKS  12
 DISP FILT   OUT            OUT                                FIXED GAIN
```

Filtered Data

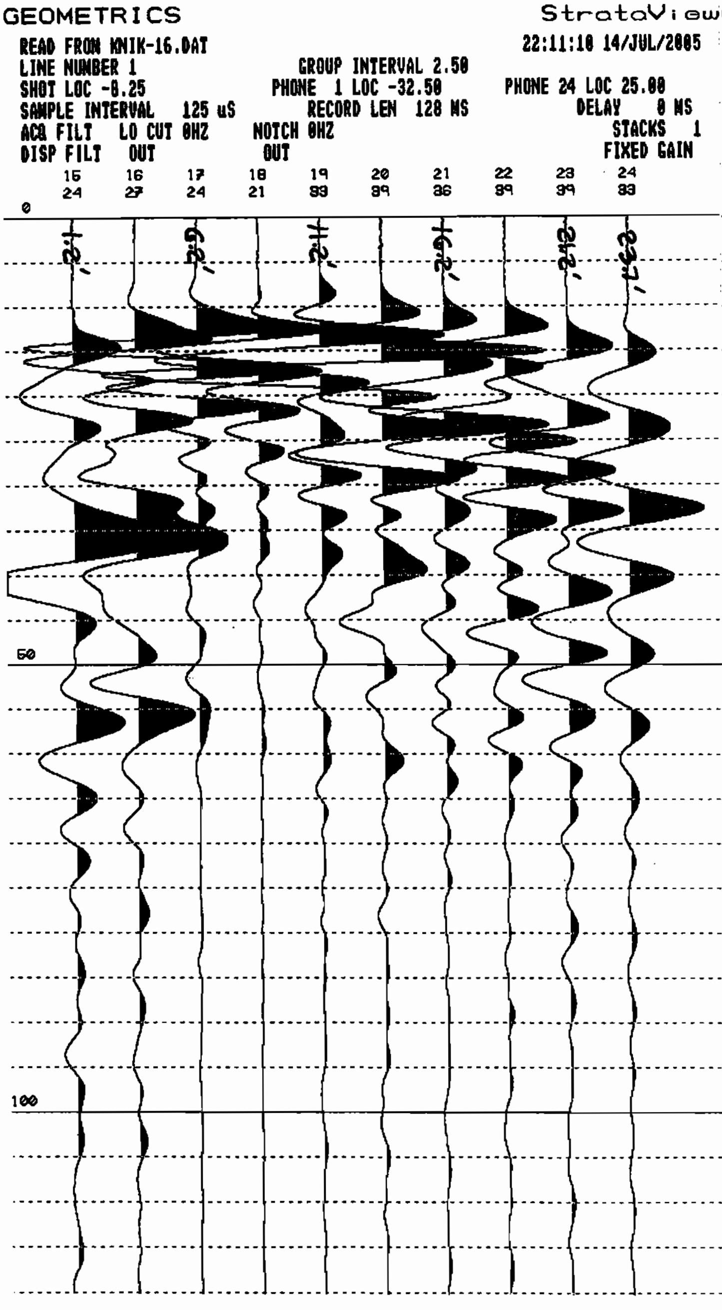


```
GEOMETRICS                                                  StrataView
 READ FROM KNIK-04.DAT                                 18:03:17 14/JUL/2005
 LINE NUMBER 1                 GROUP INTERVAL 0.00
 SHOT LOC -0.25              PHONE  1 LOC 132.50     PHONE 24 LOC 145.00
 SAMPLE INTERVAL   125 uS      RECORD LEN  256 MS              DELAY    0 MS
 ACQ FILT   LO CUT 0HZ     NOTCH 0HZ                           STACKS  12
 DISP FILT   HI CUT 100HZ   OUT                                FIXED GAIN
```

Knik Arm Crossing
Point MacKenzie, Alaska
Boring B-1
July 14, 2005

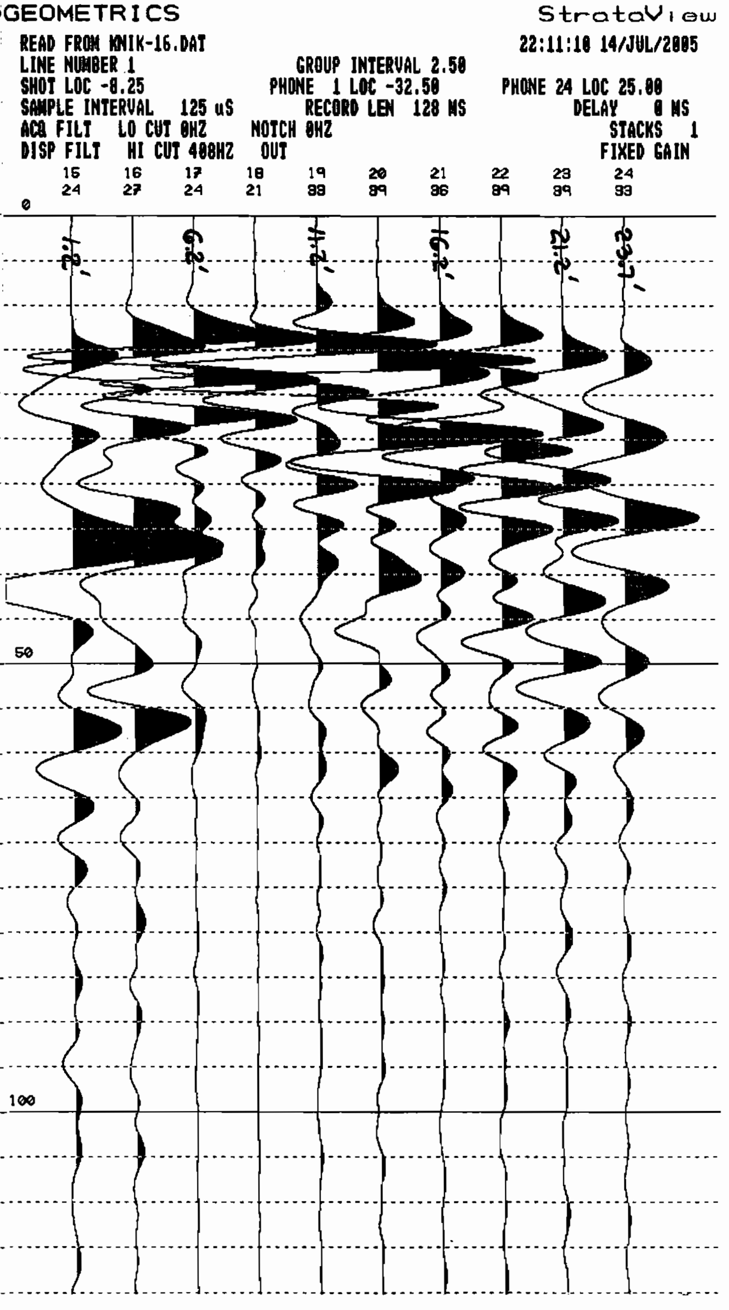
Downhole Compression-Wave Field Data
(1.2' – 23.7' bgs)

Raw Data



```
GEOMETRICS                                                  StrataView
READ FROM KNIK-16.DAT                                   22:11:10 14/JUL/2005
