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(MIDPL)

Project: Revised Master Plan Development of
Kattupalli Port

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1 Project Description

1.1 Introduction

Tamil Nadu Industrial Development Corporation Limited (TIDCO), a Government of Tamil Nadu Enterprise, is the nodal agency to identify and promote establishment of large and medium scale industries within State of Tamil Nadu. TIDCO identified the leading technology, engineering and construction conglomerate, Larsen & Toubro (L&T), as partner for developing Shipyard cum Port Complex on a Joint Venture (JV) basis and submitted a proposal to Government of Tamil Nadu (GoTN). GoTN approved TIDCO's Proposal and allotted about 1200 acres of land at Kattupalli. L&T Shipbuilding Limited, a JV of L&T and TIDCO, was formed and JV agreement was signed between the parties on April 15, 2008 to develop the Shipyard cum Port Complex at Kattupalli.

L&T Ship Building Limited (LTSB) has obtained EC & CRZ clearance for Shipyard cum Port Complex at Kattupalli, Thiruvallur District, Tamil Nadu vide Letter No. 10- 130/2007-IA.III, dated July 03, 2009. Tamil Nadu Pollution Control Board (TNPCB) has accorded Consent to Establish (CTE) vide letter dated August 18, 2009. LTSB obtained amendment for dredging and dumping from MoEF&CC vide Letter No. 10- 130/2007-IA.III, dated May 12, 2010. LTSB commenced the construction in October, 2009. Consent to Operate (CTO) was also obtained from TNPCB vide letter dated November 16, 2012 and the same is being renewed regularly. LTSB has commissioned its operations on January 30, 2013. LTSB obtained amendment to handle revised cargo traffic at the Kattupalli Port in EC & CRZ clearance along with extension of validity from MoEF&CC vide Letter No. 10- 130/2007-IA.III, dated December 17, 2014.

Considering the divergent nature of business of LTSB and to harness the potential for growth with clear focus on port business, LTSB had approached the Hon'ble National Company Law Tribunal (NCLT), Chennai with a Scheme of arrangement for demerger of port business of LTSB into a separate company Viz., M/s Marine Infrastructure Developer Private Limited (MIDPL). The Hon'ble NCLT after careful examination of the scheme had accorded its approval on March 20, 2017. Pursuant to the said NCLT Order, the Port business in Kattupalli Shipyard cum Port Complex on a going concern basis together with the identified port assets, powers, sanctions, approvals, registrations etc., stands transferred and vested with MIDPL. Accordingly, LTSB had approached MoEF&CC to bifurcate the existing Environmental and CRZ Clearance in the name of L&T Shipbuilding for Shipyard and MFF related activities and in the name of MIDPL for Port and common infrastructure related activities. Environmental and CRZ Clearance bifurcation completed on mutually acceptable division of responsibilities between LTSB & MIDPL and bifurcated EC was granted to MIDPL vide letter no. F. No.10-130/2007-IA.III dated February 9, 2018.

Through vide G.O.(Ms) No. 19 dated 01.03.2018, the share holding pattern of MIDPL is transferred from LTSB to Adani Ports and Special Economic Zone (APSEZ) Private Limited on 27.06.2018, wherein the 97% of shares of MIDPL have been transferred from L&T to APSEZ and remaining 3% continue to be held with TIDCO. Thereon, APSEZ is operating the Kattupalli Port in the name of MIDPL.

MIDPL has obtained "No increase in Pollution Load Certificate" from TNPCB on 12.01.2021 for the proposed change in cargo Mix and further Change in Product Mix to cater to needs of port users without change in the overall handling capacity of 24.65 MMTPA from MoEF&CC on October 10, 2022.

Considering the future business potential, MIDPL proposed development of Revised Master Plan of Kattupalli Port.

1.2 Project Description

1.2.1 Project Site

The Kattupalli Port is located towards North of Kamarajar (Ennore) Port near Kattupalli village of Ponneri Taluk, Thiruvallur District, Tamil Nadu. The geographic location of the Kattupalli port is at Latitude 13° 18' 50.35" N and Longitude 80° 20' 45.68" E. Location map of the project site is given as **Figure FD0101**.

