പതിനാലാം കേരള നിയമസഭ
ഒമ്പതാം സമ്മേളനം

നക്ഷത്രചിഹ്നമിടാത്ത നിയമസഭാ ചോദ്യം നമ്പർ. 1518

31-01-2018 ൽ മറുപടിക്ക്

ജൈവ വൈപ്പിൻ പദ്ധതി

ചോദ്യം

ശ്രീ.എസ്.ശർമ്മ

മറുപടി

ശ്രീ.വി.എസ്. സുനിൽകുമാർ
(കൃഷി വകുപ്പു മന്ത്രി)

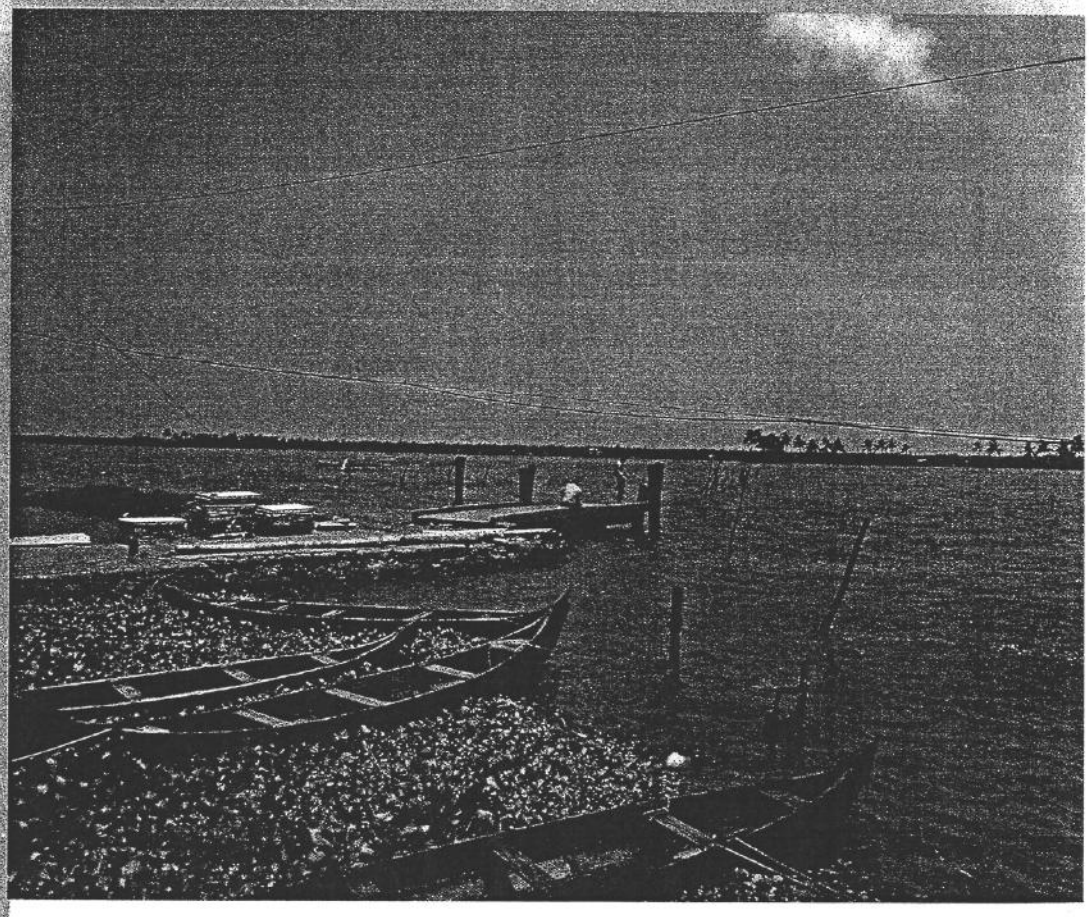
ജൈവ വൈപ്പിൻ പദ്ധതി നടത്തിപ്പു സംബന്ധിച്ച് പാരിസ്ഥിതിക ആഘാത പഠന റിപ്പോർട്ട് സർക്കാരിൽ ലഭിച്ചിട്ടുണ്ടോ; എങ്കിൽ പകർപ്പ് ലഭ്യമാക്കാമോ?	ജൈവ വൈപ്പിൻ പദ്ധതിയുടെ പരിസ്ഥിതി ആഘാത പഠന റിപ്പോർട്ടിന്റെ ഭാഗമായുള്ള NCESS-ന്റെ സ്റ്റാറ്റസ് റിപ്പോർട്ട് 25-01-2018 ൽ കെ.എൽ.ഡി.സി യിൽ ലഭ്യമായിട്ടുണ്ട്. പകർപ്പ് അനുബന്ധം I, II ആയി ചേർക്കുന്നു.

സെക്ഷൻ ഓഫീസർ

അനുബന്ധം-I

HTL, LTL AND COASTAL REGULATION ZONE FOR THE PROPOSED JAIVA VYPIN PROJECT AREA IN VEERAM PUZHA, ERNAKULAM DISTRICT, KERALA

(As per CRZ Notification 2011)



Prepared for

The Construction Engineer, Kerala Land Development Corporation Ltd,
Alappuzha

NATIONAL CENTRE FOR EARTH SCIENCE STUDIES
Ministry of Earth Sciences, Government of India
Thiruvananthapuram - 695 011, Kerala

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DOCUMENTATION PAGE

1. REPORT NUMBER	NCESS-CRZ-02 -2018
2. TYPE OF REPORT	CRZ STATUS REPORT
3. TITLE	**HTL, LTL AND COASTAL REGULATION ZONE FOR THE PROPOSED JAIVA VYPIN PROJECT AREA IN VEERAM PUZHA, ERNAKULAM DISTRICT, KERALA**
4. INVESTIGATOR MONITORING COMMITTEE PROJECT STAFF	Dr. K.K.RAMACHANDRAN , Mr. M. RAMESH KUMAR Dr. K.K.RAMACHANDRAN, Dr. D.S.SURESH BABU, Mr. M. RAMESH KUMAR Dr. M. RAMESHAN, Mr. S. L. SAJITH, Ms. JYOTI JOSEPH, Ms. PARVATHY K NAIR, Ms. S. SHAMNA, Mr. C. K. MUHAMMED HANEEFA
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 III, CRZ IVA, CRZ IVB and Coastal Zone Management Plan (CZMP).
6. ABSTRACT	The Construction Engineer, The Kerala Land Development Corporation Limited, a Kerala Government undertaking, Alappuzha has requested to provide CRZ Status Report and Maps to facilitate CRZ clearance for the proposed Jaiva Vypin Project area in Veeram Puzha located in Kadamakkudy, Nayarambalam and Ezhikkara Villages of Ernakulam District. A part of Veeram Puzha is considered in the Jaiva Vypin Project and the project area is in Kadamakuddy, Vypin and Ezhikkara Islands. The CRZ map was prepared in 1:4000 scale cadastral base maps with survey plot information. The proposed site is under CRZ as per CRZ Notification 2011 and covered in Map Nos.35& 36 of the Coastal Zone Management Plan of Kerala (CZMP, 1996). Since the above three Islands are backwater islands the CRZ landward of HTL is 50m or width of the water body, whichever is less. The Jaiva Vypin Project area in Veeram Puzha is the water area and its bed which are part of the tidal influenced water body. Veeram Puzha is part of Vembanad backwater system. As reported by the project proponent, one of the purposes of the Project is to de-silt the sediments accumulated in the water body and to enable the free flow of water in to the Pokkali fields. Pokkali farming is a term used to indicate a system of dual cultivation of Pokkali rice, a salt resistant paddy variety and Prawn intermittently in the same fields. There are openings through the sluice gates for the flow of tidal water from the lake to the field. In the case of tidal influenced water bodies the water and the bed area between LTL at the bank to the LTL on the opposite side of the bank is CRZ (CRZ Notification, 2011). The water area and its bed in the case of tidal influenced water bodies are CRZ IVB. Ecologically sensitive ecosystems such as mangroves are observed as individual trees and also in small patches at certain locations in the project area and are CRZ IA. The Pokkali fields are inter tidal zones and are categorised as CRZ IB. Since the locality of the project site belongs to the undeveloped, Grama Panchayats Kadamakuddy, Nayarambalam and Ezhikkara, the CRZ landward of the High Tide Line is CRZ III (as per CZMP, 1996). The CRZ along the vicinity of the project site consists of CRZ IA, CRZ IB, CRZ III and CRZ IVB. Layout of the project site (as provided by the project proponent) is superimposed in the CRZ Map. As per CRZ Notification 2011, Para 3, Clause (i) Sub clause (a) those activities directly related to waterfront or directly needing foreshore facilities such as ports and harbors, jetties, quays, wharves, erosion control measures, breakwaters, pipelines, lighthouses, navigational safety facilities, coastal police stations and the like are permissible within CRZ. However, there is no specific mention on permissibility of Projects like Jaiva Vypin within CRZ IVB, CRZ IA and CRZ IB in the said CRZ Notification 2011.
7. DISTRIBUTION STATEMENT	NOT FOR CIRCULATION
8. PROJECT PROPONENT	The Construction Engineer, The Kerala Land Development Corporation Ltd, Alappuzha.

HTL, LTL AND COASTAL REGULATION ZONE FOR THE PROPOSED JAIVA VYPIN PROJECT AREA IN VEERAM PUZHA, ERNAKULAM DISTRICT, KERALA

1.0 Introduction

The Kerala Land Development Corporation Limited (KLDC), a Government of Kerala undertaking has plans to implement the Jaiva Vypin project at Vypin and its adjacent Islands in Ernakulam District, Kerala. In order to facilitate the CRZ clearance for the proposed project, the Construction Engineer, Kerala Land Development Corporation Limited, Alappuzha, requested National Centre for Earth Science Studies (NCESS) Thiruvananthapuram, an agency authorized by the Government of India to prepare CRZ Status Report and CRZ Maps. The NCESS has taken up the preparation of CRZ Status Report and CRZ Maps by demarcating the High Tide Line (HTL), Low Tide Line (LTL) and Coastal Regulation Zones towards the same.

The proposed site is covered in Map No.35 and 36 of the Coastal Zone Management Plan of Kerala (CZMP, 1996). The CZMP (1996) demarcates HTL, LTL and CRZ in 1:25000 scale. However, the MoEF (1999) has directed 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 Report is prepared in cadastral scale based on field investigations carried out during the month of July, 2017. The CZMP (1996) of the area has also been referred for the above purpose. Since the project area is in the tidal influenced backwater Veeram Puzha, a part of Vembanad backwater system, the regulated development activities as provided in the Coastal Regulation Zone (CRZ) Notification, 2011 are applicable for the proposed project area.

The purpose of Jaiva Vypin project and the location of the project area etc as reported by the project proponent are given below.

1. Administrative sanction has been obtained as per GO(Rt) No.505/2015 AD Thiruananthapuram dated 13-3-2015 for the proposed project entitled 'Jaiva Vypin' based on the study report prepared by KITCO for an integrated agricultural

development of the area spread over Kadamakkudy, Nayarambalam, Edavanakkad, Pallippuram, Kuzhuppilli and Ezhikkara Villages of Ernakualam District.

