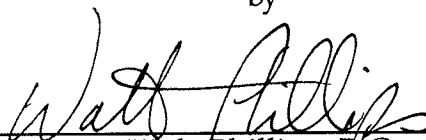


A report prepared for

HDR Engineering, Inc.
2525 C St., Suite 305
Anchorage, Ak 99503

GEOTECHNICAL INVESTIGATION
Airport Material Sites
Noorvik, Alaska

by



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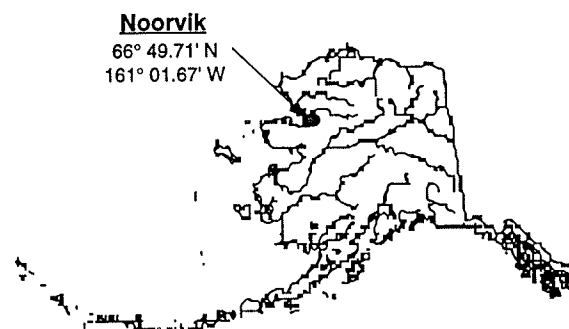
INTRODUCTION

The State of Alaska Department of Transportation and Public Facilities (DOT&PF) is planning to build a new airport complex near the community of Noorvik. Bank erosion along the Kobuk River is threatening the existing facility. Sources of unclassified and select material are needed for this project.

Historically, fine grained material has been obtained from an island sand bar upstream from Noorvik, from a point bar right in front of the community and from a nearby lake bottom. The lake bottom material was of poor quality and the other sites are either exhausted or no longer available for use.

A small DOT&PF materials site is present approximately six miles east of the community of Noorvik, near the western base of Hotham Peak. Access from Noorvik is by winter trail only. Material from this site was used successfully in construction of the airport extension. Because this pit is located so far from town and because it is presently accessible only in late winter, via an ice/snow road, it has not been utilized since the work on the airstrip was completed.

Suitable material could be imported but this would be expensive and may require several seasons to accomplish. Local source options include the river bar deposits near the summer dump, just downstream from the community (DOT&PF Site 3) and the terrace deposits adjacent to the existing Hotham Peak pit (DOT&PF Site D). The present investigation was undertaken in an effort to expand our knowledge of the soil characteristics at these two sites and to determine if sufficient usable embankment material is locally available to construct the proposed new airport. The project areas are located on land controlled by the City of Noorvik and the NANA Native Corporation.



REGIONAL SETTING

The Kobuk River Delta forms part of the Kobuk-Selawik Lowland which consists primarily of the broad flood plains and deltas of the Kobuk and Selawik Rivers and the intervening lake dotted lowlands. Most of the lowland areas are underlain by moraine deposits which are often mantled by thick stream and lake deposits. Away from the active river channels, thick organic surface deposits are common. Permafrost is present throughout the area but is discontinuous near large bodies of water. Drainage is often poor due to the low topographic gradient. Most streams on the delta are sluggish and meandering and have numerous side sloughs.

East of the delta, undifferentiated glacial and glacio-fluvial deposits have resulted in a gently rolling terrain with rounded knolls. Relief is on the order of 50 to 100 feet. This subdued glacial terrain is generally overlain by thick sequences of wind blown silt and organic material. Further to the east, Hotham Peak (which rises to over 1600 feet) is composed of Cretaceous sedimentary rock.

The climate in the Noorvik area is influenced somewhat by the maritime storms from the west but overall precipitation is very low, and winter conditions are generally cold and windy. The Environmental Atlas of Alaska, 1978, shows a mean average temperature of 21.5° F. Annual precipitation is only about 8 inches but up to four feet of annual snowfall is normal. Snow accumulation on the ground, however, is much less due to persistent winter winds and snow drifting can be significant.

Vegetation in the area is comprised primarily of wet tundra plants, sedges and dwarf shrubs. Black spruce grow on the delta and birch, willow and alder groves are present along major drainage areas.

EXPLORATION PLAN

The present geotechnical investigation has been undertaken in an effort to expand our knowledge of the soil characteristics on the river bar downstream from the community and on the terrace in the vicinity of the existing Hotham Peak pit. Our goal was to determine if earthen material suitable for access road and airport runway construction is locally available. Material is needed to construct the proposed new airport as well as the six-mile all weather road that will be needed to make operation of the Hotham Peak site feasible as a year round source of material.

In preparation for the field work we reviewed existing DOT&PF information, studied existing airphoto imagery, and interviewed several local residents to gain an overall perspective of the project area.

A 1973 field study by the State of Alaska Division of Aviation (now DOT&PF) was the first documented material source study in the Hotham Peak area. Fine sandy gravel and gravelly sand were reported to be present just west of the main drainage way that runs at the base of Hotham Peak. Three test holes, drilled to 35 feet as part of that project, encountered 1.5 to 3.75 feet of silty overburden over frost bonded granular material. The locations of the holes are shown on Plate HP-1. On the basis of that study it was estimated that 100,000 cubic yards of material suitable for topping was available.

A report describing the results of a 1976 DOT&PF materials source study in the Noorvik area indicated that material near the river (DOT&PF Site 3) contained a higher percentage of sand than that at the airport or in the nearby lake bottom borrow source. The 1976 report also referred to the Hotham Peak source but mentioned no new field work in that area. That report did note that at least one sample collected in 1973 had 13% fines which did not meet the specification for topping material.

From an airplane in May and then on foot in August, 1996, Matt Desalernos (DOT&PF Western District Design Engineer) conducted a field reconnaissance of the Hotham Peak area and concluded that the potential was high for expanding the existing pit and, if necessary, opening new pits on similar topographic features.

Two drilling plans were laid out: Phase 1 would extend our knowledge of subsurface conditions at the existing DOT&PF Site 3 for a mile or more downstream from Noorvik, and Phase 2 would evaluate the granular material and overburden silt at the Hotham Peak Site (DOT&PF Site D).

Phase 1 was limited to exploring for fine grained fill material on the low river terrace immediately downstream from town. The Phase 1 field work was scheduled for late November, 1996, using a small back-pack drill, as outlined in the exploration plan submitted to HDR on October 6, 1996.

The observations of Mr. Desalernos, supported by the stereo evaluation of 1993 color aerial photos (1"=833'), led to the formulation of the Phase 2 study plan. The second phase focused primarily on the coarser granular at the Hotham Peak site. In addition, an evaluation of the overburden silt at that site was made to determine its suitability for use as unclassified fill. Phase 2 work was originally scheduled for February or March, 1997 but because of local equipment difficulties it was rescheduled for April. The work was conducted in general accordance with the revised exploration plan submitted to HDR on March 11, 1997. In Phase 2, a standard geotechnical drill capable of drilling to 40 feet in frozen granular material and equipped for penetration testing was specified. Site preparation and drill transport was to be accomplished with a tracked dozer.

The vicinity map (Plate 1) at the end of this report shows the relationship of each of the study areas to the community of Noorvik and to the proposed airport facility.

During the planning and execution of each phase we coordinated activities with Mr. Duane Hippe, P.E., of HDR. Ms. Susan Walker of the HDR Anchorage office coordinated our activities with DOT&PF and provided permitting and logistical support. Mr. Glen Skin, Noorvik City Administrator, was very helpful in arranging for local hire and housing support.

Mr. Walter T. Phillips, PG was in charge of the field activities during the Phase 1 work and Mr. Ethan Birkholtz, DOT&PF Northern Region, was on site during much of that investigation. Mr. Thomas Pungalik acted as local guide, snow machine driver, and driller's helper. In Phase 2, Mr. Thomas Culkin supervised the field work, accompanied by Mr. Matt Desalernos from DOT&PF.

Mr. Elmer Pungalik acted as local guide & snow machine driver and Mr. Fred Jack directed the K. I. C. activities related to drill rig transport during the April, 1997 program.

NAZURUK CHANNEL SAND BAR SITE

Location and Access

The Sand Bar Site is a southerly extension of an existing DOT&PF material source (Site 3) which is located on the eastern edge of the Nazuruk Channel, just south of Noorvik. The intent was to explore and hopefully extend this sand source for a mile or so downstream. Early in the investigation, however, it became apparent that soil conditions to the south were less suitable than anticipated so the focus of the investigation was altered (in consultation with Mr. Birkholtz) to better delineate the more suitable soils north of the existing Summer Dump.

The existing road to the dump provides access to this borrow area from downtown Noorvik. Winter trails would have to be improved to allow summer haulage to the proposed airport site.

Historic Use

Embankment material for the present airport was taken in part from the low river terrace just north of town. The more recent construction of the cross-wind runway also utilized material from a similar terrace immediately downstream from town (DOT&PF Site 3).

Field Exploration

Field work began on November 12, 1996. Over a period of three days, new subsurface information was obtained at 16 locations in the vicinity of the proposed material site. Depth of exploration ranged from 3 to 18 feet, depending on subsurface conditions. Plate NC-1 shows the location of each boring.

Terrain conditions and time constraints prevented the use of heavy, mechanized equipment over much of the area, so subsurface exploration was limited to what could be accomplished with a hand-held back-pack drill. A 2.5-horsepower powerhead drill, owned and operated by Inanda Placer of Fairbanks was used for drilling and sampling. Sampling was conducted by grabbing samples from the auger bit and by coring using a 2-inch O.D. split barrel with a

carbide tipped bit. A 2-inch auger with a 2.5-inch cutting head was used. Depth of investigation was sometimes limited by drill capabilities.

At key locations, geographic coordinates (latitude and longitude) were obtained with a hand held GPS unit. Each exploration site was located either by GPS, by reference to a GPS located hole or by airphoto interpretation.

Soil type, frost and ground water conditions were noted as each hole was drilled and representative soil samples were collected. Descriptive logs of each boring presented on Plates NC-2 through NC-10. The soils and ice have been classified in accordance with the Unified Soil Classification System presented on Plate NC-11. The boring logs also show the technique used for the collection of each sample.

Laboratory Testing

At the drill site the samples were sealed in plastic bags for shipment to Anchorage for further study. The samples were visually examined in the laboratory to verify the field description and representative samples were selected to test for grain size distribution and natural moisture content. Certain samples were also tested for organic content and representative samples of the silty sand and sandy silt were then combined and tested to determine optimum moisture and density values using a Harvard miniature compaction test.

The results of the natural moisture content tests are graphically shown on the boring logs and are tabulated on the Summary of Samples (Plates NC-12 and NC-13) along with the other test values. The particle size data have been analyzed for size breaks, uniformity and curvature; results of this analysis are presented on Plate NC-14. The optimum moisture and compaction test results are shown on Plate NC-15.

Drainage and Hydrology

Surface drainage on this river terrace is fair to good depending on the underlying thermal condition. Vegetation is sparse on the active bar immediate adjacent to the river and the subsoil is drained, even where frozen. Older portions of the terrace generally support an organic mat that is sometimes a foot or more in thickness. Subsurface moisture contents tend to be higher and a thick willow growth is present.

Immediately west of the summer dump and to the south, an old slough channel is present. This provides limited surface drainage and the material in the channel is saturated beneath a depth of about two feet.

Thermal Conditions

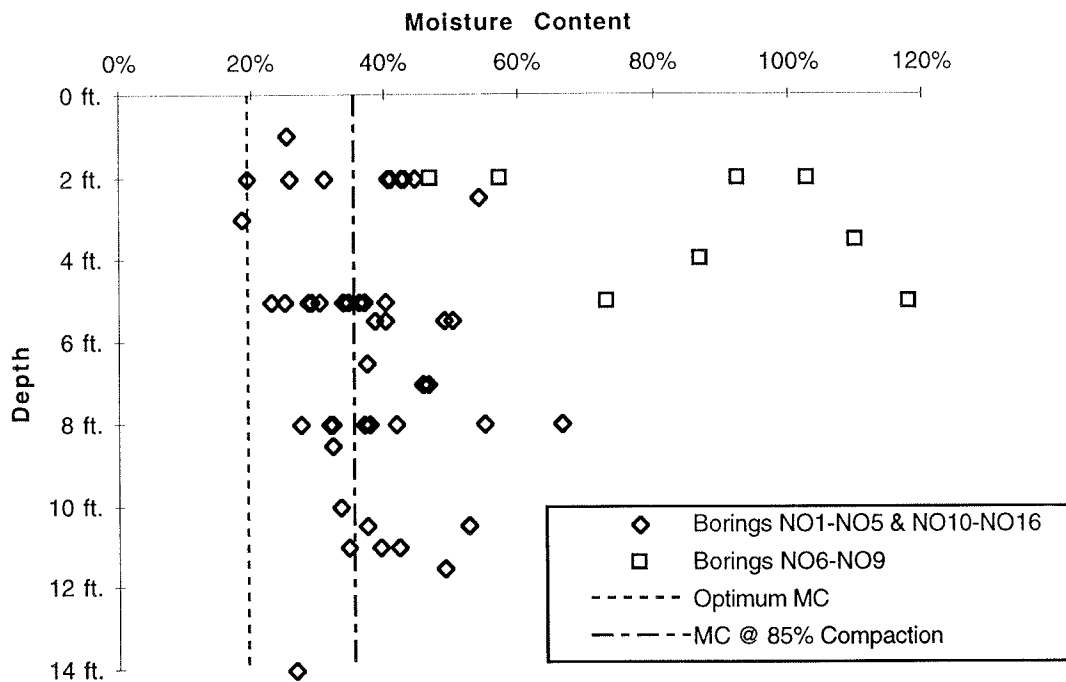
The material in the active bar and north of the summer dump is frozen silt and sandy silt. The material in the old slough channel is saturated unfrozen silt. South of the summer dump and inland from the active bar and intervening slough channel the underlying silt is, in general, frozen but it is ice rich and often contains a significant organic content.

Cobbles and Boulders

Sedimentary accumulation on this deltaic terrace has been limited to fine grained material. No cobbles or boulders were noted during the field investigation.

Quality

The silty sands reported in DOT&PF Site 3 appear to be confined primarily to the recently active river bar that extends to the south along the river edge for half a mile or so. As much as 12 feet of interbedded silty sand and sandy silt is present in this two to three hundred foot wide bar. The percentage of sand lessens somewhat to the south and east. The natural moisture content of the frozen sandy material ranges up to 40%. Interbedded silty layers have moisture contents of 60% or higher. Optimum moisture is on the order of 20% with 35% moisture corresponding to the upper bound for obtaining a relative compaction of 85%. The maximum density obtained in the lab at optimum moisture was 101 pcf. The chart on the following page shows the relationship between natural moisture content and depth for the sand and silt units in the area. Selective mining of the sandy units will be necessary to efficiently utilize this material site.



Inland from the active bar and south of the summer dump, silt and organic silt are the predominant soil types, and segregated ice and moisture contents are generally higher.

Quantity

The usable material in the area north and west of the dump is generally six to twelve feet thick. Overburden ranges from nil next to the river to about one foot at the eastern edge of the lower terrace. Overburden could be stored along the eastern edge of the terrace and it might be used to close out and restore the summer dump.

The sandy silt in the bar next to the river can be mined, but the suitability of material to the east may be limited due to the increased silt content and the presence of wet, unfrozen zones. Wet, unfrozen zones near the drainage swale could make winter excavation more difficult.

If the material from this area is placed in a frozen condition, considerable settlement and temporary loss of strength will occur when it is first thawed.

HOTHAM PEAK TERRACE SITE

Location and Access

A small DOT&PF materials site is located approximately six miles east of the community of Noorvik, near the western base of Hotham Peak. Present access is limited to a six-mile winter trail across the tundra. Due to poor surface drainage in some areas between Noorvik and Hotham Peak, it was necessary to schedule the drill program for late winter to take advantage of the frozen ground and snow cover for heavy equipment transport.

Historic Use

Material from this site was used successfully in construction of the airport extension. Because this pit is located so far from town and because it is presently accessible only in late winter via an ice/snow road, it has not been utilized since the work on the airstrip was completed.

Field Exploration

On April 2, 1997, the drill rig arrived in Noorvik by air, and the drill was moved on site. Following a one day weather delay, subsurface exploration began on April 4th.

The drill, a CME-45, was mounted on a sled. A second smaller sled was used to carry augers and other drill equipment. The drill equipment was supplied and operated by Discovery Drilling of Anchorage. Logistical support was provided by K.I.C. from their base of operations at Kotzebue. Two snow machines and a Caterpillar D-3 were used for transport. The drill rig was moved from site to site by the D-3 and a snow machine pulled the tool sled. The crews were housed in Noorvik and commuted to the project area by snow machine.

Between April 4 and 7, 1997, eleven borings in the vicinity of the proposed material site were drilled and sampled. In addition, the cut bank of the existing pit was examined. Depth of exploration ranged from 6 to 39 feet, depending on subsurface conditions and drill capabilities.

At key locations, geographic coordinates (latitude and longitude) were obtained with a hand held GPS unit. Each exploration site was located either by

GPS, by reference to a GPS located hole or by aerial photo interpretation to geographical features on the ground. The location of each exploration site is shown on Plate HP-1.

Holes were drilled with either 3.5-inch O.D. solid stem or 8-inch O.D. hollow stem augers. As each hole was drilled, the soil type and frost conditions were noted and representative soil samples were collected. Samples of the soil were obtained by driving a 2.5-inch I.D. split barrel sampler and by grab sampling off the augers. The CME-45 was equipped with a cathead and a manual drop hammer. The hammer weighed 340 pounds and had a drop of 30 inches, and blow counts for each 6-inch increment of the drive were recorded. Sampling was generally attempted at five-foot intervals. Drill behavior was also used to estimate changes in strata; cobbles in the strata were logged on the basis of hard and irregular drilling behavior. The samples were sealed in plastic bags for shipment to the laboratory for further evaluation and testing.

A graphic log of each boring drilled in 1997 is presented on Plates HP-2 through HP-12. Re-drafted logs of the three holes drilled by DOT&PF in 1973 (TH-2, 3 & 4) are shown on Plates HP-13 through HP-15. A copy of the original DOT&PF logs is shown on Plate HP-20 and is followed by a copy of the 1973 laboratory data. The soils and ice have been classified on the 1997 logs in accordance with the Unified Soil Classification System presented on Plate HP-16. The boring logs show the type of sampler used and the equivalent SPT-N value of the field blow counts. The field blow counts have been adjusted for the hammer weight and sampler annulus. Each hole was backfilled upon completion. The site was cleaned and all refuse, from lunch bags to broken equipment parts, was carried back to Noorvik for disposal.

Drilling at the Hotham Peak site was quite difficult and midway through the drilling project, a crack in the tower base developed which made it unsafe to apply the downhole pressure needed to penetrate the granular material. As a result of this strength limitation, a number of test holes were terminated at the base of the silt cover and proof of quantity was not obtained for the granular deposit. Sampling capabilities were also limited.

Laboratory Testing

Laboratory testing was conducted in Anchorage. Primary testing included natural moisture content determinations for most samples, visual classification and classification tests (particle size analysis) and specific gravity tests. Degradation, L. A.. Abrasion and modified Proctor (D1557) compaction tests were also run on certain representative samples. Preliminary moisture testing and visual classification was performed by DM&A; other laboratory testing was done by R&M Consultants. The results of the natural moisture content tests are graphically shown on the boring logs and are tabulated on the Summary of Samples (Plate HP-17) along with the other test values. The particle size data have been analyzed for size breaks, uniformity and curvature; results of this analysis are presented on Plates HP-18 and HP-19.

Degradation, L. A.. Abrasion and modified Proctor (D1557) compaction tests were performed on the bulk samples obtained from borings ORV-10 and ORV-11. The degradation value is 38 which is less than the required minimum value of 45 according to the Alaska DOT&PF Standard Specifications for base coarse aggregate, Section 703-2.03. The L. A.. Abrasion value is 28% loss, which is less than the maximum value of 50% according to the same specification. The modified Proctor (D1557) compaction test showed a maximum dry density of 136 pcf at an optimum moisture content of 7.5%. All of the above test data are presented as attachments at the end of this report.

Drainage & Hydrology

Surface drainage on this high terrace is well defined. Subsurface drainage, however, is at least partially blocked by a frozen silt cover. That frozen silt is often over saturated. The granular material beneath the silt cover is also frozen but moisture contents are moderate to low.

Thermal conditions

Beneath a seasonally active layer of a foot or two, permafrost is present throughout the study area. The silt cover is universally frozen and segregated ice is sometimes present. The visible ice content is generally limited to 5% or less. However, several one to two foot sections with as much as 25% ice were observed. In the underlying granular material, the soil moisture content is

generally low so frost bonding is sometimes weak and no significant segregated ice was reported.

Cobbles and Boulders

The gravel fraction is generally smaller than one inch in diameter but gravel to two inches was reported in some layers and scattered cobbles are present especially in the gravelly zones.

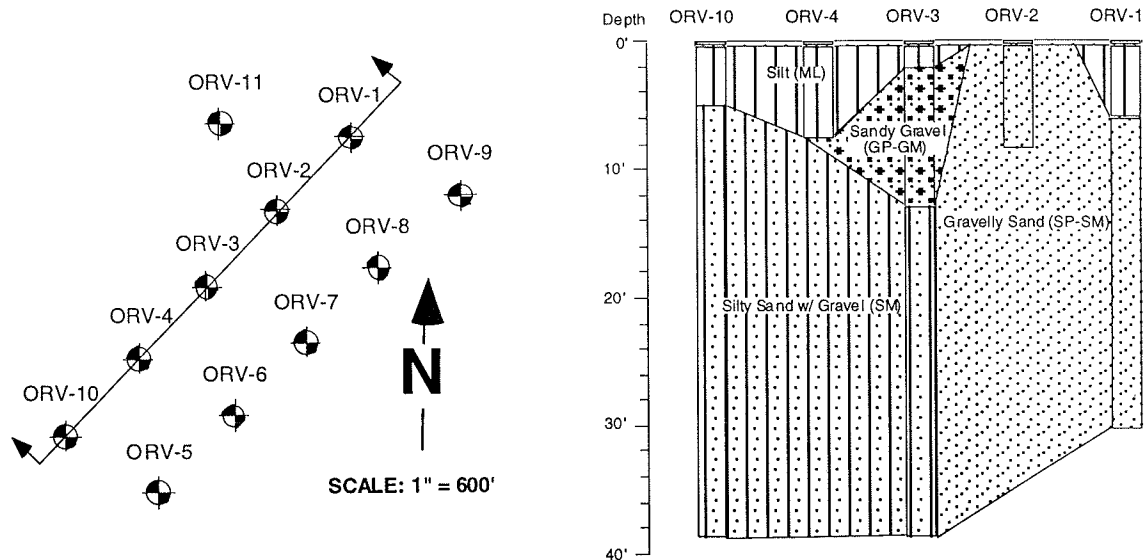
Quality

The area explored is blanketed with a 3 to 4-inch organic mat. Silt overburden depths vary with terrain conditions. At Borings ORV-2 and ORV-9, located on the nose of an east trending ridge, gravelly sand was present directly beneath the organic mat. On each flank of the ridge the silt overburden increased in thickness to about 5 to 7 feet. To the east as much as 14.5 feet of overburden was encountered in Boring ORV-6. The overburden silt sometimes incorporates traces of organic material and scattered pebbles are common.

The lower boundary of the underlying granular material is at least 36 feet deep at Boring ORV-3. The deposit is probably a pro-glacial feature and is composed primarily of a gravelly sand (SP-SM). Grain size distribution within the deposit varies considerably, with interbedded layers of silty sand (SM), sandy gravel (GP-GM) and silty gravel (GM) all present. The silt content of the granular material ranges from 5% to 24% in the 11 holes drilled in 1997. Based on the limited information available, it appears that the silt content increases towards the southern end of the area investigated.

