COASTAL ZONE MANAGEMENT PLAN OF ALAPPUZHA DISTRICT, KERALA

(As per CRZ Notification 2011 in 1: 25000 scale)



Prepared for

Kerala State Council for Science Technology and Environment,
Govt. of Kerala

NATIONAL CENTRE FOR EARTH SCIENCE STUDIES
Thiruvananthapuram 695 011, Kerala

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National Centre for Earth Science Studies, Thiruvananthapuram

Coastal Zone Management Plan (CZMP) of Alappuzha District in 1:25000

I. Introduction

The coastal policy of the Government of India and the coastal states is to develop the coastal regions of the country within the framework of Integrated Coastal Management Plans (ICMP). This will ensure the utilization of coastal resources to its optimum potential and help the sustenance of the functional integrity of coastal ecosystems. This approach will also help to contain, to a certain extent, the impact of coastal hazards to coastal communities and properties. Regulating high impact activities in the coastal zone through CRZ is one of the effective tools in this endeavour. The CRZ notifications intend to achieve the above objective through providing a framework for ICZMP. It was with this objective the Coastal Regulation Zone (CRZ) Notification (MoEF, 2011; 1991) was introduced in the country. The CRZ notification of 2011 has made it mandatory for the State to prepare Coastal Zone Management Plan (CZMP) as per the guidelines in the notification and get it approved by the Govt of India. Accordingly the preparation of the CZMP has been entrusted with the National Centre for Earth Science Studies (NCESS), Thiruvananthapuram (vide reference STED S.O (M.S) No. 02/2014/STED dt. 10.03.14 and Council (P) Order No. 356/2014/KSCSTE dt.30.04.2014). Coastal Zone Management Plan (CZMP) for Alappuzha district has been prepared as part of the study. The NCESS has been authorised by the Ministry of Environment and Forest, Govt of India to demarcate the High Tide Line and Low Tide Line for CZMP.

II. CRZ of Kerala

CRZ (2011) notification (para 7 (V) A(ii)) has approved a special status for Kerala coastal zone as "areas requiring special consideration for the purpose of protecting the critical coastal environment and difficulties faced by local communities".

1. To facilitate the above requirement, the CRZ of Kerala has been categorized under **Category V (CRZ V)** within which CRZ I, CRZ II, CRZ III and CRZ IV are defined.
2. While detailing the 'Norms for regulation of activities permissible under this notification it is mentioned under (para 8 (V) 2) that in view of the unique coastal

systems of backwater islands together with space limitations along the coast of Kerala, the following activities are regulated in CRZ:

(i) all the islands in the backwaters of Kerala shall be covered under the CRZ notification;

(ii) the islands within the backwaters shall have 50mts width from the High Tide Line on the landward side as the CRZ area;

(iii) within 50m from the HTL of these backwater islands, existing dwelling units of local communities may be repaired or reconstructed, however no new construction shall be permitted;

(iv) beyond 50mts from the HTL on the landward side of backwater islands, dwelling units of local communities may be constructed with the prior permission of the Gram panchayat;

(v) foreshore facilities such as fishing jetty, fish drying yards, net mending yard, fish processing by traditional methods, boat building yards, ice plant, boat repairs and the like, may be taken up within 50m width from HTL of these backwater islands.

3. Under 'Guidelines for preparation of Coastal Zone Management Plans in Annexure I(II)12, it has been directed that 'In the CRZ V areas the land-use map shall be superimposed on the Coastal Zone Management Plan and clearly demarcating the CRZ I, II, III, IV'.

The fisher people are confined to a very narrow stretch of 50 to 100m from the HTL and belong to 'ecosystem people' who require the coastal zone for their settlement requirements and livelihood related activities. Considering the livelihood requirements of the ecosystem people, the high density of coastal population, unique style of their livelihood activities, the CZMP have to project the various requirements to address the difficulties faced by local communities.

III. Coastal Zone Management Plans

The CRZ provides a spatial planning framework for Coastal Zone Management Plans which provide setbacks around sensitive eco-zones restricting development and other activities

close to it. Setbacks require specific reference lines and boundaries for its meaningful implementation. The High Tide Line (HTL) forms the cardinal reference line for determining the setbacks for CRZ. The 100, 200 and 500m CRZ lines landward from the HTL are the landward setback lines. The Low Tide Line (LTL) and the Territorial water boundary (12nm) form the setback lines towards the sea. The Coastal Zone Management Plans are prepared in 2 scales:

1. CZMP consisting of CRZ maps in 1:25000 scale with Survey of India toposheets as base maps.
2. CZMP consisting of CRZ maps in 1:4000 scale with cadastral maps as base maps.

The approach followed is:

i. Generation of data in 1:4000 scale on HTL, LTL and eco-morphological systems relevant for CRZ.

ii. Demarcation of HTL, LTL, ecosystems and morphology relevant for CRZ in 1:25,000.

iii. Demarcation of HTL, LTL, ecosystems and morphology relevant for CRZ in 1:4,000 scale.

iv. Preparation of CZMP maps consisting of CRZ maps in 1:25000 scale.

v. Preparation of Local Level CZMP maps in 1:4000 cadastral scale.

The CZMP/CRZ maps in 1:25000 scale with Survey of India toposheets as base maps are required for formulating policy decisions. These are to be submitted to MoEF, Govt of India for approval after stakeholder/public consultations. The local level CRZ/CZMP are prepared in 1:4000 with cadastral base maps and based on the approved CZMP.

Local level data in cadastral scale has been generated initially which is being used for preparing the 1;25000 CZMP on toposheet base maps. The same is used for local level CRZ/CZMP maps.

IV. CZMP in 1:25000 scale

The present study and report provide the CZMP in 1:25000 scale.

1. High Tide Line

Different tide levels like Mean High Water Springs, Mean Low Water Springs, Lowest Astronomical Tide, etc are defined and successfully used for navigational purposes and sea

surveying. The High Tide Level is dependent on lunar cycles. It is normally taken as the water level at which the high tide intersects with the vertical plane.

The above definition is not in commensurate with the objectives of demarcating the HTL which is to regulate the activities on the land. The experience in demarcating the HTL in Goa way back in 1992-93 brought out the limitations in assigning the usual definitions for the HTL (Menon, 1993). The HTL demarcated in this case for Goa was found to be in the sea during the next monsoon.

A functional HTL is defined in the CRZ notification with the sole objective of protecting a given stretch of coastal strip from environmental degradation. Hence an approach different from the ones followed for navigational purpose, is necessary for demarcating HTL, in tune with the definition given in the Notification.

The HTL is defined 'for the purpose of the notification' as *"the line on the land upto which the highest waterline reaches during the spring tide"* which is different from the well known and widely accepted definition of High Tide Level. The above definition of HTL takes into consideration not only the level of inundation due to maximum tide (spring tide) but also the wave set up (having a seasonal periodicity). 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.

There is a similarity between the HTL thus defined and the High Water Line (HWL) given in Survey of India (SoI) toposheets. Both are lines drawn on the land. But the HWL and HTL are different that the former gives the fair season shoreline (because SoI field mapping is conducted during non-rainy season) during spring tide while the latter accommodates the rough season (monsoon) shoreline oscillations due to monsoon wave set up in addition to spring tide inundation.

2. Low Tide Line

Unlike the HTL the Low Tide Line (LTL) has not been defined for CRZ. The HTL required specific definition since the 100, 200 and 500m setback lines are defined with respect to the HTL. The conventional definition of lowest low water level and the resultant low water line during spring tide may be taken as the LTL.

3. Setback lines

The 100, 200 and 500m setback lines are drawn landward of the HTL. Once the HTL is well defined and demarcated, the above 3 setback lines could be drawn without any ambiguity following planimetric methods.

3.1. Setback line for CRZ II

For urban areas like Alappuzha, Kayamkulam and Cherthala Municipal Councils in which developed areas are eligible to be categorized as CRZ II, the setback lines are different. Those prohibited activities listed under para 3 in the CRZ notification (2011) are applicable for the entire CRZ including CRZ II. Other construction activities are permitted in CRZ II landward of 'existing' buildings or 'existing' or 'approved' roads. The word 'existing' and 'approved' are specifically defined in the notification.

4. Influence of Tidal action

The distance up to which CRZ is applicable upstream of estuaries, creeks, backwaters and lagoons depends on the extent of tidal influence. The distance up to which tidal influence is experienced is dependent on salinity concentration: if it is 5 ppt or more (during the driest month) the water body is considered to be influenced by tidal action (MoEF, 2011). Salinity measurements are carried out during the driest month (usually during March-April) to determine the limit. Tidal barrages and bunds constructed to regulate saline intrusion are also taken as the limit of tidal influence.

5. Different approaches to demarcate HTL

The highest level horizontal positional and spatial accuracy in mapping and presenting the HTL becomes necessary for field uses by CRZ implementing agencies. The agencies are looking for a planimetric accuracy approaching zero error.

The different approaches now practiced in the country to demarcate the HTL are:

- tide level projection
- using morphological signatures
    - field methods
    - satellite data

The NCESS follows the approach using morphological signatures (CESS, 1995) where field methods and satellite data are used in combination.

