# HTL, LTL AND COASTAL REGULATION ZONE FOR THE PROPOSED CONSTRUCTION OF JETTY FOR THE INDIAN COAST GUARD AT COCHIN PORT, ERNAKULAM

(As per CRZ Notification 2011)

*Prepared for*

**M/s. COCHIN PORT TRUST, GOVT. OF INDIA**


**NATIONAL CENTRE FOR EARTH SCIENCE STUDIES**

**Ministry of Earth Sciences, Government of India**

**Thiruvananthapuram - 695 011, Kerala**



**APRIL 2016**

# HTL, LTL AND COASTAL REGULATION ZONE FOR THE PROPOSED CONSTRUCTION OF JETTY FOR THE INDIAN COAST GUARD AT COCHIN PORT, ERNAKULAM

(As per CRZ Notification 2011)

*Prepared for*

**M/s. COCHIN PORT TRUST, GOVT. OF INDIA**

**NATIONAL CENTRE FOR EARTH SCIENCE STUDIES**
**Ministry of Earth Sciences, Government of India**
**Thiruvananthapuram - 695011**

**April 2016**

**NATIONAL CENTRE FOR EARTH SCIENCE STUDIES, THIRUVANANTHAPURAM**

**DOCUMENTATION PAGE**

| | |
|---|---|
| 1. REPORT NUMBER | NCESS-CRZ-06-2016 |
| 2. TYPE OF REPORT | CRZ STATUS REPORT |
| 3. TITLE | **HTL, LTL AND COASTAL REGULATION ZONE FOR THE PROPOSED CONSTRUCTION OF JETTY FOR INDIAN COAST GUARD AT COCHIN PORT, ERNAKULAM** |
| 4. INVESTIGATOR<br>VETTING COMMITTEE<br>MONITORING COMMITTEE<br>PROJECT STAFF | Dr. K.K.RAMACHANDRAN<br>D.RAJU, M. RAMESH KUMAR, S.MOHANAN<br>Dr. T.N.PRAKASH, Dr. K.K.RAMACHANDRAN,<br>Dr. D.S.SURESH BABU<br>Dr. M. RAMESHAN, T.J. ARUN |
| 5. KEY WORDS | Coastal Regulation Zone (CRZ), CRZ Notification (1991 and 2011), Cadastral map, Embankments, land use, High Tide Line (HTL), Low Tide Line (LTL), CRZ IA, CRZ IB, CRZ II, CRZ IVA, CRZ IVB and Coastal Zone Management Plan (CZMP). |
| 6. ABSTRACT | M/s. Cochin Port, Govt. of India requested to provide CRZ Status Report and maps to facilitate CRZ clearance for the proposed construction of jetty for the Indian Coast Guard in Survey No. 560 of Kochi Corporation at Cochin Port. The CRZ map is prepared in 1:4000 scale cadastral base maps with survey plot information. The proposed site is under CRZ and covered in Map No. 34 of the Coastal Zone Management Plan (CZMP, 1995) of Kerala. Since the project site is along the banks of tidal influenced waterbody, the CRZ is 100m landward of HTL along Vembanad estuary and the width of the canal along the Eraveli canal, which is on the immediate north of the proposed site. Ecologically sensitive mangrove ecosystems to be categorized as CRZ IA are absent in the immediate vicinity of the project sites. The inter-tidal zones between HTL and LTL are CRZ IB. The tidal influenced waterbody and its bed are CRZ IVB. Since the locality of the project site belongs to developed areas of Kochi Corporation, the CRZ landward of the High Tide Line is CRZ II as per the approved CZMP of 1996. Layout of the proposed site for the construction (as provided by the project proponent) is superimposed in the CRZ Map. As per CRZ Notification (2011) Para 4, Sub-para i(f) 'construction and operation for ports and harbours, jetties, wharves, quays, slipways, ship construction yards, breakwaters, groynes, erosion control measures are permissible activities'. Further, such activities proposed shall require clearance from MoEF as per Para 4, Sub-para ii (b). |
| 7. DISTRIBUTION STATEMENT | NOT FOR CIRCULATION |
| 8. PROJECT PROPONENT | **M/s. COCHIN PORT TRUST, GOVT. OF INDIA** |

