INVESTIGATION A

CAPE DORSET, N.W.T.

Granular Program

Northwest Territories
Engineering Division

Northwest Territories

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CAPE DORSET

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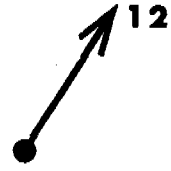

ACKNOWLEDGEMENTS

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Sandy Murray	Project Officer, Department of Transportation, G.N.W.T., Yellowknife.
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EXECUTIVE SUMMARY

The Municipality of Cape Dorset is a mature and growing community that needs a reliable and convenient source of all types of granular material.

This report presents the results of a geotechnical study, conducted under the objectives and guidelines of the Community Granular Program, to determine the 20-year demand for granular materials and the best means of satisfying that demand.

In summary, the 20-year demand for granular materials in the community is nearly 161,000 cubic meters. This demand is primarily for local capital projects and maintenance of community facilities.

In general, granular materials sufficient to meet the 5-year forecast demand are available in the Cape Dorset region. Existing sources can be expected to be depleted by 1993/94. Development of potential sources will satisfy the community's foreseen needs to 1994/95 and beyond.

Sometime after 1994/95, a quarry/crushing operation will have to be considered. Therefore, a review of the situation facing the community should be made in 1993/94 so that this important step may be made in a deliberate and well planned fashion.

Implementation of a Granular Resource Development and Management Plan by the Hamlet of Cape Dorset, based on the technical recommendations of this report and local concerns, is recommended at the earliest possible date.

1. INTRODUCTION

The geotechnical studies undertaken by the Community Granular Section are an integral part of the Community Granular Program. The goals, principles, definitions and methodology of these reports are discussed in this section.

1.1 Purpose

The Community Granular Program, Engineering Division, D.P.W., provides the capital resources for identifying, laboratory testing, developing, and restoring granular sources for all non-taxed based communities in the N.W.T. The objective is to process, stockpile, and manage granular supplies to ensure materials are available for planned community development projects, ongoing maintenance, and private use, at a reasonable cost.

To meet this objective, geotechnical investigations are planned for various communities throughout the N.W.T. and are priorized on the basis of the granular needs in the communities. These needs are derived through an analysis of the 5 year capital plans and the 20 year capital needs assessment of every GNWT Department, the N.W.T. Housing Corporation, the Federal Government and where available, the private sector. Highly speculative needs such as resource development projects (i.e. oil and gas) are beyond the scope of these studies.

The intent of this report is to precisely define the community's available granular resources and its granular needs over a 20 year horizon and develop options for the management of those resources that ensure the community's long term needs are met. The report and recommendations will enable the community, through the consultative process, to develop a comprehensive Granular Resource Development Plan that will provide control of the extraction, development, use and restoration of non-renewable granular resource areas.

1.2 Geotechnical Investigation Procedure

This granular materials study is a multi-phased investigative and assessment process that may be broken down as follows:

Terrain Analysis
- regional setting
- geology and geomorphology
- drainage
- permafrost distribution

Resource Description and Assessment
- review of pertinent information
- air photograph interpretation
- ground reconnaissance and sampling
- material quantity assessment
- material quality assessment
- ground ice and permafrost assessment
- evaluation of all sources
- access routes
- source summary

Granular Needs Assessment
- granular material breakdown
- 5 year needs assessment
- 20 year needs projections
- needs summary

Recommendations
- comparison of resources and needs
- development of options
- development of estimates
- selection of options

1.3 Specifications and Terminology

A number of systems have been devised for classifying granular materials that are based on soil characteristics and engineering properties of the material. The Community Granular Section uses the following standards, criteria and specifications to describe the material in the granular sources discussed in this report.

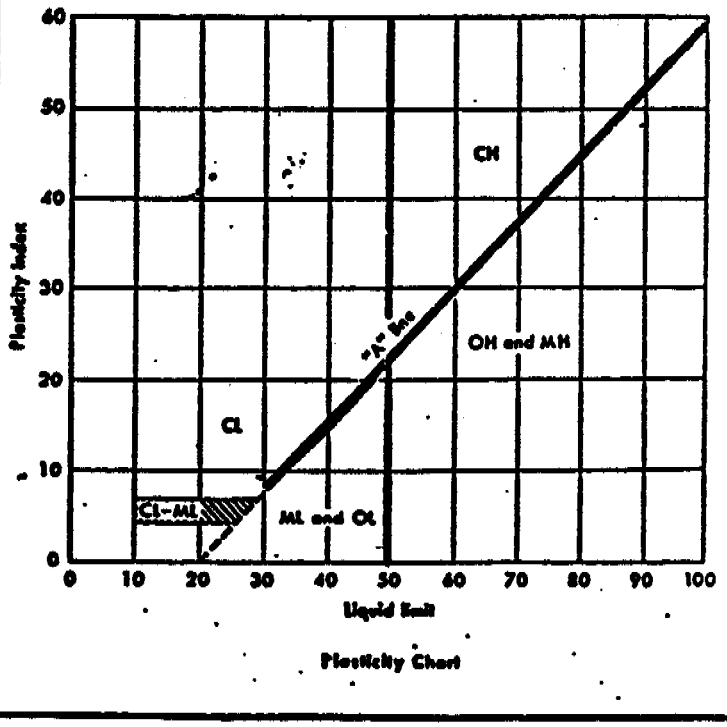
1.3.1 Classification of Soils

The Unified Soil Classification System (USC) is used to identify various types of soils through visual description in situ and in the laboratory and through tests such as Atterburgh Limits and sieve analysis. The USC system is shown on the following page.

Unified Soil Classification System

1.3.1

Major divisions			Group symbols		Typical names	Laboratory classification criteria	
Coarse-grained soils (More than half of material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than No. 4 sieve size)	Clean gravels (Little or no fines)	GW		Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows: Less than 5 per cent.....GW, GP, SW, SP. More than 12 per cent.....GM, GC, SM, SC. 5 to 12 per cent.....Borderline cases requiring dual symbols.*	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3
			GP		Poorly graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW
		Gravels with fines (Appreciable amount of fines)	GM°	d	Silty gravels, gravel-sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4
				u			Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
			GC		Clayey gravels, gravel-sand-clay mixtures		Atterberg limits above "A" line with P.I. greater than 7
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW		Well-graded sands, gravelly sands, little or no fines		$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3
			SP		Poorly graded sands, gravelly sands, little or no fines		Not meeting all gradation requirements for SW
		Sands with fines (Appreciable amount of fines)	SM°	d	Silty sands, sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4
				u			Limits plotting in hatched zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.
			SC		Clayey sands, sand-clay mixtures		Atterberg limits above "A" line with P.I. greater than 7
Fine-grained soils (More than half of material is smaller than No. 200 sieve)	Silts and clays (Liquid limit less than 50)		ML		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity		
			CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays		
			OL		Organic silts and organic silty clays of low plasticity		
	Silts and clays (Liquid limit greater than 50)		MH		Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts		
			CH		Inorganic clays of high plasticity, fat clays		
			OH		Organic clays of medium to high plasticity, organic silts		
	Highly organic soils		Pt		Peat and other highly organic soils		



Plasticity Chart

- **Dry Sieve Analysis: AASHTO T27-82:**
  Sieve down to No. 4 (4.75 mm) using sieve nest indicated in specification. Prepare grain size curve on standard form.

- **Lab Crushing:**
  Crush to required maximum size using laboratory jaw crusher. Size will be given on sample information.

- **Atterberg Limits: AASHTO T89-81 Method A. T90-81:**
  Report summary list of sample numbers with liquid limit, plastic limit, and plasticity index. Report on standard form.

- **Visual Description and Classification:**
  Give a brief visual description of sample content as per example. Classify the material as per Unified Soils system and AASHTO system including group index. Report on standard form.

- **Natural Moisture Content: AASHTO T265-79:**
  Supply summary list showing sample number and moisture content. Also complete lab data copies.

- **Magnesium Sulphate Soundness, AASHTO T104-77 (1982):**
  Report the loss on each coarse fraction and the total loss by the weighted average based on the grading of the original sample.

- **Los Angeles Abrasion, AASHTO T96-77:**
  Depending on the sample, use the appropriate grading, and report the loss as a percentage.

- **Modified Proctor Standard Proctor, AASHTO T99-81:**
  Report results of five (5) points and prepare proctor curve on standard form.

1.3.2 Engineering Properties of Materials

Granular materials have been separated into various "types" for the purposes of this report. Each type is based on the intended end use of the material and conforms to the American Association of State Highways and Transportation Officials (AASHTO) specifications, as follows:

Type	Specification
Embankment	AASHTO M 57-80
Sub-base	AASHTO M 57-80
Base	AASHTO M 147-65(80)
Surface	AASHTO M 147-65(80)
Concrete Aggregate - fine	AASHTO M 6-81
- coarse	AASHTO M 80-77(92)

All granular material samples are subjected to standard laboratory tests to ensure conformance with these specifications. The tests are:

- **Washed Sieve Analysis: AASHTO T11-82:**
  Report grain size analysis on standard form showing all calculations, eg. original dry, dry after washing amount retained per sieve and percent error. Use following sieve nest.

100 mm	4 in.	4.75 mm	No. 4
75 mm	3 in.	2.36 mm	No. 8
67.5 mm	2 1/2 in.	2.00 mm	No. 10
50 mm	2 in.	1.18 mm	No. 16
37.5 m	1 1/2 in.	0.60 mm	No. 30
25 mm	1 in.	0.425 mm	No. 40
19 mm	3/4 in.	0.300 mm	No. 50
16.5 mm	5/8 in.	0.150 mm	No. 100
12.5 mm	1/2 in.	0.075 mm	No. 200
9.5 mm	3.8 in.		

- **Petrographic Analysis, MTC LS-609:**
  Using coarse aggregate report PN number and flakiness index.

- **Fractured Face Count, MTC LS-607:**
  Report as percentage of original sample mass.
  Refer to AASHTO T4-35, Section 2.

- **Flat and Elongated Particle Count, MTC LS 608:**
  Report as percentage of original sample mass.

- **Hydrometer Analysis: AASHTO T88-81:**
  Supply all lab data and grain size curve. Plot results of grain size on Contractor's standard grain size distribution curve.

- **Washed Sieve Analysis:**
  Minus 0.075 mm: AASHTO T11-82.
  Organic Content: AASHTO T267.

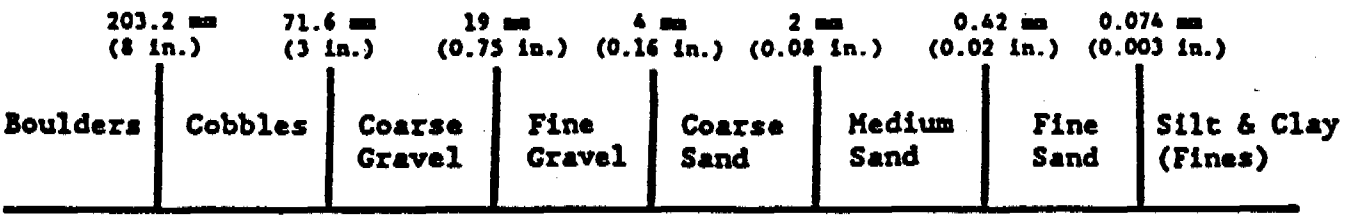
It is important to note that all samples may not have to be subjected to the full range of test procedures.

It should be noted also that ground thermal analysis and the engineering properties of permafrost unique to northern periglacial environments are taken into consideration in all situations.

1.3.3 Environments of Deposition

The properties of any granular material vary with its gradation, moisture content, vertical position in relation to the surface of the ground, and geographic location. Time and climate influence the weathering process of mechanical and chemical disintegration that breaks the material down into progressively smaller particles. The term gradation refers to the relative size of these particles in a deposit.

Size distribution is related to environments of deposition that indicate the texture and composition of a granular deposit. The amount of each size grouping in a deposit is one of the major tools used in judging, analyzing, and classifying a source for use as a construction material. Granular deposits contain particles ranging in size from boulders through clay, as indicated below.



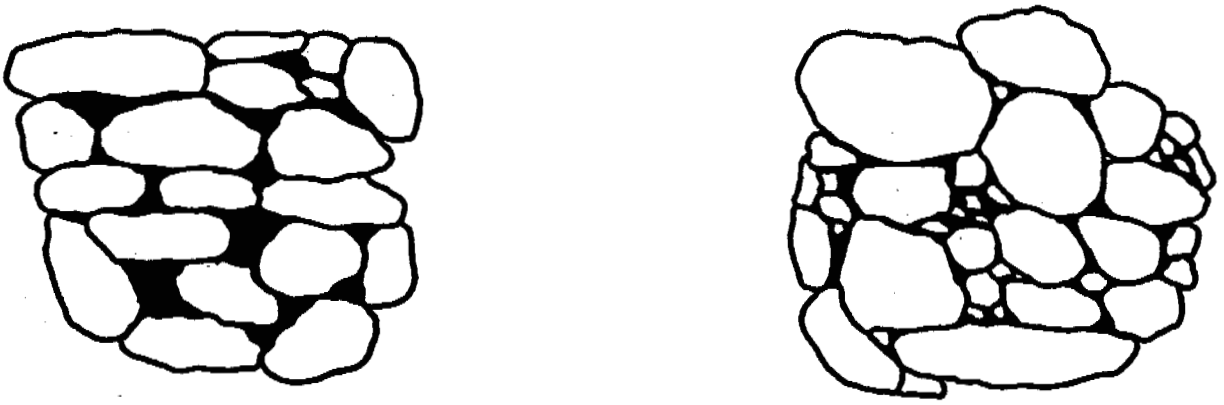
Gravel and sand particles are the most desireable and are found in glacio-fluvial deposits and post glacial beaches. Silt and clay particles, called 'fines', are undesirable over 15 percent because they tend to hold water which in periglacial environments, as in the N.W.T., results in high ice content and greater frost susceptibility. However, a lower limit of 5% is often acceptable to aid in compaction. Fines are often found in deltaic and lacrustine deposits, some fluvial sediments, and tidal flats. Post glacial/fluvial processes during the Quarternary period have also influenced the type of gradation in granular sources in the N.W.T.

Mechanical weathering is the dominant process acting on the rock strata of the precambrian outcrops throughout the N.W.T. Since the regolith produced from the weathering process occur "in situ", most granular deposits in the N.W.T. are "poorly graded" with a high percentage of "oversized" particles.

The suitability of a deposit for construction purposes is directly related to the particle distribution or grain-size curve. This curve indicates if a deposit is "well-graded" or "poorly graded", two terms that are used extensively in this report.

A "well graded" granular deposit has an equal amount of each gravel and sand size and little or no fines. These deposits are referred to as "clean" and are excellent quality materials for "pitrun" construction purposes. Eskers and raised beaches are prime examples of "clean" deposits.

A 'poorly graded' granular source has an excess of some particle sizes, a shortage or lack of others, or has nearly all particles the same size. These sources need processing to improve and upgrade their quality. Screening and washing can be used to remove undesirable particle sizes. Talus slopes, alluvial fans, and varved clays are prime examples of this type of deposit found in the N.W.T.



Poorly-graded materials with all particles the same size or with a lack of certain particle sizes (left drawing) have more voids and are less stable than well-graded materials where the voids are filled by the smaller particle (right drawing).

1.4 Volume Estimates

Volumes of granular material sources as described in this study are classified as being proven, probable, or prospective.

A **proven** volume is one where existence, extent, thickness and quality is supported by ground truth information such as a test-pitting, exposed stratigraphic sections, bore hole drilling, and aggressive sampling and ground truth reconnaissance.

A **probable** volume is one whose existence, extent, thickness and quality is inferred on the basis of direct and indirect evidence such as airphoto interpretation, geophysical data, terrain analysis, and limited sampling and ground thruth reconnaissance.

A prospective volume is one whose existence. extent. thickness and quality is suspected on\ the basis on limited direct evidence, such as airphoto interpretation, remote sensing information, or imaging radar techniques. There is no sampling or ground truth reconnaissance.

1.5 Restoration and Regulations

Pit planning, design, and restoration are important aspects of granular resource development. Environmentally, the development of any granular sources offers the potential for drainage and erosion problems, habitat destruction, and the disturbance of wildlife. In many communities in the N.W.T., excessive scarring of the surrounding terrain is a major concern. These reports take into account the economic and environmental factors of pit abandonment and reclamation. Guidelines to minimize the impact of pit development and quarry operations are available in the INAC (1982) publication "Environmental Guidelines Pits and Quarries". At all stages of pit planning, design and operation, methods that ensure final pit restoration are stressed.

Permafrost can be expected throughout the N.W.T. and results in a variety of environmentally sensitive problems related to pit abandonment and restoration; thus pit development in permafrost environments must be planned well in advance and special techniques used during the extraction of material.

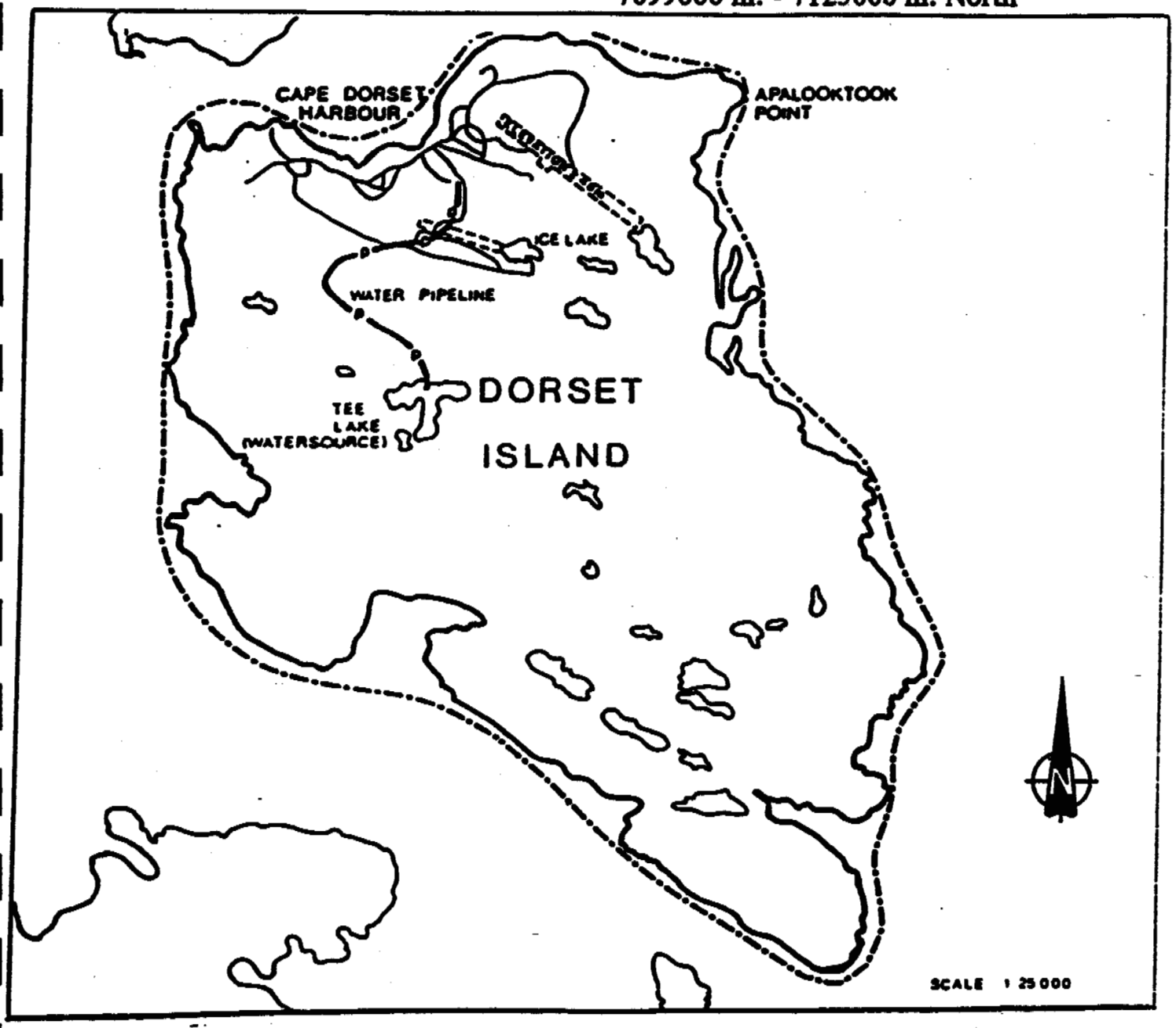
Territorial land use regulations are to be followed in all development plans, without exception, especially in the areas of land use permits, explosives, and pit abandonment.

2. TERRAIN ANALYSIS

2.1 Regional Setting

The community of Cape Dorset is located on Dorset Island off the Foxe peninsula, southwest of Baffin Island (Fig 1). The community is part of the Baffin Region of the N.W.T. Geographical location is 64 degrees 14 minutes north latitude and 76 degrees 32 minutes west longitude.

Cape Dorset.....36 C/2 1:50,000
UTMS .....350000 m. - 450000 m. East
7099000 m. - 7125000 m. North



Dorset Island Area: 21.2 km^2

2.2 Geology and Geomorphology

Cape Dorset is located within the Frobisher Upland, a highly eroded ancient mountain system comprising the S.W. portion of Baffin Island. The uplands rise abruptly from the sea to 1000 meters then slope southward into Hudson Straight. The hamlet is situated in two valleys of the Kingnait Hills separated by a bedrock ridge.

The bedrock generally consists of extremely old Precambrian gneiss and metamorphic sediments of the Proterozoic era. These crystalline rocks were emplaced during the Kenoran and modified during the Hudsonian orogeny. Folding and granitic intrusions occurred from the late Aphebian era.

These rocks approximate quartz monzonite in composition. The quartz is clear or milky. They are essentially quartz, plagioclase, and mocrocline; mafic minerals seldom exceed 5 per cent. The interlocking texture is indigenous to this region and results in a wide range of grain sizes. Quartz diorites were also present in the study region.

Rock outcrops are heavily faulted and closely jointed which has produced "block like" or "linear blocks" of very hard rock amid thick weathered regolith.

The topography is very rugged with elevations in excess of 300 meters. The community lies within two valleys that extend inland and end abruptly against precipitous bluffs of the Kingnait Hills. Fluvial and glacial processes have covered the valley floor with surficial granular deposits.

The main geomorphic processes are "solifuction" and "frost wedging". This mechanical weathering has produced large "talus" slopes at the base of the larger outcrops. These fan like features are formed by the accumulation of weathered material from frost action and then slow downward movement by gravity. They are typically composed of weathered, angular gravels to boulders referred to as "colluvial sediments".

Bedrock sediments occur below the 180 meter contour level and occupy low areas between bedrock highs. They are primarily composed of ice rich, coarse gravels and sands that have been reworked by fluvial and marine action. Onshore/offshore overlap by receding ocean levels has produced a number of post glacial and modern beaches that contain impressive accumulations of gravel/sand deposits. Marine silts and clays comprise much of the tidal flats that surround the community. Varved clays were observed among the ancient lake beds within the valleys.

The study region lies within the zone of continuous permafrost. The distribution of permafrost is uniform but the thickness of the active layer varies considerably. Segregated ice crystals were observed during sampling. Some permafrost features are restricted to the active layer only, while others are more deep-seated and involve either the aggradation or degradation of the permafrost thermal regime. Thermokarst depressions and topography is common in and around the community.

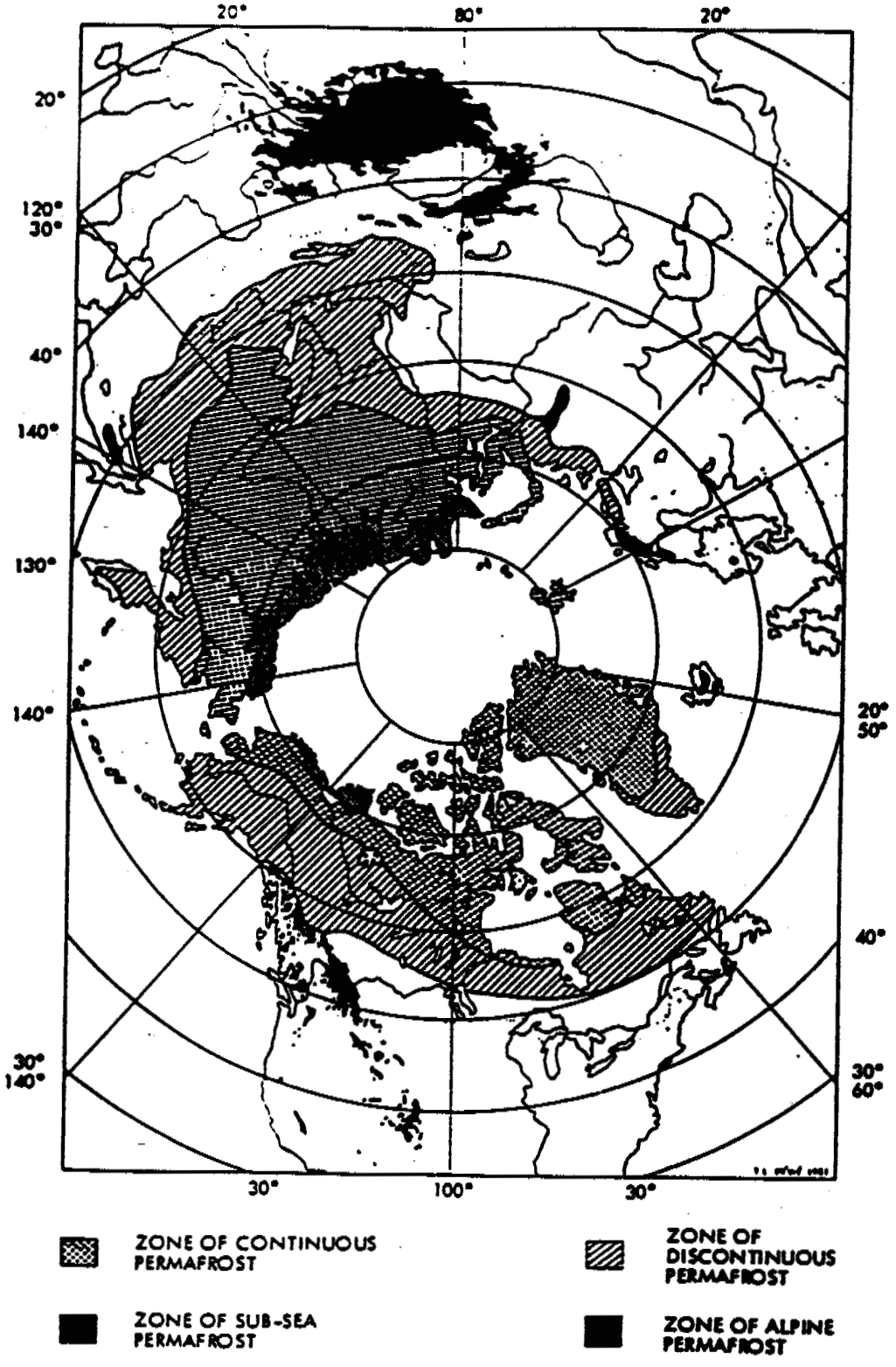
2.3 Drainage

Surface drainage is controlled by the bedrock valleys and the permafrost table. Drainage is oriented in a south to north direction from the highlands to the coastal margins. the drainage pattern could be considered radial braided and erosion in culvert ditches and housing pads is prevalent.

Lakes occupy small closed depressions and are intersected by short, rapid flowing, braided streams. The water supply for the community is Tee Lake which is post glacial and is located approximately 1.6 kilometers south of the community.

The tidal range at Cape Dorset varies from 7.5 to 11.1 meters and at low tide a muddy tidal flat is exposed in front of the settlement. A land causeway intersected by small narrow rip tides connects the Island of Cape Dorset with Mallik Island. The causeway is completely covered at high tide.

2.4 Permafrost Distribution



Northwest Territories Public Works

Date: SEPT. 1989	Title: CAPE DORSET, N.W.T.
Drawn by: FRED COLLINS.	Distribution of different types of permafrost terrain in the Northern Hemisphere
Approved by: D.P.W. ENGINEERING	
Scale: N.T.S.	Project No.: 69-9170-803
	Drawing No.: P12 2.4

3. GRANULAR SOURCES AND ASSESSMENT

This section provides an overview of the various existing and potential granular sources within the study area. Each source is described in terms of location, material type, volume, appropriate use of material, production methods and access requirements. Site details and test results for the sites can be found in Appendix A. Photographic records are included in Appendix B.

It is intended that this section be read in conjunction with the Site Location Map, Appendix C. The figures and sketches related to specific sources, site access, and cross-sections are located in Appendix A.

3.1 Existing Sources

There are a number of "borrow" areas in the vicinity of Cape Dorset that were active in the past. It is estimated that approximately 41,000 m^3 of granular materials of various types is available from these sources. The following is a brief discussion of each source.

3.1.1 Site A (Tank Farm Area - Fig. 1)

This site is located approximately 3 km N.W. of the hamlet, directly east of the existing tank farm (Photo 8). The site is highly recommended for development and is readily accessible by an all season gravel road that passes through the source. The source can be separated into two section. The major area of coarse gravel is to the northeast of the tank farm (Area 1) and is approximately 90 x 45 meters. This area is a raised storm beach that gradually widens into a large post glacial beach (Photo 12 and 13) that is approximately 100 x 40 meters (Area 2). The depth varies throughout the site from 0.7 and 2.2 meters. If an average depth of 1.5 meters is considered, this area contains some 10,000 cubic meters of very coarse gravel and 5,000 cubic meters of coarse sand. Figure 2 is a detailed cross section of the deposit as indicated by test pit CAP - 03 - FC.

As "pitrun", the material could only be used as embankment but the grain curves indicate that with screening, select grades could be produced. If screened to 2" minus approximately 15% would be lost as oversize; 40% would be lost if screened to 1" minus. There is a great deal of oversize material (Photo 10) that could be used during the construction of the marine dock. This site is highly recommended for development. A "grizzly" screener could be located at the west end of the site and select grades of material stockpiled.

3.1.2 Site B (Ice Lake - Fig. 3)

This site is located just south of Ice lake behind the new curling rink, approximately 1.5 km from the hamlet office and is between the south shore of the Lake and a rock bluff (Photo 4). The pit is a combination talus slope and beach ridge and was used to supply material for the old airport and a "berm" located on the west side of the lake. The pit still has approximately 2100 cubic meters of fine, well drained, poorly graded gravel remaining. This source could be used as surfacing material for the roads. The area is easily accessible but care is needed to ensure the integrity of Ice Lake.

3.1.3 Site 14 (Airport/M.O.T. Site - Fig. 7)

This site was the material source used by M.O.T. for the new airport construction and is an extensive area of land adjacent to the north side of the air strip. The area extends north and east and shows signs of heavy use (Photo 62).

The material consists of coarse gravel to sand with at least 40% oversize (cobbles to boulders - Photo 63). The remaining matrix is 50% coarse gravel and 50% clean, well graded sand. The grain curves are "gaped" indicating that there are two grades of material in about equal grain sizes. It is estimated that there is in excess of 9,000 cubic meters of granular material remaining, some of which could be used as "pitrun". This site is a prime source of material for future screening and crushing operations as well as embankment material. It is estimated that 3,000 m^3 could be screened for use as select grade.

In the past, the site was accessed by crossing the airstrip, however, present access is by a rather long road (+3 km) that circumvents the airstrip to the northwest through Site 13.

3.1.4 Fractured Bedrock Source (FBS)

This source is an active pit that presently supplies the community with embankment material. Approximately 5000 cubic meters have been removed as of September 1989. The source covers the northern extension of the surrounding foothills and consists of paleozoic outcrops exposed on the surface or just below it. The material is a brown/green soft, friable shale that is readily accessible as it is adjacent to the existing road (Photo 22). When subjected to L.A. Abrasion tests, up to 50% of the material is lost. Weathered quartzite and gneiss are found in thin layers between massive shale beds (Photos 23 - 26). There is approximately 6,500 m^3 of granular material remaining at this source. Processing of the material through screening would produce approximately 1,500m^3 of select material.

3.1.5 Site 13 (Fig. 5)

The access road from the tank farm to site 14 passes through to a large source of course gravels and sands (Photo 18 and 19) that the community is just beginning to use. The major portion of the site is coarse gravel with 40% oversize material.

A smaller section of the site extends along a ridge that gradually rises from the north side of the road and is approximately 60 x 40 m. The material is a coarse, well drained gravel containing approximately 20% oversize.

The deposit can be developed using a D8 Cat with a ripper and is readily accessible. This is a good source of embankment material and is a prime candidate for a crushing operation. The site has a probably volume of 8,500 m^3 of material. Processing could produce approximately 3,000 m^3 of select grade.

3.1.6 Site 3 (Fig. 8)

This was a small talus remnant approximately 30 m x 30 m that is adjacent to site 2. The site is poorly drained, severely scarred and has been depleted. The small amount of material remaining should be used for immediate restoration.

3.1.7 Site 6 (Fig. 9)

This area is adjacent to and east of the sewage lagoon. Bedrock is very near the surface but there should be sufficient material available for restoration.

3.1.8 Site 15 (Fig. 10)

This source is located east of site 6 and contains material that is 70% coarse to medium grained, poorly sorted sand and 30% coarse gravel. A marine clay layer was encountered that created drainage problems. The area has provided embankment material in the past however, the site is now depleted. Any remaining material should be used for restoration.

3.2 Potential Sources

These sources are granular deposits that contain quantities of good quality material sufficient to warrant development. In all cases, access will have to be constructed prior to development.

3.2.1 Site 2 (Fig. 11 - 13)

Site 2 is located beneath the "Kingnait" Foothills, just south of Site 4 and is the largest of available sources. The deposit consists of accumulated "colluvium" from the surrounding terrain. Talus slopes merge and form an alluvial fan that is elevated above the valley floor. Flow channels from the surrounding foothills cut into this elevated plane in a northeast - southwest direction. One such drainage channel separates the deposit into two separate sections that are referred to as 2A(west) and 2B(east). Both areas are similar in texture and composition; however, 2A contains a greater volume of material.

Test pits indicate that this deposit consists of poorly graded, well drained, subrounded, emdium to coarse, clean sand with less than 2% "fines". Note CAP-04-FC in Appendix A (Fig. 14) and photo's #31 - #40 in Appendix B. The material of 2B is slightly coarser but is not as well drained. In all, sixteen test holes were dug to an average depth of 1.0 meters; a maximum depth of 2.2 meters was achieved through the use of a backhoe. On average, permafrost was encountered at a depth of 1.0 meters but this varied considerably with each test hole.

As mentioned, a drainage channel separates Site 2 into two separate sections. The western section, 2A, is approximately 12,000 square meters with an estimated volume of 18,000 cubic meters. There is little or no organic mat over 2A.

The eastern section, 2B, has a thicker organic cover and is smaller in size, approximately 10,000 square meters. The material is slightly coarser than 2A with an estimated volume of 15,000 cubic meters. The average test hole depth is shallower than at 2A and drainage channels are more numerous.

This site is regarded as the prime source of future embankment and subbase material for use by the community. The entire area is approximately 22,000 square meters with an estimated volume of 33,000 cubic meters of poorly graded sand. Processing will be required to produce select material (11,000 m^3 could be screened).

3.2.2 Site 10 (Fig. 15)

This is a large potential source located on the western side of the island, south of the present sewage lagoon and directly beneath the Kingnait Hills. A ridge separates the all season access road to the sewage lagoon and the site.

The site is in a small valley that consists of a series of storm beaches and colluvium from the adjoining talus slopes of the Kingnait Hills. The rock is deeply weathered and remains 'in situ'. The valley acts as a modern spillway for the present drainage system that has brought down coarse gravels and sands from the surrounding hills. A small creek still flows through the valley. Sample CAP-06-FC shows the material to be a coarse, well graded gravel. It is estimated that 8000 cubic meters of material can be recovered. Screening the material could provide upwards of 5,000 m^3 of select grade.

The site can be accessed in three ways. An ice road can be constructed around the peninsula, a land route can be attempted over the western end of the ridge, or an access road can be constructed from Site 2. Regardless, accessing the site will be difficult and expensive.

3.2.3 Site 4 (Fig. 17)

This abandoned borrow pit is discussed here because it provides the easiest means of access to the largest potential source in the area (Site 2). It also is an excellent area for stockpiling material.

The site is 45m x 90m and is bounded on the north by Site 15, on the east and west by bedrock outcrops and is separated from Site 2 on the south by a 2m high rock ridge. An all season road passes through the site, ending at the ridge. There are approximately 1,000m^3 of coarse sand remaining in the area. This sand could be used as embankment material to construct a ramp over the ridge and into Site 2.

3.2.4 Tidal Flats (Fig. 18)

The tidal range at Cape Dorset is approximately 9.70 meters. At low tide a large expanse of silty material, 150.0 x 35.0 meters, is exposed. It is completely covered at high tide. The area was sampled in 1988 by DPW, in conjunction with pre-engineering for a proposed docking facility.

Test results indicate that the exposed tidal flat varies considerably in texture and composition. Generally, the material consists of 30% gravel, 55% sand and 15% 'fines'. The material is extremely wet and would have to be stockpiled and thoroughly drained before use in any major construction project. Assuming that the 'fines' content is 15% or higher throughout the site, approximately 4,000 cubic meters of material could be extracted and used as 'blend' material for a crushing project.

3.2.5 Mallik Island

This island lies to the west of Cape Dorset and is separated from Cape Dorset Island by as little as 500m in some places. The island is joined at low tide by a 2.5m wide "causeway" that is dissected by numerous swift flowing tidal runs. (photos 58 - 59). At mid-tide, this natural structure is inundated.

Mallik Island consists of a large glacial moraine that forms a central plateau (photo 55). The terrain alternates between wet, low lying, linear, sandy, post glacial spillways of the moraine and dry, shallow, sloping, sandy gravels of the plateau. Materials on the sandy plain consists of 70% clean, poorly graded sand, 20% weathered gneiss (3" minus), and 10% oversize. The material in the drainage areas consists of angular, well graded, poorly drained, gravels. Permafrost was encountered at a depth of 1.0 meters on the plateau and 0.6 meters in the spillways. There is estimated to be more than 10,000 cubic meters of general fill and embankment material available from this source; however, it would not be cost effective to develop this source due to the difficulties in accessing this site.

3.3 Quarry Sites

As indicated previously, Cape Dorset is situated in two valleys, surrounded by very rough, mountainous terrain and the ocean. It is inevitable that the community will eventually be forced to establish quarry and crushing operations to meet the need for granular materials. The following sites were found to be the most appropriate for use as quarries.

3.3.1 Site Q_1

This site is located on the south side of the old airport along the access road to Ice Lake and Site B (Photo 2). Sample CAP-05-FC was taken from this ridge to ascertain the composition and texture of the rock. The site has an adequate working face and Site B could supply a 'blend' material. However, the proximity of Q_1 to the residential subdivision being constructed on the old airstrip tends to limit the site's usefulness.

3.3.2 Site Q_2

This site is located on the south side of Site 6, which is a depleted pit. The site meets all the criteria for a quarry operation and has a good access road from the west.

M.A.C.A. indicates that the hamlet is expanding to the west as is evident by the construction of the new subdivision. Land use may be a problem, however, the rock face does continue to the west along the length of Site 6 and the western end of Q_2 may be sufficiently removed from future development to allow for a quarry operation.

3.3.3 Site Q_3

The area is located to the north of and adjacent to Site 14 (Fig. 7). This site is a prime location for a quarry operation as it meets all the necessary criteria. The site actually contains numerous rock outcrops that would be suitable for development. A 'blend' material would have to be hauled to the site.

