

**MLT-II JETTY AT KAMARAJAR PORT**

**REQUEST FOR QUOTATION**

**FOR**

**ONSHORE GEOTECHNICAL INVESTIGATION**

*Consultant*

**Prof. S. Nallayarasu**



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**INDIAN INSTITUTE OF TECHNOLOGY MADRAS**  
CHENNAI – 600 036

**Client**



**Hindustan Petroleum Corporation Ltd.**  
Gresham Assurance Building, 2<sup>nd</sup> Floor, Sir P. M. Road  
Fort, Mumbai – 400 001

**JUNE 2018**



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### 1. INTRODUCTION

Kamarajar Port has issued a letter to Hindustan Petroleum Corporation Limited (HPCL) and Bharat Petroleum Corporation Limited (BPCL) JV Company for the development of MLT-II jetty alongside the northern break water south of existing Marine Liquid Terminal I (MLT-I).

The HPCL has appointed Department of Ocean Engineering, IIT Madras as the consultant for the preparation of Detailed Project Report through a Letter of acceptance Dated 30<sup>th</sup> May 2018.

This document describes the requirement for carrying out onshore geotechnical investigation at the proposed site. Following definition applies this specification and all associated work to carry out the survey and geotechnical investigation.

- The CLIENT where used in this specification shall mean Hindustan Petroleum Corporation Limited.
- The CONTRACTOR is the party which will carry out the said bathymetry survey, Geotechnical investigation and services to perform the duties specified by the OWNER / OWNER's Engineer / CONSULTANT.
- The CONSULTANT means the OWNER's Engineer in this case is The Department of Ocean Engineering, IIT Madras (Prof. S. Nallayarasu).



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## 2. SITE LOCATION

The Proposed site is located at Vallur Village, Thiruvallur district, in Tamil Nadu. The site is 25km to the North of Chennai.

The location of the proposed site is shown in figure 2.1.



Figure 2.1 Location of site



Location of MLT-II within the port is shown in Figure 2.2.



Figure 2.2 Location of MLT-II



Figure 2.3 Location of Tank Farm and Pipeline alignment



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### 3. ONSHORE GEOTECHNICAL INVESTIGATION

#### 3.1 Scope of work

The scope of work includes the following.

- 10 Land Boreholes along Pipe trestle to a depth of 25m below existing ground level.
- 10 Land Boreholes for Tank Farm area to depth of 25m below existing ground level.

The detailed scope of work for each bore includes the activities as specified in Table 3.1

**Table 3.1 Scope of work activities for geotechnical investigation**

| S. No. | Scope of work Activity   |
|--------|--|
| 1      | Mobilization of tripod and drilling tools and accessories including personnel for carrying out Geotechnical investigation work.  |
| 2      | De-mobilization of tripod and drilling tools & accessories and personnel for carrying out Geotechnical investigation work.   |
| 3      | Setting up of drilling equipment at each borehole location as per the location coordinates   |
| 4      | Boring through soils of various strengths  |
| 5      | Collection of 100mm dia meter, 450mm long undisturbed samples from bore holes and sealing the tube with molten wax at every 1.0m.  |
| 6      | Conducting standard penetration test (SPT) in soil at every 2.0m   |
| 7      | Laboratory Experiments and studies   |
| 8      | Preparation and submission of factual report during the progress of boring and testing in draft form for comments.   |
| 9      | Preparation and submission of geotechnical investigation report including detailed results of laboratory studies, recommendation for foundation design etc for comments and incorporating the same and final submission. |



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### 3.2 Borehole locations

Bore holes are located along the proposed pipe trestle and the tank farm. The tentative locations of the proposed bore holes are specified in the tender drawings and the CONTRACTOR shall position them with coordinates based on the survey during setting up of the site.

### 3.3 Equipment and Manpower requirements

The minimum manpower the successful execution of the geotechnical investigation is given in this section. Minimum Equipment and accessories to be deployed is given below.

- Tripod or platform
- Vehicles for personnel transfer, soil samples and equipment
- Hydraulic rotatory drilling rig
- Boring & drilling accessories
- Other necessary equipment as required to executive the work.

Minimum manpower to be deployed during the execution of boreholes is given below.

- Geotechnical Expert with minimum 10 years post graduate experience : 1
- Supervisor : 1
- Master : 2
- Drilling Crew : 4

Equipment spread proposed for the project shall be having experience of previous similar operations. The drilling crew shall be experienced to handle the boring operations.

### 3.4 Methodology

The activities comprise of borehole drilling and either



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- (a) In-situ testing in borehole and
- (b) Sampling and sample handling.


Boreholes of 150mm diameter boreholes in soil using open hole rotary drilling rig may be undertaken. In case rock is encountered, rock core drilling using diamond bit with double tube NX size core barrel and N type drill rod shall be undertaken. The borehole will be terminated at specified depth below the existing seabed level. The measurements for core recovery, RQD, weathering index, fracture index shall be carried out at site.

