

**BEAUFORT SEA  
GEOTECHNICAL AND SURFICIAL SEDIMENT DATABASE**

**Prepared for:  
Supply and Services Canada  
0305-34475**

**APRIL, 1989**



---

**ABSTRACT**

In 1988, EBA Engineering Consultants Ltd. (EBA) compiled a database of 1288 borehole logs completed in the Canadian Beaufort Sea between 1973 and 1987. This report summarizes work done to expand the database in 1989 to include 1051 surficial sediment corehole logs completed between 1982 and 1988 and 46 borehole logs completed in 1988. This work was completed on contract to Supply and Services Canada on behalf of Indian and Northern Affairs Canada.

Amoco Canada Petroleum Ltd., Esso Resources Canada Ltd., Gulf Canada Resources Ltd., and the Geological Survey of Canada provided valuable data for the database expansion. Although the database now includes over 2300 entries, it is not yet complete. Some 60 borehole logs and 19 surficial sediment corehole logs from the GSC database which were received too late or were incomplete were not included in the database. Also, there are estimated to be several hundred more shallow cores available at GSC from the 1970 and 1971 M.V. Hudson Surveys which should be included in future additions to the database. Six shallow boreholes logs and 57 gravity core logs from Gulf's 1988 field program were also not included, and should be added.

The project tasks, deliverables, participants and report organization are listed herein. Also discussed are the data and methods of standardization of the logs. Diskette copies of the database have been provided under separate cover. For permanent records, paper copies of the logs compiled in this database also have been presented separately.



TABLE OF CONTENTS

	Page
ABSTRACT	i
1.0 INTRODUCTION	1
2.0 PROJECT OUTLINE	1
2.1 OBJECTIVES	1
2.2 METHODOLOGY	1
2.3 DELIVERABLES	2
2.4 DATA PRESENTATION	3
2.5 PROJECT PARTICIPANTS	4
3.0 DATABASE DESCRIPTION	5
3.1 COREHOLE OR BOREHOLE NUMBER	5
3.2 REFERENCE TO SEA LEVEL	7
3.3 SAMPLE TYPE	7
3.4 SOIL DESCRIPTION	7
3.5 SOIL CLASSIFICATION DATA	8
3.6 GROUND ICE DESCRIPTION AND SAMPLE TEMPERATURE	9
4.0 CLOSURE	9
TABLES	
FIGURES	
APPENDIX A: Surficial Sediment Corehole Log Source Reports	
APPENDIX B: Borehole Log Source Reports	



## 1.0 INTRODUCTION

In 1988, EBA Engineering Consultants Ltd. (EBA) compiled a database of 1288 borehole logs completed in the Canadian Beaufort Sea between 1973 and 1987. To expand this database, Indian and Northern Affairs Canada (INAC) retained EBA through Supply and Services Canada (DSS) to compile a database of previously collected surficial sediment data. In addition, some boreholes completed in 1988 have been included. A total of 1051 logs have been compiled. This report provides a summary of the information collected and activities undertaken to complete the contract.

The project was conducted under DSS Contract No. A7134-8-0055/01-ST dated 1989 February 1 and authorized by Mr. P. Dixon. Terms of reference were summarized in EBA Proposal No. 0305-P4444 and in the Statement of Work appended to DSS's Request for Proposal. The project was also discussed with Mr. R.J. Gowan (INAC), who was the technical authority for the project.

## 2.0 PROJECT OUTLINE

### 2.1 OBJECTIVES

The primary objective of the study was to compile, in a standardized (ESEBase) format, a database of surficial sediment core data from the Canadian Beaufort Sea. The database is intended for use in the evaluation of granular resources for construction materials. The database logs, therefore, are accurate stratigraphic and textural interpretations of the originals; however, some detailed engineering (for example, strength, consolidation, etc.) data has been omitted.



