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# DEMARCATIION OF HTL AND CRZ BOUNDARY ALONG THE LAND BEARING REVENUE SURVEY No. 275 (pt.) CTS Nos. 657(A) (pt.) AND 1295 (pt.) AT KANJUR, MUMBAI

*Sponsored by*

**Metro Infrastructure and Project Solutions India (P) Ltd.  
Mumbai**



November 2004

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राष्ट्रीय समुद्र विज्ञान संस्थान  
NATIONAL INSTITUTE OF OCEANOGRAPHY

Dona Paula, Goa - 403 004

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**Metro Infrastructure and Project Solutions India (P) Ltd.  
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INDIA

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## CONTENTS

LIST OF PLATES AND FIGURES

CONTRIBUTORS

EXECUTIVE SUMMARY

1.0. INTRODUCTION

2.0. MORPHOLOGY AND TOPOGRAPHY

3.0. MATERIAL AND METHODS

3.1. EQUIPMENT AND METHOD USED FOR SURVEYS

3.2. GLOBAL POSITIONING SYSTEM (GPS)

3.3. FEATURES OF GPS SATELLITES

3.4. PRINCIPLE OF OPERATION

3.5. PRESENT STATUS

3.6. LASER TRACK

4.0. RESULTS AND INTERPRETATION

5.0. SUMMARY AND CONCLUSIONS



## LIST OF PLATES AND FIGURES

### PLATES

- Plate-1.** Photograph showing the Nalla/Stream supporting HTL on the Eastern part of the property.
- Plate-2.** Photograph showing the canal supporting HTL at the western end of the property.
- Plate-3.** Photograph showing the tidal exchange through culvert mangroves and the development around the property.
- Plate-4.** Photograph showing the Nalla/Stream supporting the HTL and mangroves on the eastern side of the property.
- Plate-5.** Photograph showing fodder grass cultivation and the soil condition within property area.
- Plate-6.** Photograph showing the land use and soil conditions within the property area.
- Plate-7.** Photograph showing the wetland vegetation along the HTL and eastern side of the property.

### FIGURES

- Fig.1.** Map showing area surveyed.
- Fig.2.** Map showing HTL and CRZ boundary at Kanjur.



## CONTRIBUTORS

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## EXECUTIVE SUMMARY

The National objective for coastal, estuaries and creek area is to manage them to ensure sustainable development of these resources for multiple uses. Broad national objective have to be translated into implementable activities for particular area to achieve the desired results. In this instance the unit of measurement is the HTL along the streams and contiguous belt of land owned/ represented by Metro Infrastructure Project Solutions India (P) Ltd. (MIPS). The MIPS is developing this land as construction site, approached National Institute of Oceanography, an authorized agency of MOEF to delineate the High Tide Line and CRZ boundary. The main topic of the contention in the instant case is whether the plot area is falling within the ambience of Coastal Regulation Zone.

This report details the process of physical demarcation of HTL and CRZ boundary across the property bearing revenue survey No. 275, (pt) village Kanjur, Taluka Kurla, and the corresponding CTS Nos. 657 (A)(pt.) and 1295 (pt.) of village Kanjur Taluka Mulund, Mumbai Suburban District as the development site. The report identifies the horizontal position of HTL associated with the coastline morphological features. In this case concrete masonry wall of the canal (Nalla) and banks of bunded Nalla stream was considered for demarcation. The horizontal position of the plot area was also demarcated and presented on a map of 1:4000 scale.

On demarcation of High Tide Line, the designated boundary of Coastal Regulation Zone was delineated uniformly parallel to the HTL configuration and marked on the map. The result of the studies are as follows:

- That the whole stretch of above described shoreline and the property falls within the urban area.



- That the CRZ boundary of 100 m, which is a landward boundary of Coastal Regulation Zone, measured from the High Tide Line has been marked on the map (Fig.2), indicates that the 100 m stretch of the property marked as red on the map falls within the ambience of CRZ legislation defined by MoEF.
- That the present soil component reported in the plot area is within the limits of standard values of garden soil of the coastal area (Report of BSIP).
- That the development area does not fall or contain the environmentally sensitive and ecologically fragile areas as specified in the Coastal Regulation Zone Notification.
- That the development site will not alter the topography of the land surface and it will also not interfere with the drainage from upland or creeklet sources.
- That about 90% of the plot area is a cultivated grassland and the plot is surrounded by roads all four sides.
- Gas filling plant and developed settlement of Kanjur Marg is located along the northern boundary of the plot.
- Although the existing tidal excursion is taking place up to the eastern edge of the Eastern Express Highway, but for meeting the requirement of MoEF within the meaning of CRZ Notification the drainage canal (Nalla) in the west and Nalla/ stream in the east of the plot were considered as the tidal water body.
- That based on the physical demarcation and information collected on topography, morphology, land use, nature of soil it may be concluded that the existing plot area within the meaning of CRZ notification fulfills the criteria, to be designated as CRZ II.



