SHORE LINE CHANGE ATLAS OF THE INDIAN COAST

(Volume – 3)

Karnataka and Kerala




Space Applications Centre (ISRO)
Ahmedabad 380015
and
Coastal Erosion Directorate, Central Water Commission,
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Abstract	This Atlas comprises of shoreline change maps prepared using satellite data of 1989-91 and 2004-06 time-frame on 1:25,000 scale for the entire country (Volume – 3 shows maps of Karnataka and Kerala). The maps show eroding, stable and accreting coast. Data used, methodology, results, area under erosion and accretion and status of coastal protection measures are briefly described.
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PROJECT TEAM

Team Leader: Dr. Ajai

SAC, Ahmedabad

Dr. A.S. Rajawat
Dr. H.B. Chauhan
Shri Ratheesh Ramakrishnan
Ms. Sneha Rode
Shri Manik Mahapatra
Shri R.J. Bhanderi

CWC, New Delhi

Shri K.N. Keshri
Shri C.P. Singh
Shri R. Shimray
Shri D.P. Mathuria
Shri M.S. Dhillon
Shri Rajesh Yadav
Shri Shiv Sunder Singh

CWC, Kochi

Shri S.P. Abraham
Shri T.K. Sivarajan
Shri Sunil Jain

देवेंदर शर्मा
सदस्य (नदी प्रबंध)

Devender Sharma
Member(River Management)

केन्द्रीय जल आयोग
CENTRAL WATER COMMISSION
कक्ष संख्या 212 (द0), सेवा भवन,
राम कृष्ण पुरम, नई दिल्ली 110606
Room No.212 (S), Sewa Bhawan,
R.K. Puram, New Delhi-110606

PREFACE

Coastal erosion is one of the most significant coastal hazards leading to loss of valuable land and property along the coastal zone. It is serious problem for the Indian coast, especially during monsoon and cyclonic storms and storm surge events. Developmental activities along the coast as well in the catchment areas of rivers draining into the sea cause changes in the equilibrium of sediment transport along the coast and induce coastal erosion. Climate Change and consequent threat due to predicted sea level rise is expected to further accelerate coastal erosion. Measures have been undertaken for protecting the coast by maritime States and Union Territories of the country at several places. It is required that a proper inventory of current status of coastal erosion and protection measures undertaken so far be made, so that effective planning for protecting the coast can be carried out.

Due to dynamic nature of the coast, baseline data at National level on current status of coastal erosion as well measures taken by maritime States and UTs is lacking and it is in this context and based on recommendations of Coastal Protection and Development Advisory Committee (CPDAC), present work of preparation of Shoreline Change Atlas of India has been undertaken by the Space Applications Centre (ISRO), Ahmedabad and Coastal Erosion Directorate of Central Water Commission (CWC), Ministry of Water Resources, New Delhi. The shoreline change maps depict changes mapped on 1:25, 000 scale using satellite images of 1989-91 and 2004-06 time frame and status of coastal protection measures taken up by maritime states and Union Territories. The entire database is digitized and put under GIS platform. The Atlas is brought out in Six Volumes and highlights type of satellite data used, methodology adopted and salient observations.

This Atlas provides a baseline data for initiating appropriate action for protecting the Indian coast by concerned maritime States and Union Territories besides use by the scientific community as well decision makers of the country. I appreciate efforts put by all those who have made contributions to this significant task.

(Devender Sharma)
Member (RM), CWC &
Chairman (CPDAC)

Telephone: 011-26103221 **Fax:** 011-26101749 **Email:** mrm@nic.in

भारत सरकार
अन्तरीक्ष विभाग
अन्तरिक्ष उपयोग केन्द्र
आंबावाडी विस्तार डाक घर,
अहमदावाद-380015. (भारत)
दुरभाष: +91-79-6912000, 6915000
फैक्स :

Government of India
Department of Space
SPACE APPLICATIONS CENTRE
Ambawadi Vistar P.O.
Ahmedabad-380 015. (India)
Telephone : +91-79-6912000, 6915000
Fax :

A.S. Kiran Kumar
Director

Foreword

Coastal Zone is one of the most fragile and dynamic ecosystem having the interface of sea and land. Interactions between various natural processes and human activities are important factors in the coastal areas. About 40% of the world's population lives within 100 km of the coastline and this proportion is increasing. There has been increasing anthropogenic pressure on the coastal ecosystem. In addition, the coastal ecosystems are vulnerable to natural phenomenon such as waves, tides, storm surges, erosion etc.

India has a long coastline of 7516 km including that of its Island territories. Coastal Zone in India, assumes its importance because of high population pressure, development of various industries and spurt in recreational activities, exploitation of renewable and non renewable natural resources, discharge of waste effluents and municipal sewage etc. Periodic storms and cyclones as well as erosion further adds to the problems in the coastal areas. In view of the dynamic nature of the coast, it needs to be monitored regularly.

Taking appropriate coastal protection measures require spatial information on the status of the shoreline and its dynamic behavior including the areas undergoing erosion and accretion. The spatial information on the change in shoreline over a period of time and the associated processes active along the Indian coast are not available. Thus, Space Applications Centre, at the behest of Central Water Commission, Ministry of Water Resources, Government of India has taken up the task of preparation of shoreline change inventory of Indian coast based on maps prepared using satellite data of 1989-91 and 2004-06 on 1:25,000 scale. These maps depict areas under erosion, accretion as well as stable coast. In addition, the status of coastal protection measures taken by states are also depicted. This is for the first time a spatial inventory on shoreline changes using satellite data has been created for the entire country.

I am sure, the present atlas will be useful to the scientific community and decision makers in investigating the coastal changes as well as in taking appropriate action for protecting the Indian coast and thus will go a long way in conserving the coastal environment of the country. I would like to place on record my deep appreciation to all those who have made contributions for the success of this project.

(A.S. Kiran Kumar)

भारत सरकार
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अहमदाबाद-380015. (भारत)
दुरभाष: +91-79-6912000, 6915000
फैक्स :

Government of India
Department of Space
SPACE APPLICATIONS CENTRE
Ambawadi Vistar P.O.
Ahmedabad-380 015. (India)
Telephone : +91-79-6912000, 6915000
Fax :

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The baseline data on coastal landuse including delineation of HTL and LTL on 1:25,000 scale has been prepared for 1989-91 and 2004-06 time-frames using satellite data under two separate projects funded by Ministry of Environment and Forests (MoEF), Government of India, New Delhi. We gratefully acknowledge the funding support provided by MoEF and to all the participating agencies who have contributed in these projects.

The project on preparation of shoreline change for the Indian coast has been carried out jointly by Space Applications Centre and Central Water Commission, Ministry of Water Resources (MWR), Government of India. Ministry of Water Resources (MWR), Government of India is thankfully acknowledged for providing funds for preparing A-3 size Shoreline change Atlas of India using the available baseline data. We are thankful to Chairman CWC for his guidance and support. Our special thanks are due to Chairman and Members of Coastal Protection and Development Advisory Committee (CPDAC) for necessary support. Sub-Committee members of the Coastal Atlas are acknowledged for their useful suggestions and time to time guidance. Special thanks are to Director, Coastal Erosion Directorate, Central Water Commission, Ministry of Water Resources for his constant support and organizing collection of coastal protection measures data from all the maritime States and U.T. of India.

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Dr. Ajai
Group Director
Marine, Geo and Planetary Sciences Group
Space, Applications Centre (ISRO), Ahmedabad

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INTRODUCTION

Coastal zone is the area of interaction between land and sea. It includes both terrestrial as well as marine resources, which are renewable as well as non-renewable. In addition, interactions between various natural processes and human activities are important factors in the coastal area. India has a long shoreline of about 7500 km including its island territories. Coastal zone in India assumes its importance because of high productivity of its ecosystems, concentration of population, exploitation of natural resources, discharge of waste effluent and municipal sewage, development of various industries, increasing load on harbors, spurt in recreational activities and above all petroleum exploration activities.

The destruction and loss of land due to sea erosion is a severe problem, particularly for a country like India facing explosive population growth. Shoreline is a dynamic geomorphological entity, which responds to the external forces exerted by waves, tides, nearshore currents and the resultant sediment transport. When the resultant sediment transport entering a particular area is greater than the sediment going out from the area, accretion or beach development takes place. On the other hand, when there is a deficit of the incoming sediment supply into a particular area with reference to the sediment going out of the same area, beach erosion takes place. Beaches act as constant absorbers of the wave energy of water and though subject to small disturbances, remain in equilibrium. However, sometimes this equilibrium gets disturbed due to either natural phenomena or human intervention. When shore structures are constructed, it is quite likely that equilibrium condition is altered. Since this can cause considerable damage and reduce the effectiveness of such structures, it is necessary to study the equilibrium condition of shores before constructing such structures. Therefore, it is of utmost importance to get information on accreting, eroding and stable coasts so that effective measures to combat sea erosion may be taken.

Major concern of coastal zone management is to ensure a rational development of area and judicious use of its resources, which is consistent with the surrounding natural systems and environment. Environmentally effective policy decisions pertaining to coastal zone management depends upon accurate and comprehensive scientific data. A basic problem confronting our country is limited availability of geographic data on coastal zone. Accurate and updated scientific data is required on coastal wetlands/landform/land use, shoreline changes, sediment transport and water quality of near shore waters.

Satellite data have proved to be extremely useful in creating baseline inventory of the entire Indian shoreline at 1:250,000, 1:50,000 and 1:25,000 scale (Nayak et al. 1991, SAC, 2012). The prepared landuse/wetland maps show

wetland features between high and low water lines and land use features of the adjoining shore (up to 1.5 km from high waterline).

Coastal Protection and Development Advisory Committee (CPDAC) constituted by Ministry of Water Resources, Govt. of India in April, 1995 is the apex body responsible for formulating policies/ programmes, providing technical guidelines, monitoring, reviewing and co-ordinating coastal zone protection and developmental activities executed by different Central and State Departments along the Indian coastline. The committee recommended the need for preparation of Coastal Atlas showing information related to coastal erosion derived from satellite data and protection measures undertaken by all maritime states of India. A subcommittee was constituted for the purpose. The subcommittee met several times, discussed and finalised the contents of the Atlas. It was decided that shoreline change atlas of the entire Indian coast would be prepared based on Highest High Tide Line depicted on coastal landuse/landcover maps of 1989-91 and 2004-06 time-frame on 1:25,000 scale The baseline data has been generated under two projects funded by Ministry of Environment and Forests (MoEF) with Space Applications Centre, Ahmedabad as a nodal agency with active participation of several related Central & State Government Departments and Academic Institutes.

The entire database of coastal thematic maps prepared using satellite data for the period 1989-91 and 2004-06 time-frames has been digitised and put as part of Coastal Zone Information System (CZIS) in GIS environment developed at Space Applications Centre (ISRO), Ahmedabad. Coastal Zone Information System for entire India (CZIS-India) is developed to include and update all the coastal information viz. landuse, wetland, shoreline, coral reef etc. for all maritime states including Union Territories in ARC/INFO environment. The information is catalogued as per Survey of India topographical map indexing. This data has been used as a baseline data for preparing the shoreline change atlas of India.

The major task involved preparation of a digital shoreline change atlas in GIS environment using existing databases of coastal landuse/landcover maps prepared on 1:25,000 scale (1989-91 and 2004-06 time-frame), depict and quantify shoreline changes as eroding/accreting/stable, show status of shoreline protection measures taken by respective States and generate A3 size State-wise Coastal Atlas of all the maritime states of India.

The detailed tasks taken up are:

i. Quantify and classify the shoreline as shoreline under erosion, stable and accretion for all the maritime states by integrating shoreline using existing database of 1989-91 and 2004-06 period.

ii. Integrate the field information on coastal erosion and shoreline protection measures of all the maritime states of India in GIS environment.

iii. Analyse satellite data of 2011-12 period for selected hotspot areas (areas showing large shoreline changes) and understand coastal processes responsible for such changes.

iv. Generate Six Volumes of A-3 size coloured digital as well as hard copy Coastal Atlas of India (Volume 1 covering Gujarat, Daman & Diu, Volume 2 covering Maharashtra & Goa, Volume 3 covering Karnataka & Kerala, Volume 4 covering Tamilnadu, Puducherry & Andhra Pradesh, Volume 5 covering Odisha & West Bengal and Volume 6 covering Lakshadweep & Andaman & Nicobar islands).

DATA USED

Primarily, landuse/landcover maps on 1:25,000 prepared using IRS-P6 LISS-IV data of 2004-06 period and SPOT-1 & 2 Multispectral and IRS-1A & IRS-1B LISS-II data of 1989-91 period available at Space Applications Centre, Ahmedabad have been utilized. In few cases where suitable data were not available, the data of nearest time frame were used. These maps depict shoreline as Highest High Tide Line (HTL) and Low Tide Line (LTL). Shoreline changes with respect to Highest High Tide Line have been taken up for the present work. The entire database has been put in GIS environment as part of Coastal Zone Information System (CZIS) developed at Space Applications Centre (ISRO), Ahmedabad. Landsat TM, ETM and Resourcesat-1 AWiFS data of corresponding time frames was used for rechecking and confirming the continuity of HTL in adjoining map sheets. Status of coastal protection measures taken up by respective maritime states and UT were prepared in spatial format and were put in the GIS database.

List of the satellite data used is summarised in the Annexure-III (Table 3 to 6).

The status of coastal protection measures taken up by maritime states and UTs was provided by them through Central Water Commission (CWC), New Delhi. These were prepared in spatial format and were put in the GIS database. Details are provided in Annexure-III (Table 7 to 25).

METHODOLOGY

Following steps were undertaken:

i. The existing Coastal Zone Information System (CZIS) developed at Space Applications Centre (ISRO), Ahmedabad has been primarily used. Coastal landuse maps for the entire Indian coast prepared on 1:25, 000 scale for 1989-91 and 2004-06 time-frame available in CZIS have been used for shoreline change mapping.

ii. National Spatial framework from NRDB has been used for organizing and creating the database. The basic framework of CZIS-India is prepared for all maritime states and Union territories of India on 1:25,000 scale. One degree consists of 8X8 rectangular grids or cells. Each rectangular grid or cell represents one SOI topographic area on 1:25,000 scale (M.C Gupta et al., 2000).

iii. Spatial layer of Line (LN25) of 1989-91 time-frame (containing High Water Line, rail, road, drainage) has been taken from the CZIS database.

iv. Spatial layer of Line (LN25N) of 2004-06 (containing High Water Line, rail, road, drainage) has been taken from CZIS database.

v. Spatial layer of Point of habitation has been taken from CZIS database.

vi. Registration of two time-frame data sets considering rail, road and HTL of 1989-91 as base has been done.

vii. Output spatial layer showing shoreline changes using overlay of rectified coverage and base coverage is created.

viii. Maps were rechecked using Landsat TM, ETM, AWiFS and LISS-IV data to make it seamless in database.

ix. Polygons for areas under erosion and accretion were created.

x. Areas under erosion and accretion were measured for the main shoreline (excluding creeks, river mouths, estuaries). Shore length under erosion, accretion and stable categories were measured for the main shoreline (excluding creeks, river mouths, estuaries).

xi. A table containing all the above statistics has been generated for each maritime state and U.T.

xii. Status of shoreline protection measures have been depicted as per the information provided by the maritime State/UT agencies through Central Water Commission.

xiii. A standard map composition and layout were finalised and have been used for final map composition of each map.

xiv. Field checks were carried out and based on field observations, corrections were incorporated while finalizing the map. Field photographs were also taken during the field visits.

Accuracy Assessment: Classification as well as planimetric accuracy of the maps was assessed while carrying out the filed work. Overall the classification accuracy of these maps range from 90-95% at 90% confidence level. The Planimetric Accuracy of these maps is 6.25 m as per Survey of India (SOI) standard.

xv. Hotspots were identified based on the magnitude of shoreline dynamics. Recent satellite images (2011-12) were acquired and analysed.

xvi. Finalised maps depicting shoreline changes were utilized for preparing shore line change Atlas of the Indian coast (Six Volumes). Volume 1 covers Gujarat, Daman & Diu, Volume 2 covers Maharashtra & Goa, Volume 3 covers Karnataka & Kerala, Volume 4 covers Tamilnadu, Puducherry & Andhra Pradesh, Volume 5 covers Odisha & West Bengal and Volume 6 covers Lakshadweep & Andaman & Nicobar islands. Digital Atlas in form of CD was prepared.

RESULTS

Karnataka

The Karnataka coast extends from 12° 43’ N to 14° 51’ N and 74° E to 75° E. The entire coastal zone is narrow except near estuaries, where it is almost straight but interrupted at numerous points by rivers, rivulets, creeks etc. The northern coast is rocky while the southern coast has long linear beaches. The major west flowing rivers are Netravati and Sharavathi.

Coastal geomorphic features in Karnataka include beaches, rocky headlands, spits, estuaries, shallow lagoons, mudflats and mangroves at few places. Large mudflats are absent. It has long, narrow and straight beaches at Surathkal, Panamburu and near Coondapur; small crescent shaped pocket beaches at Ullal, Suratkal, Malpe and Udupi. Shallow lagoons are observed near Coondapur and the Kalinadi. Rocky coast is observed near Ankola to Karwar at numerous locations. North of Karwar, the coast is rocky and without vegetation. They form high cliffs, which are protruded into the sea. Wave interacts with them and provides material, which forms the beaches. Stabilised sand dunes are noticed along the Coondapur coast near Bijadi/Tekkatte and Kotatattu. They are observed along the coast near Kumta and also below the Tadri creek.

Mangroves are sparsely distributed in the estuarine area of Mulki, Sita, Swarna, Chakra, Haldi and Kolluru and Agnashani. Good patches of mangroves are present in the Kali Nadi estuary. Mixed mangrove is the commonly occurring mangrove community in the coastal zone of Karnataka. Exploitation of natural resources, sand mining and developmental activities such as various petrochemical, fertilizers and allied industries pose a major threat to the coastal ecosystem.

The total length of Karnataka shore line is 298.08 km (which does not include the mouth of the river/estuary, creeks and their inner parts). It is observed that 106.12 km length of the Karnataka coast has eroded, 118.65 km has accreted and 73.31 km has been stable during the time frame 1989-91 and 2004-06 (Table-1, Fig. 1). The total area eroded is 5.16 sq km and area accreted is 6.26 sq km (Table-1). The shoreline changes occurring along the Karnataka coast are discussed below for three sectors classified based on the coastal configuration, geological and geomorphological characteristics viz, the northern Karnataka; the central Karnataka and the Southern Karnataka.

The coastal region of the Northern Karnataka extends between Gotnibag bordering the Goa coast (Map Sheet No. 48J01NW) to the north of river mouth near Tengingundi (Map Sheet No. 48J12SW) in Uttar Kannada district. The coastal segments are featured by rocky headlands and inter lying pocket

beaches. A significant length of the shoreline is observed to be stable in nature. In the Northern Karnataka coast, accreting shoreline is mainly observed in the northern part upto Gokarn beach (Map Sheet No. 48J06SW). The southern part of the coastal segment from Gokarn to Tengingundi (Map Sheet No. 48J12SW) is observed to be dominated with eroding shoreline. The northern most shoreline between Gotinibag and Nachkanbag (Map Sheet No. 48J01NW) is stable. Shoreline to the north of Kali river show stable coast with protection measures (Plate 10). Accretion is observed to the north (Map Sheet No. 48J01SW) and south (Kodibag, Map Sheet No. 48J01SE) of the Kali river mouth. During the field visit, accreting coast with casuarinas plantation is observed to the north of Kali river mouth (Plate 11).

The shoreline between Kajubag and Arga (Map Sheet No. 48J01SE) is observed to be more or less stable. The beach at Kodari ((Map Sheet No. 48J02NE) is observed to be under erosion. Kodari and Kauda point (Map Sheet No. 48J02NE) is identified as hotspot where the northern coastal stretch is observed to be under erosion, while the southern coast is found to be stable (Plate 1). Coast to the south of Kodari is of rocky in nature. Field investigations have been carried out in this region and Plate 12 shows field photo of the rocky coast at Kuada point to the south of Kodari. Breakwaters are constructed near Kanmanikanta-Gudda (Map Sheet No. 48J02NE) to facilitate fishing harbor (Plate 13). The shoreline to south (Map Sheet No. 48J06NW) of Kanmanikanta-Gudda is more or less stable with small patches of eroding and accreting beaches. Plate 2 shows the eroding and stable coast near Belekeri (Map Sheet No. 48J06NW). Around 8 km stretch of the coast to the north of rocky headland at Gokarn (Map Sheet No. 48J06SW, Plate 14) is observed to be accreting (Plate 15) where wide beach are observed during the field visit (Plate 16). The shoreline between Hubbangeri (Map Sheet No. 48J07NW) to the north of Karki (Map Sheet No. 48J07SE) is more or less stable with slightly eroding coast whereas erosion is observed to be severe at Karki (Map Sheet No. 48J07SE). Plate 3 shows the eroding coastal stretch around Kodekodi, south of Kumta (Map Sheet No. 48J07NE). Erosion is observed at Kasarkod (Map Sheet No. 48J07SE) where steep cutting of sand dunes causing destruction to the terrestrial vegetations are found (Plate 17 and 18).

Rocky headlands with pocket beaches are found at the coast near Hakkalmane (Map Sheet No. 48J08NE, Plate 19). Plate 4 shows the coastal stretch between Kelaganur (Map Sheet No. 48J08NE) and Hekkalmane depicting the coastal dynamics of the region. To its south, the coastal region near Manki (Map Sheet No. 48J08NE) is slightly eroding which is protected with sea wall (Plate 20). Around 10 km of the coastal stretch to the south of Manki to Kaikani (Map Sheet No. 48J08SE) is observed to be under erosion. To the north of Badarkere (Map Sheet No. 48J08NE) steep cut indicating erosion (Plate 21) and at Murudeshwara (Map Sheet No. 48J08SE) shallow beach with exposed dykes are observed. Stable coast is observed at Kaikini

(Map Sheet No. 48J08SE) whereas to its south (Map Sheet No. 48J12SW) the coast is eroding.

The central Karnataka coast comprises of coastline between Tengingundi (Map Sheet No. 48J12SW) in Uttar Kannada district and north of Swarna estuary (Map Sheet No. 48K11NE) in Udupi district. The central Karnataka coast features straight sandy beaches with occasional rocky headlands to its northern region. In this coastal segment accreting coastal length is observed to more when compared to eroding coastal length. Erosion is observed to the northern part of the coastal segment. The coastal stretch between Tengingundi (Map Sheet No. 48J12SW) to coast south of Bhatkal (Map Sheet No. 48K09NW) is observed to be under erosion. Plate 23 shows the protection measures to check erosion of the coast to the south of Bhatkal. Wide sandy beaches are found to the west of Sarpankatte (Map Sheet No. 48K09NW, Plate 24). The coast further south upto Nuvunda (Map Sheet No. 48K10NE) is more or less stable with slight erosion near Honnimadi (Map Sheet No. 48K09NW) and slight accretion at Ammanavaratopllu (Map Sheet No. 48K09SW) and to the north of Kudarakodu (Map Sheet No. 48K09SE). Seawall is constructed along the coast near Marvanthe (Map Sheet No. 48K10NE) which are observed be destroyed under recent coastal processes (plate 25 and 26). Around 11 km stretch of coast from Vittalvadi (Map Sheet No. 48K10SE) to Kota (Map Sheet No. 48K10SE) is observed to be highly accreting. Plate 27 shows accreting coast near Koteshwara (Map Sheet 48K10SE).

The southern Karnataka coast comprises of the coastal region between south of Swarna estuary (Map Sheet No. 48K11NE) to the coast bordering Kerala (Map Sheet No. 48L13SW). The coastal region is featured by long straight sandy beaches. Within the coastal segment erosion is observed to be slightly more when compared to the accretion. Accretion is observed along the coastal region south of Swarna estuary (Map Sheet No. 48K11NE) to Badanidiyur (Map Sheet No. 48K11SE). To the south of Badanidiyur to Badagrama (Map Sheet No. 48K12NE), the coast is found to be stable in nature. Coast to the north of Padubidiri (Map Sheet No. 48K16NW) and at Hejmadikodi (Map Sheet No. 48K16SW) is observed to be under erosion (plate 28). During field visit at Hejmadikodi, heap of sands from constructional activities are found to be piled at the beach acting as sand dunes (Plate 29). Around 12 km of the coastal stretch to the south of Mulki-Pavanje estuarine mouth (Map Sheet No. 48K16SW) to the New Mangalore Port (Map Sheet No. 48L13NW) is observed to be eroding. Plate 30 and 31 shows the severe erosions at the estuarine mouth. To the north of Mukka (Map Sheet No. 48K16SW) the seawall is observed to be covered with terrestrial vegetation indicating the shoreline to be stable during recent periods (Plate 32). At Mukka (Map Sheet No. 48K16SW) severe beach erosions are observed and seawall is constructed to protect the habitation very near to the coast (Plate 33 and 34). The coast to the south of

New Mangalore port up to the Netravati River mouth is observed to be accreting (Map Sheet No. 48L13SW). Maximum accretion is observed at Bengre (Map Sheet No. 48L13SW) where wide stretch of beach is observed during the field visit (Plate 35). Coastal protection measures are constructed along the northern and southern bank of Netravati river (Plate 36 and 37). At Ullal (Map Sheet No. 48L13SW), to the south of Netravati River mouth the coast is observed to be eroding. Narrow and steep beach protected by seawall is observed at Ullal (Plate 38 and 39).

Table-1 shows the map sheet wise shoreline changes for Karnataka.

Table-1: Map sheet wise results of shoreline changes for 1989-91 and 2004-06 time-frame for Karnataka coast.

Sr. No.	Map Sheet No.	Erosion (sq. km)	Erosion Length (km)	Accretion (sq.km)	Accretion Length (km)	Stable (km)
1	48J01NW	0.03	1.19	0.06	0.88	2.46
2	48J01SW	0.15	4.47	0.22	7	5.6
3	48J01SE	0.13	3.51	0.4	4.62	7.11
4	48J02NE	0.34	7.73	0.05	2.8	5.83
5	48J06NW	0.07	3.63	0.5	13.53	1.77
6	48J06SW	0.19	3.93	0.9	14.45	1.47
7	48J07NW	0.13	3.58	0.05	0.96	0
8	48J07NE	0.11	3.43	0.09	2.62	6.48
9	48J07SE	0.33	6.92	0.01	1.01	5.04
10	48J08NE	0.71	10.24	0.08	1.9	7.16
11	48J08SE	0.31	4.65	0	0	4.37
12	48J12SW	0.24	5.07	0	0	0
13	48K09NW	0.6	8.65	0.08	2.49	7.37
14	48K09SW	0.14	4.95	0.13	3.1	0
15	48K09SE	0.03	0.87	0.13	2.06	2.17
16	48K10NE	0.02	0.8	0.56	12.9	0
17	48K10SE	0	0	1.22	12.68	1.45
18	48K11NE	0	0	0.59	6.96	6.61
19	48K11SE	0.07	4.19	0.23	7.73	1.89
20	48K12NE	0.04	1.71	0.13	3.82	3.3
21	48K16NW	0.25	4.38	0	0	1.94
22	48K16SW	0.95	12.11	0	0.39	1.29
23	48L13NW	0.24	5.93	0.34	8.18	0
24	48L13SW	0.08	4.18	0.49	8.57	0
	TOTAL	5.16	106.12	6.26	118.65	73.31

Figure 1 shows the accreting length, eroding length and stable shoreline of the Karnataka coast.

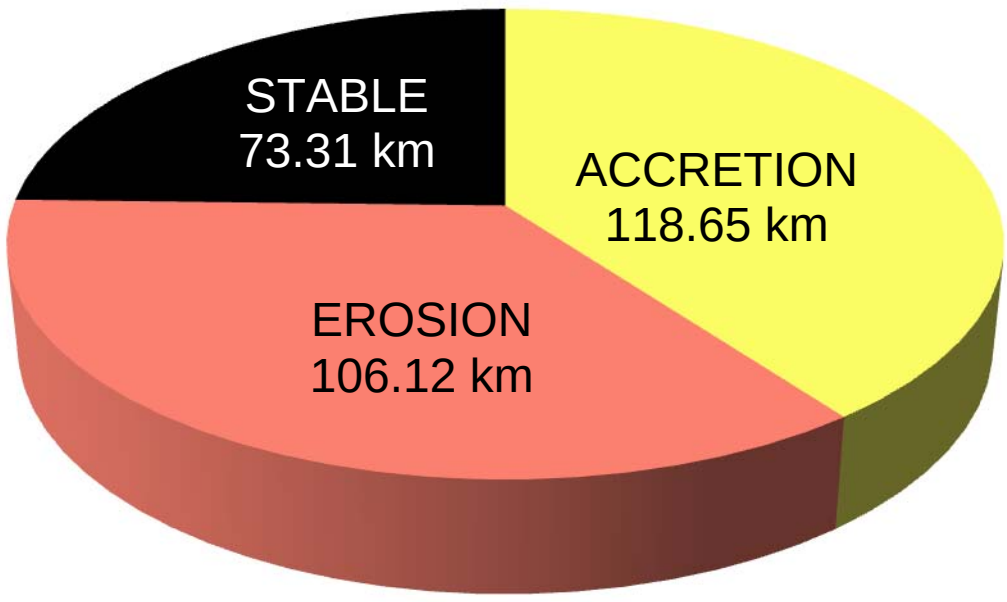

Figure 1: Status of coastal erosion, accretion and stable nature of Karnataka coast. (The total coast length of 585.6 km does not include the mouths of Rivers/creeks/estuaries)

Kerala

The Kerala coast extends from 8° 8’ N to 12° 46’ N and 74° 40’ E to 76° 56’ E along the south-western coast of India. The Kerala coast is bestowed with rivers, lakes and is famous for its beautiful beaches and backwaters. The coastline is more or less linear, it places it is offset by the presence of promontories. Another characteristic feature of Kerala coastal zone is highly population density, resulting in a more or less urbanized coastal zone. The Kerala coast extends from Manjeswaram in north to Pozhiyur in the south. Well developed sandy beaches are in Chittari, Kappad, Ponnani, Calicut, Cochin, Alleppey and Kovalam. The beach consists of sands of different fractions along with broken molluscan shells. In addition to this, cresent shaped pocket beaches are observed at Ezhimals, Dharmadom, Tellicherry, Kadur point and Ealthur. Spits can be observed at estuarine of Vambanad, Asthamudi, Shiriys, Bypore and Veli. At some places during the lean season opening of small estuaries got blocked by the growth of the spits. Cliff and rocky coasts are observed at many places on the Kerala coast. The rocky shores are made up of laterites or Precambrian crystalline such as Khondalites or charnockites. Some of the prominent rocky coasts are near Bekal, Ezhimala, Azhikode and kadalur point in the north and Vizhinjam, Varkala and Tangasseri in the south. The mangrove vegetation in the coastal area of Kerala is very sparse and thin. The Kerala coast has a number of islets or islands. Most of them are populated. Locally the islands are called thuruths. Man made thuruths are also common. The Vembanad, the Asthamudi, and Kakavvayi estuaries show more islands. The islands in the Vembanad estuariy in central Kerala are large in size compared to the islands in the Kawayi estuary. The major islands are Wellington, Kumbalam, Nettur, Madavana, Cheppanam and Perumbalam. Dharmadam, a large island with mangroves is situated in the northern Kerala.

The total length of Kerala shoreline is 585.6 km (which does not include the mouth of the river/estuary, creeks and their inner parts). In Kerala, the coastal region getting accreted is found to be more when compared with the coastal length subjected to erosion. Around 50% (294 km) of the total Kerala coast is observed to get accreted, while around 37% (218 km) of the coast is observed to get eroded and 13% (73.6 km) of the coast is more or less stable in nature (Table 2, Fig 2). The total accreted area along the Kerala coast is 9.54 sq. km and 5.31 sq. km is observed to get eroded (Table 2). Entire length of Kerala coast is divided into three sectors based on coastal configuration, geological and geomorphological characteristics. The Northern Kerala coast comprises of coastal region bordering Karnataka to Beypore located to the north of Kadalundi in Kozhikode district. The coastal sector south of Kadalundi river mouth to the Vembanad Lake mouth comes under the Central Kerala coast. The Southern Kerala coast comprises of coastal region lying between Vembanad mouth to the Kollankod, bordering Tamil Nadu.

Northern Kerala coast comprises of the coastal region south of Karnataka (Map Sheet No. 48L13SW) to the north of Kadalundi River mouth (Map Sheet No. 49M16SW). Major rivers like Chandragiri, Valapattanam, Mayyazhi Muthalipuzha and Chaliyar debouches into the Arabian Sea through the northern sector. Around 15 smaller rivers also have its opening along the northern sector. Kawayi Backwater in the Cannanore District is another major important coastal feature in the northern Kerala. The coast of northern Kerala is mostly straight sandy beaches with occasional rocky headlands. In this sector accretion is observed to be significantly more than the eroding coastal length.

Long stretch of coast (~25 km) between Manjeshwaram (Map Sheet No. 48L14NE) and Kottikulam (Map Sheet No. 48P03NW) in Kasargod district is found to be slightly accreting region. Significant accretions are widely observed at the river mouths, where southwards growth of spits are observed at the Adheeka River mouth (Map Sheet No. 48L14NE), and Chandagiri River mouth (Map Sheet No. 48L15NE) in Kasargod district. The coastal stretch between Kottikulam to Chittari river mouth (Map Sheet No. 48P03SW) is more or less stable in nature. To its south from Hosdurg (Map Sheet No. 48P03SW) to Karingode river mouth (Map Sheet No. 48P04NW) in Kasargod district, the coast is observed to have slight accretion. Field visit has been carried out and plate 40 shows the wide and stable beach to the south of Kanjangad (Map Sheet No. 48P04NW). Plate 41 shows the accretions at the north of Kariangode river mouth, where the terrestrial vegetations are observed to grow seawards.

Coastal region to the south of the river mouth also show accretion up to Udanur (Map Sheet No. 48P04NE). The coastal region from its south from Udanur to Valapattanam river mouth (Map Sheet No. 48M05NW) in Kannur district is observed to be more or less stable. Valapattanam river mouth is identified as a hot spot, where the large accretions are found towards its northern and southern mouth (Plate 42), possible enhanced due to the construction of breakwater at the mouth. Plate 5 shows the accretions developed through the years at the northern and southern part of the Valapattanam River mouth in Kannur district. The coastal region at Azhikkal (Map Sheet No. 48M05NW) south to the Valapattanam river is observed to have a long stretch of accreting coast. During the field visit, wide sandy beaches with recreational parks are found at Azhikal (Plate 43 and 44). Rocky headland (Plate 45) to the south of Azhikal (Map Sheet No. 48M05NW) possibly acts as hindrance to the littoral transport inducing accretions at Azhikal. Coast to the south of rocky headland to Kannur is more or less stable. The coastal change at Kannur (Map Sheet No. 49M05SW & 49M05SE) due to the construction of the Harbour is shown in Plate 6.

To the south of Kannur up to Muthalipuzha river mouth (Map Sheet No. 49M10SW) in Kozhikode district is observed to be more or less stable, with slight accretions at Tellicherry (Map Sheet No. 49M06NE) and slight accretion to the north of Muthalipuzha river mouth (Map Sheet No. 49M10SW). Plate 46 shows stable sandy beach to the north of Dharmadom (Map Sheet No. 49M05SE). Recent construction of breakwater to the north of Muthalipuzha river (Map Sheet No. 49M10SW) (Plate 47) have changed the coastal dynamics to the south of the river mouth. Accretions are observed along the spit to the southern coast of Muthalipuzha river mouth (Map Sheet No. 49M10SW, Plate 48). Further south, beach erosion and sever damage to terrestrial vegetations are observed during the field visit (Plate 49 and 50). Towards south, up to Pudiyangadi (Map Sheet No. 49M15SW) the coast is more or less stable with slight erosion observed at Kadalur (Map Sheet No. 49M11NE), Quilandi (Map Sheet No. 49M11NE) and Vengalam (Map Sheet No. 49M11SE). At Puthiyangadi erosion is observed during the field trip, where layer of coconut trees are reported to eroded. The coast is protected with seawall as shown in plate 51. Huge accretions are observed to the south of Chaliyar River mouth (Map Sheet No. 49M16NW) possibly due to the breakwater constructed at the river mouth.

The central Kerala coast comprises of coastal line from south of Kadalundi River mouth (Map Sheet No. 49M16SW) to the mouth of Vembanad Lake (Map Sheet No. 58C01NE). Bharathapuzha and Periyar are the major rivers getting discharged into the Arabian Sea along the central Kerala. Parts of Vembanad Lake along with its mouth at Cochin (Map Sheet No. 58C01NE) also fall in this sector. In Central Kerala also the accretion is found to be more when compared to the erosion, but the percentage of accreting coastline is comparatively less with that of the northern sector. A long stretch of coast (~ 20 km) from Kadalundi river mouth to Unniyalungal (Map Sheet No. 49N13NE) in Malappuram district is found to be more or less stable in nature. Coast to the south of Unniyalungal to the north of Bharathapuzha river mouth (Map Sheet No. 49N13SE) is observed to be slightly accreting. In spite of the breakwater constructed on the southern and northern side of the river mouth, unlike other river mouths in the northern sector, a trend in erosion is observed at the mouth, possibly due to reduced river discharges from the river. Field visit to the south of Bharathapuzha river mouth at Ponnani Map Sheet No. 49N13SE) observed stable coast with coastal protection measures (Plate 52). Around 17 km of the shoreline from the south of Veliyancode Lake (Map Sheet No. 49N14NE) to the north of Chavakkad (Map Sheet No. 58B02SW) in Thrissur district is observed to have accreting coastal region. During field visit at Edakkazhiyur (Map Sheet No. 49N14SE), wide beaches with seaward growing terrestrial vegetations are observed (Plate 53 and 54). Plate 55 shows the wide and accreting beach to the north of Chavakkad (Map Sheet No. 58B02SW).

To the south of Chavakkad to Talikkulam (Map Sheet No. 58B03NW) coastal stretch around 15 km is observed to be under erosion. Field visit near Engandiyur (Map Sheet No. 58B03NW) have observed severe erosion with destruction of seawall, coconut trees and abandoned houses along the coastal region (Plate 56 and 57). At Vadanapalli (Map Sheet No. 58B03NW), the coast is found to be eroding which is protected by seawall (Plate 58). From Talikkulam to Mathilakam (Map Sheet No. 58B03SE) slightly accreting beach is observed and to its south from Mathilakam to Eriyad (Map Sheet No. 58B04NE) in Thrissur district is observed to be under erosion. During the field visit at Eriyad it was observed that the vegetation and habitation is under threat due to severe coastal erosion (plate 59). Coastal protection measures were found to be deteriorated and a second layer of seawall is under construction (Plate 60 and 61). Accretion is observed at the northern breakwater at Periyar River mouth (Map Sheet No. 58B04NE). To the south of Periyar River mouth, from Munambam (Map Sheet No. 58B04NE) to Panambukad (Map Sheet No. 58B04SE) in Ernakulam district, the coast is observed to be stable in nature with slight erosions at Malipuram (Map Sheet No. 58B04SE). Extensive accretion is observed to the north of Vembanad Lake at Vypin (Map Sheet No. 58C01NE) in Ernakulam district. Vypin is identified as the hot spot in central sector of Kerala coast. Plate 7 shows the accretion and subsequent development activities at the northern coast of the Vembanadu estuarine mouth.

Southern sector of Kerala coast comprises of coastal region from the south of Vembanad Lake mouth (Map Sheet No. 58C01NE) to the Kollankodu coast bordering Tamil Nadu (Map Sheet No. 58H03SW). There are no major rivers in this region where the coastal water bodies comprises of mainly Lakes whose number in the southern Kerala stands to around ten comprising of smaller and larger lakes. Astamudi Lake and Vembanad Lake are the larger lake whereas Kayamkulam, Vattakayal, Veli, Paravur etc forms the smaller ones. In the southern Kerala, unlike the northern and central sectors, coastal length getting eroded is found to be comparably larger than the accreting coastal length. A long coastal stretch (~40 km) from Fort Cochin (Map Sheet No. 58C01NE) to Kottamkulangara (Map Sheet No. 58C06SW) is observed to be more or less stable, with slight erosions near Sherthalai (Map Sheet No. 58C06NW) in Alappuzha district. From Kottamkulangara to Thumboli (Map Sheet No. 58C06SW) is observed to have slight erosion. The coastal stretch between Thumboli to Thottapalli (Map Sheet No. 58C07SE) is more or less stable in nature. Recent construction of breakwaters to the north of Thottapalli has altered the coastal processes inducing accretion at Thottapalli (Plate 62). The coast to the south of Thottapalli (Map Sheet No. 58C07SE) up to Kayamkulam Lake (Map Sheet No. 58C08NE) in Alappuzha district is under severe erosion. To the south of Thottapalli seawall is constructed to check erosion and protect the habitations in the coastal region (Plate 63). Near Trikkunnapuzha severe erosion causing threat to coconut plants and scarring

of land is observed, during the field visit (Plate 64 and 65). Plate 8 shows the eroding coast to the north of Kayamkulam Lake.

The coastal stretch between Kayamkulam Lake and the coastal region near Karunagapally (Map Sheet No. 58C12SW) is observed to be more or less stable in nature. Near Panmana ((Map Sheet No. 58C12SW) in Kollam district, a large area of beach has been lost under severe erosion. Field investigations have been carried out and plate 66 shows the sand mining activities near Panmana. The houses have been abandoned and heap of sands from the mining activities are dumped on the sea shore (Plate 67). Seawall is constructed to check erosion at the adjacent region of Panmana (Plate 68). The region is identified as the hotspot in the southern Kerala coast. Plate 9 shows the extent of damage caused to the coastal region due to the mining activities. South to Panmana up to Marattadi (Map Sheet No. 58D09NW), the coastal region is more or less stable. The coastal stretch between Marattadi and Thirumullavaram (Map Sheet No. 58D09NW) is observed to be under erosion. Field investigation has been carried at Thirumullavaram. The coast is now protected by seawall as shown in plate 69. To the south at Kollam (Map Sheet No. 58D09NW), construction of breakwater has induce large accretion near the coastal regions of Kollam. The coastal region to the south of Kollam to Kollankodu (Map Sheet No. 58H03SW) is observed to be more or less stable with slight accretions at the mouth of Anjengo Lake (Map Sheet No. 58D14NW) and south to Puliakudi (Map Sheet No. 58H03SW) and erosions are observed near Vizhinjam (Map Sheet No. 58D15NE) in Thiruvananthapuram district.

Table-2 shows the maps sheet wise change shoreline change for Kerala coast

Table 2 : Map sheet wise results of shoreline changes for 1989-91 and 2004-06 time frame for Kerala coast

Serial No.	MAP no	Erosion Area (in Sq Km)	Erosion Length (Km)	Accretion Area (in Sq Km)	Accretion Length (Km)	Stable Length (Km)
1	48L13SW	0	0	0.04	2.02	0
2	48L14NW	0.01	0.96	0.02	0.8	0
3	48L14NE	0	0	0.27	11.6	2.79
4	48L14SE	0.01	0.25	0.36	15.7	0
5	48L15NE	0.01	0.96	0.23	7.72	0
6	48P03NW	0.05	3.99	0.06	3.2	3.25
7	48P03SW	0.04	2.72	0.26	11.3	1.59
8	48P04NW	0	0	0.5	7.16	0
9	48P04NE	0	0	0.24	5.16	2.89
10	48P04SE	0.07	5.15	0.2	13.8	5.4
11	48P08SW	0	0	0.01	0.4	0.67
12	49M05NW	0.08	5.9	0.73	10.9	1.74
13	49M05SW	0.04	3.04	0.05	2.21	0.29
14	49M05SE	0.07	6.18	0.16	10.1	3.4
15	49M06NE	0	0	0.15	2.97	0
16	49M10NW	0.04	2.62	0.1	6.3	6.4
17	49M10SW	0.16	10.3	0.12	3.11	1.12
18	49M11NW	0.01	1.34	0.03	2.52	0
19	49M11NE	0.19	13.6	0.02	2.31	2.39
20	49M11SE	0.07	5.05	0.04	2.92	1.2
21	49M15SW	0.84	4.34	0.06	3.01	0.36
22	49M16NW	0.1	5.88	0.23	7.76	2.35
23	49M16SW	0.02	2.1	0.12	8.22	1.76
24	49N13NW	0.04	2.8	0.03	2.31	0.6
25	49N13NE	0.04	2.77	0.07	2.48	3.4
26	49N13SE	0.03	1.6	0.27	4.14	3.51
27	49N14NE	0.06	2.38	0.41	12.2	0
28	49N14SE	0	0	0.51	4.45	0
29	58B02SW	0.3	8.29	0.15	2.36	0
30	58B03NW	0.31	8.46	0.17	5.53	1.42
31	58B03SW	0	0	0.36	8.51	0
32	58B03SE	0.07	3.12	0.07	2.54	0.73
33	58B04NE	0.19	7.95	0.07	3.48	3.23
34	58B04SE	0.13	5.92	0.21	8.86	0
35	58C01NE	0.05	1.34	1.28	7.16	0
36	58C05NW	0.01	1.05	0.07	3.77	0.68
37	58C05SW	0.11	8.78	0.06	5.43	0
38	58C06NW	0.17	5.96	0.16	5.63	2.21
39	58C06SW	0.33	9.63	0.16	3.89	0.49
40	58C07NW	0.07	4.3	0.21	7.64	2.6
41	58C07SW	0.04	2.14	0.14	3.47	0
42	58C07SE	0.23	5.14	0.01	0.84	0
43	58C08NE	0.22	11.9	0.06	2.32	0.66

44	58C08SE	0.06	4.94	0.02	3.01	0.89
45	58C12SW	0.27	6.93	0.03	2.23	0.29
46	58D09NW	0.3	9.73	0.3	8.02	0
47	58D09SW	0.06	2.53	0.03	2.06	0.76
48	58D09SE	0.13	7.6	0.04	2.88	0.94
49	58D10NE	0.03	2.94	0.1	6.65	0.7
50	58D14NW	0	0	0.07	4.02	1.61
51	58D14SW	0.01	1.14	0.12	8.63	5.37
52	58D14SE	0.01	0.88	0.02	2.25	0
53	58D15NE	0.14	9.18	0.15	10	1.7
54	58D15SE	0.01	0.54	0	0.24	0
55	58H03SW	0.08	3.72	0.19	5.94	4.21
	Total	5.31	218	9.54	294	73.6

Erosion is observed along 218 km of the Kerala coast, accretion along 294 km and over 73 km of the coast is observed to in stable condition. The shore line changes have been depicted in figure 2.

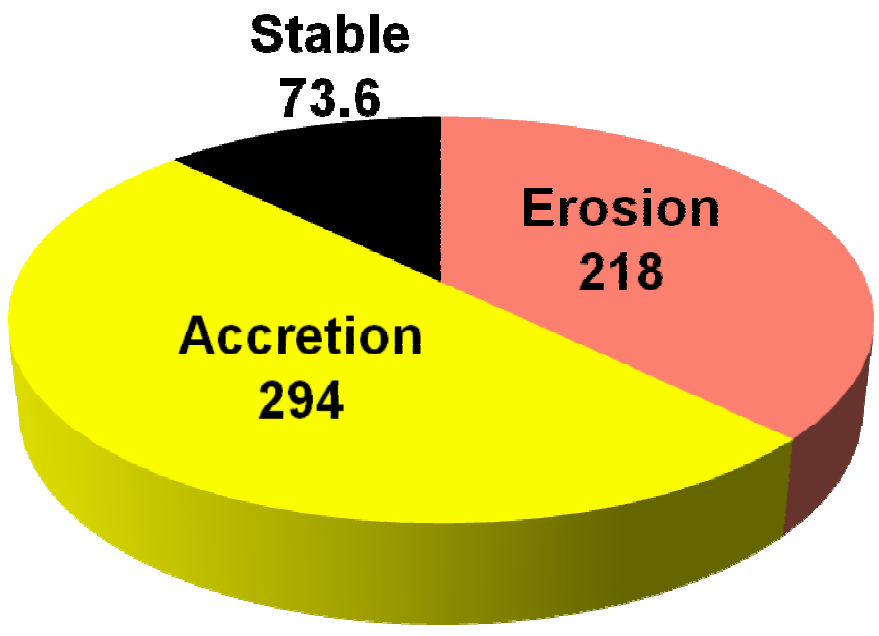

Figure 2: Status of coastal erosion, accretion and stable nature of Kerala coast. (The total coast length of 585.6 km does not include the mouths of Rivers/creeks/estuaries)

END USE

The Atlas can be used as a reference material for obtaining information on status of shoreline changes during 1989-91 and 2004-06 time-frames along entire Indian coastline. Areas under coastal erosion and status of coastal protection measures taken up by respective maritime State and Union Territory are depicted and can be used for planning coastal protection measures.

The Atlas is extremely useful to Coastal Erosion Directorate, Central Water Commission for providing guidance towards coastal protection works in maritime states of India.

All the State Public Works Departments, Ports and Harbour Authorities, Coastal Regulation Zone Authorities shall be able to have better management of the shorelines in respective states.

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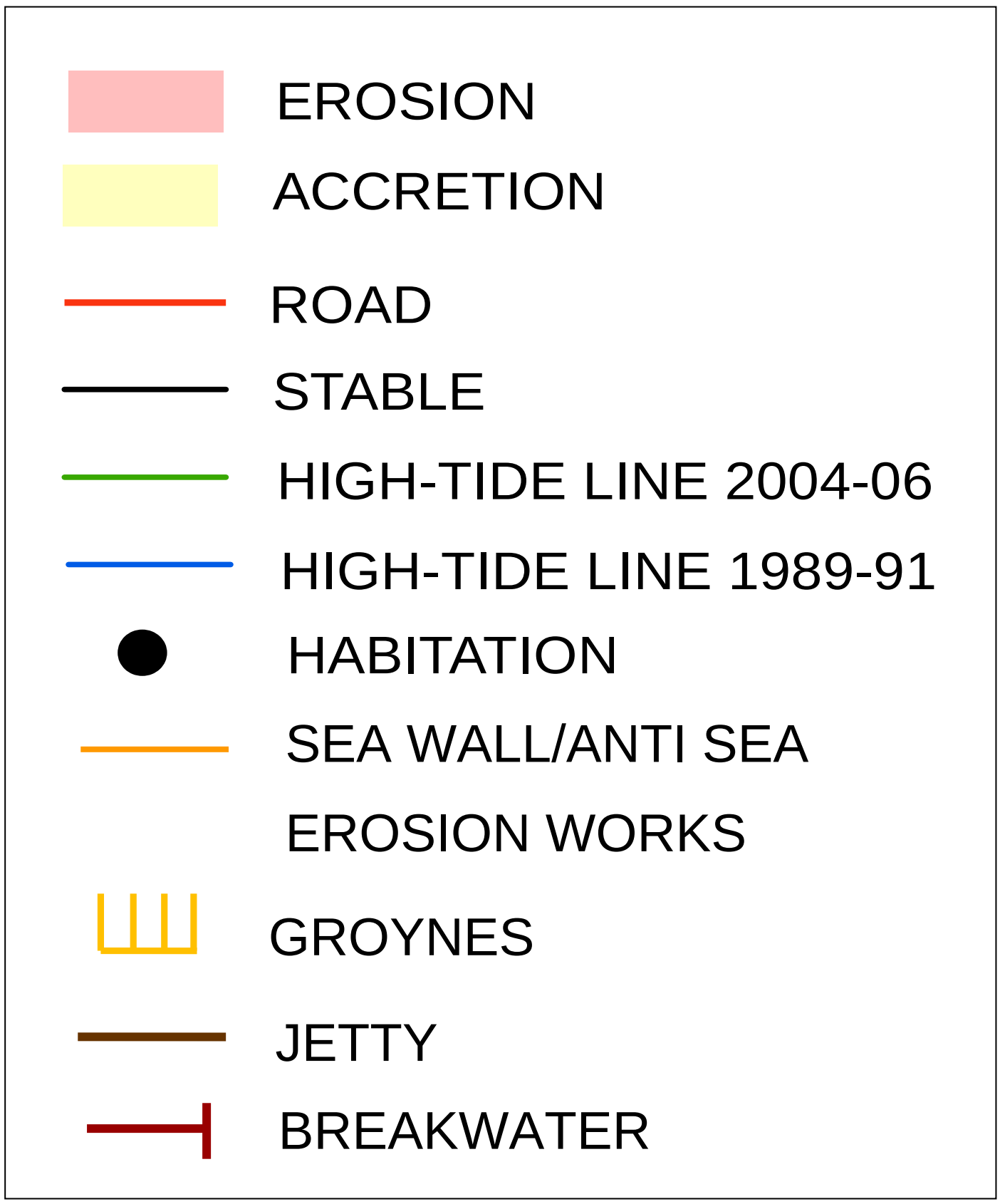
SAC, 2012, *Coastal Zones of India*, Space Applications Centre (ISRO), 2012, 597 p. ISBN: 978-81-909978-9-8.