LINE NUMBER 1                   GROUP INTERVAL 2.50
SHOT LOC -0.25                PHONE  1 LOC -32.50       PHONE 24 LOC 25.00
SAMPLE INTERVAL   125 uS        RECORD LEN  128 MS              DELAY    0 MS
ACQ FILT   LO CUT 0HZ     NOTCH 0HZ                               STACKS   1
DISP FILT   OUT            OUT                                  FIXED GAIN
```

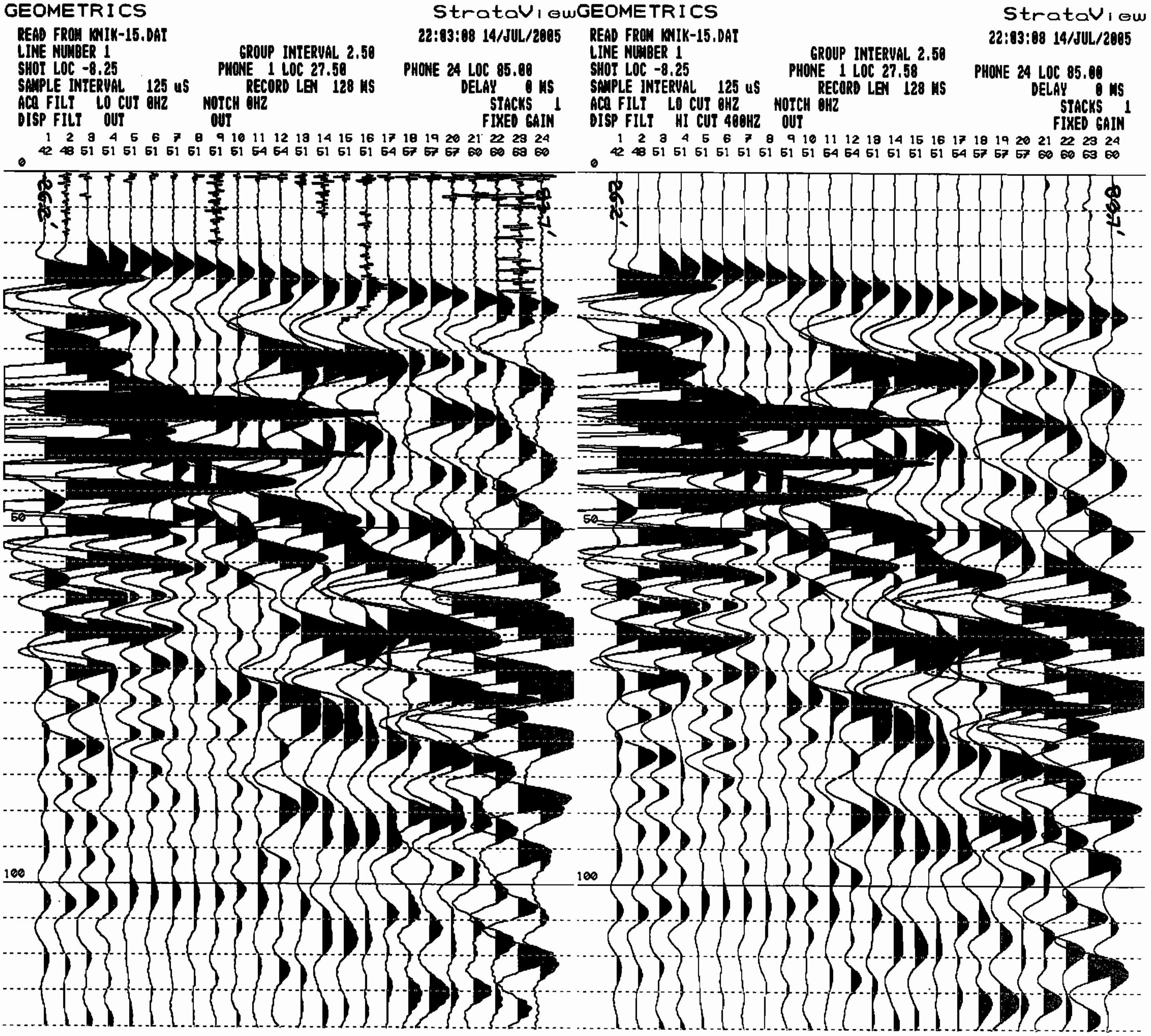
Filtered Data



```
GEOMETRICS                                                  StrataView
READ FROM KNIK-16.DAT                                   22:11:10 14/JUL/2005
LINE NUMBER 1                   GROUP INTERVAL 2.50
SHOT LOC -0.25                PHONE  1 LOC -32.50       PHONE 24 LOC 25.00
SAMPLE INTERVAL   125 uS        RECORD LEN  128 MS              DELAY    0 MS
ACQ FILT   LO CUT 0HZ     NOTCH 0HZ                               STACKS   1
DISP FILT   HI CUT 400HZ   OUT                                  FIXED GAIN
```

Knik Arm Crossing
