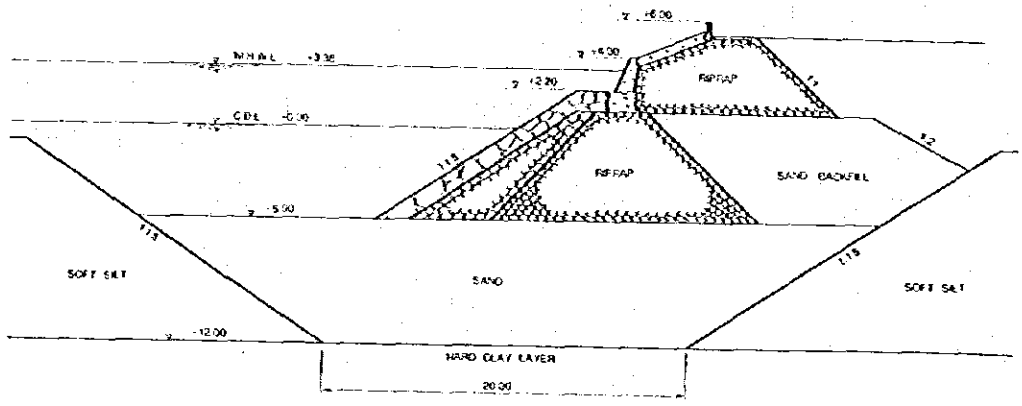


Fig. 6-2-7 South Revetment

6-2-3 Subsoil improvement

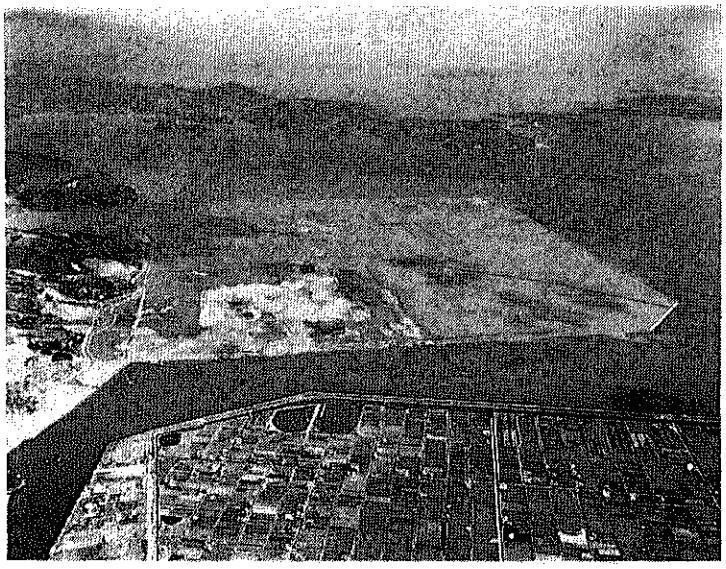
NKK, the owner of the project, started the construction of the mill upon completion of Phase I, where a paper-drain machine, which had just been innovated in Japan, was employed in autumn, 1963 to be enagaged in its first test work of the subsoil improvement.

A comparative experimental work of the paper drains and sand drains was conducted, since the silt was uniform and its thickness was even.

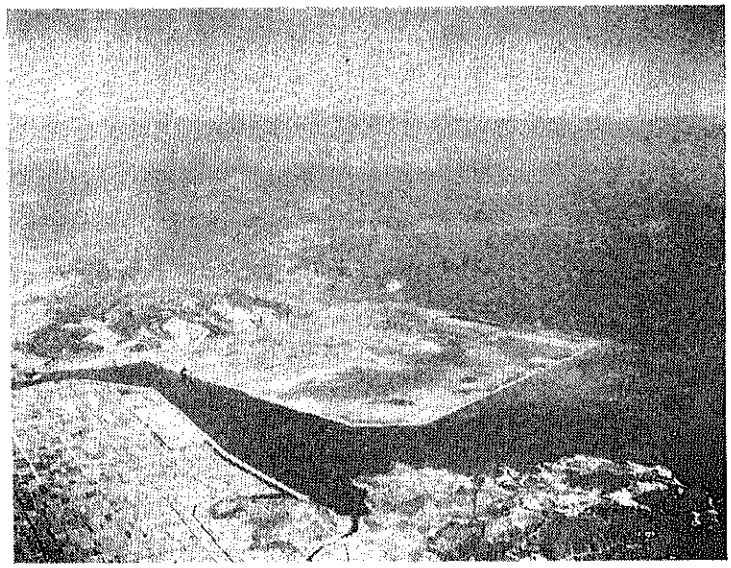
Thus it was proved that the equivalent result could be obtained, should the design for the sub-soil improvement be made just in the same conditions as of a sand drain with Barron's formula, assuming that the effect of a paper drain is equivalent to that of a sand drain 5 cm in diameter.

It was also appreciated that the period for consolidation could be shortened because of shorter pitch driving due to its small cross-section, and thereafter the method was adopted to the great extent for the subsoil improvement in this project.

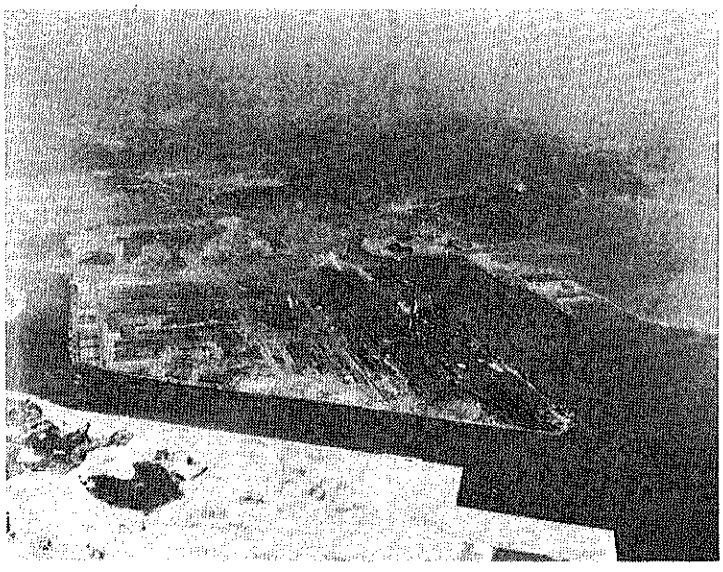
In this project other improvement methods such as replacement, sand drains, and sand compaction piling were widely employed corresponding to the purposes, time, and the design load on the reclaimed land, which resulted in the successful completion of the entire project.



(1) Early stage of Reclamation



(2) Middle stage of Reclamation



(3) Completed Steel Mill

Ⅳ. APPENDICES

List of Appendices

[A] Magnetic Detection a-1

[B] Surface Layer Improvement b-1

[C] Outline of Sonic Prospecting with Sonostrator c-1

[D] Results of Present Survey

APPENDIX A MAGNETIC DETECTION

The following is a summary of the method of magnetic detection for detecting dud shells or bombs burried in sea/river bottom or subsurface of ground to be conducted by Magnetic Detector TYPE MB-100 and TYPE 200 developed and manufactured by "Shimazu Seisakusho Ltd. as the typical equipment among those available in Japan. Both types of equipments mainly consist of detecting probe, controller, recorder and connecting cables. The principle of detection and the method of operation are entirely same in both types. The difference is that MB-100 is for single use and another set is used in combination of more than two probes. (MB-200 set has 3 probes, 4 channel controller (1 chan. is for spare) and 4 channel recorder (1 chan. is for spare).)

The operation work at the site seems rather simple, because all the work is to carry the probes closely above the sea bottom and the surface of the ground keeping them approxi-sea bottom materials.

However, to carry the probes with long and thick cables and to keep them horizontal sometimes needs a special technique according to the topographical condition and the sea bottom materials.

Although the set of MB-200 has a frame with a gradient gauge which enables the probes to be kept horizontal, it would not always be adaptable to any sites. The frame is rather large and heavy for easy carrying or setting, so that at the actual field work the most suitable method of setting probes should sometimes be deviced according to the circum-stances.

A-1 Principle of Flux Gate Type Magnetometer

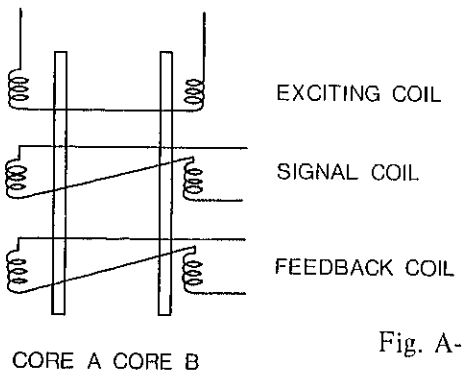


Fig. A-1-1 3 Coils in the Magnetometer Wound around Two Permalloy Cores

The magnetometer is an instrument capable of detecting changes in the magnetic field of the order of one gamma. It contains two permalloy (highly permeable material) cores

which approaches saturation easily in the weak magnetic field. The two cores are wound by 3 wirings of exciting coil, signal coil and feedback coil as shown in Fig. 1. When a 1000 Hz cycle current is superimposed by the exciting coil, the two permalloy cores are completed to be magnetically saturated during some period of every positive and negative cycle.

If there is no magnetic field around the magnetometer the magnetic satulation levels in core A and core B is same, and they are linearly symmetric each other. Therefore, the induced currents are also simmetrical, and there will be no output signal in signal coil. (See left side of Fig. A-1-2).

On the other hand, if there are some magnetic field near the magnetometer, it causes a slip of the saturation level, and the magnetic flux of each core shall become non-symmetrical, shown as b' in Fig. A-1-2.

Consequently, the output signal may be shown as e' and the measurement of output current means the intensity of external magnetic field.

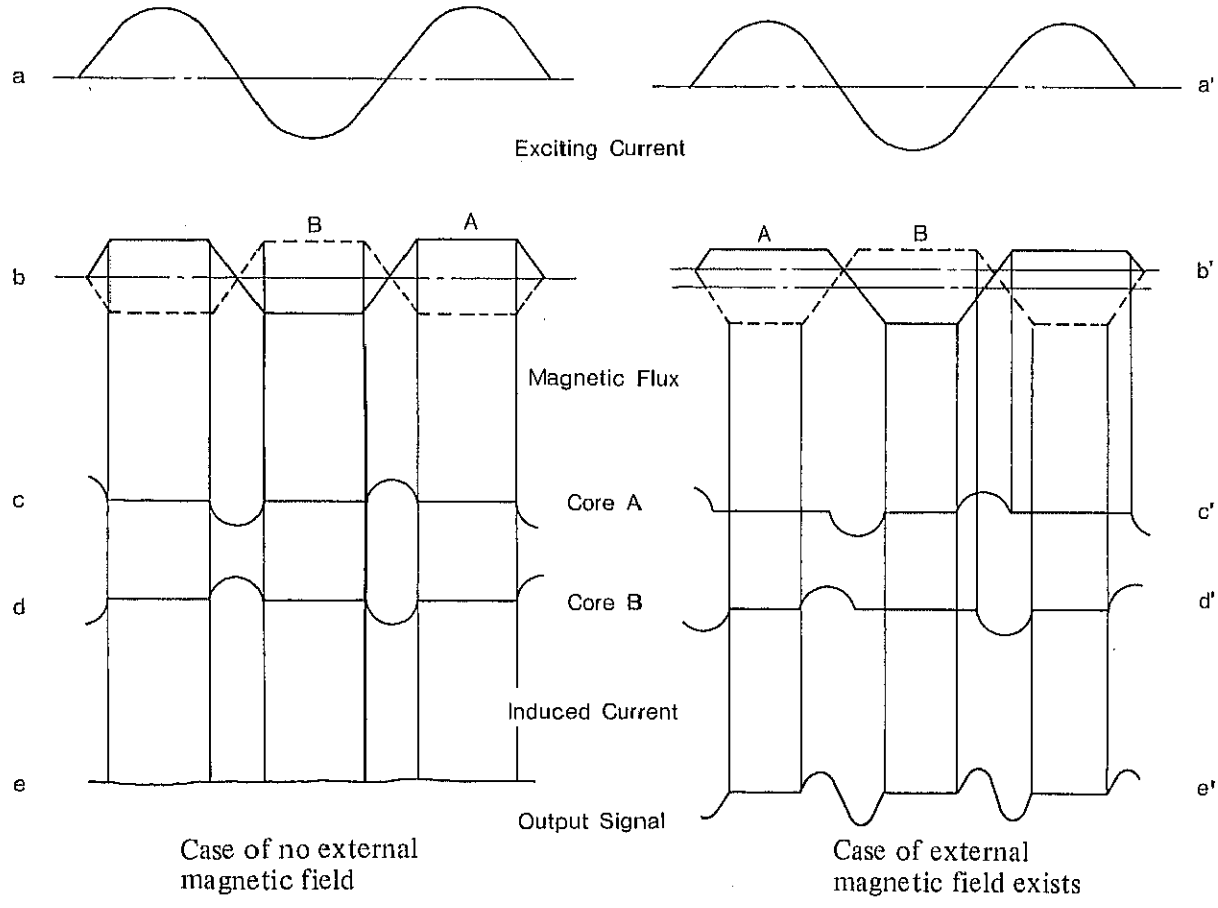


Fig. A-1-2 Relations Each Other of Exciting Current, External Magnetic Field, Magnetic Saturation of Permalloy Cores, Induced Current, and Output Signals

A-2 Principle of Detection of Feeble Magnetic Field of Buried Material by the MB-100 Probe

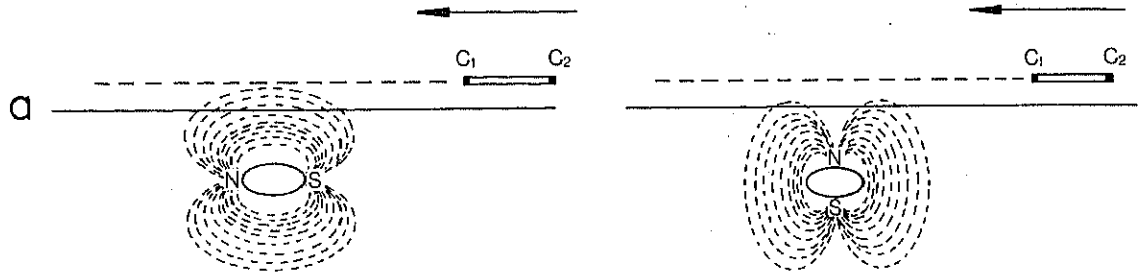
Each probe of MB-100 and MB-200 has a pair of flux gate type magnetometer connected differentially and being fixed one meter apart in it. Although the magnetometer is sensible enough to detect changes in the magnetic field of the order of one gamma, sole magnetometer can not distinguish the magnetic field of object materials against the electro motive force by the shaking or pitching of magnetometer itself in the earth's magnetic field which is much stronger than the field of buried materials.

A pair of magnetometers, however, make it possible to detect the feeble magnetic field of object materials, because the two magnetometers nullify the induced electro motive forces each other by receiving them equally.

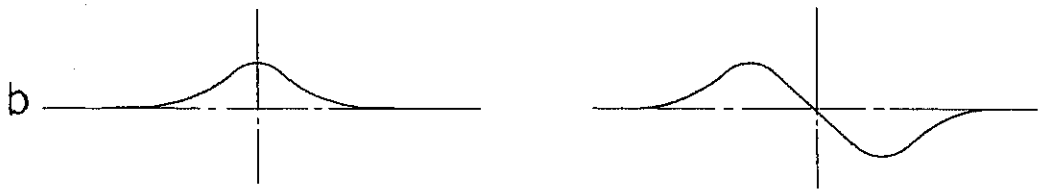
The two magnetometers, which are fixed 1 meter apart, detect the field of object materials respectively, and the difference of strength of the magnetic field may be the output signal.

Thus the probe can detect the feeble magnetic field of buried materials even if it pitches and rolls in the strong earth's magnetic field.

Fig. A-2-1 shows two examples of detection of buried magnetic materials by the probe with two magnetometers of C_1, C_2, and how the indicated records appears.



Where a magnetic material is buried and the magnetic field is as shown in a , the intensity of the magnetic field in the level of closely above the ground surface (along the dotted line) would be illustrated like b .



When the MB-100 probe, being kept horizontal as shown in a , is moved from right to left along the dotted line, magnetometer C_1's and C_2's signal would be shown as C (if they were indicated).

And the output signal, which will be made by C_1 and C_2 curves, may be indicated on the recording paper as shown in d.

Fig. A-2-1 A Few Examples of Magnetic Anomaly Record Detected by the MB-100 Probe

A-3 Typical Forms of indicated Magnetic Anomalies caused by the Buried Materials

In most of the cases the forms of the magnetic anomalies caused by the object materials are classified to several conventional patterns, and they would be conveniently approximated by a few simple models.

The approximation would of course be accompanied with some errors in calculation of depth and mass, and these errors would not be small enough to be completely ignored.

In many cases, however, the errors are usually allowed if the removal operation will carefully be performed.

If the models of the shape and the direction of the object material were given, the intensity of the magnetic field would only depend on the relation between the depth and the mass of the object materials. So that if the following two kinds of tables were previously prepared, the depth and the mass of the object materials would easily be given by the indicated anomaly curves.

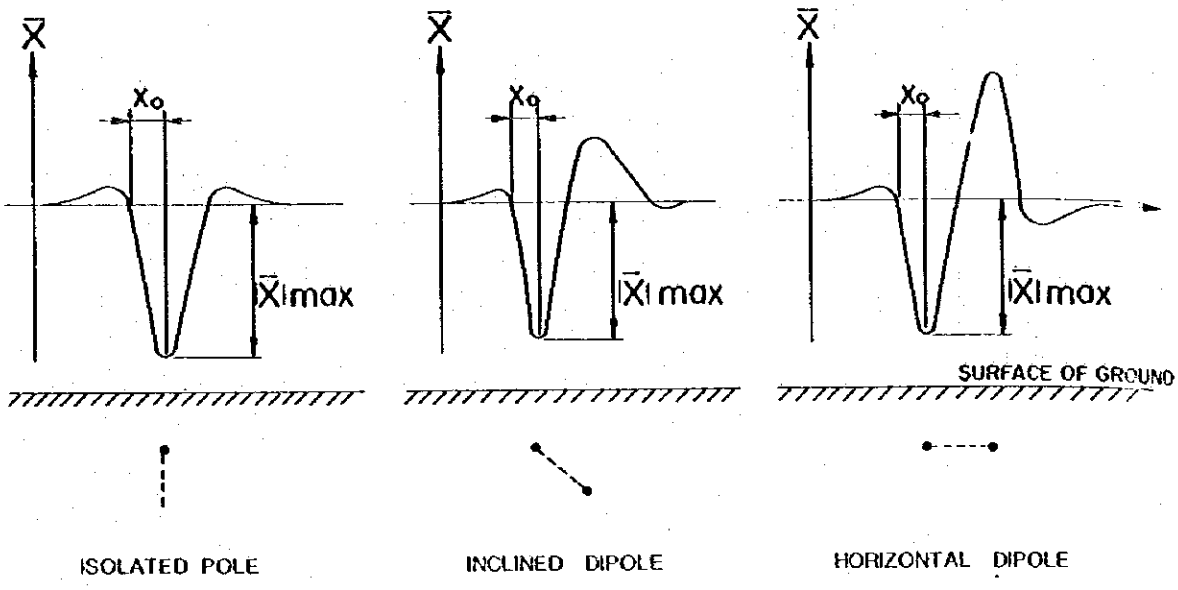
1. The table showing the relation between the form of the curve and the probe-material distance.

2. The table showing the relation between the distance and the maximum absolute value of the amplitude of the curves.

The models of indicated curves are shown in Fig. A-3-1.

Reading the values of x_0 shown in the figures on the recording paper we can know the distance of object material from the probe. And reading the maximum value of $|X|_{max.}$, we can estimate the magnetic mass of the material.

Fig. A-3-1 The Models of Form of Anomaly Curves



ISOLATED POLE

INCLINED DIPOLE

HORIZONTAL DIPOLE

(Vertical dipole, but another pole is apart enough to be regarded as sole one.)

All we have to do is to read x_0 and |X| max. on various records to determine the distance and magnetic mass. The x_0 will indicate the depth (exactly saying, not depth but distance from probe to object material), and the |X| max. will give the magnetic mass in relation to the distance.

A-4 Procedure of Detection Work

A-4-1 Procedure of the Detection Work at Site

1. Preparing
   - o The preliminary inspection of the site and/or the careful looking of large scaled map for planning.
   - o The planning for the arrangement of the survey lines, and for the most suitable method of carrying the probes.

2. Surveying
   - o Setting the control point in the object area.
   - o Marking the position of survey line by painting or the wooden stake.
   - o Sounding (measuring the depth of water) if necessary.

3. Conveyance, Fixing and Adjustment

   If the frame prepared by the maker is adaptable to the site, it should be carried to the site and be fixed up. And if it is not adaptable, the other type of the frame should be deviced according to the circumstance.
   - o Fixing the probes to the frame.
   - o Connecting the probes, the controller and the recorder.
   - o Adjusting the detector set.

4. Operation of the Detector

   The recorder has an event marker which shows, on the recording paper, the very point where the probes pass. So that we can know the position of the probe on the recording paper. If the probes cannot be moved in a constant speed, the event mark should be dotted at a close interval of unit distance so as to make it possible to locate the probes on the paper. And if the probes are moved at a constant speed, the maker may be put in a constant interval of time.