This site is still the best source of 'pitrun' material for use in a crushing operation and has the largest potential quarry 'face' of the three sites. The longer haul distance will make material from this source somewhat more expensive than material from Q_1 or Q_2.

3.3.4 Blend Sources

Given the type of rock and granular material available in Cape Dorset, a material with a high percentage of fines must be mixed with the crushed rock to produce a 'select' grade of material.

The material from the tidal flats will be most appropriate assuming it is properly stockpiled and drained before use. 'Blend' material can also be taken from the west side of Site 2.

4. SITE INFORMATION SUMMARY

The following table is an inventory of all existing and potential granular resources in the vicinity of Cape Dorset. Associated with each site is the U.S.C., distribution, volume, grade, and processing required. Samples were taken when and where possible; test results are available for viewing in Appendix 1.

4.1 TABLE 1: GRANULAR INVENTORY, CAPE DORSET 1989

SITE	USC	DESCRIPTION	VOLUME (m3)	GRADE	PROCESSING
1	---	Difficult access/low volume	---	---	Rejected
5	---	Zoning restriction	---	---	N/A
9	---	Tank Farm	---	---	N/A
12	---	Subdivision	---	---	N/A
3	---	Depleted	---	---	Restore
6	---	Depleted	---	---	Restore
7	---	Depleted	---	---	Restore
8	---	Solid waste site	---	---	Restore
15	---	Depleted	---	---	Restore
4	---	Depleted - Site 2 access	---	---	Restore
FBS	GP-wet	Poorly graded coarse gravels	6,500 proven	Embankment subbase	Pitrun/stockpile
B	GW-wet	Fine sands & gravels	2,000 probable	Base surface	Pitrun
A	GP-SP-dry	Poorly graded sandy gravels	15,000 probable	All	Pitrun/screen/crush
14	GP-SP-dry	Poorly graded sand & gravel	9,000+ probable	All	Pitrun/screen/crush
13	GP-SP-dry	Poorly graded sand & gravel	8,500 probable	All	Pitrun/screen/crush
2A	SP-dry	Poorly graded very coarse sand - some gravel	18,000 proven	Embankment Subbase blend	Pitrun/screen
2B	SP-GP-dry	Poorly graded very coarse sand - some gravel	15,000 proven	Embankment Subbase	Pitrun/screen
10	GW-wet	Well-graded fine to coarse gravels	8,000 probable	Subbase/base surfacing	Pitrun/screen
Tidal Flats	SM-MH-Wet	Silty sands/clayey sands	4,000 proven	"blend"	Stockpile and drain
Q1	N/A	Gneiss bedrock outcrops	10000	All	Quarry and crush
Q2	N/A	Gneiss bedrock outcrops	10000	All	Quarry and crush
Q3	N/A	Gneiss bedrock outcrops	Unlimited	All	Quarry and crush

5. GRANULAR NEEDS ASSESSMENT

As previously indicated, the granular requirements for Cape Dorset have been developed from each G.N.W.T. Department's 5 year capital plan and 20 year capital needs assessment, as well as information from the NWTHC, Federal Agencies and the private sector. The various projects were analyzed for their granular requirements and this information was used as the basis for establishing a 20 year granular needs projection by the type of materials required.

For the purpose of this report, granular materials have been separated into five major types: embankment, subbase, base, surfacing and concrete aggregate. However, base, surfacing, and concrete aggregate are often referred to collectively as "select grades". The reason for this is that embankment and subbase materials are often used directly from a source as "pitrun" while select grades are obtained through the processing of the material by washing, screening or crushing.

The analysis shows that Cape Dorset requires approximately 96,000 m^3 of granular materials for fiscal years 1990/91 through 1998/99. This information is shown in detail on the following pages, as is a summary of the projected requirements for fiscal years 1998/99 through 2000/2009. Detailed information for this period is available from office files. If required, however, the data should be considered speculative at best.

Table 2 represents the granular material breakdown of capital projects that was used to develop this section of the report. Various government departments were contacted to assess the granular materials required for specific capital projects. The granular material breakdown associated with each project was then tabulated. This table was then used to derive the granular needs assessment tables for individual fiscal years based on the proposed capital projects for that year.

5.1 TABLE 2: CAPITAL PROJECTS

Granular Material Breakdown
(in cubic metres)

Description	Embankment	Sub Base	Base	Surface Material	Concrete Aggregate	Riprap
Warehouse		900	450	300		
Group Home		500	175	300		
Solid Waste Facility	9000		3750	2250		
Solid Waste Facility/ Access (1 km.)	13900		1300	200		10
Solid Waste Improvements	6000		2500	1500		
Water Supply Improvements	6000		2500	1500		
Water Supply - Reservoir	30000	10000	10000			
WS-Facility Access	10000		5000	3000		
R/S/L - Lot Development (1 lot)		180	80	100		
R/S/L - New Road (1 km.)	4900		1300	1200		100
R/S/L - Resurfacing (1 km.)	600		200	1200		50
R/S/L - Road Upgrade (1 km.)				1000		
Staff Housing		400	175	200		
Single Unit (Satellite base)		300	100	200		
Duplex		500	175	200		
4-plex		675	225	200		

Description	Embankment	Sub Base	Base	Surface Material	Concrete Aggregate	Riprap
In town gas station		600	200	200	50	
Garage x 2 Bay x 3 Bay		600	200	200	50	
Firehall		350	100	200	50	
New School		400	100	200	200	
School Addition		200	50	100	100	
Museum - Low$		200	50	100	100	
Small Community Hall (250m²)		300	100	200		
Medium Community Hall (390m²)		500	175	200		
Large Community Hall (440m²)		675	225	200		
Hamlet Office		500	175	200		
Small Gym (250m²)		300	100	200		
Medium Gym (390m²)		500	175	200		
Large Gym (440m²)		675	225	200		
Medium Arena		675	225	200		
Trade Shop		300	100	200		
Small Arena		500	175	200	100	
Skating Rink		500	175	200	100	
Airstrip - New 60 x 900	81000		16200	5400		
Airstrip - Upgrade Maint/year				1700		
Airstrip - Resurface 60 x 900				5400		

Description	Embankment	Sub Base	Base	Surface Material	Concrete Aggregate	Riprap
Tankfarm - new facility	3000		2000	3000		
Tankfarm - upgrade	300	300	300			
Tankfarm - facility & access	6000		2000	6000		
Increase capacities	6000		2000	6000		
Shoreline Protection				600		4000
Sewage Lagoon	100,000m^3					
Office - small	Duplex	500	175	200	(visitor centre)	
Office - large	4-plex	675	225	200		
Arena - large		850	275	200		
Park Development (Low$)	600		200	1200		50
(High$)	4900		1300	1200		100

5.2 GRANULAR NEEDS ASSESSMENT TABLES

TABLE 3:
GRANULAR NEEDS ASSESSMENT
CAPE DORSET CAPITAL PROJECTS ESTIMATED MATERIAL REQUIREMENTS
SUMMARY
(Volumes in cubic metres)

FISCAL YEAR	EMBANKMENT	SUBBASE	BASE	SURFACING MATERIAL	CONCRETE AGG.	RIPRAP	ANNUAL TOTAL
1990 - 1991	8,000	3,835	4,710	3,040	300	20	19,905
1991 - 1992	1,300	3,325	725	100	250		5,700
1992 - 1993	5,070	5,550	4,575	4,460	100	20	19,775
1993 - 1994	6,000	1,640	2,980	1,900	50		12,570
1994 - 1995	735	2,500	1,195	1,380	200	15	6,025
1995 - 1999	9,125	17,070	8,870	14,800	50	55	49,970
1999 - 2009	5,880	20,215	9,875	10,890		60	46,920
20-YEAR TOTAL	36,110	54,135	32,930	36,570	950	170	160,865

TABLE 4:
GRANULAR NEEDS ASSESSMENT
CAPE DORSET CAPITAL PROJECTS ESTIMATED MATERIAL REQUIREMENTS
1990 - 1991
(Volumes in cubic metres)

PROJECT	EMBANKMENT	SUBBASE	BASE	SURFACING MATERIAL	CONCRETE AGG.	RIPRAP
GOVERNMENT SERVICES						
Replace Plastic Lines	1,000		500			
CULTURE & COMMUNICATIONS						
Community Museum		675	225	50		
Museum Planning		400	175	50		
MACA						
Residential Area 3	1,000	2,160	1,220	1,440		20
Solid Waste Site	6,000		2,500	1,500		
EDUCATION						
School - new		400	100		200	
School - renovate		200	50		100	
TOTAL REQUIREMENTS	**8,000**	**3,835**	**4,710**	**3,040**	**300**	**20**

TABLE 5:
GRANULAR NEEDS ASSESSMENT
CAPE DORSET CAPITAL PROJECTS ESTIMATED MATERIAL REQUIREMENTS
1991 - 1992
(Volumes in cubic metres)

PROJECT	EMBANKMENT	SUBBASE	BASE	SURFACING MATERIAL	CONCRETE AGG.	RIPRAP
ECONOMIC DEVELOPMENT						
Mallik Island Park	800	1,600				
CULTURE & COMMUNICATIONS						
Community Museum		675	225	50		
MACA						
Firehall		350	100	50	50	
Pipeline/Storage	500	300	300			
EDUCATION						
School - new		400	100		200	
TOTAL REQUIREMENTS	**1,300**	**3,325**	**725**	**100**	**250**	

TABLE 6:
GRANULAR NEEDS ASSESSMENT
CAPE DORSET CAPITAL PROJECTS ESTIMATED MATERIAL REQUIREMENTS
1992 - 1993
(Volumes in cubic metres)

PROJECT	EMBANKMENT	SUBBASE	BASE	SURFACING MATERIAL	CONCRETE AGG.	RIPRAP
GOVERNMENT SERVICES						
Increase Fuel Capacities	3,500		2,000	1,500		
TRANSPORTATION						
Terminal Expansion		600	200	50	50	
MACA						
Maintenance Garage 3-Bay		350	100	50	50	
Industrial Land Development	1,570	3,700	2,000	2,360		20
EDUCATION						
School - renovate		400	100	200		
Group Home		500	175	300		
TOTAL REQUIREMENTS	**5,070**	**5,550**	**4,575**	**4,460**	**100**	**20**

TABLE 7:
GRANULAR NEEDS ASSESSMENT
CAPE DORSET CAPITAL PROJECTS ESTIMATED MATERIAL REQUIREMENTS
1993 - 1994
(Volumes in cubic metres)

PROJECT	EMBANKMENT	SUBBASE	BASE	SURFACING MATERIAL	CONCRETE AGG.	RIPRAP
MACA						
Industrial Land Development		180	80	100		
Parking Garage 2-Bay		600	200	50	50	
Residential AREA 3		360	200	200		
Sewage Disposal	6,000		2,500	1,500		
ECONOMIC DEVELOPMENT & TOURISM						
Tourist Office		500		50		
TOTAL REQUIREMENTS	**6,000**	**1,640**	**2,980**	**1,900**	**50**	

TABLE 8:
GRANULAR NEEDS ASSESSMENT
CAPE DORSET CAPITAL PROJECTS ESTIMATED MATERIAL REQUIREMENTS
1994 - 1995
(Volumes in cubic metres)

PROJECT	EMBANKMENT	SUBBASE	BASE	SURFACING MATERIAL	CONCRETE AGG.	RIPRAP
MACA						
Industrial Land Development	735	1,800	995	1,180		15
Trade Shop		300	100	200		
EDUCATION						
School - new		400	100		200	
TOTAL REQUIREMENTS	**735**	**2,500**	**1,195**	**1,380**	**200**	**15**

TABLE 9:
GRANULAR NEEDS ASSESSMENT
CAPE DORSET CAPITAL PROJECTS ESTIMATED MATERIAL REQUIREMENTS
1995 - 1996
(Volumes in cubic metres)

PROJECT	EMBANKMENT	SUBBASE	BASE	SURFACING MATERIAL	CONCRETE AGG.	RIPRAP
MACA						
Residential Commerical		3,600	1,600	2,000		
SOCIAL SERVICES						
Group Home		500	175	300		
HOUSING						
Replacement (7)		2,100	700	1,400		
TOTAL REQUIREMENTS		**6,200**	**2,475**	**3,700**		

TABLE 10:
GRANULAR NEEDS ASSESSMENT
CAPE DORSET CAPITAL PROJECTS ESTIMATED MATERIAL REQUIREMENTS
1996 - 1997
(Volumes in cubic metres)

PROJECT	EMBANKMENT	SUBBASE	BASE	SURFACING MATERIAL	CONCRETE AGG.	RIPRAP
MACA						
Residential Commercial		2,700	1,200	1,500		
Maintenance Garage 2-Bay		1,200	400	400		
HOUSING						
Replacement (5)		1,500	500	1,000		
TOTAL REQUIREMENTS		**5,400**	**2,100**	**2,900**		

TABLE 11:
GRANULAR NEEDS ASSESSMENT
CAPE DORSET CAPITAL PROJECTS ESTIMATED MATERIAL REQUIREMENTS
1997 - 1998
(Volumes in cubic metres)

PROJECT	EMBANKMENT	SUBBASE	BASE	SURFACING MATERIAL	CONCRETE AGG.	RIPRAP
MACA Residential Commercial		2,700	1,200	1,500		
TOTAL REQUIREMENTS		**2,700**	**1,200**	**1,500**		

6. COST ESTIMATES

6.1 Crushing Cost Estimate - $34/m3

The following preliminary cost estimate is related to the production of granular materials from bedrock sources in Cape Dorset. The estimate involves the transportation of required equipment, site development, drilling, blasting, crushing, and blending, to generate approximately 20,000 m3 of select gravels. (estimates are from Canadrill).

6.1.1 Mobilization

Equipment needed: D6 Cat, 966 Loader, Primary and Secondary Crusher
Approximate weight: 160 tonnes @ $300/tonne

$48,000.00**

**The barge rates that apply will be substantially greater if the equipment that is transported requires larger capacity cranes than those normally supplied with the sealift vessel.

It should be mentioned that the above cost is based on the mobilization of the "crusher", via "sealift", from Montreal to Cape Dorset. If a "crusher" becomes available from another Baffin community due to the termination of an on-going "crushing project", then the mobilization costs would be reduced.

6.1.2 Site Development and Restoration

This will include the construction and/or upgrading of all access roads to the preferred site and the grading of the working area for site management. Culverts and ditches may be necessary for drainage. The restoration would involve site cleanup and landscaping.

Access roads, approximately 300 meters, would require 2,100 m^3 of granular material (7 m^3/m of road).

2,100 m^3 @ \$5/m^3 to place	\$10,500.00

Working area and stockpile pad would require approximately 12 hours of "Cat" time.

12 hrs. @ \$140/hr.	\$1,680.00
TOTAL	\$12,180.00

If Q_3 is chosen for a quarry operation, access roads are already in place and the total cost will be reduced by approximately \$10,000.00.

6.1.3 Drilling and Blasting

Drilling equipment is available locally. Canadrill quotes that for a quantity of 16,000 m^3 @ \$14.75/m^3

\$236,000.00

6.1.4 Crushing and Blending Costs

Hauling and stockpiling of blend material

4000m^3 @ \$10/m^3	\$40,000.00

Using daily production of 500 m^3/day and a running cost of \$7,300/day**, 20,000 m^3/day @ \$7,300/day (\$14.60/m^3)

	\$292,000.00
TOTAL	\$332,000.00

**Based on regional rates for labour, rental and fuel

6.1.5 Manpower and Accommodations

For 3 people: foreman, crusher operator, mechanic

mobilization	\$9,000.00
accommodations for 50 days @ \$150/day/man	\$22,500.00
TOTAL	\$31,500.00

6.1.6 Engineering Supervision Costs

For 2 people		
Yellowknife - Cape Dorset		$6,000.00
Accommodations for		
50 days @ $150/day/man		$15,000.00
Truck rental 50 days @ $75/day		$3,750.00
	TOTAL	$24,750.00

6.1.7 Estimate Summary

Mobilization	$48,000.00
Site Development & Restoration	$12,180.00
Drilling & Blasting	$236,000.00
Crush & Blend	$332,000.00
Manpower & Accommodation	$31,500.00
Engineering	$24,750.00
TOTAL COST	**$684,430.00**

In summary, it will cost approximately $685,000 to produce 20,000 m^3 of granular material or approximately $34/$m^3$., from bedrock sources in Cape Dorset. The total produced consists of 16,000 m^3 of blasted and crushed bedrock and 4,000 m^3 of "blend". This is a Class D estimate.

6.2 Screening Cost Estimate - $20/$m^3$

The following preliminary cost estimate is related to the production of select gravel by screening existing granular sources in Cape Dorset. This estimate involves the purchase and transportation of a portable screening plant, rental of other required equipment, site development, screening, and stockpiling to generate approximately 5,000 m^3 of select gravel.

6.2.1 Mobilization

Equipment to purchase: Assinck Bros. Model CS-4-8 Screening Plant

Purchase price at Montreal		$40,000.00
Approximate weight: 7 tonnes @ $300/tonne		$2,100.00
	TOTAL	$42,100.00

6.2.2 Site Development and Restoration

Access is already established to an existing pit. Working area and construction of a stockpile pad would require 8 hours of "Cat" time. The restoration would involve site cleanup and landscaping.

8 hrs x $140/hr	$1,120.00

6.2.3 Screening Costs

Cat D6 plus operator	120 hrs @ $140/hr	$16,800.00
Loader plus operator	120 hrs @ $140/hr	$16,800.00
Truck plus operator	120 hrs @ $75/hr	$9,000.00
Screener operator	120 hrs @ $18.50/hr	$2,220.00
	TOTAL	$44,820.00

6.2.4 Manpower and Accommodations

Mobilization for screener operator	$3,000.00
Accommodations 10 days @ $150/day	$1,500.00
TOTAL	$4,500.00

6.2.5 Engineering Supervision Costs

Yellowknife - Cape Dorset	$3,000.00
Accommodations 10 days @ $150/day	$1,500.00
Truck rental 10 days @ $75/day	$ 750.00
TOTAL	$5,250.00

6.2.6 Estimate Summary

Mobilization	$42,100.00
Site Development & Restoration	$ 1,120.00
Screening	$44,820.00
Manpower & Accommodation	$ 4,500.00
Engineering	$ 5,250.00
TOTAL COST	**$97,790.00**

In summary, it will cost approximately $97,800 to produce 5,000 m^3 of select granular material or approximately $20/$m^3$ by screening material from existing sources in Cape Dorset. To produce 5,000 m^3, it is anticipated that 10,000 m^3 to 15,000 m^3 of the existing granular source would have to be processed. This is a Class D estimate.

6.3 Site 2 Access

This access route is presented on the assumption that the granular resource is excavated during summer using conventional equipment. In addition, contractors should familiarize themselves with the "Environmental Guidelines - Pits and Quarries", and "Access Roads and Trails", published by Indian and Northern Affairs Canada.

The approach to Site 2 is possible from Site 4 (note Site Location Map). A major consideration is the need to construct a ramp over a two meter ridge that is the southeast boundary of Site 2B. The ridge separates the elevated plane of Site 2 with the flat lying bedrock of the depleted Site 4. Once the ramp has been constructed, access through Site 2 should continue in a S.E. direction and terminate 30 meters before the water pipeline from Tee Lake.

Construction of the access road should not entail cutting deeper than the base of the granular source. Drainage and erosion control must be considered in all phases of planning and development. Ideally, the natural north-south surface run-off would be utilized to drain the borrow area in a controlled manner to the lower level.

The ramp should be constructed from the remaining material in Site 4. A "dozer" is needed to "push" the remaining material into place; however, construction costs should be minimal.

Cat D6 plus operator 8 hrs @ $140/hr	$1,120.00
Loader plus operator 4 hrs @ $140/hr	$ 560.00
Truck plus operator 4 hrs @ $175/hr	$ 700.00
TOTAL	$2,380.00

7. GRANULAR RESOURCE EVALUATION

7.1 Supply and Demand

As shown in Table 12, the total amount of granular material from all existing sources is approximately 41,000 m^3, of which 26,500 m^3 is considered embankment and subbase and 14,600 m^3 select. Select grades will have to be obtained from "screening" of the unprocessed material at the specific sites shown in Table 12.

TABLE 12

AVAILABLE MATERIAL / EXISTING SOURCES

Existing Source	Grades		Totals
	Embankment/Subbase	Select (Processed)	
Site A	10,000	5,000	15,000
Site B.		2,100	2,100
Site 13	5,500	3,000	8,500
M.O.T.	6,000	3,000	9,000
F.B.S.	5,000	1,500	6,500
Total cu. m.	26,500	14,600	41,100

Of a total ten year forecast demand of approximately 96,345 cubic metres of granular material between 1990 - 1999 there is available approximately 41,000 cubic metres of varying grades of material within the vicinity of Cape Dorset for use in local capital projects.

Table 13 is a summary of the material requirements (from needs assessment tables) for all proposed capital projects from 1990 through 1999.

TABLE 13

MATERIAL REQUIREMENTS (m^3)

YEAR	EMBANKMENT/SUBBASE		SELECT	
	Increment	Cummulative	Increment	Cummulative
1990/91	11,835	11,835	8,070	8,070
1991/92	4,625	16,460	1,075	9,145
1992/93	10,620	**27,080**	9,155	**18,300**
1993/94	7,640	34,720	4,930	23,230
1994/95	3,235	37,955	2,790	26,020
1995/99	29,195	67,150	19,220	45,240

An examination of supply and demand will indicate that during the 1992/93 fiscal year, there will be a deficit of granular material from existing sources.

92/93 Embankment/Subbase (m^3)	92/93 Select Grades (m^3)
26,500 (existing) - 27,080 (required)	14,600 (existing) - 18,300 (required)
= -580	= -3,700

In the years 1993/94 and 1994/95, the requirements have been assessed as follows (Table 13):

Embankment	Select
37,955 - 27,080 = 10,875 or 11,000 m^3	26,020 - 18,300 = 9,720 or 10,000 m^3

This requirement can certainly be met from potential sites 2A & B and 10 that contain approximately 41,000 m^3 of granular material from which the required select material can be screened. These potential sources should be adequate for several years beyond 1994/95. Furthermore, as indicated in Section 6 "Cost Estimates", granular material from these sources can be obtained at only slightly over half the cost of obtaining it from a quarry/crushing operation.

7.2 Summary

Cape Dorset has sufficient granular materials to satisfy its short term needs through the 91/92 fiscal year. The community is also over 95% sufficient for its 92/93 needs for embankment/subbase and 80% sufficient for its 92/93 select needs. As the capital planning figures are unlikely to be fully realized, the community, in fact, can consider available material sufficient to 92/93.

Development of identified potential sources will be required for the requirements of subsequent years. Economic considerations indicate that these sources should be Sites 2A & B and 10.

8. RECOMMENDATIONS

It is recommended that, as soon as possible, the Municipality of Cape Dorset implement a Granular Resource Development and Management Plan based on this report and modified as is appropriate by legitimate local concerns that are properly beyond the scope of this report.

The specific technical recommendations of this report are:

1. Continue to use the existing sources until depletion which is expected to be in 1992/93.

2. Develop Site 2A & B in 1993.

3. Develop Site 10 subsequent to Site 2A & B when observation and records of usage indicate Site 2A & B is nearing depletion, i.e. has 1 to 2 years requirement remaining. Note this site will probably require access by ice road.

4. Develop quarry sites subsequently.

5. Since the requirements beyond 1994/95 are uncertain, review and reconsider source potential and requirements in 1993/94.

REFERENCES

Annual Book of Standards, American Society for Testing and Materials, (ASTM), various rock and foundation tests and standards.

Department of Indian and Northern Affairs, 1988, Plan for the Reservation and Development of Granular Materials in the vicinity of Inuvik, N.W.T., CE00992T. Prepared by Hardy BBT Limited.

Department of Indian and Northern Affairs, 1982, Environmental Guidelines Pits and Quarries.

Department of Energy, Mines and Resources, 1970, Geology and Economic Minerals of Canada, Ottawa, Canada.

Department of Public Works and Highways, 1986, Cape Dorset Granular Study, Yellowknife.

Department of Public Works, G.N.W.T., Soil Classification System, Yellowknife.

Embleton and King, 1971, Glacial and Periglacial Geomorphology, London.

Hardy BBT Limited, 1989, Deposit 467 (Willow River), Aklavik, N.W.T.

Krynine and Judd, 1957, Principles of Engineering Geology and Geotechnics, McGraw-Hill Civil Engineering Series, Toronto.

Nasa, Jet Propulsion Laboratory, 1986, Imaging Radar-C Science Plan, Pasadena, California.

GLOSSARY OF TERMS

Active layer:	the layer of ground in permafrost which thaws each summer and refreezes each fall.
Alluvial fan:	fan shaped mass of alluvial deposits shed by fluvial activity from mountain streams.
AASHTO:	American Association of State Highways and Transportation Officials, used almost exclusively by the several state Departments of Transportaion and the Federal Highway Administration in earthwork specifications for transportation lines.
Colluvial sediments:	sediments transported and deposited through the process of mass wasting (i.e. by gravity).
Continuous permafrost zone:	an area underlain by permanently frozen subsoil.
Deltaic deposits:	deposition of sediments by rivers in low energy environments, characterized by well-developed cross-bedding and sands, silts and clays.
Environment of deposition:	the lithology, composition, and diversity of all granular deposits are directly related to part and modern depositional and erosional environments.
Eskers:	a long narrow, winding ridge composed of stratified accumulations of sand and gravel produced from subglacial streams; eskers are aligned with the flow of retreating glaciers or ice sheets.

Frost Susceptible Soil:	soil in which significant ice-segregation will occur, resulting in frost heave, or heaving pressures, when requisite and freezing conditions exist.
Frost wedging:	water expanding as it freezes widens crevices in well-bedded or well-jointed rock and shatters it.
Ground-truth reconnaissance:	the physical act of acquiring data on the ground to prove geological assumptions.
In-situ:	the natural undisturbed soil or strata of weathered material in place.
Kame Terrace:	a steep-side, constructional terrace consisting of stratified sand and gravel formed as a glacio-fluvial deposit between a melting glacier or a stagnant ice lobe and a higher valley wall or lateral moraine.
Lacrustine deposits:	silts and clays deposited in lake water and later exposed either by the lowering of the water level or by the elevation of the land.
Mechanical weathering:	relates to the physical breakdown of rocks, at or near the earth's surface, by external processes (such as wind and water).
Outwash Plan:	a broad, gently sloping sheet of outwash deposited by melt water streams flowing in front of or beyond a glacier.
Oversize Material:	this refers to rock particle size as gravel particles larger than 75 mm (3") in diameter are usually considered to be too large to be used for most geotechnical uses.
Periglacial environment:	depositional and erosional environments modified by cold climates (subglacial).

Permafrost:	**the thermal condition in soil or rock where temperatures below 0° C persist over at least two consecutive winters and the intervening summer.**
Permafrost Table:	**the interface between the active layer and permafrost zone.**
Raised beaches:	**beaches formed during times of high water level and then stranded by the lowering of the water level or by the elevation of the land.**
Regolith:	**unconsolidated mantle of weathered rock and soil material on the earth's surface.**
Solifluction:	**in subarctic regions, fine rock fragments when saturated with water, spread slowly down slope and along valley floors.**
Talus slope:	**the accumulation of small fragments (scree) in the millimeter-to-meter range from cliffs or steep walls that maintain a uniform slope (commonly about 30°) as it grows.**
Territory Land Use Regulations:	**provides regulatory control for maintaining sound environmental practice for any land use activity on all lands under Federal control in the territories.**
USC:	**United Soil Classification System, used for foundation engineering such as dams, buildings, road earthwork specifications, and airfield design.**
Varved sediments:	**distinct band representing the annual deposit in sedimentary materials.**

APPENDIX A

Geotechnical Data 1985 - 1989

Laboratory Test Results
Grain Size Curves
Site Plans
Cross-Sections

APPENDIX A

Listing of Test Results and Site Plans

Site	Source Information	
Site A	CAP-01-FC	1989
	CAP-03-FC	1989
	288-1-PD	1986
	288-2-PD	1986
	288-3-PD	1986
	288-4-PD	1986
Site 2	242-01-RSPD	1987
	CAP-04-FC	1989
	245-04-RS	
Site 13 (Site 14)	244-02-RS	1987
Fractured Bedrock Source (FBS)	CAP-02-FC	1989
Site 3	202-01-RF	1985
	202-02-RF	1985
	202-03-RF	1985
Site 5 (proposed park)	204-01-RF	1985
	204-02-RF	1985
Site 10	CAP-06-FC	1989
Tidal Flats	235-01-MB	1988
	235-02-MB	1988
	230-02-MB	1988
Figures 1 - 18	Site Plans and Cross-sections	

SAMPLE DATA SHEET

PROJECT: Cape Dorset Site A		PROJECT NUMBER: 89 9170 803

PART 1 - COMPLETED IN THE FIELD

SAMPLE IDENTIFICATION: CAP-01-FC	METHOD OF SAMPLING: Shovel
LOCATION: Ridge/Beach Area West of Tank Farm Site A-1989	
TEST HOLE NUMBER	DEPTH: 0.8
FIELD DESCRIPTION: Gravel and Sand, dry permafrost at 1.1m	
LAB TESTS REQUIRED: Visual/Wash sieve/Attereerg limits	
SAMPLED BY: FC	DATE D/M/Y: 18/08/89
SAMPLE DISCARDED	RETAINED

PART 2 - COMPLETED IN THE LABORATORY

DATE RECEIVED: Sept./89	RECEIVED BY: A.Harman
REQUESTED COMPLETION DATE D/M/Y	RESULTS SUBMITTED TO

PART 3 - LABORATORY TEST RESULTS AND COMMENTS

- Sand and Gravel, brown, pebbles to 50mm (GP-5P)
- Non Plastic

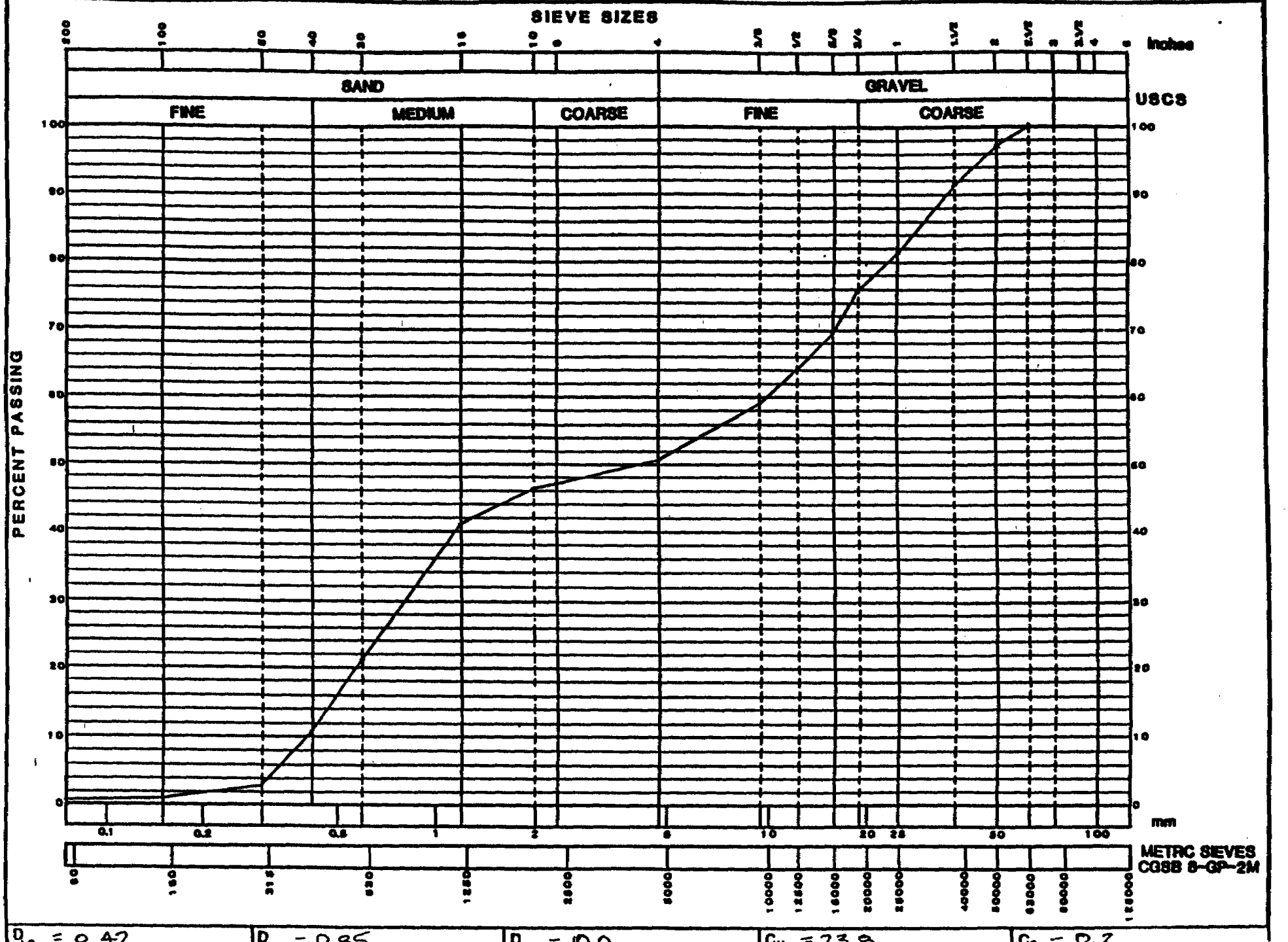
COMPILED BY	DATE D/M/Y
REVIEWED BY	DATE D/M/Y
ATTACHMENTS _____ PAGES	

WWT 260/7088

GRAIN SIZE CURVES

SAMPLE IDENTIFICATION: CAP-01-FC

TESTED BY:



D_{10} = 0.42 | D_{30} = 0.85 | D_{60} = 10.0 | C_u = 23.8 | C_c = 0.7

SAMPLE DATA SHEET

PROJECT		PROJECT NUMBER
Cape Dorset	Site A	89 9170 803

PART 1 - COMPLETED IN THE FIELD

SAMPLE IDENTIFICATION	METHOD OF SAMPLING	
CAP-03-FC		
LOCATION: Beach Ridge Site A - 1989		
TEST HOLE NUMBER	DEPTH: 1.2 m	
FIELD DESCRIPTION: Large % oversize, wet		
LAB TESTS REQUIRED: Visual, wash sieve		
SAMPLED BY: FC	DATE D/M/Y: 16/08/89	SAMPLE DISCARDED / RETAINED

PART 2 - COMPLETED IN THE LABORATORY

DATE RECEIVED	RECEIVED BY
Sept./89	A.Harman
REQUESTED COMPLETION DATE D/M/Y	RESULTS SUBMITTED TO

PART 3 - LABORATORY TEST RESULTS AND COMMENTS

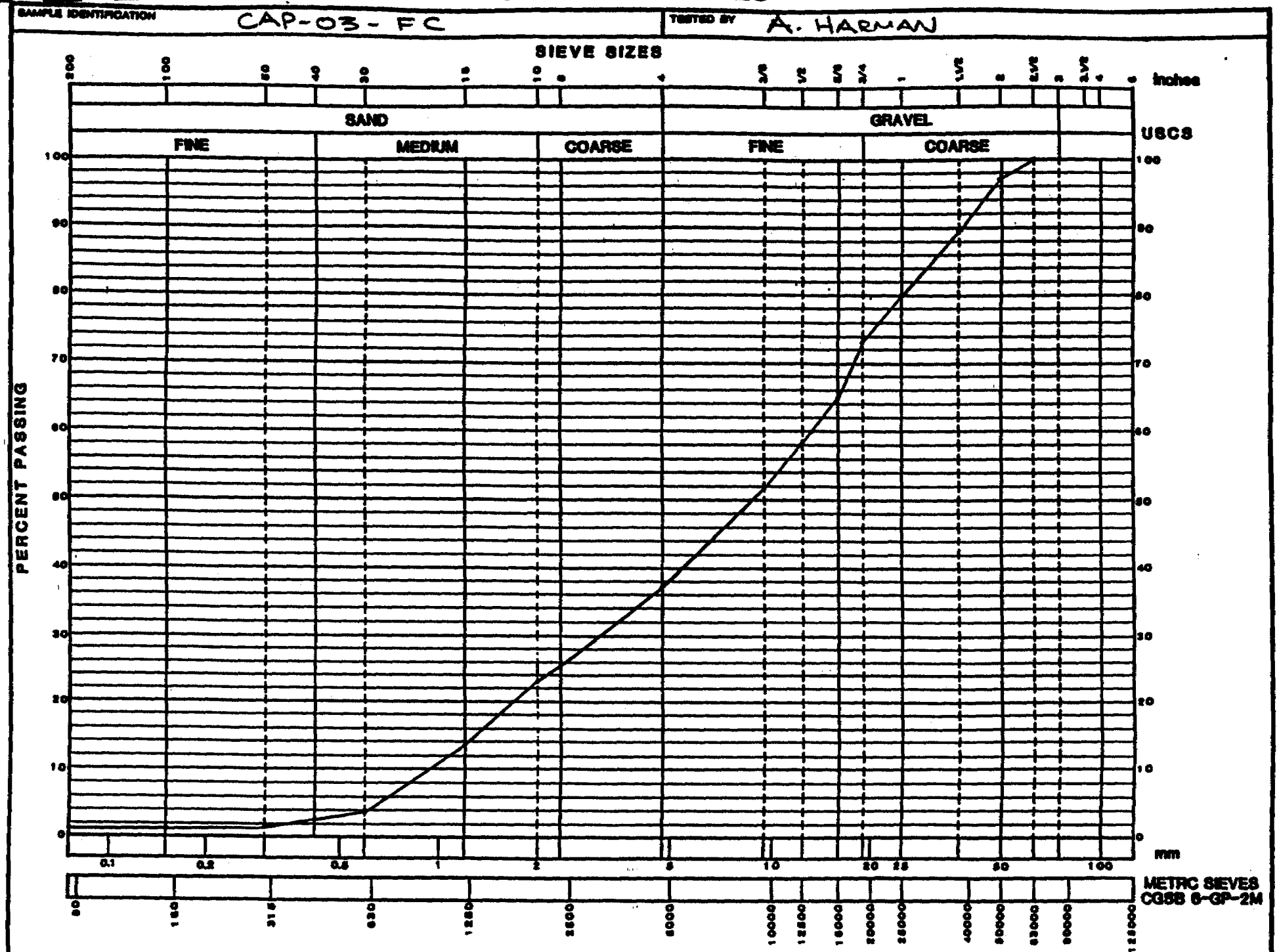
- Gravel, brown, sandy (GP)

COMPILED BY	DATE D/M/Y
REVIEWED BY	DATE D/M/Y

GRAIN SIZE CURVES

SAMPLE IDENTIFICATION: CAP-03-FC

TESTED BY: A. HARMAN



D_{10} = 0.95	D_{30} = 3.0	D_{60} = 13.0	C_u = 13.7	C_c = 0.7

TED-1 01/01 86:U

SAMPLE DATA SHEET

PROJECT	PROJECT NUMBER
Cape Dorset Granular Investigation	86-9120

PART 1 - COMPLETED IN THE FIELD

SAMPLE IDENTIFICATION	METHOD OF SAMPLING	
288-1-PD		
LOCATION: Site A - By Oil Tank Farm		
TEST HOLE NUMBER: A1	DEPTH: 1.3 m	