## 1.0. INTRODUCTION

Based on the physical demarcation and information collected the topographical morphological land use and nature of soil indicates that: The coastal zone is unique geological, physical and biological area of vital economic and environmental value. Inadequately planned coastal and marine development, poorly regulated economic activities and increasing population growth have rise to rapid destruction of coastal and marine ecosystem. The recent enactment of legislation like coastal zone regulation act are indicative of both national and state policies concern for the effect of regulating the development in environmentally sensitive coastal zones. This legislative action was mainly intended for regulating the various uses of terrestrial and aquatic resources in the coastal areas covering to a distance of 500 meters from HTL in the open coast and 100 metres in case of estuary and creeks. To bring under the regulation of Coastal Regulation Zone (CRZ) act. These areas are expected to remain qualitatively unchanged in their fauna and flora.

Metro Infrastructure and Project Solutions India (P) Ltd. is developing the site on the land comprised in revenue survey No. 275 (pt.) of village Kanjur bearing corresponding CTS Nos. 657 (A) (pt.) and 1295 (pt.) of village Kanjur Mulund, Mumbai Suburban District. To implement specific CRZ objectives set out in the regulation, the developer of the above property approached the National Institute of Oceanography (NIO) who are the authorized agency of MOEF for carrying out necessary demarcation. The objective of the present study is to examine the acceptability of this coastal development in relation with construction activities which will be carried out through morphological zone, land forms and coastal environment.





Keeping in view the requirement of Coastal Regulation Zone Legislation, National Institute of Oceanography accepted to undertake the project with following agreed scope of work.

- To delineate the relevant high tide line as per the précised policy, practice and procedure of MOEF.
- To measure the set back line and to delineate the CRZ boundary of 100m from the HTL boundary set for the administrative convenience and determination of legal bôundary or jurisdiction of CRZ and consequences within the CRZ notification of the Government of India.
- To examine the compatibility and consequences between the forces of development and forces of conservation within the meaning of CRZ notification.

### **Approach Strategy**

Based on the objective of work, National Institute of Oceanography undertook the work and carried out detailed survey of plot bearing the revenue survey No. 275 (pt.) of village Kanjur having its corresponding CTS Nos. 657 (A) (pt.) and 1295 (pt.) of village Kanjur Mulund, Mumbai Suburban District. Studies were also made about land use pattern, morphological features and environmentally sensitive areas to predict the response of the proposed development with in CRZ. Integration of all these information led to conclude the suitability vis-a-vis coastal regulation. Results are presented in the form of this report and the physical demarcation of HTL and restricted development boundary are presented in the form of a map annexed to this report.

### **Socio- Economic profile of the coastal region of Kanjur Mumbai:**

Kanjur is a heavily populated and well developed area falling within the municipal limits of Municipal Corporation of Greater Mumbai Suburban. The said piece of



land is engulfed between the Eastern Express Highway Jogeswari-Vikhroli link road, Govind Ram Jolly Marg and Kanjur village road. Bombay was ceded to Portuguese by the sultan of Gujarat in the early 16<sup>th</sup> century, it later passed to Britain as part of the dowry of Catherine of Braganza on her marriage to Charles II of England. Bombay's rise to the status of a major port began when ships of East India Company started in the 18<sup>th</sup> century to make it a regular port of call and received further impetus with the establishment of cotton mills in 1850. At present the development has taken place along the northern boundary of the plot.

The site of development is surrounded by the multi storied buildings and the distribution of urban population and economic activity reached up to the road leading to Jogeswari-Vikhroli link road and Kanjur village road. The density of urban population is very high in this segment.



## 2.0. MORPHOLOGY AND TOPOGRAPHY

### **General description of the area**

The area is bounded by Eastern Express Highway on the east, Govind Ram Jolly Marg on the west, Jogeswari-Vikhroli Link Road on the south, Kanjur village road and Nutan Nagar on the north. The plot area is a low lying area through which all the drainage from highland is flowing during the monsoon. A large extent of the plot boundary is stretched along the Eastern Express Highway. The edge of this highway is also supporting the eastern bank of the Nalla draining out the discharges associated with anthropogenic activity along the northern boundary of the plot.

The water flowing through these two Nallas existing on eastern and western sides of plot is heavily contaminated. A general assessment indicates that the creek to landward, decrease in concentration of mangrove resulted due to the discharges associated with anthropogenic activity in this zone. No much exchange of tidal water is occurring along these plots. Piling up effect is taking place during the high water. Actual tidal range in these two Nallas is less than 40cm. The tidal water as well as the waste water discharge from land is flowing out through these man made streams/ Nallas. No overflowing of saline water in to the plot is noticed. Sparse and small mangrove trees (less than 1000 Sq mtrs in area as specified in CRZ notification) are located near the junction of Eastern Express Highway and Jogaswari-Vikhroli Link Road and along the boundary abutting Eastern Express Highway (Plate-3). The exchange of water is taking place through culverts (Plate-3). Except the area described above most of the plot area is free from mangroves.



