Re: DTEPA Case No. 02/2022

From: Amardeep Raju (ad.raju@nic.in)

To: dtepa96@yahoo.in

Cc: tanmay.kumar-rj@gov.in; asnpg.mefcc@gov.in; vjoon14@gmail.com

Date: Wednesday, 22 June, 2022, 05:03 pm IST

Sir,

This has reference to the trailing email forwarding the meeting notice dated 23.06.2022 wherein the Ministry has been requested to file written statement on the date of hearing on 23.06.2022.

In this regard, the Report of the Committee constituted in compliance to the Order of Hon'ble NGT and report prepared by NCSCM is enclosed herewith

regards

From: dtepa96@yahoo.in
To: "Amardeep Raju" <ad.raju@nic.in>
Cc: vjoon14@gmail.com
Sent: Wednesday, June 22, 2022 12:52:30 PM
Subject: DTEPA Case No. 02/2022

Respected Sir,

Please find enclosed herewith the copy of order dated 21.06.2022.

Rgds.

LDC/DTEPA

D.T.E.P.A.
INWARD NO. 573
DATE : 23/06/2022

Dahanu-Taluka-Report-of-the-Committee.pdf
5.4MB

Final-Dahanu_Review Report 7May2022.pdf
23.7MB

Minutes of 3rd Meeting regarding the Original Application No. 22 of 2021 was filed by the Applicant National Fish Workers Forum & Ors. before the NGT (PB) New Delhi.

The third Meeting of the Committee was held on 28th April, 2022 in compliance of order of the Hon'ble NGT(PB) *vide* dated 15.06.2021 wherein the Hon'ble NGT has taken a view that the directions of CPCB in question and the OM issued by the MoEFCC need to be revisited by undertaking assessment and evaluation by an expert group of impact of setting up port on overall ecology of the area in question.

2.0 It was decided in the 2nd Meeting of the Committee held on 26.11.2021 that as per the directions of the NGT for 'undertaking assessment and evaluation of impact of setting of port on overall ecology of the Dahanu taluka – Ecologically fragile area', an agency of national repute may be appointed. Based on the outcome of the study, the Committee will be able to provide its recommendations.

3.0 Accordingly, the MoEFCC requested National Centre for Sustainable Coastal Management (NCSCM), Chennai to carry out an assessment study and to submit its report.

4.0 The NCSCM submitted its report vide email dated 27th April, 2022 based on the desk study which was circulated to the Committee (Annexure-I). Further, a detailed presentation was also made by the NCSCM to the Committee during the third meeting held on 28.04.2022 in which the following points were discussed:

i. A rapid preliminary environment assessment based on available literature and data set was carried out for the study. No primary data was collected. Moreover, the land-based activities and social aspects have not been covered in detail.
ii. The most likely sources of pollution in the port region are linked to construction and operation activities. It is expected that capital dredging and disposal of dredge spoils may impact water quality (e.g. turbidity) and marine ecology. During construction, the dredging activities may impact coastal morphology and short-term shoreline stability. The proposed port is

expected to follow green norms with scientifically designed EMP which would minimize the anticipated impacts to acceptable levels.

iii. Detailed maps on rivers/ creeks, lakes and ponds, dams and reservoirs were prepared to assess the natural water resources in the area under consideration. Four rivers and creeks were mapped along with the presence of wetlands.

iv. Rates of shoreline change were evaluated for open ocean sandy shoreline. The coast considered for analysis along Dahanu Taluka extends to a length of 12.79 km from South of Varor coast to Khonda creek. On an average the coast remained "stable" over the last 47 years (61%) on a long term, with accretion along 35% of the coast. Erosion was observed to occur only along 1.3% and 2.7% as artificial coast.

v. The assessment of long-term shoreline change indicates a largely stable coast (61%) but is evidencing some low erosion in recent times, which is not a major concern.

vi. As per the Techno-Economic Feasibility Report for Development of Port at Vadhavan, the total Water Demand at Port 153 KLD during phase I and 1671 KLD as per the master plan. Sakhare dam is projected as a main source of water with a storage capacity of 4.07 Mcum of water. Alternatively, it has been indicated that the option of providing dedicated desalination plant could also be examined at the detailed engineering stage.

vii. From the preliminary desk study assessment, it is expected that during the construction phase, the offshore facility is likely to cause minimal impact on air quality and land environment. However, significant short-term impacts on water quality (in particular the coastal waters and creeks) and marine biota including fisheries at the construction and reclamation sites and in the near coastal waters is expected to be high and may cause short-term change only during construction phase. However, it is expected that current baseline conditions will be restored if the port operations will be as per the prescribed green port norms.

viii. There are no designated wildlife sanctuaries, national parks, community reserves present in the vicinity of proposed Vadhavan Port area.

ix. The forests in the area under consideration belong to four forest types viz., Southern Tropical Semi-Evergreen forests, Southern Tropical Moist Deciduous Forests, Southern Tropical Dry Deciduous forests and Littoral and Swamp Forests mainly comprising of mangroves.

x. The proposed port limit boundary falls within the CRZ IA (mangrove and 50m mangrove buffer zone), CRZ IB (intertidal zone), No Development Zone (NDZ) of CRZ III, and CRZ III (between 200m to 500m). The Proposed Approach Trestle, Proposed Breakwater, Proposed Navigational Area, Proposed Offshore Reclamation Area, and Proposed Shelter Areas fall within the CRZ IV A category, whereas the Proposed Reclamation Area Nearshore falls on CRZ IB, NDZ of CRZ III, CRZ III and CRZ IVA categories. The CRZ categories along the project area include CRZ IA (Mangrove), CRZ IB (Intertidal Zone), CRZ III (No Development Zone and 200 to 500 m from HTL), CRZ IVA (Sea). However, Committee noted that since the port boundaries are not finalized, therefore the applicability of CRZ regulations will vary depending on the port boundaries.

xi. CPCB, vide directions dated 30.04.2020, re-classified 18 industrial sectors, including 'Ports and harbours, jetties and dredging operations' as 'non-industrial operations/ activities/ facilities/ infrastructure/ services'. However, considering the pollution potential, the categorization of these sectors were kept intact i.e. the category of 'Ports and harbour, jetties and dredging operations' continued to remain in red category, but under non-industrial operations. The ports are associated primarily with freight services (loading-unloading, stowing-unstowing, transport between ships or ship-port). Despite the anticipated pollution impacts, it is appropriate to mention that ports need to conform to the environmental standards and safeguards as prescribed for "Green" Ports, and by following national and international green protocols.

xii. Government of India, vide press release dated 05 Aug 2021, has undertaken green port initiatives for the major ports for adopting the green port norms for the environmental benefits. These include:

a. Monitoring environmental pollution,
b. Acquisition of dust suppression systems,
c. Setting up of sewage/ waste water treatment plants,
d. Setting up of garbage disposal system for ports and ships,
e. Developing shore reception facility for wastes from ships,
f. Setting up projects for energy generation from renewable energy sources,
g. Providing shore power to ships at berths,
h. Creating Oil Spill Response (Tier-1) capabilities at all ports,
i. Taking actions to improve harbour water quality,

j. Inclusion of sustainable practices in terminal design,
k. Development and operation
l. Increasing green cover within port premises etc

5.0 The Committee noted that NCSCM has made an assessment of the available information and the observation of the NCSCM that the proposed Vadhvan Port is located offshore and is likely to have minimal long term adverse impacts on the land and coastal environment and hence can be considered. The Committee further noted that the area under consideration has ecologically sensitive areas (ESA) such as mangroves, mudflats and an archaeological site located outside the inter-tidal area. Therefore, the port alignment as per available information be strategically designed to exclude these ESA.

6.0 The Committee further in agreement with the observation of the NCSCM observed that there is likely to be minimum impact of the port construction and operation on the overall ecology of the area and that siting of the port could be considered. However, a detailed field investigation be carried out with regard to the resource availability and the community use of these natural resources. The Committee opined that, the prima-facie mandate of the Committee is to see the impact of setting up of port on overall ecology of the area in question and as far as detailed field investigation on various environmental parameters is concerned, the same can be done as a part of EIA/EMP report as prescribed in the notification of EIA, 2006. The committee is of the view that these ecological, coastal and socio-economic aspects of port development need to be carefully drafted in the statutory EIA process for detailed analysis based on site specific primary data and impact prediction analysis.

7.0 Regarding CRZ area demarcations presented by NCSCM for the proposed port, the Committee opined that the port project need to align the facilities in the permissible areas under CRZ as per the prevailing regulatory provisions under CRZ so also the port alignment be strategically designed to exclude these ESA. .

8.0 Further to the presentation made by NCSCM and deliberations made on the report, the Committee deliberated on the mandate of the Committee as per the order of the NGT. The Committee noted that apart from 'assessment and evaluation of impact of setting up port on overall ecology of the area', the

Committee revisited the directions of CPCB dated 30th April, 2020 and OM issued by the Ministry dated 8th June, 2020. The issues and the clarifications submitted by the CPCB and the Ministry has already been discussed in the earlier meetings which are again reproduced in the following section.

9.0 As far as the directions of CPCB in question and the OM issued by the MoEFCC is concerned, the Committee had a detailed deliberation in earlier meetings in which the representative of CPCB has submitted the following clarifications:

i. In order to harmonize the 'Criteria of categorization', directions dated 04.06.2012 were issued by CPCB under Section 18(1)(b) of the Water Act, 1974 and Air Act, 1981, to all SPCBs/PCCs to maintain uniformity in categorization of industries as red, green and orange, as per list finalized by CPCB. In the said categorization the 'Ports and harbour, jetties and dredging operations' were categorized as 'red' category industry.

ii. During the Conference of the Environment Ministers of States held on April 06-07, 2015, at New Delhi, it was resolved to adopt pollution potential criteria for categorization of industries into red, orange & green categories, a committee be constituted with State representatives. A Committee comprising of CPCB and State Pollution Control Boards (Andhra Pradesh, Tamil Nadu, Maharashtra, Madhya Pradesh, Punjab and West Bengal) reviewed and classified industrial sectors into different categories, based on the criteria of respective pollution potential indices.

iii. The 'Ports and harbour, jetties and dredging operations' were again categorized under 'red' category industry, considering all sort of pollution (air, water and hazardous) generation from such projects. The water, air and hazardous pollution scores for the sector is 40, 25 and 20, respectively and Pollution Index (PI) is 85. In this regard, CPCB vide directions dated 07.03.2016 directed SPCBs/PCCs to adopt and implement the categorization finalized by CPCB.

iv. The Laghu Udyog Bharti (All India Organization in Service of Small Scale Industries) vide letter dated 13.12.2019), raised the concern regarding ban on establishment and expansion of non-industrial operations which are necessary for environmental management such as CETPs, STPs, etc. and essential services such as health care facilities, as these sectors are classified as industrial operations by CPCB vide directions dated 07.03.2016 and Hon'ble NGT vide order dated 10.07.2019, in the matter of OA No. 1038/2018, directed that *'...No further industrial activities or expansion be allowed with regard to 'red' and 'orange' category units till the said area are brought within the prescribed parameter or carrying*

capacity of the area is assessed...'. The industrial association requested to segregate such non-industrial activities from list of industrial activities.

v. CPCB in house Committee on categorization of industrial sectors, during the meeting held on 02nd March, 2020 discussed the aforesaid issues and observed that there are certain Activities/Facilities/Infrastructure/Services which are not involved in production of goods. However there is pollution potential of several activities due to their operation. Therefore, committee recommended that these non-industrial operations may be classified separately in the present categorization.

vi. The committee finalized list of such 18 (red-6, orange-5 and green-7) non-industrial operations, including therein 'Ports and harbour, jetties and dredging operations'. However, considering the pollution potential of non-industrial operations, the categories (i.e. red, orange and green) of these sectors were kept intact. CPCB *vide* directions dated 30.04.2020 communicated the list of Non-industrial Activities/ Facilities/ Infrastructure/ Services to SPCBs/PCCs for adoption and implementation.

10.0 Regarding OM issued by the Ministry dated 8th June, 2020, following clarification has been submitted by the Eco Sensitive Zone (ESZ) Division of the Ministry:

i. The Ministry vide number S.O. 416(E), dated 20th June, 1991 notified Dahanu Taluka as an Ecologically Fragile Area and imposed restrictions on setting up of different categories of industries. The said notification classified industries into three categories, namely Red Category, Green Category, and Orange Category. The red categories of industries are not permitted in the Dahanu Taluka Ecologically Fragile Area under the said notification. Ports, harbours and associated activities do not feature in any of the above three categories of industries. The said notification also provides that in case of industries that do not fall in any of the above mentioned three categories, decision in regard to their classification will be taken by the State Government for those projects having an outlay not exceeding Rs. 3 crores and for others, reference is to be made to the Ministry of Environment, Forest & Climate Change, Government of India.

ii. CPCB vide its directions No. B-29016/ROGW/IPC-VI/2020-21 dated 30.04.2020, re-categorized port and harbour, jetties and dredging operations as non-industrial activities but retained them in red category based on the pollution index.

iii. OM dated 08.06.2020, mentions that activities related to the 'port' falling in the ESA can be undertaken in accordance with the provisions of the notification S.O. 416 (E) dated 20th June 1991 and the notification S. O. 884 (E) dated 19th December, 1996 issued by the Ministry and as amended from time to time.

iv. Ministry had issued a specific clarification vide O.M dated 08.06.2020 stating that port and harbours are not classified as industrial activity and therefore can be undertaken in accordance with the provisions of the notification S.O. 416 (E) dated 20th June 1991 and the notification S.O. 884 (E) dated 19th December, 1996.

v. Development of port at Vadhavan in Dahanu Taluka Ecologically Fragile Area is a permissible activity subject to a detailed environmental impact assessment in compliance with the sector specific EAC under EIA Notification, 2006, as amended and CRZ notification 2011, as amended and other relevant statutory clearances, regulations and obligations as applicable.

11.0 The Committee after deliberating on all the documents submitted to it vis-à-vis issues in the order of NGT has the following recommendations:

i. In view of the report submitted by NCSCM and detailed deliberation made during the meeting, the Committee opined that setting up of port on overall ecology of the area in question is likely to have minimum adverse impact and the current baseline conditions would likely to be nearly restored if the port operations are as per the green port norms and following the EIA Notification, 2006, as amended and CRZ notification 2011, as amended and other relevant statutory clearances, regulations and obligations as applicable.

ii. The Committee recommended that while framing the ToR for statutory EIA, suitable studies for ecological, coastal and socio-economic parameters for direct, indirect and induced impacts may be added for carrying out detailed study with field assessment on various environmental parameters for the proposed port developmental activities in the area so also preparation of EIA/EMP report for the projects/activities scheduled in the EIA Notification, 2006, as amended.

iii. CPCB vide directions dated 07.03.2016 has classified non-industrial operations such as CETPs, STPs, health care facilities as industrial

operations. Therefore, the industrial association requested to segregate such non-industrial activities listed in the Direction dated 7th March, 2016 from list of industrial activities. The Committee opined that the step taken by CPCB is based on the finer categorization of the set of activities and categorized them into non-industrial which otherwise has been categorized as industrial activities. However, 'Ports and harbour, jetties and dredging operations' were categorized under 'red' category industry as per 2016 directions, considering all sort of pollution (air, water and hazardous) generation from such projects and that this categorization is independent of the classification of industries as mentioned in the notification dated 20th June 1991 as has been clarified by CPCB and ESZ division. The Committee also noted that both CPCB and ESZ division classified 'Ports and harbour, jetties and dredging operations as a non-industrial activity.

iv. CPCB vide letter dated 10.11.2021 clarified MoEF&CC that considering the pollution potential the category of port and harbour projects was kept intact i.e. Red, but under non-industrial operations.

v. The Committee deliberated on the Ministry's OM dated 8th June, 2020 and the directions of CPCB dated 30.04.2020:

The OM of the Ministry dated 8.06.2020 refers to directions issued by the CPCB dated 30.04.2020 and states that ***"ports, harbors, jetties and dredging operations are now listed in non-industrial operations (activities/facilities/infrastructure/services) and hence, have now been excluded from "red" category.***

It is further mentioned in the OM dated 8th June, 2020 that, ***"the matter has been considered in the Ministry. The undersigned is directed to clarify that in view of the directions of the CPCB, 'Port' does not fall in the red categories of industry. Therefore, activity relating to the port falling in the ecologically sensitive areas can be undertaken in accordance with the provisions of the Notification SO 416(E) dated 20th June, 1991 and Notification SO 884(E) dated 19th December, 1996 issued by Ministry.***

vi. Committee opined that the directions issued by CPCB are very clear on two aspects; firstly; the port and harbour are not considered as 'industry' and secondly, the ***ports, harbors, jetties and dredging operations are considered in red category.*** However, the OM dated 8th June, 2020 issued

by Ministry has instead of referring to the categorization of the industries as per Notification dated 20th June 1991 where ports, harbour jetties and dredging operations do not find mention under any category of industries referred to categorization by CPCB. The committee noted that the 1991 notification of Dahanu also appends a list of red, orange and green category of Industry that does not include port and harbours. The notification also notes that `—The case of industries which do not fall in any of the above mentioned three categories, decision in regard to their classification will be- taken.by the State "Government for those projects having, an outlay not exceeding Rs. 3 crores> and for others reference is to be made to the Ministry of Environment & Forests, Government of India. The committee felt that ministry may examine requirement of issuing a clarification in this regard.

vii. There seems a mismatch and lack of clarity in OM dated 8th June, 2020 issued by Ministry vis-a-vis CPCB directions of 7th March, 2016. The Committee has also noted that ports, harbors, jetties and dredging operations are permissible activities which can be established following the green port norms and with a detailed environmental impact assessment following the EIA Notification, 2006, as amended and CRZ notification 2011, as amended and other relevant statutory clearances, regulations and obligations as applicable.

viii. Against the aforementioned background and the analysis made by the Committee, necessary clarification as deemed appropriate may be issued.

ix. The Committee also noted that the EIA notification, 2006 has mandated in its schedule at sl. no. 7(e) that "Ports, harbors, break waters, dredging" will require Environmental Clearance wherein the General Condition shall apply wherein:

1. Capital dredging inside and outside the ports or harbors and channels are included;
2. Maintenance dredging is exempt provided it formed part of the original proposal for which Environment Management Plan (EMP) was prepared and environmental clearance obtained.

x. Further, the Committee also noted that as per the CRZ Notification of 2011 as stated in para 4 that the following activities shall be regulated except those prohibited in para 3 of the CRZ notification, 2011, -

(4) (f) construction and operation for ports and harbours, jetties, wharves, quays, slipways, ship, construction yards, breakwaters, groynes, erosion control measures;

xi. The Committee concluded its discussion with a view that construction of 'Ports and harbour, jetties and dredging operations can be considered as non-industrial activities that can be considered under Dahanu notification 1991and can be treated as a permissible activity under CRZ notification 2011 as amended, subject to a detailed EIA/EMP study following the EIA Notification, 2006, as amended, and other relevant statutory clearances, regulations and obligations including clearances from DTEPA constituted by GoI as applicable.

12.0 The Committee further mentioned that the deliberations made in this meeting and the minutes of this meeting may be considered as the final deliberation as this includes all the observations made in the earlier meetings including the appraisal of the report submitted by NCSCM. There is no need of any separate report to be submitted by the Committee.

*****

Dr. Manoranjan Hota
(Member EAC)
(Member)

Dr. M. V. Ramana Murthy
(Member EAC)
(Member)

Dr. K. Sivakumar
(Scientist – F, WII)
(Member)

Dr. Deepak Samuel. V
(Scientist – E, NCSCM)
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Dr. Bineesh,
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Shri Ajay Aggarwal,
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Shri. A. A. Shingare,
(Member Secretary, MPCB)
(Member)

Shri Narendra D. Toke,
(Director, ECCD, GoM)
(Member)

Dr. A. A. Despande,
(Adjunct Professor, Centre for Policy Studies, IIT, Bombay)
(Independent Member)

Amardeep Raju, (Scientist E)
(Convener)

Assessment and evaluation of impact of setting of port on overall ecology of the Dahanu Takula – 'Ecologically Fragile Area'

NCSCM

National Centre for Sustainable Coastal Management
Ministry of Environment, Forest and Climate Change
GOVERNMENT OF INDIA

April 2022

Assessment and evaluation of impact of setting of port on overall ecology of the Dahanu Takula – **'Ecologically Fragile Area'**

National Centre for Sustainable Coastal Management
Ministry of Environment, Forest and Climate Change
GOVERNMENT OF INDIA

April 2022

CONTENTS

EXECUTIVE SUMMARY

The Ministry of Environment, Forest and Climate Change (MoEF&CC) directed National Centre for Sustainable Coastal Management (NCSCM), MoEF&CC in its email date 16 February 2022, to examine the feasibility of undertaking these studies and the timeline required. It was also mentioned to explore studies that can be made through available secondary information. An initial terms of Reference (ToR) containing 18 (xviii)) tasks was provided to NCSCM on 16th February 2022, which was subsequently revised on 23rd February 2022, with two additional tasks totalling 20 (xx) tasks, with the inputs of the committee.

Given the short timeline (1 to 2 months), NCSCM indicated that the following tasks in the ToR can be addressed immediately (Table 1) using limited primary and secondary data/ information. Field survey of the site could however not be undertaken within the short timeline. NCSCM also indicated that in order to address the remaining tasks of the terms of reference (if required), additional time (up to 6 months) is necessary to undertake detailed field surveys and analysis to address the remaining ToR and can be carried out by any competent consultant.

Tasks undertaken by NCSCM based on the above terms of Reference

ToR No.	Terms of Reference
i	Assessment and evaluation of impact of setting up port on overall ecology of Dahanu Taluka
ii	Baseline environmental setting of 35 km. coastal belt of Dahanu Taluka to be studied for availability of natural resources, wetlands, mangroves, river deltas etc. and an analysis of baseline environmental setting of the area shall be submitted.
v	The coastal creeks and inlets at Dahanu Taluka should be studied for the availability of various species of fish and submitted.
vii	Source of pollution due to Ports and their operations/cargo type/ Hazardous Chemicals and its handling shall be studied in detail and an analysis shall be submitted.
x	Flooding and related impact on creek and control area during the cyclonic storm should be studied.
xv	Details of emission, effluents, solid waste and hazardous waste generation and their management in the existing and proposed facilities.
xvi	Requirement of water, power, with source of supply.
xvii	Vicinity of Forest areas, Wild life Sanctuaries and National Parks etc shall be analysed and submitted.
xix	Superimposing the activities and the CRZ areas along with the recommendations, which will enhance the quality of the studies and the report.
xx	Assessment of CPCB notification on classification of categories of industries specifically w.r.t. ports vis-a-vis the notification of the MoEFCC on the subject.

ToR-wise observations are listed for consideration of the Committee.

ii. Baseline environmental setting of 35 km. coastal belt of Dahanu Taluka to be studied for availability of natural resources, wetlands, mangroves, river deltas etc. and an analysis of baseline environmental setting of the area shall be submitted.

Based on the detailed analysis of available secondary data/ information, it is observed that the proposed Vadhvan Port is located offshore and is likely to have minimal impact on the land environment. The area under consideration has ecologically sensitive areas (ESA) such as mangroves, mudflats and an archaeological site located outside the inter-tidal area, the alignment of which is strategically designed to exclude these ESA. Benthic studies indicate rich faunal biodiversity, contributing to sustain healthy fishery resources. Detailed field investigation with regard to the resource availability and the community use of these natural resources is recommended.

v. The coastal creeks and inlets at Dahanu Taluka should be studied for the availability of various species of fish and submitted.

Detailed maps on rivers/ creeks, lakes and ponds, dams and reservoirs were prepared to assess the natural water resources in the area under consideration. Four rivers and creeks were mapped along with the presence of wetlands. However, secondary information pertaining to fisheries in the creek area is unavailable and hence an assessment is not made in this report.

vii. Source of pollution due to Ports and their operations/cargo type/ Hazardous Chemicals and its handling shall be studied in detail and an analysis shall be submitted.

The most likely sources of pollution in the port region are linked to construction, operation and maintenance activities. It is expected that capital dredging and disposal of dredge spills may impact water quality (e.g. turbidity) and marine ecology. During construction, the dredging activities impact coastal hydrodynamics and sediment transport thus short-term impacts on shoreline stability is anticipated. The proposed port is expected to follow green norms which would minimize the anticipated impacts to acceptable levels.

x. Flooding and related impact on creek and control area during the cyclonic storm should be studied.

A composite hazard line was drawn for the area under consideration taking into account, elevation, 1 in 100-year flood and coastal erosion after 100 years and sea level rise. This recognizes the most landward penetration of flood or any extreme event in 1 in 100-year time period. Based on this, the area under the composite hazard line is 11,094 ha (or 110.9 sq. km). Further, the assessment of long-term shoreline change indicates a largely stable coast (61%) but is evidencing some low erosion in recent times, which is not a major concern.

xv. Details of emission, effluents, solid waste and hazardous waste generation and their management in the existing and proposed facilities.

Based on available secondary information, assessment of possible emissions, effluents, solid and hazardous waste generated was made on all environmental matrices. It is expected that during the construction phase, the offshore facility is likely to cause only a minimal impact on air quality and land environment. Significant impacts on water quality at the construction and reclamation sites sand in the near coastal waters is expected to be high. Broad guidelines for management of wastes is given in significant detail in this section. Nevertheless, post construction operation and maintenance of the proposed port is likely to reverse the adverse impacts by following the prescribed norms for green port. Further detailed studies are required to ascertain the environmental quality based on the nature of cargo to be handled and the Environment Management Plan (EMP) drawn up for this purpose.

xvi. Requirement of water, power, with source of supply.

As per the Techno-Economic Feasibility Report for Development of Port at Vadhavan, the total Water Demand at Port 153 KLD during phase I and 1671 KLD as per the master plan. Sakhare dam is projected as a main source of water with a storage capacity of 4.07 Mcum of water. It is recommended that ground water use for port activity shall be avoided. The source of power is the 220-kV substation located at Boisar, 20 km from the proposed port location. During initial phase the power requirement has been projected as 13 MVA whereas it is 81 MW in the master plan stage. It is suggested to work out the detailed requirement of power and water prior to the operation of the port.

xvii. Vicinity of Forest areas, Wild life Sanctuaries and National Parks etc shall be analysed and submitted.

The forests in the area under consideration belong to four forest types viz., Southern Tropical Semi-Evergreen forests, Southern Tropical Moist Deciduous Forests, Southern Tropical Dry Deciduous forests and Littoral and Swamp Forests mainly comprising of mangroves. Based on the classification the forest cover estimated within the area under construction is 137.62 sq km.

Extensive areas of Orchards / Plantation crops comprising mainly of *Sapodilla* along with other fruit trees like Coconut, Mango, Lychee, Guava, Grapefruit, Custard Apple and Cashew nuts are present, the extent of which is estimated to be 107.10 sq km. An area of 10.34 sq km of mangrove forests are present along the estuarine regions of the Dahanu, Dhumkhet, Matgaon, Boisar, Dandi, and Murbe. According to forest cover mapping of Forest Survey of India, the study area limit sustains 105.1 sq km of forest cover), which includes Scrub forest (0.44 sq km) open forests (82.35 sq km), moderately dense forests (22.31 sq km). Based on available literature, there are NO designated wildlife sanctuaries, national parks, community reserves present in the vicinity of proposed Vadhavan Port area.

xix. Superimposing the activities and the CRZ areas along with the recommendations, which will enhance the quality of the studies and the report.