# CONTENTS



**LIST OF TABLES AND FIGURES**



**PLATES**

# HTL, LTL AND COASTAL REGULATION ZONE FOR THE PROPOSED CONSTRUCTION OF JETTY FOR THE INDIAN COAST GUARD AT COCHIN PORT, ERNAKULAM

## 1.0 Introduction

M/s. Cochin Port Trust, Govt. of India requested National Centre for Earth Science Studies (NCESS) Thiruvananthapuram, an agency authorized by Govt. of India to facilitate CRZ clearance for the proposed jetty construction for Indian Coast Guard at Cochin Port in Kochi Corporation, Ernakulam District. The NCESS has taken up the preparation of CRZ Status Report by demarcating the High Tide Line (HTL), Low Tide Line (LTL) and coastal morphologies for the proposed construction site. The proposed site is in CRZ as per the Coastal Zone Management Plan of Kerala (CZMP, 1995) and is given in Map No. 34. The CZMP (1995) demarcates HTL, LTL and CRZ in 1:12500 scale. However, the MoEF (1999) directed the project proponents to get CRZ maps prepared in cadastral scale for the project area so that more details are made available. The CRZ Notification, 2011 also directs to prepare local level CZM/CRZ maps using cadastral maps in 1:3960 or nearest scale as the base map to facilitate implementation of Coastal Zone Management Plans. Accordingly, the CRZ map is prepared in cadastral scale based on field investigations carried out during the months of March 2016. The CZMP (1995) of the area has also been referred for the above purpose. Since the site is being on the banks of Vembanad estuary, the regulated development activities as provided in the Coastal Regulation Zone (CRZ) Notification, 2011 are applicable.

## 2.0 Objective

The objectives of the study is to demarcate the HTL, LTL and CRZ categories and to prepare CRZ status reports and maps (as per CRZ Notification 2011) in cadastral scale for the site proposed for construction of jetty for Indian Coast Guard at Cochin Port, Kochi Corporation.

## 3.0 Location

The proposed site for construction of jetty is in Survey No. 560 of Kochi Corporation, Ernakulam District. The site is located between 09° 58' 02.17" N to 09° 58' 06" N Latitude and 76° 15' 09.8" E to 76° 15' 17" E Longitude (Fig.1).

## 4.0 *Coastal Regulation Zone (CRZ)*

All developmental activities in the CRZ are regulated through the CRZ Notification (MoEF, 2011). The Government of India Notification [S.O.19 (E) dated 6.1.2011] under Section 3(1) and Section 3(2)(v) of the Environment (Protection) Act, 1986 and Rule 5(3)(d) of Environment (Protection) Rules, 1986 has redefined the CRZ. Accordingly the CRZ has been declared as 'the coastal stretches of the country and the water area up to its territorial water limit' (MoEF, 2011). The CRZ consists of:

1. Land area from the High Tide Line (HTL) to 500 m on the landward side along the sea front.
2. Land area between the HTL to 100 m or width of the creek whichever is less on the landward side along the tidal influenced water bodies that are connected to the sea and the distance up to which development along such tidal influenced water bodies is to be regulated shall be governed by the distance up to which tidal effects are experienced which is determined based on salinity concentration of 5 parts per thousand (ppt) measured during the driest period of the year and distance up to which tidal effects are experienced should be clearly identified and demarcated accordingly in the Coastal Zone Management Plans (CZMPs). Tidal influenced water bodies mean the water bodies influenced by tidal effects from sea, in the bays, estuaries, rivers, creeks, backwaters, lagoons, ponds connected to the sea or creeks and the like.
3. Land area falling between the hazard line and 500 m from HTL on the landward side, in case of seafront and between the hazard line and 100 m line in case of tidal influenced water body. The word 'hazard line' denotes the line demarcated by Ministry of Environment and Forests (MoEF) through the Survey of India (SoI) taking into account tides, waves, sea level rise and shoreline changes.
4. Land area between HTL and Low Tide Line (LTL), which will be termed as the inter-tidal zone.
5. Water and the bed area between the LTL to the territorial water limit (12 nm) in case of sea and the water and the bed area between LTL at the bank to the LTL on the opposite side of the bank, of tidal influenced water bodies.