## **3.0. MATERIAL AND METHODS**

### **3.1. EQUIPMENT AND METHODS USED FOR SURVEYS**

For the purpose of meeting the requirement of the CRZ notification, the high tide line means the line on the land up to which the highest water line reaches during the spring tide. Here the word "highest water line reaches during the spring tide" refers to the mean high water spring (19 years average of spring water) that is the regular water level fluctuations caused by changes in relative position of Sun, Moon and the Earth.

Coastal stretches of seas, bays, estuaries, creeks, rivers and back waters which are influenced by tidal action (on the land ward side) are included in Coastal Regulation Zone (CRZ). Highest range of spring tide and its horizontal run up on the land was identified by way of morphological features; permanent vegetation line and flotsam as per the existing guideline of MoEF. Delineation of HTL was carried out by using the Laser Track (Measurement Device Ltd. U.K.) and the Global Positioning System techniques (Trimble, USA) and the data were collected by following the established principles in survey of this nature.

### **3.2. GLOBAL POSITIONING SYSTEM (GPS)**

The Global Positioning System known as GPS, which is a satellite based navigation and surveying system, was deployed for the determination of precise positions. GPS is primarily a navigation system for real-time positioning. However, with the transformation from the ground-to-ground survey measurements to ground-to-ground measurements made possible by GPS (and other space geodetic surveying techniques). This technique overcomes the numerous limitations of terrestrial surveying methods, like the requirement of inter-visibility of survey stations, dependability on weather, difficulties in night observations, etc. These advantages over the conventional techniques, and the



economy of operations made GPS the most promising surveying techniques of the future. With the well established high accuracy achievable with GPS in positioning of points separated by few hundreds of meters to few hundreds of kilometers, this unique surveying techniques has found important applications in diverse fields.

### 3.3. FEATURES OF GPS SATELLITES

Some of the important features of the GPS satellites are as follows.

- Design Life: 5 years (with expendables stored for 7 years).
- On orbit weight: 430 kg.
- End-of-life power: 400 W.
- Power Source: 5m<sup>2</sup> solar arrays tracking the sun and 3 Ni-Cd batteries for eclipse.
- 3 axes established, earth pointing satellites.
- Navigation Payload: Pseudo Random Noise (PRN) signal assembly, atomic frequency standard - cesium beam atomic clocks accurate to 10<sup>-14</sup> sec, processor and L band antenna.
- Codes: (a) Precision (P) Code: Generated at GPS clock frequency of 10.23 MHz (equivalent to 30 m in range) interpolated to sub-meter level. Repeats itself after 267 days, resolution = 100 nanosec. (b) Coarse Acquisition (C/A) Code: Code sequence frequency of 1.23 MHz (range 300 m) interpolated to few m. Repeats itself every 1 millisecc, resolution - 1 micro sec.
- PRN navigation signals on two frequencies.
  - a) 1575.42 MHz - L1 band - wave length 19 cm.
  - b) 1227.6 MHz - L2 band - wave length 24 cm.

### 3.4. PRINCIPLE OF OPERATION

Each GPS satellite carries an atomic clock with stability better than 1 in 10<sup>-14</sup>, which is used to generate dual frequency PRN spread spectrum L band navigation signals. These messages, continuously transmitted by satellite on P



code and C/A code modulated on L1 carrier frequency, contain information of satellite ephemeris and satellite clock error. Remote MSs, located in U.S.A., receive these messages and transfer to MCS, which computes future information to be uploaded and stored in satellite memory for further broadcast. The purpose of code is to identify each satellite uniquely, to enable measurement of signal travel time and selective denial of use to unauthorized users. The users equipment receives navigation messages from at least 4 satellites available above the horizon at any place at any time. Correlation of received code with corresponding code synthesized by receiver allows ground observer to measure transit time of signal from the satellite to the receiver, from which range to satellite can be computed. Simultaneous reception of 4 navigation signals from 4 satellite, containing information of time of transmission of code to 10 nanosec accuracy and satellite position on basis of broadcast ephemeris, enable the observer to form 4 pseudo range (actual range + offset due to user's clock bias) equations. These equations can be solved to get 3 parameters of the observer's position in 3 dimensions i.e. X, Y and Z in earth centered Cartesian Co-ordinates, or equivalently the longitude, latitude and height above ellipsoid, and the receiver clock error.