Typical borehole drilling apparatus shall have the various components as minimum.

- a. Drilling equipment: Any equipment that provides a suitable clean open hole before insertion of down hole sampling and / or testing apparatus and ensures that sampling and / or testing is performed in undisturbed ground.
- b. Drill Rig: Machine capable of providing rotation, feed and retraction, to drill pipe casing and or auger. Drill fluid pumping capacity shall be as required to promote return of drilling fluid.
- c. Drill casing: cylindrical pipe with one or more of the following purposes:
  - To support the sides of the boreholes.
  - To support drill pipe above ground surface in case of over water drilling
  - To promise return of drilling fluid.
- d. Drill pipe: Cylindrical pipe connecting drill rig and drill bit.
- e. Drill Bit: Device attached to drill pipe and used as cutting tool to drill into the ground.
  - Core drilling is a ground investigation technique comprising simultaneous drilling and sampling.
  - Core bit: Device attached to the core barrel and used as a cutting tool to drill the ground.
  - Core catcher: Device that assists retention of core in the core barrel.
  - Core Box: Box with longitudinal separators for the protection and storage of core.



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The description of the sampling apparatus is as follows.

- a. Push sampling will be undertaken in highly sensitive clays or is the clay encountered is soft to firm is accomplished by
- b. Sampler insertion equipment: apparatus providing relatively rapid continuous penetration force.
- c. Reaction equipment: reaction for the sampler insertion equipment
- d. Sampling rods: Rods that connect the sampler insertion equipment to the sampler head.

### 3.5 Conducting standard penetration test (SPT)

The standard penetration test shall be conducted as per the general specification suggested by IS/BS code of practice. The test shall be conducted using auto trip SPT set at specified interval of 1.5m at a depth where there is a stratigraphic change, whichever occurs earlier. SPT shall be terminated on recording 100 blows per 30cm or less penetration for three consecutive tests. The disturbed samples obtained from the split spoon sampler shall be visually classified, labelled for identification and preserved for laboratory testing.

### 3.6 Undisturbed Sampling Requirement

Undisturbed samples shall be taken at every 1m (wherever possible) especially in cohesive soil using suitable device such split spoon barrel etc to test their physical, chemical and strength properties.

The feasibility of a particular laboratory test relates to the sampling practice and sample handling for a particular soil and depends on factors such as soil type, available amount of sample material and sample quality. The adopted classification system for sample quality is according to IS and BS standards. The classification system recognizes 5 classes on the basis of feasibility of these classes are as follows:

- a. Class 1: undisturbed: Strength, stiffness and consolidation.
- b. Class 2: undisturbed: permeability, unit weight, boundaries of strata – fine.





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- c. Class 3: disturbed: sequence of layers
- d. Class 4: disturbed: particle size analysis, Atterberg limit, boundaries of strata – broad.
- e. Class 5: disturbed: sequence of layers.
  - The higher class includes laboratory tests of the lower class.
  - This is to assist in Geotechnical classification, identification and description of strata.

The class of the soil sample shall be indicated on the sample packing and the borelog.

### **3.7 Factual Report**

The factual report shall include an introduction outlining the objectives of the investigation, description of the procedures followed for carrying out the various field and laboratory works, equipment used, ground conditions encountered and the generalized soil profile obtained from findings of field and laboratory investigations. Engineering properties of soils shall be described in detail along with specifications, codal provisions and some engineering practice.

### **3.8 Laboratory tests**

The minimum laboratory tests to be conducted on soil samples collected at each bore hole shall be as per Table 3.2.

**Table 3.2 Laboratory Tests on soil samples**

| <b>S. No.</b> | <b>Laboratory tests</b>                                |
|---------------|--|
| 1             | Particle size distribution                             |
| 2             | Atterberg's limits                                     |
| 3             | Specific gravity / particle density                    |
| 4             | Bulk density   |
| 5             | Sedimentation / hydrometer analysis                    |
| 6             | Chloride content, soluble sulphates, carbonate content |



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| S. No. | Laboratory tests   |
|--------|--|
| 7      | Natural moisture content                                 |
| 8      | Tri-axial compression test – (Consolidated Un-drained)   |
| 9      | Tri-axial compression test – (Unconsolidated Un-drained) |
| 10     | Direct shear test  |
| 11     | Uniaxial compression test – rock sample if applicable    |
| 12     | Point Load Test – rock sample if applicable              |

### 3.9 Deliverables

Following shall be minimum deliverables.

- Daily Field report including calibration of the devices and duly signed by Field Representative of CONSULTANT.
- Actual executed bore hole shall be plotted on the bathymetry chart with coordinates and submitted separately both in hard and soft copy in Autocad format.
- Geotechnical Investigation report including interpreted data including all laboratory results.

