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GOVERNMENT OF PAKISTAN
PORT QASIM AUTHORITY

TENDER AND CONTRACT DOCUMENTS

**FOR DREDGING OF
NAVIGATIONAL CHANNEL**

**VOL. II: TECHNICAL SPECIFICATION
AND BILL OF QUANTITIES**

DECEMBER 1975

JAPAN INTERNATIONAL COOPERATION AGENCY

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PORT MUHAMMAD-BIN QASIM
NAVIGATION CHANNEL DREDGING

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I-1 GENERAL DESCRIPTION

1.1 Introduction

The Port Qasim Authority (PQA) proposes to construct an Iron Ore and Coal Berth to accommodate vessels of 75,000 DWT, in Gharo Creek, Pipri area approximately 31 km (17 miles) upstream from the mouth of Phitti Creek in the Sind Province of Pakistan. The project includes construction of the Berth and related facilities, dredging of navigation channel and installation of navigation aids. The whole project is covered under separate tender documents as follows:

- 1) Contract "A"
Iron Ore and Coal Berth, and Related Facilities.
- 2) Contract "B"
Navigation Channel Dredging
- 3) Contract "C"
Lighthouse and Related Facilities
- 4) Procurement Document for Navigation Aids

Contract "B" deals with the dredging of the navigation channel and land reclamation area at the proposed site of the Iron Ore and Coal Berth.

1.2 Scope of Works

Works to be executed under the contract comprise the dredging of the Approach Channel, Inner Channel, the Turning Basin and the land reclamation and berth areas, from the open sea up through Gharo Creek.

Dredging works will be divided into four phases as follows. The first three phases are covered in the present Contract.

Early completion	To dredge the proposed site of the Iron Ore and Coal berth and the land reclamation area to depths of 12.80 m (42 ft.) and 5.0 m (16.4 ft.) respectively.
First phase	To dredge the channel and turning basin to accommodate 25,000 DWT vessels.
	Approach Channel to a depth of 11.80 m (39 ft.)
	Inner Channel to a depth of 9.50 m (31 ft.)
	Turning Basin to a depth of 11.00 m. (36 ft.)
Second phase	To dredge the Inner Channel and turning basin for 50,000 DWT vessels.
	Inner Channel to a depth of 11.30 m (37 ft.)
	Turning Basin to a depth of 12.80 m (42 ft.)
3rd Phase (Future Contract)	To dredge the Approach Channel for 50,000 DWT vessels.
	Approach Channel to a depth of 13.6 m (45 ft.)

1.3 Drawings

Drawing No.	Title
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1-2	Channel Alignment -
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Drawing No.	Title
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8-2	Boring logs - Approach Channel, Lower Inner Channel (for reference only)
8-3	Boring logs - Berth, Turning Basin (for reference only)

1.4 Extent of Works

The contract comprises the execution of works outlined in the preceding sections and described in detail in the following sections of this Specification, on the Drawings and in the Bill of Quantities. The supply of all materials necessitated by the works as well as all temporary works and all plant equipments necessary for the execution of the works shall be within the obligations of the Contractor and shall be paid for exclusively through the rates stated in the Bill of Quantities.

1.5 Location of the Works

Definition and location of the channels to be dredged shall be as shown on Drawing No. 1-1.

1.6 Sequence of Works

Dredging works of Early Completion for the Berth and Land Reclamation areas shall be carried out and completed before the commencement of the land reclamation and berth construction, within the period agreed to in the Contract.

Dredging works of the 1st phase shall be executed to the specified depth and width for 25,000 D.W.T. vessels, throughout the channel and turning basin within the period agreed to in the Contract.

Dredging works of the 2nd phase shall not be commenced until the works of the 1st phase have been completed, checked and approved by the Engineer.

The works shall be completed to the depth and width required for 50,000 D.W.T. vessels throughout the channel and turning basin by the time agreed to in the Contract.

All works including sediment removal in the Approach Channel caused by natural causes, specially sedimentation in the monsoon seasons from April to September shall be completed within the period agreed to in the Contract.

A detailed working programme shall be prepared by the Contractor and submitted to the Engineer, and no work will be allowed to start until approval has been obtained from the Engineer.

Dredging works of the 3rd phase shall be taken up in future after completion of dredging works of Early Completion, 1st phase and 2nd phase. Details of the 3rd phase dredging have, therefore, not been described in this Specification.

I-2 LOCAL CONDITIONS

2.1 General

The following information is provided solely for the guidance of the Contractor.

The PQA takes no responsibility whatsoever as to the accuracy of the information stated in the following sections and the Contractor shall not be entitled to make any claims whatsoever due to possible deviations between the stated and actual conditions. The Contractor is supposed to have visited the Site before submitting his tender and to have made himself acquainted with all local conditions.

2.2 Location and Topography

The location of Iron Ore and Coal Berth in Gharo Creek is approximately 31 km (17 miles) east of Karachi Port, and approximately 24 km (13 miles) inland from the sea coast Buddo Island through Phitti Creek and the upper Kadiro Creek. The navigation channel cuts inland from the open sea in the N.NE direction, curves to the northerly direction around Buddo Island, and further bends to the NE direction opposite Khiprianwala Island. From the confluence of Phitti and Kadiro Creeks, the channel runs eastward.

An estuary sand bar is located in Approach channel at a distance of about 8 km (5 miles) off coast with depth of about 6 m (20 ft.)

(Refer Dwg. -1).

a) Approach Channel

The water depth of Approach Channel at the sea end section is 13.6 m (45'). Water depth in the outer Approach Channel extending

from 2.0 km to 8.0 km (1 mile to 4 miles) from the entrance, is approximately 6 m (20 ft) gradually increasing to about 12 m (40 ft). In the inner Approach Channel, 8.0 km to 14.7 km (5 miles to 8 miles) from the entrance, the water depth is generally 14 m to 21 m (45 ft to 70 ft) forming a gut of Phitti Creek with width of 700 m to 800 m (2,300 ft to 2,600 ft)

b) Inner Channel

i) Phitti Creek

The water depth of the channel extending about 17 km (9 miles) from Buddo Island varies from 10.6 m to 18 m (35 ft to 60 ft). The width is around 200 m (600 ft). In the upper reaches there is a wide water area with width of 300 m to 350 m (1,000 ft to 1,150 ft). On the west side of the creek lie Buddo and Bundal Islands with sand dunes sufficiently high. The ground level of these islands is approximately 5 m to 6 m (16 ft to 20 ft) above chart datum. The upper reaches of the creek are surrounded by swampy islands of Khipriawala and Muchak mostly submerged at MHWL.

ii) Kadito Creek

The creek extends for approximately 6.4 km (3.5 miles), narrower in width and deeper than Phitti Creek. The width is about 200 m (650 ft) and depths are from 12 m to 24 m (40 ft to 80 ft). The creek is surrounded by mangrove swamps. The general ground level of these swamps is approximately 2 m to 3 m (7 ft to 10 ft).

iii) Gharo Creek

This creek is about 24 km (13 miles) inland from the mouth of Phitti Creek and the Iron Ore and Coal Berth Site is located in its western section extending for approximately 2.7 km (1.7 miles)

with favourable width and depth. It is a calm basin miles away from the open sea with an average width of 400 m (1,300 ft) and depth varying from 10.6 m to 15 m (35 ft to 50 ft). This creek is also surrounded by mangrove swamps with ground levels varying approximately from 2 m to 3 m (7 ft to 10 ft).

