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BP Exploration (Alaska) Inc.

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Liberty Island Route  
Water / Sediment Sampling

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March 1997



MONTGOMERY WATSON

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## 1.2 DATA REPORT

This report describes sampling sites, analytes, and methodologies; presents analytical findings; and quality control established for this field effort.

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## 2. MONITORING PROCEDURES

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### 2.1 LOCATION AND PROBLEM STATEMENT

Three proposed pipeline alignments for the Liberty Island project have been identified by BPX (Alaska) Inc. (Figure 1). They are: Transect A extends N-NW from shore at SW1/2, Sec. 23, T.10N., R.18E., Umiat Meridian, to the proposed island. Transect B extends N-NE from shore at SE 1/4, Sec. 24, T.10N., R.17E., Umiat Meridian through Foggy Island Bay and terminating at the proposed island. Transect C extends NW from the proposed island through the Duck Island unit terminating at the Endicott Satellite Drilling Island. Sampling was conducted at 11 sites in water (ice) depths ranging from approximately 20.4 to 3.5 feet. Ice thickness varied from approximately 5:0 to 3.8 feet.

A shallow (10-feet), narrow (5 to 6-feet) trench below the sea floor has been proposed for Liberty pipeline construction, using a large hydraulic excavator working from a thickened ice pad on top of the sea ice. A major consideration is the potential occurrence of contaminants, including trace metals and hydrocarbons in the sediments. A baseline of sediment chemical quality is necessary to evaluate potential effects of construction activity on the marine environment. Work by Montgomery Watson at the Northstar Development Project (Montgomery Watson, April 1, 1996) demonstrated that sediment dispersal from trenching activities is most likely short in duration and limited to a small area near the trench. However, associated with the disruption of the sediment by trenching is the potential for release of toxic contaminants from the sediments that may affect the viability of epibenthos and/or plankton which live in the shallow waters of the nearshore Beaufort Sea. Background levels of these constituents were documented by measuring their concentrations at roughly 6 inches to one-foot, and 6 to 8 feet beneath the sediment surface.

### 2.2 SAMPLE LOCATIONS AND MOBILIZATION

Sample sites were positioned along the three proposed pipeline route centerlines at the locations identified on the map attached as Figure 1. The locations were staked and identified with respect to Alaska State Plane coordinates and latitude/longitude in advance by BPXA contract surveyor support. Each of the sampling locations was located by the field sampling crew by navigating a Rolligon vehicle using the GPS coordinates provided by the BPXA contract surveyor.

One Rolligon was used during the sampling regimen, and two skids were towed separately to each location. One skid held an enclosed CME-75 drill rig, which augered through the sea ice and drove and retrieved the split spoons for soil samples. The second skid held a warming shack in which extra equipment and supplies were stored.

### 2.3 SAMPLE COLLECTION PROCEDURES

Data collection at each station was performed in the following order:

1. Locate station using GPS positioning

2. Bore through ice and monitor thickness
3. Measure bottom depth (depth to seafloor)
4. Conduct salinity, conductivity/temperature profiles
5. Collect sample for dissolved oxygen (DO), turbidity, and pH at each distinct stratum
6. Collect total suspended solids (TSS)(laboratory) and turbidity (field and laboratory) samples at each distinct stratum
7. Measure current speed and direction at each distinct stratum
8. Drive and retrieve 4"x5' split spoon from surface to 5 feet below surface
9. Collect soil samples from 6" to 1' for organic, metal, and grain size analyses
10. Collect soil samples from 1' to 6' for organic, metal, and grain size analyses (to be held for possible future use)
11. Drive and retrieve 4"x5' split spoon from surface to 6 to 8 feet below surface
12. Collect soil samples from 1' to 8' for organic, metal, and grain size analyses
13. Confirm GPS location and close out site

Station positioning (Activities 1 and 13) have been outlined in Section 2.2. Techniques for each of the other activities are discussed below: Field measurements and conditions are contained in the field note forms supplied in Appendix A and are summarized in Table 2.

#### **Activity 2: Sea Ice Thickness**

The CME-75 enclosed drill rig-mounted auger was used to bore through the ice for water column and sediment sampling. Depth of the boring was monitored closely; the auger was withdrawn for depth checking and clearing of ice chips several times as the drilling progressed.

Ice depth and depth to water surface were measured using a graduated sounding rod equipped with a small hook to catch the ice edge. The top of the "black" sea ice was used as a datum.

#### **Activity 3: Bottom Depth**

The bottom depth was measured using a sounding lead and calibrated brass chain. Ice-free water depth was calculated as the difference of depth to bottom and ice-depth. The maximum free water below the ice was 15.6 feet deep at the sampling location A-8. Nearly grounded ice at a total depth of 3.5 feet was encountered at sampling location B-3, only .3 of ice free water was available.

#### **Activity 4: Conduct Salinity(Conductivity)/Temperature profiles**

Temperature and salinity measurements were made at 1-foot increments through the water profile. Pycnoclines were noted at sampling locations A-8, A-10, B-8, and C-2. After review of equipment and procedures it's most likely pycnoclines were not actually present, but false readings were recorded due to ice build-up on the salinity probe. The remaining parameters were measured at the midpoint of each ice-free water column.

#### **Activity 5: Measure Dissolved Oxygen and pH at each distinct stratum**

Due to the harsh conditions, dissolved oxygen was measured ex-situ rather than in-situ as originally planned. The field probe membrane is extremely sensitive to the cold ambient temperatures resulting in "bubble-breaches" and inaccurate readings. DO measurements were completed with a Hach 2100 colorimeter and a high range (HR) standard. Field measurements for pH were made with a Beckman

pH meter and were also conducted ex-situ. A sample aliquot collected at the midpoint, or within each pycnocline of the ice-free water column was used to measure both DO and pH within the warming shack.

#### **Activity 6: Measure Turbidity and Total Suspended Solids**

Samples of under-ice free water were collected with a stainless steel point source sampler to document the occurrence of turbidity and total suspended solids. Samples were contained in 1-liter, nalgene plastic bottles. Color and appearance were documented in the field note form for the site. Turbidity was measured on-site with a field nephelometric turbidimeter. This meter seemed to produce inaccurate readings. Thus, an additional water sample was collected for turbidity. Total suspended solids and turbidity were shipped off-site to be measured by CT&E Laboratories in Anchorage.

#### **Activity 7: Current measurements**

An Anderaa doppler current meter was used to measure current speed and direction. The meter was immersed to the centerpoint of each water column profile. The Anderaa current meter works on the doppler principle by measuring the rate of return of radio signals it emits which bounce off moving particles. If a current is present the meter measures the direction (with respect to magnetic north) and the speed. In all instances the reading was 500.14 cm/s, the maximum measurable by the instrument.

Given our past experience the high velocity readings seemed unlikely as conditions approaching quiescence were anticipated. Subsequently, it was determined that the meter does not have the capability of registering zero flow and defaults to its maximum setting when current flow is below 2 cm/sec. Thus, all readings have been reported as less than the rated sensitivity of the meter, 2 cm/sec.

#### **Activities 8, and 9 through 12: Sediment sampling**

Soil samples were collected from 6 to 12 inches below the soil/water interface as requested in the RFP.

In each instance a split spoon was driven by 340 lb. mechanical hammer with a 30-inch drop into the sediment. Each core was removed, drained, and troweled into sample jars, beginning with samples for volatile organics, and progressing to semivolatiles, petroleum hydrocarbons, total organic carbon, metals, and finally, grain size analysis. The process was repeated for a one-foot to six foot collection to be held for possible future use and finally a 6-8 foot below grade sample. Only two cores were required when using the drill rig and split spoon.

Duplicate core samples were collected for all analyses at two stations (A6 and C2), selected at random in the field.

#### **Activity 13: Site close-out**

At the completion of each site sampling effort, the field team leader confirmed that all field note form information had been entered by initialing the form. The final GPS location was recorded prior to leaving the site

### 3. MONITORING RESULTS

#### 3.1 SAMPLING CHRONOLOGY

Sampling was performed over three days, (four 12 hours shifts) from Friday, February 14, 1997 through Sunday, February 16, 1997. The following table relates the sampling order for this project:

Date	Site	Geodetic Location		Sampled by
2-14-97	B-3	Lat: 70 12 33.669	Long: 147 41 5.537	BN
	B-6	Lat: 70 13 36.283	Long: 147 39 34.382	BN
	B-8	Lat: 70 14 44.232	Long: 147 37 55.264	BN
2-15-97	B-10	Lat: 70 15 52.360	Long: 147 36 15.682	BGM
	I-1	Lat: 70 16 47.769	Long: 147 34 54.558	BGM
	C-4	Lat: 70 18 29.141	Long: 147 47 46.192	BGM
2-16-97	C-2	Lat: 70 17 7.317	Long: 147 41 21.529	BN
	A-10	Lat: 70 16 10.431	Long: 147 34 18.399	BN
	A-8	Lat: 70 14 55.970	Long: 147 33 6.441	BN
	A-6	Lat: 70 13 41.428	Long: 147 31 54.557	BGM
	A-4	Lat: 70 12 26.876	Long: 147 30 42.818	BGM

BGM = Bonnie McLean, MW

BN = Bill Nettleton, MW

##### 3.1.1 Laboratory Analyses

Samples were analyzed by LAS Laboratories, Inc. in Las Vegas Nevada and CT&E in Anchorage. Appropriate methodologies are available in the following references:

- Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW-846, November 1990)
- Methods for Chemical Analysis of Water and Wastes (EPA 600/4-79-020, March 1982)
- The following table summarizes project sampling requirements:

Measurement	Matrix	Method	Sample Container	Preservation Method	Holding Time
Salinity (Conductivity)	water	field measurement	field aliquot	n/a	n/a
Dissolved Oxygen	water	field measurement	in-situ	n/a	n/a
Turbidity	water	field measurement/ EPA 180.1	field aliquot/ 500 ml. HDPE	n/a	48 hours
Total Suspended Solids	water	SWA 160.2	500 ml HDPE	Cool to 4°C	28 days
Total Organic Carbon	soil	SWA 415.1	4oz Clear Wide Mouth	Cool to 4°C	28 days
Grain Size	soil	ASTM D-422	1L polyethylene bag	n/a	indefinite
Arsenic As	soil	SWA 6010	4oz Clear Wide Mouth	Cool to 4°C	6 months
Barium Ba, Total ionic	soil	SWA 6010	"	"	6 months
Chromium Cr, Total	soil	SWA 6010	"	"	6 months
Chromium Cr VI, Hexavalent	soil	SW 7196M	"	"	24 hours
Lead Pb	soil	SWA 6010	"	"	6 months
Mercury Hg	soil	SWA 7471	"	"	28 days
Barium sulfate	soil	Lab Method	"	"	6 months
Volatile Organic Compounds	soil	8260	2oz Clear Wide Mouth	"	14 days
Semi-volatile Organic Compounds	soil	8270	4oz Clear Wide Mouth	"	14 days
Petroleum Hydrocarbons (DRO)	soil	AK 102	8oz Clear Wide Mouth	Cool to 4°C	14 days

## 3.2 ANALYTICAL RESULTS

A summary of the analytical results for soils and water is shown in Table 4. A more detailed summary of water quality parameters including field measurements is shown in Table 2. All laboratory and field data are also included in the appendices.

### 3.2.1 Sea Water

Total suspended solids ranged from a low of 2.5 mg/l to a high of 76.5 mg/l.

Turbidity field measurements ranged from a low of 1.0 NTU to a high of 35.6 NTU. Turbidity laboratory measurements ranged from a low of 0.54 NTU to a high of 24 NTU.

Field measurements fluctuated with the inclusion of ice crystals so laboratory samples were collected for turbidity and submitted to CT&E Environmental Services in Anchorage.

### 3.2.2 Sediment Chemistry

Arsenic averaged 5.5 mg/kg throughout the pipeline alignment. The coefficient of variation (the standard deviation of the samples divided by the mean) for all of the sites was 0.43.

Barium and barium sulfate were analyzed separately as a method to quantify the barium available for biotic uptake. Barium sulfate concentration measures only insoluble barium; thus not available for biotic uptake. Total barium, as reported, is a measure of ionic or "free" barium. The mean total barium concentration was 67.5 mg/kg and the mean barium sulfate concentration was 27.5 mg/kg. The coefficients of variation were 0.48 and 0.26 for total barium and barium sulfate.

Chromium averaged 18.5 mg/kg across the pipeline alignment with a coefficient of 0.38. There were no hexavalent chromium results reported above the MRL of 3 mg/kg.

Mercury averaged 0.24 mg/kg across the pipeline alignment with a coefficient of variation of 1.03.

Lead averaged 10.1 mg/kg across the pipeline alignment with a coefficient of variation of 1.24.

There were no detections of diesel range organics (DRO).

Acetone was detected in all of the sediment samples ranging from 12 to 88 mg/kg. All of the Acetone detections are viewed as external contaminants.

With the exception of Acetone there were no volatile or semi-volatile organic compounds detected in any of the sediment samples.

## 3.3 SEDIMENT QUALITY STANDARDS

Sediment quality standards are driven by the impacts of pollutants on benthic biota. State sediment quality standards have not been established by the state of Alaska, thus other benchmark criteria were sought for comparative analysis. As the work performed at Liberty Island is a baseline study of the water and sediment quality, all criteria are used for comparison only. Exceedances do not necessarily indicate concern.




The EPA has developed a group of ecotoxicologically-based benchmark criteria (Ecotox Thresholds (ET)) for use in ecological risk assessments at Superfund sites. The ETs developed by EPA are intended to provide technical information to EPA and other government employees but do not constitute rulemaking by the EPA.

In addition to the EPA Ecotox benchmarks, the Puget Sound Dredged Disposal Analysis and EPA Region III's Risk-Based Concentrations may also serve as comparative benchmarks.

**EPA Ecotox Thresholds Benchmarks** have been developed for surface water and sediments, with sediment benchmarks presented as sediment quality criteria (SQC) for fresh and marine environments, sediment quality benchmarks (SQB), and effects range low (ERL). If neither SQC nor an SQB has been calculated, the ERL will be used as the sediment Ecotox Threshold. For the analytes detected at Liberty Island only ERLs have been calculated. The ERL represents the lower 10th-percentile concentration associated with observation of biological effects. Accordingly concentrations below the ERL should rarely be associated with adverse effects. With the exception of arsenic, lead, and mercury all results are below the ERLs. Arsenic was detected above the ERL (8.2 mg/kg) at sample locations A-4(01), A-8(01), A-10(01 & 08), B-3(01), B-6 (01 & 08), B-8 (01 & 08), B-10 (01 & 08), C-2(01 & 08), and I-1(08) with a range of 9.1 to 11.4 mg/kg. Mercury was detected above the ERL (0.15 mg/kg) in sample locations A-8(01), A-10(01 & 08) with a range of 0.151 to 0.399. It should be noted that the ERL for mercury has a relatively low correlation and consequently low accuracy between the incidence of effect and concentration, and thus is used cautiously. The presence of arsenic, lead, and mercury above their respective ERLs are viewed as variations in existing background conditions along the proposed Liberty Island pipeline routes. Table 4 provides a summary of the analytical results and benchmark screening levels.

**Puget Sound Dredged Disposal Analysis (PSDDA)** PSDDA analytic methods and criteria have been established for the Puget Sound area in Washington state. PSDDA chemical analyses were developed by the collaborative efforts of EPA Region X (Seattle), the U.S. Army Corps of Engineers, and the Washington state departments of Natural Resources and Ecology. (The Washington Department of Ecology was responsible for issuing certification for Corps of Engineers Section 404 permits). Data and criteria are reviewed annually. However, no changes in numeric standards have been made since 1988.

Three levels of contaminant concentrations have been established by PSDDA: a screening level, a bioaccumulation level, and a maximum level. Standards for each level are derived from a statistical model, in which apparent effects thresholds are defined. The model is applied to a rigorously quality-controlled database of sediment chemistry and bio-effect data. The maximum level is the level of highest apparent effects. The screening level is established at either the lowest biological effects level or at 10% of the maximum effect level. Arsenic, lead, mercury, and 42 volatile and semi-volatile organic compounds are included in the list of PSDDA parameters. There are no PSDDA criteria for diesel range organics, barium or chromium species.

Liberty Island sediment results are uniformly below the PSDDA screening level criteria for total arsenic, lead, and mercury as shown in Table 4. Results for analyses of discrete volatile and semi-volatile compounds were all below detection levels with the exception of Acetone which has been classified as an external contaminant. 

**Risk-Based Concentrations (RBCs)** EPA Region III has calculated separate carcinogenic and non-

carcinogenic RBCs for various pathways of ingestion or inhalation. The lower of the two is presented in the RBC tables published by EPA Region III, which are updated and distributed semi-annually. The various pathways include residential water, ambient air, edible fish, industrial soil ingestion, and residential soil ingestion (which are generally lower (more stringent) than industrial soil ingestion). There are no RBCs for diesel range organics.

Liberty Island sediment results are uniformly below the RBCs for all the metals sampled, including total arsenic, lead, barium and compounds, mercury, chromium III and chromium VI, as shown in Table 4. Results of analyses for discrete volatile and semi-volatile compounds were all below detection levels, with the exception of acetone.

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## **4. DOCUMENTATION AND REPORTING**

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### **4.1 FIELD DOCUMENTATION**

The field team leader was responsible for maintaining records of field activities, including field analytical measurements, sample locations, and sample identification. Data was entered into a bound notebook while field activities were in progress. All field documents were supplied to the project manager at the end of the field investigation. Field results were incorporated into progress reports or final reports, as appropriate. A sample plan checklist was used to identify sample numbers, sample locations, sample matrices, analytical parameters, sample containers, and quality control samples. This checklist was prepared by the project manager prior to mobilization and provided the field team with a concise list of samples by location. The field team leader reviewed the checklist for completion following sample collection, prior to the shipment of samples or departing from the site.

#### **4.1.1 Field Logbook**

Logbooks and data forms are necessary to provide sufficient data and observations to enable participants to reconstruct events that occurred during the project and to refresh the memory of field personnel if called upon to give testimony during legal proceedings. All daily logs were kept in bound, waterproof notebooks containing numbered pages. All entries were dated and signed. No pages were removed for any reason. Unused pages were crossed through, signed, and dated by the field team leader or project manager. Corrections were made by drawing a single line through the original entry (so the original entry can still be read) and writing the corrected entry beside the original. Corrections were initialed and dated. Copies of the original field notebook are provided in Appendix B.

#### **4.1.2 Field Note Forms**

Field note forms were used to record all data pertaining to a particular sampling event at a single sampling station. Field note forms are designed to assist the field crews in completing the work at each station. Field note forms were reviewed for completeness and accuracy and initialed in the field by the field sampling task leader. Copies of the original field note forms are provided in Appendix A.

#### **4.1.3 Photographs**

Photographs were taken at the sampling locations as directed by the team leader. Selected

photographs are provided in Appendix E. Documentation of a photograph is crucial to its validity as a representation of an existing situation. The following information was noted in the field log book:

- Date, time, and location at which the photograph was taken
- Photographer
- Weather conditions
- Description of photograph taken
- Direction

#### 4.1.4 Chain-of-Custody Forms

The purpose of chain-of-custody procedures is to ensure that the integrity of samples is maintained during their collection, transportation, storage, and analysis. All chain-of-custody requirements comply with standard operating procedures indicated in EPA sample handling protocol. Chain-of-custody records are provided in Appendix D.

#### 4.1.5 Sample Documentation

The field crew recorded the location of all samples on scaled site maps.