2. As part of the implementation of the proposed project, important canals and Veeram Puzha within this area which has got silted-up during the past several years need to be de-silted to maintain the natural tidal flows.
3. Sediment accumulation in the main canals has been seriously hampering the natural flood and ebb tidal exchange between the Vembanad Lake and the adjoining Pokkali fields.
4. Paddy cultivation in the Pokkali fields is generally taken up during April to October. To facilitate paddy cultivation, the salinity of the Pokkali fields needs to be maintained at low levels through the land drainage due to monsoonal precipitation.
5. However, dilution of salinity in the Pokkali fields can be realized only if a free flow is maintained from the rainfall-runoff from the land area to the Pokkali fields and the unobstructed flow subsequently from the Pokkali fields to the connected major canals joining the Vembanad Lake.
6. Siltation in the canals and other anthropogenic activities affecting the flow do not permit copious flow of freshwater into the system and hence affects the salinity reduction to the desired level. This creates deleterious impact on the paddy production in this region which is known globally for its high quality rice cultivation.
7. In the above fields shrimp & prawn farming are carried out during November to April. Obstruction in the free flow of saline water from the Lake and through connected canals into the Pokkali fields reduces the entry of prawn seedlings and other fishes into the Pokkali fields.

The project proponent further reported that in order to enable the free flow of water into the Pokkali fields and out, the accumulated 'Ekkal' (Sediment) has to be removed from the canals and Veeram Puzha (a part of Vembanad Lake).

2.0 Location

The proposed Jaiva Vypin Project area in Veeram Puzha falls in the following Villages.

1. Kadamakuddy Village, Kadamakuddy Island, survey No.591/1 Block No.1, Kanayannur Taluk, Ernakulam District.

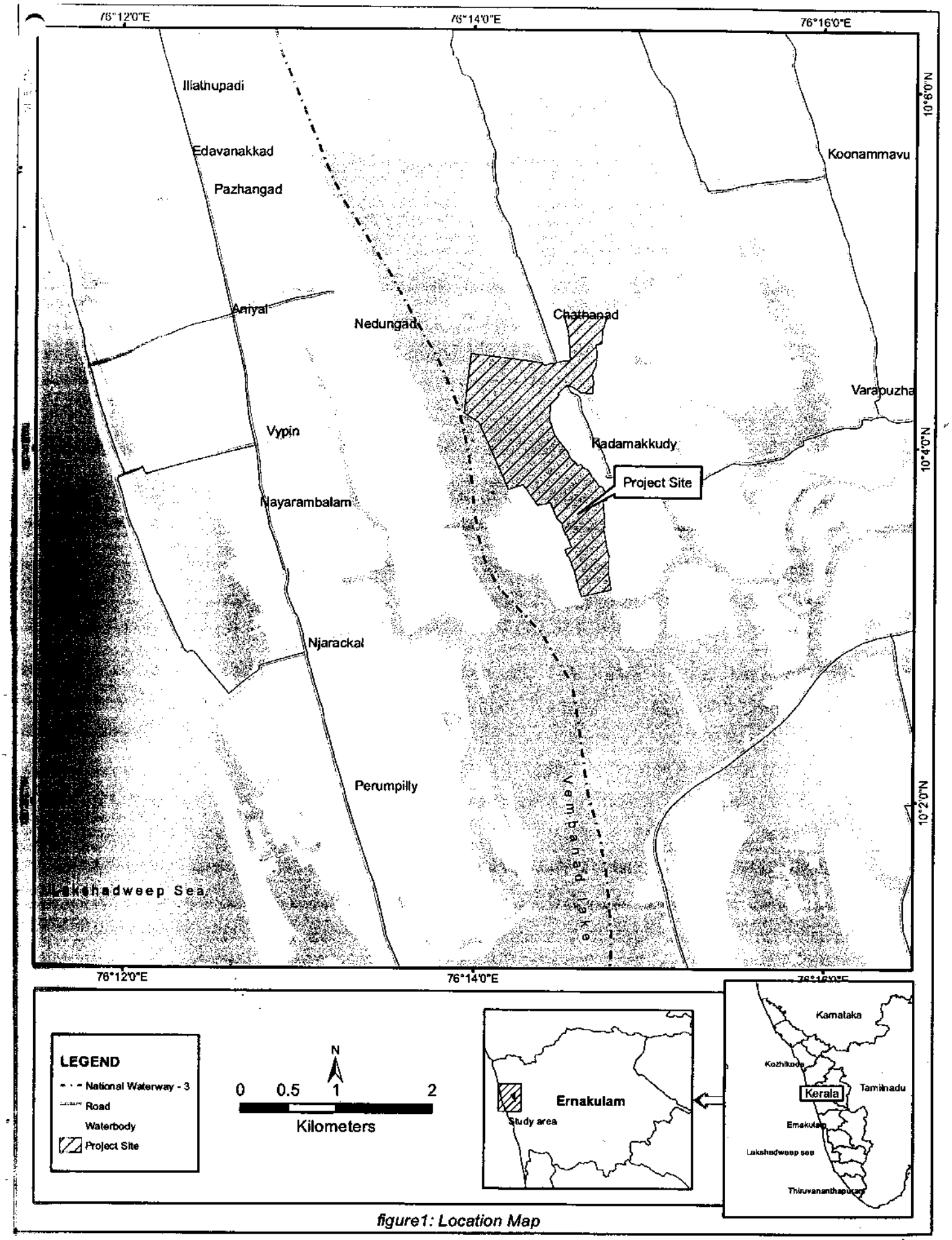


figure1: Location Map

National Centre for Earth Science Studies, Thiruvananthapuram

2. Nayarambalam Village, Vypin Island, survey No. 420 Kanayannur Taluk, Ernakulam District.

3. Ezhikkara Village, Ezhikkara Island, survey Nos.13/1 and 13/2 Paravur Taluk, Ernakulam District.

The proposed project area of Jaiva Vypin in Veeram Puzha has tidal influenced water body's water area and its bed. Many Pokkali fields of big size are found adjacent to Veeram Puzha, which supplies water to the Pokkali fields. The project area is located between 10° 3' 13.4" to 10° 4' 45.0" N Latitude and 76° 14' 0.4" to 76° 14' 44.5" E Longitude .

3.0 Objectives

The objectives of the study are:

- Delineation of the HTL and LTL for the Jaiva Vypin project area in Veeram Puzha in Kadamakuddy, Vypin and Ezhikkara Islands of Ernakulum District.
- Demarcation of the Coastal Regulation Zone (CRZ) for the project area and providing remarks on its categories with respect to the CZMP of the State and CRZ Notification 2011.
- Preparation of CRZ Status Report and CRZ Map on the basis of field observations, CZMP of Kerala and the guide lines provided in CRZ Notification 2011.

4. *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 100m 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 (ITZ).

5. The areas that are ecologically sensitive and the geomorphological features which play a role in maintaining the integrity of the coast.

6. 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 includes mangroves, corals, coral reef and its associated biodiversity, sand dunes, Protected Areas and National Parks, mudflats (which are biologically active), saltmarshes, turtle nesting grounds, horse shoe crab habitat, seagrass bed and 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.

The CRZ Notification (2011) has defined a category of 'Areas requiring special consideration' for the purpose of protecting the critical coastal environment and difficulties faced by local communities, which includes CRZ area falling within municipal limits of Greater Mumbai, the CRZ areas of Kerala including the backwaters and backwater islands and the CRZ areas of Goa (MoEF 2011). The CRZ Notification of 2011 has also defined Critical Vulnerable Coastal Areas (CVCA), which includes Sunderbans and other identified ecological sensitive areas such as Gulf of Khambat and Gulf of Kutch in Gujarat, Karwar and Coondapur in Karnataka, Vembanad in Kerala, Gulf of Mannar in Tamil Nadu, Bhaitarkanika in Orissa, Coringa, East Godavari and Krishna in Andhra Pradesh, Malvan, and Achra-Ratnagiri in Maharashtra, which shall be managed with the involvement of the local coastal communities including the fisher folk. The Ministry of Environment & Forests, Govt. of India has issued the new CRZ Notification in January 2011 in supersession of CRZ 1991 except as respects things done or omitted to be done before such supersession. Though the CRZ Notification 2011 is effective since 6th January 2011, the Coastal Zone Management Plan (CZMP, 1996) approved in 1996 remains valid till a new CZMP is approved based on the guidelines issued under CRZ Notification 2011.

5. CRZ for the state of Kerala

Coastal Zone Management Plan (CZMP) of Kerala was approved by Ministry of Environment and Forest in the year 1996. The CZMP has areas covered under CRZ-I, CRZ-II and CRZ-III. All uninhabited islands are classified as CRZ-I (subject to continuation of existing traditional rights, special rights and customary uses) except those islands which have been approved by MOEF, as CRZ - IV. In case of uninhabited islands classified as CRZ- I, in exceptional cases should a carrying capacity study establish that the proposed development will not have adverse ecological impacts, those particular islands could be reclassified as CRZ -IV, subject to prior approval of MOEF. CRZ IV is applicable to the coastal stretches in Andaman and Nicobar Islands, Lakshadweep and small islands except those designated as CRZ I, CRZ II or CRZ III. The CRZ categories were identified using satellite imagery and prepared CZMP maps in the scale 1:25,000. Later efforts were made to prepare local level

Coastal Regulation Zone Maps in cadastral scale indicating HTL, LTL and other regulation lines.

As per the CRZ Notification (2011), the CRZ along the Kerala coast consists of CRZ I, CRZ II, CRZ III and CRZ IV categories. The 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 and coral reef and associated biodiversity, sand dunes, National Parks, mudflats which are biologically active, salt marshes, turtle nesting grounds, horseshoe crab habitat, seagrass bed and nesting grounds of birds and protected areas and areas of archaeological importance and heritage sites are categorized as CRZ IA. Among these, mudflats, saltmarshes, turtle nesting grounds, horseshoe crab habitat, seagrass bed and nesting ground of birds are newly introduced under CRZ IA as per CRZ Notification 2011. In case mangroves area is more than 1000 sq. m a buffer of 50 m along the mangroves shall be provided and it is CRZ- I A. 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 Gram Panchayats, 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 IVB).

CRZ Notification 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 CRZ. The CRZ III has a 'No Development Zone' (NDZ), which extends up to 200m along the seacoast and 100m or width of the tidal waterbody whichever is less landward of HTL. When 'Hazard line', as defined in CRZ Notification 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 (CRZ Notification 2011). The Notification also declares Vembanad backwater as one among the Critically Vulnerable Coastal Areas (CVCA) for which development activities need to be within the framework of an approved ICZMP.

6. Approach and Data Source

6.1 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, bridges, culverts, bunds 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 the mapping is done in the cadastral base.

Key elements of the general approach followed in the study are:

- To verify the CZMP of the State (CZMP, 1996) and identify CRZ areas in the project area.
- To carry out field investigation on cadastral base maps.
- To delineate HTL, LTL and CRZ based on the Coastal Regulation Zone Notification (CRZ Notification, 2011).
- 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.
- To prepare the CRZ map delineating HTL and LTL in cadastral scale enable to locate the HTL and other regulation lines precisely in the field.

6.2 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 satellite images of the area
4. Cadastral maps
5. CZMP maps
6. Field mapping

6.3 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'. The Kochi coast of Kerala 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 (NHO 1977):

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 5parts per thousand (ppt) measured during the driest period of the year (MoEF, 2011).

7. Identification of HTL and CRZ

Coastal Regulation Zone Notification defines High Tide Line as "the line on the land up to 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). The HTL/LTL has to be identified based on the coastal geomorphologic signatures in the field/satellite imageries/aerial photographs following the guidelines of MoEF (MoEF, 2011, 1999). The embankments, cliffs, monsoonal berms, permanent vegetation line and sea wall have been considered for identifying the HTL. Once the HTL/LTL is identified, the distances to these are measured with respect to the survey plot boundaries identified in the field. An appraisal of existing land use/landform in the project area is carried out to identify the ecologically sensitive and important areas to be categorized as CRZ IA present in the study area. The CZMP of the State (CZMP, 1996) and the CRZ Notification (2011) have also been referred for CRZ categorization.