FIELD DESCRIPTION: Soil hing in crush material. Little sand (20% volume). Rest is gravel and cobbles

LAB TESTS REQUIRED: Wash Sieve Analysis/ Visual Description and Classification

SAMPLED BY	DATE D/M/Y	SAMPLE DISCARDED	RETAINED
Peter Deutch	14/10/86		

PART 2 - COMPLETED IN THE LABORATORY

DATE RECEIVED	RECEIVED BY
26/11/86	G. Aerts
REQUESTED COMPLETION DATE D/M/Y	RESULTS SUBMITTED TO: S. Murray

PART 3 - LABORATORY TEST RESULTS AND COMMENTS

VISUAL DESCRIPTION:

Gravel
Sub-rounded to Sub-angular
Max. size - 100 X 70 X 60
Composition -

Igneous - Granites, Biotite & Mod. Quartsz.
Trace Pyrites

Metamorphic- Gneiss
Micaceous schist

Sed. - Mud stone, chalky calcerous

Fines - Coarse sand

WASHED SIEVE ANALYSIS:

97.8% passing 67 mm Sieve
61.3% passing 25 mm Sieve
51.9% passing 19 mm Sieve
27.0% passing 4.75 mm Sieve
0.8% passing 0.075 mm Sieve

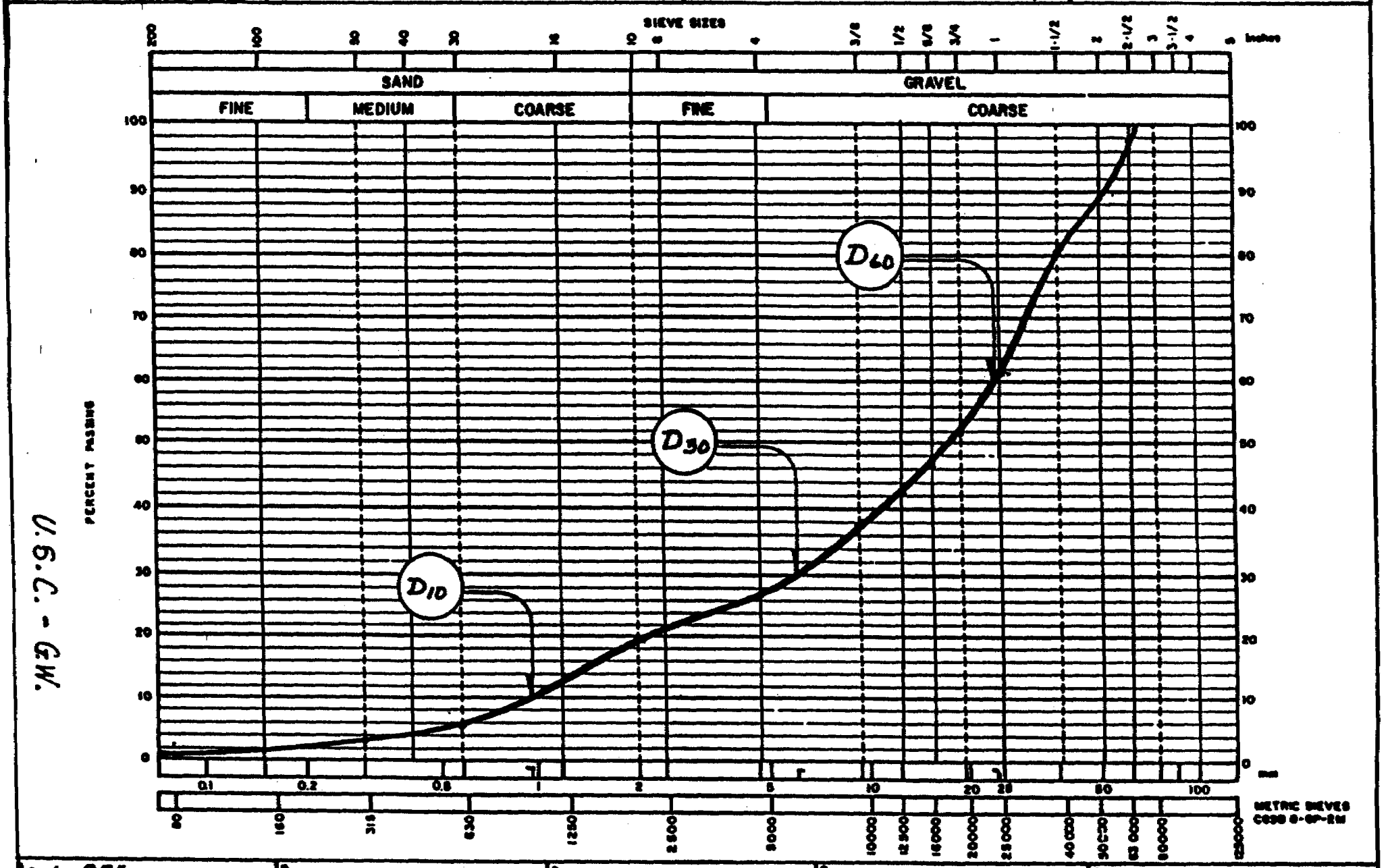
U.S.C. - G.W. well graded gravels, sandy gravels
Curve uniformity = 24.6
Curve coefficient = 1.7

COMPILED BY	DATE D/M/Y	
G. Aerts	3/12/86	
REVIEWED BY	DATE D/M/Y	ATTACHMENTS _____ PAGES

Newfoundland Department of Transportation Public Works

GRAIN SIZE CURVES

SAMPLE IDENTIFICATION: CAPE DORSET 288-1-PD *86-9120 | TESTED BY: G. AERTS 28/11/86



D_{10}	D_{30}	D_{60}	C_u	C_c
0.975	6.25	21	24.6	1.7

WT 1788/0886

SAMPLE DATA SHEET

PROJECT: Cape Dorset Granular Investigation	PROJECT NUMBER: 86-9120

PART 1 - COMPLETED IN THE FIELD

SAMPLE IDENTIFICATION: 288-2-PD	METHOD OF SAMPLING:
LOCATION: Site A - By Oil Tank Farm	
TEST HOLE NUMBER: A2	DEPTH: 1.5 m
FIELD DESCRIPTION: A material that is a 50/50 mix of sand & gravel. This is a sample in the less than 3" range.	
LAB TESTS REQUIRED: Visual/Classification & Description/ Wash Sieve Analysis	
SAMPLED BY: P. Deutsch	DATE D/M/Y: 14/10/86
SAMPLE DISCARDED	RETAINED

PART 2 - COMPLETED IN THE LABORATORY

DATE RECEIVED: 26/11/86	RECEIVED BY: G. Aerts
REQUESTED COMPLETION DATE D/M/Y:	RESULTS SUBMITTED TO: S. Murray

PART 3 - LABORATORY TEST RESULTS AND COMMENTS

VISUAL DESCRIPTION: Sandy Gravel - Sub-rounded to sub-angular
Maximum Size - 80 X 50 X 40 mm
Composition:
Igneous- Granites & Diorite
Metamorphic - Gnesisses
Mica schist
Fines:
Coarse - sub-rounded
Sand - medium to coarse
Trace silts silty clay

WASHED SIEVE ANALYSIS: 96.8% passing 50 mm Sieve
75.5.% passing 25 mm Sieve
65.3% passing 19 mm Sieve
38.4% passing 47.5 mm Sieve
1.0% passing 0.075 mm Sieve

U.S.C. - G.P. - Poorly graded sandy gravel
Curve Uniformity = 22.0
Curve Coefficient = 0.4

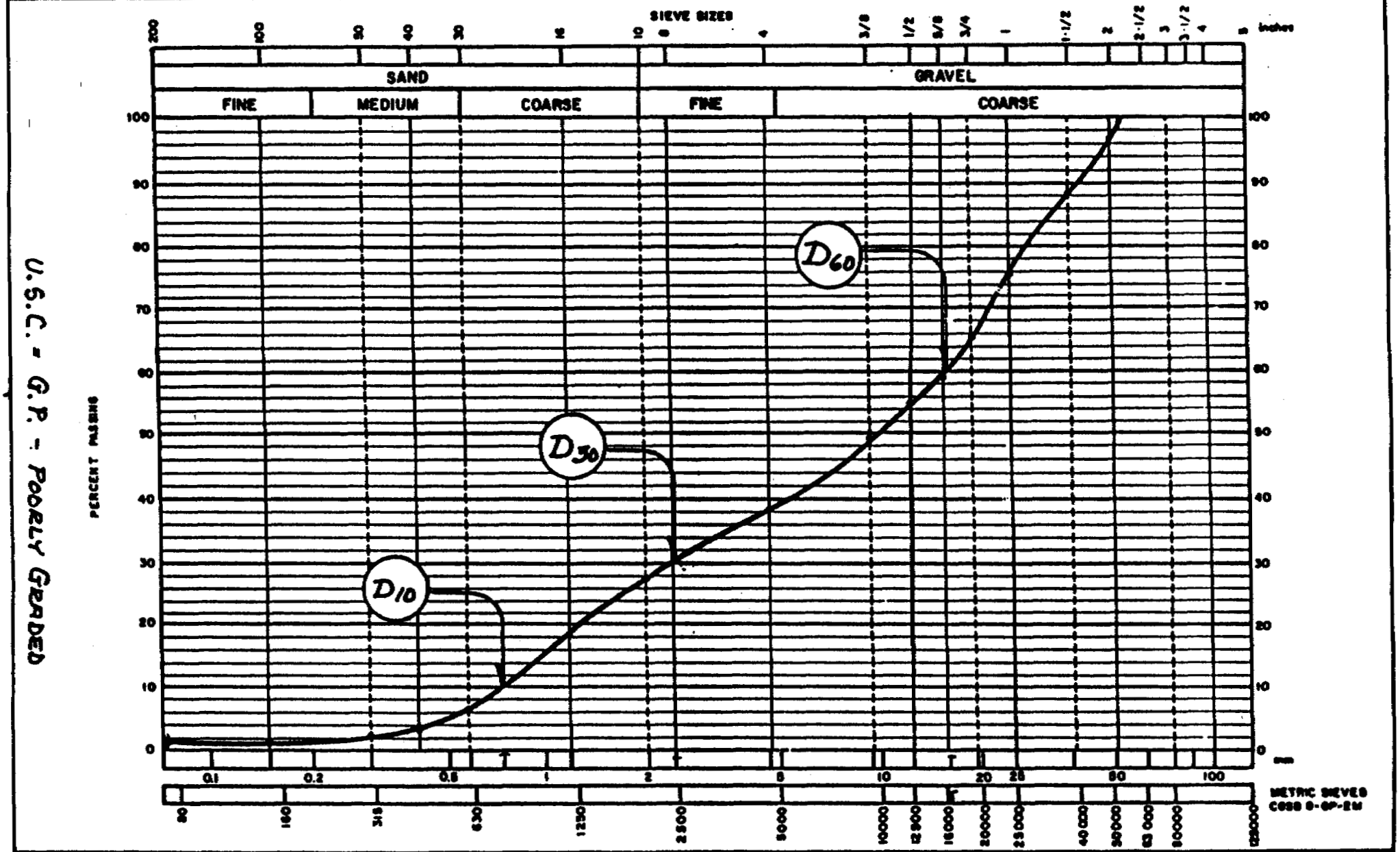
COMPILED BY: G. Aerts		DATE D/M/Y: 3/12/86	
REVIEWED BY	DATE D/M/Y	ATTACHMENTS	PAGES

Northwest Territories Public Works

GRAIN SIZE CURVES

SAMPLE IDENTIFICATION: CAPE DORSET 288-2-DD '84-912

TESTED BY: G. AERTS 3/12/86



D_{10}	D_{30}	D_{60}	C_u	C_c
0.750	2.35	16.5	22.0	0.1

NWT 1788/0888

Northwest Territories Public Works

SAMPLE DATA SHEET

PROJECT	PROJECT NUMBER
Cape Dorset Granular Investigation	86-9120

PART 1 - COMPLETED IN THE FIELD

SAMPLE IDENTIFICATION	METHOD OF SAMPLING
288-3-PD	

LOCATION: Site A - Oil Tank Farm

TEST HOLE NUMBER	DEPTH	
A3	1.5m	

FIELD DESCRIPTION: This is a sample of the material in the 3" to 6" range (GW)

LAB TESTS REQUIRED: Crush to 19 mm/Wash Sieve/L.A. Abrasion/Visual Description & Classifiacation

SAMPLED BY	DATE D/M/Y	SAMPLE DISCARDED	RETAINED
P. Deutsch	14/10/86		

PART 2 - COMPLETED IN THE LABORATORY

DATE RECEIVED	RECEIVED BY
26/11/86	Guy Aerts
REQUESTED COMPLETION DATE D/M/Y	RESULTS SUBMITTED TO
	S. Murray

PART 3 - LABORATORY TEST RESULTS AND COMMENTS

VISUAL DESCRIPTION: Cobbles - 42 - Sub-rounded to sub-angular
Nominal Size = 110 X 85 X 100 mm
Composition:
57% Metamorphic - Gneisses Schists-Quartz
43% Igneous - Diorite, Granite-Muscovite, Quartz Pyrite

Fine - Minimal silty coating
Rock Flour

WASHED SIEVE ANALYSIS: 98.8% passing 25 mm Sieve
90.1% passing 19 mm Sieve
23.0% passing 4.75 mm Sieve
1.7% passing 0.075 mm Sieve

U.S.C. G.P. - Poorly graded
Curve Uniformity = 14.9
Curve Coefficient - 5.0

L.A. ABRASION : as per grading "B" - 27.9% Loss on Abrasion
Charge = 11 shperes @ 500 revolutions
2500 (+/-) 10 Ret 1/2" 2500(+/-) Ret 3/8

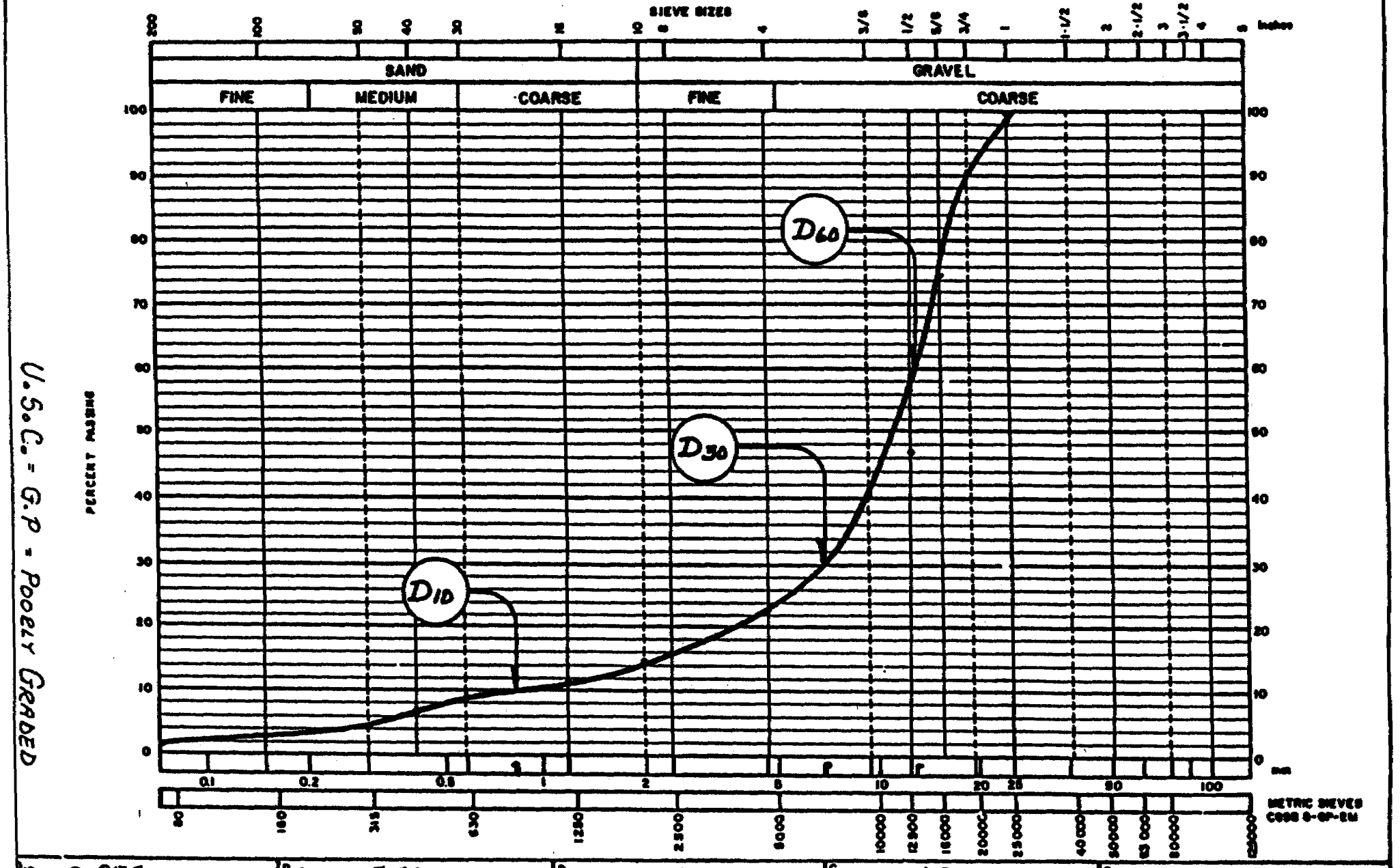
COMPILED BY	DATE D/M/Y
G. Aerts	01/12/86

REVIEWED BY	DATE D/M/Y	ATTACHMENTS _____ PAGES

GRAIN SIZE CURVES

SAMPLE IDENTIFICATION: CAPE DORSET 288-3-PD 86-9120

TESTED BY: G. AERTS 01/12/86



U.S.C. = G.P. = POORLY GRADED

D_{10}	D_{30}	D_{60}	C_u	C_c
0.875	7.55	13.0	14.9	5.0

IWT 1788/0886

SAMPLE DATA SHEET

PROJECT	PROJECT NUMBER
Cape Dorset Granular Investigation	86-9120

PART 1 - COMPLETED IN THE FIELD

SAMPLE IDENTIFICATION	METHOD OF SAMPLING
288-4-PD	

LOCATION: Site A - By Oil Tank Farm

TEST HOLE NUMBER	DEPTH	
A4	1.2 m	

FIELD DESCRIPTION: GW - this was in the unexploited section of the site. High in Gravel, cobble & boulder but low in sand

LAB TESTS REQUIRED: Wash Sieve Analysis?Visual Description & Classification

SAMPLED BY	DATE D/M/Y	SAMPLE DISCARDED	RETAINED
P. Deutsch	14/10/86		

PART 2 - COMPLETED IN THE LABORATORY

DATE RECEIVED	RECEIVED BY
26/11/86	G. Aerts
REQUESTED COMPLETION DATE D/M/Y	RESULTS SUBMITTED TO
	S. Murray

PART 3 - LABORATORY TEST RESULTS AND COMMENTS

VISUAL DESCRIPTION: Sandy Gravel - Sub-angular/angular
maxiumu Size - 125 X 75 X 45 mm
Composition:
90% Igneous - Granites Medium to coarse
Granodiorites
Quartz

10% Metomorphic - Schist - Mica/Pyrite

Fines:
Coarse - Sub-round to sub-angular
Sands - Medium sub-angular
Traces silts

WASHED SIEVE ANALYSIS: 98.1% passing 67 mmSieve
42.4 passing 19 mm Sieve
38.3 passing 4.75 mm Sieve
2.3% passing 0.075 mm Sieve

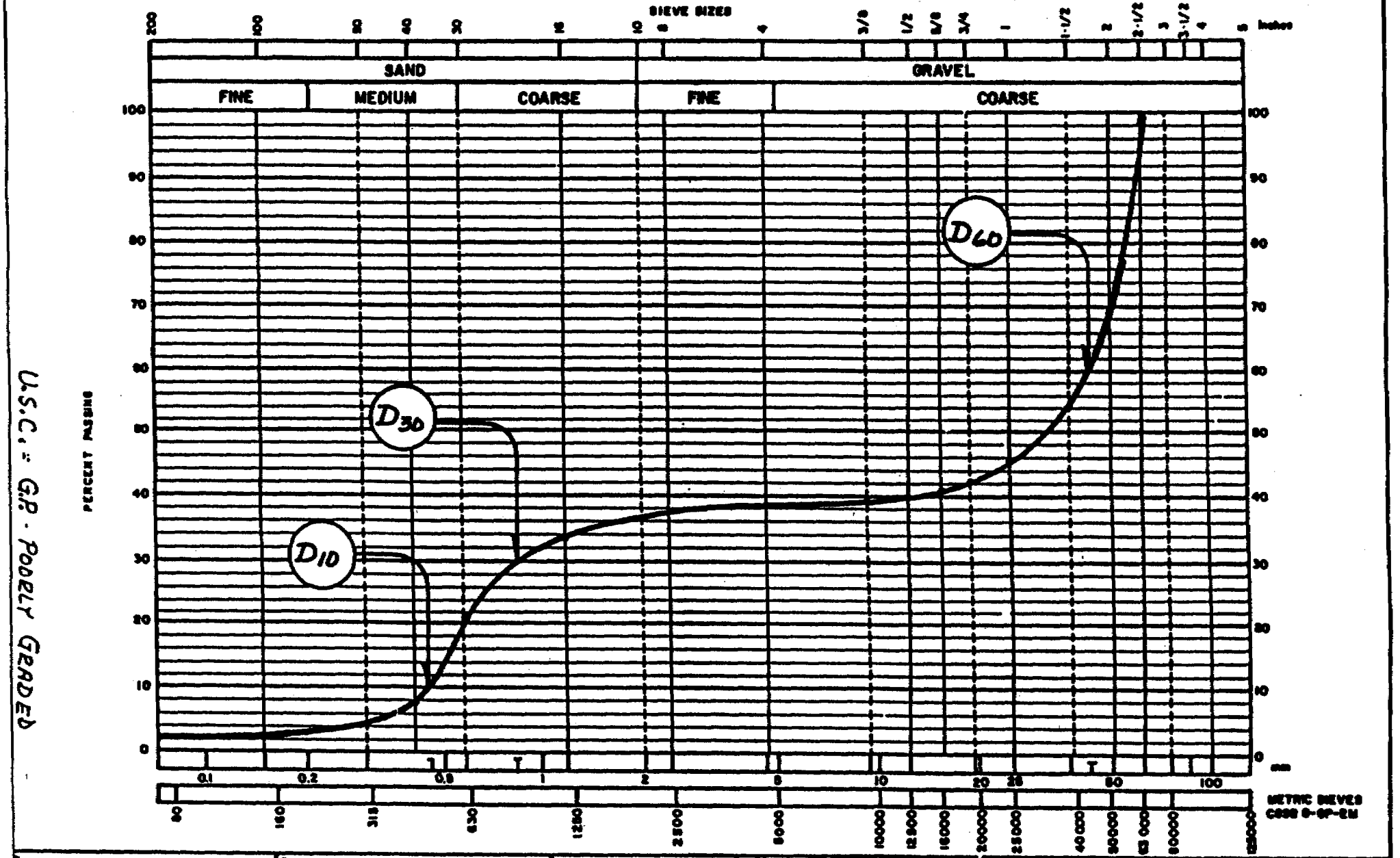
UNIFIED SOILS CLASSIFICATION: G.P. - Poorly graded gravels
Curve Uniformity = 94.7
Curve Coefficient 0.03

COMPILED BY	DATE D/M/Y
G. Aerts	28/11/86
REVIEWED BY	DATE D/M/Y
	ATTACHMENTS _____ PAGES

GRAIN SIZE CURVES

SAMPLE IDENTIFICATION: CAPE DORSET 288-4-PD *86-9120

TESTED BY: G. AERTS 28/NOV./86



D_{10}	D_{30}	D_{60}	C_u	C_c
0.475	0.875	45.0	94.7	0.03

IWT 1706/0886

SAMPLE DATA SHEET

PROJECT: CAPE DORSET Granular Investigation	PROJECT NUMBER: 87-9170

PART 1 - COMPLETED IN THE FIELD

SAMPLE IDENTIFICATION: 242-01-RSPD	METHOD OF SAMPLING: Shovel & Backhoe
LOCATION: Site 2B	
TEST HOLE NUMBER: TH 20	DEPTH: Surface - 1.0 meters
FIELD DESCRIPTION: Sand, very few rocks, Embankment	
LAB TESTS REQUIRED: Visual / W.S.A. / U.S.C.	
SAMPLED BY: R.Sotnikow	DATE D/M/Y: 16/08/87
SAMPLE DISCARDED *	RETAINED

PART 2 - COMPLETED IN THE LABORATORY

DATE RECEIVED	RECEIVED BY
REQUESTED COMPLETION DATE D/M/Y	RESULTS SUBMITTED TO

PART 3 - LABORATORY TEST RESULTS AND COMMENTS

VISUAL DESCRIPTION: Gravelly Sand : Aggregates = Angular to Sub-Angular, Maximum Particle Size-80mm, Granites, Gneisses Greywackes

Sands = Medium to Coarse, Silt Fines & Trace fine Carbonates

WASH SIEVE ANALYSIS: Based on U.S.C. Break Points

Gravels = 36.0 %

Sands = 62.0 %

Fines = 2.0 %

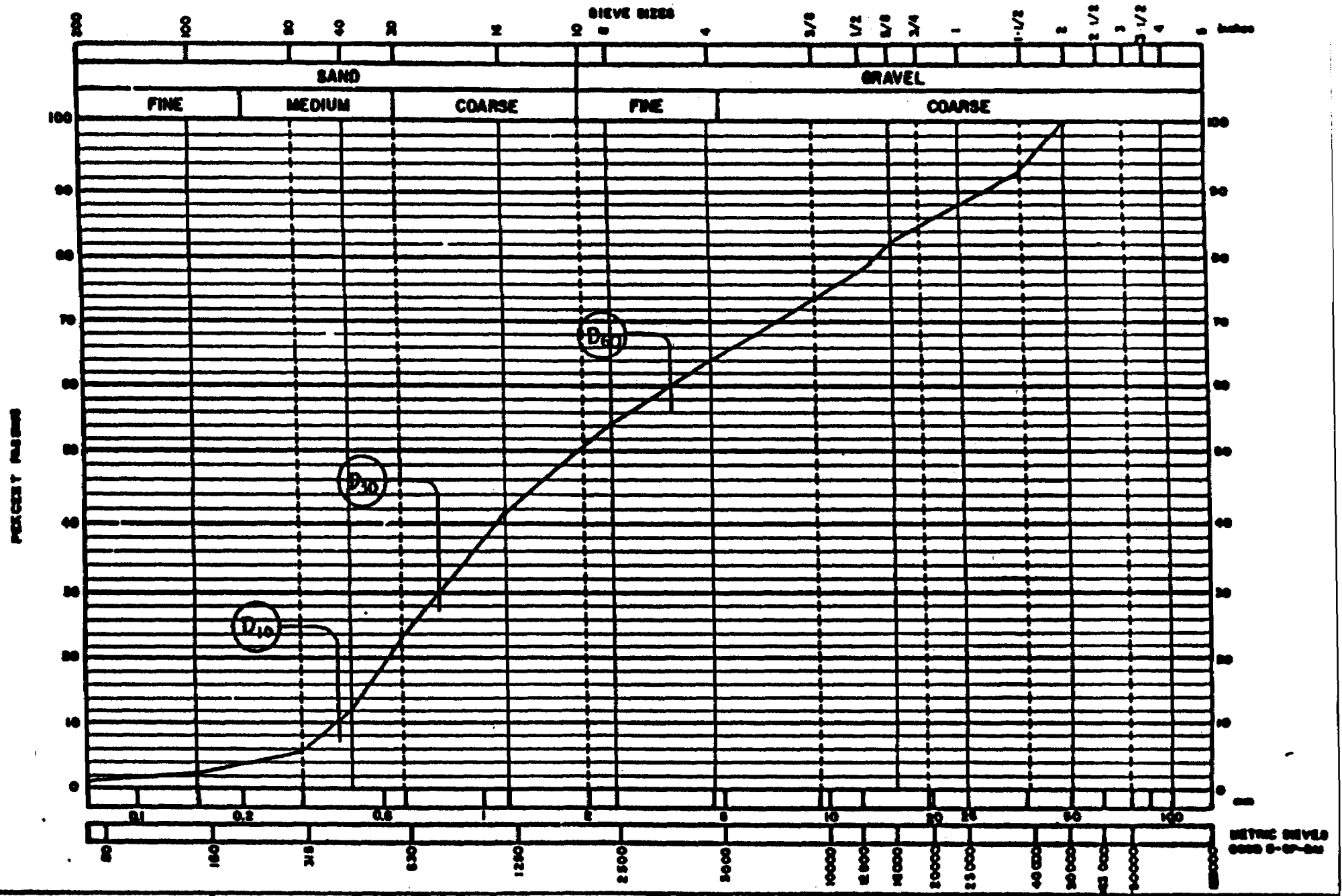
UNIFIED SOILS CLASSIFICATION: SP = Poorly Graded

COMPILED BY: Ron Sotnikow	DATE D/M/Y: N/A
REVIEWED BY	DATE D/M/Y
ATTACHMENTS	PAGE #

GRAIN SIZE CURVES

SAMPLE IDENTIFICATION: 242-01-RS

TESTED BY: Ron Sotnikow



D_{10}	D_{30}	D_{60}	C_u	C_c
.15	.630	3.60	9.16	.737

Northwest Territories Public Works

SAMPLE DATA SHEET

PROJECT	PROJECT NUMBER
Cape Dorset - Site 2 (B)	89 9170 803

PART 1 - COMPLETED IN THE FIELD

SAMPLE IDENTIFICATION	METHOD OF SAMPLING	
CAP-04-FC	Shovel	

LOCATION: Talys Slope/Site 2

TEST HOLE NUMBER	DEPTH	
	1.1m	

FIELD DESCRIPTION: Sandy well graded gravel mixture

dry, well drained Permafrost at 1.3 m

LAB TESTS REQUIRED: Visual, Wash sieve

SAMPLED BY	DATE D/M/Y	SAMPLE DISCARDED	RETAINED
F.C.	17/08/89		

PART 2 - COMPLETED IN THE LABORATORY

DATE RECEIVED	RECEIVED BY
Sept./89	A.H.
REQUESTED COMPLETION DATE D/M/Y	RESULTS SUBMITTED TO

PART 3 - LABORATORY TEST RESULTS AND COMMENTS

- Sand, brown medium grained gravelly pebbles to 50 mm, subrounded (SP)

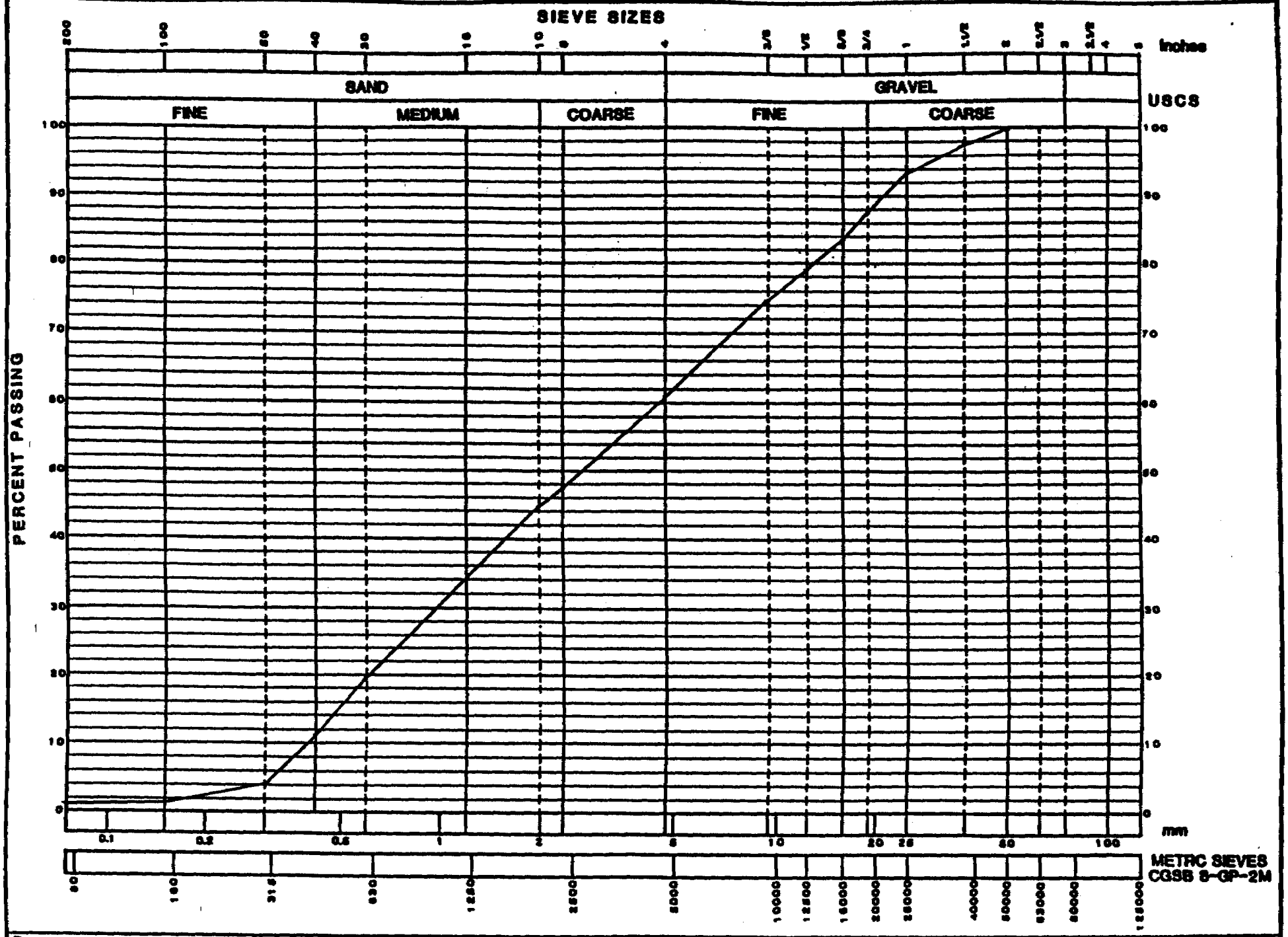
COMPILED BY	DATE D/M/Y	
REVIEWED BY	DATE D/M/Y	ATTACHMENTS _____ PAGES

NWT 2001/0886

GRAIN SIZE CURVES

SAMPLE IDENTIFICATION: CAPE DORSET - 04 - FC

TESTED BY: A. HARMAN



D_{10} = 0.4	D_{30} = 1.0	D_{60} = 4.7	C_u = 11.8	C_c = 0.5

TED-101/01 88;U

SAMPLE DATA SHEET

PROJECT: CAPE DORSET Granular Investigation	PROJECT NUMBER: 87-9170-803

PART 1 - COMPLETED IN THE FIELD

SAMPLE IDENTIFICATION: 245-04-RS	METHOD OF SAMPLING: Shovel
LOCATION: Site 2A	
TEST HOLE NUMBER: TH 4	DEPTH: 1.8m
FIELD DESCRIPTION: Sand	
LAB TESTS REQUIRED: Visual / W.S.A. / U.S.C	
SAMPLED BY: R.Snotnikow	DATE D/M/Y: 18/08/87
SAMPLE DISCARDED *	RETAINED

PART 2 - COMPLETED IN THE LABORATORY

DATE RECEIVED	RECEIVED BY
REQUESTED COMPLETION DATE D/M/Y	RESULTS SUBMITTED TO

PART 3 - LABORATORY TEST RESULTS AND COMMENTS

VISUAL DESCRIPTION: Gravelly Sand : Sub-Angular Aggregates with a Max. Size of 80mm.,composed of Granites; Quartz. Sand is Medium to Coarse grained. Silt Fines with Misc. Trace Micas.