Each sample was labeled and sealed immediately after collection. The sample label was filled out using waterproof ink and firmly affixed to the sample containers with clear waterproof tape. An alphanumeric code was assigned to each sample as an identification number to track samples at the site. The sample code is broken down as follows:

<u>Year</u>	<u>Project</u>	<u>Sample matrix</u>	<u>Sample Location</u>	<u>Sample</u>	<u>Depth</u>
97	BPXLI	SD=Sediment WA=Water	1-19	01=primary 61=duplicate	(feet)

The sample label contains the following identification:

- Date and time of collection;
- Sample identification number;
- Analysis required (including analytical method number);
- Preservation method used; and
- Initials of field team member compiling samples.

Sample volume levels were marked on each liquid sample container. After the sample was collected, pertinent information, such as sample identification number, date and time of sample collection, sample collection method, description of sample, and any field measurements (temperature, salinity, turbidity, etc.), were recorded on the field note form, and the recorder will initial the entry.

#### 4.1.6 Laboratory Data Log

All data generated was reviewed by comparing and interpreting results from chromatograms (responses, stability, retention times), accuracy (mean percent recovery of spiked samples), and precision (reproducibility of results). Laboratory Data Sheets are presented in Appendix C.

#### **4.1.7 Data Reporting and Data Deliverables**

All laboratory-generated data was supplied in both hard copy and electronic formats in compliance with EPA Tier 1 guidelines.

#### **4.1.8 Summary Statistics**

Station values for water quality parameters have been summarized in tabular form. The table includes date, time, and depth of sample; current speed and direction; temperatures, salinity, turbidity, dissolved oxygen, pH, and total suspended solids.

Water quality parameters have also been graphically displayed to illustrate the value of certain parameters at each station.

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## **5. QUALITY ASSURANCE AND QUALITY CONTROL**

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### **5.1 QUALITY ASSURANCE OBJECTIVES**

Characteristics used to assess generated data were precision, accuracy, representativeness, completeness, and comparability, often referred to as PARCC parameters. PARCC parameters are integrated throughout the work plan and applied throughout the data collection process.

Project goals express specific PARCC parameters necessary to meet regulatory requirements, such as maximum level. Performance goals are specifically related to indicator QC samples as quantitative measures of PARCC parameters. For example, analysis of one duplicate in ten samples is a performance goal, and the results of duplicate analyses are an indicator of precision.

Project goals express specific PARCC parameters necessary to meet regulatory requirements, such as maximum level. Performance goals are specifically related to indicator QC samples as quantitative measures of PARCC parameters. For example, analysis of one duplicate in ten samples is a performance goal, and the results of duplicate analyses are an indicator of precision. The completeness goal for all analytes is 87.5%, or 7 of 8 results.

### Accuracy and Precision Criteria

	Laboratory Precision (Duplicate Relative Percent Difference)		Laboratory Accuracy (Laboratory Control Sample % Recovery)	
Total Suspended Solids	20		80-120	
Total Organic Carbon	20		80-120	
Grain Size	n/a		n/a	
Arsenic As	20		80-120	
Barium Ba, Total ionic	20		80-120	
Chromium Cr, Total	20		80-120	
Chromium Cr VI, Hexavalent	20		80-120	
Lead Pb	20		80-120	
Mercury Hg	20		80-120	
Barium sulfate	20*		80-120*	
Volatile Organic Compounds	1,1-Dichloroethene	22	1,1-Dichloroethene	54-138
	Benzene	21	Benzene	70-130
	Trichloroethene (TCE)	24	Trichloroethene (TCE)	57-132
	Toluene	21	Toluene	71-129
	Chlorobenzene	21	Chlorobenzene	72-128
Semi-volatile Organic Compounds	Phenol	35	Phenol	28-110
	2-Chlorophenol	50	2-Chlorophenol	22-110
	1,4-Dichlorobenzene	27	1,4-Dichlorobenzene	21-110
	N-Nitroso-di-n-propylamine	38	N-Nitroso-di-n-propylamine	24-110
	1,2,4-Trichlorobenzene	23	1,2,4-Trichlorobenzene	32-110
	4-Chloro-3-methylphenol	33	4-Chloro-3-methylphenol	35-112
	Acenaphthene	19	4-Nitrophenol	29-127
	4-Nitrophenol	50	2,4-Dinitrotoluene	51-112
	2,4-Dinitrotoluene	47	Pentachlorophenol	41-133
	Pentachlorophenol	47	Pyrene	45-135
Pyrene	36			
Petroleum Hydrocarbons (DRO/RRO)	Diesel Range Organics	30	Diesel Range Organics	51-153

**Note:**

Only system monitoring compounds are listed for Volatile and Semi-volatile Organic Compounds.

n/a - Criteria do not apply due to the nature of the analysis

\* - Because this parameter has no standard analysis method, Limits are advisory only.

## 5.2 CALIBRATION PROCEDURES

All instruments and equipment used during the sampling and analysis were operated, calibrated, and maintained according to the manufacturer's guidelines and recommendations as well as criteria set for the instrument in the applicable methodology references. Operation, calibration, and maintenance was performed by personnel properly trained in these procedures.

### 5.2.1 Field Equipment

Each field instrument was calibrated daily and in some instances where appropriate before each use. These instruments include a portable digital temperature/salinity/conductivity meter, pH meter, dissolved oxygen meter, and a turbidity meter. Daily calibration assured accurate readings for each day of use and was noted in the Field Notebook of the calibrator.

## 5.2.2 Laboratory Instrumentation

Laboratory capabilities will be initially demonstrated for instrument and reagent/standards performed as well as accuracy and precision of analytical methodology. Brief descriptions of calibration procedures for major instrument types are presented in the previously referenced methodologies.

## 5.3 DATA VALIDATION SUMMARY

### DATA VALIDATION SUMMARY

Twenty four soil samples were collected from February 14 to February 16, 1997 for inorganics, metals, volatile organic compounds, semivolatile organic compounds, diesel range organics and grain size.

Eleven water samples were collected on February 14 to February 16, 1997 for Total Suspended Solids and Turbidity.

Data validation was done in accordance with the accuracy and precision objectives established by Lockheed Analytical Services. The data were also evaluated for conformance with the Quality Assurance Objectives specified in Section 4 of the Technical Plan (MW, 1997). Acceptance limits for accuracy and precision as well as the method reporting limit (MRL) are stated in the laboratory reports. Where applicable, data validation guidance contained in *National Functional Guidelines for Organics and Inorganic Data Review* (EPA, 1994) was followed. All data is considered valid as qualified under the data quality objectives of this project except for the issues discussed below.

### Volatile Organic Compounds

- The surrogate compound 4-bromofluorobenzene is below acceptance criteria (78-125%) for 97BPXLIA8SD01(01) (71%), 97BPXLIB8SD01(01)(72%), 97BPXLIB8SD02(08)(70%), 97BPXLIA10SD02(08)(68%), 97BPXLH1SD01(01)(70%) and 97BPXLIC4SD01(01)(75%). Sample results and the method reporting limits are usable as low estimates due to the reduced recoveries.
- The surrogate compounds 4-bromofluorobenzene and toluene-d8 are below acceptance criteria for sample ID 97BPXLIB8SD01(01). The recoveries are 83 and 72% respectively, while the acceptance limits are 84-120 and 78-125 respectively. Sample results and the method reporting limits are usable as low estimates due to the reduced recoveries.
- The internal standard compound 1,4-dichlorobenzene is below acceptance limits for 97BPXLIA6SD02(08), 97BPXLIA6SD62(08) duplicate, 97BPXLIA8SD01(01) and 97BPXLIB8SD02(08). Sample results and the method reporting limits are usable as low estimates due to the reduced recoveries.
- Several samples contain acetone, methylethylketone (MEK or 2-butanone) and carbon disulfide. These analytes are common laboratory contaminants and are due to external contamination.

### Hexavalent Chromium, Cr<sup>+6</sup>

- For hexavalent Chromium in soil by EPA Method 7196M all samples were analyzed past the 24 hour holding time. This was due to time constraints associated with shipment of the

samples to the laboratory. The results are usable as estimates due the expired holding times.

### **Inorganics**

- For Total Organics Carbon in soil the relative percent difference (RPD) is 29% for the duplicate analyses. This exceeds the acceptance limit of 20% for this parameter. All results are usable as estimates due to the failed RPD.
- For Turbidity in water several samples were analyzed past the 24 hour holding time. Associated sample results are usable as estimates due to the expired holding time.

### **Barium Sulfate**

- The method blank for selected samples was positive for barium sulfate at a concentration of 7.39 mg/kg. Associated samples within a factor of ten of the method blank concentration are flagged in the laboratory report with a "C". These results are usable as estimates due to the method blank contamination.
- The matrix spike result (26%) fails acceptance criteria (75-125%). The low percent recovery indicates a low bias in associated samples. These samples are flagged with an "N" in the laboratory report.

### **Mercury**

- The duplicate sample precision (84.6 and 81.5%) was outside acceptance limits (20%). Results are estimates due to the failed precision. Samples are flagged with an "\*" in the laboratory report.
- The matrix spike result (-44%) fails acceptance criteria (75-125%). The low percent recovery indicates a low bias in associated samples. These samples are flagged with an "N" in the laboratory report.

### **Cadmium**

- The matrix spike result (179%) fails acceptance criteria (75-125%). The low percent recovery indicates a high bias in associated samples. These samples are flagged with an "N" in the laboratory report.

Throughout the data some sample results are flagged with a "J" qualifier as estimates. This is used for results that are below the RDL (Reporting Detection Limit) but above the MDL (Method Detection Limit). It is intended for informational purposes and in no way adversely affects data quality.

**TABLE 1**  
**Sample Plan Checklist**  
**Liberty Island Pipeline Routes**  
**Water and Sediment Sampling**

Sample Identification	Borehole Number	Latitude	Longitude	Date	Time	MATRIX	FIELD PARAMETERS							ANALYTICAL PARAMETERS										
						Soil/Sediment	Sea Water	Temperature	Conductivity	Salinity	pH	Turbidity	Dissolved Oxygen	VOC (EPA 8260) SVOC (EPA 7470)	DRO (AK 102)	Mercury (EPA 7470)	Metals (EPA 6010)	Ionic Barium (BaSO4)	Chromium (Hexavalent)	TOC (ASTM 04129-82M)	Grain Size (ASTM D442)	Total Suspended Solids	Field Duplicate	
97BPXLIA6WA01(06)	A6	70 13 41.428	147 31 54.557	2/16/97	900		X	X	X	X	X	X	X											X
97BPXLIA6SD01(01)	A6	70 13 41.428	147 31 54.557	2/16/97	930	X								X	X	X	X	X	X	X	X	X	X	
97BPXLIA6SD02(08)	A6	70 13 41.428	147 31 54.557	2/16/97	1000	X								X	X	X	X	X	X	X	X	X	X	
97BPXLIA6SD62(08)	A6	70 13 41.428	147 31 54.557	2/16/97	1010	X								X	X	X	X	X	X	X	X	X	X	X
97BPXLIA6SD03(05)	A6	70 13 41.428	147 31 54.557	2/16/97	945	X	Hold																	
97BPXLIA6SD04(05)	A6	70 13 41.428	147 31 54.557	2/16/97	955	X	Hold																	
97BPXLIA6SD05(05)	A6	70 13 41.428	147 31 54.557	2/16/97	965	X	Hold																	
97BPXLIA6SD06(05)	A6	70 13 41.428	147 31 54.557	2/16/97	975	X	Hold																	
97BPXLIA6SD07(05)	A6	70 13 41.428	147 31 54.557	2/16/97	985	X	Hold																	
97BPXLIA6SD08(05)	A6	70 13 41.428	147 31 54.557	2/16/97	995	X	Hold																	
97BPXLIA10WA02(11)	A10	70 16 10.431	147 34 18.399	2/16/97	120		X	X	X	X	X	X	X											X
97BPXLIA10SD01(01)	A10	70 16 10.431	147 34 18.399	2/16/97	130	X								X	X	X	X	X	X	X	X	X	X	
97BPXLIA10SD02(08)	A10	70 16 10.431	147 34 18.399	2/16/97	150	X								X	X	X	X	X	X	X	X	X	X	
97BPXLIA10SD03(05)	A10	70 16 10.431	147 34 18.399	2/16/97	140	X	Hold																	
97BPXLIA10SD04(05)	A10	70 16 10.431	147 34 18.399	2/16/97	150	X	Hold																	
97BPXLIA10SD05(05)	A10	70 16 10.431	147 34 18.399	2/16/97	160	X	Hold																	
97BPXLIA10SD06(05)	A10	70 16 10.431	147 34 18.399	2/16/97	170	X	Hold																	
97BPXLIA10SD07(05)	A10	70 16 10.431	147 34 18.399	2/16/97	180	X	Hold																	
97BPXLIA10SD08(05)	A10	70 16 10.431	147 34 18.399	2/16/97	190	X	Hold																	



**TABLE 1  
Sample Plan Checklist  
Liberty Island Pipeline Routes  
Water and Sediment Sampling**

Sample Identification	Borehole Number	Latitude	Longitude	Date	Time	MATRIX	FIELD PARAMETERS							ANALYTICAL PARAMETERS												
						Soil/Sediment Sea Water	Temperature	Conductivity	Salinity	pH	Turbidity	Dissolved Oxygen	VOC (EPA 8260) SVOC (EPA 7470)	DRO (AK 102)	Mercury (EPA 7470)	Metals (EPA 6010)	Ionic Barium (BaSO4)	Chromium (Hexavalent)	TOC (ASTM 04129-82M)	Grain Size (ASTM D442)	Total Suspended Solids	Field Duplicate				
97BPXLIB6WA01(2.0)	B6	70 13 36.283	147 39 34.382	2/15/97	100		X	X	X	X	X	X	X													X
97BPXLIB3SD01(01)	B6	70 13 36.283	147 39 34.382	2/15/97	120	X								X	X	X	X	X	X	X	X	X	X	X		
97BPXLIB3SD02(08)	B6	70 13 36.283	147 39 34.382	2/15/97	145	X								X	X	X	X	X	X	X	X	X	X			
97BPXLIB3SD03(05)	B6	70 13 36.283	147 39 34.382	2/15/97	130	X	Hold																			
97BPXLIB6WA01(8.0)	B8	70 15 52.360	147 36 15.682	2/15/97	800		X	X	X	X	X	X	X													X
97BPXLIB10SD01(01)	B10	70 15 52.360	147 36 15.682	2/15/97	900	X								X	X	X	X	X	X	X	X	X	X			
97BPXLIB10SD02(08)	B10	70 15 52.360	147 36 15.682	2/15/97	930	X								X	X	X	X	X	X	X	X	X	X			
97BPXLIB10SD03(05)	B10	70 15 52.360	147 36 15.682	2/15/97	915	X	Hold																			
97BPXLIB2WA01(8.0)	B2	70 17 23.177	147 21 52.529	2/15/97	2100		X	X	X	X	X	X	X													X
97BPXLIB2WA02(8.0)	B2	70 17 23.177	147 21 52.529	2/15/97	2110		X	X	X	X	X	X	X													X
97BPXLIB2SD01(01)	B2	70 17 23.177	147 21 52.529	2/15/97	2120	X								X	X	X	X	X	X	X	X	X	X			
97BPXLIB2SD02(08)	B2	70 17 23.177	147 21 52.529	2/15/97	2130	X								X	X	X	X	X	X	X	X	X	X			
97BPXLIB2SD03(08)	B2	70 17 23.177	147 21 52.529	2/15/97	2140	X								X	X	X	X	X	X	X	X	X	X			
97BPXLIB2SD03(05)	B2	70 17 23.177	147 21 52.529	2/15/97	2230	X	Hold																			

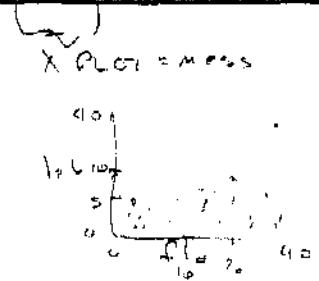


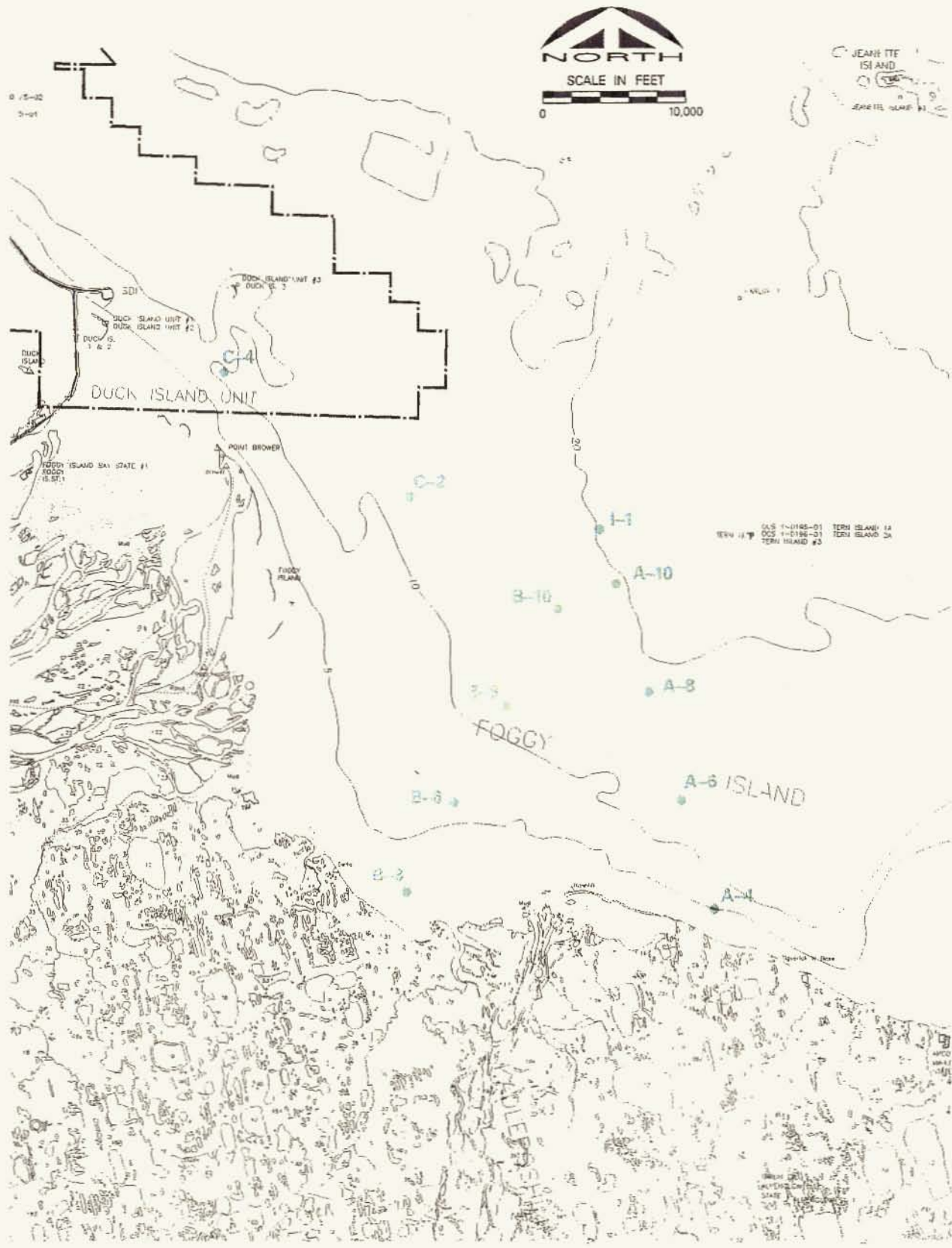
**Table 2**  
**Water Quality Parameters**  
**Liberty Island Pipeline Routes**  
**Water and Sediment Sampling**