The CRZ Notification (MoEF 2011) categorizes Coastal Regulation Zones as CRZ I,

CRZ II, CRZ III and CRZ IV based on whether the area is ecologically sensitive, developed, undeveloped or waterbody and its bed. Ecologically sensitive and important areas are CRZ IA and the intertidal zone is CRZ IB. Major CRZ IA categories include the mangroves, corals, coral reef and its associated biodiversity, sand dunes, Protected Areas and National Parks, biologically active mudflats, salt marshes, turtle nesting grounds, horse shoe crab habitat, seagrass bed, nesting ground of birds, areas of archaeological importance and heritage sites. The areas that have already been developed up to or close to the shoreline and where the built up area is more than 50% are categorized as CRZ II. Rural/undeveloped areas that are relatively undisturbed belong to CRZ III. The water area and the bed constitute CRZ IV.

In view of the unique coastal systems of backwater and backwater islands along with space limitation present in the coastal stretches of the state of Kerala, the CRZ (on the landward side) in the islands within the backwaters have been defined as 50 m from the High Tide Line on the landward side (MoEF 2011). The CRZ Notification of 2011 has also defined Critical Vulnerable Coastal Areas (CVCA), which includes Sunderbans, and other identified ecological sensitive areas in which 'Vembanad in Kerala' is also included.

The Ministry of Environment & Forests, Govt. of India has issued the new CRZ Notification in January 2011 (CRZ 2011) in supersession of CRZ 1991 except as respects things done or omitted to be done before such supersession.

## 5.0 CRZ for the State of Kerala

Coastal Zone Management Plan (CZMP) of Kerala was approved by Ministry of Environment and Forests in the year 1996. The CZMP has areas covered under CRZ-I, CRZ-II and CRZ-III. The then CRZ IV (Andamans and Lakshadweep and small islands) was absent in Kerala. CRZ notification, 2011 was issued in January 2011 in supersession of CRZ notification, 1991 (except as respects things done or omitted to be done before such supersession).

The CRZ Notification 2011 categorizes areas that are ecologically sensitive identified based on the geomorphological features (which play a role in the maintaining the integrity of the coast) such as mangroves, corals, coral reef, its associated biodiversity, sand dunes, Protected Areas, National Parks, mudflats which are biologically active,

salt marshes, turtle nesting grounds, horseshoe crab habitat, seagrass bed, nesting grounds of birds, areas of archaeological importance and heritage sites as CRZ IA. Among these, mudflats, salt marshes, turtle nesting grounds, horseshoe crab habitat, seagrass bed and nesting ground of birds are newly introduced under CRZ IA as per CRZ Notification 2011. The intertidal zone is now CRZ IB (It was CRZ I (ii) as per CRZ 1991). The CRZ, except those categorized as CRZ I, within in the Municipal Corporations and Municipal Councils (Notified urban local bodies) which are 'developed' are categorized as CRZ II while those in Gramapanchayats, being undeveloped, have been categorized as CRZ III. The categories CRZ II and III remain the same in CRZ 2011. CRZ IV is now water and the bed area between the LTL to the territorial water limit (12 nm) in the case of sea (CRZ IV A) and the water and the bed area between LTL at the bank to the LTL on the opposite side of the bank, of tidal influenced water bodies (CRZ IV B).

Though the CRZ Notification 2011 is effective since 6$^{th}$ January 2011, the Coastal Zone Management Plan (CZMP, 1995) approved in 1996 remains valid till a new CZMP is approved based on the guidelines issued under CRZ Notification 2011. The CRZ III has a No Development Zone (NDZ), which extends upto 200 m landward of the HTL by the sea. CRZ 2011 declares the land area from High Tide Line (HTL) to 500mts on the landward side along the sea front and the land area between HTL to 100 mts or width of the creek whichever is less on the landward side along the tidal influenced water bodies as under CRZ. When 'Hazard line', as defined in CRZ 2011, is provided by MoEF, the landward extent of CRZ could change according to the position of hazard line.

In view of the unique coastal systems of backwater and backwater islands in the coastal stretches of the State of Kerala where in traditional community find itself in difficulty for construction of dwelling units, the CRZ Notification 2011 declares that all the islands in the backwaters shall have 50mts width from the High Tide Line on the landward side as the CRZ area. The CRZ Notification of 2011 has also defined Vembanad as Critical Vulnerable Coastal Areas (CVCA).