Of the above four channels, the sand bar area in the Approach Channel is the shallowest section with a water depth of 6 m (20 ft). Kadiro Creek with average width of 200 m (650 ft), is the narrow section of the navigation channel. The present conditions of the channel will allow navigation of vessels of 5,000 D.W.T. to the port site in Gharo Creek.

2.3 Soil Conditions

From 1972 to 1974, the Port Qasim Authority carried out a series of boring tests at principal points in the vicinity of the port area, in the channel and in the basin to investigate the soil conditions. The results of the subsoil investigation are shown on Drawings 8-1, 8-2 and 8-3. The subsoil conditions of various areas are as follows.

a) Open Sea Area

Boring tests have been carried out to depths of 18 m (60 ft) at three locations, S-1, S-2, and S-3, in the middle section of the Approach Channel as shown on Drawing 8-1. According to the boring logs, generally, a homogeneous layer of dark gray fine micaceous sand exists below sea bed i.e. 6 m to 8 m (20 ft to 25 ft) to a depth of 18 m (60 ft) below chart datum. The N-value increases with the depth from the surface layer, with compact sand layers of N=20 in depths of 10.6 m to 12 m (35 ft to 40 ft) and N=25 ~ 30 in a depth of 18 m (60 ft).

b) Lower Reaches of Phitti Creek

The bore hole CR-6 was located in roughly the middle of the creek east of Bundal Island where depth of 10.6 m (35 ft) existed. The location of the bore hole is shown on Drawing 8-1. A surface layer of soft mud about 0.6 m (2 ft) in thickness overlies a dark gray clay deposit containing silt to a depth of 15 m (50 ft) with N-value in the range of 10 to 15. Similar deposits of slightly hard clay with some silt and sand with N-values in the range of 30 to 35 exist to depths of 18 m (60 ft).

c) Upper Reaches of Phitti Creek

The bore hole CR-7 was located in approximately the middle of Upper Reaches of Phitti Creek, as shown on Drawing 8-1. A soft mud layer of 1.0 m (3 ft) in thickness below sea bed at a depth of 10 m (33 ft) exists, under which a plastic clay deposit with silt and shell pieces extends to a depth of 21 m (70 ft). A thin layer of clay 1.2 m (4 ft) in thickness, with occasional gravel and silt is encountered around depths of 18 m (60 ft). The clay layer is rather compact with the N-values in the range of 10 in the upper layer at 12 m (40 ft) depth, and 30 in the lower layer at 18 m (60 ft) depth.

d) Gharo Creek

The proposed site of the Berth extending for 600 m (1,970 ft) was investigated through drilling of 9 bore holes (No. 101-115). Results are shown on Dwg. 8-3. Bore logs reveal the following soil characteristics.

- i) In the area covered by bore holes No. 101-108, the upper layer to the depth of 9 m to 15 m (30 ft to 50 ft) consists of rather soft gray silty clay or clayey silt of N-values below 10 with occasional layers of fine sand with N-values in the range of 20. In depths beyond 15 m (50 ft), the material is very hard

mudstone (hard silty clay or clayey silt) of N-value over 50.

ii) In the area covered by bore holes No. 110 to 115, the subsoil is of different features. Underlying a surface layer of loose clay, a deposit of sand layers 6 m to 7.6 m (20 ft to 25 ft) in thickness is encountered. The depth of the layer decreases from down-stream to up-stream, appearing at depth of 9 m (30 ft) at the up-stream end. The sand layer is compact with N values in the range of 30 to 50.

Hard mudstone with N-values over 50 underlie the sand deposits in depths of 15 m to 21 m (50 ft to 70 ft).

2.4 Meteorological Conditions

Port Muhammed Bid Qasim is located on the north east coast of the Arabian Sea, characterized by the SW monsoon in summer and NE monsoon in winter. From April to August the S.W. monsoon prevails with high temperature and humidity. The remaining period of the year has moderate temperature and humidity. Strongest wind blows from May through August. The rainfall is generally small in the area.

a) Temperature

The range of temperature according to the seasons is relatively small throughout the year. The average minimum temperature ranges between 8°C and 23°C and the average maximum between 30°C and 42°C.

b) Rainfall

The rainfall is generally small along the seacoast. The average annual rainfall in Karachi is about 20 cm (8"), and the number of rainy days in a year is less than 10. In the months of July and August, number of rainy days is more than once a month.

c) Visibility

Visibility depends on weather conditions such as dust storms, fogs, cloud, rainfall and haze. The weather in Karachi is generally fine, and the visibility is only affected by the amount of haze. Mornings are after characterized by haze disappearing by noon.

d) Winds

The S.W. monsoon from April to August and the N.E. monsoon from October to February are two distinct seasons which characterize wind conditions in the area, with variable winds in September and March. From April to August the predominant wind direction is from W to WSW and from October to February, the direction is from N to NE. Mean monthly wind velocity recorded of Manora and Karachi Airport at 0500 hrs., 0800 hrs. and 1700 hrs. are as given in Table-1.

Table - 1

MEAN MONTHLY WIND VELOCITY (KNOTS) - KARACHI

<u>Station & Time & Hours</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>
0500 Manora	5.8	3.7	4.5	5.1	7.0	8.4	9.1	8.2	8.2	6.2	2.4	5.0
Airport	2.5	1.8	2.4	2.6	4.6	7.8	8.0	7.4	5.1	1.3	1.2	3.7
0800 Manora	5.8	4.0	4.5	5.7	7.5	9.8	9.3	9.4	6.7	3.3	3.7	5.5
Airport	2.7	2.2	2.4	4.5	8.1	9.0	9.6	8.8	6.9	2.1	1.2	1.9
1700 Manora	8.8	8.8	10.4	11.7	12.4	13.2	12.3	11.6	10.5	8.8	8.1	7.5
Airport	7.4	8.4	8.8	10.4	12.0	13.5	13.5	12.3	11.5	9.4	7.3	6.2

Generally, the wind velocity is higher in the evening than in the morning. The mean maximum wind velocity 13.2 knots at Manora occurring in the evening is centered around June. From April to September, the

mean wind velocity is 5 ~ 10 knots in the mornings and 10 ~ 16 knots in the evenings, while from October to March, the velocity is 1 ~ 6 knots in the mornings and 7 ~ 16 knots in the evenings. The maximum wind velocity of 36 m/s (81 mph) was recorded at 6:00 P.M. on June 29, 1969. In general, even during the S.W. monsoon, the wind velocity seldom exceeds 20 knots (10 m/s) and strong winds over 40 knots (20 m/s) are extremely rare.

e) Storms

According to the record of storms in the Arabian Sea for 69 years from 1881 to 1949, cyclonic storms occur frequently in the months of May, June, October and November, and move in WNW direction and Storms normally do not strike the Pakistan coast recorded 87 times during the period of 69 years making the average frequency of occurrence less than 2 per year.