Sample Identification	Borehole Number	Date	Time	Ice Thickness	Depth to Water Surface	Depth to Bottom	Total Water Depth	Ice Free Water Depth	Depth of Water above Ice Bottom	Temp (°C)	Salinity (ppt) <sup>2</sup>	Calculated <sup>1</sup> Seawater Density (kg/m <sup>3</sup> )	Dissolved Oxygen (mg/l)	Turbidity (ntu), Field	Turbidity (ntu), EPA 180.1	Total Suspended Solids (TSS) EPA 160.2	pH	Conductivity (µmhos)
97BPXLIA6WA01(06)	A6	2/16/97	900	4.6	0.4	17.2	16.8	12.6	4.2	-1	30	24.34	12.6	33	24	18.4	7.8	25500
97BPXLIA10WA02(11)	A10	2/16/97	120	4.5	0.7	18.4	17.7	13.9	3.8	-2	21.5	error	10.1	31.7	3.1	76.5	7.63	18000
97BPXLIB6WA01(2.0)	B6	2/15/97	100	3.7	0.9	7.6	6.7	3.9	2.8	0	27	21.65	10.8	1	0.89	2.5	8.4	23000
97BPXLIB10WA01(8.0)	B10	2/15/97	830	3.9	0.4	13.1	12.7	9.2	3.5	-1	28	22.72	7.6	14.2	5.4	39.5	8.1	24000
97BPXLIC4WA01(7.0)	C4	2/15/97	1700	3.8	0.2	11.8	11.6	8	3.6	-1	29	24.34	11.6	18.5	7.4	15.5	7.88	18000

Note:

1. Millero, F.J. and A. Poisson. 1981. International one-atmosphere equation of state of sea water. Deep-Sea Research, Vol. 28A, No. 6, p. 625-626
2. Salinity in Parts Per Thousand (ppt) converted from percent (%)  
error = density value not available for corresponding field salinity and temperature  
Sigma<sub>t</sub> = density in kg/m<sup>3</sup> - 1,000





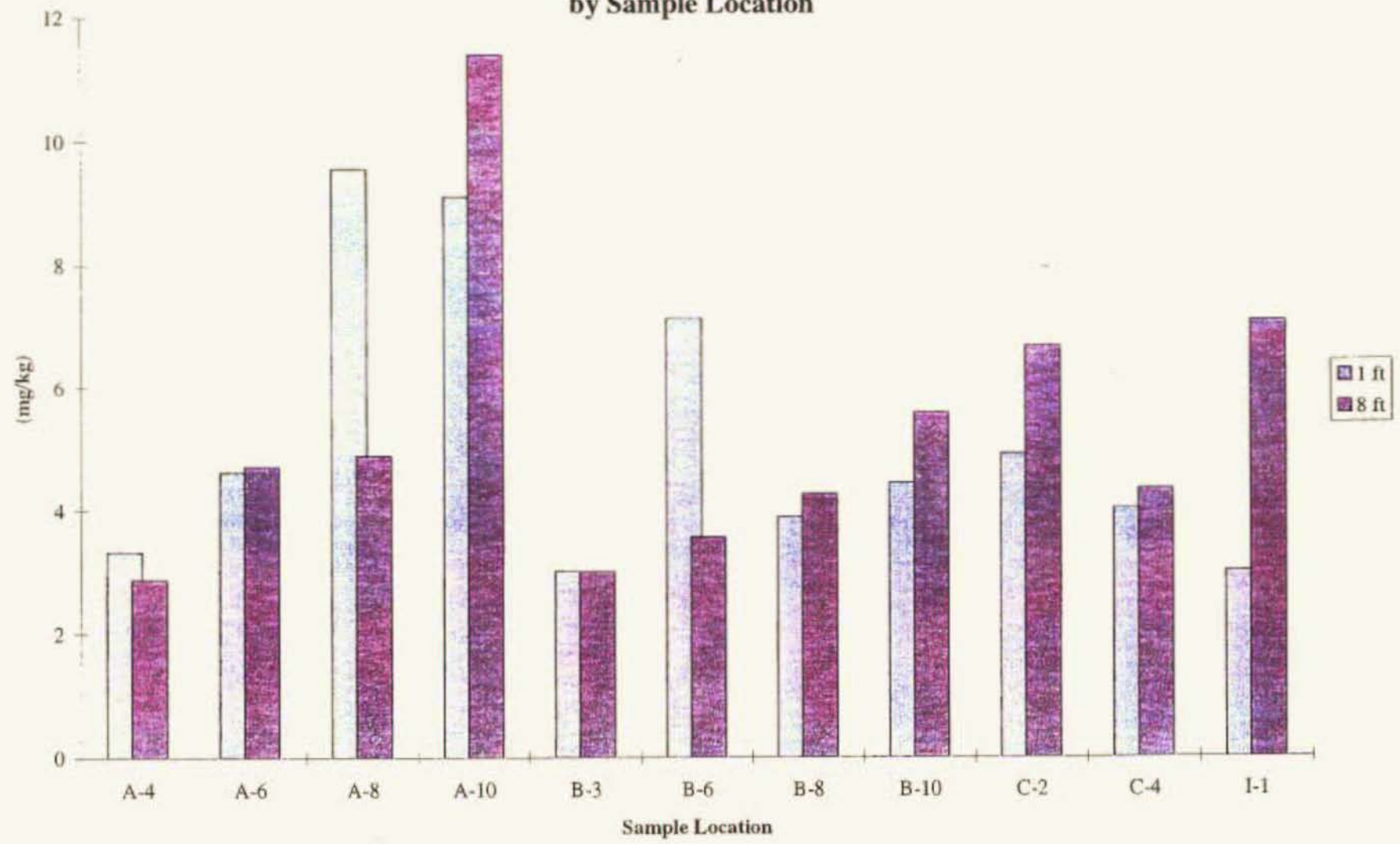
JOB NO. 63,336  
 TIME: 3-MAR-93T 14:50  
 FILE: G:\DP\LIBERTY\COMP\637\FIG1.D7



**MONTGOMERY WATSON**  
 Anchorage, Alaska

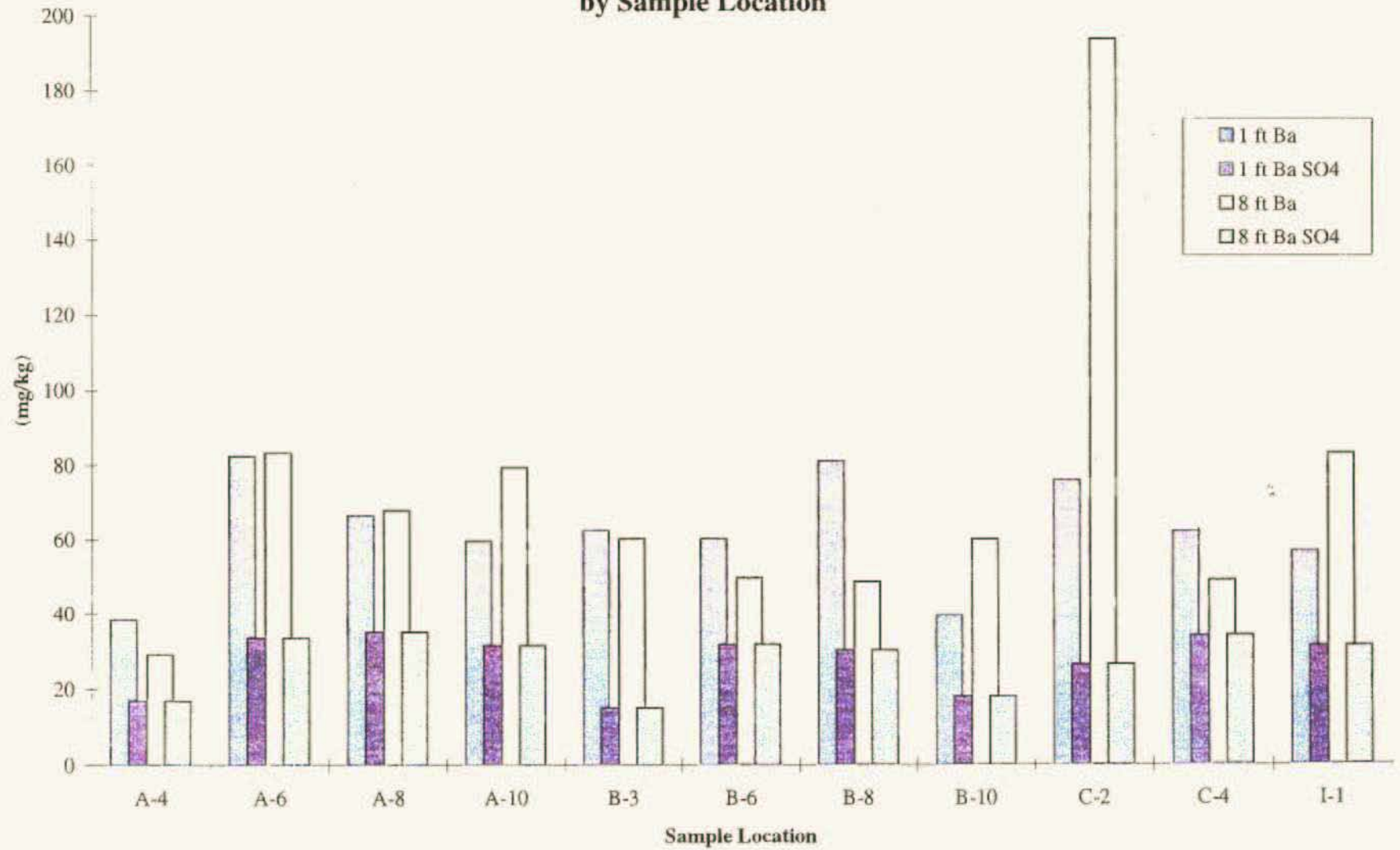
**FIGURE 1**  
 BP EXPLORATION (ALASKA) INC.  
**LIBERTY PIPELINE**  
**BOREHOLE LOCATIONS**

**Figure 2**  
**Arsenic Concentrations**  
**by Sample Location**

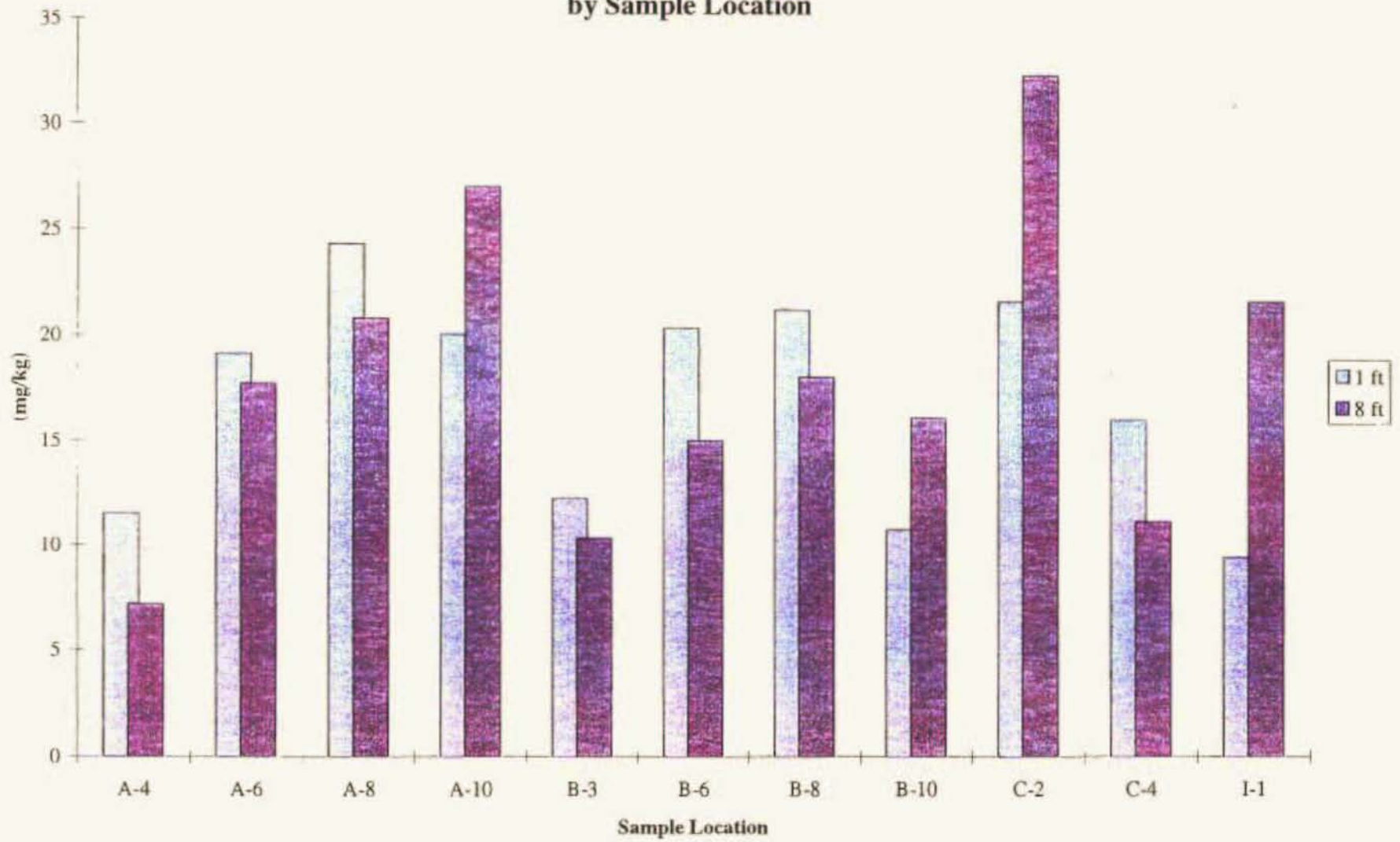




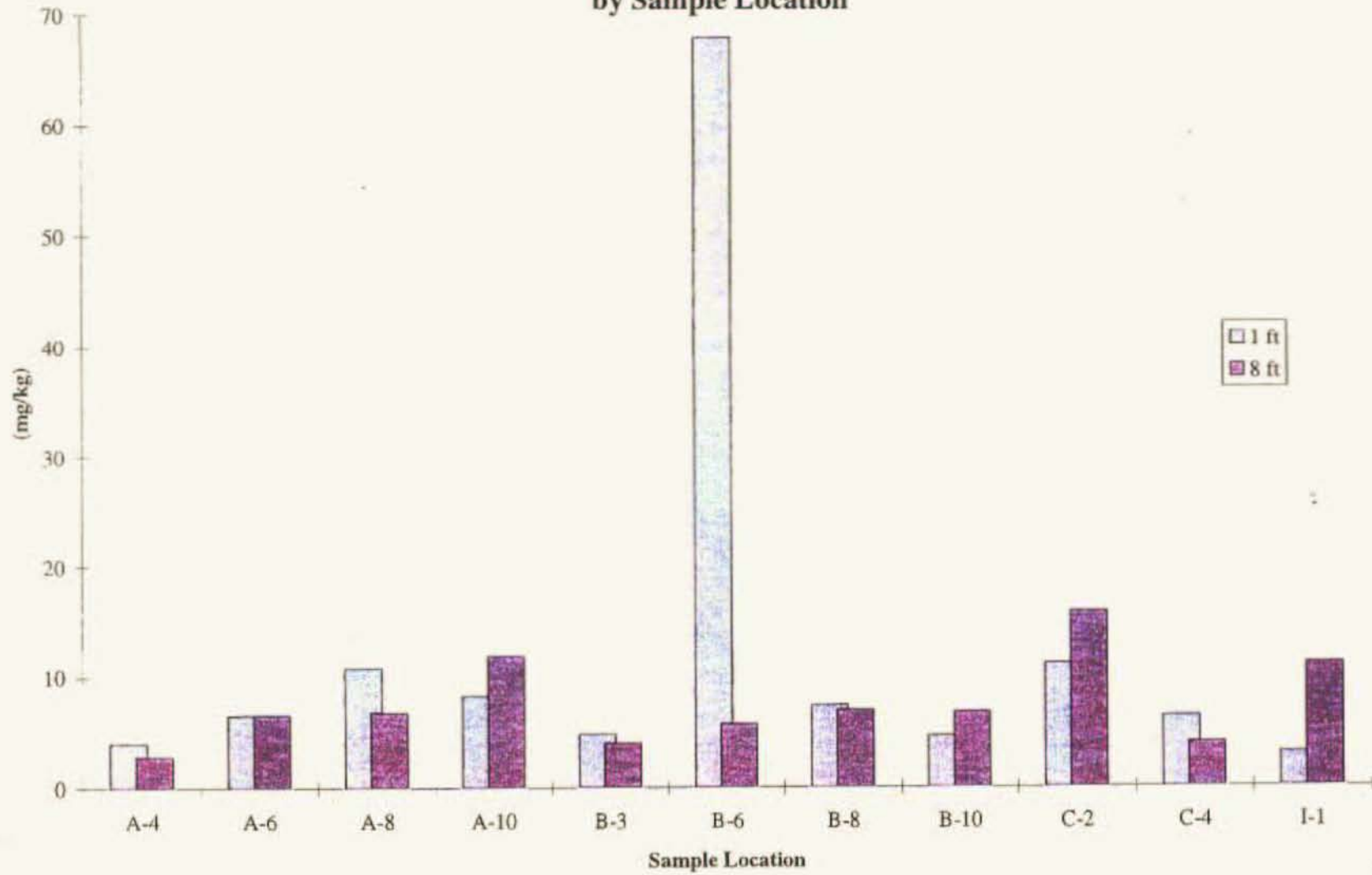
**Figure 3**  
**Barium and Barium Sulfate Concentrations**  
**by Sample Location**