Annexure-I

(Shoreline Change Maps)

COMPLETE LEGEND TO SHORELINE CHANGE MAPS



SHORELINE CHANGE MAPS

KARNATAKA

INDEX MAP

KARNATAKA

48J1NW
48J1SW
48J1SE
KARWAR
48J2NE
48J6NW
48J6SW
48J7NW
48J7NE
48J7SE
48J8NE
48J8SE
48J12SW
BHATKAL
48K9NW
48K9SW
48K9SE
48K10NE
48K10SE
48K11NE
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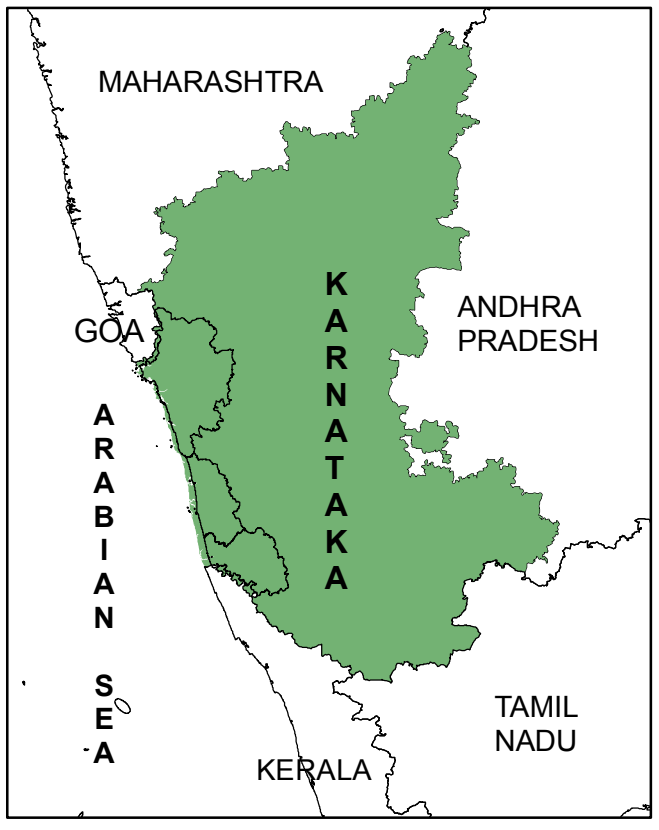
MANGALORE
48L13SW

N

ARABIAN SEA

KARNATAKA

INDIA



SHORELINE CHANGE MAP
KARNATAKA

N

48J1NW | 48J1NE
48J1SW | 48J1SE | 48J5SW
KARWAR
48J2NE | 48J6NW | 48J6NE
48J6SW | 48J6SE
48J7NW | 48J7NE
48J7SE | 48J11SW
48J8NE | 48J12NW | 48J12NE
48J8SE | 38J12SW
BHATKAL
48K9NW
48K9SW | 48K9SE
48K10NE | 48K14NW
48K10SE | 48K14SW
48K11NE | 48K15NW
48K11SE | 48K15SW
48K12NE | 48K16NW
48K16SW
48L13NW | 48L13NE
MANGALORE
48L13SW | 48l13SE

UTTAR KANNAD DISTRICT

UDUPI DISTRICT

DAKSHIN KANNAD DISTRICT

ARABIAN SEA

KARNATAKA

LEGEND

- ERODING COAST
- ACCRETING COAST
- STABLE COAST
- HTL 2004-2006

INDIA

ARABIAN SEA

BAY OF BENGAL

KARNATAKA

SHORELINE CHANGE MAP

KARNATAKA

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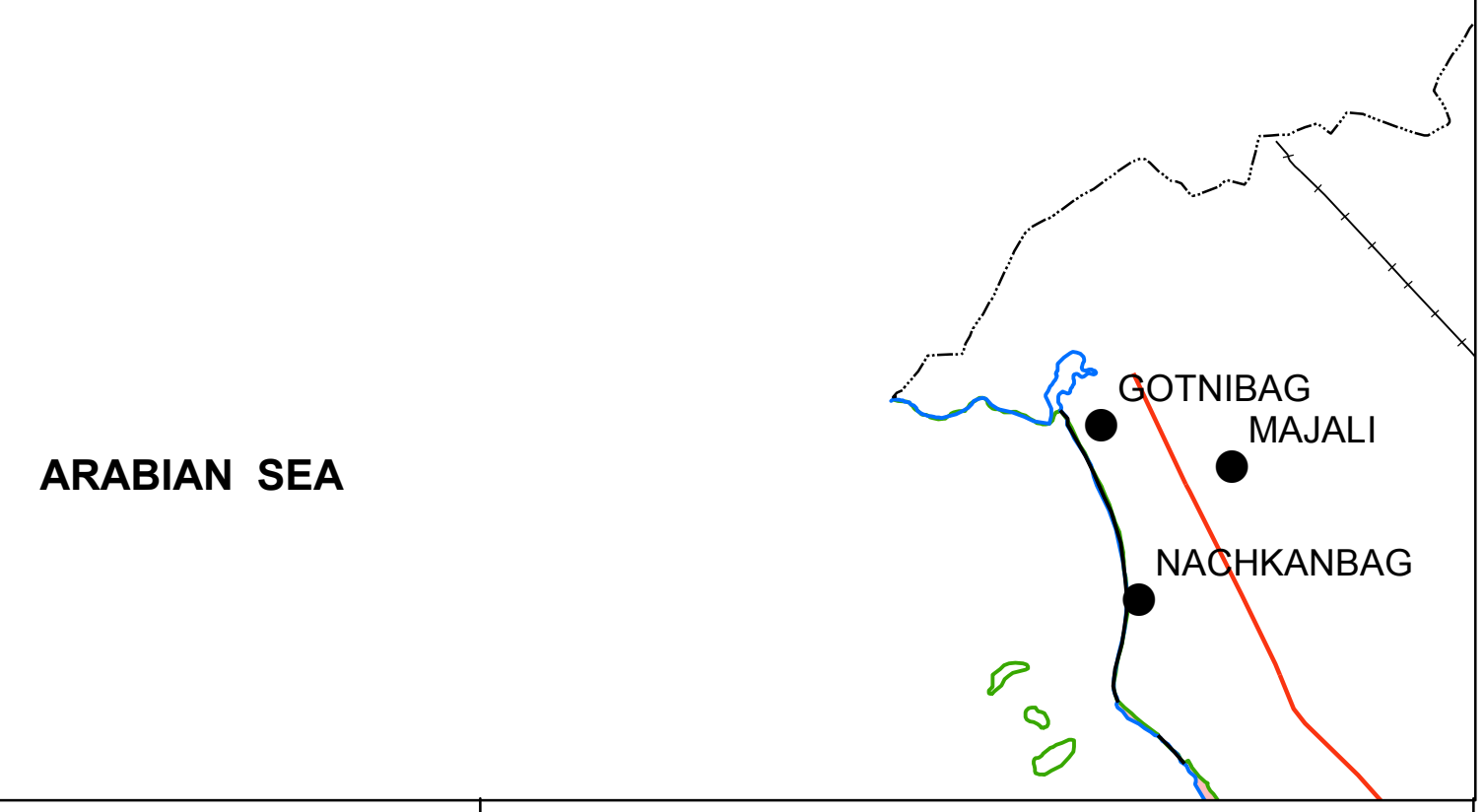
UTTAR KANNAD DISTRICT

SHEET NO. 48J01NW



Legend

- EROSION
- ACCRETION
- STABLE
- ROAD
- RAIL
- STATE BOUNDARY
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

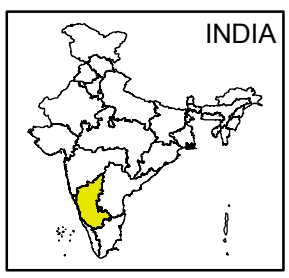
N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

48E16 SE	48I04 SW	48I04 SE
SEA		48J01 NE
SEA	48J01 SW	48J01 SE



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

SHORELINE CHANGE MAP

KARNATAKA

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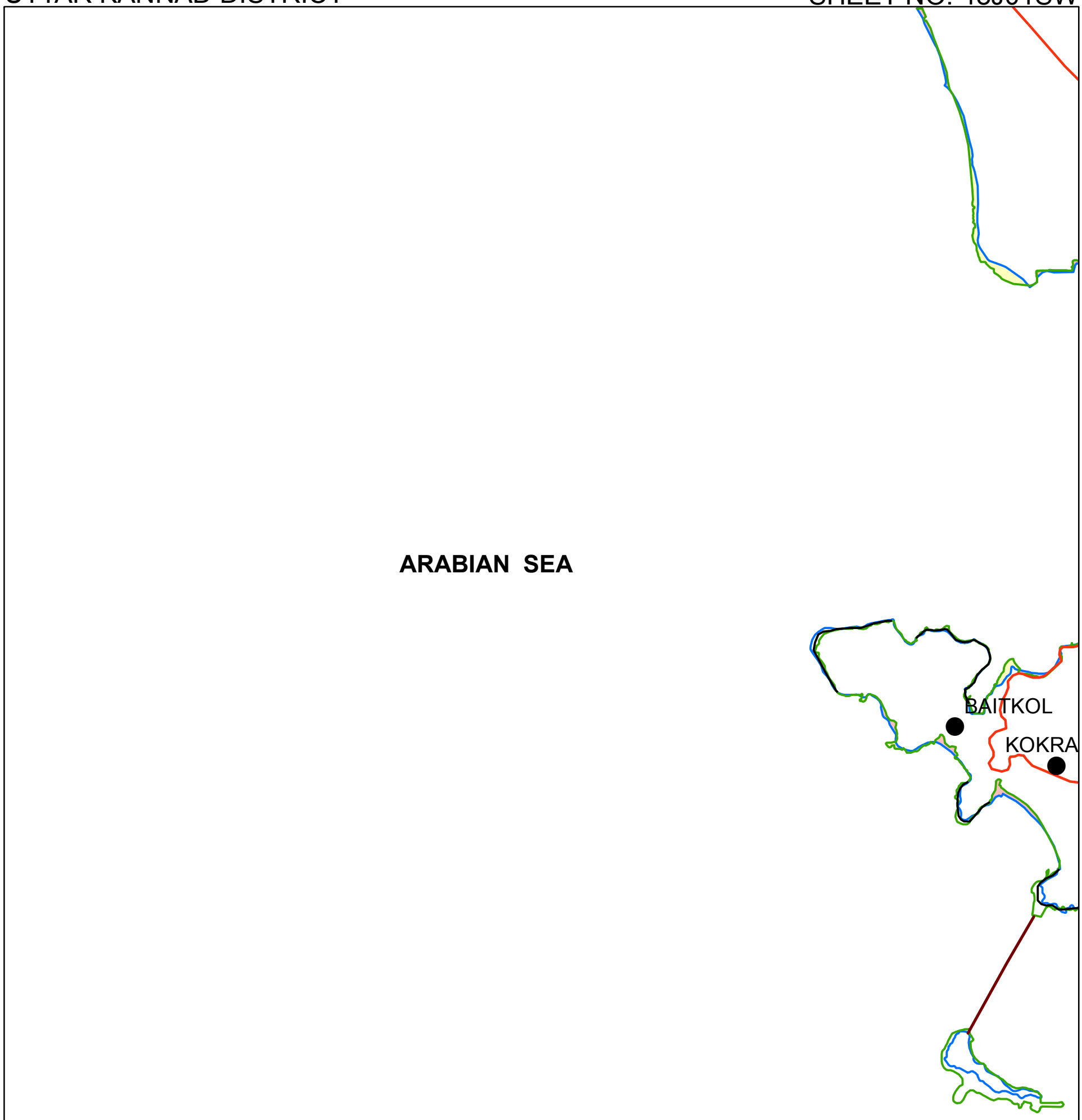
UTTAR KANNAD DISTRICT

SHEET NO. 48J01SW



Legend

- EROSION
- ACCRETION
- STABLE
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- JETTY
- HABITATION

N
W E
S
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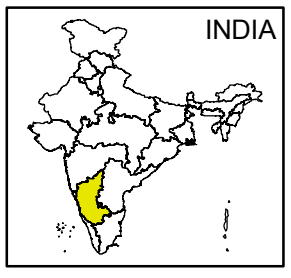
Scale in Km

INDEX TO SHEETS

SEA	48J01 NW	48J01 NE
SEA		48J01 SE
SEA	48J02 NW	48J02 NE



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

SHORELINE CHANGE MAP

KARNATAKA

FOR OFFICIAL USE ONLY

UTTAR KANNAD DISTRICT

SHEET NO. 48J01SE

KINNAR

KANASGERI

DEVBAG

DEVALVADA

SUNKERI

KODIBAG

KAJUBAG

KARWAR

HABBUVADA

SHEJVADA

BINAGA

SHANKRUBAG

ARGA

AMADALLI

KANTRIVADA

Legend

- EROSION
- ACCRETION
- STABLE
- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N

W E

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Scale in Km

INDEX TO SHEETS

48J01 NW	48J01 NE	48J05 NW
48J01 SW		48J05 SW
48J02 NW	48J02 NE	48J06 NW

INDIA

KARNATAKA

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
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SHORELINE CHANGE MAP

KARNATAKA

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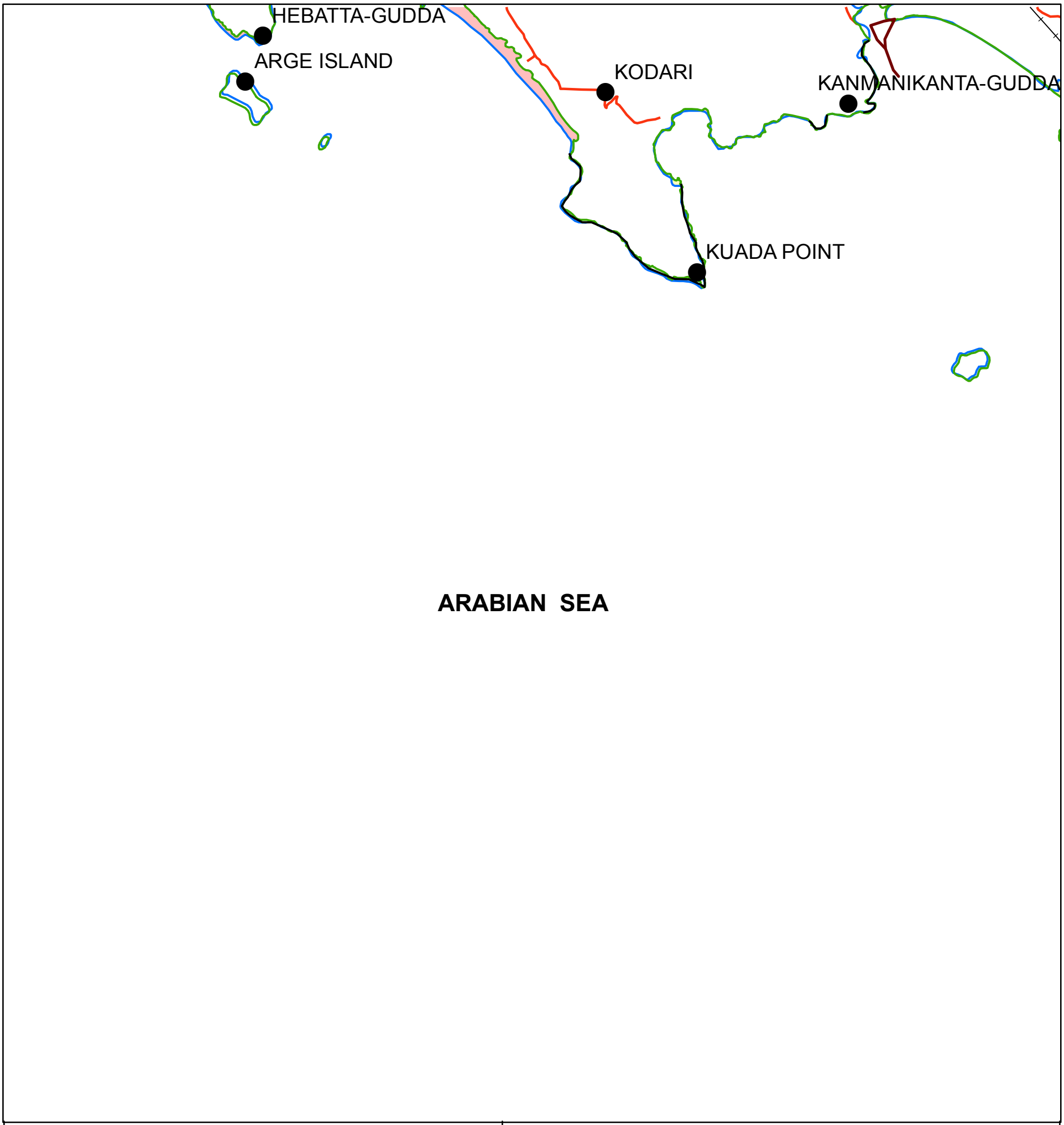
UTTAR KANNAD DISTRICT

SHEET NO. 48J02NE



Legend

- EROSION
- ACCRETION
- STABLE
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- JETTY
- HABITATION

N
W E
S

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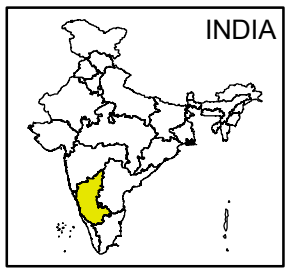
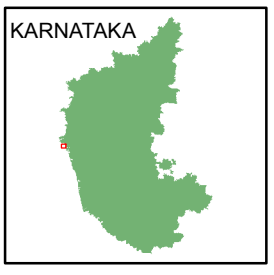
Scale in Km

INDEX TO SHEETS

SEA	48J01 SE	48J05 SW
SEA		48J06 NW
SEA	SEA	48J06 SW





DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
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SHORELINE CHANGE MAP

KARNATAKA

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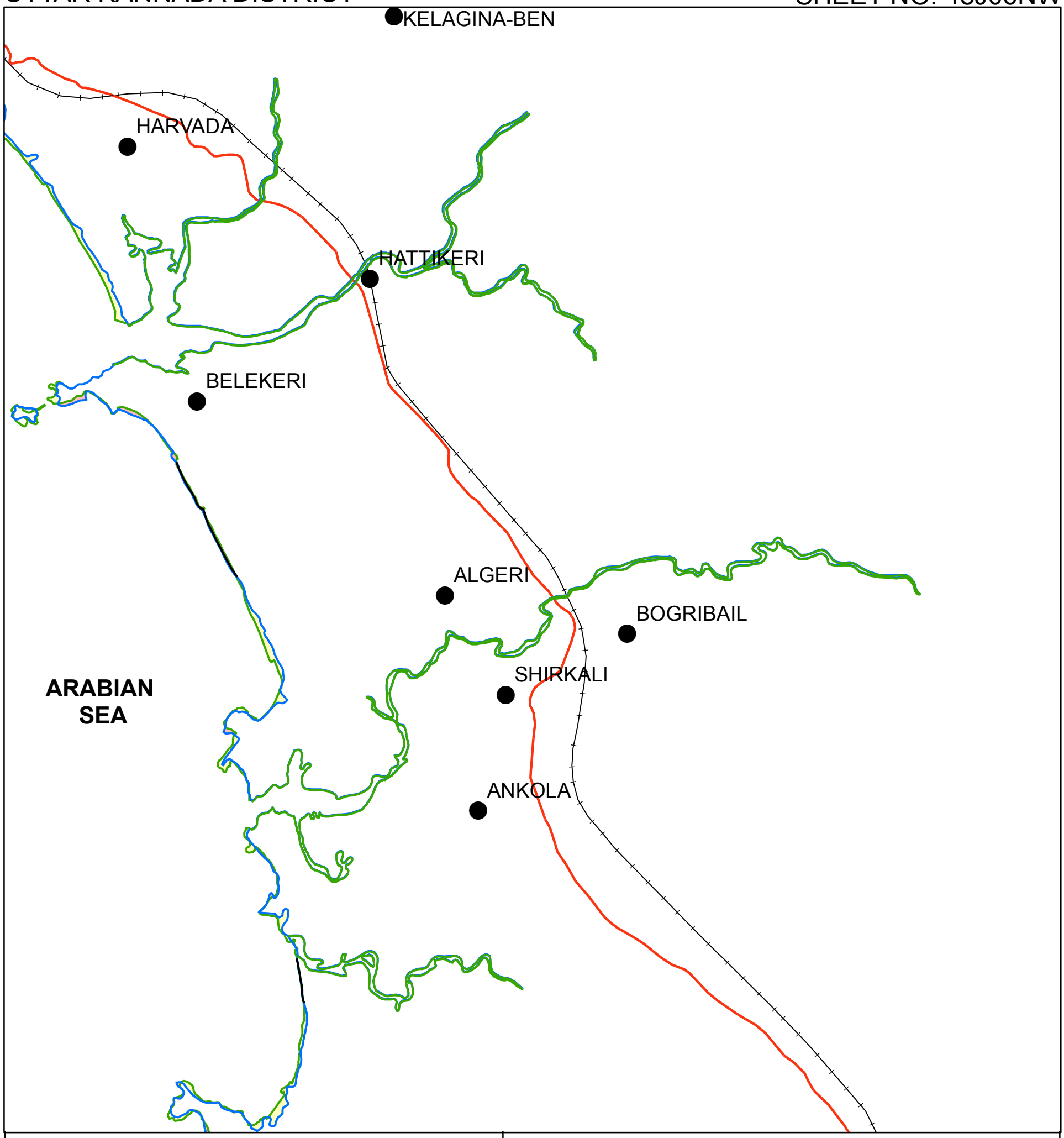
UTTAR KANNADA DISTRICT

SHEET NO. 48J06NW



Legend

- EROSION
- ACCRETION
- STABLE
- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

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W E
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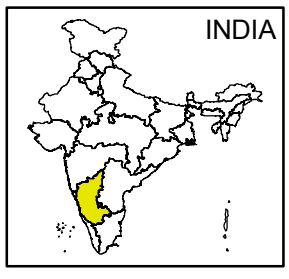
Scale in Km

INDEX TO SHEETS

SEA	48J05 SW	48J05 SE
SEA		48J06 NE
SEA	48J06 SW	48J06 SE



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
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SHORELINE CHANGE MAP

KARNATAKA

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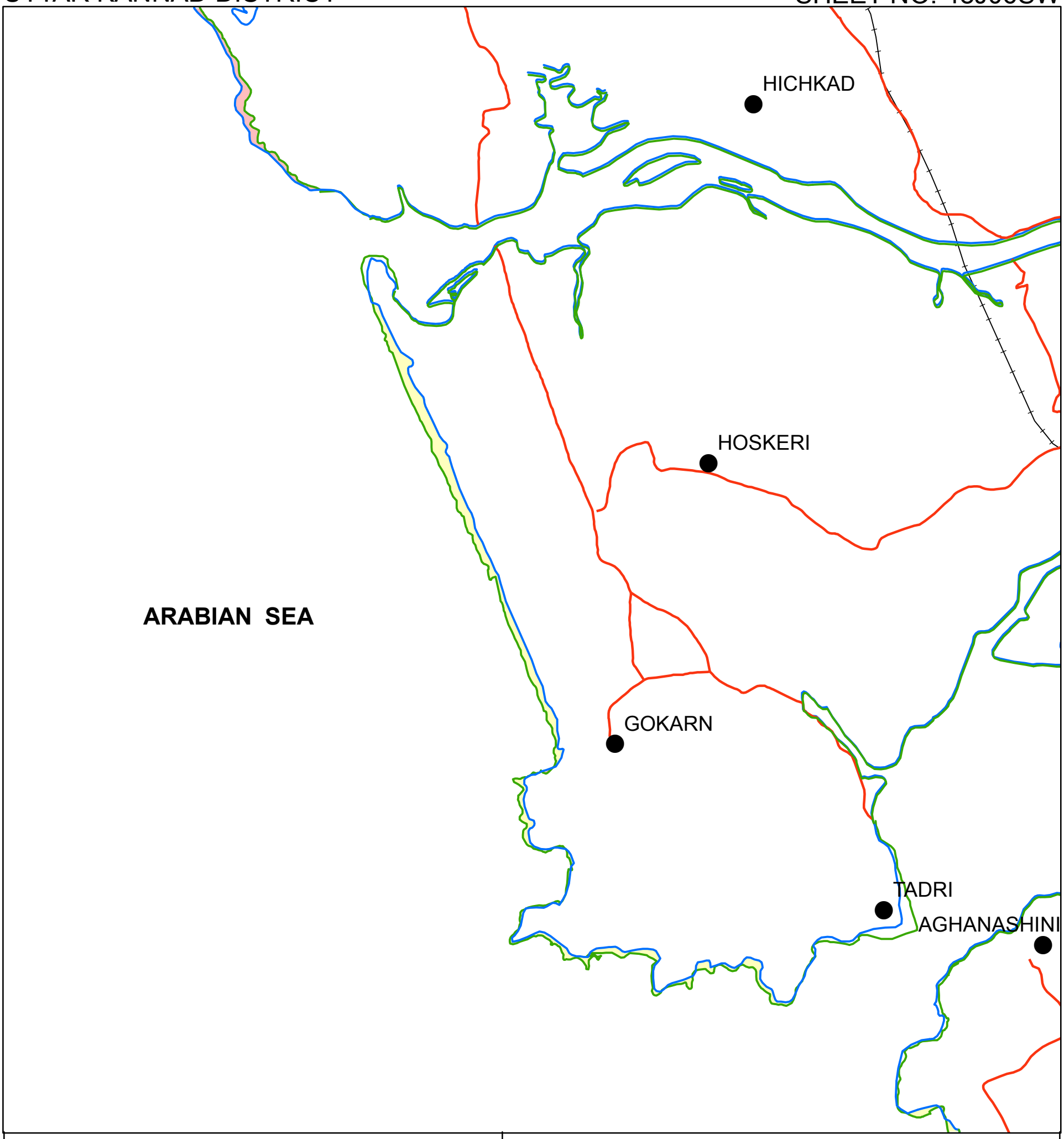
UTTAR KANNAD DISTRICT

SHEET NO. 48J06SW



Legend

- EROSION
- ACCRETION
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

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W E
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Scale in Km

INDEX TO SHEETS

48J02 NE	48J06 NW	48J06 NE
48J02 SE		48J06 SE
48J03 NE	48J07 NW	48J07 NE

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

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SHORELINE CHANGE MAP

KARNATAKA

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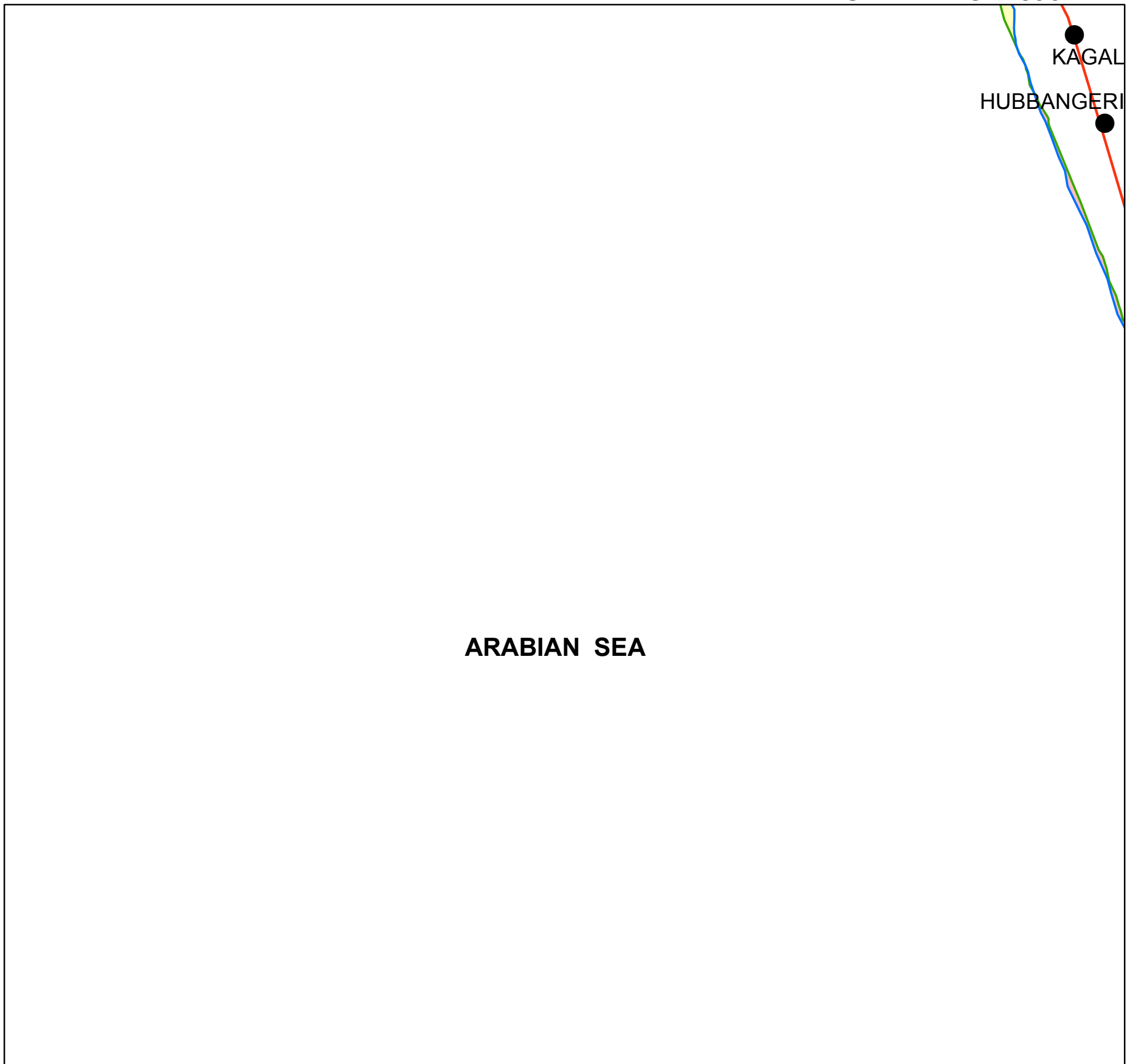
UTTAR KANNAD DISTRICT

SHEET NO. 48J07NW



Legend

- EROSION
- ACCRETION
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

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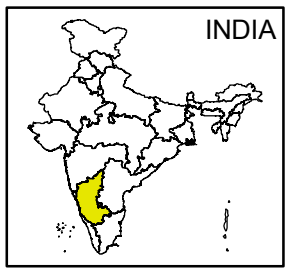
Scale in Km

INDEX TO SHEETS

SEA	48J06 SW	48J06 SE
SEA		48J07 NE
SEA	48J07 SW	48J07 SE



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
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SHORELINE CHANGE MAP

KARNATAKA

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UTTAR KANNAD DISTRICT

SHEET NO. 48J07NE

MIRJAN

HEGDE

HALKAR

DIVGI

KATGAL

KALLABBE

MURUR

HATTIKERI

KUMTA

CHANDAVAR

ARABIAN SEA

Legend

- EROSION
- ACCRETION
- STABLE
- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

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Scale in Km

INDEX TO SHEETS

SEA	48J06 SE	48J10 SW
SEA		48J11 NW
SEA	48J07 SE	48J11 SW

INDIA

KARNATAKA

DATA SOURCE:
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SHORELINE CHANGE MAP

KARNATAKA

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UTTAR KANNAD DISTRICT

SHEET NO. 48J07SE

DHARESHVAR

HEBANKERI

HALDIPUR

KARKI

ARABIAN SEA

HONAVAR

KASARKOD

Legend

- EROSION
- ACCRETION
- STABLE
- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- SEA WALL
- HABITATION

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Scale in Km

INDEX TO SHEETS

48J07 NW	48J07 NE	48J11 NW
48J07 SW		48J11 SW
48J08 NW	48J08 NE	48J12 NW

INDIA

KARNATAKA

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

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SHORELINE CHANGE MAP

KARNATAKA

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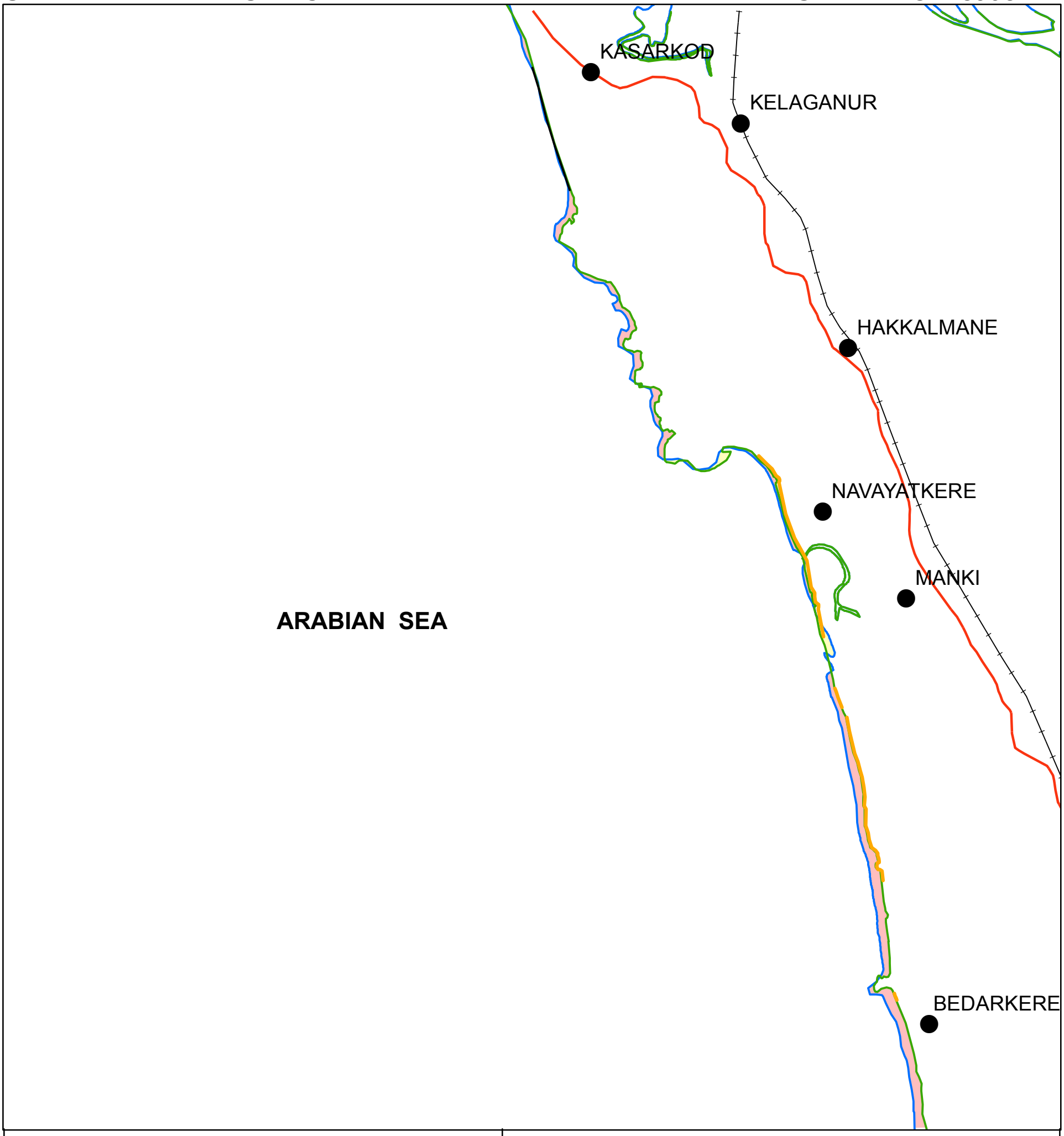
UTTAR KANNAD DISTRICT

SHEET NO. 48J08NE



Legend

- EROSION
- ACCRETION
- STABLE
- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- SEA WALL
- HABITATION

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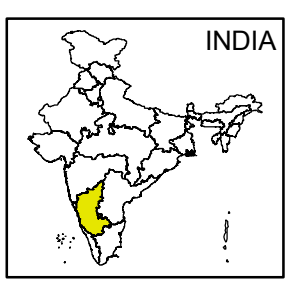
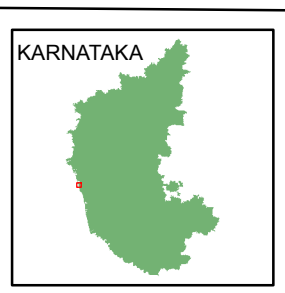
Scale in Km

INDEX TO SHEETS

48J07 SW	48J07 SE	48J11 SW
48J08 NW		48J12 NW
48J08 SW	48J08 SE	48J12 SW





DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

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SHORELINE CHANGE MAP

KARNATAKA

UTTAR KANNAD DISTRICT

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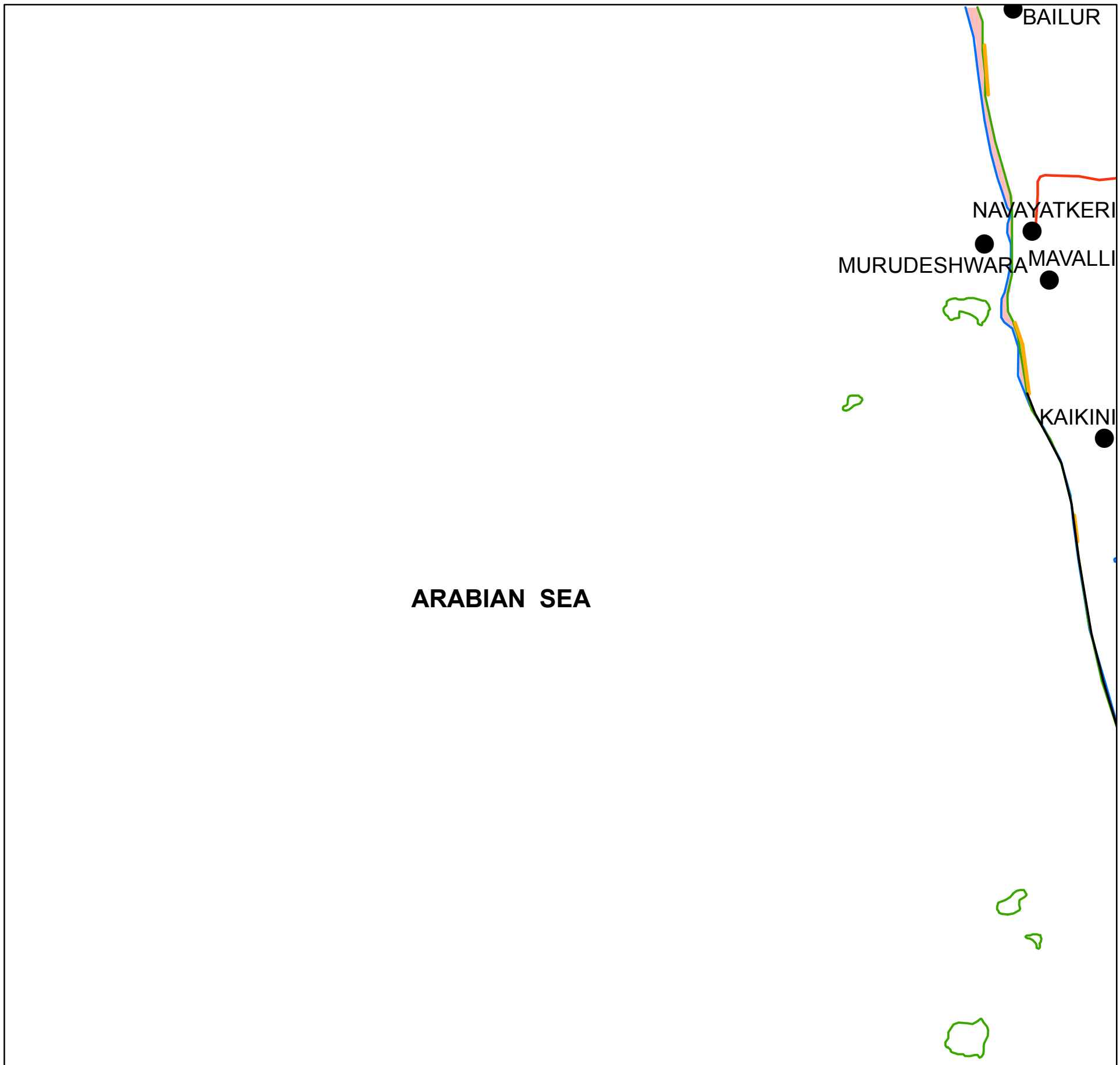
SHEET NO. 48J08SE



Legend

- EROSION
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- STABLE
- SEA WALL
- HABITATION

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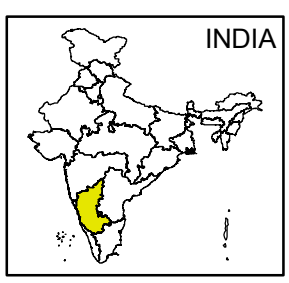
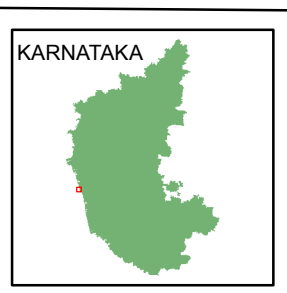
Scale in Km

INDEX TO SHEETS

48J08 NW	48J08 NE	48J12 NW
48J08 SW		48J12 SW
48J05 NW	48J05 NE	48K09 NW





DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

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SHORELINE CHANGE MAP

KARNATAKA

UTTAR KANNAD DISTRICT

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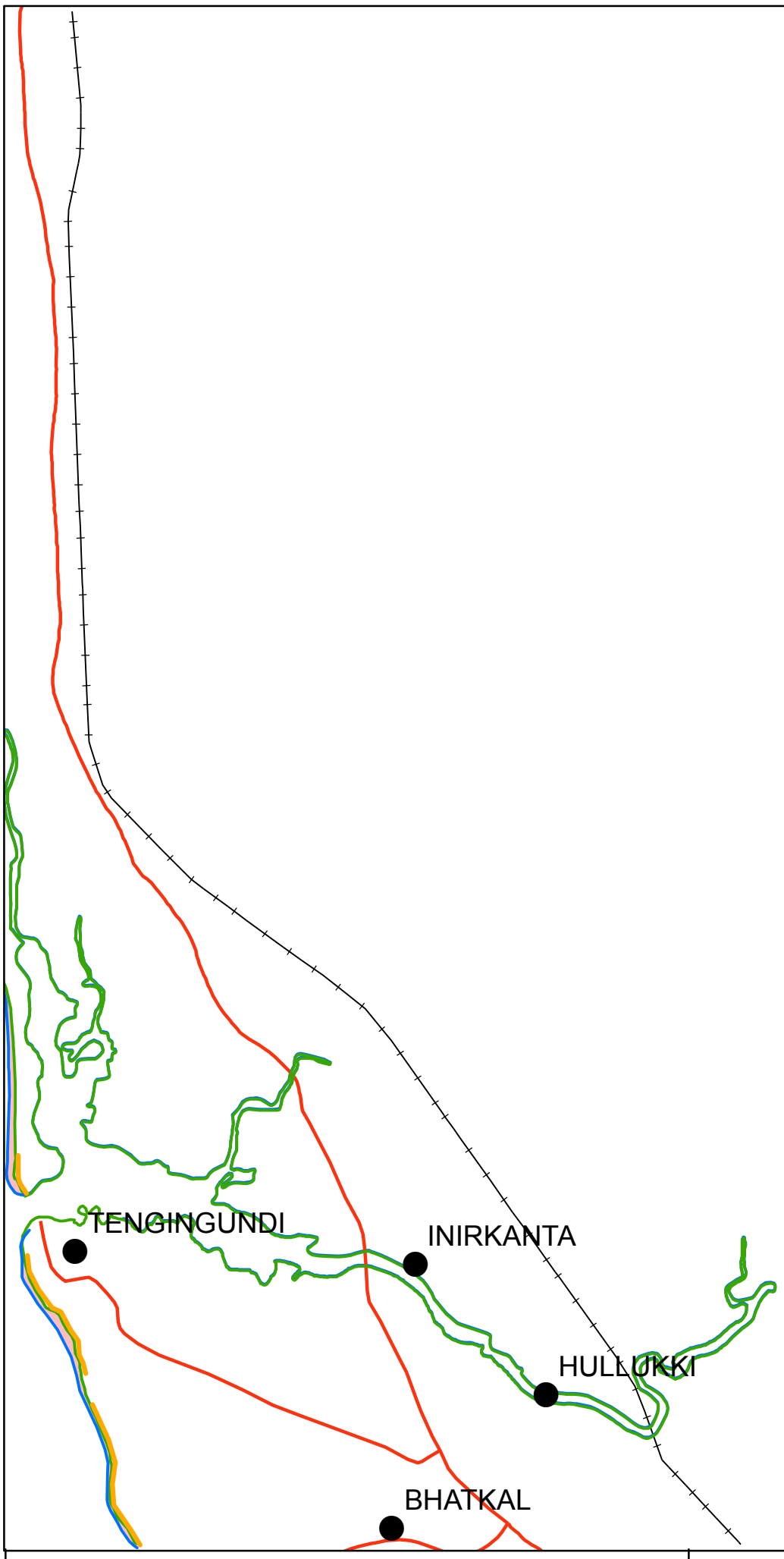
SHEET NO. 48J12SW



Legend

- EROSION
- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- SEA WALL
- HABITATION

N

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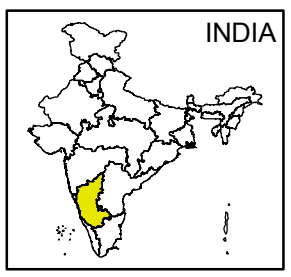
Scale in Km

INDEX TO SHEETS

48J08 NE	48J12 NW	48J12 NE
48J08 SE		48J12 SE
48K05 NE	48K09 NW	48K09 NE



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

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SHORELINE CHANGE MAP

KARNATAKA

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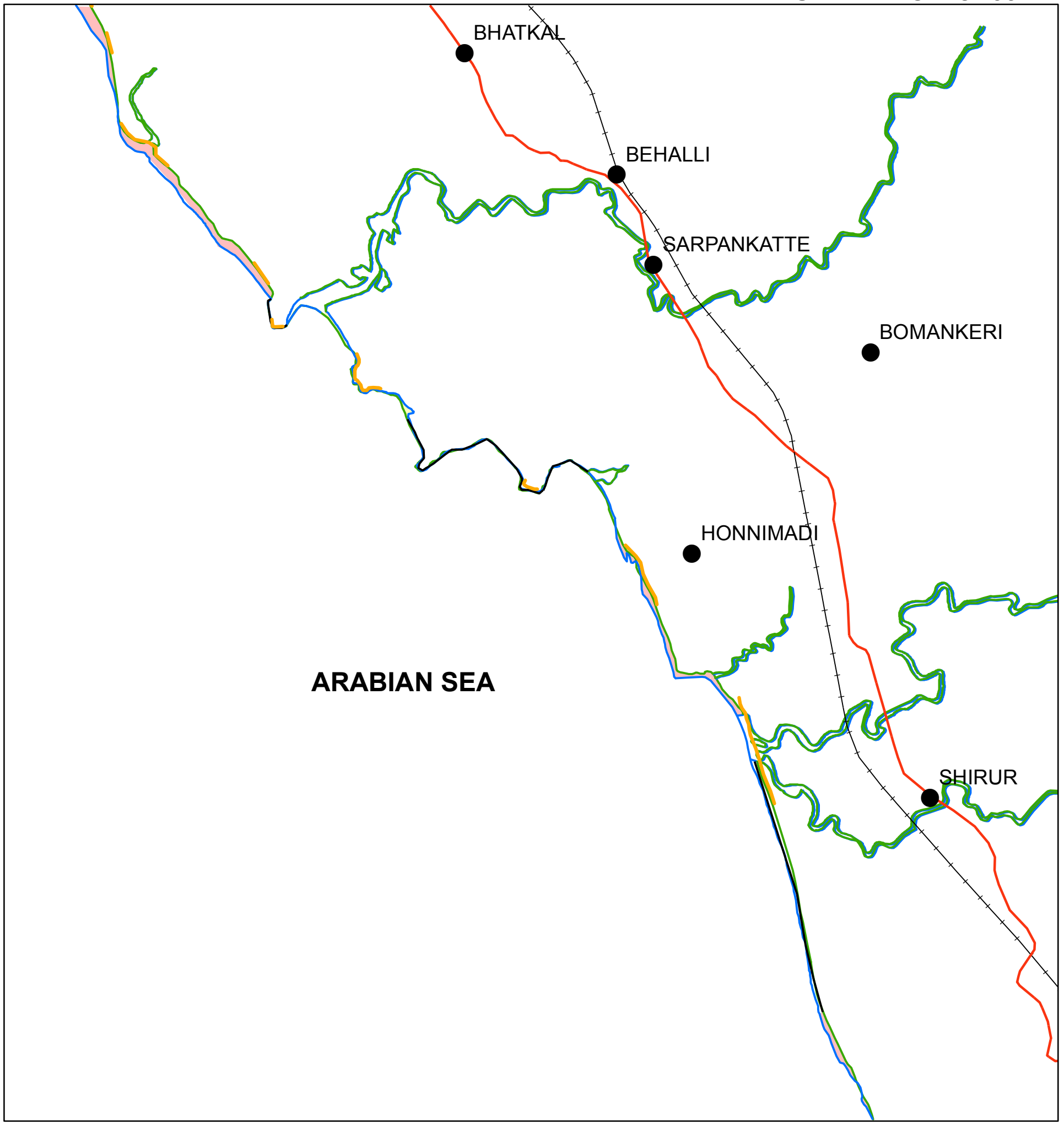
UTTAR KANNAD DISTRICT

SHEET NO. 48K09NW



Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- STABLE
- SEA WALL
- HABITATION

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W E
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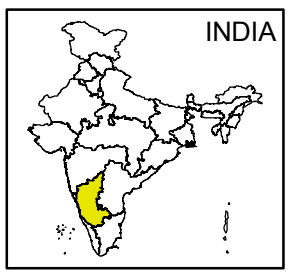
Scale in Km

INDEX TO SHEETS

48J08 SE	48J12 SW	48J12 SE
48K0 NE		48K09 NE
48K05 SE	48K09 SW	48K09 SE



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

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SHORELINE CHANGE MAP

KARNATAKA

UDUPI DISTRICT

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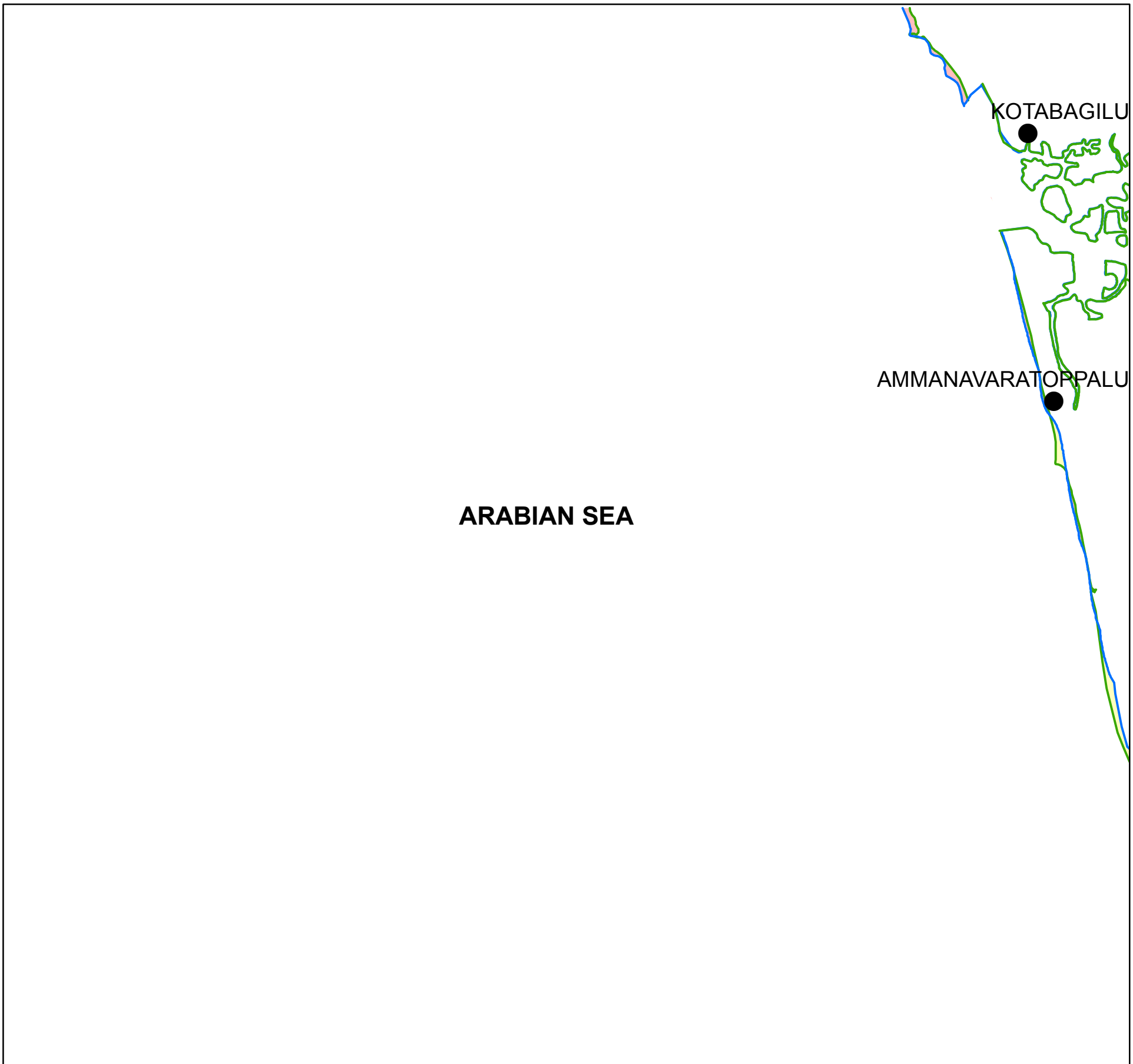
SHEET NO. 48K09SW



Legend

- EROSION
- ACCRETION
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
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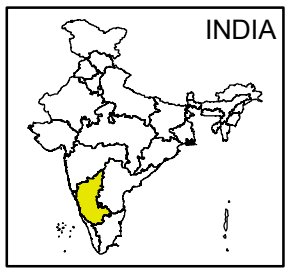
Scale in Km

INDEX TO SHEETS

SEA	48K09 NW	48K09 NE
SEA		48L13 SW
SEA	SEA	48K10 NE



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

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SHORELINE CHANGE MAP

KARNATAKA

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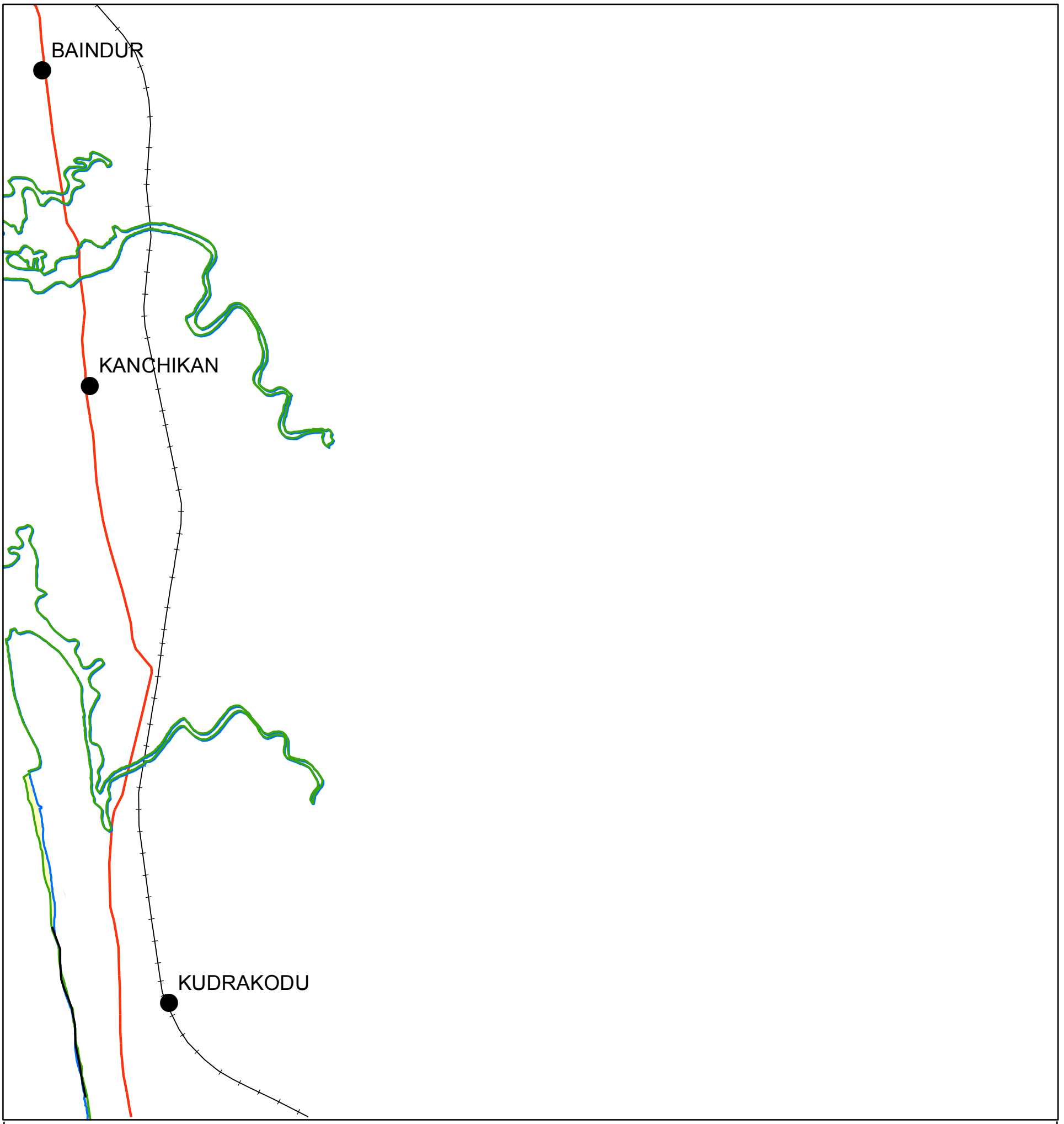
UDUPI DISTRICT

SHEET NO. 48K09SE



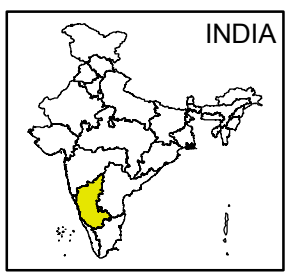
Legend

- EROSION
- ACCRETION
- STABLE
- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S
0 2
Scale in Km

INDEX TO SHEETS

48K09 NW	48L09 NE	48L13 NW
48K09 SW		48L13 NW
SEA	48K10 NE	48K14 NW



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

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SHORELINE CHANGE MAP

KARNATAKA

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UDUPI DISTRICT

SHEET NO. 48K10NE

NAVUNDA

BADAKERE

KOLLUR RIVER

MARAVANTE

HADAVU

CHAKRA RIVER

ARABIAN SEA

GUJJAD

GANGOLI

HALADI RIVER

COONDAPOOR

Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N

W E

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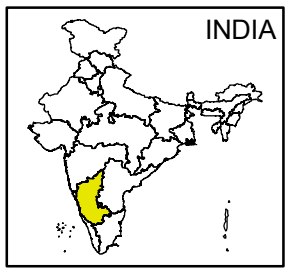
Scale in Km

INDEX TO SHEETS

48K09 SW	48K09 SE	48K13 SW
SEA		48K14 NW
SEA	48K10 SE	48K14 SW

INDIA



KARNATAKA

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

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SHORELINE CHANGE MAP

KARNATAKA

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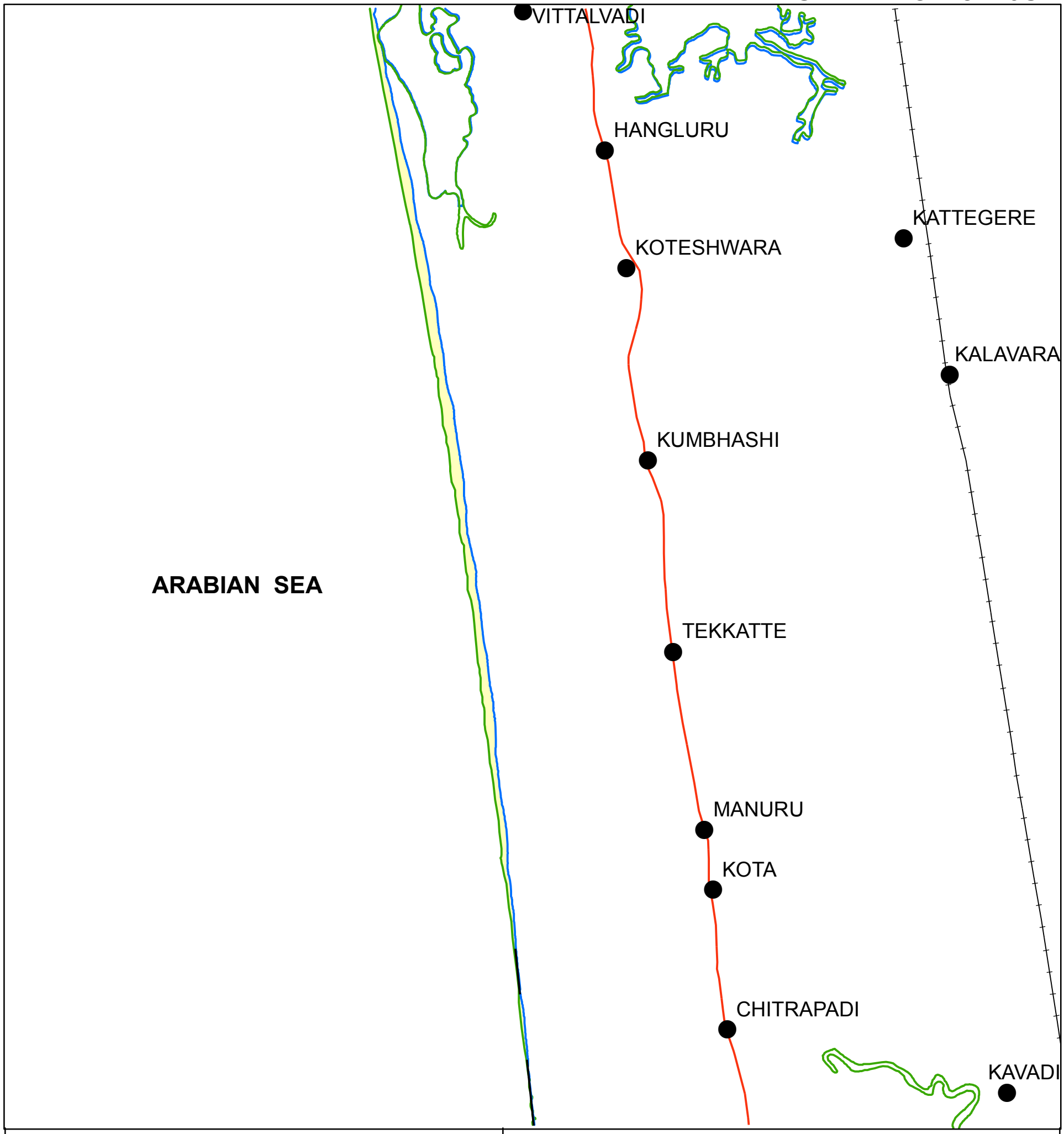
UDUPI DISTRICT