The cross-section on the next page shows the trend in overburden cover and grain size distribution across the deposit from north to south.

Cross-Section of Hotham Peak Investigation



Quantity

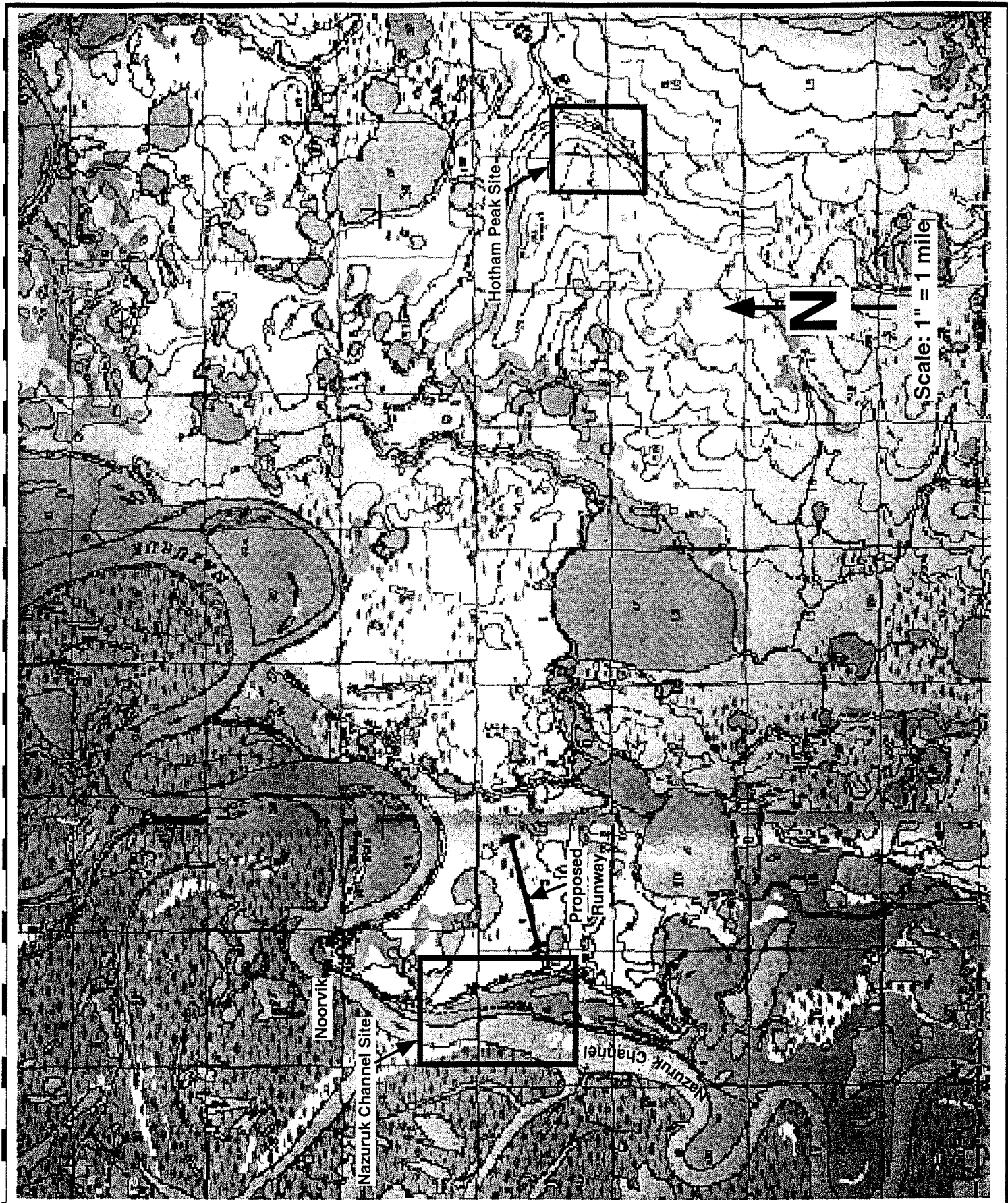
The 1997 field work showed that the existing pit can be expanded. The granular material deposit extends at least 1500 feet, north-south and 500 feet, east-west. The existing working face and deep holes at each end of the investigated area indicate that the granular deposit is on the order of 30 feet thick. Additional probe holes should be drilled as the site is being opened, to prove the quantities.

The working face can initially be quite steep because of frost bonding but final slopes should be 1.5 horizontal to 1.0 vertical or flatter. The working area can probably be left open and drained to the east. The natural moisture content of the granular material is generally low, indicating that in-situ densities are relatively high. On this basis, little shrinkage is anticipated. However, if the material is excavated and placed in a frozen condition, significant settlement should be anticipated the first time the material thaws.

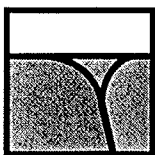
The silt cover deposit ranges in thickness from a few inches to as much as 15 feet. Natural moisture contents range from 30% to 65%. If this material is not

utilized as fill, it may be wasted into the worked out portion of the pit or stockpiled on the flanks of the ridge for use in restoration.

Based on aerial photo studies it appears that borrow conditions similar to those reported in the 1973 DOT&PF report extend intermittently for a mile or more to the southwest.



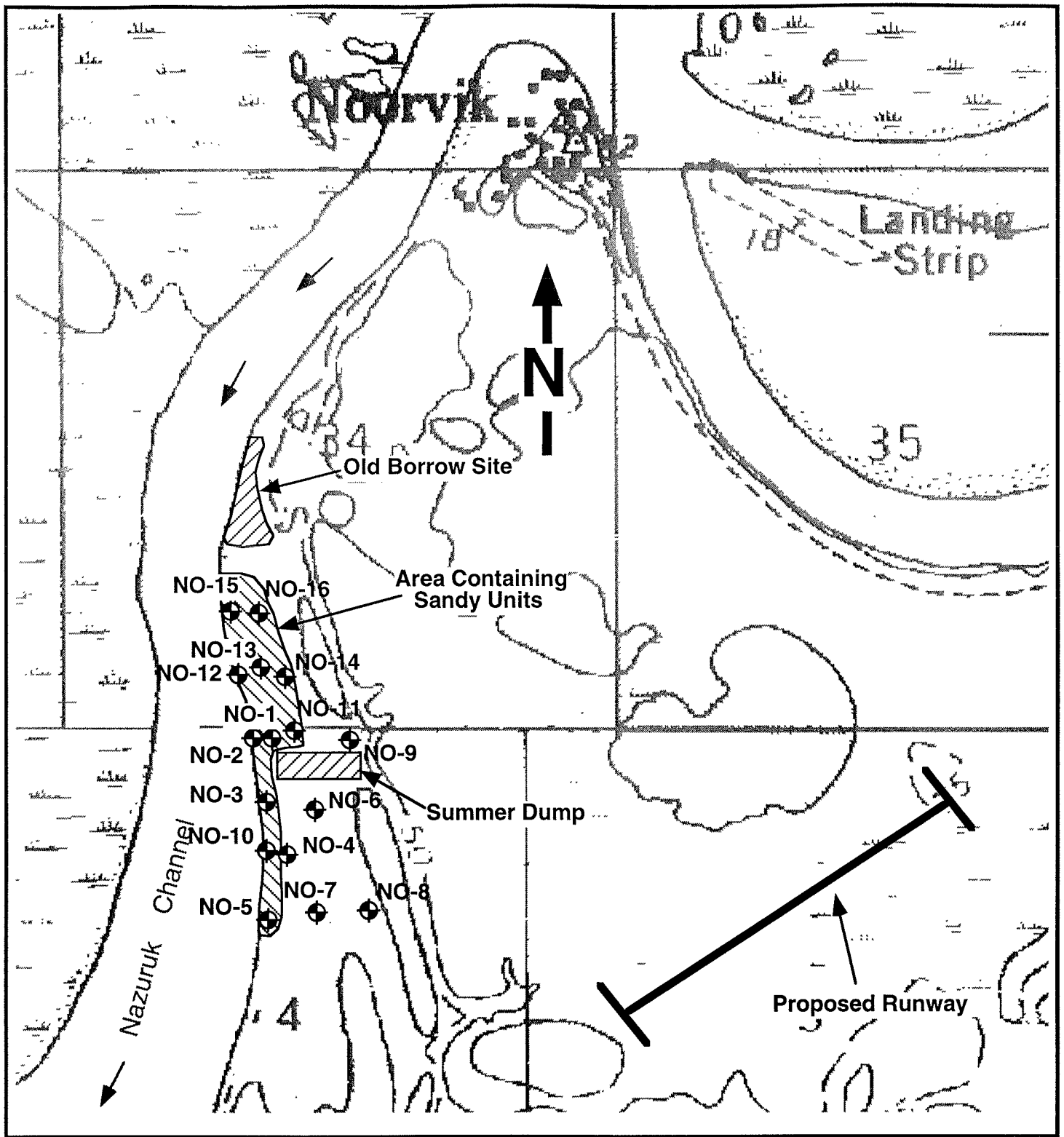
Reference: Selawik D-4 & D-5 Quadrangles, 1955



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 Arctic & Geotechnical Engineering
 Job No.: 4086.20
 Date : June 1997

VICINITY MAP
Airport Material Sites
 Noorvik, Alaska

Plate
1



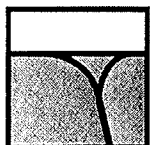
Reference: Enlargement of Selawik (D-5) Quadrangle (1955)



Scale: 1" = 1/4 mi

Legend

⊕ 1996 DMA Borings



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BORING LOCATIONS
Nazuruk Channel Material Site
 Noorvik, Alaska

Plate
NC-1

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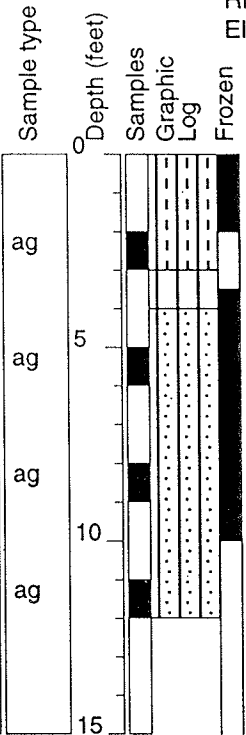
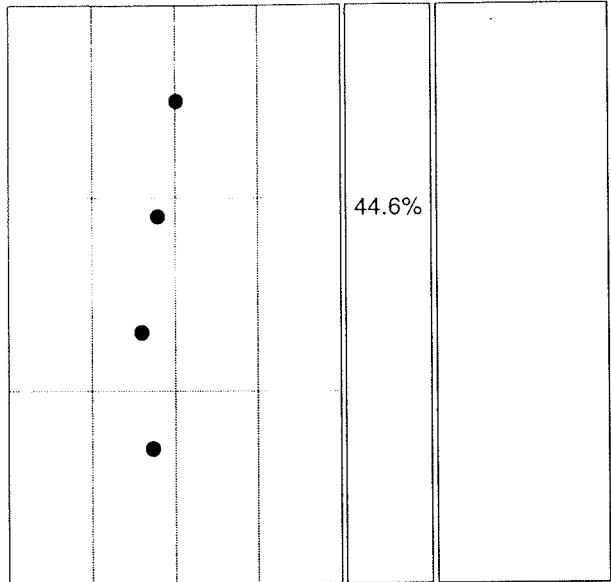
Project: Noorvik Airport Materials
 DM&A Job No. : 4086.20
 Logged By: W. Phillips

Log of HOLE : NO-1

Date Drilled: November 12, 1996
 Contractor: Inanda Placers
 Rig Type: 2.5 HP Powerhead Auger
 Elevation:

Moisture Content % (•), Salinity (Δ)
 and Blow-Counts (o)

0 20 40 60 >80 P200 Other Tests



Depth (feet)	Description
0 - 2.5	ORGANIC SILT: (OL) Brown Seasonally frozen to 2 ft.
2.5 - 3.5	SILT: (ML) Grey, w/ tr sand
3.5 - 7.5	SILTY SAND: (SM) Grey Frozen below 3.5 ft.
7.5 - 10	Drill rate increase below 7.5 ft.
10 - 15	Water observed @ 10 ft.

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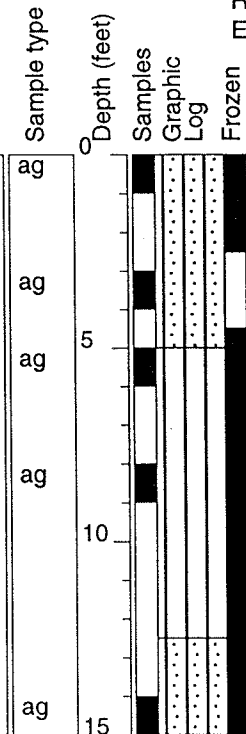
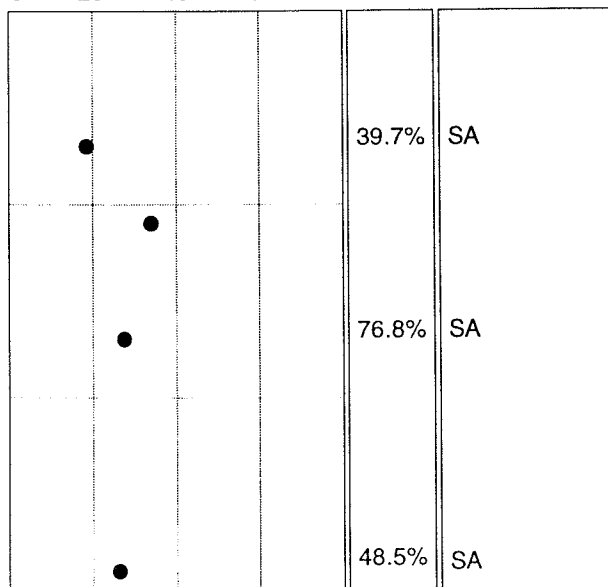
Project: Noorvik Airport Materials
 DM&A Job No. : 4086.20
 Logged By: W. Phillips

Log of HOLE : NO-2

Date Drilled: November 12, 1996
 Contractor: Inanda Placers
 Rig Type: 2.5 HP Powerhead Auger
 Elevation:

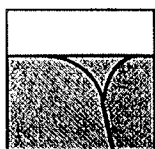
Moisture Content % (•), Salinity (Δ)
 and Blow-Counts (o)

0 20 40 60 >80 P200 Other Tests



Depth (feet)	Description
0 - 2.5	SILTY SAND: (SM) Grey-Brown Seasonally frozen to 2.5 ft.
2.5 - 4.5	Frozen below 4.5 ft.
4.5 - 12.5	SANDY SILT: (ML) Grey Slow drilling below 5 ft.
12.5 - 15	SILTY SAND: (SM) Green-Grey Drill rate increase below 12.5 ft.

Key to Samples: ag = auger grab; c = 1.4 in. I.D. tungsten bit core



Duane Miller & Associates
 Arctic & Geotechnical Engineering
 Job No.: 4086.20
 Date: June 1997

LOGS OF BORINGS NO-1 & NO-2
 Nazuruk Channel Material Site
 Noorvik, Alaska

Plate
NC-2

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Project: Noorvik Airport Materials

DM&A Job No. :4086.20

Logged By: W. Phillips

Log of HOLE : NO-3

Date Drilled: November 12, 1996

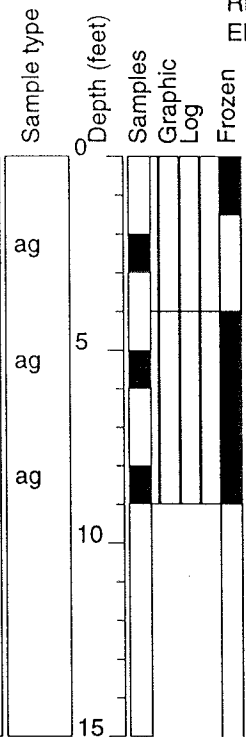
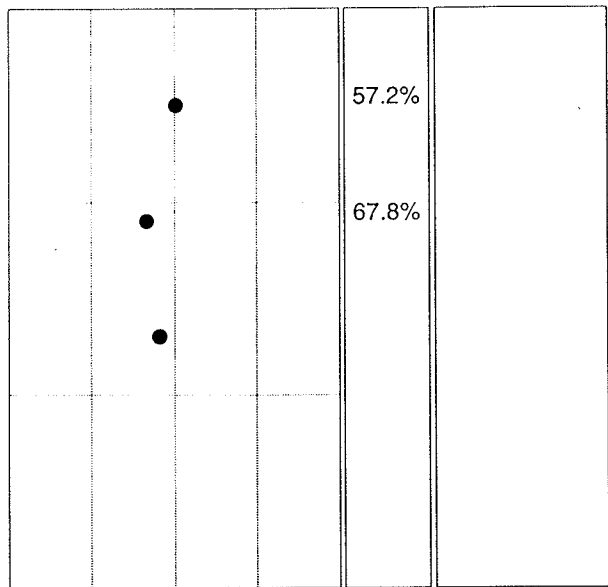
Contractor: Inanda Placers

Rig Type: 2.5 HP Powerhead Auger

Elevation:

Moisture Content % (•), Salinity (Δ)
and Blow-Counts (o)

0 20 40 60 >80 P200 Other Tests



Depth (ft)	Description
0 - 1.5	SANDY SILT: (ML) Grey-Brown Seasonally frozen w/ tr organics to 1.5 ft.
1.5 - 4.5	SILT: (ML) Grey w/ tr sand Frozen below 4 ft., w/ occaissional small pebble between 4 ft. & 4.5 ft.
4.5 - 15	

DUANE MILLER & ASSOCIATES

Project: Noorvik Airport Materials

DM&A Job No. :4086.20

Logged By: W. Phillips

Log of HOLE : NO-4

Date Drilled: November 12, 1996

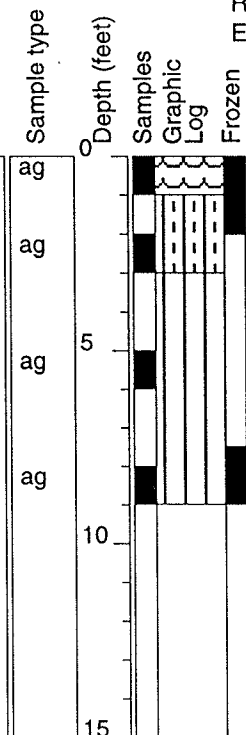
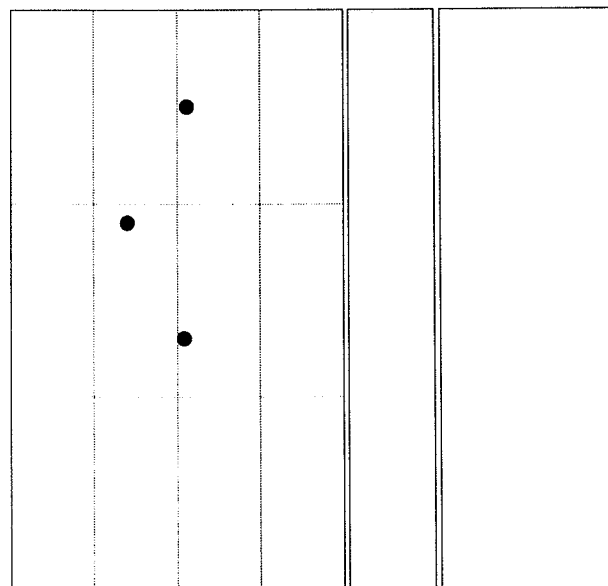
Contractor: Inanda Placers

Rig Type: 2.5 HP Powerhead Auger

Elevation:

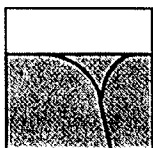
Moisture Content % (•), Salinity (Δ)
and Blow-Counts (o)

0 20 40 60 >80 P200 Other Tests



Depth (ft)	Description
0 - 2	PEAT: (Pt) Brown
2 - 4.5	ORGANIC SILT: (OL) Brown w/ tr sand Seasonally frozen to 2 ft.
4.5 - 7.5	SANDY SILT: (ML) Grey-Brown
7.5 - 15	Frozen below 7.5 ft.

Key to Samples: ag = auger grab; c = 1.4 in. I.D. tungsten bit core



Duane Miller & Associates
Arctic & Geotechnical Engineering
Job No.: 4086.20
Date: June 1997

LOGS OF BORINGS NO-3 & NO-4
Nazuruk Channel Material Site
Noorvik, Alaska

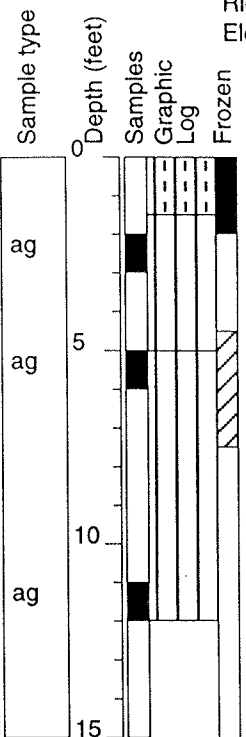
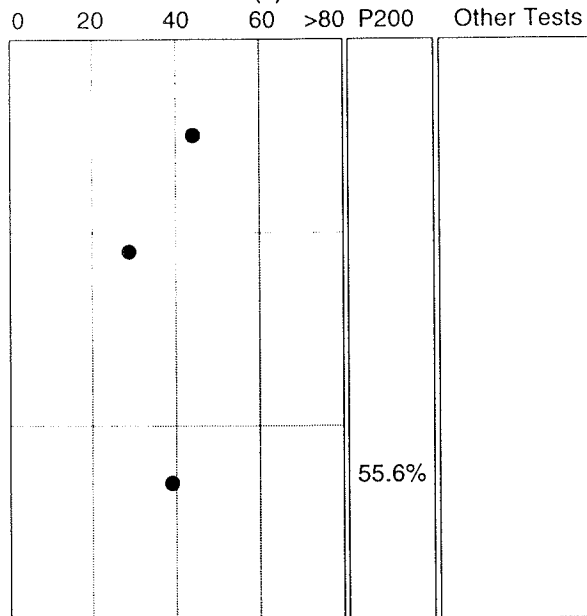
Plate
NC-3

DUANE MILLER & ASSOCIATES

Project: Noorvik Airport Materials
 DM&A Job No. :4086.20
 Logged By: W. Phillips

Log of HOLE : NO-5
 Date Drilled: November 12, 1996
 Contractor: Inanda Placers
 Rig Type: 2.5 HP Powerhead Auger
 Elevation:

Moisture Content % (•), Salinity (Δ)
 and Blow-Counts (o)



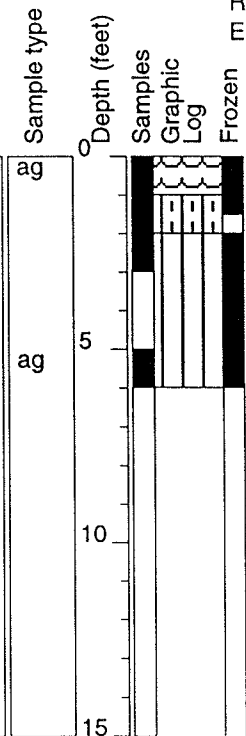
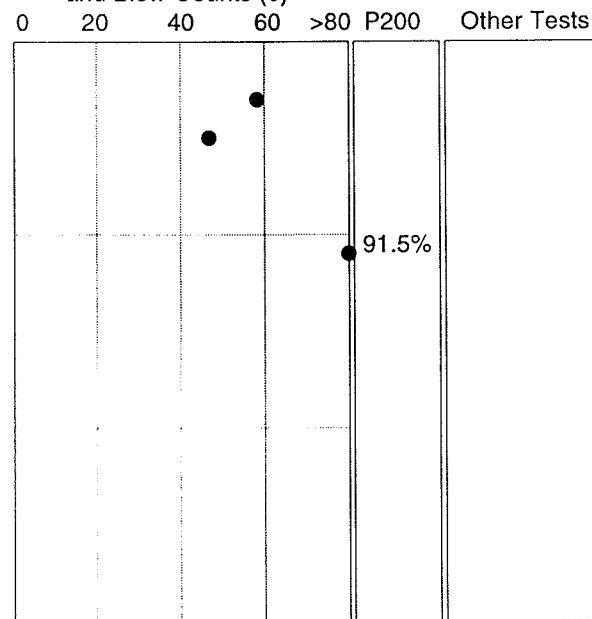
Description
ORGANIC SILT: (OL) Brown
SILT: (ML) Grey, w/ mottled brown organic silt Seasonally frozen to 2 ft. Weak frost bond between 4.5 ft. & 7.5 ft.
SANDY SILT: (ML) Grey

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Project: Noorvik Airport Materials
 DM&A Job No. :4086.20
 Logged By: W. Phillips

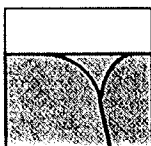
Log of HOLE : NO-6
 Date Drilled: November 13, 1996
 Contractor: Inanda Placers
 Rig Type: 2.5 HP Powerhead Auger
 Elevation:

Moisture Content % (•), Salinity (Δ)
 and Blow-Counts (o)



Description
PEAT: (Pt) Brown
ORGANIC SILT: (OL) Brown, seasonally frozen to 1.5 ft.
SILT: (ML) Grey, w/ tr sand Frozen below 2 ft.