The proposed port limit boundary falls within the CRZ IA (mangrove and 50m mangrove buffer zone), CRZ IB (intertidal zone), No Development Zone (NDZ) of CRZ III, and CRZ III (between 200m to 500m). The Proposed Approach Trestle, Proposed Breakwater, Proposed Navigational Area, Proposed Offshore Reclamation Area, and Proposed Shelter Areas fall within the CRZ IV A category, whereas the Proposed Reclamation Area Nearshore falls on CRZ IB, NDZ of CRZ III, CRZ III and CRZ IVA categories.The CRZ categories along the project area include CRZ IA (Mangrove), CRZ IB (Intertidal Zone), CRZ III (No Development Zone and 200 to 500 m from HTL), CRZ IVA (Sea).

xx. Assessment of CPCB notification on classification of categories of industries specifically w.r.t. ports vis-a-vis the notification of the MoEFCC on the subject.

The generic observation that ports are associated primarily with freight services (loading-unloading, stowing-unstowing, transport between ships or ship-port) is the basic premise for the CPCB to exclude ports from the RED category. Despite the anticipated pollution impacts, it is appropriate to mention that ports need to conform to the environmental standards and safeguards as prescribed for “Green” Ports, and by following national and international green protocols.

i. Assessment and evaluation of impact of setting up port on overall ecology of Dahanu Taluka

A summary of possible impacts was assessed by developing a matrix of activities and impacts on land, water, biota, fisheries and on air, noise and vibration.

Environment Impact matrix for Vadhavan Port

Port Activities	Phases	Impacts												
		Land		Water				Biota						
		Shoreline	Agri/ Plantn/ Horti	Ground water	Rivers, Creeks	Coastal water	Wetland	Terrestrial	Coastal	Marine	Fisheries	Air	Noise	Vibration
	Baseline													
	During construction													
	Cargo handling													
	Cargo storage and transfer													
	Dredging and reclamation													
	Waste generation/emission													
	Marine Traffic													
	Vehicular Movement													

Legend

Impacts				
Very High	High	Medium	Low	No Impact

The baseline study indicates no impact on the environment and ecology. During construction phase, likely impacts are high for shoreline and for most other variables. In the operation phase, most of the high impacts are likely to be minimized to moderate, low and to no impacts if the operations continue on a green port mode.

From the preliminary assessment, the water environment (in particular the coastal waters and creeks) and marine biota including fisheries are likely to be impacted during construction but it is expected that current baseline conditions will be restored if the port operations are as per the green port norms.

1. Background

Maharashtra State has a coastline of 720 km along the Arabian Sea with two major ports, the Mumbai Port and the Jawaharlal Nehru Port Trust (JNPT). The Vadhavan Port is proposed to be located on reclaimed land located offshore at a depth of ~20m. The site is surrounded on the West, North and South by Arabian Sea, various villages on East with discreetly habited land (19°55'46.19''N, 72°40'22.98'E). The proposed port is to be jointly developed by Jawaharlal Nehru Port Trust (JNPT) and Maharashtra Maritime Board (MMB). Due to the expansion of the Mumbai City and the availability of restricted depths in the harbour, Mumbai Port has had difficulty in evacuating goods. The JNPT Port is unable to deepened any further due to the presence of bed rock at or very close the existing bed level, creating a need for an additional mega port. With the projected demand for containers to go up, it is necessary to locate a new mega port site which can cater to increased requirement of capacity and also could be developed to handle the future deep draft ships. Considering the above was proposed to develop Vadhavan port as a satellite port for JNPT.

1.1 Context

An application was filed (Hon'ble NGT vide OA No.22 of 2021 (WZ) National Fishworkers Forum & Ors Vs MoEF&CC & Ors – F,No. IA3-3/40/2021-IA-III, CP Division dated 20.09.2021) against the directions of CPCB issued vide dated 30.04.2020 and OM of the Ministry issued vide dated 08.06.2020. Directions of CPCB are under section 18(1)(b) of the Water (Prevention and Control of Pollution) Act, 1974 and the Air (Prevention and Control of Pollutions) Act, 1981 for harmonization of classification of industrial sectors into Red, Orange, Green and White categories.

I. The petitioners alleged that the Dahanu Taluka Environmental Protection Authority (DTEPA) was called upon to decide a matter with regard to a port that was proposed to be set up in Vadhavan, a small fishing village falling within the ecologically sensitive Dahanu region. On 17.02.1997 the Govt. of Maharashtra accepted a proposal from the P&O Australia to build an international port at Vadhavan. The petitioners as well as other civil society groups petitioned the DTEPA contending that the construction of the port would cause massive damage to the Dahanu's fragile ecosystem, and would have serious repercussions with the lives of the people of Dahanu.
II. The applicants submitted before the Hon'ble tribunal that the impugned directions issued by the CPCB dated 30.04.2020 and the OM issued by the MoEFCC dated 08.06.2020 are in series of steps taken by the Central Govt. and its agencies to remove any potential impediments to the setting up of a port in Vadhavan.
    a. The applicants also pointed out that detailed discussions were held with regard to the categorization of industries at the National Level conference of

the Environment Ministries of the States held in New Delhi in April 2015; the following resolution came to be passed at the National Level Conference. A 'Working Group' comprising of the members from CPCB, APPCB, TNPCB, WBPCB, PPCB, MPPCB and Maharashtra PCB is constituted.

b. This WG shall revisit the categorization of industries that is based on pollution index criteria & environmental issues such as generation of emission, effluent and hazardous wastes.
c. The categorization will be done of the basis of composite score (0-100 marks) of Pollution Index given in accordance with the weightage.

III. CPCB vide Directions dated 7th March, 2016 declared Ports, Harbour, Jetties and Dredging operation as Red category.

IV. The petitioners alleged that on 17.02.2020 the CPCB issued OM constituting another committee to consider categorization of new/left out industrial/sectors into red, orange, green and white category of industries. The OM noted the exercise conducted in 2012 and 2016 to bring about uniformity in categorization and that a need was felt to categorize upcoming industrial sectors on a pan-India level and to resolve the anomalies in categorisation of industries.

V. CPCB vide Directions dated 7th March 2016 declared Ports, Harbour, Jetties and Dredging operations as Red category. Further CPCB vide Directions dated 30th April, 2020 declared Ports, Harbour, Jetties and Dredging operations as Non-Industrial Operations. On 20.02.2020 the Respondent no.3 (Ministry of Shipping, GOI) requested the MoEFCC to clarify whether ports fall in any of the categories that may have a detrimental effect on the environment. In response, the MoEFCC issued an OM dated 08.06.2020. The OM refers to directions issued by the CPCB dated 30.04.2020 and states that since ports, harbours, jetties and dredging operations have been listed as non-industrial operations under the CPCB directions, they no longer fall under the 'red' category.

VI. In light of the above the Honb'le tribunal observed **at para no. 16** that: -
"**Main question raised is that while the area is eco fragile areas where developmental activities are regulated the impugned CPCB guidelines and the MoEFCC OM have the effect of doing away with the precautionary principle and sought to permit unrestricted Port activities which are hazardous and polluting and incompatible with conserving the area in question consistent with the activities which can be allowed in an eco-fragile area. There is no expert study conducted nor past studies disallowing port in the area considered."**

VII. Accordingly, the hon'ble tribunal has taken a view that the directions of CPCB in question and the OM issued by the MoEFCC need to be revisited by undertaking assessment and evaluation by an expert group of impact of setting up port on overall ecology of the area in question, comprising of atleast five renowned experts, including expert in Marine Biology/Ecology and Wildlife Institute of India which may visit the site and interact with stake holders. Other members can be from EAC dealing with ports and harbours or otherwise. Till

such a study is carried out and fresh decision taken, the impugned direction and O.M. in so far as they apply to the Dahanu Taluka ecologically fragile area may not be given effect.

VIII. In compliance of the order of Hon'ble NGT vide order dated 20.09.2021, an Expert Committee has been constituted consisting of 8 members wherein 2 expert members from the EAC (Ports & Infrastructure) were nominated.

The scope of work for the committee include-

i. To study the order of Hon'ble NGT dt 15.06.2021 to have a comprehensive view on expected deliverable from the committee.
ii. To revisit the Direction of CPCB issued vide letter no. B-29016/ROGW/IPC-VI/2020-21 dt. 30.04.2021 and OM issued by MoEF vide F.No. 25/120/2015-ESZ/RE dt. 08.06.2020 by undertaking assessment and evaluation of impact of setting of port on overall ecology of the Dahanu Taluka – Ecological fragile area.
iii. Any other issues/findings felt necessary by the committee to be brought in the knowledge of Hon'ble NGT concerning the matter.
iv. Committee shall submit its report one month from the date of issuance of this order.

As per the minutes of the 2nd meeting of the Committee, following decisions were taken:

i. As far as the second part of the 'Scope of the Work' of the Committee viz 'undertaking assessment and evaluation of impact of setting of port on overall ecology of the Dahanu Taluka – Ecologically fragile area' is concerned, an agency of national repute like NEERI etc. may be appointed, once the regulatory issues are resolved. Based on the outcome of the study, the Committee will be able to provide its recommendations.
ii. In view of the above, it was proposed that NCSCM, Chennai (an agency under MoEFCC) may be appointed for conducting this study.
iii. A Draft ToR has been prepared for conducting the study and shared with NCSCM, Chennai.

1.2 Terms of Reference

The Ministry of Environment, Forest and Climate Change (MoEF&CC) directed National Centre for Sustainable Coastal Management (NCSCM), MoEF&CC in its email date 16 February 2022, to examine the feasibility of undertaking these studies and the timeline required. It was also mentioned to explore studies that can be made through available secondary information.

An initial terms of Reference (ToR) containing 18 (xviii) tasks was provided to NCSCM on 16th February 2022, which was subsequently revised on 23rd February 2022, with two additional tasks totalling 20 (xx) tasks, with the inputs of the committee.

Terms of References for the Study to be conducted in Dahanu Area

i. Assessment and evaluation of impact of setting up port on overall ecology of Dahanu Taluka
ii. Baseline environmental setting of 35 Km. coastal belt of Dahanu Taluka to be studied for availability of natural resources, wetlands, mangroves, river deltas etc. and an analysis of baseline environmental setting of the area shall be submitted.
iii. Source of livelihood for the local population shall be studied with prime focus on fishing and agriculture and submitted.
iv. Forest cover in the area shall be studied in detail along with study of the foothills w.r.t availability of wildlife including endangered species and submitted.
v. The coastal creeks and inlets at Dahanu Taluka should be studied for the availability of various species of fish and submitted.
vi. Impact of port related activities including access channel dredging, cargo handling, infrastructure such as warehouses, sheds, gantries, docks, railways, roads, canals, tunnels and bridges within the port area shall be carried out and submitted.
vii. Source of pollution due to Ports and their operations/cargo type/ Hazardous Chemicals and its handling shall be studied in detail and an analysis shall be submitted.
viii. The pollution due to discharge of emissions and effluents and its likely impact on health of workers and local population shall be carried out and submitted.
ix. Hydrodynamics study on impact of dredging on flow characteristics.
x. Flooding and related impact on creek and control area during the cyclonic storm should be studied.
xi. Study the impact of dredging and dumping on marine ecology shall be carried out and submitted.
xii. Ship Navigation studies for prevention of navigation hazards shall be analysed and submitted.
xiii. Traffic forecast and congestion studies at roads connecting arterial roads to be conducted. Detail traffic density study to be conducted since lot of container movements are expected in & out of the proposed port.
xiv. Impact of port on shoreline changes and sea bed morphology to be conducted
xv. Details of Emission, effluents, solid waste and hazardous waste generation and their management in the existing and proposed facilities.
xvi. Requirement of water, power, with source of supply.
xvii. Prepare a detailed biodiversity impact assessment report. The report shall study the impact of the activity on the intertidal biotopes, corals and coral communities if present, molluscs, sea grasses, sea weeds, subtidal habitats, fishes, cetaceans and other marine and aquatic micro, macro and mega flora and fauna including benthos, plankton, turtles, birds etc. as also the productivity.
xviii. Vicinity of Forest areas, Wild life Sanctuaries and National Parks etc shall be analysed and submitted.
xix. Superimposing the activities and the CRZ areas along with the recommendations, which will enhance the quality of the studies and the report.
xx. Assessment of CPCB notification on classification of categories of industries specifically w.r.t. ports vis-a-vis the notification of the MoEFCC on the subject.

Given the short timeline (1 to 2 months), NCSCM indicated that the following tasks in the ToR can be addressed immediately (Table 1) using limited primary and secondary data/ information. Field survey of the site could however not be undertaken within the short timeline. NCSCM also indicated that in order to address the remaining tasks of the terms of reference (if required), additional time (up to 6 months) is necessary to undertake detailed field surveys and analysis to address the remaining ToR and can be carried out by any competent consultant.

Table 1: Tasks undertaken by NCSCM based on the above terms of Reference

ToR No.	Terms of Reference
i	Assessment and evaluation of impact of setting up port on overall ecology of Dahanu Taluka
ii	Baseline environmental setting of 35 km. coastal belt of Dahanu Taluka to be studied for availability of natural resources, wetlands, mangroves, river deltas etc. and an analysis of baseline environmental setting of the area shall be submitted.
v	The coastal creeks and inlets at Dahanu Taluka should be studied for the availability of various species of fish and submitted.
vii	Source of pollution due to Ports and their operations/cargo type/ Hazardous Chemicals and its handling shall be studied in detail and an analysis shall be submitted.
x	Flooding and related impact on creek and control area during the cyclonic storm should be studied.
xv	Details of emission, effluents, solid waste and hazardous waste generation and their management in the existing and proposed facilities.
xvi	Requirement of water, power, with source of supply.
xvii	Vicinity of Forest areas, Wild life Sanctuaries and National Parks etc shall be analysed and submitted.
xix	Superimposing the activities and the CRZ areas along with the recommendations, which will enhance the quality of the studies and the report.
xx	Assessment of CPCB notification on classification of categories of industries specifically w.r.t. ports vis-a-vis the notification of the MoEFCC on the subject.

The above terms of reference are addressed in the following sections.

2. Baseline Environment

[ToR # ii- Baseline environmental setting of 35 km. coastal belt of Dahanu Taluka to be studied for availability of natural resources, wetlands, mangroves, river deltas etc. and an analysis of baseline environmental setting of the area shall be submitted]

Dahanu is a coastal taluka located in Palghar District, along the northern part of the state of Maharashtra. The state government announced the establishment of the 36th district of Maharashtra, Palghar, on August 1, 2014 (Figure 1). It was created from the former Thane District (Trombay), which was established under British India. Dahanu (Figure 2) is situated 120 km north of Mumbai and previously was a municipal council under the Thane District.

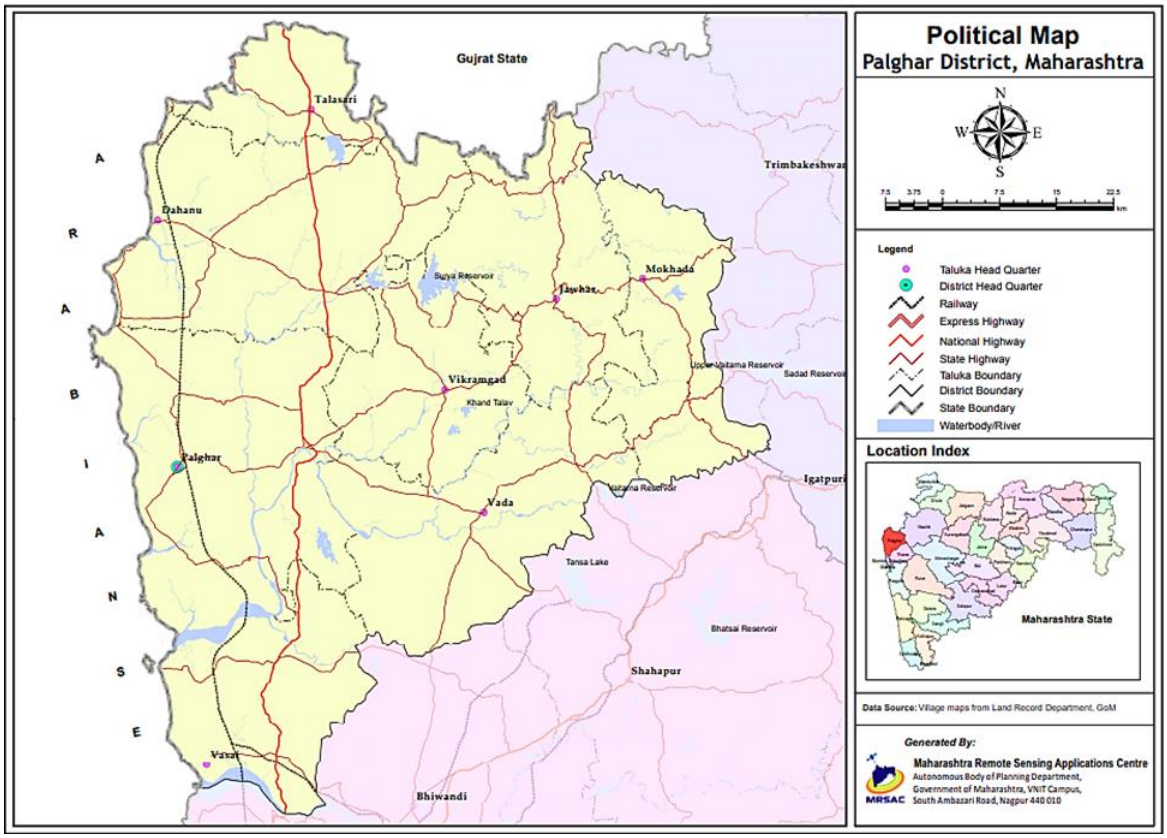

Figure 1: District map of Palghar, Maharashtra (Source: Maharashtra Remote Sensing Applications Centre)[1]

2.1 Demography

According to the 2011 Census, Dahanu has a population of 50,287 people, of which 52% are male and 48% female. The average literacy rate is 71% and 69.1 per cent of the taluka's population is Schedule Tribe. The Dahanu sub-district of Maharashtra is listed as a “Full Schedule Area” indicating that a majority of its resident population are indigenous. Hinduism and Christianity are the major religions here.

[1] https://mrsac.gov.in/writereaddata/MRSAC/map/15616303065d14966272ddfDist_Palghar.pdf

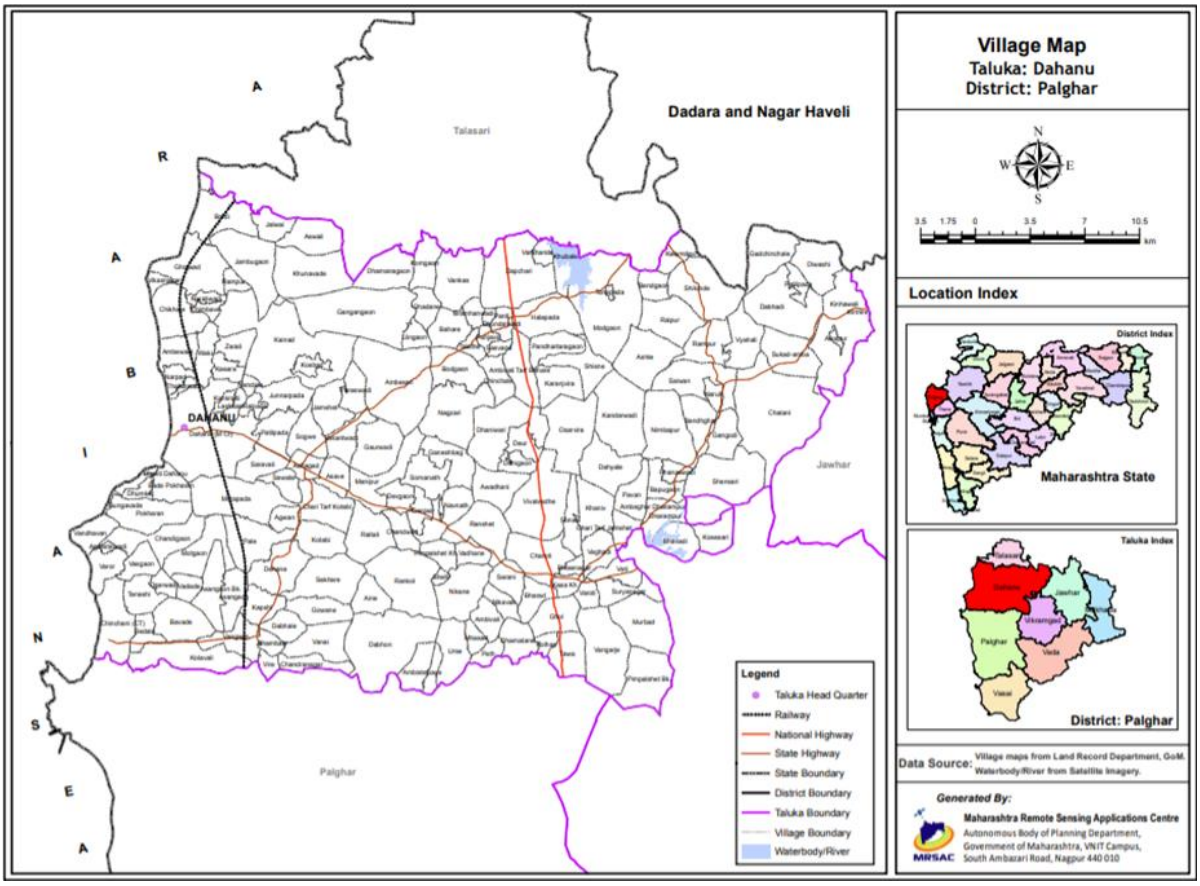

Figure 2: Map of Dahanu Taluka, Palghar District, Maharashtra (Source: Maharashtra Remote Sensing Applications Centre)[2]

The Warli or Varli are an indigenous tribe (Adivasis) of western India, living in mountainous and coastal areas along the Maharashtra-Gujarat border and surrounding areas[3]. Warli tribe are settled in Jawhar, Vikramgad, Mokhada, Dahanu and Talasari talukas of the northern Palghar district. Dahanu's population consists predominantly of the indigenous community of Warlis. They own 45,000 acres of land (18% of the total area of Dahanu Taluka *i.e.* 2,45,000 acres (99,000) hectares of land[4] and 33% of the agricultural land).

The Taluka has a large fishing, farming, and traditional artisan community. It is also a major commercial and industrial town in the Palghar district besides being known for marine fishery resources, especially for Bombay duck *(Harpodon nehereus)*. Major infrastructure near Dahanu are Adani Dahanu Thermal Power Station, Tarapur Atomic Power Plant and Tarapur Industrial Estate.

[2] https://mrsac.gov.in/writereaddata/MRSAC/map/15670696575d6795d984e10TH_PLG_Dahanu.pdf

[3] Nair R, Dhee, Patil O, Surve N, Andheria A, Linnell JDC and Athreya V (2021) Sharing Spaces and Entanglements With Big Cats: The Warli and Their Waghoba in Maharashtra, India. Front. Conserv. Sci. 2:683356. doi: 10.3389/fcosc.2021.683356

[4] Kapoor, M., K. Kohli and M. Menon (2009) India's Notified Ecologically Sensitive Areas (ESAs): The Story so far...Kalpavriksh, Delhi & WWF-India, New Delhi

In 1988[1], the Bombay Suburban Electric Supply Limited (BSES) proposed to set up a 500 MW thermal power plant. Due to the environmental consequences, the residents of Dahanu filed a Writ Petition in the Bombay High Court. The Hon'ble Bombay High Court and later the Hon'ble Supreme Court both permitted the setting up of the thermal power plant in their respective orders. However, local groups like the Dahanu Taluka Environment Protection Group (DTEPG) with assistance from groups such as the Bombay Environmental Action Group (BEAG) solicited for the declaration of the area as an ESA.

2.1.1 Ecologically Fragile Area

A report of the Ministry of Environment and Forests (MoEF) titled 'Parameters for Determining Ecological Fragility' was relied on to justify the issuance of the notification making it the first time that scientific parameters were used in declaring an area as an ESA. In 1991, the notification was proposed by Ms. Maneka Gandhi, the then Union Minister for Environment and Forests. However, the notification was finally issued after the thermal power plant was permitted.

This notification, employed categorisation of industries similar to the Doon Valley Notification, and it was the first time when the term ***'Ecologically Fragile Area'*** was used in such a notification. The 1991 Notification imposed restrictions on setting up of industries which have a detrimental effect on the environment, and laid down guidelines for setting up of industries and industrial units in certain locations based on classification. Other elements in ESA declaration that the notification introduced included the constitution of a Monitoring Committee which was to be set up immediately after the notification was issued. The Dahanu Taluka Environment Protection Authority (DTEPA) was established after the Order of the Hon'ble Supreme Court in 1996, to monitor the compliance of the Dahanu ESA Notification.

Table 2: Chronology of events for the Dahanu Notification

1988-89	Declaration of Green Zone, BSES proposed its thermal power plant
1989	Nergis Irani & Kitayun Rustom, activists from Dahanu Taluka, filed WP in Bombay High Court against the Thermal Power Plant but the plea was declined
1989-1990	Nergis Irani & Kitayun Rustom met with Ms. Maneka Gandhi, the then Minister E&F
Feb 1991	Preliminary Dahanu ESA Notification
Jun 1991	Final Dahanu ESA Notification
1994	Bittu Sehgal, editor of 'Sanctuary-Asia' filed WP in Supreme Court seeking implementation of the Dahanu ESA Notification
Oct 1996	Supreme Court directed MoEF to constitute the DTEPA
Jan 2001	The Ministry presented a background note on the Dahanu ESA Notification to the Mohan Ram Committee
	The Mohan Ram Committee examined the Dahanu ESA Notification and suggested in its last meeting on June 29, 2004 that it be reviewed against the criteria mentioned in the Pronab Sen Committee Report

In Dahanu, the DTEPA[1] has actively examined the environmental impacts of proposed development projects in the region. The Ministry of Environment and Forests (MoEF) notified Dahanu Taluka as an ESA on June 20, 1991.

2.2 Climate conditions

The average rainfall in Palghar District is approximately 2400 mm. Over the last 30 years, Palghar has seen a considerable increase in rainfall. The southwest monsoon season lasts from June to September, accounting for up to 89% of Maharashtra's annual rainfall. The average daily maximum temperature is 31°C, with a high of 34°C in April. The average daily minimum temperature is 24°C, with the lowest temperature of 18°C occurring in December. The relative humidity is often high, reaching around 85% during the monsoon season in August. In comparison to the east coast, the region is less vulnerable to natural disasters such as cyclones.

2.3 Land environment

Topographically, Dahanu Taluka can be divided into a 10-12 km wide *bandarpatti* i.e a coastal belt of lowlands and flats extending from the coast to foot of the Sahyadari Range[5]. The Dahanu coastal area has several natural resources such as mangroves, wetlands and several creeks and estuaries with good fishery potential. The *junglepatti* or the forest belt[5], to the east of the foothills consists of tropical deciduous forests. It is estimated that the forest cover in Dahanu is substantially high at 45%.

a) Geology and topography

The topography of the intertidal zone is rocky and undulated and bed levels in this zone, slant westward. The seafloor is rocky, and surface rock can be seen across the intertidal zone during low tide. These rocks are dark grey in colour, generally basaltic in nature, and subject to weathering on the surface. Weathering has occurred on the submerged rocks, and the degree of weathering varies with exposure.

b) Natural Resources

The Dahanu taluka has a variety of wildlife including endangered species such as leopards, spotted deer, barking deer, and mouse deer. The coastal creeks and inlets at Dahanu are the feeding grounds for various species of fish. Dahanu, with its 35 km coastline is like an oasis on the western coast of Maharashtra, located between Mumbai and its sprawling suburbs to the south and the industrial cities of Vapi and Surat to its north. The land use and land cover map of Dahanu taluka is in Figure 3.