**Figure 4**  
**Chromium Concentrations**  
**by Sample Location**

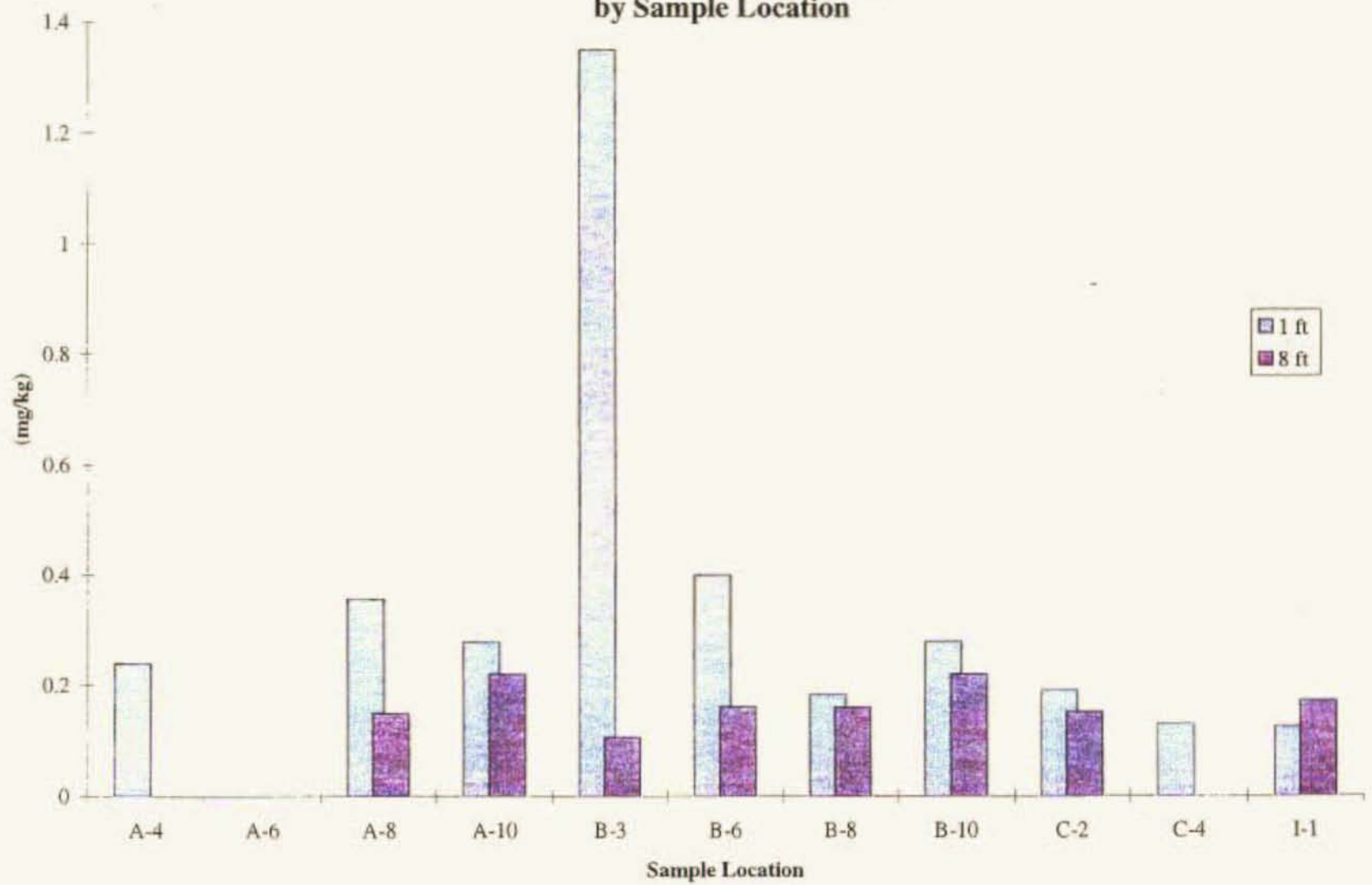


**Figure 5**  
**Lead Concentrations**  
**by Sample Location**

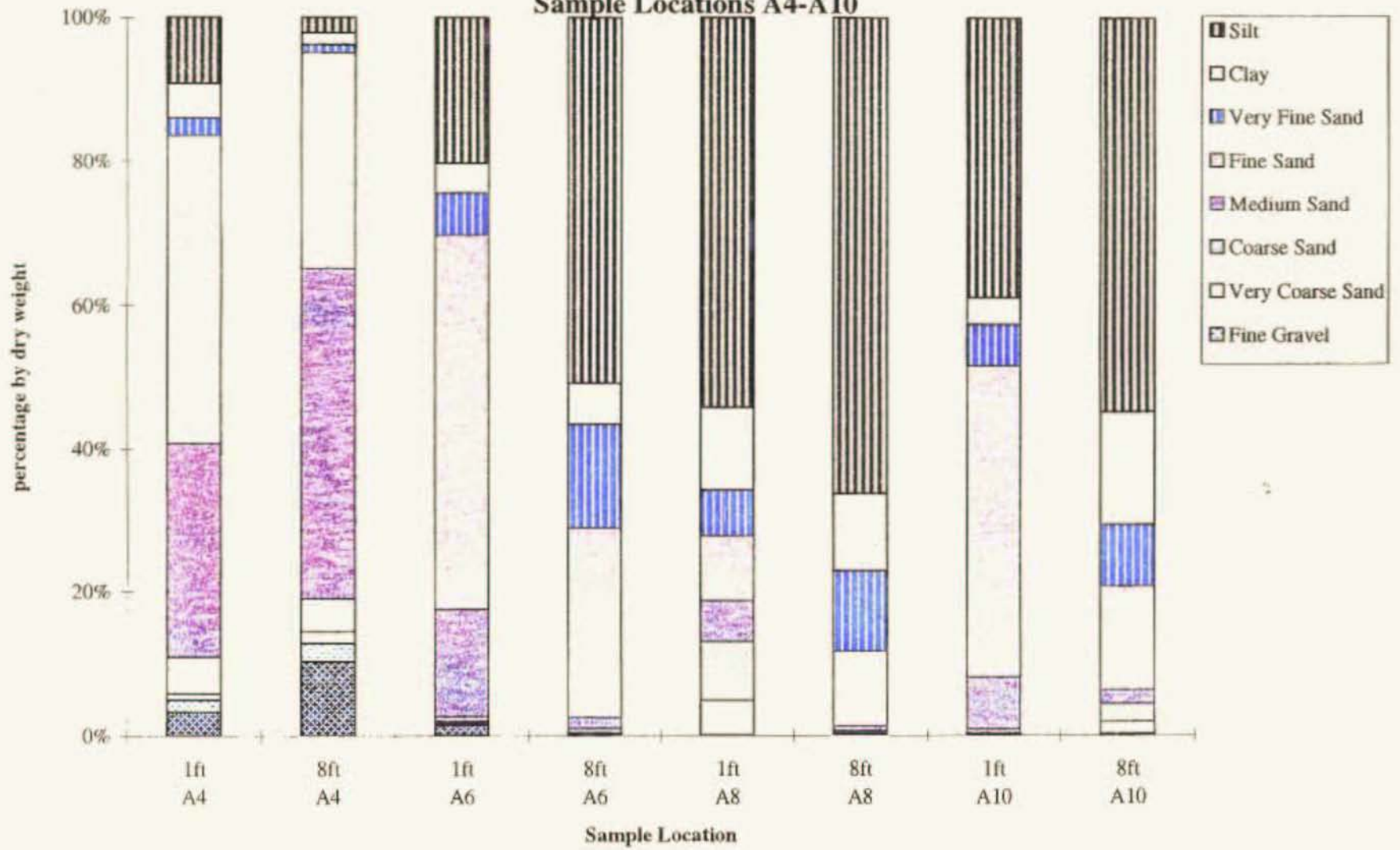




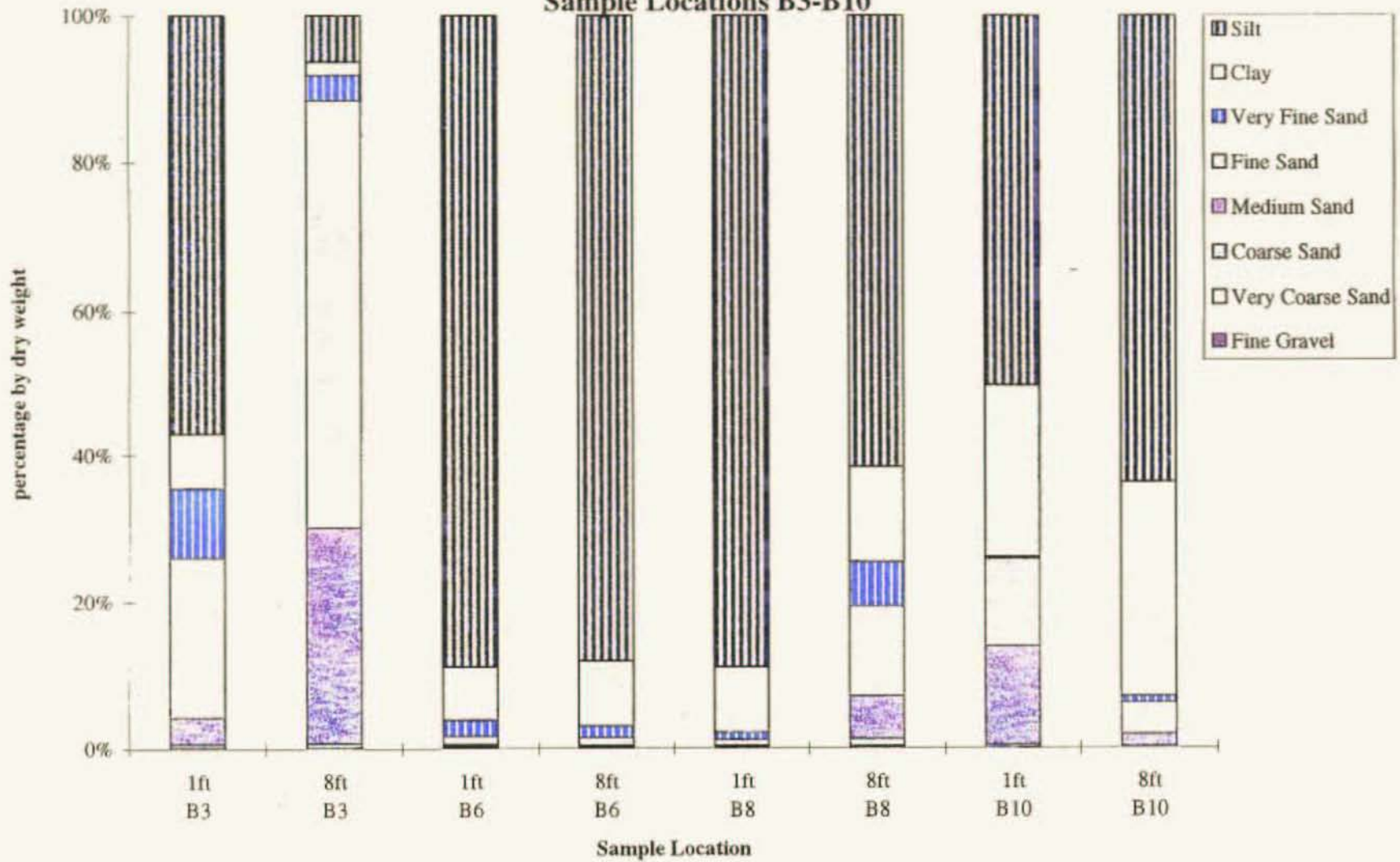
**Figure 6**  
**Concentration of Mercury**  
**by Sample Location**



**Figure 7**  
**Grain Size Distribution**  
**Sample Locations A4-A10**



**Figure 8**  
**Grain Size Distribution**  
**Sample Locations B3-B10**



**Figure 9**  
**Grain Size Distribution**  
**Sample Locations C2, C4, I1**

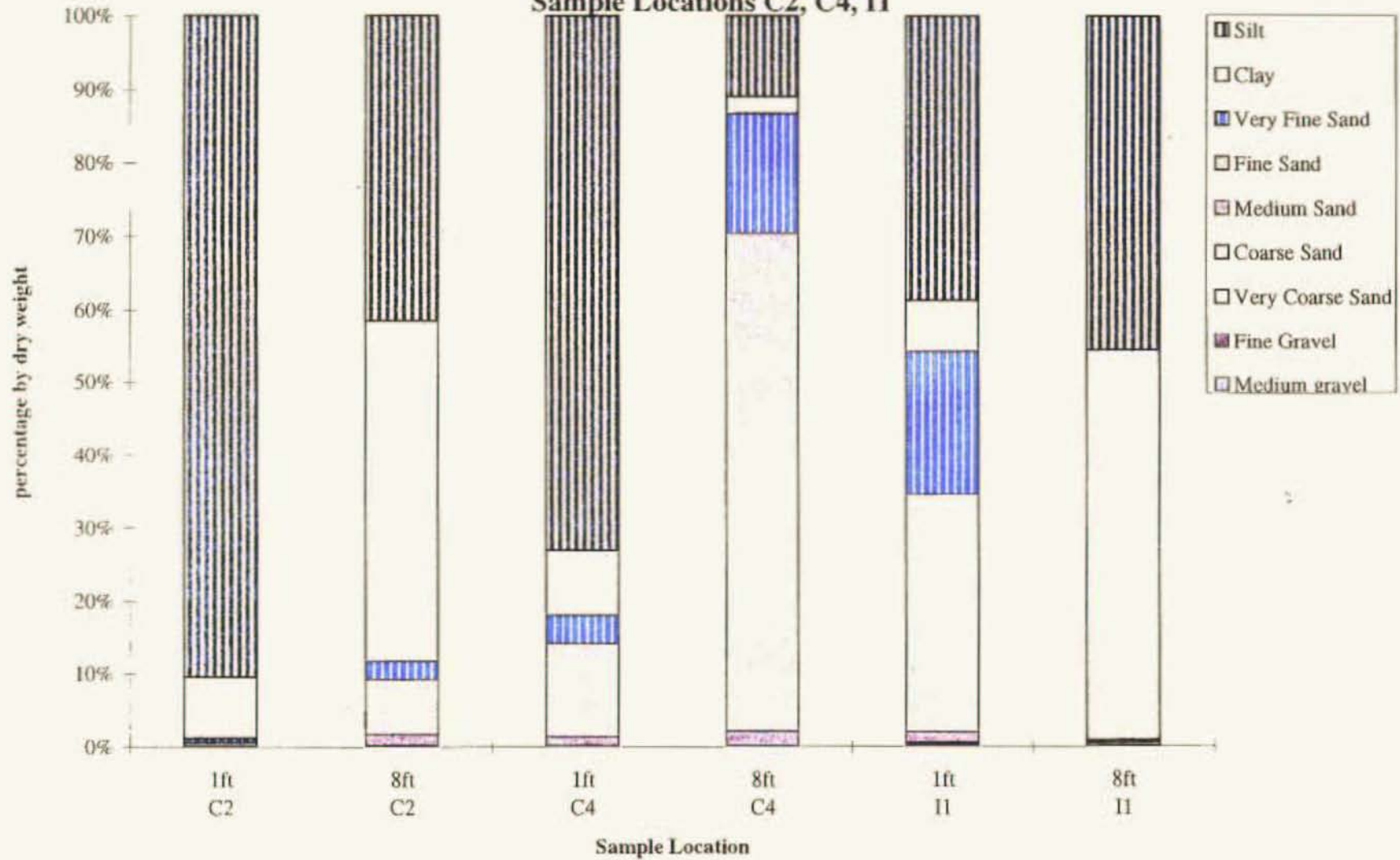


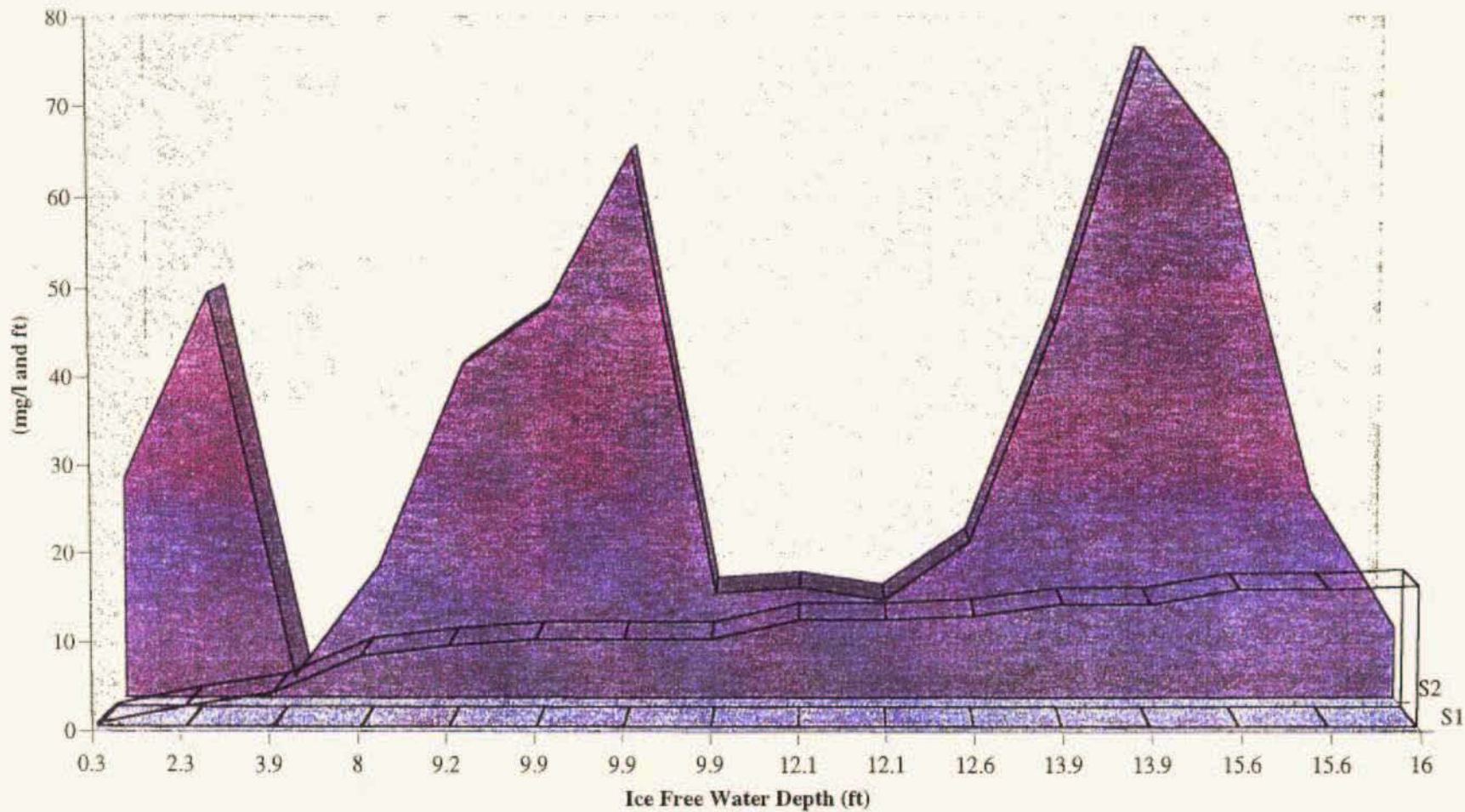








Figure 12 Total Suspended Solids by Ice Free Water Depth







**TABLE 4**  
**Summary of Analytical results and Benchmark Criteria**  
**Liberty Island Pipeline Routes**

Analyte	units	Physical and Chemical Parameters							Biological and Ecological Parameters					
		Minimum Reporting Limit (MRL)	Minimum Detection Limit (MDL)	Minimum	Maximum	Average	Standard Deviation	Coefficient of Variation	MDS for PSDDA	Screening Level	Bioaccumulation Level	Maximum Level	Risk Based Concentrations (RBC)**	Ecotox Effects Range Low (ERL)***
<b>Metals</b>														
total metals														
arsenic	mg/kg	3	2-3	3	11.4	5.5	2.36	0.43	2.5	57	507.1	700	23	8.2
barium	mg/kg	10	10	29	194	67.5	32.6	0.48	-	-	-	-	5500	-
chromium	mg/kg	3	2-3	7.15	34	18.5	7.08	0.38	-	-	-	-	78000	81
lead	mg/kg	0.6	0.2	2.79	67.8	10.1	12.6	1.24	0.5	66	-	660	660	47
mercury	mg/kg	0.1	0.1	ND	1.35	0.24	0.24	1.03	0.02	0.21	1.5	2.1	2.1	0.15
hexavalent chromium	mg/kg	0.2	0.2	ND	ND	ND	-	-	-	-	-	-	-	-
barium sulfate	mg/kg	3	2-3	15	34.9	27.5	7.2	0.26	29.7	-	-	-	-	5500
diesel range organics	mg/kg	36-54	3.6-5.4	ND	ND	ND	-	-	-	-	-	-	-	-
volatile organics	mg/kg	V		V	V	V	-	-	V	V	V	V	V	V
semi-volatile organics	mg/kg	V		ND	ND	ND	-	-	V	V	V	V	V	V
total organic carbon	mg/kg	100		<100	85900	28611	17849	0.62	-	-	-	-	-	-
<b>Water</b>														
turbidity	ntu	1	0.1	0.54	24	6.74	6.72	1						
total suspended solids	mg/l	2	0.2	2.5	76.5	32.2	22.9	0.71	na	na	na	na	na	na

V Variable values - see Table 5



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**Appendix A**  
**Field Note Forms**

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**MONTGOMERY WATSON**



On February 16, 1997, sampling was completed with the collection at sites A-6 and A-4. Flowmeter still fluctuates (no flow). After completing all the water quality parameters sampling and soil sampling.