5.1. HTL using morphological signatures

Morphological signatures are good indicators of shoreline oscillation and inundation of coastal waters, which could be used for identifying the HTL. The inundation of coastal waters on to the land and seasonal shoreline oscillations are dependent on coastal morphology. Shoreline remains stable and would not retreat significantly along cliffy coasts. The shoreline retreats up to the cliff base along pocket beaches. Artificial morphologies like seawalls confine the oscillation of shoreline along the line of the structure itself. Sandy beaches are prone to seasonal and long term shoreline oscillation. Long term stability of the beach and the position of the stable part of the beach would be evident from morphological signatures such as berm and berm crest.

This could be done by field methods and using satellite data.

5.2. Field method

The HTL has to be fixed with respect to certain reference points on the land. These reference points at sufficiently close intervals (preferably at least 1km alongshore) have to be marked with respect to latitude-longitude and known points in the base map. Geomorphologic features like berm crest, cliff, headland, line of permanent vegetation, etc are indicators of the reach of sea water into the land. Stable coastal protective structures like seawall also limit the intrusion of seawater. Hence High Tide Line (line of maximum reach of seawater into the land during spring tide) can be fixed in the field, with respect to these features and tied to the reference points, as detailed below.

a. *Landward (monsoonal) berm crest for beach*es

In all the well-formed wide beaches, one or more berms (which are nearly horizontal part of the beach formed by the deposition of sand by wave action) are usually observed. The seaward end of the berm, which shows a sudden downward slope is called the berm crest. When there is only one berm, it normally gets eroded during the monsoon with a berm crest on the landward side. But when there are two berms the landward berm is the monsoonal berm, which normally do not get eroded. Or else we can say that the erosion reaches only to

the second berm crest. Since the tidal waters do not reach the coast beyond this landward berm crest, it is taken as the HTL. The distance to this point from the reference point is measured using the beach profile to fix the position of the HTL.

b. Seawall/revetments/embankments

In highly erosion-prone areas, there are no landward second berms. Such locations will be protected mostly by seawalls. During monsoon season majority of these are devoid of beaches. The waves impinge upon the seawall during the monsoon season, especially during the high tide. Thus they are the artificial barriers stopping the waves/tides at the coast. Since the seaward part of the seawall in most cases is defaced due to erosion, the landward toe is taken as the HTL boundary in such locations. There are some locations with two or three lines of seawall, particularly in the accreting areas. The seaward seawall is considered here for the purpose. On the other extreme, in the case of continuously eroding sites there are lines of seawall which are now in the sea. In such cases the landward seawall is taken. In order to facilitate the demarcation of HTL at seawall locations, the latter has to be clearly marked in the beach profile during coastal surveys.

c. Permanent Vegetation Line

Permanent vegetation develops on the stable part of the beach. The part of the beach landward of monsoon berm crest is mostly stable. Hence the line of permanent vegetation normally follows the line of monsoon berm crest which is the HTL.

d. Tidal flats and mudflats

Tidal flats and mud flats are formed by fine-grained silts and clays in a medium to large tidal environment. They have a fairly large intertidal zone fringed by vegetation. In such cases the landward limit of HTL can be demarcated as the line of permanent vegetation other than salt marsh vegetation and mangroves of intertidal habitat. Other geomorphic signatures like changes in land forms and sediment characteristics can also be used.

e. Rocks, Headlands, Cliffs

At the rock outcrops, headlands and cliffs the water is quite deep that there is virtually no spatial displacement in the waterline. Hence, the High Water Line available in the topographical maps (transferred to the base map) can be taken as such. However, at the

eroding laterite cliffs (e.g. Varkala, Paravoor, Thalassery in Kerala), the latest position of the toe is taken from the cross section measured at the respective sites. This is to be verified against the satellite imagery and transferred to the base map.

6. 100, 200 & 500m Lines

Once the reference points and the HTL are available, it is not difficult to draw 100, 200 and 500m line on the map as required in the Notification.

The distance of 100, 200 and 500m from the HTL is converted to the map scale at each reference point and demarcated. The above lines are drawn parallel to the HTL uniformly all along the coast.

For the use in the field, the distance of LWL, 100, 200 and 500m line from HTL from all the reference points can be given as a table. The location details, including place names, latitude, longitude etc can also be given in these tables.

7. HTL demarcation in the field and CRZ map generation

Since CRZ is applicable to inland water bodies, the influence of tidal action upstream of the water bodies is determined by verifying the salinity of the water body during the driest month of the year. If the salinity is 5 ppt or more, then the water body is considered to be influenced by tidal action. This is assessed from field measurements and indicators like the limit of tidal influence given in the CZMP (1996) and presence of mangroves.

Field studies are undertaken for fixing ground control points for georeferencing and referring the position of the HTL. A hybrid approach of field studies supported through information extracted from satellite imageries and existing maps are relied upon for CRZ mapping to identify the HTL, LTL, eco-geomorphic systems and land use relevant for CRZ. The eco-geomorphic systems include mangroves, intertidal zone, mudflats, saltpans, etc.

7.1. CRZ/CZM map in 1:25000

The CRZ map in 1:25000 is prepared with Survey of India topsheets as base maps. These toposheets being of the coastal area, are restricted and hence have to be procured through proper channel following specified procedures and after giving statutory undertakings to ensure authorized use and safe custody. Toposheets of the area of study are georeferenced and the High Water Line (HWL) in the toposheets have been extracted along with other

coastal features like waterbodies, inter tidal zones, mudflats, beaches, mangroves, saltpans, prawn aqua farms, etc. The HWL is updated with current field measurements and satellite imageries to get the present HTL. Field measurements were made in 1:4000 scale for better accuracy and compatibility with large scale local level CZMP.

The variations of present HTL from that of CZMP (1996) is verified and documented. The probable reasons for the variations are looked into and the details are given wherever possible. These are provided separately.

7.2. CRZ/CZM map in 1:4000

The base map on which HTL and LTL are demarcated have to be familiar for officials of local bodies and the public. These have to be of sufficiently large scale with sufficient number of reference points identifiable on the ground for facilitating field applications.

7.3 Base maps

Cadastral maps available with Revenue/Survey and Land Records Dept are in 1:4000 or 1:5000 scale. Survey plots and plot boundaries are locatable on the ground. 'Plot boundary junction points' are taken as the reference points. The National Centre for earth Science Studies has successfully used cadastral maps for preparing Panchayat resource maps which are being widely used by local bodies for local level planning (CESS 2000).

8. Field mapping and map generation

Initially cadastral maps of the required area are obtained from the concerned departments (Revenue/ Survey and Land Records Dept). These are checked for its scale accuracy through comparing the distance of 2 known points from the map and from the ground. Toposheets and imageries of the area for which HTL is to be demarcated, are referred to know the features and available morphological signatures. Information derived from toposheets and satellite imageries of different coastal ecosystems in the given area is used as baseline information for planning the field investigations. Cadastral maps are rectified with coordinates of known ground control points (GCP) taken from the field. The datum used is WGS 84 and the projection is UTM.

Ground features that can be clearly identified both on the ground and on the cadastral map are used as ground control points (GCP). With precise planimetry of the identified GCPs, the

cadastral maps are geo-referenced with GPS/DGPS measured geo coordinates. GCPs used are survey plot boundary junctions or survey stones established at the time of field survey for the preparation of cadastral maps. These are identified in the field. At least one control point is identified within 1km of alongshore length. The coordinates (Latitude; Longitude) of the identified control points are taken using GPS/DGPS. The signature for the nearest HTL is identified and distance to the HTL from the control point is measured with distometer (usually laser distometer). The GPS/DGPS is moved along the HTL identified through signatures and the readings are recorded. Wherever possible these are linked to the control points identified earlier and distance to HTL measured with distometer. There are a few sites, especially in Arattupuzha sector (Valiazheekal, Perumpally), where the seawalls are damaged or sinking. In such locations sea water reaches landward of the line of damaged seawalls. Normally these seawalls will be repaired / reconstructed in the future itself along the original line of seawalls. Considering the above, the line of original seawalls itself is considered for HTL even though seawater temporarily reaches landward of damaged seawalls.

The data collected is transferred to cadastral maps and superimposed in GIS platform. Information from satellite imageries are used to verify the data collected and also to supplement the data wherever the area is not approachable. Cadastral maps and satellite images are rectified in the same geographical coordinate system and projection.

The most difficult part is the transferring of information from imageries to un-projected cadastral maps on which CRZ maps are prepared. This is overcome by using sufficient number of precise reference/control points spread over the entire study area for georeferencing and compartmentalizing the maps. One of the major contributors to errors is those occurring while reproducing the cadastral map from original map through photocopying and scanning. While photocopying the enlargement or reduction produce the scale error; also the shrinkage/folding of paper during the process. Another is the scale error during geo-referencing the map. It may be noted that cadastral maps have no projection while the images are projected. When overlying cadastral map on image by applying a common coordinate system, some distortions do occur at edges and in the shape of features such as road network, plot boundary etc. The errors in reproduction of cadastral maps can be minimized by taking proper precautions. The errors in georeferencing could be controlled by taking precautions through selection of proper field Ground Control Points (GCPs) and

identifying the field GCPs in the cadastral as well as satellite images precisely. And by making some finer adjustments, the ecosystem boundaries delineated from satellite images could be matched with real cadastral boundaries on the ground.