2.5 Hydrographic Conditions

a) Tides

In Phitti Creek, semi-diurnal tides with diurnal effect are observed, similar to tides in the Karachi Port.

Tidal levels at Karachi, Phitti Creek (Bundal Island) and Pipri Point are as shown in Table-2. The tidal levels at Phitti Creek were recorded for 3 months in 1970. Tides at Phitti and Pipri sites have been recorded continuously since October, 1972.

As may be seen from Fig. -1, the tidal range at Phitti Creek is about 6% greater than that at Karachi, and the range at Pipri is about 25% greater than that at Karachi. High water at Phitti and Pipri lags about 12 minutes and 55 minutes respectively behind high water at Karachi.

Chart datum (Port Qasim datum) at Phitti Creek is 1.73 m (5.68 ft) below mean sea level. The storm ranges are normally minor and could occur during the cyclones which are infrequent in this area. The extreme range recorded in Karachi was 1.2 m (3.9 ft) above maximum astronomic tide and occurred during the cyclone of 1907. It is expected that during such Storm, levels at Phitti and Pipri sites would exceed predicted tide levels by roughly the same amount.

Table - 2
COMPARISON OF TIDE ELEVATIONS

KARACHI-PHITTI-PIPRI

	Karachi	Phitti	Pipri
Extreme recorded high water (June 1902)	4.36 (14.3)	3.97 (12.7)	3.96 (13.00)
Highest astronomic tide (HAT)	3.20 (10.5)	3.44 (11.3)	3.96 (13.00)
Mean higher high water (MHHW)	2.67 (8.8)	2.91 (9.55)	3.40 (11.16)
Mean lower high water (MLHW)	2.44 (8.0)	2.26 (7.42)	2.67 (8.76)
Mean sea level (MSL)	1.65 (5.4)	1.73 (5.68)	2.05 (6.73)
Mean higher low water (MHLW)	1.08 (3.5)	1.20 (3.93)	1.43 (4.69)
Mean lower low water (MLLW)	0.43 (1.4)	0.55 (1.80)	0.70 (2.30)
Chart datum	0.0	0.0	0.0
Lowest astronomic tide (LAT)	-0.43 (-1.4)	-0.58 (-1.9)	-0.61 (-2.0)
Extreme recorded low water	-0.61 (-2.0)	-0.82 (-2.7)	-0.82 (-2.7)

NOTE

(1) Chart datum (Port Qasim datum) at Phitti and Pipri is below local mean sea level by 1.73 m (5.68 ft) and 2.05 m (6.73 ft) respectively, K.P.T. datum is 1.65 m (5.40 ft) below survey of Pakistan datum.

(2) Values of MHHW, MLHW, MHLW, and MLLW for Phitti and Pipri have been computed by PQA from tide observations between 11.10.72 and 31.12.73.

(3) Values of HAT, LAT, extreme highest and lowest water levels are observed values.

(4) Values are in meter (feet)

b) Tidal Currents

According to the Admiralty Pilot, offshore currents in the Arabian Sea generally occur in the westerly direction during the N.E. monsoon season, and in the easterly direction during the S.W. monsoon season. The maximum current velocities are approximately 1 knot and 2 knots during the two respective monsoon seasons.

A program of current measurement in the entire Phitti Creek system was carried out by both float tracking and measurement of current profiles at fixed stations. The locations at which measurements were taken are shown in Fig.-2. The maximum and average velocities recorded at the respective creeks are as given in Table-3.

Table - 3
CURRENT VELOCITIES IN KNOTS

Location	<u>Flood</u>		<u>Ebb</u>	
	Maximum	Average	Maximum	Average
Approach Channel	2.0	1.1	2.5	1.0
Buddo Island .	2.9	2.2	2.2	1.2
Phitti Creek	2.2	1.3	2.8	1.1
Kadiro Creek	1.2	0.8	1.9	1.0
Gharo Creek	2.4	1.0	3.6	1.6

According to the table, maximum current velocity of 3.6 knots has been recorded at ebb tide in the vicinity of the Berth Site in Gharo Creek. In the Creek system, ebb tide is generally stronger than flood tide. In the approach channel, the maximum velocity is 2 ~ 2.5 knots and the average about 1.0 knot without much difference at flood and ebb tides.

At the entrance of the approach channel, the flood current direction is at an angle of about 40° to the alignment of the proposed navigation channel and the velocity is less than 1 knot. At ebb tide the current is roughly in line with the alignment of the navigation channel.

c) Waves

On the coast of Pakistan, generally, waves like winds are dominated by monsoons. Waves hardly occur during the N.E. monsoon season, while waves occur during the S.W. monsoon season.

1) Wave Height

Measurement of waves at the entrance of Approach Channel commenced in November, 1972 using Waverider Buoys. Maximum wave heights recorded were in the range of 3 m to 4 m (10 ft to 12 ft) from June to August and 1 m to 2 m (3 ft to 7 ft) from November to May. The significant wave height was 3.0 m (10 ft). During the peak monsoon wave action, the Predominant wave period was in the range of 8 to 9 seconds. Significant wave height and significant wave period exceedance percentage curves recorded off the entrance are shown in Fig.-3 and Fig.-4.

According to mariners, waves in the order of $H_o=6.0$ m (19.7 ft) have been observed off Karachi during storms. However, such occurrences are very rare, and would not greatly affect the operation of vessels in the port.

No wave data has been collected in the Creeks System. According to the visual observations, waves of about 0.6 m to 1 m (2 ft to 3 ft) in height occur in the Creeks.

ii) Wave Direction

Wave directions have been measured off Karachi by the Pakistan Navy. The mean wave direction observed is 237° with 90 % of the waves having a direction between 225° and 255°.

d) Littoral Drift

On the coast of Pakistan, littoral drift depends on the S.W. monsoon wave action. In waters west of Karachi Port, littoral drift is predominantly in the easterly direction. However, littoral drift from Karachi to Phitti Creek is complicated due to the peculiar topography of the area.