SHEET NO. 48K10SE



Legend

- ACCRETION
- STABLE
- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

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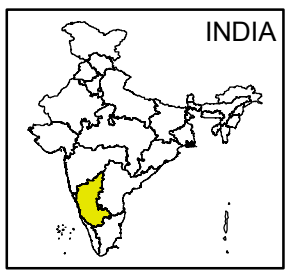
Scale in Km

INDEX TO SHEETS

SEA	48K10 NE	48K14 NW
SEA		48K14 SW
SEA	48K11 NE	48K15 NW



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

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SHORELINE CHANGE MAP

KARNATAKA

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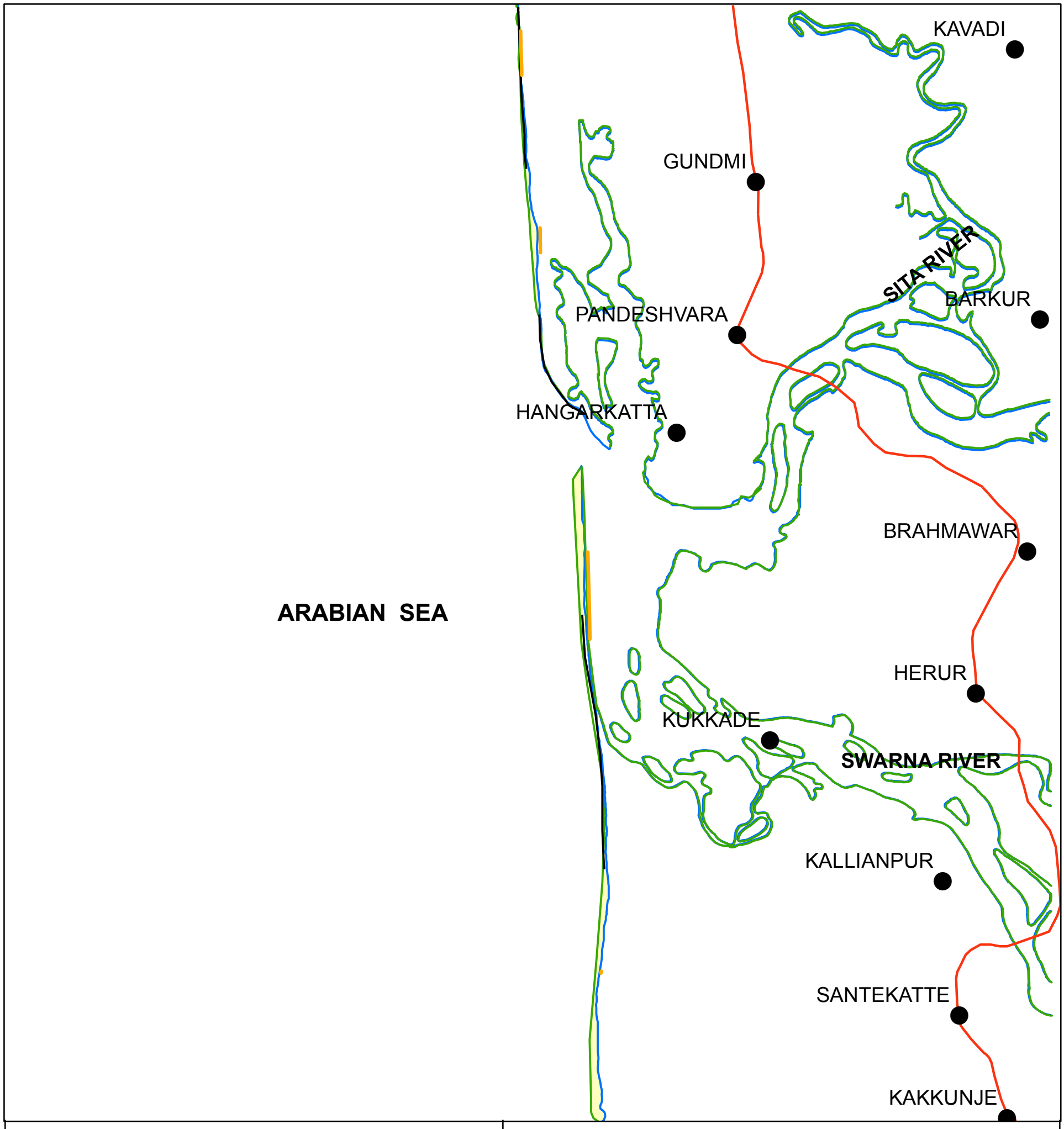
UDUPI DISTRICT

SHEET NO. 48K11NE



Legend

- EROSION
- ACCRETION
- STABLE
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- SEA WALL
- HABITATION

N
W E
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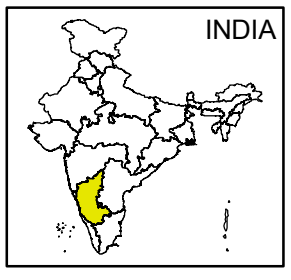
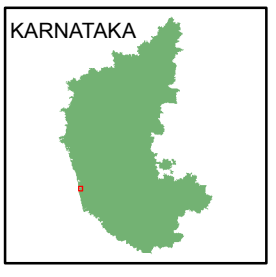
0 2

Scale in Km

INDEX TO SHEETS

SEA	48K10 SE	48K14 SW
SEA		48K15 NW
SEA	48K11 SE	48K15 SW





DATA SOURCE:
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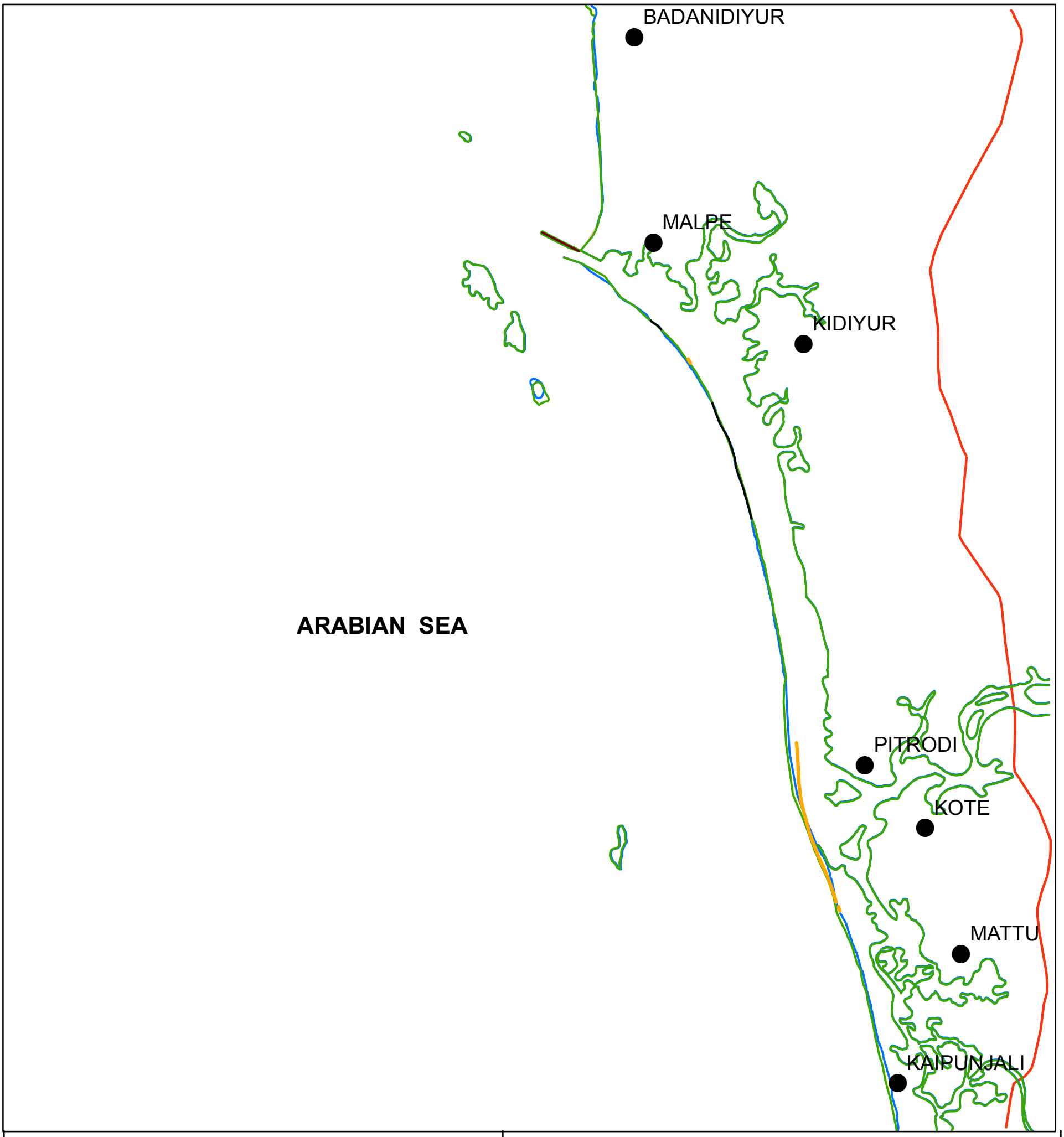
SHORELINE CHANGE MAP

KARNATAKA

FOR OFFICIAL USE ONLY

UDUPI DISTRICT

SHEET NO. 48K11SE



Legend

- EROSION
- ACCRETION
- STABLE
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- JETTY
- SEA WALL
- HABITATION

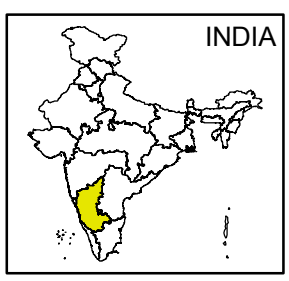
N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

SEA	48K11 NE	48K15 NW
SEA		48K15 SW
SEA	48K12 NE	48K16 NW



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

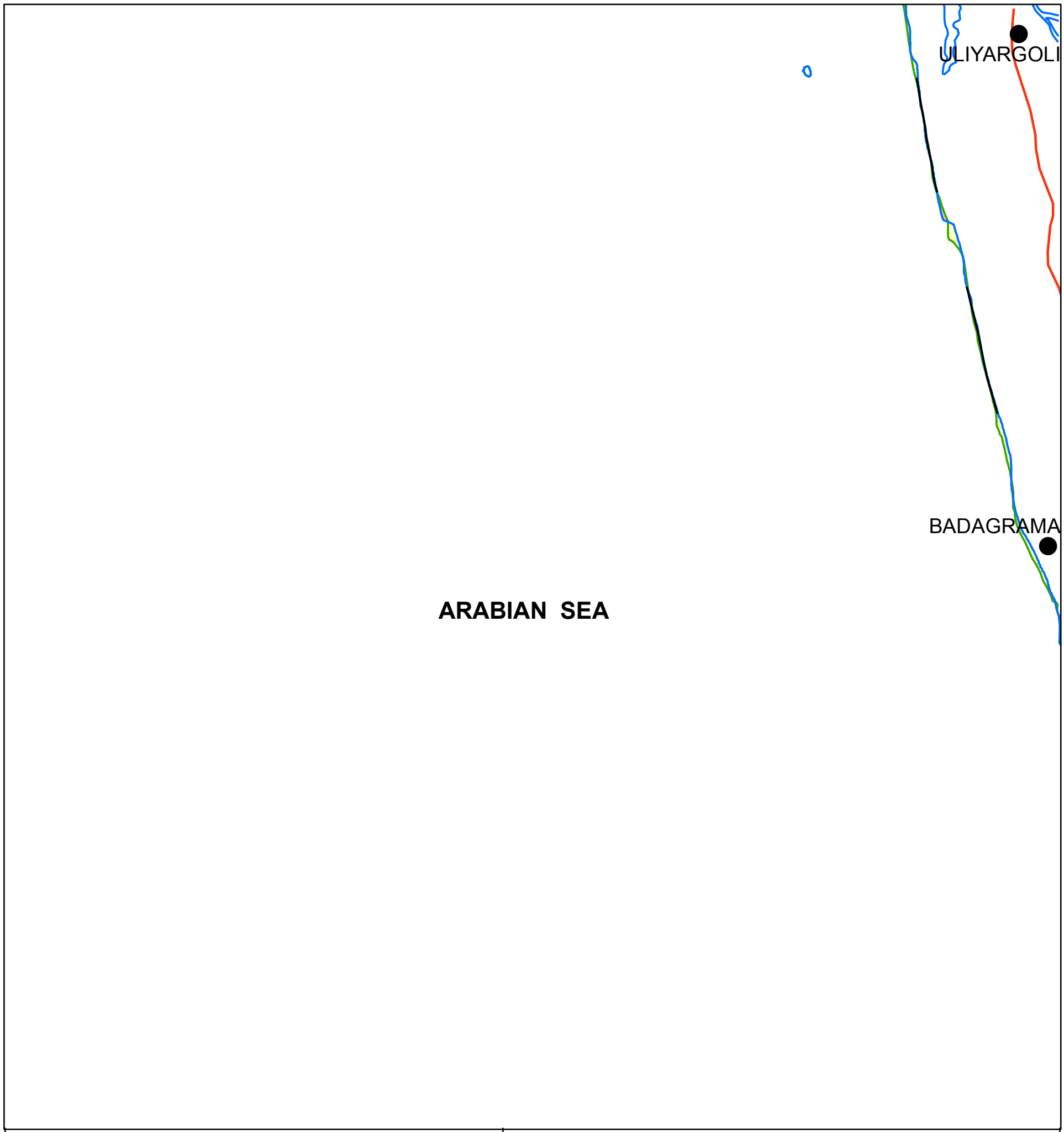
SHORELINE CHANGE MAP

KARNATAKA

UDUPI DISTRICT

FOR OFFICIAL USE ONLY

SHEET NO. 48K12NE



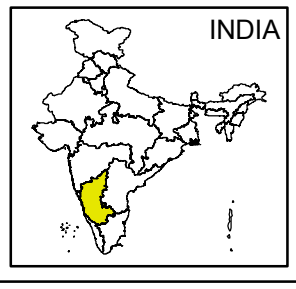
Legend

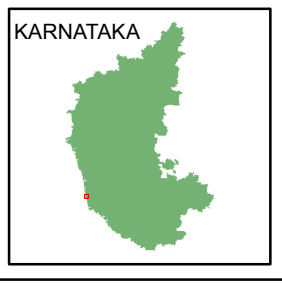
- EROSION
- ACCRETION
- STABLE
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S
0 2
Scale in Km

INDEX TO SHEETS

SEA	48K11 SE	48K15 SW
SEA		48K16 NW
SEA	48K12 SE	48K16 SW





DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
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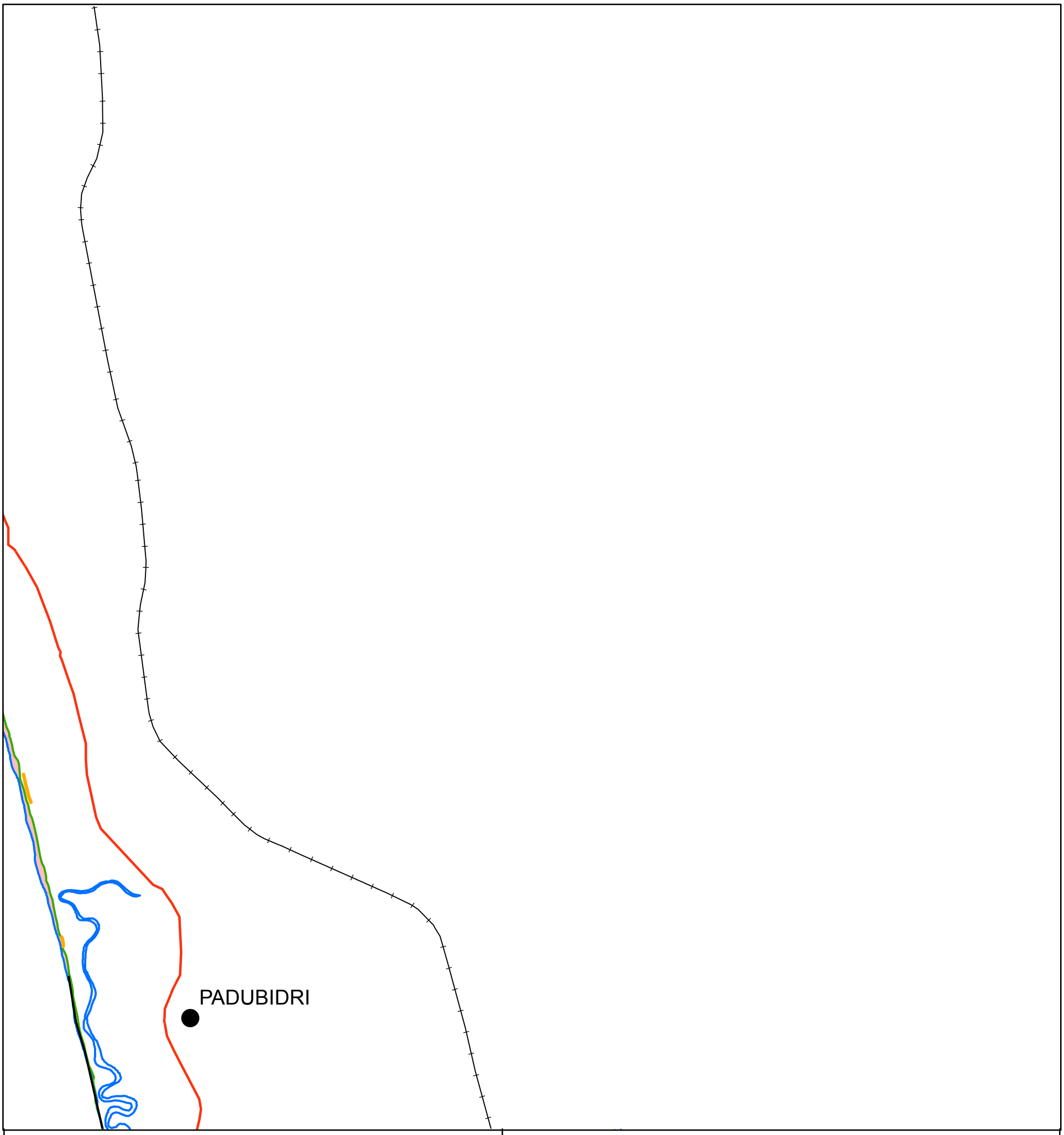
SHORELINE CHANGE MAP

KARNATAKA

FOR OFFICIAL USE ONLY

UDUPI DISTRICT

SHEET NO. 48K16NW



Legend

- EROSION
- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- SEA WALL
- HABITATION

N

W E

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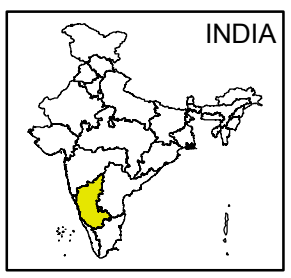
Scale in Km

INDEX TO SHEETS

48K11 SE	48K15 SW	48K15 SE
48K12 NE		48K16 NE
SEA	48K16 SW	48K16 SE

INDIA



KARNATAKA

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
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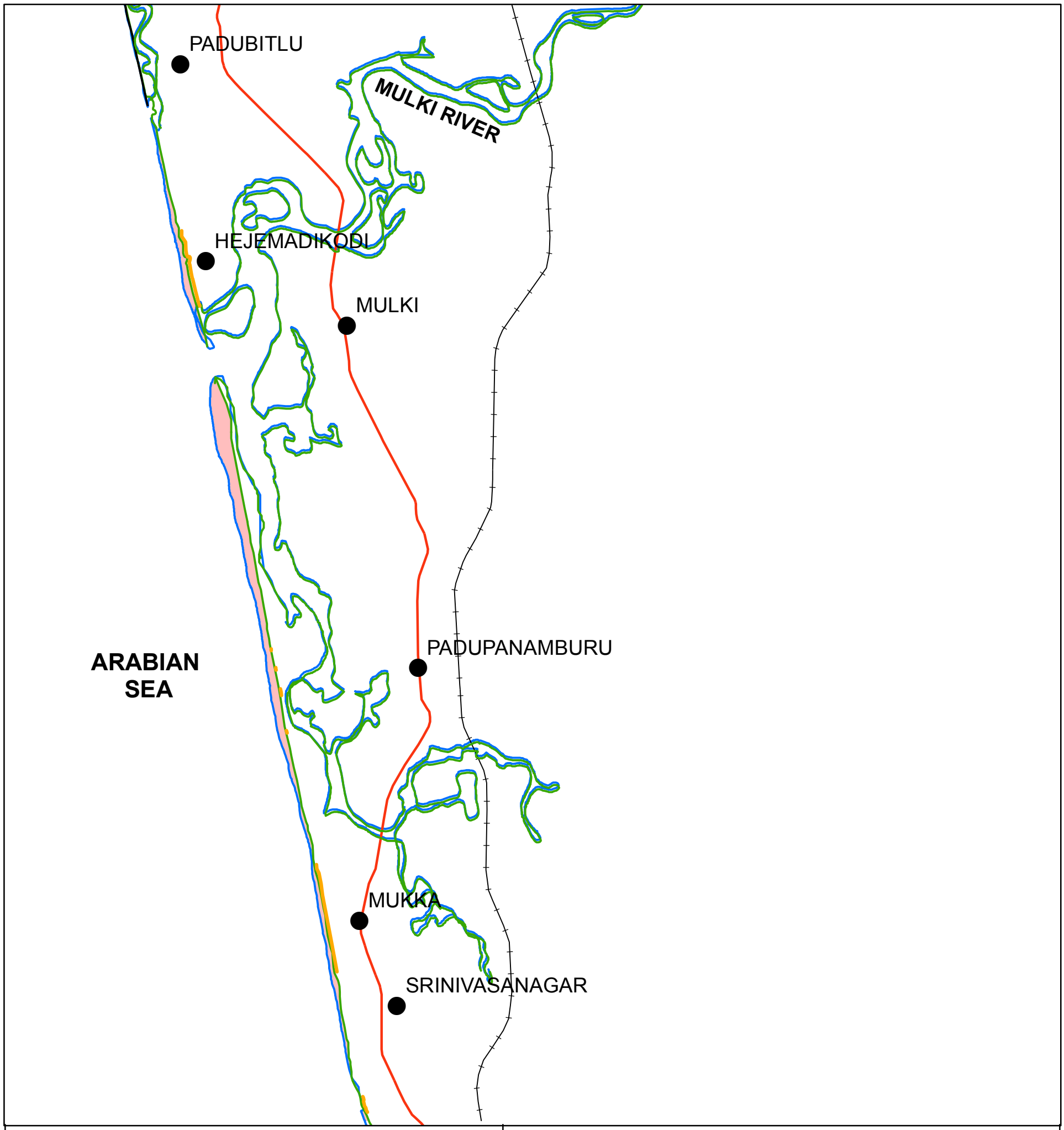
SHORELINE CHANGE MAP

KARNATAKA

DAKSHINA KANNADA DISTRICT

FOR OFFICIAL USE ONLY

SHEET NO. 48K16SW



Legend

- EROSION
- ACCRETION
- STABLE
- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- SEA WALL
- HABITATION

N
W E
S

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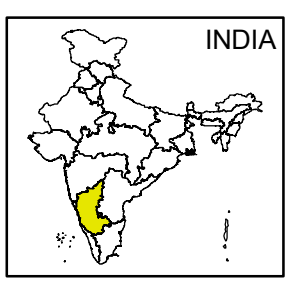
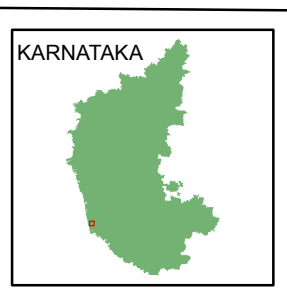
Scale in Km

INDEX TO SHEETS

48K12 NE	48K16 NW	48K16 NE
SEA		48K16 SE
SEA	48L13 NW	48L13 NE





DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

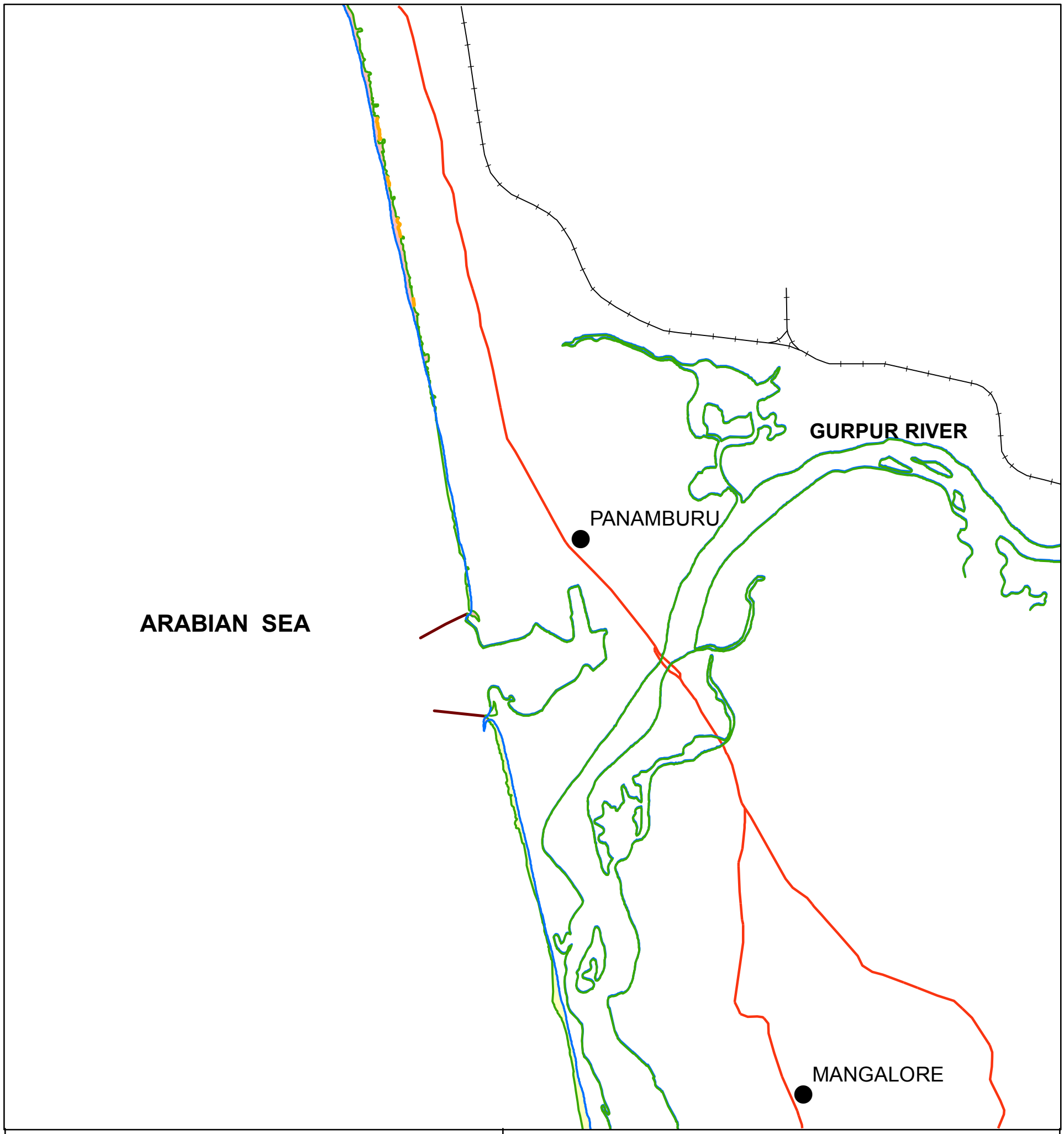
SHORELINE CHANGE MAP

KARNATAKA

DAKSHINA KANNAD DISTRICT

FOR OFFICIAL USE ONLY

SHEET NO. 48L13NW



Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- JETTY
- SEA WALL
- HABITATION

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W E
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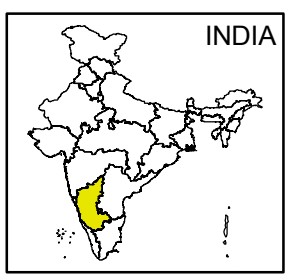
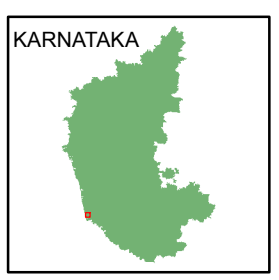
Scale in Km

INDEX TO SHEETS

48J01 NW	48J01 NE	48J05 NW
48J01 SW		48J05 SW
48J02 NW	48J02 NE	48J06 NW





DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
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AND CENTRAL WATER COMMISSION, NEW DELHI

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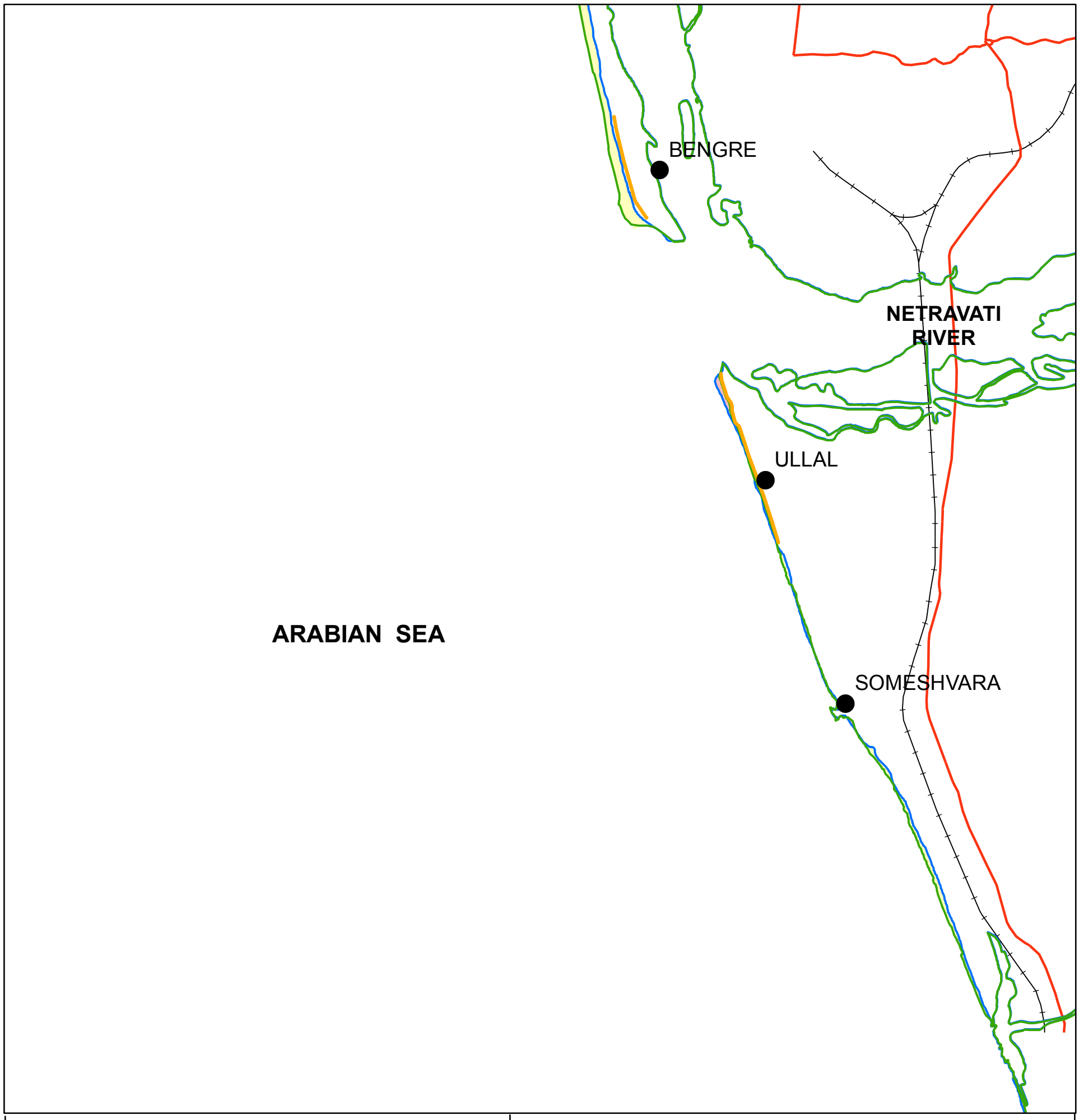
SHORELINE CHANGE MAP

KARNATAKA

DAKSHIN KANNAD DISTRICT

FOR OFFICIAL USE ONLY

SHEET NO. 48L13SW



Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- SEA WALL
- HABITATION

N
W E
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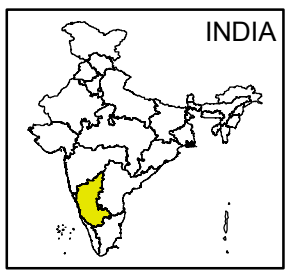
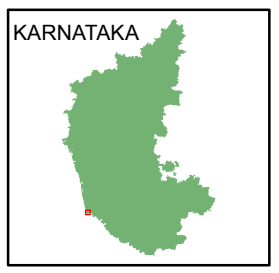
Scale in Km

INDEX TO SHEETS

SEA	48L13 NW	48L13 NE
SEA		48L13 SE
SEA	48L14 NW	48L14 NE





DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

SHORELINE CHANGE MAPS

KERALA

INDEX MAP OF KERALA

48L13SW
48L14NW 48L14NE
48L14SE
KASARAGOD
48L15NE 48P03NW
48P03SW
48P04NW 48P04NE
48P04SE 48P08SW
49M05NW 49M05NE
KANNUR
49M05SW 49M05SE 49M09SW
49M06NE 49M10NW
49M10SW 49M10SE
49M11NW 49M11NE 49M15NW
49M11SE 49M15SW
KOZHIKODE
49M16NW
49M16SW
49N13NW 49N13NE
49N13SE
49N14NE
49N14SE 58B02SW
58B03NW 58B03NE
58B03SW 58B03SE
58B04NE 58B08NW
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ERNAKULAM
58C01NE 58C05NW
58C05SW 58C05SE
58C06NW 58C06NE
58C06SW
ALAPPUZHA
58C07NW
58C07SW 58C07SE
58C08NE
58C08SE 58C12SW 58C12SE
58D09NW 58D09NE
KOLLAM
58D09SW 58D09SE
58D10NE 58D14NW
58D14SW 58D14SE
58D15NE
THIRUVANANTHAPURAM
58D15SE 58H03SW

ARABIAN SEA

N

INDIA

KERALA

SHORELINE CHANGES OF KERALA

KASARAGOD

KANNUR

KOZHIKODE

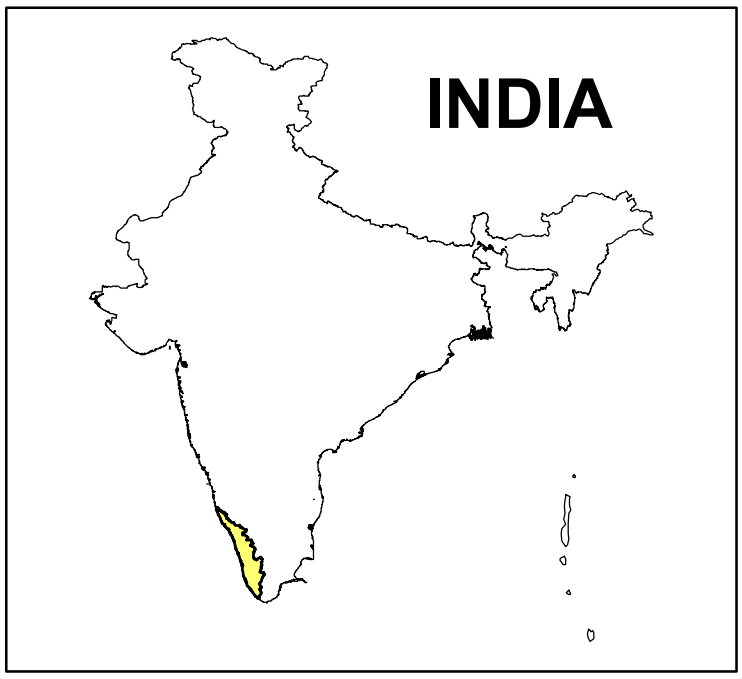
ARABIAN SEA

ERNAKULAM

ALAPPUZHA

KOLLAM

THIRUVANANTHAPURAM



LEGEND

EROSION LENGTH

ACCRETION LENGTH

STABLE LENGTH

HTL 2004-2006

SHORELINE CHANGE MAP

KERALA

FOR OFFICIAL USE ONLY

KASARAGOD DISTRICT

SHEET NO. 48L13SW

KARNATAKA

ARABIAN SEA

Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- STATE BOUNDARY
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

48L09 NE	48L13 NW	48L13 NE
SEA		48L13 SE
SEA	48L14 NW	48L14 NE

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

SHORELINE CHANGE MAP

KERALA

FOR OFFICIAL USE ONLY

KASARAGOD DISTRICT

SHEET NO. 48L14NW

ARABIAN SEA

Legend

- EROSION
- ACCRETION
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91

N
W E
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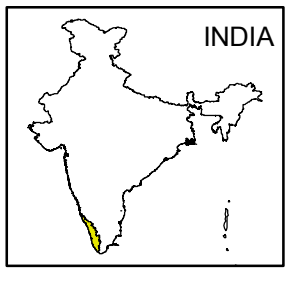
Scale in Km

INDEX TO SHEETS

SEA	48L13 SW	48L13 SE
SEA		48L14 NE
SEA	SEA	48L14 SE



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
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SHORELINE CHANGE MAP

KERALA

FOR OFFICIAL USE ONLY

KASARAGOD DISTRICT

SHEET NO. 48L14NE

MANJESHWAR

HOSANGADI

ADHEEKA RIVER

UPPALA

ARABIAN SEA

BANDYODA

Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- STABLE
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N W E S

0 2

Scale in Km

INDEX TO SHEETS

48L13 SW	48L13 SE	48P01 SW
48L14 NW		48P02 NW
SEA	48L14 SE	48P02 SW

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

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SHORELINE CHANGE MAP

KERALA

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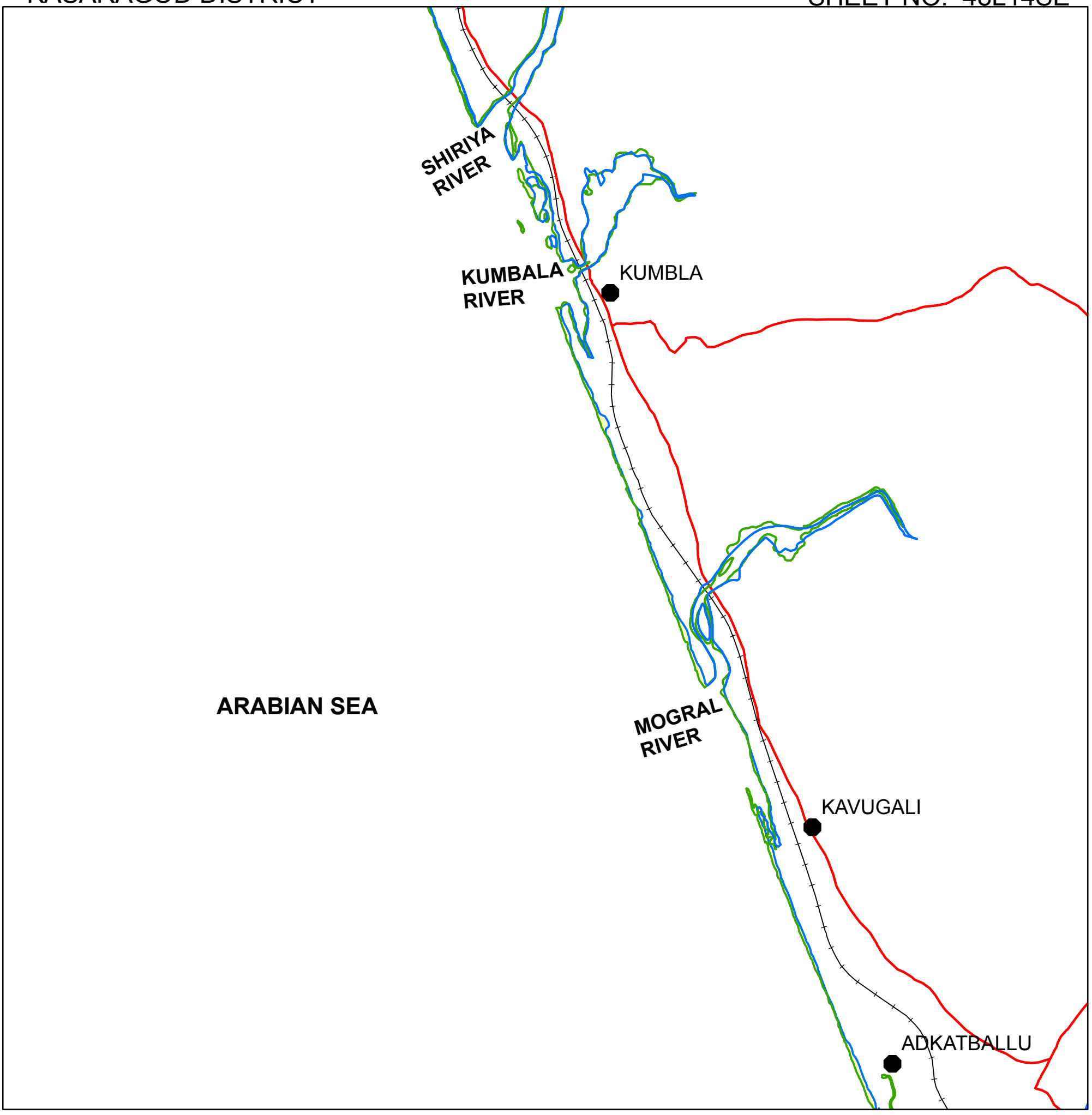
KASARAGOD DISTRICT

SHEET NO. 48L14SE



Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

48L14 NW	48L14 NE	48P02 NW
SEA		48P02 SW
SEA	48L15 NE	48P03 NW

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
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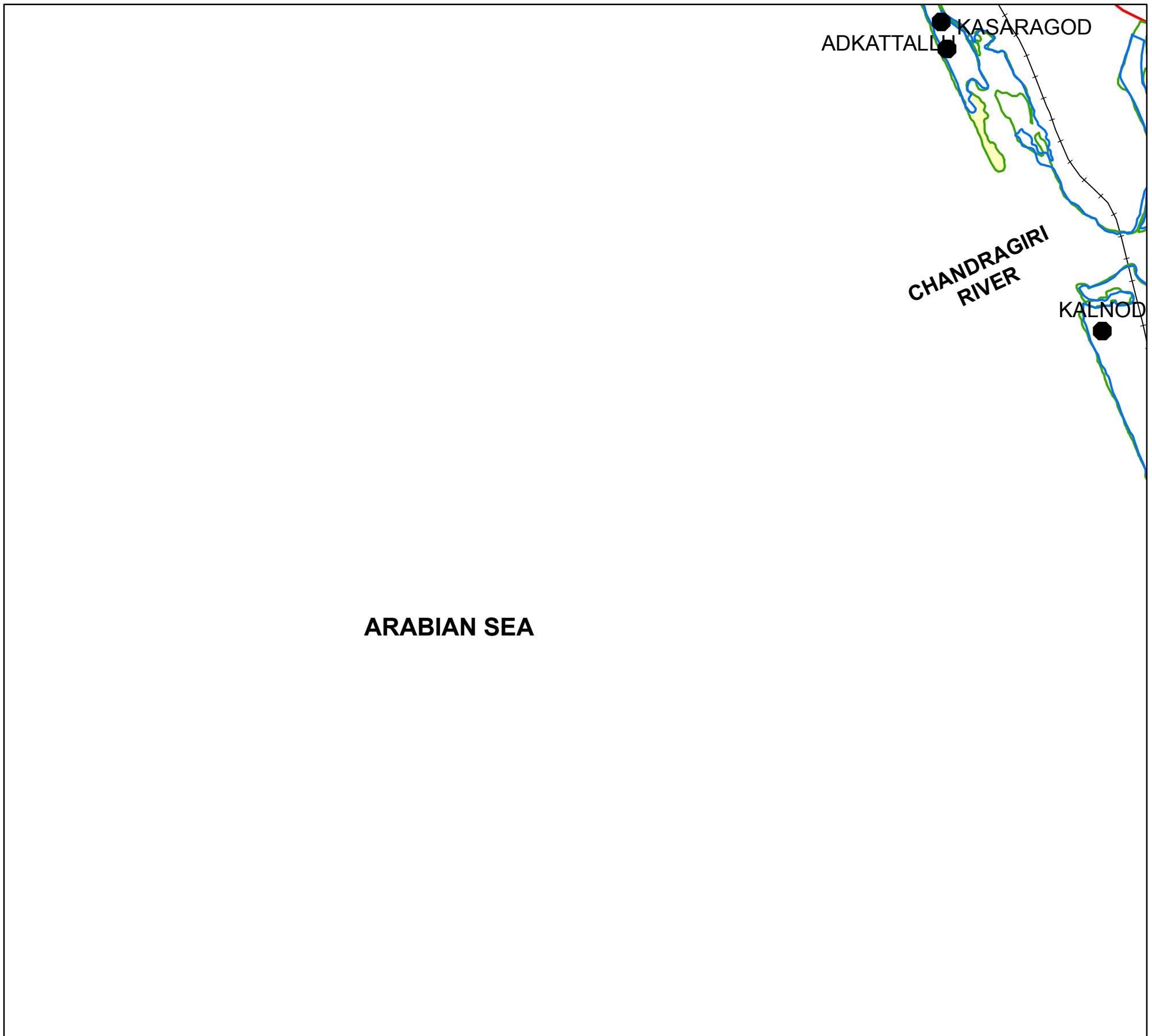
SHORELINE CHANGE MAP

KERALA

FOR OFFICIAL USE ONLY

KASARAGOD DISTRICT

SHEET NO. 48L15NE



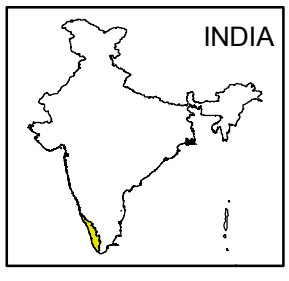
Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S
0 2
Scale in Km

INDEX TO SHEETS

SEA	48L14 SE	48P02 SW
SEA		48P03 NW
SEA	SEA	48P03 SW



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
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SHORELINE CHANGE MAP

KERALA

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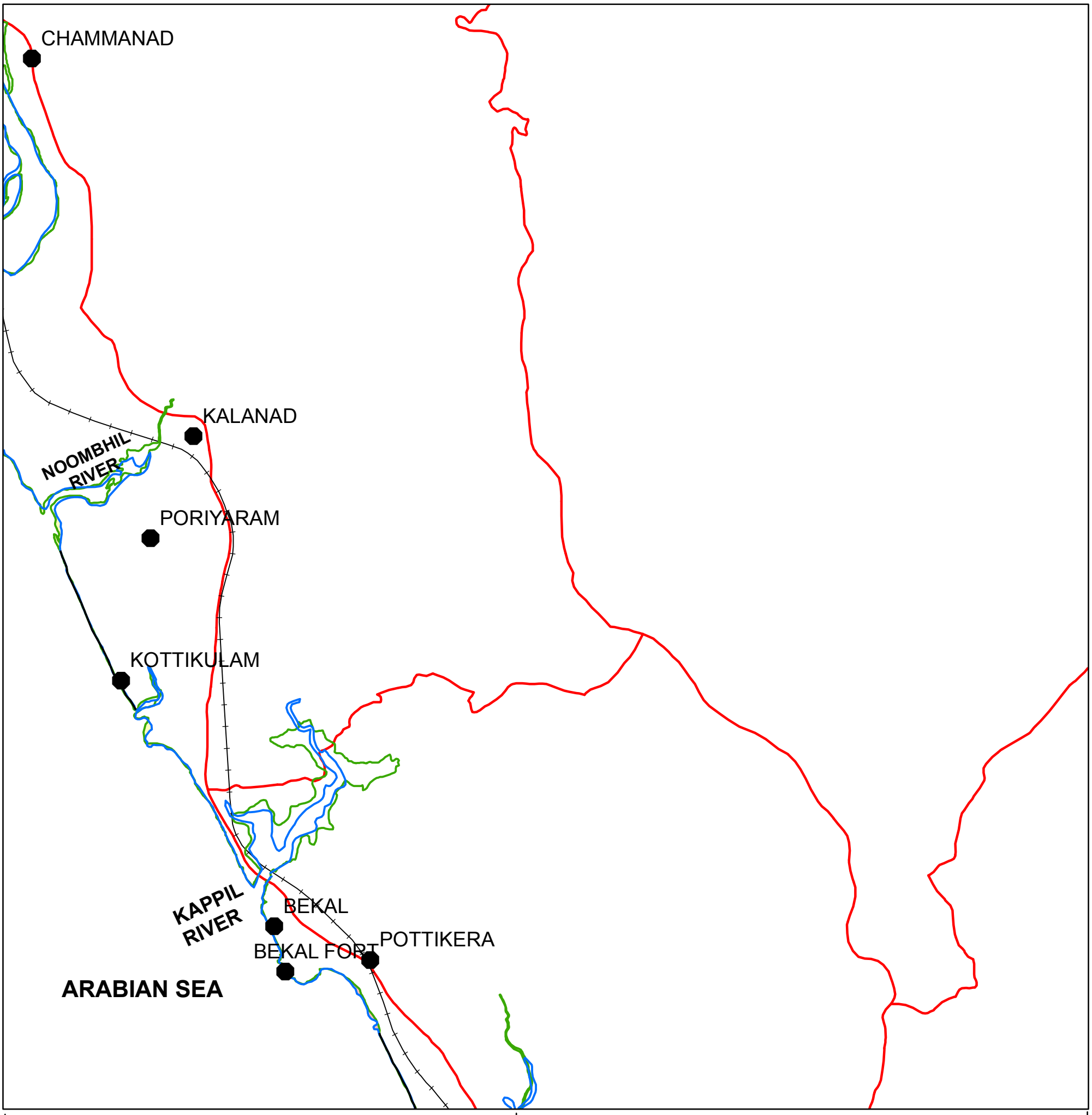
KASARAGOD DISTRICT

SHEET NO. 48P03NW



Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- STABLE
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
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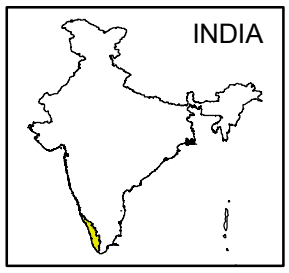
Scale in Km

INDEX TO SHEETS

48L14 SE	48P02 SW	48P02 SE
48L15 NE		48P03 NE
SEA	48P03 SW	48P03 SE



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

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SHORELINE CHANGE MAP

KERALA

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KASARAGOD DISTRICT

SHEET NO. 48P03SW

CHITTARI

CHITTARI RIVER

ATINJAL

HOSDRUG KADAPPURAM

PUNCHAVI

PADANNAKKAD

ARABIAN SEA

Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- STABLE
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N

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Scale in Km

INDEX TO SHEETS

48L15 NE	48P03 NW	48P03 NE
SEA		48P03 SE
SEA	48P04 NW	48P04 NE

INDIA

KERALA

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

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SHORELINE CHANGE MAP

KERALA

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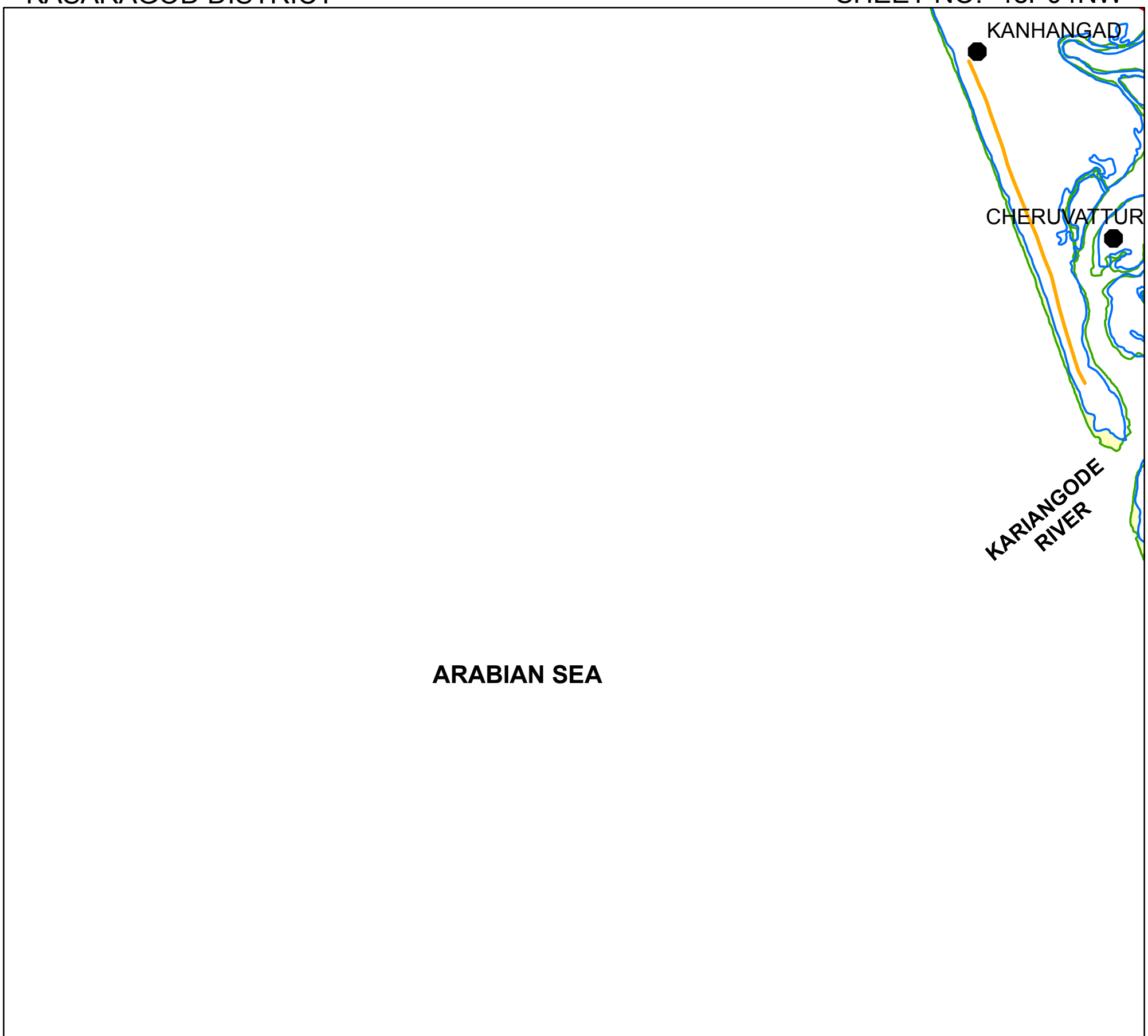
KASARAGOD DISTRICT

SHEET NO. 48P04NW



Legend

- ACCRETION
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- SEA WALL
- HABITATION

N
W E
S
0 2
Scale in Km

INDEX TO SHEETS

SEA	48P03 SW	48P03 SE
SEA		48P04 NE
SEA	SEA	48P04 SE

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
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AND CENTRAL WATER COMMISSION, NEW DELHI