   The name of the survey line and the distance of dotted point should be hand-written on the paper. The probes are moved along the survey line being kept approximately horizontal, and being kept in a constant level of 0.5 ~ 1.5 m above the sea bottom.

The method of moving the probes is usually by towing by the boat. If the magnetic anomaly is indicated on the recording paper, the very point of anomaly is easily known by the from of anomaly curves on the paper.

A-4-2 Procedure of Detecting Work at the Office

The location of the buried magnetic materials is easily known by inspecting the recording paper at the site quickly, but it takes a considerable time to estimate what the material is or the depth and the magnetic mass of the material. Therefore the records should be brought into the office and should be offered to analysis.

The process of the office work is as follows;

(1) The arrangement of the recording papers.
(2) Inspecting the records and sifting out the records which seem to due to non dangerous materials such as cans, wires, old tires and the other pieces of iron fragment.
(3) Determining the depth of the magnetic material which seems to be dangerous things.
(4) Determining the magnetic mass of the buried material.
(5) Considering what the materials are.
(6) Dotting the location of the buried materials on the map, and planning where and how deep the removal operation should be made.

A-5 Method of Detection Work at the Site by MB-200 Probes

When a probe is towed above the sea bottom, it can sweep the width of about 2 meters of the sea bottom.

Therefore, the distance of the probes each other may be allowed 2 meters at the most, and the 3 probes can sweep the sea bottom at the width of 6 meters. (See Fig. A-5-1)

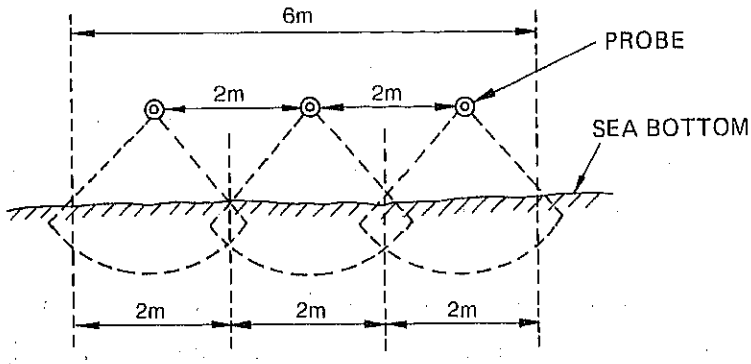


Fig. A-5-1 Width of Sweeping when 3 Probes are Fixed Every 2 Meters Apart (Profile)

Although the interval of the survey lines might at least be taken in 6 meters, it had better to be taken in 5 meters having 1 meter overlap of sweeping width. Because it is not easy to move the probe frame exactly along the surveyline. (See Fig. A-5-2)

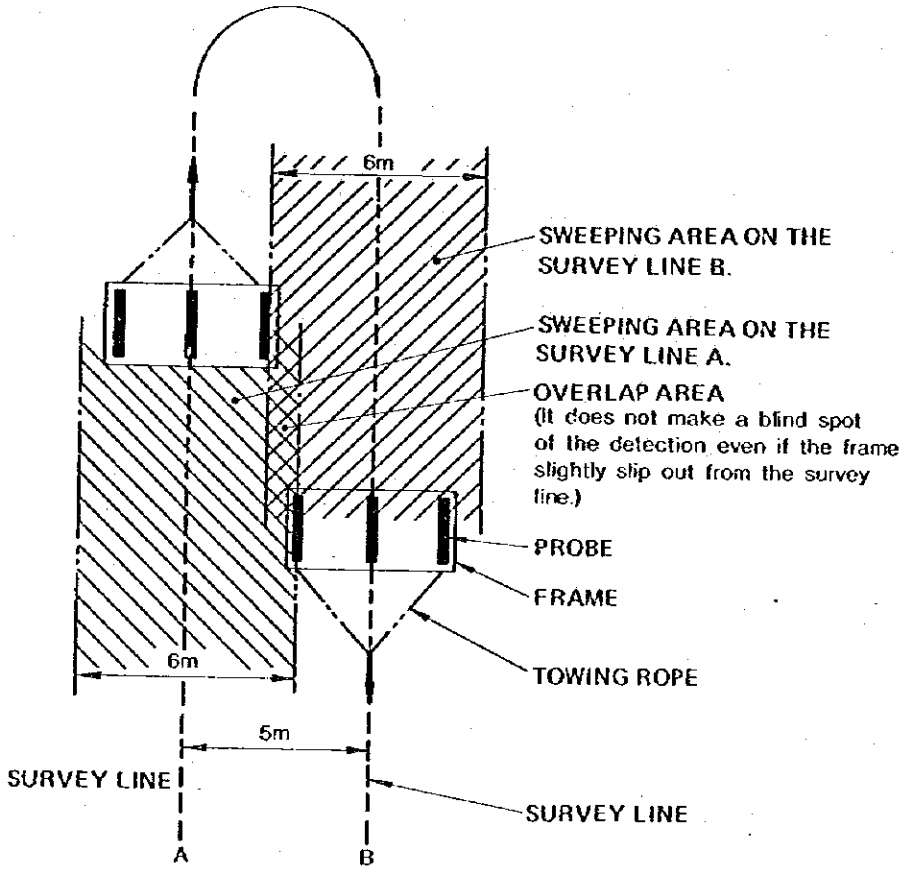


Fig. A-5-2 The Manner of Taking an Overlap Area

– How to Move the Probes with Frame

All equipment and instruments but the probes are taken on the boat, and the frame with probes are towed by the boat. The distance between the probe and the boat should be kept in about 7 meters. Because if the distance is less than 5 meters, the boat itself will disturb the magnetic field of the object material, and if the distance is more than ten meters, the position control of the frame will become difficult.

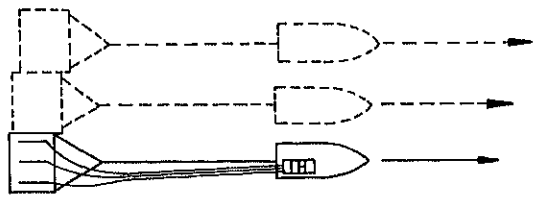


Fig. A-5-3 Towing the Frame by a Boat

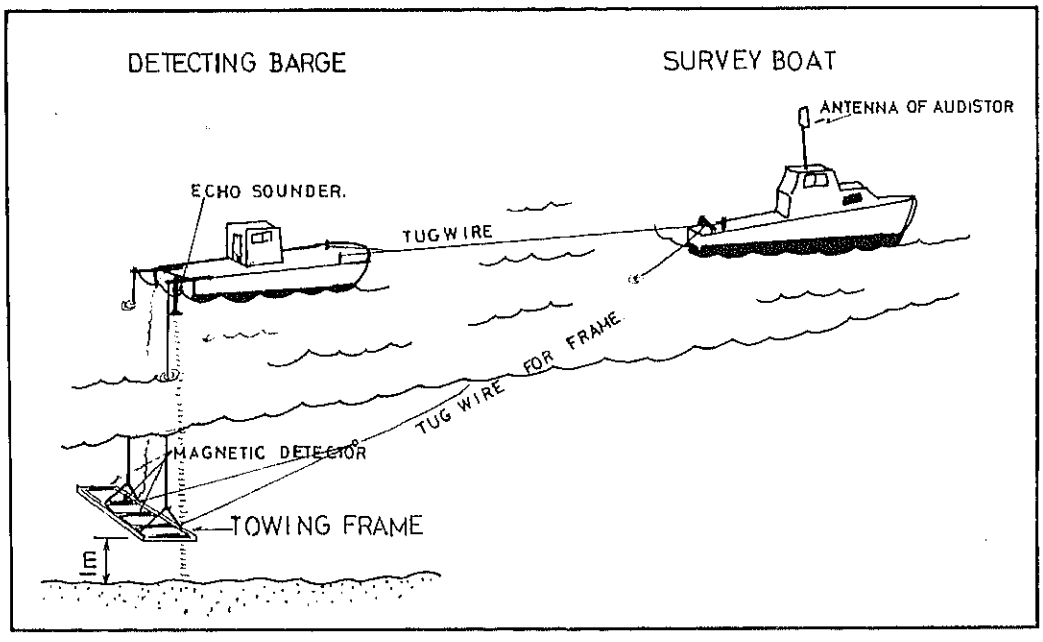


Fig. A-5-4 The General Method of Magnetic Detecting

APPENDIX B SURFACE LAYER IMPROVEMENT

Since the sunshine is so strong all the year round in Singapore that no surface layer improvement may be necessarily required. Nonetheless it might be a good practice in a certain circumstance where some parts of land are required to be covered with hill-cut soil over muddy soil surfaces. It will therefore be significant to introduce some methods of improvement which prevail in Japan.

Surface layer improvements may be classified into the following three methods which will be detailed herebelow:—

a) Replacement method
b) Surface covering method
c) Surface solidification method

B-1 Replacement Method

With this method soft soil near the surface is entirely or partially replaced with good material, which is limitedly adopted for partial improvement of the reclaimed land (e.g. for road).

Ordinary method of replacement is to excavate soft soil and replacing it with good material.
There is another method of replacing in which the good soil is forcibly pushed into the soft ground by means of bulldozer.

B-2 Surface Covering Method

If a reclaimed land is left for a considerably long time, the surface of the land will naturally get dried with cracks, where sand or hill-cut soil can be scattered in a thin layer with belt conveyors or trollies running on the surface.

In Japan, however, the surface of the land has been covered with a good material in rather esrly stages after reclamation by adopting some methods as being introduced herebelow, in order to allow employment of the subsoil improvement techniques as explained in Chapter 5, for the purpose of early utilization of the reclaimed land without waiting for drying in natural conditions.
The followings are some of the typical surface covering practice usually taken in Japan:—

B-2-1 Sheet Placement

A chemical sheet of high tensile strength is spread over the soft ground that would not naturally allow any surface covering practices, over which good soil is scattered in a layer.

As shown in Fig. B-1-1 below, the principle of this method is that the resultant friction between the sheet and the clayey surface of the ground equals the tensile force in the sheet so that there occurs a resistance to the scattered mass.

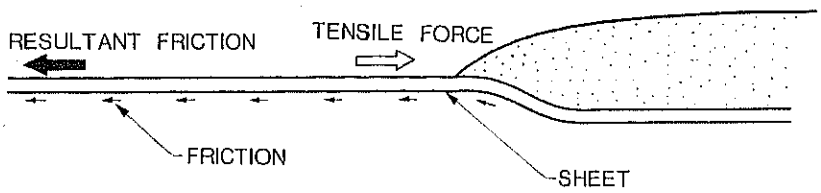


Fig. B-1-1 Sheet Method

The procedures: first, a sheet of synthetic membrane to be spread by hand over the soft surface of the ground with its one end secured to firm ground; then sand to be scattered over the sheet, beginning from the secured end of the sheet, with a small type of swamp bulldozer, belt conveyor or a jet conveyor.

The second and third layers of sand may follow as required, and heavier machinery can be employed for each successive layer. Fig. B-1-2 shows a procedure with a jet conveyor.

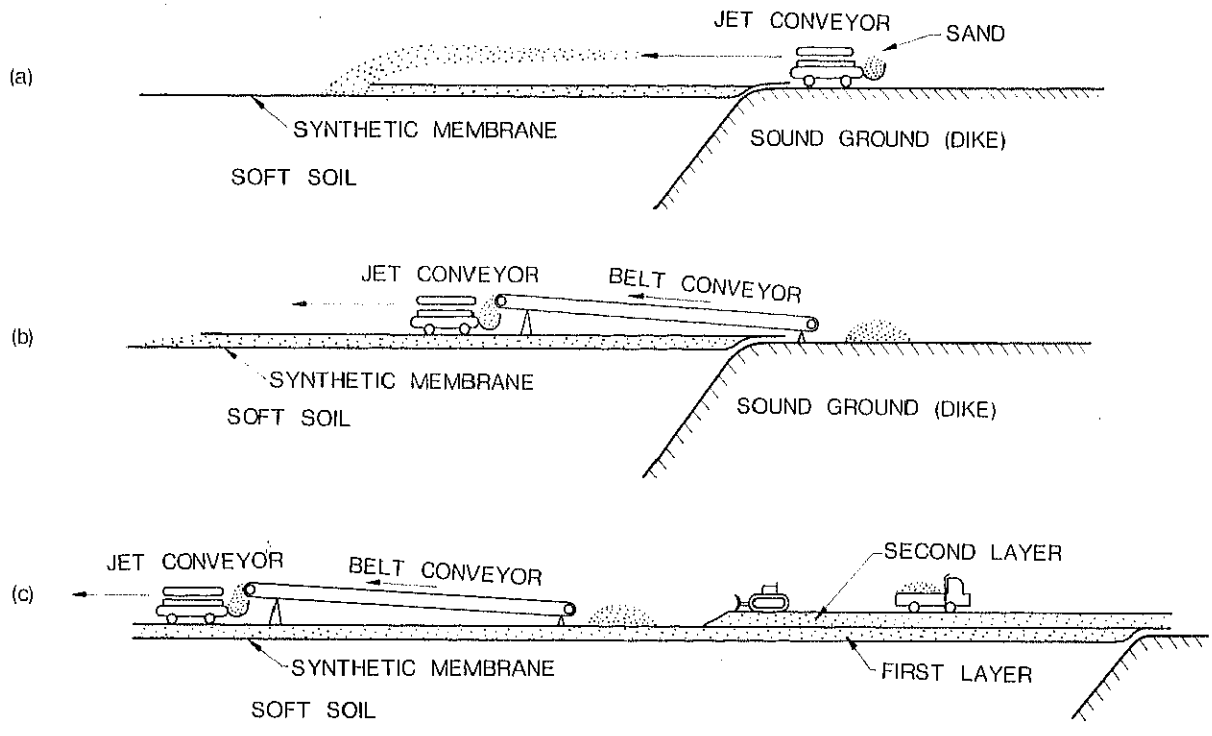


Fig. B-1-2 Sheet Method with Jet Conveyor

B-2-2 Rope-net Placement

This is a variation of the Sheet Placement which is impracticable to the extremely soft ground because of breakage of the sheet being caused by greater tensile force in the sheet exceeding its tensile strength on such unfavourable ground.

Yet, principle and procedures of the variation slightly differ from the originals:—
First, a sheet (whose tensile strength is not necessarily high) to be spread all over the ground, followed by further spreading of lattice-formed rope-net with its every ends secured to the surrounding firm ground; then, levee bodies of small cross-section called 'counter-banks' to be formed on the rope-net into lattice form with a belt conveyor or a small type of swamp bulldozer (Fig. B-2-1). The rope-net within the areas surrounded by the counter-banks will then be tensed by the lifting force resulting from the mass of the banks (Fig. B-2-2). After completion of counter-banking, soil can be scattered over the area surrounded by the counter-banks.

Even a big lorry can run about on the ground once completed with some 50 cm thick layer.

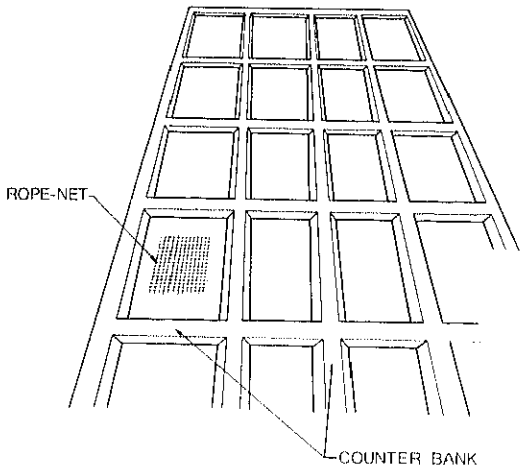


Fig. B-2-1 Counter Bank

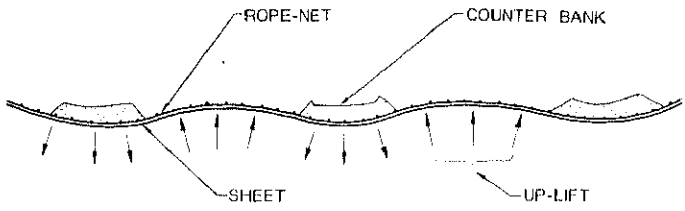


Fig. B-2-2 Rope-net

B-2-3 Bamboo-net Placement

This method has the same principle as of the traditional fascine mattress improvement.

The procedures: first, rafts on the bamboo-net to be spread over the soft ground, followed by further spreading of a sheet; then, hill-cut soil or sand to be scattered in a layer over the net/ sheet, in the same way as explained in B-2-1 above.

The Bamboo-net Placement may be employed for improvement either of the whole area of the relaimed land, or of such belt parts as to be utilized for temporary roads, etc.

B-3 Surface Solidification Methods

Surface solidification is a chemical improvement method which is to stabilize the surface layer of 1 m to 3 m thickness of the soft ground by reaction of mixing agents, which may be classified into cement mixing and lime mixing according to the kinds of the mixing agents.

B-3-1 Cement Mixing

Cement has been used anywhere in the world to improve the subgrade soil in road construction, which is today adapted for improvement of ultrasoft ground as introduced herebelow:—

In Japan, the cement milk is grouted into and mixed up with mud of the surface layer in the ultra-soft ground with floating equipments, shortly sfter reclamation. The cement milk so mixed is hydrated to form lime aluminate ($3CaO.\ Al_2O_3.\ mH_2O$) and lime silicate ($mCaO.\ SiO_2.\ nH_2O$), which compounds bind the solid particles each together to stabilize the soil.

Fig. B-3-1 presents a flow sheet of this practice, while Fig. B-3-2 shows an example of combined usage of the practice together with other surface improvement methods such as the Rope-net Placement.

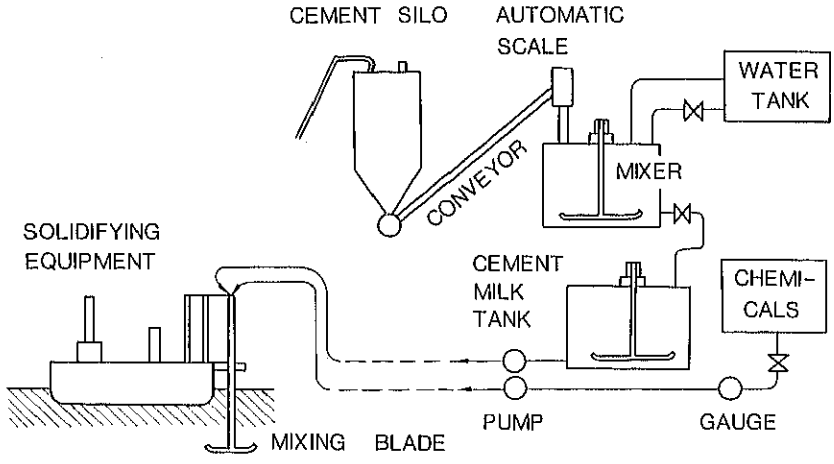


Fig. B-3-1 Flow Chart of Cement Mixing

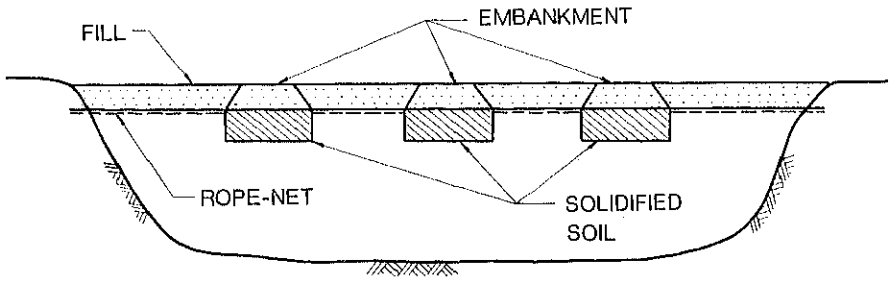


Fig. B-3-2 Combined Usage of Cement Mixing and Rope-net

B-3-2 Lime Mixing

Lime has also been used for a long time to stabilize ground surfaces, and is applied in particular cases to improve ultra-soft ground.

Granulated quick lime is usually used instead of powdery quick lime, since the latter reacts too rapidly to be desirably mixed in soft soil of high water content. The quick lime, when mixed with the soft soil, absorbs water therein, is hydrated and increases its volume, turning into slaked lime with resultant heat of 280 Kcal/kg giving off, which results in decreased water content and improvement of the soil. At the same time, the quick lime reacts on silica (SiO_2) and alumina (Al_2O_3) in the clay and the colloid to form lime silicate and lime aluminate respectively, which results in increasing particle bonding force and shear strenght of the soil.

APPENDIX C OUTLINE OF SONIC PROSPECTING WITH THE SONOSTRATOR

C-1 Sonostrator

The Sonostrator is essentially a high-power long wave echo-sounder. It is used in water-covered area to obtain continuous acoustic profiles of the bottom and the sub-bottom geologic formations.

The sound source which is installed on the boat creates a strong acoustic pulse, which transmits sound wave toward the bottom and the sub-bottom geologic formations. The reflected energy is received by the hydrophone, amplified, filtered and recorded on a time graphic sweep recorder.