[5] Kapoor, M., K. Kohli and M. Menon 2009.India's Notified Ecologically Sensitive Areas (ESAs): The Story so far...Kalpavriksh, Delhi & WWF-India, New Delhi, 112 pp.

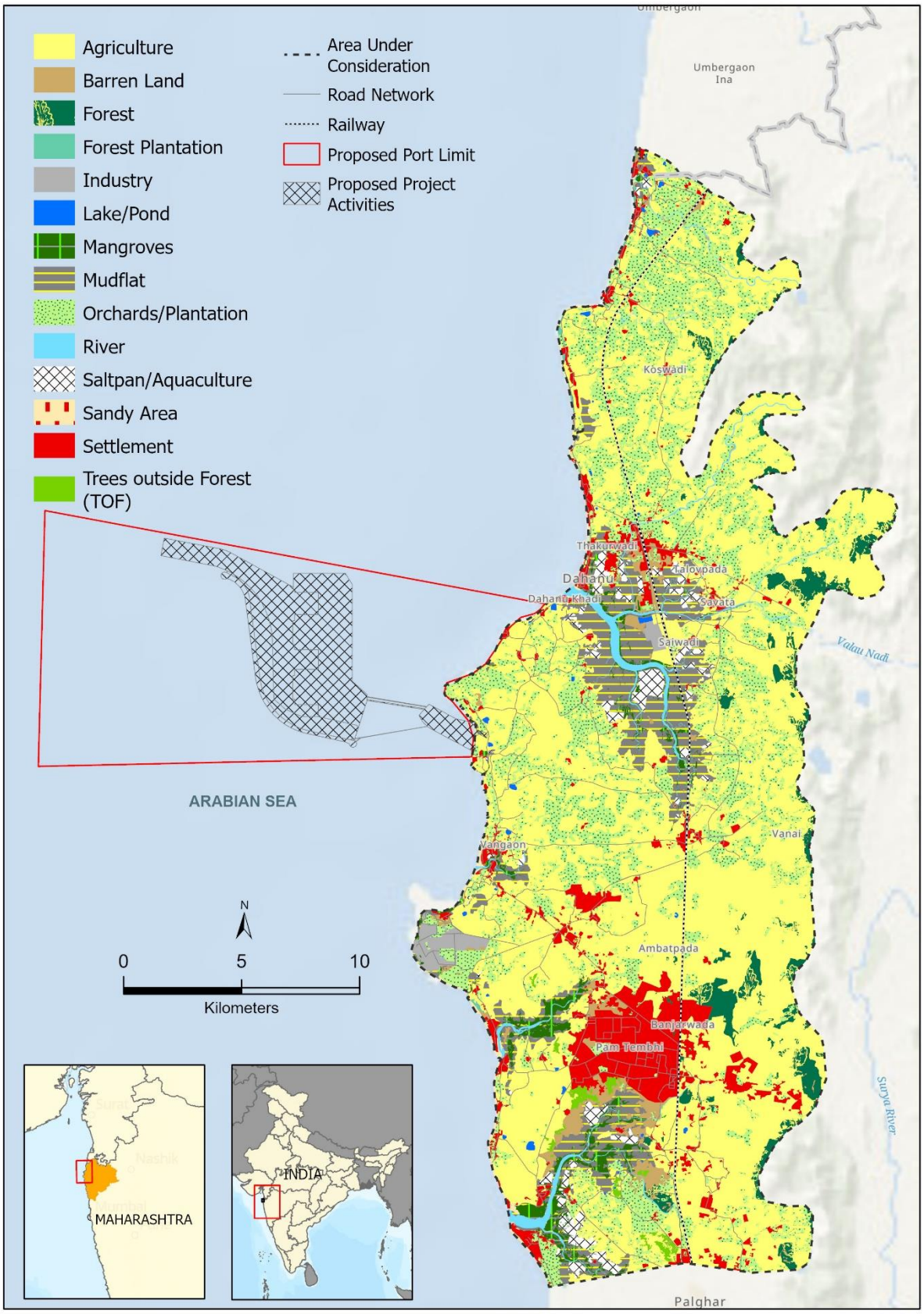

Figure 3: Land use and land cover map of the area under consideration at Dahanu Taluka

Table 3: Land use and land cover extent in the area under consideration for proposed Vadhvan Port area

Classification	Area (Sq.km)	%
Agriculture	285.8	53.5
Barren Land	10.3	1.9
Forest	17.4	3.3
Forest Plantation	0.6	0.1
Industry	4.1	0.8
Lake/Pond	1.2	0.2
Mangroves	10.3	1.9
Mudflat	37.9	7.1
Orchards/ Plantation	107.1	20.0
River	7.1	1.3
Saltpan/Aquaculture	9.4	1.8
Sandy Area	1.9	0.4
Settlement	39.0	7.3
Total Forest Area (TOF)	2.2	0.4
Total	**534.3**	**100.0**

The spatial extent of study of the 24 km proposed port site at Vadhavan, is 534.3 sq.km. The distribution of land use/ land cover and the spatial extent of each class has been quantified for the year 2022, from Sentinel Satellite data of 10m resolution is given in Table 3 and Figure 1.

c) Agriculture

Dahanu is known as the "fruit and food bowl of the region" and majority of the population practice farming or fishing. With a yearly production of over 50,000 tons of Chickoos, (a nutrient rich tropical fruit commonly called sapota/ sapodilla), 70,000 tons of freshwater fish, 2000 tons of guavas, 5,000,000 coconuts, a monthly production of 8,500 railway wagons of vegetables, 2,500 wagons of fodder, 500 truckloads of spider lilies, 2,500 truckloads of salt and a 100% employment rate, Dahanu is also known as the “fruit and flower basket” of the states of Gujarat and Maharashtra[2]. The marine fish catch in the area comprises over 3.7 lakh tonnes of crabs, pomfret and other fishes and 17,000 tonnes of prawns. Bombay duck is one of the major exports from Dahanu along with other fishes and lobster.

Dahanu remains one of the green zones in this region between the chemical corridors of Vapi, Gujarat, to the north and the industrialised zones of Palghar-Boisar to the south.

2.4 Water Environment

a) Oceanographic conditions

Bathymetry

According to the NHO hydrographic chart, the proposed port is approximately 1800 metres away from the 0 m contour. The Vadhavan Point is approximately 3500 metres

from the 5m contour. After 5m contour, the bathymetry becomes steeper, with 10m, 15m contours roughly 4400m and 5000m away from the proposed Vadhavan port.

Wind and wave

During the SW monsoon, the wind speed is strongest and is in the West-South-West direction. Approximately 85% of the time, the wind speed is less than 8 m/s. The waves follow a similar pattern of wind, with prominence in West-South-West (~ 54 percent) direction followed by South-West direction (~24 percent). During majority of time, wave height is less than 3 metres.

Tides

The mean sea level is +2.8 m CD. Based on the NHO Chart No. 210 (Umargam to Satpati) the mean high-water level during spring tide is +4.7m CD whereas at neap tide it is +3.7m CD.

Currents

During spring tide, the ocean currents in the proposed Vadhavan Port are on the order of 1.5 m/s, which is predominantly in the high tide range. During floods, the currents move south-north, while during ebbs, they traverse north-south. During the monsoon season, the direction of the surface current is highly influenced by the direction of the waves and the wind. When compared to flood tide, the current magnitude is significantly stronger during ebb tide.

b) Fisheries

The local fishery is supported by a wide range of finfish and shellfish. The region's fishery resources include typical northern Arabian sea fishes including elasmobranchs (sharks, rays, and skates), pelagic and demersal fin fishes, crustaceans like prawns, lobsters, and crabs, and cephalopods like squids, cuttlefishes, and octopus. The fishing industry has played a significant part in the region's economy. The composition of fish landings reveals 170 species of commercially important species that are harvested. *Harpadon nehereus, Nematopalaemon tenuipes, Coilia dussumieri, Liza subviridis, Exhippolysmata ensirostris, Lepturacanthus savala, Ilisha filigera, Thryssa malabarica,* and *Scoliodon laticaudus* are among the top 15 species harvested in the region. Bombay duck *(Harpadon nehereus*) is the most abundant species in *dol* nets, accounting for more than half of the catch, followed by *Nematopalaemon tenuipes*. *Scoliodon laticaudus*, a shark, dominated gillnets with >70 percent, followed by *Ilisha sp*. *Liza subviridis* dominates the catch in the beach seines. Lobsters supplies more than 90% of the harvest in the lobster gillnet fishery, making it a high-income subsistence fishery.

Fishing population

Within a 10-kilometer radius of the proposed Vadhavan Port, over 20,000 fishermen from 5000 households live in the fishing villages. Varoor, Chinchani, Ghivali,

Gungwada, Dhakti-Dahanu, and Dahanu villages each have six recognized fishing societies.

Fishing practices:

Set bagnet (Dol nets and Bokshi), drift gillnets, bottom set gillnets, shore seining, cast net, crab traps, and handpicking of bivalves are some of the fishing activities practiced in this area. The design and buoyancy of gillnets are changed to set near the surface, midwater, and bottom depending on the target species. Gill nets are used to harvest high quality fish such as seer fish, tuna, pomfret, Hilsa, sardine and mackerel. Bottom set gill nets are operated to harvest lobsters whereas drift gill nets for polynemids, ghol, koth, seerfish and pomfrets. Other gears used to harvest marine resources include barrier nets and dragnets.

Several small-scale/marginal fishermen operate shore seines, crab traps, and collect bivalve along the shore and inside the creeks during low tide in intertidal areas. Crab collectors gather crab in the mangrove part of the creek using circular traps called 'Pagoli.' Crab collection is generally undertaken by small-time fishermen particularly, the women. In the local market, these crabs fetch a good price. Slugs, bivalves, and oysters are collected by hand on the intertidal rocky area and intertidal areas of the creek by a significant number of women in these settlements. About 800 fisher folks are active in bivalve, seaweed, and ornamental seed collecting in villages such as Ghivali, Kambode, Chinchini, Matgaon, Gungwada, Asangaon, and Abhram and a majority of these activities are seasonal. Despite the fact that many non-mechanised crafts and native gears are used in the region, the catch is quite low, with catfish, polynemids, prawns, and pomfrets dominating the catch.

Post-harvest practices:

Fishing and its post-harvesting processes, such as sun-drying Bombil, are a family affair, and most fisher families rely on fisheries for a living. Fish drying of Bombay duck (Bombil), golden anchovy (Mandeli), non-penaeid prawns (Jawala, Kardi, Ambadi/Bhobi), lesser sardines (Kati), ribbon fishes (Wakati), solefish (Lep), and sciaenids (Dhoma) is the main post-harvest activity in these villages. Fish drying for consumption and commerce is carried out by a significant number of coastal people, largely women, in open, shared places in village and beach regions. This offers women with a source of income and financial security.

Fisheries facilities:

The region's fishing infrastructure is limited. Dahanu village has an ice factory/ cold storage facility and sells ice to other settlements. Ghivali, Varor, Chinchani, Gungwada, Dhakti-Dahanu, and Dahanu fishing villages are home to six recognised fisherman co-operative groups from the study region. Gungwada and Dhakti-Dahanu are the only places where diesel is stored. There are no suitable fish landing facilities in the settlements, such as a jetty or a harbour. The beach is where the majority of the fish are landed.

Fisheries economics:

The majority of the fisheries in the region are small scale/artisanal, involving a limited amount of capital and energy, as well as tiny fishing vessels (less than 16 m Overall Length - OAL) that make short fishing trips focusing on near-shore fishing grounds (up to 40 m depth). The fish harvested are primarily used for household consumption and trade, either fresh or dried. In comparison to high juvenile harvesting fisheries (Set Bagnet), few fishing methods in the region have low ecological implications (e.g. gillnetting). Fisheries in the region, on the other hand, are more labour demanding than large-scale automated fishing operations; small-scale artisanal fishing activities, on the other hand, maximize human power and contribute significantly to employment.

2.5 Coastal Ecosystems and Wetlands

The total wetland cover in the area under consideration is 2567.1 ha (provided in Table 4).

Table 4: Statistics of Baseline Environment for the area under consideration in Dahanu Taluka

Feature	**Area (ha)**
Mangrove	1167.7
Mudflat	423.7
River/Creek	832.1
Lake/Pond	143.6
Salt marsh	2.0
Total	2569.1

a) Mangroves

Out of the 1167.7 ha under mangrove cover, *Avicennia marina* is the dominant species in Dahanu taluka. The associated fauna is represented by species of gastropods - *Pirenella cingulata*, *Nassarius glans*, *Nerita oryzarum*; Crabs - *Grapsus* sp., *Ocypoda* sp., *Uca annulipes*, *Scylla* sp.; other biofoulers and avifauna such as *Bubulcus ibis*, *Egretta garzetta, Threskiornis melanocephalus* are recorded.

a) Mudflat

Out of the 2569 ha, the area under mudflat is 423 ha, which is 16.4% of the total area.

b) Rivers/ creeks and Lake/ Pond

Rivers/ creeks from the foothills of Western Ghats drain through the coastal stretches of Dahanu Taluka. Details of the rivers/ creeks, lakes and ponds is given in Table 6.

c) Salt marsh

A small patch of salt marsh about 2 ha is demarcated in the area under consideration containing species such as *Sesuvium portulacastrum, Suaeda nudiflora* and *Salvadora persica.*

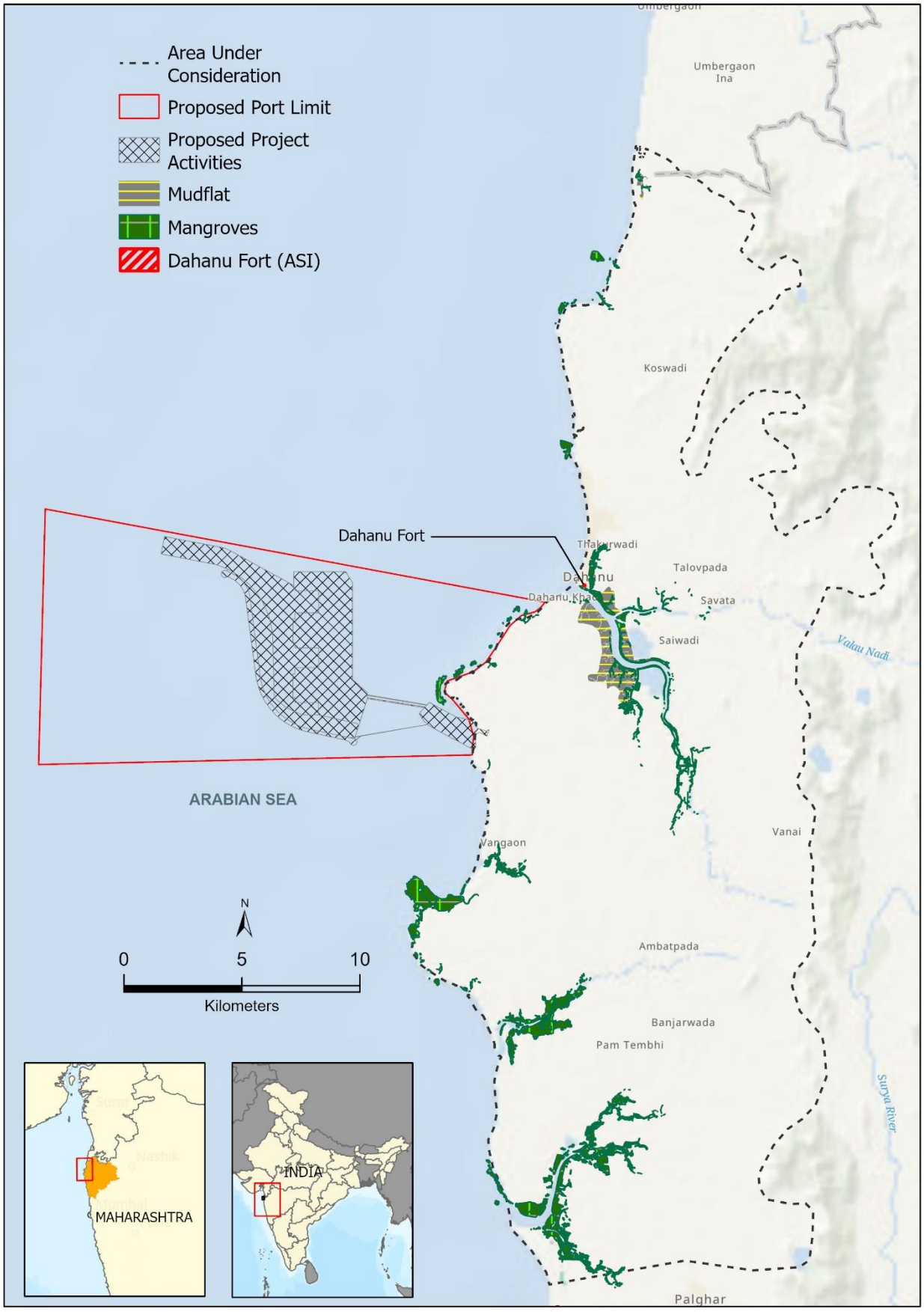

Figure 4: Mangroves and Mudflat of Dahanu Taluka

2.6 Marine Ecology

a) Plankton

Dahanu creek is rich in zooplankton resources and this has led to a good harvest of 20 to 30 tonnes of marine fishes by local fishermen per year (Fish Production Report 2006-08)[6] and is continuing to contribute to the fishery catch of Palghar district. Besides the major landings of Bombay duck and pomfrets, sciaenids, elasmobranchs, lobsters and prawns are also harvested in signficant quantities. Copepods, decapods, tintinnids, chaetognaths, fish eggs and fish larvae[6] dominate zooplankton. A total of 21 taxa of zooplankton have been recorded around the waters of Dahanu which include copepods, decapods, egg masses of invertebrates, fish eggs, fish larvae, polychaete larvae, hydrozoans, tintinnids, chaethognaths, pyrosomids, isopods, amphipods, mysids, medusae, foraminiferans, gastropods, siphnophors, ctenophors, lucifer, cladoceras, bivalves, hydrozoans, ostracods, euphausids and echinoderms[6].

Copepods are abundant in all zooplankton communities both in the open sea waters and the creek. Copepod species is represented by *Eucalanus* sp., *Paracalanus* sp., *Euchaeta* sp., *Centropages* sp., *Lucicutia* sp., *Pontella* sp., *Pleuromamma* sp. etc. The second largest group in zooplankton community was decapod larvae which included Zoea and Brachvura larval forms. This large zooplankton community helps in providing sufficient food for the estuarine and marine fishery resources around the coastal and marine waters of Dahanu. Dahanu has a 35 km coastal belt, which is rich in natural resources, including mangroves, and different kinds of fish making it an important centre of fish production. The wide inter-tidal zone provides a rich feeding ground for shore birds, and is a popular site for migratory birds.

Any disturbances due to construction activities may impact the fishery resources and other marine/ coastal biota. Coastal and marine areas with high fish yield or frequently used by locals as fishing grounds along the coast of Dahanu should be avoided.

b) Floral biodiversity

- *Avicennia marina* occurs in the intertidal zones of the Vadhavan area along with a few remnants of *Rhizophora* sp. The Vadhavan region also has *Sonneratia apetala* and *Aegiceras corniculatum*. Besides, *Acanthus ilicifolius, Acrostichum aureum, Aegiceras corniculatum, Avicennia alba, A. marina, A. officinalis, Bruguiera cylindrica, B. gymnorrhiza, Ceriops decandra, C. tagal, Cynometra iripa, Excoecaria agallocha, Kandelia candel, Lumnitzera racemosa, Rhizophora apiculata, R. mucronata, Sonneratia alba, S. apetala, S. caseolaris, S. griffithii* and *Xylocarpus granatum,* are observed along the Dahanu Taluka.
- Salt marshes such as *Cressa cretica, Fimbristylis ferruginea, Porteresia coarctata, Scirpus littoralis, Sesuvium portulacastrum, Suaeda fruticosa, S.*

[6] Kadam S.S. & Tiwari L.R. (2012) Zooplankton Composition in Dahanu Creek-West Coast of India. Research Journal of Recent Sciences, 1(5): 62-65

maritima, S. monoica, S. nudiflora and Urochondra setulosa are found along the Dahanu Taluka.

- There are no seagrasses in the area under consideration
- In the intertidal zone, cyanobacterial mats and turf algae have encrusted the tide pools and a portion of the rock. Sea weed of the genus *Ulva* abound in the rocky intertidal zone. *Ulva sp.* new recruits can be seen in small patches around the tide pools and rocks.
- The region has 36 phytoplankton genera belonging to four major taxonomic groups: diatoms, dinoflagellates, cryptophytes, and euglenophytes. Diatoms are the most numerous, with 24 genera, followed by dinoflagellates (9), cryptophytes (2), and euglenophytes (1).

c) Faunal biodiversity

- The region has a total of 22 mesozooplankton groups, dominated by copepods.
- Polychaeta dominates the subtidal followed by amphipods and mysids and intertidal macrofauna.
- Presence of small annelids on the lateral margins of the rocky patches are reported.
- Sand anemones (6 species) make up the cnidarian community. On the lateral borders of the rocky areas, there are hydrozoan colonies.
- Stone crabs and porcelain crabs can be observed in rocky places.
- Barnacles are extensively infested on the rocky plate form along the infra littoral line. They form a barnacle zone in the site's intertidal zone.
- The solid rocks form tide pools, which serve as a haven for a variety of molluscan species. Gastropods such as *Indothais sp.* and *Thais sp.* dominate the molluscan community. A few Octopus species can also be seen in tide pool areas.
- The echinoderm community is represented by sea stars and sea lilies which can be found in the rocky crevices of the region.
- The presence of Olive Ridley (*Lepidochelys olivacea*) and Green turtles (*Chelonia mydas*) in Dahanu was previously recorded (Shaikh et al., 1984)[7].
- The Lesser Egret (*Egretta garzetta)*, Intermediate Egret (*Ardea intermedia)*, Pond heron (*Ardeola grayii)*, Black Headed Ibis (*Threskiornis melanocephalus)*, Black winged still (*Himantopus himantopus)*, and Plovers are the most common bird species. A total of 123 bird species have been reported.

d) Heritage Sites

Dahanu Fort (Figure 5), located at Dahanu have archaeological importance and is classified as an Ecologically Sensitive Area (ESA) under the CRZ notification 2011 and 2019 issued under the Environment Protection Act, 1986. The Fort is located 2.1km south of Dahanu beach and was constructed by the Portuguese during the 16th century.

[7] Shaikh AK (1984). Distribution of nesting sites of sea turtles in Maharashtra. In: Silas EG (Ed.), Proceedings of the Workshop on Sea Turtle Conservation. Central Marine Fisheries Research Institute, Kochi, Special Publication 18: 109-116.

Figure 5: The Dahanu Fort, an Archaeologically important site[8]

e) Sacred Groves

Sacred groves are generally hundreds of year-old forests, largely untouched by humans, and are highly productive ecosystems. Sacred groves have a thriving population of insects, lichens and micro-organisms, and the abundance of vegetation offers various habitats, which attract birds and animals, and creates a robust food web. A total of 21 sacred groves are located at Dahanu the details of each is provided in Table 5.

Table 5: Sacred groves reported in Dahanu taluka[9]

S.No.	Taluka	Nearest village	Area (ha)	Deity
1	Dahanu	Saiwan	4 to 8	Gambhirgad
2		Ashagad	2 to 4	Santoshimata
3		Kanchad	11.16	Sri Gramdevi Kanchad
4		Suponda	2.15	Sri Gramdevi Suponda
5		Sange	37.6	Shri Tryambakeshwar
6		Gorhe	9.86	Shri Ram
7		Gorhe	3.45	Shri Laxminarayan
8		Gorhe	8.33	Hazrat Parishaha
9		Shelte	34.22	Shri Gramdevi
10		Nane	6	Shri Sidbeshwar

[8] https://fortsandtreks.blogspot.com/2018/03/dahanu-fort-trek.html
[9] Madhav Gadgil and VD Vartak. Sacred Groves of Maharashtra: An inventory. http://ces.iisc.ernet.in/envis/sdev/mg/pdfs/mg038.pdf

S.No.	Taluka	Nearest village	Area (ha)	Deity
11		Galtare	4.52	Shri Gramdevi
12		Pali	3	Shri Gramdevi
13		Gourapur	43.7	Maruti
14		Ambiste Bu	60.5	Nagnath
15		Ambiste Bu	4.25	Pir
16		Ambiste Bu	44.4	Nagnath
17		Khanivali	4.9	Pirumbaba
18		Gunj	22.36	Bharagavnath
19		Gunj	18.87	Vijreshweri
20		Biloshi	0.85	Pir
21		Ghonsai	1.32	Gramdevi

* Sacred Groves 2, 14, 15 and 16 are located within the area under consideration

f) Waghoba Shrines

A total of 46 shrines of Waghoba[10], a big cat deity the Leopard, is worshiped by the Indigenous Warli community (Figure 6). This along with the sacred grove patches of primeval forest is protected by the rural Adivasi communities as abodes of deities.

2.7 Infrastructure and Public Utilities

Dahanu has good road and rail connections. The closest railway station is Dahanu, which is around 10.5 kilometres away. The proposed port is 28 km from NH-8, which connects Mumbai and Delhi.

Key Observations

Based on the detailed analysis of available secondary data/ information, it is observed that the proposed Vadhvan Port is located offshore and is likely to have minimal impact on the land environment. The area under consideration has ecologically sensitive areas (ESA) such as mangroves, mudflats and an archaeological site located outside the inter-tidal area, the alignment of which is strategically designed to exclude these ESA. Benthic studies indicate rich faunal biodiversity, contributing to sustain healthy fishery resources. Detailed field investigation with regard to the resource availability and the community use of these natural resources is recommended.