7.1 Field Investigations

The MoEF guidelines (MoEF, 2011) stipulate that the HTL/LTL be identified based on coastal geomorphologic signatures in the field/satellite imageries/aerial photographs. Field investigation was carried out during the month of July 2017. Delineation of the HTL and LTL, and identification of Coastal Regulation Zones for the site were carried out based on geomorphic and other signatures such as mangroves, inter tidal zones (Pokkali fields), permanent vegetation line and embankments.

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 (1996) 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 of the area were also used for the same. Geomorphic features and other signatures such as embankments, inter tidal zones and mangroves etc. have been used to identify the HTL during field investigation.

A part of Veeram Puzha along the Kadamakuddy, Vypin and Ezhikkara Islands is considered as one of the project areas in the proposed Jaiva Vypin Project. Vembanad Lake is known as Veeram Puzha in this project area. Pokkali fields are found adjacent to this water body in large extent. Pokkali fields are large in size and they are separated from Veeram Puzha by bunds. Pokkali is a unique ecosystem and salt resistant rice variety, cultivated in an organic way in the water-logged coastal regions of Ernakulum, Alappuzha and Thrissur Districts of Kerala. Pokkali farming is a term used to indicate a system of dual cultivation of Pokkali rice and Prawn intermittently in the same fields. The tidal water from the Veeram Puzha is regulated through temporary sluices constructed along the bunds for agriculture and fish farming on a seasonal basis. Coconut trees planted along the bunds are observed in certain locations. Mangroves are found at certain locations on the bunds of Pokkali fields and banks of Veeram puzha as individual trees or as small patches. Settlement and coconut farms are also found at a few locations along the banks of Veeram Puzha, where there are no Pokkali fields. Pokkali fields are found in all sides of the Project area in Veeram Puzha except on the North West side. Kollam-Kottappuram Water way (NW-3) passes through Veeram Puzha.

8.0 Coastal Regulation Zone for the project site

The proposed Jaiva Vypin project area in Veeram Puzha comprises Veeram Puzha and the Pokkali fields adjacent to it. The Pokkali fields which are intertidal areas are located close to the tidal water body. Pokkali fields, the land area between HTL and LTL (inter tidal area of the tidal water body), water area and bed of the tidal water body fall under CRZ. The Veeram Puzha is part of Vembanad backwater system. This project site of the Jaiva

Vypin project proposal is adjacent to the land area of Kadamakuddy, Vypin and Ezhikkara Islands. Being in back water Islands in Vembanad backwater, the CRZ land ward from the HTL is 50 m even though the width of Veeram Puzha is more than 100 m in the project location (CRZ Notification 2011). The tidal water bodies and its bed are CRZ IVB and the intertidal areas are CRZ IB. Ecologically sensitive ecosystem such as mangroves are found as individual trees and in small patches at some location in the project area and are categorised as CRZ IA. As per the approved CZMP of the State (1996), the project area is an undeveloped one distributed in Kadamakuddy, Nayarambalam and Ezhikkara Grama Panchayats, hence the CRZ landward of the HTL has been categorized as CRZ III.

8.1 High Tide Line and Low Tide Line for the project area

The High Tide Line is the distinct line of embankments and the geomorphic signatures depicting highest high tide level in the case of tidal influenced Veeram Puzha. Along certain stretches the HTL is along the line of the embankments constructed along the banks of Veeram Puzha where there are settlements or Coconut farms. Major portion of the project area in the Veeram Puzha is adjacent to the Pokkali fields and bunds that are constructed to separate the Pokkali fields from the Puzha. Sluices are constructed at many places on the bunds to regulate tidal water to the Pokkali fields. In the Pokkali field areas the HTL is the landward end of the Pokkali fields. 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 waterbody, 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. Along certain stretches where there is no embankment, the permanent vegetation line is taken as HTL. The details are given in CRZ Map (Fig. 2).

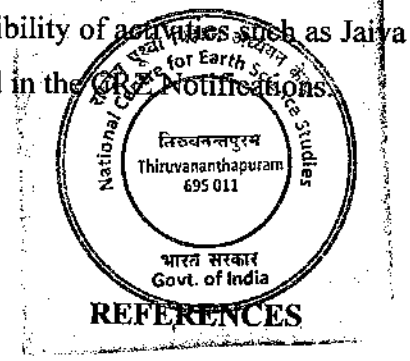
The CRZ categories 7 km around the site are given in Figure 3.

9.0 Summary

- The High Tide Line (HTL), Low Tide Line (LTL) and CRZ mapping of Veeram Puzha (project area part of Veeram Puzha) in the proposed Jaiva Vypin project in Kadamakuddy, Nayarambalam and Ezhikkara Villages of Ernakulam District has been carried out on cadastral maps on a scale of 1:4000.

- The HTL was demarcated by taking into consideration the position of the embankment and it is along the line of the embankment. In areas where embankment is absent, it is along the line of permanent vegetation.
- The CRZ categories are identified based on the CZMP of the State, CRZ Notification 2011 and coastal ecosystems and morphologies identified during the field mapping.
- The study area falls in Map Nos.35 and 36 of the CZMP (1996) of the State.
- The project area consists of tidal influenced Veeram Puzha (a part of Veeram Puzha) and adjacent Pokkali fields. There are several temporary and a few permanent sluices constructed in the bunds and embankments around the Pokkali fields to regulate the saline water from the tidal influenced water body.
- The tidal influenced water body's water area and its bed are categorized as CRZ IVB (CRZ Notification 2011).
- The tidal influenced Pokkali fields are categorized as CRZ IB (Inter Tidal Zones).
- Ecologically sensitive areas, such as mangroves which are categorized as CRZ IA are found at certain locations in the vicinity of the Project area. Inter tidal zones by the tidal influenced water bodies are categorized as CRZ IB.
- Since the project site belongs to the undeveloped areas of three Grama Panchayats namely Kadamakuddy and Nayarambalam of Kanayannur Taluk and Ezhikkara of Paravur Taluk of Ernakulam District, as per the approved CZMP of the State (1996), CRZ landward of the HTL has been categorized as CRZ III.
- The proposed project area falls under CRZ IA, CRZ IB, CRZ IVB and CRZ III.
- Being Islands in the Vembanad backwater the CRZ landward limit (CRZ III) in Kadamakuddy, Vypin and Ezhikkara Islands from the High Tide Line is 50m or width of the water body whichever is less.
- The proposed Jaiva Vypin project area as provided by the project proponent is superimposed in the CRZ Map.
- Deepening the Veeram Puzha in the Jaiva Vypin project area by de-silting the accumulated sediment to improve the natural drainage is the proposed work as reported by the project proponent.

- As per CRZ Notification 2011, Para 3, Clause (i) Sub clause (a) Those activities directly related to waterfront for their operations or directly needing foreshore facilities such as ports and harbors, jetties, quays, wharves, erosion control measures, breakwaters, pipelines, lighthouses, navigational safety facilities, coastal police stations and the like are permissible activities within CRZ. However, the permissibility of activities such as Jaiva Vypin project has not been specifically mentioned in the CRZ Notifications.



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PLATES

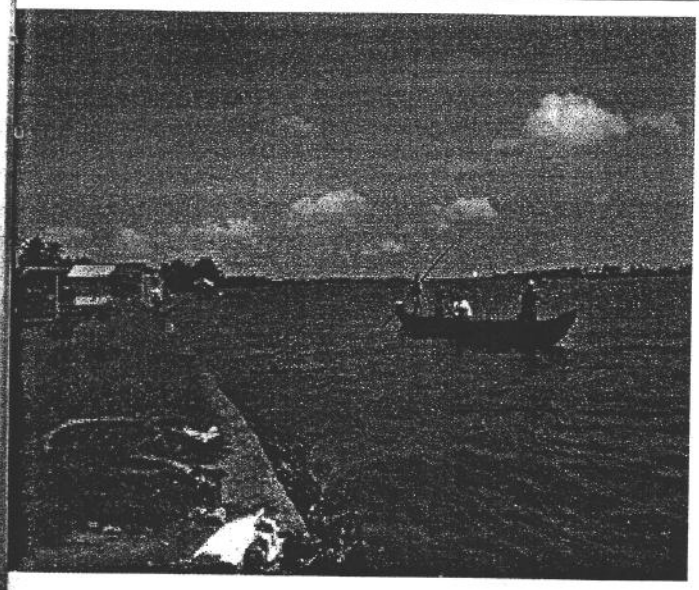

Plate 1. Proposed project area in Veeram Puzha

Plate 2. Pokkali fields (Inter Tidal Areas)

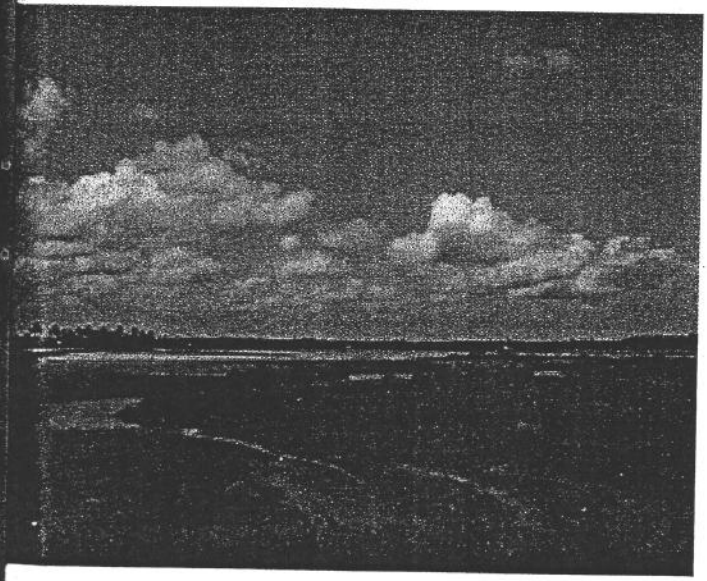

Plate 3. Pokkali field (Inter Tidal Areas)