WASH SIEVE ANALYSIS: Based on U.S.C. Break Points

Gravels = 1.0%

Sands = 98.0%

Fines = 1.0%

UNIFIED SOILS CLASSIFICATION: SP = Poorly Graded Sands, Little Fines

COMPILED BY: R. Sotnikow	DATE D/M/Y: 26/10/87	
REVIEWED BY	DATE D/M/Y	ATTACHMENTS _____ PAGES

Northwest Territories Public Works

SAMPLE DATA SHEET

PROJECT: CAPE DORSET Granular Investigation	PROJECT NUMBER: 87-9170

PART 1 - COMPLETED IN THE FIELD

SAMPLE IDENTIFICATION: 244-02-RS	METHOD OF SAMPLING: Shovel
LOCATION: Site 13	
TEST HOLE NUMBER: N/A	DEPTH: Surface - 1.0 meters
FIELD DESCRIPTION: Clean Pit Run	
LAB TESTS REQUIRED: Visual / W.S.C. / U.S.C.	
SAMPLED BY: R.Sotnikow	DATE D/M/Y: 17/08/87
SAMPLE DISCARDED *	RETAINED

PART 2 - COMPLETED IN THE LABORATORY

DATE RECEIVED /	RECEIVED BY
REQUESTED COMPLETION DATE D/M/Y	RESULTS SUBMITTED TO

PART 3 - LABORATORY TEST RESULTS AND COMMENTS

VISUAL DESCRIPTION: Gravelly Sand -
Aggregates = Sub-Angular, Max Size 120mm
composed of Granites & Carbonates
Sands = Coarse, Sub-Angular with Silt
Fines & trace Organic material

WASH SIEVE ANALYSIS: Based on U.S.C. Break Points
Gravels = 41.0 %
Sands = 58.9 %
Fines = 0.1 %

UNIFIED SOILS CLASSIFICATION: SP = Poorly Graded

COMPILED BY: Ron Sotnikow		DATE D/M/Y: N/A	
REVIEWED BY	DATE D/M/Y	ATTACHMENTS	PAGES

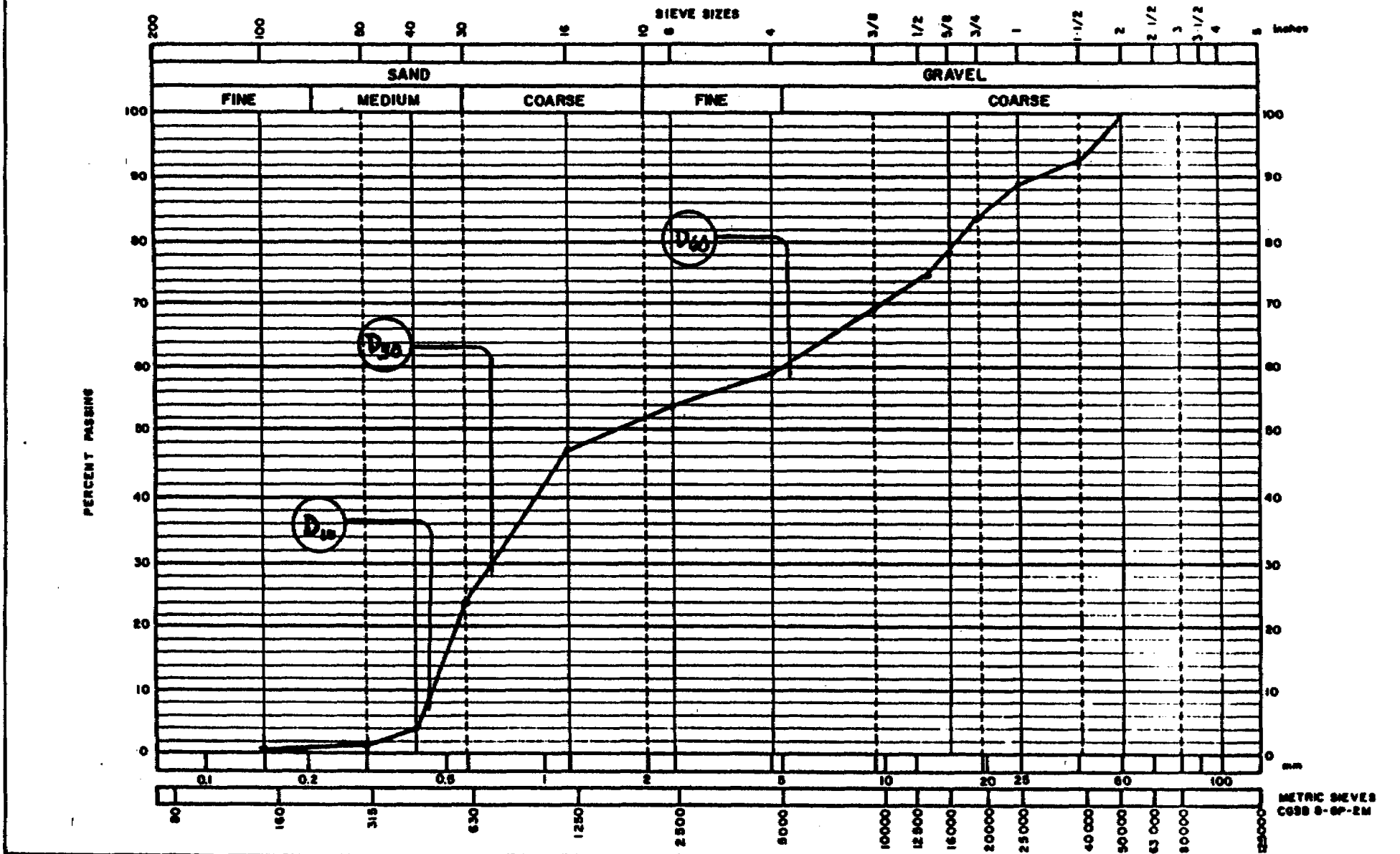
IWT 2601/0886

Northwest Territories Public Works

GRAIN SIZE CURVES

SAMPLE IDENTIFICATION: 244-02-RS

TESTED BY: Ron Sotnikow



D_{10}	D_{30}	D_{60}	C_u	C_c
.465	.675	5.0	10.75	0.195

NWT 1788/0588

Northwest Territories Public Works

SAMPLE DATA SHEET

PROJECT: Cape Dorset Site;FBS	PROJECT NUMBER: 89 9170 803

PART 1 - COMPLETED IN THE FIELD

SAMPLE IDENTIFICATION: CAP-02-FC	METHOD OF SAMPLING: Shovel
LOCATION: On Side Cut of Ridge at Present Hauling Site FBS	
TEST HOLE NUMBER	DEPTH: 1.2 m
FIELD DESCRIPTION: Dry	
LAB TESTS REQUIRED: Visual/Wash Sieve/Atterberg Limits/Proctor	
SAMPLED BY: FC	DATE D/M/Y: 16/08/89
SAMPLE DISCARDED	RETAINED

PART 2 - COMPLETED IN THE LABORATORY

DATE RECEIVED: Sept./89	RECEIVED BY: A.H.
REQUESTED COMPLETION DATE D/M/Y	RESULTS SUBMITTED TO

PART 3 - LABORATORY TEST RESULTS AND COMMENTS

- Gravel and SAnd, light brown, trace salt pebbles to 40mm, angular (GP)
- Non Plastic
- Insufficient material for a Standard Proctor

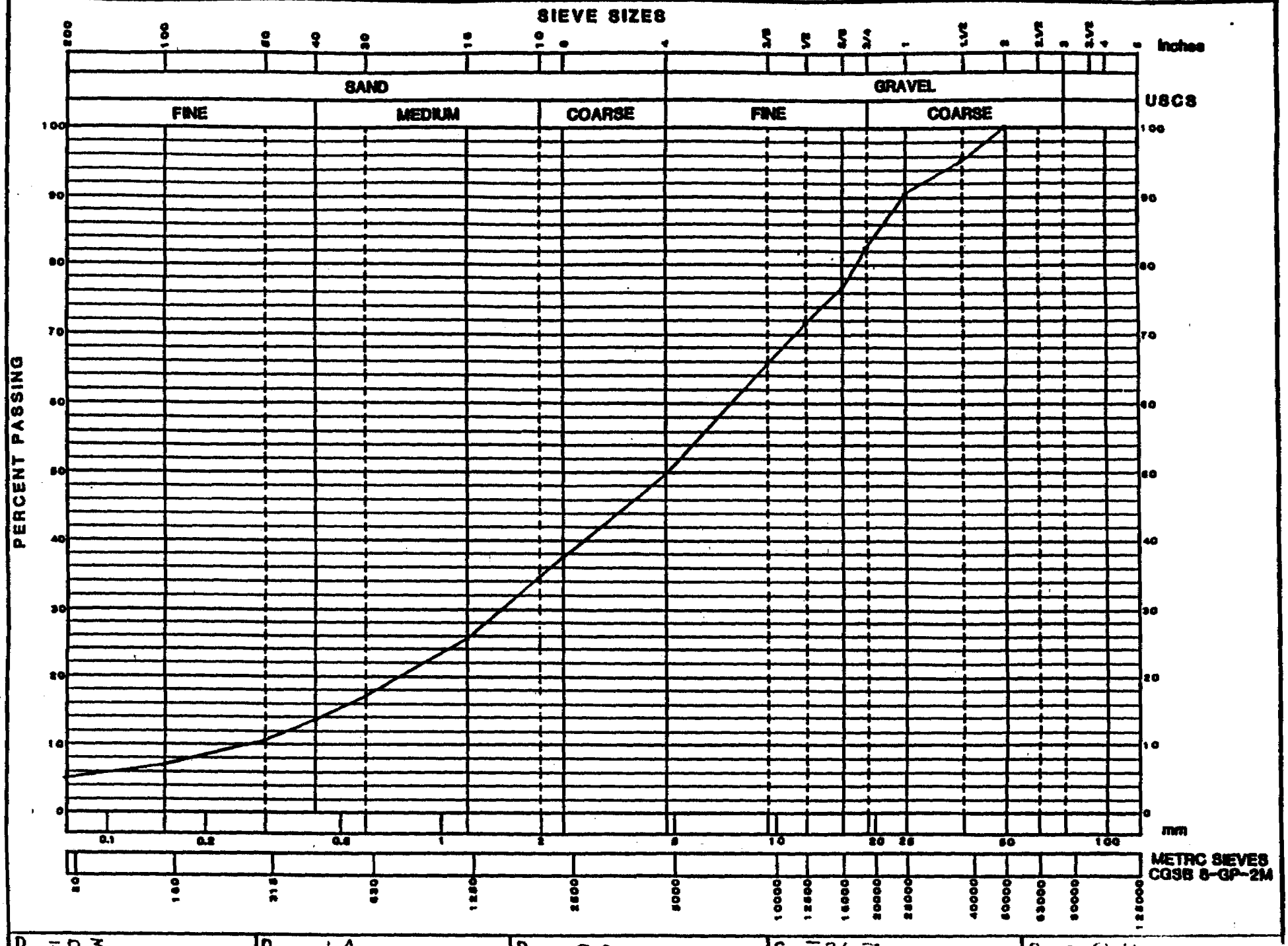
COMPILED BY	DATE D/M/Y
REVIEWED BY	DATE D/M/Y
ATTACHMENTS _____ PAGES	

NWT 2001/0886

GRAIN SIZE CURVES

SAMPLE IDENTIFICATION: CAP-02-FC

TESTED BY: A. HARMAN



$D_{10} = 0.3$ | $D_{30} = 1.4$ | $D_{60} = 8.0$ | $C_u = 26.7$ | $C_c =$

SAMPLE DATA SHEET

PROJECT	PROJECT NUMBER 85-9572

PART 1 - COMPLETED IN THE FIELD

SAMPLE IDENTIFICATION 202-01-RF	METHOD OF SAMPLING Back Hoe	
LOCATION Cape Dorset #3		
TEST HOLE NUMBER TH 9	DEPTH	
FIELD DESCRIPTION Sample Damp, Medium Penetration taken at 0.8 m		
LAB TESTS REQUIRED MSA, ATT		
SAMPLED BY R. Fournier	DATE D/M/Y 21/07/85	SAMPLE DISCARDED RETAINED

PART 2 - COMPLETED IN THE LABORATORY

DATE RECEIVED 11/08/85	RECEIVED BY M. Bouffard
REQUESTED COMPLETION DATE D/M/Y	RESULTS SUBMITTED TO S. Murray

PART 3 - LABORATORY TEST RESULTS AND COMMENTS

VISUAL DESCRIPTION

Medium-brown gravel with angular and sub-angular aggregates. Material contains traces of Mica. Max. particle size is 1".

M.S.A.

USC is SW well graded gravels, Gravely sands
Mixtures, Little Fines (8%)

AASHTO-A-1-b(0) materials consist predeminary
m 145-82 of course sand with a well graded soil binder
This group is a well graded mixture of stone fragments or gravel, coarse sand, fine sand and a now plastic soil binder.

ATTERBURG

Not possible (Sandy material).

COMPILED BY Dave Nicholson	DATE D/M/Y 01/12/85

Northern Mariana Islands Public Works
Design and Construction

GRAIN SIZE ANALYSIS

Project: 202-01-RF

Lab. Sample No.: 85-9572 CAE Project

Sample Description: U.S.C.S. is GW.

AASHTO M145-82 is

Comments:

D_{10} = .39

D_{30} = 2.1

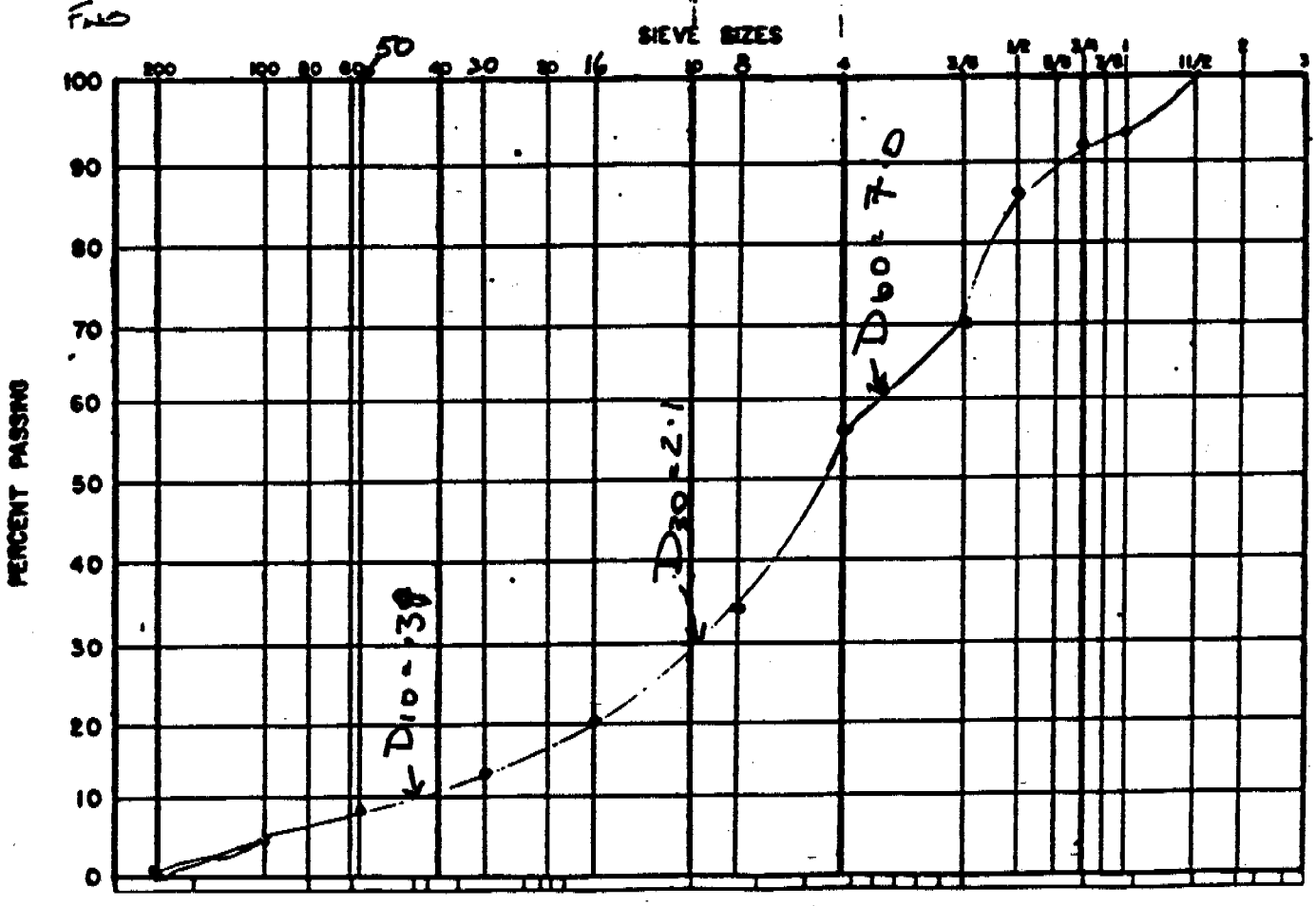
D_{60} = 7.0

C_u = 17.94

C_c = 1.61

SIEVE SIZES U.S. Standard	SIEVE SIZES Metric (mm)	% Retained Per Sieve	% Passing
3"			
1 1/2			100
1		6	94
3/4		1	93
1/2		7	86
3/8		16	70
4		13	57
8		22	35
No. 16		15	20
No. 30		7	13
No. 50		4	9
No.100	0.150	1	8
No.200	0.075	8	0

CLAY SILT	SAND			GRAVEL	
	FINE	MEDIUM	COARSE	FINE	COARSE



Northwest Territories Public Works
Design and Construction

GRAIN SIZE ANALYSIS

Project: 85-95 CAPE DORSET

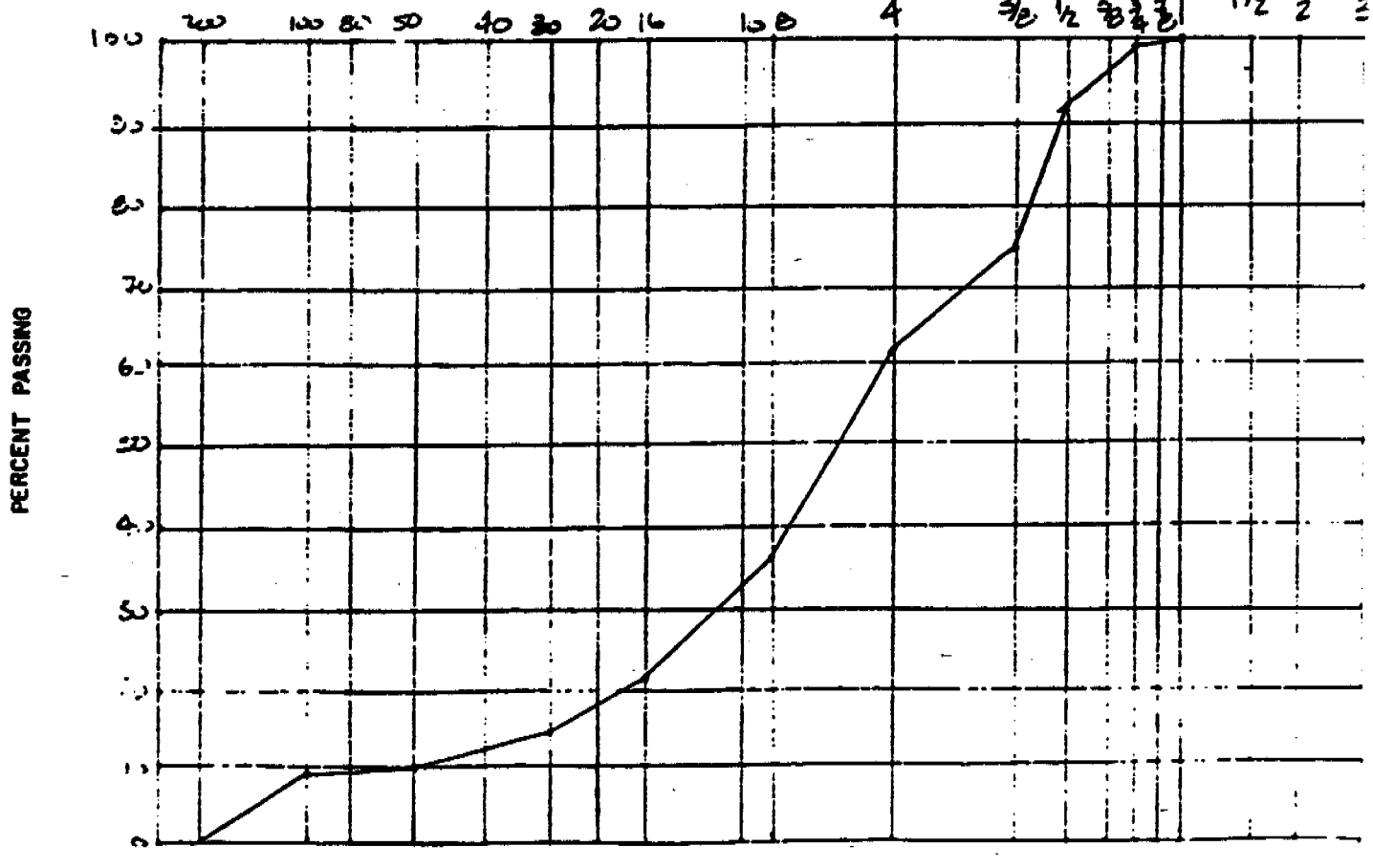
Lab. Sample No.: 202-01-BF

Sample Description: _____

Comments: SCREENED MATERIAL @ 1" PLUS REMOVED

SIEVE SIZES U.S. Standard	Metric (mm)	% Retained Per Sieve	% Passing
4"	100 mm		
3"	75 mm		
2½"	63 mm		
2"	50 mm		
1½"	37.5 mm		
1"	25 mm		100.0
¾"	19 mm		99
½"	12.5 mm		92
⅜"	9.5 mm		75
No. 4	4.75 mm		61
No. 8	2.36 mm		37
No. 16	1.18 mm		21
No. 30	0.6 mm		14
No. 50	300 µm		10
No. 100	150 µm		7
No. 200	75 µm		0

CLAY / SILT	SAND			GRAVEL	
	FINE	MEDIUM	COARSE	FINE	COARSE



SAMPLE DATA SHEET

PROJECT	PROJECT NUMBER 85.0572

PART 1 - COMPLETED IN THE FIELD

SAMPLE IDENTIFICATION 202-02-RF	METHOD OF SAMPLING Back Hoe	
LOCATION Cape Dorset #3		
TEST HOLE NUMBER TH 10	DEPTH	
FIELD DESCRIPTION Sample wet, dense taken at 1.9 m		
LAB TESTS REQUIRED WSA, ATT		
SAMPLED BY R. Fournier	DATE D/M/Y 21/07/85	SAMPLE DISCARDED RETAINED

PART 2 - COMPLETED IN THE LABORATORY

DATE RECEIVED 01/08/85	RECEIVED BY M. Bouffard
REQUESTED COMPLETION DATE D/M/Y	RESULTS SUBMITTED TO S. Murray

PART 3 - LABORATORY TEST RESULTS AND COMMENTS

VISUAL DESCRIPTION

Medium-brown gravel with angular aggregates.
Material contains traces of organics (long thin roots)
Max. Particle size is 1".

W.S.A.

U.S.C. is G.W. well graded gravels
Sand mixture, little fines (1%)
AASHTO. m-145-82 designation is 1-1-b (0)
A well graded mixture of stone fragments,
coarse sand, fine sand and a non-plastic
soil binder which consists predominantly of coarse
sand no fines.

ATTERBERG

Not possible (a sandy material)

COMPILED BY Dave Nicholson	DATE D/M/Y 02/21/85

Northwest Territories Public Works
Design and Construction

GRAIN SIZE ANALYSIS

Project: 85-59

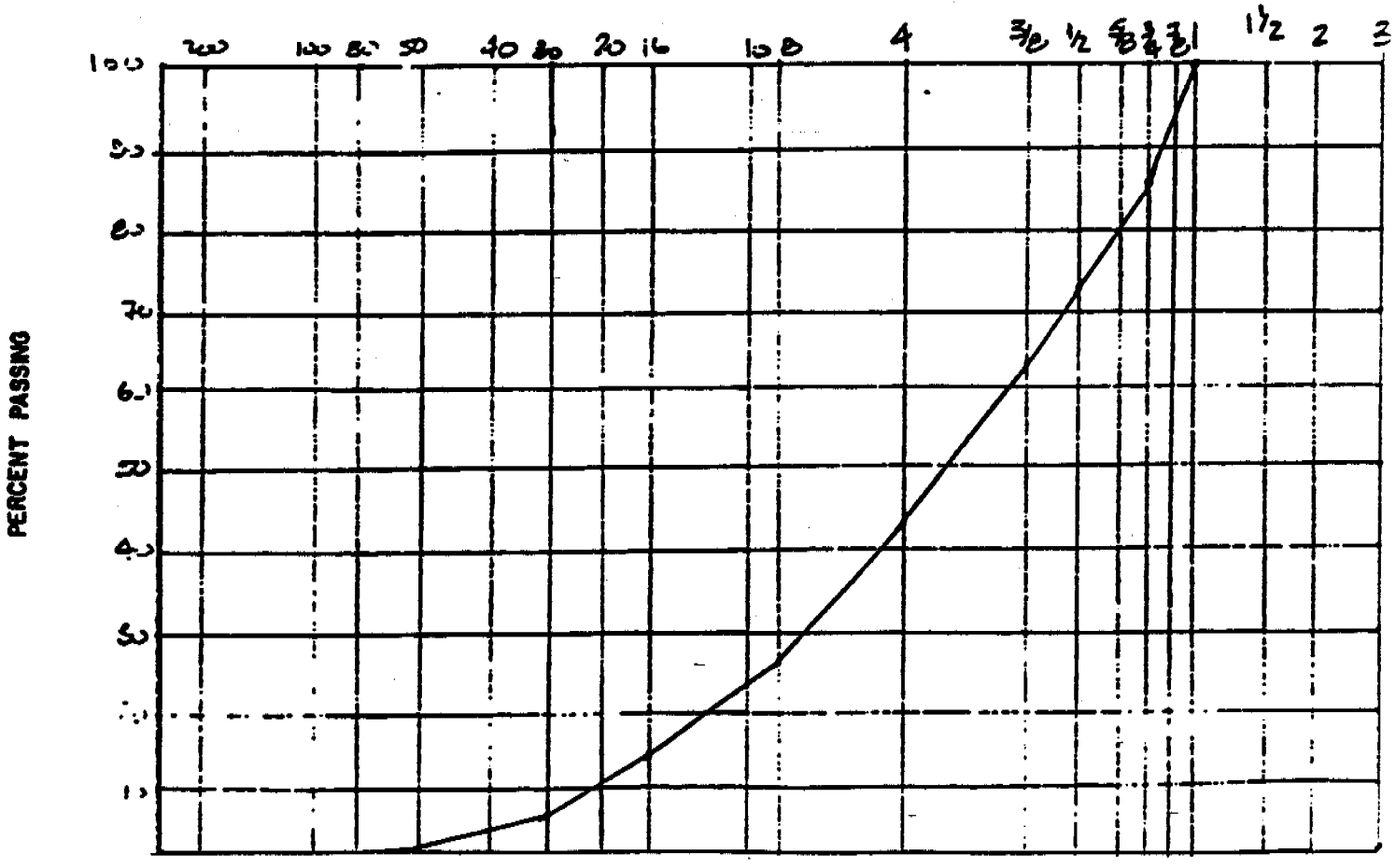
Lab. Sample No.: 202-02-RF

Sample Description: _____

Comments: SCREENED MATERIAL @ 1" PROTECTIVE CAP C's

SIEVE SIZES U.S. Standard	SIEVE SIZES Metric (mm)	% Retained Per Sieve	% Passing
4"	100 mm		
3"	75 mm		
2½"	63 mm		
2"	50 mm		
1½"	37.5 mm		
1"	25 mm		100
¾"	19 mm		86
½"	12.5 mm		73
⅜"	9.5 mm		63
No. 4	4.75 mm		43
No. 8	2.36 mm		27
No. 16	1.18 mm		14
No. 30	0.6 mm		7
No. 50	300 µm		2
No. 100	150 µm		1
No. 200	75 µm		0

CLAY / SILT	SAND			GRAVEL	
	FINE	MEDIUM	COARSE	FINE	COARSE



SAMPLE DATA SHEET

PROJECT	PROJECT NUMBER 85-9572

PART 1 - COMPLETED IN THE FIELD

SAMPLE IDENTIFICATION 202-03-RF	METHOD OF SAMPLING Shovel	
LOCATION Cape Dorset Site #3		
TEST HOLE NUMBER TH 8	DEPTH	
FIELD DESCRIPTION sample covers site #3 of about 0.1 to 0.2 m		
LAB TESTS REQUIRED W.S.A. MC. ATTERBERG (keep fine)		
SAMPLED BY R. Fournier	DATE D/M/Y 21/07/85	SAMPLE DISCARDED RETAINED

PART 2 - COMPLETED IN THE LABORATORY

DATE RECEIVED 01/08/85	RECEIVED BY Marc Bouffard
REQUESTED COMPLETION DATE D/M/Y	RESULTS SUBMITTED TO S. Murray

PART 3 - LABORATORY TEST RESULTS AND COMMENTS

VISUAL DESCRIPTION

Light-brown sitty sand, basically a nearly uniform grain size by visual inspection

W.S.A.

Not possible - material was in such insufficient quantity that it was deemed impossible to arrive at any usable numbers

ATTERBERG

Not possible - thematerial was a sitty-sand

MOISTURE CONTENT

COMPILED BY Dave Nicholson	DATE D/M/Y 27/02/85

MOISTURE CONTENT OF SOILS

MOISTURE CONTENT CALCULATION

Sample No.: 202-03-RF

Date Tested: 23/10/85

Maximum Particle Size:

Lab. Container No:

a) Tare Lab. Container	167.2	gr.
b) Sample Wet & Tare	1879.8	gr.
c) Sample Dry & Tare	1588.9	gr.
d) Wt. Water	290.9	gr.
e) Wt. Sample Dry	1421.7	gr.
f) Moisture Content	20.46	%

Tech:

Wt. Water (d): b - c

Wt. Sample Dry (e): c - a

Moisture Content (f): d/e x 100

SAMPLE DATA SHEET

PROJECT	PROJECT NUMBER 85-9572

PART 1 - COMPLETED IN THE FIELD

SAMPLE IDENTIFICATION 204-01-RF	METHOD OF SAMPLING Back Hoe	
LOCATION Cape Dorset Site #5		
TEST HOLE NUMBER	DEPTH	
FIELD DESCRIPTION Sample damp (frost at 1.0m)		
LAB TESTS REQUIRED W.S.A. , A.T.T.		
SAMPLED BY R. Fournier	DATE D/M/Y 23/07/85	SAMPLE DISCARDED RETAINED

PART 2 - COMPLETED IN THE LABORATORY

DATE RECEIVED 01/08/85	RECEIVED BY M. Boufford
REQUESTED COMPLETION DATE D/M/Y	RESULTS SUBMITTED TO S. Murray

PART 3 - LABORATORY TEST RESULTS AND COMMENTS

VISUAL DESCRIPTION

Light to medium brown gravel with sub-rounded to rounded aggregates. Material contains traces of Mica and Quartz. Aggregates aslo have flat but not elongated surfaces.

Max. particle size is 1 1/2".

ATTERBERG

The ATTERBERG was not possible (silty sand)

W.S.A.

U.S.C. ID GP poorly graded gravel, no fines
AASHTO M145-82 designated is A-1-2 (0)
Materials consists predominantly of stone fragments or gravel

A-1-a(0) According to AASHTO T27-82

A well graded mixture of stone fragments, coarse sand, fine sand, and a nonplastic soil binder.

COMPILED BY	DATE D/M/Y
REVIEWED BY	DATE D/M/Y ATTACHMENTS PAGES

Northwest Territories Public Works / Design and Construction

GRAIN SIZE ANALYSIS

Project: _____

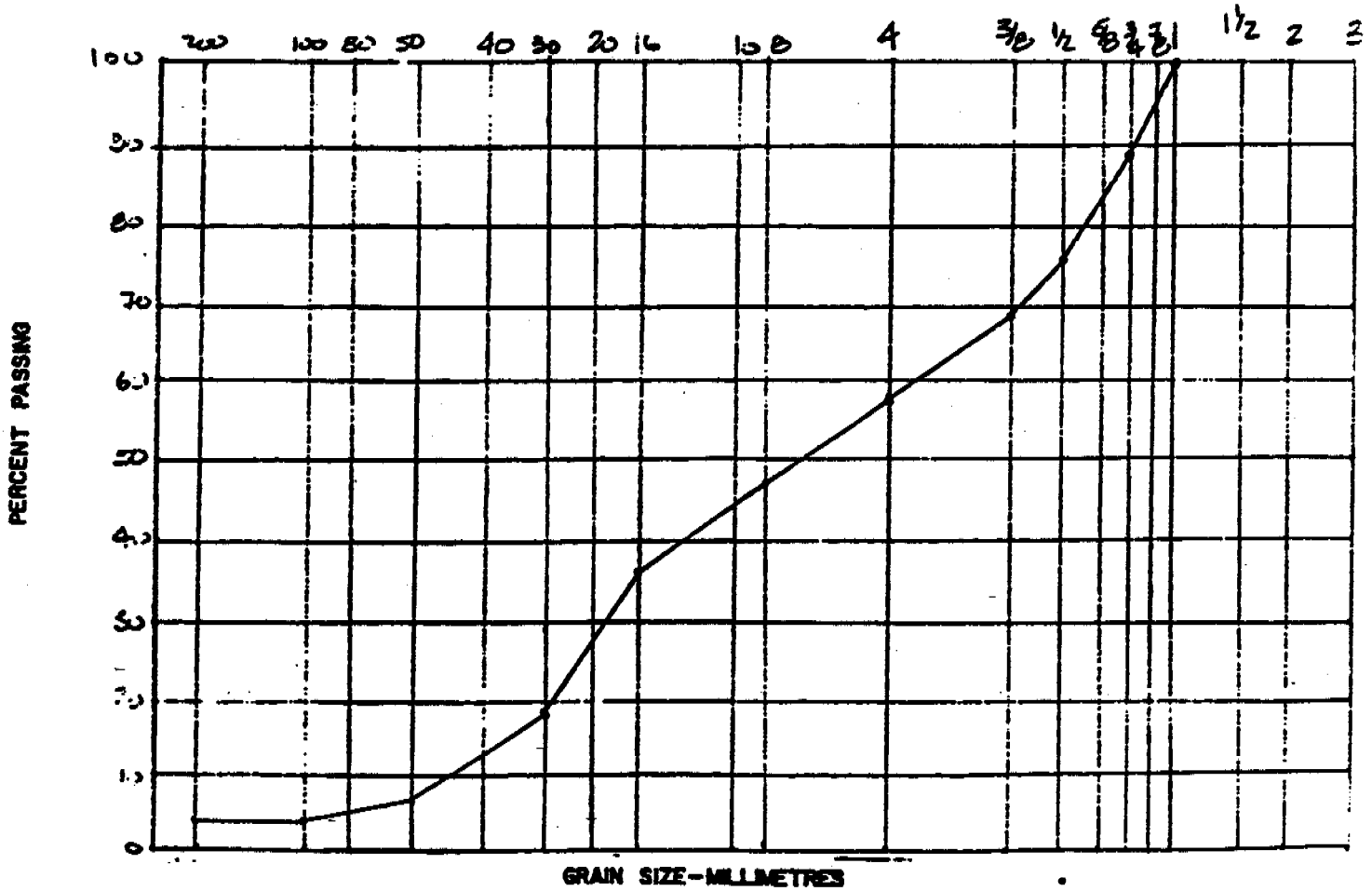
Lab. Sample No.: 20401-RF

Sample Description: _____

Comments: SCREENED. ATTERBERGS @ 1° PRORATED CALC'S

SIEVE SIZES U.S. Standard	Metric (mm)	% Retained Per Sieve	% Passing
4"	100 mm		
3"	75 mm		
2½"	63 mm		
2"	50 mm		
1½"	37.5 mm		
1"	25 mm		100
¾"	19 mm		89
½"	12.5 mm		76
⅜"	9.5 mm		69
No. 4	4.75 mm		58
No. 8	2.36 mm		47
No. 16	1.18 mm		36
No. 30	0.6 mm		19
No. 50	300 µm		6
No. 100	150 µm		4
No. 200	75 µm		4

CLAY SILT	SAND			GRAVEL	
	FINE	MEDIUM	COARSE	FINE	COARSE



SAMPLE DATA SHEET

PROJECT	PROJECT NUMBER 85-9572

PART 1 - COMPLETED IN THE FIELD

SAMPLE IDENTIFICATION 204-02-RF	METHOD OF SAMPLING Back Hoe	
LOCATION Cape Dorset Site #5		
TEST HOLE NUMBER	DEPTH	
FIELD DESCRIPTION Dry sample, medium penetration		
LAB TESTS REQUIRED Dry and Wash Seive, ATT		
SAMPLED BY R. Fournier	DATE D/M/Y 23/02/85	SAMPLE DISCARDED RETAINED

PART 2 - COMPLETED IN THE LABORATORY

DATE RECEIVED 01/08/85	RECEIVED BY M. Bouffard
REQUESTED COMPLETION DATE D/M/Y	RESULTS SUBMITTED TO S. Murray

PART 3 - LABORATORY TEST RESULTS AND COMMENTS

VISUAL DESCRIPTION

Light to Medium brown gravel with sub-rounded and rounded aggregates material. Contains flat aggregates, Quart and traces of Mica.

Maxiumum particle size 3/4".

ATTERBERG

was not possible (sandy)

WASH SEIVE ANNALYSIS

According to AASHTO T27-82

U.S.C. is GP a poorly graded gravel, gravel-sand mixture with little fines (2%)

AASHTO M145-82 is A-1-a(0) a well graded mixture of stone fragments, coarse sand , ifne sand and a nonplastic soil binder.

DRY SEIVE ANALYSIS

According to AASHTO T27-82

U.S.C. is the same as above except no fines
AASHTO M145-82 is same as above except no fines

COMPILED BY	DATE D/M/Y

Northwest Territorial Public Works
Design and Construction

GRAIN SIZE ANALYSIS

Project: Cape Dorset 85-95R

Lab. Sample No.: 204-02-LF

Sample Description: U.S.C. is GP

AASHTO M145-82 is A-1-a(0)

Comments: D.S.A.