### 3.10 Report format

The geotechnical report shall be submitted as draft for review. Final report shall be submitted incorporating the comments from CLIENT/CONSULTANT. The report shall contain the minimum as follows.

- Descriptive geology of the area
- Bore hole data (raw) and interpreted based on relevant Indian Standards
- Description of each soil strata indicating color, consistency, grading in accordance with Indian Standards for soil classification.
- Laboratory test results
- Geotechnical soil profile along the pipe trestle and tank farm.



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- Soil characteristics including design strength for each bore hole strata
- Soil strength includes SPT value, angle of internal friction, density, subgrade lateral soil modulus, modulus of elasticity of soil, undrained shear strength etc shall be provided for each soil layer either by direct testing or by interpretation from relevant literature.

### 3.11 Schedule

Following schedule shall be strictly followed

- Mobilisation within two weeks of purchase order date
- Drilling and sample collection within 4 weeks of purchase order date
- Submission of draft report within 6 weeks of purchase order date

### 3.12 Commercial conditions

The following commercial conditions apply to the bid.

- Prices shall be quoted using the price proforma given in section 4.
- All quoted prices shall exclude GST and the same shall be separately indicated.
- Prices shall be valid for 3 months.

### 3.13 Documents comprising the BID

3.13.1 The Bidder shall submit the Bid in hard copy format. The Envelopes titled as Bid shall be placed in larger envelope, which shall be sealed. The envelope shall clearly bear the identification “**BID for the ONSHORE GEOTECHNICAL INVESTIGATION FOR MLT-II PROJECT AT ENNORE PORT**” and shall clearly indicate the name and address of the Bidder. In addition, the BID Due Date should be indicated on the right hand top corner of the envelope.

3.13.2 The envelope shall be addressed to the following CONSULTANT and shall be submitted at the respective address on or before the bid due date and time:



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ADDRESS: Prof. S. Nallayarasu  
Department of Ocean Engineering  
Indian Institute of Technology Madras  
Chennai – 600 036

PHONE NO: 044-22574819

FAX NO: 044-22574800

E-MAIL ADDRESS: [nallay@iitm.ac.in](mailto:nallay@iitm.ac.in)

3.13.3 If the envelope is not sealed and marked as instructed above, the CONSULTANT assumes no responsibility for the misplacement or premature opening of the contents of the BID submitted and consequent losses, if any, suffered by the Bidder.

3.13.4 BIDs submitted by fax, telex, telegram or e-mail shall not be entertained and shall be summarily rejected.

### 3.14 BID Due Date

The BID comprising with all relevant documents shall be submitted in hard copy on or before **1700 hrs on 02.07.2018**. A receipt thereof should be obtained from the person/Authorized representative of CONSULTANT specified at **Clause 3.13.2**.

### 3.15 Late BIDs

Physical receipt of documents listed at clause **3.13.1** of the RFQ after the prescribed date and time at **clause 3.14** shall not be considered and the bid shall be summarily rejected.



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#### 4. PRICE PROFORMA

The price shall be quoted in the following format and this document shall be signed on all pages submitted together with the bid.

| Sl. No | Description of work  | Unit     | Price (Indian Rs) |
|--------|--|----------|-------------------|
| 1.     | Mobilisation   | Lump sum |                   |
| 2.     | Setting up of platform, tripod, boring to a depth of 25m below existing ground through all soil strata for <b>20 onshore</b> boreholes including all manpower and ancillary equipment, power etc. complete |          |                   |
| 3.     | Laboratory testing and reporting, interpretation, preparation and submission of report (two revisions)   |          |                   |
| 4.     | Demobilisation   |          |                   |
| 5.     | GST  |          |                   |

#### Terms and conditions

- 30% mobilisation advance is permissible with submission of Bank Guarantee for the amount.
- 50% Payment after completion of boreholes/field work.
- 10% Payment upon submission of draft report
- 10% final payment submission of final report incorporating comments from CONSULTANT.