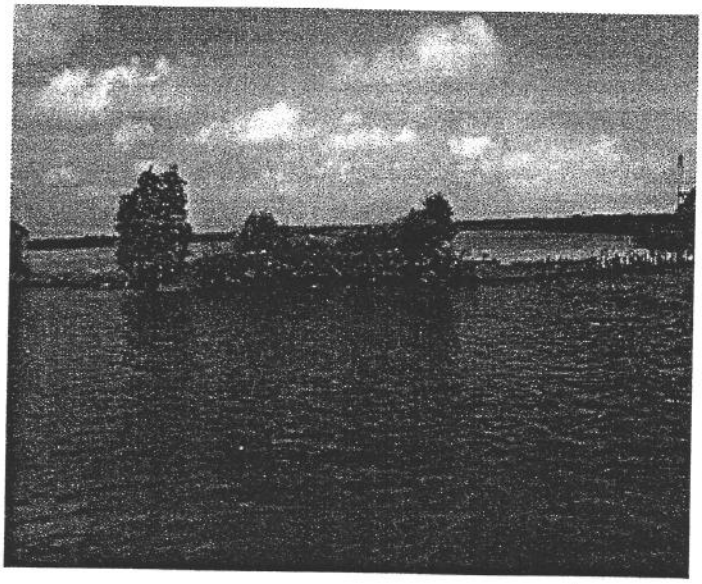

Plate 4. Mangrove stumps found on the bunds constructed along the Pokkali field

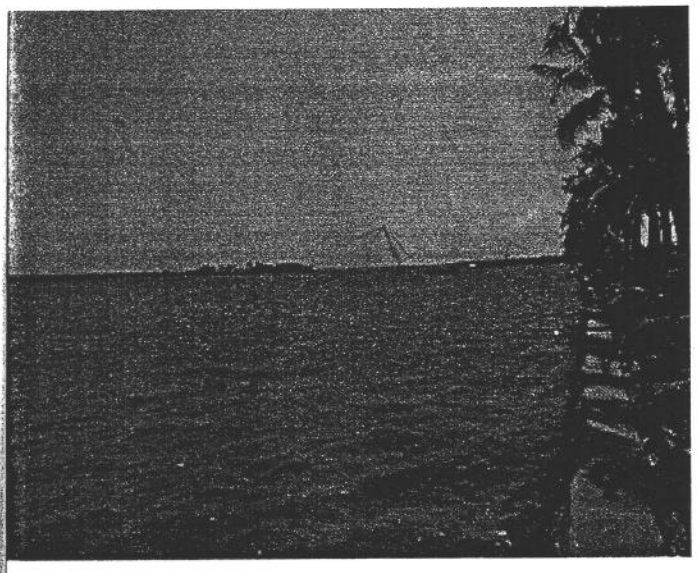

Plate 5. Veeram Puzha and Embankment

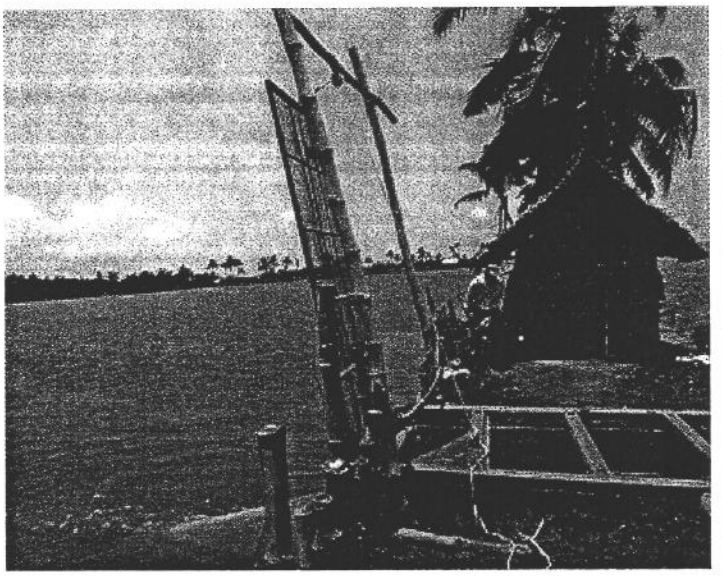

Plate 6. Veeram Puzha and Sluice on the bunds for regulating tidal water flow in the Pokkali fields

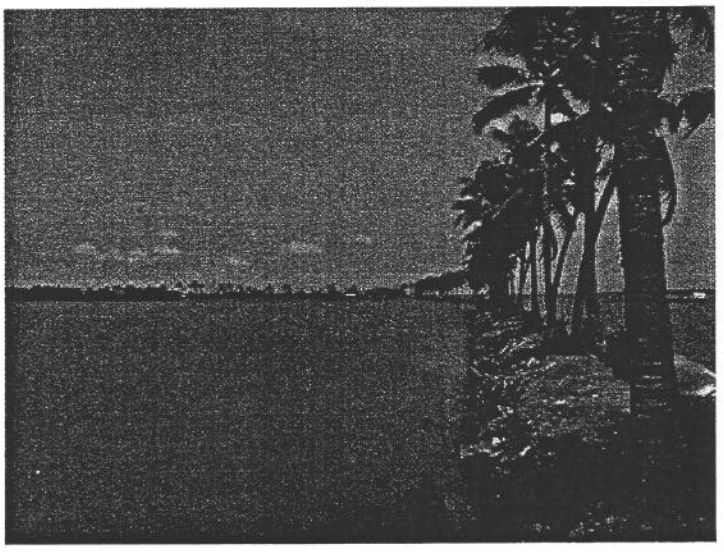

Plate 7. Veeram Puzha, bund with coconut trees and Pokkali fields

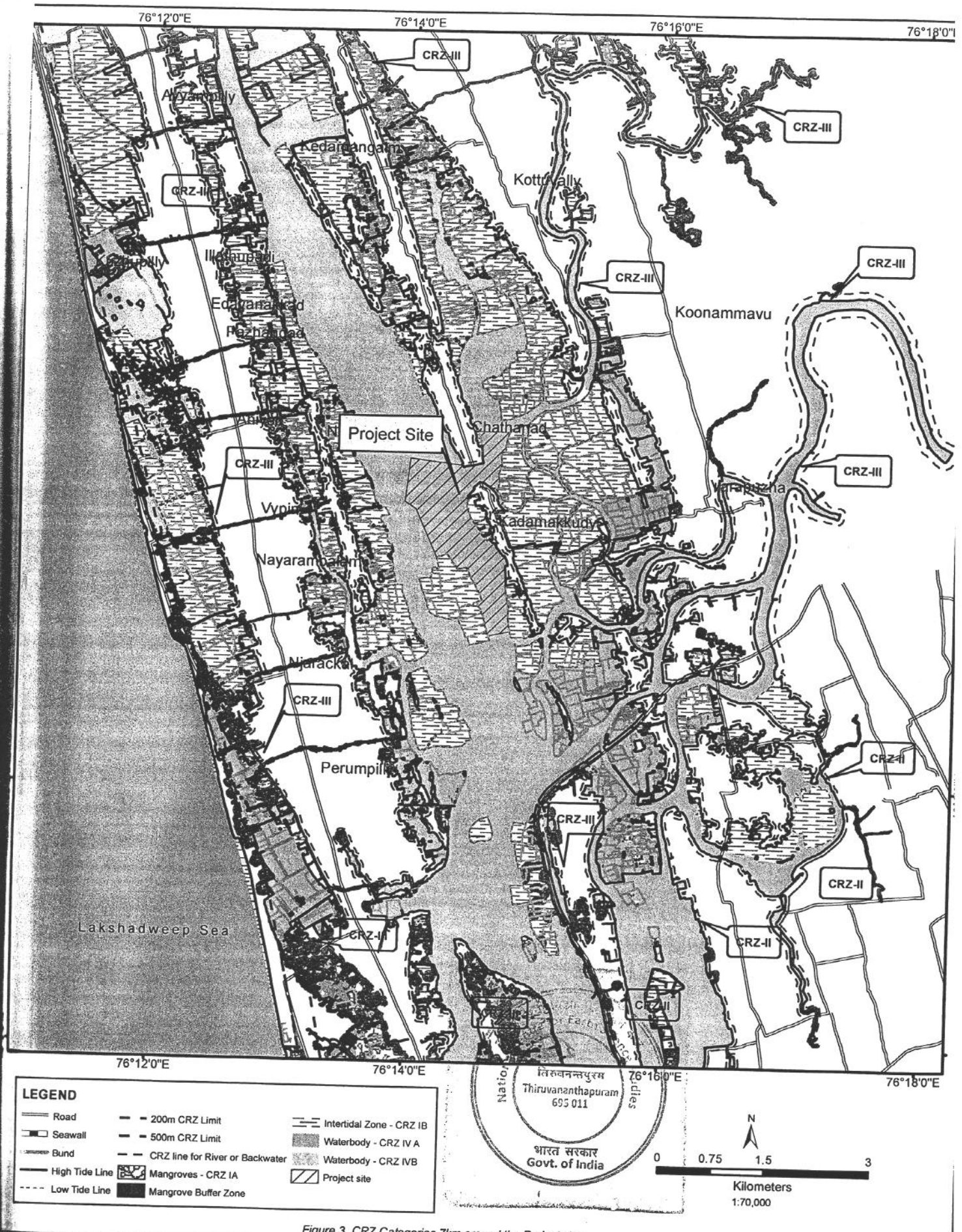

Figure 3. CRZ Categories 7km around the Project site.

National Centre for Earth Science Studies, Thiruvananthapuram

അനുബന്ധം - II

HTL, LTL AND COASTAL REGULATION ZONE FOR THE PROPOSED JAIVA VYPIN PROJECT AREA IN THE NINE CANALS AT VYPIN ISLAND, ERNAKULAM DISTRICT, KERALA

(As per CRZ Notification 2011)

Prepared for

The Construction Engineer, Kerala Land Development Corporation Ltd,
Alappuzha

NATIONAL CENTRE FOR EARTH SCIENCE STUDIES
Ministry of Earth Sciences, Government of India
Thiruvananthapuram - 695 011, Kerala

January 2018

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NATIONAL CENTRE FOR EARTH SCIENCE STUDIES, THIRUVANANTHAPURAM

DOCUMENTATION PAGE

1. REPORT NUMBER	NCESS-CRZ -03 -2018
2. TYPE OF REPORT	CRZ STATUS REPORT
3. TITLE	**HTL, LTL AND COASTAL REGULATION ZONE FOR THE PROPOSED JAIVA VYPIN PROJECT AREA IN THE NINE CANALS AT VYPIN ISLAND, ERNAKULAM DISTRICT, KERALA**
4. INVESTIGATORS MONITORING COMMITTEE PROJECT STAFFS	Dr. K.K.RAMACHANDRAN, Mr. M. RAMESH KUMAR Dr. K.K.RAMACHANDRAN, Dr. D.S.SURESH BABU, Mr. M. RAMESH KUMAR Dr. M. RAMESHAN, Mr. S. L. SAJITH, Ms. JYOTI JOSEPH, Ms. PARVATHY K NAIR, Ms. S. SHAMNA, Mr. C. K. MUHAMMED HANEEFA
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 III, CRZ IVA, CRZ IVB and Coastal Zone Management Plan (CZMP).
6. ABSTRACT	The Construction Engineer, Kerala Land Development Corporation Limited, a Kerala Government undertaking, Alappuzha has requested to provide CRZ Status Report and Maps to facilitate CRZ clearance for the proposed Jaiva Vypin Project area in the nine canals located in Pallippuram, Kuzhuppilly, Edavanakad and Nayarambalam Villages of Ernakulam District. These nine canals are connected to Veeram Puzha, which is a tidal influenced waterbody, part of Vembanad backwater system. The above nine canals are located in Vypin Island. The CRZ map of each canals were prepared in 1:4000 scale cadastral base maps with survey plot information. The proposed sites are under CRZ as per CRZ Notification 2011 and covered in Map Nos.35, 36 and 37 of the Coastal Zone Management Plan of Kerala (CZMP, 1996). Since Vypin is a backwater island the CRZ landward of HTL is 50m or width of the water body, whichever is less. The Jaiva Vypin Project area in the nine canals is the water area and its bed which are part of the tide influenced water body. As reported by the project proponent, one of the purposes of the Project is to de-silt the sediments accumulated in the water bodies and to enable the free flow of water in to the Pokkali fields. Pokkali farming is a term used to indicate a system of dual cultivation of Pokkali rice, a salt resistant paddy variety and Prawn intermittently in the same fields. There are openings through the sluice gates for the flow of tidal water from the canals to the field. In the case of tide influenced water bodies, the water and the bed area between LTL at the bank to the LTL on the opposite side of the bank are CRZ IVB (CRZ Notification, 2011). Ecologically sensitive ecosystems such as mangroves are observed as individual trees and also in small patches at certain locations in the project area and are CRZ IA. The Pokkali fields are inter tidal zones and are categorised as CRZ IB. Since the locality of the project sites belongs to the undeveloped, Grama Panchayats such as Pallippuram, Kuzhupilly, Edavanakad and Nayarambalam, the CRZ landward of the High Tide Line is CRZ III (as per CZMP, 1996). The CRZ along the vicinity of the project site consists of CRZ IA, CRZ IB, CRZ III, CRZ IVA and CRZ IVB. Layout of the project sites (as provided by the project proponent) are superimposed in the CRZ Maps. As per CRZ Notification 2011, Para 3, Clause (i) Sub clause (a) those activities directly related to waterfront or directly needing foreshore facilities such as ports and harbors, jetties, quays, wharves, erosion control measures, breakwaters, pipelines, lighthouses, navigational safety facilities, coastal police stations and the like are permissible within CRZ. However, there is no specific mention on permissibility of Projects like Jaiva Vypin within CRZ IVB, CRZ IA and CRZ IB in the CRZ Notification 2011.
7. DISTRIBUTION STATEMENT	NOT FOR CIRCULATION
8. PROJECT PROPONENT	The Construction Engineer, The Kerala Land Development Corporation Ltd, Alappuzha.