### **3.5. PRESENT STATUS**

The GPS satellite constellation is now complete, with 24 satellites in operation and the 3 spares being launched. Thus, minimum of 4 (up to 6-8 in most cases) satellites are visible at any time from any place on the earth, to enable the observer to obtain his 3-D position in real time. The selective availability (SA) - intentional degradation of the accuracy of the time and position information being transmitted by the satellite, is presently in operation, which would restrict the accuracy of the absolute position obtained from the satellite to about 100 meters in real time. However, for surveying applications, by getting the precise position of the GPS satellite from tracking data, it is possible to improve this accuracy in post-processing mode to at least few cm. The anti spoofing (AS) denial of P code



to the international users, has also been made operational, however, its effect on the accuracy of positioning in post processing mode is not significant.

### 3.6. LASER TRACK

The tripod mounted Lasertrack™ instrument, located on fixed reference points, is designed to provide fast, accurate and logistically simple positioning of dynamic vessels and barges. Other application includes hydrographic surveying of lakes and rivers. Lasertrack™ is an electronic instrument, which measures distances by timing the passage of a light pulse fired at a target. Angles are measured by optical encodes and elevation by electrolytic liquid level and /or optical encoders.

**Technical Data:** The instrument is constructed of machined aluminum and house in a water and dust proof jacket.

#### Laser

Type	:	Semiconductor
Accuracy	:	± 20cm
Measuring time	:	0.5 seconds

#### Vertical Angle

Type	:	Automatic Electrolytic Sensor
Accuracy	:	0.25°
Resolution	:	0.01°
Range	:	± 40°

#### Horizontal angle

Type	:	Encoder
Accuracy	:	0.01°
Range:	:	0° to 360°



## 4.0. RESULT AND INTERPRETATION

The Ministry of Environment & Forests, Government of India has declared the stretches of seas, bays, estuaries, creeks, rivers and backwaters which are influenced by tidal action (in the landward side) up to 500 metres, in case of the open sea and minimum 100 meters in the estuaries, rivers creeks, and back waters from High Tide Line (HTL) and the land between the Low Tide Line (LTL) and the High Tide Line as Coastal Regulation Zone; and imposes with effect from the date of the notification, the restrictions on setting up and expansion of industries, operations or processes etc; in the said Coastal Regulation Zone (CRZ). However, construction of pipeline is permitted within the Coastal Regulatory Zone as per the CRZ Notification and its subsequent amendments. For the purpose of this notification the high tide line means the line on the land up to which the highest water line reaches during the spring tide. As used here, the word highest water line reaches during the spring tide refers to the mean high water spring (19 years average of spring high waters) that is the regular water level changes caused by changes in the relative position of sun, moon and earth. A key component of the coastal regulation zone are setbacks measured from the high tide line through which coastal development is regulated in a protected zone contiguous to HTL. These setback lines are referenced to HTL and act as a buffer zones between the ocean land and upland property. Thus the precision is required in delineating the high tide line which forms the base to define the setback.

The HTL was demarcated as per the procedure given in the draft manual prepared by the authorized agencies appointed by MOEF and instructions to US Coast and Geodetic Survey guideline to their topographic field parties was also used in this project work. Accordingly the HTL was demarcated by physical survey. The horizontal position of HTL, associated with wave run up at preceding high tides and forming geomorphic features and the features such as boundary





of perennial natural terrestrial vegetation, flotsam, and drift wood have been considered. The identification of these markings enabled a reasonably accurate assessment of High Tide Line. Survey data were acquired with range and azimuth system. The operational survey accuracy is about  $\pm 20$  cm.

On demarcation of high tide line the plan annexed to this report was prepared in the scale of 1:4000. Measurements were made in metres and decimeters. But considering that the accuracy of the survey which is  $\pm 1.5$ m the measurement in decimeters were rounded to the nearest metres.

### **Location of Plot**

The plot surveyed are bearing revenue survey No. 275 (pt.) village Kanjur Taluka Kurla and the corresponding CTS Nos. 657(A) (pt.) and 1295 (pt.) of village Kanjur taluka Mulund Mumbai Suburban District and geographically located around Lat.  $19^{\circ}07'30''$  Long.  $72^{\circ}56'03''$  abutting the Eastern Express Highway and Jogeswari-Vikhroli link road. This urban land is leased by the Government of Maharashtra.

### **Terrain features and drainage**

The plot is bounded by the well developed and planned road on East, West, North and South side. The main tidal exchange to the sub-creeklet of Thane creek is short, narrow, very shallow and through a 7.5 m wide constructed canal in the north west (Plate-2) and 8 – 12 m wide Nalla abutting the stretch of Eastern Express Highway (Plate-1) and shown as blue in the plan (Fig.2). These tidal canal Nalla/ stream traverses through the edge of the plot, following the almost flat topography. The banks of these water bodies are covered with the wild vegetation. Water circulation in these water bodies is driven by the waste water discharged and the tidal flow. The tide in Thane creek is mixed and predominantly semi diurnal. The waste water from the settlement area is directly



discharge into these water bodies and the water bodies (canal, Nalla/ stream) act as a carrier of open disposal of liquid waste. The plot area falls within the coastal plains and gently sloping down from north to south and west to east.