According to the report of the British Hydraulic Research Station Ex.557 (1971), northward offshore the middle of Bundal Island, littoral drift in the northerly direction prevail, while on the south side towards the navigation channel, littoral drift in the southerly direction prevail. Further south, the direction of littoral drift turns northward. Littoral drift moves in either the north or south direction according to the wave direction. The amount of littoral drift to be deposited in the dredged channel will be the total of sand shifted in the two directions. From 1973 to 1974, a program of trial dredging was carried out in the Approach Channel to predict the amount of infill. According to the Report of H.R.S. Ex.698, the amount of infill has been estimated to be approximately 1,400,000 m³ per year.

2.6 Trial Dredging

If required for tendering, P.Q.A. will supply information on Trial Dredging carried out in the Approach Channel in 1973-74.

Fig - 3

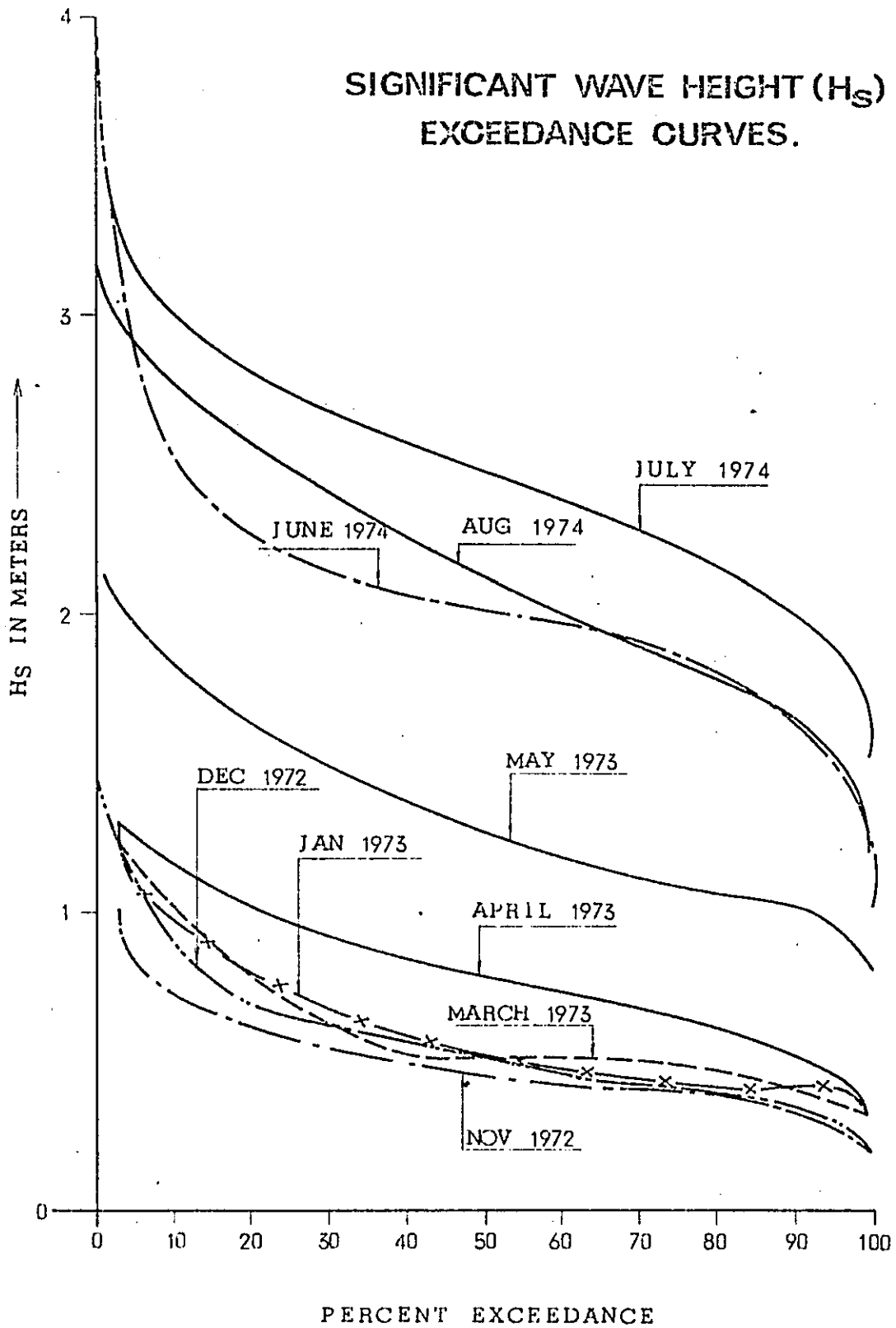
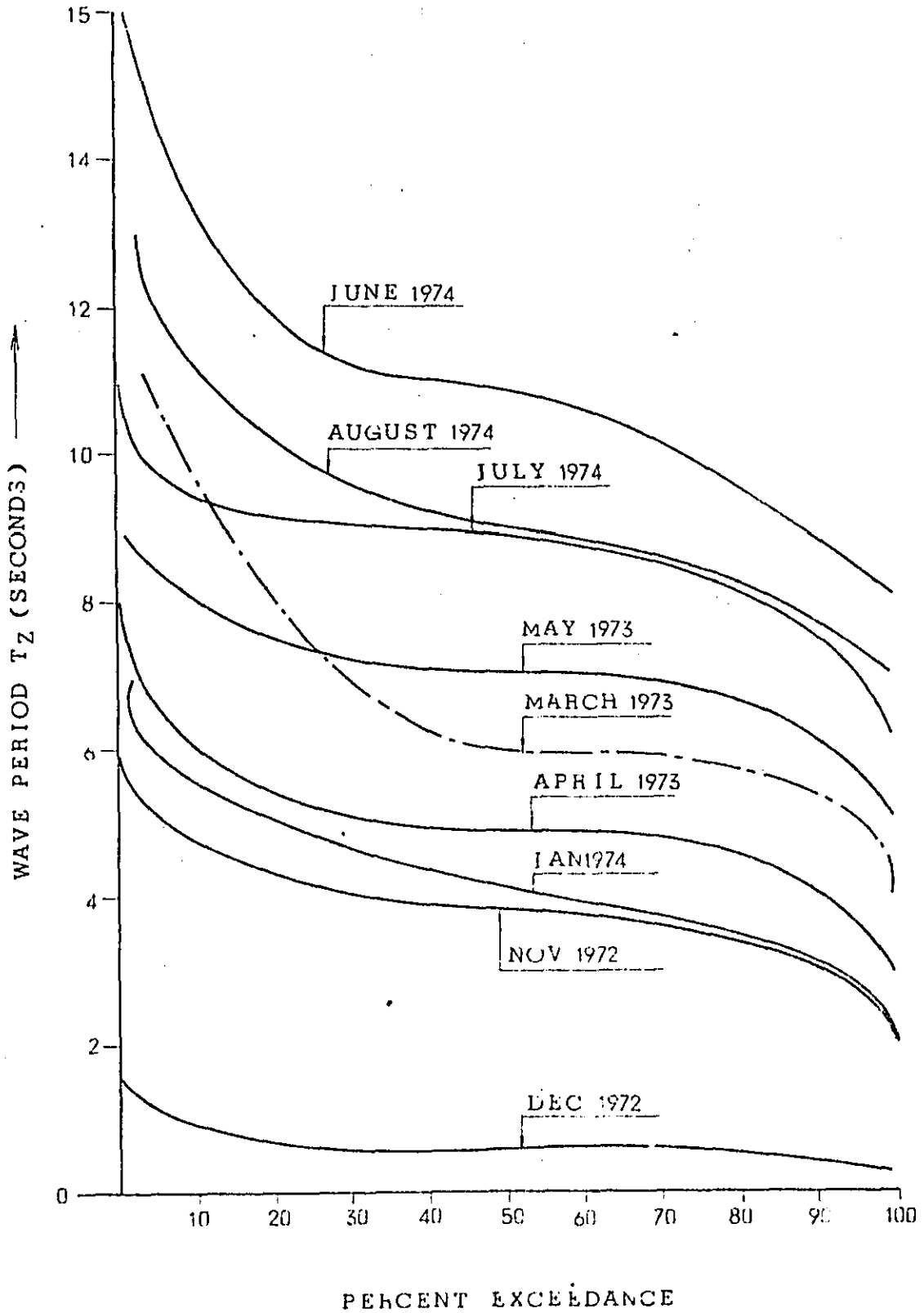