[10] Nair Ramya, Dhee, Patil Omkar, Surve Nikit, Andheria Anish, Linnell John D. C., Athreya Vidya. 2021. Sharing Spaces and Entanglements with Big Cats: The Warli and Their Waghoba in Maharashtra, India. Frontiers in Conservation Science, VOLUME 2. https://www.frontiersin.org/article/10.3389/fcosc.2021.683356. DOI=10.3389/fcosc.2021.683356.ISSN=2673-611X

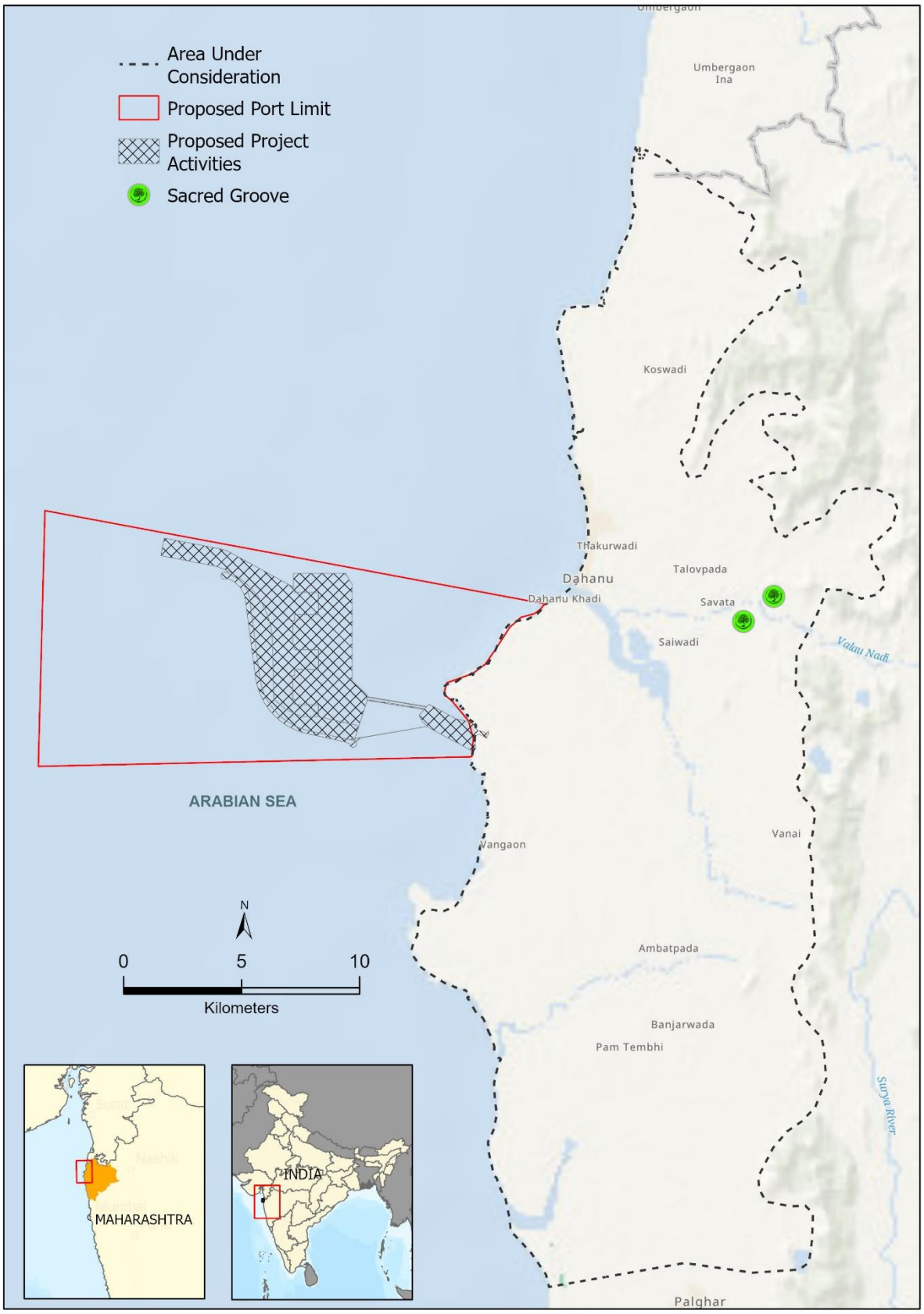

Figure 6a: Sacred Groves located within the area under consideration

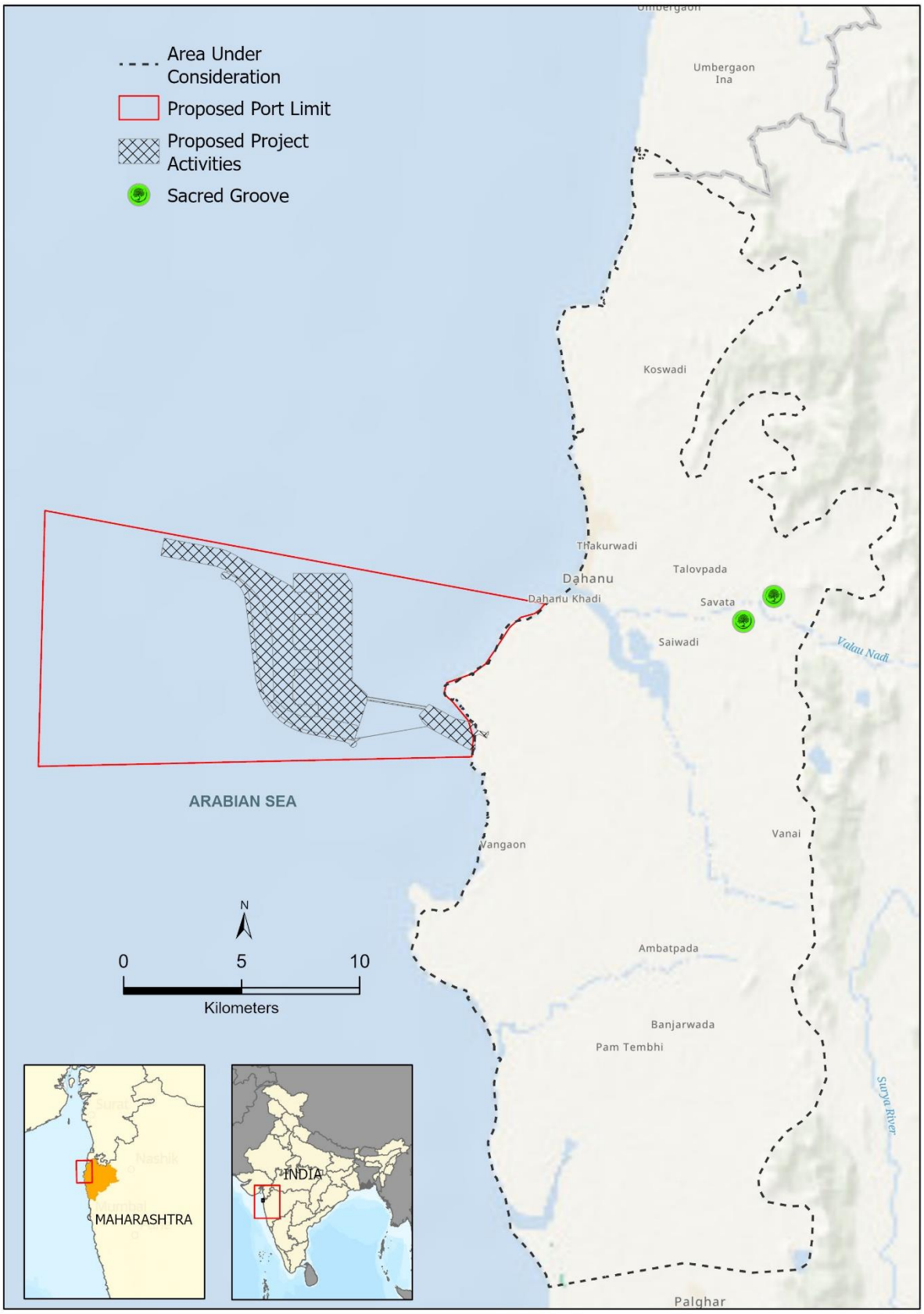

Figure 6b: Waghoba shrines, located within the area under consideration

3. Coastal Creeks, inlets and fisheries

[ToR # v- The coastal creeks and inlets at Dahanu Taluka should be studied for the availability of various species of fish and submitted.]

Rivers/ creeks from the foothills of Western Ghats drain through the coastal stretches of Dahanu Taluka. Details of lakes and ponds, rivers/ creeks, reservoir/ dam is given in Table 6.

Table 6**:** Lakes, ponds, rivers, creeks, reservoirs and dams, Dahanu Taluka

S.No.	Lake/Pond	Rivers/ Creeks	Reservoir/Dam
1.	Kariya Lake	Vahindra River	Aswali Dam
2.	Kondia Pond	Dahanu/Khonda Creek	Sakhare Dam
3.	Vadhavan (Ambistewadi) lake	Tarapur Khadi	Raitali Lake
4.	Tighrepada Lake	Varor Khadi	
5.	Varor Lake		
6.	Babhul Lake		
7.	Gholvad Lake		
8.	Gholvad Lake		
9.	Narpad Lake		
10.	Kedvanti Devi Mandir Pond		
11.	Dahanu Lake		
12.	Tanashi Lake		
13.	Tadiyala Lake		
14.	Babule Lake		
15.	Davale Lake		
16.	Gurlaai Pond		
17.	Gav Tale Lake		
18.	Chinchani Lake		
19.	Posare Lake		
20.	Ambalai Lake8		
21.	Navale Lake		
22.	Dhobi Talav Lake		
23.	Chinchani Talao Lake		

The Sakhare dam is located at the Vangaon-Kasa highway about 8 km from Vangaon railway station of Dahanu Taluka. The dam is a habitat for birds including the migratory species. A total of 33 avifauna belonging to 10 orders and 23 families have been recorded from the Sakhare Dam at Dahanu[1].

a) Freshwater (including ground and surface water)

In Palghar areas, 50 % of wells have ground water levels < 2m Below Ground Level (mbgl)[11] In Palghar district, 35% of the wells have water levels between 2 and 5 mbgl. In many sections of Palghar district, ground water levels have dropped by up to 2 metres.

[11] Ground Water Year Book of Maharashtra And Union Territory Of Dadra And Nagar Haveli (Year 2020-2021)

Figure 7: River and Creeks of Dahanu Taluka

Key Observations

Detailed maps on rivers/ creeks, lakes and ponds, dams and reservoirs were prepared to assess the natural water resources in the area under consideration. Four rivers and creeks were mapped along with the presence of wetlands. However, secondary information pertaining to fisheries in the creek area is unavailable and hence an assessment is not made in this report.

4. Sources of Pollution

[ToR # vii- Source of pollution due to Ports and their operations/ cargo type/ Hazardous Chemicals and its handling shall be studied in detail and an analysis shall be submitted.]

(a) Activities in the port

(i) Construction activities and sources of pollution

- Capital dredging and disposal of dredge spills impact water quality and marine ecology
- The dredging is likely to influence coastal hydrodynamics and sediment transport thus impacting the shoreline stability,
- Improper disposal of construction and demolition waste will impact terrestrial (including mangrove and salt marsh), coastal and benthic biodiversity
- The construction process will significantly increase the water demand and may lead to water quality deterioration and depletion of groundwater
- Ambient air quality is likely to be impaired with an increase in noise level and vibration
- Turbidity increases in coastal and marine water and sediment bound pollutant would enhance trace metal concertation in the water column
- Reduced light penetration will influence the water column primary productivity

(ii) Dredging (Capital and Maintenance) and associated pollution

- The dredging activity is often associated with temporary disturbance to the benthic habitat
- The activity causes significant stress on the aquatic life including fishes
- Improper dumping of dredged material impacts terrestrial and marine flora and fauna
- Localized clearing of vegetation due to site clearing (specially impact on mangroves) is expected to have an adverse impact

(iii) Port Operation and potential impact on environment

- Change in natural drainage and coastal processes are often associated with construction of coastal infrastructure such as breakwater, port buildings, berths etc, as the ecosystem functioning is likely to be impacted
- Spillage and leakages of cargo material at berths, loading and storage area, conveyer belts etc. may contaminate the air, land and water environment
- Oil spill from vessels serving port, Oily effluent from maintenance area and wastewater from stack yards, sewage, bilge and ballast may result in change of water quality
- Grey and black waste water generation from port activity can contaminate surface and ground water resources
- Operation of vessels will increase turbidity in the water column

- Port operation activities (such as emissions from labour camps, vehicle movement machinery, Cargo Handling and DG sets) can deteriorate ambient air quality leading to respiratory disorders in the local community.
- Increased noise level will cause physiological disturbances among marine biota
- Inadequate disposal of solid waste from port operation, cargo handling and vessels serving port will result environmental stress

(b) Cargo type

From the available information the port is expected to handle the following cargo:

- Thermal Coal
- Fertilizer
- Iron and Steel
- Non-Metallic Minerals
- Engineering Goods
- Containers
- Other Bulk

The following sources of pollution are likely during the construction phase of the proposed Vadhavan Port

Type of Cargo	Pollutant	Pollution Impacts			
		Air	Water	Soil	Biota
Thermal Coal	Coal Dust, Minerals, Trace metals	Increase in PM_{10} and $PM_{2.5}$	Spillage causes water pollution	Impact on surface soil	Inhibition of photosynthetic activities due to deposition of dust on leaves
Fertilizer	Nutrients	Changes in NO_X Level	Spillage causes eutrophication and algal bloom	Impact on surface soil	Change in plankton community structure
Iron and Steel	Ore dust, Trace metals	Increase in PM_{10} and $PM_{2.5}$	Spillage causes water pollution and eutrophication	Impact on surface soil	Inhibition of photosynthetic activities due to deposition of dust on leaves
Non-Metallic Minerals	Ore dust	Increase in PM_{10} and $PM_{2.5}$	Spillage causes nutrient enrichment	Impact on surface soil	Inhibition of photosynthetic activities due to deposition of dust on leaves
Hazardous Chemicals	Chemical spillage	Air Quality deterioration	Toxicity	Toxicity	Toxicity
Petroleum products	Bilge discharge, oily waste	Diesel Particulate Matter (DPM) - diesel soot SOx, NOx	Noxious liquid substance discharge	Chocolate mousse and tarballs	Damage to marine biota
Containers					
Engineering Goods					

(c) Hazardous chemicals

The port is expected to handle fertilizers and associated raw materials. Many of the components used for production of fertilizers are hazardous in nature (such as ammonium nitrate- explosive; nitric acid- corrosive). Any spillage or leakage of these chemical poses a significant hazard risk.

Key Observations

The most likely sources of pollution in the port region are linked to construction, operation and maintenance activities. It is expected that capital dredging and disposal of dredge spills may impact water quality (e.g. turbidity) and marine ecology. During construction, the dredging activities impact coastal hydrodynamics and sediment transport thus short-term impacts on shoreline stability is anticipated. The proposed port is expected to follow green norms which would minimize the anticipated impacts to acceptable levels.

5. Flooding and related impacts

[ToR # x- Flooding and related impact on creek and control area during the cyclonic storm should be studied.]

5.1 Delineation of Composite Hazard Line

The varying demographic, socio-economic, physical and geomorphological conditions described above, indicate the sensitive nature of India's coast and its islands. Natural and man-made hazards with accelerated climate change consequences have compounding effects on the life and livelihood of coastal communities. For this purpose, the Ministry of Environment, Forest and Climate Change (MoEFCC) has demarcated the country's hazard line through the Survey of India, and NCSCM, MoEFCC. The hazard line delineates land areas that are at risk from coastal erosion (erosion line) and coastal flooding (flood line). The "Composite Hazard Line" would show the most landward of the two – the flood and erosion lines.

Much of the increase in coastal hazard risk, particularly that associated with coastal erosion and flooding is due to:

- development located in close proximity to the coastline
- changes in hydrodynamics due to obstruction of natural coastal dynamics and function of beaches and dune systems
- conversion and development of low-lying coastal areas that are naturally prone to inundation

The primary purpose of the hazard line is to identify hazard zones along the coastline that reflects a potential danger and risk to people and their property. It is imperative to point out that such a Hazard Zone would not preclude development if this was deemed necessary by the State Government as part of their Integrated Coastal Zone Management Plan. Rather the advice would be to restrict such development if possible. However, if after due reflection, an area within the Hazard Zone was designated for future development, then such development should be provided with appropriate coastal defences in order to lower the risk to people and property. In heavily developed areas, coastal hazard maps may be used for public education and awareness purposes, or to inform evacuation for storm-tide or tsunami warnings.

India's hazard line has been demarcated based on a composite line of the shoreline changes and sea level rise due to climate change, tides and waves. This includes collection and presentation of data, identifying flood lines over the last 40 years (which includes sea level rise impacts), and a prediction of erosion to take place over the next 100 years and digital photogrammetric processing of high-resolution aerial photography data.

Very high-resolution Digital Aerial Photographs of 9 cm Ground Sampling Distance (GSD) of the entire coastal region of the country from Gujarat in the west to West

Bengal in the east covering an area of over 78,000 sq. km. was generated to prepare the digital terrain model.

The 100-year return period tidal elevations computed at the intermediate transects at every 250 m along the coast were plotted onto the 0.1 m contour data generated from high resolution DEM. The locus of these points is the flood line. For the erosion line, time series of high-resolution satellite imagery for the period from 1972 to 2012 were georeferenced. Periodic shorelines were digitized from the satellite imagery for the period from 1972 to 2010 and from the high resolution aerial ortho-image of 2012. The annual rate of erosion/ accretion was computed using the Digital Shoreline Analysis System (DSAS) at transects points at every 300 m along the coast, in terms of annual displacement from a fixed base line. The 100-year erosion/accretion rates at these transect points were extrapolated in terms of the distances from the fixed base line. These transect points were plotted on a high-resolution satellite image and the locus of these points is the erosion line.

Overlaying the Flood line and the Erosion line in a GIS environment is the basis for the composite hazard line. The segments of the Flood line /Erosion line which is the most landward was marked, to obtain the Hazard line. The composite hazard line was transferred to topographic maps for understanding the maximum levels of flood impacts.

The hazard line for the coast along Dahanu Taluka is given in Figure 9. The average daily tidal range of Dahanu Taluka is 3.3 m, which inundates an area of 8440 ha (84.4 km^2) on a daily basis. During an extreme event, an additional area of 2654 ha (i.e. 26.54 km^2) is inundated due to 1 in 100-year flooding. In the case of Dahanu, the flood line is the most landward due to the natural high elevation and coastal erosion is not a major concern. Hence the flood line becomes the composite hazard line. The area under the composite hazard line is therefore 11, 094 ha (or 110.9 km^2).

Table 7: Area of inundation within the composite hazard line in Dahanu Taluka

Details	**Area (ha)**
Area inundated during diurnal tide	8440
Additional area inundated during extreme events (1 in 100-year flood)	2654
Area within Composite Hazard Line	11094

5.2 Shoreline Change

Long-term and short-term shoreline change for the Dahanu coast is based on the analysis of eleven historic satellite images for the period between 1975 to 2022 and 2000 to 2022 respectively. Shoreline was also extracted from aerial photograph taken in 2012. Table 8 list the sources of satellite and the time period to determine long-term rates.

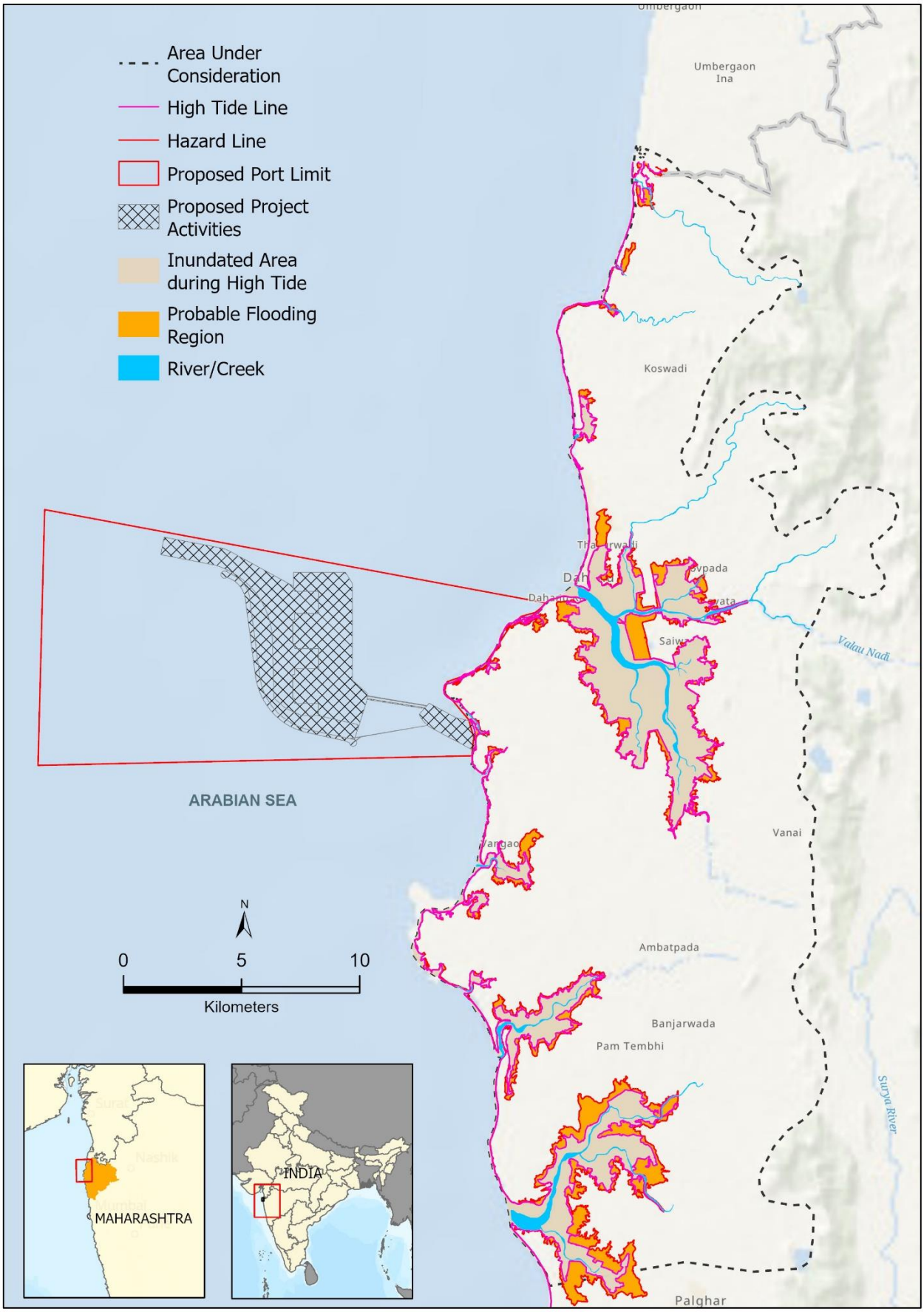

Figure 9: Composite Hazard Line for the coast along Dahanu Taluka

Table 8: Data source for extraction of shoreline

Year	Satellite	Resolution (m)
1975	Landsat	60
1990	Landsat	30
1997	LISS III	24
2001	Landsat	30
2005	LISS IV	5
2007	LISS IV	5
2009	Worldview/ GeoEye Cartosat PAN	2 2.5
2012	Aerial Photograph	9 cm
2016	LISS IV	5
2019	WorldView3 / Sentinel	2 10
2021	Sentinel	10
2022	Sentinel	10

Multiple shorelines extracted from satellite imagery were used to calculate shoreline change rates using Digital Shoreline Analysis System (DSAS) in an ArcGIS environment. Shoreline change rates of long-term from 1975 to 2022 (47 years) and short-term from 2000 to 2022 (22 years) was calculated for approximately every 100 m alongshore using the linear regression method.

Analysis of long-term and short-term shoreline change

Rates of shoreline change were evaluated for open ocean sandy shoreline. The coast considered for analysis along Dahanu Taluka extends to a length of 12.79 km from South of Varor coast to Khonda creek. On an average the coast remained “stable” over the last 47 years (61%) on a long term, with accretion along 35% of the coast (Table 9). Erosion was observed to occur only along 1.3% and 2.7% as artificial coast (i.e. coast which was highly eroding and are protected with seawalls). This suggests that the area under consideration for the proposed port was not of concern due to coastal erosion. Recent changes in shoreline (i.e. in short-term from 2000 – 2022) indicate a gradual change in shoreline towards low erosion at a few locations. Unlike in long term trends, high erosion (i.e. areas where shoreline regression is -5m / yr) is observed at the mouth of the creek located south of Tighrepada. A few important aspects for consideration are given below:

1) Shoreline change rates for the area under consideration averaged 0.47 m/yr for long term and -0.10 m/yr for short term
2) High erosion (-5.14 m/yr) is observed at the creek mouth south of Tighrepada in recent time (i.e. between 2000 and 2022)

3) Seawalls have been constructed at 2 locations i) near Varor and ii) Tadyalpada (Dhakti Dahanu taluka) totaling 350 m since the coast was gradually undergoing low erosion
4) In the long term, 61% of the coast was observed to be stable (i.e. no change for the last 47 years)
5) In short term, 50% of the coast was computed to be stable as some of the stable areas are observed to have changed to low erosion, probably due to lack of sediment movement, which is a natural phenomenon caused by the geomorphological nature and the non-linearity of the coast
6) Additionally, the areas of low accretion observed in long term is also gradually trending towards low erosion, for the above same reason(s).