The use of satellite imageries in combination with field mapping provides better results in cadastral level mapping. At the same time, various location and spatial errors that could get magnified in large scale maps like cadastral maps require to be contained through appropriate approach.

8.1. Use of Remote sensing data for HTL

With the availability of precision GPS and high resolution satellite data like WorldView, Quick Bird, IKONOS, Resourcesat (P6) and Cartosat, it is now possible to get a mapping accuracy of less than one meter for the demarcation of HTL/LTL. It requires georeferencing using accurate GPS data at precisely locatable Ground Control Points (GCPs) in satellite images to have improved accuracy level in the identification and demarcation of HTL/LTL. Accurately identifying the positions for HTL with respect to signatures may become difficult when vegetation like coconuts cover the signatures. For getting multispectral data with high spatial resolution, the WorldView-2 (PAN) image has been fused with WorldView-2 (multispectral) and has been used wherever required. The WorldView-2 images have spatial resolution of 0.50 m (Panchromatic) and 2m (multispectral).

8.2. LTL delineation

The LTL also depends on lunar cycle. The seaward/waterside limit will depend on the width of tidal flat and beach. An initial assessment of LTL could be made from Hydrographical charts. While mapping HTL the signatures of LTL could be noted and the distance from HTL to LTL may be assessed. This is further verified and corrected with the information from Hydrographical charts and satellite imageries. Information on LTL is derived from satellite imagery by identifying the seaward limit of beach/ tidal flat during fair season when the beaches/ intertidal zone have maximum width.

9. CZMP/CRZ map of Alappuzha in 1:25000 scale

The Coastal Regulation Zones in Alappuzha district is given in 10 toposheets of 1:25000 scale. These are:

Sheet Nos. 58 C5 NW, 58 C5 SW, 58 C6 NW, 58 C6 NE, 58 C6 SW, 58 C7 NW, 58 C7 SW, 58 C7 SE, 58 C8 NE and 58 C12 NW.

The CRZ field mapping was carried out during March 2014 to August 2014. As already discussed High Water Line (HWL) has been extracted from geo-referenced SOI toposheets following standard procedures. Field data was generated in 1:4000 scale from 33 villages of Alappuzha district. These villages are in 32 panchayats and 3 municipalities (Table 1).

Table 1. Local bodies in Alappuzha district that have CRZ

Sl No	Local body	Sl No	Local body
1	Chertha Municipality	16	Mararikkulam South Panchayath
2	Alappuzha Municipality	17	Aryad Panchayath
3	Kayamkulam Municipality	18	Punnapra North Panchayath
1	Aroor Panchayath	19	Punnapra South Panchayath
2	Arookutty Panchayath	20	Ambalappuzha North Panchayath
3	Ezhupunna Panchayath	21	Ambalappuzha South Panchayath
4	Panavally Panchayath	22	Purakkad Panchayath
5	Kodamthuruthu Panchayath	23	Thrikkunnapuzha Panchayath
6	Thycattussery Panchayath	24	Karthikappally Panchayath
7	Kuthiathode Panchayath	25	Chingoli Panchayath
8	Thuravoor Panchayath	26	Arattupuzha Panchayath
9	Chennam- Pallippuram Panchayath	27	Muthukulam Panchayath
10	Pattanakkad Panchayath	28	Kandallor Panchayath
11	Vayalar Panchayath	29	Pathiyoor Panchayath
12	Kadakkarappally Panchayath	30	Chettikulangara Panchayath
13	Cherthala South Panchayath	31	Krishnapuram Panchayath
14	Thannermukkam Panchayath	32	Perumbalam Panchayath
15	Mararikkulam North Panchayath		

The HWL has been appropriately modified with the HTL obtained from field observations and satellite imageries for preparing the CZMP as per CRZ 2011.

9.1. Data Sources

In addition to field investigations including GPS/DGPS mapping, data sources such as topographic sheets, hydrographic charts and satellite images have been used. An initial assessment of the morphology and ecosystems is obtained from Google imageries which are mostly QuickBird images. Google imageries (QuickBird) of 2010 and 2011, available in the

public domain, were downloaded as different scenes with resolution zoomed to the required level. These are then merged in Photoshop and georeferenced.

WorldView -2 with spatial resolution of 0.50 m (Panchromatic) and 2m (Multispectral) is also used wherever required.

9.2. Salinity and upstream boundary

The coastal areas of Alappuzha district have a network of backwaters, estuaries and interconnecting canals which brings large areas of the district within the CRZ in addition to the seacoast. These backwater systems get connected to the sea through Kayamkulam and Andhakaranazhi tidal inlets in the district. Poomeen Pozhi, Kochupozhi, Vavakkad Pozhi, Arappa Pozhi, Vadapozhi, Thumboli pozhi, Priyadarshini Pozhi, Odapozhi, Vazhakkottam Pozhi, Arakka Pozhi, Mararikkulam Pozhi, Chethipozhi, Chennavelipozhi and Arthungal Pozhi are some of the minor seasonal inlets (*Arappas*) which are not backed by any backwater system. The Vembanad backwater system which extends further north of the district, is the major component in this network. It is spread over 196 km in the north-south and 29 km in the east-west directions with depths ranging from 0.6 m to 4m. It receives drainage from five rivers, Periyar in the north to Achankovil in the south. The Vembanad wetland system is a major habitat for fishery and other organisms. It also harbours a variety of birds. There are many historic places situated on the banks and hinterlands of the Vembanad backwaters. Industries based on fishery, coir, shell and tourism are flourishing in this sector. The National Waterway also passes through this. The development on the banks of the backwater system has resulted in large scale reclamations over the last many years.

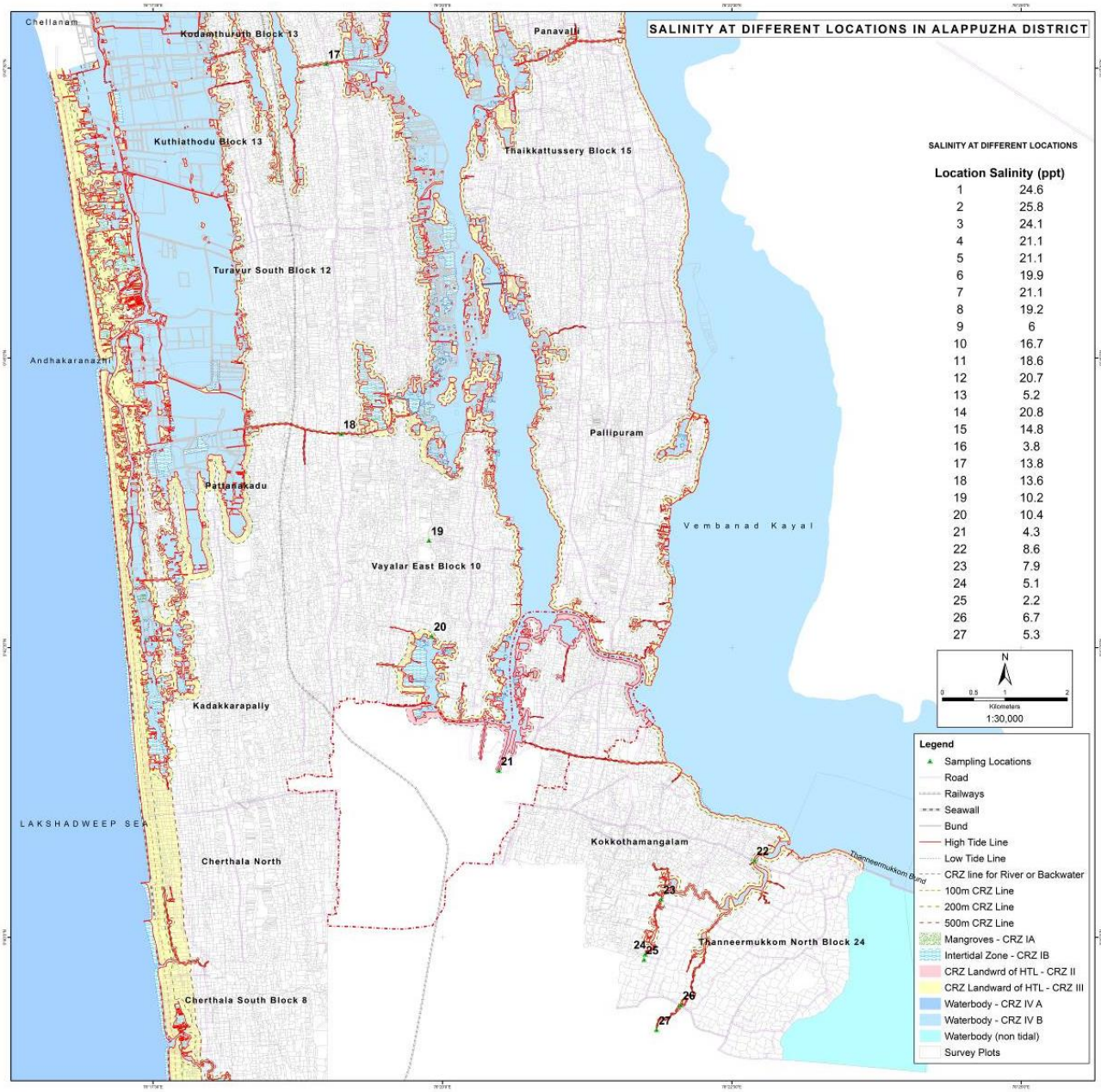


Figure 1. Salinity distributions in Alappuzha district (northern part)

Vembanad backwater system is one among the three Ramsar sites in Kerala. It is also declared as a Critically Vulnerable Coastal Area (CVCA) in the CRZ (2011) notification.