1.2.2 Proposed Project Development

Revised Master Plan of Kattupalli Port is proposed with flexibilities to accommodate all berths (existing as well as proposed) as multipurpose with transloading facilities, backup facilities and independent port craft facilities, waste reception facilities, conveyor systems, drainage, water supply, electrical works, internal roads, railway works and other utilities, amenities and bunkering considering the future business potential.

- Revised master plan development – additional Quay length of ~9567 m berth length, quay length of 1250 m Barge berths & ~12 Port Craft facilities are proposed (including existing approved 2 port craft). Total quay length of berth proposed as a part of revised master plan will be ~11467 m in addition to 1250 m long barge berths, transloading facility & 2 no SPM's are also proposed to handle Multi-Purpose and Liquid/Gas/Cryogenic cargoes. Total cargo handling capacity will be approximately 320 MMTPA along with increased backup facilities.
- For easy evacuation of cargo, a new rail, road and utilities is also proposed within the existing port boundary.
- The Project Cost in line to Revised Master Plan development is **INR 53,031 Crores**¹.

1.2.3 Project Brief

Development of 5 Berths with total quay length of ~1900 m and 2 Port Craft Berths are approved as a part of existing port, out of which 3 berths are constructed and operational. Fourth and Fifth berths are not yet constructed. As part of Revised Master Plan development, additional quay length of ~9567 m for berths, quay length of 1250 m for barge berths & ~12 port craft facilities are proposed (including existing approved 2 port craft). Total quay length of berth proposed as a part of revised master plan will be ~11467 m in addition to 1250 m long barge berths, Trans loading Facility & 2 no SPM's are also proposed. Port Craft facilities will be executed progressively with the berth execution and location of port craft to be finalized adjacent to the berth for smoother operation. Type of berth and type of cargo is commercial and as per the business requirement. Hence revised master plan development is proposed with flexibilities to accommodate all berths (existing as well as proposed) as multipurpose.

Along with berths, transloading facilities, SPM's, backup facilities and independent port craft facilities, waste reception facilities, conveyor systems, drainage, water supply, electrical works, internal roads, railway works and other utilities, amenities and bunkering will be developed to accommodate all multipurpose cargo such as Liquid, Bulk, Break Bulk, Project Cargo, dry cargo, General Cargo, Container, Ro – Ro, Automobile and any other non-hazardous cargoes

¹ Cost also does not cover land acquisition cost

& Liquid /Gas/ cryogenic cargo (Cryogenic Gases (Upto -162 degree Celsius, Pressurized Gases). Depending on the business requirements, LNG will also be handled through FSRU and LPG will be handed through FSO, in addition to land-based terminal as part of Revised Master Plan development.

In addition to these, as per the business requirement, it is proposed to develop Port backup Industries and Industrial development area and its associated infrastructure.

Apart from existing Breakwater, two new Breakwater of about total 12.10 km length is proposed, out of which new Northern Breakwaters will be about 9.02 & 1.22 km and new Southern Breakwater will be about 1.86 km.

It is estimated that ~ 85 Mm³ of dredged material will be generated. Entire dredged material will be used for reclamation. Additional material for reclamation will be borrowed from identified borrow area (onshore/offshore). Total proposed quantity for Reclamation including landfilling is estimated about 138 Mm³ which will be used for reclaiming 1145 Ha area.

Maintenance dredging quantity is estimated as 1.25 - 2 Mm³/annum. The maintenance dredging material will be disposed at the offshore disposal ground to be identified through hydro dynamic modelling study.

Total cargo handling capacity will be approximately 320 MMTPA. Average dredge depth at berths will be (-) 20.5 m CD to (-) 25 m CD.

For easy evacuation of cargo, a new rail, road and utility corridor is also proposed within existing Port boundary. However, feasibility of alignment of proposed corridor will be checked during detailed study. This rail line will connect Kattupalli port with nearby southern rail link at Ennore Railyard and proposed Northern Rail Link at L&T Spur location. However, in parallel to this Revised Master Plan development, to cater immediate cargo evacuation requirement, connecting to southern rail link is being taken up and separate CRZ clearances are in progress.