The sound source of the Sonostrator consists of a magneto-strictive oscillation transducer which creates an acoustical elastic pulse mainly 1 to 9 kHz. The significant energy is 3 to 4 kHz. These frequencies are approximately ten times higher than other equipment such as Speaker, Soner Boomer, etc. and about 100 times higher than that of conventional seismic method. Since higher frequencies and a shorter pulse improve the resolution, thinner beds and finer stratigraphic changes are detectable. The Sonostrator consists of two electronic units, the transmitting and the receiving section. Fig. C-1-1 shows a block diagram of the Sonotrator.

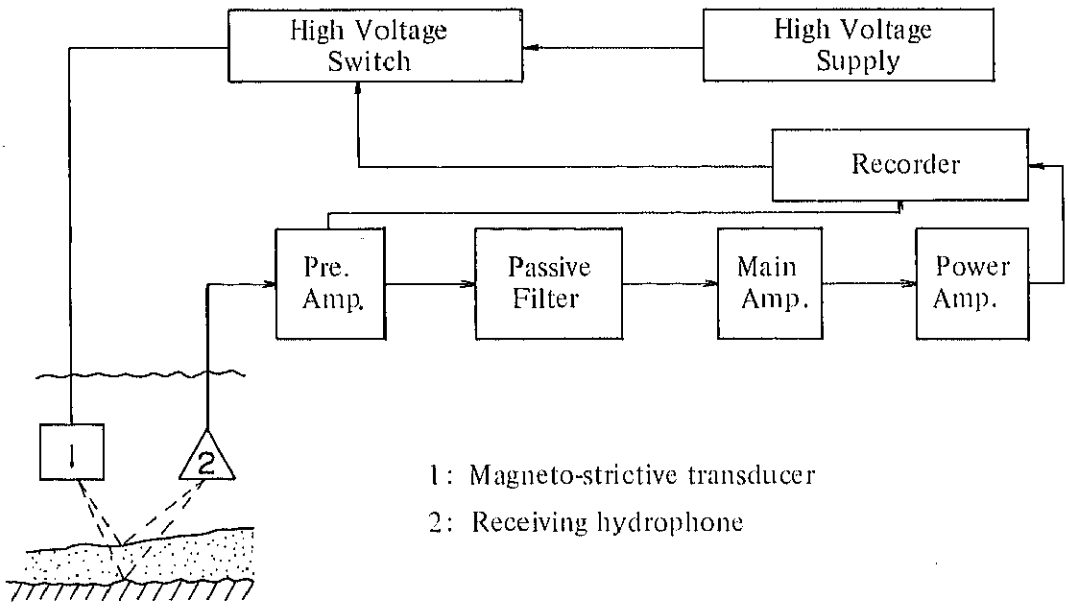


Fig. C-1-1 Block Diagram of the Sonostrator

The recorder provides the synchronized trigger pulse corresponding to a writing stylus positioned at the top of the recording paper. The trigger pulse switches on the current which charged up to 1,500 volts.

The current passing through the magneto-strictive oscillator produces a loud sound of short duration. The repetition rate of the acoustic pulse is three times per second. The

Time Variable Gain (T.V.G.) printed amplifier is used to give a clean record of shallow layers while a higher gain is used on the deeper layers.

As the sound velocity within the sediments is not precisely known, the depth scale was based on a velocity in water of 1,500 meter per second in the present investigation.

C-2 Analysis and Interpretation

Analysis and interpretation of records are made as follows;

(1) Extract geologic information from various reflections.

(2) Classify the geologic strata based on the characteristics shown on the records.

(3) Determine the depth of a reflective horizon and compose geologic profiles with adjustment of tidal height, draught and the other corrections. In this case, the depth is determined by following equation on the assumption that the transmitting velocity in water and layers equal to 1,500 m/sec.

$D = 1/2\ V.T \quad (m)$

V : average transmitting velocity in water and sediments

T : reflective travel time

(4) In correlation with the geologic information, dredging data, penetrating data, geological map, and etc. around prospecting area, clarify the relation between the records and the actual geologic strata and interpret them geologically.

(5) Compile the above results such as the geologic profile and other drawings.

C-3 Particular Pattern of Sonostrator

In general, the particular pattern on sonic prospecting records (limited only Sonostrator is characterized in proportion to lithologic condition of sediments as follows;

Clay, silt, fine sand: Shows a light pattern, sometimes has several weak reflections parallel to the surface of stratum.

Medium to coarse sand: Shows striped to bedded pattern, at places includes many fine reflections oblique to surface of stratum.

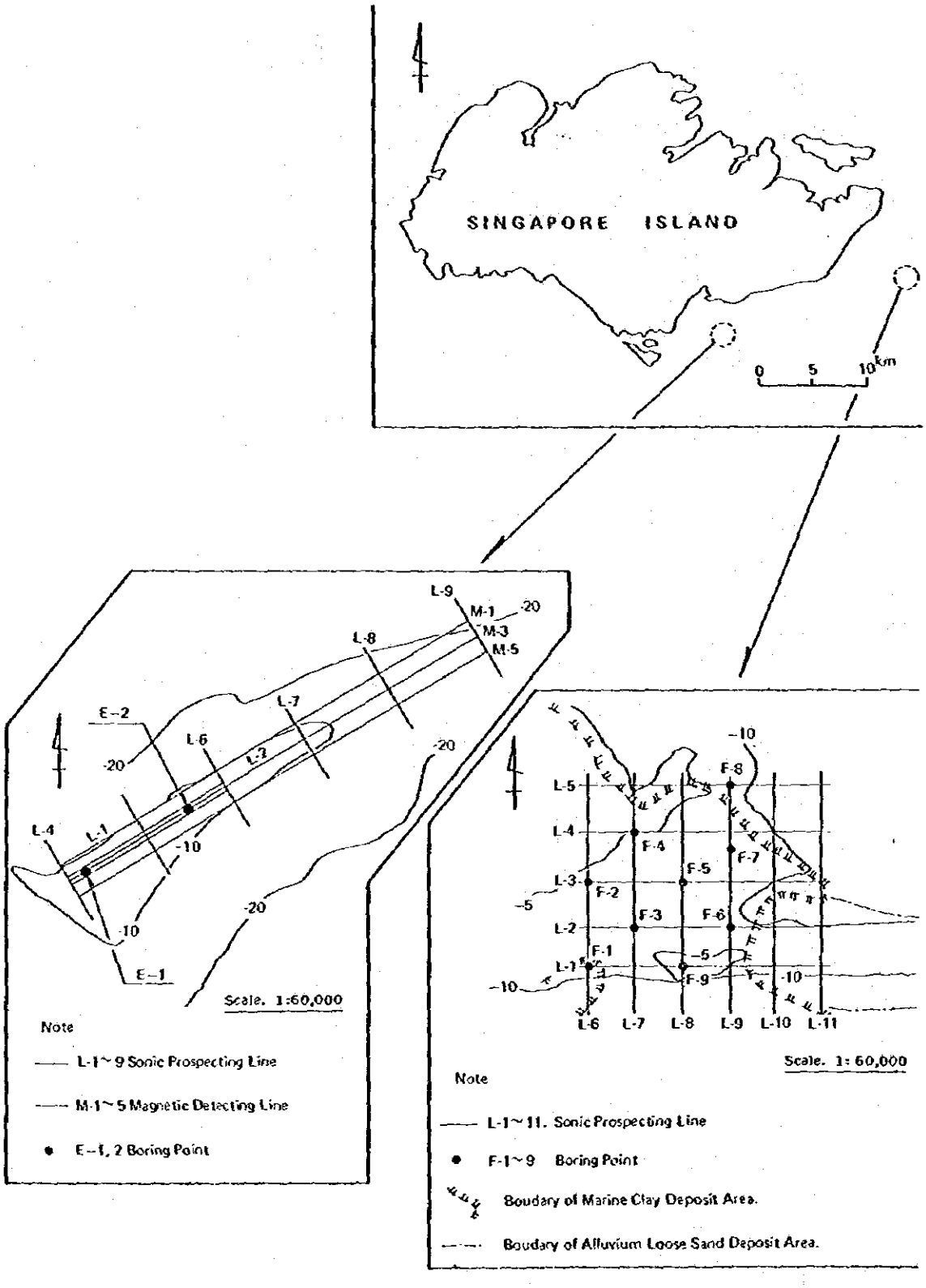
Gravel: Shows fine radial pattern congregated irregularly (diffraction waves) and wavy pattern that is congregation of irregular reflections. Below this pattern, records are normally poor or too light.

Rock: Most of the sonic waves are reflected and not absorbed into the surface of rocks, therefore relatively stronger reflections are recorded. There is almost no trace of reflected data recorded under rocks.

In many cases, these characteristics are not so evident, and have so many varieties in the actual conditions. Accordingly, much attentions must be paid for analysis.

APPENDIX D RESULTS OF PRESENT SURVEY

- Plan of Present Survey
- Coordinates of Boring Points
- Drilling Logs
- Summary of Soil Tests
- Outer Shoal , Geological Cross Section , L–1 & L–2
  , L–3, L–4 & L–5
  , L–6 & L–7
  , L–8 & L–9
- Outer Shoal , Track Chart for Sonic Prospecting
- Outer Shoal , Sounding Map
- Outer Shoal , Track Chart for Magnetic Detecting
- Outer Shoal , Location Map of Magnetic Anomalies for Magnetic Detecting
- Offshore Changi , Geological Cross Section , L–1 & L–2
  , L–3 & L–4
  , L–5 & L–6
  , L–7 & L–8
  , L–9 & L–10
  , L–11
- Offshore Changi , Track Chart for Sonic Prospecting
- Offshore Changi , Sounding Map
- Offshore Changi , Track Chart for Magnetic Detecting
- Offshore Changi , Location Map of Magnetic Anomalies for Magnetic Detecting



Plan of Present Survey

COORDINATES OF BORING POSITIONS

POSITIONS	PLANE RECTANGULAR COORDINATES (P.S.A. GRID) X	Y	GEOGRAPHICAL COORDINATES LAT.	LONG.
E-1	-3875.00	1880.00	1 15 9.3596	103 52 11.6284
E-2	-3225.00	2960.00	1 15 30.5230	103 52 46.5679
F-1	3020.00	18845.00	1 18 53.8370	104 1 20.4813
F-2	3975.00	18840.00	1 19 24.9312	104 1 20.3216
F-3	3465.00	19345.00	1 19 8.3248	104 1 36.6582
F-4	4485.00	19335.00	1 19 41.5354	104 1 36.3370
F-5	3995.00	19835.00	1 19 25.5801	104 1 52.5119
F-6	3425.00	20335.00	1 19 7.0201	104 2 8.6865
F-7	4310.00	20330.00	1 19 35.8351	104 2 8.5269
F-8	5000.00	20325.00	1 19 58.3011	104 2 8.3668
F-9	3035.00	19850.00	1 18 54.3231	104 1 52.9949

Drilling Logs

DRILLING LOG

Remarks

Name of Project Fill Materials for Reclamation Projects
Type of Drilling Rotary
Hole Number No. E-1
Elevation ACD -8.60 m.
Date 18th to 21st November, 1978
Water Table m.
Driller Koken Boring ( )

Elevation in m.	Depth in m.	Thickness	Type of Soil	Colour	Relative Density or Consistency	General Remarks
20.10	11.50	11.50	Marine Clay	Greenish grey to Grey	Very soft	Very sticky. Uniform. High water content. Contains some sea shell fragments. With some fine sand. With some organic matters.
25.60	17.00	5.50	Clay with organic	Brownish grey	Soft	Contains fibrous organic matters. Less organic matters at 14m. Observed some laminae of organic matters.
28.70	20.10	3.10	Marine Clay	Dark grey	Soft	Sticky. Uniform.
30.00	21.40	1.30	Silty Clay	Grey to Reddish brown	Stiff	With some mudstone gravel (ϕ=2~5mm) With some sand pockets
30.70	22.10	0.70	Organic Clay	Brownish grey to black	Soft	With decomposed wood
34.05	25.45	3.35	Silty Clay	Grey to Reddish brown	Soft	High plasticity with some decomposed vegetables.
				End of Drilling		

Standard Penetration Test or Core Recovery

Depth in m.	Sampling for Lab.	N-Value	Blows Per Each 10cm	(N—Value)
2.15 – 2.45	P-1	0	Self Penetration	(γ_t = 1.58 g/cm^3)
4.15 – 4.45	P-2	0	Self Penetration with weight	(γ_t = 1.55)
6.15 – 6.45	P-3	0	Self Penetration with weight	(γ_t = 1.63)
8.15 – 8.45	P-4	1	1/30	(γ_t = 1.60)
10.15 – 10.45	P-5	1	1/30	(γ_t = 1.53)
12.15 – 12.45	P-6	2	1/15 1/15	(γ_t = 1.60)
14.15 – 14.45	P-7	3	1 1 1	(γ_t = 1.59)
16.15 – 16.45	P-8	3	1 1 1	(γ_t = 1.57)
18.15 – 18.45	P-9	3	1 1 1	(γ_t = 1.61)
20.15 – 20.45	P-10	11	3 4 4	(γ_t = 1.90)
22.15 – 22.45	P-11	2	1/15 1/15	(γ_t = .73)
24.15 – 24.45	P-12	3	1 1 1	(γ_t = .80)
25.15 – 25.45	P-13	3	1 1 1	(γ_t = .89)

Core Recovery

DRILLING LOG

Remarks

Name of Project Fill Materials for Reclamation Projects
Type of Drilling Rotary
Hole Number No. E-2
Elevation ACD -8.30 m.
Date 22nd to 25th November, 1978
Water Table m.
Driller Koken Boring ( )

Elevation in m.	Depth in m.	Thickness	Type of Soil	Colour	Relative Density or Consistency	General Remarks
17.90	9.60	9.60	Marine Clay	Greenish grey to Grey	Very soft	Sticky, uniform. High water content. Contains seashell fragments. With small quantity of fine sand. With small quantity of organic matters. With lots of organic matters.
19.70	11.40	1.80	Organic Clay	Dark brown to Black	Soft	With some fine sand pockets. With decomposed woods.
21.30	13.00	1.60	Silty Clay	Yellowish orange to Grey	Stiff	High plasticity. Low water content.
23.80	15.50	2.50	Sandy Clay	Light brown	Stiff	Sand is fine grained. With small quantity of seashell fragments
30.75	22.45	6.95	Marine Clay	Grey	Soft	Contains some fine sand at upper portion. Gradually change to uniform marine clay. With some seashell fragments.
				End of Drilling		

Standard Penetration Test or Core Recovery

Depth in m.	Sampling for Lab.	N-Value (Blows)	Blows Per Each 10cm	
2.15 – 2.45	P-1	0	Self Penetration	(γ_t = 1.62 g/cm^3)
4.15 – 4.45	P-2	0	Self Penetration	(γ_t = 1.61)
6.15 – 6.45	P-3	0	Self Penetration	(γ_t = 1.70)
8.15 – 8.45	P-4	1	1/30	(γ_t = 1.62)
10.15 – 10.45	P-5	3	1 1 1	(γ_t = 1.79)
12.15 – 12.45	P-6	13	3 4 6	(γ_t = 1.88)
14.15 – 14.45	P-7	14	4 5 5	(γ_t = 1.80)
16.15 – 16.45	P-8	4	1 1 2	(γ_t = 1.78)
18.15 – 18.45	P-9	3	1 1 1	(γ_t = 1.77)
20.15 – 20.45	P-10	3	1 1 1	(γ_t = 1.74)
22.15 – 22.45	P-11	3	1 1 1	(γ_t = 1.78)

(N—Value) 10 20 30 40 50

Core Recovery

DRILLING LOG

Remarks

Name of Project Fill Materials for Reclamation Projects Type of Drilling,

Hole Number No. F-1 Elevation ACD -7.00 m. Date 13th to 15th December, 1978

Water Table m. Driller Koken Boring ( )

Scale in m.	Elevation in m.	Depth in m.	Thickness	Legend	Type of Soil	Colour	Relative Density or Consistency	General Remarks
1–2	9.10	2.10	2.10		Sand with Gravel	Greenish grey		Sand is medium to coarse grained. With seashell fragments
3–8	13.20	8.20	6.10		Marine Clay	Grey to Dark grey	Very soft	Uniform, sticky. With some fine sand and seashell fragments. Contains black organic matters and sand below 7.5m
9–12	18.80	11.80	3.60		Clayey Sand	Brownish grey	Very loose	Sand is medium to coarse grained. With some fine gravel (ø = 2 to 5mm)
13–14	21.40	14.40	2.60		Silty Clay	Reddish brown to Grey	Very stiff	Sticky. With some black organic matters
15–20	27.20	20.20	5.80		Marine Clay	Dark grey	Soft	Uniform. Very sticky.
21–22	29.10	22.10	1.90		Clay with organic	Dark grey	Medium	With black organic matters
23–28	35.60	28.60	6.50		Clayey Sand	Greenish grey to Grey	Medium to Dense	Sand is medium to coarse grained. Partly changes to fine sand. With some fine gravel and organic matters
29–30	37.35	30.35	1.75		Silty Clay	Greenish grey to Light brown	Hard	With fine sand
31					End of Drilling			

Standard Penetration Test or Core Recovery

Depth in m.	Sampling for Lab.	N-Value	Blows Per Each 10cm			
2.15–2.45	P-1	0	Self Penetration			
4.15–4.45	P-2	0	Self Penetration			
6.15–6.45	P-3	0	Self Penetration			
8.15–8.45	P-4	1	1/30			
10.15–10.45	P-5	3	1	1	1	
12.15–12.45	P-6	18	5	6	7	
14.15–14.45	P-7	6	2	2	2	
16.15–16.45	P-8	3	1	1	1	
18.15–18.45	P-9	4	1	1	2	
20.15–20.45	P-10	6	2	2	2	
22.15–22.45	P-11	38	12	15	11	
24.15–24.45	P-12	17	4	5	8	
26.15–26.45	P-13	18	4	6	8	
28.15–28.45	P-14	15	5	5	6	
30.15–30.35	P-15	50/19	25	25/9		

(N—Value) 10 20 30 40 50

Core Recovery

DRILLING LOG

Remarks

Name of Project Fill Materials for Reclamation Projects Type of Drilling

Hole Number No. F-2 Elevation ACD -6.60 m. Date 9th to 14th December, 1978

Water Table ... m. Driller Koken Boring ( )

Scale in m.	Elevation in m.	Depth in m.	Thickness	Legend	Type of Soil	Colour	Relative Density or Consistency	General Remarks
1	8.10	1.50	1.50		Clayey Sand with Gravel	Greenish grey		With seashell fragments
4	10.70	4.10	2.60		Silty Sand	Greenish grey	Very dense	Uniform. Sand is fine to medium grained
13	20.10	13.50	9.40		Clayey Sand with Gravel	Yellowish brown to Grey	Dense to Very dense	Semi-angular to round gravel with dia. of 2 to 3mm. Max. dia. is about 5mm. Majority is quartz gravel. Contains some feldspar gravel.
17	23.60	17.00	3.50		Silty Sand	Purplish grey	Very dense	Uniform. Sand is fine grained.
23	29.60	23.00	6.00		Clayey Silt	Grey to Yellowish brown	Hard	With some fine sand.
25	31.87	25.27	2.27		Silty Sand	Whitish to Yellowish grey	Very dense	Sand is fine grained.
26						End of Drilling		

Standard Penetration Test or Core Recovery

Depth in m.	Sampling for Lab.	N-Value	Blows Per Each 10cm
2.15	P-1	50/14	26 24/4
2.29			
4.15	P-2	47	14 17 16
4.45			
6.15	P-3	50/12	33 17/2
6.27			
8.15	P-4	50/15	28 22/5
8.30			
10.15	P-5	50/14	29 21/4
10.29			
12.15	P-6	50/12	41 9/2
12.27			
14.15	P-7	50/10	50
14.25			
16.15	P-8	50/8	50/8
16.23			
18.15	P-9	50/9	50/9
18.25			
20.15	P-10	50/7	50/7
20.22			
22.15	P-11	50/14	36 14/4
22.29			
24.15	P-12	50/14	36 14/4
24.29			
25.15	P-13	50/12	40 10/2
25.27			

(N—Value) 10 20 30 40 50

Core Recovery

DRILLING LOG

Remarks

Name of Project Fill Materials for Reclamation Projects Type of Drilling Rotary

Hole Number No. F-3 Elevation ACD -9.80 m. Date 28th Nov. to 4th Dec. 1978

Water Table m. Driller Koken Boring ( )

Scale in m.	Elevation in m.	Depth in m.	Thickness	Legend	Type of Soil	Colour	Relative Density or Consistency	General Remarks	Standard Penetration Test or Core Recovery: Depth in m.	Sampling for Lab.	N-Value	Blows Per Each 10cm	(N—Value)
1													Core Recovery
2								Sand is fine to medium grained. With small quantity of gravel with dia. of 2 ~ 3 mm.	2.15 2.45	P-1	15	4 5 6	
3													
4	13.70	3.90	3.90		Clayey Sand	Whitish brown	Medium		4.15 4.30	P-2	50/15	30 20/5	
5													
6									6.15 6.27	P-3	50/12	41 9/2	
7								Semi-angular to round gravel. Dia. of gravel is generally 2~3 mm. Max. dia. is about 5 mm.					
8					Clayey Sand with gravel	Whitish brown to Grey	Very dense		8.15 8.35	P-4	50/20	21 29	
9													
10	20.30	10.50	1.80		Silty Clay	Yellowish brown to Grey	Hard	Well cemented. Uniform.	10.15 10.31	P-5	50/16	26 24/6	
11	21.25	11.45	0.95		Silty Clay	Greenish grey	Hard	Fairly well cemented. Uniform.	11.15 11.45	P-6	47	15 16 16	
12													
13					End of Drilling								
14													
15													
16													
17													
18													
19													
20													