CONTENTS

LIST OF TABLES AND FIGURES

PLATES

HTL, LTL AND COASTAL REGULATION ZONE FOR THE PROPOSED JAIVA VYPIN PROJECT AREA IN THE NINE CANALS AT VYPIN ISLAND, ERNAKULAM DISTRICT, KERALA

1.0 Introduction

The Kerala Land Development Corporation Limited (KLDC), a Government of Kerala undertaking, plans to implement the Jaiva Vypin project at Vypin and its adjacent Islands in Ernakulam District, Kerala. In order to facilitate the CRZ clearance for the proposed project, the Construction Engineer, Kerala Land Development Corporation Limited, Alappuzha, requested National Centre for Earth Science Studies (NCESS) Thiruvananthapuram, an agency authorized by the Government of India to prepare CRZ Status Report and CRZ Maps. The NCESS has taken up the preparation of CRZ Status Report and CRZ Maps by demarcating the High Tide Line (HTL), Low Tide Line (LTL) and Coastal Regulation Zones towards the same.

The proposed sites are covered in Map No.35, 36 and 37 of the Coastal Zone Management Plan of Kerala (CZMP, 1996). The CZMP (1996) demarcates HTL, LTL and CRZ in 1:25000 scale. However, the MoEF (1999) has directed 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 Report is prepared in cadastral scale based on field investigations carried out during the month of July, 2017. The CZMP (1996) of the area has also been referred for the above purpose. Since the project sites are within/adjacent to canals of Vembanad backwater system, the regulated development activities as provided in the Coastal Regulation Zone (CRZ) Notification, 2011 are applicable for the proposed project area.

The objectives of Jaiva Vypin project and the locations of the project sites as reported by the project proponent are given below:

1. Administrative sanction has been obtained as per GO(Rt) No.505/2015 AD Thiruvananthapuram dated 13-3-2015 for the proposed project entitled 'Jaiva

Vypin' based on the study report prepared by KITCO for an integrated agricultural development of the area spread over Kadamakkudy, Nayarambalam, Edavanakkad, Pallippuram, Kuzhuppilly and Ezhikkara Villages of Ernakualam District.

2. As part of the implementation of the proposed project, important canals and Veeram Puzha within the project area which has got silted-up during the past several years need to be de-silted to maintain the natural tidal flows.
3. Sediment accumulation in the main canals has been seriously hampering the natural flood and ebb tidal exchange between the Vembanad Lake and the adjoining Pokkali fields.
4. Paddy cultivation in the Pokkali fields is generally taken up during April to October. To facilitate paddy cultivation, the salinity of the Pokkali fields needs to be maintained at low levels through the land drainage from monsoonal precipitation.
5. However, dilution of salinity in the Pokkali fields can be realized only if a free flow is maintained from the rainfall-runoff from the land area to the Pokkali fields and the unobstructed flow subsequently from the Pokkali fields to the connected major canals joining the Vembanad Lake.
6. Siltation in the canals and other anthropogenic activities affecting the flow do not permit copious flow of freshwater into the system and hence affects the salinity reduction to the desired level. This creates deleterious impact on the paddy production in this region which is known globally for its high quality rice cultivation.
7. In the above fields shrimp & prawn farming are carried out during November to April. Obstruction in the free flow of saline water from the Lake and through connected canals into the Pokkali fields reduces the entry of prawn seedlings and other fishes into the Pokkali fields.

The project proponent further reported that in order to enable the free flow of water into the Pokkali fields and out, the accumulated 'Ekkal' (Sediment) has to be removed from the canals and Veeram Puzha (a part of Vembanad Lake).

2.0 Location

The proposed Jaiva Vypin Project area in the nine tidal influenced canals is located at Vypin Island in the following Villages (Figure.1)

1. Vadayil *Thodu* - Pallippuram Village - Block No. 2 – Sy. Nos. 46, 42, 40, 37, 36, 201,204,206. The project area is located between Latitudes 10^0 9'31.25"N and 10^0 9' 53.28"N; Longitudes 76^0 10'38.01"E and 76^0 11'10.93"E
2. Karuthala *Thodu* – Pallippuram Village - Block No. 2 – Survey Nos.- 298 to 304, 309,310,317, 318 and 321. The project area is located between Latitudes 10^0 8'31.73"N and 10^0 8'52.44"N ; Longitudes 76^0 11'2.39"E and 76^0 11'56.42"E
3. Vasthery *Thodu* - Pallippuram Village - Block No. 2 – Sy. Nos. 445 to 448, 409,410, 405,404, 385,384. The project area is located between Latitudes $10^0$8'2.93"N and $10^0$8'21.61"N ; Longitudes $76^0$11'14.70"E and $76^0$12'6.97"E
4. Ramavarma *Thodu* – Pallippuram Village - Block No. 2 – Sy. Nos. 492, 508, 509, 510, 576, 577, 580, 605, 676, 675, 680, 692, 693. The project area is located between Latitudes $10^0$7'23.41"N and $10^0$7'46.55"N; Longitudes; $76^0$11'19.03"E to $76^0$12'24.18"E
5. Vemplayi *Thodu* – Kuzhuppilly Village- Block No.3 – 174, 168, 163, 162, 161, 157, 69, 68, 242, 241, 270. The project area is located between Latitudes $10^0$6'56.41"N and $10^0$7'8.46"N ; Longitudes $76^0$11'45.81"E and $76^0$12'31.58"E
6. Kuzhupilly Puthen *Thodu* – Edavanakadu Village – East Block No.5 – Sy. Nos. - 44, 45, 46, 65, 66 and West Block No. - 5. Sy. Nos. – 28, 27, 26, 11, 13, 14, 8, 15. The project area is located between Latitudes $10^0$5'53.82"N and $10^0$6'18.82"N ; Longitudes $76^0$11'25.95"E and $76^0$12'49.37"E
7. Pazhangad *Thodu* – Edavankadu Village – Block No.4 – 143, 144, 145, 146, 169, 170, 171, 196, 197, 199 and Block No.5. Sy. No. - 222, 228, 229, 236, 237, 238, 181, 182, 158, 159, 160, 161. The project area is located between Latitudes $10^0$5'3.2"N and $10^0$5'28.86"N; Longitudes $76^0$11'39.85"E and $76^0$13'7.32"E
8. Aniyal *Thodu*- Nayarambalam Village - Block No. - 5. Sy. Nos. - 303, 295, 298, 294, 289, 288, 279, 278, 271, 263 and 262 and Block No.3.Sy. Nos. - 292, 294, 297, 298, 299, 291, 292. The project area is located between Latitudes $10^0$4'36.12"N and $10^0$5'4.92"N ; Longitudes $76^0$11'48.40"E and $76^0$13'21.39"E
9. Aniyal Nedungad *Thodu* – Nayarambalam Village - Block No. - 6. Sy. Nos. – 157 and Block No. 8 – 208, 249, 273, 274, 278, 286, 287, 288, 291. The project area is located between Latitudes $10^0$4'52.10"N and $10^0$4'0.17"N ; Longitudes $76^0$12'56.15"E and $76^0$13'15.38"E

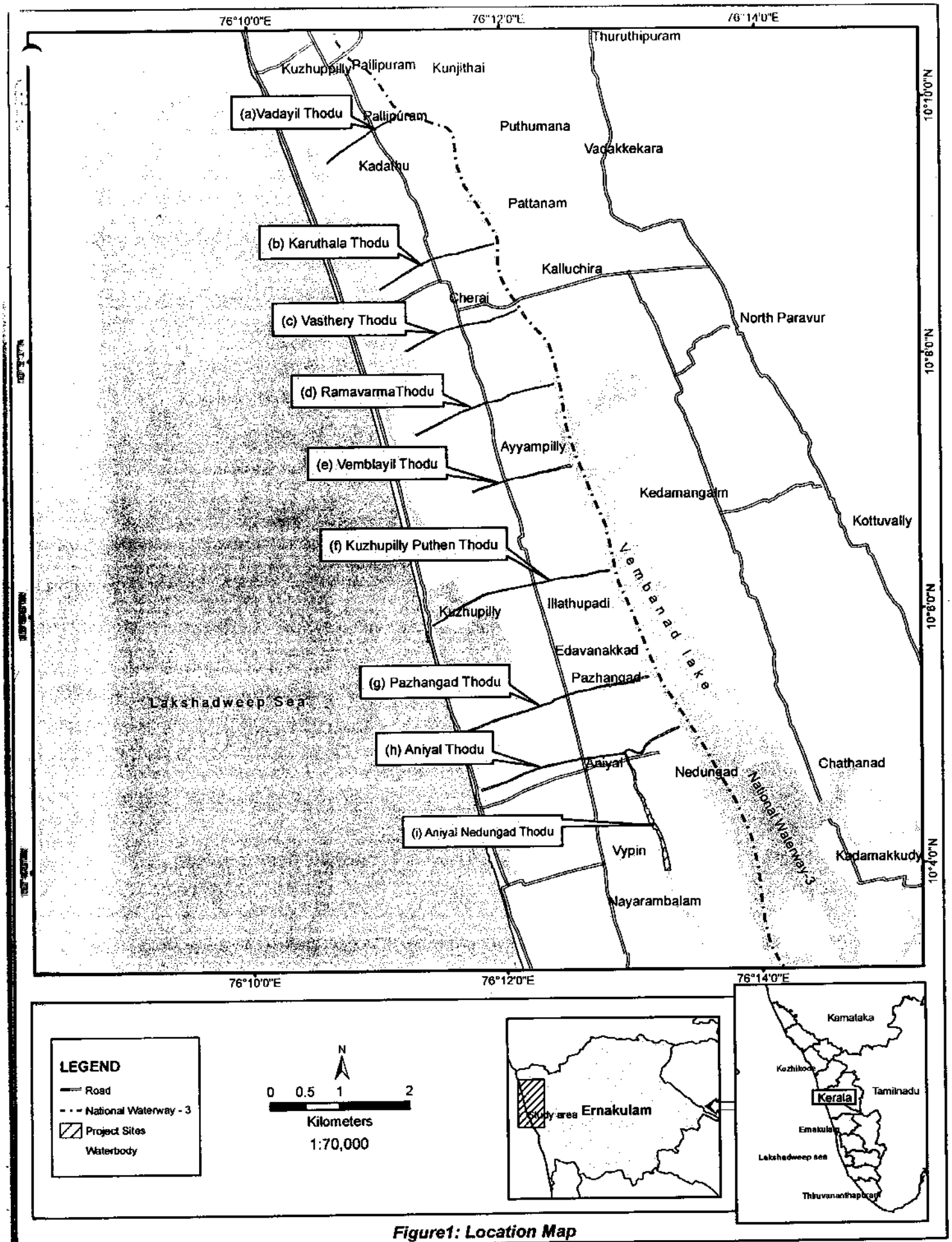


Figure1: Location Map

National Centre for Earth Science Studies, Thiruvananthapuram

The proposed project area of Jaiva Vypin has tide influenced water bodies (canals) water area and its bed. Many Pokkali fields of large extent are found adjacent to the canals.