---

Some of the major tasks that were required to complete the database included:

- a) Confirm the availability of and acquire copies of the surficial sediment data from Federal government departments and the major Beaufort Sea petroleum operators.
- b) Interpret and standardize, in ESEBase format, the stratigraphic, index test (moisture content, Atterberg Limits, gradation analyses) and permafrost data for each log.
- c) Review and edit the final logs as required.
- d) Prepare floppy disk and paper copies of the logs.
- e) Prepare this final report.

## 2.2 METHODOLOGY

The listing of geotechnical reports developed for the 1988 contract was redistributed to the major Beaufort Sea operators (Amoco Canada Petroleum Company Ltd. (Amoco), Esso Resources Canada Ltd. (ESSO), and Gulf Canada Resources Ltd. (Gulf) to help identify missing or newly acquired data, and to confirm permission to use their data. The Geological Survey of Canada (GSC) also provided a database file of available data. The data which has been compiled comprises the following:

Amoco: 45 surficial sediment logs  
Esso : 460 surficial sediment logs  
Gulf : 405 surficial sediment logs and 50 borehole logs  
GSC : 91 surficial sediment logs



The GSC database also contained 60 borehole logs which were not included due to time constraints, and 19 additional surficial sediment logs which were considered to contain insufficient data to be included.

GSC is known to have an additional several hundred logs (Hudson cores). Although these were obtained in the early 1970's, they were not included in the database because of time limitations and because they would require extensive revision to convert from detailed geological logs to compatible engineering logs.

Some 1988 data acquired for Gulf has not been included due to time constraints. These consist of 6 shallow borehole logs and 57 gravity core logs. A listing of reports identified as containing Beaufort Sea surficial sediment data is provided in Appendix A. Appendix B lists reports containing new (1988) Beaufort Sea borehole logs.

### 2.3 DELIVERABLES

Final deliverables required under this contract are listed below:

- a. Surficial sediment database for the Beaufort Sea in, five copies on floppy disks and five bound paper copies.
- b. A final report, in twenty copies, describing the work undertaken and summarizing significant aspects of the database.

### 2.4 DATA PRESENTATION

In total, 1051 logs were included in the database. Logs located within the Isserk (103 logs) and Erksak (137 logs) areas (see Figure 1) have been compiled separately into Volume I of the printed logs for INAC's convenience, as these were the major areas of interest in INAC's 1988



contract. All logs are stored on disk in one database called 'beau1989'. Using ESEBase, the database can be easily combined with the database compiled in 1988.

The printed logs are presented in three volumes under the title "Beaufort Sea Database 1989 Surficial Sediment and Borehole Log Data", as follows:

- Volume I - Surficial Sediment Logs for the Isserk and Erksak Regions of the Beaufort Sea; Gulf Canada Resources Ltd.
- Volume II - Surficial Sediment Logs for the Beaufort Sea; Esso Resources Canada Ltd.
- Volume III - Surficial Sediment and Borehole Logs for the Beaufort Sea; Amoco Canada Petroleum Ltd., Geological Survey of Canada, Gulf Canada Resources Ltd.

## 2.5 PROJECT PARTICIPANTS

Personnel from EBA's Calgary office were primarily involved in this project, compiling the logs and doing the reporting. EBA Edmonton staff also participated by providing reports and field data, and some 1988 ESEBase logs.

Liaison with the Beaufort Sea operators and at the Geological Survey of Canada was conducted by EBA Calgary staff. The following people should be acknowledged for their assistance:

- o Mr. Kevin Hewitt - Amoco Canada Petroleum Company Ltd.
- o Mr. Ken Croasdale - Esso Resources Canada Ltd.
- o Mr. Chris Graham - Gulf Canada Resources Ltd.
- o Mr. Brian Rogers - Gulf Canada Resources Ltd.
- o Mr. Steve Blasco - Geological Survey of Canada (Bedford N.S.)
- o Mr. Don Gillespie - Geological Survey of Canada (Bedford N.S.)
- o Mr. Bob Harmes - Geological Survey of Canada (Bedford N.S.)