All equipment moved to a pick-up, traveled to Endicott, packed equipment for shipping, all samples to travel to Anchorage as checked baggage.

Upon arrival in Anchorage, all samples were put into refrigerator.

On February 17, 1997, turbidity and TSS water was taken to CAS, which was closed for the holiday. The samples were taken to CT & E, Anchorage. This change occurred because of the short holding time for the turbidity samples.

Liberty Is. 2-14-97  
Table Contents

~~2-14-97~~

Start  
Liberty Is

*(Signature)*

2-14-97 Liberty Is  
1200 at airport  
1305 Take off  
1430 arrive - Jose & Dil. on site  
Plu Veeo vehicle  
# 20165

1600 Arrive Sundersott  
ok in, move equipment  
from Bldg 604 to 608  
AK AL process shipment  
not yet Plu Contact  
Expid on wild Plu

1800 @ Dinner

1830 Plu remaining  
Equipment

1900 Leave for Ice Rd

1930 arrived @ B3 setup  
on location

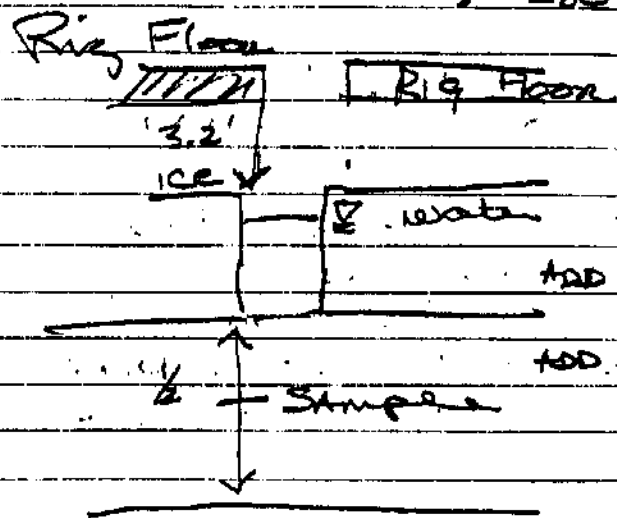
off loaded equipment to  
Polygon to skids.  
Set up work station within  
Inll Rig enclosure.

H&S meeting completed by  
Doc. Diller. I spent 3 hrs  
w/ Bill on frost sample to review procedure  
RSM

BPX(A) 2-15-97

Liberty TS

0280101



Reviewed w/BLO

BPM

2-15-97 Liberty TS

0600 get fuel - 7 gal. complete

0630 Drive for site w/ walt

0800 arrive on BJO

0830 Tailgate Meeting

collected water sample

@ 8' BTI

Soil samples

to LAB 0900 (1.5-1')

Hold 0915 (1-2.5) comp.

to LAB 0930 (6-8') comp.

0950 → Rig Stand hit by ROD

slides from bracing - we

go to warm up stack while  
Discovery repairs

1100 still on stand by

1118 Travel to II

1300 arrive II

Completed samples

Wa 1345

Soil 1400, 1430, 1445

Traveled to

C-4 This movement  
took 1.75 Hr. completed

BPM

(1 1/2 hrs  
total)

2-15-97 Liberty Is.

C4

usa @ 1700

Sol. 1730, 1745, 1800

Travel of Poligon to main  
load change over crew.

Took Stamps to  
Warehouse. Packed & cleaned  
bottles, left in coolers  
secured in P/L.

Difficult to collect  
0-1.0' because of deep  
like conditions.

Question Turb meter -  
Will collect additional  
500 mg for Turb @ Lab.

End 2115

Bgm

2-16-97

0530 prepare for days  
sampling -  
2 locations on A line

Left  
Prepare cooler for  
ship samples @ baggage

0730 at A6

Bill didn't take in  
Flow meter for shipping  
to UW.

Mike will take to  
Deadhorse - AK Goldstak  
Shipping on MW#.

A6 usa (06) @ 900

sol (01) 5-11

(02) 6-8

1-6' Hdd

100 Depe 97 BPX LE A6 SD 62 (08)

Moved to A4  
Wind continued to increase  
F 35' mph, snow ground  
blow out = 1/2 in. 1

2-16-97 Liberty Is

A4

WA 01 (05) @ 1100

1130 5-10'

1200 6-8'

1145 1-6' Helo

Very soupy - lost most 5-10"  
Ropes w/ Rig moved to road.  
Pack and equipment to P/U  
Moved to Endicott

Packed-up equipment left  
2 pallets @ warehouse  
for shipment.

Samples packed for baggage  
tagging (4 coolers)  
Drove to Deadhorse

Dropped off P/U

Travel to PB Bx

to Anch

to Fox - left

all samples in Refrig

End. 2030

Bern



# MEMORANDUM



MONTGOMERY WATSON

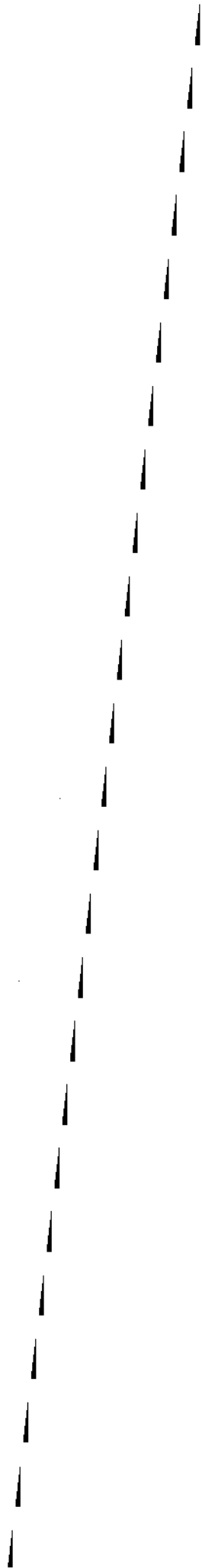
**To:** File **Date:** March 5, 1997  
**From:** Bill Nettleton **Reference:** 1189002.280101  
**Subject:** Liberty Island (Nights)  
Water/Sediment Sampling

The purpose of this memorandum is to summarize the field work that occurred during the night shift on February 14 through February 16, 1997 at BP Exploration (Alaska), Inc.'s Liberty Island project site. Montgomery Watson's field team worked two twelve hour shifts. This memorandum contains the events which occurred during the night shift. I was supervising the night shift and Bonnie McLean was supervising the day shift. Erin from Duane Miller & Associates provided acted as geologist and assisted with various tasks. Discovery Drilling operated a CME-75 mounted on a sled and enclosed with a wooden structure with a nylon sock over the rig tower. Gary was the driller and Ken the assistant. The sled was moved via Rolligon provided by Catco and operated by J.R. (Carl). The water sampling consisted of the following tasks:

- depth of ice and water measurements;
- measure the speed and direction of the current;
- Salinity, temperature, and specific conductivity at one foot intervals in the water column below the ice;
- collect water sample from mid-depth of each distinct salinity layer;
- perform field analysis of collected water for pH, turbidity, and dissolved oxygen;
- collect soil samples in the first eight feet of sediment using a 3" diameter split-spoon sampler;
- log sediment geology; and
- collect soil samples for VOCs, DRO, metals, and grain size analysis.

Table 1 provides a chronological listing of the tasks completed for each night shift.

<b>Table 1</b>		
<b>Date</b>	<b>Task</b>	<b>Remarks/Problems</b>
2/14/97	Water/Sediment Sampling for B3, B6, & B8	B3 tasks completed by Bonnie and myself to coordinate procedures. Flow meter malfunctioning. Completed all of the other tasks. Left rig setup on next location (B10)
2/15/97	Water/Sediment Sampling for C2, A10, & A8	Had problem with salinity probe icing over. Salinity values read low when icing occurred. Cleaning probe just prior to insertion helped. Completed all tasks except current measurements.
2/16/97	Demobe	Assisted Bonnie with demobe activities.



Liberty Is. 2-14-97  
Table Contents

1.

2-14-97  
Start  
Liberty Is  
Eger

2-14-97 Liberty Island

1200 at airport

1305 Take off

1430 arrive - Jose & Dil on site  
Plu. Veeo vehicle

# 20165

1600 Arrive Endicott

ok in, move equipment  
from Bldg 604 to 608.  
AKAL property, shipment  
not yet Plu. Contact  
Explosion with Plu.

1800 @ Dinner

1830 Plu remaining  
Equipment

1900 Leave for Ice Rd

1930 arrived @ B3 setup  
on location

off loaded equipment to  
Rollon to skids.

Set up work station within  
Infl Rig enclosure.

H&S meeting completed by  
Doc Duller. I spent 3 hrs  
w/ Billon hot temps to review procedure

2-15-97 Liberty Is.

C4

Lsa @ 1700

SOL 1730, 1745, 1800

Travel w/ Religion to main  
road change over crews.Took Stamples to  
Warehouse. Packed & cleaned  
bottles, left in cooler  
secured in P/C.Difficult to collect  
0-1.0' because of trap  
like conditions.Question Turb meter -  
Will collect additional  
500 mg for Turb @ Lab.

End 2/15

Bgm

2-16-97

0530 prepare for days  
sampling -  
2 locations on A line

Dyt

Prepare cooler for  
ship samples @ baggage

0730 at A6

Bill didn't take in  
Flora meter for shipping  
to UW.Mike will take to  
Dea Shoran - AK Goldstark  
Shipping on MUI#.

A6 Lsa (06) @ 900

sol (01) 5-15'

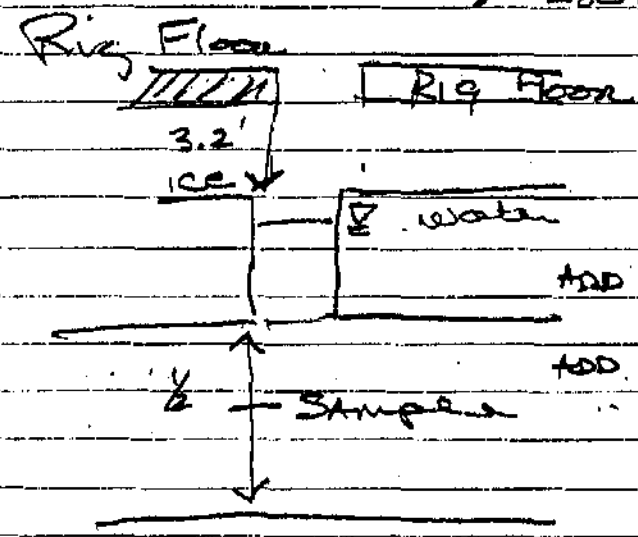
(02) 6-8'

1-6' Held

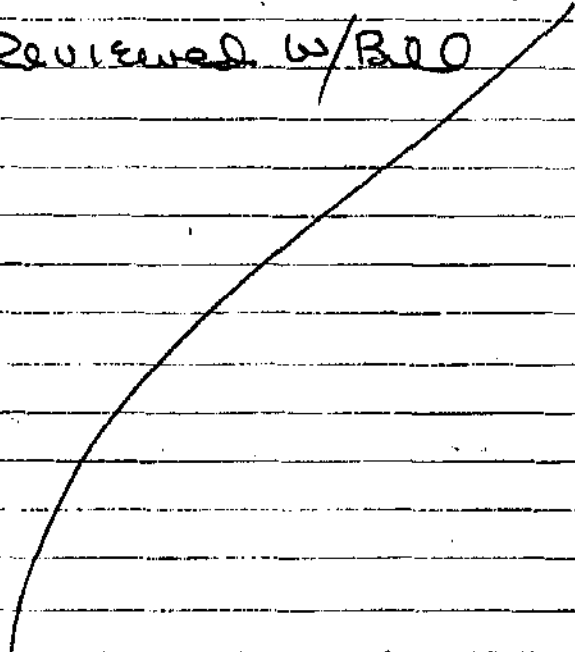
1010 Depo 97 Bpx LZ A6 SD 62 (08)

Moved to A4  
Wind continued to increase  
F 35' mph, snow ground  
blizzard = visibility poor. 1000

BPX(A) 2-15-97 Liberty TS  
0280101



Reviewed w/BLO



BPM

2-15-97 Liberty TS

0650 get fuel - Total complete  
 0630 Leave for site w/walt  
 0800 arrive on B10  
 0830 Tailgate meeting  
 collected water samples @ 8' BTI  
 Soil samples  
 to LAB 0900 (1.5-1')  
 Hold 0915 (1-2.5' comp)  
 to LAB 0930 (6-8') comp

0950 → Rig Stand hit by ROD  
 slides from bracing - we  
 go to warm up shack while  
 discovering repairs

1100 still on Stand by (1 1/2 Hr)  
 1118 Travel to I1 (Total)  
 1300 arrive I1  
 Completed samples  
 Wa 1345  
 Soil 1400, 1430, 1445  
 Traveled to  
 C-4 This movement  
 took 1.75 Hr. Completed

BPM

7 2-16-97 Liberty Is

A4

WA 01 (05) @ 1100

1130 5-10'

1200 6-8'

1145 1-6' Held

Very scruffy - lost most 5-10"  
Relinquish w/ Rig moved to road.  
Pack and equipment to P/U  
Moved to Endeavor

Packed up equipment left  
2 pallets @ warehouse  
for shipment.

Samples packed for baggage  
tagging (4 coolers)  
Drove to Deadhorse

Dropped off P/U

Travel to PB Bt

to Anch

to Fox - left

all samples in Refrig

End. 2030

Boyer



MONTGOMERY WATSON

NIGHTS

DATE: 2/14/97 - 2/15/97

DAY	S	M	T	W	TH	FR	S
						X	

FIELD

DAILY QUALITY CONTROL REPORT

PROJECT MANAGER Brett Johela  
 PROJECT Liberty Island  
 JOB NO. 1189002.280101  
 CONTRACT NO. \_\_\_\_\_

WEATHER	Bright Sun	<u>Clear</u>	Overcast	Rain	Snow
TEMP	<u>To 32</u>	32-50	50-70	70-85	85 up
WIND	Still	<u>Moderate</u>	High		Report No. <u>EPX LI</u>
HUMIDITY	<u>Dry</u>	Moderate	Humid		# /

SUBCONTRACTORS ON SITE:

Discovery Drilling - GARY + KEH  
Deane Miller & Assoc. ERIN  
CatCo TR (CARL)

EQUIPMENT ON SITE:

CME-75 on site RD-85  
Snowwand chain

WORK PERFORMED (INCLUDING SAMPLING):

SAMPLED B-3, very little water, Banded on site for water sampling.

SAMPLED B-6, NOT ENOUGH WATER FOR FLOW METER

SAMPLED B-9, took 3 sets of WATER SAMPLES BASED ON SALINITY PROFILE. RAN OUT OF SOIL TARS HAD ENOUGH TO TAKE VOLS AT EACH DEPTH. ISAGED ENOUGH TO DO OTHER TARS LATER. FLOW METER DID NOT WORK. SAMPLED IT TWICE WITH NO LUCK. VELOCITIES INTERMITTENT BETWEEN 30% + 20%. ICE IN HOLE MAY BE CAUSING PROBLEM

SET RIG UP ON B-10.

NO PICTURES TAKEN

PROJECT: \_\_\_\_\_  
JOB NO.: \_\_\_\_\_

REPORT NO.: \_\_\_\_\_  
DATE: 2/15/97

**QUALITY CONTROL ACTIVITIES (INCLUDING FIELD CALIBRATIONS)**

Microtip calibrated at \_\_\_\_\_ ppm

PID N/A

DO - ~~1450~~

**HEALTH AND SAFETY LEVELS AND ACTIVITIES:** Daily tailgate meeting completed

GARY (DISCOVERY) COMPLETED TAILGATE SAFETY MEETING.

INJURIES: NONE ACCIDENTS: NONE NEAR MISSES: NONE

**PROBLEMS ENCOUNTERED/CORRECTION ACTION TAKEN:**

Weight on chain adds 0.7'

SAMPLE Bomb on CHAIN ADDS 0.6' (center of bomb)

FLOW METER PRODUCES ERRATIC READINGS WHEN USED. ONLY USED ONCE, BUT TRIED SEVERAL TIMES.

**SPECIAL NOTES:**

CAMERA!!!

ERIN PREFERS HER LOGGING FORM. I SAID OK, BUT WILL NEED COPIES OF HER COMPLETED LOGS

**TOMORROW'S EXPECTATIONS:**

3-6 holes tomorrow IF ALL GOES WELL

BY: Bill Hamm

TITLE: Asst. Eng.





MONTGOMERY WATSON

DATE: 2-15-97 0800

FIELD

DAY	S	M	T	W	TH	F	S
							X

0630

DAILY QUALITY CONTROL REPORT

PROJECT MANAGER: Brett Johanson

PROJECT: Liberty Island

JOB NO.: 1189002.280101

CONTRACT NO. \_\_\_\_\_

WEATHER	Bright Sun	Clear ✓	Overcast	Rain	Snow
TEMP	To 32 -19	32-50	50-70	70-85	85 up
WIND	Still	Moderate 20 mph	High	Report No. <u>BPX LI</u>	
HUMIDITY	Dry ✓	Moderate	Humid	# <u>2</u>	

SUBCONTRACTORS ON SITE:

Discovery Drilling - Scott Clinkbeard, Jeff Deana Miller & Assoc. - Gen. Walt Phillips  
CatCo - Jimen

EQUIPMENT ON SITE:

CME-75 on slip, RD-85 Raylign  
Sunward stand

WORK PERFORMED (INCLUDING SAMPLING):

97 BPX LI SD/WA 01/02/03 (Depth)

ID # (Time) water, SD (1) - SD (5) - SD (8)

①	B10	-	0830	905	915	930
			Depth SD 62 (08)		1000	
②	=	1	1345	1400	1430	1445
③	C4		1700	1730	1745	1800

PROJECT: BPX LI  
JOB NO.: 0250/01

REPORT NO.: LI #2  
DATE: 2-15-97 0800

**QUALITY CONTROL ACTIVITIES (INCLUDING FIELD CALIBRATIONS)**

Microtip calibrated at: \_\_\_\_\_ ppm

PID N/A

DO - Hach 700 DR - HR 0-14 mg/L

**HEALTH AND SAFETY LEVELS AND ACTIVITIES:** Daily tailgate meeting completed 0800

INJURIES: 0 ACCIDENTS: 0 NEAR MISSES: 0

**PROBLEMS ENCOUNTERED/CORRECTION ACTION TAKEN:**

Difficult to collect the 0-1.0 samples - <sup>soapy, no recovery -</sup> had to open  
drisk at BIO.