DRILLING LOG

Remarks

Name of Project Fill Materials for Reclamation Project Type of Drilling Rotary

Hole Number No. F-4 Elevation ACD -5.30 m. Date 6th to 7th December, 1978

Water Table m. Driller Koken Boring ( )

Scale in m.	Elevation in m.	Depth in m.	Thickness	Legend	Type of Soil	Colour	Relative Density or Consistency	General Remarks
1					Clayey Sand with Gravel	Yellow-ish grey	Medium	Semi-angular to round gravel with Ø of 2-3mm. With shell fragments
2	7.10	1.80	1.80					
3					Silty Sand	Whitish grey to Yellow-ish orange	Very dense	Sand is fine to medium
4	9.40	4.10	2.30					
5					Clayey Sand with Gravel	Whit-ish grey	Very dense	Contains a lot of gravel at some portion. With angular feldspar gravel
6	11.40	5.80	1.70					
7					Clayey Sand	Whitish grey	Dense	Sand is fine to medium grained. Uniform
8	13.30	8.00	2.20					
9					Clayey Sand with Gravel	Yellow-ish orange	Very dense	Gravel is generally semi-round quartz with dia. of 2 - 3 mm.
10	15.10	9.80	1.80					
11								
12								
13					Clayey Sand	Whit-ish grey	Very dense	Sand is fine to medium grained. With some fine gravel
14	18.90	13.60	3.80					
15					Clayey Sand with Gravel	Yellow-ish grey	Very dense	Quartz gravel. Dia. of gravel is 2 - 3 mm
16	20.55	15.25	1.65					
17						End of Drilling		
18								
19								
20								

Standard Penetration Test or Core Recovery

Depth in m.	Sampling for Lab.	N-Value	Blows Per Each 10cm			
0.15						
0.45	P-1	18	4	5	9	
2.15		50/8	50/8			
2.23	P-2					
4.15		50/11	47	3/1		
4.26	P-3					
6.15						
6.45	P-4	40	13	12	15	
8.15		50/17	26	24/7		
8.32	P-5					
10.15		50/22	19	22	9/2	
10.37	P-6					
12.15		50/19	23	27/9		
12.29	P-7					
14.15		50/14	32	18/4		
14.29	P-8					
15.15		50/10	50			
15.25	P-9					

(N—Value) 10 20 30 40 50

Core Recovery

DRILLING LOG

Remarks

Name of Project Fill Materials for Reclamation Projects Type of Drilling Rotary

Hole Number No. F-5 Elevation ACD -8.20 m. Date 29th to 30th November, 1978

Water Table m. Driller Koken Boring ( )

Scale in m.	Elevation in m.	Depth in m.	Thickness	Legend	Type of Soil	Colour	Relative Density or Consistency	General Remarks
1–20	13.90	5.70	5.70		Clayey Sand with gravel	Reddish brown to Grey	Medium to Very dense	Almost semi-round quartz gravel. Generally gravel is fine grained, i.e. Ø=2 - 3mm. Max. dia. of gravel is about 5mm.
	16.10	7.90	2.20		Clayey Sand	Grey to Brown	Dense	Sand is fine to medium grained. With fine gravel.
	20.20	12.00	4.10		Clayey Sand with gravel	Reddish brown to Brown	Very dense	Almost semi-round quartz gravel. With feldspar gravel. Gravel is fine grained. Max. dia. of gravel is 5mm.
						End of Drilling		

Standard Penetration Test or Core Recovery

Depth in m.	Sampling for Lab.	N-Value Blows	Blows Per Each 10cm		
2.15	P-1	22	6	7	9
2.45					
4.15	P-2	50/16	25	25/6	
4.31					
5.15	P-3	50/24	21	22	7/4
5.39					
6.15	P-4	46	17	15	14
6.45					
8.15	P-5	50/17	23	27/7	
8.32					
10.15	P-6	50/14	24	26/4	
10.29					
11.15	P-7	50/10	50		
11.25					

(N—Value) 10 20 30 40 50

Core Recovery

DRILLING LOG

Remarks

Name of Project Fill Materials for Reclamation Project Type of Drilling Rotary

Hole Number No. F-6 Elevation ACD -8.90 m. Date 1st to 4th December, 1978

Water Table m. Driller Koken Boring ( )

Scale in m.	Elevation in m.	Depth in m.	Thickness	Legend	Type of Soil	Colour	Relative Density or Consistency	General Remarks
1–5								
6	14.90	6.00	6.00		Clayey Sand	Yellowish brown	Medium to Dense	Sand is medium to coarse grained. With some fine gravel (Ø = 2 to 3 mm)
7–11					Clayey Sand with Gravel	Yellowish brown to Greenish grey	Dense to Very dense	Semi-angular to round gravel. Dia. of gravel is generally 2 to 3 mm. Max. dia. is about 5mm. Contains a lot of gravel with Ø of 3 - 5mm below 12m
12	21.24	12.34	6.34					
13–20						End of Drilling		

Standard Penetration Test or Core Recovery

Depth in m.	Sampling for Lab.	N-Value Blows	Blows Per Each 10cm	
2.15 – 2.45	P-1	20	6	7 7
4.15 – 4.45	P-2	33	10	10 13
6.15 – 6.45	P-3	41	12	13 16
8.15 – 8.45	P-4	47	11	14 22
10.15 – 10.41	P-5	50/26	19	21 10/6
12.15 – 12.34	P-6	50/19	22	28/9

(N—Value) 10 20 30 40 50

Core Recovery

DRILLING LOG

Remarks

Name of Project Fill Materials for Reclamation Projects Type of Drilling Rotary

Hole Number No. F-7 Elevation ACD -7.50 m. Date 9th to 11th December, 1978

Water Table m. Driller Koken Boring ( )

Scale in m.	Elevation in m.	Depth in m.	Thickness	Legend	Type of Soil	Colour	Relative Density or Consistency	General Remarks
1	7.60	0.10	0.10		Clayey Sand with Gravel	Grey		With seashell fragments
2								Small quantity of gravel around 2m. Sand is fine to medium grained. Semi-angular to round gravel with diameter of 2 to 3 mm.
3					Clayey Sand with Gravel	Greenish grey	Dense to Very dense	
4	12.30	4.80	4.70					
5					Sandy Clay with Gravel	Yellowish brown	Hard	Dia. of gravel is 3 to 5mm. Max. dia. is about 7mm.
6	13.70	6.20	1.40					
7								
8								
9								Quartz gravel with dia. of 2 to 3mm. Max. dia. is about 5mm. A lot of gravel at 10m.
10					Clayey Sand with Gravel	Greenish grey	Dense to Very dense	
11								
12	19.30	11.80	5.60					
13	20.74	13.24	1.44		Silty Sand	Brown to Greenish grey	Very dense	Sand is fine grained.
14					End of Drilling			
15								
16								
17								
18								
19								
20								

Standard Penetration Test or Core Recovery

Depth in m.	Sampling for Lab.	N-Value	Blows Per Each 10cm		
2.15	P-1	40	11	13	16
2.45					
4.15	P-2	55	17	18	20
4.45					
6.15	P-3	50/24	18	20	12/4
6.39					
8.15	P-4	41	12	13	16
8.45					
10.15	P-5	50/19	24	26/9	
10.34					
12.15	P-6	50/13	36	14/3	
12.28					
13.15	P-7	50/9	50/9		
13.24					

(N—Value)

Core Recovery

DRILLING LOG

Remarks

Name of Project Fill Materials for Reclamation Project Type of Drilling Rotary

Hole Number No. F-8 Elevation ACD -9.40 m. Date 6th to 7th December, 1978

Water Table m. Driller Koken Boring ( )

Scale in m.	Elevation in m.	Depth in m.	Thickness	Legend	Type of Soil	Colour	Relative Density or Consistency	General Remarks
1								
2								
3								
4								
5								
6								
7								
8	17.20	7.80	7.80		Marine Clay	Dark grey	Very soft	Sticky, uniform. High water content. With some fine sand.
9								
10								
11								
12								
13					Clayey Sand with Gravel	Grey to Red-dish brown	Very loose to Loose	Gravel is semi-angular to round with dia. of 2 to 3mm. Max. dia. of gravel is about 5mm.
14	23.90	14.50	6.70					
15								
16								
17								
18								
19								
20	30.10	20.70	6.20		Marine Clay	Dark grey	(Soft)	
21								
22								
23	32.90	23.50	2.80		Silty Clay	Green-ish grey	(Medium)	
24								
25					Clayey Sand with Gravel	Green-ish grey	Very dense	Gravel is semi-angular to round with dia. of 2 to 3 mm. Max. dia. is about 5mm.
26	35.52	26.12	2.62					
27								
28					End of Drilling			

Standard Penetration Test or Core Recovery

Depth in m.	Sampling for Lab.	N-Value	Blows Per Each 10cm
2.15	P-1		Self Penetration
2.45			
4.15	P-2		Self Penetration with weight
4.45			
6.15	P-3	1	1/30
6.45			
8.15	P-4	3	1 1 1
8.45			
10.15	P-5	5	1 2 2
10.45			
11.15	P-6	3	1 1 1
11.45			
24.15	P-7	50/18	21 29/8
24.35			
26.00	P-8	50/12	40 10/2
26.12			

(N—Value) 10 20 30 40 50

Core Recovery

DRILLING LOG

Remarks

Name of Project Fill Materials for Reclamation Projects
Type of Drilling Rotary
Hole Number No. F-9
Elevation ACD -6.50 m.
Date 16th to 18th December, 1978
Water Table m.
Driller Koken Boring ( )

Scale in m.	Elevation in m.	Depth in m.	Thickness	Legend	Type of Soil	Colour	Relative Density or Consistency	General Remarks
1	7.90	1.40	1.40		Sand with Gravel	Green-ish grey		Sand is coarse grained. With shell fragments
2								
3								
4								
5								
6								
7								
8								Sand is fine grained. With small quantity of fine gravel. Partly, material changes to silty clay
9						Yellowish brown to Grey		
10	16.60	10.10	8.70		Sandy Silt		Hard	
11								Quartz and feldspar gravels. Semi-angular to round gravels with dia. of 2 to 3 mm. Max. dia. is about 5 mm.
12								
13								
14	20.77	14.27	4.17		Clayey Sand with Gravel	Green-ish grey	Very hard	
15								
16						End of Drilling		
17								
18								
19								
20								

Standard Penetration Test or Core Recovery

Depth in m.	Sampling for Lab.	N-Value	Blows Per Each 10cm			
2.15	P-1	50/28	13	18	19/8	
2.43						
4.15	P-2	50/20	23	27		
4.35						
6.15	P-3	50/16	31	19/6		
6.31						
8.15	P-4	50/26	17	21	12/6	
8.41						
10.15	P-5	50/19	21	29/9		
10.34						
12.15	P-6	50/18	26	24/8		
12.33						
14.15	P-7	50/12	37	13/2		
14.27						

(N—Value) 10 20 30 40 50

Core Recovery

Summary of Soil Tests

No.

SUMMARY OF SOIL TEST

Project _____ Bore Hole E-1

Location of project _____

Sample no.		P-3	P-8	P-9	P-10	P-12				
Sample depth		6.00 m ~ 6.45 m	16.00 m ~ 16.45 m	18.00 m ~ 18.45 m	20.00 m ~ 20.45 m	24.00 m ~ 24.45 m	m ~ m	m ~ m	m ~ m	m ~ m
Condition of sample		Disturbed ~~Undisturbed~~	Disturbed ~~Undisturbed~~	Disturbed ~~Undisturbed~~	Disturbed ~~Undisturbed~~	Disturbed ~~Undisturbed~~	Disturbed Undisturbed	Disturbed Undisturbed	Disturbed Undisturbed	Disturbed Undisturbed
Natural water content, %		70.4	65.7	66.9	53.2	31.50				
Specific gravity		2.645	2.606	2.616	2.695	2.686				
Wet density, g/cm³		(1.63)	(1.57)	(1.61)	(1.90)	(1.80)				
Dry density, g/cm³		(0.96)	(0.95)	(0.96)	(1.24)	(1.37)				
Natural void ratio		(1.76)	(1.74)	(1.73)	(1.17)	(0.96)				
Degree of saturation , %		(100)	(98)	(100)	(100)	(88)				
Atterberg limits	Liquid limit , %	77	92	87	55	63				
	Plastic limit , %	28	37	31	22	24				
	Plasticity index	49	55	56	33	39				
Grain size analysis	Gravel , %	0	1	0	1	0				
	Sand , %	2	3	1	12	2				
	Silt , %	31	21	22	25	25				
	Clay & colloid , %	67	75	77	62	73				
	Max. diameter, mm	2.00	4.76	2.00	4.76	4.76				
	Diam. at 60%	0.0020	0.0020	0.0012	0.0045	0.0017				
	Diam. at 10%	-	-	-	-	-				
Visual soil description		Clay	Clay with organic	Clay	Silty Clay	Silty Clay				
Unified soil classification		CH	CH	CH	CH	CH				
Unconfined compression test	Undisturbed sample, kg/cm²									
	Remoulded sample, kg/cm²									
	Sensitivity ratio									
	Strain at failure, %									
Triaxial compression test	Angle of internal friction									
	Cohesion, kg/cm²									
	Condition of drainage									
Consolidation test	Preconsolidation pressure, kg/cm²									
	Compression index									
Shear test	Angle internal friction									
	Cohesion, kg/cm²									
	Condition of Drainage									
Remarks:										

No.

SUMMARY OF SOIL TEST

Project _____ Bore Hole E-2

Location of project _____

Sample no.		P-2	P-5	P-6	P-7	P-10				
Sample depth		4.00 m 4.45 m	10.00 m 10.45 m	12.00 m 12.45 m	14.00 m 14.45 m	20.00 m 20.45 m	m m	m m	m m	m m
Condition of sample		Disturbed ~~Undisturbed~~	Disturbed ~~Undisturbed~~	Disturbed ~~Undisturbed~~	Disturbed ~~Undisturbed~~	Disturbed ~~Undisturbed~~	Disturbed Undisturbed	Disturbed Undisturbed	Disturbed Undisturbed	Disturbed Undisturbed
Natural water content, %		71.2	69.1	34.3	41.2	55.1				
Specific gravity		2.660	2.607	2.681	2.697	2.672				
Wet density, g/cm³		(1.61)	(1.79)	(1.88)	(1.80)	(1.74)				
Dry density, g/cm³		(0.94)	(1.06)	(1.40)	(1.27)	(1.12)				
Natural void ratio		(1.83)	(1.46)	(0.92)	(1.12)	(1.39)				
Degree of saturation , %		(100)	(100)	(100)	(99)	(100)				
Atterberg limits	Liquid limit , %	70	99	75	62	73				
	Plastic limit , %	26	40	27	24	28				
	Plasticity index	44	59	48	38	45				
Grain size analysis	Gravel , %	0	1	0	0	0				
	Sand , %	3	11	7	30	1				
	Silt , %	41	24	23	24	20				
	Clay & colloid , %	56	64	70	46	79				
	Max. diameter, mm	4.76	4.76	4.76	4.76	2.00				
	Diam. at 60%	0.0063	0.0040	0.0022	0.023	0.0014				
	Diam. at 10%	-	-	-	-	-				
Visual soil description		Clay	Organic Clay	Silty Clay	Sandy Clay	Clay				
Unified soil classification		CH	CH	CH	CH	CH				
Unconfined compression test	Undisturbed sample, kg/cm²									
	Remoulded sample, kg/cm²									
	Sensitivity ratio									
	Strain at failure,%									
Triaxial compression test	Angle of internal friction									
	Cohesion, kg/cm²									
	Condition of drainage									
Consolidation test	Preconsolidation pressure, kg/cm²									
	Compression index									
Shear test	Angle internal friction									
	Cohesion, kg/cm²									
	Condition of Drainage									
Remarks:										

No. SUMMARY OF SOIL TEST

Project _____ Bore Hole F-1

Location of project _____

Sample no.		P-1	P-2	P-3	P-4	P-5	P-6	P-7	P-8	P-9
Sample depth		2.00 m ~ 2.45 m	4.00 m ~ 4.45 m	6.00 m ~ 6.45 m	8.00 m ~ 8.45 m	10.00 m ~ 10.45 m	12.00 m ~ 12.45 m	14.00 m ~ 14.45 m	16.00 m ~ 16.45 m	18.00 m ~ 18.45 m
Condition of sample		Disturbed ~~Undisturbed~~	Disturbed ~~Undisturbed~~	Disturbed ~~Undisturbed~~	Disturbed ~~Undisturbed~~	Disturbed ~~Undisturbed~~	Disturbed ~~Undisturbed~~	Disturbed ~~Undisturbed~~	Disturbed ~~Undisturbed~~	Disturbed ~~Undisturbed~~
Natural water content, %		50.4	65.2	63.2	59.0	23.9	30.1	42.9	63.2	61.9
Specific gravity		2.678	2.694	2.699	2.664	2.632	2.704	2.664	2.712	2.708
Wet density, g/cm³		(1.71)	(1.63)	(1.65)	(1.70)	(1.85)	(1.89)	(1.75)	(1.65)	(1.64)
Dry density, g/cm³		(1.14)	(0.99)	(1.01)	(1.07)	(1.49)	(1.45)	(1.22)	(1.01)	(1.01)
Natural void ratio		(1.35)	(1.73)	(1.67)	(1.49)	(0.76)	(0.86)	(1.18)	(1.68)	(1.67)
Degree of saturation , %		(100)	(100)	(100)	(100)	(82)	(95)	(97)	(100)	(100)
Atterberg limits	Liquid limit , %	69	86	80	-	-	53	67	88	83
	Plastic limit , %	24	28	29	-	-	24	23	30	26
	Plasticity index	45	58	51	-	-	29	44	58	57
Grain size analysis	Gravel , %	5	0	1	3	11	0	0	0	0
	Sand , %	20	1	4	39	68	9	5	3	4
	Silt , %	22	15	17	9	4	21	27	13	9
	Clay & colloid , %	53	84	78	49	17	70	68	84	87
	Max. diameter, mm	9.52	2.00	9.52	4.76	4.76	4.76	4.76	4.76	4.76
	Diam. at 60%	0.013	-	-	0.18	0.80	0.0019	-	-	-
	Diam. at 10%	-	-	-	-	-	-	-	-	-
Visual soil description		Clay	Clay	Clay	Clayey Sand	Clayey Sand	Silty Clay	Silty Clay	Clay	Clay
Unified soil classification		CH	CH	CH	(CL)	(SC)	CH	CH	CH	CH
Unconfined compression test	Undisturbed sample, kg/cm²									
	Remoulded sample, kg/cm²									
	Sensitivity ratio									
	Strain at failure,%									
Triaxial compression test	Angle of internal friction									
	Cohesion, kg/cm²									
	Condition of drainage									
Consolidation test	Preconsolidation pressure, kg/cm²									
	Compression index									
Shear test	Angle internal friction									
	Cohesion, kg/cm²									
	Condition of Drainage									

Remarks:

No.

SUMMARY OF SOIL TEST

Project _____ Bore Hole F-1

Location of project _____

Sample no.		P-10	P-11	P-12	P-13	P-14	P-15			
Sample depth		20.00 m ~ 20.45 m	22.00 m ~ 22.45 m	24.00 m ~ 24.45 m	26.00 m ~ 26.45 m	28.00 m ~ 28.45 m	30.00 m ~ 30.35 m	m ~ m	m ~ m	m ~ m
Condition of sample		Disturbed ~~Undisturbed~~	Disturbed ~~Undisturbed~~	Disturbed ~~Undisturbed~~	Disturbed ~~Undisturbed~~	Disturbed ~~Undisturbed~~	Disturbed ~~Undisturbed~~	Disturbed Undisturbed	Disturbed Undisturbed	Disturbed Undisturbed
Natural water content, %		61.3	25.8	25.3	26.2	25.6	18.2			
Specific gravity		2.717	2.590	2.623	2.621	2.634	2.689			
Wet density, g/cm³		(1.60)	(2.02)	(2.01)	(1.89)	(1.92)	(2.06)			
Dry density, g/cm³		(0.99)	(1.61)	(1.60)	(1.50)	(1.53)	(1.74)			
Natural void ratio		(1.74)	(0.61)	(0.64)	(0.75)	(0.72)	(0.55)			
Degree of saturation , %		(96)	(100)	(100)	(92)	(93)	(89)			
Atterberg limits	Liquid limit , %	83	-	-	-	-	45			
	Plastic limit , %	24	-	-	-	-	20			
	Plasticity index	57	-	-	-	-	25			
Grain size analysis	Gravel , %	0	2	4	8	4	0			
	Sand , %	2	79	86	70	77	2			
	Silt , %	16	7	2	11	10	69			
	Clay & colloid , %	82	12	8	11	9	29			
	Max. diameter, mm	2.00	4.76	9.52	9.52	9.52	2.00			
	Diam. at 60%	0.0010	0.50	0.43	0.29	0.22	0.027			
	Diam. at 10%	-	-	0.060	0.017	0.0033	-			
Visual soil description		Clay	Clayey Sand	Clayey Sand	Clayey Sand	Clayey Sand	Silty Clay			
Unified soil classification		CH	(SC)	SW	(SM)	(SM)	CL			
Unconfined compression test	Undisturbed sample, kg/cm²									
	Remoulded sample, kg/cm²									
	Sensitivity ratio									
	Strain at failure, %									
Triaxial compression test	Angle of internal friction									
	Cohesion, kg/cm²									
	Condition of drainage									
Consolidation test	Preconsolidation pressure, kg/cm²									
	Compression index									
Shear test	Angle internal friction									
	Cohesion, kg/cm²									
	Condition of Drainage									
Remarks:										

No.