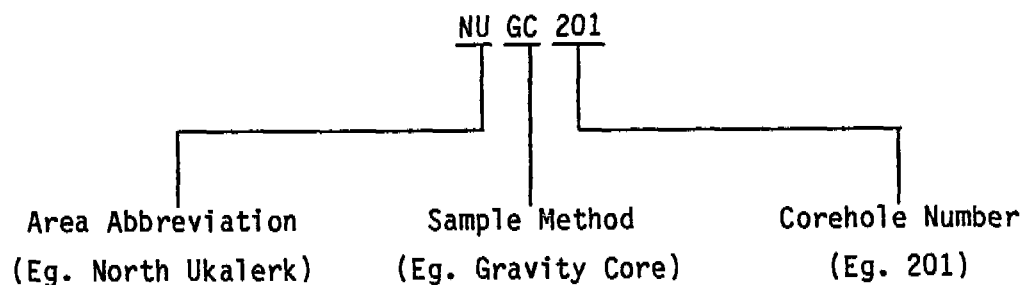
### 3.0 DATABASE DESCRIPTION

The Beaufort Sea Database was prepared with ESEBase, Version 3.0. As can be expected with so many logs, the original format, numbering system, datum, etc., are not consistent. The following sub-sections describe some of the modifications required to standardize the logs to ESEBase format.

Figure 2 presents a typical borehole log, as produced by the ESEBase program.

#### 3.1 COREHOLE OR BOREHOLE NUMBER

To accommodate similar corehole or borehole numbers from logs acquired in different areas, some renaming and renumbering has been done. This renumbering follows a similar format to the 1988 work, however, gravity cores and piston cores were also distinguished from boreholes where possible. ESEBase allows eight characters for a borehole name. Some examples of revised identification format are as follows:





For many coreholes where sample numbers were two digits or less, the year of sampling was also included. For example:

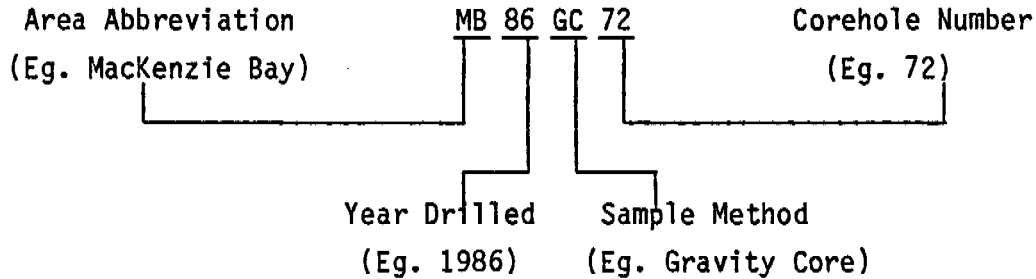
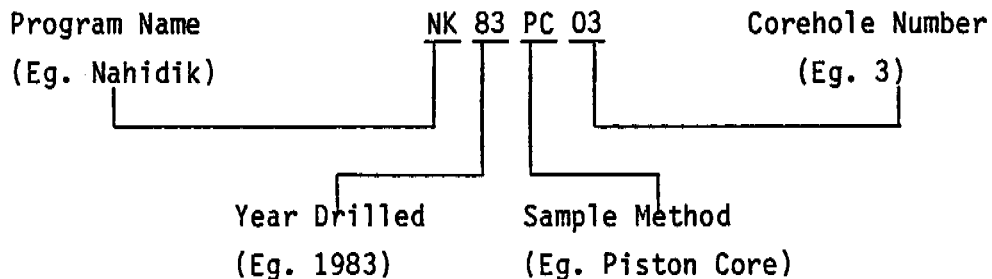


Table 1 summarizes the area abbreviations used for each block in the database. For blocks included in previous work, the same abbreviation was used where possible. Some new blocks have been added.

Gravity cores from the Ukalerk area were bisected into North and South as the South section is considered to belong to the Erksak region. Renaming consisted of replacing the "UB" prefix with the appropriate prefix "NU" or "SU", but the actual corehole number remains the same.