SHORELINE CHANGE MAP

KASARAGOD/KANNUR DISTRICT

KERALA

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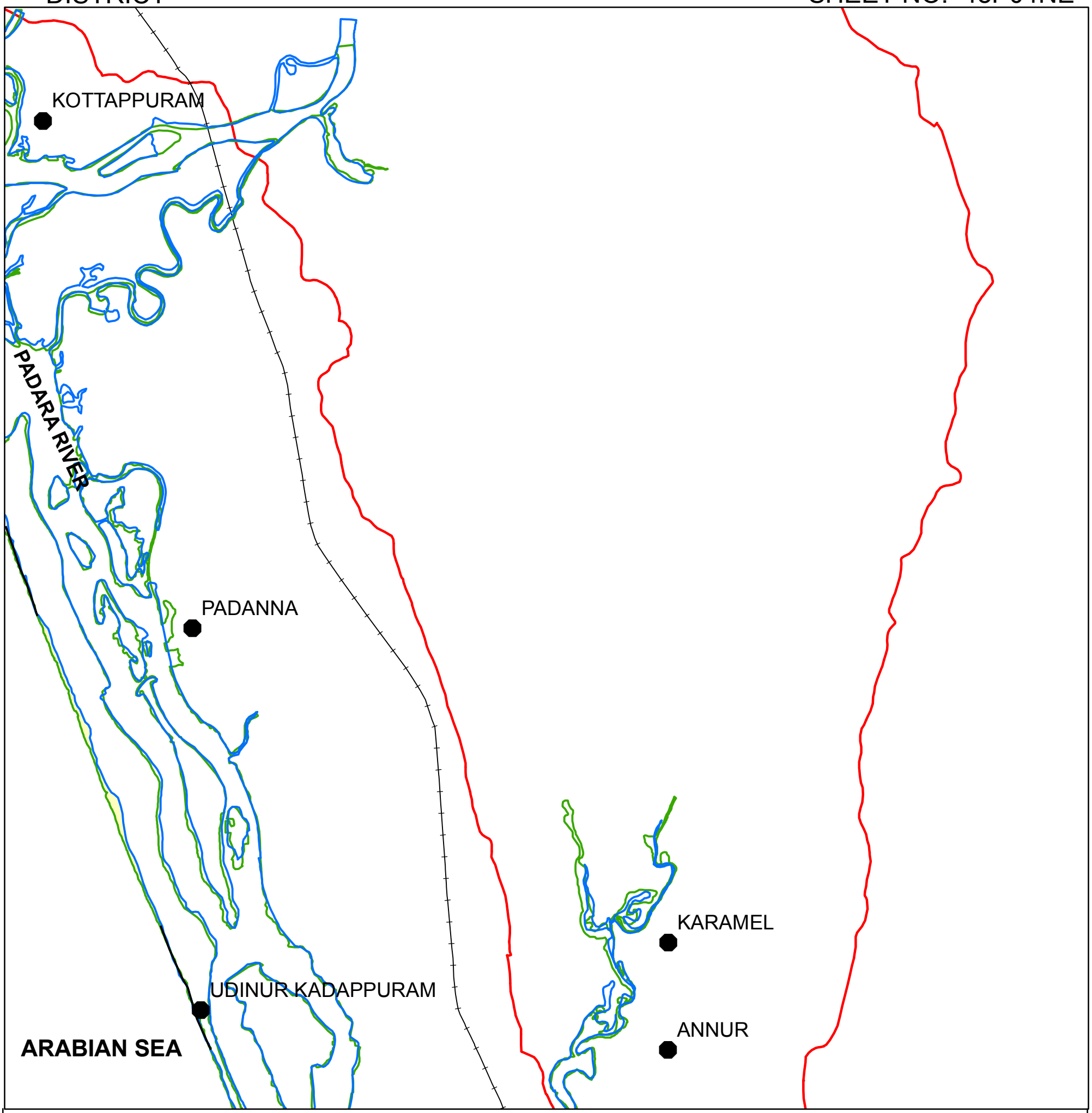
SHEET NO. 48P04NE



Legend

- ACCRETION
- ROAD
- RAIL
- STABLE
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

48P03 SW	48P03 SE	48P07 SW
48P04 NW		48P08 NW
SEA	48P04 SE	48P08 SW

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
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SHORELINE CHANGE MAP

KASARAGOD/KANNUR DISTRICT

KERALA

FOR OFFICIAL USE ONLY

SHEET NO. 48P04SE

METTAMMAL
LLAMBACHI
MUTIYALAM
PAYYANNUR
TAIKADAPPURAM
KAWAYI
KAWAYI BACKWATER
KANHIMANGALAM
VADAKKUMPAD
RAMANTALI
ARABIAN SEA
EZHIMALA
PUTIYANGADI
ETTIKKULAM
MOUNT DILLI

Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- STABLE
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
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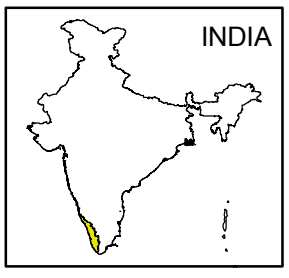
0 2
Scale in Km

INDEX TO SHEETS

48P04 NW	48P04 NE	48P08 NW
SEA		48P08 SW
SEA	SEA	48M05 NW



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
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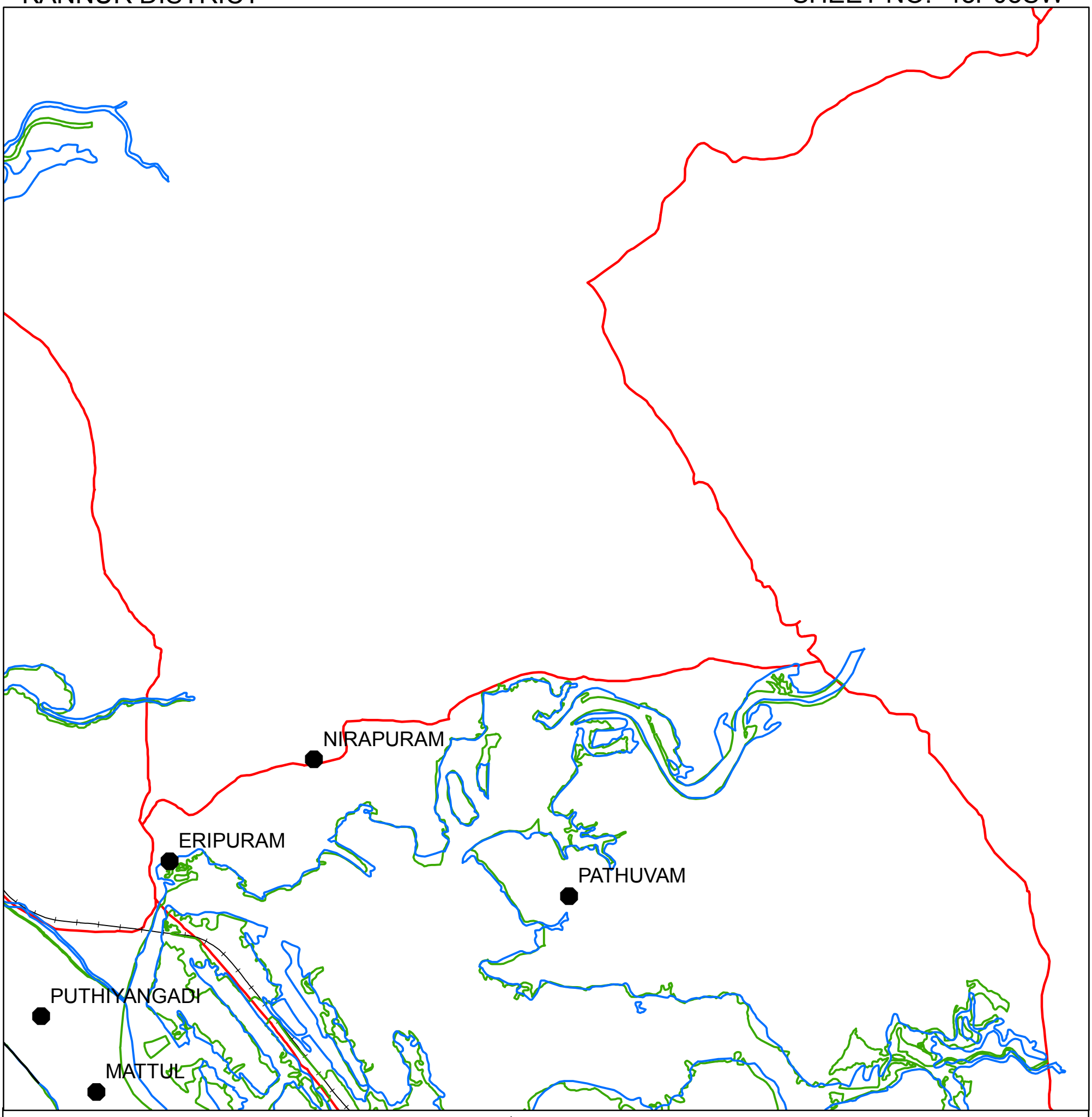
SHORELINE CHANGE MAP

KERALA

FOR OFFICIAL USE ONLY

KANNUR DISTRICT

SHEET NO. 48P08SW



Legend

- ACCRETION
- ROAD
- RAIL
- STABLE
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

48P04 NE	48P08 NW	48P08 NE
48P04 SE		48P08 SE
SEA	48M05 NW	48M05 NE

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

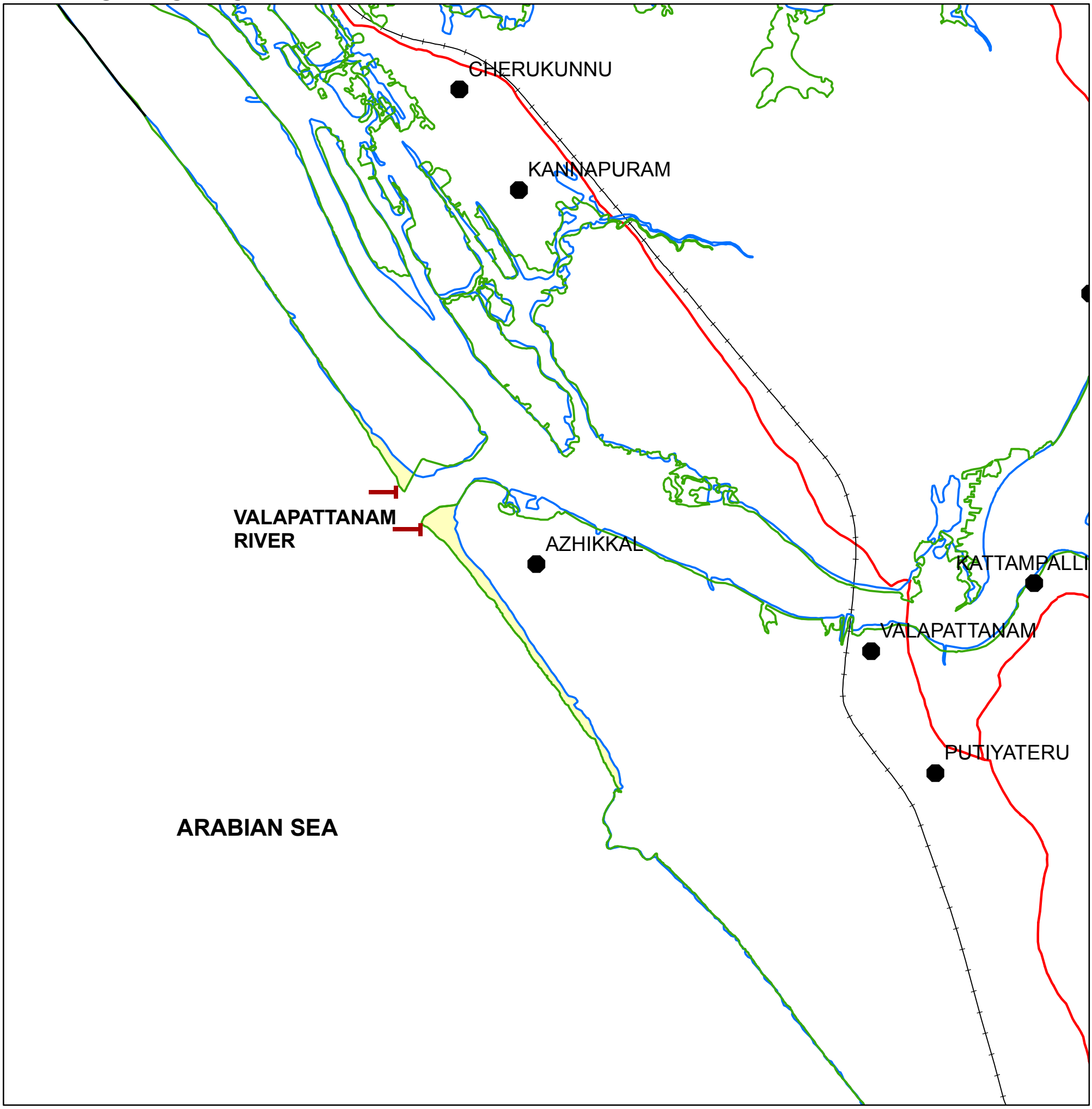
SHORELINE CHANGE MAP

KERALA

FOR OFFICIAL USE ONLY

KANNUR DISTRICT

SHEET NO. 49M05NW



Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- STABLE
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- BREAK WATER
- HABITATION

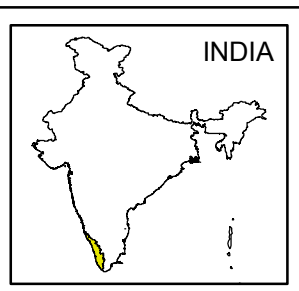
N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

48P04 SE	48P08 SW	48P08 SE
SEA		49M05 NE
SEA	48M05 SW	49M05 SE



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
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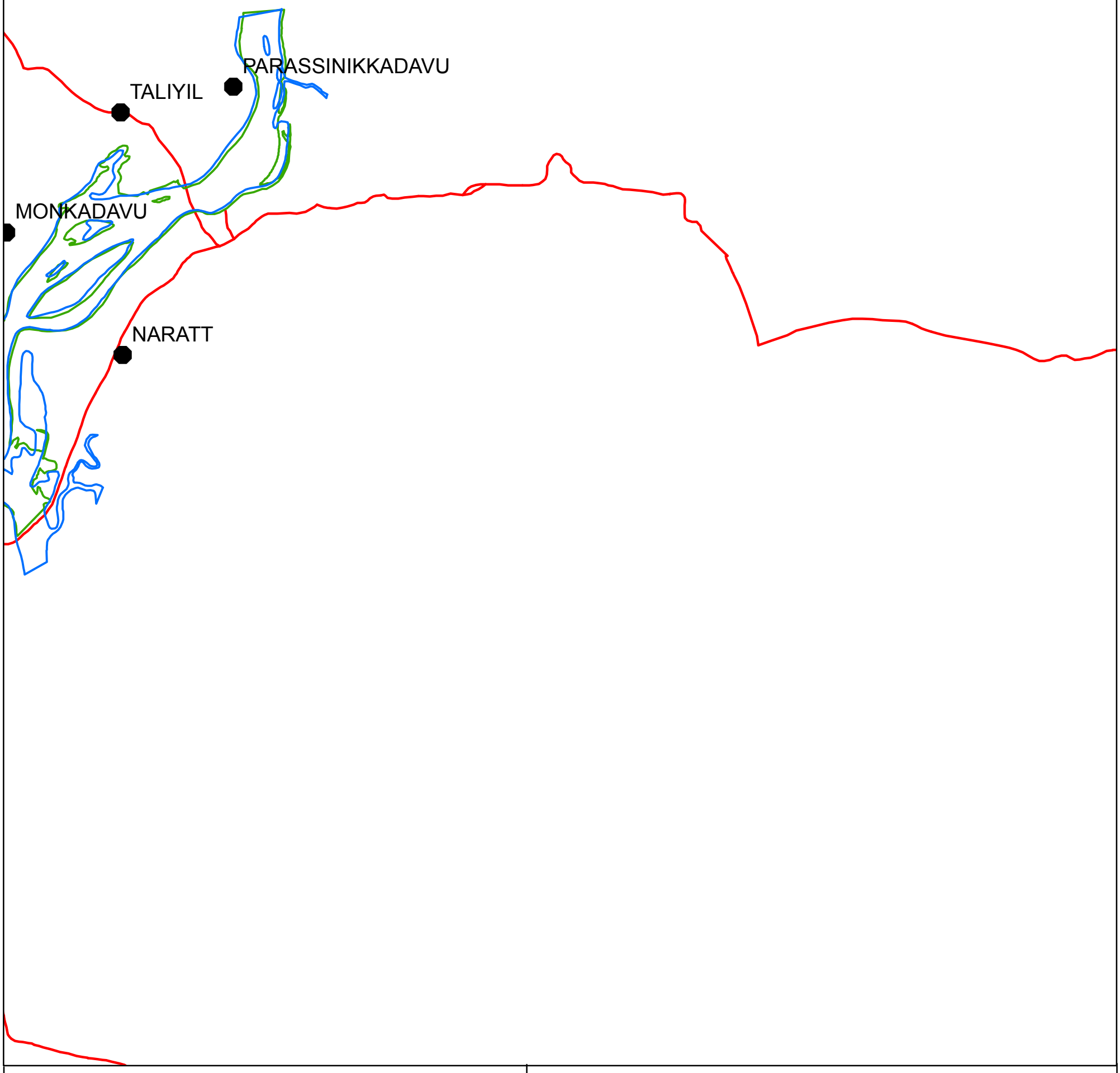
SHORELINE CHANGE MAP

KERALA

FOR OFFICIAL USE ONLY

KANNUR DISTRICT

SHEET NO. 49M05NE



Legend

- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
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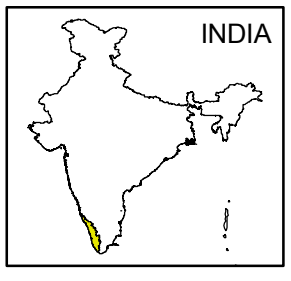
Scale in Km

INDEX TO SHEETS

48P08 SW	48P08 SE	48P12 SW
49M05 NW		49M09 NW
49M05 SW	49M05 SE	49M09 SW



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

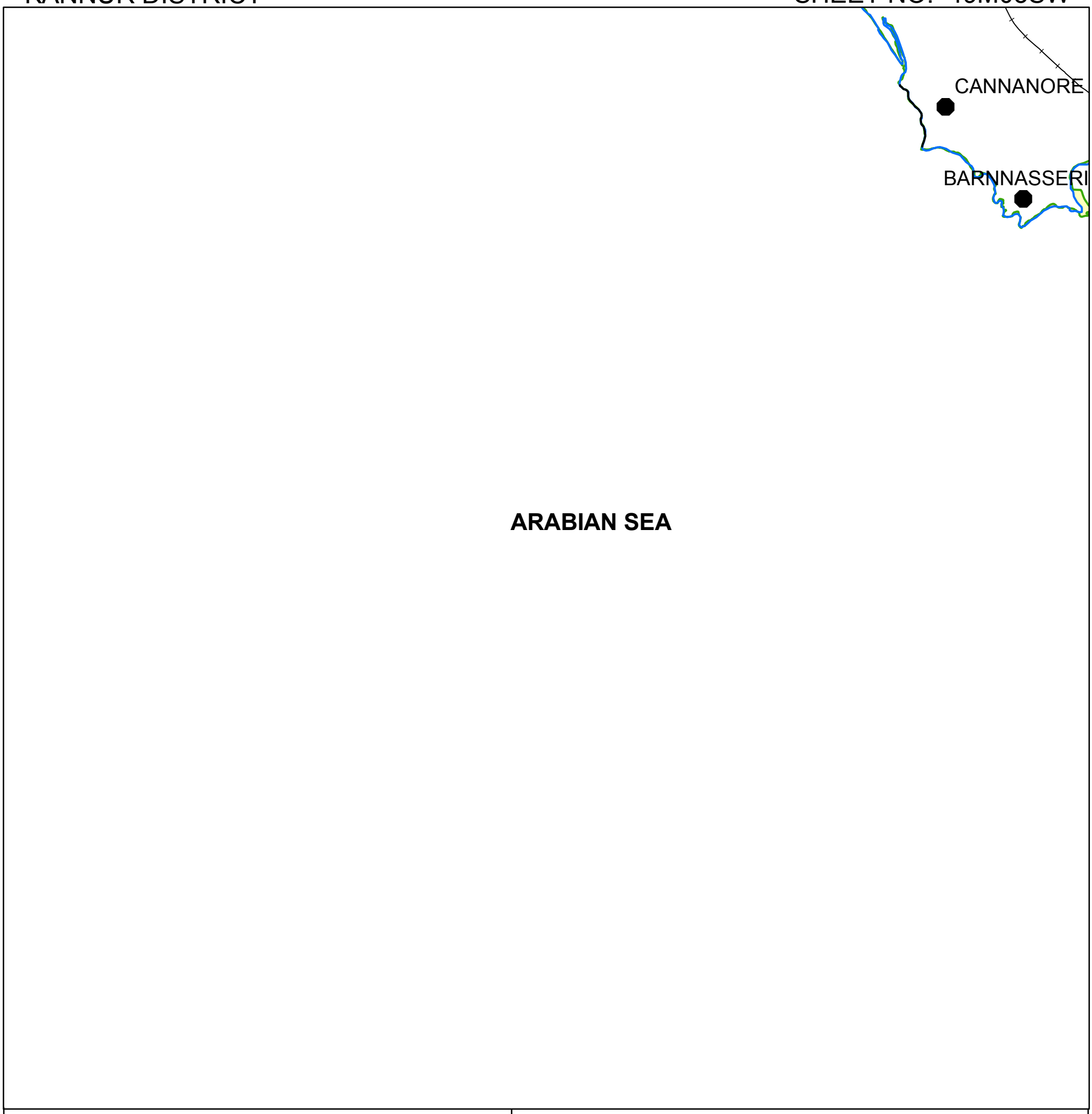
SHORELINE CHANGE MAP

KERALA

FOR OFFICIAL USE ONLY

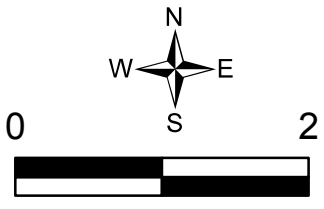
KANNUR DISTRICT

SHEET NO. 49M05SW



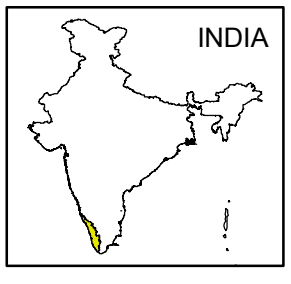
Legend

- EROSION
- ACCRETION
- RAIL
- STABLE
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION



INDEX TO SHEETS

SEA	49M05 NW	49M05 NE
SEA		49M05 SE
SEA	SEA	49M06 NE



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

SHORELINE CHANGE MAP

KERALA

FOR OFFICIAL USE ONLY

KANNUR DISTRICT

SHEET NO. 49M05SE

KIZHATTALLI

KIZHUNNA

KOTTAM

ORIKKRA

EDAKAD

DHARMADOM

ANJARAKANDY RIVER

ARABIAN SEA

Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- STABLE
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- SEA WALL
- BREAK WATER
- HABITATION

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Scale in Km

INDEX TO SHEETS

49M05 NW	49M05 NE	49M09 NW
49M05 SW		49M09 SW
SEA	48M06 NE	49M10 NW

INDIA

KERALA

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

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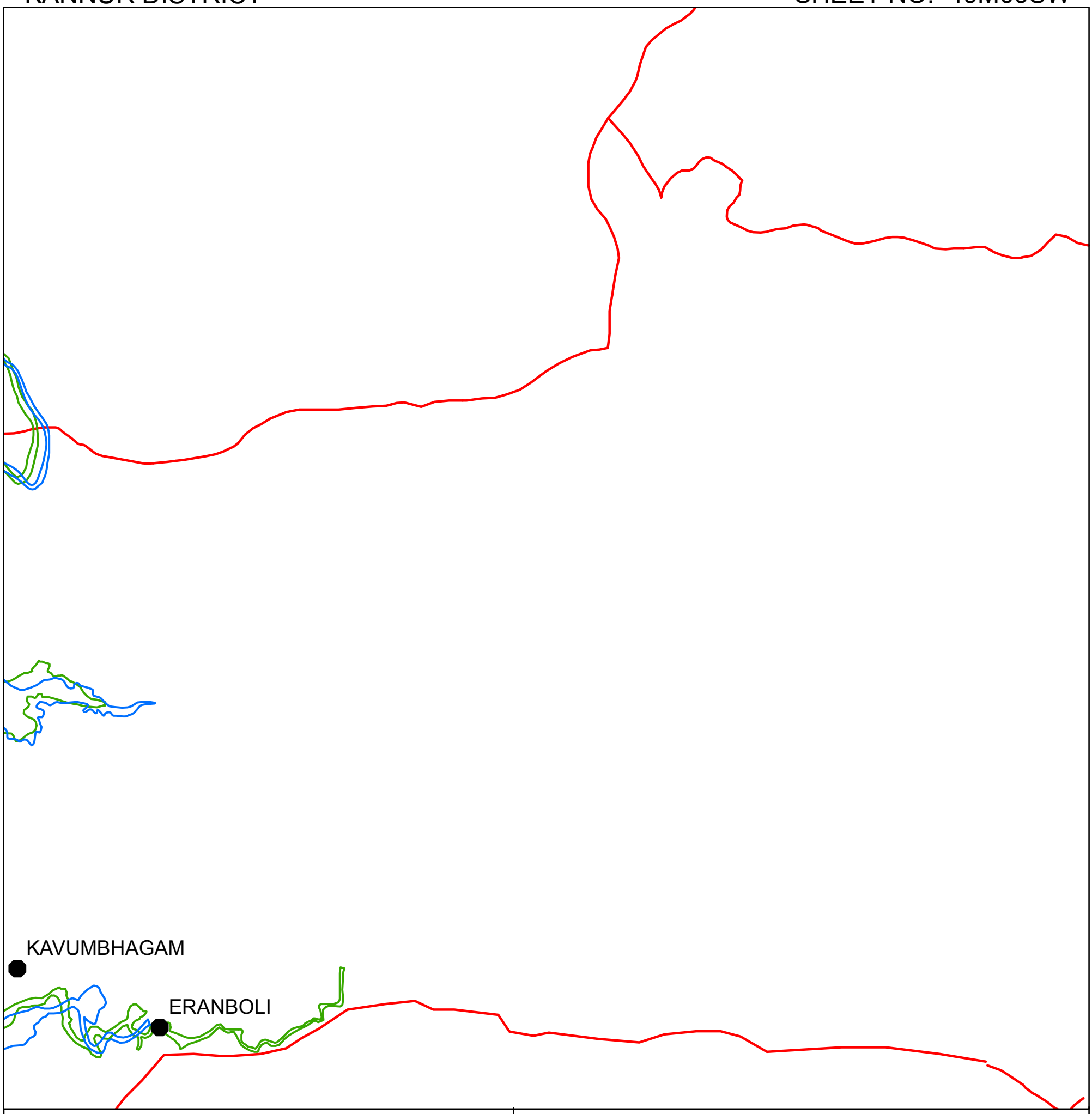
SHORELINE CHANGE MAP

KERALA

FOR OFFICIAL USE ONLY

KANNUR DISTRICT

SHEET NO. 49M09SW



Legend

- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
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0 2
Scale in Km

INDEX TO SHEETS

49M05 NE	49M09 NW	49M09 NE
49M05 SE		49M09 SE
49M06 NE	49M10 NW	49M10 NE

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

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AND CENTRAL WATER COMMISSION, NEW DELHI

SHORELINE CHANGE MAP

KERALA

FOR OFFICIAL USE ONLY

KANNUR DISTRICT

SHEET NO. 49M06NE

TELLICHERRY

ARABIAN SEA

Legend

- ACCRETION
- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

49M05 SW	49M05 SE	49M09 SW
SEA		49M10 NW
SEA	SEA	49M10 SW

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

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AND CENTRAL WATER COMMISSION, NEW DELHI

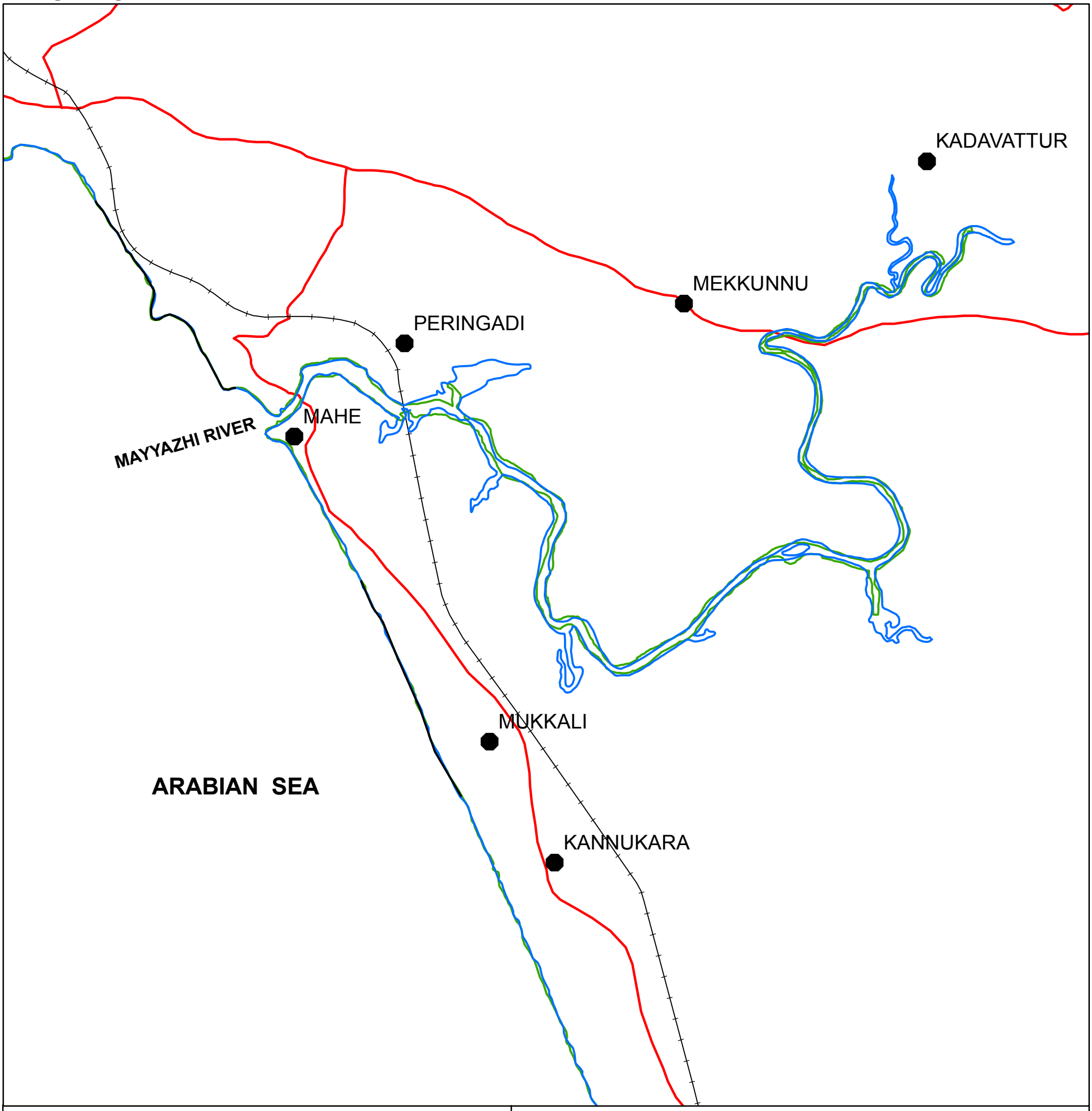
SHORELINE CHANGE MAP

KANNUR/KOZHIKODE DISTRICT

KERALA

FOR OFFICIAL USE ONLY

SHEET NO. 49M10NW



Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- STABLE
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S

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Scale in Km

INDEX TO SHEETS

49M10 SE	49M09 SW	49M09 SE
49M06 NE		49M10 NE
SEA	48M10 SW	49M10 SE

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

SHORELINE CHANGE MAP

KERALA

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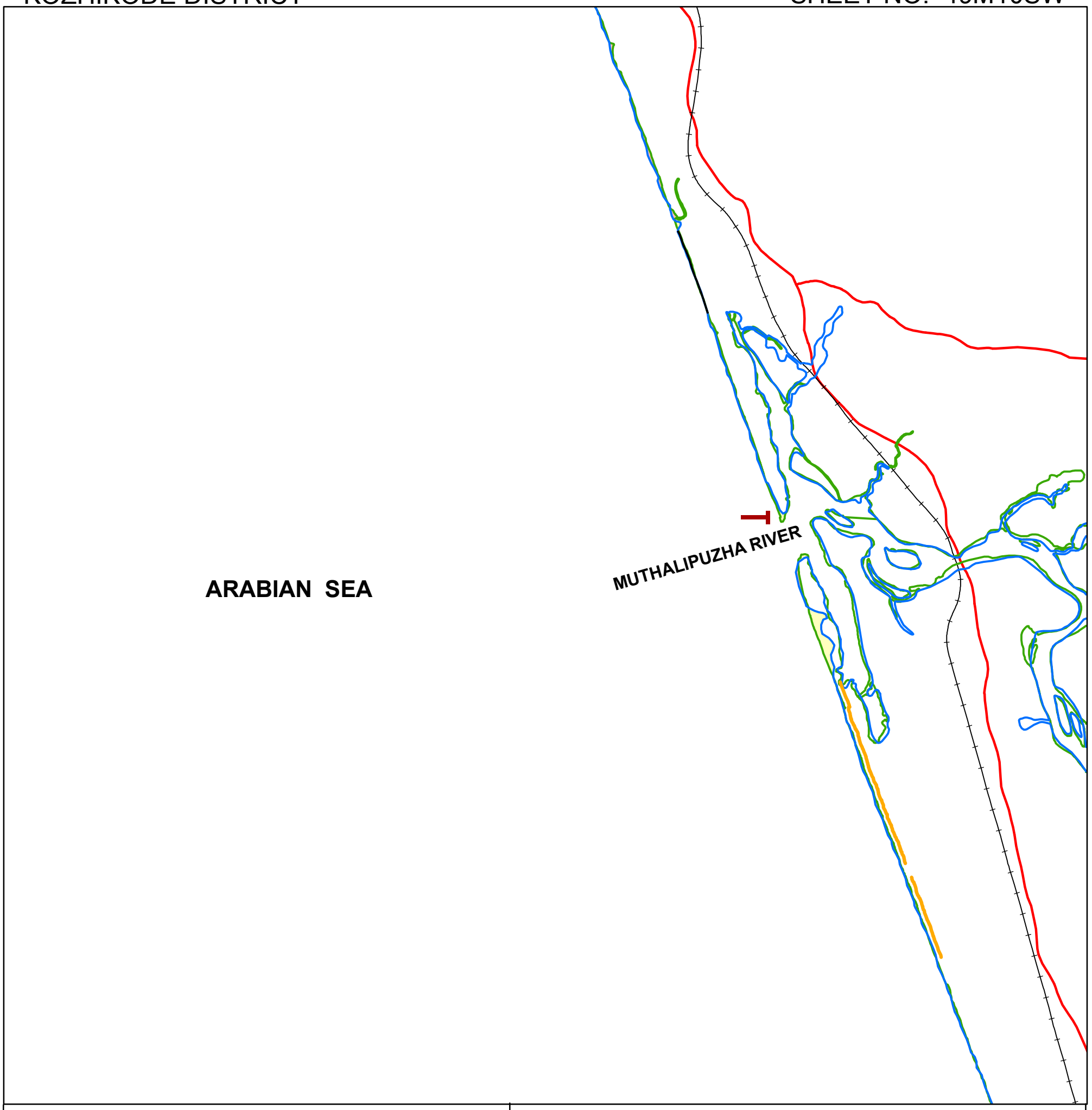
KOZHIKODE DISTRICT

SHEET NO. 49M10SW



Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- STABLE
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- SEA WALL
- BREAK WATER

N
W E
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Scale in Km

INDEX TO SHEETS

49M06 NE	49M10 NW	49M10 NE
SEA		49M10 SE
SEA	48M11 NW	49M11 NE

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

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AND CENTRAL WATER COMMISSION, NEW DELHI

SHORELINE CHANGE MAP

KERALA

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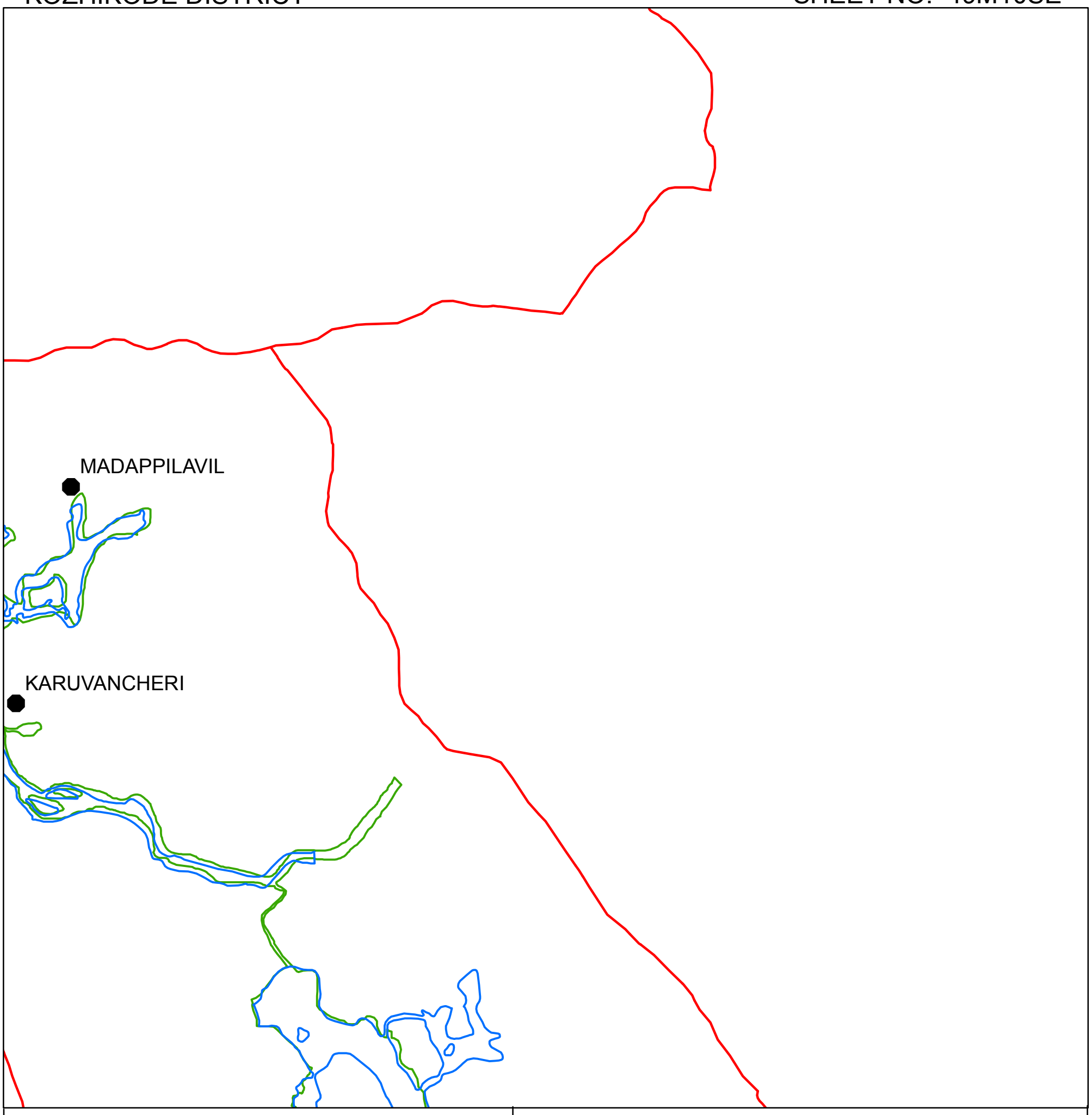
KOZHIKODE DISTRICT

SHEET NO. 49M10SE



Legend

- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
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Scale in Km

INDEX TO SHEETS

49M10 NW	49M10 NE	49M14 NW
49M10 SW		49M14 SW
49M11 NW	49M11 NE	49M15 NW

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

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AND CENTRAL WATER COMMISSION, NEW DELHI

SHORELINE CHANGE MAP

KERALA

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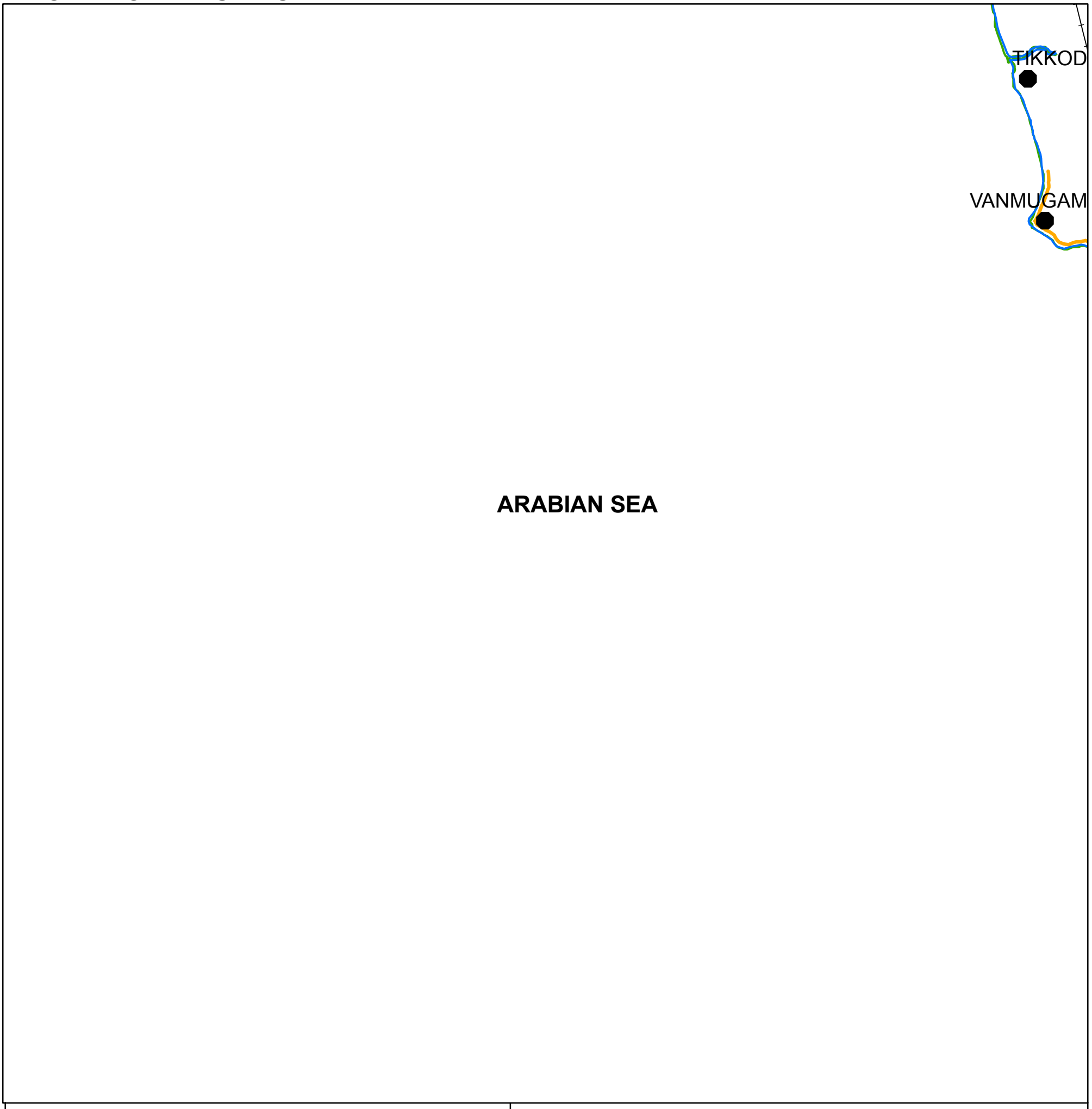
KOZHIKODE DISTRICT

SHEET NO. 49M11NW



Legend

- EROSION
- ACCRETION
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- SEA WALL
- HABITATION

N
W E
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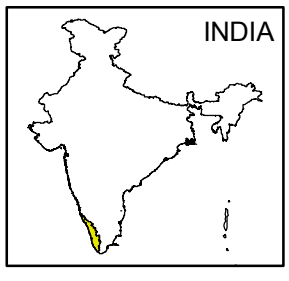
Scale in Km

INDEX TO SHEETS

SEA	49M10 SW	49M10 SE
SEA		49M11 NE
SEA	SEA	49M11 SE



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

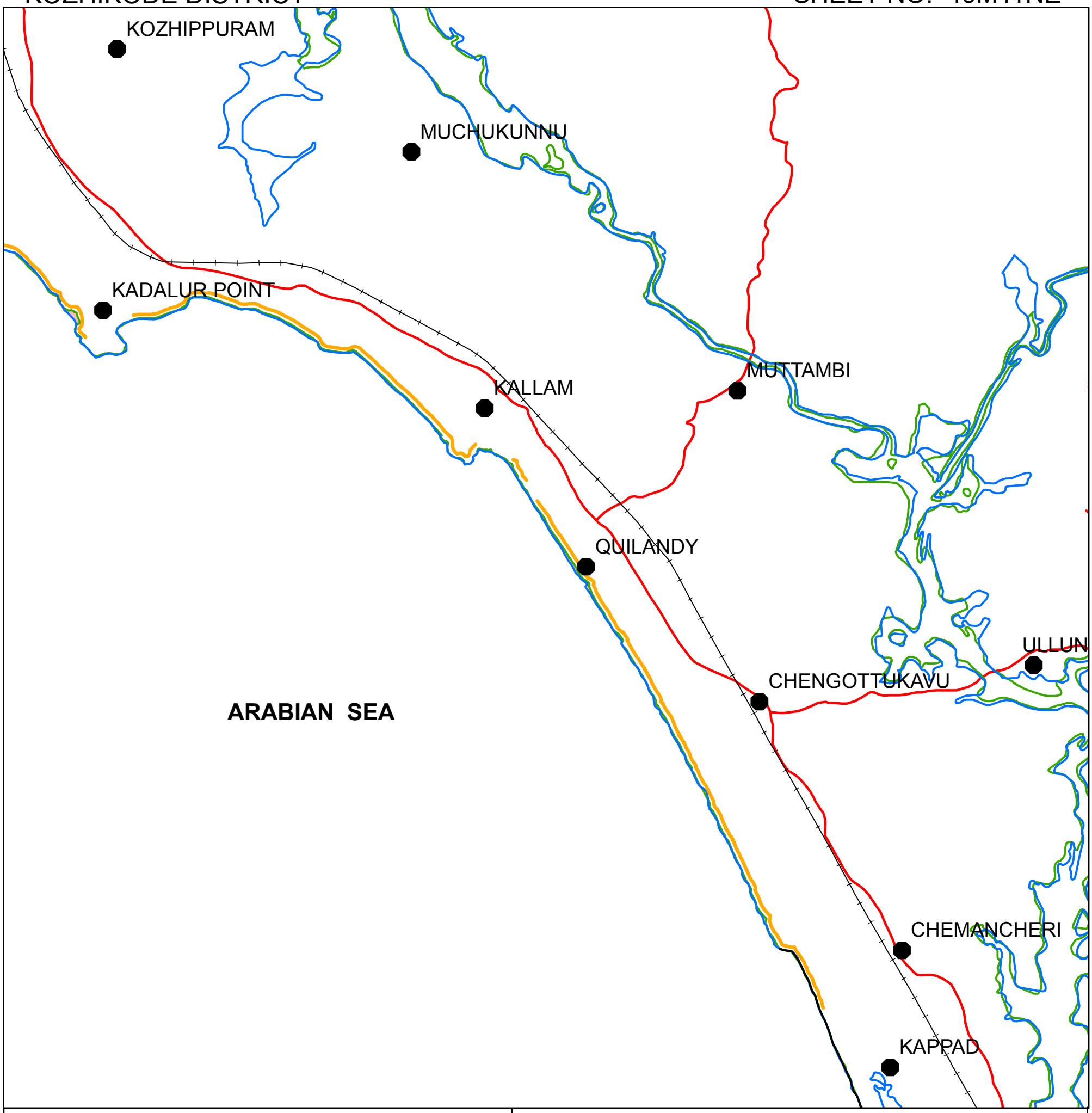
SHORELINE CHANGE MAP

KERALA

FOR OFFICIAL USE ONLY

KOZHIKODE DISTRICT

SHEET NO. 49M11NE



Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- STABLE
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- SEA WALL
- HABITATION

N
W E
S

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Scale in Km

INDEX TO SHEETS

49M10 SW	49M10 SE	49M14 SW
49M11 NW		49M15 NW
SEA	48M11 SE	49M15 SW

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

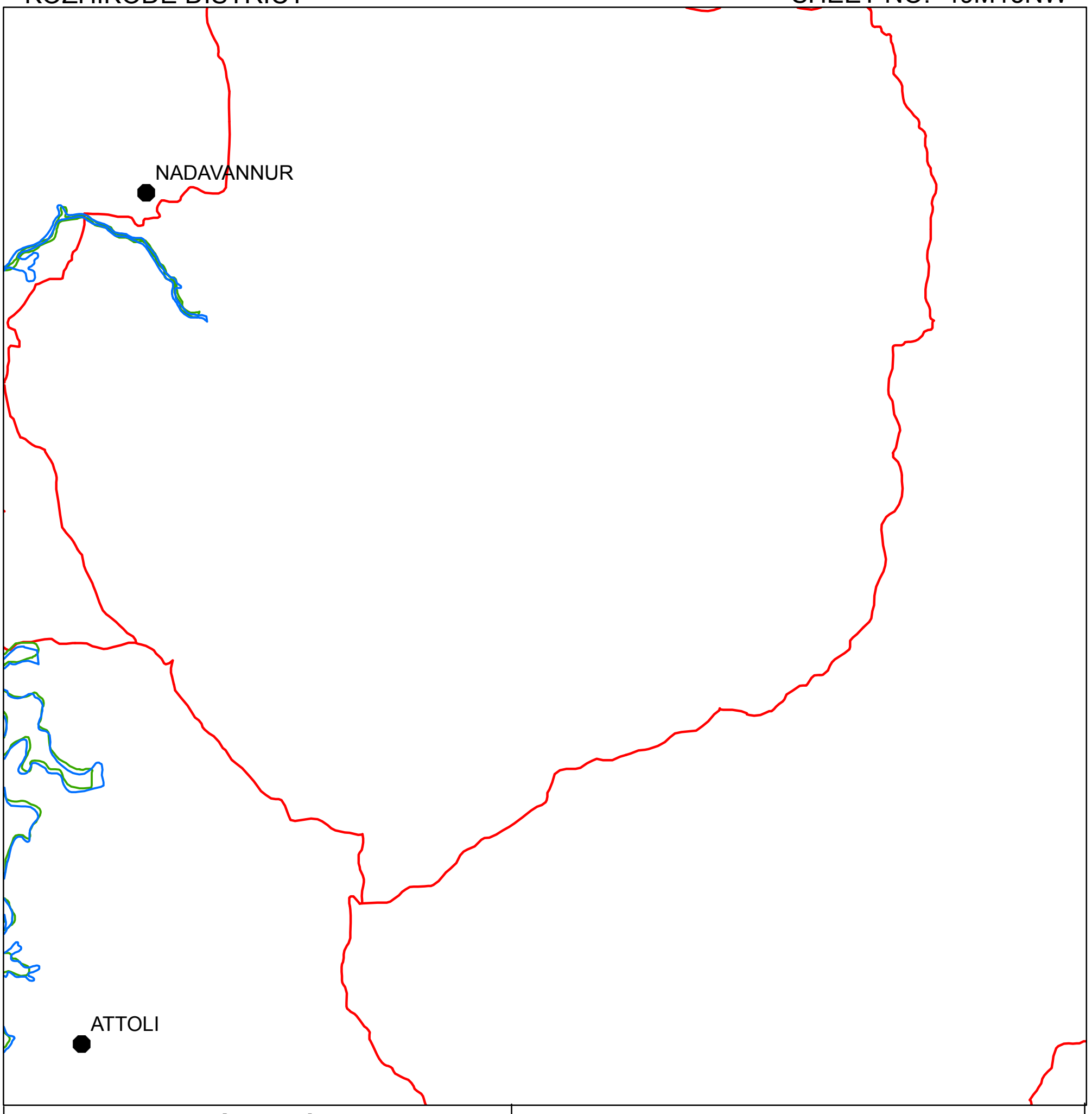
SHORELINE CHANGE MAP

KERALA

FOR OFFICIAL USE ONLY

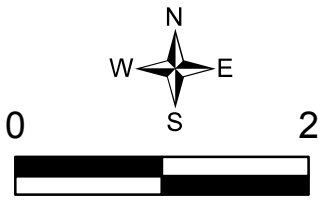
KOZHIKODE DISTRICT

SHEET NO. 49M15NW



Legend

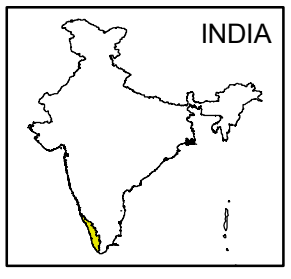
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION



Scale in Km

INDEX TO SHEETS

49M10 SE	49M14 SW	49M14 SE
49M11 NE		49M15 NE
49M11 SE	49M15 SW	49M15 SE



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
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SHORELINE CHANGE MAP

KERALA

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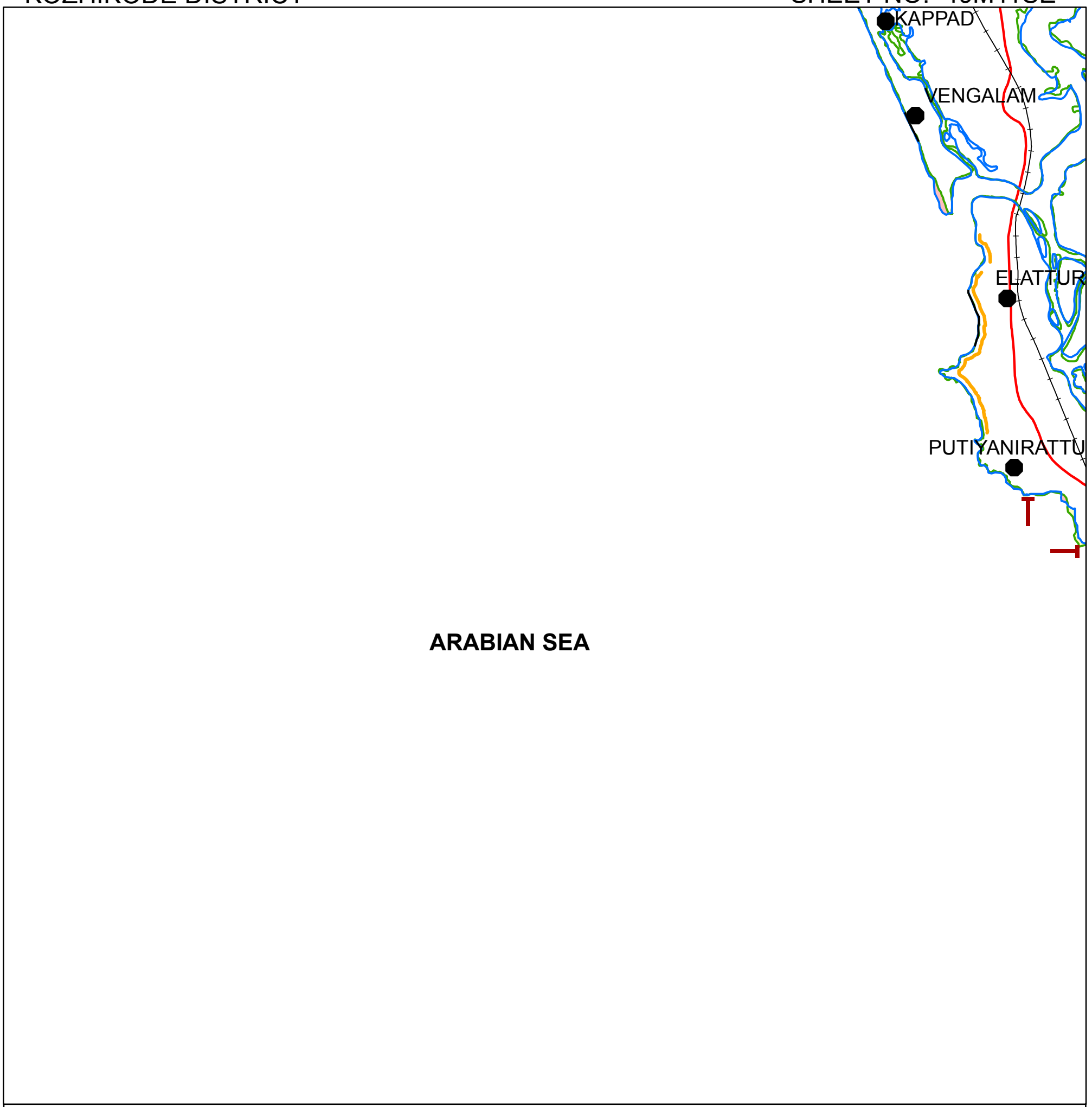
KOZHIKODE DISTRICT

SHEET NO. 49M11SE



Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- STABLE
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- SEA WALL
- BREAK WATER
- HABITATION

N
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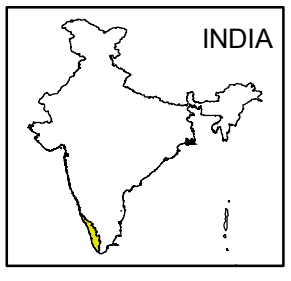
Scale in Km