Fig - 4

WAVE PERIOD (T_z) EXCEEDANCE CURVES



I-3 GENERAL REQUIREMENT

3.1 General

Volume I, Parts 1 through 5 preceding these Technical Specifications contain provisions and requirements essential to these Specifications and apply to Volume II whether or not referred to herein.

3.2 Dredging Plant

It is thus the responsibility of the Contractor to decide upon the extent and type of the dredging plant to be employed with due consideration to the soil conditions, hydraulic conditions and disposal conditions etc. at the Site and no liability shall rest upon the P.Q.A. in any respect with regard to the accuracy of the information given on these items in the Specification.

The Contractor shall be entirely responsible for the sufficiency of the dredging plant, machineries, tools, and implements used for the fulfilment of the Contract whether such means may or may not be approved or recommended by the Engineer, and he shall repair or replace any damaged or ship-wrecked plant or equipment at his own cost.

3.3 Setting Out

The Contractor shall establish all necessary bench marks which shall be referred to the existing bench mark as indicated by the Engineer. The setting out of the bench marks shall be made in co-operation with the Engineer and to his approval.

The Contractor shall be responsible for establishing and maintenance of all marks, beacons, markers and buoys, onshore and offshore, during the execution of the dredging works.

3.4 Execution of Dredging Works

The dredging shall be carried out to the depths and lines shown on the Drawings within the tolerances stated in the Technical Specifications for various types of work.

All slopes indicated on the Drawings are the steepest permitted slopes.

3.5 Dumping Areas

The dredged materials shall be transported and disposed in the dumping areas shown on the Drawing (4-3) or as directed by the Engineer.

Except when otherwise authorized by the Engineer in writing, no dumping shall be done outside the prescribed areas.

Dumping operations shall be carried out in such a way (subject to the approval of the Engineer) that backwashing into the navigation channel is avoided. In the event of tidal currents carrying dredged materials from the dumping area back into the channel, the Engineer may order dumping at a greater distance from the channel, so as to prevent the return of sediments or he may order for temporary interruption of operations under certain stages of the tides. If dumping areas other than those shown on the Drawings are proposed by the Contractor, their acceptance shall be subject to the written approval of the Engineer. All expenses incurred in connection with providing and making available such dumping areas shall be borne by the Contractor, and all materials deposited thereon and all operations in connection therewith shall be at the Contractor's risk.

Any material which is deposited in areas other than those designated or approved by the Engineer shall not be paid for, and the Contractor shall be required to remove such material and deposit it where directed at his own expense.

Any material which is deposited on the dredged areas during the contract period because of spillage from the dredger shall not be paid for, and the Contractor shall be required to remove such material and deposit it where directed at his own expense, or he may dredge sufficient overdepth at his own expense to account for material returning to the dredged areas due to the dredging operations.

With regard to the sediments that have been returned obviously by natural causes between April to August, payment for dredging in the Approach Channel only shall be made in accordance with the measurement procedure specified herein.

3.6 Surveys and Soundings

Before the commencement of any dredging, all channel areas and adjacent areas of which the levels might be affected by the dredging works shall be surveyed, levelled and sounded by the Contractor on scales as specified or directed by the Engineer. The Contractor upon completion of the dredging works the areas shall be surveyed, levelled and sounded again by these surveys, levellings and soundings shall be executed under the Engineer's supervision and be approved by him, and the results thereof shall be recorded in plans and sections by the Contractor and mutually signed by the Engineer and the Contractor as truly representing the configurations of the areas in question.

3.7 Sweep of Dredged Area

Whenever ordered by the Engineer during the execution of the dredging, levels and soundings shall be taken by the Contractor to ascertain the correct execution of the works, and, the Contractor shall sweep the dredged area.

3.8 Wrecks and Other Obstructions

Wrecks being encountered during the execution of the works shall either be salvaged or demolished to 1.0 m (3.3 ft) below dredged level. Such work will be paid as additional work, if the Engineer permits. The method of removal, whether by salvaging or by demolition, shall be approved by the Engineer. The salvaged materials shall belong to the PQA and shall be deposited as instructed by the Engineer.

3.9 Use of Explosives

The Contractor shall not make use of any explosives in the course of dredging without written permission of the Engineer.

The Contractor shall obtain necessary permission from the authorities concerned for the use of explosives and their storage in magazines, and the type and place of erection of such magazines shall be approved by the concerned authorities and by the Engineer. The Contractor shall bear all costs in connection with the use and storing of explosives and shall further at his own expense, arrange for the provision of safety guards for the protection of the public and others during blasting operations. When blasting is permitted, it shall be carried out strictly in accordance with arrangements previously agreed to in writing by the Engineer.

The Contractor shall maintain a register for control of the storage and the use of explosives.

3.10 Provisions for the Engineer

The Contractor shall provide to the Engineer free of charge a suitable furnished accommodation onboard the dredgers with meals, etc. throughout the execution period for the works.

A site office complete with equipment and furnishings as detailed below shall be provided by the Contractor for the use of the Engineer soon after acceptance of the Tender and maintained and serviced by him for the full period required under the terms of the Contract. Layout and full details of the Site office, furnishings, services and other items shall be submitted for the Engineer's approval before the construction is commenced.