Many coreholes from the GSC database are identified by the program name rather than a geographic region name as an identifying prefix. The corehole name format is otherwise consistent with the other renamed boreholes or coreholes. For instance:



The original corehole or borehole numbers (i.e. from the original logs) are identified in the top center block of the printout logs and in "note\_3" or "xref\_3" of the database index page, if these have been changed.

### 3.2 REFERENCE TO SEA-LEVEL

To facilitate searching capabilities with respect to sea level or seabed, all coreholes have been referenced to a seabed at zero metres elevation. To allow ESEBase to provide seabed profiles, a negative water depth was entered in the "top/hole" field of the database index page for each corehole log.

### 3.3 SAMPLE TYPE

Table 2 presents a list of sample types and corresponding abbreviations used for the database. For gravity cores having no recovery where the depth of penetration is unknown, the sample type is not described under sample data, but only under soil description.

### 3.4 SOIL DESCRIPTION

The stratigraphic information on the logs includes the following components where available:

- o principal component (e.g. Clay, Sand, Silt, etc.)
- o Unified Soil Classification (USC)
- o principal component modifier(s) (e.g. silty, some sand, etc.)
- o particle shape
- o structure
- o moisture
- o consistency
- o plasticity
- o colour
- o ground ice description

It should be noted that many gravity core entries are the composite of several trials at the same location (for instance A, B and C). Where change in soil type does not occur at the same depth, an average depth was calculated. However, the actual depth of a particular sample (generally the most descriptive sample was input) was plotted. For this reason, occasionally the range of a particular soil sample does not match exactly to the soil description.

Many gravity core logs gave no indication of the depth of penetration. In these cases, an arbitrary value of 0.1m was assigned.

### 3.5 SOIL CLASSIFICATION DATA

Moisture contents, Atterberg Limits, limited grain size analyses and Unified Soil Classification (USC) data have been included in the database.

All moisture contents from original logs have been included, except where several moisture contents were performed on subsamples of a single sample. If the moisture contents were similar for the subsamples then only one moisture content value was recorded; however, moisture contents which varied considerably from one subsample to the next (e.g. sand and clay layers within a sample) were included.

Atterberg Limits and grain size analyses were used to check and provide Unified Soil Classification System (USC) classifications. Stratigraphy entered in the 'soil description' section of ESELog have USC classifications in upper and lower case characters. Upper case characters (e.g. CL), imply that there is soil test data to confirm the classification, while lower case USC classifications (e.g. cl) implies that there is only the logger's estimate of the USC classification. On occasion there is soil test data which is insufficient to fully determine the classification, for example if a grain size analysis has been done but

silt and clay contents have not been distinguished. Thus if a soil description is incomplete, for instance for a sand with a high fines content, it would be difficult to say whether the sand should be classed as "SM" or "SC". In these cases lower case USC classifications are used, particularly if the logger made no attempt at classification. All USC classifications have been entered in upper case characters in the 'Basic Soil Characteristics Data' file where test data is available.

All available grain size data has been included in the database. The '% Fines' field presented in the 'Basic Soil Characteristics Data' file is the total percentage of silt and clay (i.e. that passing the No. 200 sieve) as determined from hydrometer and/or sieve analysis. The data collected for the 'D<sub>50</sub>' field included in the 'Basic Soil Characteristics Data' file, is presented in micro-metres. All 'D<sub>50</sub>' data calculated and presented as such were entered into the database. 'D<sub>50</sub>' data not previously presented were calculated for the remaining grain size analyses, except for the fine-grained soils where more than 50% passes the No. 200 sieve.

### 3.6 GROUND ICE DESCRIPTION AND SAMPLE TEMPERATURE

The ground ice description standard used for this database follows the guidelines established by NRC. Ground ice information has been stored in the 'Ground Ice Description' field of the 'Scientific', 'Permafrost' and 'Rock Data' file. Soil sample temperature has been entered in the 'Temp' field of the 'Scientific', 'Permafrost' and 'Rock Data' file. This field is presented on the borehole log for logs where temperature data is available.