During the high tide the tidal excursion is up to the head of the creeklet joining the eastern express highway and the Jogeswari Vikroli link road. Tidal excursion along the plot is through small culverts (Plate-3) constructed for maintaining the water discharge. It appears that waste water discharge is many more time than the tidal flow. The hydrodynamic regime is confined to the canal and the Nalla/ stream orientating NE-SW direction does not have any impact on the morphology of the area. The banks of Nalla/ stream abutting the Eastern Express Highway are low and occasionally distinguished by sparse and small stretch of mangrove swamps measuring less than 1000 sq mtrs in area (Plates-3 & 4).

### Tides

Tides are semi diurnal in nature and have a range of about 4 mtrs at Trombay. Various tide levels at Apollo Bundar and Trombay are tabulated below:

Tidal station	Mean Low water spring	Mean Low water neap	Mean sea level	Mean high water neap	Mean high water spring
Apollo bundar	+ 0.76	+ 1.86	+ 2.51	+ 3.30	+ 4.42
Trombay	+ 0.68	+ 1.70	+ 2.52	+ 3.35	+ 4.37

The following conclusions were drawn through the perception and judgment of the team of NIO carrying out the CRZ mapping. Factors considered to make decisions are placed below.



- That the physical demarcation of HTL and CRZ boundaries relevant to the project site was carried out during August 2004.
- That the plot boundaries were shown by the representative of Metro Infrastructure and Project Solutions and has been confirmed through city survey map supplied by sponsor.
- That the plot area falls in Development Plan Sheet No. E16 & 17 of Mumbai Municipal Corporation index plan for eastern and western suburbs.
- That the existing approved CZMP plan of Government of Maharashtra was referred for the preparation of this report.
- That the surroundings of plot area is populated and developed urban area.
- That the onshore development has existed in this vicinity for several decades.
- That the item XIII of approved CZMP of Maharashtra State, states that mangroves with an area of 1000 square metres or more would be classified CRZ I.
- That the High Tide Line on the NW and SW of the plot is bounded by masonry wall of the canal (shown as blue in the map Fig.2). The tidal oscillation takes place along these wall (Plate-2).
- That on the east, the High Tide Line is bounded by the bank of Nalla/ stream along the Eastern Express Highway (shown as blue in the map Fig.2) (Plate-1).
- That the development work will not alter the topography of the land surface and thus will not interfere with the drainage from the upland or creek let sources.
- The plot area is located about 2500 m away from the western bank of Thane creek.



- That the main tidal excursion is taking place along the eastern side of the Eastern Express Highway which is 2500 m away from the main body of Thane creek.
- That the water of canal and Nalla/ stream is heavily contaminated.
- That the plot area is a low lying area, some portion of it holding back the drainage water from the high land during the monsoon time.
- That the uppermost layer of sediment is a consolidated or partially consolidated muddy sediment.
- Fine grained sediment originated from the drainage input are deposited/ depositing over this plot. Thus the plot area is having continuously an accretional environment responsible for bed elevation of the plot.
- That about 90% of plot area is cultivated with grass land and the plot is surrounded by roads all four sides (Plates- 3,5 & 6).
- That the present soil component reported in the plot area is within the limits of standard values of garden soil of the coastal area (Report of (BSIP).
- The amount of water exchange during flooding and draw down cycle is very less. In fact the discharge water brought from the settlement area is playing more dominant role than the tidal flow.
- The High Tide Line is limited within the canal on the west of the plot and the Nalla/ stream located east of the plot area (Plates 1 & 2).
- The proposed development site does not fall or contain the following environmentally sensitive ecologically fragile areas:

National park sanctuaries.

Mangroves.

Coral or coral reefs.

Area rich in genetic diversity.

Presence of sand dunes.

Low lying area may be affected by the sea level rise due to green house effects.



- That this land is reserved for district commercial and industrial zone including flower market.
- That the land is leased out by Government of Maharashtra.
- That the development site does not show the signatures of reclamation.
- That the existing land does not fall within the inter tidal zone criteria.