The requirements are:-

- a) A suitable air conditioned site office of 100 square metres (about 1100 sq. feet) of usable floor area complete with all necessary lavatories, washing, shower and other fittings including a refrigerator to the approval of the Engineer.
- b) Services to the above building including overhead tank, potable hot and cold water supply, drainage, electric lighting, telephones. The Contractor's price shall include installation, charges and other running expenses in respect of all these services.
- c) Furnishings, including plan chests, desks, tables, chairs, cupboards, shelves, blinds for windows, insect screens etc., all to the approval of the Engineer.

The Contractor shall provide, maintain and service at the Site during the execution of the Works and until completion of the Contract the following instruments all new, for the use of the Engineer. These instruments will become the property of the Contractor on completion of the Contract.

- i) One typewriter
- ii) One copying machine, electro-magnetic or other suitable type
- iii) Two 12 digit electronic calculating machines with two memories and printer.

The Contractor shall provide, maintain and service at his own cost two new chauffeur driver cars of approved make for the exclusive use of the Engineer, with full replacements as and where necessary.

The Contractor shall provide, maintain and service a launch of approved design for the use of the Engineer, at all times complete with crew, VHF radio, all fuel, stores, life saving equipment and spare parts. The launch shall be seaworthy of more than 200 h.p. with sitting accommodation for minimum of 6 persons.

3.11 Contractor's Facilities

The Contractor shall procure the necessary land area at his own responsibility for use as machinery storage areas, office and lodgings for staff, workshops and other temporary buildings. The PQA may provide the necessary water front area within Port Muhammed Bin Qasim mutually agreed free of charge at a suitable location to be limits.

The Contractor shall submit a plan of temporary work yard, jetties etc. showing the planned layout and dimensions and obtain the Engineer's approval.

The Contractor shall be responsible for the construction of buildings and power and water facilities himself.

The Contractor shall also be responsible for the removal of all such facilities after the completion of Works.

With regard to mooring facilities for tug boats, launches, barges and other floating equipment, the Contractor shall be responsible for the erection and removal at his own expenses.

3.12 Requirement of the Port Authorities

Fishing boats and other small boats will use the channels even during the period of the dredging works. The Contractor's dredger shall not hinder the movement of these boats.

To prevent the collision of a dredger in operation or waiting and tug boats and anchor barges etc, with other vessels, working lights or anchor lights and shapes shall be installed and maintained by the Contractor at night and during daytime to meet the requirements of essential regulations.

3.13 Communications

The Contractor shall provide radio telephone communications between the dredging plants and Engineer's and Contractor's Site offices.

3.14 Daily Log and Monthly Report

a) The Contractor shall maintain a daily log noting important events pertaining to the Works, the working hours, the number of laborers employed, effective operational time of equipment or auxiliary equipment, overtime hours, delays due to meteorological and marine conditions, the lack of labor, materials or equipment, progress made and instructions, notifications and recommendations made by the Engineer. The log shall be signed daily by the Contractor and shall be approved weekly by the Engineer.

(b) The Contractor shall furnish to the Engineer six copies of the monthly report, within seven (7) days after the end of every month, indicating progress made, inventories of material used and stored on work-site, equipment available and hours utilized, the summary of the daily log of the month and all important events in relation to the Works.

3.15 Records and Photos

(a) The Contractor shall observe and record the tidal level from the Commencement Date until completion, which record shall be referred to the Port Qasim datum. The Contractor shall submit one original and two copies of tidal records and sounding records transferred to the datum to the Engineer at the end of each month.

(b) The Contractor shall submit three sets of photographs relevant to the Works whenever required by the Engineer or deemed necessary.

3.16 As-built Drawings

As the Work progresses, the Contractor shall record all changes and variations from the original plans approved by the Engineer and shall prepare and submit as-built drawings reflecting these changes, upon completion of the Works in accordance with the requirements of the General Conditions and as herein specified under Clause 5 - SURVEYING. The as-built drawings shall be made in accordance with instructions of the Engineer as to the size and scale.

I-4 DREDGING WORKS

4.1 Dredging Areas

The Approach Channel shall be dredged to the required width and depth as shown on the Drawings for the 1st and 3rd phases.

The Inner Channel and the Turning Basin shall be dredged in locations as shown on the Drawings where the design depth is not satisfactory.

The Land Reclamation area and Berth area shall be dredged as defined under Early Completion phase.

4.2 Width, Depth and Side Slopes

The dredging width, depth and side slopes shall be as follows..

Phase	Location	Depth below PQ datum	Width	Side Slopes
Early Completion	Land Reclamation area	5.0 m (16.4 ft)		1:6
	Berth area	12.80 m (42 ft)		1:6,1:3
1st Phase	Approach Channel	11.80 m (39 ft)	280m ~ 185m (920ft ~ 607ft)	1:20
	Inner Channel	9.50 m (21 ft)	145 m (476 ft)	1:6
	Turning Basin	11.00 m (36 ft)	370 m (1214 ft)	1:6
2nd Phase	Inner Channel	11.30 m (37 ft)	180 m (590 ft)	1:6
	Turning Basin	12.80 m (42 ft)	450 m (1476 ft)	1:6
3rd Phase (Future Contract)	Approach Channel	13.60 m (45 ft)	300m ~ 225m (984ft ~ 738ft)	1:20

No portion of the finished dredging works shall be left at levels higher than those shown on the drawings.

In order to cover inaccuracies of the dredging process, over dredging in depths of up to 0.6 m (2 ft) below the required depths within the limits of the Specified bottom width shall be measured and paid for at the unit rate for dredging stated in the Bill of Quantities. Over dredging at the Land Reclamation area shall be limited to 0.5 m (1.6 ft) below the required depth.

However, over dredging of the slopes shall not be paid for.

The side slopes may be dredged in steps allowing the upslope material to fall down in the cuts outside the limiting slope plane. The dredging procedure shall be approved by the Engineer after it is proved by the soundings that the excavations correspond to and allow for a natural creation of slopes outside the theoretical limiting slope plane.

The bottom width of the waterway shall not be less than the width specified on the Drawings. In no case shall both edge lines of the bottom be inside the designed edge lines. However no payment shall be made for any dredging beyond the designed edge lines.

Dredging beyond the over dredging of 0.6 m (2 ft) below the required depth shall not be paid for.

4.3 Dumping Areas

In principle, the dredged materials from the Approach Channel shall be dumped at the offshore dumping area shown on the Drawings, at depth exceeding 20 m (66 ft) below PQ datum where the water depth shall not be less than 20 m (66 ft) below PQ datum after dumping the materials.