### 4.0 CLOSURE

In a total, 1051 corehole and borehole logs from the Beaufort Sea have been summarized in a database suitable for interpreting the distribution



of granular resources and restrictions on their development. These logs provide a valuable addition to the database completed in 1988.

In the future, the 79 GSC logs and the GSC Hudson core data not yet included in the database should be added. Also, the 63 shallow boreholes and gravity cores from Gulf's 1988 data should be included.

Regular maintenance of the database by updating annually with new borehole data will ensure a reliable source of data on Beaufort Sea granular resources.

Respectfully submitted,

EBA ENGINEERING CONSULTANTS LTD.

Prepared by:

Reviewed by:



R.I. Olthof, P.Eng.,  
Geotechnical Engineer

RIO:NRM:c1c



N.R. MacLeod, P.Eng.,  
Project Director

THE ASSOCIATION OF  
PROFESSIONAL ENGINEERS,  
GEOLOGISTS and GEOPHYSICISTS  
OF THE NORTHWEST TERRITORIES  
**P 018**  
**EBA ENGINEERING  
CONSULTANTS LTD.**



---

0305-34475

LIST OF TABLES

TABLE 1      EXPLORATION BLOCK NAMES AND ABBREVIATIONS

TABLE 2      SAMPLE TYPES AND ABBREVIATIONS



TABLE 1

EXPLORATION BLOCK NAMES AND ABBREVIATIONS

<u>BLOCK NAME</u>	<u>ABBREVIATION</u>
Baillie Island	BI
Herschel (Borrow)	HB
Isserk (Borrow)	IB
Issigak	IS
Kugmallit Bay	KM
Mackenzie Bay	MB
Minuk	MK
Nipterk - West	NW
North Ukalerk	NU
South Tarsiut	ST
South Ukalerk	SU
Nahidik (program name used where exploration block not available in GSC records)	NK



---

TABLE 2  
SAMPLE TYPES AND ABBREVIATIONS

<u>SAMPLE TYPE</u>	<u>ABBREVIATION</u>
Grab	Grab
Shelby Tube	T
Gravity Core	GC
Piston Core	PC
No Recovery	NR