INDEX TO SHEETS

49M11 NW	49M11 NE	49M15 NW
SEA		49M15 SW
SEA	SEA	49M16 NW



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
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AND CENTRAL WATER COMMISSION, NEW DELHI

SHORELINE CHANGE MAP

KERALA

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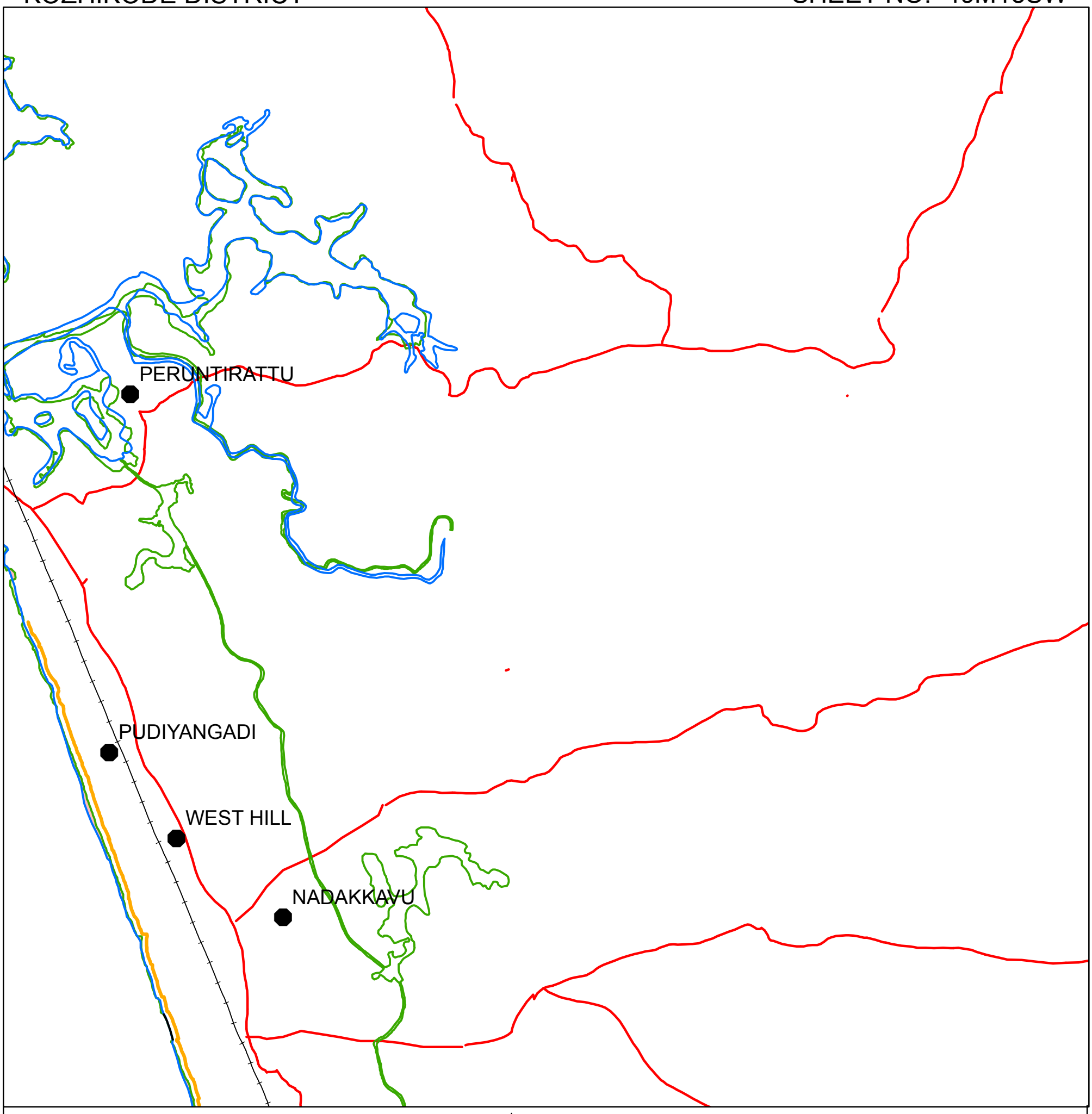
KOZHIKODE DISTRICT

SHEET NO. 49M15SW



Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- STABLE
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- SEA WALL
- HABITATION

N
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Scale in Km

INDEX TO SHEETS

49M11 NE	49M15 NW	49M15 NE
49M11 SE		49M15 SE
SEA	48M16 NW	49M16 NE

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
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AND CENTRAL WATER COMMISSION, NEW DELHI

SHORELINE CHANGE MAP

KOZHIKODE/MALAPPURAM DISTRICT

KERALA

FOR OFFICIAL USE ONLY

SHEET NO. 49M16NW

CALICUT
KALLAYI
OLAVANNA
KALLAYI RIVER
MEENCHANTHA
CHERUVANNUR
KOLATHARA
AZHINNILAM
FEROKE
BEYPORE
ARABIAN SEA
CHALIYAR RIVER
KADALUNDI

Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- STABLE
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- SEA WALL
- BREAK WATER
- HABITATION

N
W E
S
0 2
Scale in Km

INDEX TO SHEETS

49M11 SE	49M15 SW	49M15 SE
SEA		49M16 NE
SEA	48M16 SW	49M16 SE

INDIA

KERALA

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

SHORELINE CHANGE MAP

KERALA

FOR OFFICIAL USE ONLY

MALAPPURAM DISTRICT

SHEET NO. 49M16SW

KADALUNDI RIVER

VALLIKUNU

ARIYALLU

KODAKKAD

PARAPPANANGADI

POORAPPUZHA RIVER

PARIYAPURAM

ARABIAN SEA

Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- STABLE
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- SEA WALL
- HABITATION

N

W E

S

0 2

Scale in Km

INDEX TO SHEETS

SEA	49M16 NW	49M16 NE
SEA		49M16 SE
SEA	49N13 NW	49N13 NE

INDIA

KERALA

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

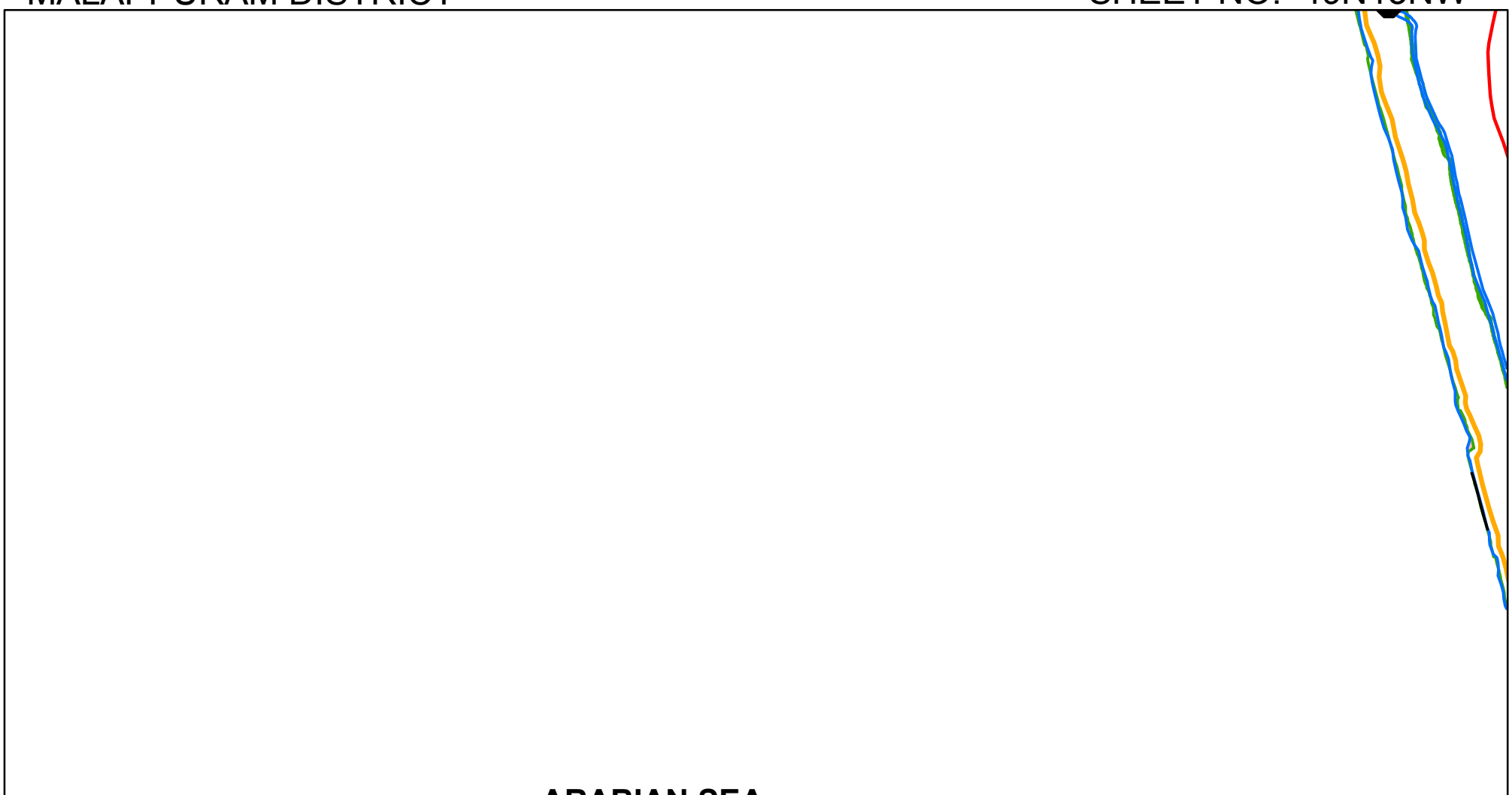
SHORELINE CHANGE MAP

KERALA

FOR OFFICIAL USE ONLY

MALAPPURAM DISTRICT

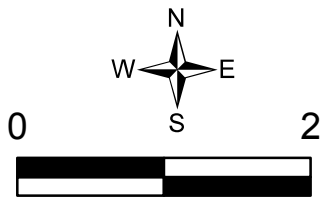
SHEET NO. 49N13NW



ARABIAN SEA

Legend

- EROSION
- ACCRETION
- ROAD
- STABLE
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91



Scale in Km

INDEX TO SHEETS

SEA	49M16 SW	49M16 SE
SEA		49N13 NE
SEA	SEA	49N13 SE

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
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AND CENTRAL WATER COMMISSION, NEW DELHI

SHORELINE CHANGE MAP

KERALA

FOR OFFICIAL USE ONLY

MALAPPURAM DISTRICT

SHEET NO. 49N13NE

KALAL KADAPPURAM

KORANGATTU

UNNIYALUNGAL

TIRUR

PUTIYANGADI

VEMANNA

ARABIAN SEA

Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- STABLE
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N

W E

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Scale in Km

INDEX TO SHEETS

49M16 SW	49M16 SE	58A04 SW
49N13 NW		58B01 NW
SEA	49N13 SE	58B01 SW

INDIA

KERALA

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
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AND CENTRAL WATER COMMISSION, NEW DELHI

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SHORELINE CHANGE MAP

KERALA

FOR OFFICIAL USE ONLY

MALAPPURAM DISTRICT

SHEET NO. 49N13SE

KUTTAYI

PURATTU

ARABIAN SEA

BHARATHA PUZHA RIVER

IZHUVATTIRATTI

PONNANI

KADAVANAD

Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- STABLE
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- SEA WALL
- BREAK WATER
- HABITATION

N

W E

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0 2

Scale in Km

INDEX TO SHEETS

49N13 NW	49N13 NE	58B01 NW
SEA		58B01 SW
SEA	49N14 NE	58B02 NW

INDIA

KERALA

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

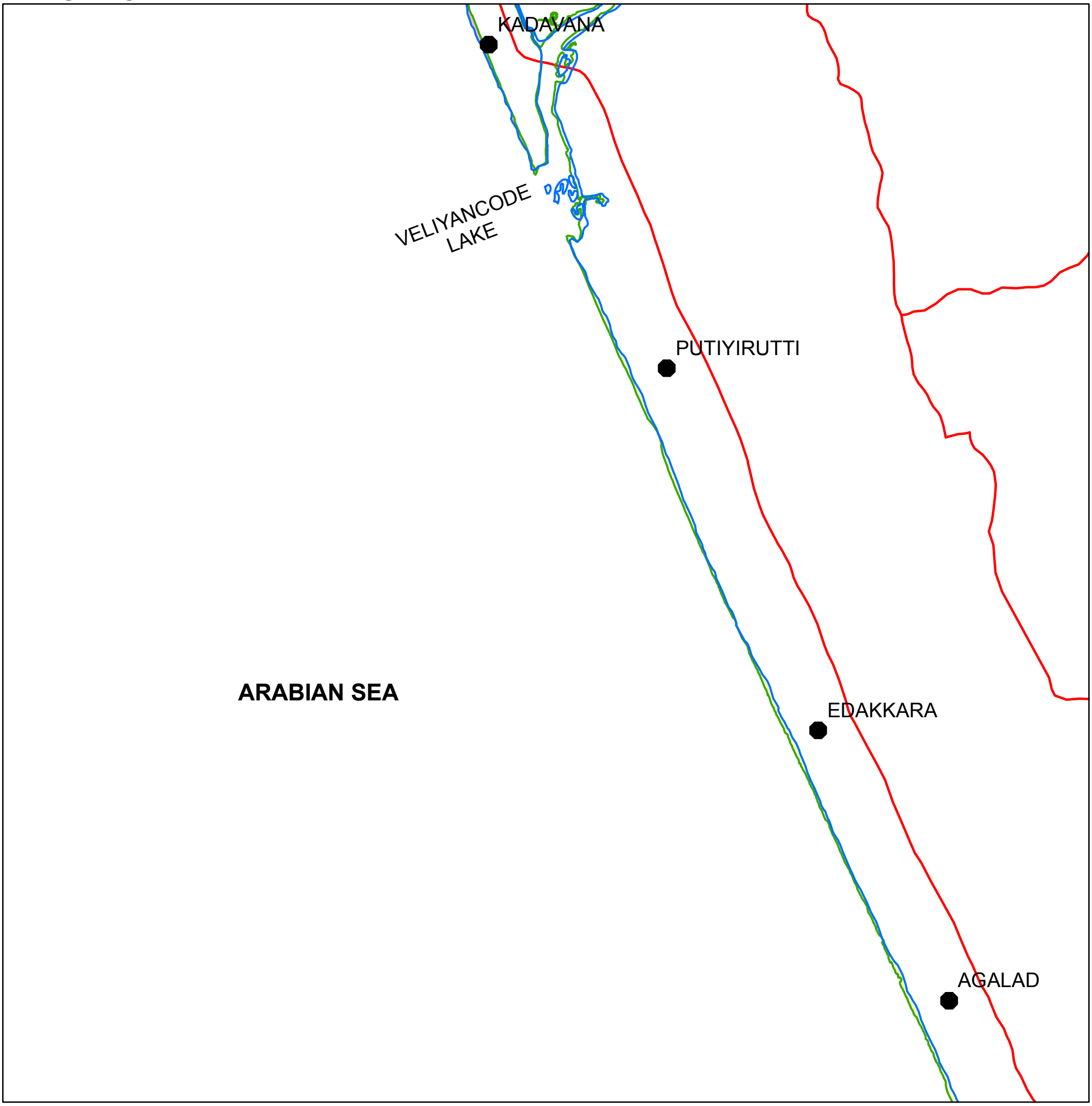
SHORELINE CHANGE MAP

MALAPPURAM/THRISSUR DISTRICT

KERALA

FOR OFFICIAL USE ONLY

SHEET NO. 49N14NE



Legend

- EROSION
- ACCRETION
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

SEA	49N13 SE	58B01 SW
SEA		58B02 NW
SEA	49N14 SE	58B02 SW

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

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AND CENTRAL WATER COMMISSION, NEW DELHI

SHORELINE CHANGE MAP

KERALA

FOR OFFICIAL USE ONLY

THRISSUR DISTRICT

SHEET NO. 49N14SE

EDAKKAZHIYUR

ARABIAN SEA

Legend

- ACCRETION
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S
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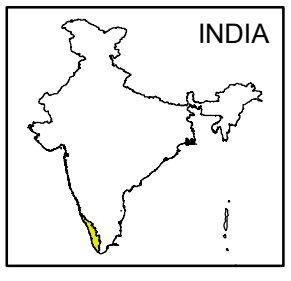
Scale in Km

INDEX TO SHEETS

SEA	49N14 NE	58B02 NW
SEA		58B02 SW
SEA	SEA	58B03 NW



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

SHORELINE CHANGE MAP

KERALA

FOR OFFICIAL USE ONLY

THRISSUR DISTRICT

SHEET NO. 58B02SW

CHAVAKKAD

VATTEKKAD

ARABIAN SEA

CHETWAYI

KUNDAZHIYUR

CHETTAVA LAKE

Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- SEA WALL
- HABITATION

N

W E

S

0 2

Scale in Km

INDEX TO SHEETS

49N14 NE	58B02 NW	58B02 NE
49N14 SE		58B02 SE
SEA	58B03 NW	58B03 NE

INDIA

KERALA

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

SHORELINE CHANGE MAP

KERALA

FOR OFFICIAL USE ONLY

THRISSUR DISTRICT

SHEET NO. 58B03NW

ENGANDIYUR

VADANAPALLI

TALIKKULAM

TRIPRAYAR

KURIAMUTTAM

ARABIAN SEA

Legend

- EROSION
- ACCRETION
- ROAD
- STABLE
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- SEA WALL
- HABITATION

N W E S

0 2

Scale in Km

INDEX TO SHEETS

49N14 SE	58B02 SW	58B02 SE
SEA		58B03 NE
SEA	58B03 SW	58B03 SE

INDIA

KERALA

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

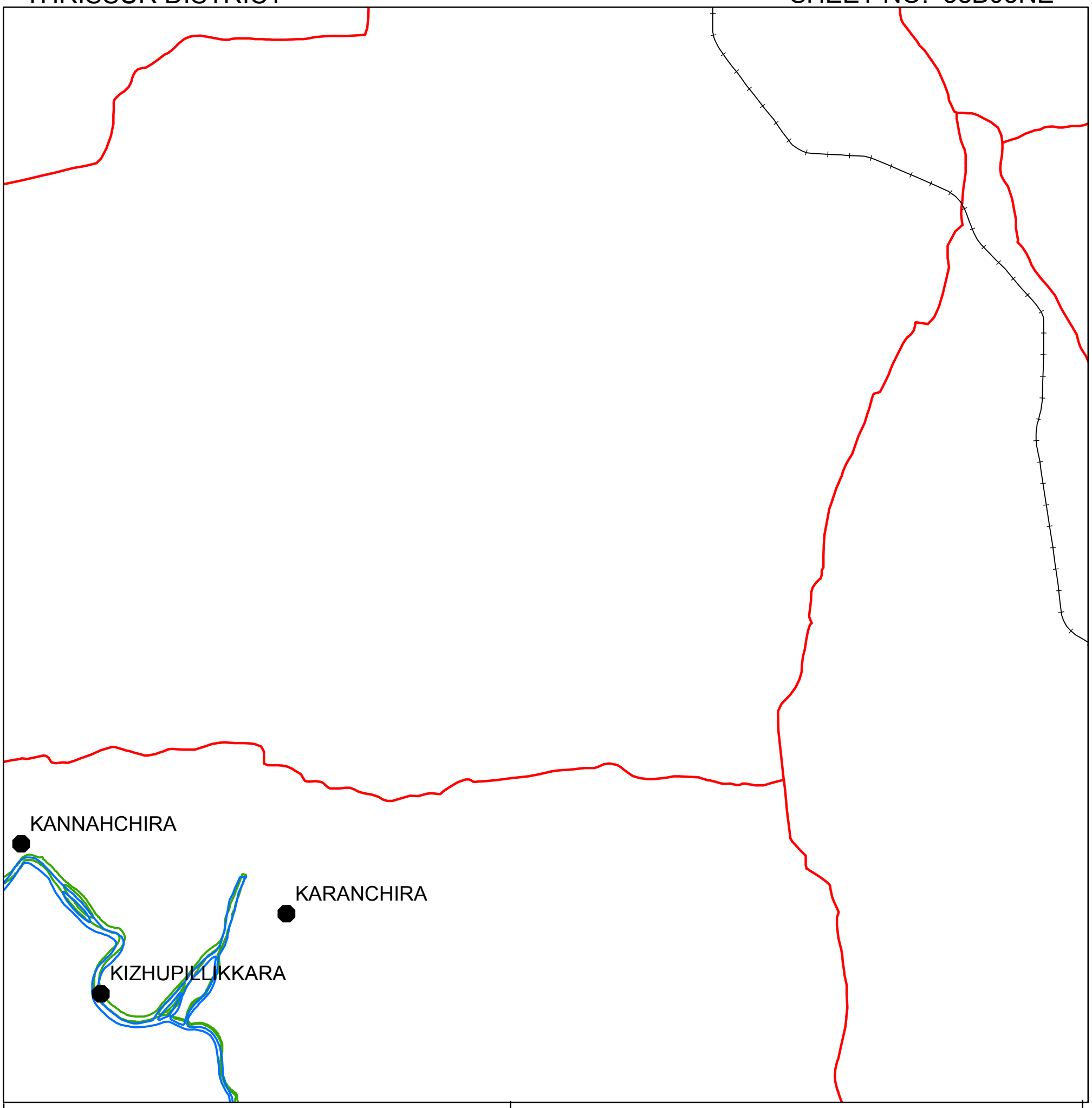
SHORELINE CHANGE MAP

KERALA

FOR OFFICIAL USE ONLY

THRISSUR DISTRICT

SHEET NO. 58B03NE



Legend

- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

58B02 SW	58B02 SE	58B06 SW
58B03 NW		58B07 NW
58B03 SW	58B03 SE	58B07 SW

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

SHORELINE CHANGE MAP

KERALA

FOR OFFICIAL USE ONLY

THRISSUR DISTRICT

SHEET NO. 58B03SW

Legend

- ACCRETION
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- SEA WALL
- HABITATION

N
W E
S
0 2
Scale in Km

INDEX TO SHEETS

SEA	58B03 NW	58B03 NE
SEA		58B03 SE
SEA	SEA	58B04 NE

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

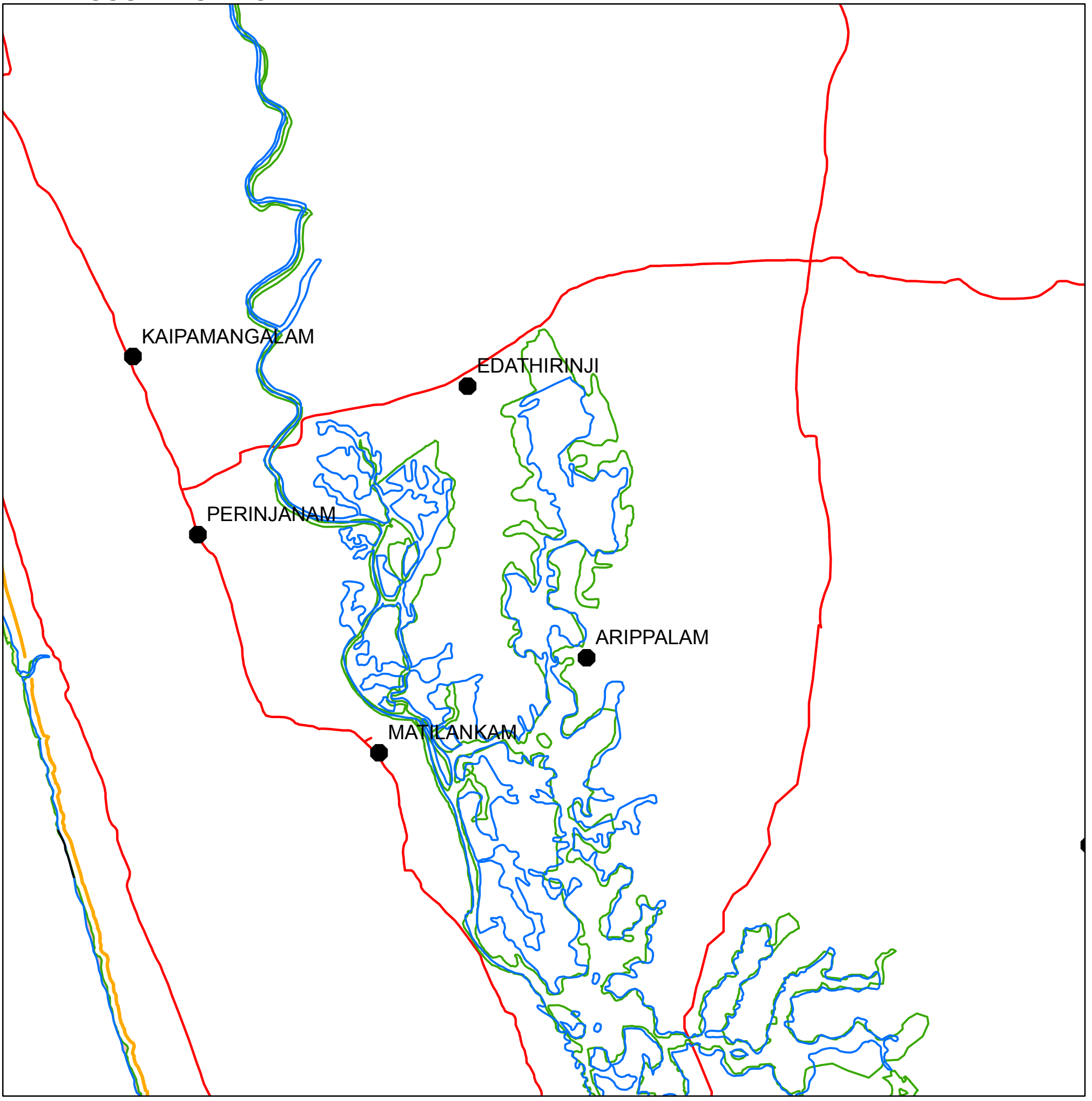
SHORELINE CHANGE MAP

KERALA

FOR OFFICIAL USE ONLY

THRISSUR DISTRICT

SHEET NO. 58B03SE



Legend

- EROSION
- ACCRETION
- ROAD
- STABLE
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- SEA WALL
- HABITATION

N

W E

S

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Scale in Km

INDEX TO SHEETS

58B03 NW	58B03 NE	58B07 NW
58B03 SW		58B07 SW
SEA	58B04 NE	58B08 NW

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

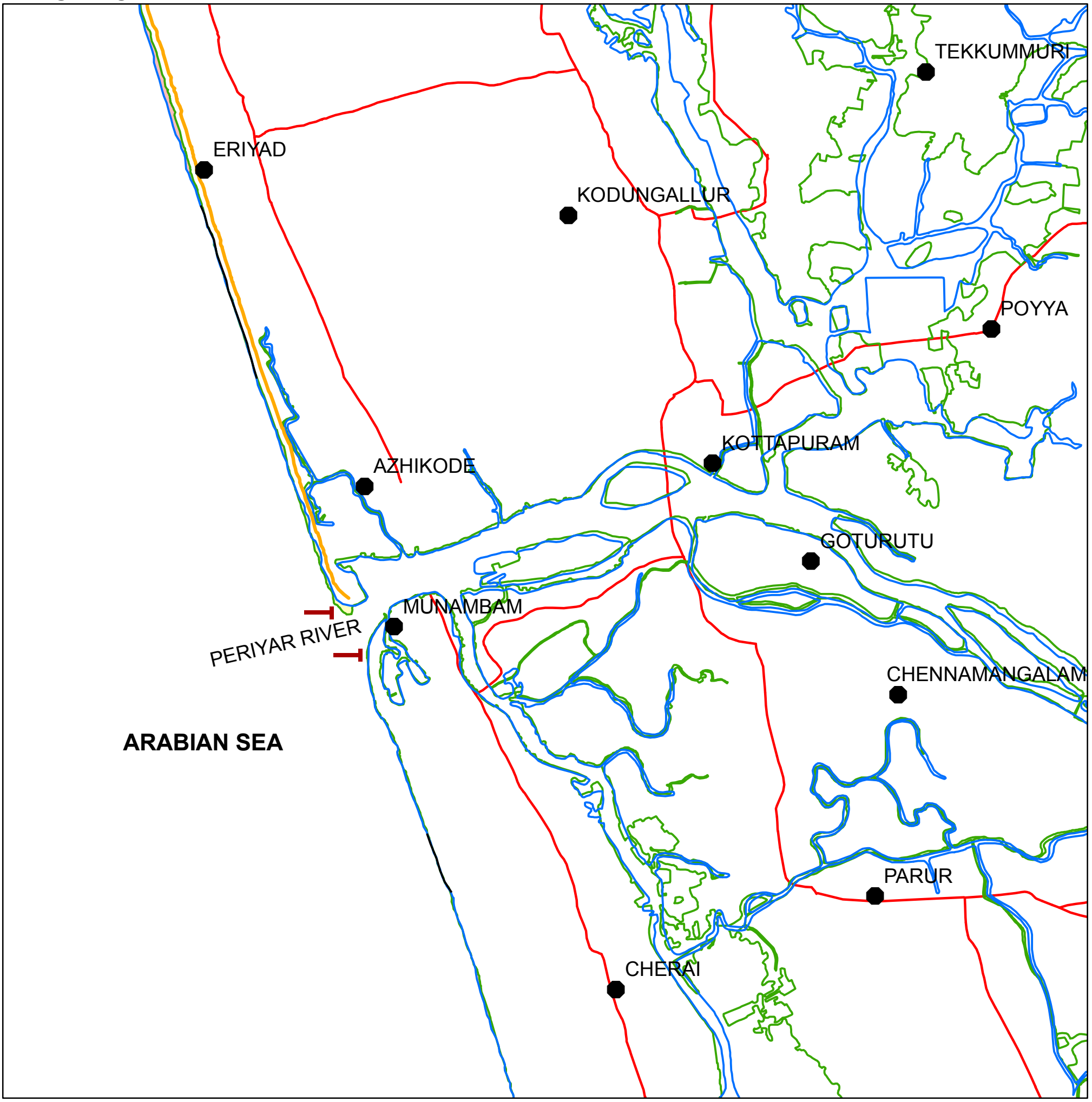
SHORELINE CHANGE MAP

THRISSUR/ERNAKULAM DISTRICT

KERALA

FOR OFFICIAL USE ONLY

SHEET NO. 58B04NE



Legend

- EROSION
- ACCRETION
- ROAD
- STABLE
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- SEA WALL
- BREAK WATER
- HABITATION

N
W E
S

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Scale in Km

INDEX TO SHEETS

58B03 SW	58B03 SE	58B07 SW
SEA		58B08 NW
SEA	58B04 SE	58B08 SW

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

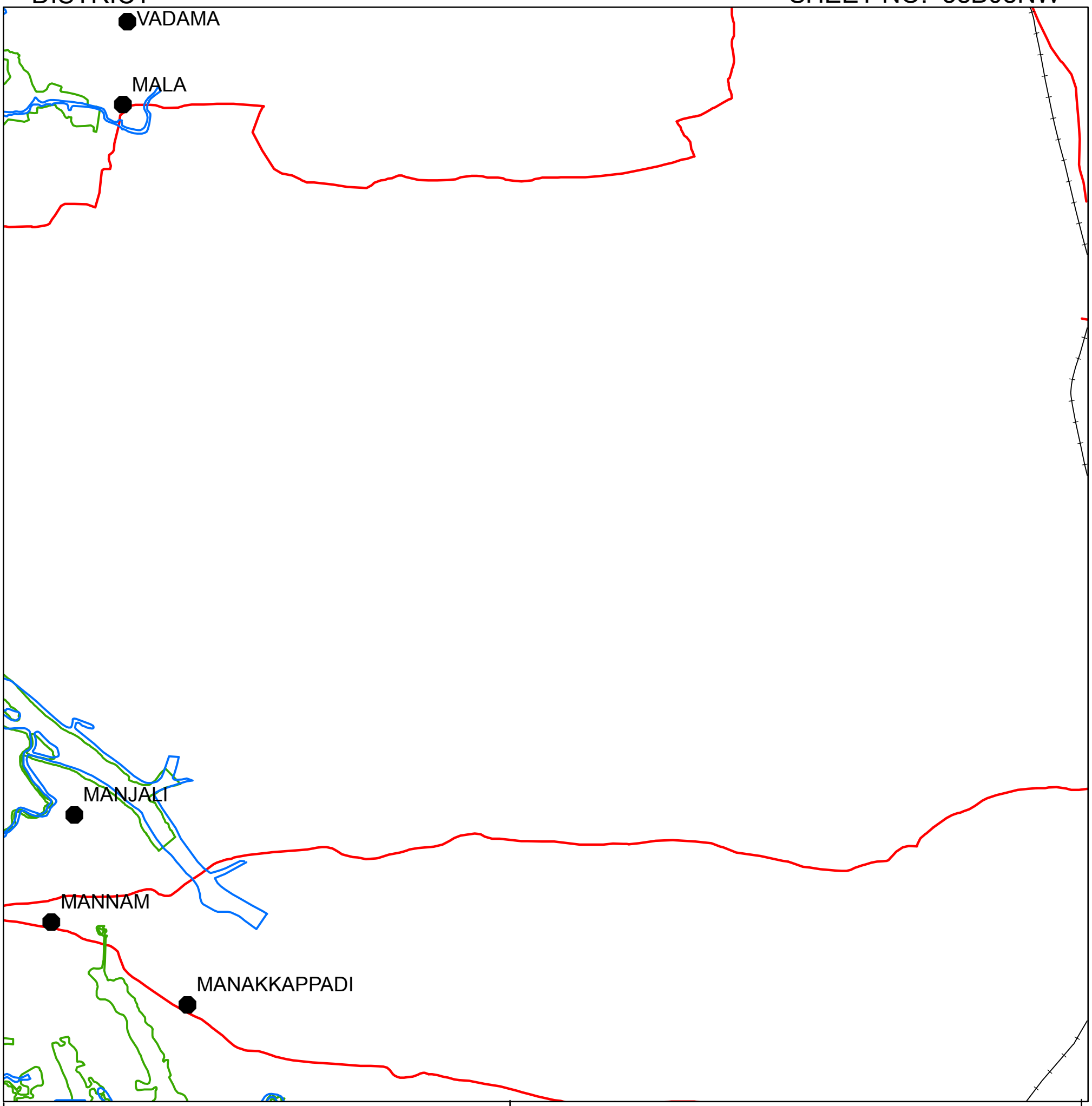
SHORELINE CHANGE MAP

THRISSUR/ERNAKULAM DISTRICT

KERALA

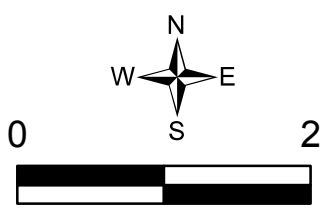
FOR OFFICIAL USE ONLY

SHEET NO. 58B08NW



Legend

- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION



Scale in Km

INDEX TO SHEETS

58B03 SE	58B07 SW	58B07 SE
58B04 NE		58B08 NE
58B04 SE	58B08 SW	58B08 SE

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

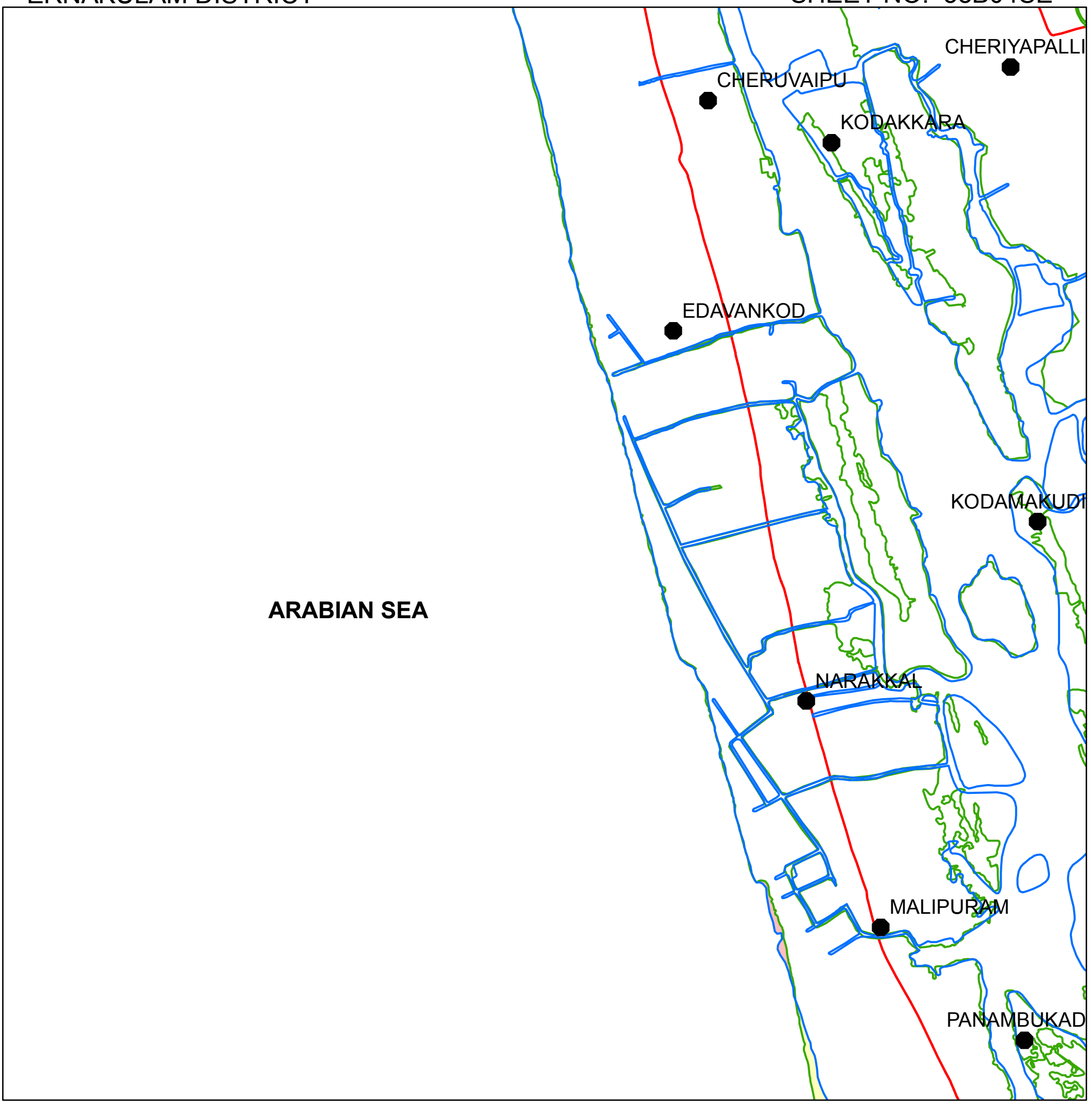
SHORELINE CHANGE MAP

KERALA

FOR OFFICIAL USE ONLY

ERNAKULAM DISTRICT

SHEET NO. 58B04SE



Legend

- EROSION
- ACCRETION
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

SEA	58B04 NE	58B08 NW
SEA		58B08 SW
SEA	58C01 NE	58C05 NW

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

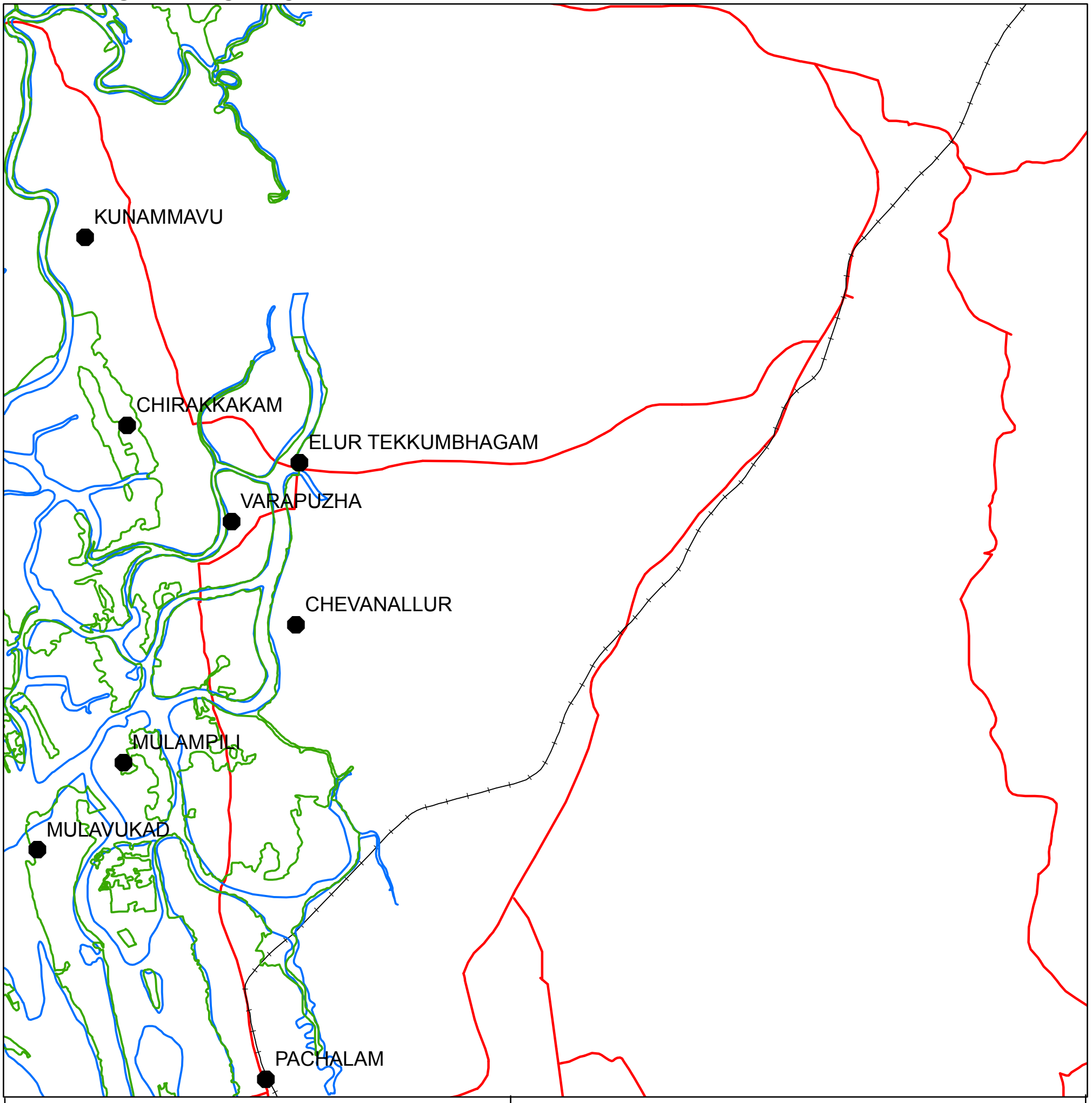
SHORELINE CHANGE MAP

KERALA

FOR OFFICIAL USE ONLY

ERNAKULAM DISTRICT

SHEET NO. 58B08SW



Legend

- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
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Scale in Km

INDEX TO SHEETS

58B04 NE	58B08 NW	58B08 NE
58B04 SE		58B08 SE
58C01 NE	58C05 NW	58C05 NE

INDIA

KERALA

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

SHORELINE CHANGE MAP

KERALA

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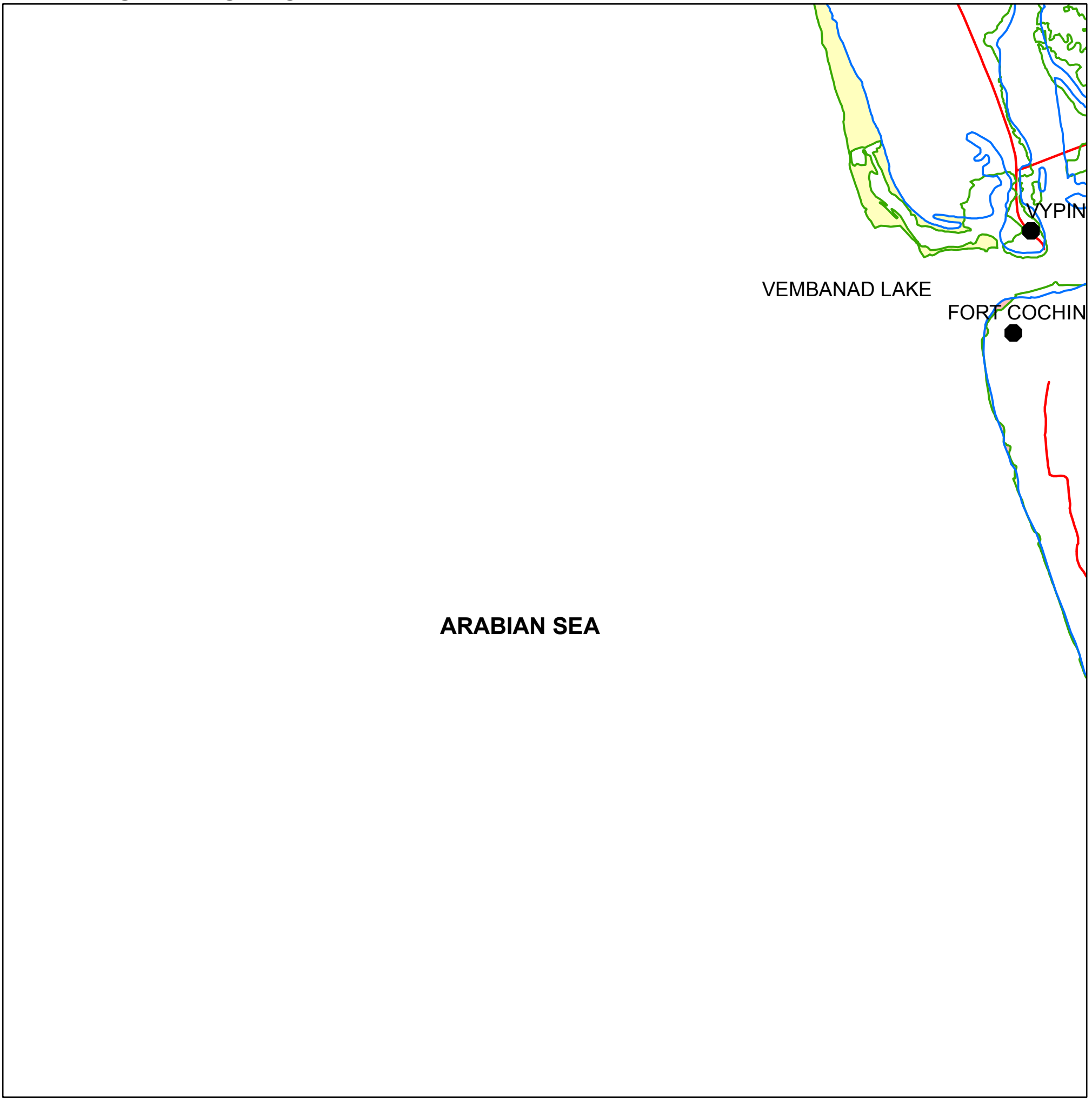
ERNAKULAM DISTRICT

SHEET NO. 58C01NE



Legend

- EROSION
- ACCRETION
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
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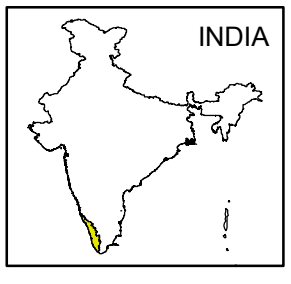
Scale in Km

INDEX TO SHEETS

SEA	58B04 SE	58B08 SW
SEA		58C05 NW
SEA	SEA	58C05 SW



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

SHORELINE CHANGE MAP

ERNAKULAM/ALLEPPEY DISTRICT

KERALA

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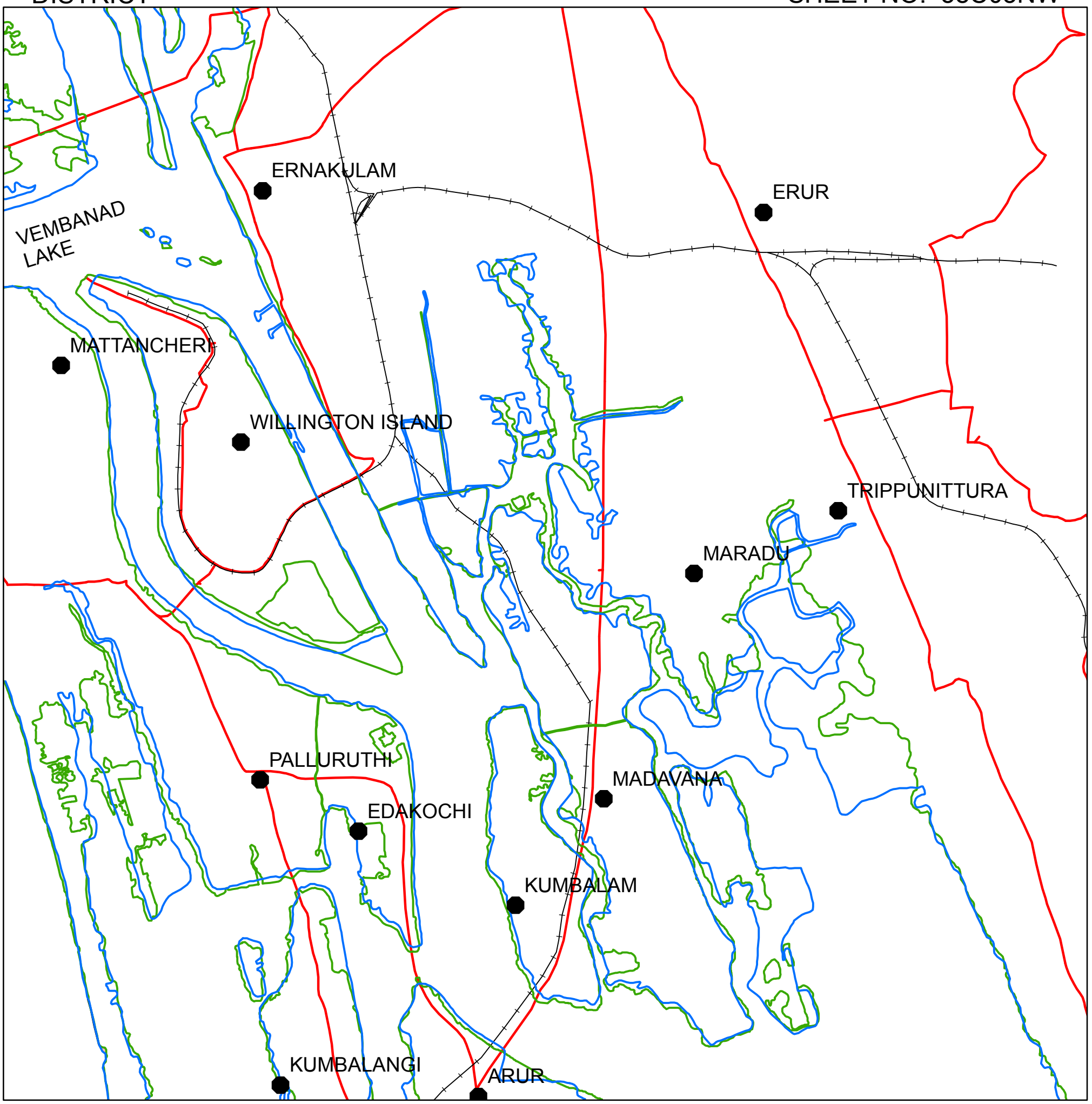
SHEET NO. 58C05NW



Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- STABLE
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S

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Scale in Km

INDEX TO SHEETS

58B04 SE	58B08 SW	58B08 SE
58C01 NE		58C05 NE
SEA	58C05 SW	58C05 SE

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
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AND CENTRAL WATER COMMISSION, NEW DELHI

SHORELINE CHANGE MAP

ERNAKULAM/ALAPPUZHA DISTRICT

KERALA

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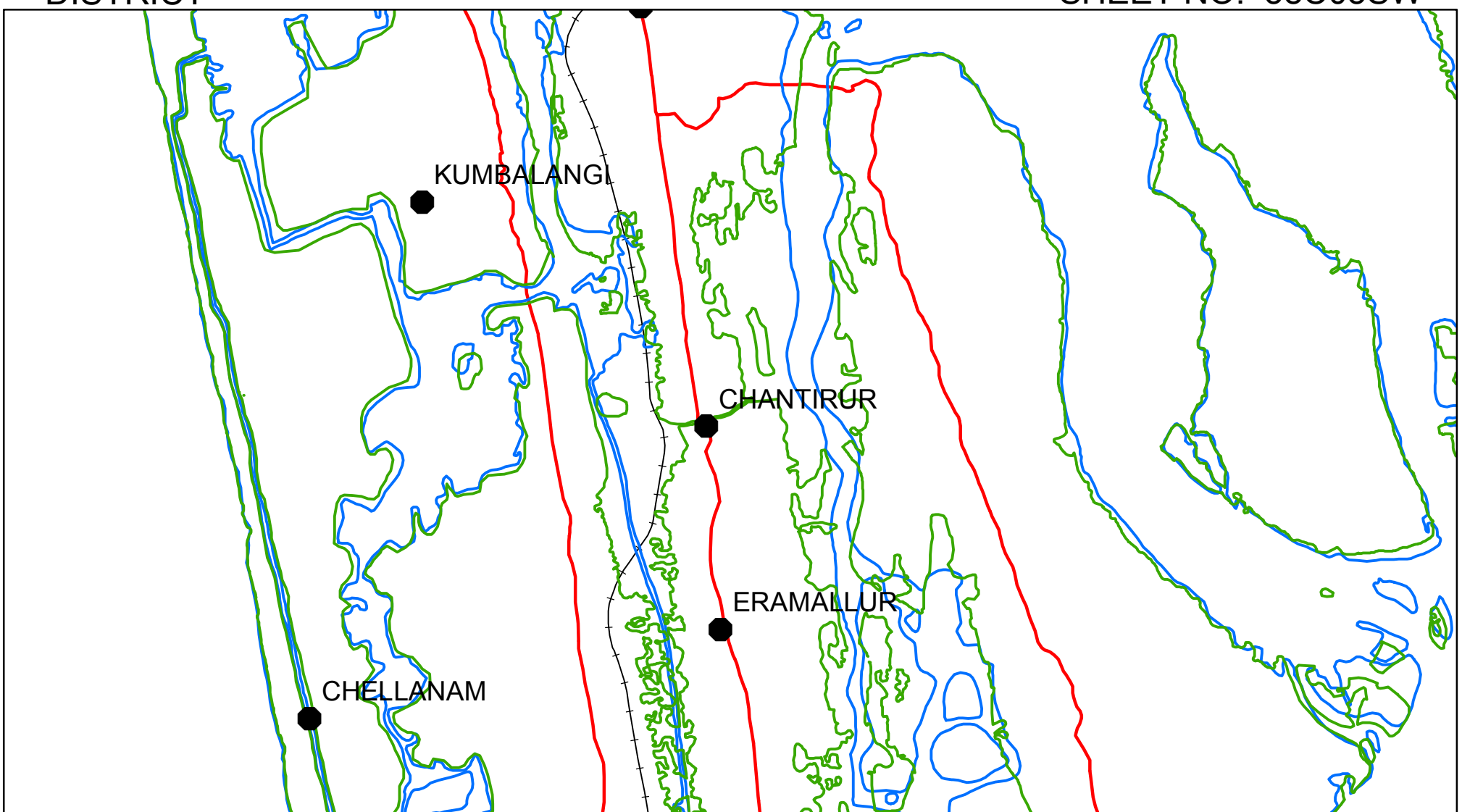
SHEET NO. 58C05SW



Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- SEA WALL
- HABITATION

N
W E
S

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Scale in Km

INDEX TO SHEETS

58C01 NE	58C05 NW	58C05 NE
SEA		58C05 SE
SEA	58C06 NW	58C06 NE

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

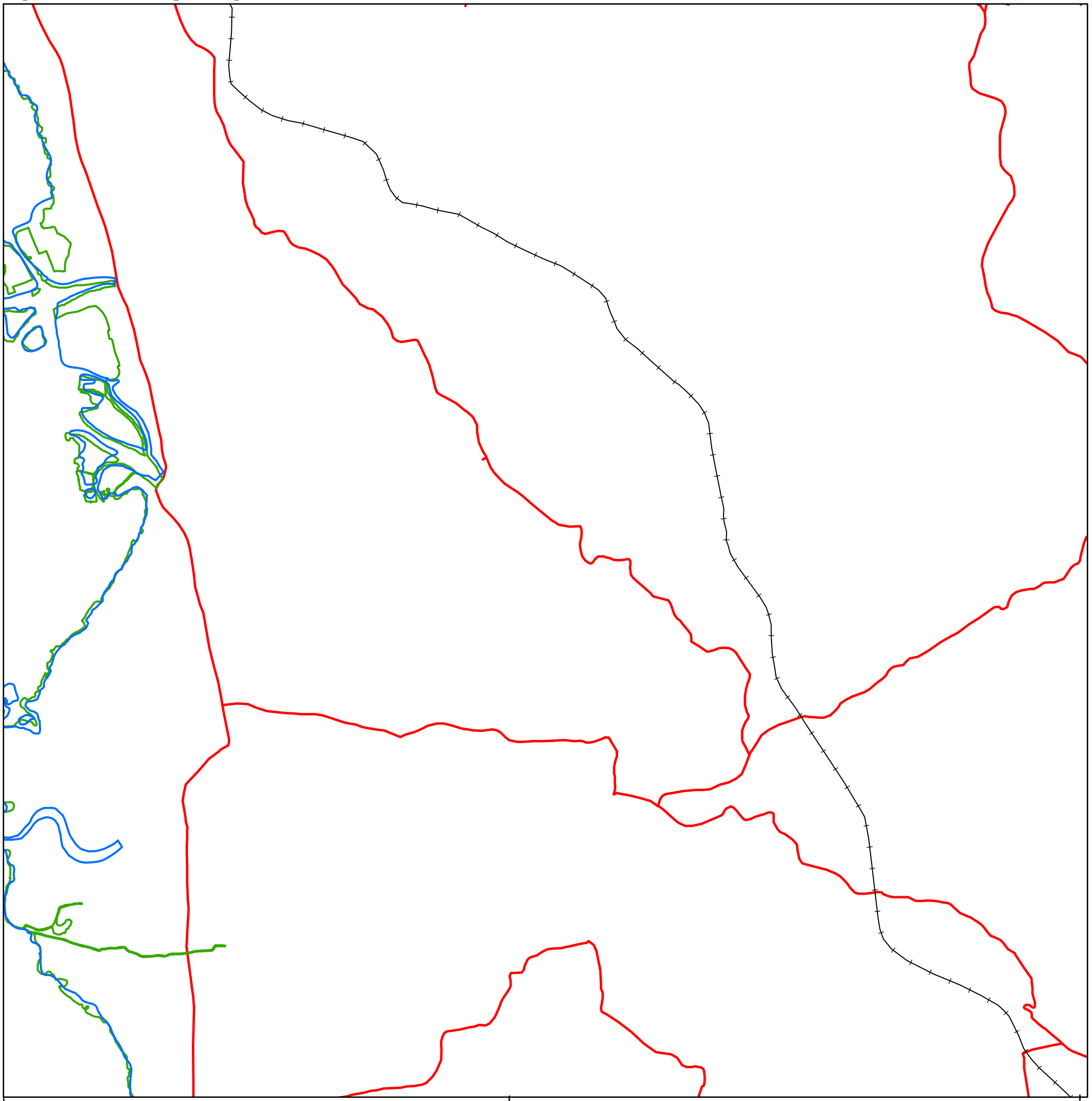
SHORELINE CHANGE MAP

ERNAKULAM/ALAPPUZHA/
KOTTAYAM DISTRICT

KERALA

FOR OFFICIAL USE ONLY

SHEET NO. 58C05SE



Legend

- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

58C05 NW	58C05 NE	58C09 NW
58C05 SW		58C09 SW
58C06 NW	58C06 NE	58C10 NW

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
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AND CENTRAL WATER COMMISSION, NEW DELHI

SHORELINE CHANGE MAP

KERALA

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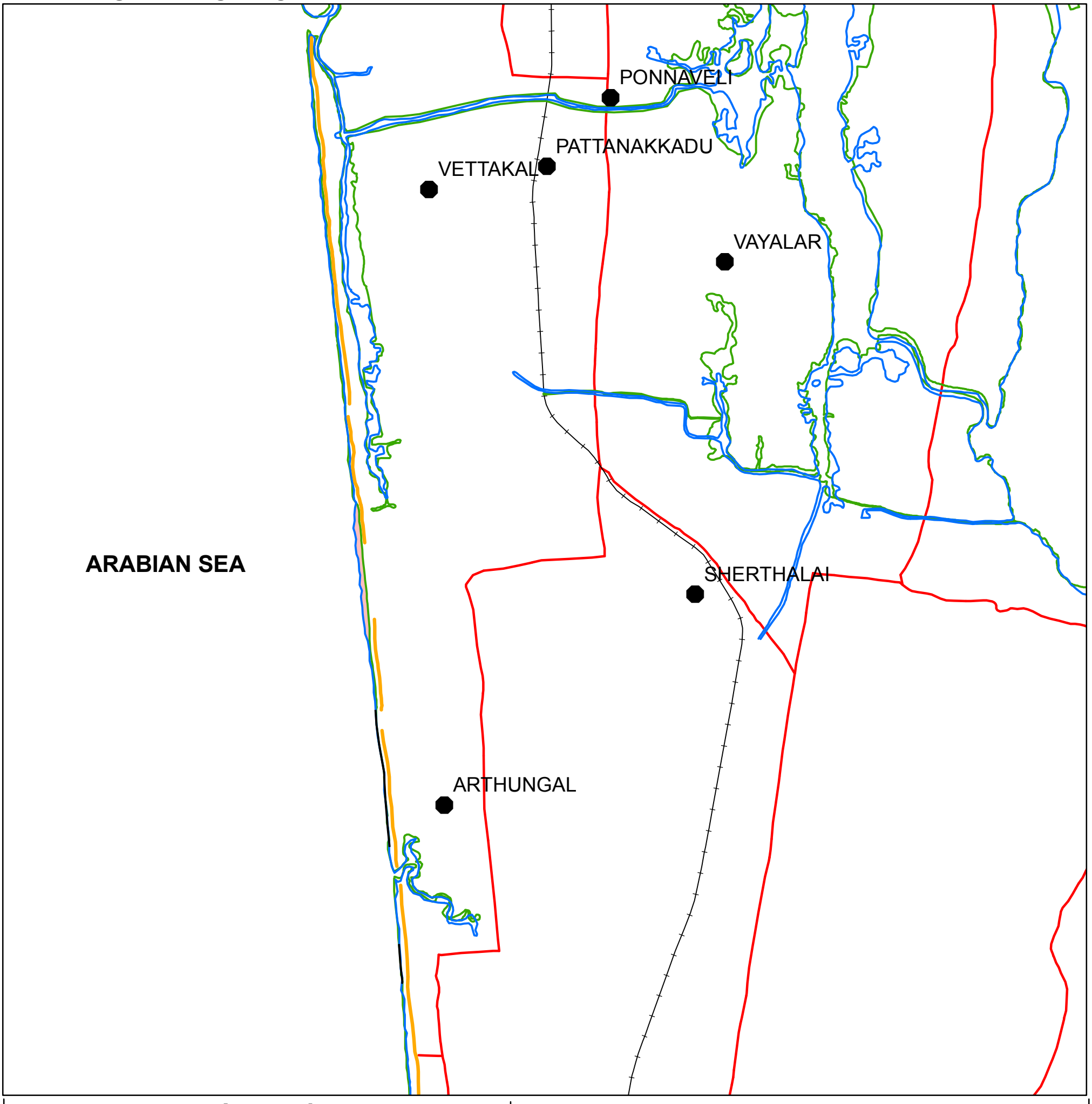
ALAPPUZHA DISTRICT

SHEET NO. 58C06NW



Legend

- EROSION
- ACCRETION
- ROAD
- STABLE
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- SEA WALL
- HABITATION

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

SEA	58C05 SW	58C05 SE
SEA		58C06 NE
SEA	58C06 SW	58C06 SE

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

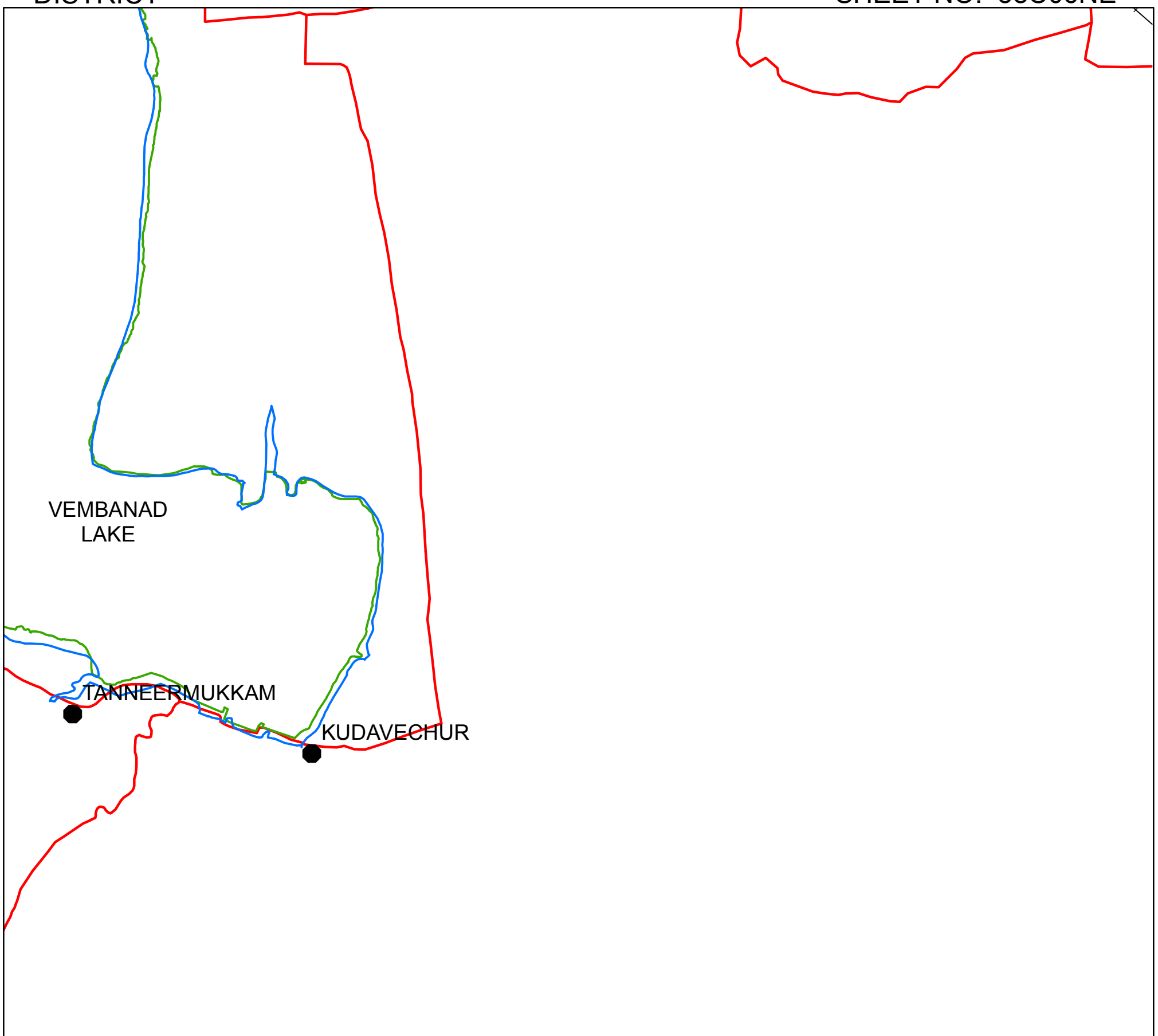
SHORELINE CHANGE MAP

ALAPPUZHA/KOTTAYAM DISTRICT

KERALA

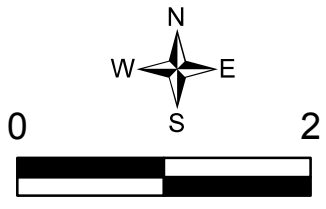
FOR OFFICIAL USE ONLY

SHEET NO. 58C06NE



Legend

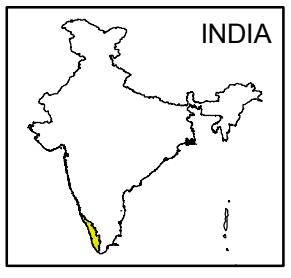
- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION



Scale in Km

INDEX TO SHEETS

58C05 SW	58C05 SE	58C09 SW
58C06 NW		58C10 NW
58C06 SW	58C06 SE	58C10 SW



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

SHORELINE CHANGE MAP

KERALA

FOR OFFICIAL USE ONLY

ALAPPUZHA DISTRICT

SHEET NO. 58C06SW

KOTTAMKULANGARA

ARABIAN SEA

KOTTUKADA

TUMBOLI

Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- STABLE
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N

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Scale in Km

INDEX TO SHEETS

SEA	58C06 NW	58C06 NE
SEA		58C06 SE
SEA	58C07 NW	58C07 NE

INDIA

KERALA

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

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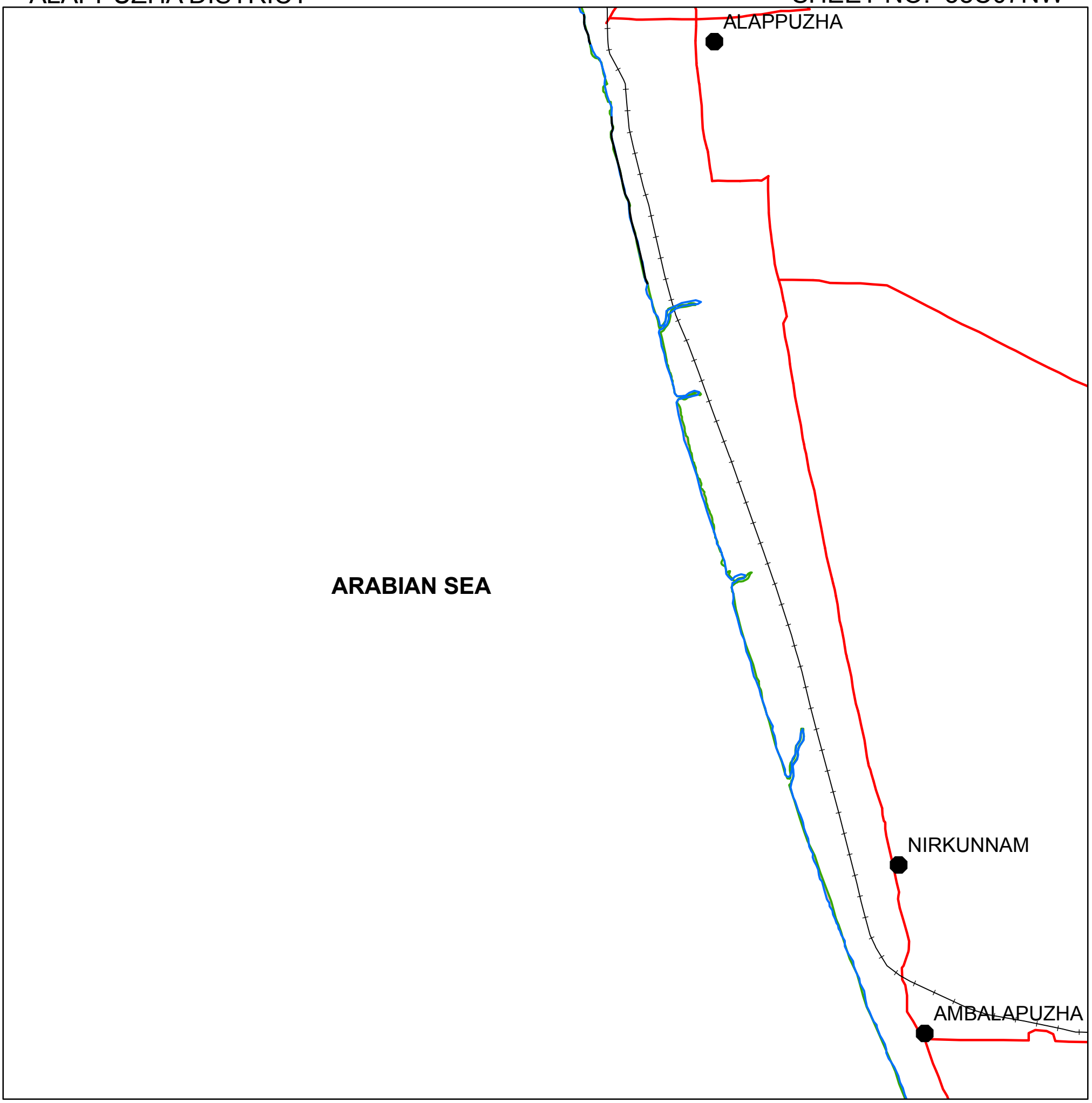
SHORELINE CHANGE MAP

KERALA

FOR OFFICIAL USE ONLY

ALAPPUZHA DISTRICT

SHEET NO. 58C07NW



Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- STABLE
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

SEA	58C06 SW	58C06 SE
SEA		58C07 NE
SEA	58C07 SW	58C07 SE

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

SHORELINE CHANGE MAP

KERALA

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ALAPPUZHA DISTRICT

SHEET NO. 58C07SW

Legend

- EROSION
- ACCRETION
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
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0 2
Scale in Km

INDEX TO SHEETS

SEA	58C07 NW	58C07 NE
SEA		58C07 SE
SEA	SEA	58C08 NE

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

SHORELINE CHANGE MAP

KERALA

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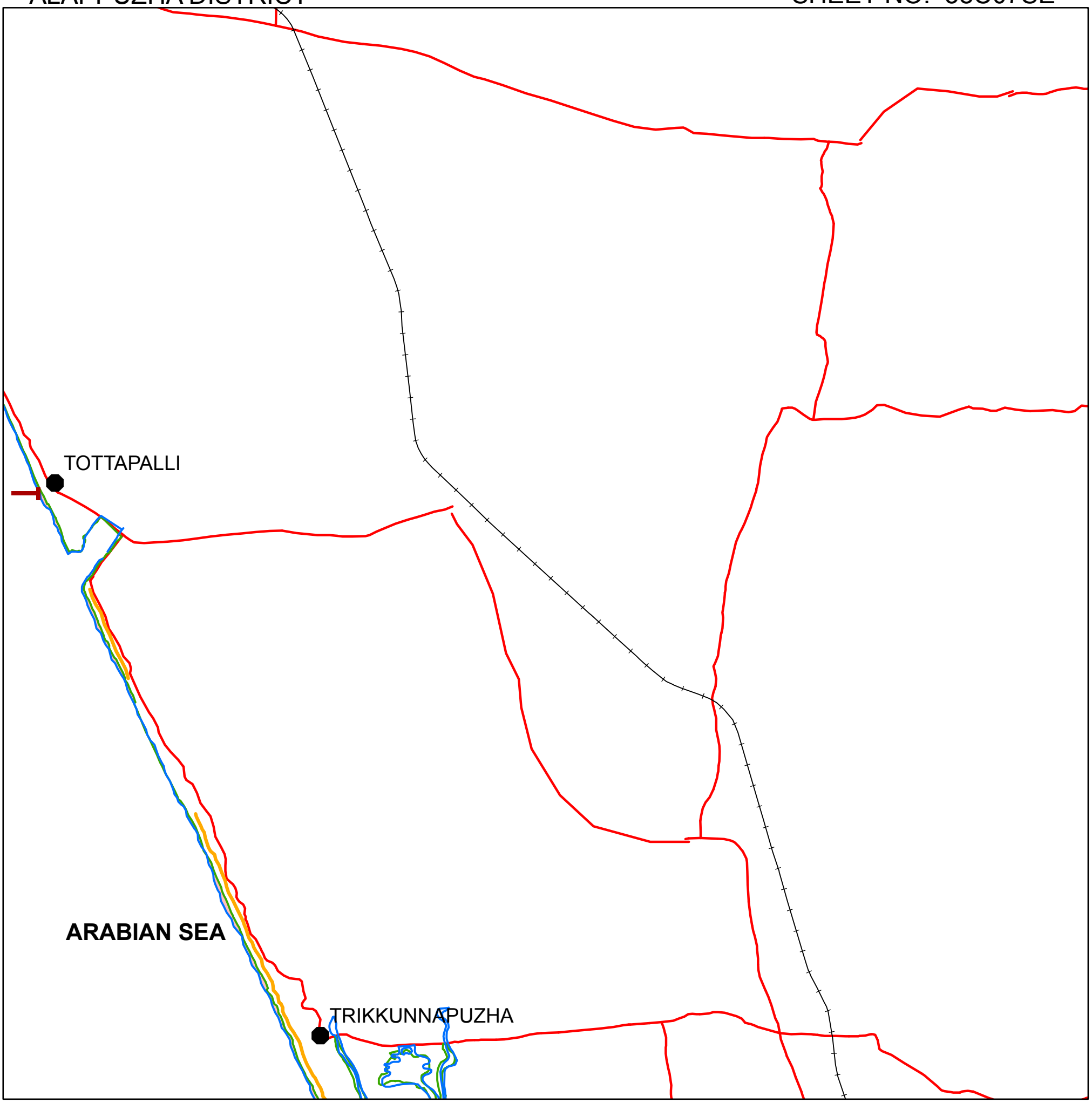
ALAPPUZHA DISTRICT

SHEET NO. 58C07SE



Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- SEA WALL
- BREAK WATER
- HABITATION

N
W E
S
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Scale in Km

INDEX TO SHEETS

58C07 NW	58C07 NE	58C11 NW
58C07 SW		58C11 SW
SEA	58C08 NE	58C12 NW

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

SHORELINE CHANGE MAP

KERALA

FOR OFFICIAL USE ONLY

ALAPPUZHA DISTRICT

SHEET NO. 58C08NE

CHINGOLI

KANAKAKUNNU

VATTAPARAMBU

ARABIAN SEA

PUDUPPALLI

KAYAMKULAM LAKE

Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- STABLE
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- SEA WALL
- BREAK WATER
- HABITATION

N

W E

S

0 2

Scale in Km

INDEX TO SHEETS

58C07 SW	58C07 SE	58C11 SW
SEA		58C12 NW
SEA	58C08 SE	58C12 SW

INDIA

KERALA

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

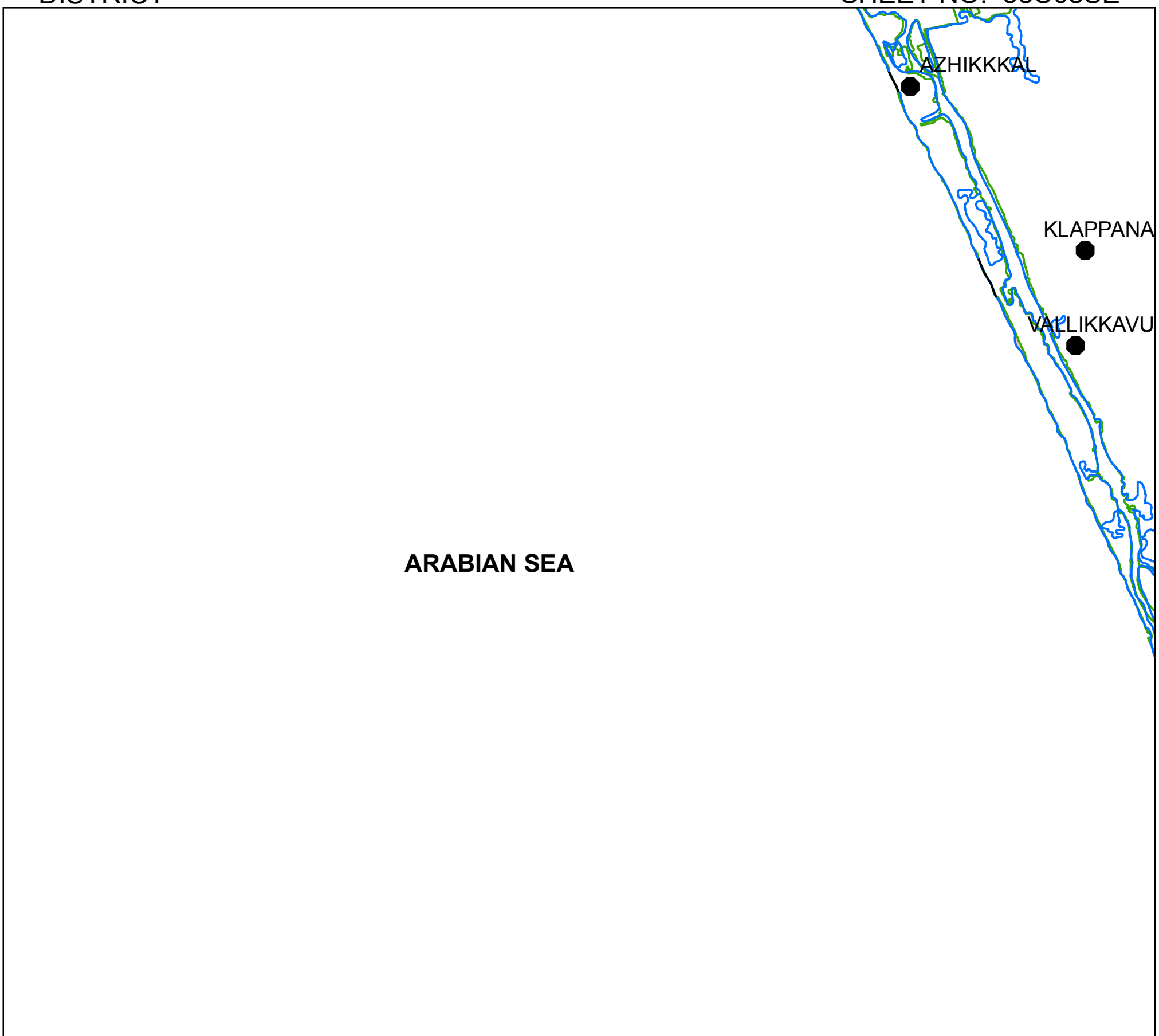
SHORELINE CHANGE MAP

ALAPPUZHA/KOLLAM DISTRICT

KERALA

FOR OFFICIAL USE ONLY

SHEET NO. 58C08SE



Legend

- EROSION
- ACCRETION
- STABLE
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S

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Scale in Km

INDEX TO SHEETS

SEA	58C08 NE	58C12 NW
SEA		58C12 SW
SEA	SEA	58D09 NW

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

SHORELINE CHANGE MAP

KERALA

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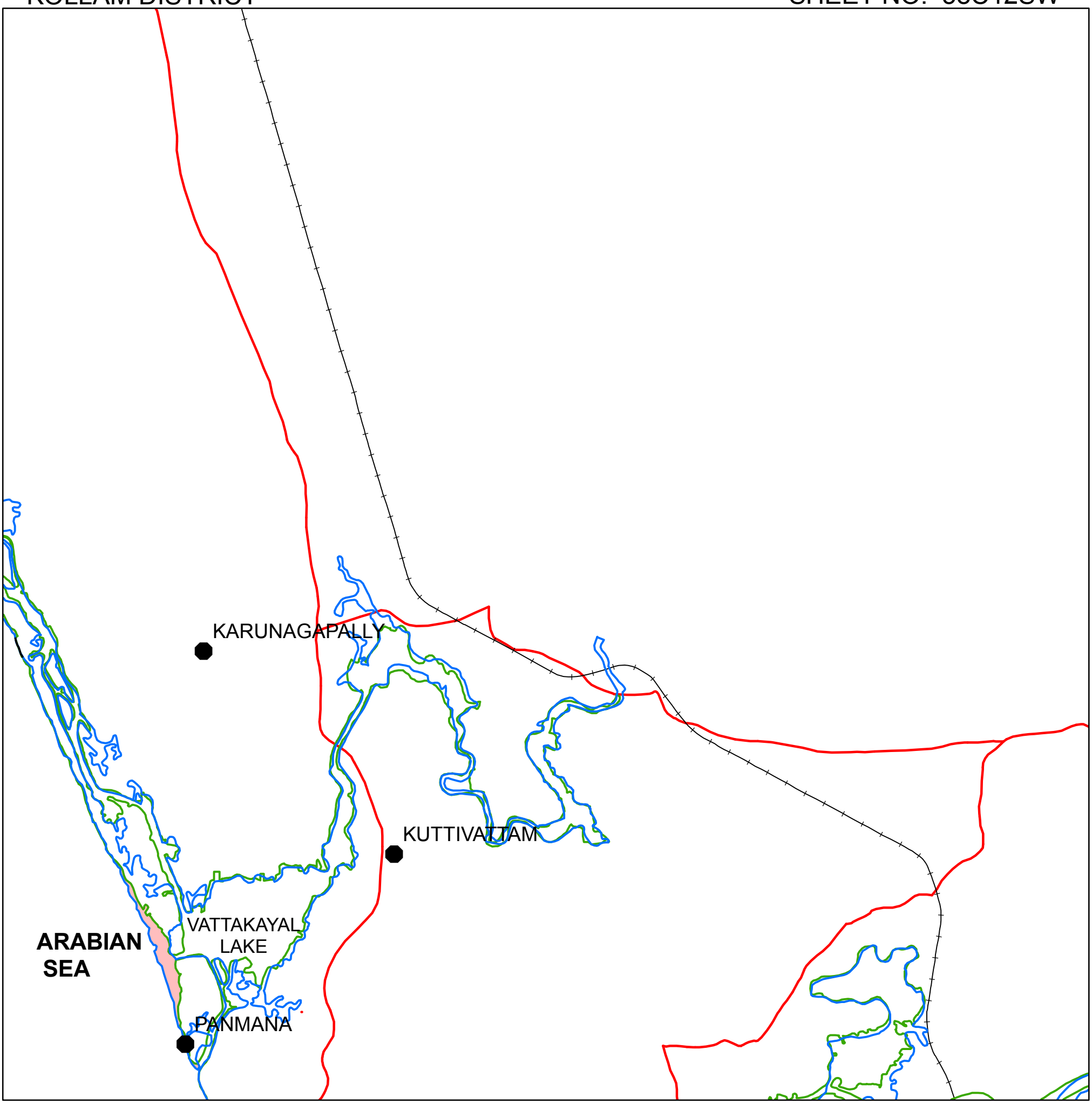
KOLLAM DISTRICT

SHEET NO. 58C12SW



Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- STABLE
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S

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Scale in Km

INDEX TO SHEETS

58C08 NE	58C12 NW	58C12 NE
58C08 SE		58C12 SE
SEA	58D09 NW	58D09 NE

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

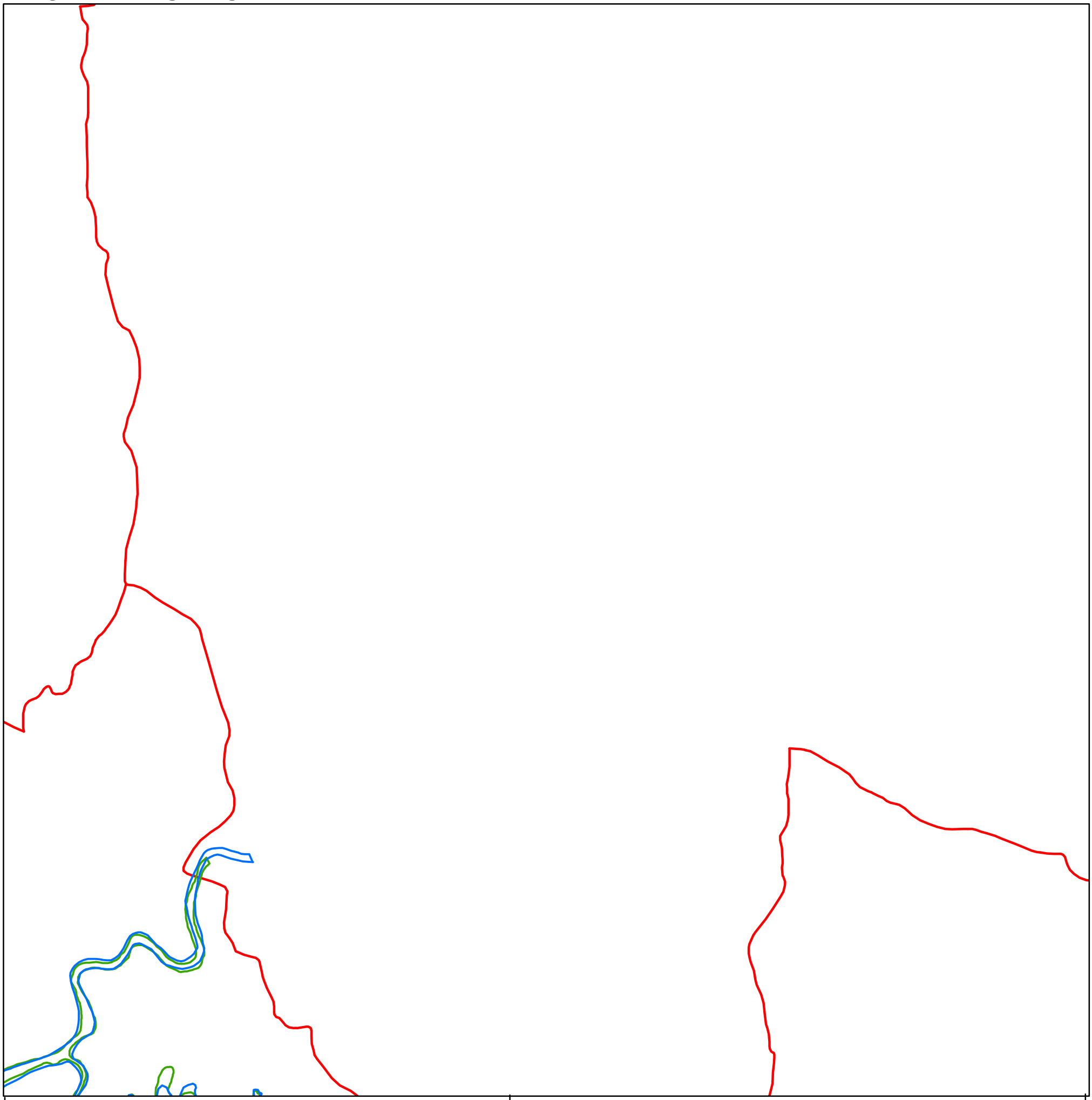
SHORELINE CHANGE MAP

KERALA

FOR OFFICIAL USE ONLY

KOLLAM DISTRICT

SHEET NO. 58C12SE



Legend

- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91

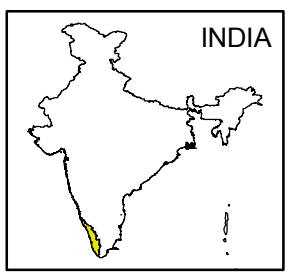
N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

58C12 NW	58C12 NE	58D16 NW
58C12 SW		58D16 SW
58D09 NW	58D09 NE	58D13 NW



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

SHORELINE CHANGE MAP

KERALA

FOR OFFICIAL USE ONLY

KOLLAM DISTRICT

SHEET NO. 58D09NW

ARAKKAL

MUKKUNNAPURAM

PATTAMTURUT

CHAVARA

TEKKUMBHAGAM

PUTTANTURA

ASHTAMUDI LAKE

INCHAVILSERI

NEENDAKARA

ANCHALUMMUD

ARABIAN SEA

MARATTADI

TIRUMULLAVARAM

KOLLAM

CHINNAKKADA

Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- SEA WALL
- BREAK WATER
- HABITATION

N

W E

S

0 2

Scale in Km

INDEX TO SHEETS

58C08 SE	58C12 SW	58C12 SE
SEA		58D09 NE
SEA	58D09 SW	58D09 SE

INDIA

KERALA

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

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SHORELINE CHANGE MAP

KERALA

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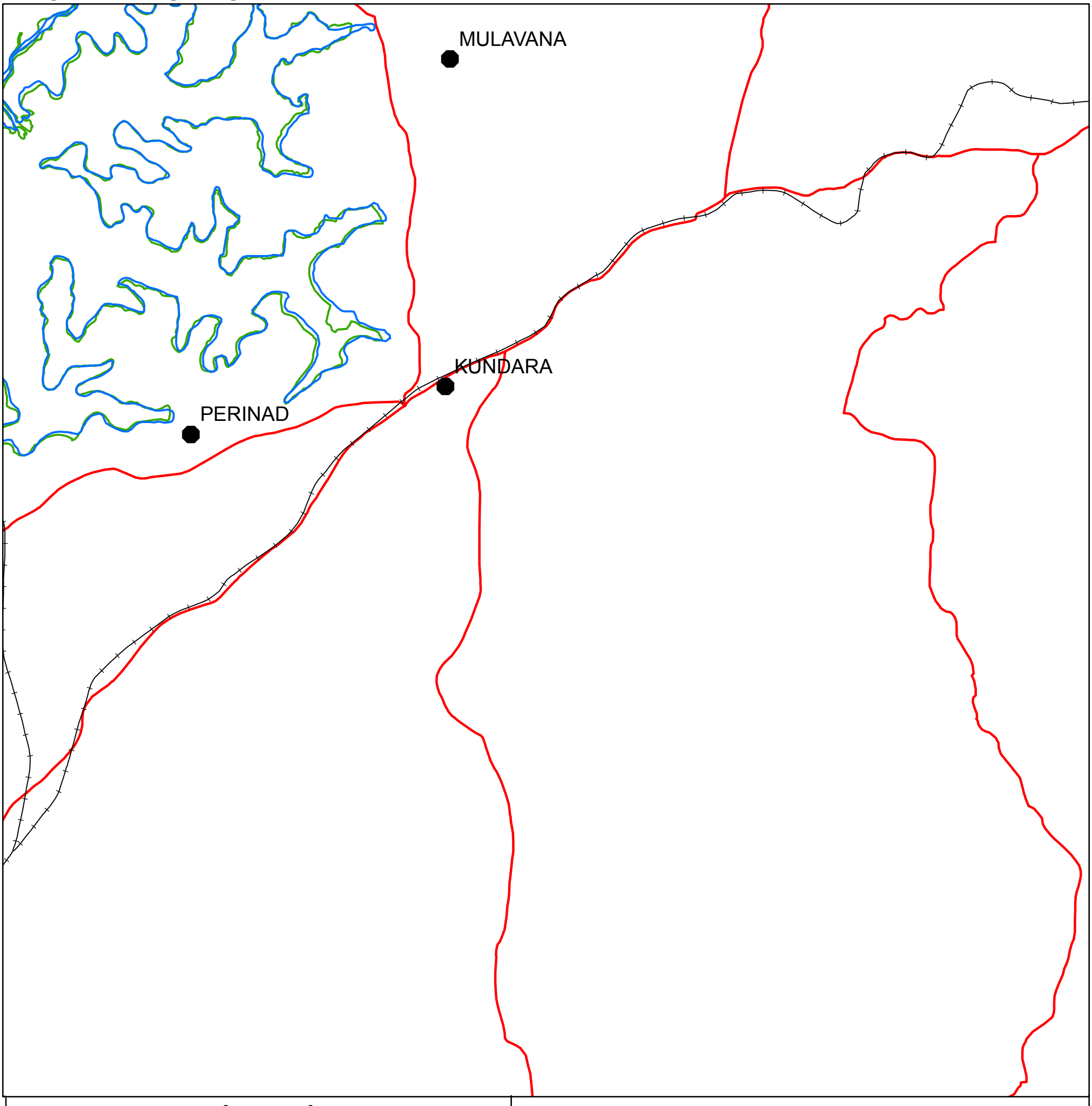
KOLLAM DISTRICT

SHEET NO. 58D09NE



Legend

- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

58C12 SW	58C12 SE	58C16 SW
58D09 NW		58D13 NW
58D09 SW	58D09 SW	58D13 SW

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

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SHORELINE CHANGE MAP

KERALA

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KOLLAM DISTRICT

SHEET NO. 58D09SW

ARABIAN SEA

Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- STABLE
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- SEA WALL

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

SEA	58D09 NW	58D09 NE
SEA		58D09 SE
SEA	SEA	58D10 NE

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
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SHORELINE CHANGE MAP

KOLLAM/THIRUVANANTHAPURAM DISTRICT **KERALA**

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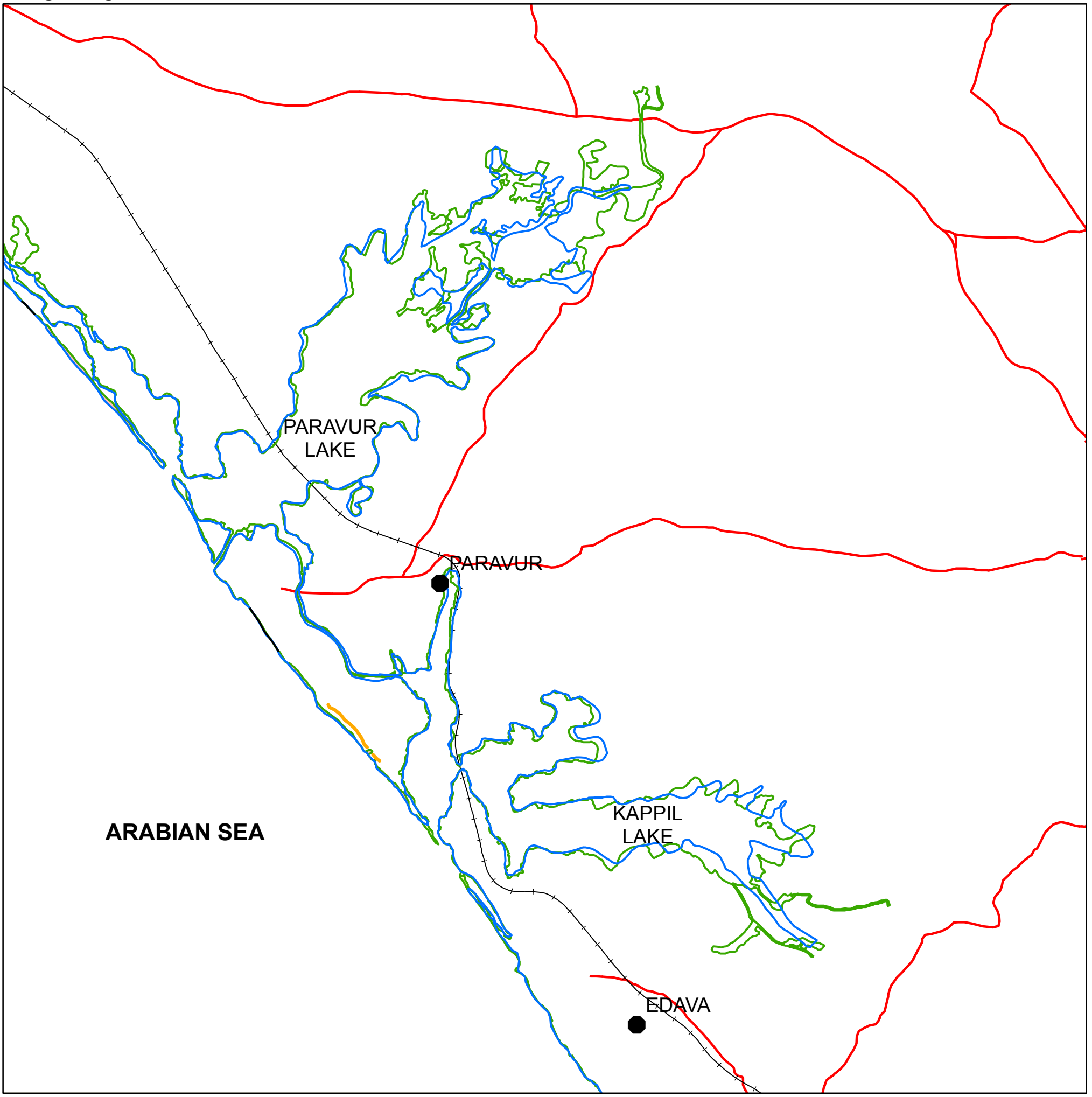
SHEET NO. 58D09SE



Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- STABLE
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- SEA WALL
- HABITATION

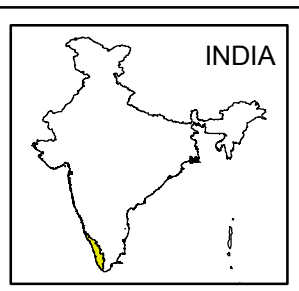
N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

58D09 NW	58D09 NE	58D13 NW
58D09 SW		58D13 SW
SEA	58D10 NE	58D14 NW



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

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SHORELINE CHANGE MAP

KERALA

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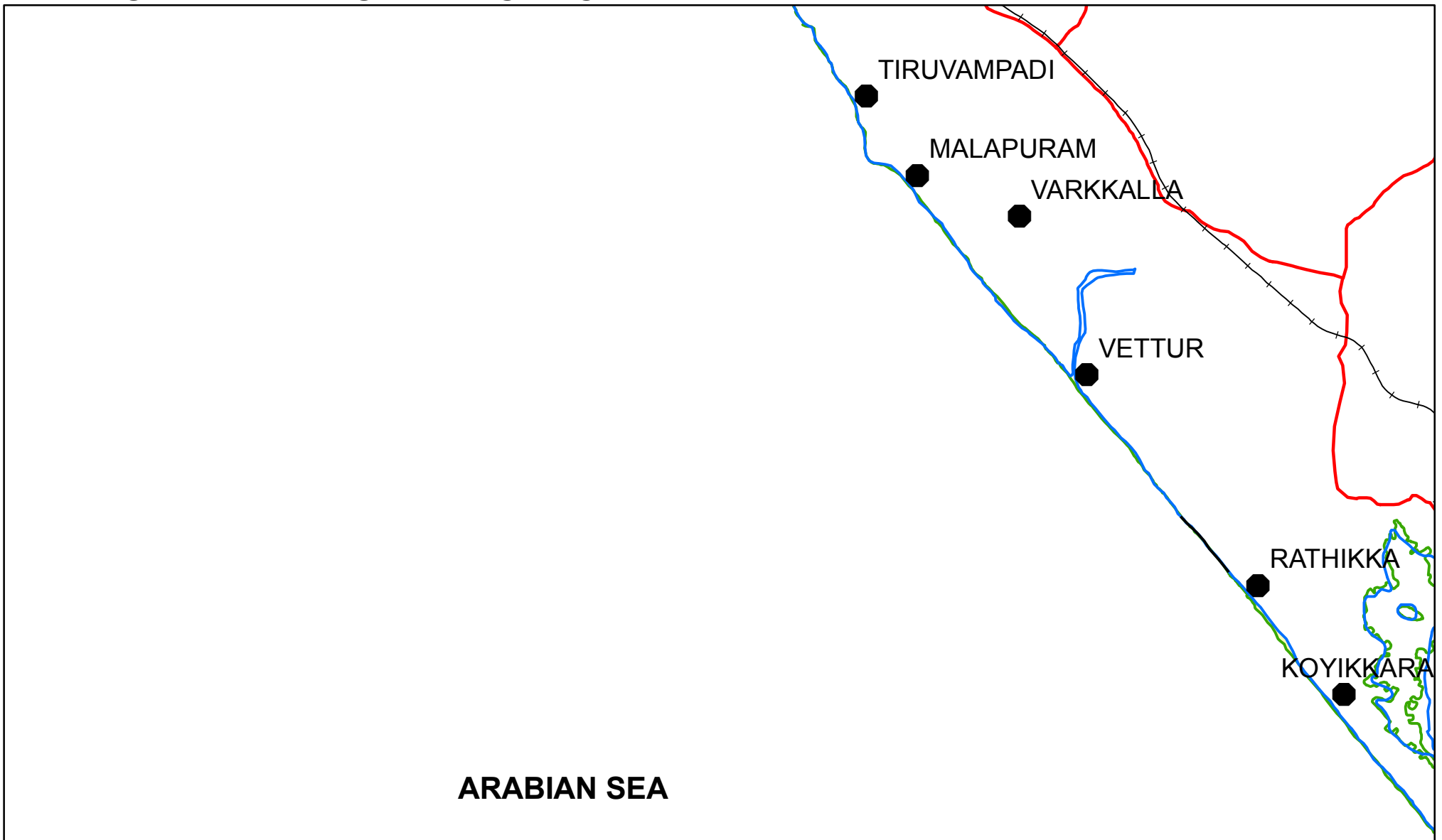
THIRUVANANTHAPURAM DISTRICT

SHEET NO. 58D10NE



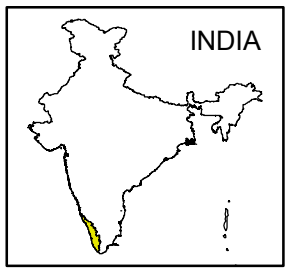
Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- STABLE
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S
0 2
Scale in Km

INDEX TO SHEETS

58D09 SW	58D09 SE	58D13 SW
SEA		58D14 NW
SEA	SEA	58D14 SW



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

SHORELINE CHANGE MAP

KERALA

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THIRUVANANTHAPURAM DISTRICT

SHEET NO. 58D14NW

MUNGOTTU

ANJENGO

AYIKKUDL

KUNDALU

CHIRAYINKIL

ARABIAN SEA

AZHUR

ANJENGO LAKE

Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- STABLE
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- BREAK WATER
- HABITATION

N

W E

S

0 2

Scale in Km

INDEX TO SHEETS

58D09 SE	58D13 SW	58D13 SE
58D10 NE		58D14 NE
SEA	58D14 SW	58D14 SE

INDIA

KERALA

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
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SHORELINE CHANGE MAP

KERALA

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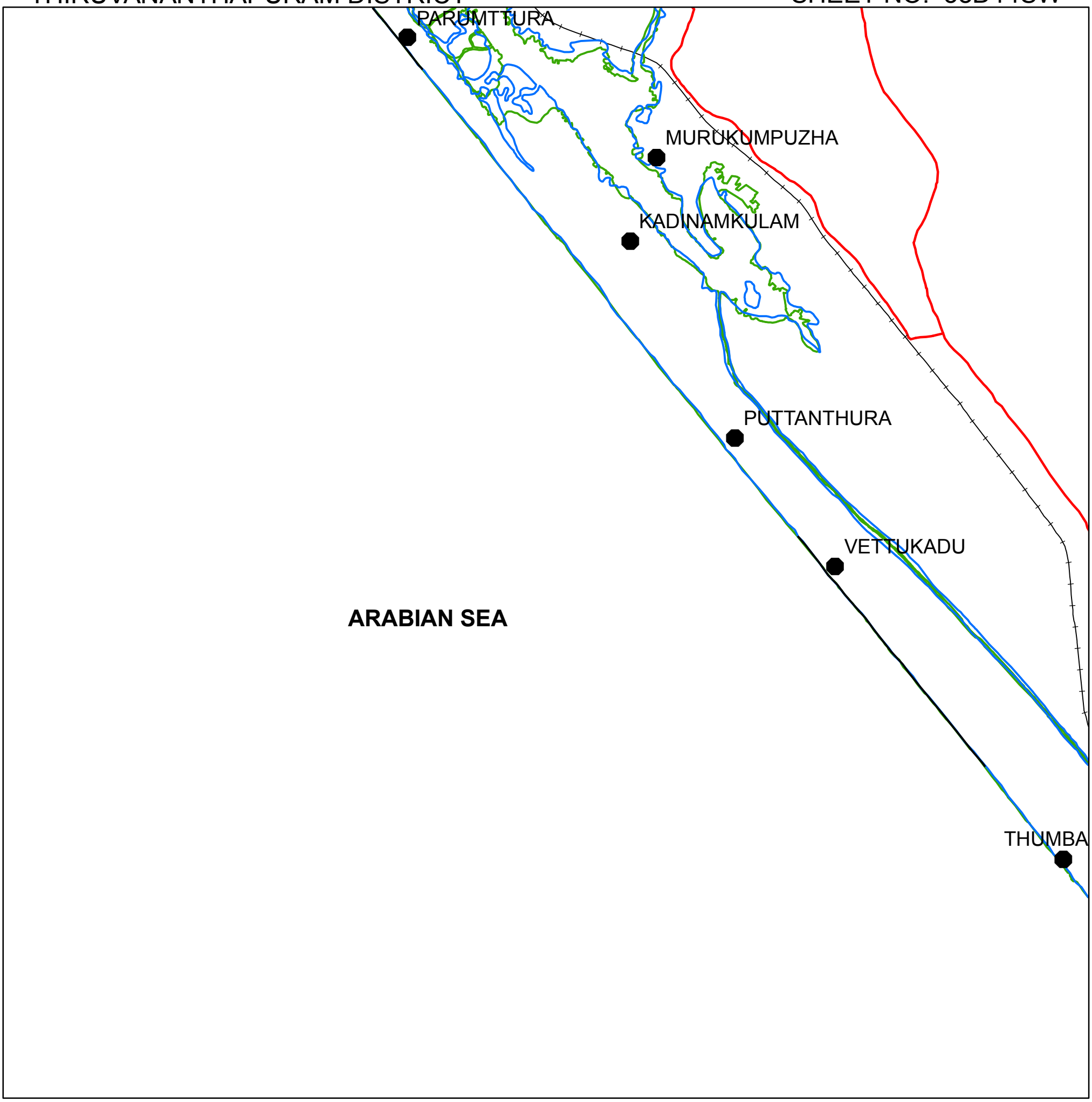
THIRUVANANTHAPURAM DISTRICT

SHEET NO. 58D14SW



Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- STABLE
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

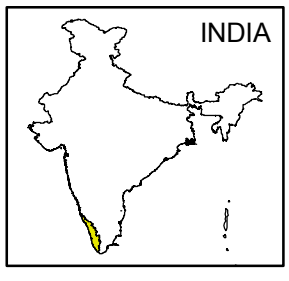
N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

58D10 NE	58D14 NW	58D14 NE
SEA		58D14 SE
SEA	SEA	58D15 NE



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

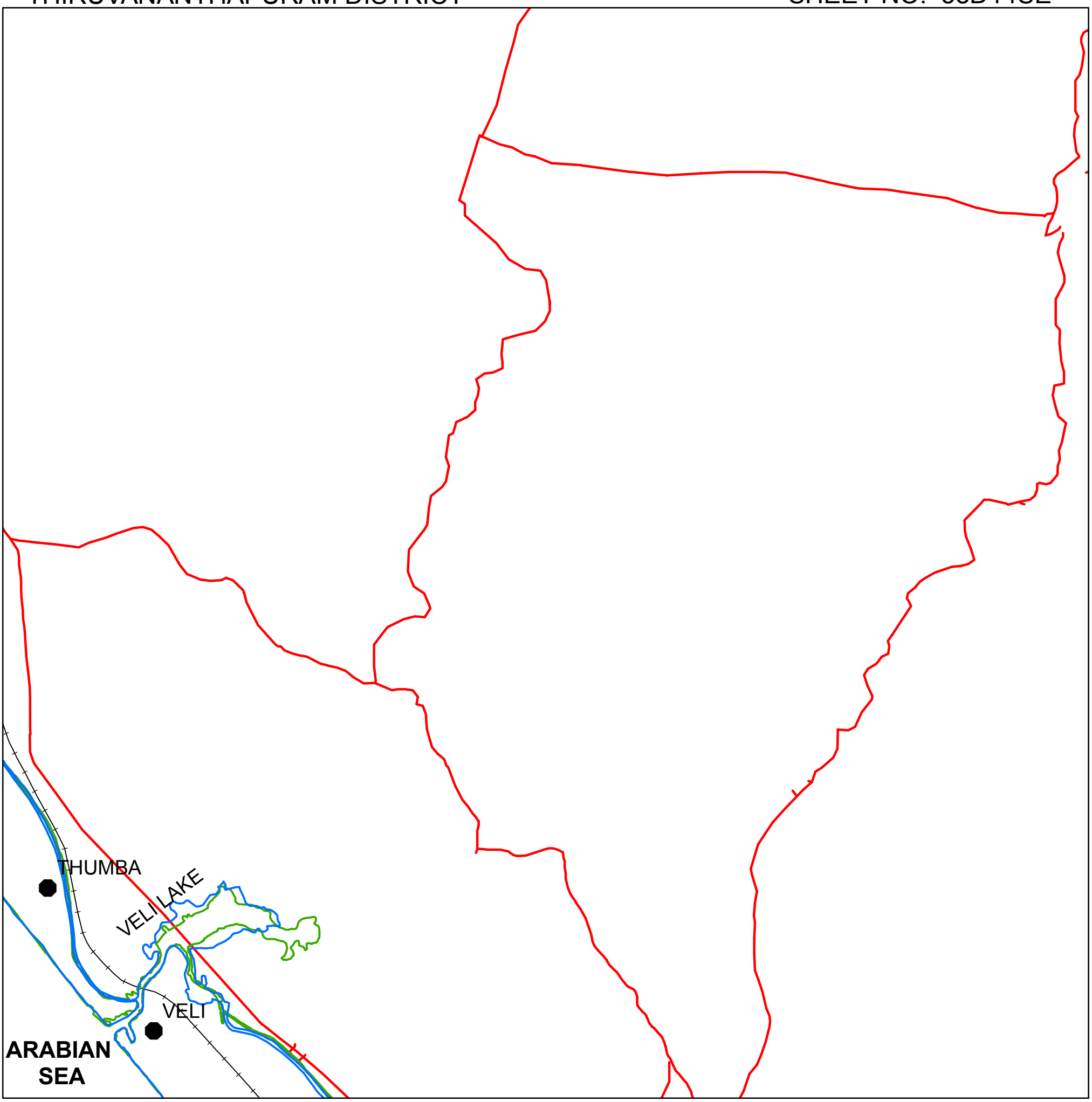
SHORELINE CHANGE MAP

KERALA

FOR OFFICIAL USE ONLY

THIRUVANANTHAPURAM DISTRICT

SHEET NO. 58D14SE



Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- STABLE
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

58D14 NW	58D14 NE	58H02 NW
58D14 SW		58H02 SW
SEA	58D15 NE	58H03 NW

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

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SHORELINE CHANGE MAP

KERALA

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THIRUVANANTHAPURAM DISTRICT

SHEET NO. 58D15NE

PETTA

SANKUMAKHAM

MUTTATTARA

TIRUVALLAM

ARABIAN SEA

KOVALAM

VILINJAM

Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- STABLE
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N

W E

S

0 2

Scale in Km

INDEX TO SHEETS

58D14 SW	58D14 SE	58H02 SW
SEA		58H03 NW
SEA	58D15 SE	58H03 SW

INDIA

KERALA

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

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SHORELINE CHANGE MAP

KERALA

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THIRUVANANTHAPURAM DISTRICT

SHEET NO. 58D15SE

ARABIAN SEA

Legend

- EROSION
- ACCRETION
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- BREAK WATER

N
W E
S
0 2
Scale in Km

INDEX TO SHEETS

SEA	58D15 NE	58H03 NW
SEA		58H03 SW
SEA	SEA	58H04 NW

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

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SHORELINE CHANGE MAP

KERALA

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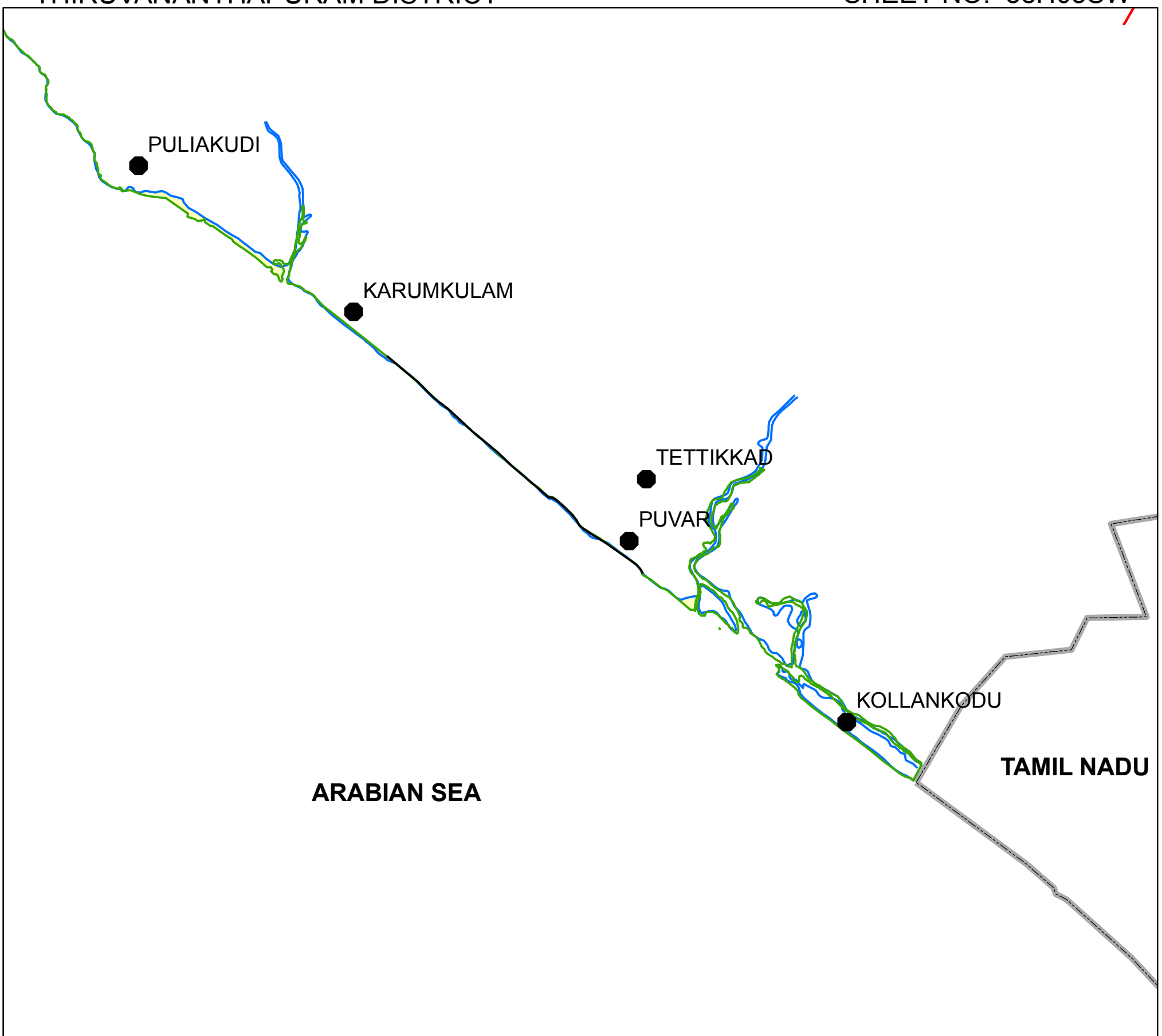
THIRUVANANTHAPURAM DISTRICT

SHEET NO. 58H03SW



Legend

- EROSION
- ACCRETION
- STABLE
- STATE BOUNDARY
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

58D15 NE	58H03 NW	58H03 NH
58D15 SE		58H03 SH
SEA	58H04 NW	58H04 NH

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

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AND CENTRAL WATER COMMISSION, NEW DELHI

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Annexure-II

(Plates)

Plate 1: Coastal stretch around Kodari showing eroding areas and stable coast, map sheet no. 48J02NE (Image: LISS IV November 2011).