Lighted marker buoys shall be installed to demarcate boundary of the dumping area for the Approach Channel to allow its identification both during the daytime and at night.

The type and the number of lighted buoys shall be approved by the Engineer. The dredged materials from the Inner Channel, Turning Basin and Land Reclamation and Berth areas shall be disposed off in areas along the channel at the specified location shown on the Drawings which shall be at least 500 m (1640 ft) from the sides of the channel.

The ground level of the dumping areas after dumping shall not exceed +5.0 m (16.4 ft) above PQ datum. The final levels of the dumping areas after disposal of the materials shall be determined by surveys entered on drawings for submission to the Engineer.

4.4 Rock and Hard Materials

If rock and hard materials are encountered, removal and disposal of such materials requiring blasting or other special procedure, shall be measured and paid for separately as additional works.

4.5 Special Period of Sedimentation

Re-dredging of sediments in the Approach Channel due to the natural causes from April to August shall be measured and paid for additionally after the Engineer accepts the correctness of sounding surveys carried out by the Contractor and approves the volume. The Contractor shall execute accurate sounding surveys for the measurement of sediment volume before and after the aforementioned period.

4.6 Change of Lighted Buoys

Lighted Buoys will be installed at positions shown on the Drawing under a Separate Contract to facilitate safe navigation of vessels and after the completion of the 1st phase dredging works.

The Contractor shall not damage the buoys and the sinkers, etc. during the 2nd phase operation.

If these buoys obstruct dredging in the opinion of the Engineer, they may be temporarily moved by the Contractor to locations specified by the Engineer. However such temporarily moved buoys shall be re-installed by the Contractor in new positions as shown on the Drawings at the completion of the 2nd phase dredging.

The Contractor shall bear all the cost incurred in connection with temporary removal, reinstallation and maintenance of the buoys. If any of the buoys is damaged during temporary removal and reinstallation, repairs shall be made at the Contractor's cost.

4.7 Dredging of the Iron-Ore and Coal Berth and Land Reclamation Areas

The Land Reclamation area shown on the Drawing shall be dredged to -5.0 m (-16.4 ft). The dredged materials shall be dumped at the location specified by the Engineer.

The tolerance of dredging depth is ± 0.5 m (± 1.6 ft). In the case of overdredging exceeding -5.5 m (-18 ft), the Contractor shall be charged the actual cost of filling the bottom with sand and riprap upto -5.5 m (-18 ft).

The dredging of the Berth Area shall be carried out in the same manner as the Inner Channel dredging.

Dredging in these areas shall be completed by the specified dates, to enable commencement of the works under Contract "A".

Final surveys for the measurement and acceptance of the Works shall be carried out by the Contractor for the approval of the Engineer.

The Contractor shall remove all dredging plant from the Site as soon as possible to enable the Contractor for Contract 'A' to enter the Site.

5. SURVEYING

5.1 General

The available Decca Sea Fix System with PQA presently covers the Approach channel but it is intended to extend the coverage to the entire Port area. The Contractor will be allowed to locate his position relative to the dredging areas with this system. When the Contractor and/or the Engineer judge that positioning with the aforementioned system is impossible or inaccurate due to mechanical trouble or other reasons, positions shall be taken by the Contractor's own method approved by the Engineer.

5.2 Surveying Instruments

The Contractor shall install and maintain the following electronic/survey instruments on-board survey launches and dredgers to carry out surveys and to utilize the Decca Sea Fix system during the dredging operation.

Electronic Decca Sea Fix Equipment:

Receiver (including track plotter)

80402B

Decca Lattice Charts of Specified Scales

Antenna	7928
Electronic Unit	7816
Punch log Control Unit	9817
Power Supply and Cables	

Survey Equipment: Pointer, Theodolit, Levelling, instruments and drafting/plotting equipment. Echo Sounder (marine survey type), Sextails, Station.

The instruments for sounding and positioning shall be handled by well experienced hydrographic surveyor and their staff, and shall be kept in good condition for operation at any time.

5.3 Methods of Survey

Grid, at 30 meters (100 ft) intervals shall be established for detailed surveys of the dredging areas, unless otherwise directed by the Engineer. The soundings shall, as far as possible, be performed in calm weather. Bar calibration of the echo sounding equipment shall be carried out prior to the commencement and after completion of each day's surveying and at such other times as the Engineer may direct and the corrections shall be confirmed by the Engineer.

5.4 Scale of Surveys

5.5 Interim Measurement

a) Approach Channel

The dredged volume for monthly payment during the period from September to March shall be calculated on the basis of the surveys to be carried out by the Contractor every 30 days with lines of sounding 90 m (300 ft) apart.

The dredging of slopes shown on the Drawing and for over dredging as specified in Clause 4.2 herein shall also be calculated based on these surveys.

Monthly payment of the dredging during the period from April to August shall be made tentatively on the basis of hopper measurements as directed by the Engineer. These monthly measurements/payments shall be adjusted by the detailed surveys to be carried out by the Contractor as described in Clause 5.3 herein. Those areas which have been dredged completely shall be surveyed by the beginning of April and in the beginning of September each year by the Contractor.

Infills payable to the Contractor shall be determined by the above mentioned Surveys.

In absence of these surveys or deviation of the survey period described above, payment for infill shall not be made.

Monthly payments by hopper measurements during the period from April to August shall be allowed on the condition that the Contractor furnishes an automatic recording system to the satisfaction of the Engineer for estimation of the dredging quantities.

Prior to measurement of dredging quantities by hopper, a conversion coefficient between recorded figures on the automatic system of the dredging plant and dredged quantities calculated on the basis of regular surveys shall be obtained and submitted to the Engineer for his approval.

b) The minimum interval of interim measurements for the Inner Channel and the Turning Basin shall be one month.

c) Measurement for dredging of the Land Reclamation and Berth areas shall be made upon completion only.

5.6 Final Measurement

Final surveys except that of Approach Channel shall be carried out by the Contractor on the completion of the dredging Works and after informing the Engineer. Regarding Approach Channel, final survey for the 1st phase shall be carried out in March after the infill caused by the last monsoon has been dredged.

Final survey shall cover the entire channel, basins and areas whether dredged or not, by the Contractor under the supervision of the Engineer.

The Contractor shall submit survey data plotted on a plan that the specified water depth and width shown on the Drawings are achieved in the entire area and the slopes have been finished into specified shape.

The Contractor shall make sectional drawings at 90 meters (300 ft) intervals including slopes.

The final survey for the 1st phase shall be considered as the pre-dredging survey for the 2nd phase.

5.7 Drawings of Surveys

For each survey the Contractor shall immediately prepare drawings on which results of the survey shall be recorded in the form of plans and sections to the specified scale or the scale agreed to by the Engineer.

After the results plotted on each drawings have been checked and verified, the Contractor and the Engineer shall sign and date each agreed drawings.