## 6.0 Approach

Coastal geomorphology and ecosystems of the proposed area has been studied using Survey of India toposheets and very high resolution satellite images (World View - 2). Toposheets and satellite images came handy in capturing diverse coastal ecosystems in the proposed area as baseline information prior to field investigations. The CZMP (1996) of the State was referred to ascertain applicability of site-specific coastal regulation criteria.

Cadastral maps in 1:4000 scale have been used as the base map. Field investigation was conducted to capture the ground details. Collateral cadastral features-unambiguous locations identifiable both on the ground and in the cadastral maps, such as survey plot boundary junctions, survey stones, canal crossing, etc. are used as ground control points (GCP). Cadastral maps were georeferenced with precision geo-coordinates measured using GPS at pre-identified GCPs to collate spatial data onto a GIS platform. Planimetric standards were met to maintain accuracy of measurements. UTM projection on to WGS 84 datum has been adopted for appropriate GIS composition.

The HTL and LTL were located with respect to survey plots. The HTL and CRZ boundaries are re-locatable in the field with respect to survey plots keeping desirable positional accuracy since mapping is done in the cadastral base.

The following elements form the general approach of the study:

- To prepare the CRZ map delineating HTL and LTL in cadastral scale.
- To verify the proposed site based on CZMP of the State (CZMP, 1995) and identify CRZ areas.
- To gather information on status of eco-systems (such as mangroves, tidal flats, etc.) in the proposed development site and its vicinity.
- To observe and record physical signatures for identifying HTL and map the distance to HTL with respect to survey plots.

### 6.1. Data source

Different sets of data were used for compilation of the final map and preparation of the CRZ report. The principal data sources are listed below:

1. Survey of India Toposheets
2. Very high resolution satellite imagery (World View -2)
3. Timeline google images of the area
4. Cadastral maps
5. CZMP maps
6. Field mapping

### 6.2. Influence of tidal action

The Coastal Zone Regulations are applicable to the seacoasts and banks of water bodies influenced by tidal action. Therefore tidal range is an important parameter that decides the extent of CRZ along rivers and backwaters. It also determines the reach of the 'highest water line during the spring tide. Kochi coast has micro-tidal environment with tidal range varying from 0.2m to 0.9m. Tidal range data with respect to Chart Datum pertaining to Kochi area (Naval Hydrographic Chart No.2004) as provided by Naval Hydrographic Office, Dehra Dun is given below:

Table 1. Tide data with respect to Chart Datum pertaining to Kochi

| Tide at Kochi | Height (m) |
|---|---|
| Mean High Water Spring | 1.20 |
| Mean High Water Neap | 0.80 |
| Mean Sea Level | 0.60 |
| Mean Low Water Neap | 0.60 |
| Mean Low Water Spring | 0.30 |

The distance up to which development along bays, estuaries, creeks and backwaters is regulated under CRZ depends on the landward extent of tidal influence. The distance up to which tidal influence is experienced is fixed based on salinity concentration of 5 parts per thousand (ppt) as per MoEF 2011.

## 7.0 Identification of HTL and CRZ

Coastal Regulation Zone Notification defines High Tide Line as "the line on the land upto which the highest waterline reaches during the spring tide". The sea level thus formed due to the combined effect of spring tide and wave set up gives the line of maximum reach of water on the land. The conventional definition of lowest low water level and the resultant low water line during spring tide has been taken as the Low Tide Line (LTL).

### 7.1. Field investigation

The MoEF guidelines (MoEF, 2011) stipulate that the HTL/LTL be identified based on coastal geomorphologic signatures in the field/satellite imageries/aerial photographs. Therefore, delineation of the HTL and LTL and identification of Coastal Regulation Zones for the site were carried out based on geomorphic signatures.

Field investigation was carried out during the month of March 2016. Local level (cadastral) map of 1:4000 scale pertaining to the project site was used as base map. The configuration of HTL/LTL was plotted with respect to the survey plots. DISTOPRO laser meter along with a Brunton compass and Trimble Juno SB GPS were used for field mapping. An appraisal of existing land use/landform in the project area was carried out to identify the occurrence of ecologically sensitive and important areas eligible to be categorized as CRZ IA. The CZMP (1995) of the State and CRZ Notification, 2011 were referred to in addition to the landuse for demarcating the CRZ categories.