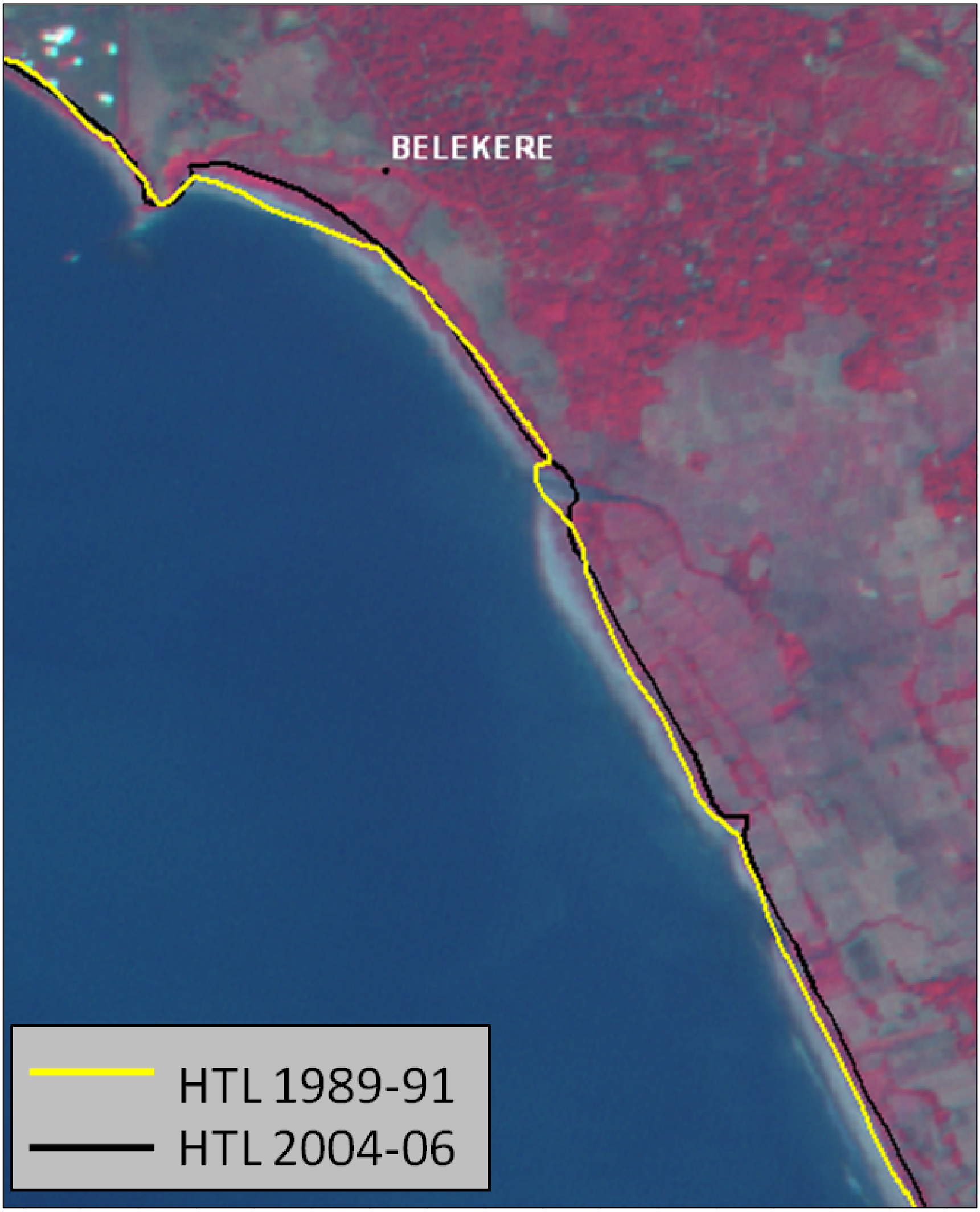

Plate 2: Coastal stretch around Belekere, showing eroding and stable coast, map sheet no. 48J06NW (Image: LISS IV November 2011).

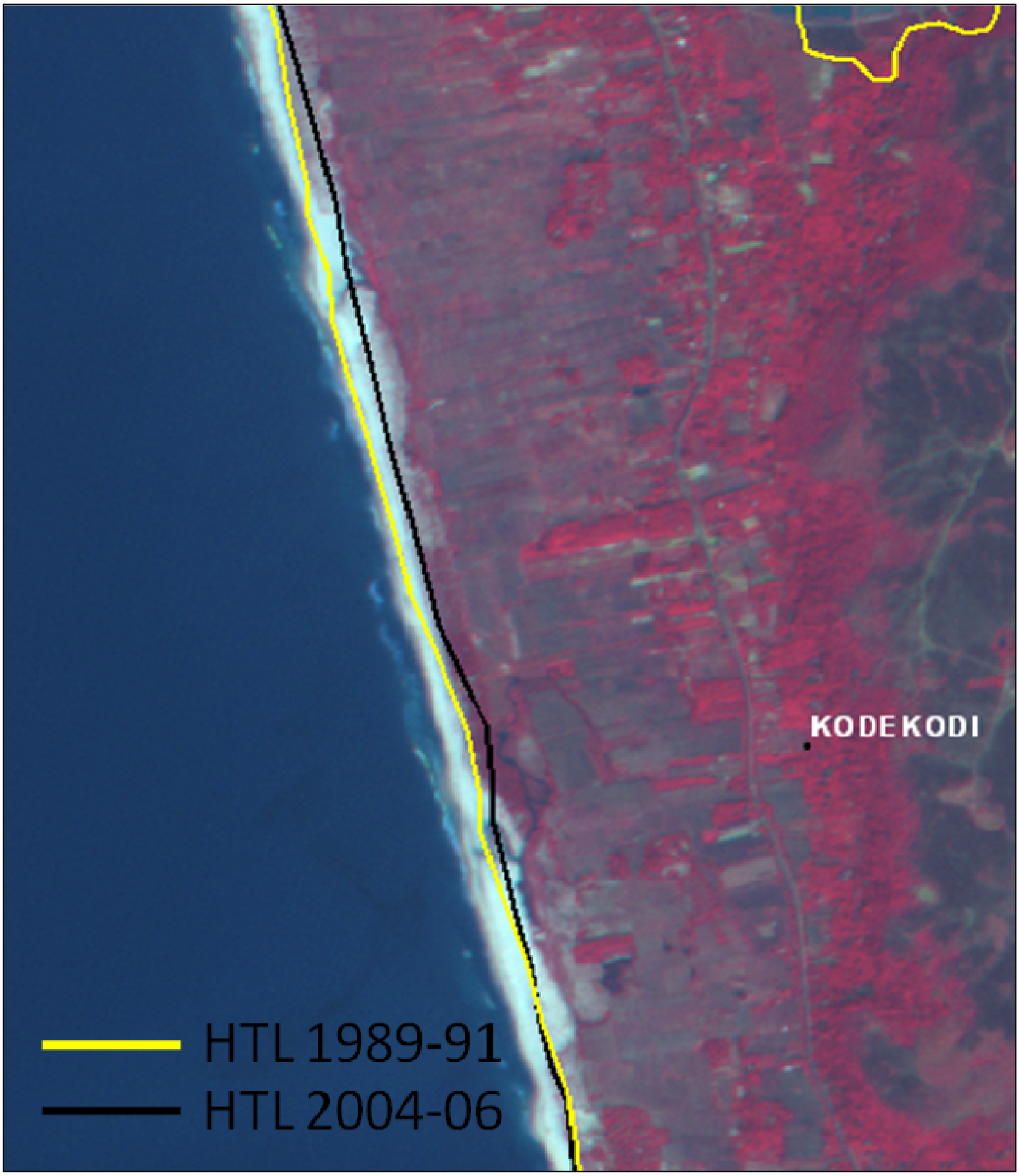

Plate 3: Coastal stretch around Kodekodi, south of Kumta showing eroding areas, map sheet no. 48J07NE (Image: LISS IV November 2011).

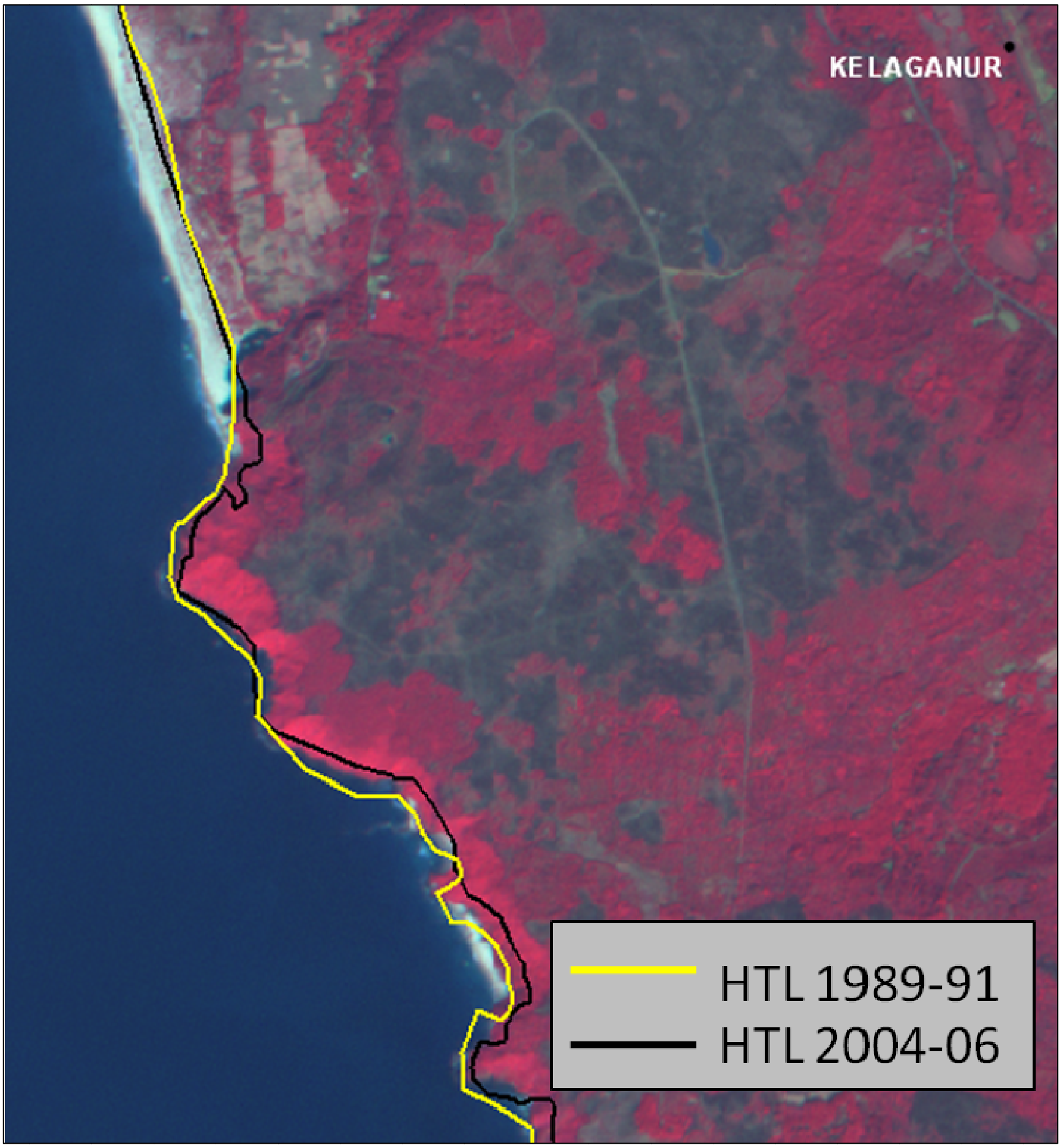

Plate 4: Stable coast around Kelaganur and eroding stretch up to Hakkalmane, map sheet no. 48J08NE (Image: LISS IV November 2011).

Plate 5: 2011-12 LISS IV image overlaid with high tide line of 2004-06 and 1989-91, showing the changes at Valapattanam River mouth near Azhikkal in Kannur District due to the construction of break waters (49M05NW).

Plate 6: 2011-12 LISS IV image overlaid with high tide line of 2004-06 and 1989-91, showing the coastal changes at Kannur due to the construction of break waters (49M05SW and 49M05SE).

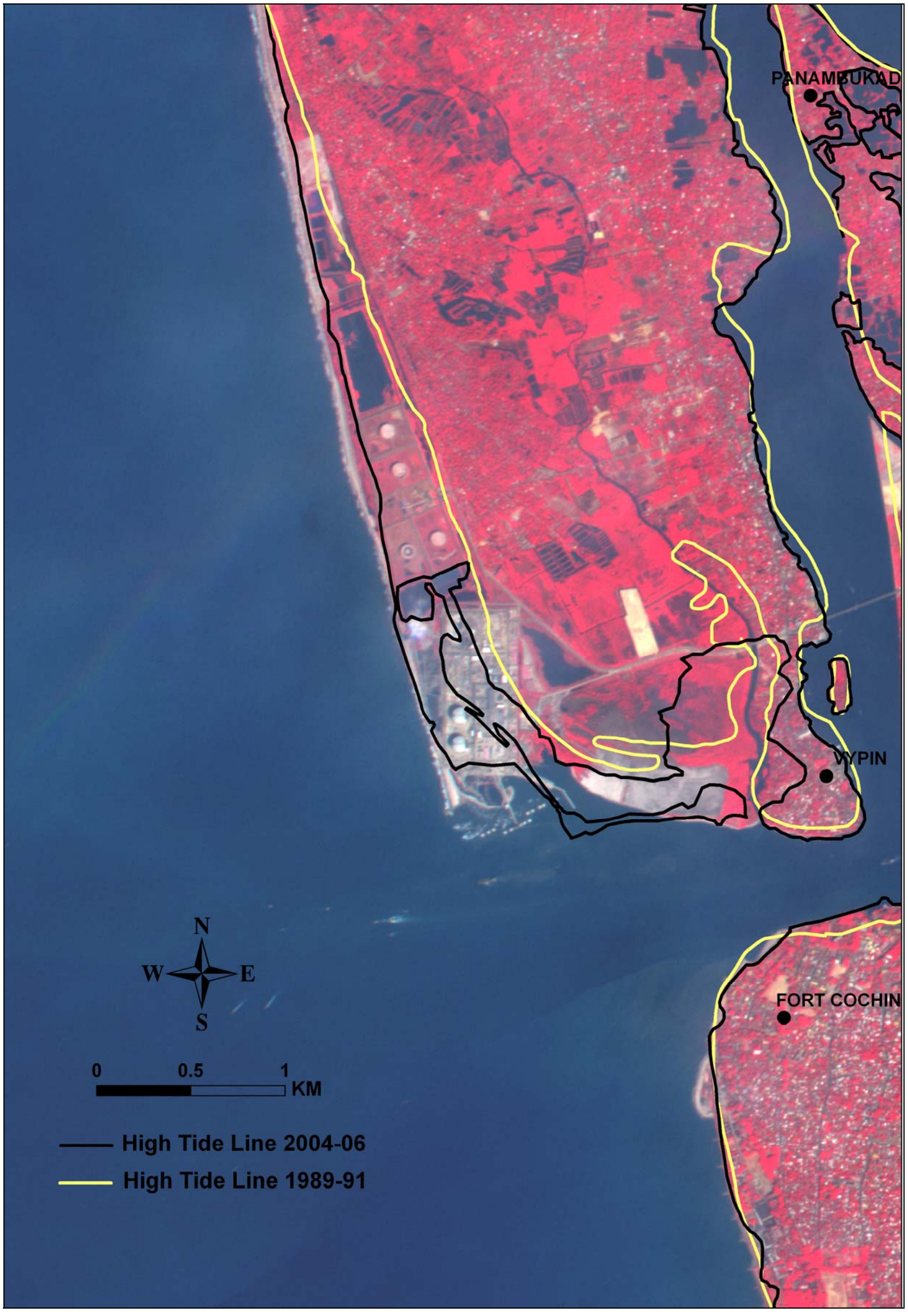

Plate 7: 2011-12 LISS IV image overlaid with high tide line of 2004-06 and 1989-91, showing accretion and subsequent constructional activities at the north of Vembanad Lake mouth in Ernakulam (58C01NE).

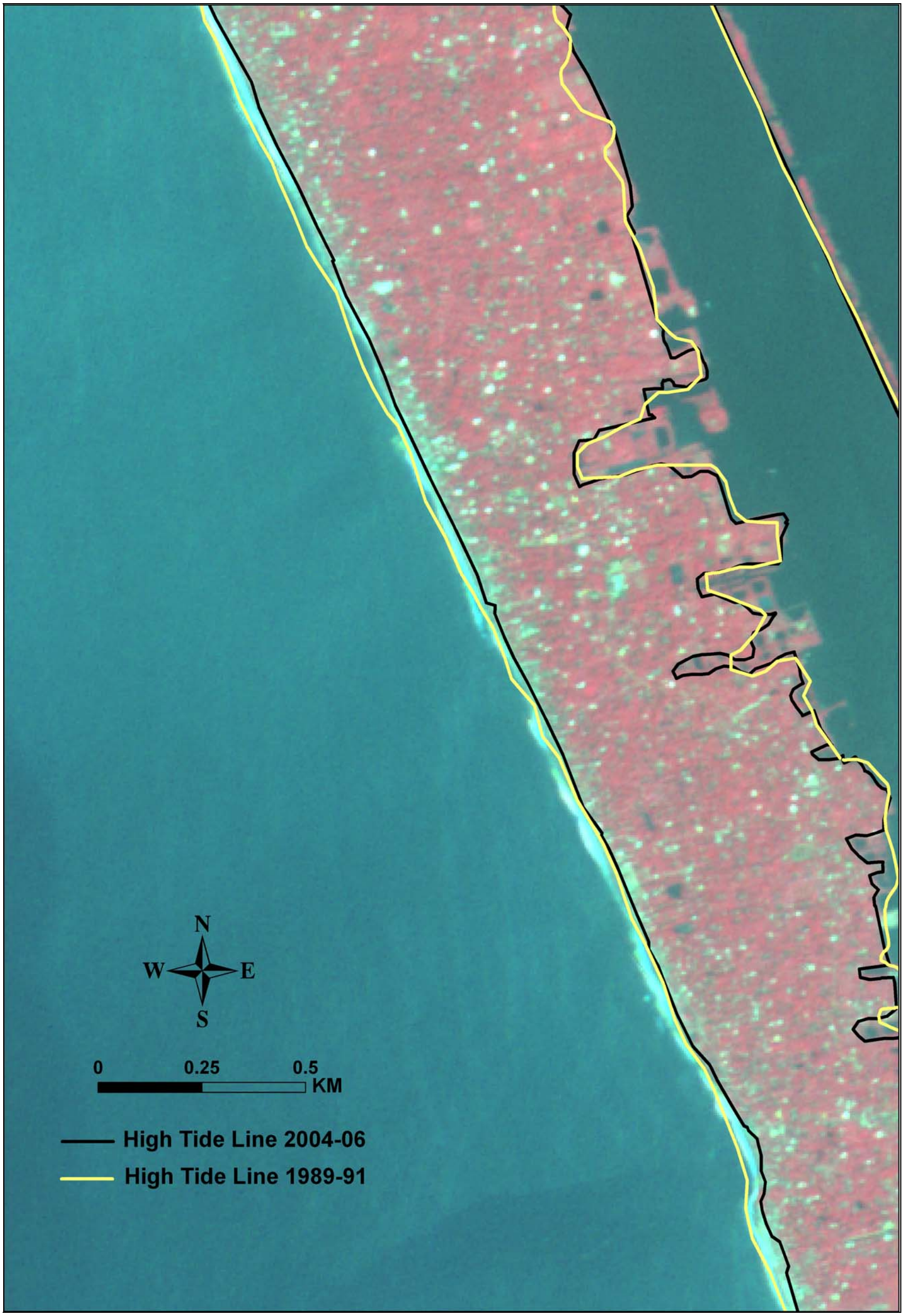

Plate 8: 2011-12 LISS IV image overlaid with high tide line of 2004-06 and 1989-91, showing severe erosion to the north of Kayamkulam Lake in Alappuzha district (58C08NE).

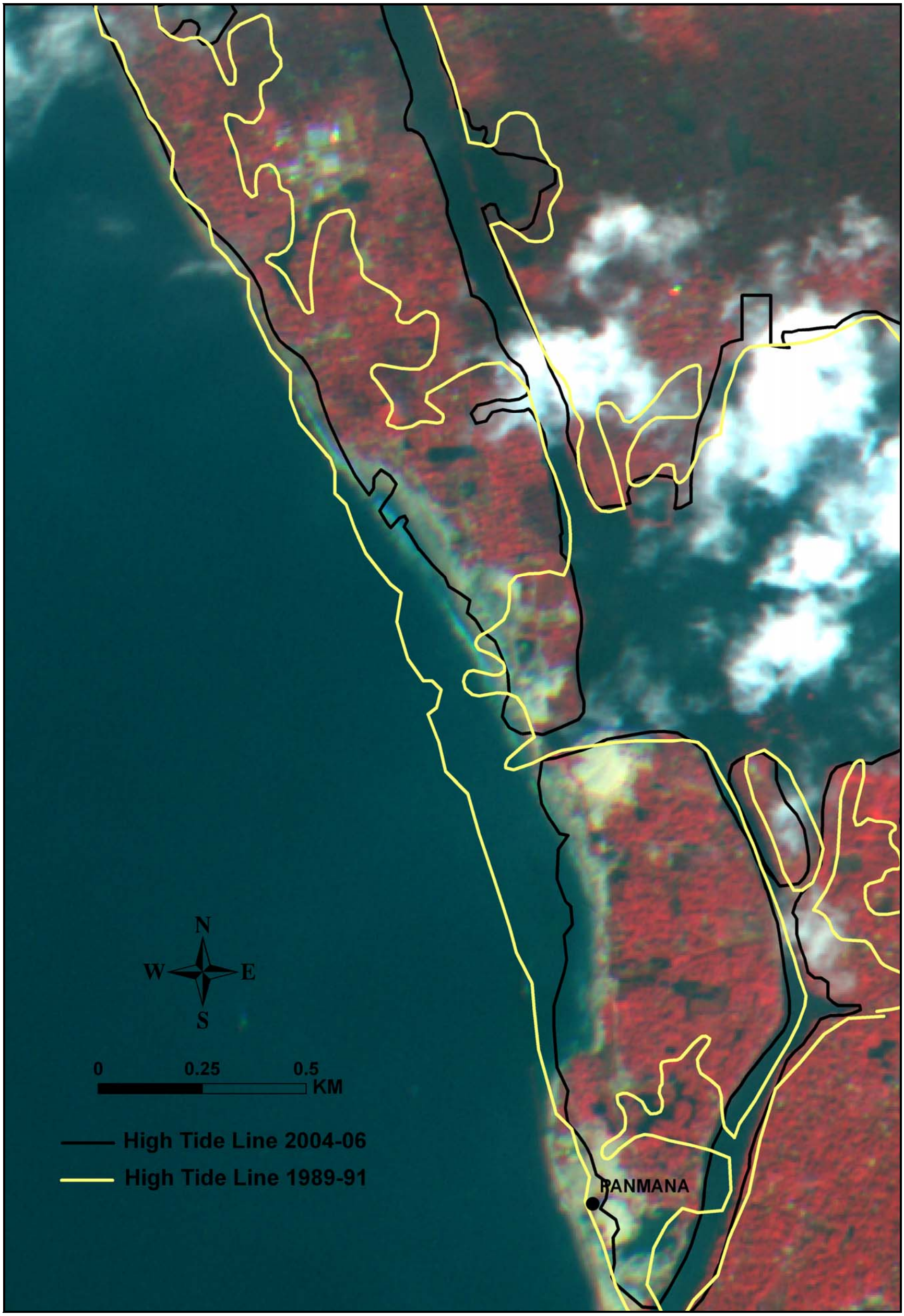

Plate 9: 2011-12 LISS IV image overlaid with high tide line of 2004-06 and 1989-91, showing severe erosion near Panamana in Kollam district (58C12SW).

FIELD PHOTOGRAPHS: KARNATAKA

Plate 10: Sea wall constructed to the north of the Kali river mouth (48J01SW) along Northern Karnataka coast

Plate 11: Casuarina plantations at Kali River mouth (48J01SW) along Northern Karnataka coast

Plate 12: Rocky coast near Kuada point to the south of Kodari (48J02NE) along Northern Karnataka coast

Plate 13: Breakwater constructed, facilitating the Jetty near Kanmanikanta Gudda (48J02NE) along Northern Karnataka coast

Plate 14: Rocky headlands at Gokarn (48J06SW) along Northern Karnataka coast

Plate 15: Accreting beach, north of Gokarna (48J06SW) along Northern Karnataka coast

Plate 16: Wide beach to the north of Gokarna (48J06SW) along Northern Karnataka coast

Plate 17: Extensive erosion visible from the steep cut of sand dunes near Kasarkod (48J07SE) along Northern Karnataka coast

Plate 18: Terrestrial vegetation getting destroyed due to erosion near Kasarkod (48J07SE) along Northern Karnataka coast

Plate 19: Pocket beaches and rocky headland near Hakkalmane (48J08NE) along Northern Karnataka coast

Plate 20: Coastal protection measures at Manki beach (48J08NE) along Northern Karnataka coast

Plate 21: Sand dunes removed due to coastal erosion to the north of Badarkere (48J08NE) along Northern Karnataka coast

Plate 22: Flat beach with rocky outcrops at Murudeswara (48J08SE) along Northern Karnataka coast

Plate 23: Protection measures to check coastal erosion, south of Bhatkal (48K09NW) along Central Karnataka coast

Plate 24: Wide sandy beach to the west of Sarpankatte (48K09NW) along Central Karnataka coast

Plate 25: Protection measures at Marvante (48K10NE) along Central Karnataka coast

Plate 26: Sea wall destruction at Marvante (48K10NE) along Central Karnataka coast

Plate 27: Accreting coast near Koteshwara (48K10SE) along Central Karnataka coast

Plate 28: Beach erosion observed near Hejmadikodi (48K16SW) along the Southern Karnataka coast

Plate 29: Artificial sand dunes from dumping of sands near Hejmadikodi (48K16SW) along the Southern Karnataka coast

Plate 30: Wave scaring to the south of Mulki-Pavanje estuarine mouth (48K16SW) along Southern Karnataka coast

Plate 31: Destruction of terrestrial vegetation to the south of Mulki-Pavanje estuarine mouth (48K16SW) along Southern Karnataka coast

Plate 32: Sea wall covered with vegetation indicating a stable shoreline north of Mukka (48K16SW) along Southern Karnataka coast

Plate 33: Beach erosion at Mukka (48K16SW) along Southern Karnataka coast

Plate 34: Measures to protect habitation from the coastal erosion at Mukka (48K16SW) along Southern Karnataka coast

Plate 35: Accretion along the wide stretch of Beach at Bengare (48L13SW) on Southern Karnataka coast

Plate 36: Sea wall constructed to the northern bank of Netravati river at Bengare (48L13SW) along Southern Karnataka coast

Plate 37: Sea wall to check coastal erosion at the southern bank of Netravati river (48L13SW) along Southern Karnataka coast

Plate 38: Very steep and narrow beach at Ullal (48L13SW) along Southern Karnataka coast

Plate 39: Seawall at Ullal (48L13SW) along Southern Karnataka coast

FIELD PHOTOGRAPHS: KERALA

Plate 40: Wide and stable beach with protection measures south of Kanjhangad (48P04NW) along Northern Kerala coast

Plate 41: Terrestrial vegetation grown seawards indicating accretion to the north of Kariangode river mouth (48P04NW) along Northern Kerala coast

Plate 42: Accreting beach with terrestrial vegetation to the south of Valapattanam river mouth (49M05NW) along Northern Kerala coast

Plate 43: Wide sandy beaches at Azhikal (49M05NW) along Northern Kerala coast

Plate 44: Constructions for recreational activities along the beach at Azhikal (49M05NW) on Northern Kerala coast

Plate 45: Rocky headland to the south of Azhikal (49M05NW) along Northern Kerala coast

Plate 46: Stable sandy beach to the north of Dharmadom (49M05SE) along Northern Kerala coast

Plate 47: Breakwater constructed to north of Muthalipuzha river (49M10SW) along Northern Kerala coast

Plate 48: Accretion along the spit to the southern coast of Muthalipuzha river mouth (49M10SW) on Northern Kerala coast

Plate 49: Beach erosion and seawall constructed to the south of Muthalipuzha river mouth (49M10SW) along Northern Kerala coast

Plate 50: Severe damage of terrestrial vegetations now protected by seawall to the south of Muthalipuzha river mouth (49M10SW) along Northern Kerala coast

Plate 51: Seawall constructions at Puthiyangadi beach (49M15SW) along Northern Kerala coast

Plate 52: Seawall constructed at Ponnani south of Bharatha Puzha river mouth (49N13SE) along Central Kerala coast

Plate 53: Wide beaches at Edakkazhiyur (49N14SE) along Central Kerala coast

Plate 54: Terrestrial vegetations growing seaward, indicating accretion to the south of Edakkazhiyur (49N14SE) along Central Kerala coast

Plate 55: Wide and accreting beach to the north of Chavakkad (58B02SW) along Central Kerala coast

Plate 56: Destruction of seawall and coconut trees along the eroding coast near Engandiyur (58B03NW) on Central Kerala coast

Plate 57: House abandoned due to erosion near Engandiyur (58B03NW) along Central Kerala coast

Plate 58: Seawall constructions to the north of Vadanapalli (58B03NW) along Central Kerala coast

Plate 59: Vegetation and habitation under threat due to erosion at Eriyad (58B04NE) along Central Kerala coast

Plate 60: Destruction of sea wall at Eriyad (58B04NE) along Central Kerala coast

Plate 61: Two layers of protection measures at Eriyad (58B04NE) along Central Kerala coast

Plate 62: Recent accretion of beach at Thottapalli (58C07SE) along Southern Kerala coast

Plate 63: Seawall construction to the south of Thottapalli (58C07SE) along Southern Kerala coast

Plate 64: Coconut plants under threat of uprooting to the north of Thrikkunnapuzha (58C07SE) along Southern Kerala coast

Plate 65: Erosion to the north of Kayamkulam Lake (58C08NE) along Southern Kerala coast

Plate 66: Sand mining activities near Panamana (58C12SW) along Southern Kerala coast

Plate 67: Abandoned house and heap of sand from sand mining activities near Panamana (58C12SW) along Southern Kerala coast

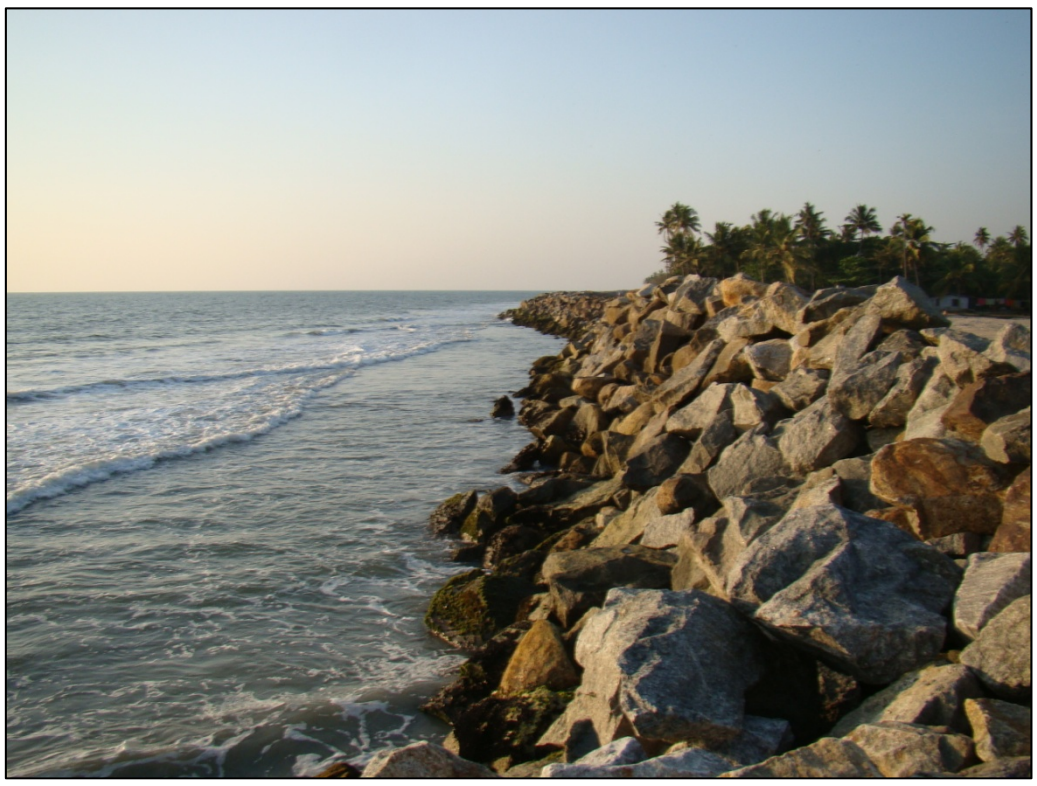

Plate 68: Seawall near Panamana (58C12SW) along Southern Kerala coast

Plate 69: Seawall at Thirumullavaram (58D09NW) along Southern Kerala coast

Annexure-III

(Data Used)

Table-3: Satellite data used for Karnataka Coast (1989-91 time-frame).

S.No	Map Number	Satellite	Sensor	Path	Row	Date
1	48J/01NW	SPOT	HRV1-MLA	D-208	320	17-03-1989
2	48J/01SE	SPOT	HRV1-MLA	D-208	320	17-03-1989
3	48J/01SW	SPOT	HRV1-MLA	D-208, D208	320, 321	17-03-1989
4	48J/02NE	SPOT	HRV1-MLA	D-208	320	17-03-1989
5	48J/06NW	SPOT	HRV1-MLA	D-208	320	17-03-1989
6	48J/07NE & 48J/07NW	SPOT	HRV1-MLA	D-208	320	17-03-1989
7	48J/07SE	SPOT	HRV1-MLA	D-208	320	17-03-1989
8	48J/08NE	SPOT	HRV1-MLA	D-208	320	17-03-1989
9	48J/08SE	SPOT	HRV1-MLA	D-208	320	17-03-1989
10	48J/12SW	SPOT	HRV1-MLA	D-208	320	17-03-1989
11	48K/09NW	SPOT	HRV1-MLA	D-208	320	17-03-1989
12	48K/09SE	SPOT	HRV1-MLA	D-208	320	17-03-1989
13	48K/09SW	SPOT	HRV1-MLA	D-208	320	17-03-1989
14	48K/10NE	SPOT	HRV1-MLA	D-208	320	17-03-1989
15	48K/10SE	SPOT	HRV1-MLA	D-208	320	17-03-1989
16	48K/11NE	SPOT	HRV1-MLA	D-208	320	17-03-1989
17	48K/11SE	SPOT	HRV1-MLA	D-208	320	17-03-1989
18	48K/12NE	SPOT	HRV1-MLA	D-208	320	17-03-1989
19	48K/16NW	SPOT	HRV1-MLA	D-208	320	17-03-1989
20	48K/16SW	SPOT	HRV1-MLA	D-208	320	17-03-1989
21	48L/13NW	SPOT	HRV1-MLA	D-208	320	17-03-1989
22	48L/13SW	SPOT	HRV1-MLA	D-208	320	17-03-1989

Table-4: Satellite data used for Kerala Coast (1989-91 time-frame).

S.No	Map Number	Satellite	Sensor	Path	Row	Date
1	48L/13SW	SPOT	HRV1-MLA	210	325	17-03-1989
2	48L/14NE 48L/14NW	SPOT	HRV1-MLA	210	325	17-03-1989
3	48L/14SE	SPOT	HRV1-MLA	210	325	17-03-1989
4	48L/15NE	SPOT	HRV1-MLA	211	325	08-3-1988

5	48P/03NW	SPOT	HRV1-MLA	211	325	08-3-1988
6	48P/03SW	SPOT	HRV1-MLA	211	325	08-3-1988
7	48P/04NE	SPOT	HRV1-MLA	211	326	07-3-1989
8	48P/04NW	SPOT	HRV1-MLA	211	326	07-3-1989
9	48P/04SE	SPOT	HRV1-MLA	211	326	07-3-1989
10	48P/08SW	SPOT	HRV1-MLA	211	326	07-3-1989
11	49M/05NE	SPOT	HRV1-MLA	211	326	07-3-1989
12	49M/05NW	SPOT	HRV1-MLA	211	326	07-3-1989
13	49M/05SE	SPOT	HRV1-MLA	211	326 327	17-03-1989 09-02-1989
14	49M/05SW	SPOT	HRV1-MLA	212	326	09-02-1989
15	49M/09SW	SPOT	HRV1-MLA	212	327	17-03-1989
16	49M/10NW 49M/06NE	SPOT	HRV1-MLA	212	327	17-03-1989
17	49M/10SE	SPOT	HRV1-MLA	212	327	17-03-1989
18	49M/10SW	SPOT	HRV1-MLA	212	327	17-03-1989
19	49M/11NE	SPOT	HRV1-MLA	213 212	327	04-02-1989 17-03-1989
20	49M/11NW	SPOT	HRV1-MLA	212	327	17-03-1989
21	49M/11SE	SPOT	HRV1-MLA	213	327	04-2-1989
22	49M/15NW	SPOT	HRV1-MLA	213 212	327	04-02-1989 17-03-1989
23	49M/15SW	SPOT	HRV1-MLA	213 213	328 327	04-02-1989
24	49M/16NW	SPOT	HRV1-MLA	213	328	04-2-1989
25	49M/16SW	SPOT	HRV1-MLA	213	328	04-2-1989
26	49N/13NE&NW	SPOT	HRV1-MLA	214	328	04-2-1989
27	49N/13SE	SPOT	HRV1-MLA	213 213	329 328	04-02-1989 04-02-1989
28	49N/14NE	SPOT	HRV1-MLA	213	329	04-02-1989
29	58B/02SW	SPOT	HRV1-MLA	214	329	04-02-1989
30	58B/03NE	SPOT	HRV1-MLA	214	329	04-02-1989
31	58B/03NW	SPOT	HRV1-MLA	214	329	04-02-1989
32	58B/03SE	SPOT	HRV1-MLA	214 214	330 329	04-02-1989 04-02-1989
33	58B/03SW	SPOT	HRV1-MLA	214	329	04-02-1989

34	58B/04NE	SPOT	HRV1-MLA	214	330	04-02-1989
35	58B/04SE	SPOT	HRV1-MLA	214	330	04-02-1989
36	58B/08NW	SPOT	HRV1-MLA	214	330	04-02-1989
37	58B/08SW	SPOT	HRV1-MLA	214	330	04-02-1989
38	58C/05NW 58C/01NE	SPOT	HRV1-MLA	214	330	04-02-1989
39	58C/05SE	SPOT	HRV1-MLA	215	331	23-11-1989
40	58C/05SW	SPOT	HRV1-MLA	215	331	23-11-1989
41	58C/06NE	SPOT	HRV1-MLA	215	331	23-11-1989
42	58C/06NW	SPOT	HRV1-MLA	215	331	23-11-1989
43	58C/06SW	SPOT	HRV1-MLA	215	331	23-11-1989
44	58C/07NW	SPOT	HRV1-MLA	215	331	23-11-1989
45	58C/07SW 58C/07SE	SPOT	HRV1-MLA	215 215	332, 331	07-11-1989 23-11-1989
46	58C/08NE	SPOT	HRV1-MLA	215	332	07-11-1989
47	58C/08SE	SPOT	HRV1-MLA	215	332	07-11-1989
48	58C/12SE	SPOT	HRV1-MLA	215	332	07-11-1989
49	58C/12SW	SPOT	HRV1-MLA	215	332	07-11-1989
50	58D/09NE	SPOT	HRV1-MLA	215	332	07-11-1989
51	58D/09NW	SPOT	HRV1-MLA	215	332	07-11-1989
52	58D/09SE	SPOT	HRV1-MLA	216 215	333 332	09-12-1990 07-11-1989
53	58D/09SW	SPOT	HRV1-MLA	215	332	7-11-1989
54	58D/10NE	SPOT	HRV1-MLA	216	333	9-12-1990
55	58D/14NW	SPOT	HRV1-MLA	216	333	9-12-1990
56	58D/14SE	SPOT	HRV1-MLA	216	333	9-12-1990
57	58D/14SW	SPOT	HRV1-MLA	216	333	9-12-1990
58	58D/15NE	SPOT	HRV1-MLA	216	333	9-12-1990
59	58H/03SW	SPOT	HRV1-MLA	216	333	9-12-1990

Table-5: Satellite data used for Karnataka Coast (2004-06 time-frame).

Sr. No	Map Number	Satellite	Sensor	Orbit	Scene	Date
1	48J/01NW	IRS P6	LISS IV	8185, 11581	59, 124	15-05-2006 09-01-2006
2	48J/01SE	IRS P6	LISS IV	8185	59, 60	15-05-2005
3	48J/01SW	IRS P6	LISS IV	8185	59, 60	15-05-2005
4	48J/02NE	IRS P6	LISS IV	8185	60	15-05-2005
5	48J/06NW	IRS P6	LISS IV	7290, 8085	111, 60	13-03-2005 15-05-2005
6	48J/07NW	IRS P6	LISS IV	7290	111, 112	13-03-2005
7	48J/08NE 48J/08SE	IRS P6	LISS IV	11311	117	21-12-05
8	48J/12SW	IRS P6	LISS IV	7489	111	27-03-2005
9	48K/09SE	IRS P6	LISS IV	7489	112	27-03-2005
10	48K/09NW 48K/09SW	IRS P6	LISS IV	10288	118	10-10-2005
11	48K/10NE 48K/10SE	IRS P6	LISS IV	7489	114	27-03-2005
12	48K/11NE	IRS P6	LISS IV	7489	113	27-03-2005
13	48K/11SE	IRS P6	LISS IV	5727	118	29-11-2004
14	48K/12NE	IRS P6	LISS IV	5727	119	23-11-2004
15	48K/16NW 48K/16SW	IRS P6	LISS IV	5727	119	23-09-2004 20-10-2005
16	48L/13NW 48L13SW	IRS P6	LISS IV	11524	120, 121	05-01-2006

Table-6: Satellite data used for Kerala Coast (2004-06 time-frame).

Sr. No	Map Number	Satellite	Sensor	Orbit	Scene	Date
1	48L/13SW, 48L/13SE	IRS P6	LISS IV	11524	120	5-1-2006
2	48L/14NW, 48L/14SE	IRS P6	LISS IV	11922	141, 142	2-2-2006
3	48P/03NW, 48P/03SW	IRS P6	LISS IV	11922	141, 142	2-2-2006

4	48P/04NE, 48P/04NW, 48P/04SE	IRS P6	LISS IV	11993	53, 54	7-2-2006
5	49P8SW, 49M/05NE, 49M/05NW, 49M/05SW	IRS P6	LISS IV	11652	125, 126	14-01-2006
6	49M/05SE, 49M/05SW, 49M/10NW, 49M/06NE, 49M/09SW	IRS P6	LISS IV	1976	141, 142	4-3-2004
7	49M/10SW, 49M11NE, 49M/11NW	IRS P6	LISS IV	2658	136	21-04-2004
8	49M/10SE, 49M/11NE, 49M/11SE	IRS P6	LISS IV	5926	123	7-12-2004
9	49M/15NW, 49M/15SW; 49M16NW, 49M16SW; 49N13/NE, SE, NW	IRS P6	LISS IV	12078	151, 152, 153	13-02-2006
10	49N/13NE, NW, SE	IRS P6	LISS IV	11396	130	27-12-05
11	49N/13NE, 49N/13SE; 49N14NE, 58B/02SW	IRS P6	LISS IV	1365	149, 150, 151	21-01-2004
12	58B/02SW, 58B/03NW, NE, SW	IRS P6	LISS IV	1706	149, 150	14-02-2004
13	58B/02SW, 58B/03NW, NE, SW, SE, 58B04/NE, 58B04SE	IRS P6	LISS IV	2047	148	9-3-2004

14	58C/01NE, 58C/05NW, 58C/05SW; 58B04/NE, 58B04SE; 58B/03NE, 58B/03SE; 58B/08NW, 58B/08SW	IRS P6	LISS IV	11112	131, 132, 133	7-12-2005
15	58C/05SE, SW, NW; 58C/06NE, NW, SW; 58B/08SW	IRS P6	LISS IV	12490	114, 115	14-03-2006
16	58C/07SE, 58C/08NE, 58C/06SW, 58C/07NW, 58C/07SW	IRS P6	LISS IV	12064	26, 27, 28, 29	12-2-2006
17	58C/08NE, 58C/08SE; 58C/12SW, 58C/12SE; 58D/09NE, 58D/09NW	IRS P6	LISS IV	6338	133	5-1-2005
18	58D/09NW, SW, SE; 58C/12SW; 58C/05SW, NW, SE; 58C/06NE, NW, SW, SE	IRS P6	LISS IV	12007	160, 161	8-2-2006
19	58D/09NE, 58D/09SE; 58D/10NE; 58D/14NW, 58D/14SW	IRS P6	LISS IV	11737	133, 134	20-01-2006
20	58D/15NE; 58H/03SW; 58D/14SE	IRS P6	LISS IV	11936	127, 128	3-2-2006

Table-7: Protected and vulnerable reaches, Mangalore.

Protected Reaches	
Latitude/Longitude	Length (in m)
Lat - 12^0 58' 30" Long - 74^0 47' 48"	25.00
Lat - 12^0 58' 50" Long - 74^0 47' 44"	25.00
Lat - 12^0 58' 50" Long - 74^0 47' 44"	100.00
Lat - 12^0 58' 50" Long - 74^0 47' 44"	25.00
Lat - 12^0 58' 50" Long - 74^0 47' 44"	25.00
Lat - 13^0 02' 53" Long - 74^0 46' 53"	20.00
Lat - 13^0 03' 02" Long - 74^0 46' 51"	25.00
Lat - 13^0 03' 10" Long - 74^0 46' 59"	25.00

Vulnerable Reaches	
Latitude/Longitude	Length (in m)
Lat - 12^0 49' 36" Long - 74^0 50' 08"	738.00
Lat - 12^0 50' 05" Long - 74^0 49' 58"	2750.00
Lat - 12^0 50' 52" Long - 74^0 49' 26"	924.00
Lat - 12^0 57' 46" Long - 74^0 47' 56"	250.00
Lat - 12^0 58' 01" Long - 74^0 47' 53"	90.00
Lat - 12^0 59' 10" Long - 74^0 47' 38"	281.00
Lat - 12^0 59' 10" Long - 74^0 47' 38"	205.00
Lat - 13^0 00' 08" Long - 74^0 47' 25"	200.00
Lat - 13^0 01' 24" Long - 74^0 47' 09"	1170.00
Lat - 13^0 02' 37" Long - 74^0 46' 56"	3495.00

Table-8: Location and specification of protection measures implemented, Mangalore.

Location Taluka/District	Type of Protection work	Specification	Latitude/Longitude
Mangalore/ Dakshina Kannada	Emergent Protection Work	Ullala Town Mangalore Taluk Ch : 6.007 to 6.745 km Length : 738.00m Type : Sea Wall Constructed using Armour Stones	Lat - 12^0 49' 36" Long - 74^0 50' 08"
Mangalore/ Dakshina Kannada	Emergent Protection Work	Ullala Town Mangalore Taluk Ch : 7.425 to 10.175 km Length : 2750.00 m Type : Sea Wall Constructed using Armour Stones	Lat - 12^0 50' 05" Long - 74^0 49' 58"
Mangalore/ Dakshina Kannada	Emergent Protection Work	Bengre Village Mangalore Taluk Ch : 10.706 to 11.630 km Length : 924.00m Type : Sea Wall Constructed using Armour Stones	Lat - 12^0 50' 52" Long - 74^0 49' 26"
Manglore/ Dakshina Kannada	Emergent Protection Work	Kulai Village Mangalore Taluk Ch : 24.400 to 24.650 km Length : 250.00 m Type : Sea Wall Constructed using Armour Stones	Lat - 12^0 57' 46" Long - 74^0 47' 56"
Manglore/ Dakshina Kannada	Emergent Protection Work	Kulai Village Mangalore Taluk Ch : 24.983 to 25.073 km Length : 90.00 m Type : Sea Wall Constructed using Armour Stones	Lat - 12^0 58' 01" Long - 74^0 47' 53"
Manglore/ Dakshina Kannada	Permanent Sea Wall	Hosabettu Village Mangalore Taluk Ch : 25.950 to 25.975 km Length : 25.00 m Type : KERS Designed Sea Wall Constructed using Armour Stones	Lat - 12^0 58' 30" Long - 74^0 47' 48"

Manglore/ Dakshina Kannada	Permanent Sea Wall	Hosabettu Village Mangalore Taluk Ch : 26.150 to 26.175 km Length : 25.00 m Type : KERS Designed Sea Wall Constructed using Armour Stones	Lat - 12^0 58' 50" Long - 74^0 47' 44"
Manglore/ Dakshina Kannada	Permanent Sea Wall	Hosabettu Village Mangalore Taluk Ch : 26.175 to 26.275 km Length : 100.00 m Type : KERS Designed Sea Wall Constructed using Armour Stones	Lat - 12^0 58' 50" Long - 74^0 47' 44"
Manglore/ Dakshina Kannada	Permanent Sea Wall	Hosabettu Village Mangalore Taluk Ch : 26.275 to 26.300 km Length : 25.00 m Type : KERS Designed Sea Wall Constructed using Armour Stones	Lat - 12^0 58' 50" Long - 74^0 47' 44"
Manglore/ Dakshina Kannada	Permanent Sea Wall	Hosabettu Village Mangalore Taluk Ch : 26.325 to 26.350 km Length : 25.00 m Type : KERS Designed Sea Wall Constructed using Armour Stones	Lat - 12^0 58' 50" Long - 74^0 47' 44"
Manglore/ Dakshina Kannada	Emergent Protection Work	Hosabettu Village Mangalore Taluk Ch : 26.550 to 26.831 km Length : 281.00 m Type : Sea Wall Constructed using Armour Stones	Lat - 12^0 59' 10" Long - 74^0 47' 38"
Manglore/ Dakshina Kannada	Emergent Protection Work	Gudde Koppala Village Mangalore Taluk Ch : 26.920 to 27.125 km Length : 205.00 m Type : Sea Wall Constructed using Armour Stones	Lat - 12^0 59' 10" Long - 74^0 47' 38"

Manglore/ Dakshina Kannada	Emergent Protection Work	Gudde Koppala Village Mangalore Taluk Ch : 27.726 to 27.926 km Length : 200.00 m Type : Sea Wall Constructed using Armour Stones	Lat - 13^0 00' 08" Long - 74^0 47' 25"
Manglore/ Dakshina Kannada	Emergent Protection Work	Mukka - Sasihitlu Village Mangalore Taluk Ch : 30.650 to 31.820 km Length : 1170.00 m Type : Sea Wall Constructed using Armour Stones	Lat - 13^0 01' 24" Long - 74^0 47' 09"
Manglore/ Dakshina Kannada	Emergent Protection Work	Mukka - Sasihitlu Village Mangalore Taluk Ch : 32.035 to 35.530 km Length : 3495.00 m Type : Sea Wall Constructed using Armour Stones	Lat - 13^0 02' 37" Long - 74^0 46' 56"
Manglore/ Dakshina Kannada	Permanent Sea Wall	Sasihitlu Village Mangalore Taluk Ch : 33.530 to 35.550 km Length : 20.00 m Type : KERS Designed Sea Wall Constructed using Armour Stones	Lat - 13^0 02' 53" Long - 74^0 46' 53"
Manglore/ Dakshina Kannada	Permanent Sea Wall	Sasihitlu Village Mangalore Taluk Ch : 35.805 to 35.830 km Length : 25.00 m Type : KERS Designed Sea Wall Constructed using Armour Stones	Lat - 13^0 03' 02" Long - 74^0 46' 51"
Manglore/ Dakshina Kannada	Permanent Sea Wall	Sasihitlu Village Mangalore Taluk Ch : 36.105 to 36.130 km Length : 25.00 m Type : KERS Designed Sea Wall Constructed using Armour Stones	Lat - 13^0 03' 10" Long - 74^0 46' 59"

Table-9: Location and specification of protection measures implemented, Mangalore.