Point MacKenzie, Alaska
Boring B-1
July 14, 2005

Downhole Compression-Wave Field Data
(26.2' – 83.7' bgs)



Raw Data

```
GEOMETRICS                                            StrataView
 READ FROM KNIK-15.DAT                                22:03:08 14/JUL/2005
 LINE NUMBER 1                  GROUP INTERVAL 2.50
 SHOT LOC -8.25              PHONE  1 LOC 27.50       PHONE 24 LOC 85.00
 SAMPLE INTERVAL   125 uS       RECORD LEN  128 MS          DELAY    0 MS
 ACQ FILT   LO CUT 0HZ     NOTCH 0HZ                           STACKS   1
 DISP FILT   OUT            OUT                              FIXED GAIN
      1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
     42 48 51 51 51 51 51 51 51 51 54 54 51 51 51 51 54 57 57 57 60 60 63 60
 0
```

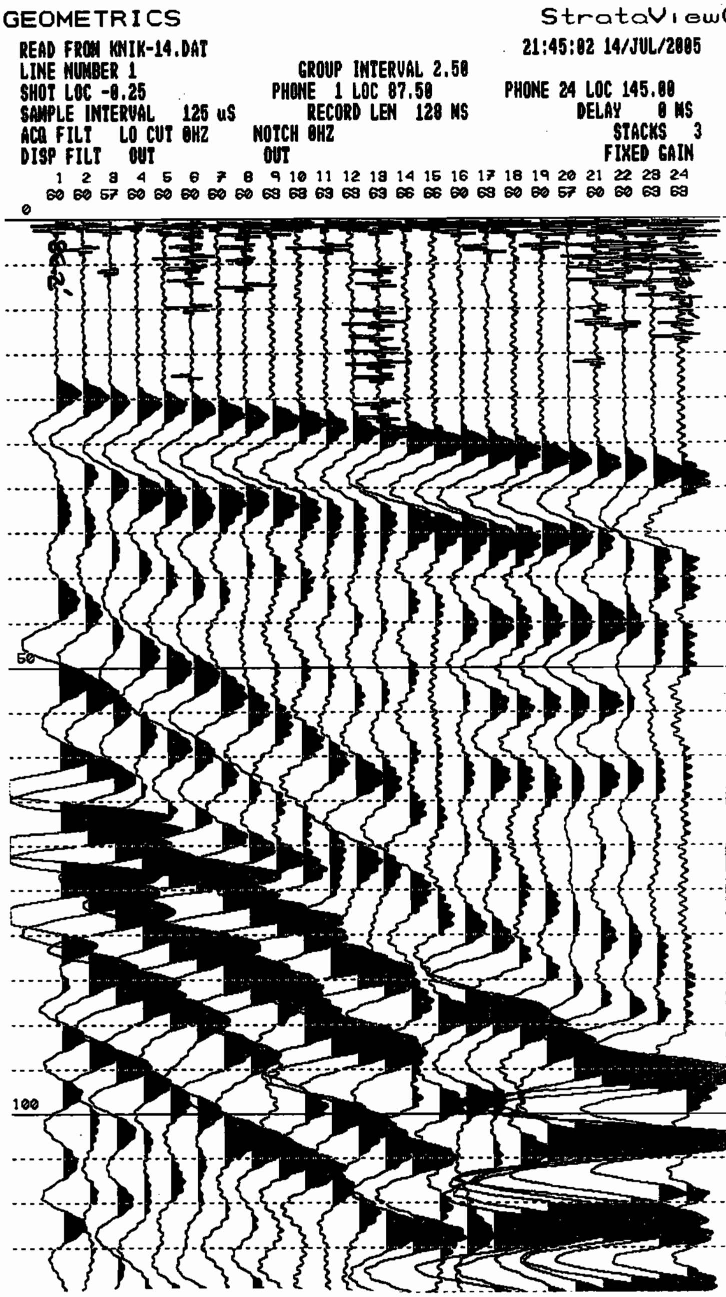
Filtered Data

```
GEOMETRICS                                            StrataView
 READ FROM KNIK-15.DAT                                22:03:08 14/JUL/2005