SUMMARY OF SOIL TEST

Project _____ Bore Hole F-2

Location of project _____

Sample no.		P-1	P-2	P-3	P-4	P-5	P-6	P-7	P-8	P-9
Sample depth		2.00 m ~ 2.29 m	4.00 m ~ 4.45 m	6.00 m ~ 6.27 m	8.00 m ~ 8.30 m	10.00 m ~ 10.29 m	12.00 m ~ 12.27 m	14.00 m ~ 14.25 m	16.00 m ~ 16.23 m	18.00 m ~ 18.25 m
Condition of sample		Disturbed	Disturbed	Disturbed	Disturbed	Disturbed	Disturbed	Disturbed	Disturbed	Disturbed
Natural water content, %		19.3	13.2	19.8	13.6	14.0	16.3	16.2	16.2	14.2
Specific gravity		2.634	2.634	2.626	2.635	2.644	2.690	2.677	2.649	2.662
Wet density, g/cm³		(2.05)	(2.11)	(2.10)	(2.11)	(2.11)	(2.12)	(2.12)	(2.11)	(2.11)
Dry density, g/cm³		(1.72)	(1.86)	(1.75)	(1.86)	(1.85)	(1.82)	(1.82)	(1.82)	(1.85)
Natural void ratio		(0.53)	(0.41)	(0.50)	(0.42)	(0.43)	(0.48)	(0.47)	(0.46)	(0.44)
Degree of saturation , %		(95)	(84)	(100)	(86)	(86)	(92)	(93)	(94)	(86)
Atterberg limits	Liquid limit , %	-	-	-	-	-	-	-	-	45
	Plastic limit , %	-	-	-	-	-	-	-	-	16
	Plasticity index	-	-	-	-	-	-	-	-	29
Grain size analysis	Gravel , %	4	35	2	16	9	7	1	2	0
	Sand , %	68	44	74	62	69	40	32	39	22
	Silt , %	14	5	10	4	3	27	30	32	35
	Clay & colloid , %	14	16	14	18	19	26	37	27	43
	Max. diameter , mm	4.76	9.52	4.76	4.76	4.76	9.52	4.76	9.52	4.76
	Diam. at 60%	0.32	1.80	0.41	1.30	1.30	0.13	0.041	0.090	0.025
	Diam. at 10%	0.0010	-	-	-	-	0.0010	-	-	-
Visual soil description		Silty Sand	Clayey Sand with gravel	Clayey Sand with gravel	Clayey Sand with gravel	Clayey Sand with gravel	Clayey Sand with gravel	Silty Sand	Silty Sand	Clayey Silt
Unified soil classification		(SC)	(SC)	(SC)	(SC)	(SC)	(CL)	(CL)	(CL)	CL
Unconfined compression test	Undisturbed sample, kg/cm²									
	Remoulded sample, kg/cm²									
	Sensitivity ratio									
	Strain at failure,%									
Triaxial compression test	Angle of internal friction									
	Cohesion, kg/cm²									
	Condition of drainage									
Consolidation test	Preconsolidation pressure, kg/cm²									
	Compression index									
Shear test	Angle internal friction									
	Cohesion, kg/cm²									
	Condition of Drainage									
Remarks:										

No.

SUMMARY OF SOIL TEST

F-2

Project _____ Bore Hole _____

Location of project _____

Sample no.		P-10	P-11	P-12	P-13					
Sample depth		20.00m ~ 20.22m	22.00m ~ 22.29m	24.00m ~ 24.29m	25.00m ~ 25.27m	m ~ m	m ~ m	m ~ m	m ~ m	m ~ m
Condition of sample		Disturbed ~~Undisturbed~~	Disturbed ~~Undisturbed~~	Disturbed ~~Undisturbed~~	Disturbed ~~Undisturbed~~	Disturbed Undisturbed	Disturbed Undisturbed	Disturbed Undisturbed	Disturbed Undisturbed	Disturbed Undisturbed
Natural water content, %		16.2	18.7	18.1	18.8					
Specific gravity		2.683	2.652	2.639	2.639					
Wet density, g/cm³		(2.13)	(2.15)	(2.10)	(2.09)					
Dry density, g/cm³		(1.83)	(1.81)	(1.78)	(1.76)					
Natural void ratio		(0.46)	(0.46)	(0.48)	(0.50)					
Degree of saturation , %		(94)	(100)	(99)	(99)					
Atterberg limits	Liquid limit , %	48	47	-	-					
	Plastic limit , %	15	17	-	-					
	Plasticity index	33	30	-	-					
Grain size analysis	Gravel , %	0	1	1	2					
	Sand , %	22	65	67	71					
	Silt , %	37	16	14	12					
	Clay & colloid , %	41	18	18	15					
	Max. diameter, mm	4.76	4.76	4.76	4.76					
	Diam. at 60%	0.016	0.21	0.17	0.34					
	Diam. at 10%	-	-	-	-					
Visual soil description		Clayey Silt	Clayey Silt	Silty Sand	Silty Sand					
Unified soil classification		CL	SC	(SC)	(SC)					
Unconfined compression test	Undisturbed sample, kg/cm²									
	Remoulded sample, kg/cm²									
	Sensitivity ratio									
	Strain at failure,%									
Triaxial compression test	Angle of internal friction									
	Cohesion, kg/cm²									
	Condition of drainage									
Consolidation test	Preconsolidation pressure, kg/cm²									
	Compression index									
Shear test	Angle internal friction									
	Cohesion, kg/cm²									
	Condition of Drainage									

Remarks:

No.

SUMMARY OF SOIL TEST

Project _____ Bore Hole F-3

Location of project _____

Sample no.		P-1	P-2	P-3	P-4	P-5	P-6			
Sample depth		2.00 m ~ 2.45 m	4.00 m ~ 4.30 m	6.00 m ~ 6.27 m	8.00 m ~ 8.35 m	10.00 m ~ 10.31 m	11.00 m ~ 11.45 m	m ~ m	m ~ m	m ~ m
Condition of sample		Disturbed ~~Undisturbed~~	Disturbed ~~Undisturbed~~	Disturbed ~~Undisturbed~~	Disturbed ~~Undisturbed~~	Disturbed ~~Undisturbed~~	Disturbed ~~Undisturbed~~	Disturbed Undisturbed	Disturbed Undisturbed	Disturbed Undisturbed
Natural water content, %		16.4	15.1	11.3	13.6	22.0	21.3			
Specific gravity		2.640	2.624	2.624	2.642	2.702	2.661			
Wet density, g/cm³		(2.03)	(2.13)	(2.20)	(2.15)	(1.97)	(2.06)			
Dry density, g/cm³		(1.74)	(1.85)	(1.98)	(1.89)	(1.61)	(1.70)			
Natural void ratio		(0.51)	(0.42)	(0.33)	(0.40)	(0.67)	(0.57)			
Degree of saturation , %		(84)	(95)	(91)	(91)	(88)	(100)			
Atterberg limits	Liquid limit , %	-	-	-	-	58	57			
	Plastic limit , %	-	-	-	-	22	20			
	Plasticity index	-	-	-	-	36	37			
Grain size analysis	Gravel , %	1	8	15	1	0	0			
	Sand , %	68	69	60	46	8	14			
	Silt , %	13	4	6	22	51	48			
	Clay & colloid , %	18	19	19	31	41	38			
	Max. diameter, mm	4.76	4.76	4.76	4.76	4.76	4.76			
	Diam. at 60%	0.25	0.75	1.18	0.15	0.015	0.024			
	Diam. at 10%	-	-	-	-	-	-			
Visual soil description		Clayey Sand	Clayey Sand with gravel	Clayey Sand with gravel	Clayey Sand with gravel	Silty Clay	Silty Clay			
Unified soil classification		(SC)	(SC)	(SC)	(CL)	CH	CH			
Unconfined compression test	Undisturbed sample, kg/cm²									
	Remoulded sample, kg/cm²									
	Sensitivity ratio									
	Strain at failure,%									
Triaxial compression test	Angle of internal friction									
	Cohesion, kg/cm²									
	Condition of drainage									
Consolidation test	Preconsolidation pressure, kg/cm²									
	Compression index									
Shear test	Angle internal friction									
	Cohesion, kg/cm²									
	Condition of Drainage									

Remarks:

No.

SUMMARY OF SOIL TEST

Project _____ Bore Hole F-4

Location of project _____

Sample no.		P-1	P-2	P-3	P-4	P-5	P-6	P-7	P-8	P-9
Sample depth		0.00 m 0.45 m	2.00 m 2.23 m	4.00 m 4.26 m	6.00 m 6.45 m	8.00 m 8.32 m	10.00 m 10.37 m	12.00 m 12.29 m	14.00 m 14.29 m	15.00 m 15.25 m
Condition of sample		Disturbed XXXXX	Disturbed XXXXX	Disturbed XXXXX	Disturbed XXXXX	Disturbed XXXXX	Disturbed XXXXX	Disturbed XXXXX	Disturbed XXXXX	Disturbed XXXXX
Natural water content, %		17.0	17.2	12.9	22.2	18.4	16.4	15.6	15.6	12.4
Specific gravity		2.648	2.634	2.626	2.631	2.629	2.629	2.623	2.632	2.636
Wet density, g/cm³		(2.15)	(1.99)	(2.14)	(2.03)	(2.07)	(2.07)	(2.12)	(2.12)	(2.13)
Dry density, g/cm³		(1.84)	(1.70)	(1.90)	(1.66)	(1.75)	(1.78)	(1.83)	(1.83)	(1.90)
Natural void ratio		(0.44)	(0.55)	(0.39)	(0.58)	(0.50)	(0.48)	(0.43)	(0.44)	(0.39)
Degree of saturation , %		(100)	(82)	(88)	(100)	(96)	(90)	(95)	(94)	(84)
Atterberg limits	Liquid limit , %	-	-	-	-	-	-	-	-	-
	Plastic limit , %	-	-	-	-	-	-	-	-	-
	Plasticity index	-	-	-	-	-	-	-	-	-
Grain size analysis	Gravel , %	31	0	10	0	1	0	1	7	32
	Sand , %	56	78	69	72	76	77	77	75	50
	Silt , %	3	8	5	10	5	7	5	1	3
	Clay & colloid , %	10	14	16	18	18	16	17	17	15
	Max. diameter, mm	9.52	4.76	9.52	4.76	4.76	4.76	4.76	4.76	9.52
	Diam. at 60%	1.50	0.38	0.50	0.18	0.42	0.38	0.39	0.88	1.50
	Diam. at 10%	0.0040	-	-	-	-	-	-	-	0.0010
Visual soil description		Clayey Sand with gravel	Silty Sand	Clayey Sand with gravel	Clayey Sand	Clayey Sand with gravel	Clayey Sand	Clayey Sand	Clayey Sand with gravel	Clayey Sand with gravel
Unified soil classification		(SC)	(SC)	(SC)	(SC)	(SC)	(SC)	(SC)	(SC)	(SC)
Unconfined compression test	Undisturbed sample, kg/cm²									
	Remoulded sample, kg/cm²									
	Sensitivity ratio									
	Strain at failure,%									
Triaxial compres-sion test	Angle of internal friction									
	Cohesion, kg/cm²									
	Condition of drainage									
Consoli-dation test	Preconsolidation pressure, kg/cm²									
	Compression index									
Shear test	Angle internal friction									
	Cohesion, kg/cm²									
	Condition of Drainage									

Remarks:

No.

SUMMARY OF SOIL TEST

Project _____ Bore Hole F-5

Location of project _____

Sample no.		P-1	P-2	P-3	P-4	P-5	P-6	P-7		
Sample depth		2.00 m ~ 2.45 m	4.00 m ~ 4.31 m	5.00 m ~ 5.39 m	6.00 m ~ 6.45 m	8.00 m ~ 8.32 m	10.00 m ~ 10.29 m	11.00 m ~ 11.25 m	m ~ m	m ~ m
Condition of sample		Disturbed XXXXX	Disturbed XXXXX	Disturbed XXXXX	Disturbed XXXXX	Disturbed XXXXX	Disturbed XXXXX	Disturbed XXXXX	Disturbed XXXXX	Disturbed XXXXX
Natural water content, %		14.4	10.8	12.1	18.9	14.7	14.2	12.2		
Specific gravity		2.616	2.620	2.628	2.626	2.626	2.624	2.630		
Wet density, g/cm³		(2.00)	(2.12)	(2.10)	(2.00)	(2.13)	(2.18)	(2.13)		
Dry density, g/cm³		(1.75)	(1.91)	(1.87)	(1.68)	(1.86)	(1.91)	(1.90)		
Natural void ratio		(0.50)	(0.37)	(0.40)	(0.56)	(0.41)	(0.37)	(0.39)		
Degree of saturation , %		(76)	(76)	(80)	(88)	(93)	(99)	(83)		
Atterberg limits	Liquid limit , %	-	-	-	-	-	-	-		
	Plastic limit , %	-	-	-	-	-	-	-		
	Plasticity index	-	-	-	-	-	-	-		
Grain size analysis	Gravel , %	9	27	18	1	14	2	19		
	Sand , %	68	57	56	67	65	77	61		
	Silt , %	6	3	11	14	4	5	3		
	Clay & colloid , %	17	13	15	18	17	16	17		
	Max. diameter, mm	9.52	9.52	9.52	4.76	9.52	4.76	9.52		
	Diam. at 60%	0.56	1.20	0.95	0.27	0.90	0.42	1.00		
	Diam. at 10%	-	-	0.0013	0.0010	-	-	-		
Visual soil description		Clayey Sand With Gravel	Clayey Sand With Gravel	Clayey Sand With Gravel	Clayey Sand	Clayey Sand With Gravel	Clayey Sand With Gravel	Clayey Sand With Gravel		
Unified soil classification		(SC)	(SC)	(SC)	(SC)	(SC)	(SC)	(SC)		
Unconfined compression test	Undisturbed sample, kg/cm²									
	Remoulded sample, kg/cm²									
	Sensitivity ratio									
	Strain at failure,%									
Triaxial compression test	Angle of internal friction									
	Cohesion, kg/cm²									
	Condition of drainage									
Consolidation test	Preconsolidation pressure, kg/cm²									
	Compression index									
Shear test	Angle internal friction									
	Cohesion, kg/cm²									
	Condition of Drainage									

Remarks:

No.

SUMMARY OF SOIL TEST

Project _____ Bore Hole F-6

Location of project _____

Sample no.		P-1	P-2	P-3	P-4	P-5	P-6			
Sample depth		2.00 m ~ 2.45 m	4.00 m ~ 4.45 m	6.00 m ~ 6.45 m	8.00 m ~ 8.45 m	10.00 m ~ 10.41 m	12.00 m ~ 12.34 m	m ~ m	m ~ m	m ~ m
Condition of sample		Disturbed Undisturbed	Disturbed Undisturbed	Disturbed Undisturbed	Disturbed Undisturbed	Disturbed Undisturbed	Disturbed Undisturbed	Disturbed Undisturbed	Disturbed Undisturbed	Disturbed Undisturbed
Natural water content, %		17.8	17.6	16.2	17.6	15.6	12.3			
Specific gravity		2.634	2.638	2.632	2.649	2.653	2.639			
Wet density, g/cm³		(2.12)	(2.06)	(2.12)	(2.14)	(2.08)	(2.07)			
Dry density, g/cm³		(1.80)	(1.75)	(1.82)	(1.82)	(1.80)	(1.84)			
Natural void ratio		(0.46)	(0.51)	(0.44)	(0.46)	(0.47)	(0.43)			
Degree of saturation , %		(100)	(92)	(96)	(100)	(87)	(75)			
Atterberg limits	Liquid limit , %	-	-	-	-	-	-			
	Plastic limit , %	-	-	-	-	-	-			
	Plasticity index	-	-	-	-	-	-			
Grain size analysis	Gravel , %	2	2	11	6	11	22			
	Sand , %	77	74	72	66	69	62			
	Silt , %	5	6	2	8	2	5			
	Clay & colloid , %	16	18	15	20	18	11			
	Max. diameter, mm	4.76	4.76	9.52	9.52	4.76	9.52			
	Diam. at 60%	0.41	0.37	0.53	0.34	0.70	1.15			
	Diam. at 10%	-	-	-	-	-	0.0028			
Visual soil description		Clayey Sand	Clayey Sand	Clayey Sand with gravel	Clayey Sand with gravel	Clayey Sand with gravel	Clayey Sand with gravel			
Unified soil classification		(SC)	(SC)	(SC)	(SC)	(SC)	(SC)			
Unconfined compression test	Undisturbed sample, kg/cm²									
	Remoulded sample, kg/cm²									
	Sensitivity ratio									
	Strain at failure, %									
Triaxial compression test	Angle of internal friction									
	Cohesion, kg/cm²									
	Condition of drainage									
Consolidation test	Preconsolidation pressure, kg/cm²									
	Compression index									
Shear test	Angle internal friction									
	Cohesion, kg/cm²									
	Condition of Drainage									

Remarks:

No.

SUMMARY OF SOIL TEST

Project _____ Bore Hole F-7

Location of project _____

Sample no.		P-1	P-2	P-3	P-4	P-5	P-6	P-7		
Sample depth		2.00m 2.45m	4.00m 4.45m	6.00m 6.39m	8.00m 8.45m	10.00m 10.34m	12.00m 12.28m	13.00m 13.24m	m m	m m
Condition of sample		Disturbed Undisturbed	Disturbed Undisturbed	Disturbed Undisturbed	Disturbed Undisturbed	Disturbed Undisturbed	Disturbed Undisturbed	Disturbed Undisturbed	Disturbed Undisturbed	Disturbed Undisturbed
Natural water content, %		20.1	13.1	21.5	16.5	16.4	14.8	14.6		
Specific gravity		2.623	2.625	2.664	2.627	2.632	2.646	2.636		
Wet density, g/cm³		(1.98)	(2.05)	(2.00)	(2.02)	(2.05)	(2.09)	(2.19)		
Dry density, g/cm³		(1.65)	(1.81)	(1.65)	(1.73)	(1.76)	(1.82)	(1.91)		
Natural void ratio		(0.59)	(0.45)	(0.68)	(0.52)	(0.49)	(0.45)	(0.38)		
Degree of saturation , %		(89)	(77)	(88)	(84)	(87)	(86)	(100)		
Atterberg limits	Liquid limit , %	-	-	-	-	-	-	-		
	Plastic limit , %	-	-	-	-	-	-	-		
	Plasticity index	-	-	-	-	-	-	-		
Grain size analysis	Gravel , %	2	23	2	4	28	1	0		
	Sand , %	73	55	57	74	58	30	39		
	Silt , %	9	6	12	6	4	24	28		
	Clay & colloid , %	16	16	29	16	10	45	33		
	Max. diameter, mm	4.76	9.52	4.76	4.76	9.52	4.76	4.76		
	Diam. at 60%	0.25	0.89	0.24	0.48	1.30	0.020	0.068		
	Diam. at 10%	0.0014	0.0010	-	-	0.0047	-	-		
Visual soil description		Clayey Sand with gravel	Clayey Sand with gravel	Clayey Sand with gravel	Clayey Sand with gravel	Clayey Sand with gravel	Silty Sand	Silty Sand		
Unified soil classification		(SC)	(SC)	(SC)	(SC)	(SC)	(CL)	(CL)		
Unconfined compression test	Undisturbed sample, kg/cm²									
	Remoulded sample, kg/cm²									
	Sensitivity ratio									
	Strain at failure,%									
Triaxial compression test	Angle of internal friction									
	Cohesion, kg/cm²									
	Condition of drainage									
Consolidation test	Preconsolidation pressure, kg/cm²									
	Compression index									
Shear test	Angle internal friction									
	Cohesion, kg/cm²									
	Condition of Drainage									

Remarks:

No. SUMMARY OF SOIL TEST

Project _____ Bore Hole F-8

Location of project _____

Sample no.		P-1	P-2	P-3	P-4	P-5	P-6	P-7	P-8	
Sample depth		2.00 m ~ 2.45 m	4.00 m ~ 4.45 m	6.00 m ~ 6.45 m	8.00 m ~ 8.45 m	10.00 m ~ 10.45 m	11.00 m ~ 11.45 m	24.00 m ~ 24.35 m	25.00 m ~ 26.12 m	m ~ m
Condition of sample		Disturbed ~~Undisturbed~~	Disturbed ~~Undisturbed~~	Disturbed ~~Undisturbed~~	Disturbed ~~Undisturbed~~	Disturbed ~~Undisturbed~~	Disturbed ~~Undisturbed~~	Disturbed ~~Undisturbed~~	Disturbed ~~Undisturbed~~	Disturbed Undisturbed
Natural water content, %		81.7	81.7	68.8	17.6	18.3	16.4	12.0	12.3	
Specific gravity		2.689	2.698	2.705	2.657	2.646	2.642	2.629	2.630	
Wet density, g/cm³		(1.56)	(1.59)	(1.60)	(2.10)	(2.02)	(2.07)	(2.11)	(2.11)	
Dry density, g/cm³		(0.86)	(0.88)	(0.95)	(1.79)	(1.71)	(1.78)	(1.88)	(1.88)	
Natural void ratio		(2.13)	(2.10)	(1.85)	(0.49)	(0.55)	(0.49)	(0.40)	(0.40)	
Degree of saturation , %		(100)	(100)	(100)	(96)	(88)	(89)	(80)	(81)	
Atterberg limits	Liquid limit , %	98	90	86	-	-	-	-	-	
	Plastic limit , %	29	27	27	-	-	-	-	-	
	Plasticity index	69	63	59	-	-	-	-	-	
Grain size analysis	Gravel , %	0	0	1	7	6	16	42	29	
	Sand , %	1	1	4	60	62	58	39	52	
	Silt , %	20	22	24	6	6	5	7	7	
	Clay & colloid , %	79	77	71	27	26	21	12	12	
	Max. diameter, mm	2.00	2.00	9.52	4.76	9.52	9.52	9.52	9.52	
	Diam. at 60%	0.0018	-	0.0020	0.71	0.63	0.92	2.10	1.50	
	Diam. at 10%	-	-	-	-	-	-	0.0037	0.0015	
Visual soil description		Clay	Clay	Clay	Clayey Sand With Gravel	Clayey Sand With Gravel	Clayey Sand With Gravel	Clayey Sand With Gravel	Clayey Sand With Gravel	
Unified soil classification		CH	CH	CH	(SC)	(SC)	(SC)	(GC)	(SC)	
Unconfined compression test	Undisturbed sample, kg/cm²									
	Remoulded sample, kg/cm²									
	Sensitivity ratio									
	Strain at failure,%									
Triaxial compression test	Angle of internal friction									
	Cohesion, kg/cm²									
	Condition of drainage									
Consolidation test	Preconsolidation pressure, kg/cm²									
	Compression index									
Shear test	Angle internal friction									
	Cohesion, kg/cm²									
	Condition of Drainage									
Remarks:										

No.