PART II BILL OF QUANTITIES

II-1. INTRODUCTION

This Bill of Quantities has been established for the calculation of the Contract Price for the Works and shall, when priced by the Contractor, form an integral part of the Contract.

The priced Bill of Quantities shall serve as the basis for the determination of the Monthly Statements of Account and of the Final Account.

In the description of the items in the Bill of Quantities only sufficient specification to indentify the respective works to be executed has been given. The items shall comply with Drawings and Specifications of the Contract Documents and shall include all costs, expenses, liabilities and risks in connection with the proper execution and completion of the works in accordance with the Contract, including amongst others the cost of drawings and specifications required from the Contractor, the cost of all materials, labour, and all which are missing in Bill of Quantities, but are required by the Contractor for the execution of the works, as well as all overhead charges and profit.

The whole of the Works shall be covered by the quantities with affixed unit rates. The rates shall, therefore, include all works and deliveries which may not be especially mentioned in the documents but which can in a reasonable way be inferred from the documents.

The quantities given in the Bill of Quantities shall be regarded as approximate only, and the Contractor shall satisfy himself in regard

to the general accuracy of the indicated quantities. The actual quantities which shall serve as the basis for the determination of the payment shall be calculated net and shall be applicable fo finished work only, except where otherwise specified. The Contractor shall be deemed to have fully considered all the conditions, obligations and requirements of the Contract Documents before entering the respective Schedule Rates against the items in the Bill of Quantities.

Each individual item in the Bill of Quantities shall be priced, and the tender will not be considered valid, unless a price is affixed to each item. The unit rates set down against each item shall not be subject to revision except in accordance with Volume I, Part 2, Appendix F.

All permanent Works the dimensions of which for one reason or another cannot be ascertained after complition, shall in due time be measured jointly by the Engineer and the Contractor, and the results shall be recorded on special attachment sheets which shall be signed by the two parties, and which shall later on serve as the basis for establishing the payments to be made for such Work.

In case of daywork, the Contractor shall from the commencement of such work furnish the Engineer with daily lists of the quantities of materials used, the working days or hours of labour employed and of plant and machinery used, prepared in detail and in such a way as to enable the ascertainment of expenses to be paid on daywork basis. After due approval by the Engineer in respect of accuracy these lists shall form the basis for the Monthly and Final Statements of Account for daywork.

2. Rules for Measurements

The final volume of dredged quantities shall be measured "in situ" and be determined on the basis of sounding and levelling plans and sections established prior to the commencement of the dredging works, and on the basis of the required theoretical final levels and earth slopes as shown on the Drawings and stated in the Specifications.

The monthly Statements of Account shall be based on interim measurements as specified in clause 5.5 of the Specifications.

The unit rates shall be per cubic metre (m^3) of dredged material.

Demurrage for idle time shall be compensated in accordance with the General Conditions of the Contract, and the Contractor shall submit the unit rates for various dredgers in the prescribed form of these Tender Documents.

Item No.	Pay Item	Unit	Quantity (Approx.)	Schedule Rate in PAK. RS		Item Price in PAK. RS	
				RS.	Paisa	RS.	Paisa
	<u>DIVISION - I PRELIMINARIES</u>						
1.1.1	Mobilization of all plant and equipment for the dredging of Approach Channel.	lump Sum	1	—			
1.1.2	Mobilization of all plant and equipment for the dredging of Inner Channel.	lump Sum	1	—			
1.1.3	Provide and maintain and service all temporary facilities and equipment.	lump Sum	1	—			
1.1.4	Demobilization of all plant and equipment.	lump Sum	1	—			
	TOTAL: PRELIMINARIES.						

Item No.	Pay Item	Unit	Quantity (Approx.)	Schedule Rate in PAK. RS		Item Price in PAK. RS	
				RS.	Paisa	RS.	Paisa
<u>DIVISION - II. DREDGE AND DISPOSE DREDGED MATERIAL IN EARLY COMPLETION AS FOLLOWS:</u>							
2.1	Land Reclamation Area to a depth of 5.0 m (16.4 ft) below datum.	cu.m.	180,000				
2.2	Iron-ore Coal Berth Area to a depth of 12.8 m (42 ft) below datum.	cu.m.	93,000				
TOTAL: DREDGE AND DISPOSE DREDGED MATERIAL IN EARLY COMPLETION							

Item No.	Pay Item	Unit	Quantity (Approx.)	Schedule Rate in PAK. RS		Item Price in PAK. RS	
				RS.	Paisa	RS.	Paisa
<u>DIVISION - III. DREDGE AND DISPOSE</u> <u>DREDGED MATERIAL IN FIRST PHASE</u> <u>AS FOLLOWS:</u>							
3.1	Approach Channel to a depth of 11.80 m (39 ft) below datum.	cu.m	13,300,000				
3.2	Inner Channel to a depth of 9.5 m (31 ft) below datum.	cu.m	480,000				
3.3	Turning Basin to a depth of 11.0 m (36 ft) below datum.	cu.m	361,000				
TOTAL: DREDGE AND DISPOSE DREDGED MATERIAL IN FIRST PHASE							

Item No.	Pay Item	Unit	Quantity (Approx.)	Schedule Rate in PAK. RS		Item Price in PAK. RS	
				RS.	Paisa	RS.	Paisa
<u>DIVISION - IV DREDGE AND DISPOSE DREDGED MATERIAL IN SECOND PHASE AS FOLLOWS:</u>							
4.1	Inner Channel to a depth of 11.3 m (37 ft) below datum.	cu.m	3,043,000				
4.2	Turning Basin to a depth of 12.8 m (42 ft) below datum.	cu.m	815,000				
4.3	Remove and relocate lighted buoys in Inner Channel	Nos.	35				
TOTAL: DREDGE AND DISPOSE DREDGED MATERIAL IN SECOND PHASE.							

Item No.	Pay Item	Unit	Quantity (Approx.)	Schedule Rate in PAK. RS		Item Price in PAK. RS	
				RS.	Paisa	RS.	Paisa
	<u>DIVISION - V. DREDGE AND DISPOSE DREDGED MATERIAL IN THIRD PHASE AS FOLLOWS:</u>						
5.1	Approach Channel to a depth of 13.6 m (45 ft) below datum.	cu.m	13,400,000				
5.2	Remove and relocate lighted buoys in Approach Channel	Nos.	16				
	TOTAL: DREDGE AND DISPOSE DREDGED MATERIAL IN THIRD PHASE.						

4. SUMMARY

PAK RS

DIVISION - I PRELIMINARIES
DIVISION - II EARLY COMPLETION
DIVISION - III FIRST PHASE DREDGING
DIVISION - IV SECOND PHASE DREDGING

TOTAL PRICE: NAVIGATION CHANNEL DREDGING

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