Protected Reaches		Vulnerable Reaches	
Latitude / Longitude	Length (In m)	Latitude / Longitude	Length (in m)
A) Kaup Assembly constituency			
From 13°05'09" N 74°46'29" E To 13°05'47" N 74°46'15" E Hejmady Kodi	1200.00		
From 13°06'16" N 74°46'07" E To 13°06'19" N 74°46'06" E Hejmady	100.00		
From 13°06'28" N 74°46'05" E To 13°06'31" N 74°46'04" E Hejmady	100.00		
From 13°08'47" N 74°46'21" E To 13°08'47" N 74°46'24" E Padubidre Nadipatna	300.00		
From 13°08'44" N 74°45'33" E To 13°08'46" N 74°45'33" E Padubidre Kadipatna	100.00		
13°09'18" N 74°45'25" E Tenka Yermal	100.00	From 13°09'22" N 74°45'24" E To 13°09'34" N 74°45'21" E Tenka Yermal	500.00
13°09'36" N 74°45'20" E Tenka Yermal	100.00		
From 13°09'42" N 74°45'18" E To 13°09'50" N 74°45'16" E Tenka Yermal (Near Breakwater)	400.00	From 13°09'42" N 74°45'18" E To 13°09'50" N 74°45'16" E Tenka Yermal (Near Breakwater)	400.00
From 13°10'25" N 74°45'07" E	400.00		

To 13°10'33" N 74°45'05" E Bada Yermal			
13°13'35" N 74°44'11" E Kaup Padu	40.00	13°13'35" N 74°44'11" E Kaup Padu	50.00
13°16'25" N 74°43'20" E Uliyargoli Padukere	50.00		
From 13°16'29" N 74°43'29" E To 13°17'25" N 74°43'12" E Katpadi Mattu cross to Padukere Kanakoda Bhajana Mandira, Udyavara.	3300.00	From 13°16'29" N 74°43'29" E To 13°17'25" N 74°43'12" E Katpadi Mattu cross to Padukere Kanakoda Bhajana Mandira, Udyavara.	3300.00
From 13°17'25" N 74°43'13" E To 13°17'35" N 74°43'12" E Udyavara Padukere (North of Udyavara Kanakoda Bhajana Mandira)	400.00		
13°20'49" N 74°43'20" E Kidiyooru Kudru Kere	100.00		
13°20'08" N 74°42'28" E Kidiyooru Padukere	50.00		
B) Byndoor Assembly constituency			
13°55'24" N 74°35'04" E Shiroor Alvegadde	200.00		
13°54'43" N 74°35'22" E Shiroor Karavali	600.00		
13°51'4" N 74°36'2" E Paduvary	190.00		
13°50'36" N 74°36'53" E Hosahitlu	200.00		
13°50'20" N	50.00		

74°36'35" E Paduvary			
13°50'05" N 74°36'20" E Paduvary	1170.00		
13°47'20" N 74°37'02" E Koderi	100.00		
13°48'52" N 74°37'16" E Karkikali	600.00	13°48'10" N 74°37'12" E Karkikali	2200.00
C) Udupi Assembly constituency			
13°24'30" 74°41'30" Paduthonse Perlakadi	65.00		
13°24'30" 74°41'30" Hude Perlakadi	190.00		
13°23' 74°42'30" Kemmannu Hude	200.00		
13°23'30" 74°42' Kemmannu Hude	23.00		
13°23'30" 74°42' Paduthonse Perlakadi	25.00		
13°24' 74°41' Paduthonse Hoode	650.00		
13°24' 74°41' Paduthonse Hoode	140.00		
13°23'30" 74°39'30" Paduthose Perlakadi	25.00		
		13°22'30" 74°38'	110.00
		13°22'30" 74°38'	80.00
		13°22'30" 74°38'	100.00
		13°24' 74°41'	200.00
D) Kundapur Assembly constituency			
13°25'20" 74°39'30"	550.00		

Kodi Bengre				
13°25'23" N 74°39'31" E Kodi Bengre	175.00			
13° - 27½' 74°-42' Kodi Bengre	100.00			
13° - 26½' 74°-41' Hangarakatte	21.00			
13°28'13" N 74°41'22" E Kodi Kanyana	500.00	13°28'13" N 74°41'22" E	40.00	
13°28'30" N 74°41'10" E Kotatattu	170.00			
13°29'37" N 74°41'13" E Kotatattu	200.00			
13°29'39" N 74°41'14" E Kotatattu	300.00			
13° 25'30" 74°40'33" Kundapura Kodi	550.00			
13° 26'19" 74°41'36" Kundapura Kodi	1100.00	13° 26'19" 74°41'36"	46.00	

Table-10: Protected reaches of Bhatkal and Honavar, Uttar Kannada district.

Sr. No.	PROTECTED REACHES					
	Latitude/Longitude		Length (km)	Coastal Chainage (km)		Location
	From	To		From	To	
BHATKAL TALUKA IN UTTARA KANNADA DISTRICT						
1	13°55.5' N 74°34.7' E	13°56.26' N 74°34.4' E	1.556	138.060	139.616	Gorte
2	13°56.26' N 74°34.4' E	13°56.66' N 74°34.24' E	0.870	139.780	140.650	Belke
3	13°56.84' N 74°33.64' E	13°57' N 74°33.52' E	0.300	141.925	142.225	Hadinsudigadde

4	13^{0}57.64’ N 74^{0}32.44’ E	13^{0}57.84’ N 74^{0}32.30’ E	0.450	145.550	146.000	Mundalli
5	13^{0}58.08’ N 74^{0}31.9’ E	13^{0}58.1’ N 74^{0}31.82’ E	0.042	147.300	147.342	Talgod
6	13^{0}58.24’ N 74^{0}31.72’ E	13^{0}58.36’ N 74^{0}31.64’ E	0.240	147.830	148.070	Talgod
7	13^{0}59.02’ N 74^{0}31’ E	13^{0}59.56’ N 74^{0}30.8’ E	1.177	149.675	150.852	Jalikodi
8	13^{0}59.68’ N 74^{0}30.8’ E	13^{0}59.72’ N 74^{0}30.76’ E	0.084	151.074	151.158	Jali
9	13^{0}59.94’ N 74^{0}30.56’ E	14^{0}0.68’ N 74^{0}30.44’ E	1.324	151.670	152.994	Honnegadde-Hertar
10	14^{0}0.82’ N 74^{0}30.4’ E	14^{0}1.42’ N 74^{0}30.3’ E	1.270	153.280	154.550	Tenginagundi
11	14^{0}1.68’ N 74^{0}30.24’ E	14^{0}1.9’ N 74^{0}30.1’ E	0.754	154.750	155.504	Alvekodi
12	14^{0}4.14’ N 74^{0}29.6’ E	14^{0}4.32’ N 74^{0}29.56’ E	0.400	159.680	160.080	Mathadahitlu
13	14^{0}4.9’ N 74^{0}29.4’ E	14^{0}5.32’ N 74^{0}29.24’ E	0.785	161.100	161.885	Mavalli
14	14^{0}6.46’ N 74^{0}29.06’ E	14^{0}6.68’ N 74^{0}28.37’ E	0.550	162.550	163.100	Murdeshwar
15	14^{0}7.03’ N 74^{0}28.84’ E	14^{0}7.22’ N 74^{0}28.78’ E	0.504	163.650	164.154	Tudalli
16	14^{0}8.36’ N 74^{0}28.68’ E	14^{0}8.38’ N 74^{0}28.50’ E	0.250	165.200	165.450	Bailur Anantwadi
		Total	10.556			
HONNAVAR TALUKA IN UTTARA KANNADA DISTRICT						
1	14^{0}9.12’ N 74^{0}28.58’ E	14^{0}10.26’ N 74^{0}28.49’ E	1.302	170.700	172.002	Manki Doddagunda
2	14^{0}10.26’ N 74^{0}28.3’ E	14^{0}10.45’ N 74^{0}28.11’ E	0.625	172.025	172.650	Manki
3	14^{0}10.83’ N 74^{0}28.25’ E	14^{0}11.97’ N 74^{0}27.83’ E	1.705	172.730	174.435	Manki
4	14^{0}15.97’ N 74^{0}25.82’ E	14^{0}16.07’ N 74^{0}25.80’ E	0.200	184.230	184.430	Kasarkod Tonka
5	14^{0}16.17’ N 74^{0}25.76’ E	14^{0}16.92’ N 74^{0}25.51’ E	1.440	184.620	186.060	Kasarkod Tonka
6	14^{0}17.80’ N 74^{0}25.39’ E	14^{0}18.12’ N 74^{0}25.16’ E	0.780	188.110	188.890	Pavinakurve

7	14^{0}18.24’ N 74^{0}25.11’ E	14^{0}18.30’ N 74^{0}25.08’ E	0.105	189.108	189.213	Pavinakurve
8	14^{0}18.46’ N 74^{0}25.01’ E	14^{0}18.48’ N 74^{0}25’ E	0.055	189.530	189.585	Pavinakurve
9	14^{0}18.65’ N 74^{0}24.93’ E	14^{0}18.90’ N 74^{0}24.84’ E	0.530	189.895	190.425	Pavinakurve
10	14^{0}18.92’ N 74^{0}24.80’ E	14^{0}18.93’ N 74^{0}24.79’ E	0.045	190.447	190.492	Taribagilu
11	14^{0}19’ N 74^{0}24.70’ E	14^{0}19.2’ N 74^{0}24.68’ E	0.138	190.750	190.888	Taribagilu
12	14^{0}19.4’ N 74^{0}24.60’ E	14^{0}19.7’ N 74^{0}24.55’ E	0.570	192.030	192.600	Taribagilu
		Total	7.495			
		Grand Total	18.051			

Table-11: Location and specification of Protection measures. Kumta, Uttar Kannada district.

Location Taluk/District,	Type of Protection Work	Specification	Latitude /Longitude
Kumta/ Uttara Kannada	Sea Wall	Dhareshwara Ch-196.00 to 196.30km Length-300m Type-Constructed Using Armour Stones	Lat - 14°23' Long- 74°25'
Kumta/ Uttara Kannada	Sea Wall	Kadekodi- Alvedande Ch-201.00 to 201.250km Length-250m Type-Constructed Using Armour Stones	Lat - 14°26' Long- 74°22'
Kumta/ Uttara Kannada	Sea Wall	Vannalli Ch-203.088 to 203.590 km Length-502m Type-Constructed Using Armour Stones	Lat - 14°27' Long- 74°20'
Kumta/ Uttara Kannada	Sea Wall	Kadle Ch-206.950 to 207.100km Length-150m Type-CWPRS Designed Sea Wall Constructed Using Armour Stones	Lat - 14°27' Long- 74°20'

Kumta/ Uttara Kannada	Sea Wall	Kadle Ch-207.100 to 207.200km Length-100m Type-KERS Designed Sea Wall Constructed Using Armour Stones	Lat - 14°27' Long- 74°20'
Kumta/ Uttara Kannada	Sea Wall	Holanagadde Ch-208.600 to 208.900km Length-300m Type- CWPRS Designed Sea Wall Constructed Using Armour Stones	Lat - 14°14'27" Long- 74°25'
Kumta/ Uttara Kannada	Sea Wall	Bada Ch-209.778 to 210.019 km Length-275m Type-Constructed Using Armour Stones	Lat - 14°14'27" Long- 74°20'
Kumta/ Uttara Kannada	Sea Wall	Bada Ch-209.750 to 210.040 km Length-290m Type-CWPRS Designed Sea Wall Constructed Using Armour Stones	Lat - 14°14'27" Long- 74°20'
Kumta/ Uttara Kannada	Sea Wall	Hubbangeri Ch-210.3 to 210.8 km Length-500m Type-Emergent Protection Work Constructed Using Armour Stones	Lat - 14°14'27" Long- 74°20'
Kumta/ Uttara Kannada	Sea Wall	Jestapura Ch-210.8- 210.83 km Length-38m Type-CWPRS Designed Sea Wall Constructed Using Armour Stones	Lat - 14°14'27" Long- 74°20'
Kumta/ Uttara Kannada	Sea Wall	Kirubele Ch-215.220 to 215.710 km Length-490m Type-Sea Wall Constructed Using Armour Stones	Lat - 14°14'27" Long- 74°20'

Kumta/ Uttara Kannada	Sea Wall	Tadari Ch-217.590 to 218.300 km Length-710m Type-CWPRS Designed Sea Wall Constructed Using Armour Stones	Lat - 14°31' Long- 74°20'
Kumta/ Uttara Kannada	Sea Wall	Tadari - Belekan Ch-218.6 to 219 km Length-370m Type-KERS Designed Sea Wall Constructed Using Armour Stones	Lat - 14°31' Long- 74°21'
Kumta/ Uttara Kannada	Sea Wall	Gokarna Ch-225.015 to 225.211 km Length-275m Type-CWPRS Designed Sea Wall Constructed Using Armour Stones	Lat - 14°32' Long- 74°19'
Kumta/ Uttara Kannada	Sea Wall	Dubbanashashi Ch-227.230 to 227.510 km Length-280m Type-CWPRS Designed Sea Wall Constructed Using Armour Stones	Lat - 14°35'30" Long- 74°18'
Kumta/ Uttara Kannada	Sea Wall	Gangekolla Ch-230.5- 230.542 km Length-42m Type-Emergent Protection Wall Constructed Using Armour Stones	Lat - 14°35' Long- 74°18'

Table-12: Protected coastal reaches of Ankola and Karwar, Uttar Kannada district.

Sr.No.	PROTECTED REACHES					
	Latitude/ Longitude		Length (km)	Coastal Chainage (km)		Loacation
	From	To		From	To	
ANKOLA TALUKA IN UTTARA KANNADA DISTRICT						
1	14^0 36.9'N $74^0$17.50'E	14^0 36.8'N $74^0$17.30'E	0.400	232.035	232.435	Manjuguni
2	14^0 38.5'N $74^0$37.46'E	14^0 38.58N $74^0$17.47'E	0.620	239.380	240.000	Belamber
3	14^0 38.11'N 74^0 17.5'E	14^0 38.29N 74^0 17.5'E	0.540	240.130	240.670	Belamber
4	14^0 34.57'N $74^0$16.38'E	14^0 34.59'N $74^0$16.37'E	0.020	244.930	244.950	Keni
5	14^0 40.14'N $74^0$16.47'E	14^0 30.30'N $74^0$16.57'E	0.600	246.250	246.850	Keni
6	14^0 40.31'N $74^0$16.57'E	14^0 41.35'N $74^0$16.30'E	0.180	246.880	247.060	Keni
7	14^0 41.25'N $74^0$16.30'E	14^0 41.27'N $74^0$16.31'E	0.045	248.355	248.400	Bhavikeri
8	14^0 41.27'N $74^0$16.30'E	14^0 41.32'N $74^0$16.27'E	0.200	248.400	248.600	Bhavikeri
9	14^0 42.2'N $74^0$16.12'E	14^0 42.8'N $74^0$16.7'E	0.260	249.700	249.960	Belekeri
10	14^0 42.40'N $74^0$15.49'E	14^0 42.52'N $74^0$15.49'E	0.125	252.000	252.125	Harwada
11	14^0 43.54'N $74^0$15.17'E	14^0 44.1'N $74^0$15.10'E	0.634	253.800	254.434	Harwada
		Total	3.624			
KARWAR TALUKA IN UTTARA KANNADA DISTRICT						
1	14^0 46.45'N $74^0$10.7'E	14^0 46.35'N $74^0$10.7'E	0.950	255.750	256.700	Mudga
2	14^0 51.5'N $74^0$6.7'E	14^0 55.5'N $74^0$6.7'E	1.790	290.810	292.600	Kodibag
3	14^0 51.2'N $74^0$6.39'E	14^0 51.38'N $74^0$6.32'E	0.600	294.155	294.755	Devbag
4	14^0 51.8'N $74^0$6.42'E	14^0 51.46'N $74^0$6.36'E	1.098	295.977	297.075	Devbag
5	14^0 52.37'N $74^0$6.14'E	14^0 52.48'N $74^0$6.2'E	0.500	298.200	298.700	Dandebag
		Total	4.938			
		Grand Total	8.562			

Table-13: Specification of protection measures for coastal reaches of Ankola and Karwar, Uttar Kannada district.

Sr. No	Location (Taluka/ District)	Length (km)	Coastal Chainage (km)		Type of Protec-tion Work	Specification	Latitude/ Longitude	
			From	To			From	To
ANKOLA TALUKA IN UTTARA KANNADA DISTRICT								
1	Manjuguni	0.400	232.035	232.435	Sea Wall	Length 19.25 m Type-Rubble Mound Type as per Design Furnished by C.W.P.R.S Pune.	14^0 36.9'N $74^0$17.50' E	14^0 36.8'N $74^0$17.30' E
2	Belamber	0.620	239.380	240.000	Sea Wall	..Do..	$14^0$38.5'N $74^0$37.46' E	$14^0$38.58 N $74^0$17.47' E
3	Belamber	0.540	240.130	240.670	Sea Wall	..Do..	$14^0$38.11' N 74^0 17.5'E	$14^0$38.29 N $74^0$17.5'E
4	Keni	0.020	244.930	244.950	Sea Wall	..Do..	$14^0$34.57' N $74^0$16.38' E	$14^0$34.59' N $74^0$16.37' E
5	Keni	0.600	246.250	246.850	Sea Wall	..Do..	$14^0$40.14' N $74^0$16.47' E	$14^0$30.30' N $74^0$16.57' E
6	Keni	0.180	246.880	247.060	Sea Wall	..Do..	$14^0$40.31' N $74^0$16.57' E	$14^0$41.35' N $74^0$16.30' E
7	Bhavikeri	0.045	248.355	248.400	Sea Wall	..Do..	$14^0$41.25' N $74^0$16.30' E	$14^0$41.27' N $74^0$16.31' E
8	Bhavikeri	0.200	248.400	248.600	Sea Wall	..Do..	$14^0$41.27' N $74^0$16.30' E	$14^0$41.32' N $74^0$16.27' E
9	Belekeri	0.260	249.700	249.960	Sea Wall	..Do..	14^0 42.2'N $74^0$16.12' E	14^0 42.8'N $74^0$16.7'E
10	Harwada	0.125	252.000	252.125	Sea Wall	..Do..	$14^0$42.40' N $74^0$15.49'	$14^0$42.52' N $74^0$15.49'

							E	E
11	Harwada	0.634	253.800	254.434	Sea Wall	..Do..	$14^0$43.54' N $74^0$15.17' E	14^0 44.1'N $74^0$15.10' E
	Total	3.624						
KARWAR TALUKA IN UTTARA KANNADA DISTRICT								
1	Mudga	0.950	255.750	256.700	..Do..		$14^0$46.45' N $74^0$10.7'E	$14^0$46.35' N $74^0$10.7'E
2	Kodibag	1.790	290.810	292.600	..Do..		14^0 51.5'N $74^0$6.7'E	14^0 55.5'N $74^0$6.7'E
3	Devbag	0.600	294.155	294.755	..Do..		14^0 51.2'N $74^0$6.39'E	$14^0$51.38' N $74^0$6.32'E
4	Devbag	1.098	295.977	297.075	..Do..		14^0 51.8'N $74^0$6.42'E	14^0 51.46'N $74^0$6.36'E
5	Dandebag	0.500	298.200	298.700	..Do..		$14^0$52.37' N $74^0$6.14'E	$14^0$52.48' N $74^0$6.2'E
	Total	4.938						
	Grand Total	8.562						

Table-14: Vulnerable reaches, Kumta, Uttara Kannada district.

Sr. No.	Latitude/ Longitude	Length
1.	Lat - 14°30' Long-74°17'	500mt
2.	Lat - 14°27' Long-74°18'	1000mt

Table-15: Vulnerable coastal reaches of Ankola and Karwar, Uttar Kannada district.

Sr.No	VULNERABLE REACHES					
	Latitude/ Longitude		Length (km)	Coastal Chainage (km)		Loacation
	From	To		From	To	
	ANKOLA TALUKA IN UTTARA KANNADA DISTRICT					
1	14^0 37.46'N $74^0$17.47'E	14^0 38.9'N $74^0$17.5'E	0.430	240.00	240.430	Belamber

2	14^0 41.30'N $74^0$16.35'E	14^0 41.25'N $74^0$16.30'E	0.355	248.000	248.355	Bhavikeri
3	14^0 42.46'N $74^0$15.50'E	14^0 42.48'N $74^0$15.49'E	0.200	251.800	252.000	Harwada
4	14^0 42.52'N $74^0$15.49'E	14^0 42.50'N $74^0$15.48'E	0.500	252.125	252.625	Harwada
5	14^0 42.47'N $74^0$15.17'E	14^0 42.51'N $74^0$15.10'E	0.420	253.380	253.800	Harwada
6	14^0 37.45'N $74^0$17.42'E	14^0 37.5'N $74^0$17.7'E	0.150			Nadibag
		Total	2.055			
KARWAR TALUKA IN UTTARA KANNADA DISTRICT						
1	14^0 51.7'N $74^0$6.37'E	14^0 51.45'N $74^0$6.52'E	1.275	295.800	297.075	Devbag
2	14^0 51.46'N $74^0$6.36'E	14^0 52.4'N $74^0$6.30'E	0.600	297.075	297.675	Devbag
3	14^0 52.48'N $74^0$6.2'E	14^0 52.54'N $74^0$5.59'E	0.500	297.700	298.200	Dandebag
4	14^0 53.10'N $74^0$6.2'E	14^0 53.16'N $74^0$6.3'E	0.100	299.050	299.150	Nechkanbag
		Total	2.475			
		Grand Total	4.530			

Table-16: Protected reaches of Ernakulam district (Chellanam island-Fort Kochi to South Chellanam).

Sr. No.	Chainage	Latitude / Longitude
1.	463m	10º 01’ 04.70” N, 76º 20’ 36.54” E
2.	20800	9º 47’ 23.20” N, 76º 16’ 40.07” E

Table-17: Vulnerable reaches of Ernakulam district (Chellanam island-Fort Kochi to South Chellanam).

Sr. No.	Chainage	Latitude / Longitude	Length (m)
1	3023	9º 56’ 41.66” N	200
		76º 14’ 30.17” E	
2	3223	9º 56’ 36.31” N	
		76º 14’ 33.04” E	
3	3925	9º 56’ 12.13” N	150
		76º 14’ 41.10” E	
4	4075	9º 56’ 09.04” N	

		76º 14’ 42.07” E	
5	4582	9º 56’ 58.57” N	125
		76º 14’ 48.89” E	
6	4707	9º 55’ 55.92” N	
		76º 14’ 49.35” E	
7	5527	9º 55’ 32.23” N	250
		76º 14’ 56.64” E	
8	5777	9º 55’ 25.73” N	
		76º 14’ 59.29” E	
9	6227	9º 55’ 05.34” N	200
		76º 15’ 06.08” E	
10	6427	9º 55’ 00.17” N	
		76º 15’ 07.41” E	
11	6712	9º 54’ 50.11” N	551
		76º 15’ 10.02” E	
12	7263	9º 54’ 30.50” N	
		76º 15’ 17.23” E	
13	7340	9º 54’ 23.68” N	32
		76º 15’ 19.96” E	
14	7372	9º 54’ 22.38” N	
		76º 15’ 20.56” E	
15	8475	9º 53’ 47.30” N	986
		76º 15’ 24.47” E	
16	9461	9º 53’ 38.30” N	
		76º 15’ 26.90” E	
17	9541	9º 53’ 25.09” N	620
		76º 15’ 35.89” E	
18	10161	9º 53’ 40.89” N	
		76º 15’ 48.03” E	
19	11200	9º 52’ 32.51” N	325
		76º 15’ 50.72” E	
20	11525	9º 52’ 21.18” N	
		76º 15’ 56.32” E	
21	11660	9º 52’ 17.03” N	120
		76º 15’ 57.32” E	
22	11780	9º 52’ 11.08” N	
		76º 15’ 59.17” E	
23	13407	9º 51’ 17.76” N	1437
		76º 15’ 55.56” E	
24	14844	9º 50’ 44.13” N	
		76º 16’ 05.40” E	
25	20385	9º 47’ 43.20” N	415
		76º 16’ 41.12” E	
26	20800	9º 47’ 23.20” N	
		76º 16’ 40.07” E	

Table-18: Protected and vulnerable reaches of Trissur district.

Protected Reaches				Vulnerable Reaches				
From		To		From		To		
Lat	Long	Lat	Long	Lat	Long	Lat	Long	Distance
10° 41' 7.6"	75° 57' 25.7"	10° 34' 10.3"	76° 0' 34.1"					14058m
10° 34' 10.3"	76° 0' 34.1"	10° 33' 19.2"	76° 0' 58.7"					1749m
10° 33' 19.2"	76° 0' 58.7"	10° 33' 13.6"	76° 1' 1.2"	10° 33' 19.2"	76° 0' 58.7"	10° 33' 13.6"	76° 1' 1.2"	200m
10° 33' 13.6"	76° 1' 1.2"	10° 33' 10.5	76° 1' 2.9"					100m
10° 33' 10.5	76° 1' 2.9"	10° 32' 54.5"	76° 1' 7.5"	10° 33' 10.5	76° 1' 2.9"	10° 32' 54.5"	76° 1' 7.5"	512m
10° 32' 54.5"	76° 1' 7.5"	10° 32' 32.2"	76° 1' 16.5"					736m
10° 32' 32.2"	76° 1' 16.5"	10° 32' 29.3"	76° 1' 17.8"	10° 32' 32.2"	76° 1' 16.5"	10° 32' 29.3"	76° 1' 17.8"	105m
10° 32' 29.3"	76° 1' 17.8"	10° 32' 22.6"	76° 1' 21.6"					228m
10° 32' 22.6"	76° 1' 21.6"	10° 31' 53.1"	76° 1' 35.5"	10° 32' 22.6"	76° 1' 21.6"	10° 31' 53.1"	76° 1' 35.5"	1004m
10° 31' 53.1"	76° 1' 35.5"	10° 31' 50.8"	76° 1' 35.9"					80m
10° 31' 50.8"	76° 1' 35.9"	10° 31' 47.6"	76° 1' 36.9"	10° 31' 50.8"	76° 1' 35.9"	10° 31' 47.6"	76° 1' 36.9"	100m
10° 31' 47.6"	76° 1' 36.9"	10° 31' 40.6"	76° 1' 39.5"					223m
10° 31' 40.6"	76° 1' 39.5"	10° 31' 39.1"	76° 1' 42.1"	10° 31' 40.6"	76° 1' 39.5"	10° 31' 39.1"	76° 1' 42.1"	65m
10° 31' 39.1"	76° 1' 42.1"	10° 31' 26.6"	76° 1' 46.1"					402m
10° 31' 26.6"	76° 1' 46.1"	10° 31' 19.3"	76° 1' 49.9"	10° 31' 26.6"	76° 1' 46.1"	10° 31' 19.3"	76° 1' 49.9"	281m
10° 31' 19.3"	76° 1' 49.9"	10° 30' 52"	76° 2' 2.8"					865m
10° 30' 52"	76° 2' 2.8"	10° 30' 49.7"	76° 2' 5.1"	10° 30' 52"	76° 2' 2.8"	10° 30' 49.7"	76° 2' 5.1"	105m
10° 30' 49.7"	76° 2' 5.1"	10° 30' 36.9	76° 2' 11.2"					437m
10° 30' 36.9	76° 2' 11.2"	10° 30' 23.1"	76° 2' 25.8"					
10° 30' 23.1"	76° 2' 25.8"	10° 30' 12.2"	76° 2' 31.1"	10° 30' 23.1"	76° 2' 25.8"	10° 30' 12.2"	76° 2' 31.1"	454m
10° 30' 12.2"	76° 2' 31.1"	10° 29' 19.2"	76° 3' 0.0"					1795m
10° 29' 19.2"	76° 3' 0.0"	10° 29' 1.8"	76° 3' 9.3"	10° 29' 19.2"	76° 3' 0.0"	10° 29' 1.8"	76° 3' 9.3"	600m

10° 29' 1.8"	76° 3' 9.3"	10° 28' 43.6"	76° 3' 18.1"					617m
10° 30' 49.7"	76° 2' 5.1"	10° 28' 43.6"	76° 3' 18.1"	10° 30' 49.7"	76° 2' 5.1"	10° 28' 43.6"	76° 3' 18.1"	366m
10° 28' 43.6"	76° 3' 18.1"	10° 28' 28.0"	76° 3' 25.8"					180m
10° 28'28.0"	76° 3' 25.8"	10° 28' 26"	76° 3' 30"	10° 28'28.0"	76° 3' 25.8"	10° 28' 26"	76° 3' 30"	278m
10° 28' 26"	76° 3' 30"	10° 28' 2.6"	76° 3' 39.6"					626m
10° 28' 2.6"	76° 3' 39.6"	10° 27' 54.2"	76° 3' 43"	10° 28' 2.6"	76° 3' 39.6"	10° 27' 54.2"	76° 3' 43"	293m
10° 27' 54.2"	76° 3' 43"	10° 27' 45.6"	76° 3' 49.5"					280m
10° 27' 45.6"	76° 3' 49.5"	10° 27' 34.1"	76° 3' 56.3"	10° 27' 45.6"	76° 3' 49.5"	10° 27' 34.1"	76° 3' 56.3"	392m
10° 27' 34.1"	76° 3' 56.3"	10° 26' 35.3"	76° 4' 24.2"					2043m
10° 26' 35.3"	76° 4' 24.2"	10° 25' 54.8"	76° 4' 38.2"					1263m
10° 25' 54.8"	76° 4' 38.2"	10° 25' 48"	76° 4' 41"					200m
10° 25' 48"	76° 4' 41"	10° 20' 51.2"N	76° 6' 39"E					9900m
10° 20' 51.2"N	76° 6' 39"E	10° 17' 4.6"N	76° 7' 52.4"E					7443m
				10° 18' 42.9"N	76° 7' 23.8"E	10° 17' 4.6"N	76° 7' 52.4"E	2496m
10° 17' 4.6"N	76° 7' 52.4"E	10° 11' 38.6"N	76° 9' 30.6"E					10191m
10° 11' 31.9"N	76° 9' 34.2"E	10° 10' 26.5"N	76° 9' 26.7"E					958m
				10° 16' 58.1"N	76° 07' 53.8"E	10° 11' 31.9"N	76° 9' 34.2"E	

Table-19: Protected reaches of Mallapuram district under CES section, Parappanangadi.

Sr. No.	Location (Taluk/ District)	Type of protection work	Specification (Rubble mound)	From	
				Latitude	Longitude
1	Padinjarekara (Tirur/	Break water	1 No. 254M	N 10°47'29.2" N 10°47'00"	E 75°54'29.7" E75°54'39.06"

	Malappuram)				
2	Padinjarekara (Tirur/ Malappuram)	Seawall	3.8	N 10°47'31"	E 75°54'36"
3	kootay (Tirur/ Malappuram)	Seawall	0.25	N 10°50'38"	E 75°53'54"
4	unnyal (Tirur/ Malappuram)	Seawall	2	N 10°55'06"	E 75°52'57"
5	Thanur (Tirur/ Malappuram)	Seawall	6	N 10°56'36"	E 75°52'37"
6	Poorapuzha South (Tirur/ Malappuram)	Seawall	1	N 11°00'36"	E 75°51'34"
7	Poorapuzha North (Tirurangadi/ Malappuram)	Seawall	3.8	N 11°01'21"	E 75°51'23"
8	Parapanangadi (Tirurangadi/ Malappuram)	Seawall	7.3	N 11°03'32"	E 75°50'36"
9	Parapanangadi (Tirurangadi/ Malappuram)	Groynes	3Nos. 15m each for 300m	N 11°02'55"	E 75°50'57"

Table-20: Protected reaches of Mallapuram district.

PROTECTED REACHES						Length in meters
From			To			
Latitude /Longitude			Latitude /Longitude			
	Degree	Minutes		Degree	Minutes	
N	10	41.161	N	10	41.927	1427
E	75	55.386	E	75	57.057	
N	10	42.240	N	10	43.469	2777
E	75	56.924	E	75	56.060	
N	10	43.914	N	10	44.257	726
E	75	56.138	E	75	55.999	
N	10	44.257	N	10	44.502	415
E	75	55.999	E	75	55.899	
N	10	44.502	N	10	44.714	410

E	75	55.899	E	75	55.804	
N E	10 75	44.714 55.804	N E	10 75	45.105 55.641	845
N E	10 75	45.105 55.614	N E	10 75	45.418 55.515	610
N E	10 75	45.418 55.515	N E	10 75	45.440 55.502	40m wide thodu
N E	10 75	45.440 55.502	N E	10 75	45.772 55.363	635
N E	10 75	45.772 55.363	N E	10 75	46.140 55.231	835
N E	10 75	46.140 55.231	N E	10 75	46.087 54.956	1838
N E	10 75	46.807 54.956	N E	10 75	47.040 54.814	600
N E	10 75	47.536 54.609	N E	10 75	49.152 54.224	3139
N E	10 75	49.152 54.224	N E	10 75	49.554 54.141	754
N E	10 75	49.554 54.141	N E	10 75	49.739 65.102	350
N E	10 75	50.532 53.929	N E	10 75	50.655 53.906	215
N E	10 75	50.655 53.906	N E	10 75	50.796 53.879	265
N E	10 75	54.378 53.109	N E	10 75	53.726 53.243	1170
N E	10 75	56.407 52.646	N E	10 75	55.131 52.940	2350
N E	10 75	57.090 52.528	N E	10 75	56.606 52.594	800
N E	10 75	57.288 52.428	N E	10 75	57.090 52.528	400
N E	10 75	57.321 52.417	N E	10 75	57.944 52.182	1183
N E	10 75	57.478 52.156	N E	10 75	58.867 52.045	1109
N E	10 75	58.867 52.045	N E	10 75	58.928 51.772	2046
N E	11 75	0.598 51.574	N E	11 75	1.114 51.484	1365
N E	11 75	1.343 51.367	N E	11 75	2.888 50.98	2935
N	11	2.936	N	11	3.312	700
E	75	50.984	E	75	50.924	
N E	11 75	3.538 50.844	N E	11 75	4.159 50.682	1145

N	11	4.393	N	11	5.452	2050
E	75	50.613	E	75	50.292	
N	11	5.574	N	11	5.053	1000
E	75	50.270	E	75	50.127	
N	11	6.090	N	11	7.370	2600
E	75	50.097	E	75	49.596	

Table-21: Vulnerable reaches of Mallapuram district.

VULNERABLE REACHES						Length in meters
From			To			
Latitude /Longitude			Latitude /Longitude			
	Degree	Minutes		Degree	Minutes	
N E	10 75	41.161 55.386	N E	10 75	42.405 56.850	2405
N E	10 75	42.660 56.739	N E	10 75	42.814 56.660	300
N E	10 75	44.257 55.999	N E	10 75	44.502 55.899	415
N E	10 75	44.714 55.804	N E	10 75	45.105 55.641	845
N E	10 75	45.772 55.363	N E	10 75	46.140 55.231	835
N E	10 75	46.807 54.956	N E	10 75	47.040 54.814	600
N E	10 75	47.299 34.642	N E	10 75	47.536 54.609	500
N E	10 75	49.152 54.224	N E	10 75	49.554 54.141	754
N E	10 75	49.739 65.102	N E	10 75	50.532 53.929	1870
N E	10 75	50.655 53.906	N E	10 75	50.796 53.879	265
N E	10 75	50.796 53.879	N E	10 75	51.499 53.702	1937
N E	10 75	53.480 53.295	N E	10 75	51.499 53.702	2950
N E	10 75	53.726 53.243	N E	10 75	53.480 53.295	450
N E	10 75	54.640 53.047	N E	10 75	54.378 53.109	450
N E	10 75	54.847 53.012	N E	10 75	54.640 53.047	450
N E	10 75	55.131 52.940	N E	10 75	54.847 53.012	500
N	10	56.606	N	10	56.407	450

E	75	52.594	E	75	52.646	
N E	10 75	57.090 52.528	N E	10 75	56.606 52.594	800
N E	10 75	57.288 52.428	N E	10 75	57.090 52.528	400
N	11	0.615	N	11	0.714	1000
E	75	51.401	E	75	51.520	
N	11	2.816	N	11	3.720	1000
E	75	51.401	E	75	51.520	
N	11	6.091	N	11	6.895	800
E	75	50.097	E	75	50.127	
N	10	59.602	N	10	59.201	600
E	75	51.833	E	75	51.976	

Table-22: Status of protection measures, Cherthala.

Sr. No.	LOCATION	Chainage (km)		Latitude		Longitude		Distance in metres	Work Required
		From	To	From	To	From	To		
	BASED ON BLS STONE								
1	Between BLS 135 to 147	102.265	105.388	9◦ 37.159’	9◦ 37.428’	76◦ 17.856’	76◦ 17.721’	3123	intact sea wall , no work required
2	Chethi pozhi Between BLS 143 to 145	104.597	104.747	9◦ 37.333’	9◦ 47.251’	76◦ 17.792’	76◦ 17.772’	150	Chethi Pozhi
3	construction of original sea wall between BLS 147 to 151	105.388	106.154	9◦ 37.428’	9◦ 38.152’	76◦ 17.721’	76◦ 17.715’	625	original sea wall required 12 th terminated work
4	Virgin beach between BLS 148 and 149	105.65	105.791	9◦ 47.412’	9◦ 47.251’	76◦ 16.635’	76◦ 16.675’	141	12th terminated work, Resort area
5	Construction of original sea wall between 151 to 154	106.154	106.824	9◦ 38.152’	9◦ 38.516’	76◦ 17.715’	76◦ 17.696’	670	original sea wall required , 12 th terminated work
6	Between BLS 154 and 163	106.824	109.344	9◦ 38.516’	9◦ 39.926’	76◦ 17.696’	76◦ 17.539’	2520	intact sea wall , no work required

7	Chenna veli Pozhi between BLS 156 and 158	107.75	107.83	9◦ 39.040’	9◦ 39.128’	76◦ 17.635’	76◦ 17.623’	80	Chennaveli Pozhi
8	Construction of original sea wall between 162 to 164	109.344	109.755	9◦ 39.926’	9◦ 40.147’	76◦ 17.539’	76◦ 17.531’	411	original sea wall required
9	Arthinkal Pozhi between BLS 162 and 163	109.229	109.304	9◦ 39.735’	9◦ 39.778’	76◦ 17.549’	76◦ 17.544’	75	Arthinkal Pozhi
10	Between BLS 164 and 168	109.755	110.798	9◦ 40.147’	9◦ 40.722’	76◦ 17.531’	76◦ 17.468’	1043	intact sea wall , no work required
11	Between BLS 168 and 172	110.798	111.798	9◦ 40.722’	9◦ 41.284’	76◦ 17.468’	76◦ 17.429’	1000	Groynes proposed, original sea wall required
12	Between BLS 172 and 173	111.798	112.059	9◦ 41.284’	9◦ 41.427’	76◦ 17.429’	76◦ 17.392’	261	intact sea wall , no work required
13	Between BLS 173 and 174	112.059	112.199	9◦ 47.412’	9◦ 41.502’	76◦ 16.635’	76◦ 16.391’	140	original sea wall required
14	Between BLS 173 and 179	112.199	113.436	9◦ 41.502’	9◦ 42.167’	76◦ 16.391’	76◦ 17.319’	1.237	intact sea wall , no work required
15	Between BLS 179 and 180	113.436	113.712	9◦ 42.167’	9◦ 42.323’	76◦ 17.319’	76◦ 17.311’	276	original sea wall required
16	Between BLS 180 and 183	113.712	114.397	9◦ 42.323’	9◦ 42.696’	76◦ 17.311’	76◦ 17.259’	685	intact sea wall , no work required
17	Between BLS 182 and 183	114.397	114.517	9◦ 42.696’	9◦ 42.764’	76◦ 17.259’	76◦ 17.250’	120	Reformation work required
18	Between BLS 183 and 189	114.517	116.129	9◦ 42.764’	9◦ 43.677’	76◦ 17.250’	76◦ 17.163’	1622	intact sea wall , no work required
19	Between BLS 189 and 194	116.129	116.29	9◦ 47.412’	9◦ 43.769’	76◦ 16.635’	76◦ 17.149’	161	Proposed reformation work

									13th 1st and 2nd Phase
20		116.29	116.544	9◦ 43.769’	9◦ 43.909’	76◦ 17.149’	76◦ 17.137’	254	intact sea wall , no work required
21		116.544	116.744	9◦ 43.909’	9◦ 44.018’	76◦ 17.137’	76◦ 17.129’	200	12th completed
22		116.744	116.819	9◦ 44.018’	9◦ 44.056’	76◦ 17.129’	76◦ 17.129’	75	Proposed reformation work 13th 1st and 2nd
23		116.819	117.031	9◦ 44.056’	9◦ 44.172’	76◦ 17.129’	76◦ 17.111’	212	virgin beach , original work required
24		117.031	117.061	9◦ 44.172’	9◦ 44.189’	76◦ 17.111’	76◦ 17.104’	30	Proposed reformation work 13th 1st and 2nd Phase
25		117.061	117.101	9◦ 44.189’	9◦ 44.211’	76◦ 17.104’	76◦ 17.101’	40	intact sea wall , no work required
26		117.101	117.138	9◦ 44.211’	9◦ 44.230’	76◦ 17.101’	76◦ 17.100’	37	Proposed reformation work 13th 1st and 2nd Phase
27	Between BLS 193 and 195	117.138	117.578	9◦ 44.230’	9◦ 44.466’	76◦ 17.100’	76◦ 17.081’	440	intact sea wall , no work required
28	Between BLS 195 and 198	117.578	117.588	9◦ 47.412’	9◦ 44.476’	76◦ 16.635’	76◦ 17.081’	10	Proposed reformation work budget work
29		117.588	117.645	9◦ 44.476’	9◦ 44.507’	76◦ 17.081’	76◦ 16.675’	57	intact sea wall , no work required

30		117.645	117.685	9◦ 44.507’	9◦ 44.529’	76◦ 16.675’	76◦ 17.075’	40	Proposed reformation work budget work
31		117.685	118.311	9◦ 44.529’	9◦ 44.891’	76◦ 17.075’	76◦ 17.079’	626	intact sea wall
	BASED ON CP STONE								
32	Between CP 4365 & CP 4367 up to chappakkadavu FG	123.319	123.119	9◦ 47.412’	9◦ 47.251’	76◦ 16.635’	76◦ 16.675’	305	intact sea wall , no work required
33	Between CP 4367 & CP 4370	123.119	122.719	9◦ 47.212’	9◦ 47.010’	76◦ 16.681’	76◦ 16.712’	400	intact sea wall , no work required
34	Between CP 4369 & CP 4370	122.719	122.519	9◦ 47.010’	9◦ 46.914’	76◦ 16.712’	76◦ 16.732’	200	Proposed reformation work
35	Between CP 4370 & CP 4372	122.519	121.994	9◦ 46.914’	9◦ 46.732’	76◦ 16.732’	76◦ 16.762’	525	intact sea wall , no work required
36	Between CP 4371 & CP 4372 80m from 4372 towards north	121.994	121.899	9◦ 46.732’	9◦ 46.691’	76◦ 16.762’	76◦ 16.767’	95	Proposed reformation work
37	Between CP 4372 & CP 4374	121.899	121.612	9◦ 46.691’	9◦ 46.462’	76◦ 16.767’	76◦ 16.801’	287	intact sea wall , no work required
38	Reformation between CP 4373 & 4381	121.612	119.982	9◦ 46.462’	9◦ 45.658’	76◦ 16.801’	76◦ 16.936’	1630	Proposed reformation work
39	Between CP 4381 & CP 4384	119.982	119.065	9◦ 45.658’	9◦ 45.165’	76◦ 16.936’	76◦ 17.000’	917	intact sea wall , no work required
40	Between CP 4384 & CP 4385 Reformation	119.065	118.742	9◦ 45.165’	9◦ 45.005’	76◦ 17.000’	76◦ 17.046’	323	Proposed reformation work

Table-23: Status of coastal protection measures, Kozhikode.

Sr No	PROTECTED REACHES			
	Location	Lat	Long	Length
1	Kadalundikadavu seawall South end North end	 11 7 31.45N 11 8 5.34N	 75 49 31.50E 75 49 14.47E	1100m
2	Vakkadavu Gap south end North end	 11 8 5.34N 11 8 7.85N	 75 49 14.47E 75 49 15.00E	150m
3	Kappalangadi seawall South end North end	 11 8 7.85N 11 8 6.75N	 75 49 15.00E 75 49 14.15E	650m
4	Kadukkabazar seawall South end North end	 11 8 6.75N 11 8 7.64N	 75 49 14.15E 75 49 15.37E	969m
5	Chaliyam seawall South end North end	 11 8 7.64N 11 9 13.37N	 75 49 15.37E 75 48 27.44E	788m
6	Chaliyam FG South end North end	 11 9 13.37N 11 9 15.27N	 75 48 27.44E 75 48 24.85E	79m
7	Chaliyam seawall South end North end	 11 9 15.27N 11 9 20.44N	 75 48 24.85E 75 48 16.60E	475m
8	NIRDESH (virgin beach) South end North end (Break water, Chaliyam)	 11 9 20.44N 11 9 30.00N	 75 48 16.60E 75 48 00.65E	390m
9	Beypore break water	11 9 45.78N	75 48 08.09E	210m Chaliyar river

10	Beypore seawall South end North end	 11 9 49.88N 11 10 40.14N	 75 48 10.17E 75 47 41.19E	578m
11	Godeeswaram seawall South end North end	 11 10 40.14N 11 10 42.34N	 75 47 41.19E 75 47 51.15E	1126m
12	Kaithavalappu colony virgin beach South end North end	 11 10 42.34N 11 10 58.72N	 75 47 51.15E 75 47 46.40E	535 m
13	Kaithavalappu colony Gabion seawall South end North end	 11 10 58.72N 11 11 12.50N	 75 47 46.40E 75 47 40.09E	465m
14	Kaithavalappu seawall South end North end	 11 11 12.50N 11 11 35.06N	 75 47 40.09E 75 47 31.04E	733m
15	Marad FG South end North end	 11 11 35.06N 11 11 37.44N	 75 47 31.04E 75 47 30.31E	85m
16	Marad seawall South end North end	 11 11 37.44N 11 11 38.24N	 75 47 30.31E 75 47 22.11E	1477m
17	Kappakkal seawall South end North end	 11 11 38.24N 11 12 59.57N	 75 47 22.11E 75 46 58.68E	1500m
18	Chakkumkadavu seawall South end North end (Kallai break water south)	 11 12 59.57N 11 13 35.95N	 75 46 58.68E 75 46 46.81E	1121m
19	Kallai break water north	11 13 41.87N	75 46 46.70E	150m Kallai river

	Kallai seawall South end North end	 11 13 41.87N 11 17 47.63N	 75 46 46.70E 75 46 43.03E	255m
20	Kothi vigin beach South end North end	 11 17 47.63N 11 13 49.19N	 75 46 43.03E 75 46 42.16E	56m
21	Kothi gabion seawall South end North end	 11 13 49.19N 11 13 51.82N	 75 46 42.16E 75 46 41.01E	
22	Kothi vigin beach South end North end	 11 13 51.82N 11 13 55.53N	 75 46 41.01E 75 46 39.28E	115m
23	Kothi gabion seawall South end North end	 11 13 55.53N 11 13 56.94N	 75 46 39.28E 75 46 38.58E	60m
24	Kothi vigin beach South end North end	 11 13 56.94N 11 18 58.94N	 75 46 38.58E 75 46 37.55E	55m
25	Kothi gabion seawall South end North end	 11 18 58.94N 11 14 07.22N	 75 46 37.55E 75 46 33.69E	296m
26	Kothi vigin beach South end North end	 11 14 07.22N 11 14 19.29N	 75 46 33.69E 75 46 28.59E	380m
27	South of south pier seawall South end North end	 11 14 19.29N 11 14 37.50N	 75 46 28.59E 75 46 25.46E	485m
28	South beach, virgin beach South end North end	 11 14 37.50N 11 14	 75 46 25.46E 75 46	300m

		48.51N	21.60E	
29	South beach seawall South end North end	 11 14 48.51N 11 14 28.31N	 75 46 21.60E 75 46 31.40E	190m
30	South beach virgin beach South end North end	 11 14 28.31N 11 15 02.38N	 75 46 31.40E 75 46 16.81E	325m
31	old telrgraph office seawall (Granite plat form south) South end North end	 11 15 02.38N 11 15 15.60N	 75 46 16.81E 75 46 12.25E	445m
32	Calicut virgin beach South end North end	 11 15 15.60N 11 16 01.30N	 75 46 12.25E 75 45 55.88E	1367m
33	Thoppayil Puthiyakadavu seawall South end North end	 11 16 01.30N 11 16 10.35N	 75 45 55.88E 75 45 53.22E	290m
34	Thoppayil virgin beach South end North end	 11 16 10.35N 11 16 16.65N	 75 45 53.22E 75 45 50.89E	343m
35	Vellayail seawall South end North end	 11 16 16.65N 11 16 20.36N	 75 45 50.89E 75 46 49.66E	120m
36	Kamburam virgin beach South end North end	 11 16 20.36N 11 16 48.79N	 75 46 49.66E 75 45 39.57E	967m
37	Bangladesh colony seawall South end North end	 11 16 48.79N 11 17 04.27N	 75 45 39.57E 75 45 33.66E	500m
38	Bangladesh colony gabion			360m

	seawall South end North end	11 17 04.27N 11 17 16.26N	75 45 33.66E 75 45 34.23E	
39	Varakkal virgin beach South end North end	11 17 16.26N 11 17 28.39N	75 45 34.23E 75 45 25.01E	410m
40	Butt road beach gabion seawall South end North end	11 17 28.39N 11 17 21.74N	75 45 25.01E 75 45 25.01E	300m
41	Athanikkal virgin beach South end North end	11 17 21.74N 11 17 50.23N	75 45 25.01E 75 45 22.75E	370m
42	Athanikkal gabion seawall South end North end	11 17 50.23N 11 17 55.22N	75 45 22.75E 75 45 15.36E	135m
43	Drain South end North end	11 17 55.22N 11 17 56.22N	75 45 15.36E 75 45 15.19E	
44	Koya road virgin beach South end North end	11 17 56.22N 11 18 04.87N	75 45 15.19E 75 45 11.46E	275m
45	Puthiyangadi Pallikkandi gabion seawall South end North end	11 18 04.87N 11 18 10.75N	75 45 11.46E 75 45 10.14E	150m
46	Edakkal-Puthiyappa beach South end	11 18 10.75N	75 45 10.14E	1311m

	North end (south break water) (Puthiyappaharbour)	11 19 00.66N	75 44 49.18E	
47	Puthiyappa fishing harbour south break water North break water	11 19 00.66N 11 19 34.61N	75 44 49.18E 75 44 14.74E	
48	Narichal seawall South end North end	11 19 34.61N 11 19 45.49N	75 44 14.74E 75 44 12.71E	400m
49	Chettikulam seawall South end North end	11 19 45.49N 11 20 01.65N	75 44 12.71E 75 44 03.77E	806m
50	Chettikulam virgin beach South end North end	11 20 01.65N 11 20 25.20N	75 44 03.77E 75 44 12.59E	307m
51	Mukkadi seawall South end North end	11 20 01.65N 11 20 25.20N	75 44 03.77E 75 44 12.59E	875m
52	Elathur seawall South end North end (Korapuzha &Thodu south)	11 20 32.86N 11 20 49.766N	75 44 11.17E 75 44 13.14E	420m
53	Thodu South end North end	11 20 49.766N 11 20 50.85N	75 44 13.14E 75 44 16.60E	
54	Mattuvayal seawall South end North end (Korapuzha &Thodu south)	11 20 50.85N 11 20 55.61N	75 44 16.60E 75 44 14.39E	570m

Table-24: Status of vulnerable reaches, Kozhikode.

VULNARABLE REACHES				Remarks
Location	Latitude	Longitude	Length	
Kadalundikadavu seawall South end North end	 11 7 15.38N 11 8 5.34N	 75 49 29.65E 75 49 14.47E	1100m	North end
Kappalangadi seawall South end North end	 11 8 7.85N 11 8 18.35N	 75 49 15.00E 75 49 13.18E	350m	South end
Chaliyam seawall South end North end	 11 8 7.64N 11 9 2 7.88N	 75 49 15.37E 75 49 35.55E	288 m	South end
Chaliyam seawall South end North end	 11 9 15.27N 11 9 20.44N	 75 48 24.85E 75 48 16.60E	475m	 500 m sanctioned under XII FC
NIRDESH(virgin beach) South end North end	 11 9 20.44N 11 9 30.00N	 75 48 16.60E 75 48 00.65E	390m	
Beypore seawall South end North end	 11 9 49.88N 11 10 40.14N	 75 48 10.17E 75 47 41.19E	300m	
				800 m completed under XII FC ,200 m sanctioned under 13th FC
Kaithavalappu colony virgin beach South end North end	 11 10 42.34N 11 10 58.72N	 75 47 51.15E 75 47 46.40E	535 m	
				435 m completed under XII FC

Kaithavalappu seawall South end North end	 11 11 63.38N 11 11 35.06N	 75 47 23.54E 75 47 31.04E	550m	
Kappakkal seawall South end North end	 11 11 15.32N 11 12 59.57N	 75 46 13.28E 75 46 58.68E	650m	North end
Kallai seawall South end North end	 11 13 41.87N 11 17 47.63N	 75 46 46.70E 75 46 43.03E	255m	
Kothi vigin beach South end North end	 11 17 47.63N 11 13 49.19N	 75 46 43.03E 75 46 42.16E	56m	
				117 m completed under XII FC
Kothi vigin beach South end North end	 11 13 51.82N 11 13 55.53N	 75 46 41.01E 75 46 39.28E	115m	
Kothi vigin beach South end North end	 11 13 56.94N 11 18 58.94N	 75 46 38.58E 75 46 37.55E	55m	
Kothi vigin beach South end North end	 11 14 07.22N 11 14 19.29N	 75 46 33.69E 75 46 28.59E	380m	
South of south pier seawall South end North end	 11 14 19.29N 11 14 37.50N	 75 46 28.59E 75 46 25.46E	485m	
South beach, virgin beach South end North end	 11 14 37.50N 11 14	 75 46 25.46E 75 46	300m	

	48.51N	21.60E		
South beach seawall South end North end	 11 14 48.51N 11 14 28.31N	 75 46 21.60E 75 46 31.40E	190m	
old telrgraph office seawall (Granite plat form south) South end North end	 11 15 02.38N 11 15 15.60N	 75 46 16.81E 75 46 12.25E	445m	
Calicut virgin beach South end North end	 11 15 15.60N 11 16 01.30N	 75 46 12.25E 75 45 55.88E	1367m	
Thoppayil virgin beach South end North end	 11 16 10.35N 11 16 16.65N	 75 45 53.22E 75 45 50.89E	343m	110 m sanctionedunder XIII FC
Vellayail seawall South end North end	 11 16 16.65N 11 16 20.36N	 75 45 50.89E 75 46 49.66E	120m	
Kamburam virgin beach South end North end	 11 16 20.36N 11 16 48.79N	 75 46 49.66E 75 45 39.57E	967m	115 m sanctionedunder XIII FC
Bangladesh colony seawall South end North end	 11 16 48.79N 11 17 04.27N	 75 45 39.57E 75 45 33.66E	500m	
Bangladesh colony virgin beach South end North end	 11 17 16.26N 11 17 28.39N	 75 45 34.23E 75 45 25.01E	410m	150 m sanctionedunder XIII FC Phase III
Athanikkal virgin beach South end North end	 11 17 21.74N 11 17	 75 45 25.01E 75 45	370m	250 m sanctionedunder XIII FC Phase II

	50.23N	22.75E		
Koya road virgin beach			275m	235 m sanctionedunder XIII FC Phase II
South end	11 17 56.22N	75 45 15.19E		
North end	11 18 04.87N	75 45 11.46E		
Edakkal-Puthiyappa beach			1311m	
South end	11 18 10.75N	75 45 10.14E		
North end (Puthiyappaharbour)	11 19 00.66N	75 44 49.18E		
Chettikulam virgin beach			307m	
South end	11 20 01.65N	75 44 03.77E		
North end	11 20 25.20N	75 44 12.59E		
Chettikulam virgin beach			500m	
South end	11 20 14.38N	75 44 11.74E		
North end	11 20 25.20N	75 44 12.59E		
Mattuvayal seawall			570m	
South end	11 20 50.85N	75 44 16.60E		
North end (Korapuzha &Thodu south)	11 20 55.61N	75 44 14.39E		

Table-25: Status of coastal protection measures, Kollam.

Latitude	Longitude	Locality	Remarks	Chainage in km
8° 46 '55 "N	76º 40' 23 "E	Kappil		
8 47 17 N	76 40 05 E		Protected reach	0-0.870
8 47 26 N	76 39 57 E		Vulnerable reach	0.870-1.240
8 47 37 N	76 39 47 E		Protected	1.240-

			reach	1.700
8 47 38 N	76 39 46 E		Vulnerable reach	1.700-1.750
8 47 39 N	76 39 45 E	Thekkumbhagam	Vulnerable reach	1.750-1.800
8 48 39 N	76 38 52 E	Pozhikkara regulator		3.800-4.00
8 49 16 N	76 38 36 E	Mukkom Pozhi		5.440-5.340
8 52 40 N	76 36 07 E	Thanni	Protected reach	5.340-8.320
8 50 45 N	76 37 23 E	CP 308		
8 50 46 N	76 37 22 E	Thanni	Vulnerable reach	8.320-8.520
8 50 46 N	76 37 22 E		Budget proposal for 32 Nos of groins average 50 m length for a stretch of 4.650 km	
8 51 08 N	76 37 03 E		Protected reach	8.520-9.440
8 51 12 N	76 36 59 E	Chanakazhikom	Vulnerable reach	9.440-9.600
8 51 18 N	76 36 54		Protected reach	9.600-9.825
8 51 20 N	76 36 51 E	Eravipuram	Vulnerable reach	9.825-9.965
8 51 27 N	76 36 45E	CP 317	Vulnerable reach	9.965-10.225
8 51 33 N	76 36 38 E		Protected reach	10.225-10.300
8 51 46 N	76 36 24 E	Kakkathopu	-do-	10.300—10.900
8 52 02 N	76 36 05 E	Mundakkal Papanasam	-do-	
8 52 22 N	76 35 43 E		-do-	
8 52 22 N	76 35 35 E	Kollam beach		12.700-14.000
8 53 50 N	76 33 04 E	Thirumullavaram	-do-	14.000-18.500