## 5.0. SUMMARY AND CONCLUSIONS

The following conclusions were drawn based on the précised policy, practice and procedure of MoEF when ever there was ambiguity, perception and judgment of the team of NIO carrying out the CRZ mapping prevailed:

- Although the existing main tidal excursion is taking place up to the eastern edge of Eastern Express Highway but for meeting the requirement of MoEF within the meaning of CRZ notification, the drainage canal in the west and Nalla/ stream in the east were considered as tidal water body (Plates-1 & 2).
- The constructed banks of canal and the well marked bank of Nalla was accepted as the high tide line marker and used for its demarcation (Plates-1 & 2).
- Based on the demarcation of relevant High Tide Line, set back lines varying 8 to 12 m equivalent to a width of Nalla located on the east abutting the Eastern Express Highway and 7.5 m across the canal (Nalla) located on the west, were measured from the High Tide Line and marked on the map (Fig.2) annexed to this report.
- Buffer zone of 50 m around mangrove and marshy saline soil (wetland) (Plates-3,4 & 7) area along HTL of Eastern Nalla is also delineated and presented in Fig. 2 of this report. Buffer zone around mangroves area located at the junction of Eastern Express Highway and Jogeshwari-Vikhroli link road was not considered for demarcation as per the item (VI) of the MoEF notification No. J17011/8/95-IA III dated January 19, 2000.
- The CRZ boundary of 100 metres, which is a landward boundary of the Coastal Regulation Zone, measured from the High Tide Line and marked with red colour, indicates that this part of the development site falls within the ambience of CRZ legislation defined by MoEF (Fig.2).



- The plot area does not fall or contain the environmentally sensitive and ecologically fragile area as specified in the Coastal Regulation Zone Notification.
- The existing land does not fall within the inter tidal zone criteria.
- Presently about 90% plot area is a cultivated grassland (Plates-5,6 & 3) and the plot is surrounded by developed roads on all four sides. Based on this fact combining with physical demarcation and the information collected on the topography, morphology, land use, physical features of land, and the nature of soil indicate that the plot area bearing the revenue survey No 275 (pt.) of village Kanjur, corresponding CTS Nos. 657(A) (pt.) and 1295 (pt.) of village Kanjur taluka Mulund Mumbai Suburban District, within the meaning of CRZ notification fulfills the criteria to be designated as CRZ II.



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**Plate-1**



Photograph showing the Nalla/stream supporting HTL on the Eastern part of the property.

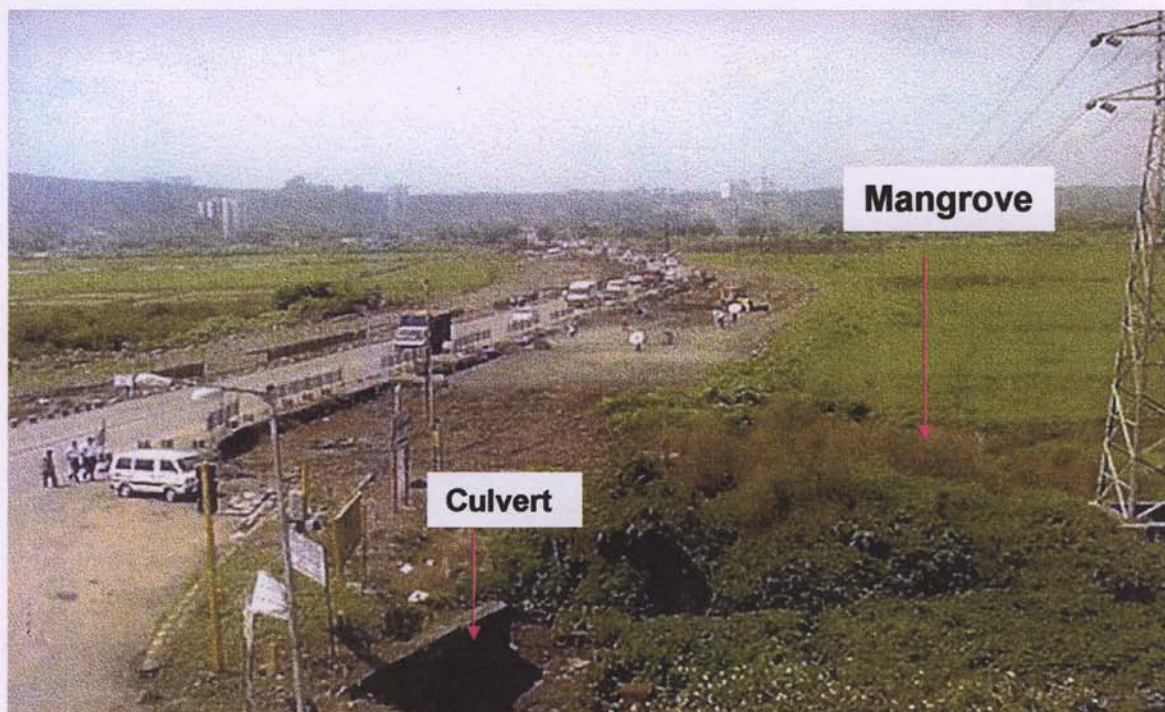
**Plate-2**



Photograph showing the canal supporting HTL at the western end of the property.