**SPECIAL NOTES:** Standby 0850-1110 repair rig shed -  
D Travel from ~~IL~~ IL to C4 took 1 hr 45 min

**TOMORROW'S EXPECTATIONS:** Complete prepare equipment  
and samples for shipping

BY: Burcham TITLE: FTL



MONTGOMERY WATSON

NIGHT SHIFT

DATE: 2-5-97 / 2-16-97

DAY: X S M T W TH F X

FIELD

DAILY QUALITY CONTROL REPORT

PROJECT MANAGER: Brett Johal  
PROJECT: Liberty Island  
JOB NO.: 1189002, 220101  
CONTRACT NO.:

WEATHER	Bright Sun	Clear	Overcast	Rain	Snow
TEMP	To 32	32-50	50-70	70-85	85 up
WIND	Still	Moderate	High		
HUMIDITY	Dry	Moderate	Humid		
					Report No. BPK LI 3

SUBCONTRACTORS ON SITE:  
Discovery Dredging  
Dwayne Miller & Assoc.  
CatCo

EQUIPMENT ON SITE:  
CME-75 on site, RD-85  
Snowward chow

WORK PERFORMED (INCLUDING SAMPLING):

- SAMPLED C2, A10, & A8
- ROLLED DUPE ON A10(B) SO
- CAUGHT UP ON LABELS (still need some done)
- Took pictures of soil & WATER SAMPLING

PROJECT: Liberty Is  
JOB NO.: \_\_\_\_\_

REPORT NO.: 3  
DATE: 2/16/97

**QUALITY CONTROL ACTIVITIES (INCLUDING FIELD CALIBRATIONS)**

Microtip calibrated at: \_\_\_\_\_ ppm

PID N/A

DS - NO STANDARD

ALSO NEED SALINITY STANDARD

HEALTH AND SAFETY LEVELS AND ACTIVITIES: Daily tailgate meeting completed ✓

INJURIES: NONE ACCIDENTS: NONE NEAR MISSES: NONE

**PROBLEMS ENCOUNTERED/CORRECTION ACTION TAKEN:**

SALINITY PROBE GETS GLOGGED WITH ICE  
ON THE WAY DOWN & UP - CLEAN & CHECK  
W/ EACH USE - SALINITY OF SALT WATER OCEANS  
≈ 29-30‰

**SPECIAL NOTES:**

SEE NOTE IN DRILL SHACK  
TO BEYHIE

**TOMORROW'S EXPECTATIONS:**

A6 & A4  
DEMO BE

BY: \_\_\_\_\_ TITLE: \_\_\_\_\_



MONTGOMERY WATSON

DATE: 2/16/97 0700-2100

FIELD

DAY	S	M	T	W	TH	F	S
	X						

DAILY QUALITY CONTROL REPORT

PROJECT MANAGER: Brett Schelan  
 PROJECT: Liberty Island  
 JOB NO.: 1189002.280101  
 CONTRACT NO.:

WEATHER	Bright Sun	Clear X	Overcast	Rain	Snow ground
TEMP	To 32 -20°F	32-50	50-70	70-85	85 up
WIND	Still	Moderate	High 30-50mph	Report No. BPX LI	
HUMIDITY	Dry	Moderate X	Humid	4	

SUBCONTRACTORS ON SITE:

Discovery Drilling  
 Duane Miller & Assoc.  
 Catco

EQUIPMENT ON SITE:

CME-75 on sled RD-85  
 Snowward sled

DO, EC, pH, Turb.

WORK PERFORMED (INCLUDING SAMPLING):

WA 01 (06) @ 0900  
 Sampled A6 @ .5' & 6-8' BGS  
 Duplicate 97 BPC LI A6 SD 62 (08) @ 1010  
 Comp. 1-6' Bagged for later use

WA 01 (05) @ 1100  
 Sampled 1130, 1204 (A 4) @ .5' & 6-8' BGS  
 @ 1145 Comp. 1-6' Bagged for later use

Recovered 05 - 1' very lumpy, lost most,  
 moved forward & resampled using  
 3' x 2 1/2" SS, this worked better.

Packed out equipment, samples & all  
 debris. Ground Blizzards made travel  
 to grid point very slow.

Packed equipment for equipment, left  
 2-pallets at warehouse w/ Ed & Bruce,  
 prepared samples for travel to Anch.  
 Four sevens check at baggage.

PROJECT: Liberty  
JOB NO.: \_\_\_\_\_

REPORT NO.: 04  
DATE: 2-16-97

**QUALITY CONTROL ACTIVITIES (INCLUDING FIELD CALIBRATIONS)**

Microtip calibrated at: \_\_\_\_\_ ppm  
PTD N/A  
DO - HR

**HEALTH AND SAFETY LEVELS AND ACTIVITIES:**

Daily tailgate meeting completed by Kyle Blum

INJURIES: 0 ACCIDENTS: 0 NEAR MISSES: 0

**PROBLEMS ENCOUNTERED/CORRECTION ACTION TAKEN:**

Turb meters operation  
mastered - collect samples, soil  
for lab. analysis

**SPECIAL NOTES:**

**TOMORROW'S EXPECTATIONS:**

Prepare samples for  
ship ment to labs.

BY: Begm TITLE: FLT

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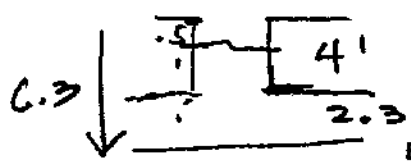
## Appendix B

### Field Notes

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**MONTGOMERY WATSON**



A4

BP Exploration (Alaska), Inc.  
LIBERTY ISLAND Water/Sediment Sampling

wind chills -35°F

FIELD NOTE FORM

Station No.	A4	Air Temp	-20°F	Date	2-16-97
		Wind	NE 20-40 mph	Crew	BGM
		Sky	clear	Start Time	1050

Deck  
3.3' to Ice  
Surface

A	Ice Thickness	4.0	Description	Staked by BP
B	Depth to Water Surface	0.5		
C	Depth to Bottom	6.3	Latitude	70 12 26.88
C-B	Total Water Depth	5.8	Longitude	147 30.42.82
D-(A-B)	Ice Free Water Depth	2.3	Northing	312 495.83
D-F	Depth of Water Above Ice Bottom:		Easting	5 927 747.46

8.3  
-3.3

Depth	Temp. C	Salinity	EC	DO	Turb./TSS	Current V	Direction
0.5	-1.5	22	19,000	13.1	21-	None	recorded
1.0	-1.5	2					
1.5	-1.5						
2.1	-1.5						
<i>BGM</i>							

Bottom

sampled  
TSS  
Turb  
pH 7.8

WATER SAMPLE:	96 BPK LI WA 01 (05)
TSS	DATE: 2-16 TIME: 1100 DEPTH (BIS) (5.0)

Depth	Grain Size	Metals #1	TOC	DRO	SVOA's	VOA	TIME
5-10'	✓	✓	✓	✓	✓	✓	1130
6.0-8.0	✓	✓	✓	✓	✓	✓	1200
1.0-6.0'	Comp held ml						1145

little  
recovery -  
re-sampled  
HOLD 3'-5.

COMMENTS:	21.2' 96 GPL LI A4 WA 01 (01)
-----------	-------------------------------

DO METER USED: YSI OR HACH (STD.) HR 0-14 mg/l  
Turb. collect by Gals  
Shallow water Turb may be high  
Flow meter would not stop at 3' flow

*BGM*



A6



BP Exploration (Alaska), Inc.  
LIBERTY ISLAND Water/Sediment Sampling  
FIELD NOTE FORM

A6

Station No.	A6	Air Temp	-33.9	Date	2-16-96
		Wind	35-45 mph NE	Crew	BGM
		Sky	clear	Start Time	0845

		Location	
A	Ice Thickness	4.6	Description
B	Depth to Water Surface	0.4	Stationed by BP
C	Depth to Bottom	17.2	Deck to Ice Surface 3.3'
C-B	Total Water Depth	16.2	Latitude
D-(A-B)	Ice Free Water Depth	12.6	Longitude
D-F	Depth of Water Above Ice Bottom:	4.2	Northing
			Easting

BIS  
11'

Depth	Temp. C	Salinity	EC	DO	Turb/TSS	Current V	Direction
1.5	-1.0	29	21500				
3.5	-1.0	30	23500				
5.5	-1.0	30	25000				
7.5	-1.0	30	25000				
9.5	-1.0	30	25500				
11.5	-1.0	30	25500				
12.5	-1.0	30	25500				

Bottom

Sample  
14.2'  
Below  
Deck  
pH 7.8  
6.4'  $\approx$   
6.5'

WATER SAMPLE:		96	BPX LI	A6	WA 01	(06)
TSS	DATE: 2/16	TIME: 0900	DEPTH (BIS) (10.5)			

F Turb. collected

Depth	Grain Size	Metals #1	TOC	DRO	SVOA's	VOA	TIME
5-1.0'	/	/	/	/	/	/	0930
6.0-8.0	/	/	/	/	/	/	1000
1.0-6.0'	Holer						0945

HOLD

Comment:  
 Dupl 97 BPX LI A6 SD 62 (08) @ 1010  
 DO METER USED: YSLOB HACH (STD.) #R 0-14

BGM



MONTGOMERY WATSON

BP Exploration (Alaska), Inc.  
LIBERTY ISLAND Water/Sediment Sampling  
FIELD NOTE FORM

Station No. <b>A 8</b>	Air Temp <b>-20°F</b>	Date <b>2/16/97</b>
	Wind <b>25 mph</b>	Crew <b>KILL EGIN GARY BEN</b>
	Sky <b>Clear</b>	Start Time <b>0320</b>

Ice		Location	
A	Ice Thickness <b>4.3</b>	Description	
B	Depth to Water Surface <b>0.8'</b>		
C	Depth to Bottom <b>19.9'</b>		
C-B	Total Water Depth <b>19.1'</b>		
D-(A-B)	Ice Free Water Depth <b>15.6'</b>		
D-F	Depth of Water Above Ice Bottom:		
		Latitude	
		Longitude	
		Northing	
		Easting	

Below Bottom ICE

Water Column Profile						TIME	PEI
Depth	Temp. C	Salinity	EC	DO	Turb./TSS	Current V	Direction
1.0	-1.0	29.5	25,000				
2.0	-1.0	29.5	25,000	8.7	21.2	0350	7.83
3.0	-1.0	29.5	25,000				
4.0	-1.0	29.5	25,000				
5.0	-2.0	31.0	25,500				
6.0	-2.0	31.0	25,500				
7.0	-2.0	31.0	25,500				
8.0	-2.0	31.0	25,500				
9.0	-2.0	31.0	25,500	9.8	7.5	0400	7.88
10.0	-2.0	31.0	25,500				
11.0	-2.0	31.0	25,500				
12.0	-2.0	31.0	26,000				
13.0	-2.0	31.5	26,000				
14.0	-2.0	31.5	26,000				

SAMPLE 2.5'

SAMPLE 9.5'

WATER SAMPLE: TSS DATE: **2/16/97** TIME: **BRE** DEPTH (BIS): ( )

Sediment		Record Sample Time					
Depth	Grain Size	Metals #1	TOC	DRO	SVOA's	VOA	TIME
5-1.0'							0430
6.0-8.0							0440
1.0-6.0'							0430

HOLD

Comments:

DO METER USED: YSI OR HACH (STD.)

SHOULD HAVE SALINITY QUAC SOLUTION  
VSE PROBE CLOGGED W/ICE. D-TCEN + USED



BP Exploration (Alaska), Inc.  
LIBERTY ISLAND Water/Sediment Sampling  
FIELD NOTE FORM

Station No. <b>A-10</b>	Air Temp <b>-20°F</b>	Date <b>2/16/97</b>
	Wind <b>25 mph</b>	Crew <b>BH, EB, GARY + KEN</b>
	Sky <b>Clear</b>	Start Time <b>0030</b>

A	Ice Thickness	<b>4.5</b>	Description	
B	Depth to Water Surface	<b>0.7</b>		
C	Depth to Bottom	<b>18.4</b>	Latitude	
C-B	Total Water Depth	<b>17.7</b>	Longitude	
D-(A-B)	Ice Free Water Depth	<b>13.9</b>	Northing	
D-F	Depth of Water Above Ice Bottom:		Easting	

*Water Column Profile*

Depth #	Temp. C	Salinity	EC	DO	Turb./TSS	Current V	Direction
01	-2°C	17.523	20000				
02	-2°	17.523	20000			TIME	
03	-2	17.0235	19000				
04	-2	17.0235	19000	9.4	23.9	0110	7.70
05	-2	17.0235	19000				
06	-2	17.0242	19000				
07	-2	17.0240	19000				
08	-2	17.0235	19000				
09	-2	17.0212	18000				
10	-2	21.0	18000				
11	-2	21.5	18000	10.1	31.7	0120	7.63
12	-2	22.0	18000				
13	-2	22.0	18500				

BELOW ICE BOTTOM

SAMPLE 4.5'

SAMPLE 0.0'

WATER SAMPLE: TSS DATE: **2/16/97** TIME: **SEE ABOVE** DEPTH (BIS) ( )

*Sediment Record Sample Time*

Depth	Grain Size	Metals #1	TOC	DRO	SVOA's	VOA	TIME
.5-1.0'	/	/	/	/	/	/	0130
6.0-8.0	/	/	/	/	/	/	0150
1.0-6.0'	/	/	/	/	/	/	0130

HOLD

Comments:

DO METER USED: YSI OR HACH (STD.)  
YSI METER FOR PROFILE MAY BE GIVING FALSE READINGS FROM ICE CLOGGING PROBE. WE WASHED THE PROBE OUT (UP + DOWN QUICKLY) + RE-SAMPLED PREVIOUS STATIONS

BN



MONTGOMERY WATSON

BP Exploration (Alaska), Inc.  
LIBERTY ISLAND Water/Sediment Sampling  
FIELD NOTE FORM

Station No.	03	Air Temp	-17°C	Date	2-14-97
		Wind	+12 kts	Crew	BN/EG/GC/KH
		Sky	clear	Start Time	2:30

98  
50  
148

Ice		Location	
A mud/decks 32	Ice Thickness	3.5	Description
B 38	Depth to Water Surface	0.8	
C 63	Depth to Bottom	3.3	Latitude
D C-B	Total Water Depth	2.5	Longitude
D-(A-B)	Ice Free Water Depth	.3	Northing
D-F	Depth of Water Above Ice Bottom:		Easting

Water Column Profile							
Depth	Temp. C	Salinity/‰	ECUM/‰	DO meter	Turb./TSS	Current V	Direction
3.2	0	17	14000	3.2	35.6	None	

PH  
7.6

<b>WATER SAMPLE:</b>			
TSS	DATE: 2-14	TIME: 2200	DEPTH (BIS): (3.3)

Sediment Record Sample Time							
Depth	Grain Size	Metals #1	TOC	DRO	SVOA's	VOA	TIME
.5-1.0'							
6.0-8.0							
1.0-6.0'							

HOLD

Comments:  
 BN (Emit), 98 (Helper), GC (DRILLER - DISCOVERY), KH (Helper).  
 DO METER USED: YSI OR HACH (STD.)

93

32



MONTGOMERY WATSON

BP Exploration (Alaska), Inc.
LIBERTY ISLAND Water/Sediment Sampling
FIELD NOTE FORM

Station No. B6
Air Temp -19°C
Wind ±10 Kts
Sky Clear
Date 2/15/97
Crew DJ, Eric, Gary, + Ken
Start Time 0030

Table with columns for Ice (A-F) and Location (Description, Latitude, Longitude, Northing, Easting). Values include Ice Thickness 3.7', Depth to Water Surface 0.9', etc.

Water Column Profile table with columns: Depth, Temp. C, Salinity, EC, DO %, Turb/TSS, Current V, Direction. Data points from 1' to 6' depth.

PH 8.4

WATER SAMPLE: TSS, DATE: 2/15, TIME: 0100, DEPTH (BIS) (5.7) 20' BEL

Sediment table with columns: Depth, Grain Size, Metals #1, TOC, DRO, SVOA's, VOA, TIME. Rows for 5-1.0, 6.0-8.0, 1.0-6.0.

HOLD

Comments: Double checked @ 22 1/2' below bottom of ice. Below ice free water
DO METER USED: YSI OR (HACH (STD.))



MONTGOMERY WATSON

BP Exploration (Alaska), Inc.  
LIBERTY ISLAND Water/Sediment Sampling  
FIELD NOTE FORM

Station No. <b>B8</b>	Air Temp <b>-20 F</b>	Date <b>2-15-97</b>
	Wind <b>15</b>	Crew <b>Bill, Eric, Gary, &amp; Ken</b>
	Sky <b>clear</b>	Start Time

Ice		Location	
A	Ice Thickness <b>5'</b>	Description	
B	Depth to Water Surface <b>0.7'</b>	Latitude <b>70 14' 44"</b>	Longitude <b>147 37' 56"</b>
C	Depth to Bottom <b>15.0'</b>	Northing	Easting
C-B	Total Water Depth <b>14.3'</b>		
D-(A-B)	Ice Free Water Depth <b>9.9'</b>		
D-F	Depth of Water Above Ice Bottom:		

Water Column Profile							P <sub>H</sub>
Depth	Temp. C	Salinity	EC	DO	Turb./TSS	Current V	Direction
1.0	-2°C	29.5	24,000	9.2	<del>5.19</del> 4.73		7.9
2.0	-2	29.5	24,500				
3.0	-2	31.0	24,500	8.9	1.02		7.60
4.0	-2	31.0	24,500				
5.0	-2	29.5	24,000				
6.0	-2	29.5	24,000	8.7	2.46		7.74
7.0	-2	29.5	24,000				
8.0	-2	29.5	24,000				

CURRENT

SAMPLE 1.5'  
- sample 3.5'  
- sample 6.5'

WATER SAMPLE: **3 depths (1.5', 3.5', 6.5' BBI)**

TSS DATE: **2/15** TIME: **0400 (4:00)** DEPTH (BIS) ( )

Sediment:		Record Sample Time					
Depth	Grain Size	Metals #1	TOC	DRO	SVOA's	VOA	TIME
5-1.0'							
6.0-8.0							
1.0-6.0'							

HOLD

Comments

DO METER USED: YSI OR **HACH (STD.)**



BP Exploration (Alaska), Inc.  
LIBERTY ISLAND Water/Sediment Sampling  
FIELD NOTE FORM

Station No.	B 10	Air Temp	-19°F	Date	2-15-97
		Wind	20 E	Crew	Logan - WP
		Sky	clear	Start Time	8:20 AM

above  
3.2  
above

A	Ice Thickness	3.9	Description	
B	Depth to Water Surface	0.4		
C	Depth to Bottom	13.1	Latitude	70 15 52.360
C-B	Total Water Depth	12.7	Longitude	147 36 15.682
D-(A-B)	Ice Free Water Depth	9.2	Northing	5948 925.57
D-F	Depth of Water Above Ice Bottom:		Easting	301 581.47

2.7  
3 =  
9.2

Depth	Temp. C	Salinity	EC	DO mg/L	Turb. FSS	Current V	Direction
4	0.0	13	21000				
5	-0.5	25	22000				
6	-1.0	28	24000				
7	-1.0	28	24000				
8	-1.0	28	24000	7.6	14.2	None detected	
9	-1.0	28	24500				
10	-1.0	28	25000				
11	-1.0	29	24000				
12	-1.0	29	24000				

sample  
pH  
8.1

Bottom

WATER SAMPLE:			
TSS	DATE: 4/16	TIME: 8:30	DEPTH (BIS) (8.0) Below Ice Surface

Depth	Grain Size	Metals #1	TOC	DRO	SVOA's	VOA	TIME
5-1.0'	✓	✓	✓	✓	✓	✓	0900
6.0-8.0	✓	✓	✓	✓	✓	✓	0915
1.0-6.0'	✓	✓	✓	✓	✓	✓	0930

HOLD

DO METER USED: XSLOR HACH (STD.) NR (1-14 mg) Module 525



MONTGOMERY WATSON

BP Exploration (Alaska), Inc.  
LIBERTY ISLAND Water/Sediment Sampling  
FIELD NOTE FORM

Station No.	C-2 (We)	Air Temp	-14°F	Date	2/15/97
		Wind	20 mph	Crew	EM, EDH, GARY, & KEH
		Sky	clear	Start Time	2000