Revised Master Plan development of Kattupalli Port will be carried out in total area of 2472.85 ha which includes 133.50 ha of existing area, 761.8 Ha of govt. land, 781.4 ha of Private and proposed sea reclamation of 796.15 ha. Present land use is Sea, intertidal area, sandy area/beach, abandon salt pans, and land with/without scrub land sparse vegetation (*Prosopis juliflora* /Casuarina/Eucalyptus). Apart from port backup area, external road, rail and utility corridor is proposed in an area of around 30 ha to provide connectivity.

1.2.4 Cargo Mix and Cargo Handling Capacity

The indicative list of cargo mix proposed to be handled in RMP is presented in **Table 1**.

Table 1: Cargo Mix for Revised Master Plan

S. No.	Cargo Type	Cargo Mix
1.	Multipurpose (Including Liquid)	Coal / Iron ore / limestone / Mines & Minerals & other dry bulk/Fertilizers and raw materials for manufacture of fertilizer / food grains / sugar / clinker / cement / Project cargo / timber & wood / machines/ Iron steel products / Break Bulk etc./Container, Ro – Ro & Automobiles and any other non-hazardous cargo All Class A, B, C petroleum products, excluded petroleum products Including Petrochemical products, Hazardous, Toxic and Non-Hazardous chemicals/Liquids and other Liquid cargos. Tentative list of hazardous liquid cargo but not limited to are as follows: Ethylene, Propylene (Propene), Butadiene, Pentane, Ethyl Mercaptan Motor Spirit, Propylene Oxide, Hexane, Naphtha, Acetone, Methyl Chloride / Chloro Methane, Cyclohexane, Benzene, Ethyl Acetate, Acrylonitrile Acetonitrile, Methyl Methacrylate, Methacrylonitrile, Methanol (Methyl Alcohol), Isopropyl Alcohol, Ethyl Alcohol (Ethanol), Ethylene di chloride, Methyl Isobutyl Ketone, Ethyl Benzene, N-Butyl Acetate, Isobutyl

S. No.	Cargo Type	Cargo Mix
		Alcohol (Iso Butanol), N-Butyl Alcohol (N-Butanol), Epichlorohydrine, Styrene, O-Xylene, High Speed Diesel, Cumene, Crude Oil, Aviation Fuel, Kerosene, Acetic Acid, Acetic Anhydride, Non-edible/Mentha Oil Low Sulphur Heavy Stock/ Furnace oil, Carbon Black Feedstock (CBFS), Aniline, Methyl Ethyl Ketone Peroxide, Ethyl Hexanol-2, Vinyl Chloride, Phenol, Naphthalene, Ethylene Glycol, Mono Ethylene Glycol, Toluene 2.4 -di isocyanate, Diphenyl Methane Di-Isocyanate, Edible oil/Palm Oil, Paraffin, Bitumen, Sulphur, Lube oil, Asphalt, Coal, CNG, NG, LPG Ammonia (NH ₃), Diammonium Phosphate, Muriate of Potash (MOP), Soda Ash (Sodium Carbonate), Urea, Limestone, Caustic Soda, Sulphuric acid, Phosphoric acid, Piperine/ Piperidine, Chloroform, Hydrochloric Acid (HCL), Ethylene diamine (EDA), MDI etc.
2.	Gas / Cryogenics/Liquid	LNG, Propane, Butane, LPG, CNG, NG and All Class A, B, C petroleum products, excluded petroleum products including Petrochemical products, Hazardous, Toxic and Non-Hazardous chemicals/Liquids and other Liquid cargos.

1.2.5 Salient Features of the Revised Master Plan Development

The salient features of Proposed Kattupalli port have been tabulated in **Table 2**.