**Plate-3**



Photograph showing the tidal exchange through culvert, mangroves and the development around the property.

**Plate-4**



Photograph showing the Nalla/Stream supporting the HTL and mangroves on the eastern side of property.



**Plate-5**

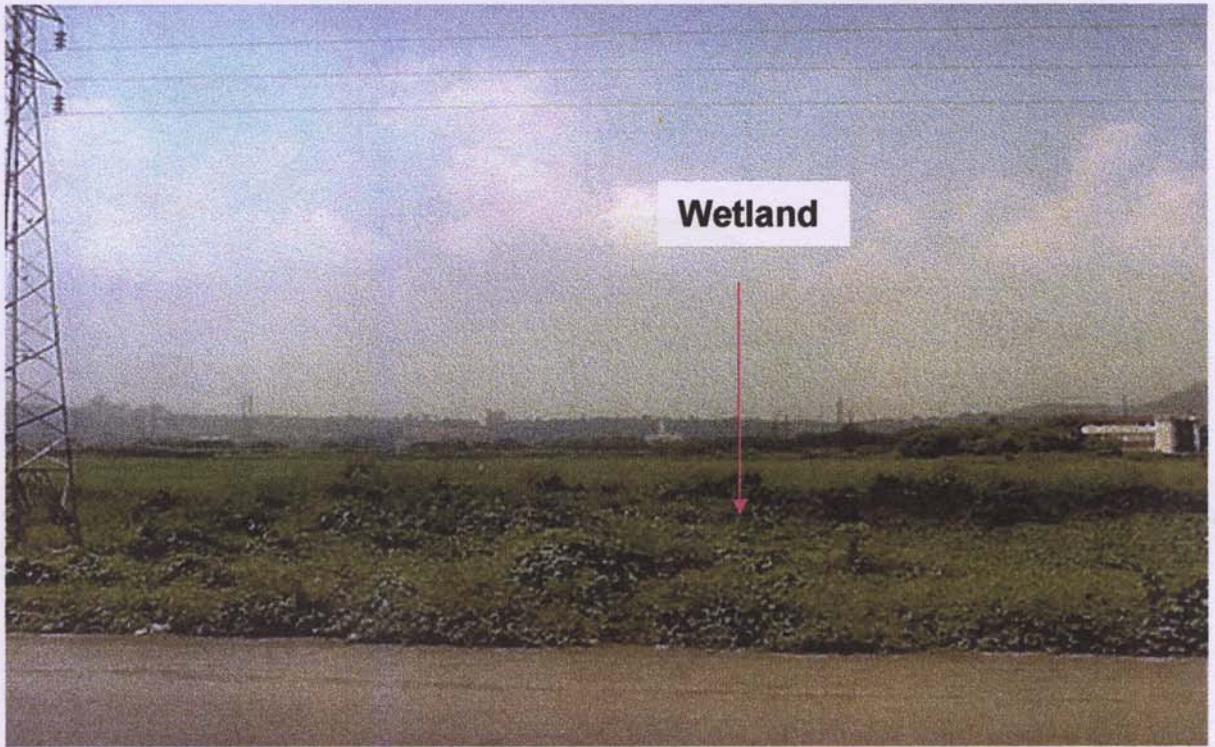


Photograph showing fodder grass cultivation and the soil condition within the property area.

**Plate-6**



Photograph showing the land use and soil condition within the property area.



Photograph showing the wetland vegetation along the HTL and eastern side of the property.



MAP SHOWING THE NOTIONAL LOCATION OF THE AREA (Fig. 1)





19 °08'00"

2116750mN

2116500mN

211683649"