The Thanneermukkom barrier of about 1250 m long constructed across the Vembanad backwater at one of its narrower part prevent the ingress of salinity further south into the Kuttanad region during summer season and also to retain the fresh water inflow from the rivers into the backwater. The bund divides the backwater into two distinct segments - the freshwater dominant southern zone and the saltwater dominant northern zone.

The Thottappally spillway is another tidal barrier on the south side which regulates the ingress of salinity in the southern sector.

Table 2. Salinity at different locations in Alappuzha district

Sl. No.	Location	Latitude	Longitude	Date	Salinity (ppt)
1	Kayamkulam Canal	9°10'24.3"	76°29'47.3"	29.3.14	24.6
2	Kayamkulam Kayal South Canal	9°10'03.3"	76°29'48.6"	29.3.14	25.8
3	Kavadipalam	9°09'31.9"	76°30'02.7"	29.3.14	24.1
4	Choolatheruvu.	9°13'55.3"	76°26'28.4"	29.3.14	21.1
5	Canal Eastern side of NTPC	9°15'6.60"	76°25'54.8"	29.3.14	21.1
6	Canal aside Karthikapally to Trikkunnapuzha	9°15'36.0"	76°26'46.3"	29.3.14	19.9
7	Trikkunnapuzha	9°15'28.1"	76°25'30.2"	29.3.14	21.1
8	Trikkunnapuzha	9°15'29.1"	76°25'29.7"	29.3.14	19.2
9	Pulikkal Ar (Small Stream)	9°15'50.3"	76°25'4.9"	29.3.14	6.0
10	Pulikkal Ar	9°15'55.00"	76°25'0.30"	29.3.14	16.7
11	Kayamkulam Kayal. Puthuval Bridge	9°08'58.0"	76°30'37.6"	28.4.14	18.6
12	Kayamkulam Kayal South Canal.	9°08'55.7"	76°30'18.9"	28.4.14	20.7
13	Kayamkulam Kayal South Canal. NH Bridge	9°09'10.4"	76°30'41.5"	28.4.14	5.2
14	Kayamkulam main canal-Karaiath Bridge location	9°10'57.9"	76°30'0.6"	28.4.14	20.8
15	Kayamkulam main canal-Eriyodu Bridge location	9°11'38.4"	76°30'02.2"	28.4.14	14.8
16	Kayamkulam main canal-Pathiyoor Bridge location.	9°12'42.3"	76°29'50.0"	28.4.14	3.8
17	Canal crossing bridge Aroor to Sherthala	9°47'32.3"	76°18'59.5"	29.4.14	13.8
18	Ponnamveli Thode	9°44'20.7"	76°19'07.4"	29.4.14	13.6
19	Mukkannan kavala	9°43'25.5"	76°19'52.9"	29.4.14	10.2
20	Vayalar	9°42'36.0"	76°19'54.4"	29.4.14	10.4
21	Irumbupalam. Bridge location along TS canal	9°41'26.3"	76°20'29.2"	29.4.14	4.3
22	Kattachira Ar-Bridge location along Shertalai to Thanneermukkom road.	9°40'39.8"	76°22'41.6"	29.4.14	8.6
23	Kattachira Ar	9°40'19.7"	76°21'53.3"	29.4.14	7.9
24	Tributary of Kattachira Ar	9°39'51.3"	76°21'45.0"	29.4.14	5.1
25	Tributary of Kattachira Ar	9°39'48.5"	76°21'44.4"	29.4.14	2.2
26	Kattachira Ar- Mattathiparambu	9°39'25.0"	76°22'03.4"	29.4.14	6.7
27	Kattachira Ar	9°39'12.1"	76°21'50.9"	29.4.14	5.3

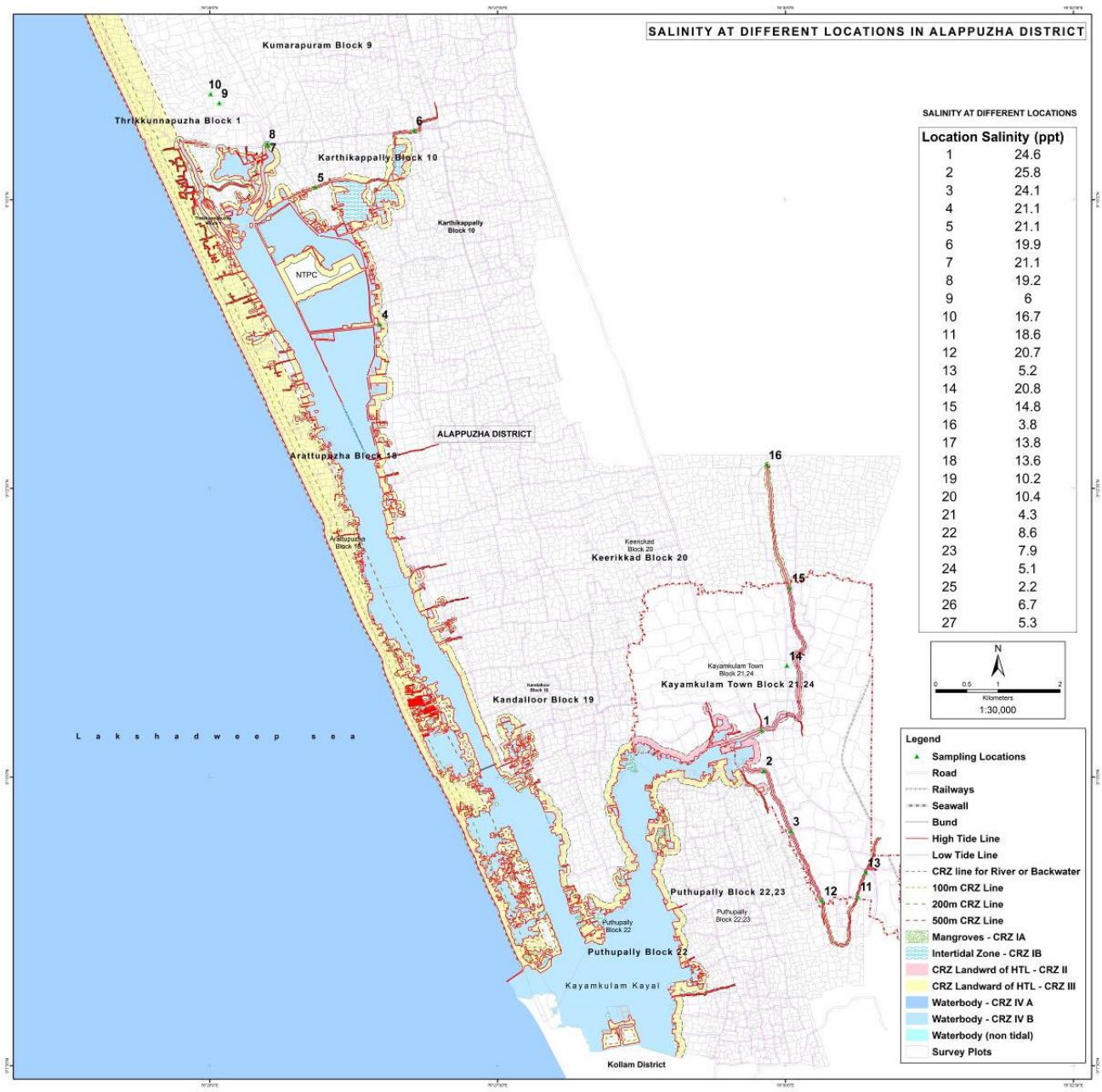


Figure 2. Salinity distributions in Alappuzha district (Kayamkulam kayal)

The salinity of 5 ppt is limited to the part of the backwater north of Thanneermukkom bund. Many of the canals have sluices to regulate the saline incursion and limiting the salinity less than 5 ppt. Details of salinity measurements are given in Table 2, Figure1 and Figure 2.