SUMMARY OF SOIL TEST

Project _____ Bore Hole F-9

Location of project _____

Sample no.		P-1	P-2	P-3	P-4	P-5	P-6	P-7		
Sample depth		2.00 m ~ 2.43 m	4.00 m ~ 4.35 m	6.00 m ~ 6.31 m	8.00 m ~ 8.41 m	10.00 m ~ 10.34 m	12.00 m ~ 12.33 m	14.00 m ~ 14.27 m	m ~ m	m ~ m
Condition of sample		Disturbed Undisturbed	Disturbed Undisturbed	Disturbed Undisturbed	Disturbed Undisturbed	Disturbed Undisturbed	Disturbed Undisturbed	Disturbed Undisturbed	Disturbed Undisturbed	Disturbed Undisturbed
Natural water content, %		19.0	21.6	19.8	21.6	13.6	13.7	14.4		
Specific gravity		2.631	2.644	2.630	2.647	2.610	2.629	2.626		
Wet density, g/cm³		(2.02)	(1.98)	(2.10)	(1.97)	(2.13)	(2.15)	(2.13)		
Dry density, g/cm³		(1.70)	(1.63)	(1.75)	(1.62)	(1.88)	(1.89)	(1.86)		
Natural void ratio		(0.55)	(0.62)	(0.50)	(0.63)	(0.39)	(0.39)	(0.41)		
Degree of saturation , %		(91)	(92)	(100)	(90)	(91)	(92)	(92)		
Atterberg limits	Liquid limit , %	51	53	48	49	-	-	-		
	Plastic limit , %	19	17	21	14	-	-	-		
	Plasticity index	32	36	27	35	-	-	-		
Grain size analysis	Gravel , %	5	0	0	0	2	6	4		
	Sand , %	36	20	33	37	65	72	75		
	Silt , %	24	38	40	36	8	6	5		
	Clay & colloid , %	35	42	27	27	25	16	16		
	Max. diameter, mm	4.76	4.76	2.00	4.76	4.76	9.52	4.76		
	Diam. at 60%	0.077	0.035	0.063	0.063	0.49	0.70	0.65		
	Diam. at 10%	-	-	-	-	-	0.0017	0.0017		
Visual soil description		Sandy Silt	Sandy Silt	Sandy Silt	Sandy Silt	Clayey Sand With Gravel	Clayey Sand With Gravel	Clayey Sand With Gravel		
Unified soil classification		CH	CH	CL	CL	(SC)	(SC)	(SC)		
Unconfined compression test	Undisturbed sample, kg/cm²									
	Remoulded sample, kg/cm²									
	Sensitivity ratio									
	Strain at failure,%									
Triaxial compression test	Angle of internal friction									
	Cohesion, kg/cm²									
	Condition of drainage									
Consolidation test	Preconsolidation pressure, kg/cm²									
	Compression index									
Shear test	Angle internal friction									
	Cohesion, kg/cm²									
	Condition of Drainage									

Remarks:

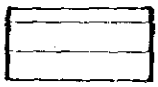
THE STUDY OF FILL MATERIALS

GEOLOGIC CROSS SECTIONS OF OUTER SHOAL

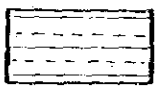
SCALE V : 1 / 400

H : 1 / 10,000

REGEND



UPPER MARINE CLAY

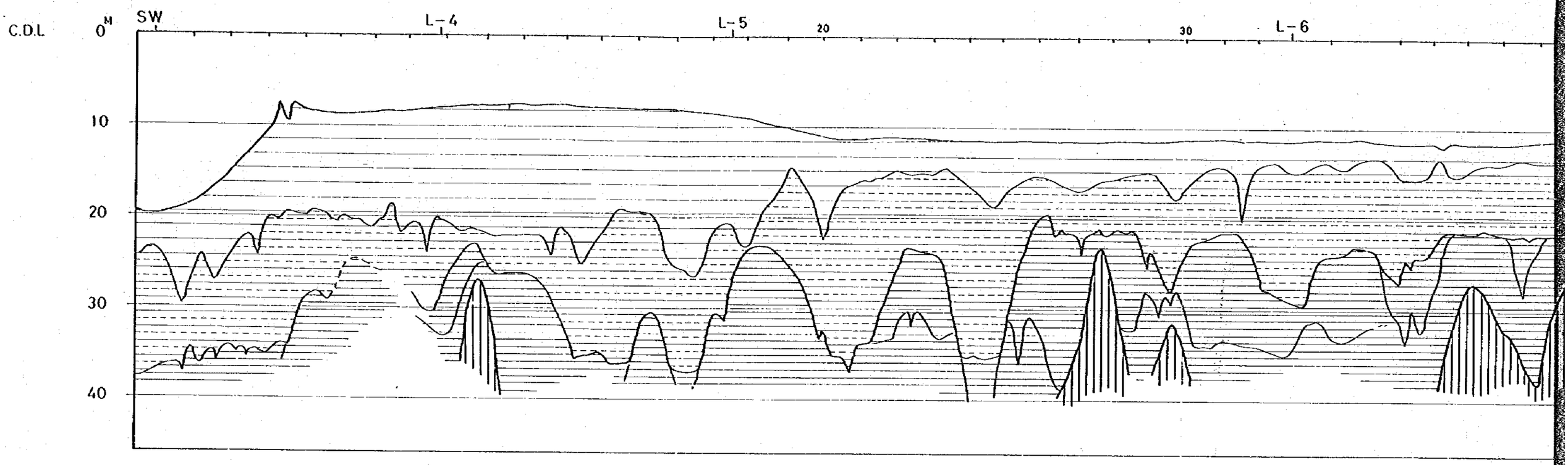


UPPER MARINE CLAY WITH ORGANIC OR SANOY MATERIALS.

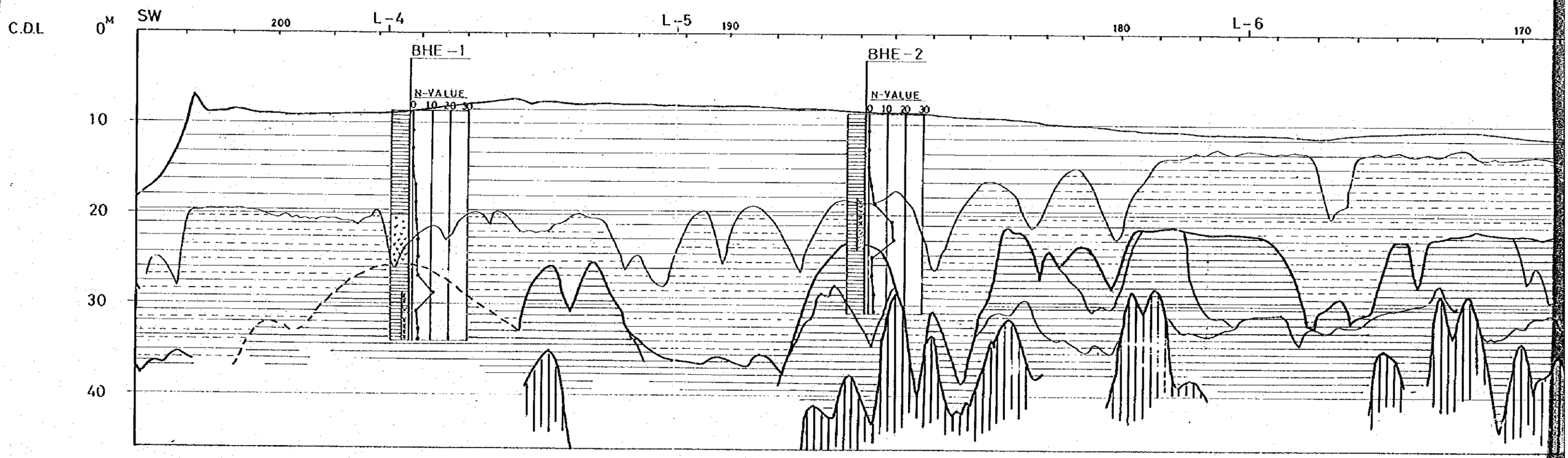
LOWER MARINE CLAY

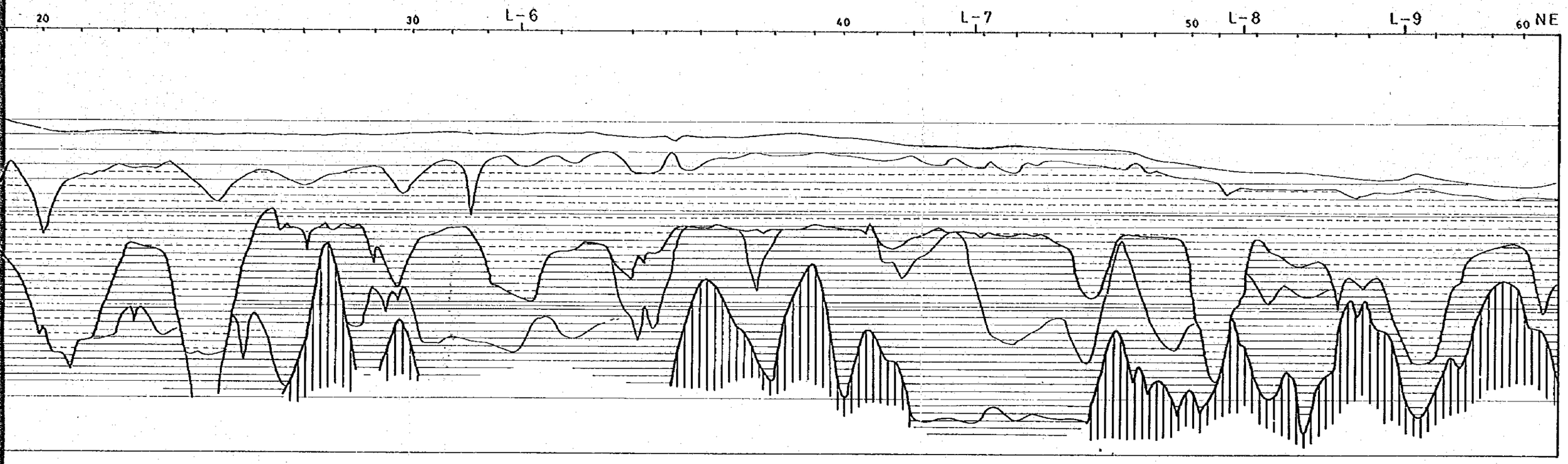
OLD ALLUVIUM.