Long-term shoreline change maps for the area between South of Varor coast to Khonda creek are presented in Figures 10 to 12 and in Figures 13 to 15 for short-term changes in shoreline

Table 9: Long-term changes in the shoreline along Dahanu Coast

Long Term Shoreline Classification	Length (km)	% of Erosion and Accretion	Cumulative % of Erosion and Accretion
Length of Coastline (km)	12.79		
High Erosion	Nil		
Medium Erosion	0.09	0.72	
Low Erosion	0.08	0.62	1.35
Artificial coast	0.35	2.73	2.73
Stable Coast	7.79	60.88	60.88
Low Accretion	4.15	32.43	
Medium Accretion	0.33	2.61	35.04

Table 10: Short-term changes in the shoreline along Dahanu Coast

Short Term Shoreline Classification	Length (km)	% of Erosion and Accretion	Cumulative % of Erosion and Accretion
Length of Coastline (km)	12.79		
High Erosion	0.04	0.33	
Medium Erosion	0.21	1.61	
Low Erosion	2.90	22.70	24.64
Artificial coast	0.35	2.74	2.74
Stable Coast	6.43	50.25	50.25
Low Accretion	2.54	19.86	
Medium Accretion	0.32	2.51	22.37

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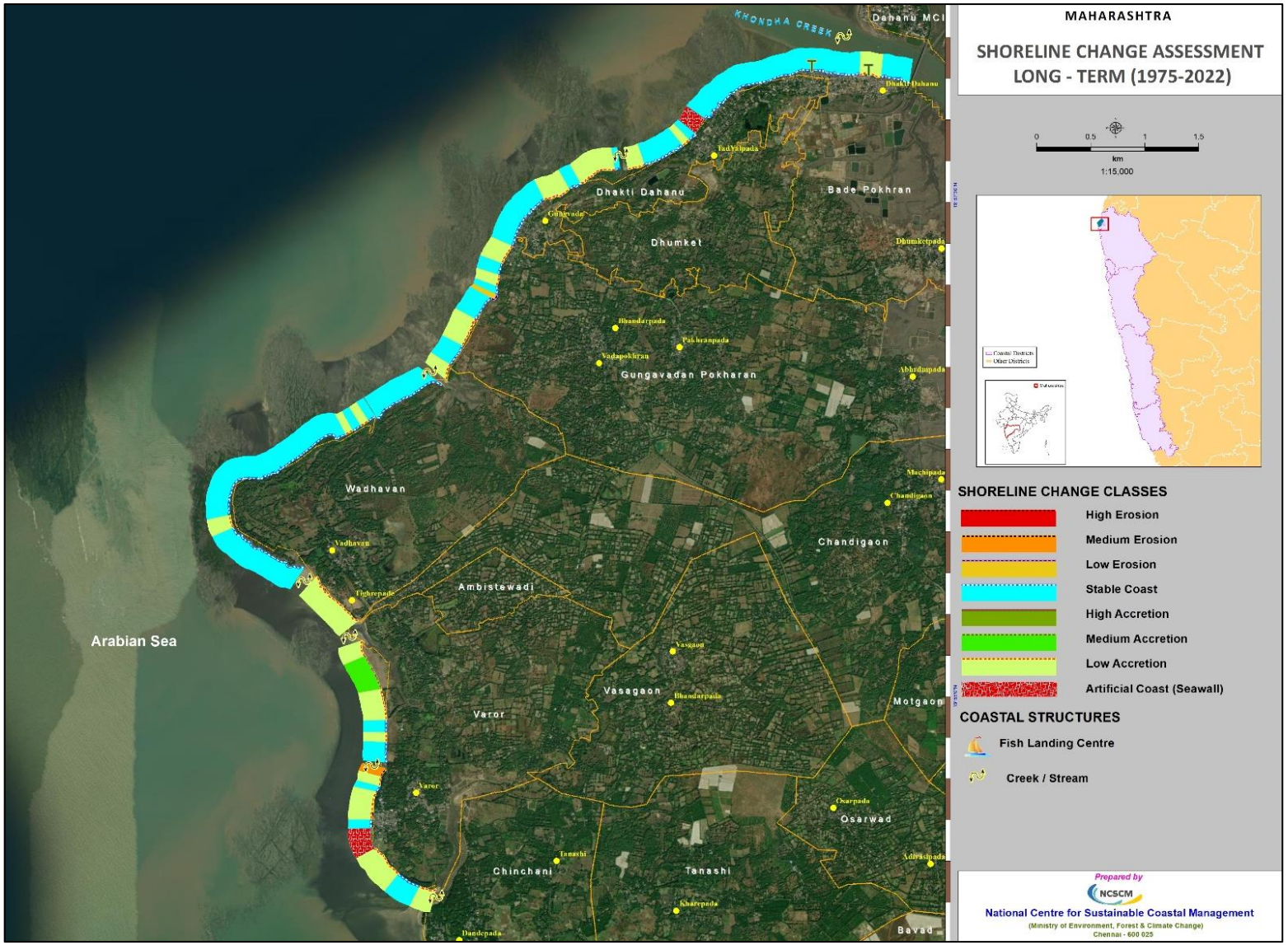


Figure 10: Shoreline change map for long term change

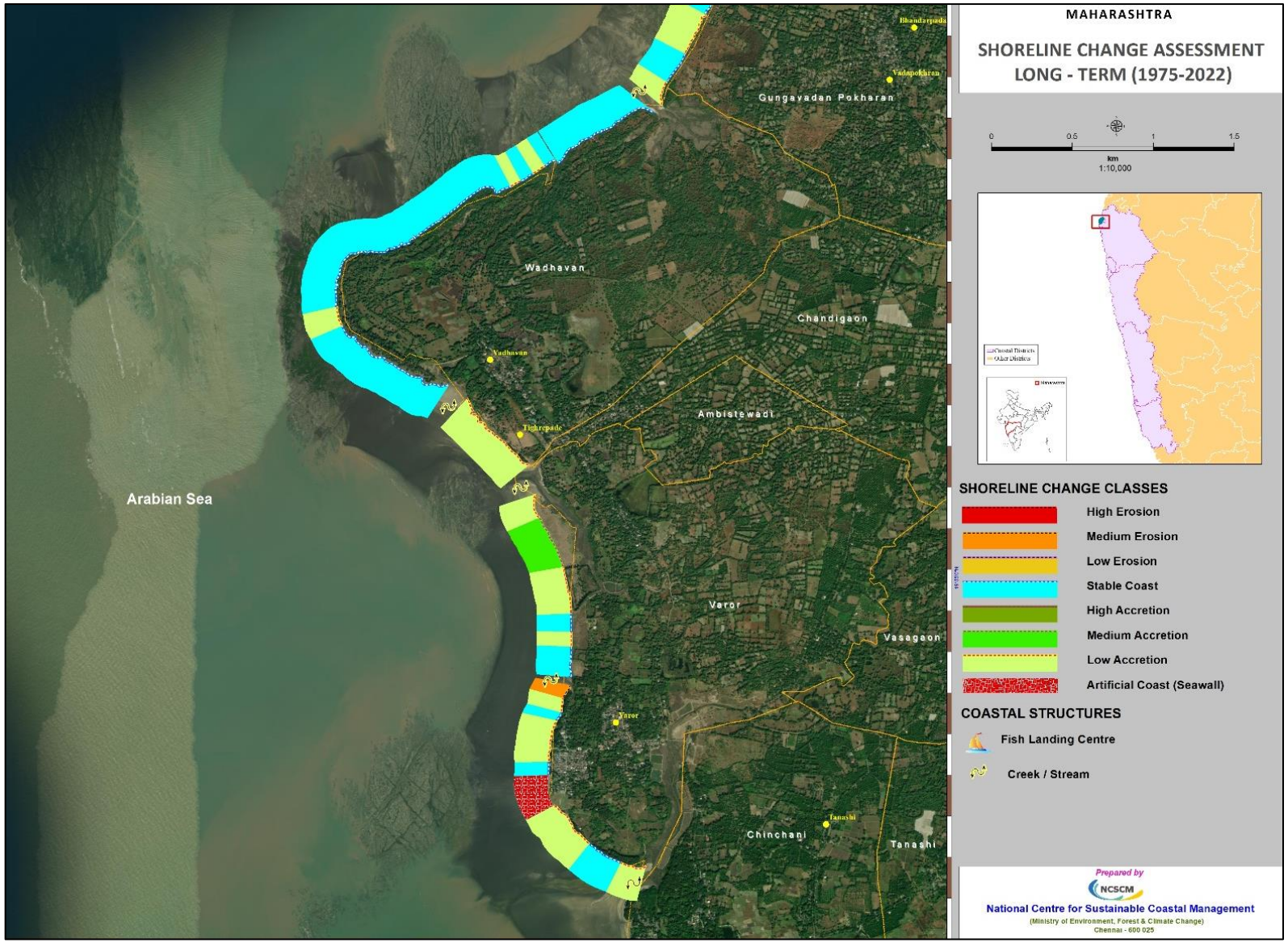


Figure 11: Shoreline change map for long term change- part 1(1:10k)

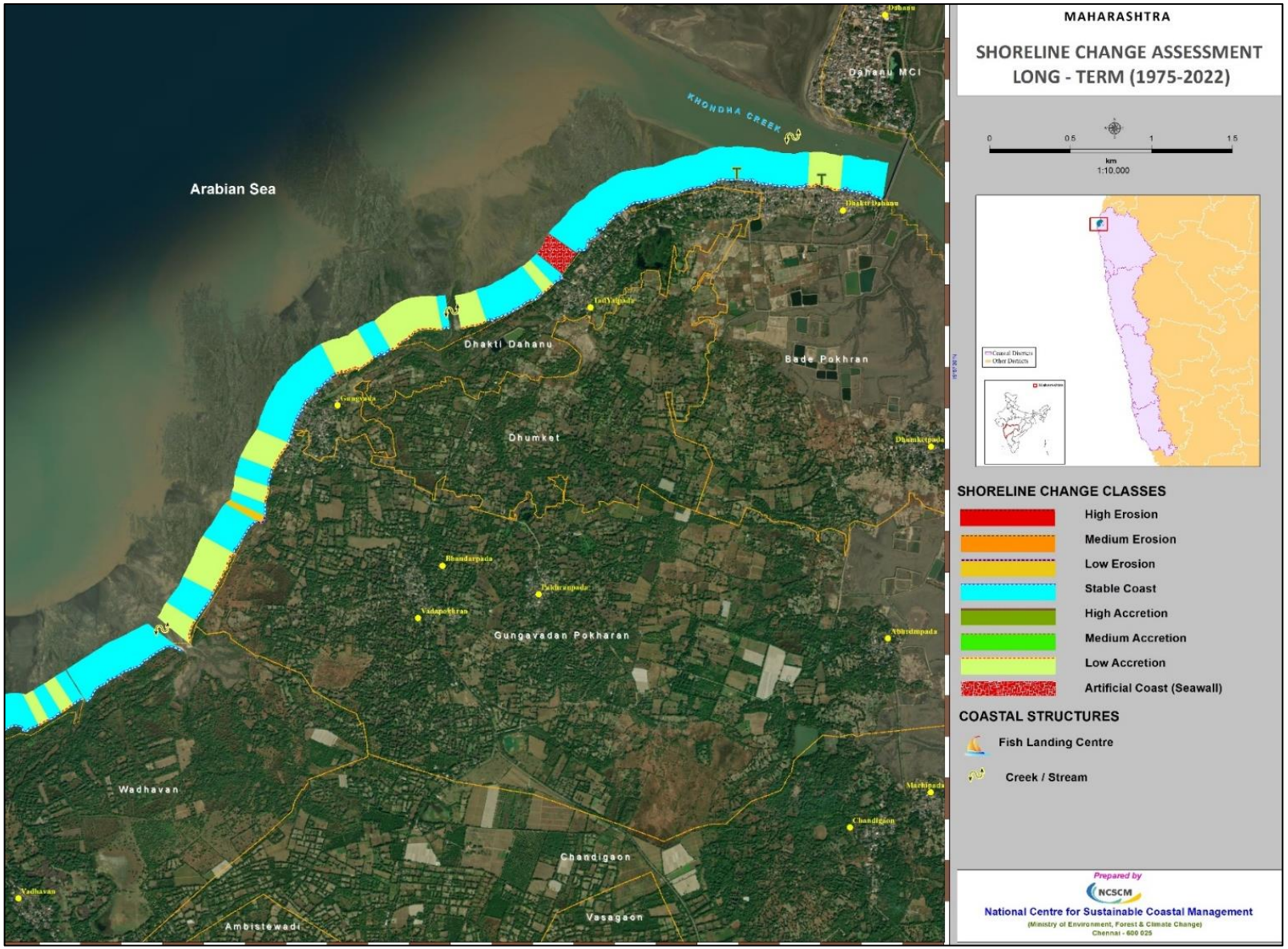


Figure 12: Shoreline change map for long term change- part 2(1:10k)

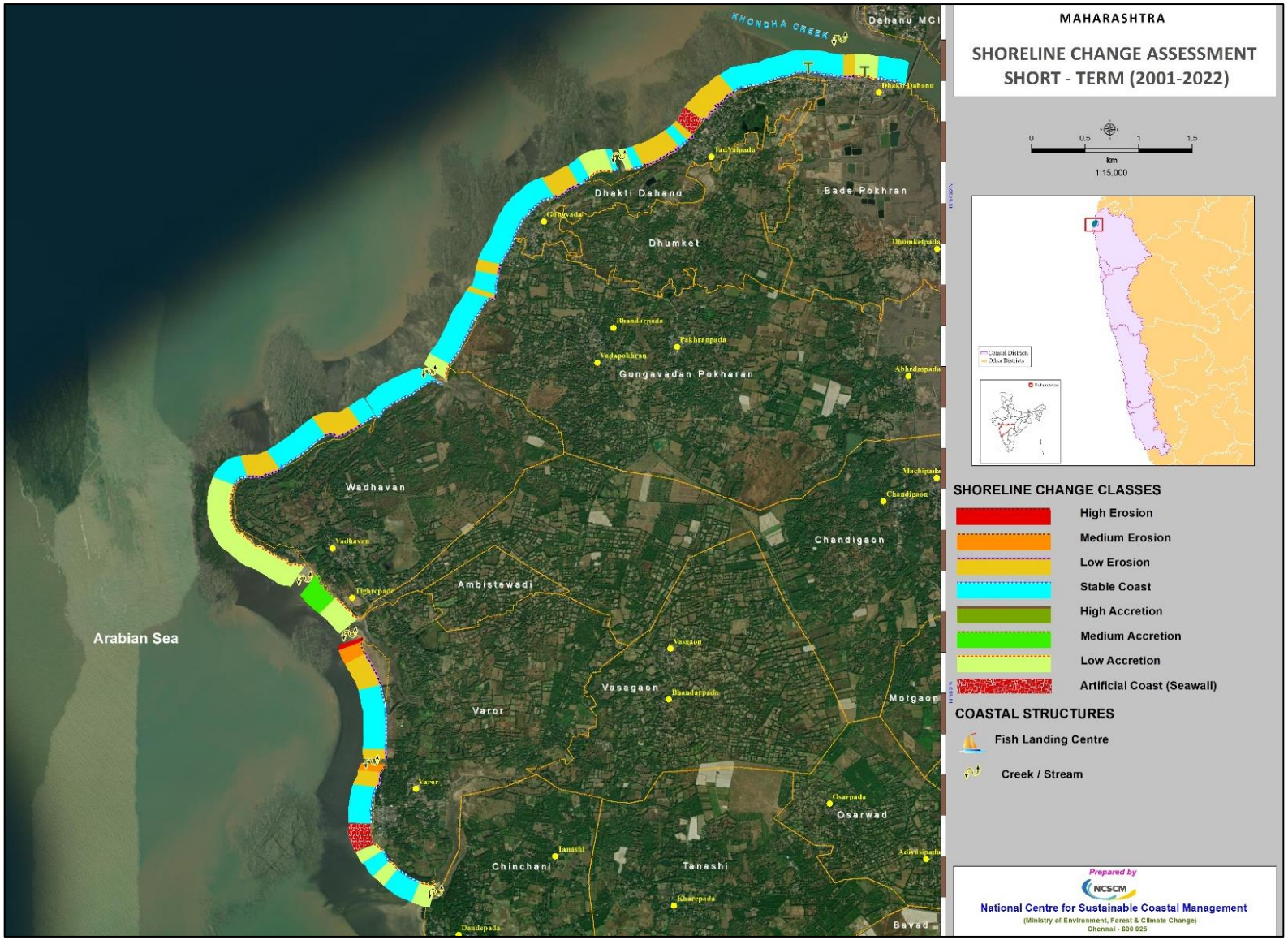


Figure 13: Shoreline change map for Short term change

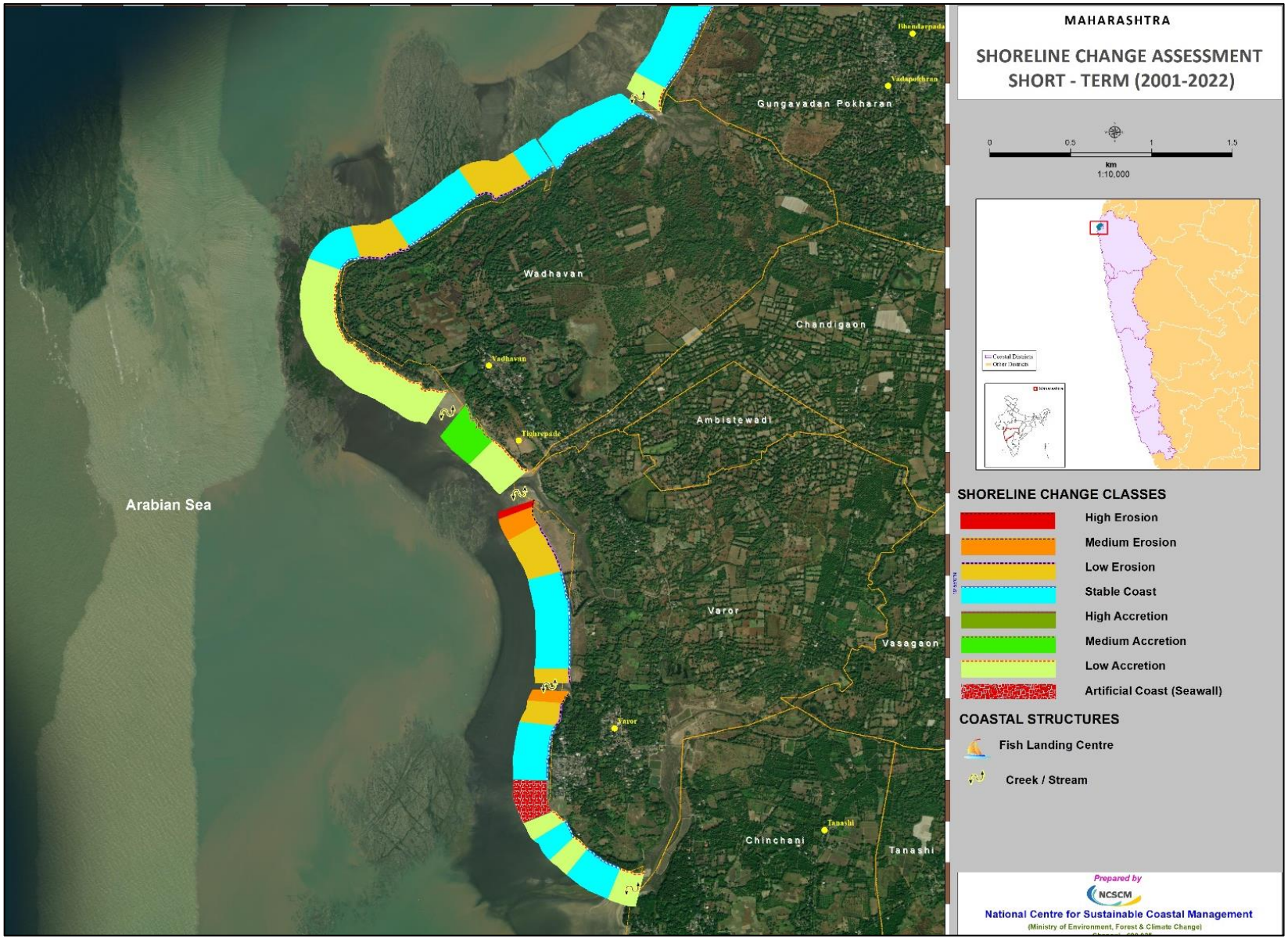


Figure 14: Shoreline change map for Short term change- part 1(1:10k)

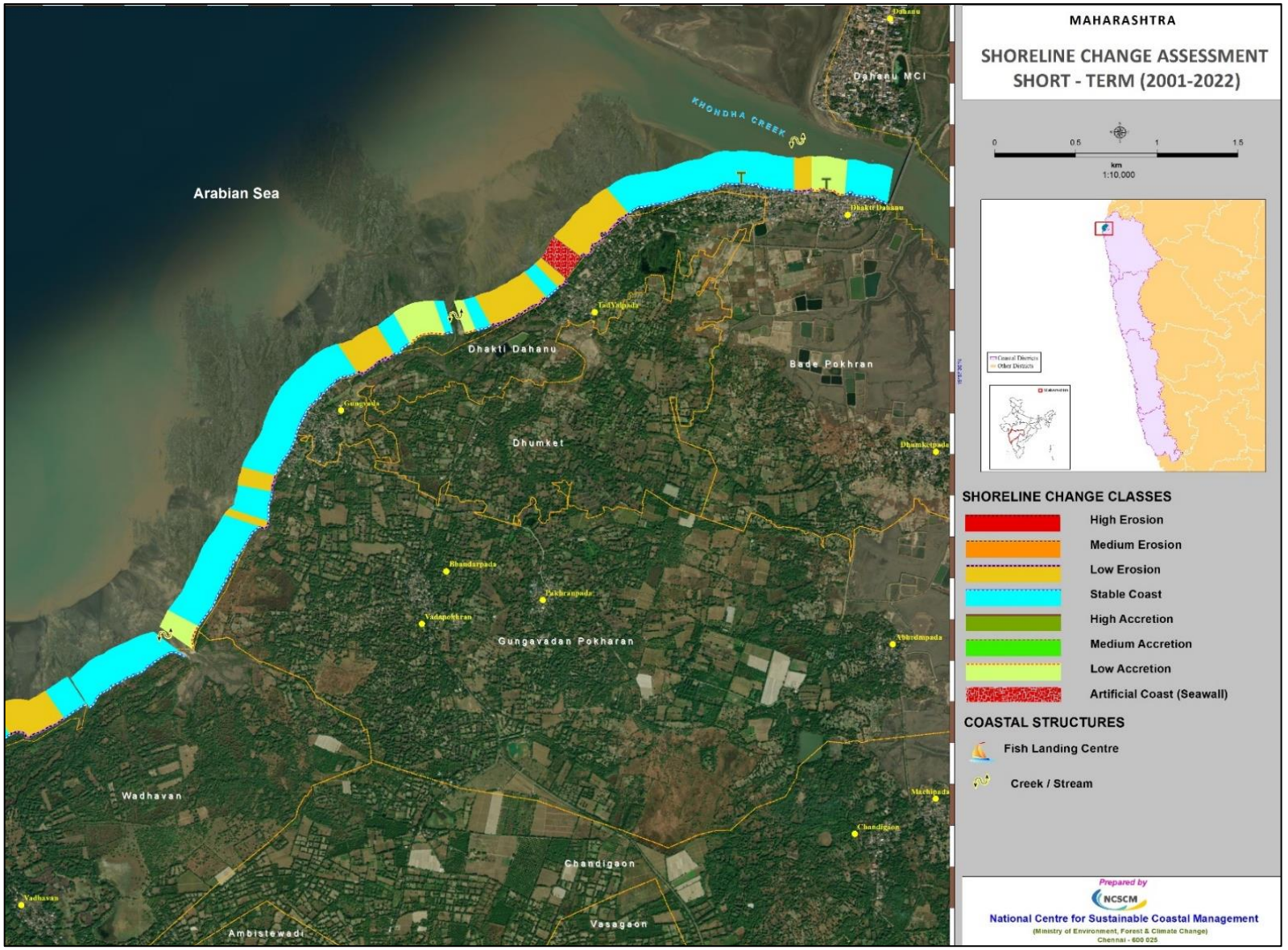


Figure 15: Shoreline change map for Short term change- part 2(1:10k)

5.3 Impact of Flooding in and around the Dahanu Creek

Floods and flood-related damage in low-lying coastal areas caused by natural hazards such as heavy local precipitation, large river flows, and storm surges have been well known for centuries. They result in significant loss of life and property, as well as damage to coastal structures. A storm surge is a natural extreme event that occurs when the water level rises above the projected astronomical tides. River deltas are flooded as a result of the combined effects of ocean tides and surges that intrude into the river, excluding surplus water from heavy rainfall pouring out of the river into the ocean.

Waves and tidal range play the major roles in the analysis of coastal flooding. Significant wave height was obtained from satellite altimetry data for the entire Indian coast from 2009-2015 (Figure 16). The average significant wave height varied from 0.97 m to 1.39 m along the Indian coast. The highest significant wave height of about 1.39 m was observed along the coast of Maharashtra, on the west coast of India. However, the maximum significant wave height of 3.0 m is observed during the passage of tropical cyclones along the West Coast of India.

The tidal range along the Indian coast varies between 1 and 6 m, and macro tides (> 4 m) were observed along the coasts of Maharashtra and Gujarat on the west coast of India. In particular, the tides are semi-diurnal with diurnal inequality in nature at Dahanu Creek, and the maximum tidal range is about 5.87 m during spring tide, whereas it is 2.1 m during neap tide. Similarly, the assessment of the nearshore and tidal circulations in the vicinity of the creek clearly demonstrated that the current magnitude is about 1.3 m/s during spring tide, whereas about 0.7 m/s during neap tide. The direction of the current varies from 5º – 25º with respect to the northward direction during flood tide, whereas it is about 210º – 220º during ebb tide.

Coastal bathymetry in and around the Dahanu creek is presented in Figure 17. Coastal bathymetry has been obtained from the GEBCO and CMAP Hydrographic chart data sets. The GEBCO bathymetry data has about 300 m horizontal resolution, whereas the CMAP data is random data points and are high density at the coastal region compared to other regions. These two data sets were combined, and optimal interpolation was performed to reduce data noise in the bathymetry data set. The data clearly indicates the bathymetry contours are very shallow along the coast and in the creek regions, varying 1- 3 m depth whereas depth contours increase about 30 m in the offshore region at the outer boundary of the proposed project layout. The bathymetry contours clearly indicate shallowness of the area and is more prone to the waves, tides and surge during the extreme events. Therefore, risk factors are in high around the creek region due to uneven events.