10. CRZ categories

The CRZ of Alappuzha consists of CRZ I (CRZ IA & CRZ IB), CRZ II, CRZ III and CRZ IV. The CRZ IA are those ecologically sensitive and the geomorphological features which play a role in maintaining the integrity of the coast as listed under para '7(i)A' such as mangroves, corals, sand dunes, seagrass, nesting grounds of birds, areas of structures of archaeological importance and heritage sites, etc. The CRZ IB is area between Low Tide Line and High Tide Line. The CRZ II is those developed areas (with more than 50% built up area) in legally designated urban areas. Alappuzha, Kayamkulam and Cherthala Municipalities are the urban areas in Alappuzha district. The CRZ in these urban areas which have more than 50% built up area, is CRZ II. The CRZ III is undeveloped areas in the CRZ of Alappuzha. The CRZ IV is the nearshore waters, the tidal influenced inland waterbodies and the bed. The details are given in the attached CRZ map (Table 1).

The spread of mangroves is limited to Puthuppally, Arattupuzha, Karthikappally and Kandalloor regions of Kayamkulam Kayal; Pallipuram, Thaikkattussery, Panavalli, Vaduthala, Arookutti areas of Vayalar Kayal; Aroor and south east of Chellanam of Vembanad kayal and in Ezhupunna, Thuravur regions of Ezhupunna Kayal. Extensive mangrove patches are also seen in the active *Pokkali* fields of Kadakkarapally, Kodamthuruth and Pattanakadu regions.

The major mangrove species observed are *Avicennia officinalis*, *Rhizophora mucronata*, *Bruguiera gymnorrhiza*, *Acrostichum aureum*, *Acanthus ilicifolius* and *Sonneratia alba*. The major mangrove associates are *Pandanus odoratissimus, Cayratia trifolia*, *Cerbera Odollam*, *Clerodendrum inerme, Calophyllum inophyllum*, *Premna serratifolia* and *Thespesia populnea*.

CRZ IB includes the tidal flats and inter tidal zones spread along the backwaters and rivers in the CRZ area and the seasonal beach along the seacoast. In many areas, large number of coconut trees are planted along narrow bunds in the tidal influenced water bodies. These areas are shown as inter tidal zone due to scale limitations. Reclamation of tidal flats and waterbody has caused significant changes in the morphology and HTL in certain places.

Urban areas in the district such as Alappuzha, Kayamkulam and Cherthala Municipalities are highly developed with very high potential for further development. The Kerala Coastal Zone

Management Authority and the Govt of Kerala took the view that the CRZ in these urban areas, other than CRZ I, CRZ IV and open spaces such as parks and play grounds have built up area more than 50% and hence could be considered as CRZ II. Accordingly the CRZ in Alappuzha, Kayamkulam and Cherthala Municipalities, other than CRZ I and CRZ IV, are shown as CRZ II.

The district has HTL for a length of 1057.06 km. The total CRZ area 75.4 km^2 out of which 4.75 km^2 is CRZ II and 53.75 km^2 is CRZ III. Mangrove area (CRZ IA) is 1.43 km^2 with a mangrove buffer zone of 5.40 km^2. The intertidal zone (mostly mudflats on the banks of backwater) is spread over 11.07 km^2 (Table 3 and Table 4).

Table 3. CRZ details of Alappuzha District*

HTL Length (km)	Mangroves (CRZ IA) (km^2)	Inter Tidal Zone (CRZ IB) (km^2)	Mangrove buffer zone (CRZ I) (km^2)	CRZ II (km^2)	CRZ III (km^2)	CRZ (total km^2)
1057.06	**1.43**	**11.07**	**5.40**	**4.75**	**53.75**	**75.4**

***** excluding CRZ IV

Table 4. CRZ details of Alappuzha District in village *

Village	Block	High Tide Line (km)	Inter Tidal Zone (CRZ IB) km²	Mangroves (CRZ IA) km²	Mangrove Buffer Zone (CRZ I) (km²)	CRZ II (km²)	CRZ III (km²)
Ambalapuzha	14,15	3.93	0.032	0.000	0.000	0.00	1.94
Arattupuzha	18	93.02	0.768	0.154	0.437	0.00	7.37
Ariyad South Alapuzha Municipality	4,10	8.43	0.080	0.000	0.000	1.26	0.00
Aroor		81.18	0.347	0.282	1.037	0.00	1.79
Cherthala Municipality	10	26.82	0.038	0.004	0.022	0.78	0.00
Cherthala North		4.48	0.072	0.000	0.000	0.00	0.88
Cherthala South	8	16.77	0.307	0.000	0.000	0.00	1.72
East of Ezhupunna		11.22	0.031	0.030	0.131	0.00	0.23
Ezhupunna		90.33	0.600	0.270	0.646	0.00	1.83
Kadakkrapalli		38.88	0.724	0.050	0.252	0.00	1.79
Kalavoor	1,2	13.96	0.147	0.000	0.000	0.00	1.49
Kandalloor	19	0.00	0.223	0.008	123.65m²	0.00	0.57
Karthikappally	10	0.00	0.549	67.49 m²	0.000	0.00	0.90
Karuvatta	1,2,21	5.25	0.156	0.000	0.000	0.00	1.17
Kayamkulam Town including Kayamkulam Municipality	19,20, 21,22, 23,24	0.00	0.058	0.002	0.000	0.71	0.18
Kodamuthuruth	13	74.65	0.477	0.037	0.115	0.00	1.54
Kokkothamangalam		11.44	0.019	0.000	0.000	67.31 m²	0.34
Kuthiathodu	13	45.67	0.335	0.036	0.080	0.00	1.40
Mararikulam North	30,31	21.04	0.350	0.001	0.000	0.00	2.41
Mullakal Alappuzha Municipality		10.62	0.264	0.004	0.033	1.99	0.01
Pallipuram		47.69	0.170	0.014	0.056	0.00	1.33
Panavalli		37.24	0.197	0.009	0.045	0.00	1.03
Pathirappally	2,7	15.59	0.046	0.000	0.000	0.005 m²	2.56
Pattanakadu		88.51	0.793	0.100	0.529	0.00	2.77
Punnappra	9,12,13	19.20	0.417	0.002	0.000	26.04 m²	3.09
Purakkad	18,19,20,21	8.61	0.187	0.000	0.000	0.00	2.82
Puthupally	22,23	0.00	0.306	0.040	0.072	0.01	1.05
South of Karthikappalli		0.00	23.67 m²	0.000	0.000	0.00	0.03
Thanneermukkom North	24	6.46	0.000	0.000	0.000	0.00	0.23
Thrikkunnapuzha	1	8.29	0.211	62.76 m²	0.000	0.00	4.37
Thykkattucheri	15	45.60	0.242	0.021	0.089	0.00	1.32
Turavur South	12	106.52	1.337	0.211	1.007	0.00	2.40
Vaduthalamattathi bhagam	1	64.76	0.436	0.116	0.564	0.00	1.76
Vayalar East	10	50.89	0.605	0.031	0.082	0.00	1.42
Adjoining areas of villages inside the Kayal			0.550	0.007	0.201		
Total area		**1057.06**	**11.07**	**1.43**	**5.40**	**4.75**	**53.75**

***** excluding CRZ IV

11. Summary

- Alappuzha District has Lakshadweep Sea is on its west with CRZ along seacoast. The Vembanad backwater system with its network of backwaters such as Kayamkulam Kayal, Vayalar Kayal, Ezhupunna Kayal and interconnecting canals brings large areas of the district within the CRZ. Few small seasonal tidal inlets (*arappas*) also have CRZ on the banks.
- The backwater system gets connected to the sea through Kayamkulam and Andhakaranazhi tidal inlets.
- Thanneermukkom bund and Thottappally spillway limit the ingress of saline water further upstream in the Vembanad backwater system.
- There are many small streams (*arappas*) which seasonally get connected to the sea between Thottappally and Andhakaranazhi.
- Poomeen Pozhi, Kochupozhi, Vavakkad Pozhi, Arappa Pozhi, Vadapozhi, Thumboli pozhi, Priyadarshini Pozhi, Odapozhi, Vazhakkottam Pozhi, Arakka Pozhi, Mararikkulam Pozhi, Chethipozhi, Chennavelipozhi and Arthungal Pozhi are some of the minor seasonal inlets (*arappas*). These are not backed by any river-backwater system.
- Bunds and sluices have regulated the flow of tidal waters in many canals and rivers.
- CRZ map of Alappuzha District is contained in toposheets Nos. 58 C5 NW, 58 C5 SW, 58 C6 NW, 58 C6 NE, 58 C6 SW, 58 C7 NW, 58 C7 SW, 58 C7 SE, 58 C8 NE and 58 C12 NW.
- The CZMP is prepared in 1:25000 scale based on field information collected with respect to 1:4000 cadastral maps.
- Large scale reclamations have modified the HTL over the last many years.
- Alappuzha, Kayamkulam and Cherthala Municipalities are highly developed with a very high potential for further development. Hence the CRZ in these Municipalities, other than CRZ I, CRZ IV and open spaces such as parks and playgrounds is considered to have built up area more than 50%.