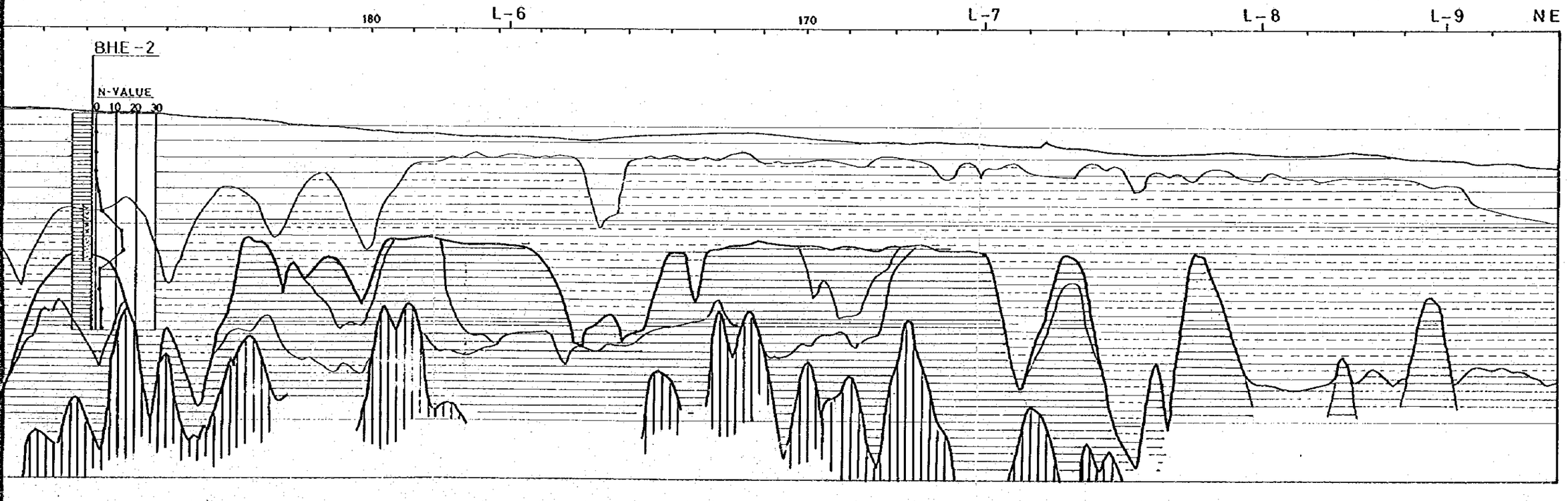
L-1


C.D.L
0 M
SW
L-4
L-5
20
30
L-6
10
20
30
40

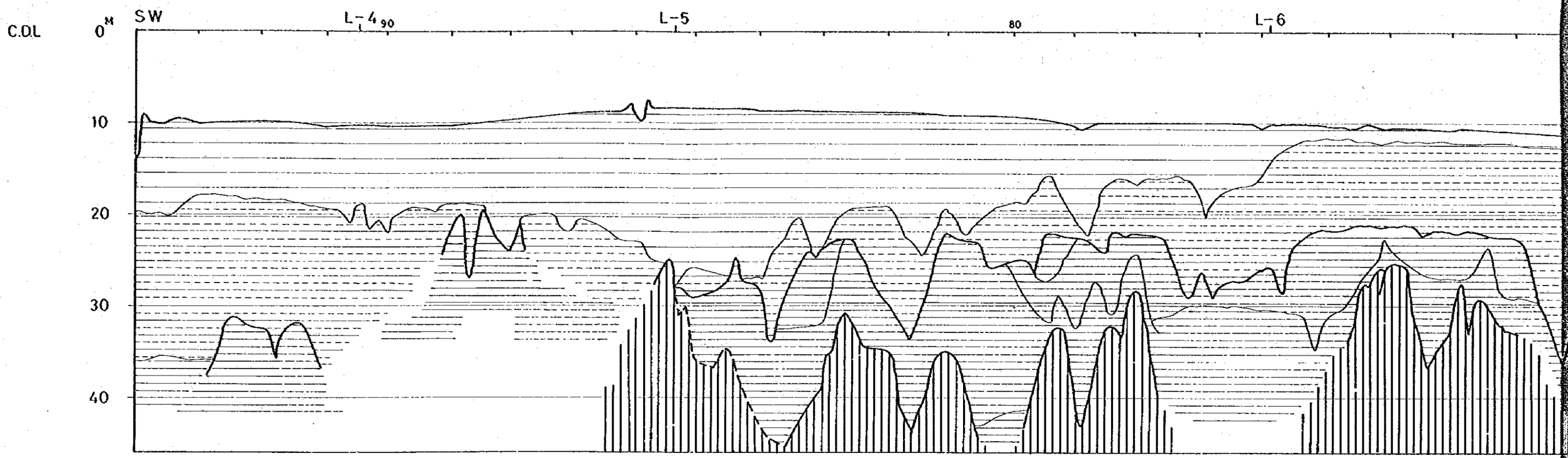
L-2


C.D.L
0 M
SW
200
L-4
L-5
190
180
L-6
170
BHE-1
BHE-2
N-VALUE
0 10 20 30
N-VALUE
0 10 20 30
10
20
30
40

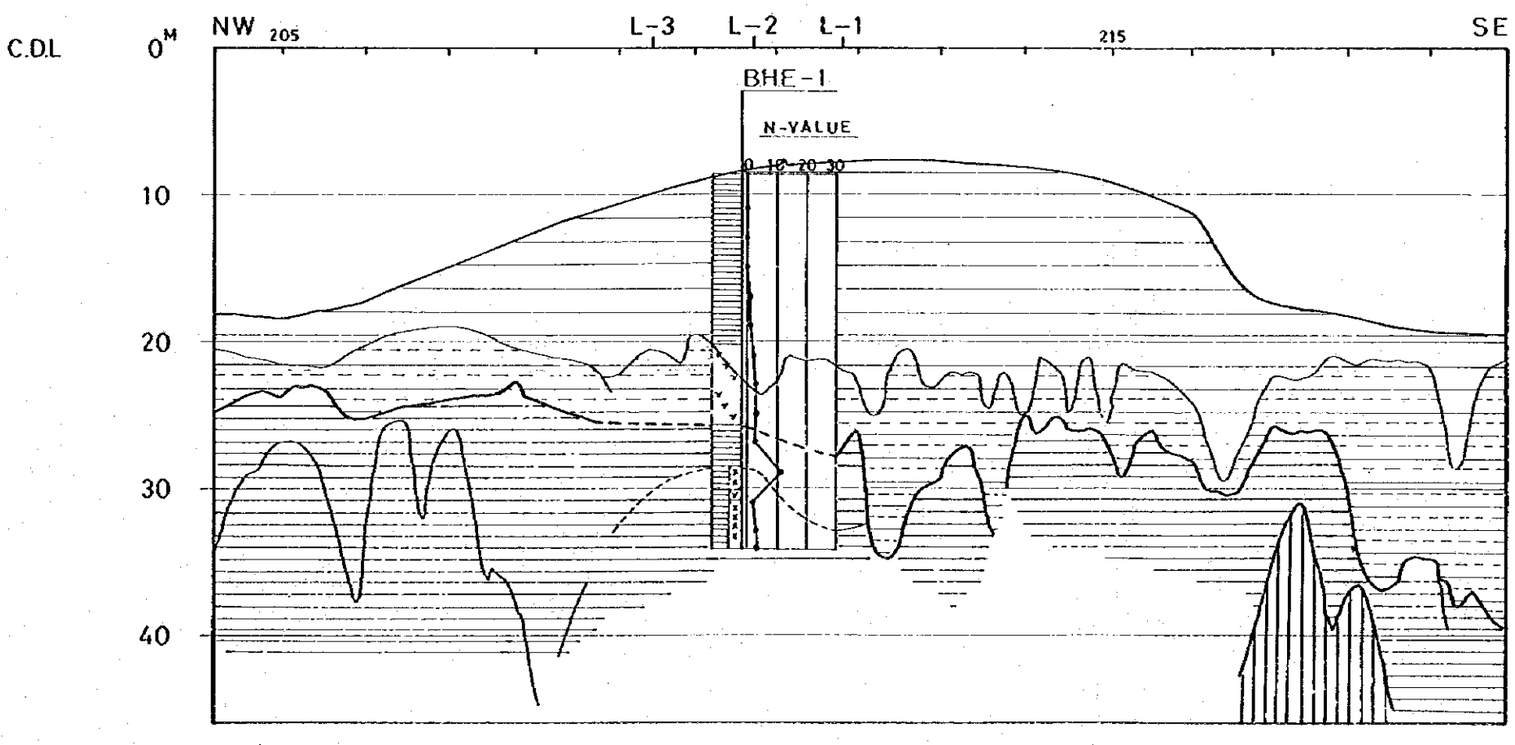

20
30
L-6
40
L-7
50
L-8
L-9
60 NE


180
L-6
170
L-7
L-8
L-9
NE
BHE-2
N-VALUE
0 10 20 30

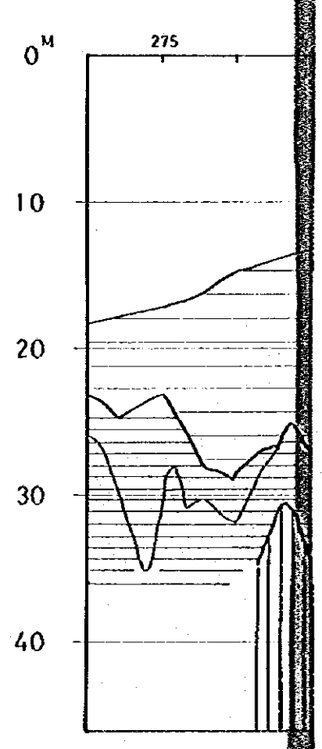
L-3

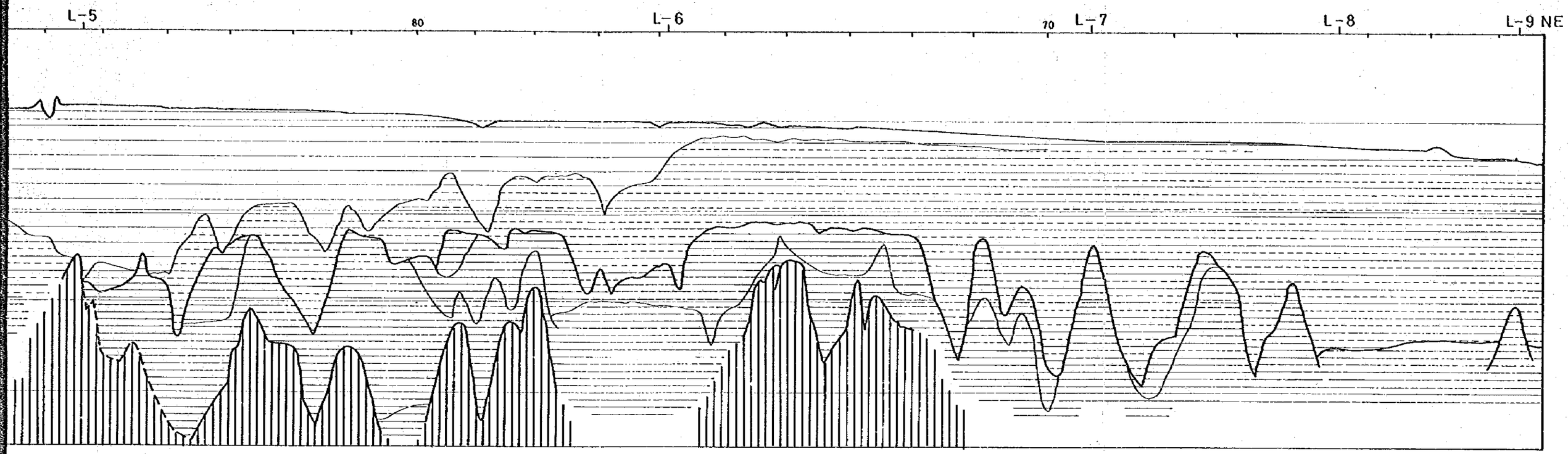

C.D.L
0M
SW
L-4 90
L-5
80
L-6
10
20
30
40

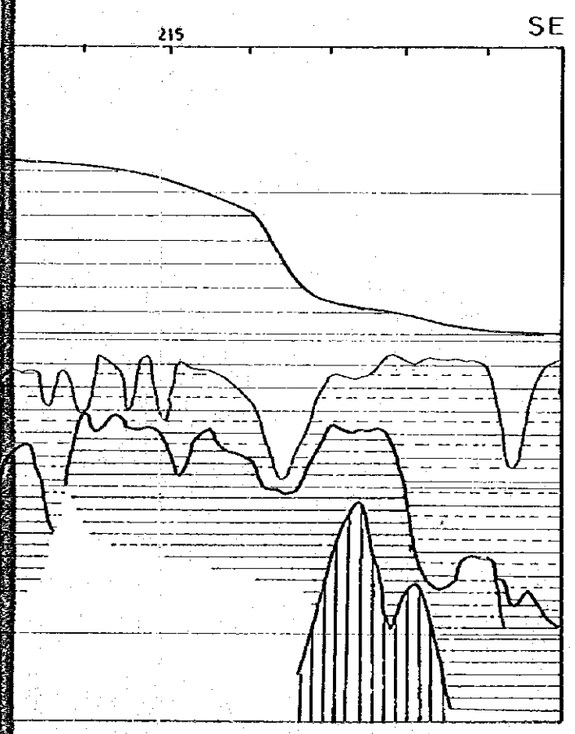
L-4


C.D.L
0M
NW 205
L-3
L-2
L-1
215
SE
BHE-1
N-VALUE
0 10 20 30
10
20
30
40

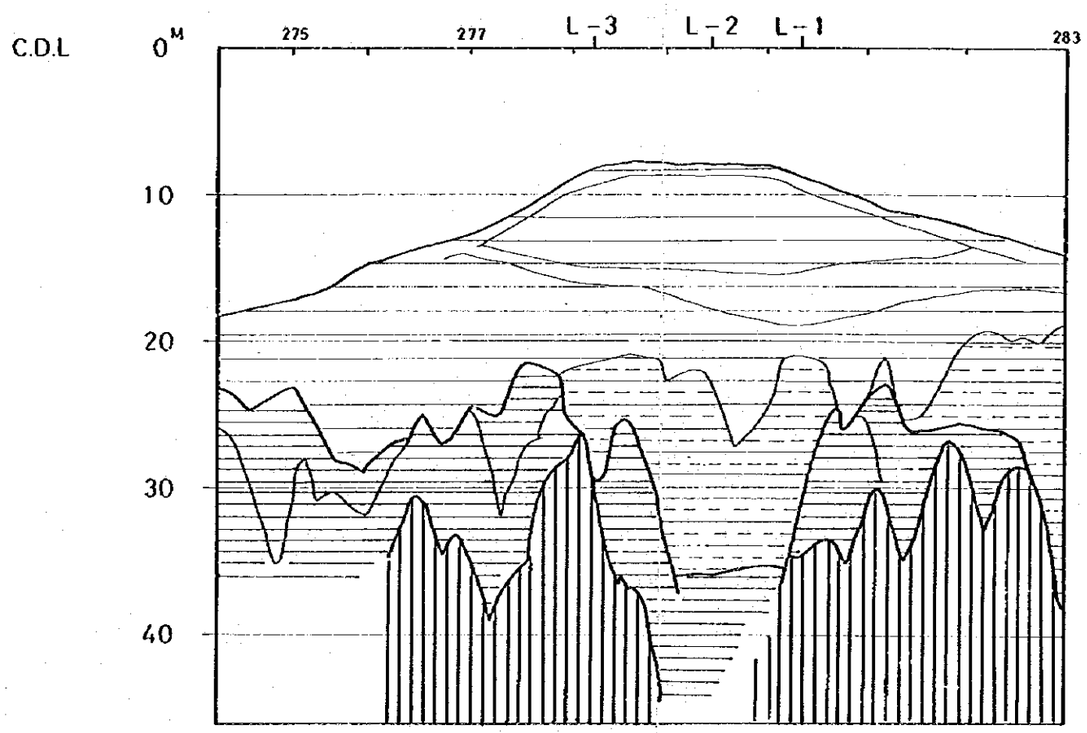
L-5


C.D.L
0M
275
10
20
30
40

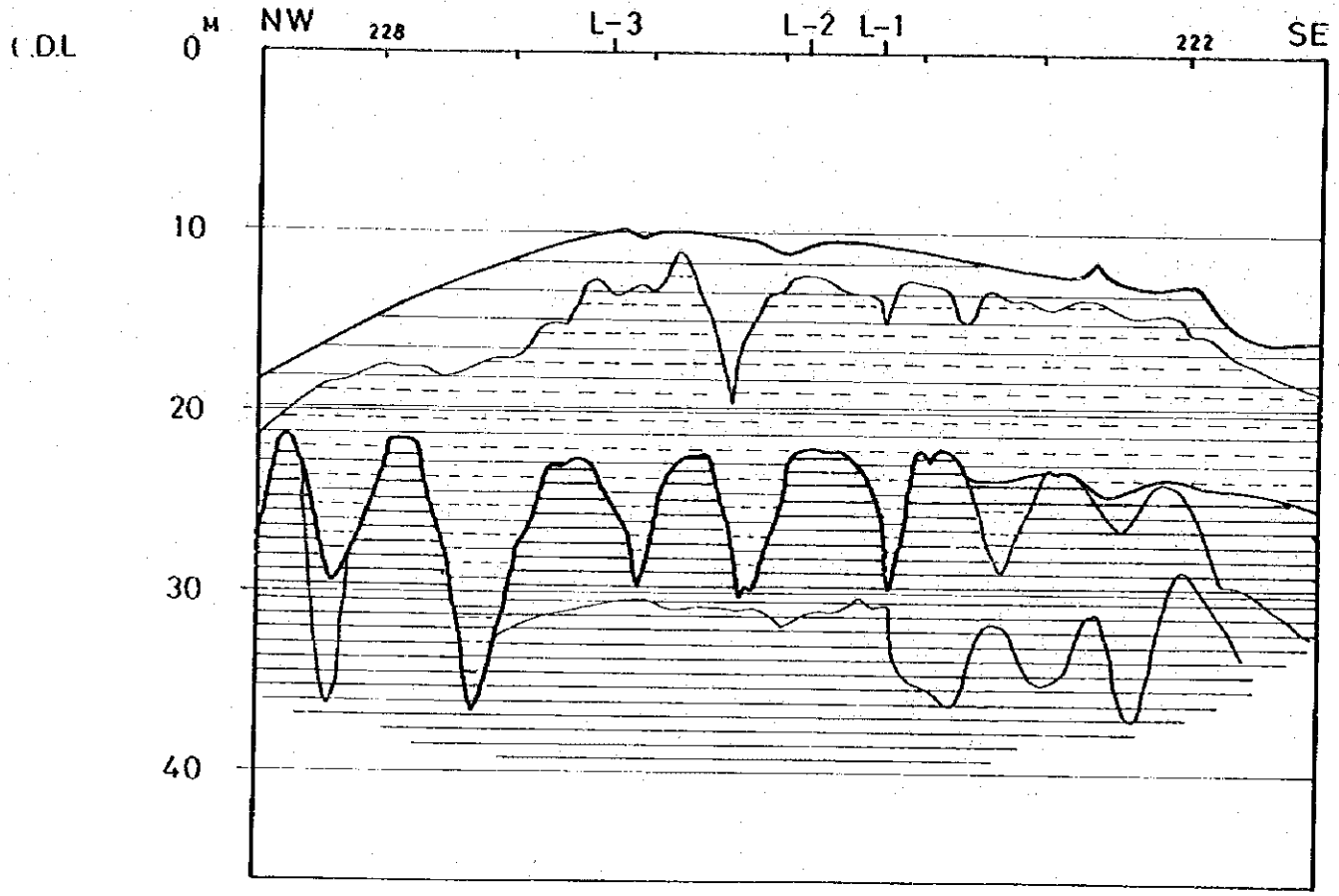




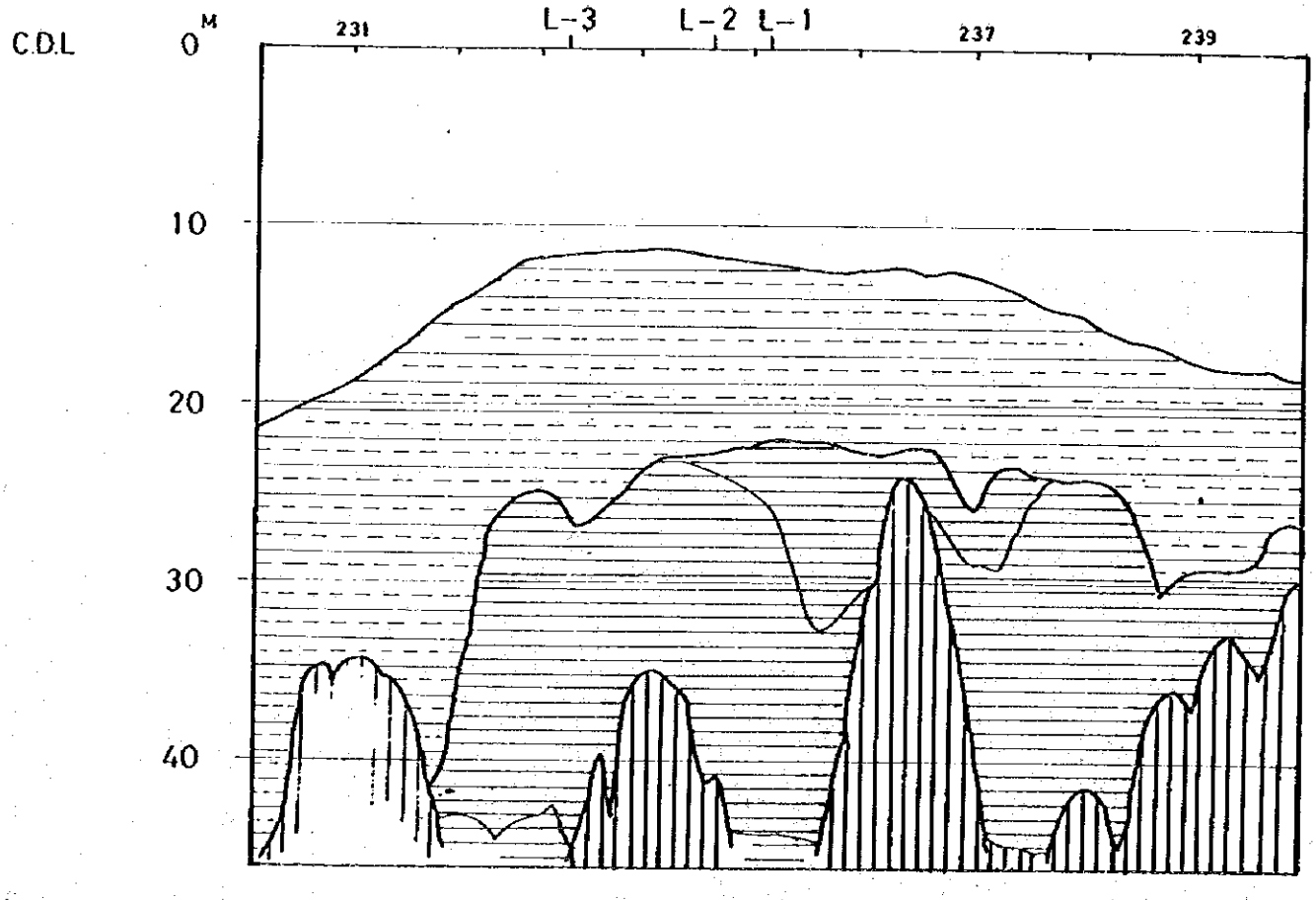
L-5



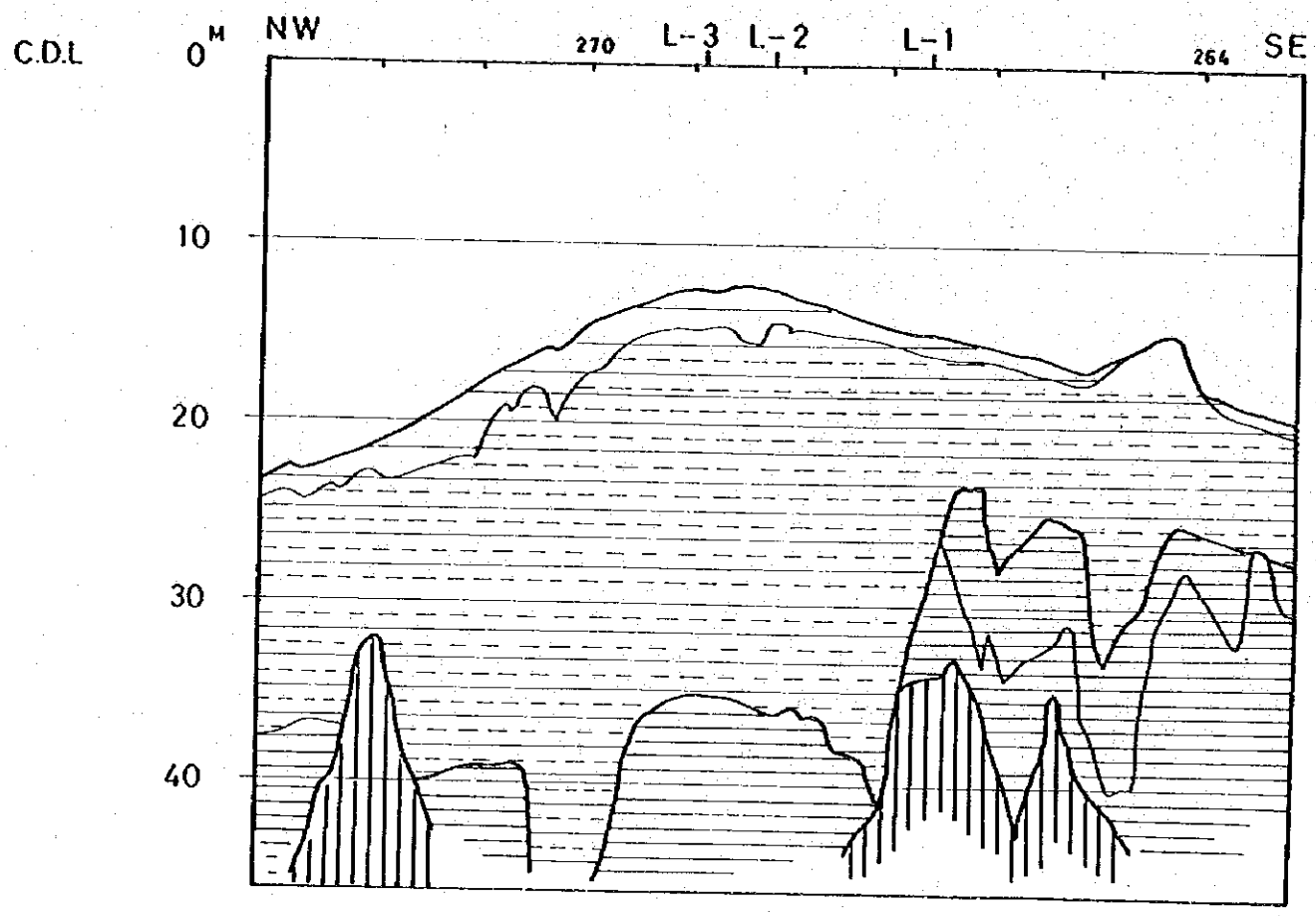
L-6


C.D.L
0 M
NW
228
L-3
L-2
L-1
222
SE
10
20
30
40

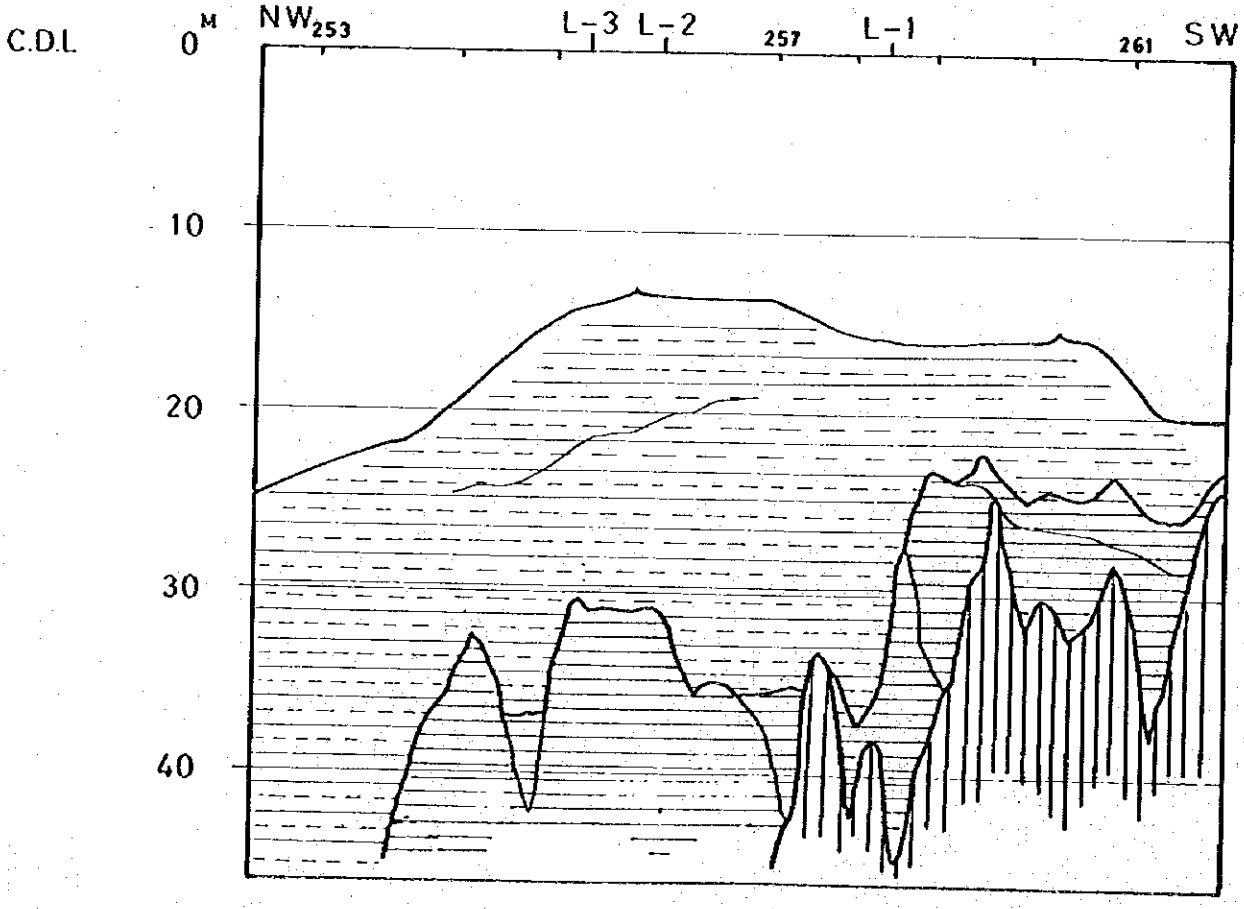
L-7


C.D.L
0 M
231
L-3
L-2
L-1
237
239
10
20
30
40

L-8


C.D.L
0 M
NW
270
L-3
L-2
L-1
264
SE
10
20
30
40

L-9


C.D.L
0 M
NW253
L-3
L-2
257
L-1
261
SW
10
20
30
40

OUTER SHOAL

L-1

L-2

L-3

L-4

L-5

L-6

L-7

E-1

E-2

OUTER STARN

5 Hrs STERN

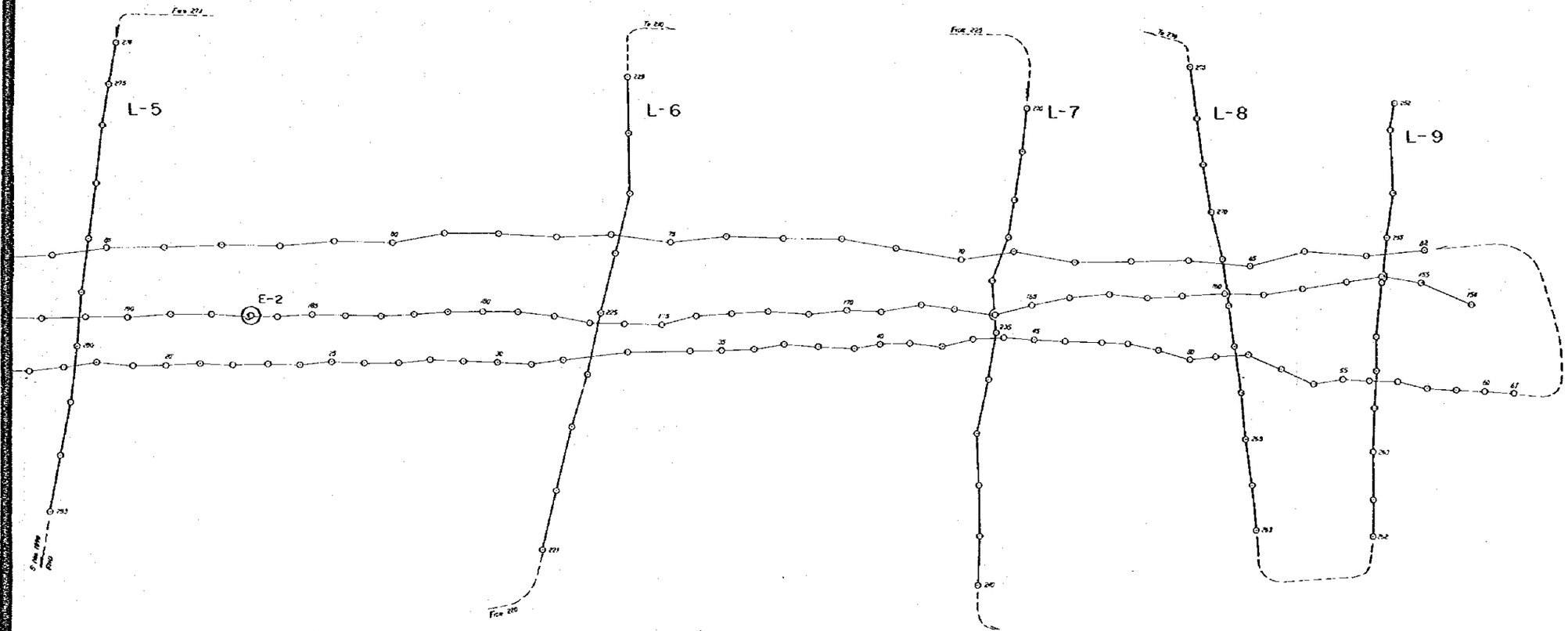
0 200 600 1000 m

Memoir

1. The chart is constructed electric distance meter (Audistor) lattices upon the following station.
   stove 1 (SAKIJANG) X=−7 280.404 Y= +3 366.592
   stove 2 (TUNAS) X=−1 494.644 Y= − 720.918
2. The chart is plotted on the Plane rectangular Grid in meters based upon the co-ordinates (0°00N , 0°00E) of origin of Government Office Building being in Lat 1°17'15"528N, Long. 103°51'10"808 E.

DRW－E-1

OUTER SHOAL



Survey points

Boring points E-1

0 200 600 1000 m

THE STUDY OF FILL MATERIALS

TRACK CHART

for Sonic Prospecting

JAN . 1979

OUTER SHOAL

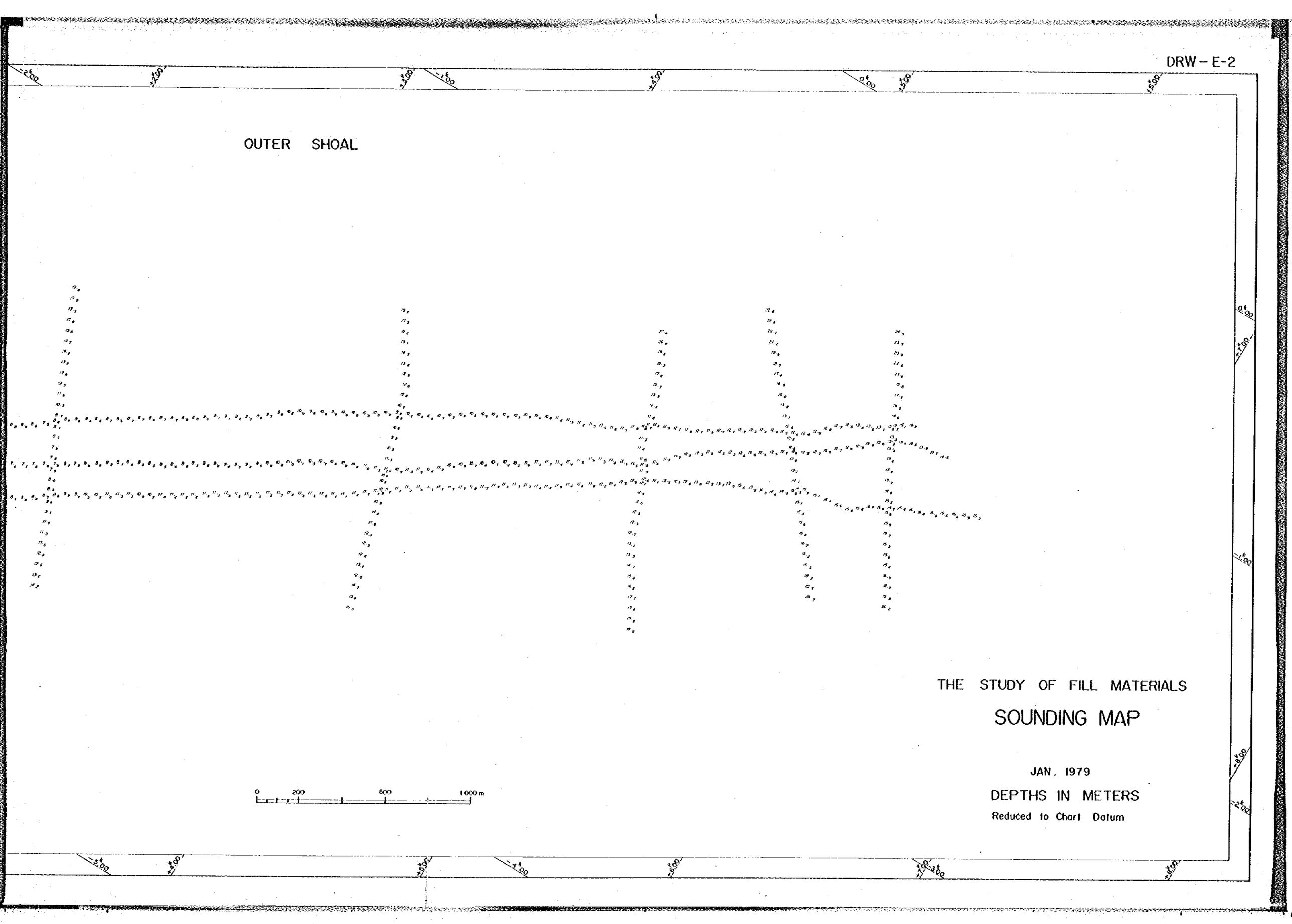
Memoir

1. The chart is constructed electric distance meter (Audistor) lattices upon the following station.
   slave 1 (SAKIJANG) X=-7 280.404 Y=+3 366.592
   slave 2 (TUNAS) X=-1 494.644 Y=- 720.918
2. The chart is plotted on the Plane rectangular Grid in meters based upon the co-ordinates (0^{K} 00N , 0^{K} 00E) of origin at Government Office Building being in Lat. 1°17'15"528N, Long. 103°51'10"808E .