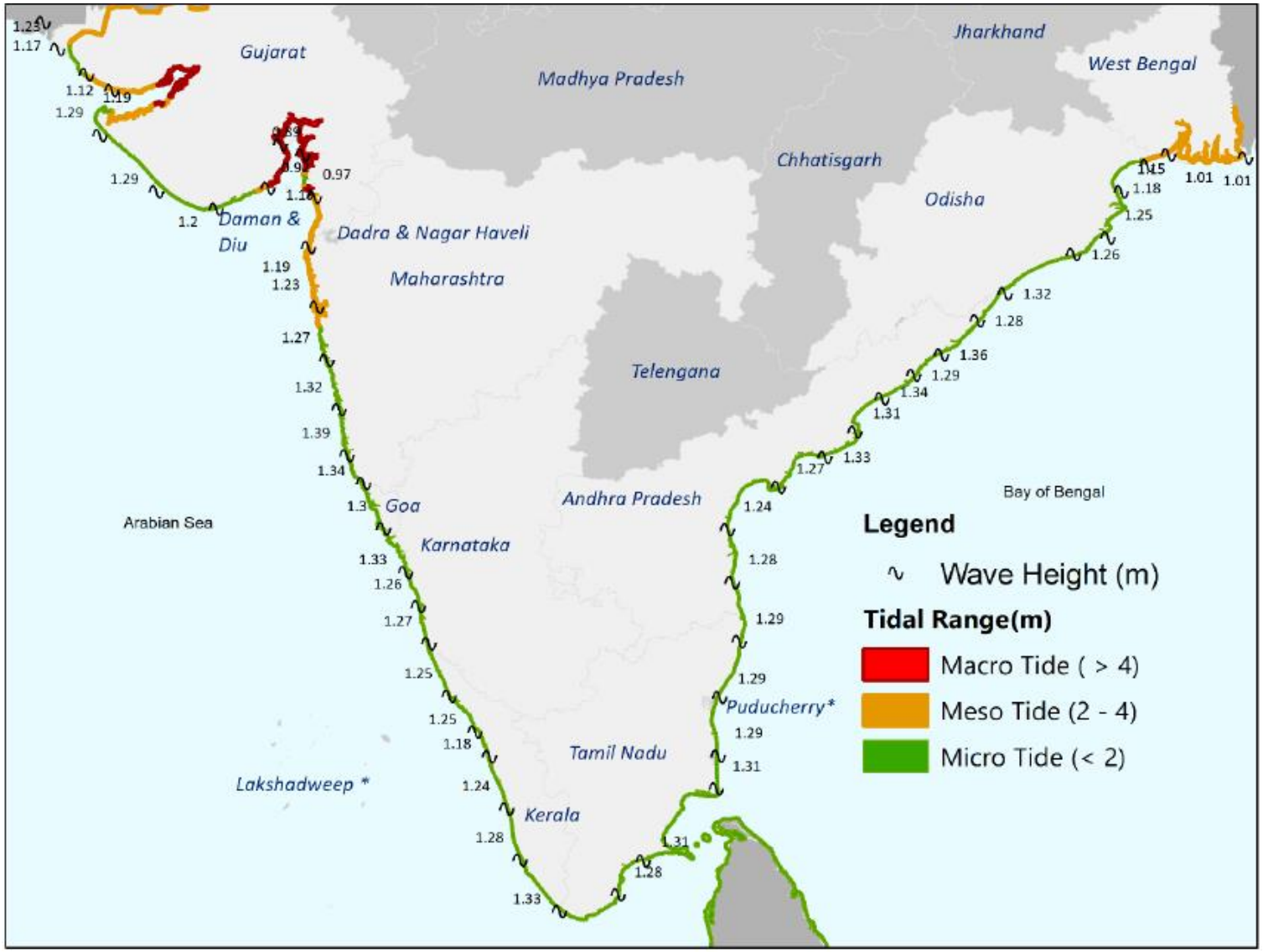


Figure 16: Mean significant wave height and tidal range along the Indian coast

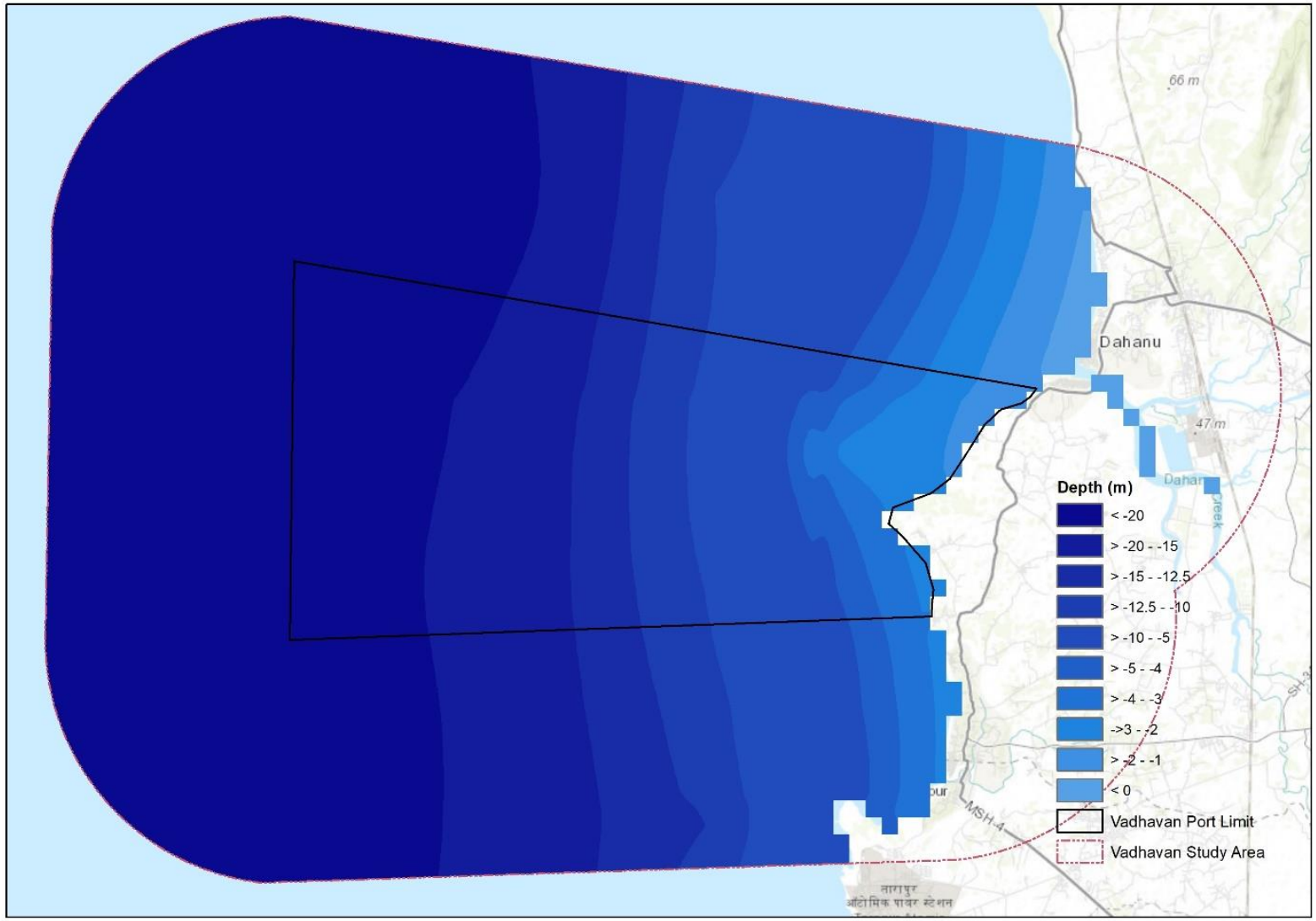


Figure 17: Bathymetry in around the Dahanu Creek, Maharashtra

a) Tropical storms

In the Arabian Sea basin, the maximum number of cyclones occur near the Maharashtra-Gujarat coast of India. The tropical storm tracks along the west coast of India are obtained from the archive of best track data through IMD for the period of 1990-2015. The analysis of cyclonic storm events indicates that there are 45 events that pass along the west coast, covering the coastal area of Dahanu Creek. The genesis of the tropical cyclones over the North Indian Ocean by covering the Arabian Sea and Bay of Bengal is shown in Figure 18. A storm surge is a rise in water level that occurs due to the effects of (a) inverted barometric pressure and (b) wind stress. The analysis of storm surge carried out from the cyclones about 12 passes in the vicinity of Dahanu creek has generated a surge of more than 0.8 m with a maximum of 2 m. The locations near Dahanu creek indicate that the surge varies from 1.5 to 4.3 m and the corresponding water level varies from 4.5 to 7.2 m. The coast is highly vulnerable based on its nature, where the water level is higher than 5m during extreme events, as most of the area is low-lying around the Dahanu creek.

Table 11: Maximum possible storm surge amplitudes and total water level elevations (surge + wind waves) at selected locations along the west coast of India in the Arabian Sea (source: Shaji et al., 2014)

Location	Favorable wind direction	Peak surge amplitude (m)	Maximum value of total water level (m)	Classification of the coast
Muthan Point (Nagercoil)	SW	1.4	2.3	B
Cochin	W	1.6	2.7	B
Calicut	WSW	2.1	3.5	B
Mangalore	WSW	1.8	3.0	B
Bhatkal	WSW	2.7	4.5	B
Panjim	WSW	1.7	2.8	B
Devgad	WSW	1.5	2.5	B
Ratnagiri	W	1.8	3.0	B
Harnaf	WSW	1.7	2.8	B
Mouth of Rajpuri River (Murud)	W	3.1	5.2	C
Mouth of Patel Ganga River	W	4.3	7.2	C
Bombay	W	1.5	4.5	B
Agashi Bay	W	4.2	7.0	C
Dahapu	W	4.0	6.7	C
Bulasar Kheri	W	4.5	7.5	C
Suvali Point	WSW	3.3	5.5	C
Mindola	WSW	5.2	8.7	C
Mal Bank	S	4.3	7.2	C
Mahuva Road	SE	2.0	3.4	B
Jafarabad	SSE	3.1	5.2	C
Diu	SSE	2.2	3.7	B
Veeraval	SW	1.5	2.5	B
Porbandar	SSW	1.6	2.7	B
Dwarka	SW	1.6	2.7	B
Balachin	W	5.1	8.5	C
Rann of Kachchh	WSW	3.9	6.5	C

Type A: total water level > 2m, Type B: 2-5m, and Type C:>5m

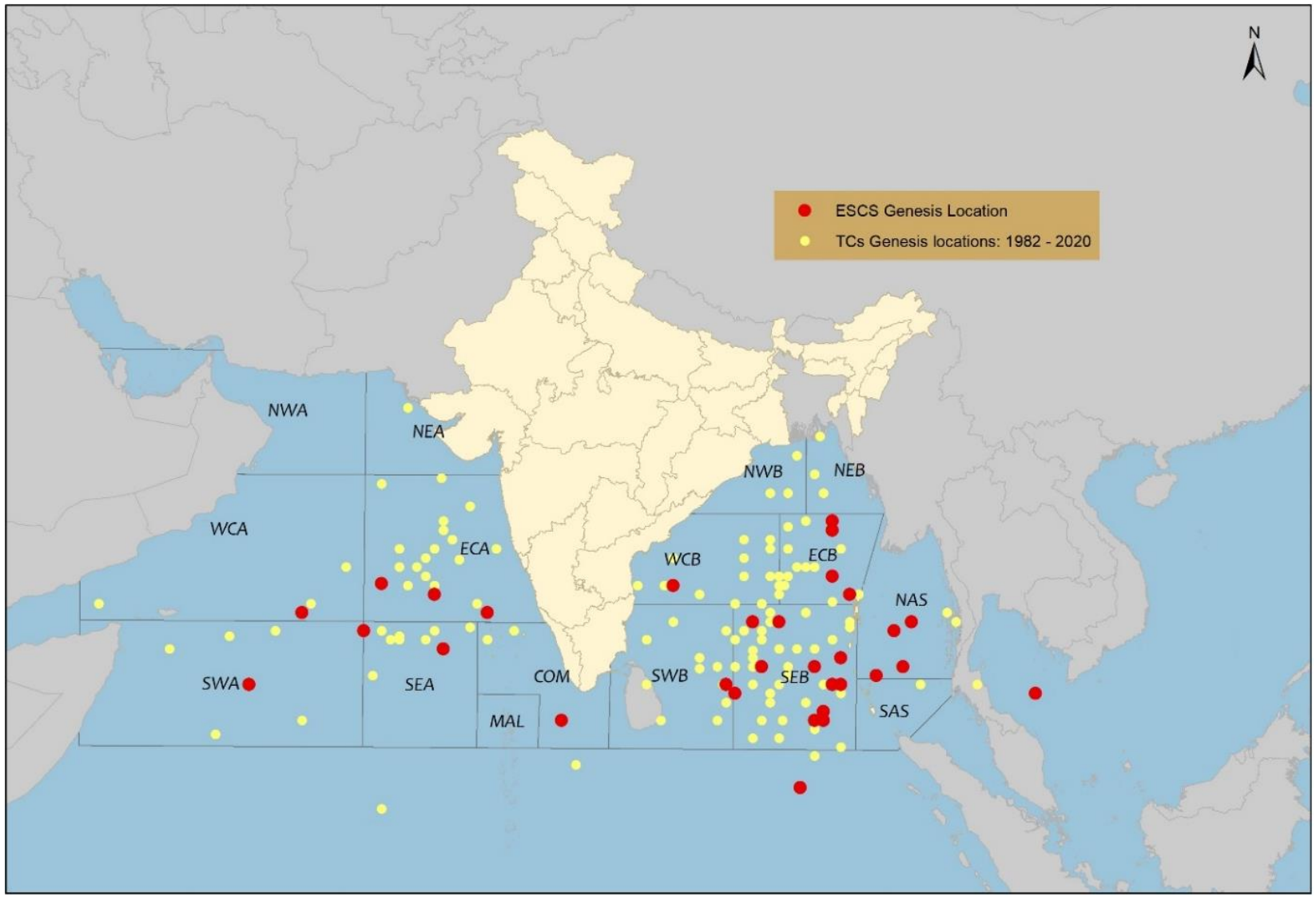


Figure 18: Genesis of tropical cyclones over the North Indian Ocean, covering Arabian Sea and Bay of Bengal during 1982–2000

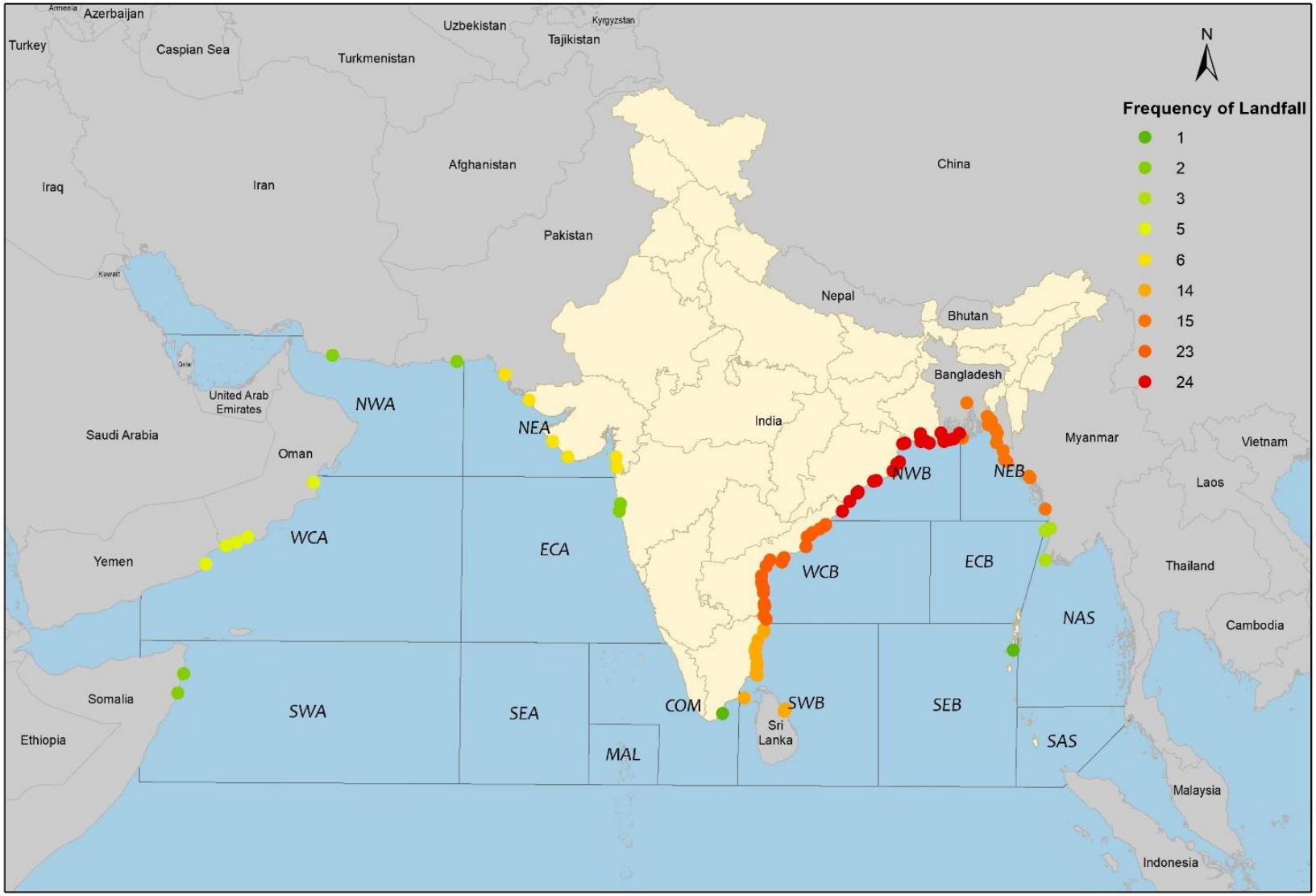


Figure 19: Landfall locations of tropical cyclones along the Indian coast during 1982–2000.

b) Rainfall

Data Set on Daily Gridded Rainfall with a horizontal resolution of 0.25 x 0.25 degrees over the creeks of Dahanu in Dahanu Taluka, Palghar district of Maharashtra state, obtained through IMD for the period of 2010–2021. The unit of rainfall is millimetres (mm). This data is available for 121 years, from 1901 to 2021, and is arranged into 135x129 grid points. The yearly data file consists of 365/366 records corresponding to non-leap/ leap years. The maximum rainfall in a year for the period of 11 years is shown in Figure 20. The maximum rainfall falls in the range of 650–720 mm during the period of 2014–2016 and then varies from 470–540 mm in the other years.

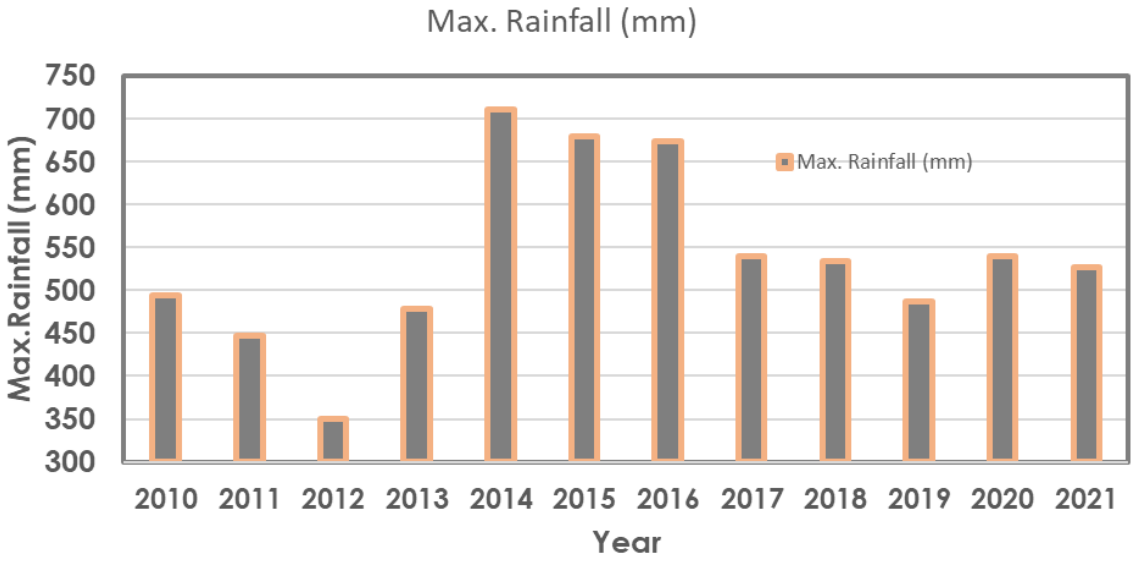


Figure 20: Maximum rainfall in a year in the vicinity of the Dahanu Creek region

c) Return period of rainfall

Rainfall data for a period of 11 years has been plotted using the Generalised Extreme Value distribution in the R-programming suite. The maximum likelihood estimation provided the parameter estimates mu = 57.7050, sigma = 54.5160, and xi = 0.26094. The positive xi (shape value) indicates the data fits the GEV Type II Frechet Distribution (Figure 21)

Table12: Return period of rainfall in the vicinity of Dahanu Creek

Return period (yr)	**Rainfall (mm)**
10	224.62
20	302.27
30	354.01
40	394
50	427.07
60	455.51
70	480.61
80	503.17
90	523.71
100	542.63

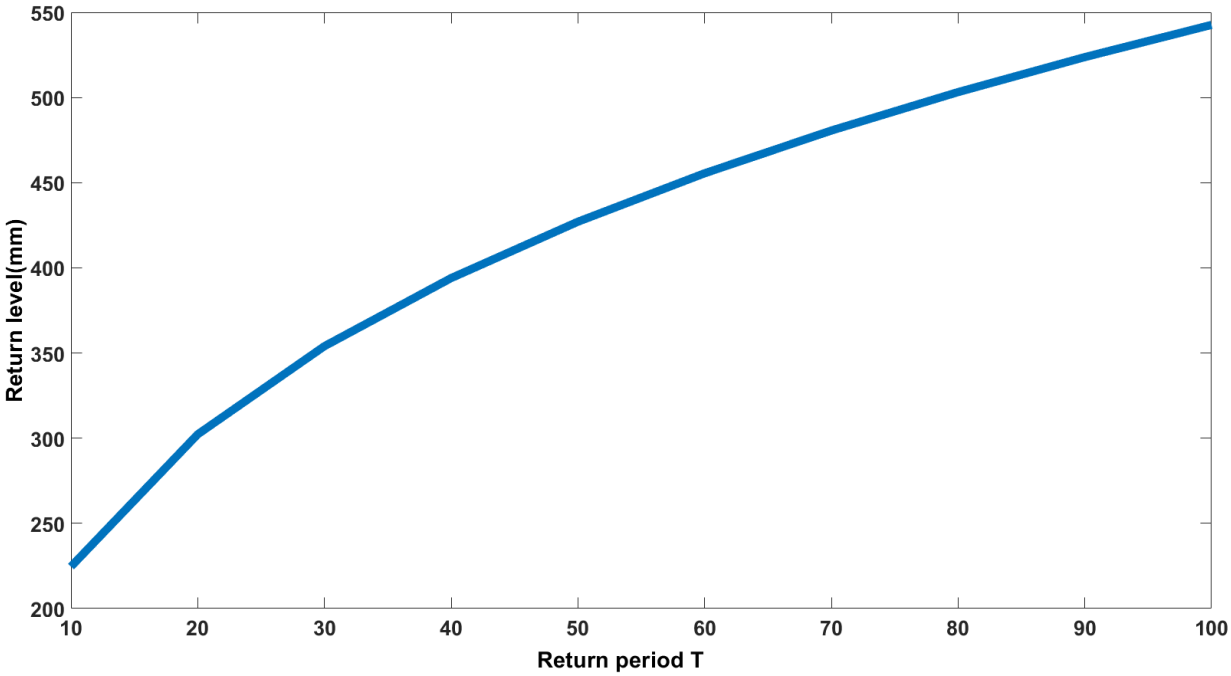


Figure 21: Return period of maximum rainfall for future projections of 30 yr, 50 yr, and 100 yr.

d) Areas of Flooding

Flood-affected areas have been marked along the creeks of Dahanu, using data of maximum annual rainfall and composite hazard line. Details pertaining the composite hazard is discussed in Section 5.1. A comprehensive study combining riverine flood models with a mixture of coastal storm surge models is required to assess the resulting flood inundation with the forcing mechanism of heavy rainfall, flood water, and storms.

Key Observations

A composite hazard line was drawn for the area under consideration taking into account, elevation, 1 in 100-year flood and coastal erosion after 100 years and sea level rise. This recognizes the most landward penetration of flood or any extreme event in 1 in 100-year time period. Based on this, the area under the composite hazard line is 11,094 ha (or 110.9 sq. km). Further, the assessment of long-term shoreline change indicates a largely stable coast (61%) but is evidencing some low erosion in recent times, which is not a major concern.

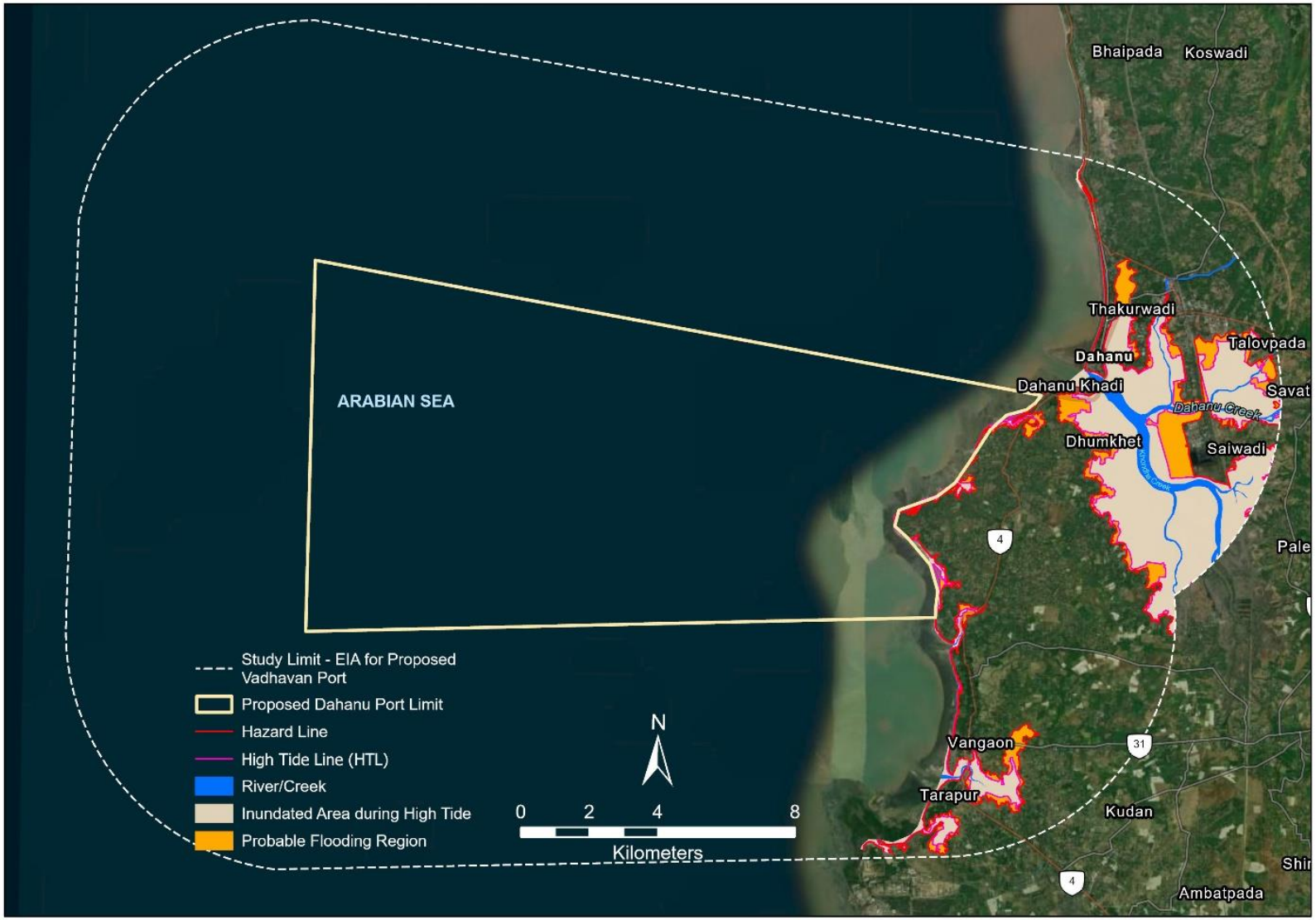


Figure 22: Flood-affected areas in and around the Dahanu creek.

6. Details of emission, effluents etc.

[ToR # xv- Details of emission, effluents, solid waste and hazardous waste generation and their management in the existing and proposed facilities.]