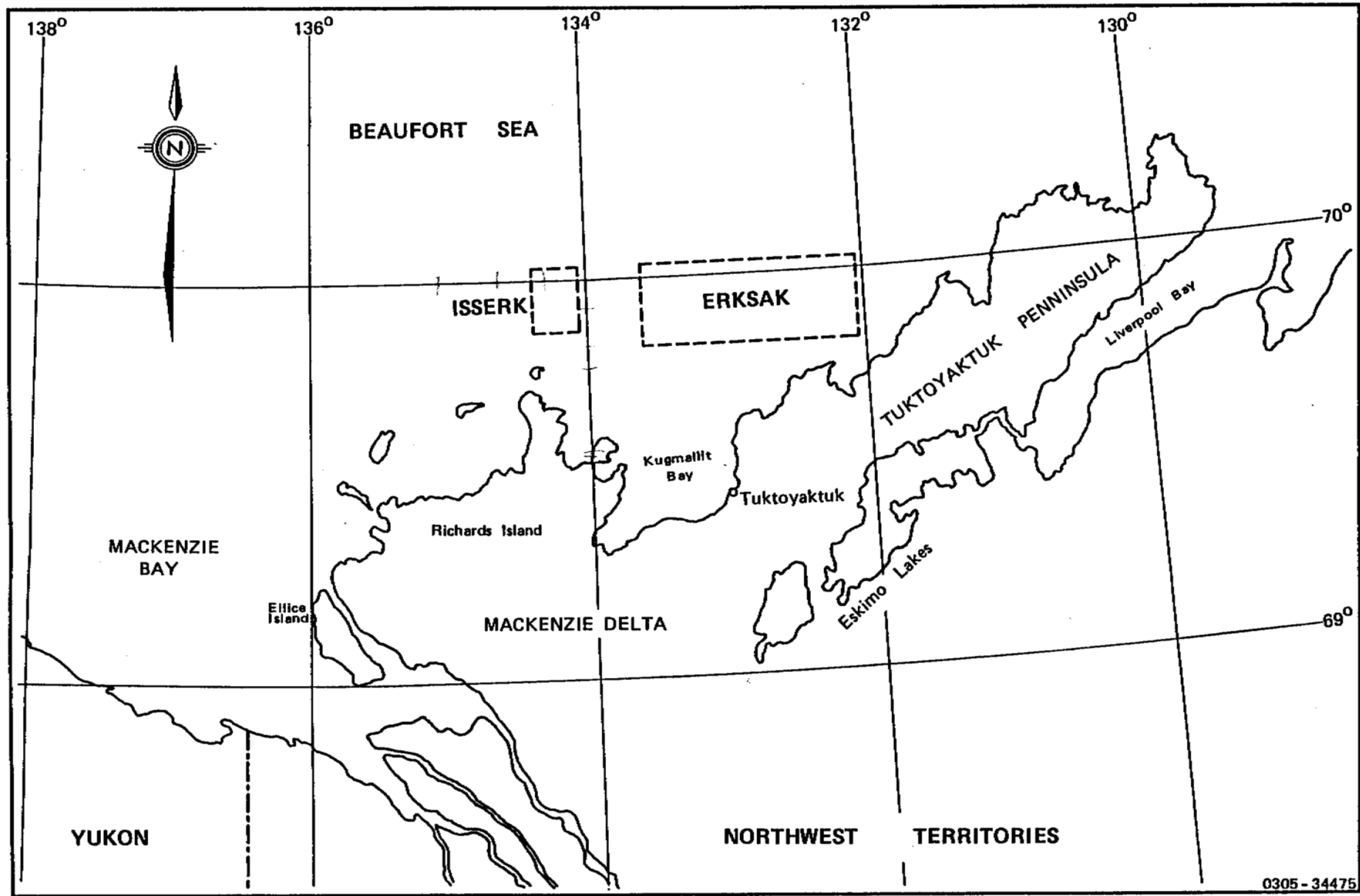


LIST OF FIGURES

FIGURE 1 AREA MAP OF THE BEAUFORT SEA

FIGURE 2 TYPICAL ESEBASE BOREHOLE LOG





0305-34475

FIGURE 1 AREA MAP OF THE BEAUFORT SEA

SOUTH UKALERK BORROW SITE		ORIGINAL BOREHOLE NO. UB82629	BOREHOLE No. SUGC029
GULF CANADA RESOURCES INC.		WATER DEPTH - 25.9m	Project No: EBA # 101-3659
DRILL SHIP - M.V. FRANK BRODERICK		DEPTHS ARE REFERENCED TO SEABED	ELEVATION -25.90 (m)
SAMPLE TYPE	<input type="checkbox"/> SHELBY TUBE	<input checked="" type="checkbox"/> NO RECOVERY	<input checked="" type="checkbox"/> SPLIT SPOON
		<input type="checkbox"/> DISTURBED	<input type="checkbox"/> PISTON
			<input type="checkbox"/> GRAVITY CORE

DEPTH (m)	SAMPLE TYPE	SAMPLE NO	SOIL DESCRIPTION	A D50 (um) A				FINES (%)				USC	DEPTH (ft)
				2000	4000	6000	8000	20	40	60	80		
0.0		29A	CLAY - sandy, soft, dark olive grey										0.0
		29A	SAND (sm) - some silt, trace shell fragments, fine grained, dark olive grey, black sand bands									SM	
			END OF GRAVITY CORE										
1.0													1.0
													2.0
													3.0

EBA Engineering Consultants Ltd. Calgary, Alberta		COMPLETION DEPTH 0.2 m	COMPLETE 82/08/14
LOGGED BY JB	DWG NO.	Page 1 of 1	