		Location	
A	Ice Thickness	4.5'	Description
B	Depth to Water Surface	1.0'	
C	Depth to Bottom	16.6'	Latitude
C-B	Total Water Depth	15.6'	Longitude
D-(A-B)	Ice Free Water Depth	12.1'	Northing
D-F	Depth of Water Above Ice Bottom:		Easting

4.5  
7' BELOW  
ICE  
BOTTOM

Depth	Temp. C	Salinity ppt	EC	DO	Turb./TSS	Current V	Direction
1.0	-1.0	14.5	13,000				
2.0	-1	20.0	17,500				
3.0	-1	21.5	18,500	9.6	3.67		7.87 -51
4.0	-1	23.0	21,000				
5.0	-1	24.0	24,000				
6.0	-1.5	24.0	24,000				
7.0	-1.5	24.0	24,000				
8.0	-1.5	24.0	24,000	13.2	2.13		7.77 -52
9.0	-1.5	24.0	24,000				
10.0	-1.5	24.0	24,000				
11.0	-1.5	24.0	24,000				

**WATER SAMPLE:**  
 TSS: \_\_\_\_\_ DATE: 2/15 TIME: 2100 DEPTH (BIS): (3.0', 8.0')

Depth	Grain Size	Metals #1	TOC	DRO	SVOA's	VOA	TIME
5-1.0'	/	/	/	/	/	/	2220
6.0-8.0	/	/	/	/	/	/	2800
1.0-6.0'	2	1-bul	Bags				2200

HOLD

**Comments:**  
 SD-62-08 is DUPE FOR SD-62-08  
 DO METER USED: YSI OR HACH (STD.)





MONTGOMERY WATSON

BP Exploration (Alaska), Inc.  
 LIBERTY ISLAND Water/Sediment Sampling  
 FIELD NOTE FORM

Station No.	C-4	Air Temp	-20 F	Date	2-15-97
		Wind	25 MPH (E-SE)	Crew	Beggs
		Sky	Clear	Start Time	1645

Deck  
-3.2

ICE			LOCATION		
A	Ice Thickness	3.8'	Description	E. Duck Island	
B	Depth to Water Surface	0.2			
C	Depth to Bottom	11.0	Latitude	701624.24	
C-B = D	Total Water Depth	11.6	Longitude	1473759.7	
D-(A-B)	Ice Free Water Depth	8.2	Northing	298095.9	
D-F	Depth of Water Above Ice Bottom:		Easting	5952260	

D

Depth	Temp. C	Salinity ‰	EC	DO	Turb./TSS	Current V	Direction
5.	1.0	5	5000				
7	-1.	29	18.000	11.6	18.5	ND	
9	-1.	29	18.000				
11	-1.5	30	18.000				

PH

7.88

Sample

97 BPX LI C4  
WA 01 (7)

**WATER SAMPLE:**  
 TSS: \_\_\_\_\_ DATE: 2/15 TIME: 1700 DEPTH (BIS) ( 7.5 )

Below Top  
Ice

Depth	Grain Size	Metals #1	TOC	DRO	SVOA's	VOA	TIME
5-1.0'							
6.0-8.0							
1.0-6.0'							

HOLD

Comments:

DO METER USED: YS100P-HACH (STD.) HR 0-14



BP Exploration (Alaska), Inc.  
LIBERTY ISLAND Water/Sediment Sampling  
FIELD NOTE FORM

Station No.	<b>LI</b>	Air Temp	<b>-22</b>	Date	<b>2-15-97</b>
		Wind	<b>E 25 mph</b>	Crew	<b>Byn</b>
		Sky	<b>Clear</b>	Start Time	<b>1310</b>

A	Ice Thickness	<b>4.4</b>	Description	
B	Depth to Water Surface	<b>.45</b>		
C	Depth to Bottom	<b>20.4</b>	Latitude	<b>70 16 47.769</b>
C-B	Total Water Depth	<b>19.5</b>	Longitude	<b>147.34 54.558</b>
D-(A-B)	Ice Free Water Depth	<b>15.5</b>	Northing	<b>5925 150 15</b>
D-F	Depth of Water Above Ice Bottom:		Easting	

3.3  
23.7  
14

7.7 Icefree  
9.4  
33  
14.4

Depth	Temp. C	Salinity	EC	DO	Turb./TSS	Current V	Direction
7	1.0	23	21000				
9	0.0	29	25000				
11	-0.5	29	24000				
13	-1.0	29	24000				
15	-1.0	29	24000	93	14.	ND	ND ←
17	-1.0	29	24000				
19	-1.0	29.5	25000				
21	-1.0	29.5	25000				
23	-1.0	29.	25000				

Sample  
14 Below  
Depth  
Ph  
7.5

**WATER SAMPLE:**  
TSS:      DATE: **2/15**      TIME: **1345**      DEPTH (BIS) (**11 -**)

97 BPK LI LI

Depth	Grain Size	Metals #1	TOC	DRO	SVOA's	VOA	TIME
5-1.0'							1450
6.0-8.0							1430
1.0-6.0'							1445

01 SD (01)  
03 SD (05)  
02 HOLD SD (08)

**COMMENTS:**

DO METER USED: YSI OR HACH (STD.)



# SOIL BORING LOG

PROJECT NO.:

1189002.028101

BORING NO.:

A4

SHEET

1 OF 1

PROJECT LIBERTY Island SITE Sample Loc

CLIENT BDX (A)

GEOLOGIST Bon

DATE 2/16/97 WEATHER -19°F clear

LOCATION COORDINATES 32495.63/5927747.44

ELEVATION DATUM

DRILLING METHOD HS

BORING SIZE 1 1/4" ID HAMMER DROP (NVLBS) 30/340

RIG TYPE CME 75

DRILLER/COMPANY Discover

# SAMPLES Split-spoon

SAMPLER TYPE/DIAMETER 4 / 2.1/2"

TOTAL DEPTH (FT) see bottom of log

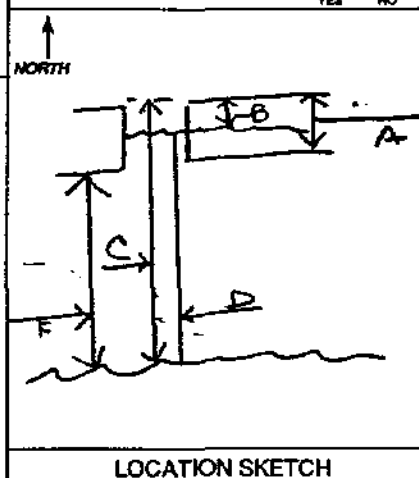
DEPTH TO SWL (FT) N/A

TOP OF HOLE ELEVATION N/A

DEPTH (FEET)	GRAIN SIZE				SOIL CLASS	PID (PPM)	SAMPLE	
	BLOWS (8 IN.)	% GRAVEL	% SAND	% FINES			MAX SIZE (#)	TIME
0								
1							1130	1130
2								
3								
4							1145	1145
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								

## SOIL DESCRIPTION (ASTM 2488)

Be, gravelly sand, little fines  
broken gravel, some 1-2"  
most < 1/2"



- A = Ice Thickness
- B = Depth to water from Top Ice
- C = Depth to Bth. (Top Ice)
- D = Total water ⇒ (C - B)
- E = Ice Free Water
- ⇒ D - (A - B)
- G = Depth of water above Ice
- ⇒ (D - F)



# SOIL BORING LOG

PROJECT NO.: 189002.028101

BORING NO.: A6

SHEET 1 OF 1

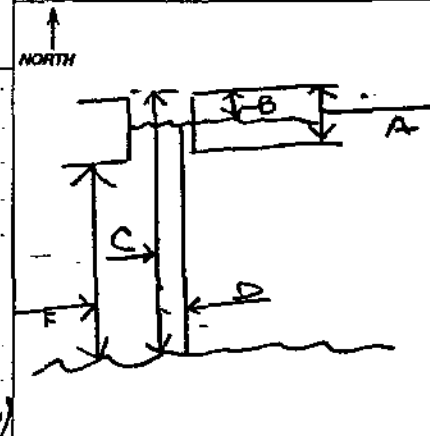
PROJECT Liberty Island SITE Sample Loc 97 BPX LI CLIENT BPX (A) GEOLOGIST \_\_\_\_\_

DATE 2/16/96 WEATHER -33°F 35 mph wind LOCATION COORDINATES \_\_\_\_\_ ELEVATION DATUM \_\_\_\_\_

DRILLING METHOD HS BORING SIZE 6 1/4" ID HAMMER DROP (IN/LBS) 20/340 RIG TYPE CME 75 DRILLER/COMPANY Discover

# SAMPLES \_\_\_\_\_ SAMPLE TYPE Split-spoon SAMPLER TYPE/DIAMETER 4" / 2.1/2" TOTAL DEPTH (FT) \_\_\_\_\_ see bottom of log DEPTH TO SWL (FT) N/A TOP OF HOLE ELEVATION \_\_\_\_\_

DEPTH (FEET)	GRAIN SIZE				SOIL CLASS	PID (PPM)	SAMPLE TIME	INTERVAL	SOIL DESCRIPTION (ASTM 2486)	WELL COMPLETED?		
	BLOWS (6 IN.)	% GRAVEL	% SAND	% FINES						MAX SIZE (IN)	YES	NO
0											<input type="checkbox"/>	<input checked="" type="checkbox"/>
1									SP, dete, coarse			
2					SP				0.0-5.0 Gray fine sand, loose - no 1/4" pebbles noted			
3												
4									5.0 - Gray Sand, med dense to dense w/ thin (1/16 to 1/4") interbeds of black silt (organic?) silt) - thicker black zones include some organic fragments (PE)			
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												
21												



- \_\_\_\_\_ A = Ice Thickness
- \_\_\_\_\_ B = Depth to water from Top Ice
- \_\_\_\_\_ C = Depth to Btm (Top Ice)
- \_\_\_\_\_ D = Total Water  
⇒ (C - B)
- \_\_\_\_\_ E = Ice Free Water  
⇒ D - (A - B)
- \_\_\_\_\_ G = Depth of water above Ice  
⇒ (D - F)





Location of Hole  
DECK TO ICE: 32  
ICE THICK: 75 - 32 = 43  
DECK TO MUD: 238 - 32 = 192  
DECK TO H<sub>2</sub>O: 40 - 32 = 08

23  
3  
20

Conditions

Rig Type Same  
Sampling Methods Same  
Hammer Wt. and Drop Same  
Hammer Type MANUAL AUTOMATIC  
Started TIME 0305 DATE 2-16-97  
Completed TIME 0500 DATE 2-16-97

Hole Depth (Ft)				
Casing Depth (Ft)				
Water Depth (Ft)				
Time				
Date				

Surface Elevation \_\_\_\_\_ Datum \_\_\_\_\_

Sample Depth	Sampler Type*	Blows / 6-in.	Inches Driven	Inches Recovered	Depth In Feet	Sample	Graphic Log	Frozen?
0405		1/2	6	4.8	1			
		1/2	6		1			
		2	6		2			
		2	6		2			
		3	6		3			
		3	6		3			
		4	6		4			
		4	6		4			
		8	6		5			
		8	6		5			
0440		9	6	3.5	5			
		7	6		6			
		4	6		6			
		4	6		7			
		5	6		7			
		5	6		8			
		7	6		8			
					9		TD	
					10			
					11			

Instrumentation \_\_\_\_\_ Date \_\_\_\_\_  
Backfilled TIME \_\_\_\_\_ DATE \_\_\_\_\_ BY \_\_\_\_\_

Gry Silt (ml) very soft, wet, becoming stiff below 2.5

Brn fibrous organic layer, odoriferous moist, soft

overstuffed sampler

Silty sand (sm) Gry, moist to dry, compact

Very layered - predominantly silt w/ some fine sand (ML) gry, moist to dry, stiff

occas. ±2" layer clean sands (fine to med grain) gry, moist → to (SP-SM)

\*Sample Types: ac = air chip; ag = auger grab; ab = auger bit; cc = continuous core; cb = logged continuous core; fs = Shelby tube; sh = 2.5" ID Split barrel w/340 lb hammer; ss = 1.4" ID Split barrel w/140 lb hammer



Location of Hole

DECK TO ICE: 32  
 DECK TO H<sub>2</sub>O: 39 - 32 = 07  
 ICE THICKNESS: 72 - 32 = 40  
 DECK TO MUD: 216 - 32 = 184

Conditions

Rig Type CME 75  
 Sampling Methods SM SS 4"  
 Hammer Wt. and Drop 340 / 30  
 Hammer Type MANUAL AUTOMATIC  
 Started TIME 0015 DATE 2-16-97  
 Completed TIME 0215 DATE 2-16-97

Hole Depth (Ft)				
Casing Depth (Ft)				
Water Depth (Ft)				
Time				
Date				

Surface Elevation \_\_\_\_\_ Datum \_\_\_\_\_

Instrumentation \_\_\_\_\_ Date \_\_\_\_\_  
 Backfilled TIME \_\_\_\_\_ DATE \_\_\_\_\_ BY \_\_\_\_\_

Sample Depth	Sampler Type*	Blows / 6-in.	Inches Driven	Inches Recovered	Depth in Feet	Sample Graphic Log	Frozen?
		2	6	42			
		4	6		1		
		3	6		2		
		6	6		3		
		10	6		4		
		11	6		5		
		10	6		6		
		13	6		7		
		16	6		8		
		12	6		9		
		4	6		10		
		7	6		11		
		6	6				
		5	6				
		5	6				
		4	6				

0130

Fine grained silty sand to silt w/ some (SM), moist, stiff, layered w/ blk organics grey to tan

Sampler stuffed

Distinct tan layer silty sand

0200

Grey silt (mc), moist, stiff, w/ blk layers multiple layers 2-3" thick mc/SM

Ben Fibrous organics, moist, stiff

Silt w/ some sand

Silty Sand (SM) layer, moist, tan, fine-grained

\*Sample Types: ac = air drop; ag = auger grab; ab = auger bulk; ac = continuous core; cb = bagged continuous core; br = Shelby tube; sb = 2.5" ID Split barrel w/340 lb hammer; ss = 1.4" ID Split barrel w/140 lb hammer



# SOIL BORING LOG

PROJECT NO.: 189002 028101

BORING NO.: B3

SHEET 1 OF 1

PROJECT Liberty Island SFFE Sample Loc

CLIENT EPX (A) GEOLOGIST QB

DATE 2-14-97 WEATHER clear - 17°C, calm

LOCATION COORDINATES \_\_\_\_\_ ELEVATION DATUM 2

DRILLING METHOD HS

BORING SIZE \_\_\_\_\_ HAMMER DROP (IN/LS) \_\_\_\_\_

RIG TYPE CME 75 DRILLER/COMPANY Discover

# SAMPLES \_\_\_\_\_ SAMPLE TYPE Soil-spoon SAMPLER TYPE/DIAMETER 2.1/2" TOTAL DEPTH (FT) \_\_\_\_\_ see bottom of log DEPTH TO SWL (FT) N/A TOP OF HOLE ELEVATION N/A

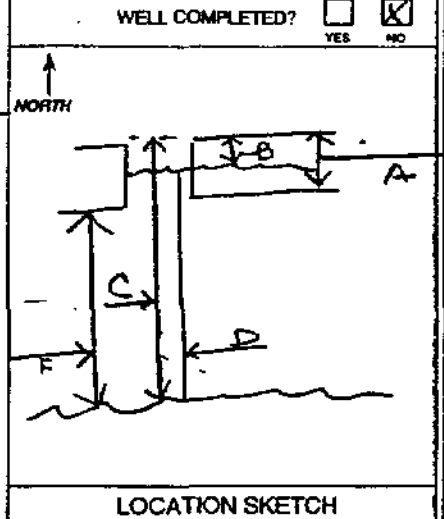
DEPTH (FEET)	GRAIN SIZE				SOIL CLASS	PID (PPM)	SAMPLE TIME	INTERVAL
	BLOWS (6 IN)	% GRAVEL	% SAND	% FINES				
0								
1	1/4							
2	1/4							
3	1/4							
4	3							
5	3							
6	3							
7	4							
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								

SOIL DESCRIPTION (ASTM 2488)

Soft saturated @ mudline - no recovery

DRX Gry

14.8  
2  
12.8  
3  
15.8  
6.3  
2.5



B-6

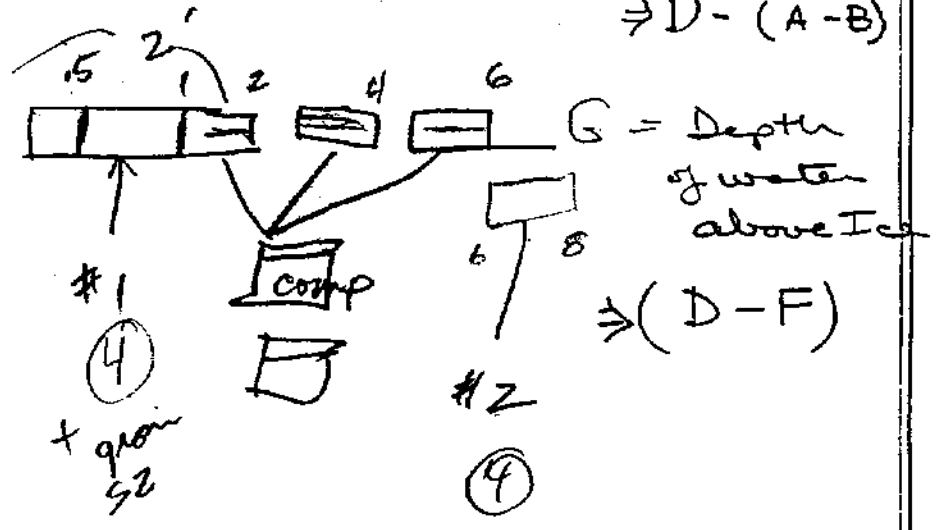
3.7' A = Ice Thickness

0.9 B = Depth to water from Top Ice

7.6' C = Depth to Bt (Top Ice)

6.7' D = Total water ⇒ (C - B)

4.1' E = Ice Free Water ⇒ D - (A - B)







Project: Liberty GEO Hole No. B3 (E)

Job No. 4119.22 Total Depth 83



Contractor: Discovery Operator GC Logged By CB

Location of Hole B3 - Environmental  
\* suggest auger 6" then push Shelby or Shelby @  
mudline - let it rest prior to pulling.  
[Environmental samples taken]

Deck to ice: 30  
Conditions DECK TO MUD: 63 - 30 = 33  
Depth to H<sub>2</sub>O: 30 - 30 = 0  
Ice thickness: 3

Rig Type CME 75  
Sampling Methods 4" SS  
Hammer Wt. and Drop 340  
Hammer Type MANUAL AUTOMATIC  
Started TIME 2100 DATE 2-14-97  
Completed TIME 2320 DATE 2-14-97

Hole Depth (Ft)			
Casing Depth (Ft)			
Water Depth (Ft)			
Time			
Date			

Surface Elevation \_\_\_\_\_ Datum \_\_\_\_\_

Instrumentation \_\_\_\_\_ Date \_\_\_\_\_  
Backfilled TIME \_\_\_\_\_ DATE \_\_\_\_\_ BY \_\_\_\_\_

Sample Depth	Sampler Type*	Blows / 6-in.	Inches Driven	Inches Recovered	Depth in Feet	Sample Graphic Log	Frozen?
2220	0 <sup>2</sup> SS	3	6	24" <sup>ENV</sup>	1	<p>* Saturated, very soft mudline no recovery @ top 6" trace fibrous DRK GRY SILT (MC) w/ some organics (sticks) soft, moist, sample color layered blk/gy (predominant) [4 grab samples @ top 6" / 1 grain / 1 composite samples]</p> <p>becoming soft to stiff below 3", less layered coloring</p> <p>4" Peat (PE) brn moist, soft fibrous</p> <p>Grey silty sand (to sandy SILT/SM), moist, fine grained, stiff [2 bag composite samples] sampler not overfilled</p> <p>Coarse silty gravel w/ sand (G-SM), subround, round &lt; 1/4", wet</p>	
		3	6		2		
		4	6		3		
		5	6		4		
		6	6		5		
		7	6		6		
		8	6		7		
		7	6		8		
		3	6		9		
		3	6		10		
2330		4	6		11		TD