### 7.2. Landuse

A detailed appraisal of the ecosystems and existing landuse in the project area was carried out to help the categorization of the regulation zones pertaining to sensitive and important coastal ecosystems. Survey of India topographic maps and very high resolution satellite imageries (World View - 2) of the area were also used for the same whenever required. Geomorphic features and other signatures such as berm crests, seawalls, embankments and inter tidal zones have been used to identify the HTL during field investigation.

The site proposed for the construction of a jetty for the Indian Coast Guard is on the

banks of Vembanad estuary. Eraveli canal starts immediate north of the project site. Adjoining areas of the proposed site has been occupied by human settlements. An old workshop and boat landing jetty exist in the proposed site.

## 8.0 Coastal Regulation Zone for the project site

The area proposed for the construction of jetty is along the banks of tidal influenced Vembanad estuary having a width of more than 100m and the CRZ of the area is 100m landward of the High Tide Line along the estuary and width of the tidal influenced waterbody along Eraveli canal. Since the project area is in Kochi Corporation, the provisions and regulations of CRZ Notification, 2011 are applicable landward of the existing authorized structures such as buildings and roads, provided that those structures exists prior to the date of CRZ Notification, 1991 (CRZ Notification, 1991, 2011). The land area between HTL and LTL, the tidal influenced waterbody and its beds are also included under CRZ. There are no critical and vulnerable ecosystems in the immediate vicinity of the project site to be categorized as CRZ IA.

### 8.1. High Tide Line and Low Tide Line

The distinct line of embankments and the geomorphic signatures depicting highest high tide level is considered as the High Tide Line along the estuary and tidal influenced waterbody. The Low Tide Line is the lowest low water level resulting from the low water line during the lowest spring tide. In some part of the river, the water level during different tide conditions are confined to the vertical plane of the embankments and therefore the LTL and HTL remain the same in a spatial frame.

### 8.2. CRZ Categories

The proposed jetty construction is in the developed areas of Kochi Corporation, the CRZ landward of the High Tide Line is CRZ II. The details are shown in the CRZ map (Figure 2). There are no ecologically sensitive mangroves ecosystems present in the vicinity of the project site to be categorized as CRZ IA. The inter-tidal zones (between HTL and LTL) are CRZ IB. The waterbody and its bed in the tidal influenced waterbody is CRZ IVB. The CRZ categories 7km around the proposed project site is given in figure 3.

## 9.0 Summary and Recommendation

- The High Tide Line, Low Tide Line and CRZ mapping in the vicinity of the proposed site for the construction of jetty for Indian Coast Guard in survey no. 560 of Kochi Corporation at Cochin Port was carried out on cadastral maps having a scale of 1:4000.
- The distinct line of embankments and other relevant geomorphic signatures depicting highest high tide level is considered as the High Tide Line in the case of Vembanad estuary and tidal influenced Eraveli canal.
- The CRZ categories were identified based on field investigation and CZMP of the state.
- The project site is on the banks of Vembanad estuary having a width of more than 100m and the CRZ is 100m landward of High Tide Line. The CRZ landward of HTL along Eraveli canal is the width of the waterbody on either side.
- The ecologically sensitive mangrove ecosystems to be categorized as CRZ IA are absent in the site or in the immediate vicinity of the project site.
- Inter tidal zones are categorized as CRZ IB.
- Since the locality of the project site belongs to developed urban areas of Kochi Corporation, the CRZ landward of the High Tide Line is CRZ II.
- The Layout of the proposed construction of jetty as provided by the project proponent is superimposed in the CRZ Map.
- As per CRZ Notification 2011 Para 4, Sub-para i(f) 'construction and operation for ports and harbours, jetties, wharves, quays, slipways, ship construction yards, breakwaters, groynes, erosion control measures are permissible activities'. Further such activities proposed shall require clearance from MoEF as per Para 4, Sub-para ii (b).

## REFERENCES


MoEF, 1991. Notification No.S.0114 dated 19th February, 1991, Ministry of Environment and Forests, Government of India, New Delhi.

CZMP, 1996. Coastal Zone Management Plan of Kerala, 1995. Dept. of Science Technology and Environment, Government of Kerala, 77p.