- The Alappuzha district has HTL for a length of 1057.06 km.
- The CRZ of the district consists of CRZ I, CRZ II, CRZ III and CRZ IV. Parks, playgrounds and similar open spaces in urban areas (not shown in the present CZMP) are to be categorized as CRZ III.
- The total CRZ area excluding CRZ IV is 75.4 km^2.
- The CRZ of Cherthala, Alappuzha and Kayamkulam municipalities which have more than 50% built up area, is CRZ II. The total area of CRZ II is 4.75 km^2. Parks, playgrounds and similar open spaces in the above municipalities are CRZ III.
- The total area of CRZ III in the panchayaths of Alappuzha district is 53.75 km^2.
- Mangrove area (CRZ IA) is 1.43 km^2 with a mangrove buffer zone of 5.40 km^2.
- The major mangrove species observed are *Avicennia officinalis*, *Rhizophora mucronata*,*Bruguiera gymnorrhiza*, *Acrostichum aureum*, *Acanthus ilicifolius* and *Sonneratia alba*. The major mangrove associates are *Pandanus odoratissimus*, *Cayratia trifolia*, *Cerbera Odollam*, *Clerodendrum inerme*, *Calophyllum inophyllum*, *Premna serratifolia* and *Thespesia populnea*.
- Notified archeological sites and heritage sites are CRZ IA.
- Intertidal zone (which includes sandy beaches and tidal flats on the banks of backwater/ river) is CRZ IB and is spread over 11.07 km^2.Coconut trees are intermittently planted along narrow bunds in some of the tidal influenced waterbodies. These areas are shown as inter tidal zone due to scale limitations.
- No distinction is made between biologically active and 'not biologically active' mudflats.

DOCUMENTATION PAGE

1. REPORT NUMBER	CESS - PR- 10- 2014
2. TYPE OF REPORT	PROJECT REPORT
3. TITLE	CZMP OF ALAPPUZHA DISTRICT, KERALA
4. PRINCIPAL INVESTIGATOR INVESTIGATORS PROJECT FELLOWS	K. V. Thomas List of Project team given overleaf
5. KEY WORDS	Coastal Zone Management Plan (CZMP), Coastal Regulation Zone (CRZ), Coastal morphologies, berm crest, cliff, High Water Line, High Tide Line (HTL), Low Tide Line (LTL), CRZ IA, CRZ IB, CRZ II, CRZ III and CRZ IV, Thanneermukkom bund, Thottappally spillway
6. ABSTRACT	The CZM/CRZ maps of Alappuzha district in 1:25000 scale (as per CRZ 2011 notification) with Survey of India toposheets as base maps are presented in this report. The data was generated with cadastral accuracy, which was later transferred to base maps extracted from toposheets in 1:25000. The CRZ of Alappuzha district is shown in 10 toposheets in 1:25000 scale. The coastal areas of Alappuzha district have a network of backwaters, estuaries and interconnecting canals which brings large areas of the district within the CRZ in addition to the seacoast. The Vembanad backwater system which extends further north of the district is the major component in this network. Thanneermukkom bund and Thottappally spillway regulates the ingress of salinity further upstream in the backwater system in the north and south part of the district. The backwater system gets connected to the sea through Kayamkulam and Andhakaranazhi tidal inlets. Mangroves are observed along the banks of Kayamkulam Kayal, Vayalar Kayal, Ezhupunna Kayal etc. which are categorized as CRZ IA. The CRZ IB is intertidal area between Low Tide Line and High Tide Line. Reclamation of mudflats/tidal flats and waterbody has caused significant changes in the morphology and HTL in certain places. The CRZ in urban areas other than CRZ I and CRZ IV, which have more than 50% built up area, is CRZ II. Urban areas such as Alappuzha, Kayamkulam and Cherthala Municipality in Alappuzha district are highly developed with very high potential for further development and hence the entire CRZ other than CRZ I and CRZ IV in these are included under CRZ II. The CRZ III is undeveloped areas in the CRZ of the district which includes the CRZ of gram panchayats. The CRZ IV is the nearshore waters, the tidal influenced inland waterbodies and the bed. The district has HTL for a length of 1057.06 km. The total CRZ area is 75.4 km^2. CRZ II is 4.75 $km^2$and CRZ III is 53.75 km^2. Mangrove area (CRZ IA) is 1.43 km^2 with a mangrove buffer zone (CRZ I) of 5.40 km^2. The intertidal zone, CRZ IB (mostly mudflats on the banks of backwater) is spread over 11.07km^2.
7. DISTRIBUTION STATEMENT	NOT RESTRICTED
8. INSTITUTION	Kerala State Council for Science Technology and Environment, Govt. of Kerala

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D. Raju		
M.K. Sreeraj		
M.K. Rafeeque		
Dr. K. Raju		
S. Mohanan		

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Muhammed Sameer	-	Technical Assistant
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K.V. Laju Prasad	-	Technical Assistant
R. Shihabudeen	-	Technical Assistant

Coastal Zone Management of Kerala - Alappuzha District

76°17'30"E

76°20'0"E

9°5'30"N

9°3'0"N

ERNAKULAM DISTRICT

Lakshadweep Sea

Aroor

Vembanad Kayal

A L A P P U Z H A

Continued to sheet no. 58 C5 SW

Index Map

58 C5 NW



CZMP MAP IN 1:25000

SHEET No.	DISTRICT	TALUK
58 C5 NW	ALAPPUZHA	CHERTHALA

Map Projection : UTM Zone 43 N
Datum : WGS 84

CRZ of Alappuzha District is shown on toposheet nos.58 C5 NW, 58 C5 SW, 58 C6 NW, 58 C6 NE, 58 C6SW, 58 C7 NW, 58 C7 SW, 58 C7 SE, 58 C8 NE and 58 C12 NW

Legend

- Church
- Mosque
- Temple
- Road
- Railway line
- Seawall
- Bund (many of the narrow bunds not shown)
- Municipal/ Corporation Boundary
- Village Boundary
- High Tide Line
- Low Tide Line
- CRZ Line for River or Backwater
- 100m CRZ Line
- 200m CRZ Line
- 500m CRZ Line
- Mangroves - CRZ IA
- Mangrove Buffer Zone - CRZ I
- Inter Tidal Zone - CRZ IB
- CRZ II [Being in Corporation/Municipality, the developed area (>50% builtup area) in the CRZ is CRZ II]
- CRZ III
- Waterbody (sea) - CRZ IV A
- Waterbody (backwater) - CRZ IV B
- Waterbody (non-tidal)
- 45 Survey Plots

Coastal Zone Management Plan
Alappuzha District, Kerala

Mapped During	Scale
March - 2014 September - 2014	0 250 500 1,000 Meters 1:25,000

Checked by	Approved by
DRAFT MAP	

Refer CRZ report for details

National Centre for Earth Science Studies
Akkulam, Thuruvikkal P.O
Thiruvananthapuram - 11

Coastal Zone Management of Kerala - Alappuzha District

Continued to sheet no. 58 C5 NW

76°17'30"E 76°20'0"E

9°50'0"N 9°47'30"N

ERANAKULAM

Aroor

Filtration Pond

Vaduthalamattathi bhagam

Vembanad Kayal

Vaduthalamattathi Bhagam Block 1

P e r u m p a l a m

Ezhupunna

A L A P P U Z H A

Panavalli

Coconut on intermittent bunds

Kodamuthuruth Block 13

Vembanad Kayal

Vayalar Kayal

KOTTAYAM

Thykkattucheri Block 15

Kuthiathodu Block 13

Turavur South Block 12

Pallipuram

L a k s h a d w e e p s e a

Continued to sheet no. 58 C6 NW

Index Map

58 C5 SW



± CZMP MAP IN 1:25000

SHEET No.	DISTRICT	TALUK
58 C5 SW	ALAPPUZHA	CHERTHALA

Map Projection : UTM Zone 43 N
Datum : WGS 84

CRZ of Alappuzha District is shown on toposheet nos.58 C5 NW, 58 C5 SW, 58 C6 NW, 58 C6 NE, 58 C6SW, 58 C7 NW, 58 C7 SW, 58 C7 SE, 58 C8 NE and 58 C12 NW

Legend

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- Mosque
- Temple
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Coastal Zone Management Plan
Alappuzha District, Kerala

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March - 2014 September - 2014	0 250 500 1,000 Meters 1:25,000

Checked by	Approved by
DRAFT MAP	

Refer CRZ report for details

National Centre for Earth Science Studies
Akkulam, Thuruvikkal P.O
Thiruvananthapuram - 11