D_{10} = .45

D_{30} = 2.0

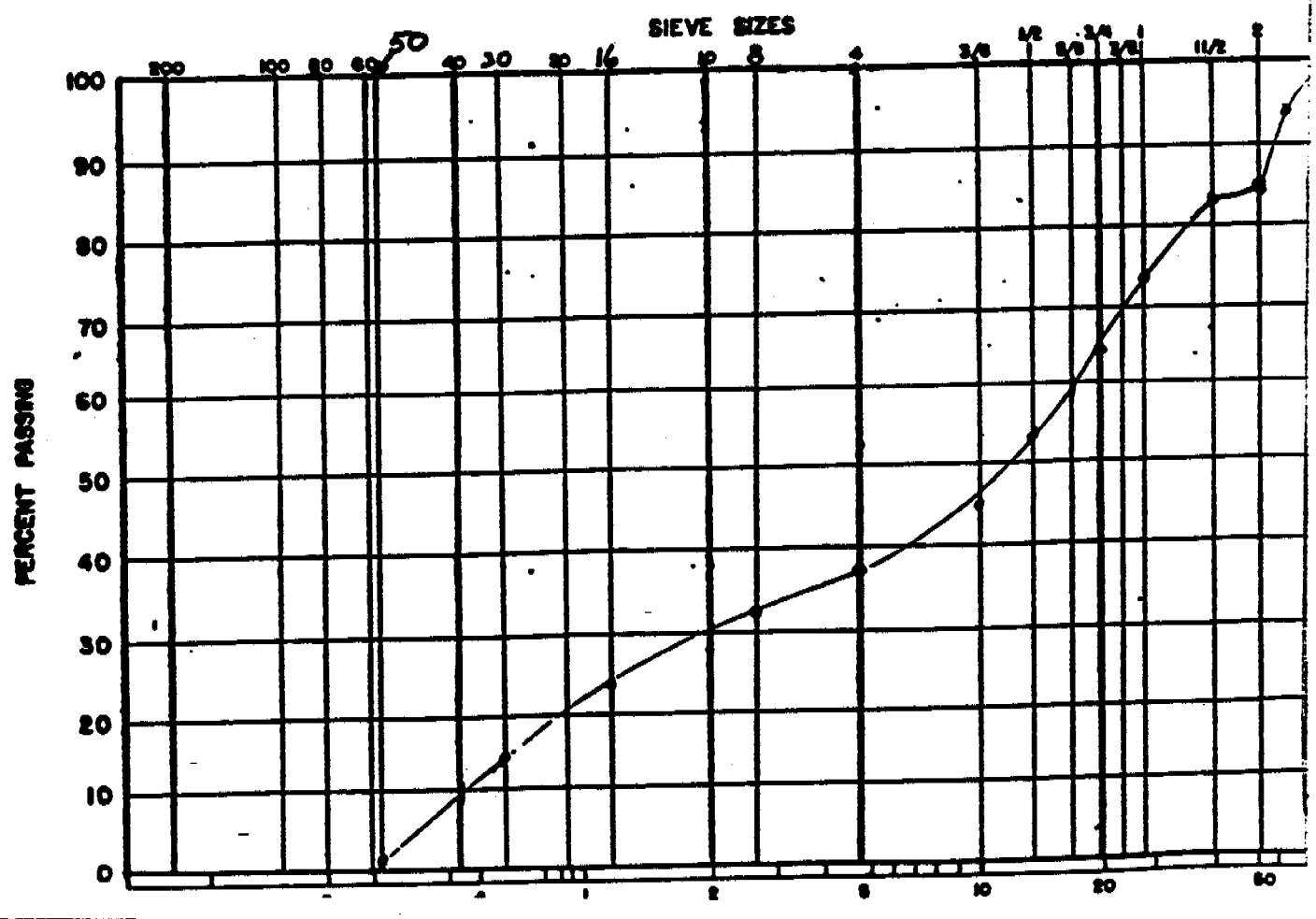
D_{60} = 15

C_u = 2.2

C_c = 0.6

SIEVE SIZES U.S. Standard	Metric (mm)	% Retained Per Sieve	% Passing
3"			100
2½		6	99
2"		9	85
1½		1	84
1"		11	73
¾"		8	65
½"		12	53
⅜"		7	46
#4		8	38
#8		6	32
No. 16		8	24
No. 30		10	14
No. 50		13	1
No.100	0.150	1	0
No.200	0.075	0	0

CLAY SILT	SAND			GRAVEL	
	FINE	MEDIUM	COARSE	FINE	COARSE



Northwest Territories Public Works

SAMPLE DATA SHEET

PROJECT		PROJECT NUMBER
Cape Dorset Site 10		89 9170 803

PART 1 - COMPLETED IN THE FIELD

SAMPLE IDENTIFICATION	METHOD OF SAMPLING	
CAP-06-FC	Shovel	

LOCATION: Area of Site 10, Kame Terrace - 1989

TEST HOLE NUMBER	DEPTH	
	1.8 m	

FIELD DESCRIPTION: Gravel and Sand

LAB TESTS REQUIRED: Visual/Wash sieve

SAMPLED BY	DATE D/M/Y	SAMPLE DISCARDED	RETAINED
F.C.	20/08/89		

PART 2 - COMPLETED IN THE LABORATORY

DATE RECEIVED	RECEIVED BY
Sept./89	A.H.
REQUESTED COMPLETION DATE D/M/Y	RESULTS SUBMITTED TO

PART 3 - LABORATORY TEST RESULTS AND COMMENTS

- Gravel and Sand, light brown, pebbles to 50 mm, angular (GW)

COMPILED BY	DATE D/M/Y

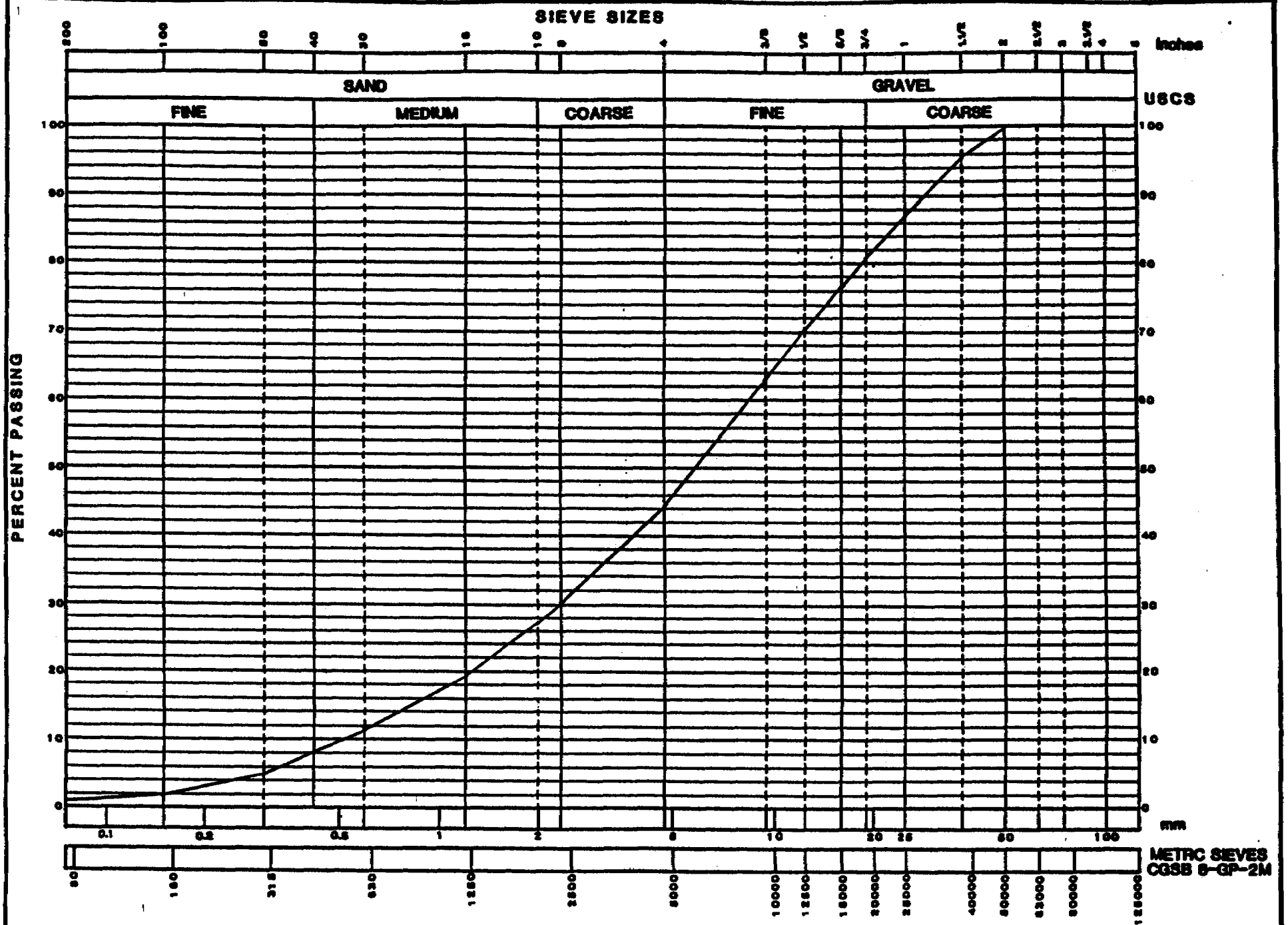
REVIEWED BY	DATE D/M/Y	ATTACHMENTS ____ - ____ PAGES

NWT 2601/0886

GRAIN SIZE CURVES

SAMPLE IDENTIFICATION: CAP-06-FC

TESTED BY: A. HARMAN



D_{10} = 0.51	D_{30} = 2.36	D_{60} = 9.0	C_u = 17.6	C_c = 1.7

Northwest Territories Public Works

SAMPLE DATA SHEET

PROJECT: CAPE DORSET - Investigation for Fines	PROJECT NUMBER: 88-9190-803

PART 1 - COMPLETED IN THE FIELD

SAMPLE IDENTIFICATION: 235-1-MB	METHOD OF SAMPLING: Backhoe	
LOCATION: Tidal Flats - 264 ft. from road between hotel and Co-op garage.		
TEST HOLE NUMBER: 1	DEPTH: 0.45m	
FIELD DESCRIPTION: Tidal Flats		
WSA		
LAB TESTS REQUIRED: Obtain instructions from Sandy Murray		
SAMPLED BY: M. Buckley	DATE D/M/Y: 23/08/88	SAMPLE DISCARDED / RETAINED: X

PART 2 - COMPLETED IN THE LABORATORY

DATE RECEIVED: September 1, 1988	RECEIVED BY: Bob Fougere
REQUESTED COMPLETION DATE D/M/Y: September 9, 1988	RESULTS SUBMITTED TO: Sandy Murray

PART 3 - LABORATORY TEST RESULTS AND COMMENTS

Gravel	32%
Sand	65%
Fines	3%

COMPILED BY	DATE D/M/Y	
REVIEWED BY	DATE D/M/Y	ATTACHMENTS _____ PAGES

NWT 2601/0686

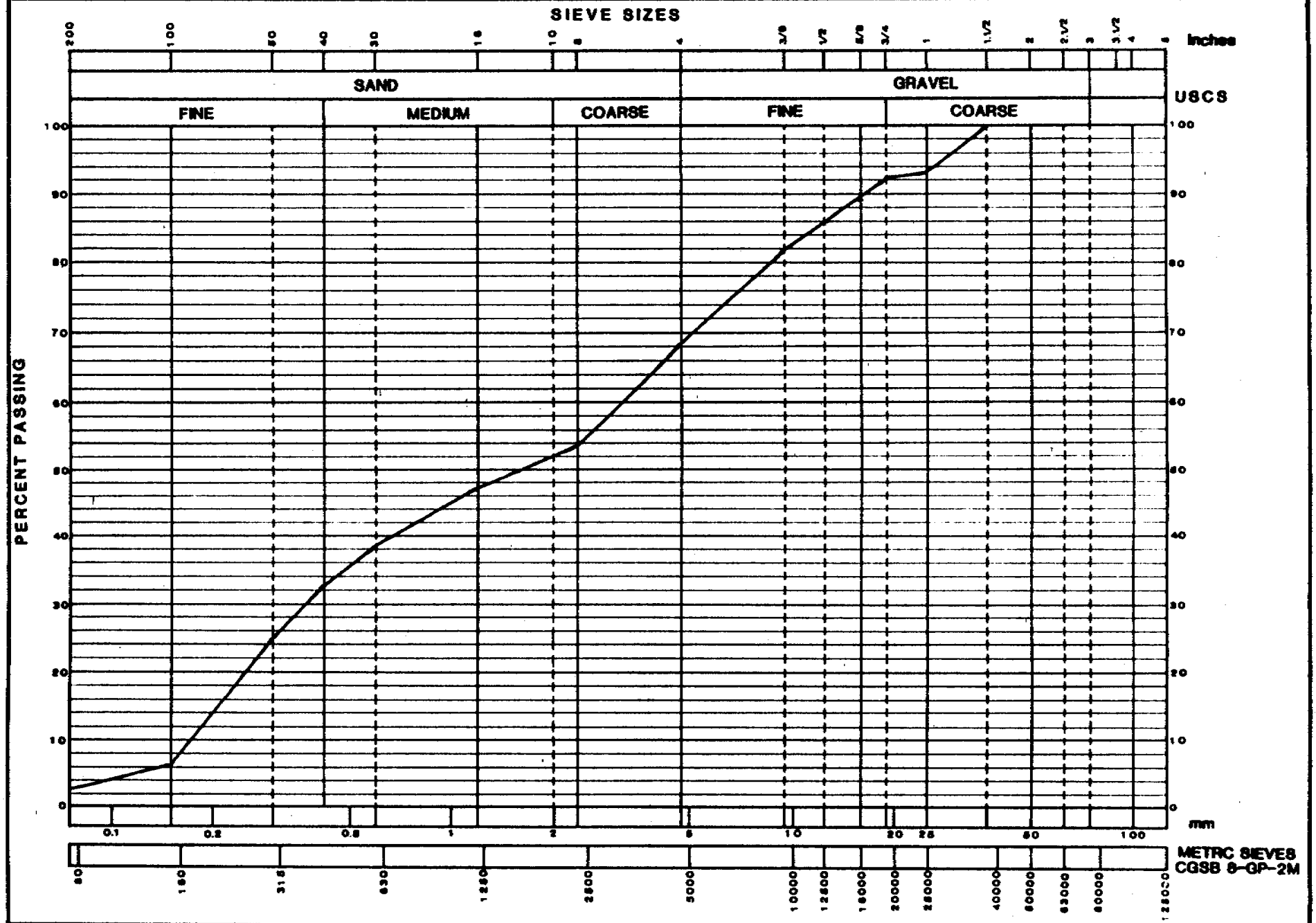
F-0486 - C 6

Northwest Territories Canada CAPE DORSET 88-9190-803

GRAIN SIZE CURVES

SAMPLE IDENTIFICATION 235-1-MB

TESTED BY NORDIC ENGINEERING LTD TS



D_0	D_{30}	D_{60}	C_u	C_c
0.17	0.37	3	17.65	0.27

TED-101/01 88;U

Northwest Territories Public Works

SAMPLE DATA SHEET

PROJECT: CAPE DORSET - Investigation for Fines	PROJECT NUMBER: 88-9190-803

PART 1 – COMPLETED IN THE FIELD

SAMPLE IDENTIFICATION: 235-2-MB	METHOD OF SAMPLING: Backhoe
LOCATION: Tidal Flats - 264 ft. from road between hotel and Co-op garage.	
TEST HOLE NUMBER: 1	DEPTH: 2.1 metres
FIELD DESCRIPTION: Tidal Flats overlain with cobbles, boulders, sand, WSA, LTS, MC.	
LAB TESTS REQUIRED: Obtain Instructions from Sandy Murray, DPW & H.	
SAMPLED BY: M. Buckley	DATE D/M/Y: 23/08/88
SAMPLE DISCARDED	RETAINED: X

PART 2 – COMPLETED IN THE LABORATORY

DATE RECEIVED: September 1/88	RECEIVED BY: Bob Fougere
REQUESTED COMPLETION DATE D/M/Y: September	RESULTS SUBMITTED TO: Sandy Murray

PART 3 – LABORATORY TEST RESULTS AND COMMENTS

Gravel	26%
Sand	50%
Fines	24%
Moisture Content	11.1%

Non-Plastic

COMPILED BY	DATE D/M/Y
REVIEWED BY	DATE D/M/Y
ATTACHMENTS _____ PAGES	

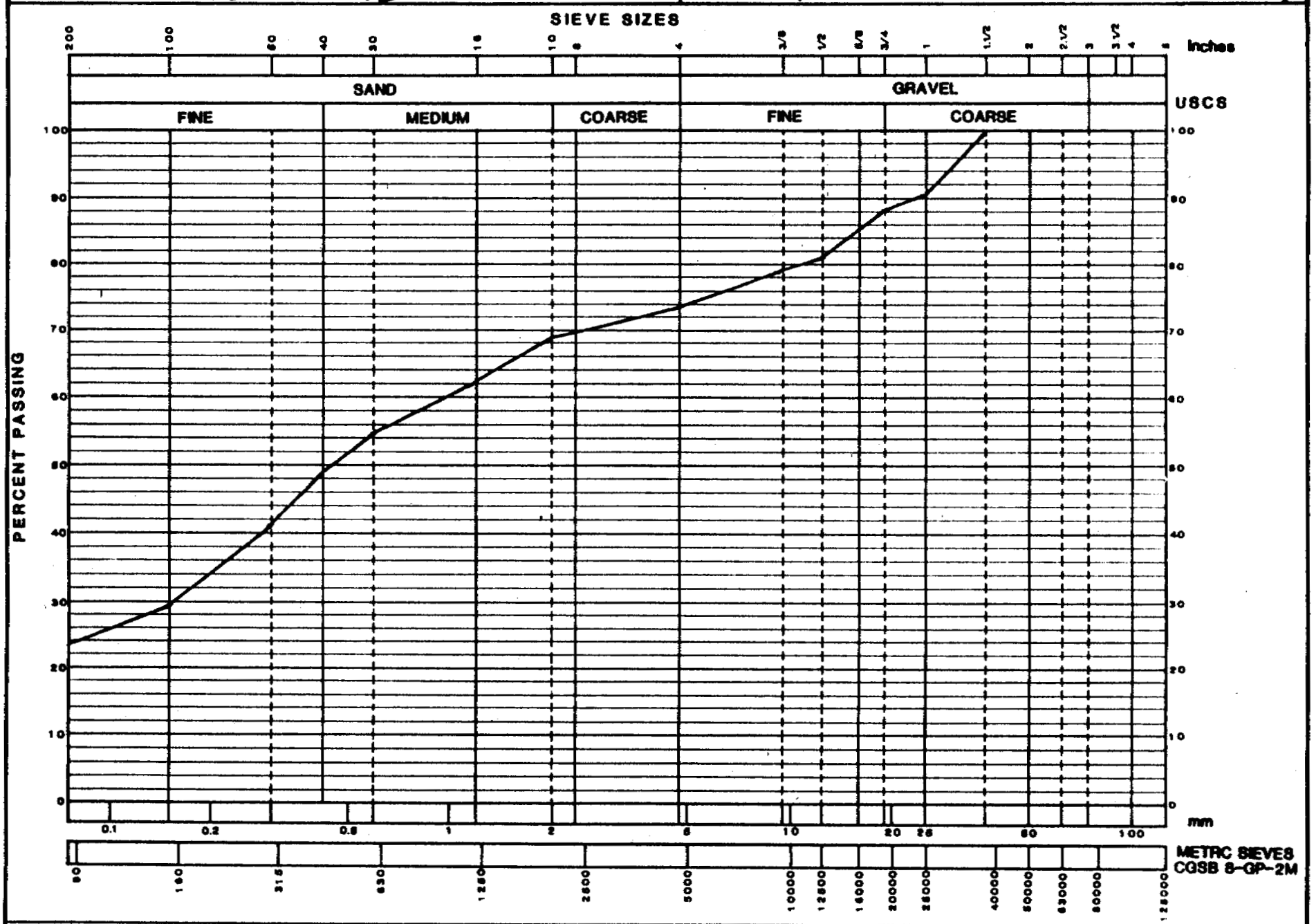
NWT 2601/0886

F-0486 - 3 €

Northwest Territories Canada CAPE DORSET 88-9190-803 **GRAIN SIZE CURVES**

SAMPLE IDENTIFICATION 235 - 2 - MB

TESTED BY NORDIC ENGINEERING LTD TS



D_0	D_{30}	D_{60}	C_u	C_c

TED-101/01 88;IJ

Northwest Territories Public Works

SAMPLE DATA SHEET

PROJECT: CAPE DORSET - Investigation for Fines	PROJECT NUMBER: 88-9190-803

PART 1 - COMPLETED IN THE FIELD

SAMPLE IDENTIFICATION: 230-2-MB	METHOD OF SAMPLING: Shovel
LOCATION: Tidal Flats - 400' from road, 250' east of base of Rock slope. Adjacent Lots 118 and 119	
TEST HOLE NUMBER: 2	DEPTH: 16 inches
FIELD DESCRIPTION: Tidal Flats overlain with cobbles, boulders, sand	
WSA	
LAB TESTS REQUIRED: Obtain instructions from Sandy Murray, DPW & H	
SAMPLED BY: M. Buckley	DATE D/M/Y: 18/08/88
SAMPLE DISCARDED	RETAINED: X

PART 2 - COMPLETED IN THE LABORATORY

DATE RECEIVED: September 1, 1988	RECEIVED BY: Bob Fougere
REQUESTED COMPLETION DATE D/M/Y: September 9, 1988	RESULTS SUBMITTED TO: Sandy Murray

PART 3 - LABORATORY TEST RESULTS AND COMMENTS

Gravel	44%
Sand	54%
Fines	2%

COMPILED BY	DATE D/M/Y	
REVIEWED BY	DATE D/M/Y	ATTACHMENTS _____ PAGES

NWT 2601/0986

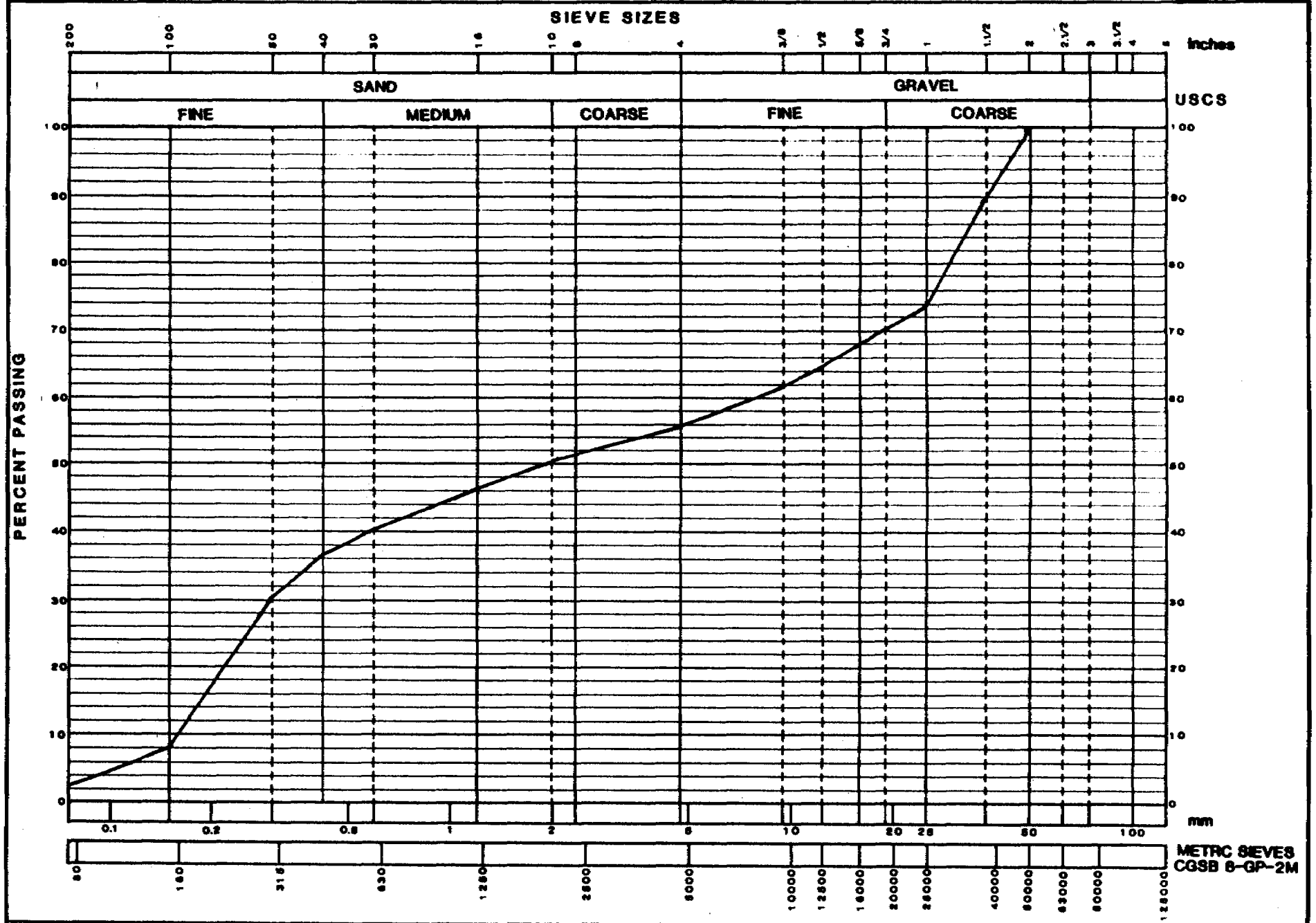
F-0486 - 016

Northwest Territories Canada CAPE DORSET 88-9190-803

GRAIN SIZE CURVES

SAMPLE IDENTIFICATION 230-2-MB

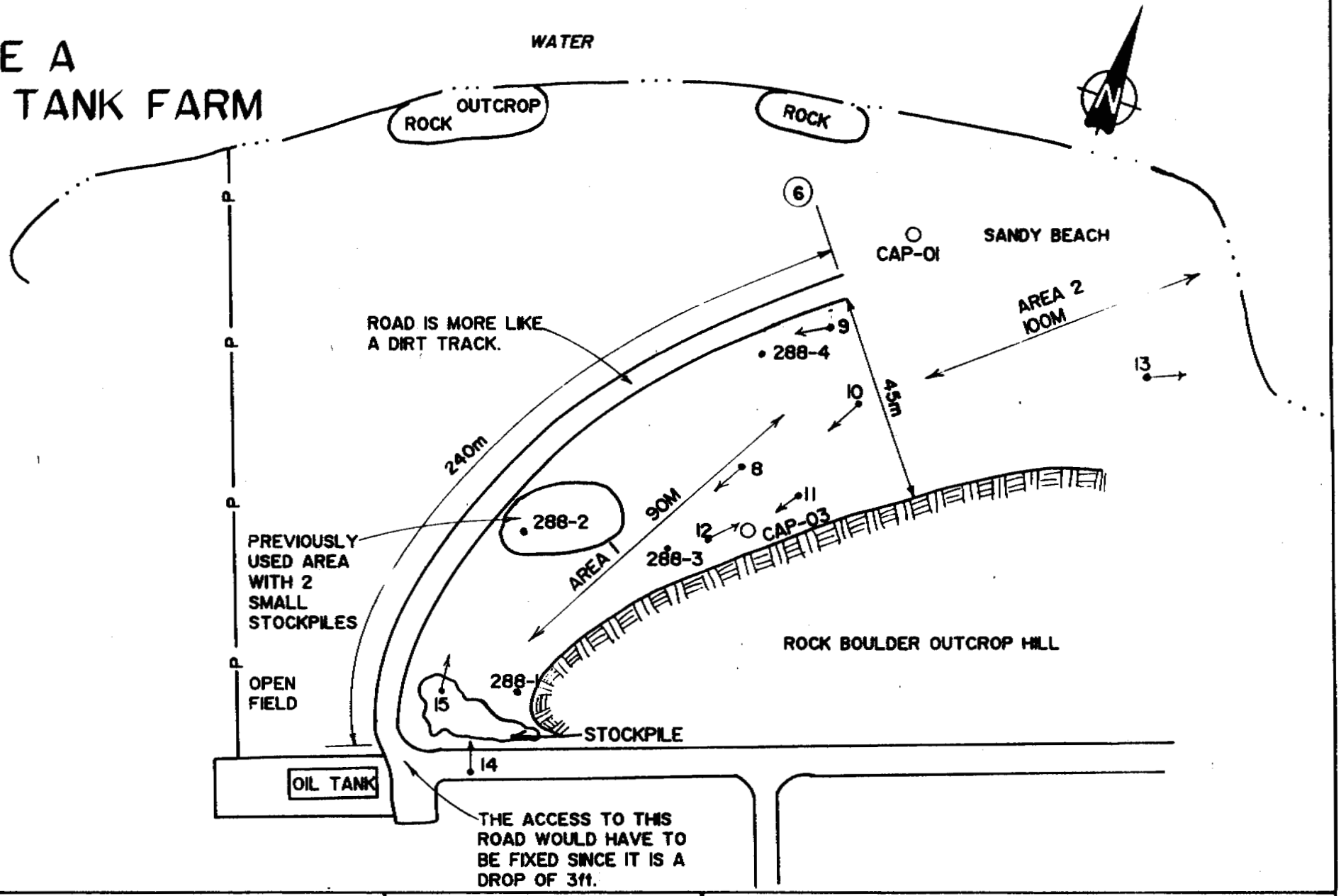
TESTED BY NORDIC ENGINEERING LTD TS



D_0	D_{30}	D_{60}	C_u	C_c
0.16	0.31	8	50.0	0.08

TSD-101/0168;U

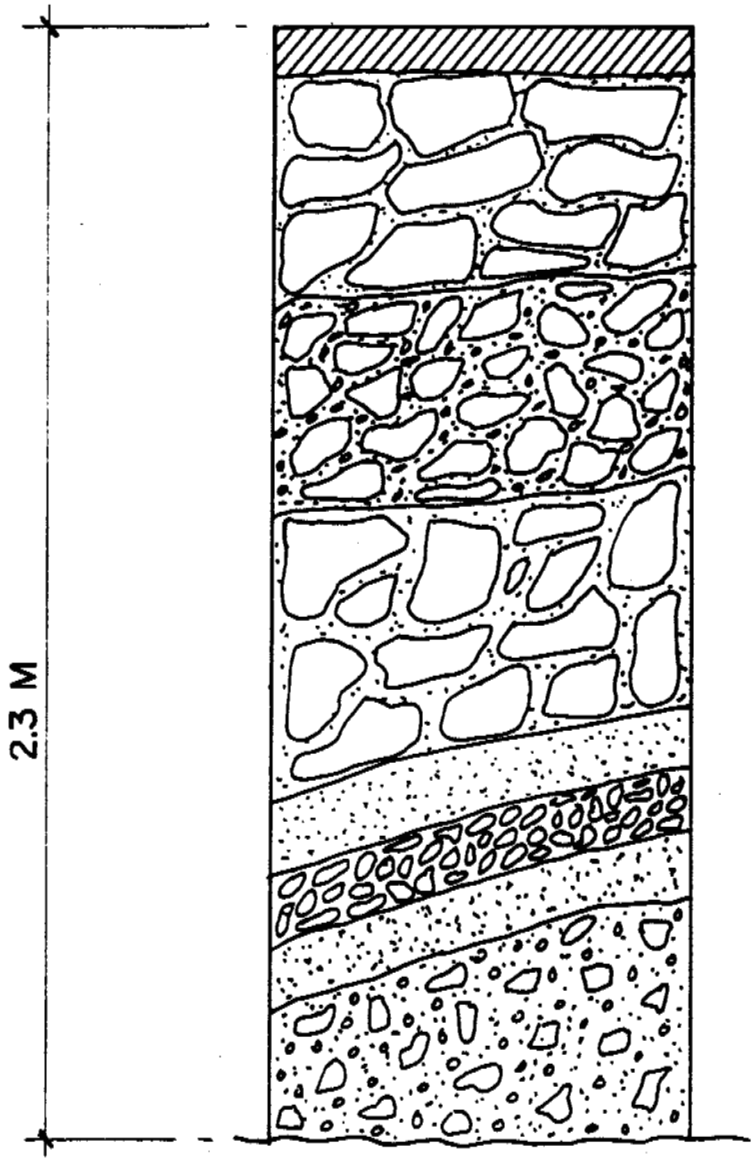
SITE A
BY TANK FARM



Northwest Territories Public Works

Date: APRIL 1990	Title: CAPE DORSET SITE A
Drawn by: B. ROCHON	
Approved by:	
Scale: N.T.S.	Project No.: 90-9170-803
	Drawing No.: FIGURE 1

SITE A: TEST PIT CAP-03-FC (Photo # 11)



0.1M ORGANIC

0.4M LARGE COBBLES WITH COARSE GRAVEL 15-30cm

0.4M SMALL COBBLES AND PEBBLES 2-15cm

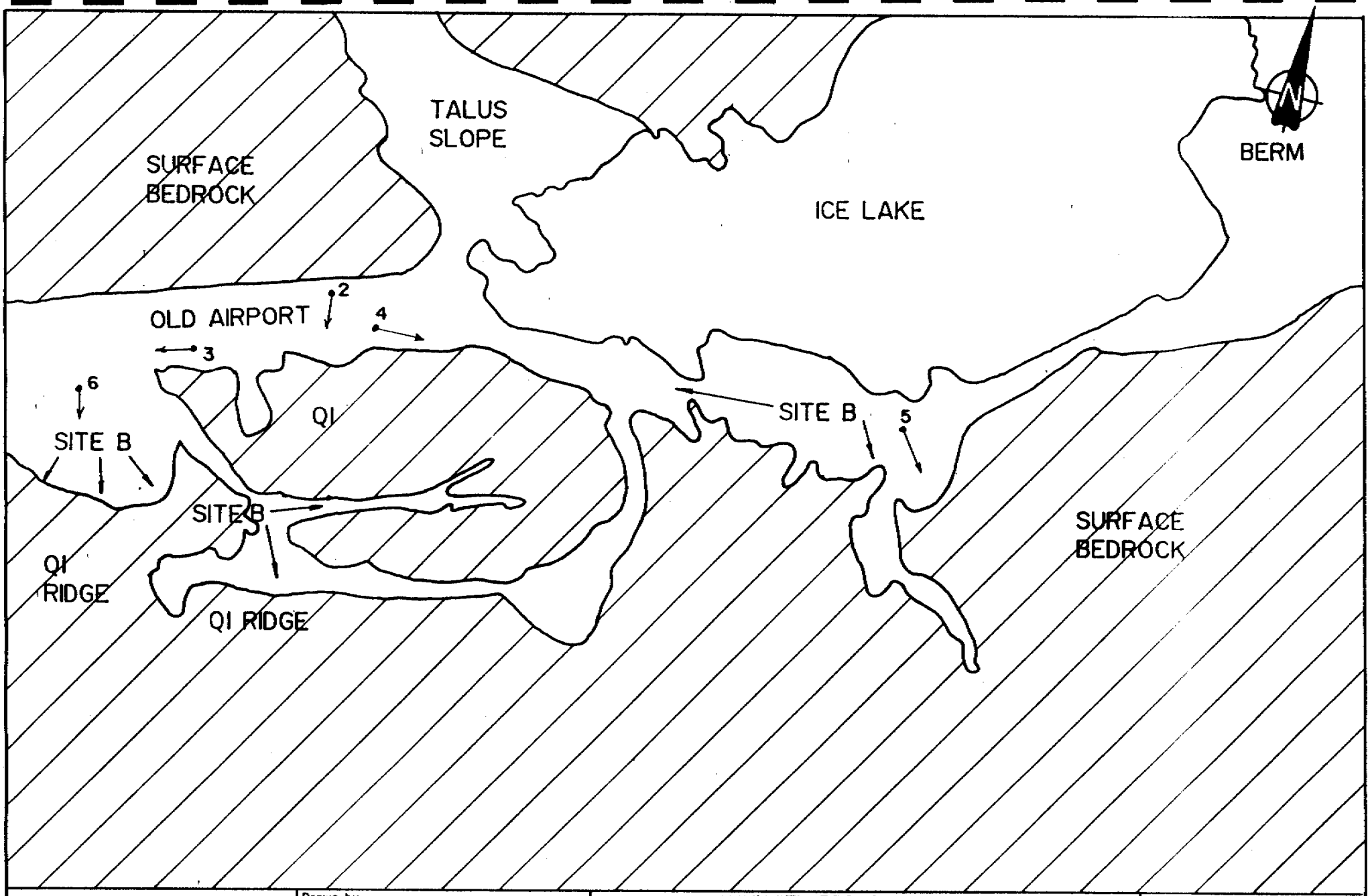
0.5M COARSE GRAVEL AND COBBLES 15-30cm

0.4M INTERBEDDED LAYERS OF PEBBLES AND COARSE SAND.

0.5M SMALL COBBLES AND PEBBLES IN A SAND MATRIX 2-6cm

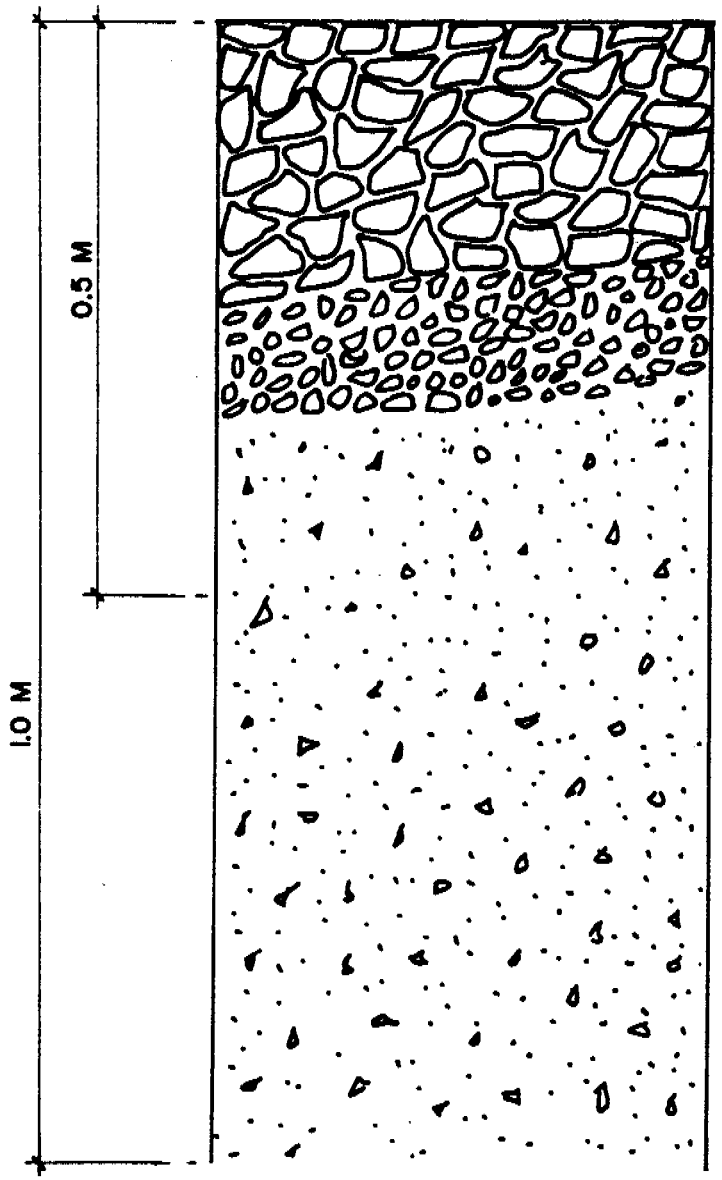
Northwest Territories Public Works

Checked by		COMMUNITY PROGRAMS SECTION ENGINEERING DIVISION			
Approved by		CAPE DORSET: SITE A CROSS SECTION CAP-03-FC			
REVISIONS		69-9170-803			
Date	By				
		Drawn by B.ROCHON	Date NOV. 1989	Scale N.T.S.	Dwg. No. FIG. 2



Northwest Territories Public Works	Drawn by: B. ROCHON Checked by: Approved by: D.P.W. ENG. Date: DEC. 1989 Scale: 1:2000	COMMUNITY PROGRAMS SECTION ENGINEERING DIVISION CAPE DORSET SITE B: ICE LAKE 89-9170-803	REVISIONS Date / By Drawing No FIG. 3

SITE B: (ICE LAKE)
REPRESENTATIVE CROSS SECTION



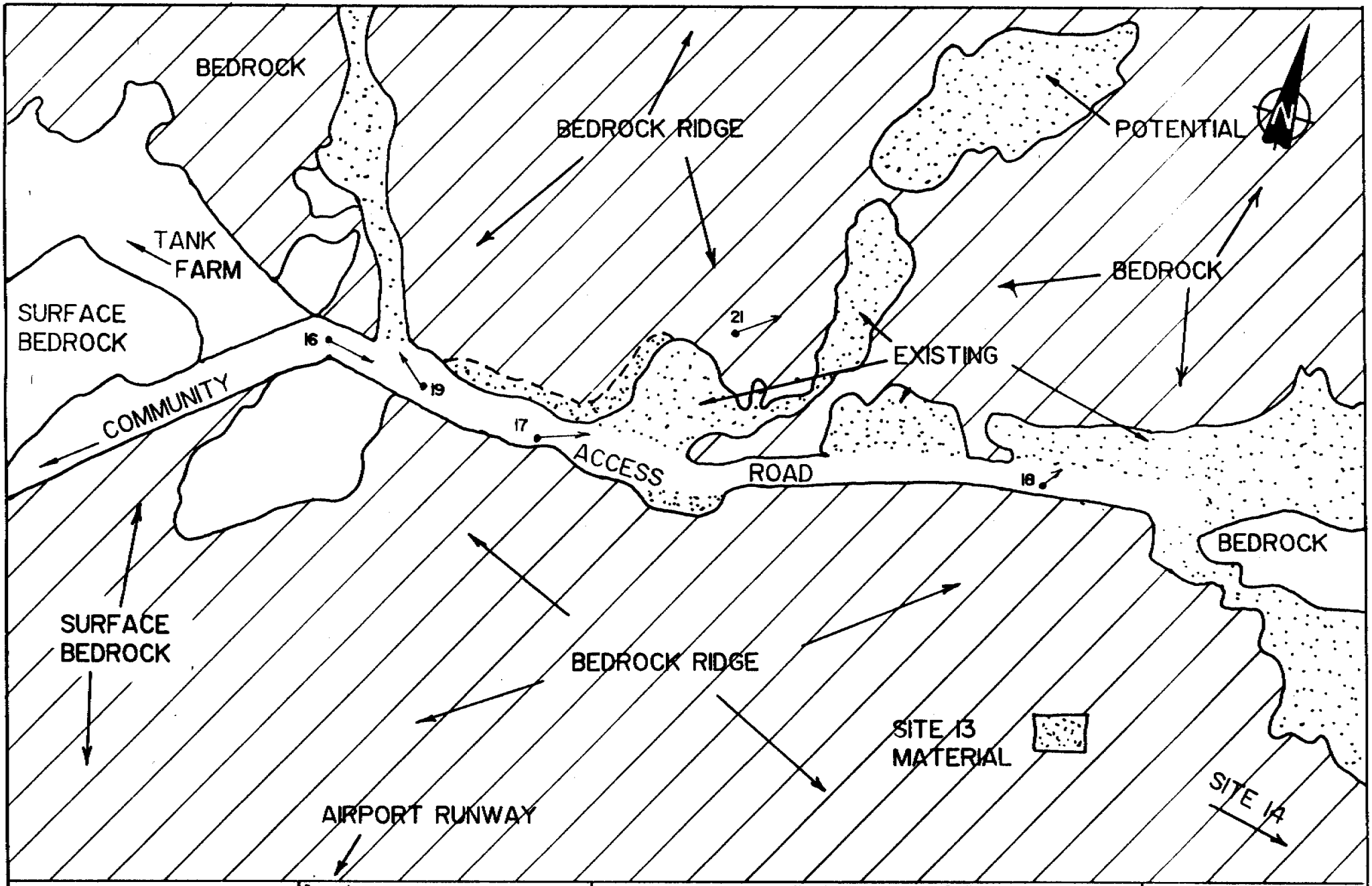
0.2M WEATHERED MATERIAL

0.1M FINE GRAVEL

0.7M COARSE SAND

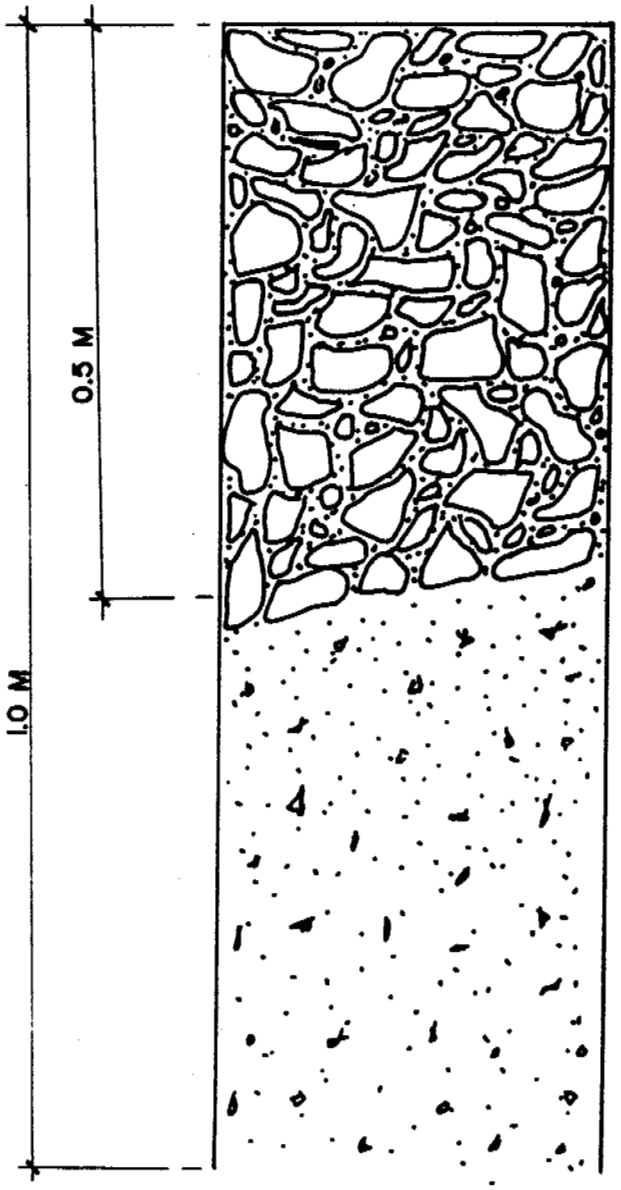
Northwest Territories Public Works

Checked by		COMMUNITY PROGRAMS SECTION ENGINEERING DIVISION
Approved by		
REVISIONS		SITE B - PIT WALL CAPE DORSET, N.W.T.
Date	By	
		Drawn by B.ROCHON · Date DEC.1989 · Scale N.T.S. · Dwg. No. FIG. 4



Northwest Territories Public Works	Drawn by: B. ROCHON Checked by: Approved by: D.P.W. ENG. Date: DEC. 1989 Scale: 1:2000	COMMUNITY PROGRAMS SECTION ENGINEERING DIVISION CAPE DORSET SITE 13 69-9170-803	REVISIONS Date / By Drawing No. FIG. 5

SITE 13: REPRESENTATIVE CROSS SECTION



NO ORGANICS

0.5M COARSE GRAVEL, PEBBLES AND COBBLES. MAX. 30cm.