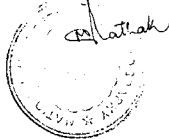
2116000mN

2115750mN

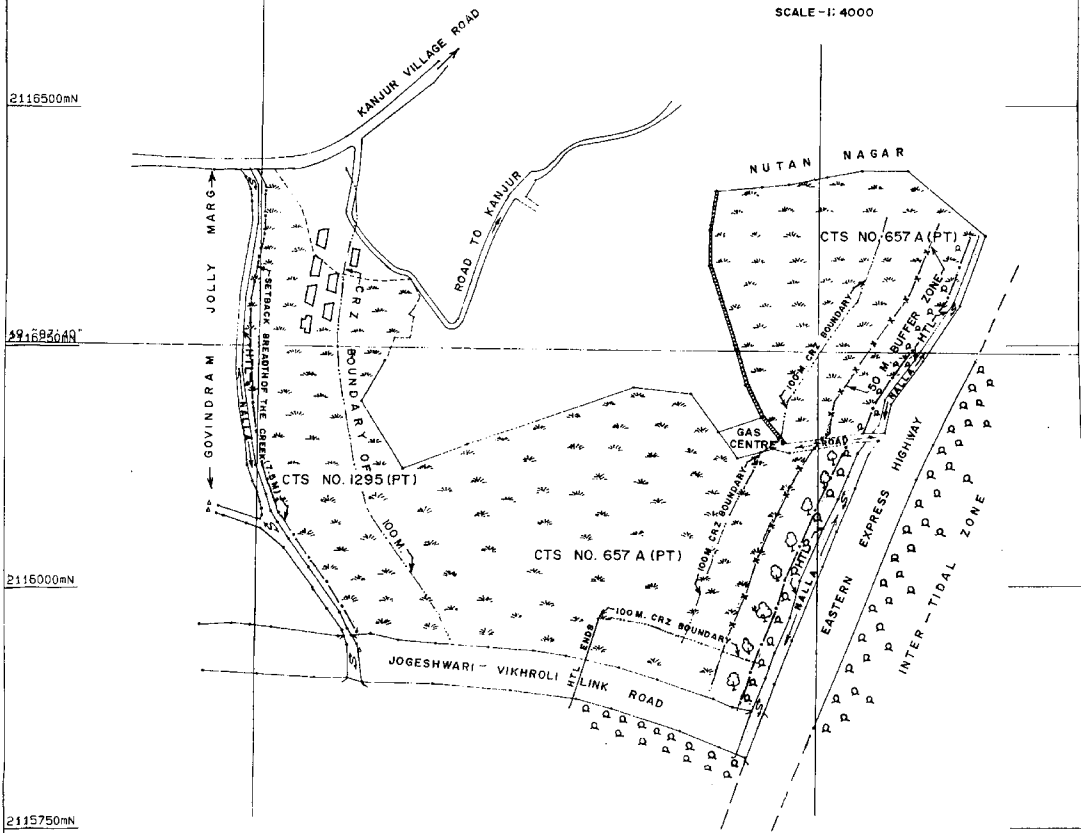
19 °07'20"

2115500mN

*certified copy*



**INDIA WEST COAST**  
**MUMBAI (KANJURMARG)**  
 NATIONAL INSTITUTE OF OCEANOGRAPHY  
 (Council of Scientific & Industrial Research)  
 DONA PAULA-GOIA, INDIA  
 DELINEATION OF HIGH TIDE LINE  
 FOR  
 METRO INFRASTRUCTURE & PROJECT SOLUTION  
 PVT. LTD. MUMBAI  
 SURVEY SEASON: SEPT. 2004  
 SPHERIOD: WGS-84, CENTRAL MERIDIAN: 75°  
 PROJECTION UNIVERSAL TRANSVERSE MERCATOR  
 SCALE-1: 4000



**MEMOIR**

1. ELECTRONIC POSITIONING SYSTEM LASERTRACK & DGPS WAS USED FOR DELINEATION OF HTL
2. THE POSITIONS OF HIGH TIDE LINE WERE OBTAINED BY PHYSICALY WALKING OVER THE AREA
3. THE SYMBOLS AND ABBREVIATIONS ARE USED AS PER THE NHO PUBLICATION FOR THE INDIAN CHART NO. 5020
4. SETBACK LINES ARE DRAWN PARALLEL TO THE HTL
5. SEE REPORT ON DEMARCATION OF HTL AND CRZ BOUNDARIES ALONG THE LAND BEARING REVENUE NO. 275 CTS NO. 657(A) & 1295

**LEGEND**

- WALL
- GRASS
- MANGROVE
- BUSH
- 100 M. CRZ BOUNDARY
- STRUCTURE
- 50 M. BUFFER ZONE
- HIGH TIDE LINE (HTL)
- SETBACK BREADTH OF THE CREEK
- FLOW PATTERN

<b>NATIONAL INSTITUTE OF OCEANOGRAPHY</b> (Council of Scientific & Industrial Research) DONA PAULA-GOIA INDIA				
<b>METRO INFRASTRUCTURE &amp; PROJECT SOLUTION PVT. LTD., MUMBAI</b>				
DEMARCATION OF HIGH TIDE LINE AND CRZ BOUNDARY AT MUMBAI KANJURMARG CTS NO. 1295 (PT), 657A (PT)				
SPHERIOD WGS 84 CENTRAL MERIDIAN: 75° PROJECTION UNIVERSAL TRANSVERSE MERCATOR SCALE - 1:4000				
SURVEY SEASON: SEPT. 2004				
PROJECT NO.	DRAWING NO.	PREPARED BY	CHECKED BY	APPROVED BY
SBP 1535	FIG. 0.2	KCP, PG DKN, 07	MCP, KLK	NCP

2115500mN

72 °56'00"

2115500mN

2115500mN

72 °56'20"

2115500mN