 LINE NUMBER 1                  GROUP INTERVAL 2.50
 SHOT LOC -8.25              PHONE  1 LOC 27.58       PHONE 24 LOC 85.00
 SAMPLE INTERVAL   125 uS       RECORD LEN  128 MS          DELAY    0 MS
 ACQ FILT   LO CUT 0HZ     NOTCH 0HZ                           STACKS   1
 DISP FILT   HI CUT 400HZ   OUT                              FIXED GAIN
      1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
     42 48 51 51 51 51 51 51 51 51 54 54 51 51 51 51 54 57 57 57 60 60 63 60
 0
```

Knik Arm Crossing
Point MacKenzie, Alaska
Boring B-1
July 14, 2005

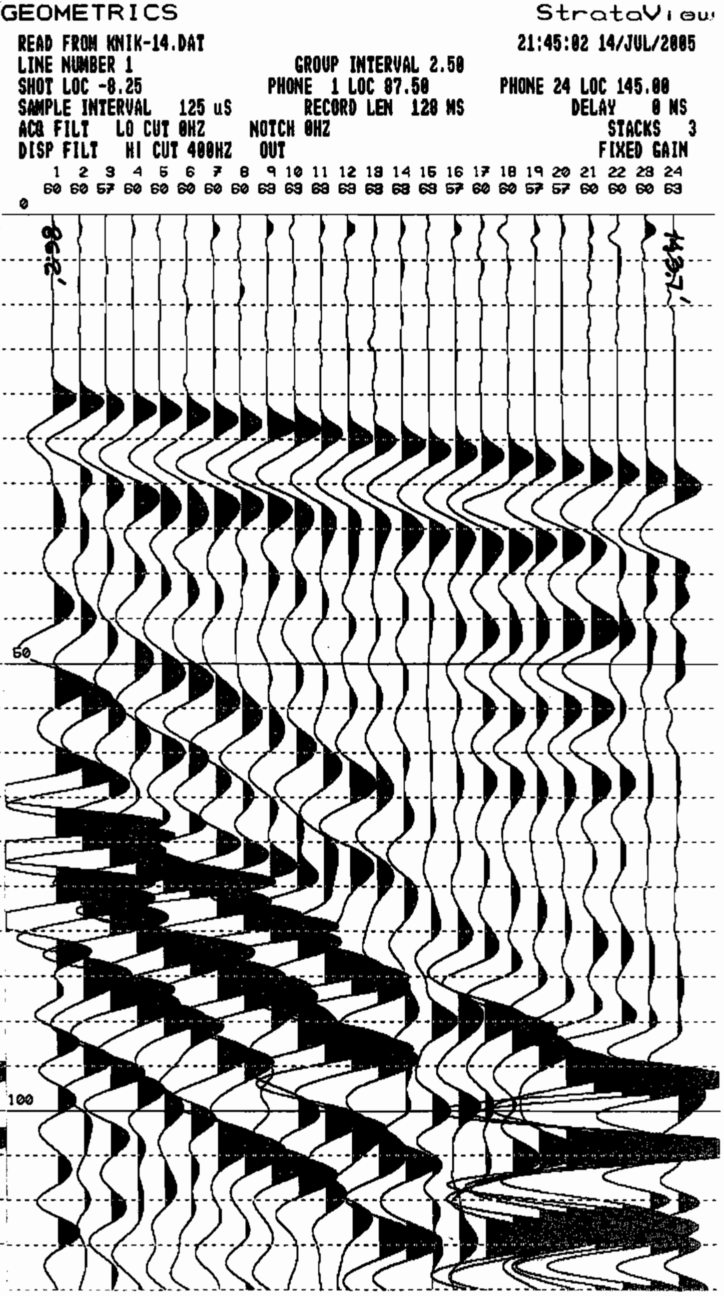
Downhole Compression-Wave Field Data
(86.2' – 143.7' bgs)

Raw Data



```
GEOMETRICS                                               StrataView
 READ FROM KNIK-14.DAT                                21:45:02 14/JUL/2005
 LINE NUMBER 1                  GROUP INTERVAL 2.50
 SHOT LOC -0.25              PHONE  1 LOC 87.50      PHONE 24 LOC 145.00
 SAMPLE INTERVAL   125 uS        RECORD LEN  120 MS              DELAY    0 MS
 ACQ FILT   LO CUT 0HZ      NOTCH 0HZ                             STACKS   3
 DISP FILT   OUT               OUT                               FIXED GAIN
```

Filtered Data



```
GEOMETRICS                                               StrataView
 READ FROM KNIK-14.DAT                                21:45:02 14/JUL/2005
 LINE NUMBER 1                  GROUP INTERVAL 2.50
 SHOT LOC -0.25              PHONE  1 LOC 87.50      PHONE 24 LOC 145.00
 SAMPLE INTERVAL   125 uS        RECORD LEN  120 MS              DELAY    0 MS
 ACQ FILT   LO CUT 0HZ      NOTCH 0HZ                             STACKS   3
 DISP FILT   HI CUT 400HZ   OUT                                  FIXED GAIN
```

APPENDIX I

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL/ENVIRONMENTAL REPORT

Important Information About Your Geotechnical/Environmental Report

CONSULTING SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND FOR SPECIFIC CLIENTS.