0.5M COARSE SAND, SOME PEBBLES

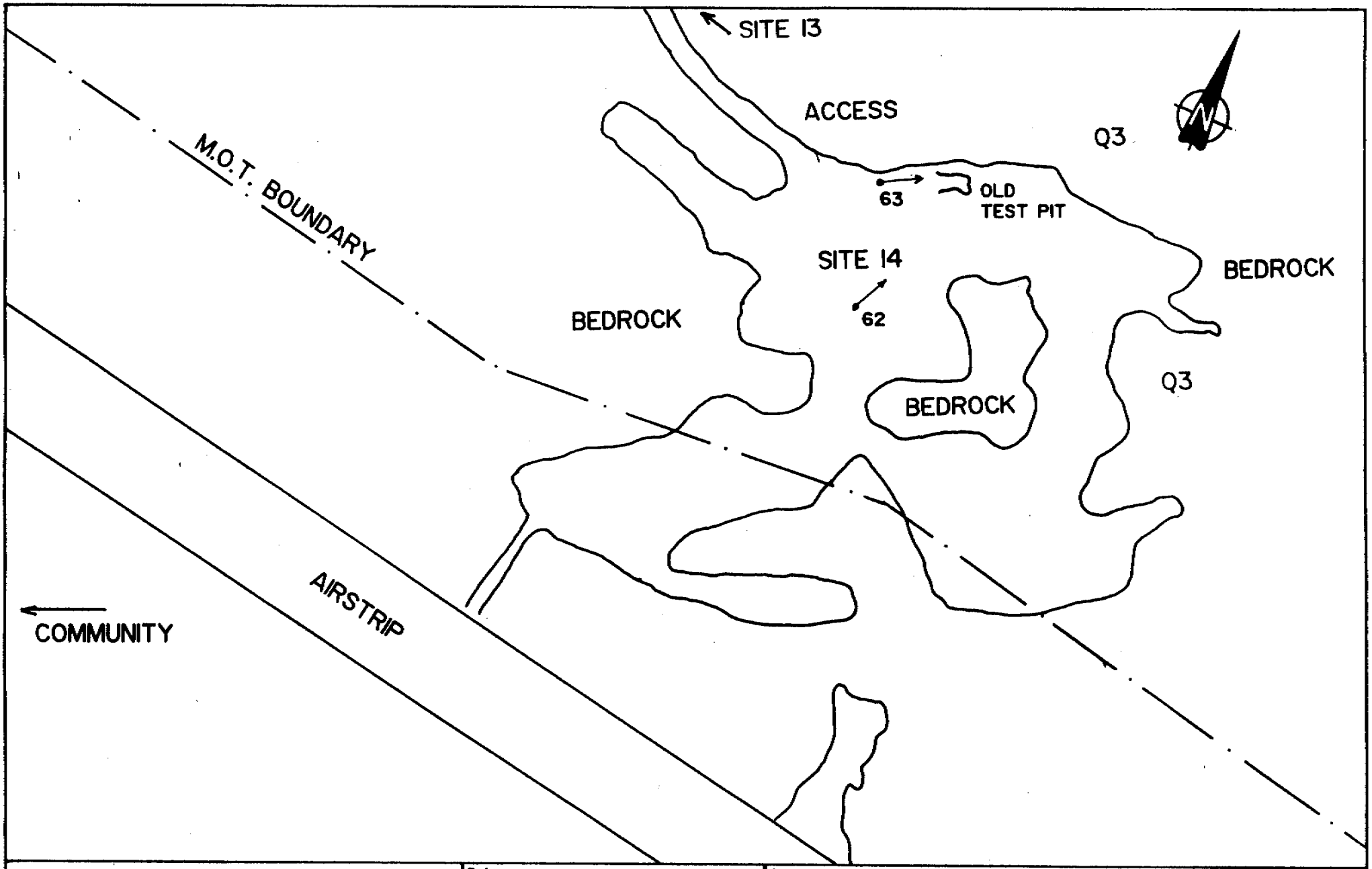
Northwest Territories Public Works

Checked by	
Approved by	
REVISIONS	
Date	By

COMMUNITY PROGRAMS SECTION
ENGINEERING DIVISION

SITE 13 - CROSS SECTION
CAPE DORSET, N.W.T.

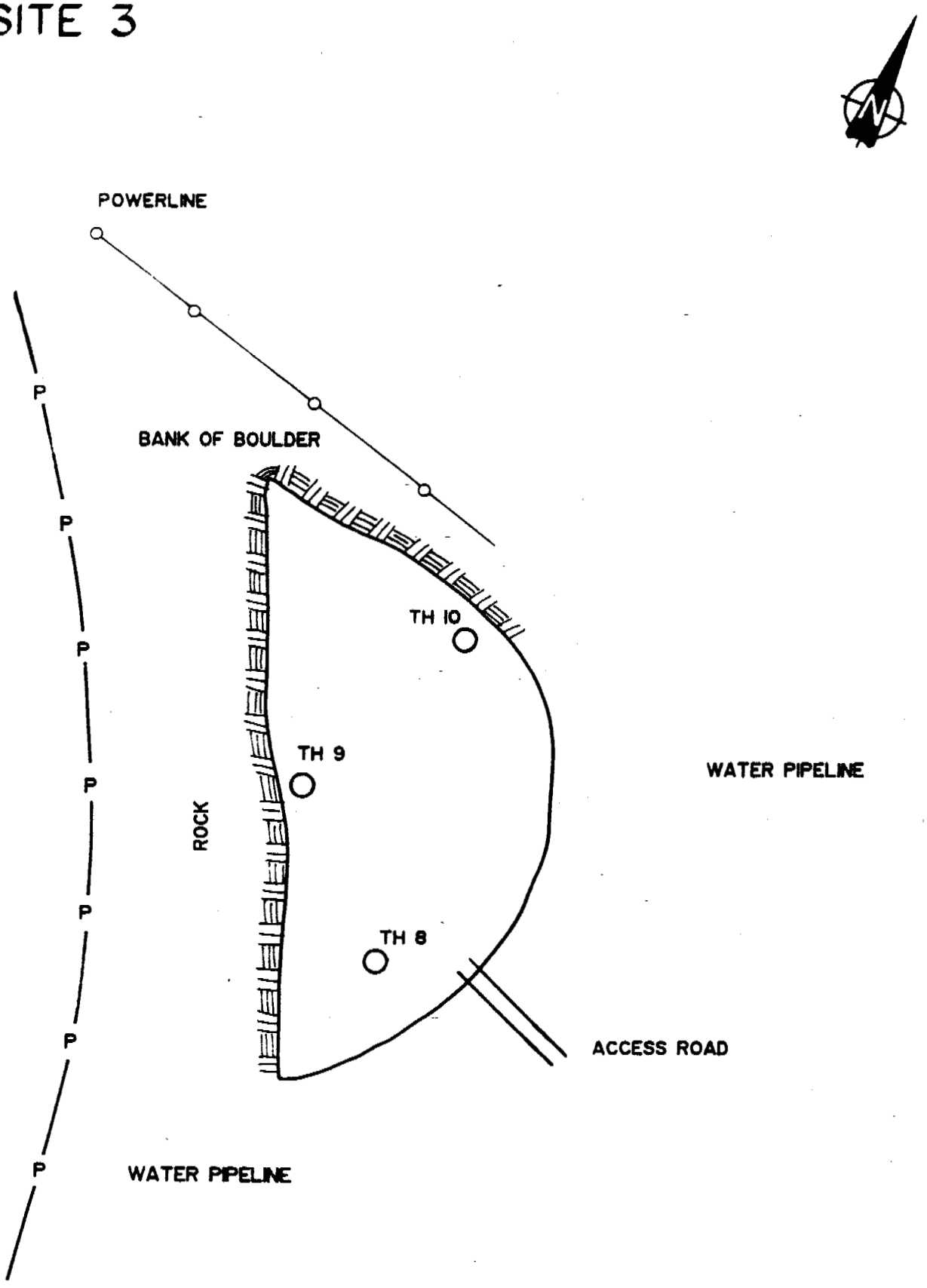
Drawn by	Date	Scale	Dwg. No.
B.ROCHON	DEC.1989	N.T.S.	FIG. 6



Northwest Territories Public Works

Date	APRIL 1990
Drawn by	B. ROCHON
Approved by	
Scale	1:500
Title	CAPE DORSET SITE 14
Project No.	89-9120-803
Drawing No.	FIG. 7

SITE 3



Northwest Territories Public Works and Highways

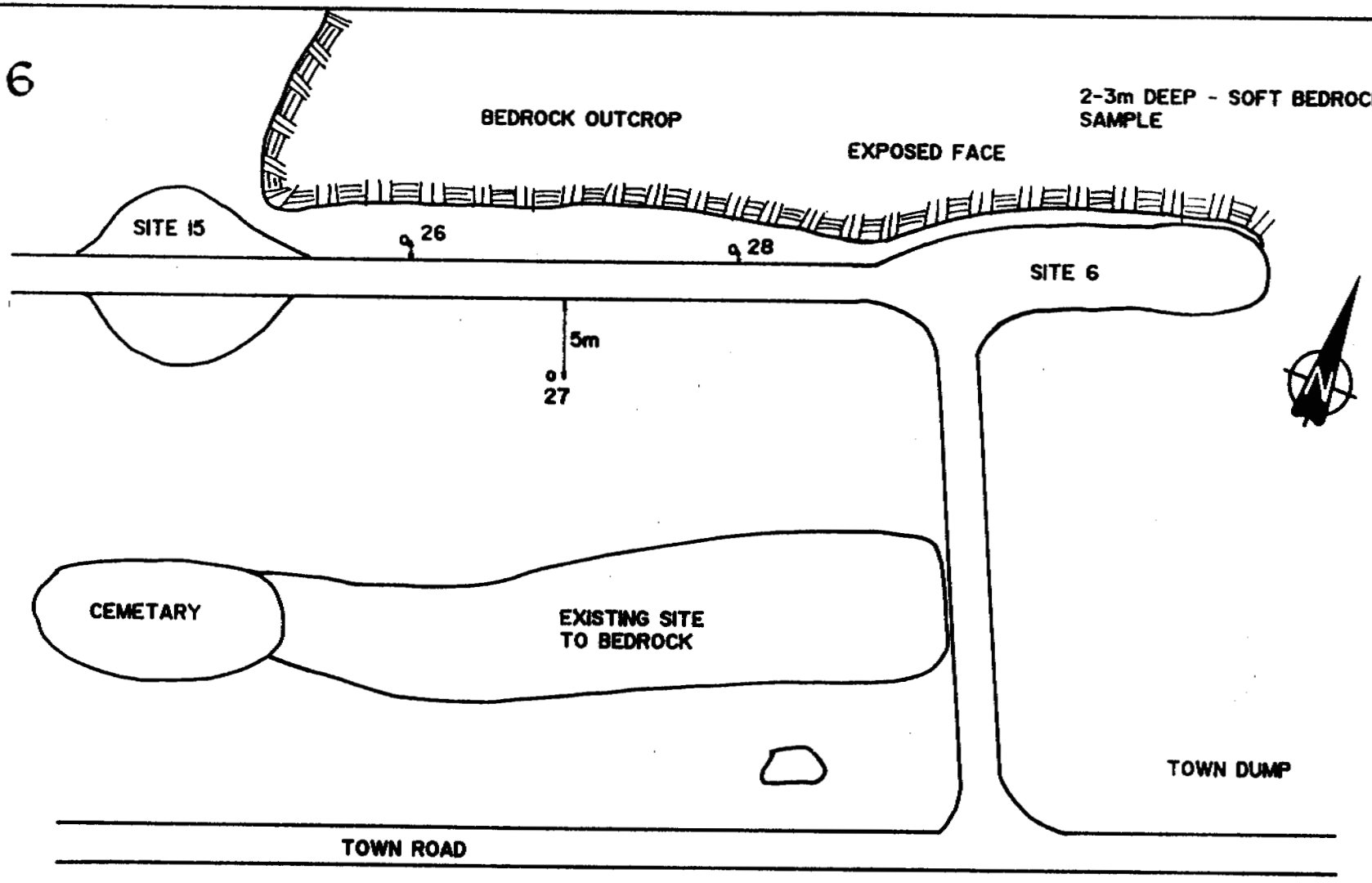
Date	AUG. 1988
Drawn by	BETH McGALE
Approved by	
Scale	N.T.S.

Title: **CAPE DORSET SITE 3**

Project No. 88-9170-803

Drawing No. FIG. 8

SITE 6



Northwest Territories Public Works and Highways

Date	AUG. 1988
Drawn by	BETH McGALE
Approved by	
Scale	N.T.S.

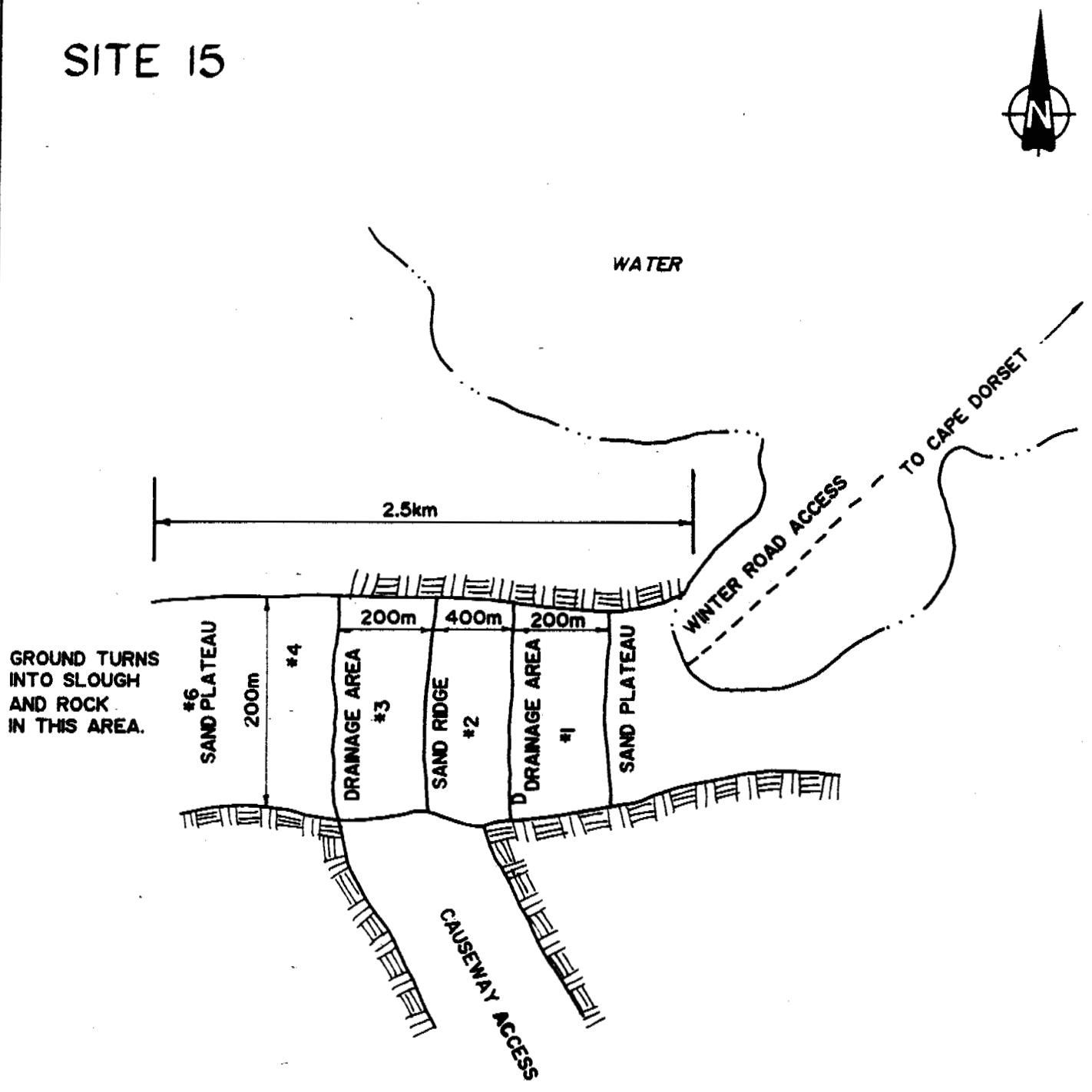
Title

CAPE DORSET SITE 6

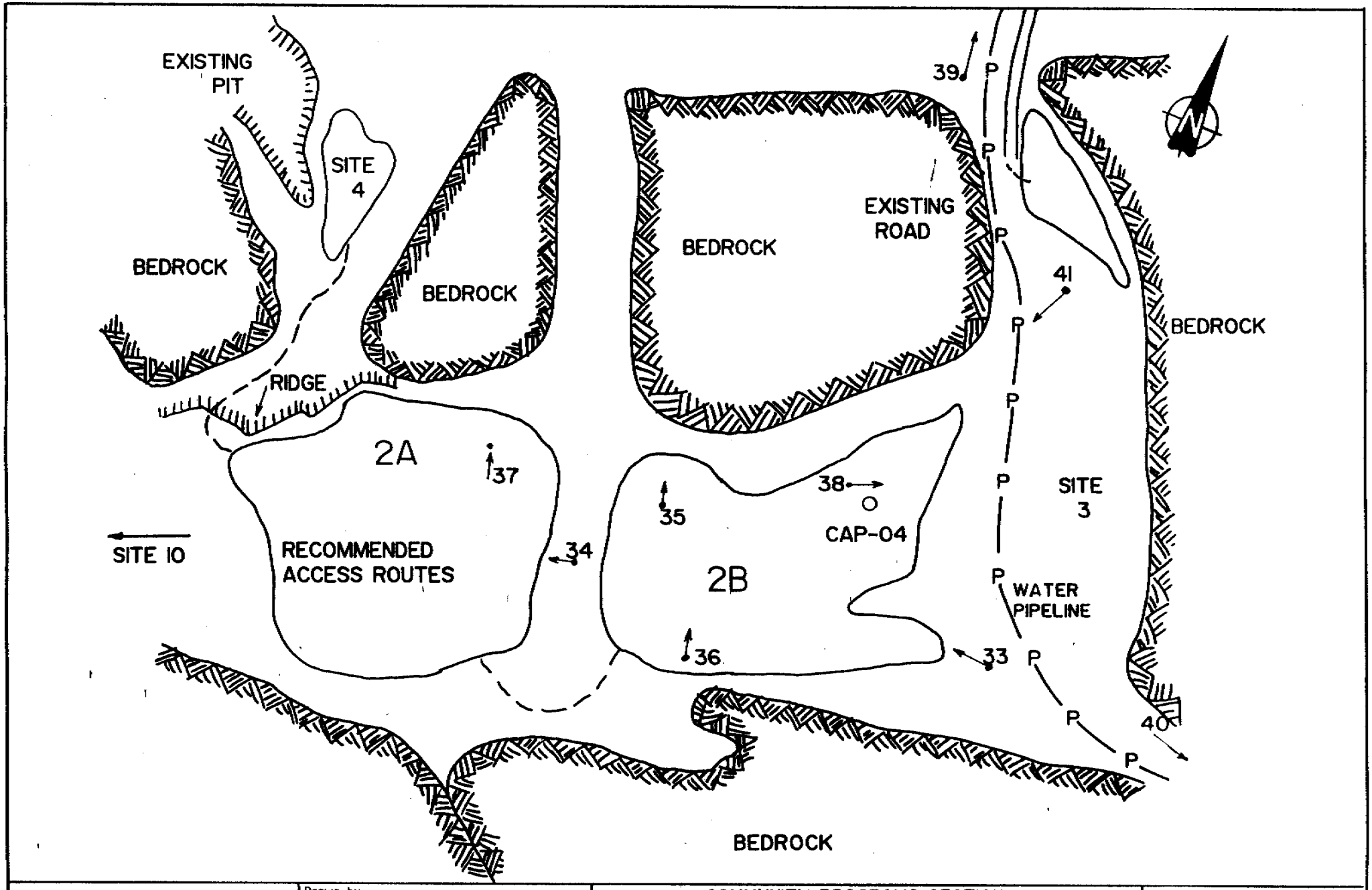
Project No 88-9120-803

Drawing No FIG. 9

SITE 15

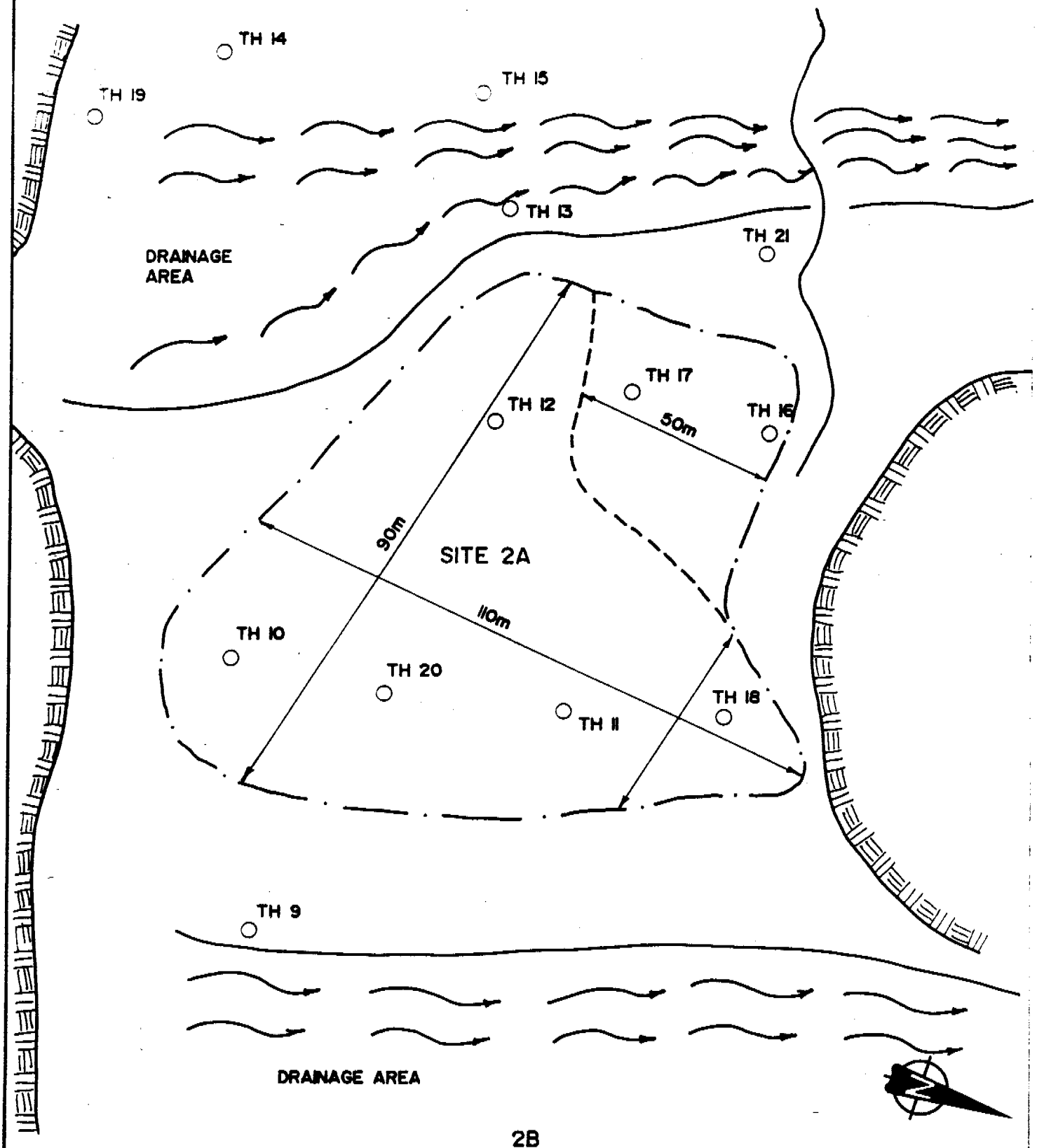


Northwest Territories Public Works and Highways	Date: AUG. 1988	Title: CAPE DORSET SITE 15
	Drawn by: BETH McGALE	
	Approved by:	
	Scale: N.T.S.	Project No.: 88-9120-803
		Drawing No.: FIG. 10



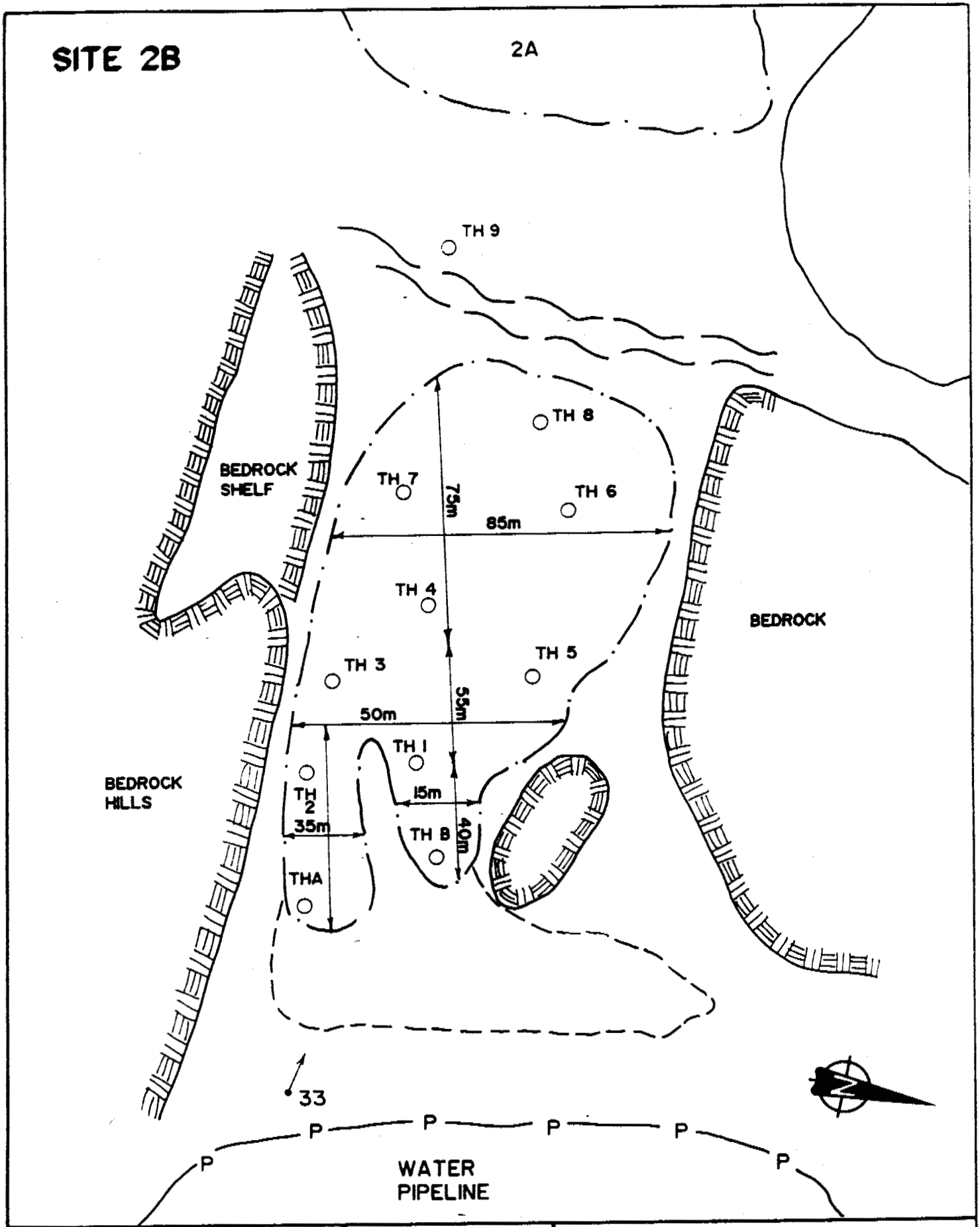
Northwest Territories Public Works	Drawn by: B. ROCHON Checked by: Approved by: Date: APRIL 1990 Scale: N.T.S.	COMMUNITY PROGRAMS SECTION ENGINEERING DIVISION **CAPE DORSET** **SITE 2A & 2B** 89-9120-803	REVISIONS Date / By Drawing No. FIG. 11

SITE 2A



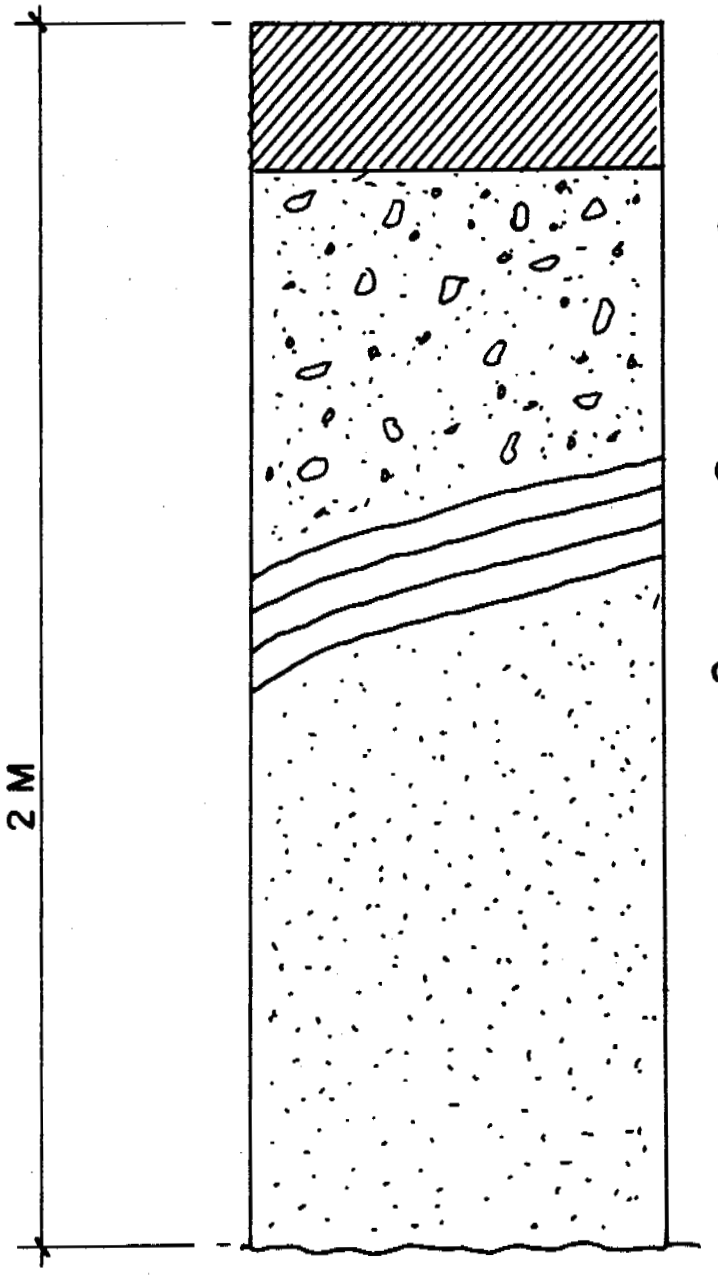
2B

Northwest Territories Public Works and Highways	Date: AUG. 1988	Title: CAPE DORSET SITE 2A	
	Drawn by: BETH McGALE		
	Approved by:		
	Scale: N.T.S.	Project No.: 88-9120-803	Drawing No.: FIG. 12



Northwest Territories Public Works and Highways	Date APR. 1990	Title CAPE DORSET SITE 2B	
	Drawn by B. ROCHON		
	Approved by		
	Scale N.T.S.	Project No. 88-9120-803	Drawing No. FIG. 13

SITE 2: TEST PIT CAP-04-FC (Photo # 38)



0.3 ORGANIC

0.6 COARSE SAND CONTAINING 15% PEBBLES/COBBLES

0.2 INTERBEDDED LAYERS OF FINE SAND AND COARSE GRAVEL

0.9 CLEAN FINE SAND

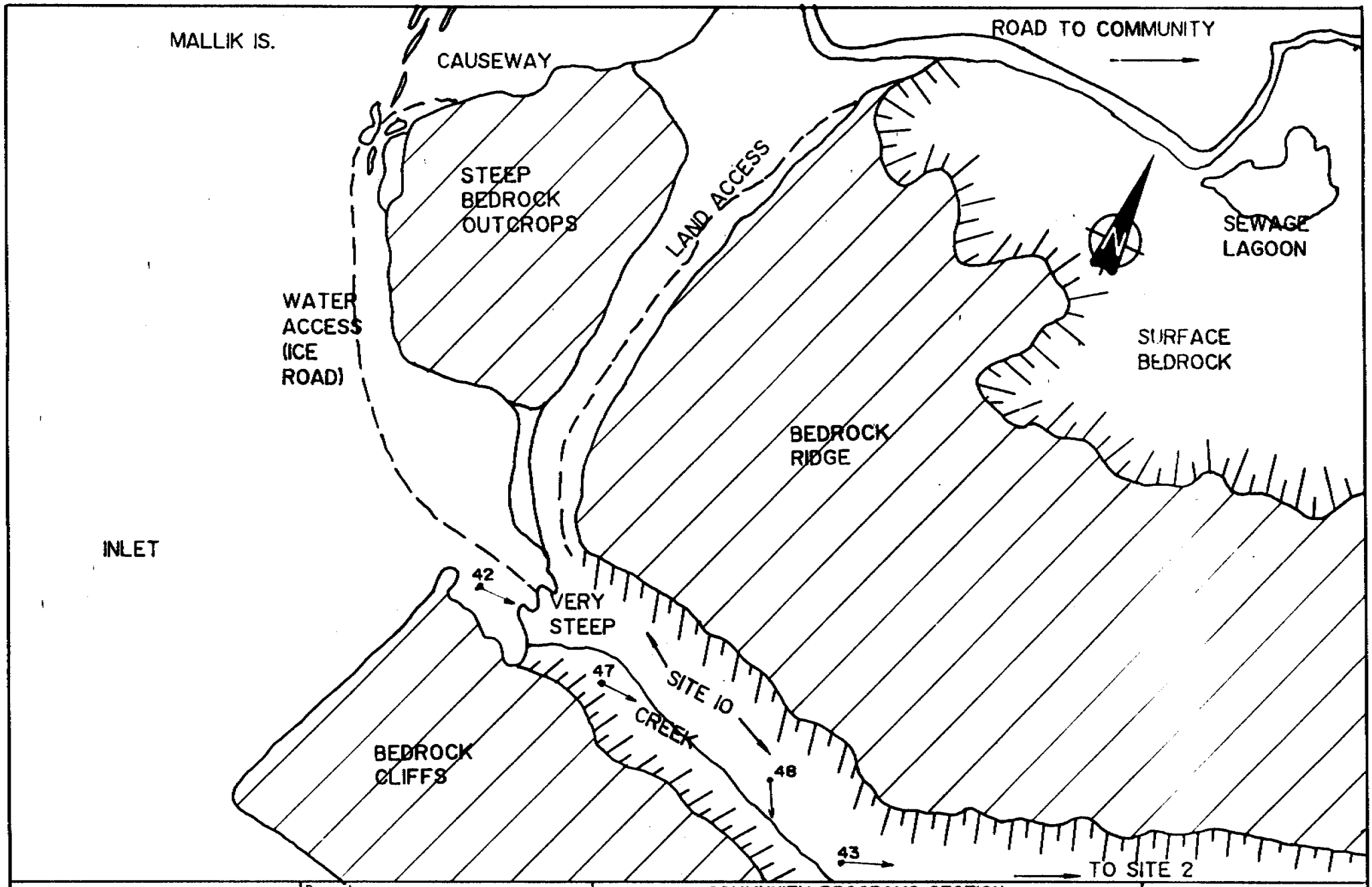
Northwest Territories Public Works

Checked by	
Approved by	
REVISIONS	
Date	By

COMMUNITY PROGRAMS SECTION
ENGINEERING DIVISION

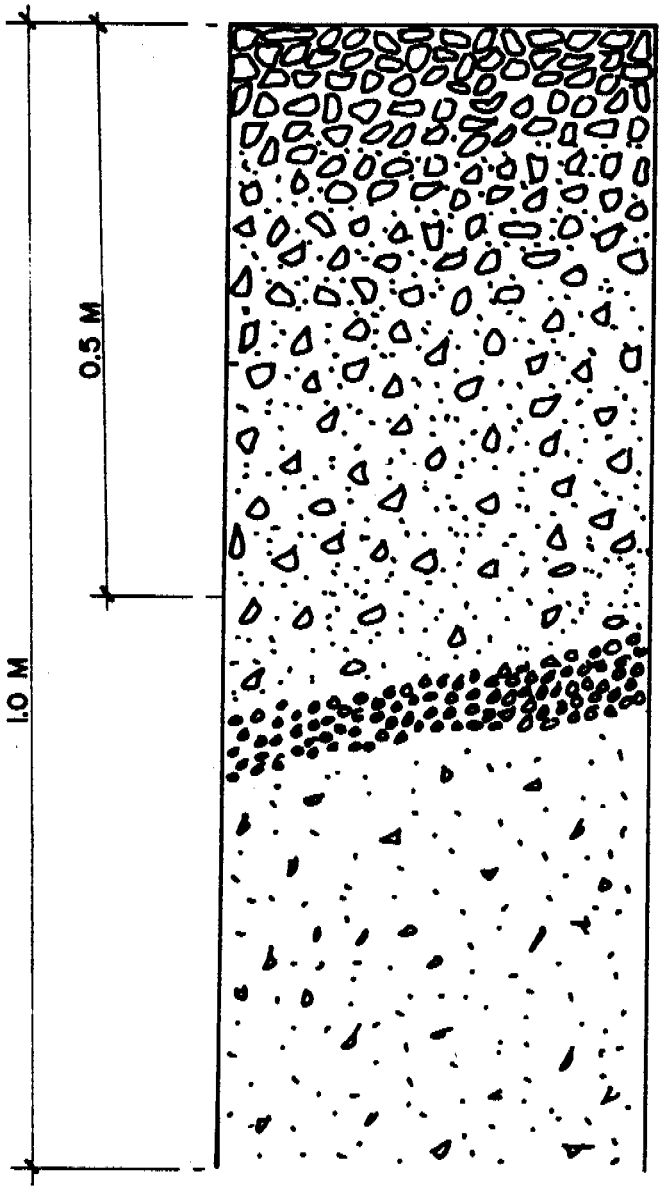
CAPE DORSET: SITE 2
CROSS SECTION CAP-04-FC

Drawn by	Date	Scale	Dwg. No.
A.ROCHON	NOV. 1989	N.T.S.	FIG. 16



Northwest Territories Public Works	Drawn by: B. ROCHON Checked by: Approved by: Date: DEC. 1989 Scale: N.T.S.	COMMUNITY PROGRAMS SECTION ENGINEERING DIVISION CAPE DORSET SITE 10 89-9170-803	REVISIONS Date / By Drawing No. FIG. 15

SITE 10: REPRESENTATIVE CROSS SECTION



NO ORGANICS

0.6M COARSE GRAVEL AND PEBBLES, CLEAN, ANGULAR, SUB-ROUNDED. MAX. SIZE 12cm.