\* Sample Types: ac = air chip; ag = auger grab; ab = auger bulk; cc = continuous core; cb = bagged continuous core; fb = Shelby tube; sh = 2.5" ID Split barrel w/340 lb hammer; ss = 1.4" ID Split barrel w/140 lb hammer



Location of Hole  
DECK TO MUD: 10<sup>6</sup> - 3 = 7<sup>6</sup>  
DECK TO ICE: 3<sup>0</sup>  
DEPTH TO H<sub>2</sub>O: 3<sup>9</sup> @ 0037  
ICE THICKNESS: 6<sup>7</sup> - 3<sup>0</sup> = 3<sup>7</sup>

Conditions

Rig Type CME 45  
Sampling Methods 4" SS  
Hammer Wt. and Drop 340 30"  
Hammer Type MANUAL AUTOMATIC  
Started TIME 0030 DATE 2-15-97  
Completed TIME 0200 DATE 2-15-97

Hole Depth (Ft)			
Casing Depth (Ft)			
Water Depth (Ft)			
Time			
Date			

Surface Elevation \_\_\_\_\_ Datum \_\_\_\_\_

Instrumentation \_\_\_\_\_ Date \_\_\_\_\_  
Backfilled TIME \_\_\_\_\_ DATE \_\_\_\_\_ BY \_\_\_\_\_

0108  
0136

Sample Depth	Sampler Type*	Blows / 6-in.	Inches Driven	Inches Recovered	Depth in Feet	Sample	Graphic Log	Freeze?
	SH	2	6	48"				
		2	6		1		DRY-GRY SILT (ML), soft, moist, coloring layered Blk/Gry	
		3	6					
		5	6		2			
		5	6					
		7	6		3			
		8	6				GRY silt w/sand (ML), stiff, moist, occas: 1/2" fibrous organic layers	
		8	6		4			
		4	6		5		sand - very color layered - no organics noted moist, fine grained	
		4	6					
		7	6		6			
		7	6					
		6	6		7			
		6	6					
		7	6		8		medium grain sand w/silt (SP-SM), dk gry, V <sub>c</sub> (50%?)	
		8	6					
					9			
					10			
					11			

\*Sample Types: sh = sh chip; sg = sizer grab; sb = sizer bulk; cc = continuous core; cb = lagged continuous core; fsr = Shelby tube; sh = 2.5" ID Split barrel w/340 lb hammer; ec = 1.4" ID Split barrel w/140 lb hammer



Duane Miller & Associates  
Arctic & Geotechnical Engineering  
**FIELD LOG**

Project: L1B GED Hole No. BBE  
Job No. 4119.22 Total Depth 86  
Contractor: Discovery Operator GL Logged By CR

Location of Hole  
DECK TO ICE:  $3^2$   
DECK TO MUD:  $18^2 - 3^2 = 15^2$   
DEPTH TO H<sub>2</sub>O:  $3^2 @ 0240$   
ICE THICK:  $8^2 - 3^2 = 5^2$

20  
3  
19  
17  
Conditions  
 $\frac{26^2}{-18^2} = 8^2$

Rig Type CME 175  
Sampling Methods SS  
Hammer Wt. and Drop 340 / 30  
Hammer Type MANUAL AUTOMATIC  
Started TIME 0230 DATE 2-15-  
Completed TIME 0500 DATE 2-15-

Hole Depth (Ft)			
Casing Depth (Ft)			
Water Depth (Ft)			
Time			
Date			

Surface Elevation \_\_\_\_\_ Datum \_\_\_\_\_

Sample Depth	Sampler Type*	Blows / 6-in.	Inches Driven	Inches Recovered	Depth in Feet	Sample Graphic Log	Instrumentation	Date
0400		2	6	4 <sup>0</sup>				
		3	6		1			
		5	6					
		6	6		2			
		6	6					
		6	6		3			
		7	6					
		7	6		4			
		7	6					
		8	6		5			
0990		6	6					
		8	6		6			
		7	6					
		8	6		7			
		8	6					
		8	6		8			
		7	6					
					9			
					10			
					11			

Instrumentation \_\_\_\_\_ Date \_\_\_\_\_  
Backfilled TIME \_\_\_\_\_ DATE \_\_\_\_\_ BY \_\_\_\_\_

DRK GRAY w/ BRN LAYERS SILT (ML), soft, moist  
Layers of BRN & DRK BRN organics (not fibrous) (PT)  
becoming Lt Gray to WH below 3<sup>6</sup>  
& sander still (ML) silt w/ sand  
Same  
BRN Fibrous organics (PT), woody fragments  
Gray silt (ML), stiff, moist, w/ some sand

\*Sample Types: ac = air chip; ag = auger grab; ab = auger bulk; cc = continuous core; cb = bagged continuous core; fb = Shelby tube; sb = 2.5" ID Split barrel w/340 lb hammer; sc = 1.4" ID Split barrel w/140 lb hammer



MONTGOMERY WATSON

# SOIL BORING LOG

PROJECT NO.:

189002 028101

BORING NO.:

310

SHEET

1 OF 1

PROJECT Liberty Island SITE Sample Loc

CLIENT BPX (A)

GEOLOGIST B...

DATE 2-15-57 WEATHER Clear -20°F

LOCATION COORDINATES 5948 42557/301581

ELEVATION DATUM

DRILLING METHOD HS

BORING SIZE 6 1/4" SS HAMMER DROP (BL/BS) 30/340

RIG TYPE CME 75

DRILLER/COMPANY Discovery

# SAMPLES 1 SAMPLE TYPE Split-spoon SAMPLER TYPE/DIAMETER 4" / 2.125" TOTAL DEPTH (FT) 21 see bottom of log DEPTH TO SWL (FT) N/A TOP OF HOLE ELEVATION N/A

DEPTH (FEET)	GRAIN SIZE			SOIL CLASS	PI (PPM)	TIME	INTERVAL
	BLOWS (6 IN)	% GRAVEL	% SAND				
0	0			SP+ML			
1	0			SP	2.5		
2	0			SP+ML			
3	0			ML	2.5		
4	0			SP			
5	0			SP			
6	0			ML	4.0		
7	0			ML			
8	0						
9	0						
10	0						
11	0						
12	0						
13	0						
14	0						
15	0						
16	0						
17	0						
18	0						
19	0						
20	0						
21	0						

**SOIL DESCRIPTION (ASTM 2486)**

0.0-3.0 Gray silty Sand (SP+ML) grading to fine grained Sand (SP), loose

3.0-4.5 (SP+ML) Banded dk gray to black silt & fine sand, with silt zones to 4" thick (but varying from 1/4" to 4")

4.5-6.0 Gray fine sand (SP), loose to med dense

6.0-7.0 Black silt (check organic content) stiff (ML)

7.0-7.5 Interbedded (1/2" to 2") black silt and Gray Brown silt w/ trace (P) sand

7.5-8.0 silt in bit (stiff) (ML) Black

8.0-9.0 silt in bit (stiff) (ML) Black

9.0-10.0 silt in bit (stiff) (ML) Black

10.0-11.0 silt in bit (stiff) (ML) Black

11.0-12.0 silt in bit (stiff) (ML) Black

12.0-13.0 silt in bit (stiff) (ML) Black

13.0-14.0 silt in bit (stiff) (ML) Black

14.0-15.0 silt in bit (stiff) (ML) Black

15.0-16.0 silt in bit (stiff) (ML) Black

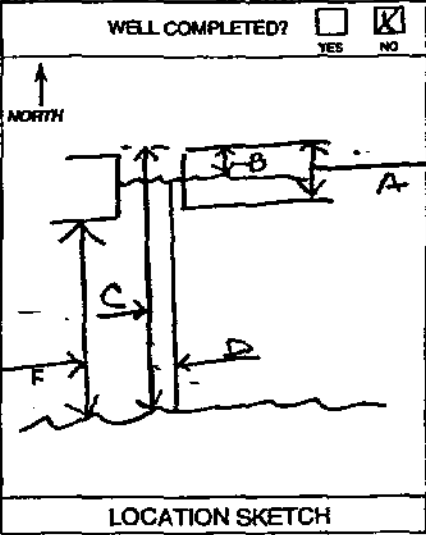
16.0-17.0 silt in bit (stiff) (ML) Black

17.0-18.0 silt in bit (stiff) (ML) Black

18.0-19.0 silt in bit (stiff) (ML) Black

19.0-20.0 silt in bit (stiff) (ML) Black

20.0-21.0 silt in bit (stiff) (ML) Black



A = Ice Thickness  
 B = Depth to water from Top Ice  
 C = Depth to B (Top Ice)  
 D = Total water ⇒ (C - B)  
 E = Ice Free Water  
 ⇒ D - (A - B)  
 G = Depth of water above Ice ⇒ (D - F)

### Summary -

0.0-6.0 Sand (SP) w/ scattered thin silt layers

6.0-8.0 Silt (ML)

File: user name\project\file Name  
4: 00-XXX-00 00:00  
6.No. 0000 0000



Duane Miller & Associates  
Arctic & Geotechnical Engineering  
**FIELD LOG**

Project: LIB GEO

Hole No. 02 E

Job No. 4119.22

Total Depth 5'

Sheet 1/1

Contractor: DD

Operator LC

Logged By SAB

14.3  
+ 8.3  
22.6  
17.1  
3.4  
5.1  
11.6  
10.1  
10.1  
10.1

Location of Hole  
DECK TO ICE: 33'  
DECK TO MUD: 19' 6" - 3" = 16'  
DECK TO H<sub>2</sub>O: 4' 6" - 3" = 1" @ 2015  
ICE THICKNESS: 7' 5" - 3" = 4 1/2'

Conditions

Rig Type CME 75

Sampling Methods SS

Hammer Wt. and Drop 340 / 30

Hammer Type MANUAL AUTOMATIC

Started TIME 2000 DATE 2-15-97

Completed TIME \_\_\_\_\_ DATE \_\_\_\_\_

Hole Depth (Ft)

Casing Depth (Ft)

Water Depth (Ft)


Surface Elevation \_\_\_\_\_ Datum \_\_\_\_\_

Time

Date

Instrumentation \_\_\_\_\_

Backfilled TIME \_\_\_\_\_ DATE \_\_\_\_\_ BY \_\_\_\_\_

Sample Depth	Sampler Type*	Blows / 6-in.	Inches Driven	Inches Recovered	Depth in Feet	Sample	Graphic Log	Frozen?
2055		2	6					
		3	6		1			
		3	6					
		4	6		2			
		4	6					
		4	6		3			
		4	6					
2120		4	6		4			
		4	6					
		4	6		5			
					6			
					7			
					8			
					9			
					10			
					11			

No Recover. - very soft grey silt (MC)  
moist - weight of hammer pushing  
sampler down - tried again hoping hole  
would collapse - no luck - moving  
ahead 3' Redrill @ 2135

\*Sample Types: ac = air chip; ag = auger grab; ab = auger ball; cc = continuous core; cb = bagged continuous core; br = Shelby tube; sh = 2.5" ID Split barrel w/340 lb hammer; ss = 1.4" ID Split barrel w/140 lb hammer



Duane Miller & Associates  
Arctic & Geotechnical Engineering  
**FIELD LOG**

Project: L13 GEO Hole No. C2E 204  
Job No. 4119.22 Total Depth 80  
Contractor: DT Operator GL Logged By GLB

Sheet 1

217  
30  
247

Location of Hole  
DECK TO ICE: 30  
DECK TO MUD: 196 - 30 = 166  
DECK TO H<sub>2</sub>O: 40 - 30 = 10 @ 2015  
ICE THICKNESS: 75 - 30 = 45  
  
N 70 17' 12"  
W 147 41' 36"  
Conditions

Rig Type CME 75  
Sampling Methods SS 4"  
Hammer Wt. and Drop 340/30  
Hammer Type MANUAL AUTOMATIC  
Started TIME 2135 DATE 2-15-97  
Completed TIME 2240 DATE 2-15-97

Hole Depth (Ft)				
Casing Depth (Ft)				
Water Depth (Ft)				
Time				
Date				

Surface Elevation \_\_\_\_\_ Datum \_\_\_\_\_

Instrumentation \_\_\_\_\_  
Backfilled TIME \_\_\_\_\_ DATE \_\_\_\_\_ BY \_\_\_\_\_

2200

X

2230

Sample Depth	Sampler Type*	Blows / 6-in.	Inches Driven	Inches Recovered	Depth in Feet	Sample	Graphic Log	Frozen?
	1	6	40					
	2	6			1			
	3	6			2			
	4	6			3			
	5	6			4			
	6	6			5			
	7	6			6			
	8	6			7			
	9	6			8			
	10	6			9			
	11	6			10			
	12	6	20		11			
	13	6			12			
	14	6			13			
	15	6			14			
	16	6			15			
	17	6			16			
	18	6			17			
					18			
					19			
					20			
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					98			
					99			
					100			

Sampler over-stuffed w/ice from auger  
- disregard last 12" blow counts  
  
Layered blk/gry (predominant) silt/cl  
stiff moist, fine grained, 2" layer  
of black organics @ 40  
  
Sampler over-stuffed  
  
lt grey silt (clay?), dry, very stiff  
  
TD

\*Sample Types: ac = air chip; ag = auger grab; ab = auger bulk; cc = continuous core; cb = bagged continuous core; br = Shelby tube; sh = 2.5" ID Split barrel w/340 lb hammer; ss = 1.4" ID Split barrel w/140 lb hammer



MONTGOMERY WATSON  
Engineering, Inc.

# SOIL BORING LOG

PROJECT NO.: 1189002.028101

BORING NO.: C-4

SHEET 1 OF 1

PROJECT Liberty Island SITE Sample Loc

CLIENT BPX (A) GEOLOGIST Bgn

DATE 2/15/97 WEATHER cold, clear

LOCATION COORDINATES N 80° 45' W 5952260'

ELEVATION DATUM

DRILLING METHOD HS

BORING SIZE

HAMMER DROP (IN/LBS)

RIG TYPE CME 75

DRILLER/COMPANY Discover

# SAMPLES 3 SAMPLE TYPE Split-spoon SAMPLER TYPE/DIAMETER 2-1/2" TOTAL DEPTH (FT) 17.0 sec bottom of log N/A DEPTH TO SWL (FT) N/A TOP OF HOLE ELEVATION N/A

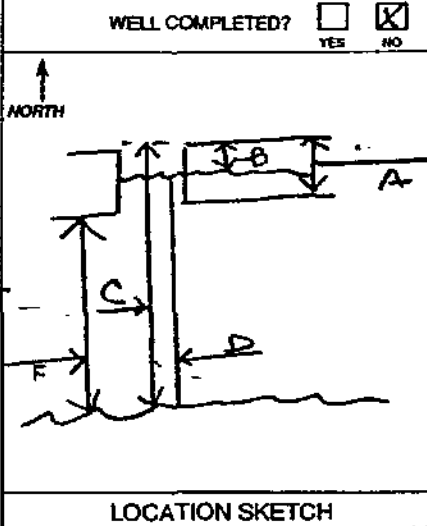
DEPTH (FEET)	BLOWS (6 IN)	GRAN SIZE			SOIL CLASS	PID (PPM)	SAMPLE	
		% GRAVEL	% SAND	% FINES			TIME	INTERVAL
0		10	90					
1		2	98			1630		
2								
3								
4						1645		
5								
6								
7						1700		
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								

**SOIL DESCRIPTION**  
(ASTM 2488)

*Some silt w/ fine sand*  
 Decid. green to blk, silty sand  
 97 BPX LI SD 01 (01)  
 silt, black

silt, dk. blk, silt, <2% sand  
 medium to fine

dk. blk, silt, very stiff



97 BPX LI SD 03 (5)  
 dk grey, silty sand 1/4"  
 loose fine sand

97 BPX LI SD 02 (8)

**LOCATION SKETCH**

A = Ice Thickness  
 B = Depth to top of water from Top Ice  
 C = Depth to B (Top Ice)  
 D = Total water ⇒ (C - B)  
 E = Ice Free Water  
 ⇒ D - (A - B)  
 G = Depth of water above Ice  
 ⇒ (D - F)

JOB No. 0000.0000



MONTGOMERY WATSON

# SOIL BORING LOG

PROJECT NO.:

1189002.028101

BORING NO.:

11

SHEET

1 OF 1

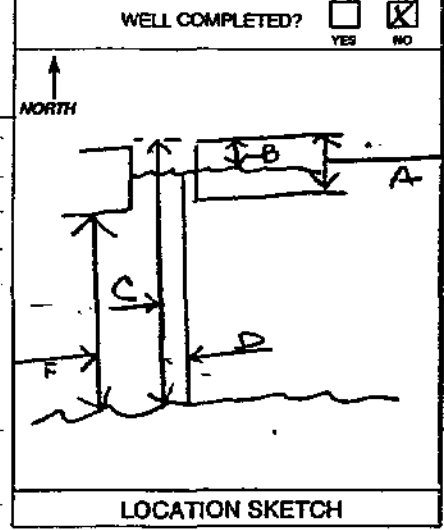
PROJECT Liberty Island SITE Sample Loc I1 CLIENT BPX (A) GEOLOGIST SP

DATE 2/15/97 WEATHER Clear -19°F LOCATION COORDINATES

DRILLING METHOD HS BORING SIZE 6 1/4" HAMMER DROP (IN/LBS) 30/340 RIG TYPE CME 75 DRILLER/COMPANY Discovery

# SAMPLES 36 SAMPLE TYPE Split-spoon SAMPLER TYPE/DIAMETER 4" / 2 1/2" TOTAL DEPTH (FT) N/A see bottom of log DEPTH TO SWL (FT) N/A TOP OF HOLE ELEVATION N/A

DEPTH (FEET)	GRAIN SIZE				SOIL CLASS	PID (PPM)	SAMPLE TIME	INTERVAL	SOIL DESCRIPTION (ASTM 2488)
	BLOWS (6 IN)	% GRAVEL	% SAND	% FINES					
0					ML			0.0-0.5 Soft Silt w/ fine sand.	
1					SP+ ML	25'		0.5-3.0 dk gray v. fine sand w/ thin layers of dk gray to black silt; (soft)	
2									
3									
4					SP	4"		3.0-5.0 Gray med. sand (loose to m. dense)	
5									
6					SP+ ML			5.0-6.5 Interbedded black silt (ML) and fine to v. fine gray and gray brown sand (SP)	
7								Bands of silt generally $\leq 1/4"$ , sand $\leq 1/2"$	
8	36	0	0	100	ML	4"		6.5-8.0 DK Gray silt stiff to H. stiff	
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									



WELL COMPLETED?  YES  NO

A = Ice Thickness  
 B = Depth to water from Top Ice  
 C = Depth to Bot (Top Ice)  
 D = Total water  $\Rightarrow (C - B)$   
 E = Ice Free Water  
 $\Rightarrow D - (A - B)$   
 G = Depth of water above Ice  
 $\Rightarrow (D - F)$

e 97 BPX LI SD  
 1400 - 01 (1.5-1.0)  
 1445 - 02 (6.0-8.0)  
 1430 - 03 (1.0-6.0)  
 K4cl2

File: user name/project/File Name  
 01: 00:XX-00 00:00  
 JOB No. 0000.0000