Table 2: Salient Features of Proposed Development

Features/Description	Unit	Existing Facilities at Kattupalli Port	Proposed Revised Mater Plan Development
Handling Capacity	MTPA ²	24.65	320 (Including existing approved capacity)
Cargo Mix	-	Container (MTEUs), Break Bulk / General ³ (MMTPA), Project Cargo, Ro-Ro (No's), Non-Hazardous Liquid Cargo ⁴ (MMTPA)	Revised Master Plan Development of Kattupalli Port involves handling and storage of Multipurpose Cargoes including liquid, Coal, Iron Ore, Bulk, Break Bulk, Project Cargo, General Cargo, Dry Cargo Container, Fertilizer and FRM, Ro – Ro & Automobiles and any other non-hazardous cargo and Liquid/ Gas / Cryogenics (Upto -162 degree Celsius) cargoes including All Class A, B, C petroleum products, excluded petroleum products, Non - Classified Chemicals & Petroleum products Hazardous, Toxic and Non Hazardous chemicals/Liquids and other Liquid cargos Including LNG/CNG/LPG etc., Apart from port backup area, external road, rail (double line), utility corridors and 30 MLD capacity of desalination plant etc. Port backup Industries & Industrial development area and its infrastructure
Length of Northwestern Breakwater	m	1775	Apart from existing breakwaters, two new breakwater of about total 12.1 km length is proposed, out of which new Northern Breakwaters will be about 9.02 & 1.22 km and new Southern Breakwater will be about 1.86 km
Length of South Breakwater	m	1665	
Total Area	Ha	~136.28	Revised Master Plan Development of Kattupalli Port will be carried out in total area of 2472.85 ha which includes 136.28 ha of existing area, 927.11 Ha of government land, 613.31 ha of private and proposed sea reclamation of 796.15 Ha including basin and all developable area.

² MTPA: Million tons per annum

³ General Cargo includes additional handling of Agricultural Products, Fertilizers, Scrap, Soda Ash, Pig Iron, Sponge Iron, Iron products, Bentonite, Silica Sand, Clinker, Feldspar Cargos, Aluminium Ingots, Salt, Laterite, Magnesite, Cobble Stones, Cement, Piperine, Food grains including pulses, Sugar and other clean cargo under Break Bulk / General Cargo

⁴ Liquid Cargo Includes additional handling of cargoes Glycerine, Crude Glycerine, Fatty Acid, Mineral Oil-Light, Heavy White Oil, Tall Oil Fatty Acids, 2- Propyl Heptanol (2-PH), Di Octyl Phthalate, Bio Diesel, Castor Oil, Molasses, Oleic Acid (Composition: Oleic Acid- 70-100% By Weight Or Fatty Acids: C16-18 And C18-Unsaturated), Palm Kernel Fatty Acid, RBD Hard Palm Stearin and other Non-Hazardous Cargo

Features/Description		Unit	Existing Facilities at Kattupalli Port	Proposed Revised Mater Plan Development
Dredging Quantity		MCM	12 out of 24 approved	Dredging will be carried out at proposed berthing areas and for widening and deepening of existing approach channel, as per the revised master plan development requirements. It is estimated that ~ 85 Mm ³ (MCM) of dredged material will be generated. Entire dredged material will be used for reclamation. Additional material for reclamation will be borrowed from identified borrows area (onshore/offshore). Total proposed quantity for Reclamation including landfilling is estimated about 138 Mm ³ (MCM) which will be used for reclaiming 1145 Ha area.
Reclamation		MCM	6.5	
Offshore Disposal		MCM	5.5	
Maintenance Dredging		MCM/Annum	~0.4	1.25-3.2
Diameter of Turning Circle		m	580	One 650 m & two new 700 m
Depth at Turning Circle (Manoeuvring Areas)		below CD m	(-) 16.0	(-) 20.5 & (-) 25.0
Quay Length		m	1900 and 2 Port Craft Berths. Only 3 out of 5 berths are existing	11467 (Cumulative) in addition to 1250 m long barge berths and 12 Port Craft Berths + Trans loading Facility & 2 SPMs
Approach Channel	Outer Channel	Width	180 m	500 m
		Depth	(-) 16.0 m	(-) 27.0 m
		Length	2325 m	5000 m
	Inner Channel	Width	225 m	500
		Depth	(-) 16.0 m	(-) 25.0 m
FSRU and FSO (as on Interim Option)		Plant Capacity /Storage	-	FSRU: 2.5 MTPA /1,80,000 m ³ FSO: 1216 MT/Hour / 25,000 MT
Water (Potable) Source		m ³ /day	60/CMWSSB Desalination Plant	30000 (Proposed Captive Desalination Plant Cumulative))
Seawater Intake for Desalination Plant		MLD	-	~75
Reject from Desalination Plant		MLD	-	~45
Seawater intake for Regasification/Process if any		MLD	-	2880 (Total 2955 MLD for Desalination and LNG/LPG Regasification Plant)
Power		MVA	5	100
Greenbelt and other areas		Acres	62.84	241
New Road/Rail		-	-	The rail connectivity to existing Kattupalli port is also proposed from the existing nearby railway line and is termed as southern link. However in parallel to Revised Master Plan Development, to cater immediate cargo evacuation requirement, connecting to southern rail link is being taken up and separate CRZ clearances for the same has already