Coastal Zone Management of Kerala - Alappuzha District

76°25'0"E

76°27'30"E

9°42'30"N

9°40'0"N

KOTTAYAM

Vembanad Kayal

Kokkothamangalam

Thanneermukkom Bund

Thanneermukkom North Block 24

A L A P P U Z H A

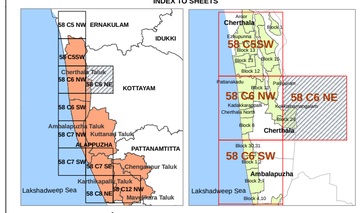
Continued to sheet no. 58 C6 NW

Index Map

58 C6 NE



INDEX TO SHEETS



CZMP MAP IN 1:25000

SHEET No.	DISTRICT	TALUK
58 C6 NE	ALAPPUZHA	CHERTHALA

Map Projection : UTM Zone 43 N
Datum : WGS 84

CRZ of Alappuzha District is shown on toposheet nos.58 C5 NW, 58 C5 SW, 58 C6 NW, 58 C6 NE, 58 C6SW, 58 C7 NW, 58 C7 SW, 58 C7 SE, 58 C8 NE and 58 C12 NW

Legend

- Church
- Mosque
- Temple
- Road
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- Seawall
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Coastal Zone Management Plan
Alappuzha District, Kerala

Mapped During	Scale
March - 2014 September - 2014	0 250 500 1,000 Meters 1:25,000

Checked by	Approved by
DRAFT MAP	

Refer CRZ report for details

National Centre for Earth Science Studies
Akkulam, Thuruvikkal P.O
Thiruvananthapuram - 11

Coastal Zone Management of Kerala - Alappuzha District

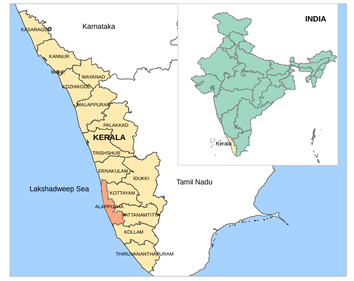
Continued to sheet no. 58 C5 SW

76°17'30"E 76°20'0"E 9°42'30"N 9°40'0"N

Filtration Pond
Coconut on intermittent bunds
Pattanakadu
A L A P P U Z H A
Vayalar Kayal
Pallipuram
Vembanad Kayal
Vayalar East Block 10
Kadakkrapalli
Cherthala Municipality
AC Canal
Kokkothamangalam
Cherthala North
Arthunkal Pozhi
Cherthala South Block 8
Chennaveli Pozhi
Mararikulam North Block 30,31
Lakshadweep Sea
Tamil Nadu

Index Map

58 C6 NW



± CZMP MAP IN 1:25000

SHEET No.	DISTRICT	TALUK
58 C6 NW	ALAPPUZHA	CHERTHALA

Map Projection : UTM Zone 43 N
Datum : WGS 84

CRZ of Alappuzha District is shown on toposheet nos.58 C5 NW, 58 C5 SW, 58 C6 NW, 58 C6 NE, 58 C6SW, 58 C7 NW, 58 C7 SW, 58 C7 SE, 58 C8 NE and 58 C12 NW

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Alappuzha District, Kerala

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March - 2014 September - 2014	0 250 500 1,000 Meters 1:25,000

Checked by	Approved by
DRAFT MAP	

Refer CRZ report for details

National Centre for Earth Science Studies
Akkulam, Thuruvikkal P.O
Thiruvananthapuram - 11

Continued to sheet no. 58 C6 SW

Coastal Zone Management of Kerala - Alappuzha District

Continued to sheet no. 58 C6 NW

76°17'30"E 76°20'0"E

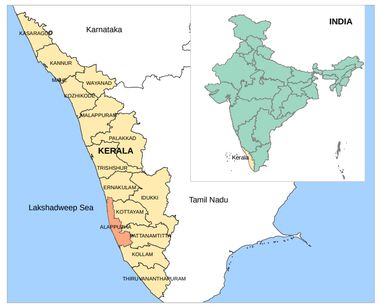
9°35'0"N 9°32'30"N

Chethi Pozhi
Maranikkulam North Block 30,31
Mararikkulam Pozhi
Arakka Pozhi
Kalavoor Block 1,2
A L A P P U Z H A
Vazhakkottam Pozhi
L a k s h a d w e e p s e a
Pathirappally Block 2,7
Odapozhi
Priyadarshini Pozhi
Thumboli Pozhi
Ariyad South Block 4,10
Alappuzha Municipality
Mullakal

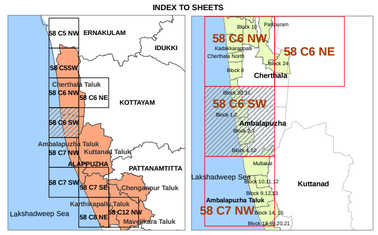
Continued to sheet no. 58 C7 NW

Index Map

58 C6 SW



INDEX TO SHEETS



± CZMP MAP IN 1:25000

SHEET No.	DISTRICT	TALUK
58 C6 SW	ALAPPUZHA	AMBALAPUZHA CHERTHALA

Map Projection : UTM Zone 43 N
Datum : WGS 84

CRZ of Alappuzha District is shown on toposheet nos.58 C5 NW, 58 C5 SW, 58 C6 NW, 58 C6 NE, 58 C6SW, 58 C7 NW, 58 C7 SW, 58 C7 SE, 58 C8 NE and 58 C12 NW

Legend

- Church
- Mosque
- Temple
- Road
- Railway line
- Seawall
- Bund (many of the narrow bunds not shown)
- Municipal/ Corporation Boundary
- Village Boundary
- High Tide Line
- Low Tide Line
- CRZ Line for River or Backwater
- 100m CRZ Line
- 200m CRZ Line
- 500m CRZ Line
- Mangroves - CRZ IA
- Mangrove Buffer Zone - CRZ I
- Inter Tidal Zone - CRZ IB
- CRZ II [Being in Corporation/Municipality, the developed area (>50% builtup area) in the CRZ is CRZ II]
- CRZ III
- Waterbody (sea) - CRZ IV A
- Waterbody (backwater) - CRZ IV B
- Waterbody (non-tidal)
- 45 Survey Plots

Coastal Zone Management Plan
Alappuzha District, Kerala

Mapped During	Scale
March - 2014 September - 2014	0 250 500 1,000 Meters 1:25,000
Checked by	Approved by
DRAFT MAP	

Refer CRZ report for details

National Centre for Earth Science Studies
Akkulam, Thuruvikkal P.O
Thiruvananthapuram - 11

Coastal Zone Management of Kerala - Alappuzha District

Continued to sheet no. 58 C6 SW

76°17'30"E | 76°20'0"E | 9°27'30"N | 9°25'0"N

Pathirappally Block 2,7

ALAPPUZHA MUNICIPALITY

Mullakal

Vadapozhi

Arappa Pozhi

Paravur Block 10,11,12

A L A P P U Z H A

Vavakkad Pozhi

Punnappra Block 9,12,13

Kochu Pozhi

L a k s h a d w e e p s e a

Poomeen Pozhi

Ambalapuzha Block 14, 15

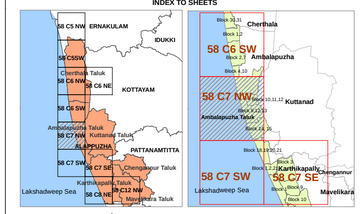
Purakkad Block 18,19,20,21

Index Map

58 C7 NW



INDEX TO SHEETS



± CZMP MAP IN 1:25000

SHEET No.	DISTRICT	TALUK
58 C7 NW	ALAPPUZHA	AMBALAPUZHA

Map Projection : UTM Zone 43 N
Datum : WGS 84

CRZ of Alappuzha District is shown on toposheet nos.58 C5 NW, 58 C5 SW, 58 C6 NW, 58 C6 NE, 58 C6SW, 58 C7 NW, 58 C7 SW, 58 C7 SE, 58 C8 NE and 58 C12 NW

Legend

- Church
- Mosque
- Temple
- Road
- Railway line
- Seawall
- Bund (many of the narrow bunds not shown)
- Municipal/ Corporation Boundary
- Village Boundary
- High Tide Line
- Low Tide Line
- CRZ Line for River or Backwater
- 100m CRZ Line
- 200m CRZ Line
- 500m CRZ Line
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- Inter Tidal Zone - CRZ IB
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- CRZ III
- Waterbody (sea) - CRZ IV A
- Waterbody (backwater) - CRZ IV B
- Waterbody (non-tidal)
- 45 Survey Plots

Coastal Zone Management Plan
Alappuzha District, Kerala

Mapped During	Scale
March - 2014 September - 2014	0 250 500 1,000 Meters 1:25,000
Checked by	Approved by
DRAFT MAP	

Refer CRZ report for details

National Centre for Earth Science Studies
Akkulam, Thuruvikkal P.O
Thiruvananthapuram - 11