0 200 600 1000 m

DRW - E-2

OUTER SHOAL



THE STUDY OF FILL MATERIALS

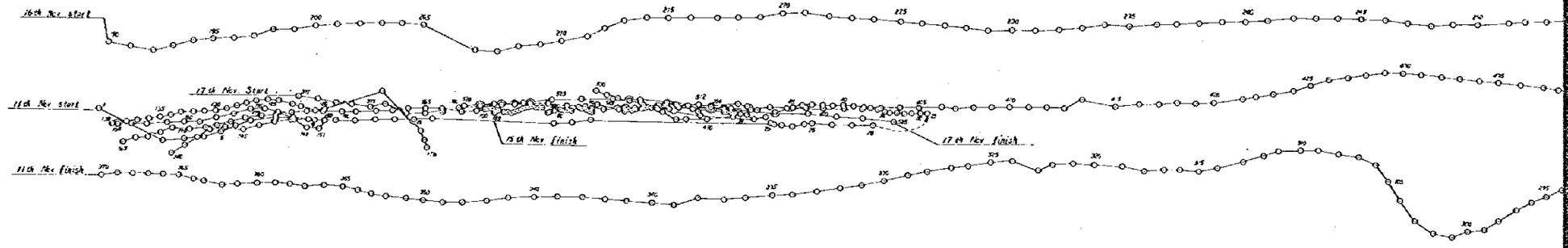
SOUNDING MAP

JAN. 1979

DEPTHS IN METERS

Reduced to Chart Datum

OUTER SHOAL



Memoir

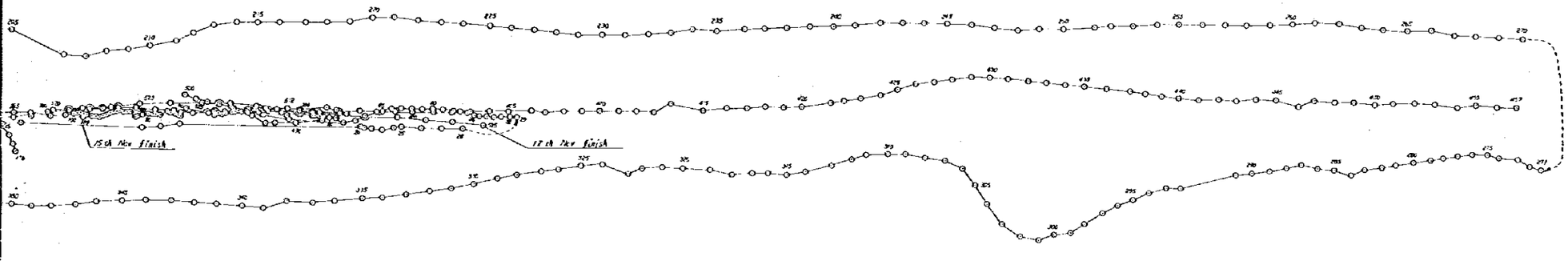
1. The chart is constructed electric distance meter (Audistor) lattices upon the following station.
   slave 1 (SAKIJANG) X = -7 280.404 Y = +3 366.592
   slave 2 (TUNAS) X = -1 494.644 Y = - 720.918
2. The chart is plotted on the Plane rectangular Grid in meters based upon the co-ordinates (0° 00N , 0° 00E) of origin at Government Office Building being in Lat. 1°17'15"528N, Long. 103°51'10"808 E .

0 200 600 1 000 m

Survey points

DRW--E-3

OUTER SHOAL



0 200 600 1 000m

Survey points

THE STUDY OF FILL MATERIALS

TRACK CHART

for Magnetic Detecting

JAN. 1979

XI

OUTER SHOAL

Memoir

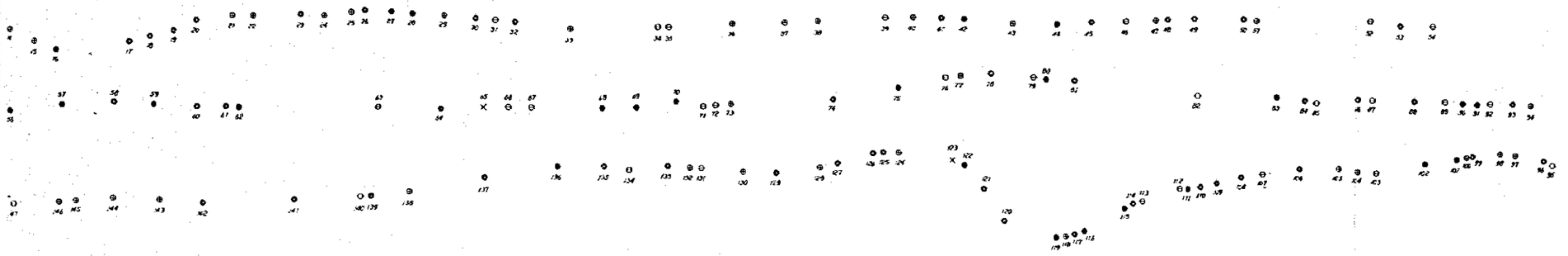
1. The chart is constructed electric distance meter (Audistor) tottices upon the following station:
   slave 1 (SAKIJANG) X=-7 280.404 Y=+3 366.592
   slave 2 (TUNAS) X=-1 494.644 Y=- 720.918
2. The chart is plotted on the Plane rectangular Grid in meters based upon the co-ordinates (0^k 00N , 0^k 00E) of origin at Government Office Building being in Lat. 1°17'15".528N, Long. 103°51'10".808E.

0 - 4 GCm² x
5 - 20 GCm² o
21 - 50 GCm² ⊕
51 - 100 GCm² ⊖
101 - 200 GCm² ●
Over 201 GCm² ●

0 200 600 1000 m

DRW - E-4

OUTER SHOAL



0 - 4 GCm² ×
5 - 20 GCm² ○
21 - 50 GCm² ●
51 - 100 GCm² ⊖
101 - 200 GCm² ◆
Over 201 GCm² ◇

0 200 600 1000 m

THE STUDY OF FILL MATERIALS

LOCATION MAP OF MAGNETIC ANOMALIES

for Magnetic Detecting

JAN. 1979

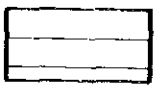
THE STUDY OF FILL MATERIALS

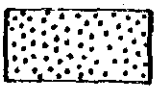
GEOLOGIC CROSS SECTIONS OF OFFSHORE CHANGI

SCALE V : 1 / 400
H : 1 / 10,000

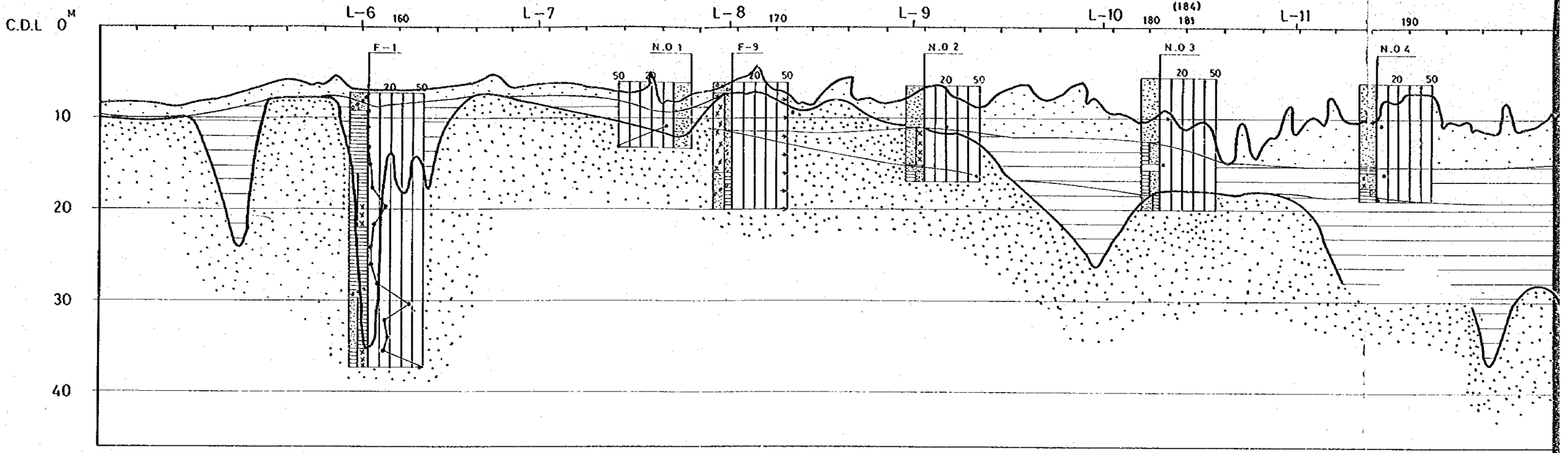
REGEND


LOOSE SAND

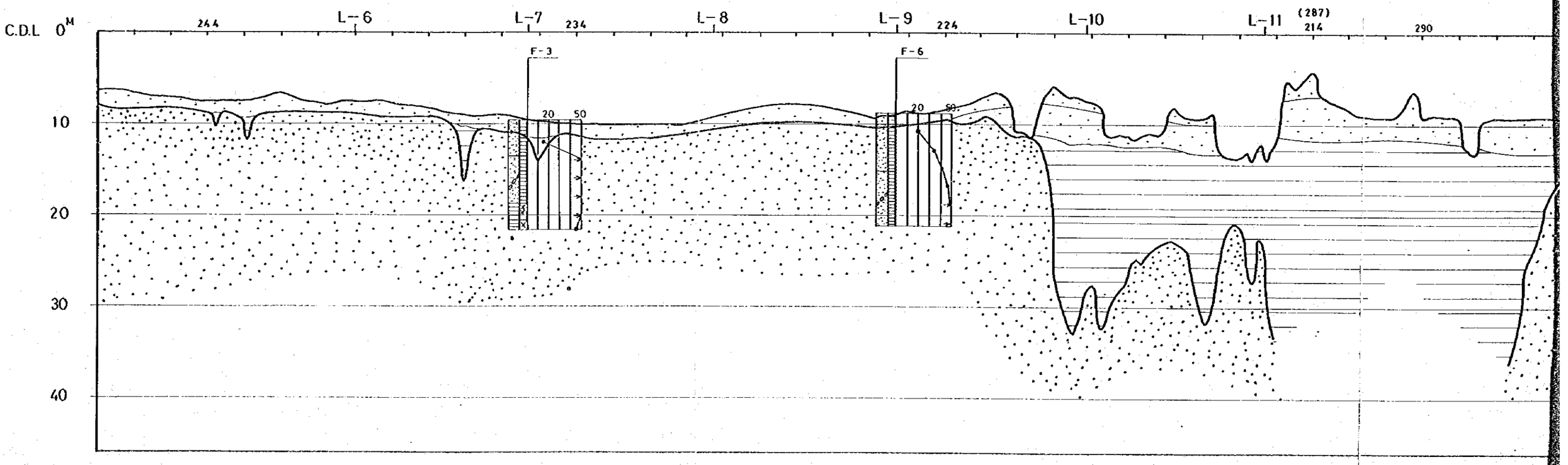

UPPER MARINE CLAY


OLD ALLUVIUM

L－1


C.D.L
0 M
10
20
30
40
L－6
160
L－7
L－8
170
L－9
L－10
180
(184)
181
L－11
190
F－1
N.0 1
F－9
N.0 2
N.0 3
N.0 4
20
50

L－2


C.D.L
0 M
10
20
30
40
244
L－6
L－7
234
L－8
L－9
224
L－10
L－11
(287)
214
290
F－3
F－6
20
50