Features/Description	Unit	Existing Facilities at Kattupalli Port	Proposed Revised Mater Plan Development
			obtained by MIDPL vide letter no. F. No.11-22/2019-IA.III dated December 02, 2019 In future the existing facility of southern connectivity of the Kattupalli Port, will not be sufficient to cater the projected increase in traffic of the port as well as operationally there will be need of another railway link to the Kattupalli port which is proposed from Minjur station, situated on the north side of existing railway link and is termed as northern link. However, feasibility of alignment of proposed corridor will be checked during detailed study. Apart from port backup area, external road, rail and utility corridor is proposed in an area of around 30 ha to provide connectivity
Employment	Nos.	1200 (Direct and Indirect)	1500 Direct & 4500 Indirect
Project Cost	Crores	4675 As per EIA	53031
Navigational Aids	-	Channel marker buoys, Fairway buoy and Turning circle buoys, Front and rear leading light, Berth corner lights, Maritime Buoyage Systems (Lateral marks, Cardinal marks, Isolated danger marks, Safe water marks, Special marks) and Other Marks (Lighthouse, Beacons, Sector lights, Leading lines, Port or Harbour marks), VTMS, Tugs, etc.,	
Environmental Aspects	-	Stacks for DG, Oil Water Separator (3KLD), STP (45 KLD), Organic Waster Convertor, Hazardous waste to Authorized Vendor/TSDF, PPEs, Approved Oil Spill Contingency Plan and Green Belt	Covered Coal Storages; Wind Barrier; Covered Conveyor; Dust Suppression System; Use of Specialised Unloaders; Proper housekeeping; Trucks & railway wagons covered with tarpaulin; Washing of Trucks Tyres and areas susceptible for coal; Green Belt, Stacks for DG, ETP (1500 KLD), STP (240 KLD), Settling Pond at Coal Stockyard; Storm Water Drainage System, Organic Waster Convertor, Hazardous waste to Authorized Vendor/TSDF, PPEs, Updated Oil Spill Contingency Plan and Green Belt

With a view to optimize the waterfront area, utilize the maximum marine development potential, increasing the backup area usage to accommodate future cargo projections and business requirement, MIDPL proposes to revise the Master Plan. Revised Master Plan is presented as **Figure FD0102**.

1.3 CRZ Compatibility

The National Centre for Sustainable Coastal Management (NCSCM) which is one of the MoEF&CC authorized agencies has carried out demarcation of High Tide Line (HTL), Low Tide Line (LTL) and Coastal Regulation Zone (CRZ) classification of the project site. Based on the survey, CRZ set back lines were demarcated and the project layout was superimposed on CRZ map.

- Revised masterplan activities are falling CRZ IB, CRZIII and CRZ IV. Cargo handling operations at berths and transportation, Storage, SPM operations, Intake outfall facilities of Desalination and LNG/LPG, Common Operation Buildings and Other Facilities, Utilities, Dredging/Reclamation/Breakwater, etc. are envisaged in CRZ area.
- The activities proposed within CRZ area are permissible as per CRZ notification, 2011/2019

- Proposed port location does not contain environmentally sensitive areas such as National parks / marine parks, sanctuaries, wildlife habitats, corals / coral reefs. It also does not include breeding and spawning grounds of fish and other marine life, area of outstanding natural beauty / historically / heritage area, area rich in genetic diversity.