3.0 Objectives

The objectives of the study are:

- Delineation of the HTL and LTL for the Jaiva Vypin sites along the nine tidal influenced canals in Vypin Island of Ernakulum District.
- Demarcation of the Coastal Regulation Zone (CRZ) for the project sites and to provide status on their categories with respect to the CZMP of the State and CRZ Notification 2011.
- Preparation of CRZ Status Report and CRZ Map on the basis of field observations, CZMP of Kerala and the guide lines provided in CRZ Notification 2011.

4. *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 100m 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 (ITZ).

5. The areas that are ecologically sensitive and the geomorphological features which play a role in maintaining the integrity of the coast.

6. 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 includes mangroves, corals, coral reef and its associated biodiversity, sand dunes, Protected Areas and National Parks, mudflats (which are biologically active), saltmarshes, turtle nesting grounds, horse shoe crab habitat, seagrass bed and 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.

The CRZ Notification (2011) has defined a category of 'Areas requiring special consideration' for the purpose of protecting the critical coastal environment and difficulties faced by local communities, which includes CRZ area falling within municipal

limits of Greater Mumbai, the CRZ areas of Kerala including the backwaters and backwater islands and the CRZ areas of Goa (MoEF 2011). The CRZ Notification of 2011 has also defined Critical Vulnerable Coastal Areas (CVCA), which includes Sunderbans and other identified ecological sensitive areas such as Gulf of Khambat and Gulf of Kutch in Gujarat, Karwar and Coondapur in Karnataka, Vembanad in Kerala, Gulf of Mannar in Tamil Nadu, Bhaitarkanika in Orissa, Coringa, East Godavari and Krishna in Andhra Pradesh, Malvan, and Achra-Ratnagiri in Maharashtra, which shall be managed with the involvement of the local coastal communities including the fisher folk. The Ministry of Environment & Forests, Govt. of India has issued the new CRZ Notification in January 2011 in supersession of CRZ 1991 except as respects things done or omitted to be done before such supersession. Though the CRZ Notification 2011 is effective since 6th January 2011, the Coastal Zone Management Plan (CZMP, 1996) approved in 1996 remains valid till a new CZMP is approved based on the guidelines issued under CRZ Notification 2011.

5. CRZ for the state of Kerala

Coastal Zone Management Plan (CZMP) of Kerala was approved by Ministry of Environment and Forest in the year 1996. The CZMP has areas covered under CRZ-I, CRZ-II and CRZ-III. All uninhabited islands are classified as CRZ-I (subject to continuation of existing traditional rights, special rights and customary uses) except those islands which have been approved by MOEF, as CRZ - IV. In case of uninhabited islands classified as CRZ- I, in exceptional cases should conduct a carrying capacity to study establish that the proposed development will not have adverse ecological impacts, those particular islands could be reclassified as CRZ -IV, subject to prior approval of MOEF. CRZ IV is applicable to the coastal stretches in Andaman and Nicobar Islands, Lakshadweep and small islands except those designated as CRZ I, CRZ II or CRZ III. The CRZ categories were identified using satellite imagery and prepared CZMP maps in the scale 1:25,000. Later efforts were made to prepare local level Coastal Regulation Zone Maps in cadastral scale indicating HTL, LTL and other regulation lines.

As per the CRZ Notification (2011), the CRZ along the Kerala coast consists of CRZ I, CRZ II, CRZ III and CRZ IV categories. The 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 and coral reef and associated

biodiversity, sand dunes, National Parks, mudflats which are biologically active, salt marshes, turtle nesting grounds, horseshoe crab habitat, seagrass bed and nesting grounds of birds and protected areas and areas of archaeological importance and heritage sites are categorized as CRZ IA. Among these, mudflats, saltmarshes, turtle nesting grounds, horseshoe crab habitat, seagrass bed and nesting ground of birds are newly introduced under CRZ IA as per CRZ Notification 2011. In case mangroves area is more than 1000 sq. m a buffer of 50 m along the mangroves shall be provided and it is CRZ- I A. 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 Gram Panchayats, 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 IVB).

CRZ Notification 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 CRZ. The CRZ III has a 'No Development Zone' (NDZ), which extends up to 200m along the seacoast and 100m or width of the tidal waterbody whichever is less landward of HTL. When 'Hazard line', as defined in CRZ Notification 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 (CRZ Notification 2011). The Notification also declares Vembanad backwater as one among the Critically Vulnerable Coastal Areas (CVCA) for which development activities need to be within the framework of an approved ICZMP.

6. Approach and Data Source

6.1 Approach

Coastal geomorphology and ecosystems of the proposed sites have 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, bridges, culverts, bunds 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 the mapping is done in the cadastral base.

Key elements of the general approach followed in the study are:

- To verify the CZMP of the State (CZMP, 1996) and identify CRZ areas in the project area.
- To carry out field investigation on cadastral base maps.
- To delineate HTL, LTL and CRZ based on the Coastal Regulation Zone Notification (CRZ Notification, 2011).
- To gather information on the 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.

- To prepare the CRZ map delineating HTL and LTL in cadastral scale enable to locate the HTL and other regulation lines precisely in the field.

6.2 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 satellite images of the area
4. Cadastral maps
5. CZMP maps
6. Field mapping

6.3 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'. The Kochi coast of Kerala 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 (NHO 1977):

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 5parts per thousand (ppt) measured during the driest period of the year (MoEF, 2011).

7. Identification of HTL and CRZ

Coastal Regulation Zone Notification defines High Tide Line as "the line on the land up to 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). The HTL/LTL has to be identified based on the coastal geomorphologic signatures in the field/satellite imageries/aerial photographs following the guidelines of MoEF (MoEF, 2011, 1999). The embankments, cliffs, monsoonal berms, permanent vegetation line and sea wall have been considered for identifying the HTL. Once the HTL/LTL is identified, the distances to these are measured with respect to the survey plot boundaries identified in the field. An appraisal of existing land use/landform in the project area is carried out to identify the ecologically sensitive and important areas to be categorized as CRZ IA present in the study area. The CZMP of the State (CZMP, 1996) and the CRZ Notification (2011) have also been referred for CRZ categorization.

7.1 Field Investigations

The MoEF guidelines (MoEF, 2011) stipulate that the HTL/LTL be identified based on coastal geomorphologic signatures in the field/satellite imageries/aerial photographs. Field investigation was carried out during the month of July 2017. Delineation of the HTL and LTL, and identification of Coastal Regulation Zones for the sites were carried out based on geomorphic and other signatures such as mangroves, inter tidal zones, permanent vegetation line and embankments.

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 (1996) 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 of the area were also used for the same. Geomorphic features and other signatures such as embankments, inter tidal zones and mangroves etc. have been used to identify the HTL during field investigation.

The nine tidal canals (*Thodu*) in Vypin Island which are connected to the Vembanad backwater are considered as one of the project areas in the proposed Jaiva Vypin Project. In the Vypin area Vembanad Lake is known as Veeram Puzha. Pokkali fields of large and small size are found adjacent to the canals in large extent. These canals supply water to the Pokkali fields which are separated from the canals by embankments/bunds. Pokkali is a unique ecosystem and salt resistant rice variety, cultivated in the water-logged coastal regions of Ernakulum, Kannur, Alappuzha and Thrissur Districts of Kerala. Pokkali farming is a term used to indicate a system of dual cultivation of Pokkali rice and Prawn intermittently in the same fields. The tidal water from the nine canals is regulated through temporary /permanent sluices constructed along the bunds for agriculture and fish farming on a seasonal basis.

(a) Vadayil *Thodu*

Vadayil *Thodu* is a tidal canal located in Pallippuram Village in Vypin Island. The width of the canal is 15 m (approximately). Vadayil *Thodu* starts from the tidal water body at east, passes through the land area of Pallippuram Village and joins the tidal water body to west. Embankments are found at the settlement areas along the *Thodu*. Several small canals (5 to 8 m width) are found flowing from Vadayil *Thodu* towards the land area. Several fish ponds (Filtration Ponds) are found on the North West of the *Thodu*. A long canal from Vadyil *Thodu* at the west is connected to a fish pond. Mixed vegetation is found within the settlement areas. Single stumps of mangroves are found in the vicinity of the Vadayil *Thodu*.

(b) Karuthala *Thodu*

Karuthala *Thodu* another tidal canal located in Pallippuram Village in Vypin Island. The width of the canal is 15 m (approximately). Karuthala Thodu starts from the tidal

water body at east, passes through the land area of Pallippuram Village and joins the tidal water body on the west. A few small canals originating from this *Thodu* flow towards the land area. Big fish ponds are located on the west and east end of the *Thodu*. *Thodu* with embankments and areas without embankments are noted in the settlement areas. Karuthala bridge is built across the *Thodu*. Locations such as Karuthala west and east are located on the banks of this *Thodu*. Mixed vegetations are found along the banks of the *Thodu*. Mangroves as single stumps and patches are found along the banks and fish ponds. Sluices are built along the bunds of the fish ponds to regulate tidal water flow.

(c) Vasthery *Thodu*

Vasthery *Thodu* a tide influenced canal is located in Pallippuram Village of Vypin Island. Cherai is a tourism location on the banks of this *Thodu*. Settlements, religious places such as temple and church are located in the vicinity of the *Thodu*. Vasthery *Thodu* starts from the tidal water body on the east, crossing the land area of Pallippuram Village finally joining the tidal water body on the west. A lengthy canal of 5m wide originating from this *Thodu* flow towards south culminating into Pokkali fields. Vasthery bridge and other small bridges are found across the *Thodu*. Large and small sized Pokkali fields are distributed on west end of the *Thodu*. Sluices are built along the bunds lining the Pokkali fields to regulate tidal water flow in to the fields. Mangrove patches are found along the banks of Pokkali fields and on the eastern bank of the *Thodu*.

(d) Ramavarma *Thodu*

Ramavarma *Thodu* is also a tidal influenced canal located in Pallippuram Village in Vypin Island. Large extent of pokkali fields are found adjacent to the *Thodu*. Sluices are found along the embankments of the *Thodu* to regulate water flow in to the fields. Ayyampilly and Manapilly are located on the banks of the *Thodu*. Manapilly bridge and other small bridges are built across the *Thodu*. Ramavarma *Thodu* starts from the tidal water body on east, passing through the land area of Pallippuram Village and joins the tidal water body to the west. National water way NW-3 passes through the water body on the west (Veram Puzha). Embankments are found bounding certain settlement areas. Long concreate emabankment is constructed on the western side of the *Thodu* and wide

bunds are constructed beyond this to protect Pokkali fields. Mangroves as patches and single stumps are found along the bunds of Pokkali fields and on the banks of the *Thodu*.