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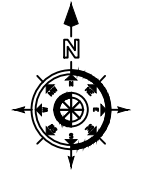
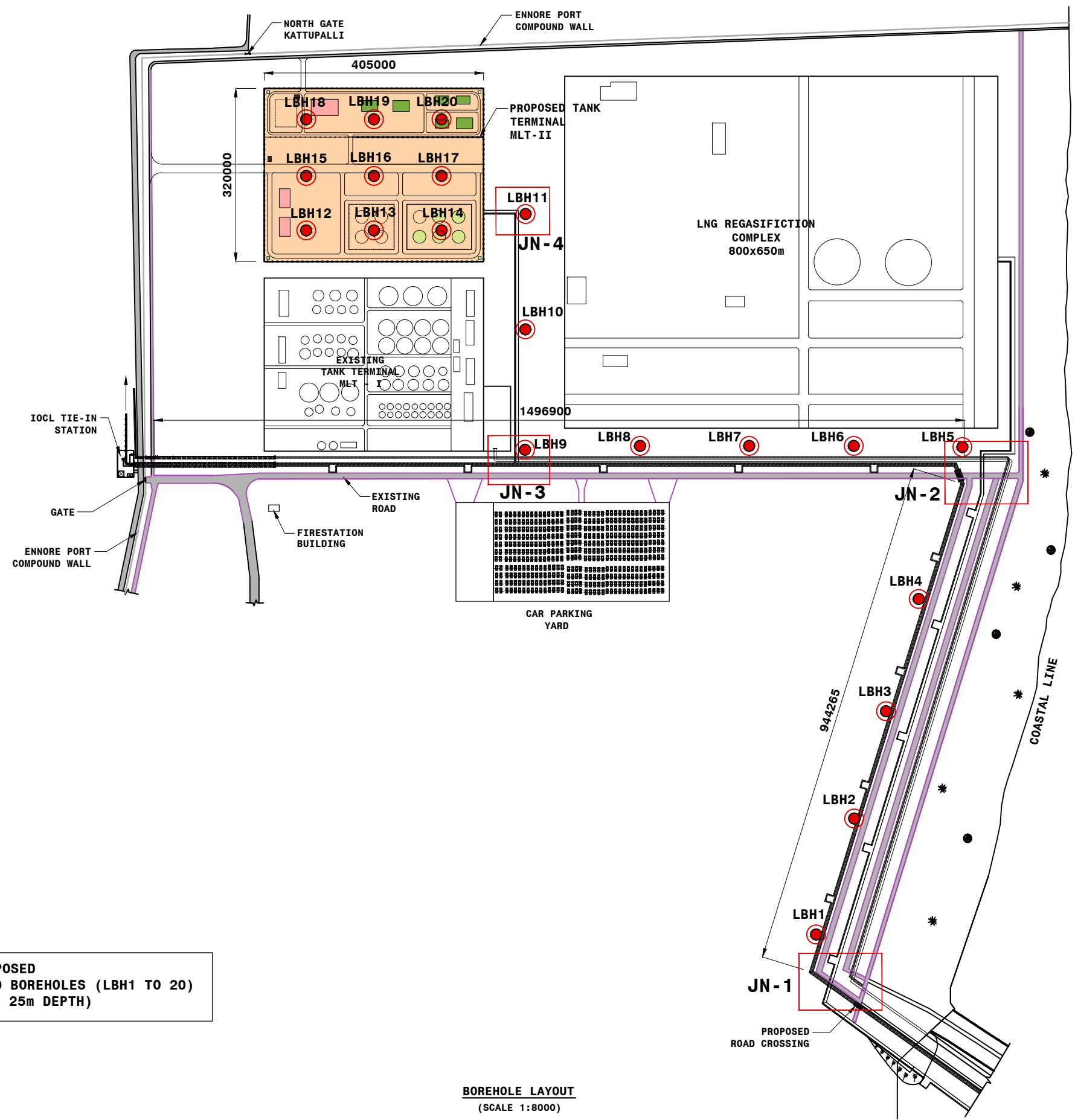
# **APPENDIX A**

## **TENTATIVE BOREHOLE LOCATION**



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**PROPOSED LAND BOREHOLES (LBH1 TO 20) (FOR 25m DEPTH)**

**BOREHOLE LAYOUT**  
(SCALE 1:8000)

- NOTES:**
1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.
  2. ALL LEVELS INDICATED ARE IN METERS WITH RESPECT TO CHART DATUM.

|   |          |                   |        |         |
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| REV.  | DATE     | DESCRIPTION       | DRAWN  | CHECKED |
| <b>REVISION</b>   |          |                   |        |         |
| CONSULTANT:   |          |                   |        |         |
| <b>PROF. S. NALLAYARASU</b><br>DEPARTMENT OF OCEAN ENGINEERING<br>IIT MADRAS, CHENNAI   |          |                   |        |         |
| OWNER:  |          |                   |        |         |
| <b>HINDUSTAN PETROLEUM CORPORATION LTD.</b><br>GRESHAM ASSURANCE BUILDING, 2ND FLOOR,<br>SIR P. M. ROAD, FORT, MUMBAI - 400 001 |          |                   |        |         |
| TITLE:  |          |                   |        |         |
| <b>LAYOUT OF LAND BOREHOLES</b>   |          |                   |        |         |
| PROJECT:  |          |                   |        |         |
| <b>MLT-II JETTY FOR HANDLING POL &amp; LPG FOR HPCL/BPCL AT KAMARAJAR PORT</b>  |          |                   |        |         |
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