The following port activities cause significant source of emission and effluents during construction and operation period

- Construction and reclamation
- Dredging
- Port Operation – Cargo handling, ship movement, vehicular movement
- Land based activities and generation of waste

Table 13: Potential Impacts and mitigation measures identified

Sources	Emission, effluents, solid waste and hazardous waste generation	Potential Impact on environment and ecology
Construction of the port	– construction and demolition waste – Dust – SO_X, NO_X, CO and CO_2 – Noise and Vibration	– Disposal of construction waste – Impact on air quality due to vehicular movement – Increased noise level and vibration – Impact on the water quality – Increased turbidity – Surface run off – Discharge of sediment bound pollutants – Reduced light penetration – Impact on coastal hydrology
Dredging	– Dredge spill – Suspended sediments	– Disposal of waste – Impact on air quality • Generation of dust • Release of SO_2, NO_2, CO and CO_2 – Increased noise level and vibration – Impact on the water quality • Increased turbidity • Increase suspended sediment • Release of organic matter – Impact on coastal hydrology – Alteration in the soil characteristics – Coastal erosion – Changes in the current patterns – Impact on the ecology and fishery resources • Reduction/ loss of benthic habitats • Impact on primary productivity • Reduced density/ loss of indigenous species
Port Operation	– Effluent from port	– Spillage/ runoff during coal other dry cargo handling and unloading

Sources	Emission, effluents, solid waste and hazardous waste generation	Potential Impact on environment and ecology
	– Domestic waste water – Oil Spillage – bilge, ballast water – Cargo spillage	– Water pollution – bilge, ballast water and sewage – Oil spill or spillage of oily waste, lubricants and fuel from the windblown dust – Fire hazard due to coal handling and storage
Land based activities – Solid waste Waste from construction, port operation, oily waste, bilge water, ballast water.	– Solid waste from port activities – C&D waste – Plastic waste – Ship and cargo waste – Hazardous waste	– Solid waste can be categorized into biodegradable and non-biodegradable waste – Deterioration of water quality – Floating garbage leads to unsanitary conditions – Heavy metal pollution – Oxygen depletion –harmful to fish and other aquatic flora and fauna – Nutrient enrichment – could lead to eutrophication and algal bloom – Bio concentration and bio magnification – Risk for public health – Liquid waste can lead to detergent pollution

6.1 Measures for mitigating pollution due to port activities

a) Dust Management

Specific dust management plan for periodical monitoring and maintenance of air quality in the port area, in the following lines:

- The port shall identify potential leakage zones along the closed conveyor belt and adopt specific measures to settle dust, preventing spillage/dispersion
- Water sprinklers shall be provided in the area of coal loading and unloading, storage and vehicle path/roads
- The port shall construct a compound wall all along the periphery of the premises and coal handling units with minimum 9 meters height
- Dust screens shall be provided along the port boundary, especially the area bordering the thermal power station, with a height of 2 meters above the maximum stack height
- Paved roads need to be constructed mandatorily along the transport route to prevent dust generation due to vehicular movement
- The construction materials shall be covered with sheets/enclosed during transportation and storage to avoid dust generation
- The port shall store cement on platforms covered with polythene sheets to minimize moisture absorption, which will in turn prevent generation of dust

Only vehicles with valid Pollution under Control (PUC) certificates from CPCB authorized testing centers should be used for transportation in the port area. Periodical emission check for vehicles shall be carried out.

b) Wastewater and Storm water

- Installation of Sewage/Effluent Treatment Plant (STP/ETP) in the port area to treat wastes from port activities shall be constructed. The treatment plant shall be designed to use the treated wastewater and sludge (after appropriate processing) for horticulture/ green belt development. The location and size of the treatment plant, method to be used etc. should be clearly marked on the site map. The treated wastewater, if disposed into the port waters should conform to the Water Quality Standards for Harbour Waters (SW IV).
- Installation of storm drainage that discharges directly into surface waters shall be made mandatory. Oil/ grit or oil/ water separators in all runoff collection areas should be installed so that pollutants do not get washed into the surface waters. Locations of storm water drains must be recorded on the site map
- Regular maintenance of oil/ water separators and storm water drains. Periodic safe disposal of recovered contaminated solids or liquids
- The port shall collect the oil wastes in barges, vehicles, or central collection systems and storage tanks. The capacity of oil waste collection facility shall be established based on applicable MARPOL provisions
- Wastewater containing noxious chemicals from bulk tank should be managed through appropriate onsite or off-site treatment prior to discharge
- The port shall monitor the e-wastes and plastic pollution periodically
- The sewage from ships should be collected and treated onsite or off-site according to the recommendations provided in IMO's Comprehensive Manual on Port Reception Facilities (1999) and the Guidelines for Ensuring the Adequacy of Port Waste Reception Facilities (Resolution MEPC.83(44))
- Smaller vessels are often equipped with recycling and chemical toilets, and have holding tanks which can be safely discharged in the shore facilities; appropriate facilities must be made available for collection of wastes from such source.
- Coastal water quality shall be maintained according to CPCB Primary Water Quality Criteria for Class SW-IV (For Harbour Waters)

c) Solid waste

- The waste management plan should include minimization at source using three R's (reduce, reuse and recycle)
- Use prefabricated materials rather than those constructed on-site. Use standard sizing for materials to avoid generating waste from off cuts.
- Provide a dedicated storage area for the separation, collection and recycling of waste with good access
- All biodegradable wastes must be collected separately, composted and used for green belt development/ horticulture

- Production of non-biodegradable materials wastes should be minimized
- The management of the different kinds of wastes generated should be done in a comprehensive manner and conform to the Solid Waste Management Rules (2016), Construction and Demolition Waste Management Rules, 2016, Plastic Waste Management Rules 2018 and e-waste (Management) Rules, 2016 and as superseded from time to time.

d) Hazardous Materials Management

General instructions on handling cargo:

The port shall implement measures for proper screening, and transport of cargo based on local and international regulations, including the following elements:

- Establishment of segregated and access-controlled storage areas with the means to collect or contain accidental releases
- Provision of personal protective equipment for those handling such cargo
- Requesting dangerous goods manifesto for hazardous materials whether in transit, loading or unloading to and from ships, including safety data sheets and Hazchem code, proper shipping (technical) name, hazard class, United Nations number, and packing group
- Training staff in relevant aspects of dangerous goods management including screening and acceptance of dangerous goods at the port. Delivery and storage areas for such goods must be clearly marked. Posters depicting safety measures as well as responses should be clearly visible
- Emergency response procedures specific to dangerous goods must be in place. First aid kits as well as other necessary equipment to respond to any such emergencies must be made available
- Hazardous wastes shall be collected, treated, stored and disposed off only in such facilities as may be authorized for this purpose
- The port shall make an application in Form 1 to the State Pollution Control Board for the grant of authorization collection, reception, treatment, transport, storage and disposal of hazardous wastes
- Hazardous materials storage and handling facilities shall be constructed away from active traffic and protected from potential leaks through vibration due to heavy vehicle movement and/or vehicle accidents
- The port shall provide covered and ventilated temporary storage areas for leaking hazardous cargo designed to facilitate collection of leaks and spills. This is for long term compliance.
- The port shall ensure that the hazardous wastes are packaged in a manner suitable for storage and transport and the labelling and packaging shall be easily visible and be able to withstand physical conditions and climate factors
- Proper storage and disposal methods be followed as per the State Government rules for storage and disposal of hazardous waste
- Legal monitoring of Restriction of Hazardous Substances Directive (RoHS) compliance shall be implemented

- The management of Hazardous wastes is governed by the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016

e) Oil Spill

The port shall have Oil Spill Contingency Plan and management measures for responding to oil spill emergencies within the port limits. The management measure must follow Merchant Shipping Act, Part XIA, 1958 and MARPOL,73/78 Annex I. The port must prevent and plan for controlling spillage following IMO's Manual on oil pollution, Section II, and as follows:

- The port shall identify areas within the port that are sensitive to spills and release of hazardous materials
- A standard operating procedure (SOP) must be in place specifying alert mechanisms to ensure that any spillage is reported promptly to the respective personnel and appropriate actions taken
- Provision of specialized oil spill response equipment (e.g. containment booms, recovery devices, and oil recovery or dispersant application vessels)
- Periodic training for the response personnel. Indian Coast Guard, nodal agency for oil spill management must be involved in such training exercises

Spill Prevention

- Oil and chemical-handling facilities shall be located with consideration of natural drainage systems and environmentally-sensitive areas (e.g. mangroves, and beaches, providing physical separation / distance whenever possible)
- Where possible, the port shall include secondary containment for above ground liquid storage tanks and tanker truck loading and unloading areas
- Fuel dispensing equipment shall be equipped with "breakaway" hose connections that provide emergency shutdown of flow should the fueling connection be broken by movement
- Encircling the ships/tankers with appropriate booms and removing the spilled oil through appropriate means or oil absorbent filaments or mechanical skimmers
- The port must conduct regular inspections of the cargo in the terminals and storage areas to identify any potentially dangerous situations to take appropriate control measures.
- The port shall ensure that no spillage of Petroleum, Oil and Lubricants (POL) or chemicals occurs while unloading from ship or barge vessels to pipeline/road vessels (Considering the future expansion of the port activities) through periodic survey

f) Green belt development

Plants grown in such a way as to function as pollutant sinks are collectively referred to as green belts. They are also effective in noise and vibration mitigation apart from providing aesthetic appearance. Vegetation with broad leaves and rough surfaces can also be utilised as dust traps and when planted downwind of dust sources. This will help in abatement of dust pollution in addition to controls by spraying water.

- Green belt acts as effective natural pollution abatement measure. The optimal location and density of green belts can be determined using numerical mathematical models such as WRF-Chem, HYSPLIT-HYBRID and AERMOD models.
- The green belts are effective as a pollution sink only within the tolerance levels of the constituent plants and hence the pollution parameters are to be periodically monitored. The pollution Attenuation Factor (AF) gives the effectiveness of a green belt in attenuating pollution.
- Besides the indigenous species, promotion of plants with high potential to absorb pollutants shall be identified.

6.2 Environmental guidelines for Green belt development

Guidelines for developing green belts around an industrial area were issued by the CPCB in 2000. Some highlights are as follows:

- No forest land to be converted into non-forest activity for the sustenance of the industry (Forest Conservation Act, 1980)
- No prime agricultural land to be converted into industrial site
- The green belt shall be designed to have shorter trees and bushes/shrubs in the inner side close towards the port area and with increasing heights towards the boundary
- Three layers of the green belt vegetation of all growing trees shall be provided
- The selected species should be indigenous and as per the recommended list of CPCB. The species should have dust and noise tolerance and enhance the aesthetics of the port area
- The green belt between two adjoining large-scale industries shall be 1km
- Reclaimed (treated) wastewater should be used to raise green belt and to create water body for aesthetics, recreation and if possible for aquaculture. The green belt shall be 1/2 km wide around the limit of the industry. For industry having odour problem it shall be 1 km wide
- Sufficient space to be earmarked for storage of solid wastes so that these could be available for possible reuse
- Lay-out and structure of the industry that may come up in the area must conform to the landscape of the area without affecting the scenic features of that place
- Associated township of the industry must be created at a space having physiographic barrier between the industry and the township

Table 14: Selection of plant species based on the cargo handled and the nature of the major pollutant

Criteria	Absorption of gases	Absorption of suspended particulate matter
Crown	Adequate height	Adequate height and wide spread crown
Foliage	Openness in canopy	Abundance of surface
Leaves	Long and broad	Supported on firm petioles

6.3 Measures for Preventing pollution and Environmental Protection

Immediate measures

- The port shall establish management measures for planned port activities including dredging, construction, laying of pipelines to ensure that no harm is caused to the indigenous flora and fauna of the habitat
- Prohibition of dumping of any kind of waste, including untreated sewage and solid waste in CRZ 1A

Long – term measures

- The port shall develop long term ballast water management and treatment systems in the port area in accordance with the provisions of Ballast Water Management Convention, IMO, 2004.
- Regular monitoring measures shall be carried out to identify any invasive alien species in the port area and appropriate management measures must be taken to eradicate such species.
- Renewable energy options (e.g. solar/ wind energy) for the port operations shall be considered to reduce the energy footprint. Solar panels shall be installed wherever possible.
- Corporate Social Responsibility (CSR) activities planned by the port must be need-based and appropriate to the local community.
- Planned afforestation to increase mangrove cover along the creeks shall be executed

Key Observations

Based on available secondary information, assessment of possible emissions, effluents, solid and hazardous waste generated was made on all environmental matrices. It is expected that during the construction phase, the offshore facility is likely to cause only a minimal impact on air quality and land environment. Significant impacts on water quality at the construction and reclamation sites sand in the near coastal waters is expected to be high. Broad guidelines for management of wastes is given in significant detail in this section. Nevertheless, post construction operation and maintenance of the proposed port is likely to reverse the adverse impacts by following the prescribed norms for green port. Further detailed studies are required to ascertain the environmental quality based on the nature of cargo to be handled and the Environment Management Plan (EMP) drawn up for this purpose.

7. Requirement of water, power etc.

[ToR # xvi- Requirement of water, power, with source of supply.]

As per the Techno-Economic Feasibility Report for Development of Port at Vadhavan, the total Water Demand at Port 153 KLD during phase I and 1671 KLD as per the master plan. Sakhare dam is projected as a main source of water with a storage capacity of 4.07 Mcum of water. Alternatively, it has been indicated that the option of providing dedicated desalination plant could also be examined at the detailed engineering stage. A study conducted by Apraj et al., (2017) indicated that healthy ground water quality with more than 97% of the groundwater samples were safe to moderately safe for irrigation related use. It is recommended that ground water use for port activity shall be avoided[12].

The source of power is the 220-kV substation located at Boisar, 20 km from the proposed port location. During initial phase the power requirement has been projected as 13 MVA whereas it is 81 MW in the master plan stage.

Key Observations

As per the Techno-Economic Feasibility Report for Development of Port at Vadhavan, the total Water Demand at Port 153 KLD during phase I and 1671 KLD as per the master plan. Sakhare dam is projected as a main source of water with a storage capacity of 4.07 Mcum of water. It is recommended that ground water use for port activity shall be avoided. The source of power is the 220-kV substation located at Boisar, 20 km from the proposed port location. During initial phase the power requirement has been projected as 13 MVA whereas it is 81 MW in the master plan stage. It is suggested to work out the detailed requirement of power and water prior to the operation of the port.

[12] Apraj MV et al., (2017). Quality of Irrigation Groundwater from Palghar and Dahanu Tehsils of Coastal Konkan. Journal of Soil Salinity and Water Quality 9(2)270-274

8. Vicinity of forest areas etc.

[ToR # xvii- Vicinity of Forest areas, Wildlife Sanctuaries and National Parks etc shall be analysed and submitted.]

Forest Cover Assessment of India (ISFR, 2021), includes all lands of more than one hectare in area with the tree canopy density of more than 10 percent (ISFR, 2021) irrespective of their ownership, land use and legal status and all types of tree crops (natural and manmade) and tree species along with bamboos, fruit bearing trees, coconut palm trees etc are considered. Based on this, spread over 36 districts under five Divisions (Amravati, Aurangabad, Konkan, Nagpur, Nashik and Pune) about 16.51 percent of the geographical area of the State of Maharashtra is only recorded to be under forest cover against the national forest cover of 21.71 percent.

The Konkan Division comprises of Seven coastal districts (Sindhudurg, Ratnagiri, Raigad, Mumbai City, Mumbai Suburban, Thane and Palghar), among which, Palghar forms the northern most district delimited from the old Thane district. With Dahanu, a tribal Taluka forming the northern extent, Palghar district comprises of 8 talukas (Palghar, Vada, Vikramgad, Jawhar, Mokhada, Dahanu, Talasari and Vasai-Virar). Dahanu Taluka, is geographically located between 19°52’ and 20°7’ North latitude and 72°40’ and 73°6’ East longitude. The physical extent of the proposed Vadhavan port is limited between 19° 54’ 5” - 20°0°0’’ N latitude & 72° 30’ 0’’ E longitude to 19 °54’ 26” N - 19° 57’ 58” N latitude and 72° 40’30” - 72° 42’ 15’’ E longitude & and falls in Dahanu taluka.

Estimation of Forest Cover

In order to understand the present environmental settings of the surrounding areas of the proposed project, Vadhavan, a spatial extent of 534.14 sq km with a distance of approximately 28 km towards the east reaching the foot hills of Western Ghats and with a north-south distance of 97 km is considered as the Area under consideration. This area falls in Talasari, Dahanu and Palghar talukas.

The forest cover of the area under consideration is estimated based on digital image processing of Sentinel 2 A – MSS data (26 February 2022) with 10m spatial resolution. Based on NDVI threshold slicing, the forest cover is delineated. The resultant image is subjected to elimination of areas less than 0.5 hectare and contextual editing and scrutiny with high resolution images of Google Earth. Considering the landscape components and ecological fragility of the area, in the present estimate, all tree agglomerations greater than 0.5 hectare is accounted as forest cover.

Forest cover also includes palms, wind breaks, coastal shelter belts and corridors of trees with more than 0.5 hectare and of width of more than 20m. Forest cover is further classified as 1) Natural forests 2) Plantation forests 3) Orchards/Plantation crops 4) Trees Resource Outside Forests (TROF) and 5) Mangrove Forests. Agglomerations/scattered tree or woody vegetation of more than 0.5 hectare growing

outside the designated natural forest areas are designated as TROF. Isolated tree stands and those along field bunds, canals and road sides of less than 20m width and in-home steads, though of significance could not be included under tree cover.

Forest Cover in the vicinity of Vadhavan Port

The area under consideration has a vast landscape; pristine coastline and mangroves facing the Arabian sea on western side and forested mountain chains of western Ghats on the eastern side, with Banganga, Tumb, Vaitarna Rivers and its estuaries along large agriculture-horticulture farms between these natural boundaries. The forests of in this region belong to four forest types *viz*., Southern Tropical Semi-Evergreen forests, Southern Tropical Moist Deciduous Forests, Southern Tropical Dry Deciduous forests and Littoral and Swamp Forests mainly comprising of mangroves.

Table 15. Forest cover statistics in the area under consideration

S.No.	Type	Area (sq. km)	% to Total area
1	Natural Forest	17.39	3.26
2	Forest Plantation	0.61	0.11
3	Mangroves	10.34	1.94
4	Orchards/Plantation	107.10	20.05
5	TROF	2.18	0.41
	Total	137.62	25.76

Based on the classification the forest cover estimated within the area under construction is 137.62 sq km (Fig 1). Natural forests which are found along the foot hills of Western Ghats comprising mainly of natural teak forests accounting for 17. 39 sq km (Table 15).

Apart from *Tectona grandis*, other species include *Terminalia tomentosa, Lagerstroemia parviflora, Adina cordifolia, Boswellia serrata, Aegle marmelos, Anogeissus latifolia, Accacia catechu, Pterocarpus marsupium Cassia fistula, Dalbergia latifolia, Bombax malabarica* etc.

Forest plantations mainly consist of *Tectona grandis* and *Casuarina equisetifolia* along the coasts which accounts to 0.61 sq km. Extensive areas of Orchards / Plantation crops comprising mainly of Sapodilla along with other fruit trees like Coconut, Mango, Lychee, Guava, Grapefruit, Custard Apple and Cashew nuts are found, the extent of which is estimated to be 107.10 sq km. About 10.34 sq km of mangrove forests are found along the estuarine regions of the Dahanu, Dhumkhet, Matgaon, Boisar, Dandi, and Murbe (Fig. 2). Dominat species includes *Avicennia marina, Sonneratia alba, Sonneratia apetala, Ceriops tagal, Bruguiera cylindrica* etc. Towards north of Vadhavan port within 7 kms along the Dahanu creek about 2.48 sq km (Fig. 3) mangrove forests are found. Towards the south of the port mangrove forests are found

along the creeks of Banganga river (Fig. 4). Within the study limits there are no protected areas.

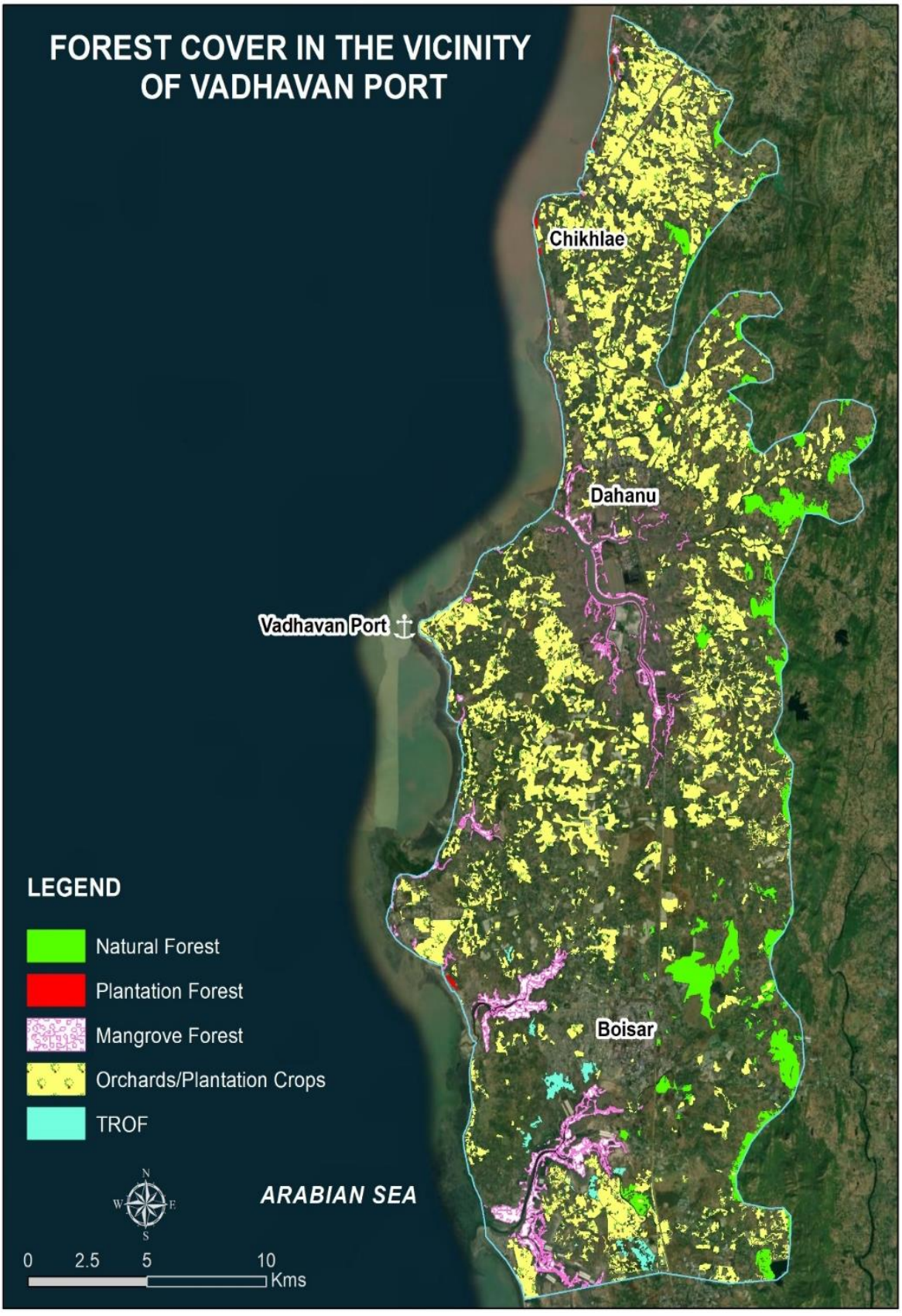


Figure 23: Forest cover in the vicinity of Vadhavan port

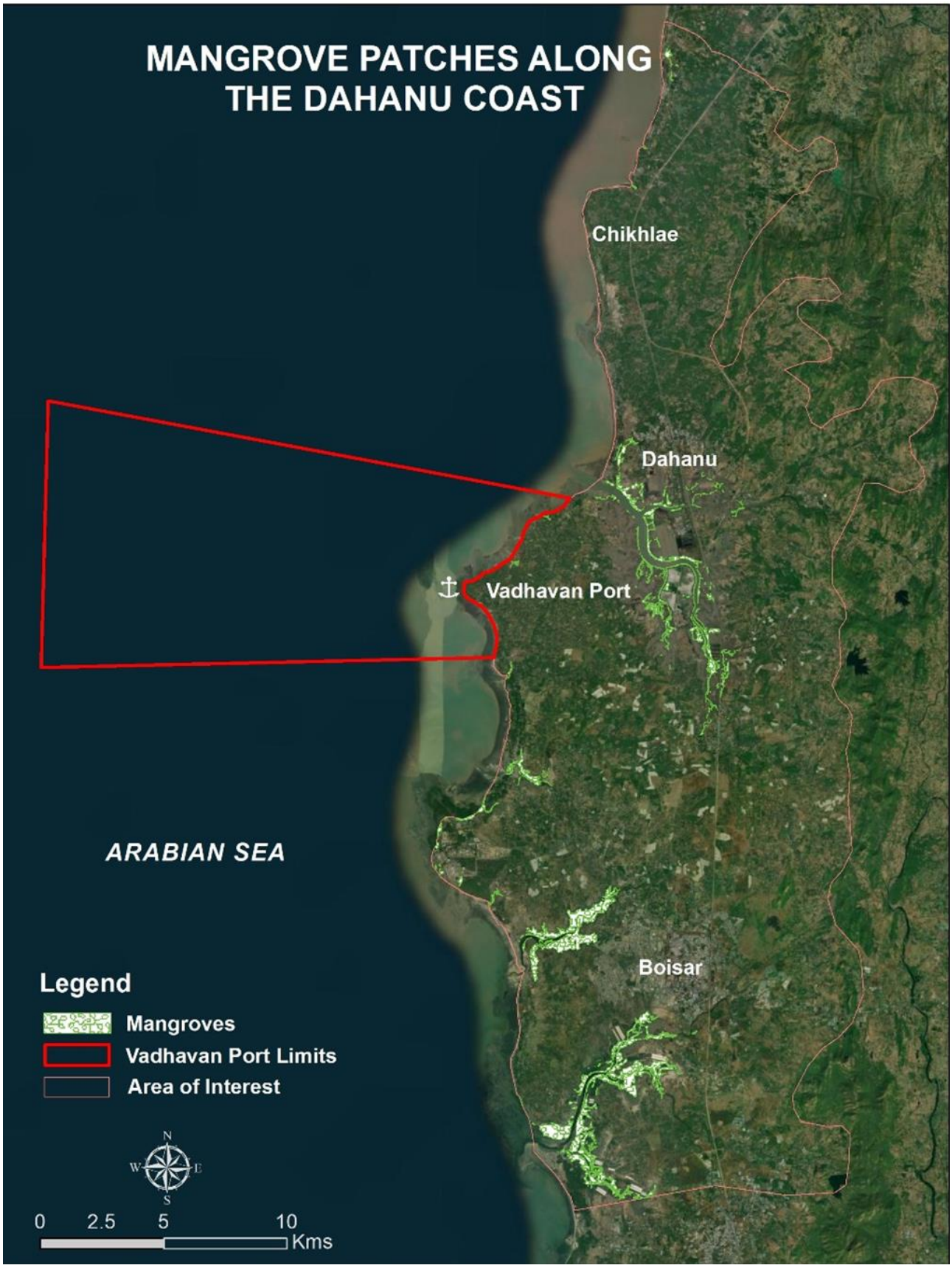


Figure 24: Vadhavan port and Mangrove patches along Dahanu Coast

Figure 25: Mangrove patches along Dahanu creek

Figure 26: Mangrove patches along the estuarine reaches of Banganga river

According to forest cover mapping of Forest Survey of India, the study area limit sustains 105.1 sq km of forest cover (Figure 5), which includes Scrub forest (0.44 sq km) open forests (82.35 sq km), moderately dense forests (22.31 Sq km).

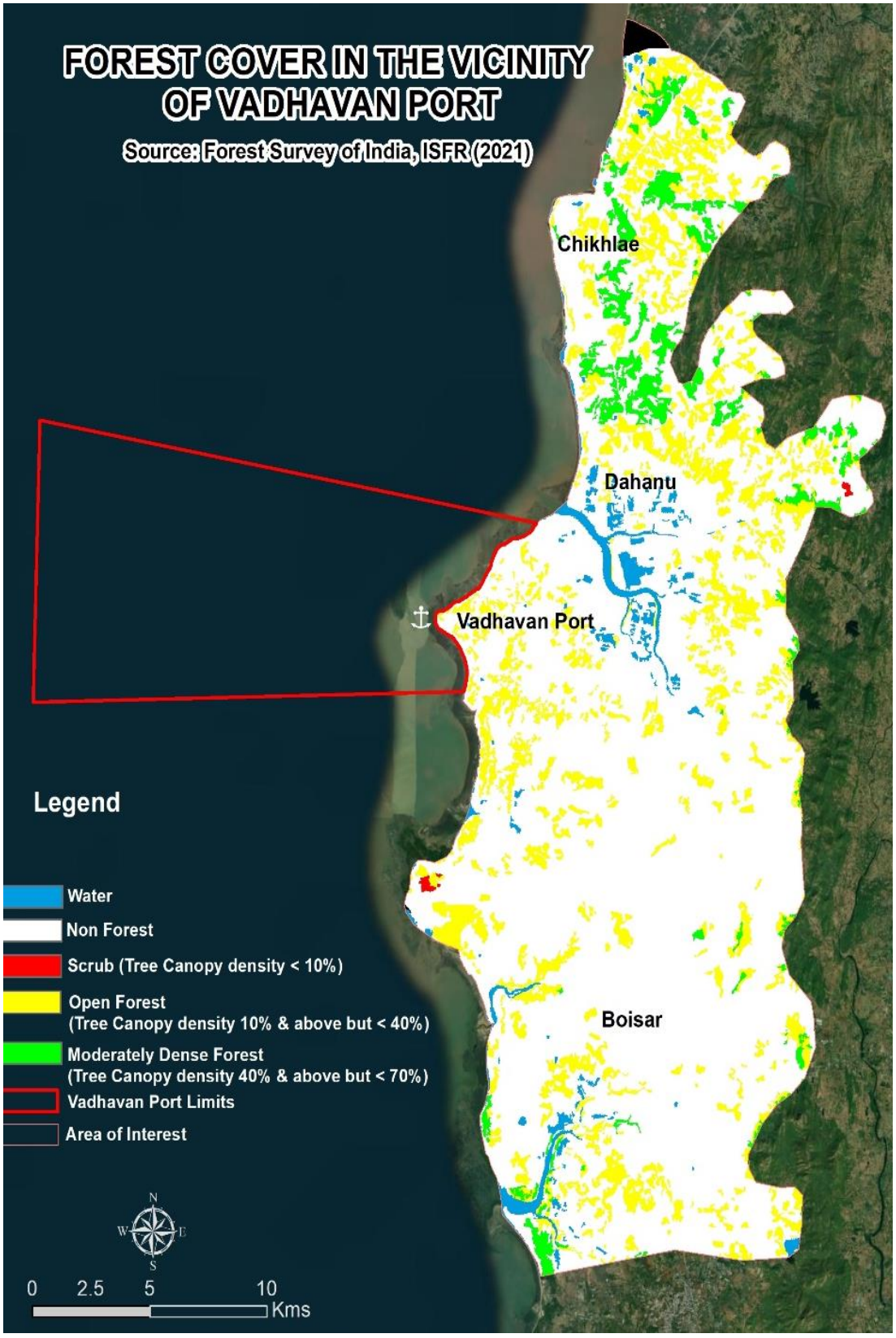


Figure 27: Forest cover within the Area under construction– Source – FSI, ISFR 2021

No designated wildlife sanctuaries, national parks, community reserves are present in the vicinity of proposed Vadhavan Port area.