(e) Vemblayi *Thodu*

Vemblayi *Thodu* is yet another tidal influenced canal located in Kuzhupilly Village of Vypin Island. Ayyampily and Edavanakadu are located on the north and south of the *Thodu*. Embankments are found lining the *Thodu* in the settlement areas. Mixed vegetation within the settlements is found distributed in the vicinity of the *Thodu*. Vemblayi *Thodu* orginates from the tidal water body on the west, cut across the land area of Pallippuram Village further east to join the tidal water body on the east (Veeram Puzha). Large Pokkali fields are located on the northern and southern parts in the eastern position of the *Thodu*. Sluices are constructed along the embankments/bunds of the *Thodu* to regulate the tidal water flow in to the fields. Mangrove patches are found along the bunds of the Pokkali fields and on the banks of the the *Thodu*.

(f) Kuzhupilly Puthen *Thodu*

Kuzhupilly Puthen *Thodu* orginates from the tidal water body on the east, flows cutting across the land area of Edavanakad Village flowing to west joining the tidal water body on west (Veeram Puzha). The middle portion of the *Thodu* passes through the settlement areas. Large and small Pokkali fields are found adjacent to the *Thodu* at its east and west portion. Embankments are found along the settlement areas. At certain portions no bunds are found lining the *Thodu*. Single stumps and patches of mangroves are found along the banks of the pokkali fields and *Thodu*. Edavanakad is located on the banks of the *Thodu*.

(g) Pazhangad *Thodu*

Pazhangad *Thodu* starts from the tidal water body on west (Veeram Puzha), crossing through the land area of Edavanakad Village terminating at Pazhangad beach. Sandy beach, seawall, and Oliparambil temple are found in the beach. In the settlement areas embankments are found along the *Thodu*. Pazhangad bridge and other small bridges are built across the *Thodu*. Large and small pokkali fields occupy areas adjacent to the *Thodu*. Sluices are constructed along the embankments/bunds lining the *Thodu* to

regulate water in to the Pokkali fields. Edavanakad is located at the banks of the *Thodu*. Single stumps and patches of mangroves are located along the bunds constructed to protect the Pokkali fields.

(h) Aniyal *Thodu*

Aniyal *Thodu* orginates from the tidal water body on the west (Veeram Puzha), passes through the land area of Nayarambalam Village, flowing along the banks of Pokkali fields debouching to the sea at Aniyal beach. Sandy beaches are bound by seawall at Aniyal beach. Areas with and without embankments are found along the *Thodu*. Single strands of mangroves are observed at a few locations along the banks of the *Thodu*. Aniyal bridge and a few small bridges are built across the *Thodu*. Settlements and mixed vegetation are the main landuse area. Paddy cultivation is practiced in certain pokkali fields. Sluices are constructed along the embankments/bunds of the *Thodu* and Pokkali fields to regulate tidal water in to the Pokkali fields. Large and small pokkali fields are located adjacent to the Aniyal *Thodu* towards western and eastern parts. Single strands and patches of mangroves are noted along the bunds constructed to protect the Pokkali fields.

(i) Aniyal Nedungad *Thodu*

Aniyal Nedungad *Thodu* orginates from the eastern part of Aniyal *Thodu* and flows towards south. Large Pokkali fields are occupy the area adjacent to this *Thodu*. Nedungad and Nayambalam Villages are located on the banks of this *Thodu*. Kappilchira bridge and another small bridge is built across the *Thodu*. Areas with and without embankments are found along the *Thodu*. Settlements and mixed vegetation are observed as landuse of the area in the vicinity of the *Thodu* and Pokkali fields. Mangroves as patches and single strands are found along the embankments/bunds constructed along the *Thodu*. Patches of mangroves are also observed on the bunds of the pokkali fields. A few sluices are located along the embankments/bunds of the *Thodu* to regulate the tidal water in to the pokkali fields.

8.0 Coastal Regulation Zone for the project site

The proposed Jaiva Vypin project area include the nine tidal influenced canals networked and connected to Veeram Puzha (part of Vembanad back water system), comprising water area and the floor of the canals having connection with the Pokkali

fields adjacent to it. The Pokkali fields, which are intertidal areas, are located close to the canals. Pokkali fields, the area between HTL and LTL (inter tidal area of the tidal water bodies), water area and bed of the tidal influenced canals fall under CRZ. This project sites of the proposed Jaiva Vypin project are located in Vypin Island. Being a back water Island in Vembanad backwater system, the CRZ land ward of the HTL is 50 m or width of the waterbody whichever is less (CRZ Notification 2011). The tidal water bodies (canals) and its bed are CRZ IVB and the intertidal areas by the *Thodu*/canals including the intertidal area by the Aniyal beach are CRZ IB. Ecologically sensitive ecosystem such as mangroves are found as individual trees and in small patches at certain location along the banks of the canals and along the bunds of the pokkali fields in the project area and are categorised as CRZ IA. Mangroves having more than 1000 sq.m area are provided with a buffer zone of 50m around it and is CRZ I. As per the approved CZMP of the State (1996), the project area is located in Pallippuram, Kuzhupilly, Edavanakad and Nayarambalam Grama Panchayats, hence the CRZ landward of the HTL has been categorized as CRZ III.

8.1 High Tide Line and Low Tide Line for the project area

The High Tide Line is the distinct line of embankments and the geomorphic signatures depicting highest high tide level in the case of tidal influenced nine connected canals of Vembanad backwater system in Vypin Island. In certain stretches the HTL is along the line of the embankments constructed by the banks of the canals where there are settlements or coconut plantations. In areas where no embankment, the canal area is well defined with the permanent vegetation line which is taken as HTL. Major parts of the project area of the tidal canals are adjacent to the Pokkali fields and bunds that are constructed to separate the Pokkali fields from the canals. Sluices are constructed at many places on the embankments/bunds to regulate tidal water to the Pokkali fields. In the Pokkali field areas the HTL is the landward limit of the Pokkali fields. 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 canals, 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. The details are given in CRZ Map (Fig. 2(a) to 2(i))

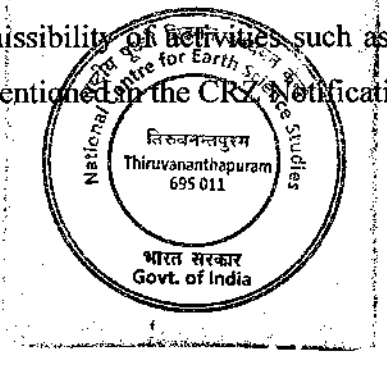
The CRZ categories 7 km around the site are given in Figure 3.

9.0 Summary

- The High Tide Line (HTL), Low Tide Line (LTL) and CRZ mapping of the nine tidal influenced canals and its adjacent areas in the proposed Jaiva Vypin project in Pallippuram, Kuzhupilly, Edavanakad, and Nayarambalam Villages of Ernakulam District has been carried out on cadastral maps on a scale of 1:4000.
- The HTL was demarcated by taking into consideration the position of the embankment and it is along the line of the embankment. In areas where embankment is absent, it is along the line of permanent vegetation and or the landward boundaries of mangroves and intertidal zone/bunds/landward boundary of Pokkali field.
- The CRZ categories are identified based on the CZMP of the State, CRZ Notification 2011 and coastal ecosystems and morphologies identified during the field mapping.
- The study area falls in Map Nos.35, 36 and 37 of the CZMP (1996) of the State.
- The project area consists of tidal influenced nine canals connected to Veeram Puzha (a part of Vembanad back water system) in Vypin island and adjacent Pokkali fields. There are several sluices constructed along the bunds and embankments of the canals and its sub canals to regulate the saline water from the tidal influenced canals to the Pokkali fields.
- The sea water area and its bed up to 12NM is categorized as CRZ IVA.
- The tidal influenced water area and its bed in the canal are categorized as CRZ IVB (CRZ Notification 2011).
- The tidal influenced Pokkali fields are categorized as CRZ IB (Inter Tidal Zones).
- Ecologically sensitive areas, such as mangroves which are categorized as CRZ IA are found at certain locations in the vicinity of the project area. A buffer zone of 50 m is provided around the mangrove area having a spread of more

than 1000 sq.m. which is CRZ I. Inter tidal zones by the tidal influenced water bodies are categorized as CRZ IB.

- Since the project site belongs to the undeveloped areas of three Grama Panchayats namely Pallippuram, Kuzhupilly, Edavanakad of Kochi Taluk and Nayarambalam of Kanayannur Taluk of Ernakulam District, as per the approved CZMP of the State (1996), CRZ landward of the HTL has been categorized as CRZ III.
- The proposed project area falls under CRZ IA, CRZ IB, CRZ IVB and CRZ III.
- Being an Island (Vypin Island) in the Vembanad backwater the CRZ landward limit (CRZ III) from the High Tide Line is 50m or width of the water body whichever is less.
- The proposed Jaiva Vypin project area as provided by the project proponent is superimposed in the CRZ Map.
- Deepening the nine tidal influenced canals as part of the Jaiva Vypin project by de-silting the accumulated sediment so as to improve the natural flow of flood and ebb tides is proposed by the project proponent.
- As per CRZ Notification 2011, Para 3, Clause (i) Sub clause (a) those activities directly related to waterfront for their operations or directly needing foreshore facilities such as ports and harbors, jetties, quays, wharves, erosion control measures, breakwaters, pipelines, lighthouses, navigational safety facilities, coastal police stations and the like are permissible activities within CRZ. However, the permissibility of activities such as Jaiva Vypin project has not been specifically mentioned in the CRZ Notifications.