Coastal Zone Management of Kerala - Alappuzha District

76°25'0"E

76°27'30"E

9°20'0"N

9°17'30"N

Continued to sheet no. 58 C7 SW

Continued to sheet no. 58 C7 SW

Purakkad
Block 18,19,20,21

Karuvatta
Block 1,2,21

Block 3

Thottappally Spillway

Thottappally harbour

A L A P P U Z H A

Kumarapuram
Block 9

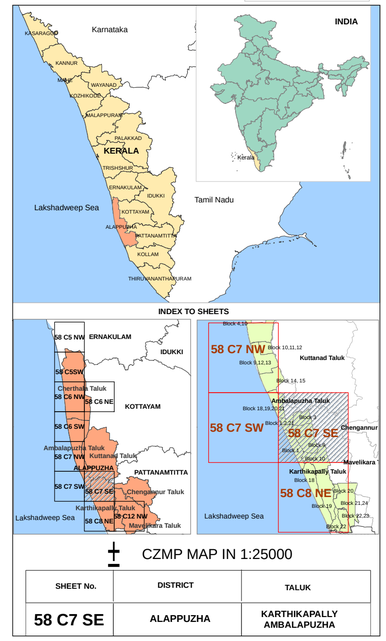
Thrikkunnapuzha
Block 1

Karthikappally
Block 10

L a k s h a d w e e p s e a

Index Map

58 C7 SE



± CZMP MAP IN 1:25000

SHEET No.	DISTRICT	TALUK
58 C7 SE	ALAPPUZHA	KARTHIKAPALLY AMBALAPUZHA

Map Projection : UTM Zone 43 N
Datum : WGS 84

CRZ of Alappuzha District is shown on toposheet nos.58 C5 NW, 58 C5 SW, 58 C6 NW, 58 C6 NE, 58 C6SW, 58 C7 NW, 58 C7 SW, 58 C7 SE, 58 C8 NE and 58 C12 NW

Legend

- Church
- Mosque
- Temple
- Road
- Railway line
- Seawall
- Bund (many of the narrow bunds not shown)
- Municipal/ Corporation Boundary
- Village Boundary
- High Tide Line
- Low Tide Line
- CRZ Line for River or Backwater
- 100m CRZ Line
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- 500m CRZ Line
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- Inter Tidal Zone - CRZ IB
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- Waterbody (backwater) - CRZ IV B
- Waterbody (non-tidal)
- 45 Survey Plots

Coastal Zone Management Plan
Alappuzha District, Kerala

Mapped During	Scale
March - 2014 September - 2014	0 250 500 1,000 Meters 1:25,000
Checked by	Approved by
DRAFT MAP	

Refer CRZ report for details

National Centre for Earth Science Studies
Akkulam, Thuruvikkal P.O
Thiruvananthapuram - 11

Coastal Zone Management of Kerala - Alappuzha District

Continued to sheet no. 58 C7 NW

76°17'30"E

76°20'0"E

9°20'0"N

9°17'30"N

A L A P P U Z H A

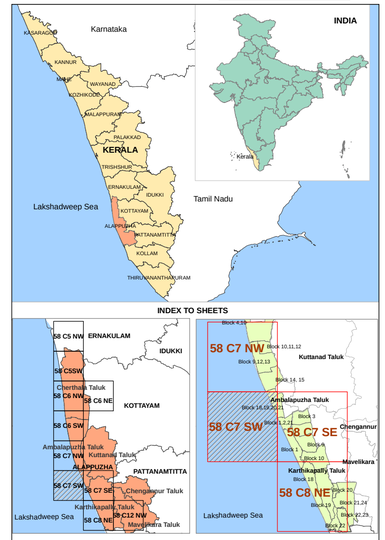
Purakkad
Block 18,19,20,21

L a k s h a d w e e p s e a

Continued to sheet no. 58 C7 SE

Index Map

58 C7 SW



CZMP MAP IN 1:25000

SHEET No.	DISTRICT	TALUK
58 C7 SW	ALAPPUZHA	AMBALAPUZHA

Map Projection : UTM Zone 43 N
Datum : WGS 84

CRZ of Alappuzha District is shown on toposheet nos.58 C5 NW, 58 C5 SW, 58 C6 NW, 58 C6 NE, 58 C6SW, 58 C7 NW, 58 C7 SW, 58 C7 SE, 58 C8 NE and 58 C12 NW

Legend

- Church
- Mosque
- Temple
- Road
- Railway line
- Seawall
- Bund (many of the narrow bunds not shown)
- Municipal/ Corporation Boundary
- Village Boundary
- High Tide Line
- Low Tide Line
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- 100m CRZ Line
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- 45 Survey Plots

Coastal Zone Management Plan
Alappuzha District, Kerala

Mapped During	Scale
March - 2014 September - 2014	0 250 500 1,000 Meters 1:25,000

Checked by	Approved by
DRAFT MAP	

Refer CRZ report for details

National Centre for Earth Science Studies
Akkulam, Thuruvikkal P.O
Thiruvananthapuram - 11

Coastal Zone Management of Kerala - Alappuzha District

Continued to sheet no. 58 C7 SE

Continued to sheet no. 58 C12 NW

76°25'0"E

76°27'30"E

9°12'30"N

9°10'0"N

Thrikkunnapuzha Block 1

NTPC

Karthikappally Block 10

Kayamkulam Kayal

A L A P P U Z H A

Arattupuzha Block 18

Keerickad Block 20

L a k s h a d w e e p s e a

KAYAMKULAM MUNICIPALITY Block 21,24

Kandalloor Block 19

Puthupally Block 22,23

Puthupally Block 22

Kayamkulam Kayal

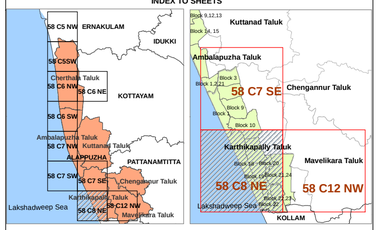
Kollam District

Index Map

58 C8 NE



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± CZMP MAP IN 1:25000

SHEET No.	DISTRICT	TALUK
58 C8 NE	ALAPPUZHA	KARTHIKAPALLY

Map Projection : UTM Zone 43 N
Datum : WGS 84

CRZ of Alappuzha District is shown on toposheet nos.58 C5 NW, 58 C5 SW, 58 C6 NW, 58 C6 NE, 58 C6SW, 58 C7 NW, 58 C7 SW, 58 C7 SE, 58 C8 NE and 58 C12 NW

Legend

- Church
- Mosque
- Temple
- Road
- Railway line
- Seawall
- Bund (many of the narrow bunds not shown)
- Municipal/ Corporation Boundary
- Village Boundary
- High Tide Line
- Low Tide Line
- CRZ Line for River or Backwater
- 100m CRZ Line
- 200m CRZ Line
- 500m CRZ Line
- Mangroves - CRZ IA
- Mangrove Buffer Zone - CRZ I
- Inter Tidal Zone - CRZ IB
- CRZ II
- CRZ III [Being in Corporation/Municipality, the developed area (>50% builtup area) in the CRZ is CRZ II]
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- Waterbody (backwater) - CRZ IV B
- Waterbody (non-tidal)
- 45 Survey Plots

Coastal Zone Management Plan
Alappuzha District, Kerala

Mapped During	Scale
March - 2014 September - 2014	0 250 500 1,000 Meters 1:25,000
Checked by	Approved by
DRAFT MAP	

Refer CRZ report for details

National Centre for Earth Science Studies
Akkulam, Thuruvikkal P.O
Thiruvananthapuram - 11

Coastal Zone Management of Kerala - Alappuzha District

76°32'30"E

76°35'0"E

9°12'30"N

9°10'0"N

Continued to sheet no. 58 C8 NE

Continued to sheet no. 58 C12 NW

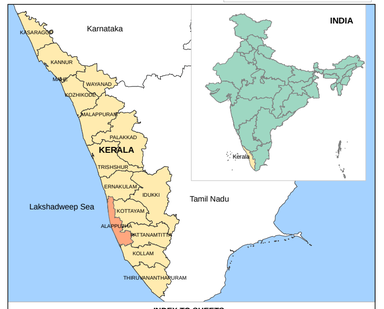
A L A P P U Z H A

KAYAMKULAM MUNICIPALITY
Block 21,24

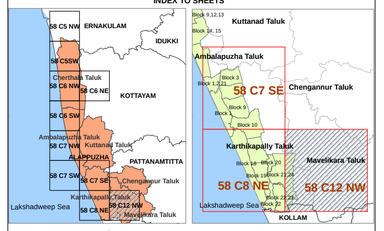
Puthupally
Block 22,23

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58 C12 NW



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± CZMP MAP IN 1:25000

SHEET No.	DISTRICT	TALUK
58 C12 NW	ALAPPUZHA	KARTHIKAPALLY

Map Projection : UTM Zone 43 N
Datum : WGS 84

CRZ of Alappuzha District is shown on toposheet nos.58 C5 NW, 58 C5 SW, 58 C6 NW, 58 C6 NE, 58 C6SW, 58 C7 NW, 58 C7 SW, 58 C7 SE, 58 C8 NE and 58 C12 NW

Legend

- Church
- Mosque
- Temple
- Road
- Railway line
- Seawall
- Bund (many of the narrow bunds not shown)
- Municipal/ Corporation Boundary
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Coastal Zone Management Plan
Alappuzha District, Kerala

Mapped During	Scale
March - 2014 September - 2014	0 250 500 1,000 Meters 1:25,000
Checked by	Approved by
DRAFT MAP	

Refer CRZ report for details

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Akkulam, Thuruvikkal P.O
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