FIGURE 2 TYPICAL ESEBASE BOREHOLE LOG

---

0305-34475

APPENDIX A  
SURFICIAL SEDIMENT COREHOLE LOG  
SOURCE REPORTS



APPENDIX A  
SURFICIAL SEDIMENT COREHOLE LOG SOURCE REPORTS

DATE (Yr/Mo.)	REPORT TITLE	NAME OF CONSULTANT	CONSULTANT ID NO.
BEAUFORT SEA PROJECTS FOR AMOCO CANADA PETROLEUM CO. LTD.			
82-07	1982 Offshore Geotechnical Site Investigation Baillie Island Gravel Search, Beaufort Sea	EBA Engineering	0101-3605
81-07	1981 Offshore Geotechnical Site Investigation South Tarsiut Borrow Area, Beaufort Sea	EBA Engineering & McClelland Eng.	0101-3210
BEAUFORT SEA PROJECTS FOR ESSO RESOURCES CANADA LTD.			
83-07	1983 Offshore Geotechnical Site Investigation Issigak Borrow Site, Beaufort Sea	EBA Engineering	0101-3868
BEAUFORT SEA PROJECTS FOR GEOLOGICAL SURVEY OF CANADA			
82-	Geological Survey of Canada - Computer Database	-	- !
84-	Marine Science Atlas of the Beaufort Sea - Sediments 1984	-	Misc. Report* No. 38

\* Indicates reports for which logs are not included in the database  
! Not all logs in GSC database have been included in EBA database.

APPENDIX A  
SURFICIAL SEDIMENT COREHOLE LOG SOURCE REPORTS

DATE (Yr/Mo.)	REPORT TITLE	NAME OF CONSULTANT	CONSULTANT ID NO.
Beaufort Sea Projects For Gulf Canada Resources Ltd.			
82-09	1982 Offshore Geotechnical Site Investigation, Herschel Borrow Site, Beaufort Sea	EBA Engineering	0101-3662
82-09	1982 Offshore Geotechnical Site Investigation, Kringalik Site, Beaufort Sea	EBA Engineering	0101-3658*
82-08	1982 Offshore Geotechnical Site Investigation, Ukalerk Borrow Site, Beaufort Sea	EBA Engineering	0101-3659
82-09	1982 Offshore Geotechnical Site Investigation, Isserk Borrow Site, Beaufort Sea	EBA Engineering	0101-3686
88-08	1988 Offshore Geotechnical Site Investigation, Proposed Pipeline Route, Beaufort Sea, Canada	EBA Engineering	0101-4912B*
88-08	1988 Offshore Geotechnical Site Investigation, Nerlerk Berm B-67, Beaufort Sea, Canada	EBA Engineering	0101-4912C*
88-08	Summer 1988 Offshore Geotechnical Site Investigation Issigak, Minuk, Akpak Plateau and Nipterk Borrow Sites, Beaufort Sea	EBA Engineering	0101-4912E

\* Indicates reports for which logs are not included in the database

---

0305-34475

APPENDIX B  
BOREHOLE LOG SOURCE REPORTS



0305-34475

APPENDIX B  
BOREHOLE LOG SOURCE REPORTS (1988 Data)

## BEAUFORT SEA PROJECTS FOR GULF CANADA RESOURCES LTD.

DATE (Yr/Mo.)	REPORT TITLE	NAME OF CONSULTANT	CONSULTANT ID NO.
88-04	1988 Offshore Geotechnical Site Investigation Proposed North Point Pipeline Route, Beaufort Sea	EBA Engineering	0101-4809
88-08	1988 Offshore Geotechnical Site Investigation Proposed Pipeline Route, Beaufort Sea	EBA Engineering	0101-4912B
88-08	1988 Offshore Geotechnical Site Investigation Nerlerk Berm B-67, Beaufort Sea, Canada	EBA Engineering	0101-4912C
88-08	1988 Offshore Geotechnical Site Investigation Amauligak B-46 and D-32, Beaufort Sea, Canada	EBA Engineering	0101-4912D
88-08	Summer 1988 Offshore Geotechnical Site Investigation Issigak, Minuk, Akpak Plateau and Nipterk Borrow Sites, Beaufort Sea	EBA Engineering	0101-4912E