Key to Samples: ag = auger grab; c = 1.4 in. I.D. tungsten bit core



Duane Miller & Associates
 Arctic & Geotechnical Engineering
 Job No.: 4086.20
 Date : June 1997

LOGS OF BORINGS NO-5 & NO-6
 Nazuruk Channel Material Site
 Noorvik, Alaska

Plate
NC-4

DUANE MILLER & ASSOCIATES

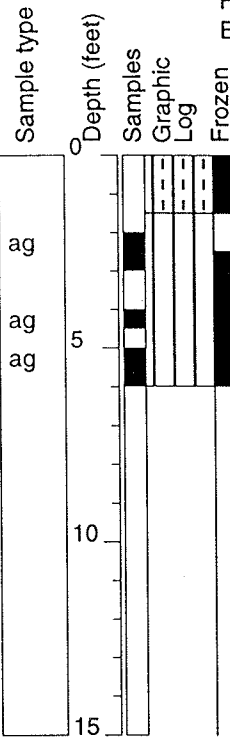
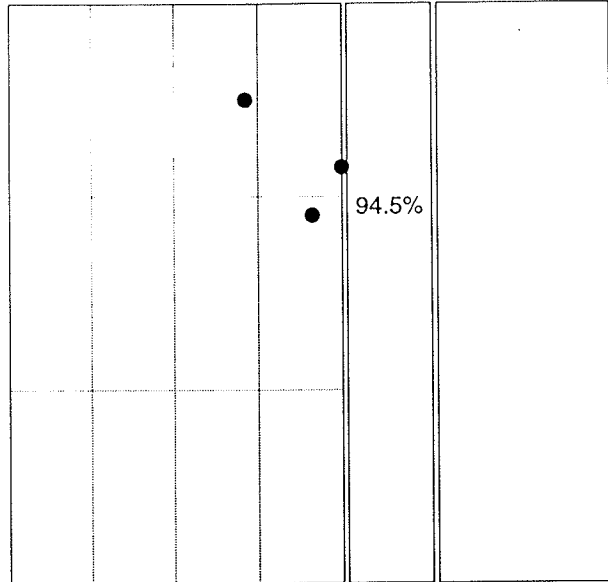
Project: Noorvik Airport Materials
 DM&A Job No. :4086.20
 Logged By: W. Phillips

Log of HOLE : NO-7

Date Drilled: November 13, 1996
 Contractor: Inanda Placers
 Rig Type: 2.5 HP Powerhead Auger
 Elevation:

Moisture Content % (•), Salinity (Δ)
 and Blow-Counts (o)

0 20 40 60 >80 P200 Other Tests



Description

ORGANIC SILT: (OL) Brown
 Seasonally frozen to 1.5 ft.
 SILT: (ML) Grey-Brown
 Frozen below 2.5 ft.
 Grey, slow drilling below 3.5 ft.

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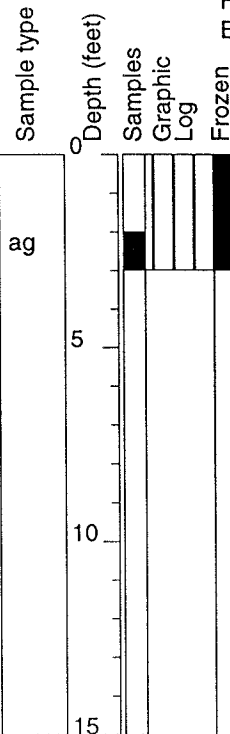
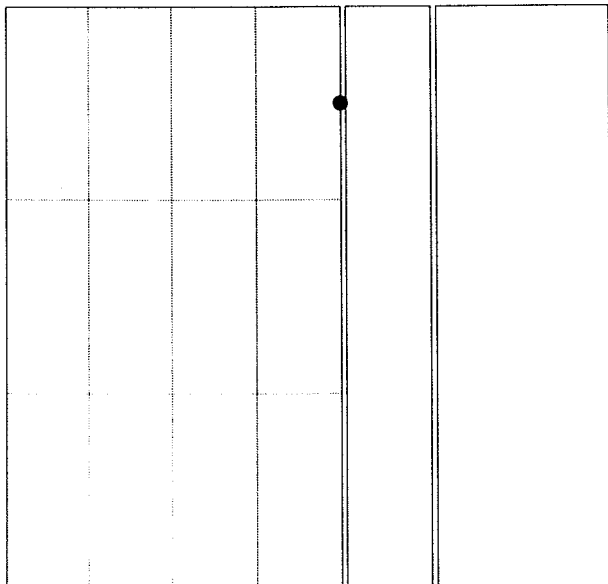
Project: Noorvik Airport Materials
 DM&A Job No. :4086.20
 Logged By: W. Phillips

Log of HOLE : NO-8

Date Drilled: November 13, 1996
 Contractor: Inanda Placers
 Rig Type: 2.5 HP Powerhead Auger
 Elevation:

Moisture Content % (•), Salinity (Δ)
 and Blow-Counts (o)

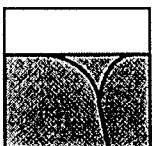
0 20 40 60 >80 P200 Other Tests



Description

SILT: (ML) Grey-Brown, w/ 6 in. organic
 mat @ surface
 Icy, slow drilling below 1 ft.

Key to Samples: ag = auger grab; c = 1.4 in. I.D. tungsten bit core



Duane Miller & Associates
 Arctic & Geotechnical Engineering
 Job No.: 4086.20
 Date: June 1997

LOGS OF BORINGS NO-7 & NO-8
Nazuruk Channel Material Site
 Noorvik, Alaska

Plate
NC-5

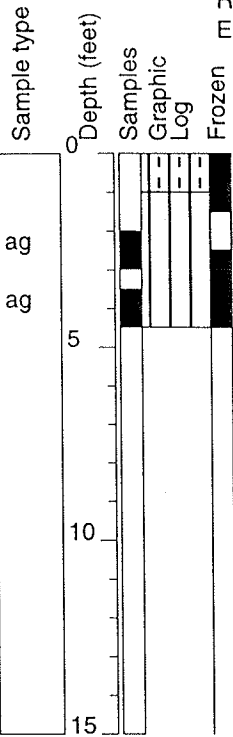
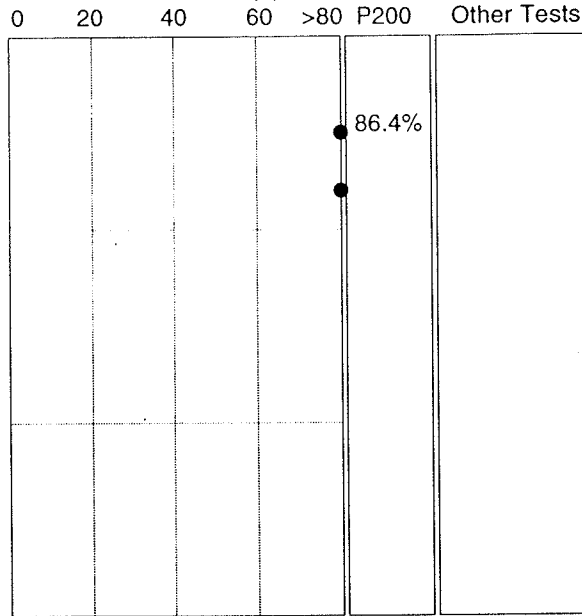
DUANE MILLER & ASSOCIATES

Project: Noorvik Airport Materials
 DM&A Job No. :4086.20
 Logged By: W. Phillips

Log of HOLE : NO-9

Date Drilled: November 13, 1996
 Contractor: Inanda Placers
 Rig Type: 2.5 HP Powerhead Auger
 Elevation:

Moisture Content % (•), Salinity (Δ)
 and Blow-Counts (o)



Description

ORGANIC SILT: (OL) Brown, w/ organic mat @ surface

SILT: (ML) Grey-Brown, mottled Seasonally froz to 1.5 ft. froz below 2.5 ft. lcy, very slow drilling below 3.5 ft.

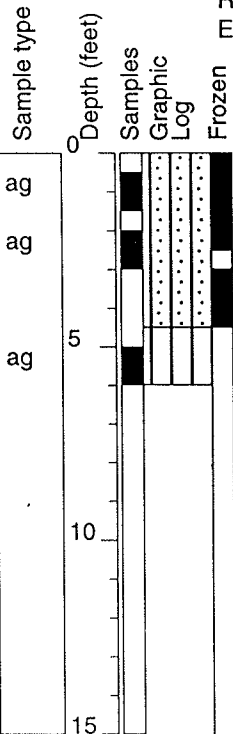
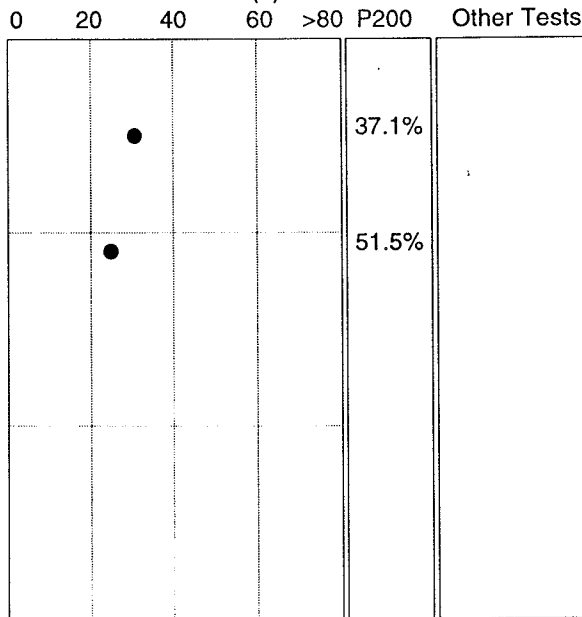
DUANE MILLER & ASSOCIATES

Project: Noorvik Airport Materials
 DM&A Job No. :4086.20
 Logged By: W. Phillips

Log of HOLE : NO-10

Date Drilled: November 13, 1996
 Contractor: Inanda Placers
 Rig Type: 2.5 HP Powerhead Auger
 Elevation:

Moisture Content % (•), Salinity (Δ)
 and Blow-Counts (o)

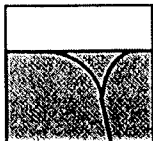


Description

SILTY SAND: (SM) Grey-Brown, w/ thin layer of organic silt @ surface
 Seasonally frozen to 2.5 ft.
 Frozen below 3 ft.

SANDY SILT: (ML) Greenish-Grey, slow drilling below 4.5 ft.

Key to Samples: ag = auger grab; c = 1.4 in. I.D. tungsten bit core



Duane Miller & Associates
 Arctic & Geotechnical Engineering
 Job No.: 4086.20
 Date : June 1997

LOGS OF BORINGS NO-9 & NO-10
 Nazuruk Channel Material Site
 Noorvik, Alaska

Plate
NC-6

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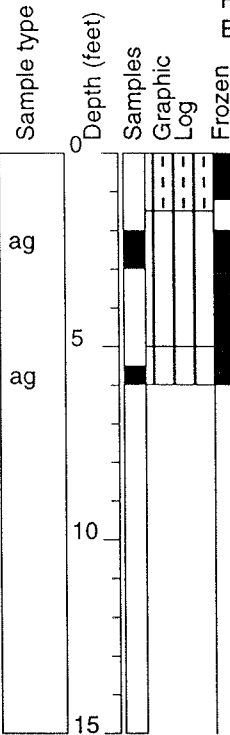
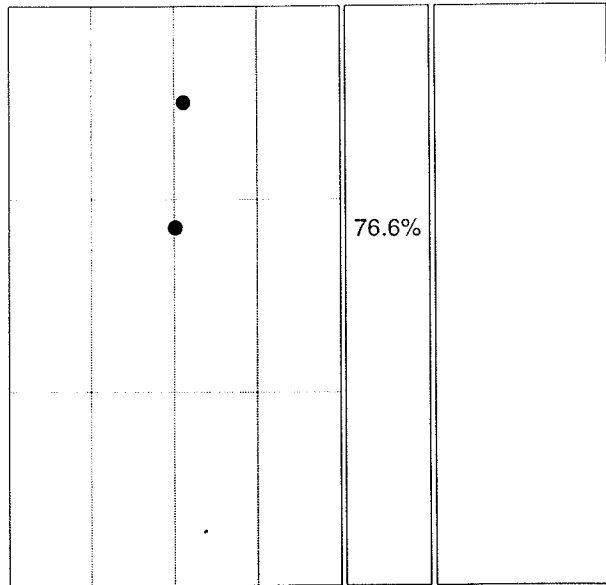
Project: Noorvik Airport Materials
 DM&A Job No. :4086.20
 Logged By: W. Phillips

Log of HOLE : NO-11

Date Drilled: November 14, 1996
 Contractor: Inanda Placers
 Rig Type: 2.5 HP Powerhead Auger
 Elevation:

Moisture Content % (•), Salinity (Δ)
 and Blow-Counts (o)

0 20 40 60 >80 P200 Other Tests



Description

ORGANIC SILT: (OL) Brown, w/ 9 in. organic mat @ surface, seasonally frozen to 1.2 ft.
 SANDY SILT: (ML) Grey-Brown Frozen below 2 ft.
 SILT: (ML) Grey

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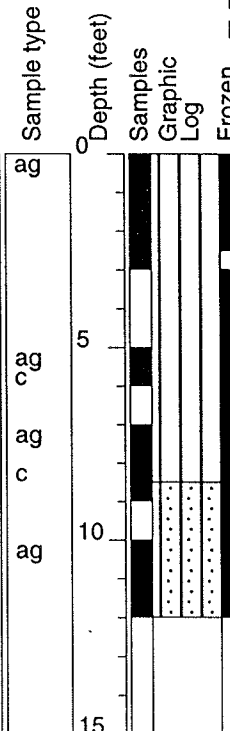
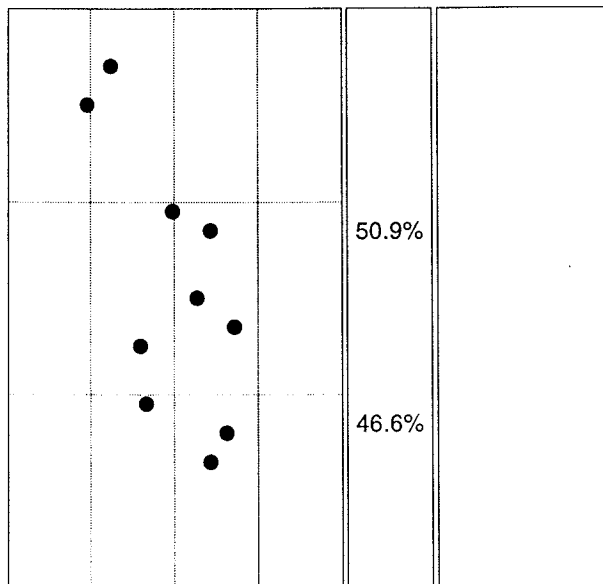
Project: Noorvik Airport Materials
 DM&A Job No. :4086.20
 Logged By: W. Phillips

Log of HOLE : NO-12

Date Drilled: November 14, 1996
 Contractor: Inanda Placers
 Rig Type: 2.5 HP Powerhead Auger
 Elevation:

Moisture Content % (•), Salinity (Δ)
 and Blow-Counts (o)

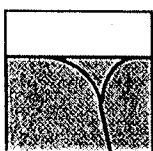
0 20 40 60 >80 P200 Other Tests



Description

SANDY SILT: (ML) Brown to Grey-Brown w/ silty sand layers
 Seasonally frozen to 2.5 ft.
 Frozen below 2.5 ft.
 With organics @ 8 ft.
 SILTY SAND: (SM) Grey w/ thin organic seams

Key to Samples: ag = auger grab; c = 1.4 in. I.D. tungsten bit core



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 Arctic & Geotechnical Engineering
 Job No.: 4086.20
 Date : June 1997

LOGS OF BORINGS NO-11 & NO-12
Nazuruk Channel Material Site
 Noorvik, Alaska

Plate
NC-7

DUANE MILLER & ASSOCIATES

Project: Noorvik Airport Materials

DM&A Job No. :4086.20

Logged By: W. Phillips

Log of HOLE : NO-13

Date Drilled: November 14, 1996

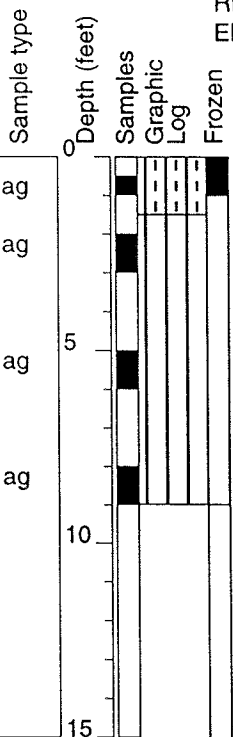
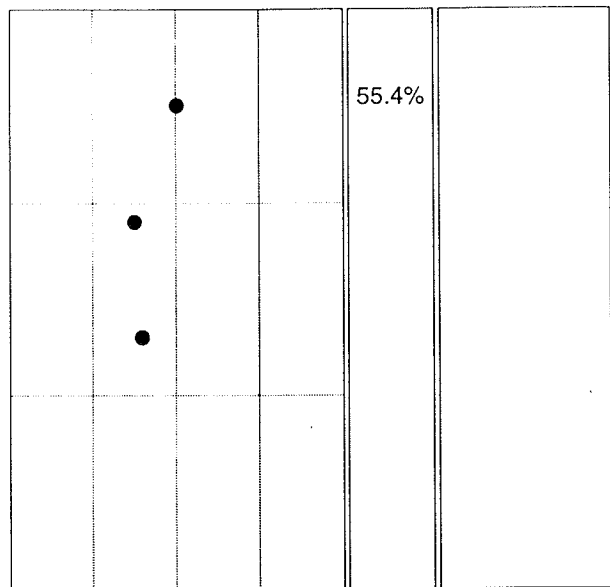
Contractor: Inanda Placers

Rig Type: 2.5 HP Powerhead Auger

Elevation:

Moisture Content % (•), Salinity (Δ)
and Blow-Counts (o)

0 20 40 60 >80 P200 Other Tests



Description

ORGANIC SILT: (OL) Brown w/ 6 in. organic mat @ surface, seasonally frozen to 1 ft.

SANDY SILT: (ML) Grey-Brown, w/ tr organics in thin layers

Water observed @ 8.5 ft.

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Project: Noorvik Airport Materials

DM&A Job No. :4086.20

Logged By: W. Phillips

Log of HOLE : NO-14

Date Drilled: November 14, 1996

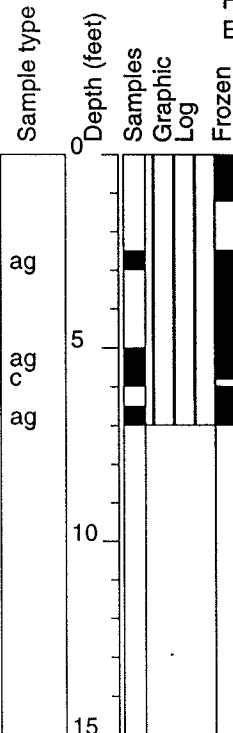
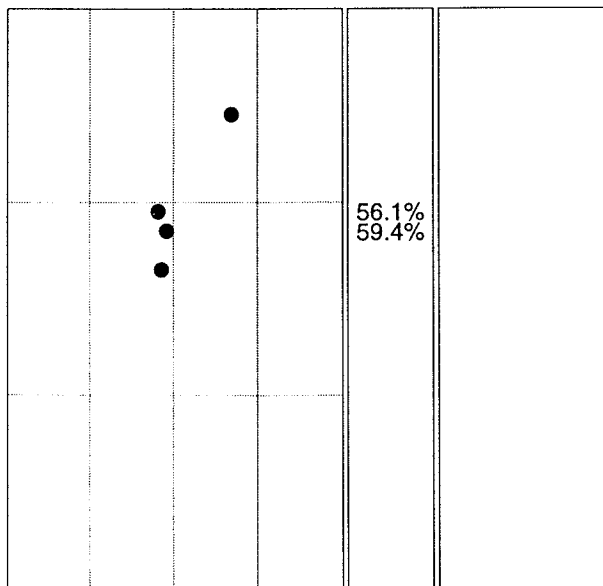
Contractor: Inanda Placers

Rig Type: 2.5 HP Powerhead Auger

Elevation:

Moisture Content % (•), Salinity (Δ)
and Blow-Counts (o)

0 20 40 60 >80 P200 Other Tests

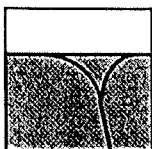


Description

SANDY SILT: (ML) Grey, w/ 9 in. organic mat @ surface
Seasonally frozen to 1.2 ft.
Frozen below 2.5 ft.

Thin thaw zone between 5.8 ft. & 6.0 ft.