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PLATES

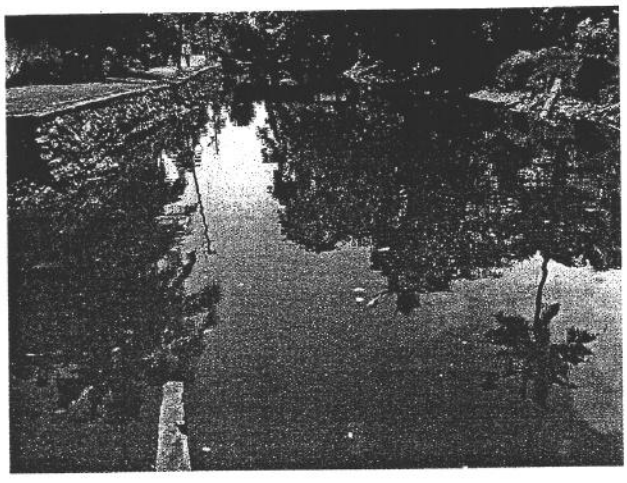

Plate 1: Vadayil *Thodu*

Plate 2: Karuthala *Thodu*

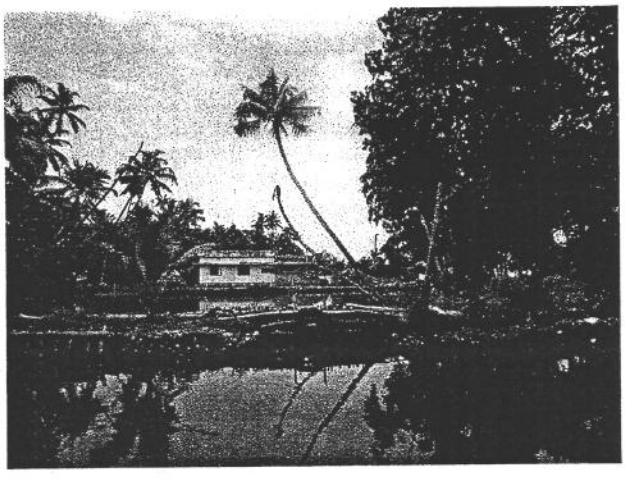

Plate 3: Vasthery *Thodu* and the sluice along its bank

Plate 4: Pokkali field separated from the Ramavarma *Thodu*

Plate 5: Pokkali field adjacent to Ramavarma *Thodu*

Plate 6: Ramavarma *Thodu*

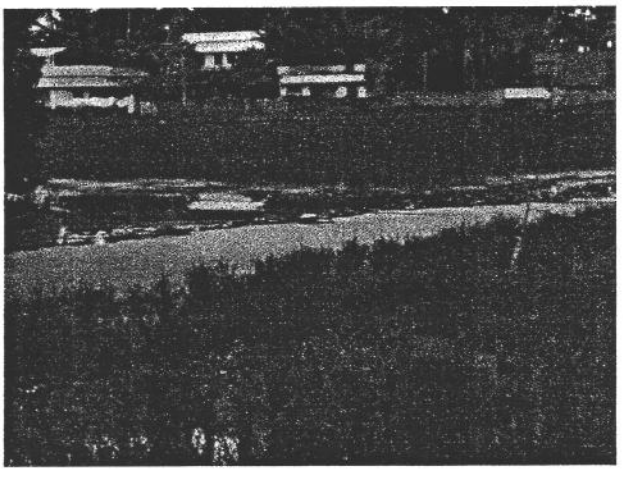

Plate 7: Pokkali field adjacent to Vemblayi *Thodu*

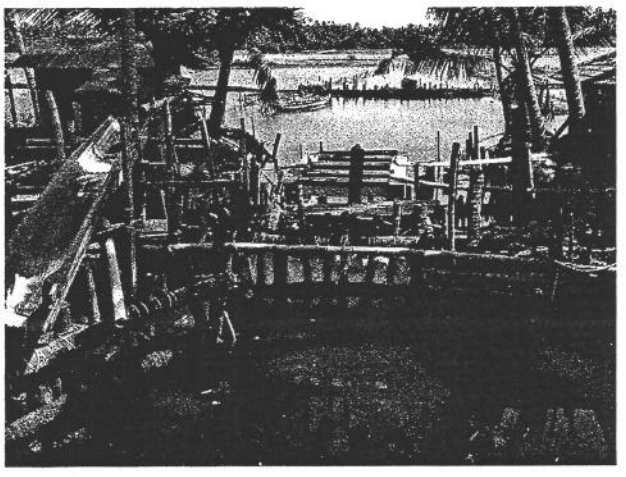

Plate 8: Sluice and Pokkali field along the bank of Vemblayi *Thodu*

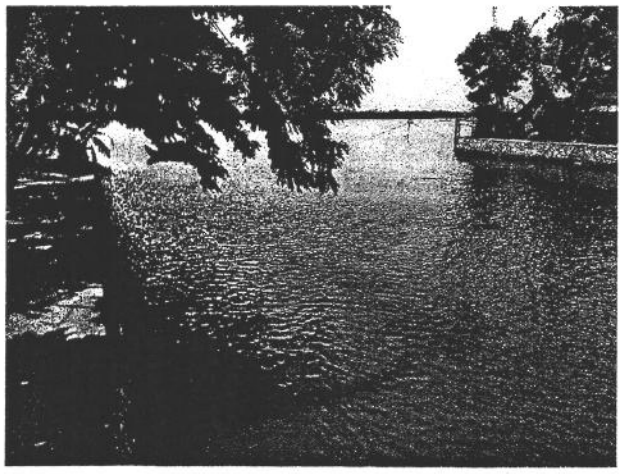

Plate 9: Kuzhupilly Puthen *Thodu*

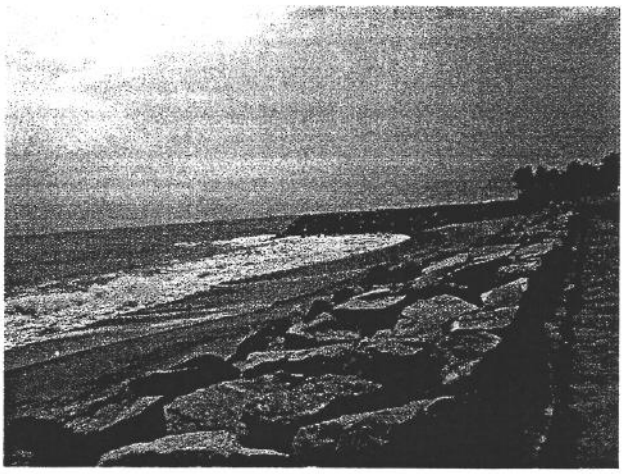

Plate 10: Pazhangad beach with seawall

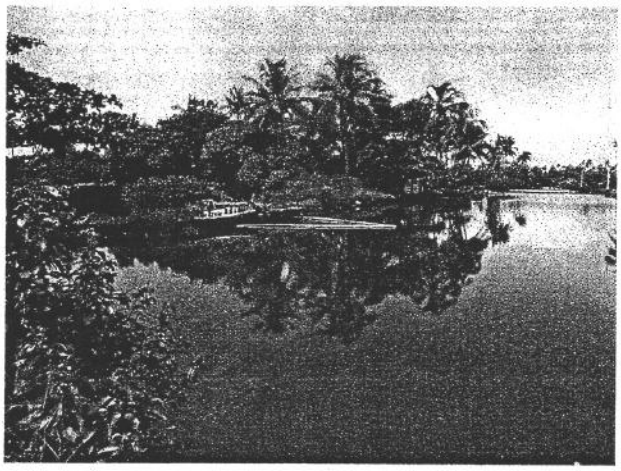

Plate 11: Sluice along the bank of Pazhangad *Thodu*

Plate 12: Mangrove patches along the banks and Pokkali fields adjacent to the Aniyal *Thodu*

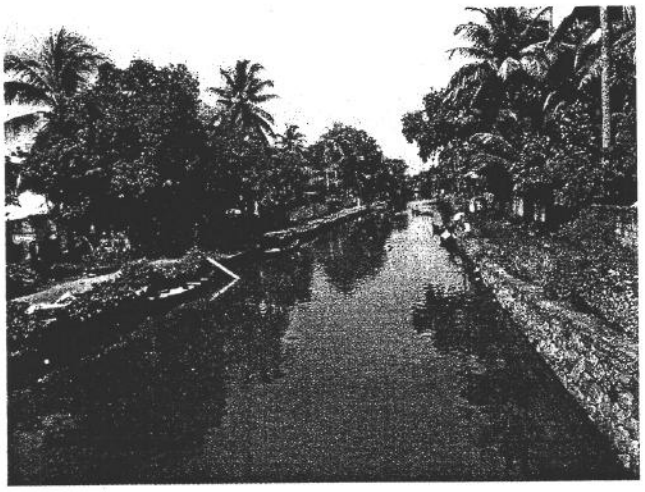

Plate 13: A view of Aniyal *Thodu*

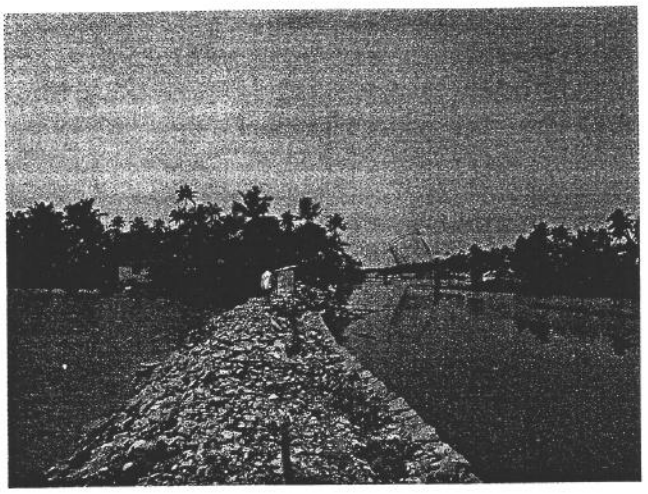

Plate 14: Aniyal Nedungad *Thodu* on the right and Pokkali field in the left

Plate 15: A sluice along the bank of Aniyal Nedungad *Thodu*

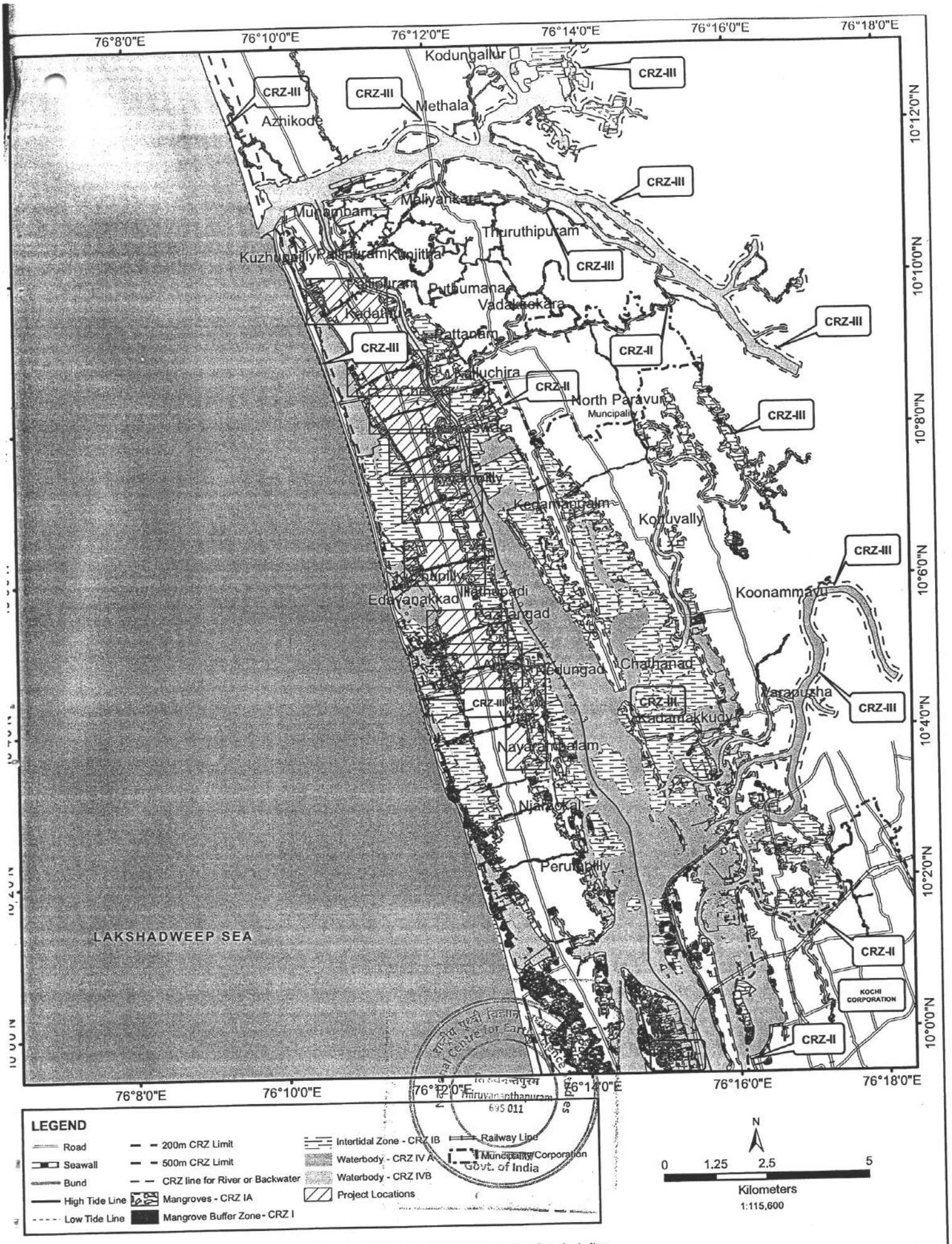

Figure 3. CRZ Categories 7km around the 9 project sites.