GRADES INTO COARSE SAND

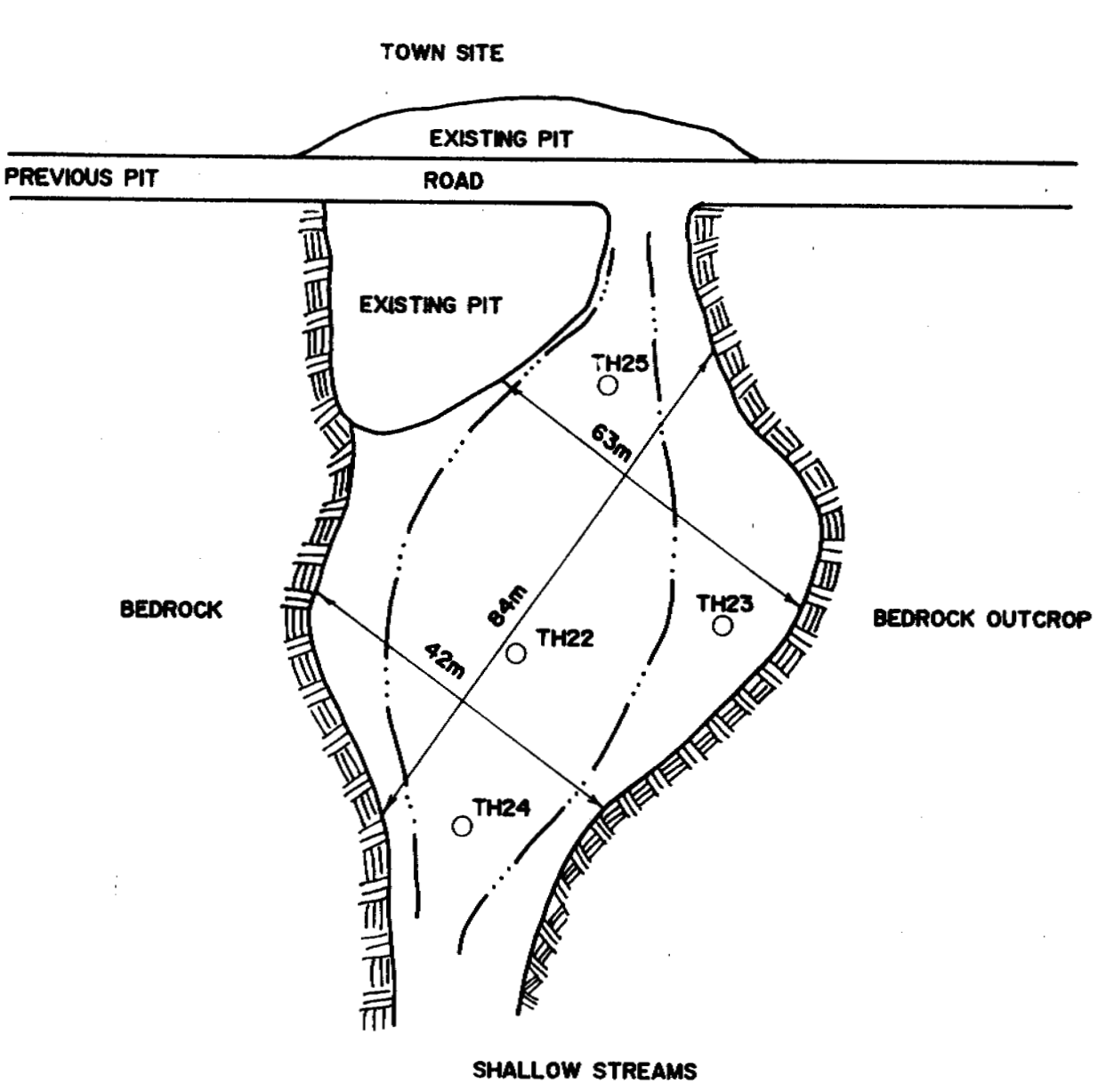
BAND OF ROUNDED PEBBLES, 8-10 cm WIDE.

0.4M OF SAND/GRAVEL MIX.

Northwest Territories Public Works

Checked by	COMMUNITY PROGRAMS SECTION ENGINEERING DIVISION
Approved by	
REVISIONS	SITE 10 - CROSS SECTION CAPE DORSET, N.W.T.
Date / By	
Drawn by B.ROCHON	Date DEC.1989
Scale N.T.S.	Dwg. No. FIG. 16

SITE 4
TESTHOLES
22 TO 25



Northwest Territories Public Works and Highways

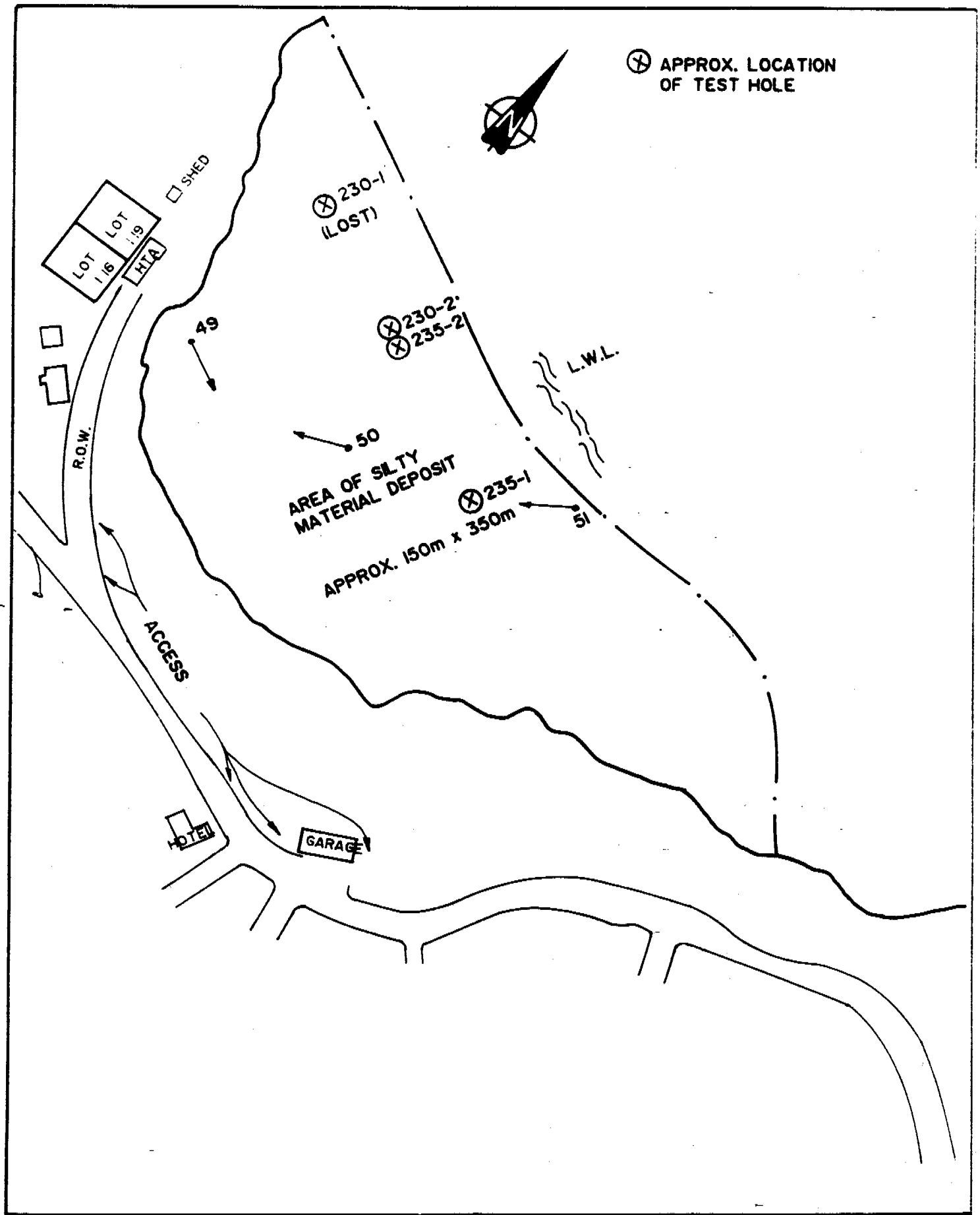
Date	AUG. 1988
Drawn by	BETH McGALE
Approved by	
Scale	N.T.S.

Title

CAPE DORSET SITE 4

Project No. 88-9120-803

Drawing No. FIG. 17



Northwest Territories Public Works

Date	APR. 1990
Drawn by	B. ROCHON
Approved by	
Scale	N.T.S.

Title: CAPE DORSET TIDAL FLATS

Project No. 89-9120-803

Drawing No. FIG. 18

APPENDIX B

Ground Reconnaissance Photographs
August 1989
#1 - 63

PHOTO INDEX

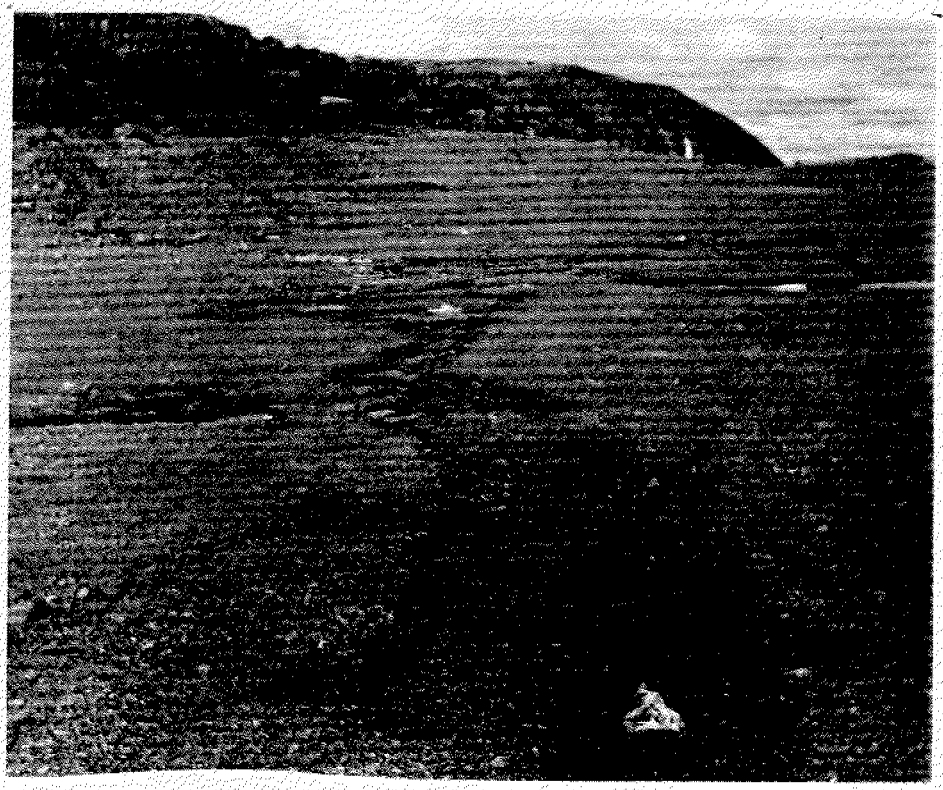
NUMBER	PHOTO DESCRIPTION
1	Overview of Cape Dorset looking directly east.
2 - 5	Site B (Ice Lake)
6	Old Airport Runway
7	View of Q1
8 - 15	Site A
16 - 21	Site 13
22 - 26	FBS
27	Dump Site
28	Sewage Lagoon
29	Site 8
30	Ridge between sewage lagoon and Site 10
31 - 41	Site 2
42 - 48	Site 10
49 - 54	Tidal Flats
55	Mallik Island
56 - 61	Causeway / Mallik Island
62 - 63	Site 14 (MOT site)

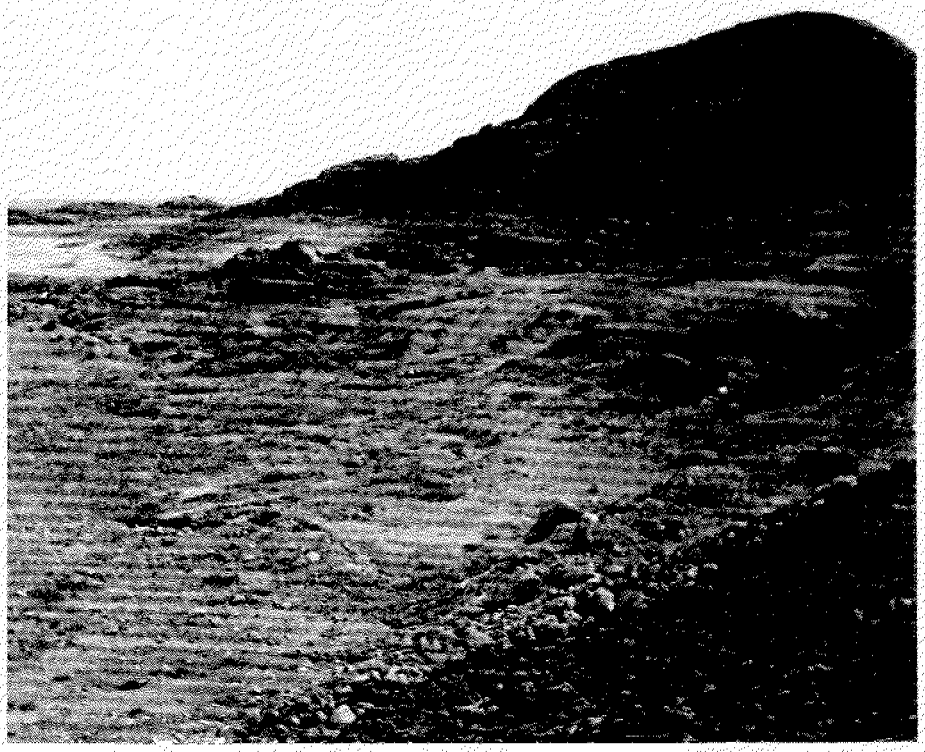
#2

Site B looking southeast from old airport. Q1 is in middle background.

#3

View of Q1 and Site B looking southwest from old airport. Drainage is from abandoned borrow at Site B.



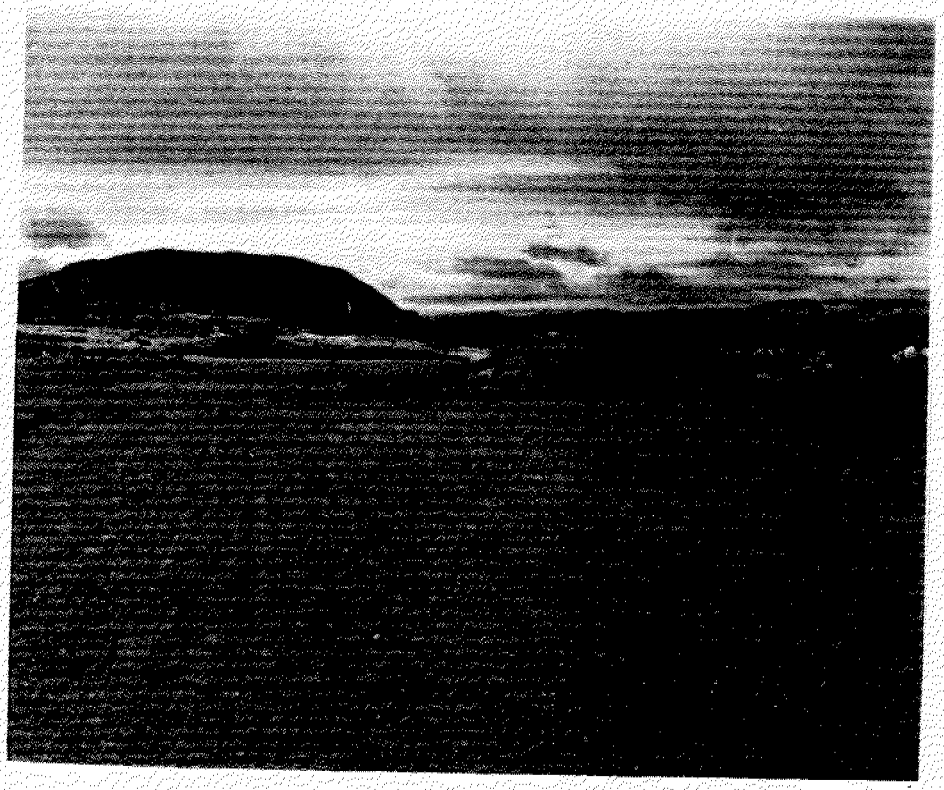


#4

Good view of the fine sands and gravels of Site 'B". Ice Lake in top left corner. This pit is presently abandoned but note the volume of material remaining.

#5

Site 'B' material in foreground with Q_1 in background.

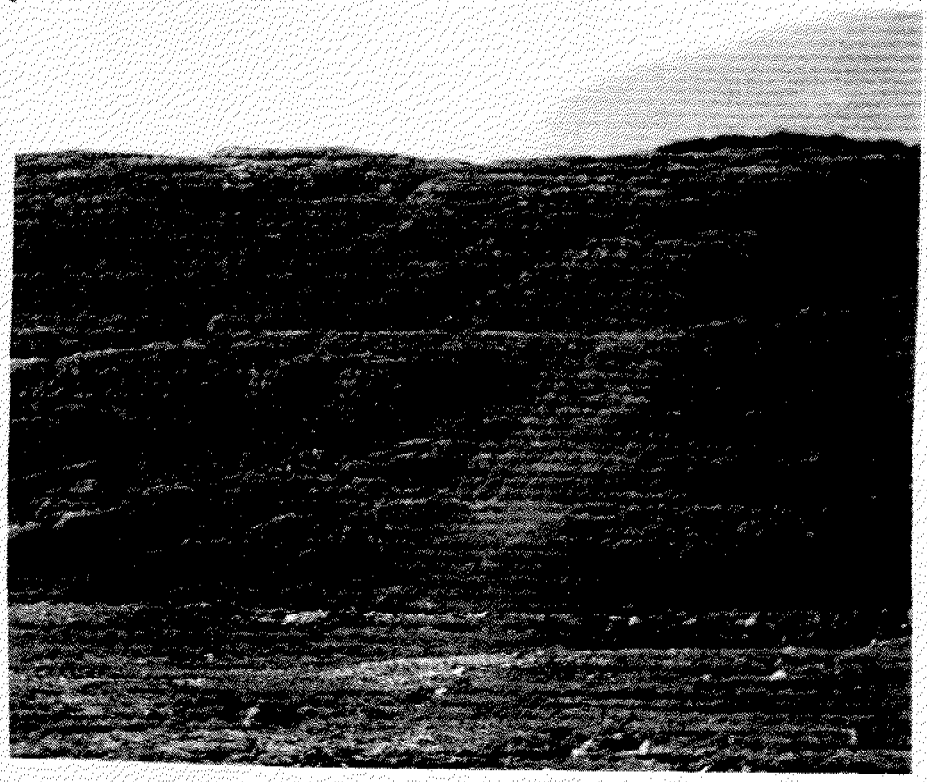


#6

Old airport runway looking west. Origin of stockpile in photo unknown. Area of new subdivision in far background.

#7

View of proposed quarry Site Q1. Note available access and working face. View is directly south from old airport road.



#8

View of Site A from middle of deposit. Note depth of test pit 288-2.

#9

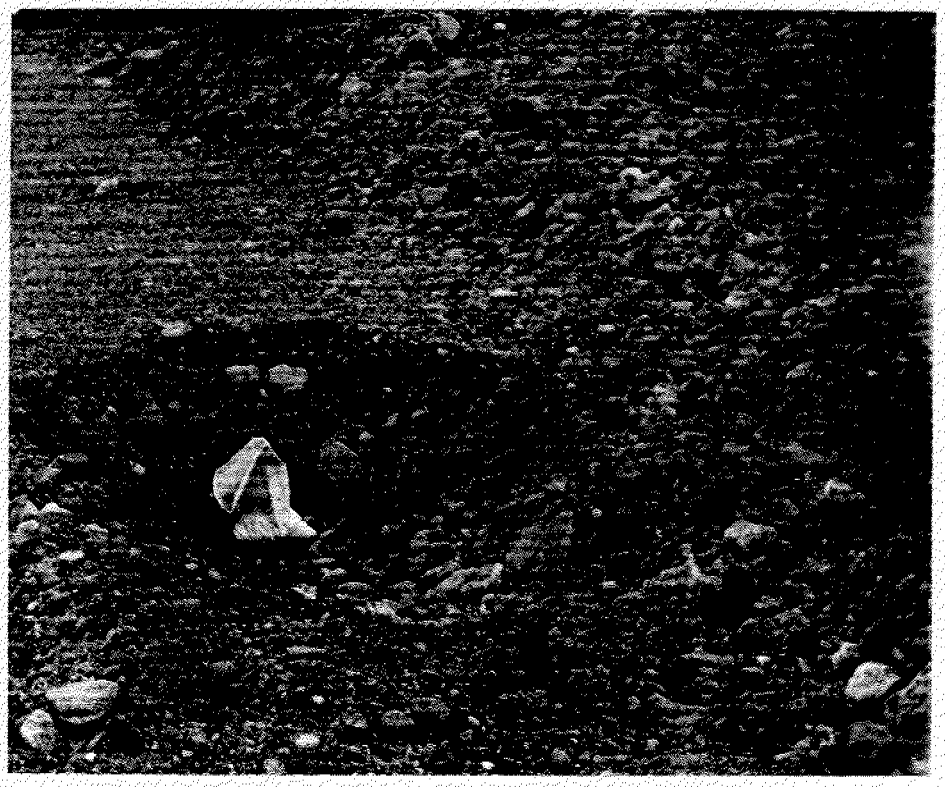
View of Area 1, Site A. Note coarse material.

#10

Site 'A' material 50 meters
from test pit
CAP - 03 - FC.

#11

View of test pit CAP-03-FC.
Pit is near southern
boundary of deposit.
Note cross-section in
appendix.

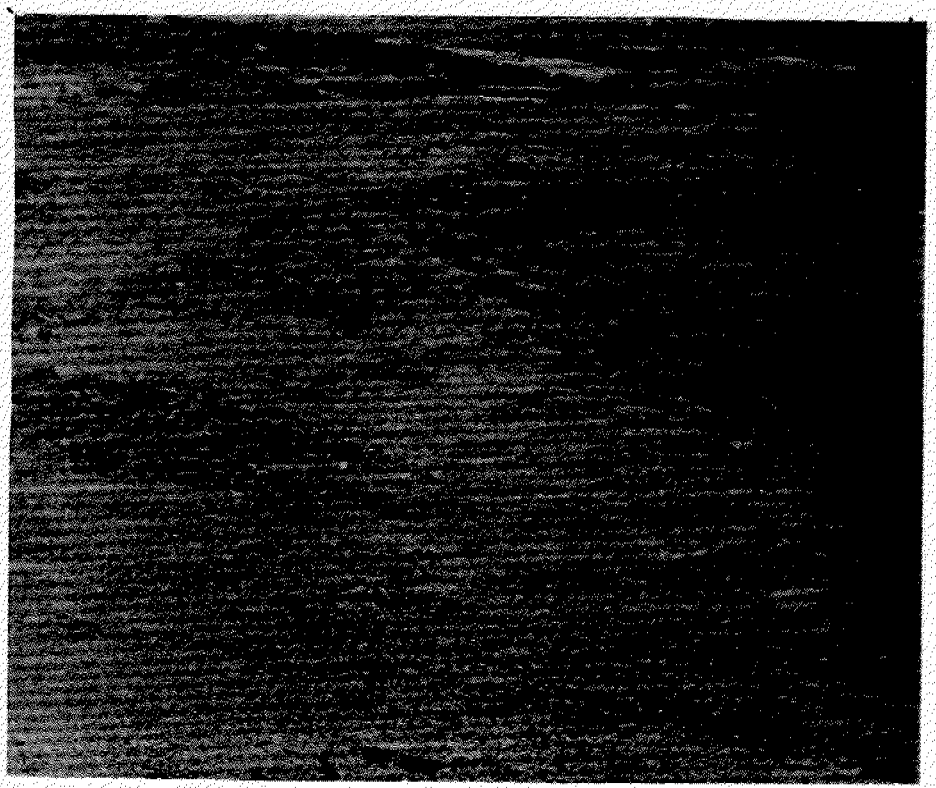


#12

View of Site "A", looking directly east from Area 1.

#13

Site "A" grades into a coarse sand. View is of Area 2.



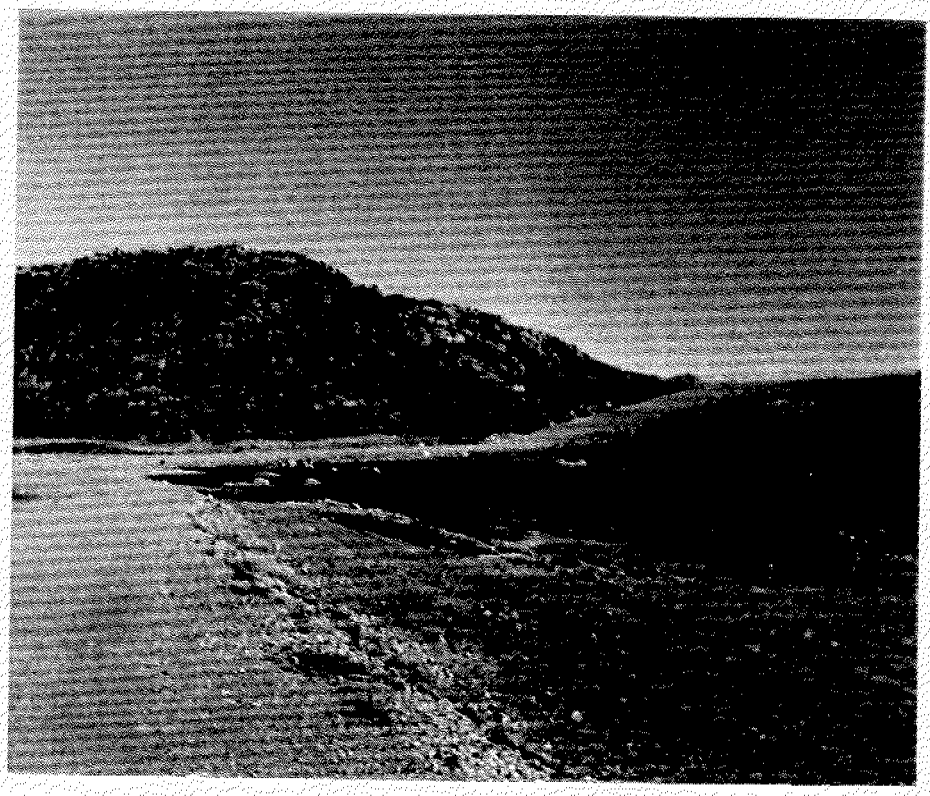
#14

Southern boundary of Site 'A'. Deposit continues 80 meters (in width directly north of gravel p View taken from access roa to tank farm.

(see photo 15)

#15

Site 'A' deposit. View taken from top of gravel pile in photo 14 looking directly north.

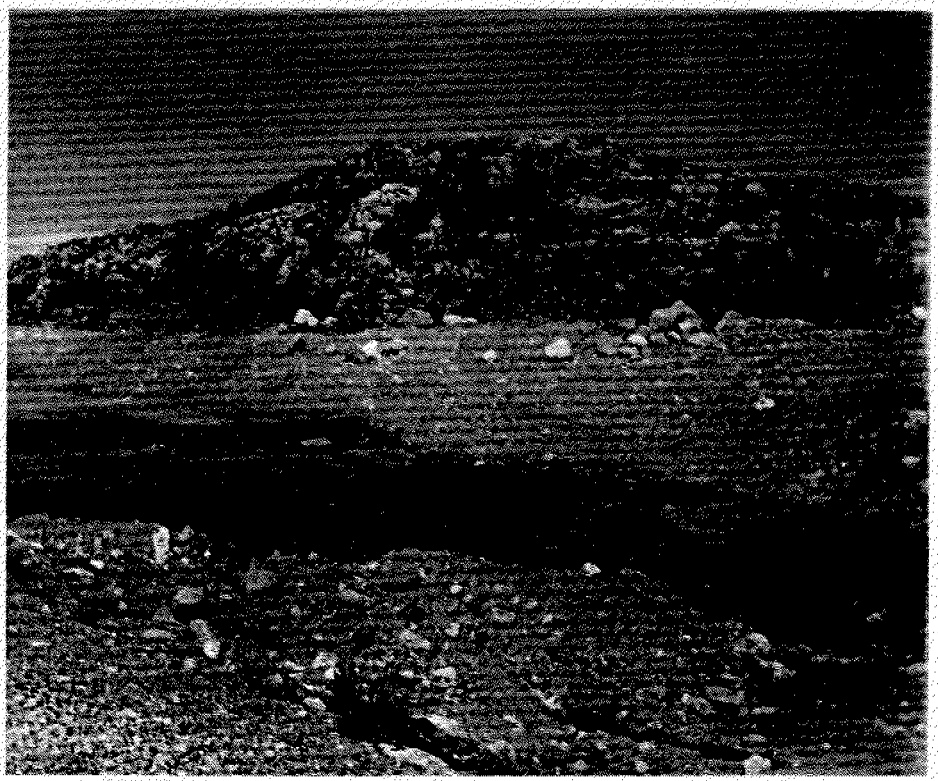


#16

Relatively new road that provides access to Site '13 and M.O.T. area (Site '14') Ridge in background separat Site '13' and Site 'A'. Site '13' deposit follows north side of ridge as illustrated in photo 17.

#17

View of Site '13' that is continuous along north side of access road.



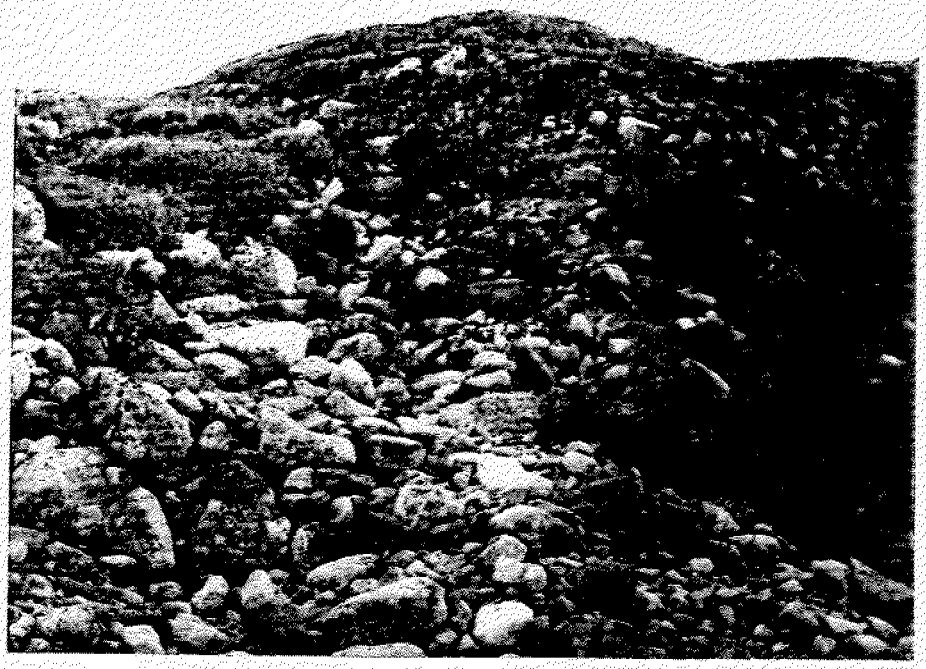
#18

View of Site '13' material from access road. Material needs screening.

#19

View of material above road on ridge. Considered an extension of Site '13'.

#20



Ridge between Site '13' and Site 'A'. Photo taken from access road to M.O.T. area.

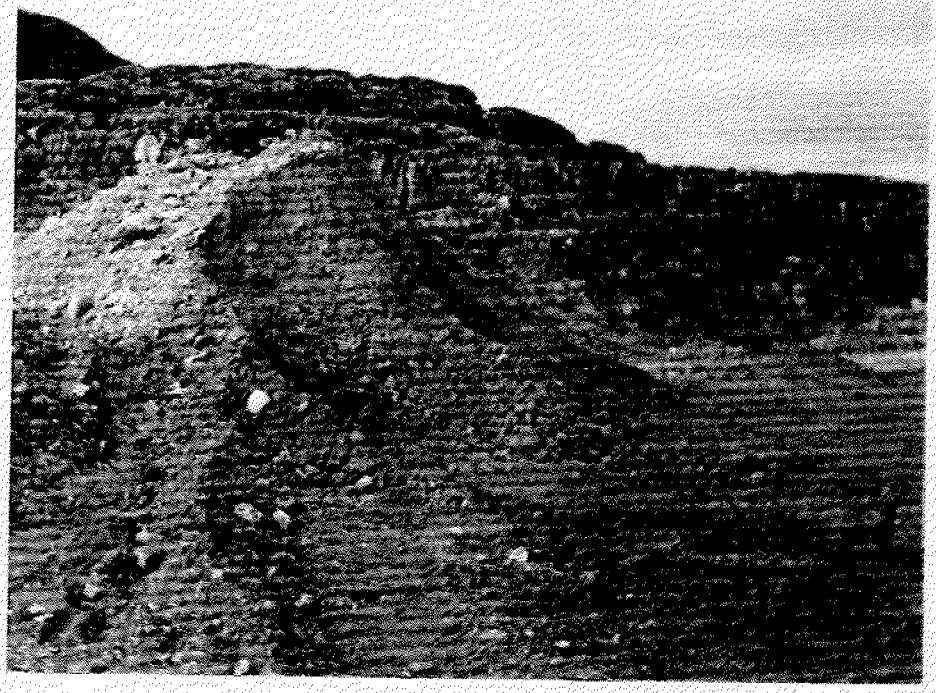
#21

Coarse gravel and sand on ridge directly above Site '13'.

#22

Vertical stratigraphy of fractured bedrock source. Deposit consists of marine glauconitic shales. Note looseness and friability of material. Cut is approximately 2 meters in height and 30 meters in length. Material presently used as embankment for new subdivision. Contractor used sand from Site '15' as a blend source for shales; used as surfacing material for roads.

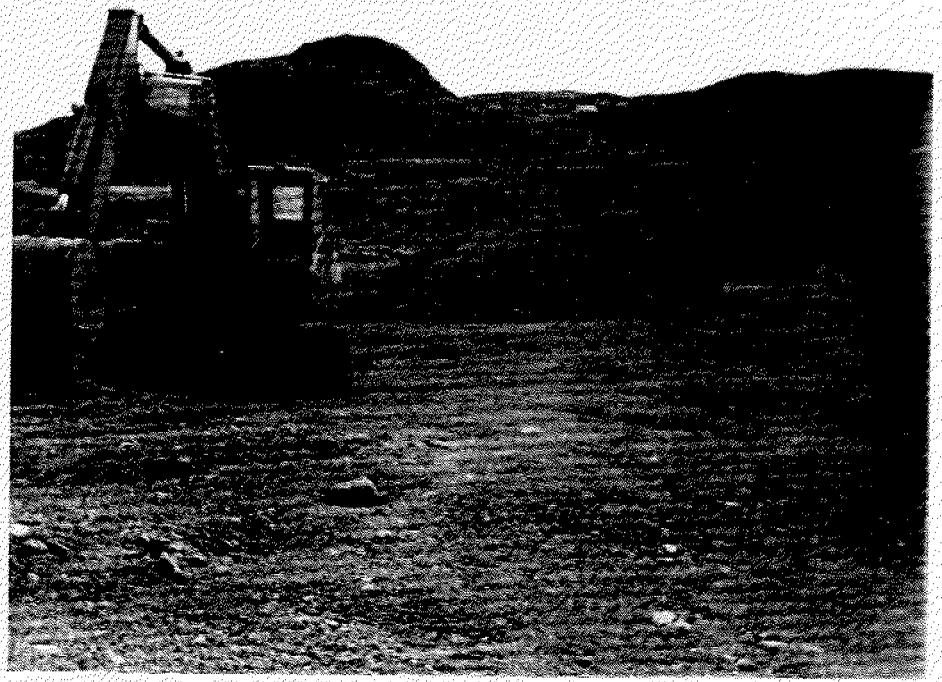
#23



Excavation work and stockpiling of 'FBS'.