Key to Samples: ag = auger grab; c = 1.4 in. I.D. tungsten bit core



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Arctic & Geotechnical Engineering
Job No.: 4086.20
Date : June 1997

LOGS OF BORINGS NO-13 & NO-14
Nazuruk Channel Material Site
Noorvik, Alaska

Plate
NC-8

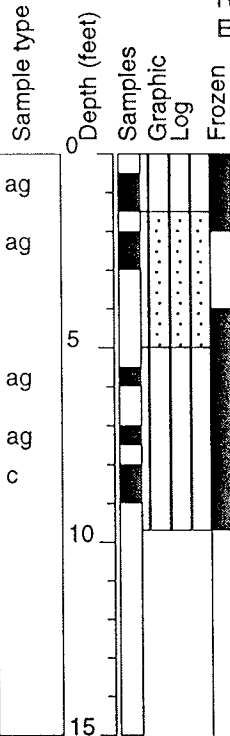
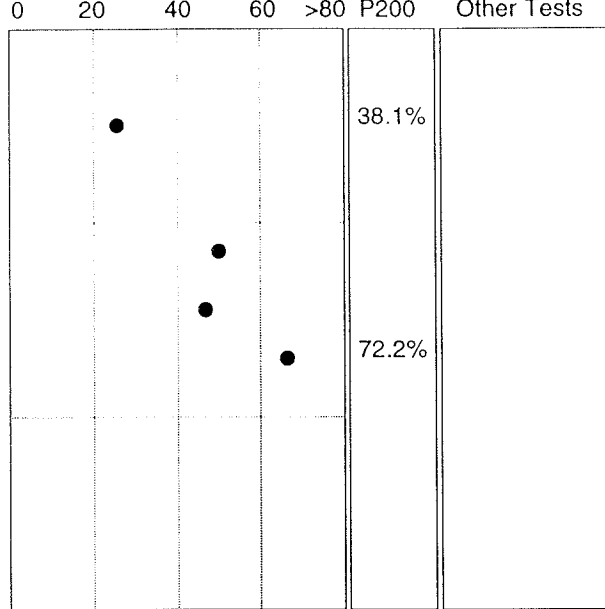
DUANE MILLER & ASSOCIATES

Project: Noorvik Airport Materials
 DM&A Job No. :4086.20
 Logged By: W. Phillips

Log of HOLE : NO-15

Date Drilled: November 14, 1996
 Contractor: Inanda Placers
 Rig Type: 2.5 HP Powerhead Auger
 Elevation:

Moisture Content % (•), Salinity (Δ)
 and Blow-Counts (o)



Depth (feet)	Description
0 - 2	SILT: Grey-Brown, w/ tr sand
2 - 4	SILTY SAND: (SM) Brown Seasonally frozen to 2 ft.
4 - 5	Frozen below 4 ft.
5 - 10	SILT: (ML) Grey, w/ tr sand & thin interbedded organic seams

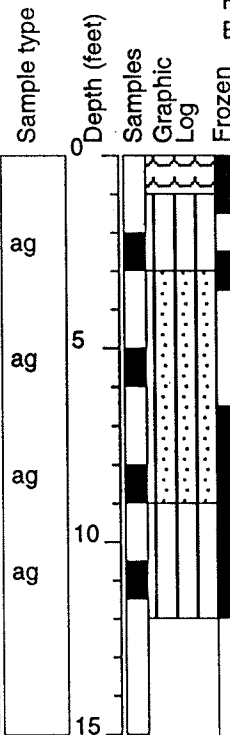
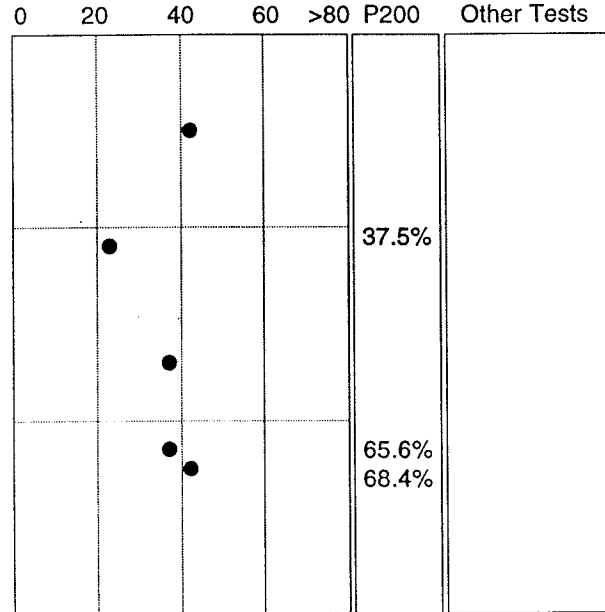
DUANE MILLER & ASSOCIATES

Project: Noorvik Airport Materials
 DM&A Job No. :4086.20
 Logged By: W. Phillips

Log of HOLE : NO-16

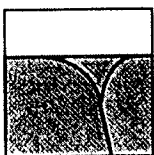
Date Drilled: November 14, 1996
 Contractor: Inanda Placers
 Rig Type: 2.5 HP Powerhead Auger
 Elevation:

Moisture Content % (•), Salinity (Δ)
 and Blow-Counts (o)



Depth (feet)	Description
0 - 1.5	PEAT: (Pt) Organic mat
1.5 - 2.5	SILT: (ML) Grey-Brown, w/ tr sand Seasonally frozen to 1.5 ft.
2.5 - 3.5	SILTY SAND: (SM) Grey Frozen layer between 2.5 ft. & 3.5 ft.
3.5 - 6.5	Frozen below 6.5 ft.
6.5 - 10	SANDY SILT: (ML) Grey, interbedded w/ Grey-Brown silty sand

Key to Samples: ag = auger grab; c = 1.4 in. I.D. tungsten bit core



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 Arctic & Geotechnical Engineering
 Job No.: 4086.20
 Date : June 1997

LOGS OF BORINGS NO-15 & NO-16
 Nazuruk Channel Material Site
 Noorvik, Alaska

Plate
NC-9

DUANE MILLER & ASSOCIATES

Project: Noorvik Airport Materials
 DM&A Job No. :4086.20
 Logged By: W. Phillips

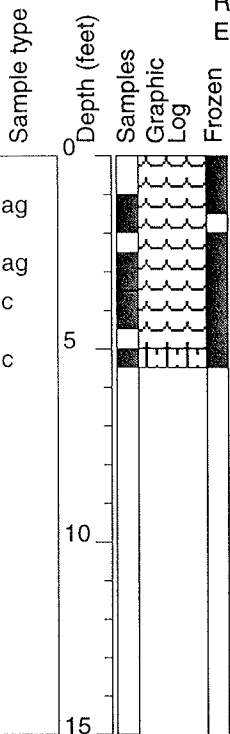
Log of HOLE : NL-1

Date Drilled: November 13, 1996
 Contractor: Inanda Placers
 Rig Type: 2.5 HP Powerhead Auger
 Elevation:

Moisture Content % (•), Salinity (Δ)
 and Blow-Counts (o)

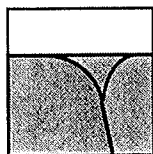
0 20 40 60 >80 P200 Other Tests

				•		
				•		
				•		
				•		



Description
PEAT: (Pt) Brown, w/ fibrous organic mat to 1.5 ft., amorphous below 1.5 ft. Seasonally frozen to 1.5 ft. Frozen below 2 ft.
ORGANIC SILT: (OL) Brown

Key to Samples: ag = auger grab; c = 1.4 in. I.D. tungsten bit core



Duane Miller & Associates
 Arctic & Geotechnical Engineering
 Job No.: 4086.20
 Date : June 1997

LOG OF BORING NL-1
Nazuruk Channel Material Site
 Noorvik, Alaska

Plate
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MAJOR DIVISIONS			SYMBOL	TYPICAL NAMES
COARSE GRAINED SOILS More than 50% larger than #200 sieve, 0.075 mm	GRAVELS More than half of the coarse fraction is larger than #4 sieve size, > 4.75 mm.	Clean gravels with little or no fines	GW	Well graded gravels, sandy gravel
			GP	Poorly graded gravels, sandy gravel
		Gravels with more than 12% fines	GM	Silty gravels, silt sand gravel mixtures
			GC	Clayey gravels, clay sand gravel mixtures
	SANDS More than half of the coarse fraction is smaller than #4 sieve size	Clean sands with little or no fines	SW	Well graded sand, gravelly sand
			SP	Poorly graded sands, gravelly sand
		Sands with more than 12% fines	SM	Silty sand, silt gravel sand mixtures
			SC	Clayey sand, clay gravel sand mixtures
FINE GRAINED SOILS >50% finer than #200 sieve, 0.075 mm	<p>Plasticity Chart</p>	SILTS and CLAYS Liquid limit less than 50	ML	Inorganic silt and very fine sand, rock flour
			CL	Inorganic clay, gravelly and sandy clay, silty clay
		SILTS and CLAYS Liquid limit greater than 50	OL	Organic silts and clay of low plasticity
			MH	Inorganic silt
			CH	Inorganic clay, fat clay
			OH	Organic silt and clay of high plasticity
HIGHLY ORGANIC SOILS			Pt	Peat and other highly organic soil

KEY TO TEST DATA

Dd = Dry Density (pcf)
 TC = Thaw Consolidation
 TCf = Thaw Consolidation (field)
 UU = Unconsolidated Undrained Triaxial
 CU = Consolidated Undrained Triaxial
 CD = Consolidated Drained Triaxial
 LL = Liquid Limit
 PL = Plastic Limit
 PI = Plastic Index
 S.G. = Specific Gravity
 SA = Sieve Analysis
 MA = Sieve and Hydrometer Analysis
 OLI = Organic Loss

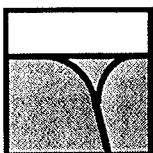
KEY TO SAMPLE TYPE

Ag = Auger grab
 Ab = Auger bulk
 Sh = 2.5" ID split barrel w/340 lb. manual hammer
 Sha = 2.5" ID split barrel w/340 lb. automatic hammer
 Tw = Shelby tube

UNIFIED SOIL CLASSIFICATION SYSTEM

GROUP	ICE VISIBILITY	DESCRIPTION	SYMBOL	
N	Segregated ice not visible by eye	Poorly bonded or friable	Nf	
		Well bonded	No excess ice	Nb
			Excess microscopic ice	Nbn Nbe
V	Segregated ice is visible by eye and is one inch or less in thickness	Individual ice crystals or inclusions	Vx	
		Ice coatings on particles	Vc	
		Random or irregularly oriented ice	Vr	
		Stratified or distinctly oriented ice	Vs	
ICE	Ice greater than one inch in thickness	Ice with soil inclusions	ICE + soil type	
		Ice without soil inclusions	ICE	

ICE CLASSIFICATION SYSTEM



Duane Miller & Associates
 Arctic & Geotechnical Engineering
 Job No.: 4086.20
 Date: June 1997

**SOIL and ICE CLASSIFICATION
 and KEY TO DATA**
 Nazuruk Channel Material Site
 Noorvik, Alaska

Plate
NC-11

Boring	Sample Depth	Soil Type (USCS)	Frz?	Sample Type	Moisture Content	passing #200	Organic loss	Other Tests
NO-1	2.0 ft.	OL	No	Grab	40.2%			
NO-1	5.0 ft.	SM	Yes	Grab	35.8%	44.6%		
NO-1	8.0 ft.	SM	Yes	Grab	31.8%			
NO-1	11.0 ft.	SM	Yes	Grab	34.4%			
NO-2	0.0 ft.	SM	Yes	Grab				
NO-2	3.0 ft.	SM	No	Grab	18.3%	39.7%		SA
NO-2	5.0 ft.	ML	Yes	Grab	34.2%			
NO-2	8.0 ft.	ML	Yes	Grab	27.2%	76.8%		SA
NO-2	14.0 ft.	SM	Yes	Grab	26.3%	48.5%		SA
NO-3	2.0 ft.	ML	No	Grab	40.5%	57.2%		
NO-3	5.0 ft.	ML	Yes	Grab	33.6%	67.8%		
NO-3	8.0 ft.	ML	Yes	Grab	36.6%			
NO-4	0.0 ft.	Pt	Yes	Grab				
NO-4	2.0 ft.	OL	No	Grab	42.1%			
NO-4	5.0 ft.	ML	No	Grab	28.3%			
NO-4	8.0 ft.	ML	Yes	Grab	41.4%			
NO-5	2.0 ft.	ML	No	Grab	44.1%			
NO-5	5.0 ft.	ML	Yes	Grab	28.5%			
NO-5	11.0 ft.	ML	No	Grab	39.1%	55.6%		
NO-6	0.0 ft.	Pt	Yes	Grab				
NO-6	1.0 ft.	OL	No	Grab	58.1%			
NO-6	2.0 ft.	ML	Yes	Grab	46.6%			
NO-6	5.0 ft.	ML	Yes	Grab	117.8%	91.5%		
NO-7	2.0 ft.	ML	No	Grab	57.0%			
NO-7	4.0 ft.	ML	Yes	Grab	87.0%			
NO-7	5.0 ft.	ML	Yes	Grab	72.8%	94.5%		
NO-8	2.0 ft.	ML	Yes	Grab	92.4%			
NO-9	2.0 ft.	ML	No	Grab	103.0%	86.4%		
NO-9	3.5 ft.	ML	Yes	Grab	110.2%			
NO-10	0.5 ft.	OL	Yes	Grab				
NO-10	2.0 ft.	SM	Yes	Grab	30.6%	37.1%		
NO-10	5.0 ft.	ML	Yes	Grab	24.8%	51.5%		
NO-11	2.0 ft.	ML	Yes	Grab	42.1%			
NO-11	5.5 ft.	ML	Yes	Grab	40.0%	76.6%		

SUMMARY OF SAMPLES

Duane Miller & Associates
 Job No. 4086.20
 June 1997

Nazuruk Channel Material Site
 Noorvik, Alaska

Plate
NC-12

Boring	Sample Depth	Soil Type (USCS)	Frz?	Sample Type	Moisture Content	passing #200	Organic loss	Other Tests
NO-12	0.0 ft.	ML	Yes	Grab				
NO-12	1.0 ft.	ML	Yes	Grab	25.2%			
NO-12	2.0 ft.	ML	No	Grab	19.2%			
NO-12	5.0 ft.	ML	Yes	Grab	39.7%			
NO-12	5.5 ft.	ML	Yes	Core	48.7%	50.9%		
NO-12	7.0 ft.	ML	Yes	Grab	45.6%			
NO-12	8.0 ft.	ML	Yes	Core	54.6%		2.6%	
NO-12	8.5 ft.	SM	Yes	Core	31.7%			
NO-12	10.0 ft.	SM	Yes	Grab	33.1%			
NO-12	10.5 ft.	SM	Yes	Grab	52.4%	46.6%	0.4%	
NO-12	11.5 ft.	SM	Yes	Grab	48.6%			
NO-13	0.5 ft.	OL	Yes	Grab				
NO-13	2.0 ft.	ML	No	Grab	40.2%	55.4%		
NO-13	5.0 ft.	ML	No	Grab	29.8%		0.7%	
NO-13	8.0 ft.	ML	No	Grab	31.7%			
NO-14	2.5 ft.	ML	Yes	Grab	53.9%			
NO-14	5.0 ft.	ML	Yes	Grab	36.7%	56.1%		
NO-14	5.5 ft.	ML	Yes	Core	38.4%	59.4%		
NO-14	6.5 ft.	ML	Yes	Grab	37.0%			
NO-15	0.5 ft.	ML	Yes	Grab				
NO-15	2.0 ft.	SM	No	Grab	25.7%	38.1%		
NO-15	5.5 ft.	ML	Yes	Grab	49.7%			
NO-15	7.0 ft.	ML	Yes	Grab	46.4%			
NO-15	8.0 ft.	ML	Yes	Core	66.4%	72.2%		
NO-16	2.0 ft.	ML	No	Grab	42.5%			
NO-16	5.0 ft.	SM	Yes	Grab	22.9%	37.5%		
NO-16	8.0 ft.	SM	Yes	Grab	37.4%			
NO-16	10.5 ft.	ML	Yes	Grab	37.2%	65.6%		
NO-16	11.0 ft.	ML	Yes	Grab	42.0%	68.4%		
NL-1	1.0 ft.	Pt	Yes	Grab	217.6%			
NL-1	2.5 ft.	Pt	Yes	Grab	323.5%			
NL-1	3.5 ft.	Pt	Yes	Core	254.2%			
NL-1	5.0 ft.	OL	Yes	Core	224.9%			

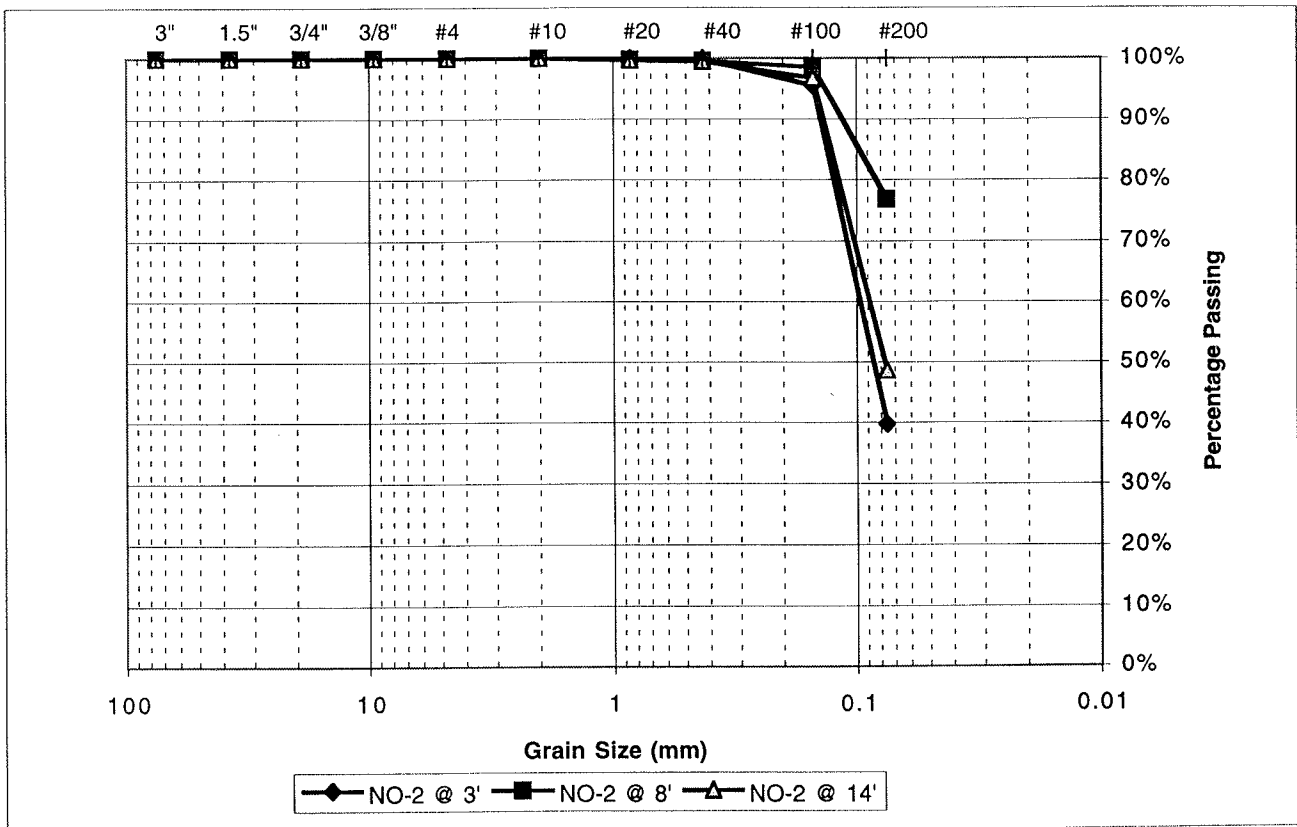
SUMMARY OF SAMPLES

Nazuruk Channel Material Site
Noorvik, Alaska

Duane Miller & Associates
Job No. 4086.20
June 1997

Plate
NC-13

Boring =>	NO-2	NO-2	NO-2
Depth =>	3.0 ft.	8.0 ft.	14.0 ft.
3"	100%	100.0%	100.0%
1 1/2"	100%	100.0%	100.0%
3/4"	100.0%	100.0%	100.0%
3/8"	100.0%	100.0%	100.0%
#4	100.0%	100.0%	100.0%
#10	100.0%	100.0%	100.0%
#20	100.0%	99.8%	99.7%
#40	99.9%	99.6%	99.5%
#100	95.4%	98.5%	96.7%
#200	39.7%	76.8%	48.5%
Analysis of Data			
D10 size =>			
D30 size =>			
D50 size =>	0.085 mm		0.077 mm
D60 size =>	0.097 mm		0.088 mm
Coeff. of Uniformity, Cu =			
Coeff. of Curvature, Cc =			
Gravel (+#4) percentage =	0.0%	0.0%	0.0%
Sand percentage =	60.3%	23.2%	51.4%
Fines percentage =	39.7%	76.8%	48.5%
Unified Soil Class Symbol =	SM	ML	SM