Consultants prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your consultant prepared your report expressly for you and expressly for the purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the consultant. No party should apply this report for any purpose other than that originally contemplated without first conferring with the consultant.

THE CONSULTANT'S REPORT IS BASED ON PROJECT-SPECIFIC FACTORS.

A geotechnical/environmental report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. Depending on the project, these may include: the general nature of the structure and property involved; its size and configuration; its historical use and practice; the location of the structure on the site and its orientation; other improvements such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask the consultant to evaluate how any factors that change subsequent to the date of the report may affect the recommendations. Unless your consultant indicates otherwise, your report should not be used: (1) when the nature of the proposed project is changed (for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one, or chemicals are discovered on or near the site); (2) when the size, elevation, or configuration of the proposed project is altered; (3) when the location or orientation of the proposed project is modified; (4) when there is a change of ownership; or (5) for application to an adjacent site. Consultants cannot accept responsibility for problems that may occur if they are not consulted after factors which were considered in the development of the report have changed.

SUBSURFACE CONDITIONS CAN CHANGE.

Subsurface conditions may be affected as a result of natural processes or human activity. Because a geotechnical/environmental report is based on conditions that existed at the time of subsurface exploration, construction decisions should not be based on a report whose adequacy may have been affected by time. Ask the consultant to advise if additional tests are desirable before construction starts; for example, groundwater conditions commonly vary seasonally.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes, or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical/environmental report. The consultant should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

MOST RECOMMENDATIONS ARE PROFESSIONAL JUDGMENTS.

Site exploration and testing identifies actual surface and subsurface conditions only at those points where samples are taken. The data were extrapolated by your consultant, who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your consultant can work together to help reduce their impacts. Retaining your consultant to observe subsurface construction operations can be particularly beneficial in this respect.

A REPORT'S CONCLUSIONS ARE PRELIMINARY.

The conclusions contained in your consultant's report are preliminary because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Actual subsurface conditions can be discerned only during earthwork; therefore, you should retain your consultant to observe actual conditions and to provide conclusions. Only the consultant who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations based on those conclusions are valid and whether or not the contractor is abiding by applicable recommendations. The consultant who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

THE CONSULTANT'S REPORT IS SUBJECT TO MISINTERPRETATION.

Costly problems can occur when other design professionals develop their plans based on misinterpretation of a geotechnical/environmental report. To help avoid these problems, the consultant should be retained to work with other project design professionals to explain relevant geotechnical, geological, hydrogeological, and environmental findings, and to review the adequacy of their plans and specifications relative to these issues.

BORING LOGS AND/OR MONITORING WELL DATA SHOULD NOT BE SEPARATED FROM THE REPORT.

Final boring logs developed by the consultant are based upon interpretation of field logs (assembled by site personnel), field test results, and laboratory and/or office evaluation of field samples and data. Only final boring logs and data are customarily included in geotechnical/environmental reports. These final logs should not, under any circumstances, be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process.

To reduce the likelihood of boring log or monitoring well misinterpretation, contractors should be given ready access to the complete geotechnical engineering/environmental report prepared or authorized for their use. If access is provided only to the report prepared for you, you should advise contractors of the report's limitations, assuming that a contractor was not one of the specific persons for whom the report was prepared, and that developing construction cost estimates was not one of the specific purposes for which it was prepared. While a contractor may gain important knowledge from a report prepared for another party, the contractor should discuss the report with your consultant and perform the additional or alternative work believed necessary to obtain the data specifically appropriate for construction cost estimating purposes. Some clients hold the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes that aggravate them to a disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY.

Because geotechnical/environmental engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, consultants have developed a number of clauses for use in their contracts, reports and other documents. These responsibility clauses are not exculpatory clauses designed to transfer the consultant's liabilities to other parties; rather, they are definitive clauses that identify where the consultant's responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.

The preceding paragraphs are based on information provided by the
ASFE/Association of Engineering Firms Practicing in the Geosciences, Silver Spring, Maryland