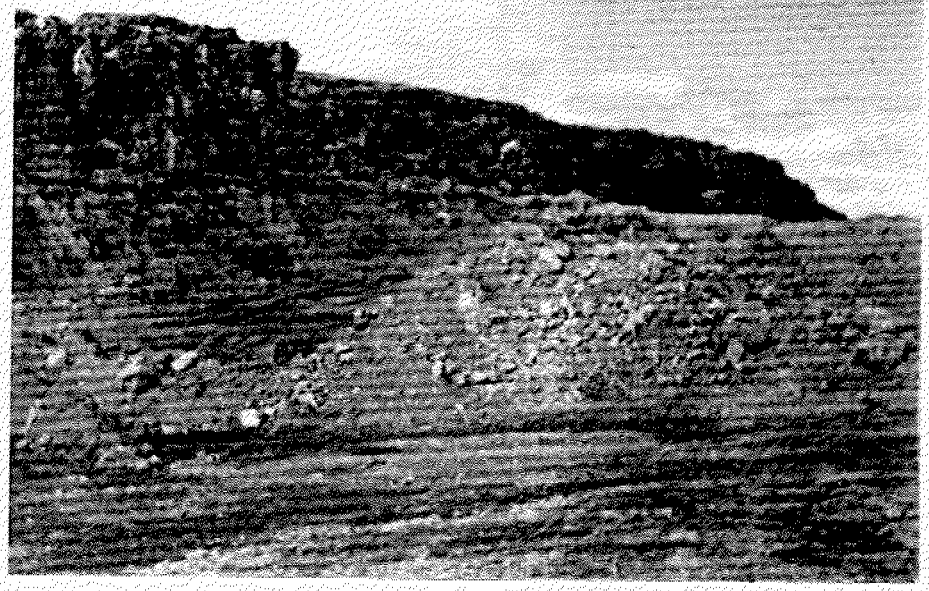
#24

Stockpiling of 'FBS' material at Site '15'. Site '15' was depleted and abandoned at end of 1988 season.



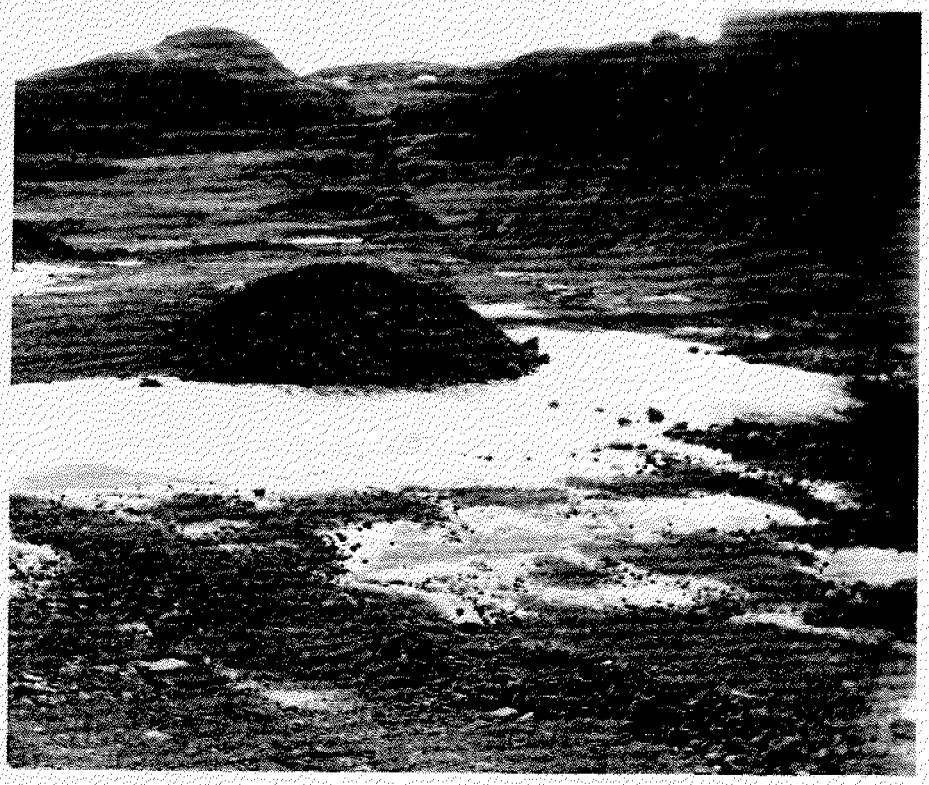
#25

View of existing material a 'FBS'. Note continuation o source ridge in background.



#26

Environmental problems due to removal of overburden and existing material at 'FBS'. Ponding a result of poor drainage techniques.



#27

Dump at sewage lagoon, western terminus of islan Site 10 is located behind ride in background.

#28

Sewage lagoon. View is directly west, causeway is to the right of photo.

#29

View of Site '8', depleted and abandoned at end of 1987 season. Site in need of restoration.

#30

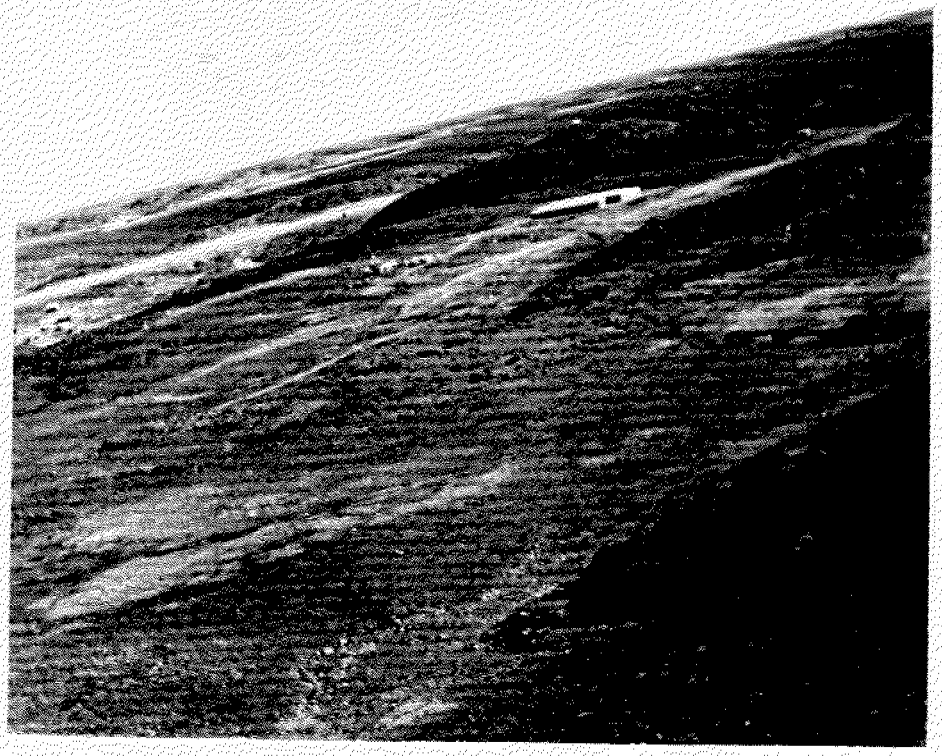
View of ridge between sewage lagoon and Site '10'.

#31

Good overview of entire Site 2 deposit. View is northwest from Kingnait Hills.

#32

View of Site 2 from a higher elevation, but looking northeast.

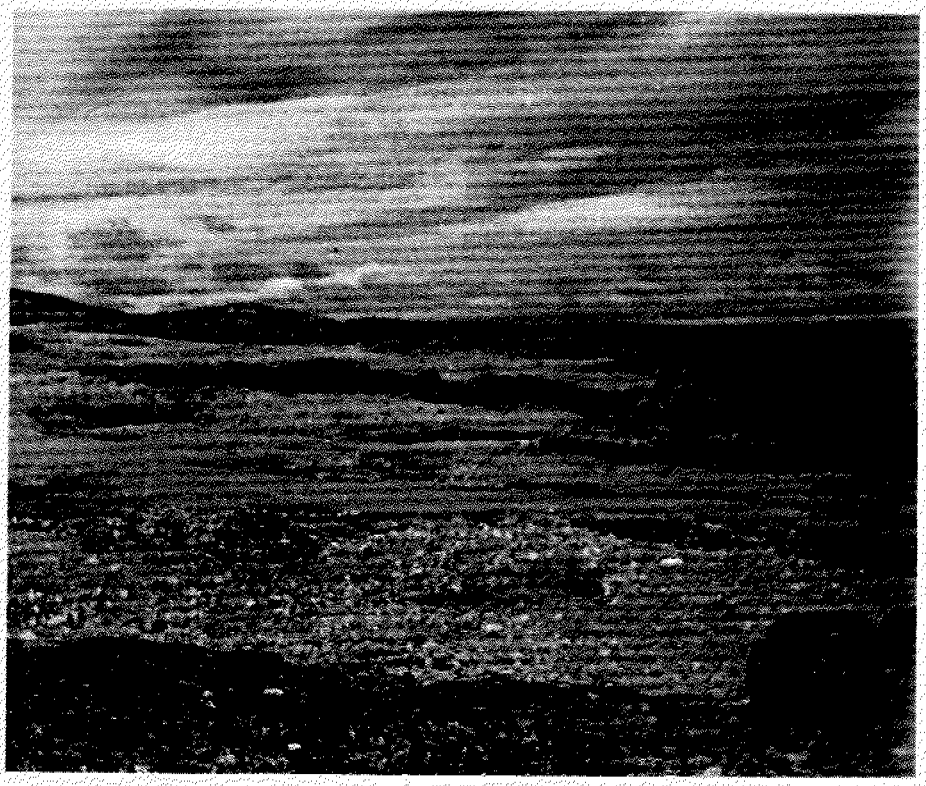


#33

View of eastern boundary of Site '2' (referred to as '2B' in report).

#34

View of Site '2' material approximately in middle of deposit.



#35

Good view of coarse sand a Site '2'. Note material is well drained.

#36

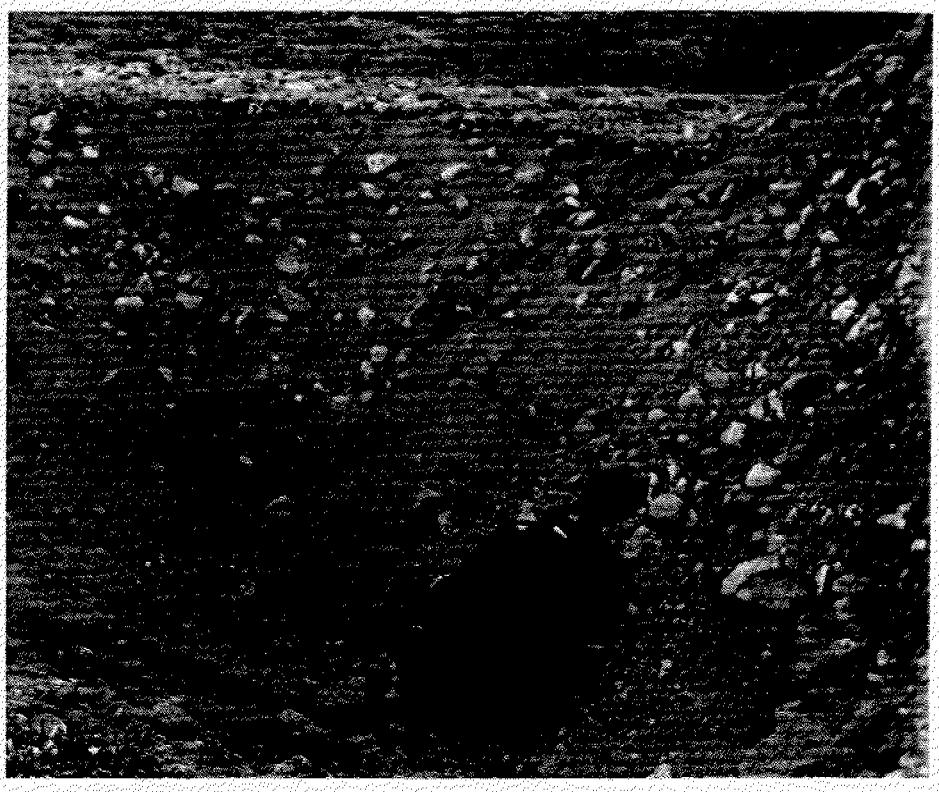
Shallow depth at southern boundary of Site '2'. Test pit 15 meters from base of Kingnait Hills.

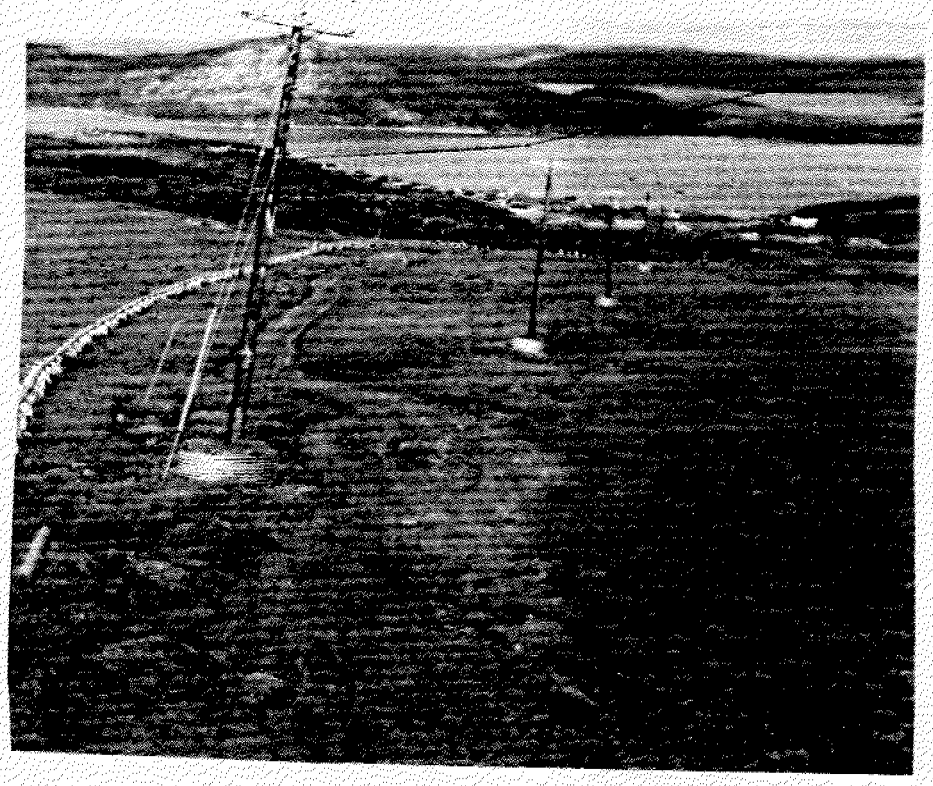
#37

Coarser material at '2A'

#38

Large test pit
CAP -04 - FC, Site '2'.



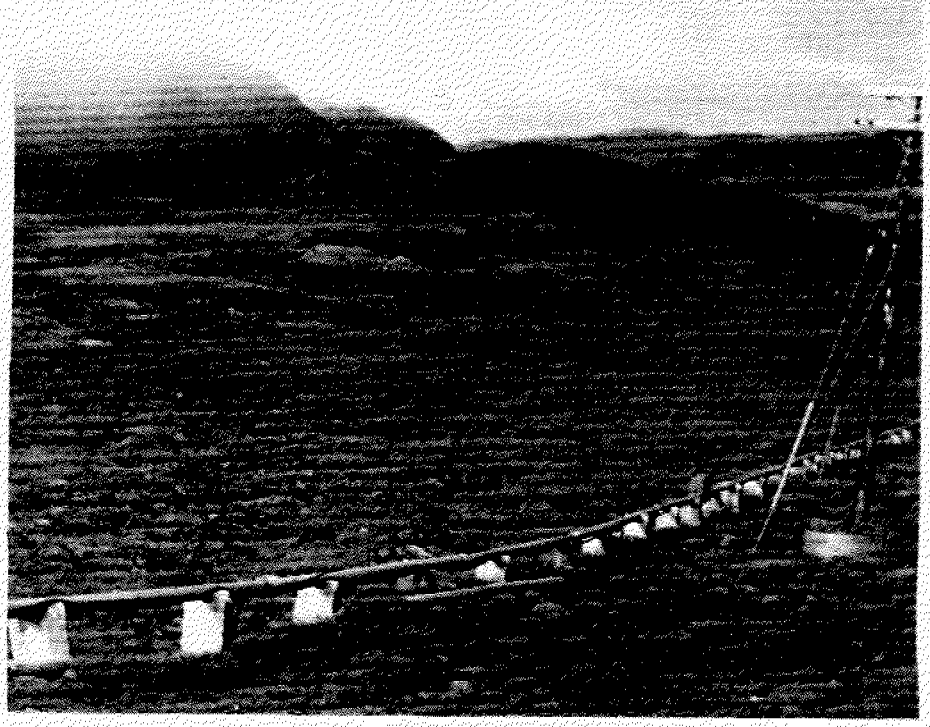


#39

Water pipeline from Tee Lake. View is directly north. Mallik Island in background.

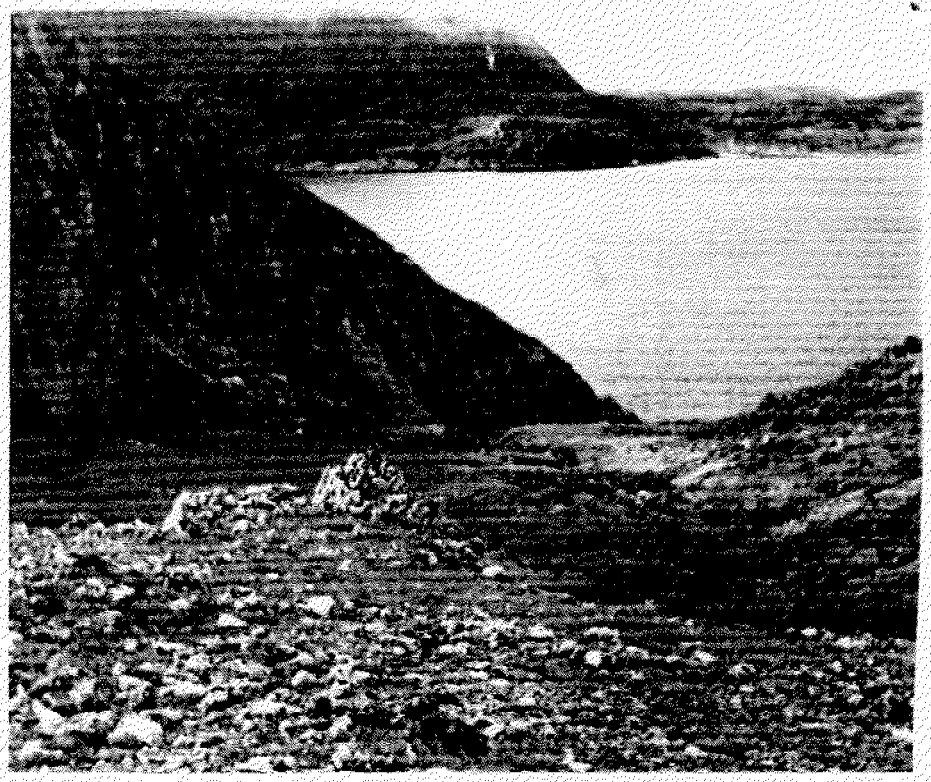
#40

Raised water pipeline to Tee Lake. Note poor drainage on surface.



#41

A panoramic view of Site 2 as seen from water pipeline. View is directly west. Note access to Site 10 in top middle of photo.



#42

Access route to Site 10 only if ice road is built from western terminus of island. Steepness of route will be a problem.

#43

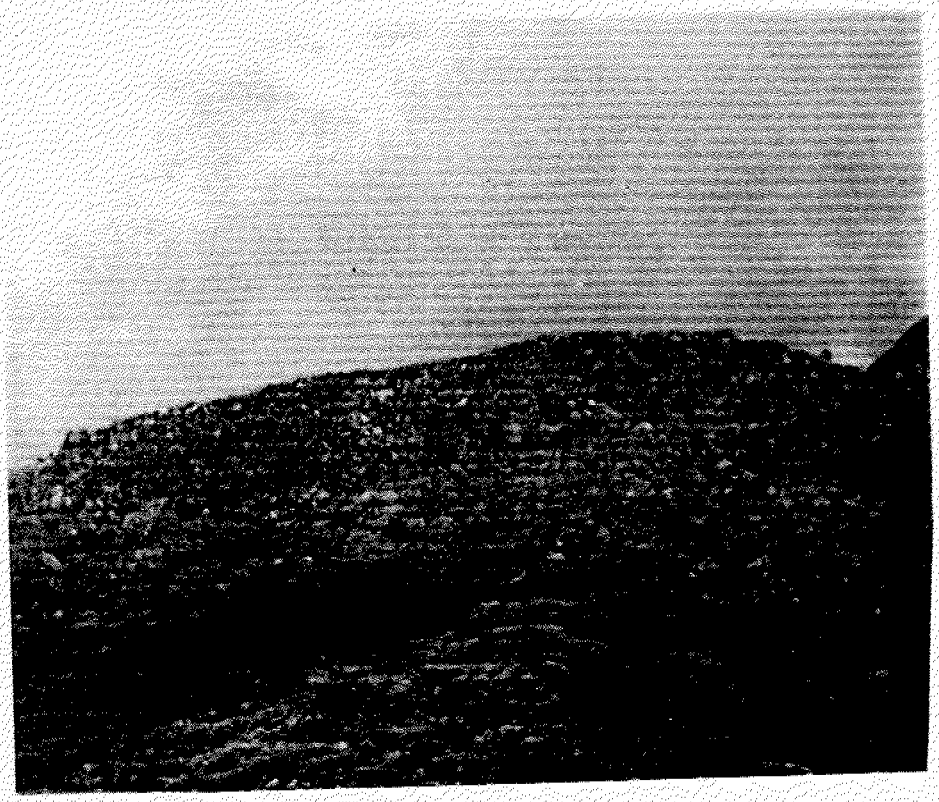
View of well graded, well drained, medium to coarse gravels at Site 10. Screening will be necessary.

#44

Far eastern terminus of Site 10. Access to Site 2 at top left.

#45

Kame Terrace at Site 10. View is looking directly east.



#46

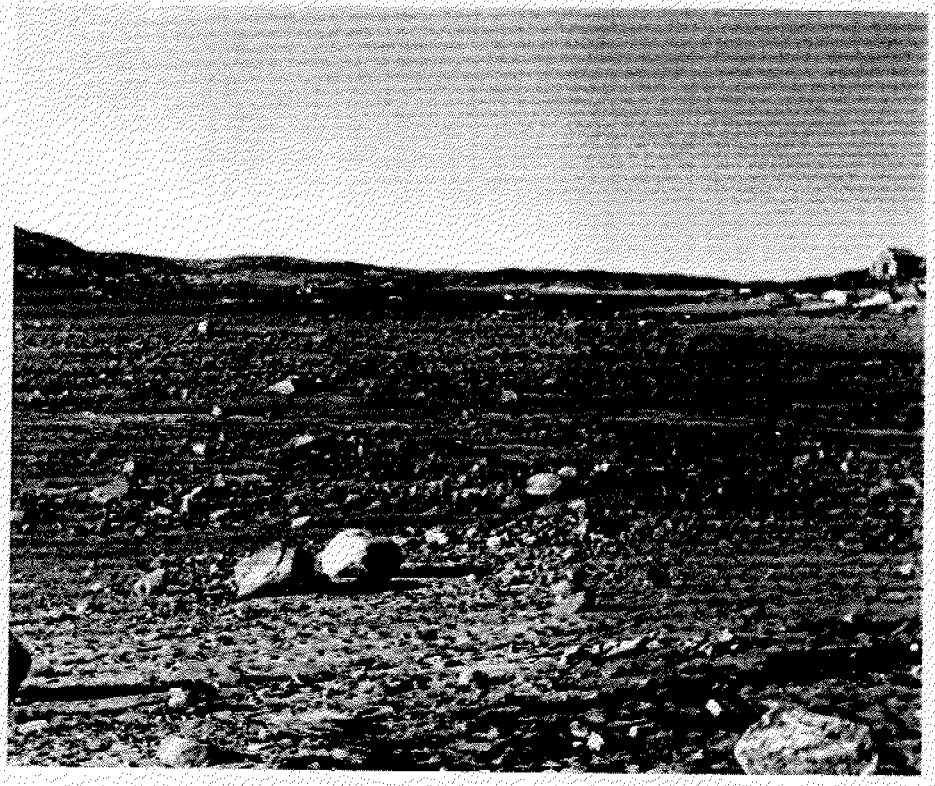
Raised beach terrace at Site '10'. Note volume of material.

#47

Typical well graded gravels at Site '10'.

#48

Rock cliffs represent southern boundary of Site '10'. View is east towards Site '2'. Note talus slope in background.

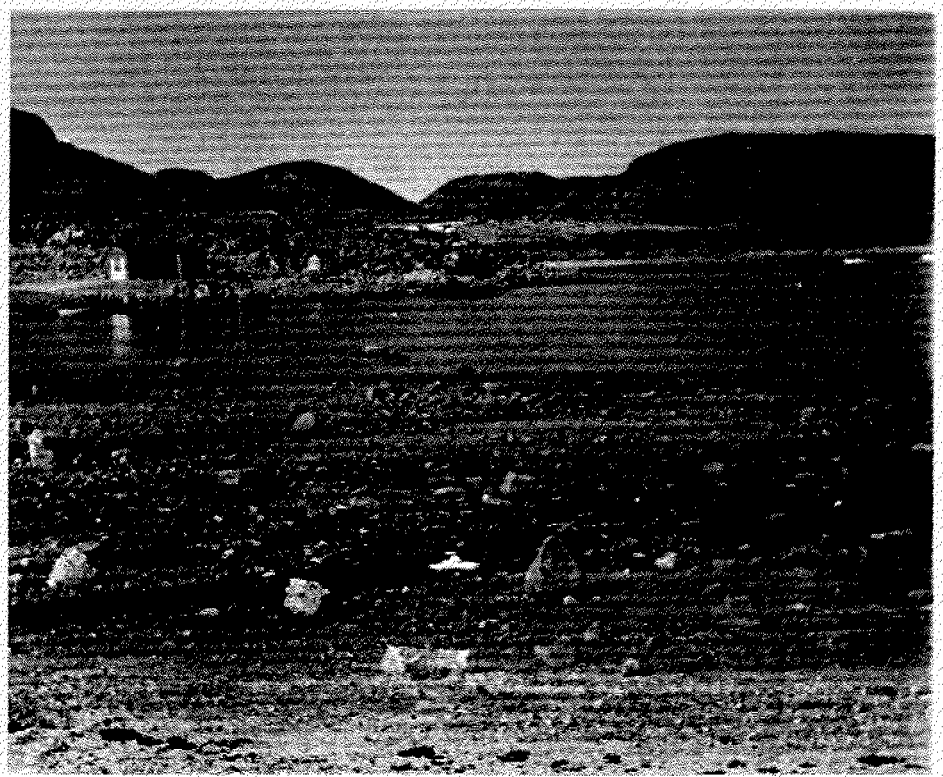


#49

Tidal flat exposed at low tide.

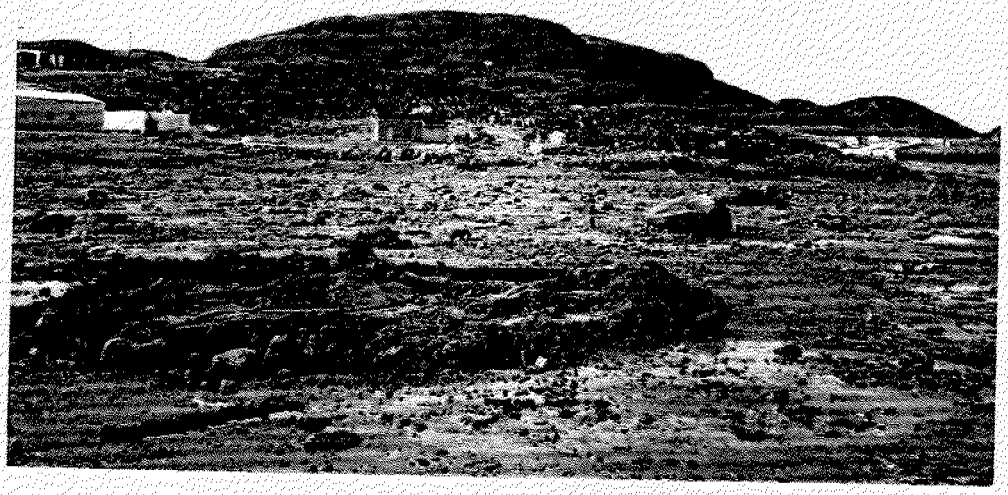
#50

Tidal flat exposed at mean tide.



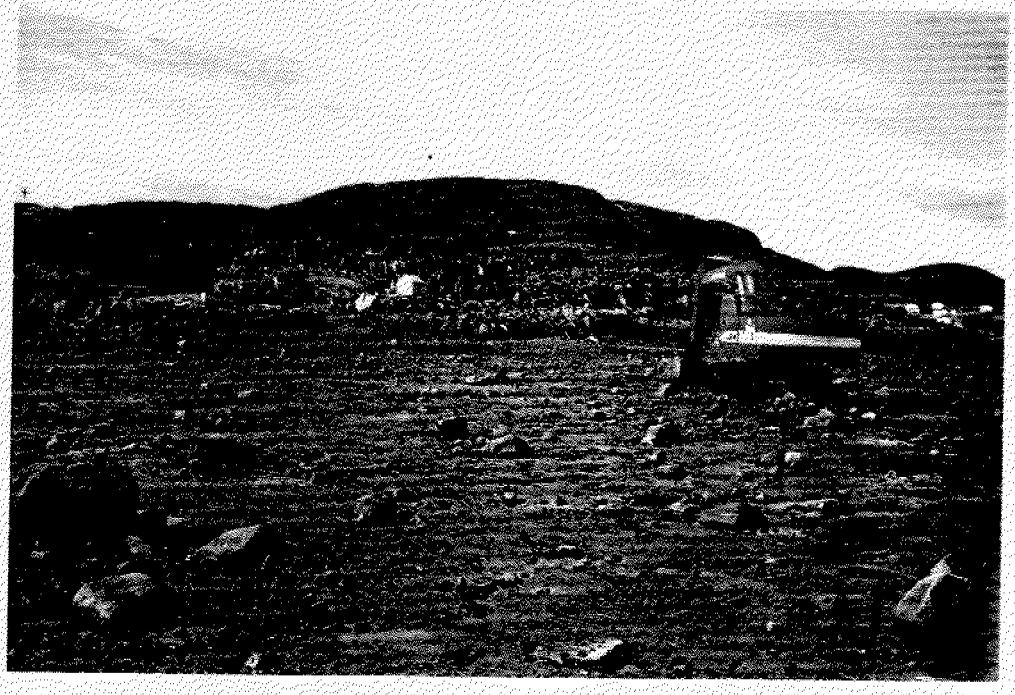
#51

Tidal flat at low tide: note test pit in foreground.



#52

Test hole 235 - 0 - MB. Note use of heavy machinery on tidal flat.



#53

Coarse sediments from t
0.7 meters at test pit
235 - 01 - MB. Tidal
currents significantly
affect the size, sortin
and distribution of
sediments over most of
the tidal flats.

#54

Fine material below
0.7 meters at
235 - 01 - MB.
Good blend source.

#55

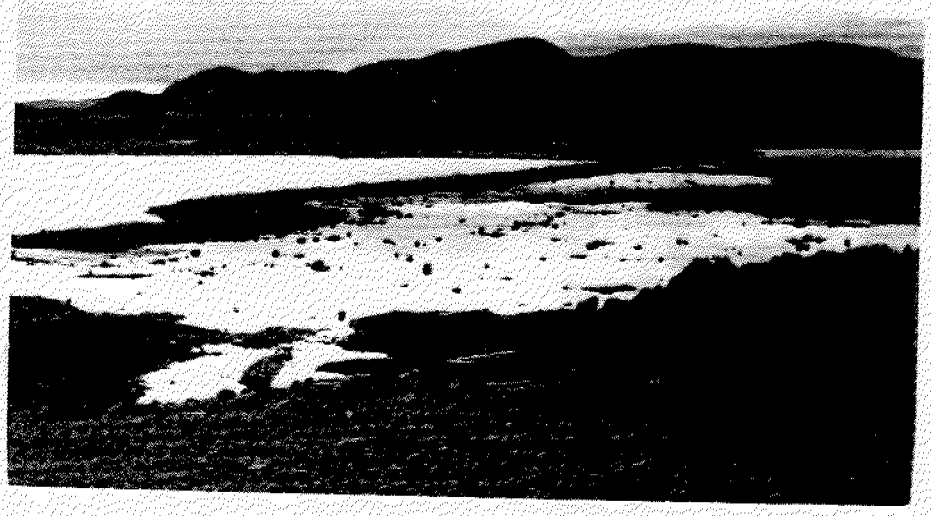
Mallik Island -
Note central plateau in
middle of moraine.

#56

Causeway at low tide,
between Mallik Island
and Dorset Island.

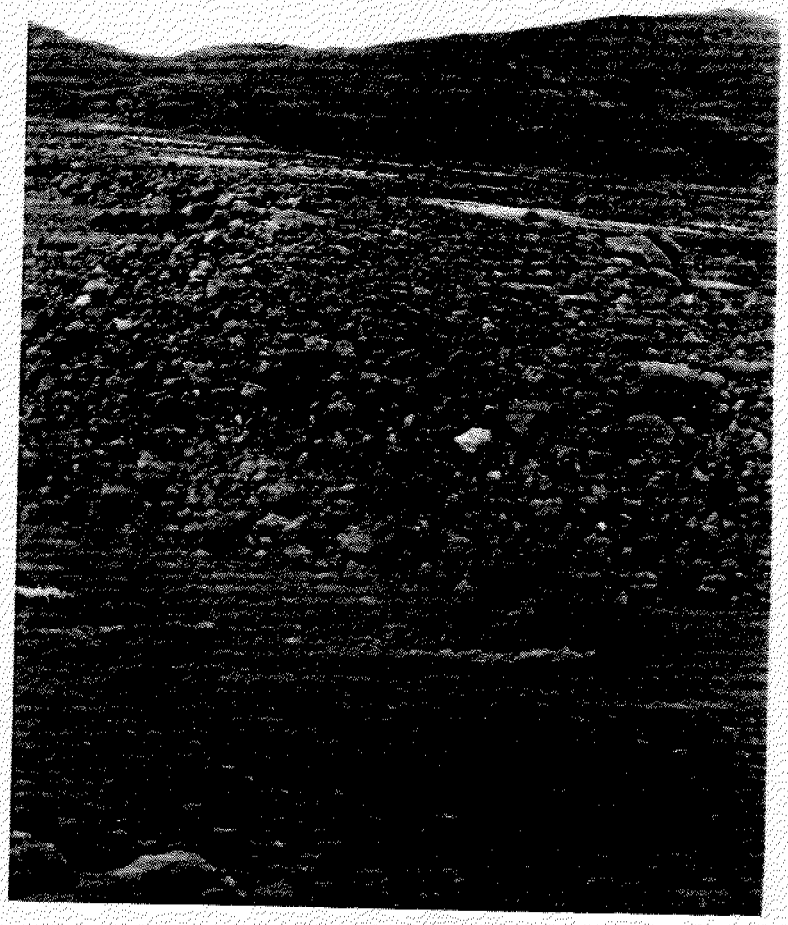
#57

Western extent of Mallik Island, as viewed from causeway.



#58

Good view of exposed causeway at low tide. Although causeway looks continuous, it is dissected by numerous small channels.



#59

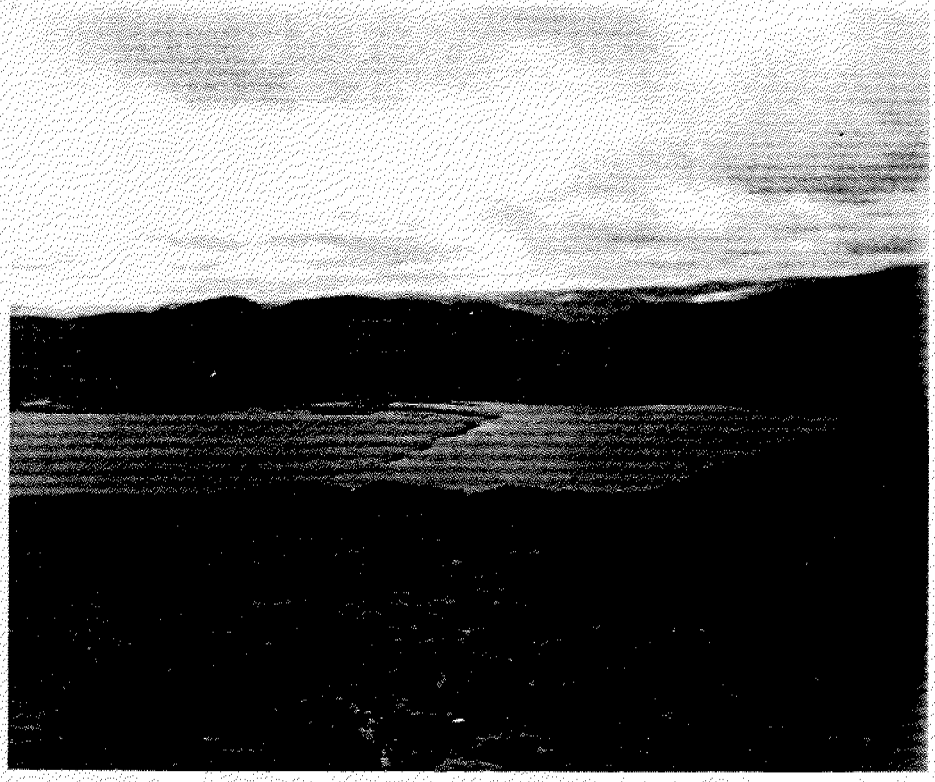
View of strong 'rip-tide' that dissects causeway during ebb tide. As tide ebbs, these small rip-tides become increasingly powerful, causing a great deal of erosion.

#60

View of causeway from top of access route (land route) to Site '10'.

#61

Overview of causeway from Kingnait Hills above Site '2'.



#62

Site 14. View is to the north and east, Q3 is in background. This is a prime screening or crushing site.

#63

Old Test pit, Site 14. Note large percentage of oversize material. View is looking directly northeast towards Q3.

APPENDIX C

Source Location Map

CAPE DORSET HARBOUR

TIDAL FLATS

SITE A

SITE 13

SITE 14 (MBT)

SITE 12

SITE 13

SITE 4

SITE 3

SITE 2

SITE 1

SITE 5

AIRSTRIP

RADAR

TOWER

ICE LAKE
WL 52.3

WATER PIPELINE

CAPE DORSET

HUDSON STRAIT

LEGEND

- EXISTING GRANULAR SOURCE
- POTENTIAL GRAN. SOURCE
- ACCESS (PROPOSED)
- PIPELINE

Northwest Territories Public Works

Design

Drawn: B. ROCHON

Approved

Director

Project Title

GRANULAR INVESTIGATION

CAPE DORSET, N.W.T.

Drawing Title

SOURCE LOCATION MAP 5.0

200 400

C.I. = 5 METERS

Scale 1:6600

D.F.W. Project No.: 89-9170-803

Date: DEC. 89

Drawing No.