Project = Noorvik Airport

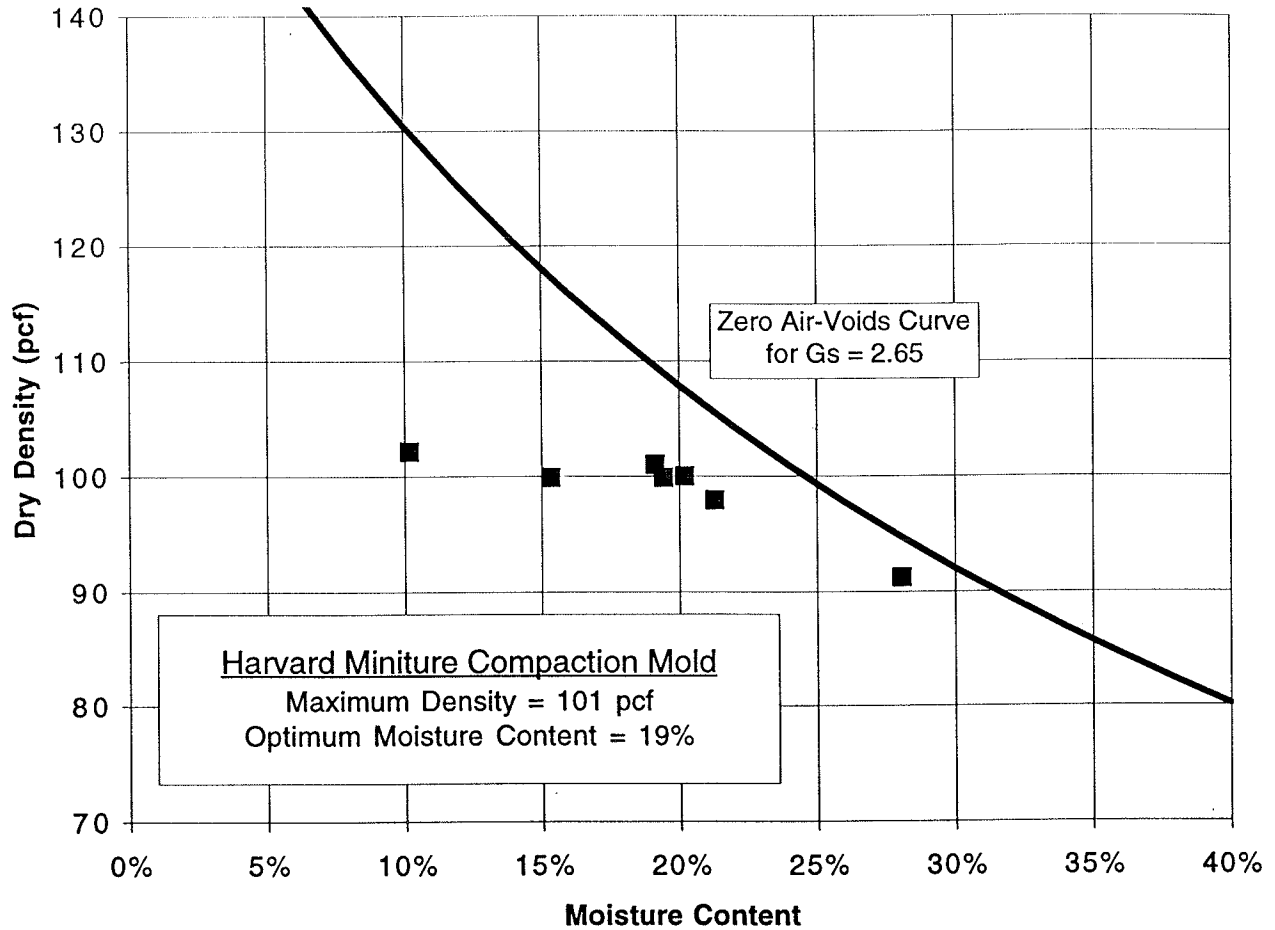
By = M. Hendee

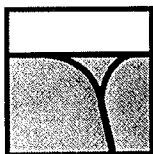
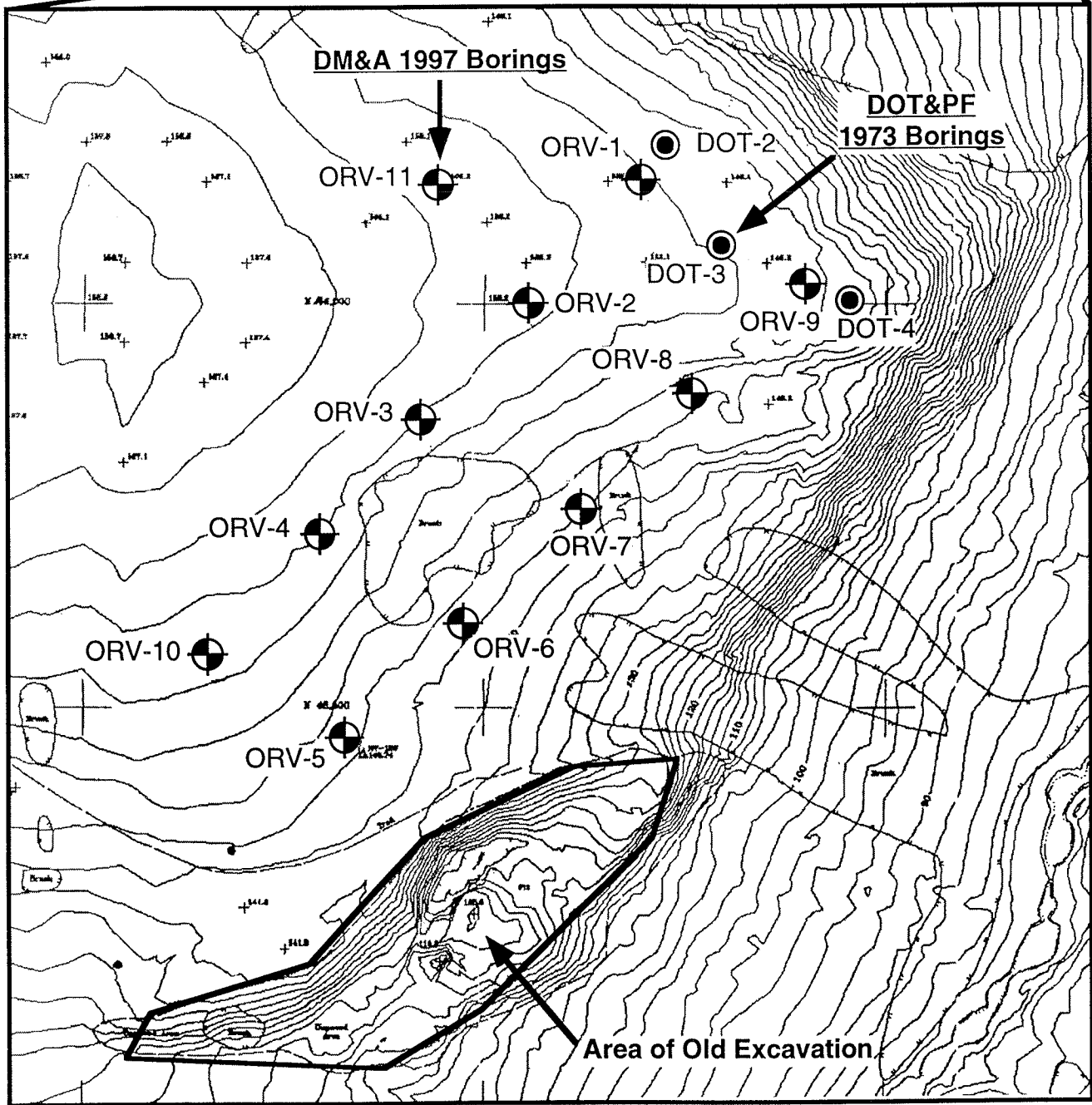
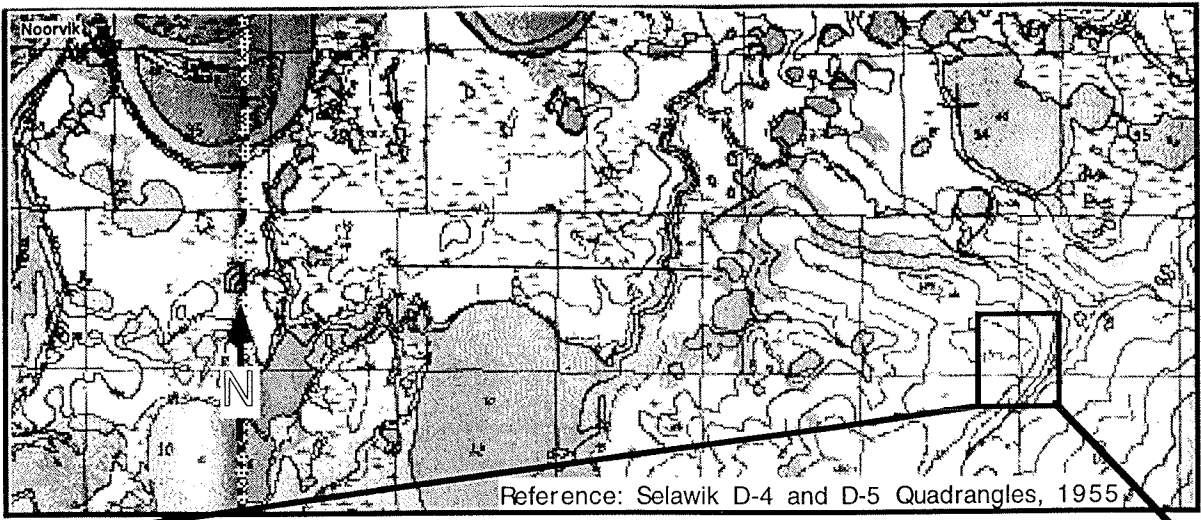
Job No. = 4086.2

Date = Jan-8-97

Sample Source = Combined samples (NO-1 @ 8.0' & 11.0'),(NO-2 @ 0'),
(NO-12 @ 8.5', 10.0', 11.5'),(NO-16 @ 8.0')

Sample Description = Silty Sand (SM)





Duane Miller & Associates
Arctic & Geotechnical Engineering
Job No.: 4086.20
Date : July 1997

BORING LOCATIONS
Hotham Peak Material Site
Noorvik, Alaska

Plate
HP-1

DUANE MILLER & ASSOCIATES

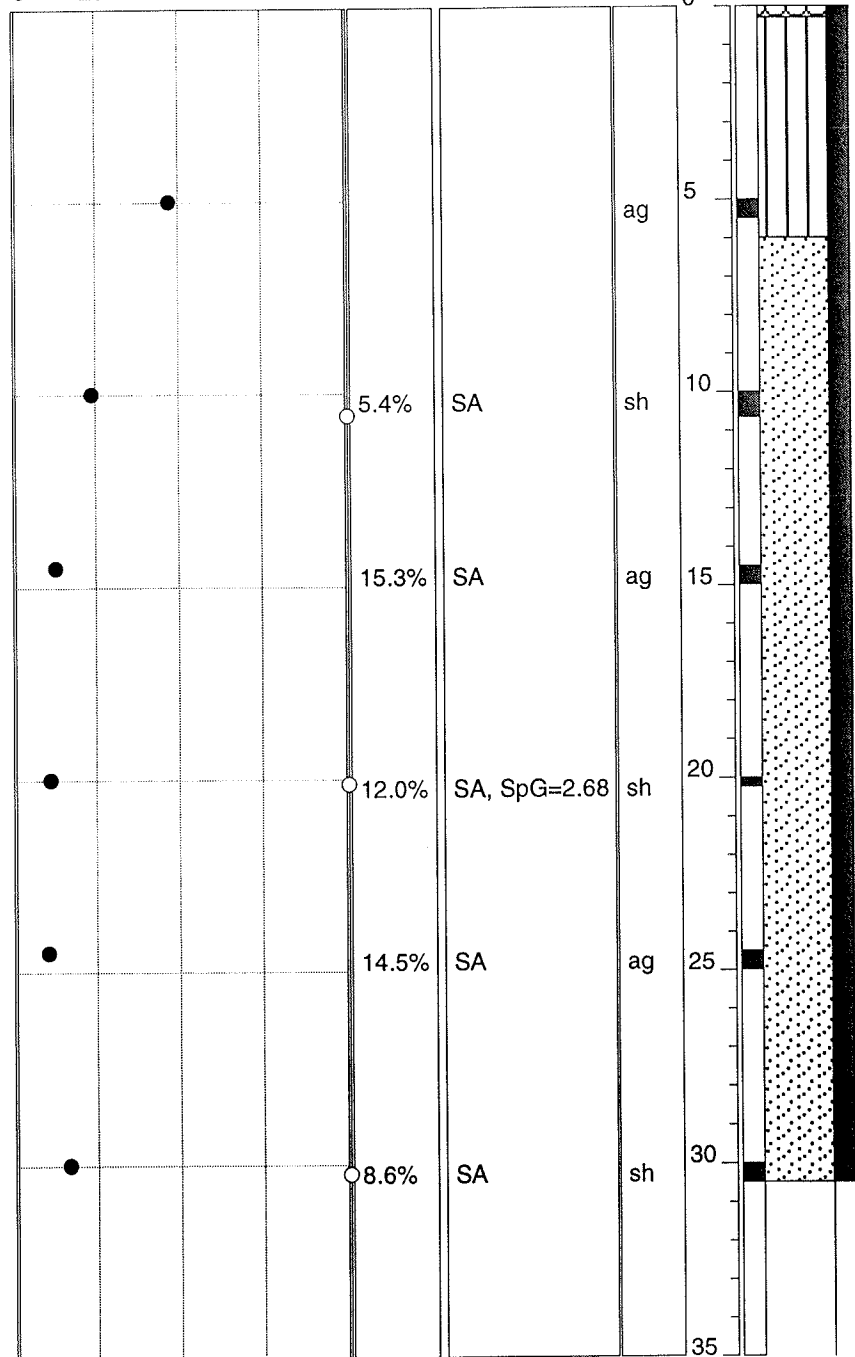
Project: Noorvik Airport
 DM&A Job No. :4086.20
 Logged By: T. Culkin

Log of HOLE : ORV-1

Date Drilled: April 4, 1997
 Contractor: Discovery Drilling
 Rig Type: CME-45 w/ 8" Dia. H.S. Auger
 Elevation:

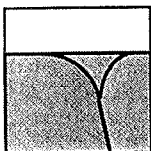
Moisture Content % (•), Salinity (Δ)
 and Blow-Counts (o)**

0 20 40 60 >80 P200 Other Tests



Description
PEAT: (Pt) Vegetation mat, frozen
SILT: (ML) (Nb) Gray-brown w/ tr organics, well bonded w/ no visible ice
GRAVELLY SAND: (SP-SM) (Vx,Vc) Gray-brown w/ interbedded layers of Silty Sand (SM), Sandy Gravel (GW-GM) & Silty Gravel (GM), gravel is sub-rounded to 2", 5% clear visible ice as crystals & coatings
Little gravel from 18 ft. to 18.5 ft.
Scattered cobbles below 23 ft.
Rough drilling below 25.5 ft.

*The field blow counts have been adjusted for hammer weight and sampler annulus



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 Job No.: 4086.20
 Date: June 1997

LOG of BORING ORV-1
 Hotham Peak Material Site
 Noorvik, Alaska

Plate
HP-2

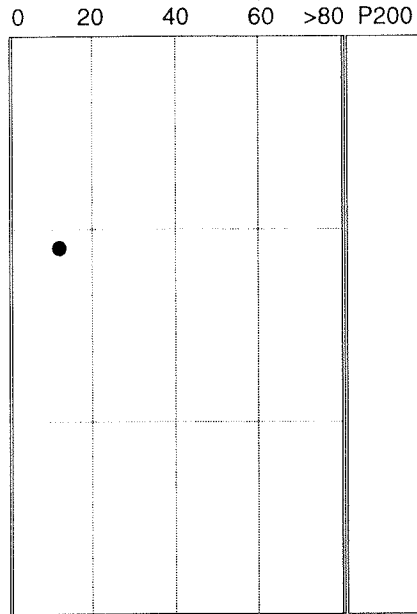
DUANE MILLER & ASSOCIATES

Project: Noorvik Airport
 DM&A Job No. :4086.20
 Logged By: T. Culkin

Log of HOLE : ORV-2

Date Drilled: April 4, 1997
 Contractor: Discovery Drilling
 Rig Type: CME-45 w/ 8" Dia. H.S. Auger
 Elevation:

Moisture Content % (•), Salinity (Δ)
 and Blow-Counts (o)**

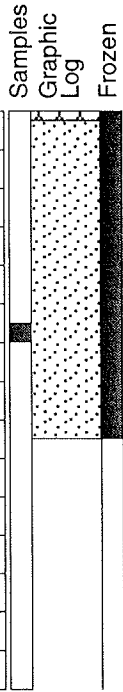


Other Tests

Sample type

ag

Depth (feet)



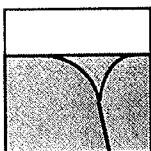
Description

PEAT: (Pt) Vegetation mat, frozen

GRAVELLY SAND: (SP-SM) (Vx) Gray-brown, gravel is sub-rounded to 2" diameter, 5% clear visible ice as crystals

Little gravel from 6.5 ft. to 7.5 ft.

*The field blow counts have been adjusted for hammer weight and sampler annulus



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 Date : June 1997

LOG of BORING ORV-2
 Hotham Peak Material Site
 Noorvik, Alaska

Plate
HP-3

DUANE MILLER & ASSOCIATES

Project: Noorvik Airport
 DM&A Job No. :4086.20
 Logged By: T. Culkin

Log of HOLE : ORV-3

Date Drilled: April 4, 1997
 Contractor: Discovery Drilling
 Rig Type: CME-45 w/ 3" S.F. Auger
 Elevation:

Moisture Content % (•), Salinity (Δ)
 and Blow-Counts (o)

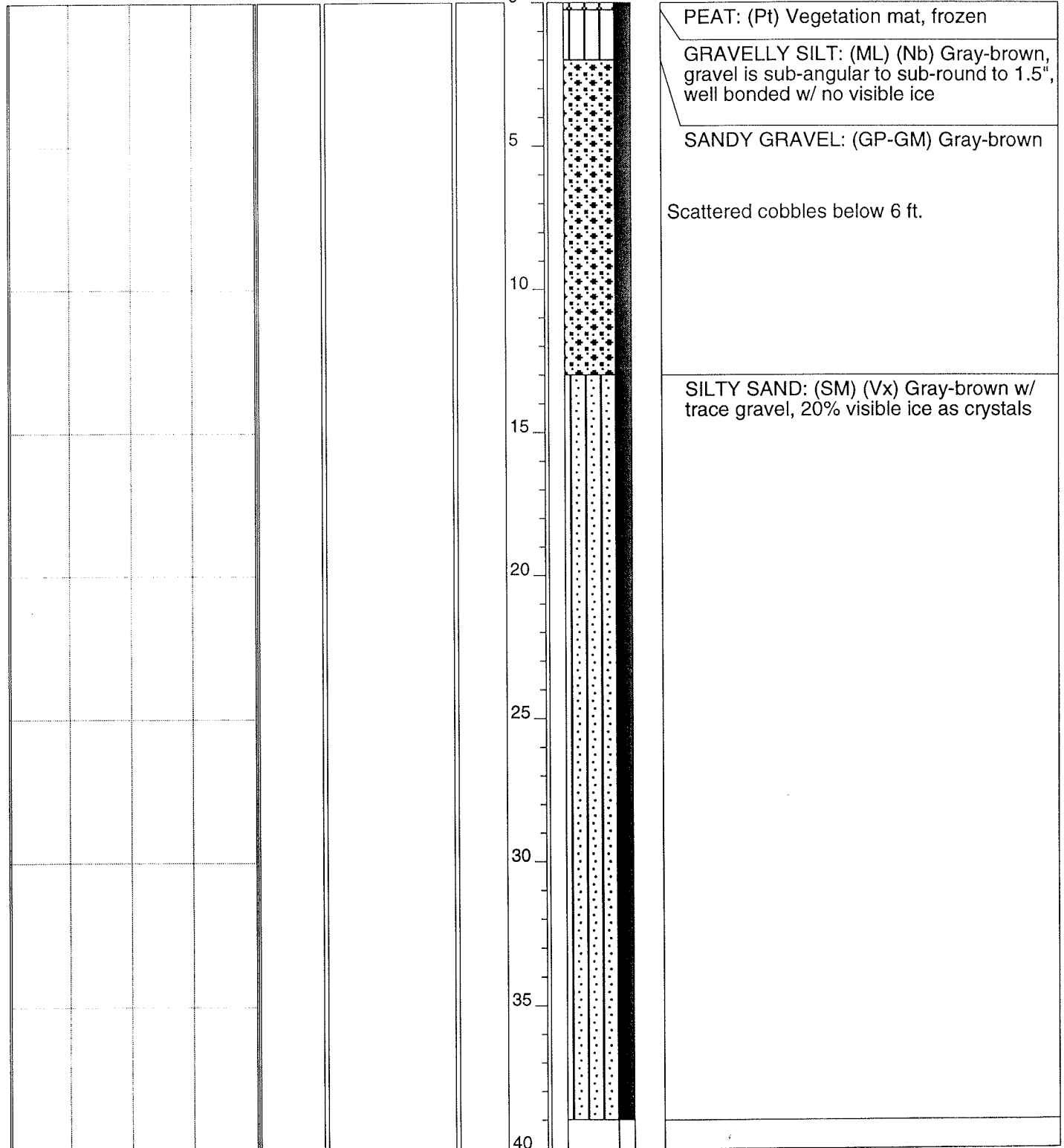
0 20 40 60 >80 P200 Other Tests

Sample type

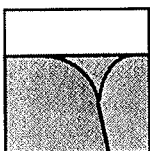
Depth (feet)

Samples
 Graphic
 Log
 Frozen

Description



*The field blow counts have been adjusted for hammer weight and sampler annulus



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 Date : June 1997

LOG of BORING ORV-3
Hotham Peak Material Site
 Noorvik, Alaska

Plate
HP-4

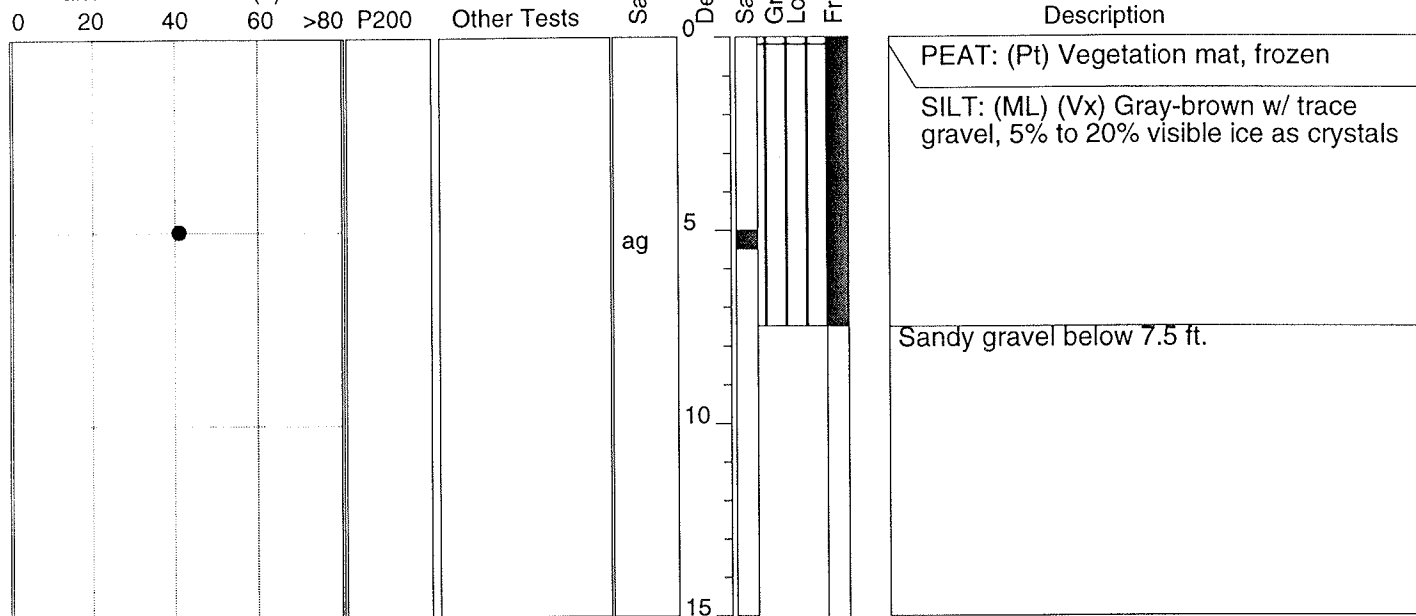
DUANE MILLER & ASSOCIATES

Project: Noorvik Airport
 DM&A Job No. :4086.20
 Logged By: T. Culkin

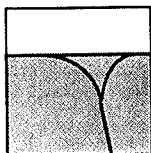
Log of HOLE : ORV-4

Date Drilled: April 4, 1997
 Contractor: Discovery Drilling
 Rig Type: CME-45 w/ 3.5" Dia. S.F. Auger
 Elevation:

Moisture Content % (•), Salinity (Δ)
 and Blow-Counts (o)**



*The field blow counts have been adjusted for hammer weight and sampler annulus



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 Date : June 1997

LOG of BORING ORV-4
 Hotham Peak Material Site
 Noorvik, Alaska

Plate
HP-5

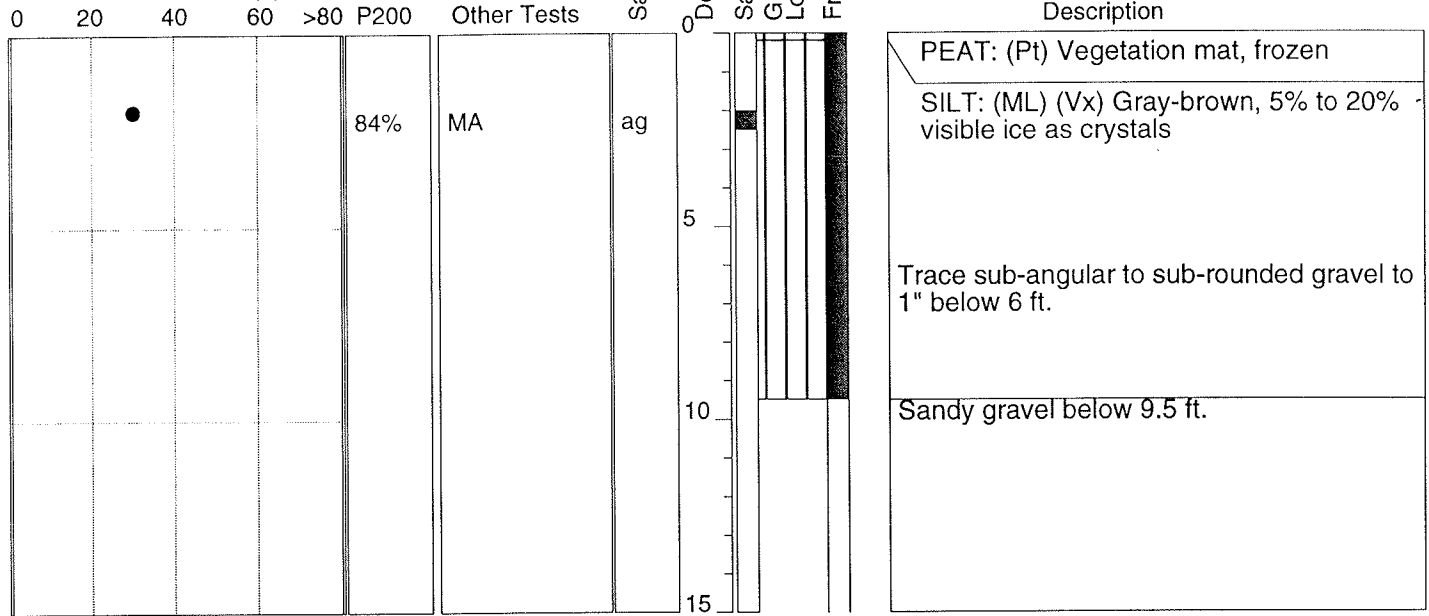
DUANE MILLER & ASSOCIATES

Project: Noorvik Airport
 DM&A Job No. :4086.20
 Logged By: T. Culkin

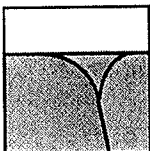
Log of HOLE : ORV-5

Date Drilled: April 4, 1997
 Contractor: Discovery Drilling
 Rig Type: CME-45 w/ 3.5" Dia. S.F. Auger
 Elevation:

Moisture Content % (•), Salinity (Δ)
 and Blow-Counts (o)**



*The field blow counts have been adjusted for hammer weight and sampler annulus



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 Job No.: 4086.20
 Date : June 1997

LOG of BORING ORV-5
Hotham Peak Material Site
 Noorvik, Alaska

Plate
HP-6

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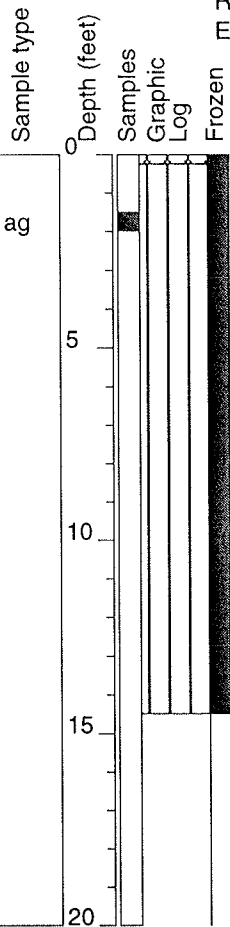
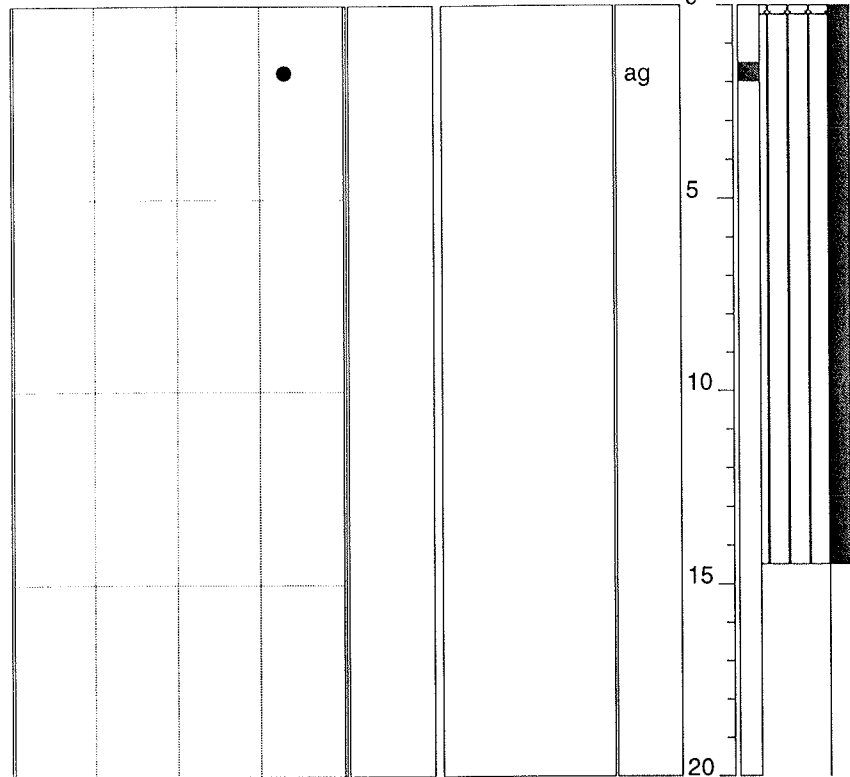
Project: Noorvik Airport
 DM&A Job No. :4086.20
 Logged By: T. Culkin

Log of HOLE : ORV-6

Date Drilled: April 4, 1997
 Contractor: Discovery Drilling
 Rig Type: CME-45 w/ 3.5" Dia. S.F. Auger
 Elevation:

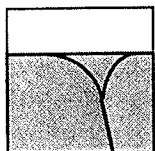
Moisture Content % (•), Salinity (Δ)
 and Blow-Counts (o)**

0 20 40 60 >80 P200 Other Tests



Depth (feet)	Description
0 - 14.5	PEAT: (Pt) Vegetation mat, frozen SILT: (ML) (Vx) Gray-brown w/ trace organics, 5% to 25% visible ice as crystals
14.5 - 20	Sandy gravel below 14.5 ft.

*The field blow counts have been adjusted for hammer weight and sampler annulus



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 Date : June 1997

LOG of BORING ORV-6
Hotham Peak Material Site
 Noorvik, Alaska

Plate
HP-7

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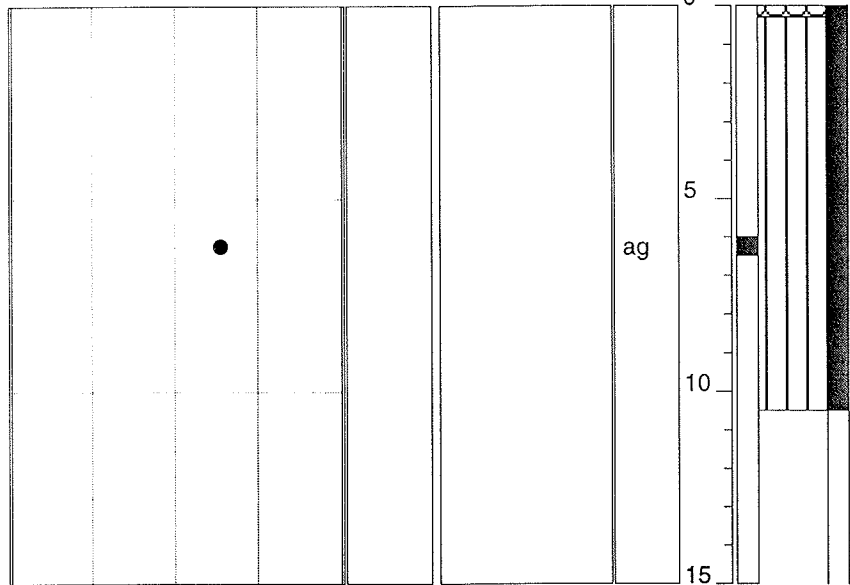
Project: Noorvik Airport
 DM&A Job No. :4086.20
 Logged By: T. Culkin

Log of HOLE : ORV-7

Date Drilled: April 4, 1997
 Contractor: Discovery Drilling
 Rig Type: CME-45 w/ 3.5" Dia. S.F. Auger
 Elevation:

Moisture Content % (•), Salinity (Δ)
 and Blow-Counts (o)**

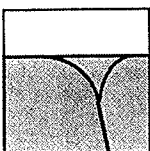
0 20 40 60 >80 P200 Other Tests



Description

PEAT: (Pt) Vegetation mat, frozen
SILT: (ML) (Nb) Gray-brown w/ trace gravel to 1", well bonded with no visible ice (Vx) 25% visible ice as crystals from 3 ft to 4 ft
Sandy gravel below 10.5 ft.

*The field blow counts have been adjusted for hammer weight and sampler annulus



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 Date: June 1997

LOG of BORING ORV-7
 Hotham Peak Material Site
 Noorvik, Alaska

Plate
HP-8

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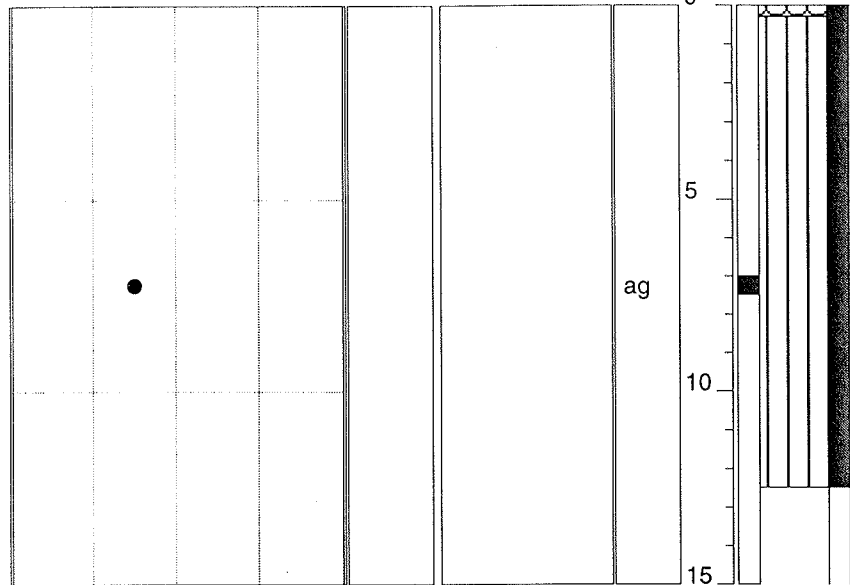
Project: Noorvik Airport
 DM&A Job No. :4086.20
 Logged By: T. Culkin

Log of HOLE : ORV-8

Date Drilled: April 4, 1997
 Contractor: Discovery Drilling
 Rig Type: CME-45 w/ 3.5" Dia. S.F. Auger
 Elevation:

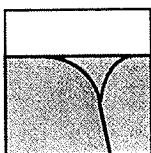
Moisture Content % (•), Salinity (Δ)
 and Blow-Counts (o)**

0 20 40 60 >80 P200 Other Tests



Description
PEAT: (Pt) Vegetation mat, frozen
SILT: (ML) (Vx) Gray-brown, 25% visible ice as crystals to 1/4"
Trace sub-rounded gravel to 1" below 4 ft.
Gravel below 12.5 ft.

*The field blow counts have been adjusted for hammer weight and sampler annulus



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 Date : June 1997

LOG of BORING ORV-8
Hotham Peak Material Site
 Noorvik, Alaska

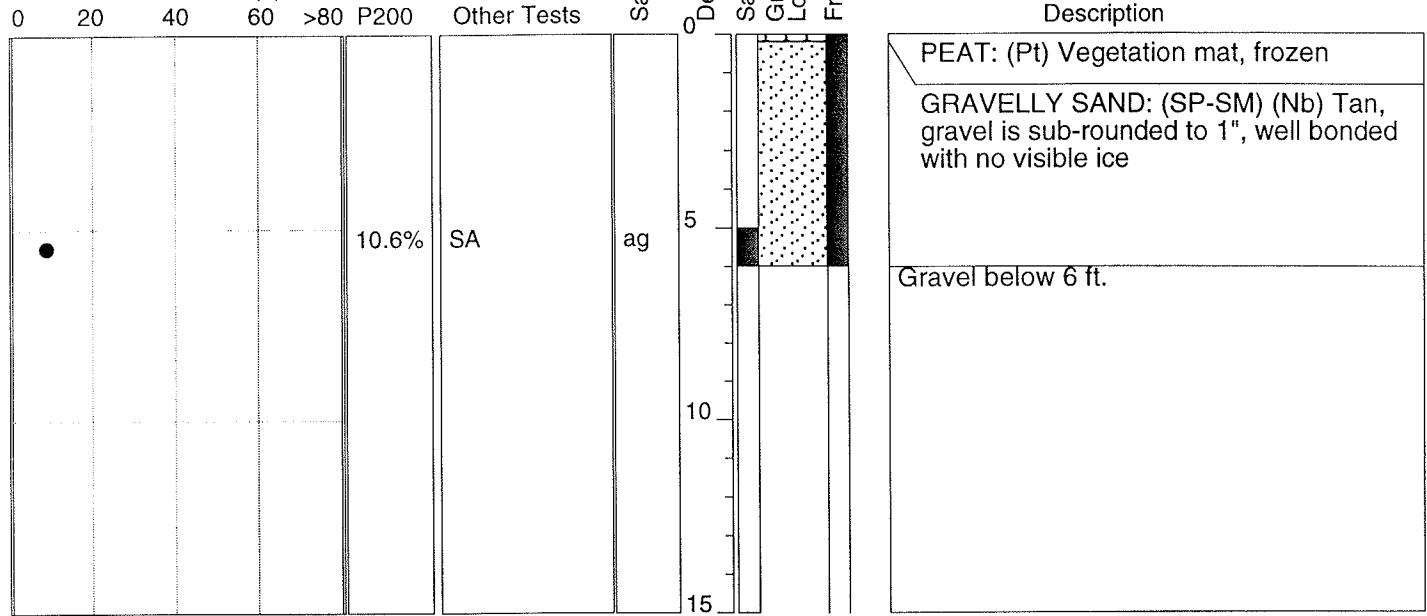
Plate
HP-9

DUANE MILLER & ASSOCIATES

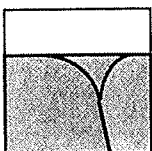
Project: Noorvik Airport
 DM&A Job No. :4086.20
 Logged By: T. Culkin

Log of HOLE : ORV-9
 Date Drilled: April 4, 1997
 Contractor: Discovery Drilling
 Rig Type: CME-45 w/ 3.5" Dia. S.F. Auger
 Elevation:

Moisture Content % (•), Salinity (Δ)
 and Blow-Counts (o)**



*The field blow counts have been adjusted for hammer weight and sampler annulus



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 Date : June 1997

LOG of BORING ORV-9
 Hotham Peak Material Site
 Noorvik, Alaska

Plate
HP-10

DUANE MILLER & ASSOCIATES

Project: Noorvik Airport
 DM&A Job No. :4086.20
 Logged By: T. Culkin

Log of HOLE : ORV-10

Date Drilled: April 4, 1997
 Contractor: Discovery Drilling
 Rig Type: CME-45 w/ 3.5" Dia. S.F. Auger
 Elevation:

Moisture Content % (•), Salinity (Δ)
 and Blow-Counts (o)**

0 20 40 60 >80 P200

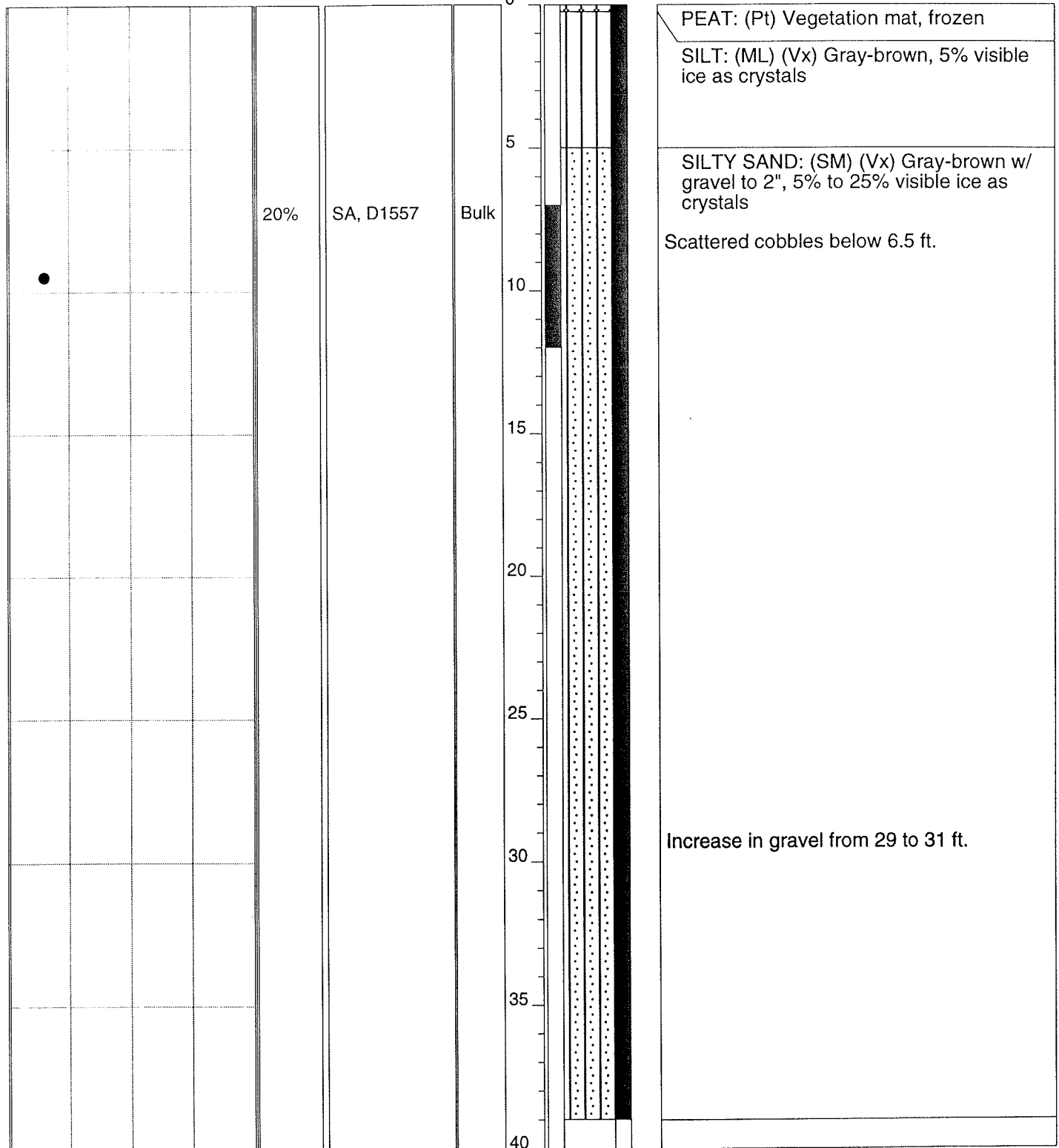
Other Tests

Sample type

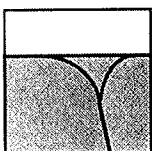
Depth (feet)

Samples
 Graphic
 Log
 Frozen

Description



*The field blow counts have been adjusted for hammer weight and sampler annulus



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 Job No.: 4086.20
 Date : June 1997

LOG of BORING ORV-10
 Hotham Peak Material Site
 Noorvik, Alaska

Plate
HP-11

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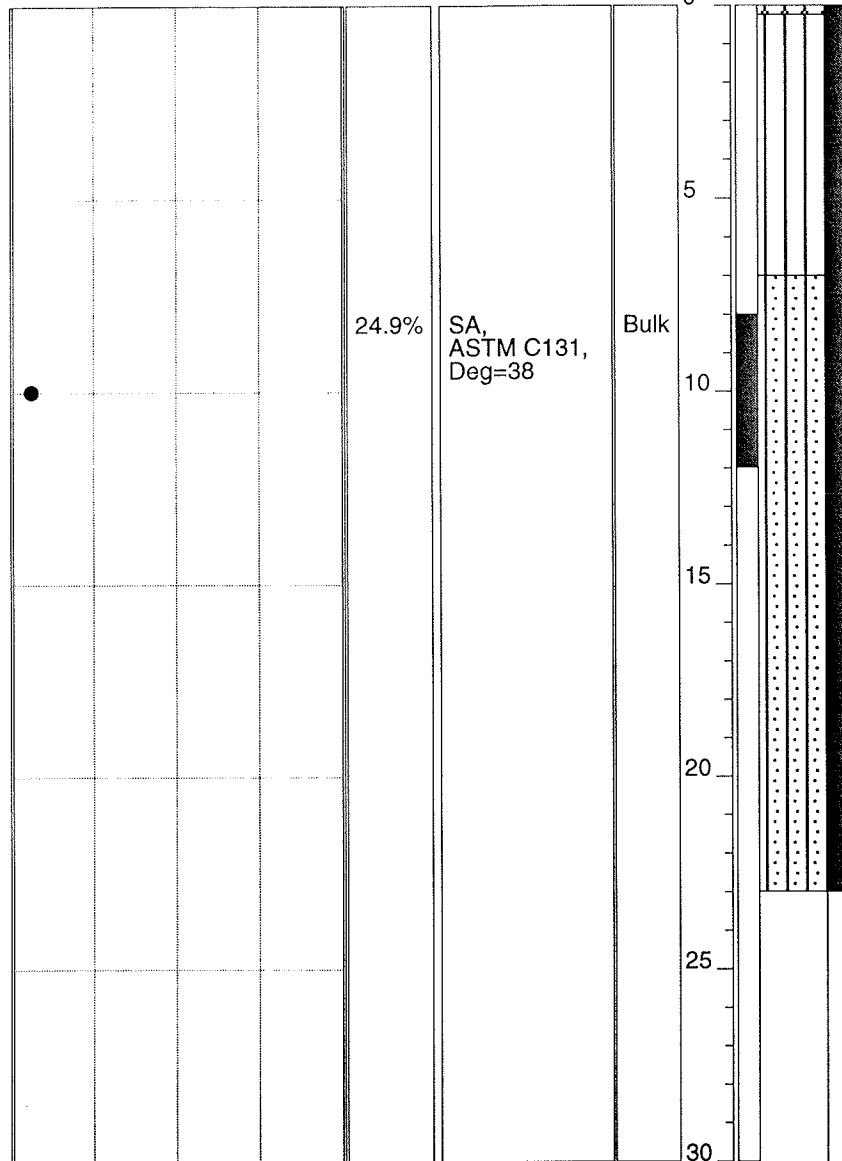
Project: Noorvik Airport
 DM&A Job No. :4086.20
 Logged By: T. Culkin

Log of HOLE : ORV-11

Date Drilled: April 4, 1997
 Contractor: Discovery Drilling
 Rig Type: CME-45 w/ 3.5" Dia. S.F. Auger
 Elevation:

Moisture Content % (•), Salinity (Δ)
 and Blow-Counts (o)**

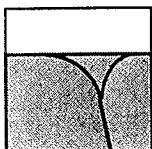
0 20 40 60 >80 P200 Other Tests



Description

0 - 1.5 ft	PEAT: (Pt) Vegetation mat, frozen
1.5 - 12 ft	SILT: (ML) (Vx) Gray-brown w/ trace organics, sand & gravel to 1", 5% visible ice as crystals
12 - 27 ft	SILTY SAND: (SM) (Vx) Tan w/ gravel to 1.5", 5% visible ice as crystals Color change to gray & scattered cobbles below 12 ft.
27 - 30 ft	

*The field blow counts have been adjusted for hammer weight and sampler annulus



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 Job No.: 4086.20
 Date : June 1997

LOG of BORING ORV-11
Hotham Peak Material Site
 Noorvik, Alaska

Plate
HP-12

DUANE MILLER & ASSOCIATES

Project: Noorvik Airport
 DM&A Job No. :4086.20
 Logged By: D. Pavay

Log of HOLE : DOT TH-2*

Date Drilled: July 22, 1973
 Contractor: N/A
 Rig Type: B-50 w/ 6" Dia. S.F. Auger
 Elevation: N/A

Moisture Content % (•), Salinity (Δ)
 and Blow-Counts (o)

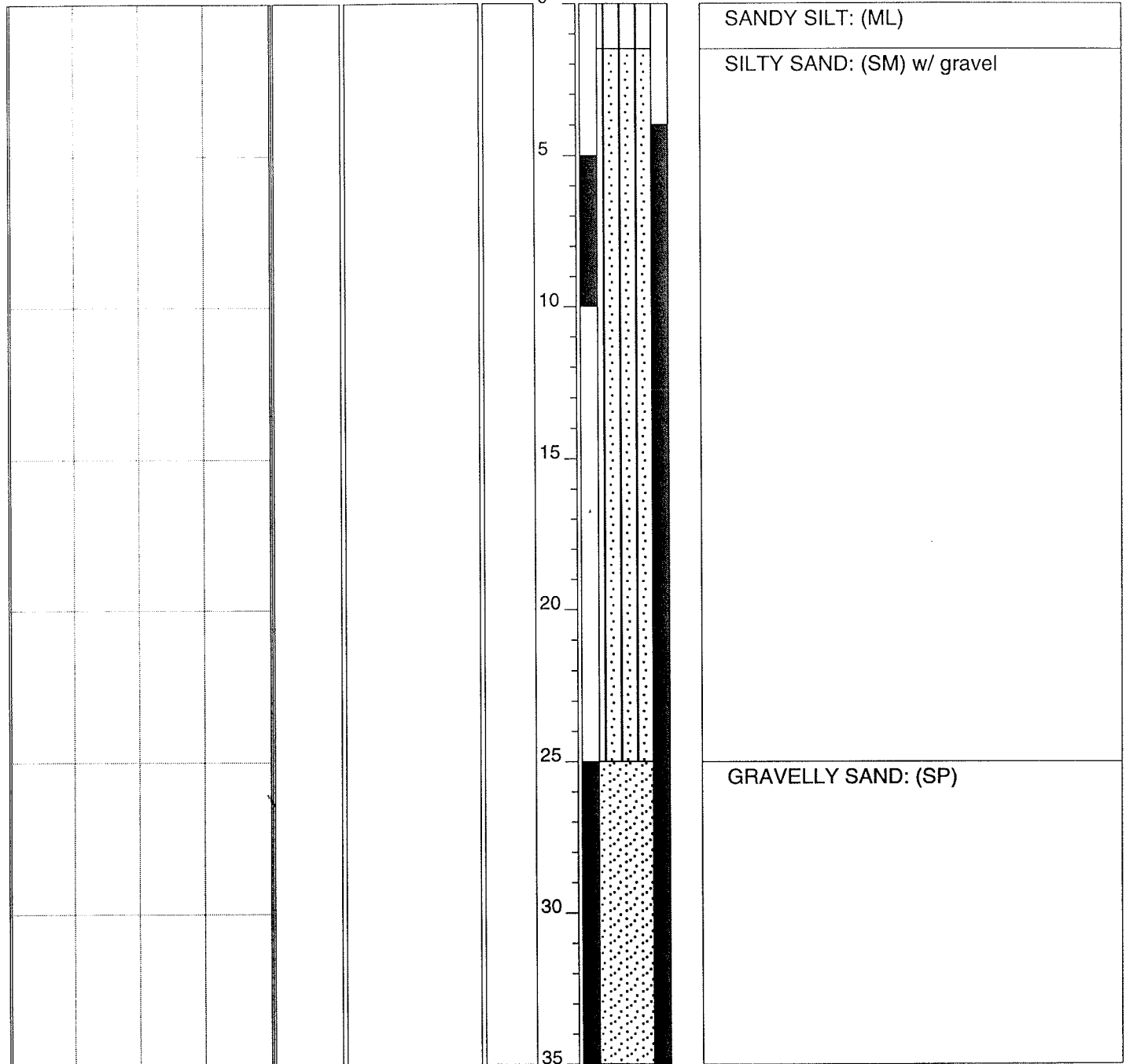
0 20 40 60 >80 P200 Other Tests

Sample type

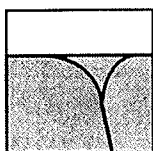
Depth (feet)

Samples
 Graphic
 Log
 Frozen

Description



*Re-drafted from original DOT boring log.



Duane Miller & Associates
 Arctic & Geotechnical Engineering
 Job No.: 4086.20
 Date : June 1997

LOG of BORING DOT TH-2
Hotham Peak Material Site
 Noorvik, Alaska

Plate
HP-13

DUANE MILLER & ASSOCIATES

Project: Noorvik Airport
 DM&A Job No. :4086.20
 Logged By: D. Pavey

Log of HOLE : DOT TH-3*

Date Drilled: July 22, 1973
 Contractor: N/A
 Rig Type: B-50 w/ 6" Dia. S.F. Auger
 Elevation: N/A

Moisture Content % (•), Salinity (Δ)
 and Blow-Counts (o)

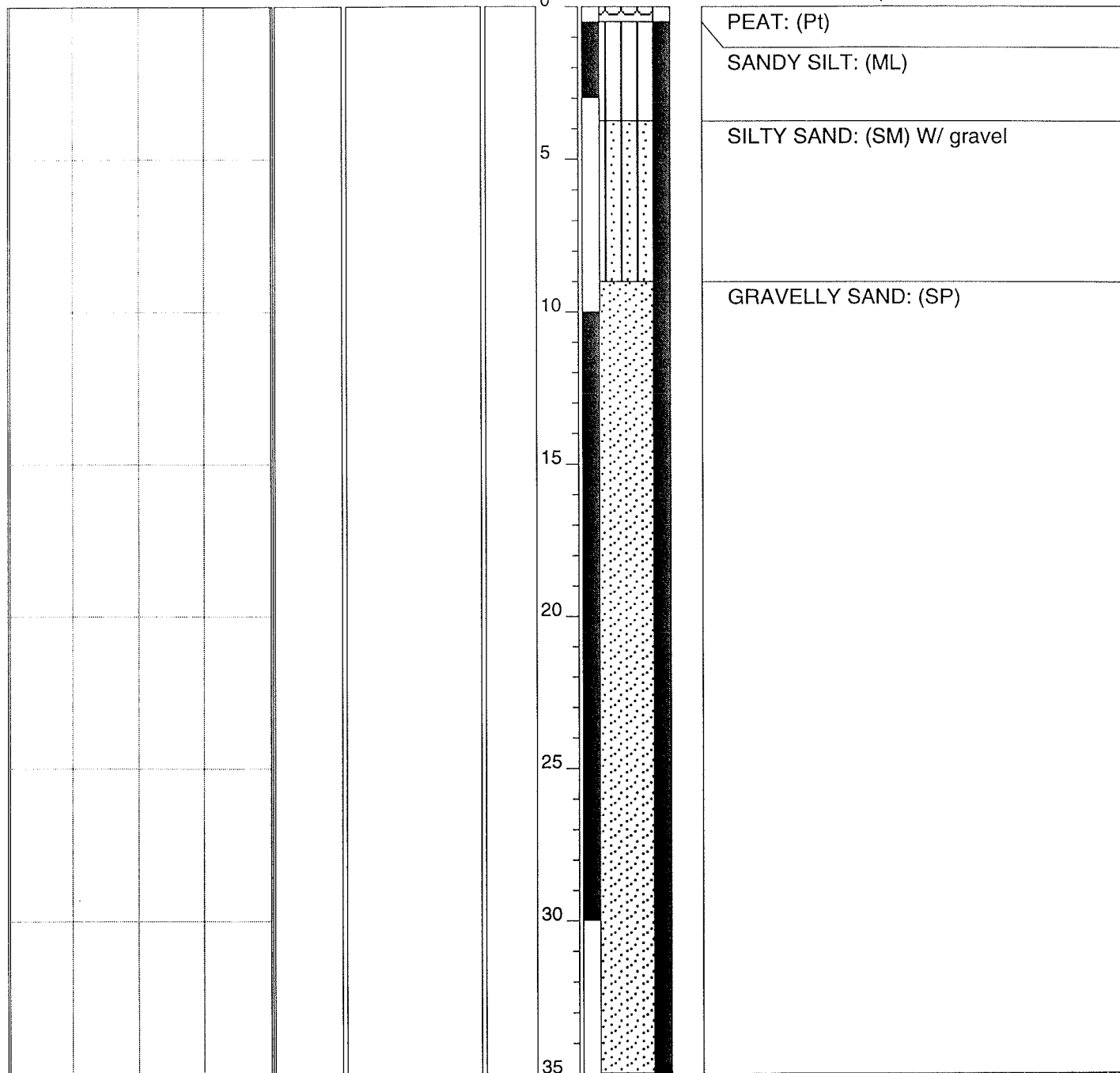
0 20 40 60 >80 P200 Other Tests

Sample type

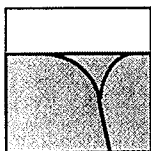
Depth (feet)

Samples
 Graphic
 Log
 Frozen

Description



*Re-drafted from original DOT boring log.



Duane Miller & Associates
 Arctic & Geotechnical Engineering
 Job No.: 4086.20
 Date : June 1997

LOG of BORING DOT TH-3
 Hotham Peak Material Site
 Noorvik, Alaska

Plate
HP-14

DUANE MILLER & ASSOCIATES

Project: Noorvik Airport
 DM&A Job No. :4086.20
 Logged By: D. Pavey

Log of HOLE : DOT TH-4*

Date Drilled: July 22, 1973
 Contractor: N/A
 Rig Type: B-50 w/ 6" Dia. S.F. Auger
 Elevation: N/A

Moisture Content % (•), Salinity (Δ)
 and Blow-Counts (o)

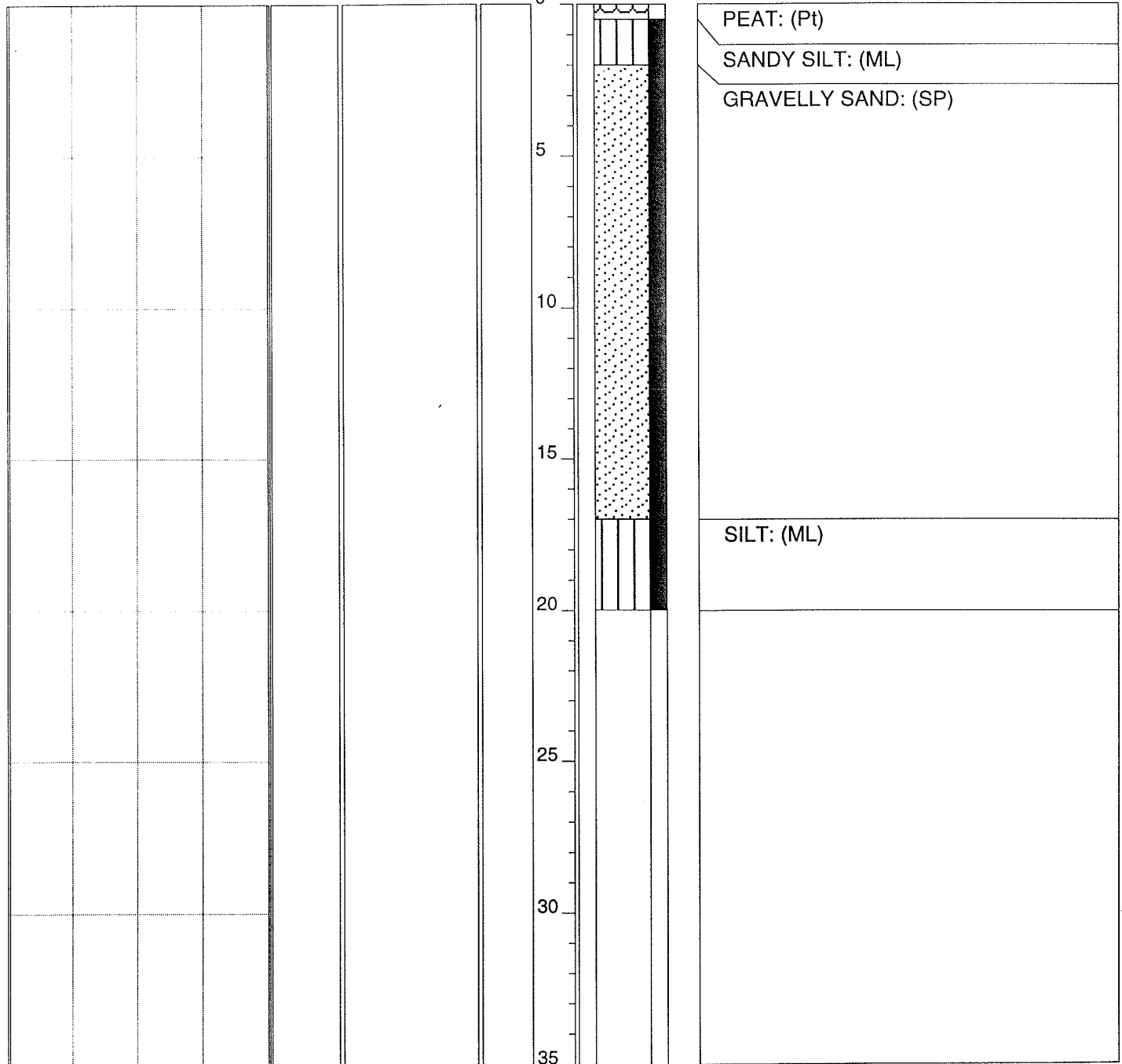
0 20 40 60 >80 P200 Other Tests

Sample type

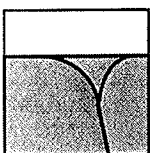
Depth (feet)

Samples
 Graphic
 Log
 Frozen

Description



*Re-drafted from original DOT boring log.



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 Job No.: 4086.20
 Date : June 1997

LOG of BORING DOT TH-4
Hotham Peak Material Site
 Noorvik, Alaska

Plate
HP-15

MAJOR DIVISIONS		SYMBOL	TYPICAL NAMES	
COARSE GRAINED SOILS More than 50% larger than #200 sieve, 0.075 mm	GRAVELS More than half of the coarse fraction is larger than #4 sieve size, > 4.75 mm.	Clean gravels with little or no fines	GW	Well graded gravels, sandy gravel
			GP	Poorly graded gravels, sandy gravel
		Gravels with more than 12% fines	GM	Silty gravels, silt sand gravel mixtures
			GC	Clayey gravels, clay sand gravel mixtures
	SANDS More than half of the coarse fraction is smaller than #4 sieve size	Clean sands with little or no fines	SW	Well graded sand, gravelly sand
			SP	Poorly graded sands, gravelly sand
		Sands with more than 12% fines	SM	Silty sand, silt gravel sand mixtures
			SC	Clayey sand, clay gravel sand mixtures
FINE GRAINED SOILS >50% finer than #200 sieve, 0.075 mm	<p>Plasticity Chart</p> <p>Plasticity Index</p> <p>Liquid Limit</p>	SILTS and CLAYS Liquid limit less than 50	ML	Inorganic silt and very fine sand, rock flour
			CL	Inorganic clay, gravelly and sandy clay, silty clay
		SILTS and CLAYS Liquid limit greater than 50	OL	Organic silts and clay of low plasticity
			MH	Inorganic silt
		CH	Inorganic clay, fat clay	
		OH	Organic silt and clay of high plasticity	
	HIGHLY ORGANIC SOILS	Pt	Peat and other highly organic soil	

KEY TO TEST DATA

Dd = Dry Density (pcf)
 TC = Thaw Consolidation
 TCf = Thaw Consolidation (field)
 UU = Unconsolidated Undrained Triaxial
 CU = Consolidated Undrained Triaxial
 CD = Consolidated Drained Triaxial
 LL = Liquid Limit
 PL = Plastic Limit
 PI = Plastic Index
 S.G. = Specific Gravity
 SA = Sieve Analysis
 MA = Sieve and Hydrometer Analysis
 OLI = Organic Loss

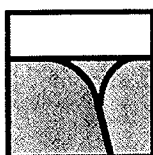
KEY TO SAMPLE TYPE

Ag = Auger grab
 Ab = Auger bulk
 Sh = 2.5" ID split barrel w/340 lb. manual hammer
 Sha = 2.5" ID split barrel w/340 lb. automatic hammer
 Tw = Shelby tube

UNIFIED SOIL CLASSIFICATION SYSTEM

GROUP	ICE VISIBILITY	DESCRIPTION	SYMBOL	
N	Segregated ice not visible by eye	Poorly bonded or friable	Nf	
		Well bonded	No excess ice	Nb
			Excess microscopic ice	Nbn Nbe
V	Segregated ice is visible by eye and is one inch or less in thickness	Individual ice crystals or inclusions	Vx	
		Ice coatings on particles	Vc	
		Random or irregularly oriented ice	Vr	
		Stratified or distinctly oriented ice	Vs	
ICE	Ice greater than one inch in thickness	Ice with soil inclusions	ICE + soil type	
		Ice without soil inclusions	ICE	

ICE CLASSIFICATION SYSTEM



Duane Miller & Associates
 Arctic & Geotechnical Engineering
 Job No.: 4086.20
 Date: June 1997

**SOIL and ICE CLASSIFICATION
 and KEY TO DATA**
 Hotham Peak Material Site
 Noorvik, Alaska

Plate
HP-16

Boring	Sample Depth	Soil Type (USCS)	Frz?	N-value blows/ft	Moisture Content	Passing #200	Other Tests
ORV-1	5.0 ft.	ML	Yes	Grab	37.6%		
ORV-1	10.0 ft.	SP-SM	Yes	156	19.0%	5.4%	SA
ORV-1	14.5 ft.	SM	Yes	Grab	10.2%	15.3%	SA
ORV-1	20.0 ft.	GW-GM	Yes	156	9.0%	12.0%	SA, SpG=2.68
ORV-1	24.5 ft.	GM	Yes	Grab	8.5%	14.5%	SA
ORV-1	30.0 ft.	SP-SM	Yes	87	13.7%	8.6%	SA
ORV-2	5.5 ft.	SP-SM	Yes	Grab	11.9%		
ORV-4	5.0 ft.	ML	Yes	Grab	41.0%		
ORV-5	2.0 ft.	ML	Yes	Grab	29.8%	84.0%	MA
ORV-6	1.5 ft.	ML	Yes	Grab	65.8%		
ORV-7	6.0 ft.	ML	Yes	Grab	51.2%		
ORV-8	7.0 ft.	ML	Yes	Grab	30.2%		
ORV-9	5.0 ft.	SP-SM	Yes	Grab	8.7%	10.6%	SA
ORV-10	7.0 ft.	SM	Yes	Bulk	12.2%	20.0%	SA, D1557
ORV-11	8.0 ft.	SM	Yes	Bulk	5.3%	24.9%	SA, ASTM C131=28% Loss, Deg=38

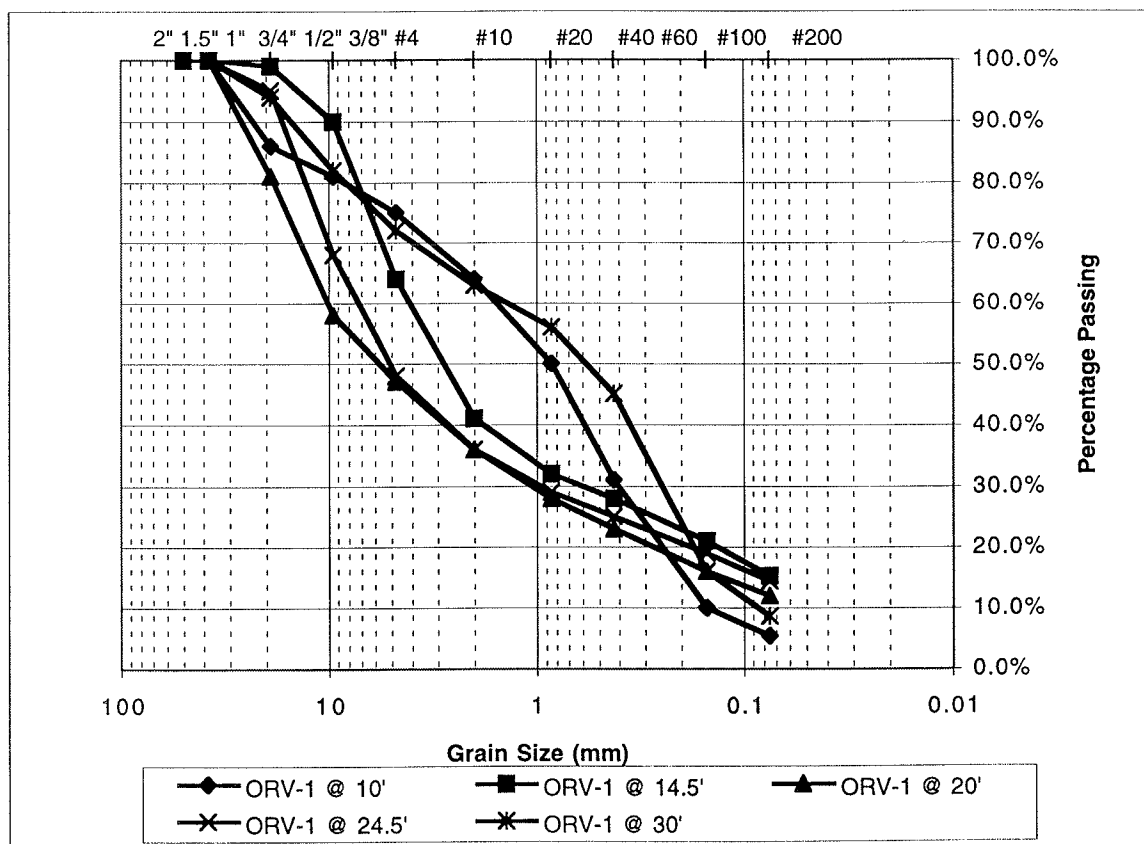
SUMMARY OF SAMPLES

Duane Miller & Associates
 Job No. 4086.20
 June 1997

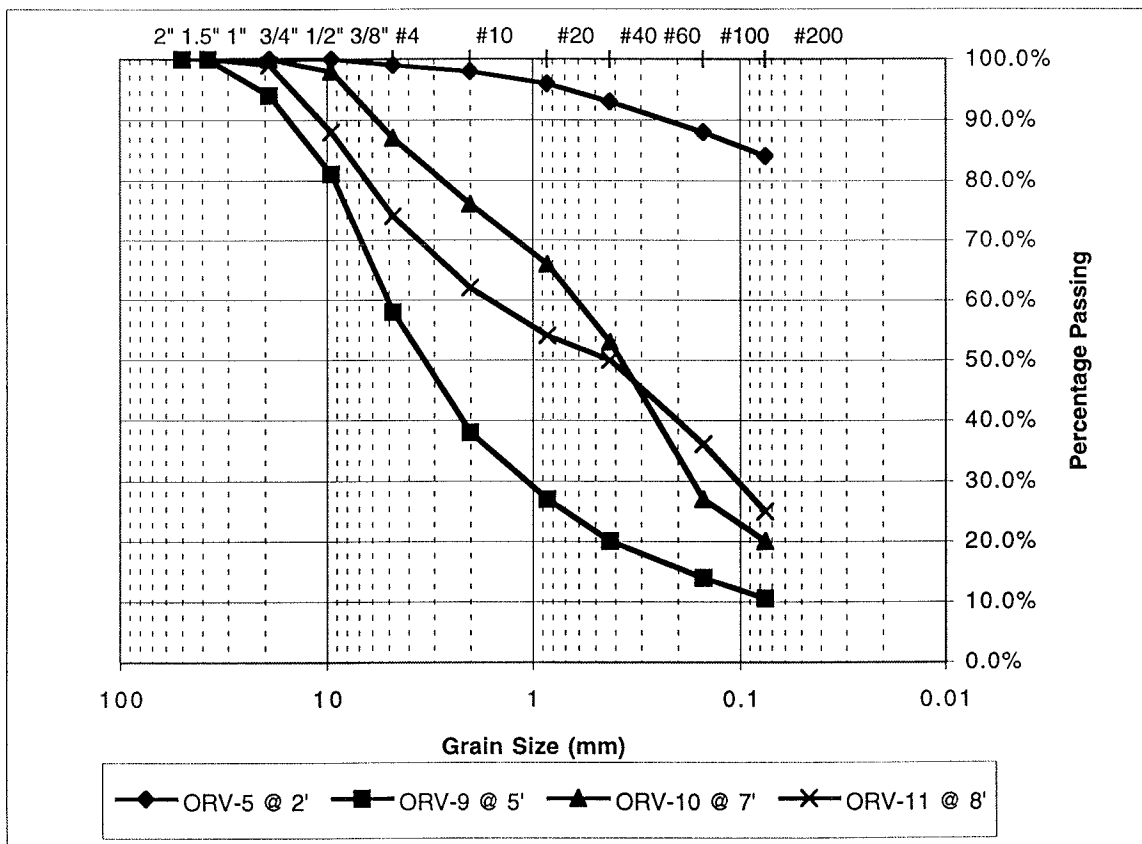
Hotham Peak Material Site
 Noorvik, Alaska