MoEF, 1996. Letter No. J-17011/23/92-1A III dated 27th September 1996 to the Chief Secretary, Govt. of Kerala. Ministry of Environment and Forests, Government of India, New Delhi.

MoEF, 1999. Letter No.J.17011/8/92-1A III dated 4 January 1999 to the Chief Secretary of Coastal States. Ministry of Environment and Forests, Government of India, New Delhi.

MoEF, 2011. Notification No. S.O.19 (E) dated 6.1.2011, Ministry of Environment and Forests, Government of India, New Delhi.

NHO, 2000. Hydrographic chart No. 2004 - Naval Hydrographic Office, Dehra Dun.

## PLATES

Plate 1. Proposed site for jetty Construction

Plate 2. Existing workshop and boat yard

Plate 3. Eraveli canal with distinct embankment


Plate 4. The existing township and human settlement along the western margin of the project site.

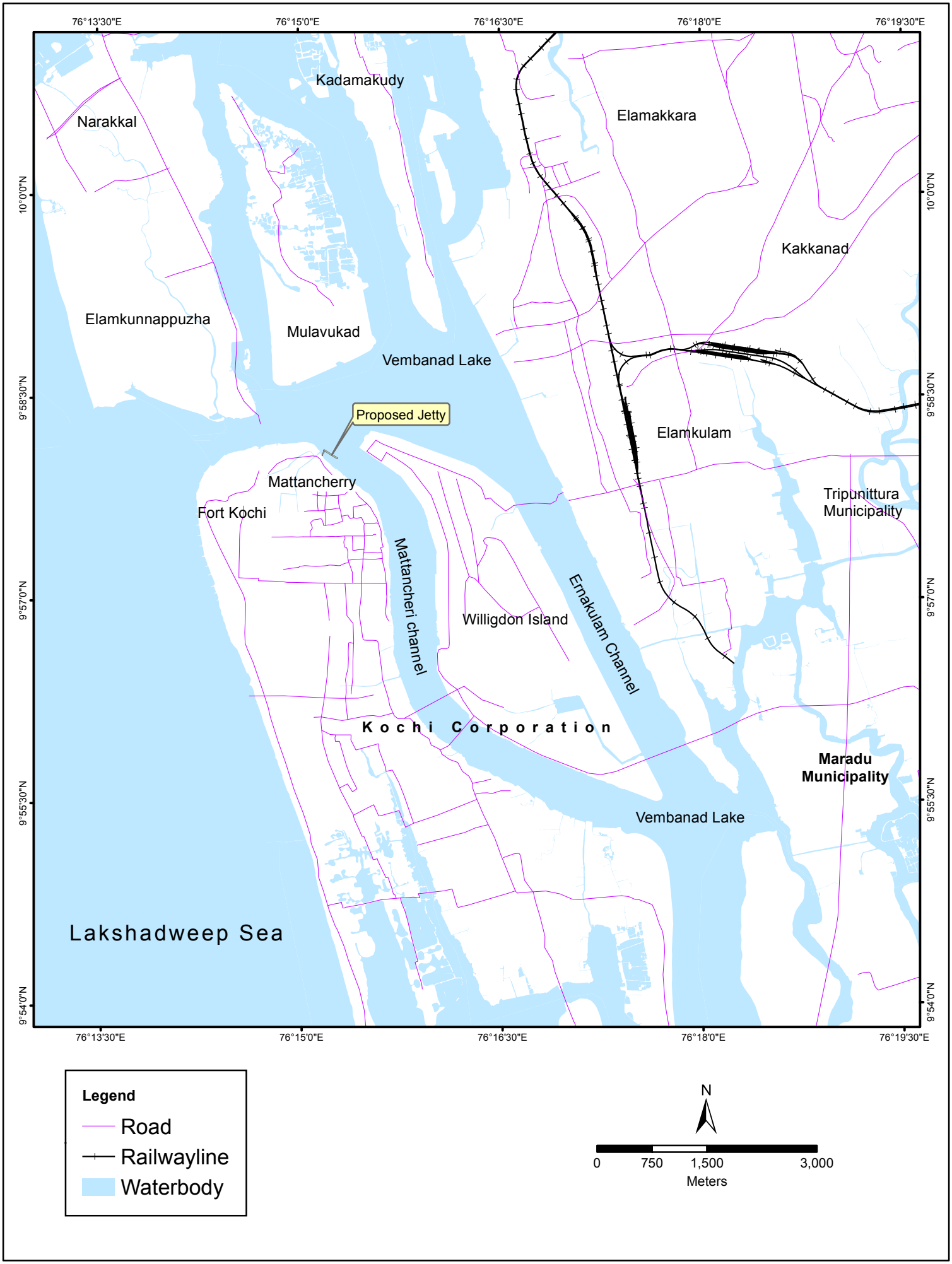


Figure 1. Location Map

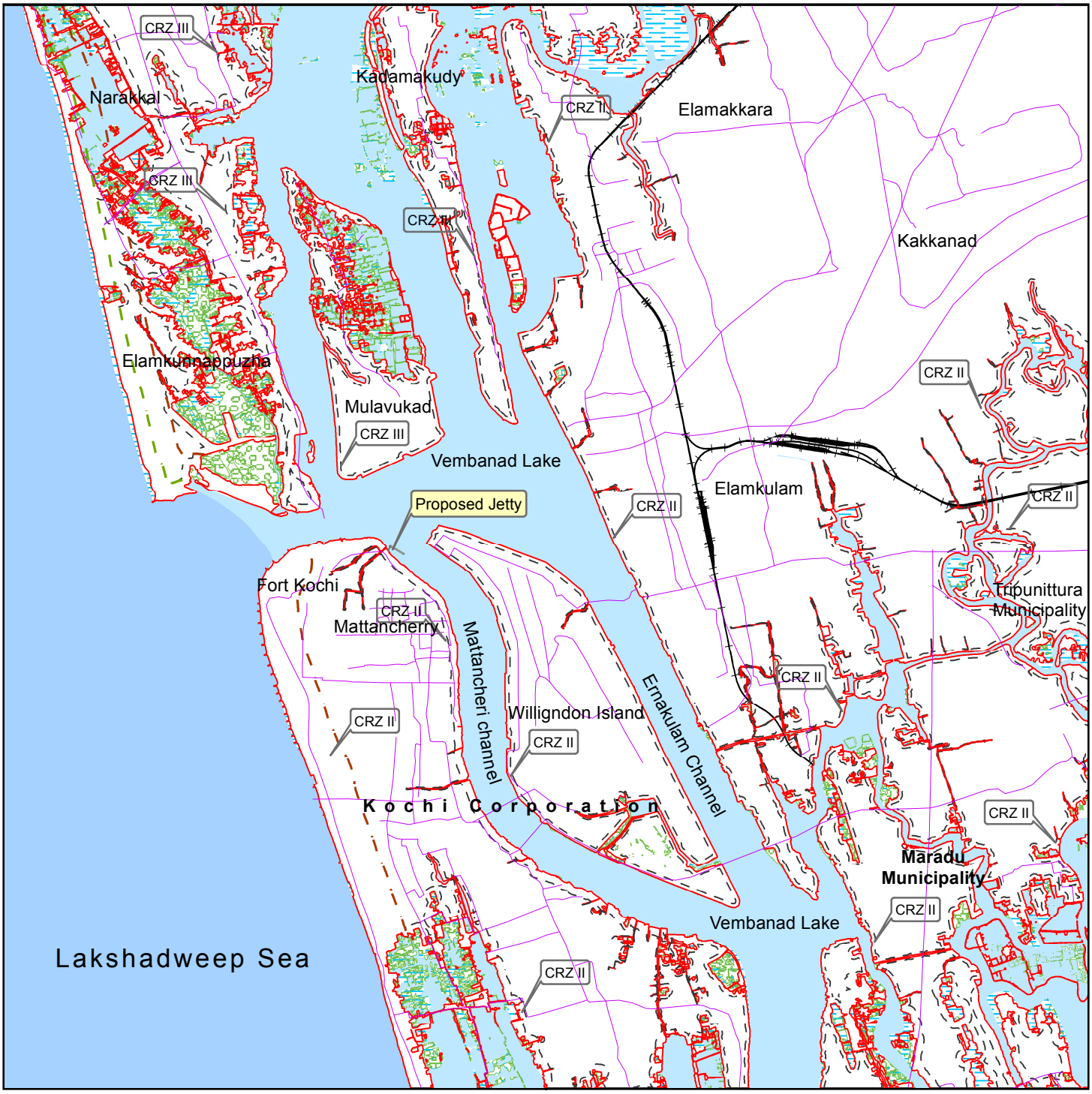


Figure 3. CRZ Catogories 7 km around the proposed project site

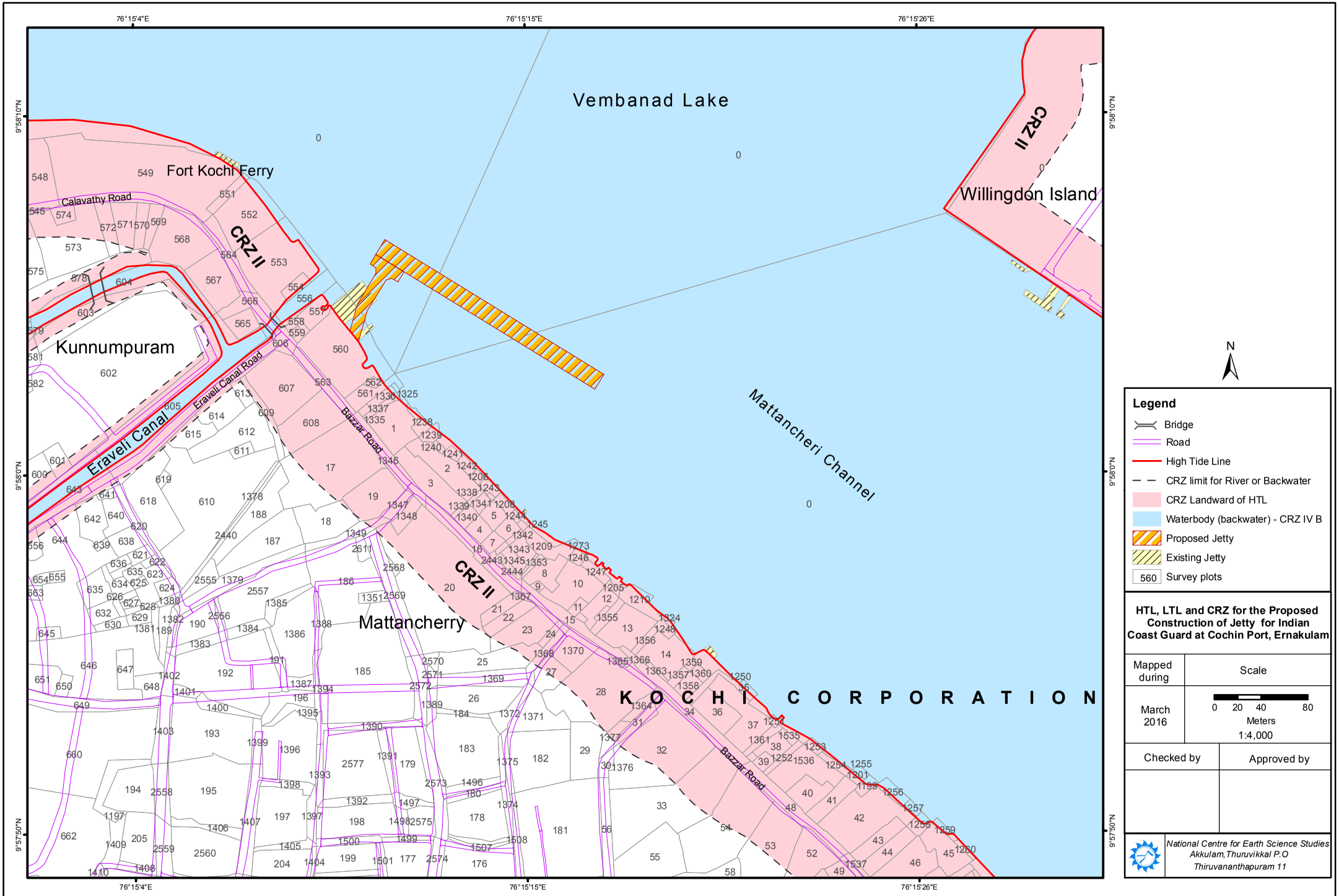


Figure 2. CRZ Map (Refer CRZ Status Report for more details)