Key Observations

The forests in the area under consideration belong to four forest types viz., Southern Tropical Semi-Evergreen forests, Southern Tropical Moist Deciduous Forests, Southern Tropical Dry Deciduous forests and Littoral and Swamp Forests mainly comprising of mangroves. Based on the classification the forest cover estimated within the area under construction is 137.62 sq km.

Extensive areas of Orchards / Plantation crops comprising mainly of *Sapodilla* along with other fruit trees like Coconut, Mango, Lychee, Guava, Grapefruit, Custard Apple and Cashew nuts are present, the extent of which is estimated to be 107.10 sq km. An area of 10.34 sq km of mangrove forests are present along the estuarine regions of the Dahanu, Dhumkhet, Matgaon, Boisar, Dandi, and Murbe. According to forest cover mapping of Forest Survey of India, the study area limit sustains 105.1 sq km of forest cover), which includes Scrub forest (0.44 sq km) open forests (82.35 sq km), moderately dense forests (22.31 sq km).

Based on available literature, there are NO designated wildlife sanctuaries, national parks, community reserves present in the vicinity of proposed Vadhavan Port area.

9. Coastal Regulation Zone

[ToR # xix- Superimposing the activities and the CRZ areas along with the recommendations, which will enhance the quality of the studies and the report.]

a) Superimposing the draft project activities of Dahanu Port on the land use/ESA map to classify coastal regulation zone categories

A draft land use/ESA map of 1:25000 scale is prepared for the proposed Vadhavan Port, Dahanu, Maharashtra based on the data base used for the preparation of CZMP as per CRZ Notification, 2011 for Maharashtra State. The proposed project activity data were extracted from the draft Index Map (1:55000) prepared by Institute of Remote Sensing, Chennai (REF NO. AU/IRS/RM/196-2022 DT. 02.03.2022) and redrawn for the following:

- Demarcation of Ecological Sensitive Areas (ESAs)
- CRZ categorization as per CRZ Notification 2011
- Preparation of Land use/ESAs map based on approved CZMP
- Superimposing the project layout plan on the map

b) Base map and Data Source

Digitized cadastral map as base map of the proposed project area were extracted from the approved CZMP of Maharashtra State as per CRZ Notification 2011. Also, the Coastal Regulation Zone (CRZ) categories and associated information were extracted from the CZMP map. The principal data sources include:

- Approved CZMP as per CRZ Notification, 2011
- Draft Index Map of Institute of Remote Sensing (IRS) for the project site

c) Landuse/Landcover

The landuse/landcover along the proposed project site is Industries and associated facilities, refineries, container terminals, residential areas, recreational areas, road and rail networks, other infrastructure facilities, rivers and streams, mangroves, etc.

d) Coastal Regulation Zone Categories for the Proposed Dahanu Port

The proposed port limit boundary falls within the CRZ IA (mangrove and 50m mangrove buffer zone), CRZ IB (intertidal zone), No Development Zone (NDZ) of CRZ III, and CRZ III (between 200m to 500m). The Proposed Approach Trestle, Proposed Breakwater, Proposed Navigational Area, Proposed Offshore Reclamation Area, and Proposed Shelter Area falls within the CRZ IV A category whereas the Proposed Reclamation Area Nearshore falls on CRZ IB, NDZ of CRZ III, CRZ III and CRZ IVA categories.

The proposed project activities superimposed in 1:25000 Scale Landuse/ESAs map is given in the Annex. The CRZ categories along the project area are CRZ IA

(Mangrove), CRZ IB (Intertidal Zone), CRZ III (No Development Zone and 200 to 500 m from HTL), CRZ IVA (Sea). The approximate area of Proposed project activities falling each CRZ categories are given in the Table 16 which is extracted from the IRS prepared draft Index map of scale 1:55,000.

Table 16: CRZ categories in Hectares

S. No.	Name of Proposed Activities	Mangroves (CRZ IA)	50m Mangrove Buffer Zone (CRZ IA)	Intertidal Zone (CRZ IB)	No Development Zone (CRZ III)	200 to 500m from HTL (CRZ III)	Sea (12Nm) (CRZ-IVA)
1	Proposed Approach Trestle						19.09
2	Proposed Breakwater						179.90
3	Proposed Navigational Area						1143.13
4	Proposed Offshore Reclamation Area						1369.89
5	Proposed Reclamation Area Nearshore			52.52	9.51	2.35	171.59
6	Proposed Shelter Area						503.60
7	Proposed Port Limit Boundary	39.53	50.86	225.51	17.91	2.35	16560.63

The Land use/ESA map (1:25000 scale) has been prepared in accordance with the approved CZMP maps of Maharashtra State (2011). The proposed Dahanu port project site falls within the Sheet No. E43 A9/NE (Map No. MH 97) of approved CZMP of Maharashtra State prepared as per CRZ Notification 2011.

Key Observations

The proposed port limit boundary falls within the CRZ IA (mangrove and 50m mangrove buffer zone), CRZ IB (intertidal zone), No Development Zone (NDZ) of CRZ III, and CRZ III (between 200m to 500m). The Proposed Approach Trestle, Proposed Breakwater, Proposed Navigational Area, Proposed Offshore Reclamation Area, and Proposed Shelter Areas fall within the CRZ IV A category, whereas the Proposed Reclamation Area Nearshore falls on CRZ IB, NDZ of CRZ III, CRZ III and CRZ IVA categories.The CRZ categories along the project area include CRZ IA (Mangrove), CRZ IB (Intertidal Zone), CRZ III (No Development Zone and 200 to 500 m from HTL), CRZ IVA (Sea).

10. Assessment of CPCB Notification

[ToR # xx- Assessment of CPCB notification on classification of categories of industries specifically w.r.t. ports vis-a-vis the notification of the MoEFCC on the subject.]

Central Pollution Control Board in its notification dated March 07, 2016 has classified various industrial sector into four categories based on the Pollution Index (PI):

No.	Pollution Index	Category
1	≥ 60	RED
2	41 to 59	ORANGE
3	21 to 40	GREEN
4	≤ 20	WHITE

With score of 85, the ports and harbour, jetties and dredging operations has been categorized as **RED** Category.

a) Ports as a service sector

- Ports are associated primarily with freight services (loading-unloading, stowing-unstowing, transport between ships or ship-port) and are in general associated with the service sector.
- However, port activities such as infrastructure development, operation and maintenance may cause environmental stress, but much of it reversible, if the port operates in following the sustainable green port guidelines with both environmental and economic benefits.
- The port operates within the framework of national and internal maritime rules, laws and legislation and the activities are periodically monitored for environmental, ecological and social variables, to rule out any adverse impact on the terrestrial and aquatic environment,
- These activities are aligned to the environmental guidelines and emission norms of CPCB including seawater use classification guidelines (SW-IV).
- Government of India, vide press release dated 05 Aug 2021, has undertaken green port initiatives for the major ports for adopting the green port norms for the environmental benefits. These include:
    - Monitoring environmental pollution,
    - Acquisition of dust suppression systems,
    - Setting up of sewage/ waste water treatment plants,
    - Setting up of garbage disposal system for ports and ships,
    - Developing shore reception facility for wastes from ships,
    - Setting up projects for energy generation from renewable energy sources,
    - Providing shore power to ships at berths,
    - Creating Oil Spill Response (Tier-1) capabilities at all ports,

- Taking actions to improve harbour water quality,
- Inclusion of sustainable practices in terminal design,
- Development and operation
- increasing green cover within port premises etc.

As the shipping and port sector does not involve any production related activities which can significantly impact the environment, the Central Pollution Control Board (CPCB) took an initiative to reclassify the ports and harbours as non-industrial operation (service sector). CPCB has issued directions vide letter no. B-29016/ROGW/IPC-VI/2020-20 dated 30th April 2020 notified that the port, harbours, jetties and dredging operation as Non-Industrial Operations (Activities/Facilities/Infrastructure/Services), thereby excluding from 'Red' category.

As per the direction issued by CPCB, the port does not fall in the red categories of industry. Hence, activities relating to the 'port' falling in the Ecologically Sensitive Area, may be considered in accordance with the provisions of the Notification S.O.416(E) dated 20th June, 1991 and Notification S.O.884(E) dated 19th December, 1996 issued by the Ministry and as amended from time to time.

A chronological sequence of OM/ directions issued by CPCB and MoEF&CC on categorization of Ports is given Table 17.

Key Observations

The generic observation that ports are associated primarily with freight services (loading-unloading, stowing-unstowing, transport between ships or ship-port) is the basic premise for the CPCB to exclude ports from the RED category. Despite the anticipated pollution impacts, it is appropriate to mention that ports need to conform to the environmental standards and safeguards as prescribed for "Green" Ports, and by following national and international green protocols.

Table 17: Chronological sequence of OM/ directions issued by CPCB and MoEF&CC on categorization of Ports

Date	S.No.	Orig. S.No.	Industrial Sector	W1	W2	W	A1	A2	A	H	W+A+H	Revised category	Remarks
March 7, 2016	46	65	Ports and harbour, jetties and dredging operations	30	10	40	15	10	25	20	85	R - R	This category contains all sorts of pollution
April 30, 2020	5	46	Ports and harbour, jetties and dredging operations								85	Under List of non-industrial operations (activities/ facilities/ infrastructure/services)	This category contains all sorts of pollution
June 8, 2020		MoEFCC OM dated 8th June 2020	Ports and harbour, jetties and dredging operations										Para 4 indicates "Port does not fall in the red categories of industry"
													Therefore, activities relating to the 'port' falling in the Ecologically Sensitive Area, can be undertaken in accordance with the provisions of the Notification S.O.416(E) dated 20th June, 1991 and Notification S.O.884(E) dated 19th December, 1996 issued by the Ministry and as amended from time to time.

Category	**Type of Pollution**
W	Water Pollution
A	Air Pollution
H	Hazardous Waste Generation
A1+A2	Overall Air Pollution Score
W1+W2	Overall Water Pollution Score
W+A+H	Grand Total

11. Summary

11.1 Assessment of impacts

[ToR # i- Assessment and evaluation of impact of setting up port on overall ecology of Dahanu Taluka]

A summary of possible impacts was assessed by developing a matrix of activities and impacts on land, water, biota, fisheries and on air, noise and vibration (Figure 28).

Figure 28: Environment Impact matrix for Vadhavan Port

Port Activities		Impacts												
		Land		Water				Biota						
		Shoreline	Agri/ Plantn/ Horti	Ground water	Rivers, Creeks	Coastal water	Wetland	Terrestrial	Coastal	Marine	Fisheries	Air	Noise	Vibration
	Baseline													
	During construction													
	Cargo handling													
	Cargo storage and transfer													
	Dredging and reclamation													
	Waste generation/emission													
	Marine Traffic													
	Vehicular Movement													

Legend

Impacts				
Very High	High	Medium	Low	No Impact

The following are key observations from the available secondary and limited primary data used for the preliminary assessment.

- The baseline study indicates no impact on the environment and ecology
- During construction phase, likely impacts are high for shoreline and high for most other variables
- In the operation phase, most of the high impacts are likely to be minimized to moderate, low and to no impacts if the operations continue on a green port mode
- From the preliminary assessment, the water environment (in particular the coastal waters and creeks) and marine biota including fisheries are likely to be

impacted during construction but it is expected that current baseline conditions will be restored if the port operations are as per the green port norms

Table 18: Environment and Ecological Impact Matrix for the proposed Vadhavan Port

	Impact Count				
Environment and Ecology					
Land Environment	2	0	1	4	17
Water Environment	0	2	1	6	15
Biota	1	3	2	9	9
Fisheries	0	0	2	3	3
Air, Noise, Vibration	0	3	6	12	3

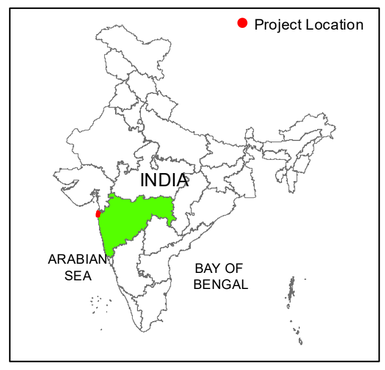
Table 19: Environmental impact of Phase wise port activities

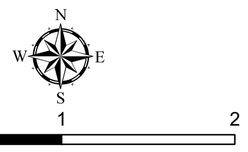
	Impact count				
Activity Phase					
Baseline	0	0	0	0	13
During Construction	1	6	4	1	1
Operation and Maintenance	2	2	8	33	33

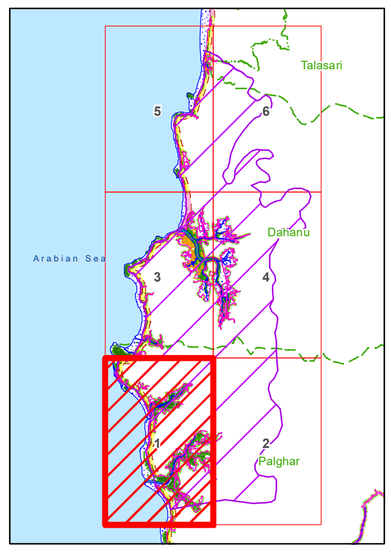
SWOT Analysis

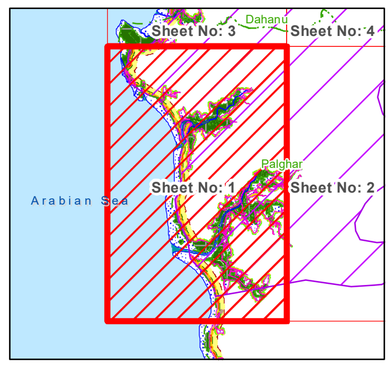
Strengths	**Opportunities**
Contributing to the National GDP	Enhanced green cover through green belt development and
Enhanced National Blue Economy	Increased extent of mangrove cover through plantation
Strategic geographic offshore location	Reduction in Air and Noise pollution due to offshore location
Important service sector contributing to large scale employment	Offshore structures act as Fish aggregating device (FAD) and artificial reef (AR)
Least impact on near coastal and land environment	Enhanced value chain
Resource efficiency (Circular economy)	Climate Efficient seaport
Weakness	**Threats**
High implementation costs	Proximity to ecologically sensitive area
Conflict among various stakeholders	Impact on Fishing space

Sheet No: 1









Map prepared in accordance with approved CZMP of Maharashtra and Gujarat States as per CRZ Notification, 2011

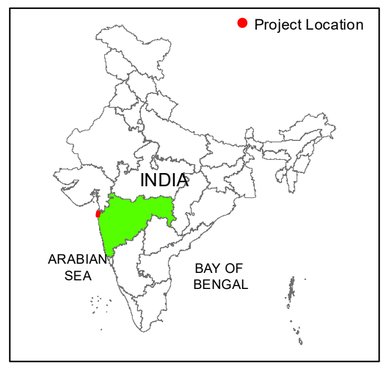
Legend

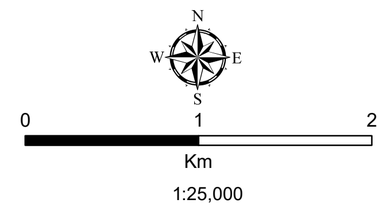
- Port
- Road
- Railway Line
- Sluice
- Seawall
- High Tide Line
- Low Tide Line
- 100 m CRZ Line in CRZ III Area
- 200 m CRZ Line - NDZ
- 500 m CRZ line
- CRZ Line for River or Creek
- Port Limit
- Archeological and Heritage Sites - CRZ IA
- Mangroves - CRZ IA
- 50 m Mangrove Buffer Zone - CRZ - IA
- Mudflat - CRZ IA
- Salt Marsh - CRZ IA
- Intertidal Zone - CRZ IB
- CRZ Landward of HTL - CRZ II
- No Development Zone - CRZ III
- 200 to 500 m from HTL - CRZ III
- Waterbody - CRZ IVA
- Waterbody - CRZ IVB
- Survey Plots
- Village Boundary
- Municipal Boundary
- Taluka Boundary

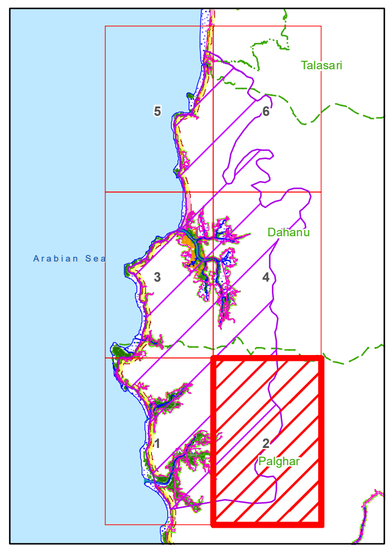
Proposed Project Site (As given by the Project Proponent)

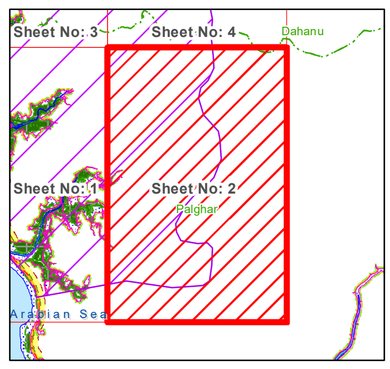
- Proposed Project Site

Sheet No: 2









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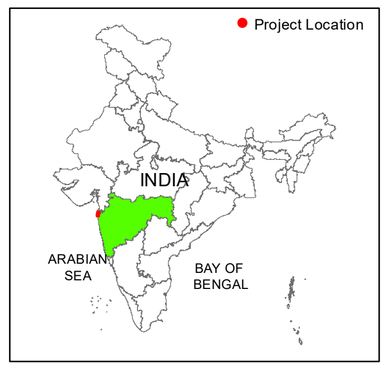

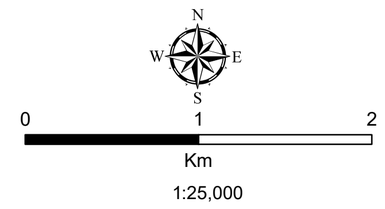

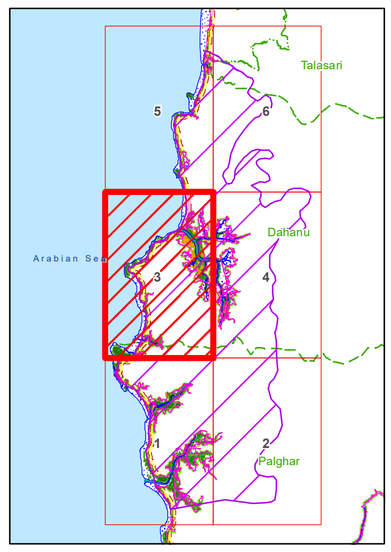

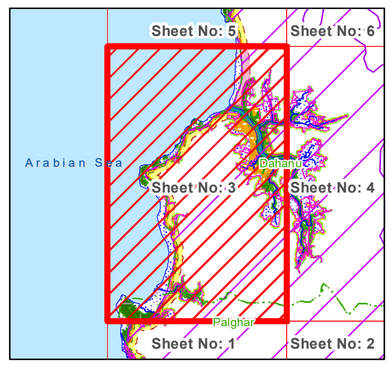

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- Taluka Boundary

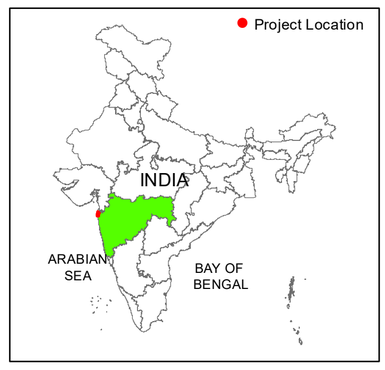
Proposed Project Site (As given by the Project Proponent)

- Proposed Project Site

Sheet No: 4

72°46'0"E
72°48'0"E
72°50'0"E
20°0'0"N
19°58'0"N
19°56'0"N
19°54'0"N
19°52'0"N

Dahanu Municipal Corporation
Dahanu MCI
Patilpada
Saravali
Ashagad
Sawata
Motapada
Agwan
Dahanu
Pale
Motgaon
Asangaon Bk
Asangaon
Dehane
Dabhale
Vangaon
Khambale
Kolavali
Palghar



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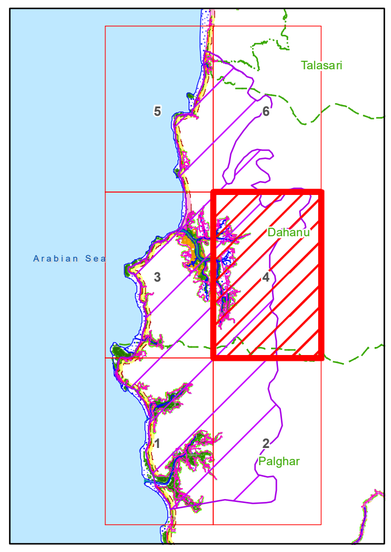
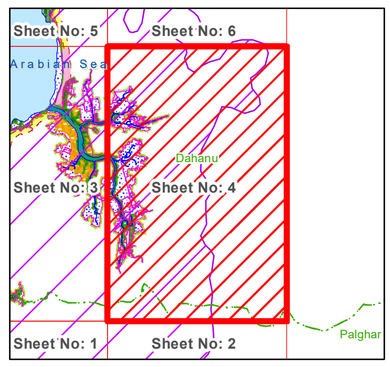




Map prepared in accordance with approved CZMP of Maharashtra and Gujarat States as per CRZ Notification, 2011

Legend

- Port
- Road
- Railway Line
- Sluice
- Seawall
- High Tide Line
- Low Tide Line
- 100 m CRZ Line in CRZ III Area
- 200 m CRZ Line - NDZ
- 500 m CRZ line
- CRZ Line for River or Creek
- Port Limit
- Archeological and Heritage Sites - CRZ IA
- Mangroves - CRZ IA
- 50 m Mangrove Buffer Zone - CRZ - IA
- Mudflat - CRZ IA
- Salt Marsh - CRZ IA
- Intertidal Zone - CRZ IB
- CRZ Landward of HTL - CRZ II
- No Development Zone - CRZ III
- 200 to 500 m from HTL - CRZ III
- Waterbody - CRZ IVA
- Waterbody - CRZ IVB
- Survey Plots
- Village Boundary
- Municipal Boundary
- Taluka Boundary

Proposed Project Site (As given by the Project Proponent)

- Proposed Project Site

Sheet No: 5

72°40'0"E 72°42'0"E 72°44'0"E

20°6'0"N 20°4'0"N 20°2'0"N

Arabian Sea

Gujarat

Dehari

Govada

Talasari

Zai

Bordi

Jambugaon

Gholwad

Vikasnagar

Chikhale

Dahanu

Ambewadi

Narpad

Thakurwadi

Dahanu Municipal Corporation

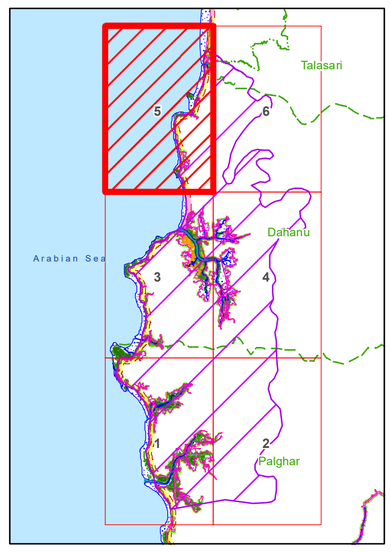
Dahanu MCI

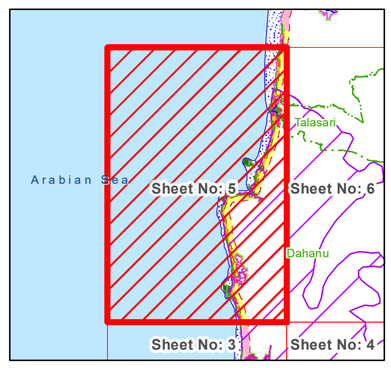
N
W E
S

0 1 2

Km

1:25,000





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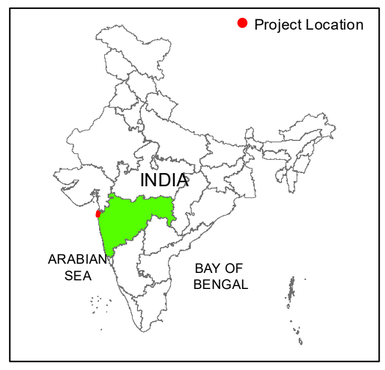
Proposed Project Site (As given by the Project Proponent)

- Proposed Project Site

Sheet No: 6

72°46'0"E
72°48'0"E
72°50'0"E
20°8'0"N
20°6'0"N
20°4'0"N
20°2'0"N

Umbergaon
Umbergaon CT
Solsumba
Karambele
Dehari
Gujarat
Dahad
Govada
Zai
Talasari
Maharashtra
Bordi
Jambugaon
Gholwad
Rampur
Dahanu
Dahanu MCI
Dahanu Municipal Corporation



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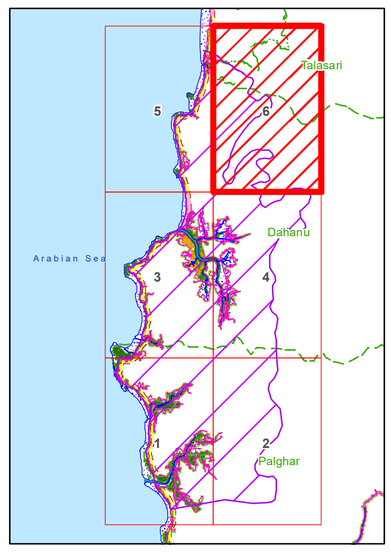

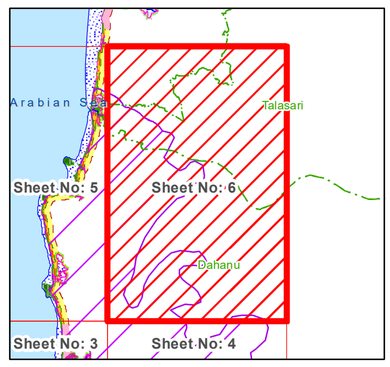

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- Proposed Project Site

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