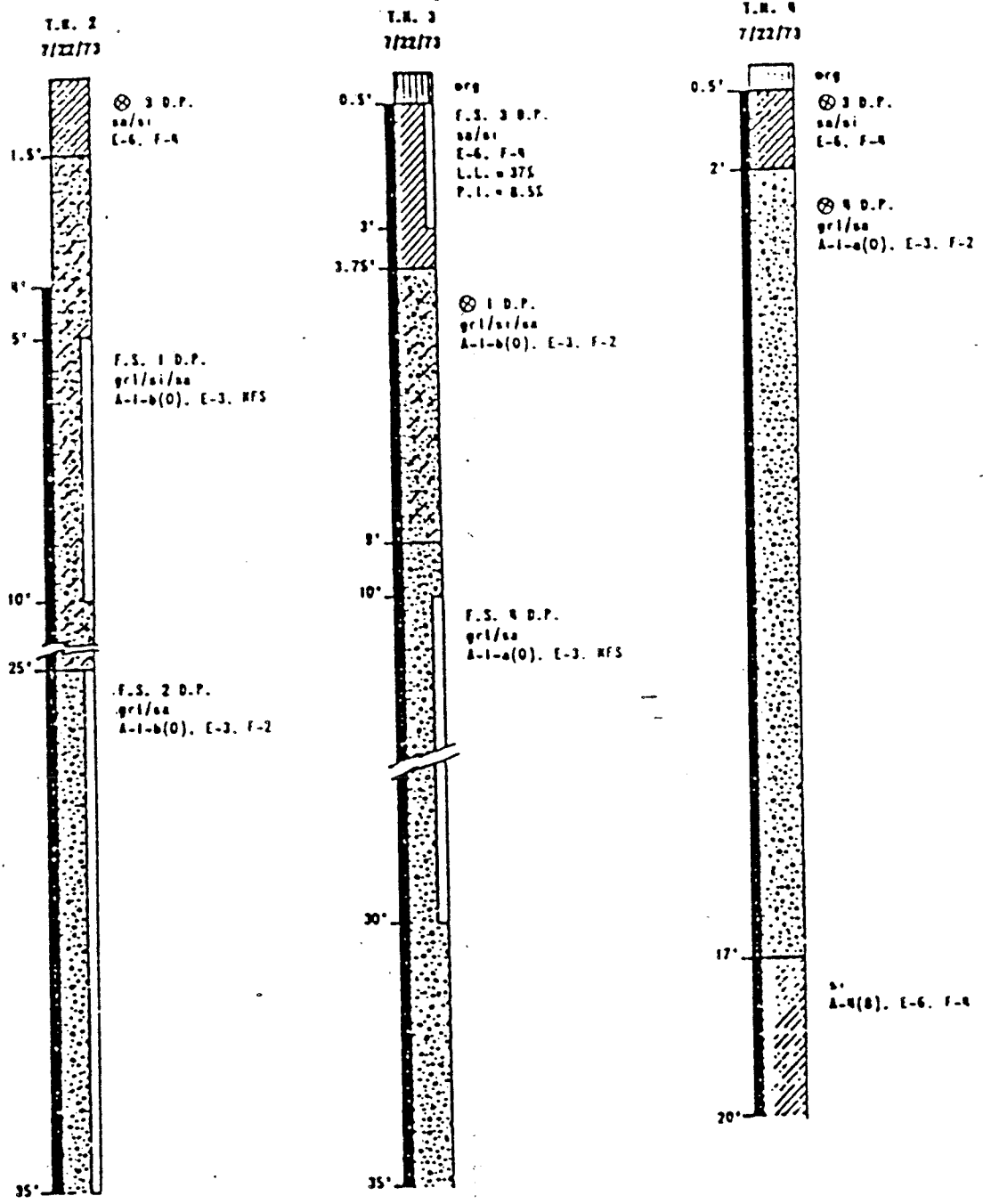
Plate
HP-17

Boring =>	ORV-1	ORV-1	ORV-1	ORV-1	ORV-1
Depth =>	10.0 ft.	14.5 ft.	20.0 ft.	24.5 ft.	30.0 ft.
3" =>	100.0%	100.0%	100.0%	100.0%	100.0%
1 1/2" =>	100.0%	100.0%	100.0%	100.0%	100.0%
3/4" =>	86.0%	99.0%	81.0%	95.0%	94.0%
3/8" =>	81.0%	90.0%	58.0%	68.0%	82.0%
#4 =>	75.0%	64.0%	47.0%	48.0%	72.0%
#10 =>	64.0%	41.0%	36.0%	36.0%	63.0%
#20 =>	50.0%	32.0%	28.0%	29.0%	56.0%
#40 =>	31.0%	28.0%	23.0%	25.0%	45.0%
#100 =>	10.0%	21.0%	16.0%	19.0%	16.0%
#200 =>	5.4%	15.3%	12.0%	14.5%	8.6%
Analysis of Data					
D10 size =>	0.150 mm		0.060 mm		0.086 mm
D30 size =>	0.404 mm	0.601 mm	1.053 mm	0.961 mm	0.248 mm
D50 size =>	0.850 mm	2.806 mm	5.738 mm	5.091 mm	0.582 mm
D60 size =>	1.566 mm	4.087 mm	10.090 mm	7.200 mm	1.386 mm
Coeff. of Uniformity, Cu =	10.44		168.17		16.21
Coeff. of Curvature, Cc =	0.70		1.83		0.52
Gravel (+#4) percentage =	25.0%	36.0%	53.0%	52.0%	28.0%
Sand percentage =	69.6%	48.7%	35.0%	33.5%	63.4%
Fines percentage =	5.4%	15.3%	12.0%	14.5%	8.6%
Unified Soil Class Symbol =	SP-SM	SM	GW-GM	GM	SP-SM



Boring =>	ORV-5	ORV-9	ORV-10	ORV-11
Depth =>	2.0 ft.	5.0 ft.	7.0 ft.	8.0 ft.
3" =>	100.0%	100.0%	100.0%	100.0%
1 1/2" =>	100.0%	100.0%	100.0%	100.0%
3/4" =>	100.0%	94.0%	100.0%	99.0%
3/8" =>	100.0%	81.0%	98.0%	88.0%
#4 =>	99.0%	58.0%	87.0%	74.0%
#10 =>	98.0%	38.0%	76.0%	62.0%
#20 =>	96.0%	27.0%	66.0%	54.0%
#40 =>	93.0%	20.0%	53.0%	50.0%
#100 =>	88.0%	14.0%	27.0%	36.0%
#200 =>	84.0%	10.6%	20.0%	24.9%
Analysis of Data				
D10 size =>		0.075 mm		
D30 size =>		1.073 mm	0.169 mm	0.103 mm
D50 size =>		3.361 mm	0.377 mm	0.425 mm
D60 size =>		5.045 mm	0.617 mm	1.615 mm
Coeff. of Uniformity, Cu =		67.27		
Coeff. of Curvature, Cc =		3.05		
Gravel (+#4) percentage =	1.0%	42.0%	13.0%	26.0%
Sand percentage =	15.0%	47.4%	67.0%	49.1%
Fines percentage =	84.0%	10.6%	20.0%	24.9%
Unified Soil Class Symbol =	ML	SP-SM	SM	SM





Boring Logs for TH-2, TH-3 and TH-4 from Noorvik Materials Investigation by Div. of Aviation, Dec. 4, 1973, which are shown as DOT-2, DOT-3 and DOT-4 on Plate HP-1. See the following page for laboratory data from 1973.

PROJECT NAME

Nonryk

1973

SOILS ANALYSIS

PROJECT NO.

13-83-6-311-298-243

STATION	Depth in Ft.	Field No.	Lab No.	Nat Moist	MECHANICAL ANALYSIS - PASSING										L.L.	P.L.	P.I.	UNIFIED CLASS.	ASSHO Class	FAA	Frost FSY	
					3"	2"	1"	3/4"	1/2"	3/8"	#10	#40	#200	#425								
T.H. 1A	1.0 - 1.5	1	NA76-358	90.2														Org. Sa Si	A-4(8)	E-6	F4	
1A	2.0 - 2.2	2	NA76-359	164.6														Org. Si		E-13		
1A	2.5 - 3.0	3	NA76-360	69.6														Sa Si	A-4(8)	E-6	F4	
1A	3.5 - 4.0	4	NA76-361	57.1														Sa Si	A-4(8)	E-6	F4	
1A	5.0 - 5.5	5	NA76-362	38.3														Cl Si	A-4(8)	E-6	F4	
2A	1.5 - 2.0	7	NA76-363	32.3														Sa Si	A-4(8)	E-6	F4	
2A	6.0 - 6.5	9	NA76-364	25.4														Sa Si	A-4(7)	E-6	F4	
3A	3.5 - 4.5	11	NA76-365	32.9														Org. Cl Si	A-4(8)	E-6	F4	
4A	2.0 - 3.0	13	NA76-366	17.0														Si Sa	A-4(2)	E-6	F7	
4A	3.0 - 3.5	14	NA76-367	52.7														Org. Si	A-4(8)	E-6	F.	
4A	6.2 - 7.0	15	NA76-368	13.5														Sa Si	A-4(6)	E-6	F4	
5A	1.5 - 2.0	16	NA76-369	43.8														Sa Si	A-4(8)	E-6	F4	
5A	5.0 - 6.0	17	NA76-370	37.9														Sa Si	A-4(7)	E-6	F4	
6A	2.0 - 3.0	18	NA76-371	54.1														Si Si	A-4(8)	E-6	F4	
6A	4.5 - 5.5	19	NA76-372	39.6														Sa Si	A-4(7)	E-6	F4	
7A	3.5 - 4.5	20	NA76-373	20.9														Sa Si	A-4(4)	E-6	F4	
Bank Exposure																						
Upstream Island		21	NA76-374															Sa	A-3(0)	E-3	NFS	
Beach	Surface	22	NA76-375															Sa Grvl	A-1-a(0)	E-2	NFS	
Beach "Point"	0.5 - 1.0	23	NA76-376															Grvl Sa	A-1-a(0)	E-2	NFS	
Beach, N.Selawik Lake	Surface	24	NA76-377															Grvl Sa	A-1-a(0)	E-2	NFS	
Beach, N.Selawik Lake	1.0 - 2.0	25	NA76-378															Grvl Sa	A-1-a(0)	E-2	NFS	
Beach, N.Selawik Lake	0 - 1.0	26	NA76-379															Grvl Sa	A-1-a(0)	E-2	NFS	
Beach, N.Selawik Lake	Surface	27	NA76-380															Sa Grvl	A-1-a(0)	E-3	NFS	
Hotham Peak Site T12	5.0 - 10.0	FS111P	NA73-549															Si Grl Sa	A-1-b(0)	E-3	F2	
Hotham Peak Site T13	10.0 - 30.0	FS40P	NA73-552															Grl Sa w/ssi	A-1-a(0)	E-3	F2	

LABORATORY TEST REPORT



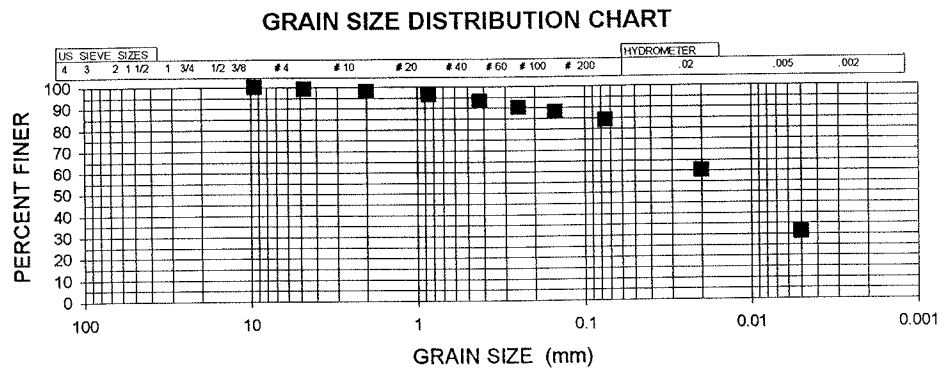
R&M CONSULTANTS, INC.

9101 VANGUARD DR. ANCHORAGE, ALASKA 99507 PH 907-522-1707

CLIENT/PROJECT: Duane Miller & Associates / Noorvik Airport (Fld. Inv. # 2)
 TEST ON: _____
 SOURCE: _____
 SAMPLED FROM: _____
 LOCATION: ORV 5 @ 2 to 2.5

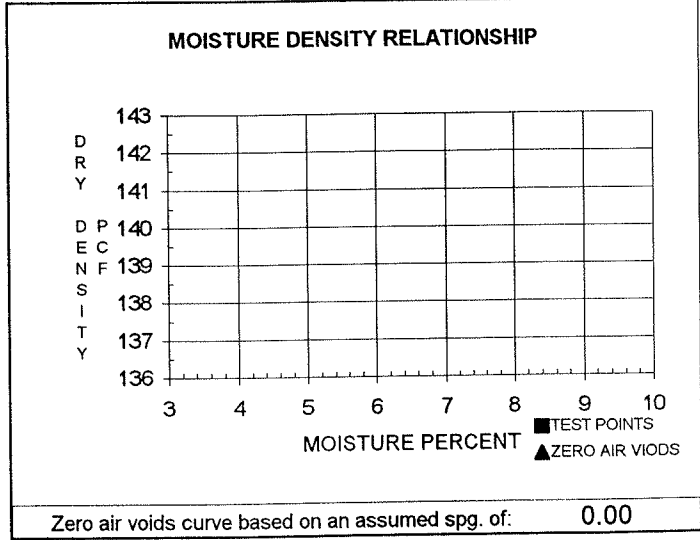
R&M PROJECT: 651017
 LAB NO.: 7190
 SUBMITTED BY: Client
 FIELD NO.: _____
 DATE SAMPLED: _____
 DATE REPORTED: 5-16-97
 DEPTH: _____
 DATE RECEIVED: 5-15-97

GRAIN SIZE DISTRIBUTION			CLASSIFICATION			COMPACTION	
SIEVE	% PASS	SPEC.		UNIFIED	AASHTO	FAA	
5"			% + 10				OPTIMUM MOISTURE:
4"			% + 3				MAX. WET DENSITY:
3"			% GRAVEL				MAX. DRY DENSITY:
2"			% SAND				CORR. MAX. DRY DENSITY:
1 1/2"			% SILT				% FRACTURE:
1"			% CLAY				METHOD:
3/4"			FSV				NATURAL DENSITY:
1/2"			LL				NATURAL MOISTURE:
3/8"	100		PL				WEIGHT LOOSE:
#4	99		PI				WEIGHT RODDED:
#8			CLASS				
#10	98						
#16							
#20	96						
#30							
#40	93						
#50							
#60	90						
#80							
#100	88						
#200	84						
.02MM	60						
.005MM	31						
.002MM							



TOTAL WT. TESTED: 161 GMS.

COARSE	SPEC	FINE	SPEC	DELETERIOUS MAT.
				MINUS #200 MESH
				SOFT FRAGMENTS
				COAT & LIG. OR L.T.WT.PT.
				CLAY LUMPS
				STICKS & ROOTS
				FRIABLE PARTICLES
				THIN-ELONGATED
				ORGANIC COLOR
				FINENESS MODULUS
				SULFATE SOUNDNESS
				DEGRADATION VALUE
				ABSORPTION
				SPG.-BULK
				SPG.-BULK S.S.D.
				SPG.-APPARENT



ORGANIC CONTENT %: _____
 L.A. ABRASION LOSS: _____
 REMARKS: _____

Tested By: AJS/KCB Checked By: DKJ

Signed By: *[Signature]*

LABORATORY TEST REPORT



R&M CONSULTANTS, INC.

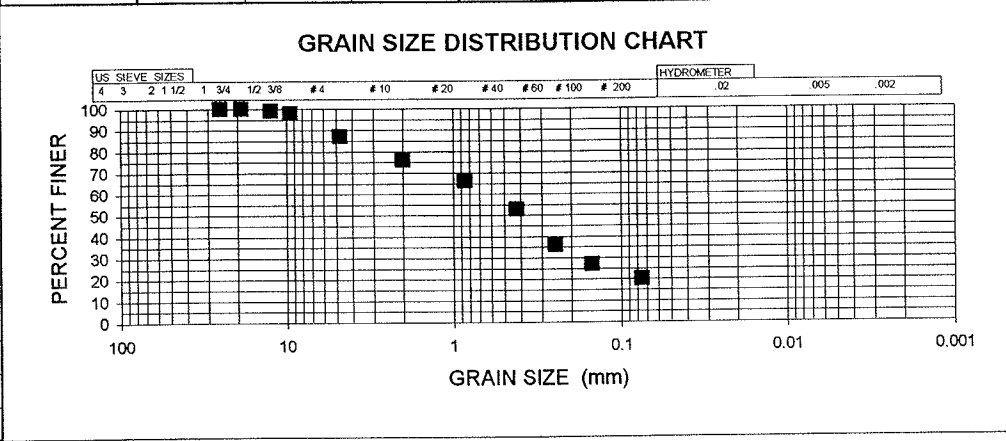
9101 VANGUARD DR. ANCHORAGE, ALASKA 99507 PH 907-522-1707

CLIENT/PROJECT: Duane Miller & Associates / Noorvik Airport (Fld. Inv. # 2)
 TEST ON: _____
 SOURCE: _____
 SAMPLED FROM: Boring
 LOCATION: ORV 10 @ 7.0

R&M PROJECT: 651017
 LAB NO.: 7190
 SUBMITTED BY: Client
 DATE SAMPLED: N/A
 DEPTH: _____
 FIELD NO.: _____
 DATE REPORTED: 5-16-97
 DATE RECEIVED: _____

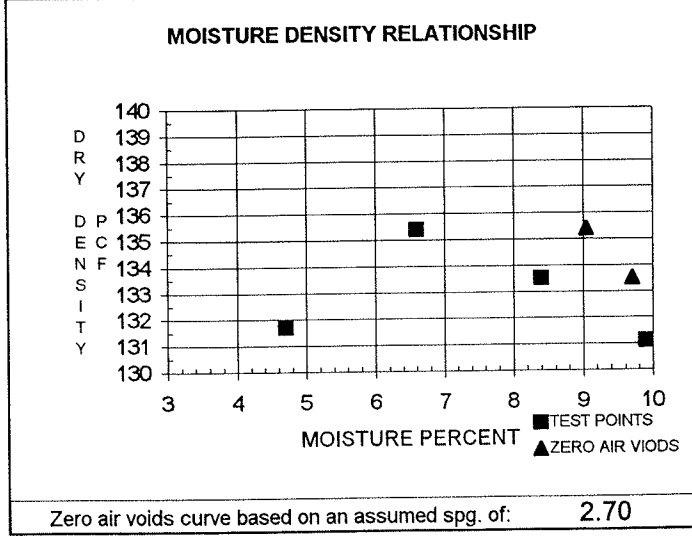
GRAIN SIZE DISTRIBUTION			CLASSIFICATION			COMPACTION	
SIEVE	% PASS	SPEC.	UNIFIED	AASHTO	FAA		
5"			% + 10			OPTIMUM MOISTURE:	7.5
4"			% + 3			MAX. WET DENSITY:	
3"			% GRAVEL			MAX. DRY DENSITY:	136.5
2"			% SAND			CORR. MAX. DRY DENSITY:	
1 1/2"			% SILT			% FRACTURE:	
1"	100		% CLAY			METHOD:	
3/4"	100		FSV			NATURAL DENSITY:	
1/2"	99		LL			NATURAL MOISTURE:	
3/8"	98		PL			WEIGHT LOOSE:	
#4	87		PI			WEIGHT RODDED:	
#8			CLASS				

#10	76
#16	
#20	66
#30	
#40	53
#50	
#60	36
#80	
#100	27
#200	20
.02MM	
.005MM	
.002MM	



TOTAL WT. TESTED: 18,865 GMS.

COARSE	SPEC	FINE	SPEC	DELETERIOUS MAT.
				MINUS #200 MESH
				SOFT FRAGMENTS
				COAT & LIG. OR L.T.WT.PT.
				CLAY LUMPS
				STICKS & ROOTS
				FRIABLE PARTICLES
				THIN-ELONGATED
				ORGANIC COLOR
				FINENESS MODULUS
				SULFATE SOUNDNESS
				DEGRADATION VALUE
				ABSORPTION
				SPG.-BULK
				SPG.-BULK S.S.D.
				SPG.-APPARENT



ORGANIC CONTENT %: _____
 L.A. ABRASION LOSS: _____
 REMARKS: _____

Tested By: AJS Checked By: DKJ
 Signed By: *[Signature]*