1.4 Need and Justification for Revision of Master Plan for Kattupalli Port

To address the basic infrastructure needed to match the growing GDP of the country, Sea Port infrastructure are grossly inadequate for the nation to meet the growing challenges which in turn successfully integrate Indian Trade with the Global economy in terms of productivity, efficiency, state-of-art technology and surpass global developments in the Shipping sector.

The port is located on the east coast of the Indian peninsula known as the Coromandel Coast in the Bay of Bengal and is known at the “gateway” to India and is well connected to other major cities by rail and road network. The port lies in northern suburbs of Chennai is poised to act as an ideal alternative gateway for Chennai and Ennore port.

Buckingham Canal is a tidal influenced canal and is passing through the proposed Revised Master Plan development, which has also been declared as prestigious National Waterway-4 project by Gol shows that there is enormous potential of movement of cargo.

Based on the available hinterland the revised traffic forecast for the Kattupalli port has been worked out as given below:

- Multi-Purpose (including Liquid) – 320 MMTPA (including Existing - 24.65 MTPA)

2 Description of Environment

Project Influence Area (PIA)/Study Area: As per the Ports and Harbour EIA guidance manual issued by MoEF&CC, an area within 5 km radius from project boundary for primary data generation and 15 km radius as the general study area for secondary data generation is considered. A map showing the study area and monitoring locations are given as **Figure FD0103**.

Study Period: Initial baseline terrestrial and marine environmental surveys were carried out covering the three seasons during 2018.

In line to ToR conditions MIDPL has also assessed Biodiversity of the area, viz, estuary and coastal region, collected three season's data in the coastal region as well as estuarine region at proposed site covering northern end of project and salt pans present in the western Kosattalaiyar including survey during monsoon season along with the other places. The baseline Terrestrial, Marine and Biodiversity (Estuarine & Coastal) data are revalidated during the year 2022 -2023.

2.1 Terrestrial Environment

- The site is comprised of Sea, abandoned Salt pans, Agriculture Crop Lands, Scrub Land, Plantation, Built-up-Industrial, Waterlogged areas of River, Aquaculture etc.
- The study area mostly comprises of Bay of Bengal, Wetlands-Manmade (Waterlogged/Salt pans), Agriculture-Crop Land, Wasteland-Scrub Land, Reservoir/Lakes/Ponds, Built-up-Industrial, Built-up-Rural, Agriculture-Aquaculture, Built-up-Urban, River/Stream/Canals, Agriculture-Plantation, Swamp and Inland Wetland.

- Buckingham Canal is passing between the land parcels of proposed RMP, which has also been declared as prestigious National Waterway-4 project by Gol.
- The existing Kattupalli port back-up area is plain with few undulations and back-up area was reclaimed to a height of (+) 4.5 to (+) 5.0 m CD which serves as the cargo storage yards.
- Proposed development area falls under Seismic Zone-III (medium risk zone) and Cyclone prone area as per IS 1893 (Part I) and Climatic Disasters Risk map of Tamil Nadu.
- As per the Project site specific meteorological data, the predominant wind directions observed were from Southeast.

2.1.1 Air Quality

- Maximum concentrations of Sulphur Dioxide (SO₂), Nitrogen Dioxide (NO₂), Particulate Matter (PM_{2.5}), Particulate Matter (PM₁₀), Carbon Monoxide (CO), Ozone (O₃), Ammonia (NH₃), Lead (Pb), Benzene (C₆H₆), Benzo (a) Pyrene (BaP) – Particulate phase only, Arsenic (As), Nickel (Ni), are well within the National Ambient Air Quality Standards for Residential areas at all monitoring locations during the study period.
- PM₁₀ concentration ranged between 31 µg/m³ and 79.6 µg/m³ at Kattupalli (during winter season) and Uranambedu (during Pre-monsoon season) respectively. NAAQ stipulated standard for PM₁₀ for 24 hr average is 100 µg/m³. PM_{2.5} concentration ranged between 10 µg/m³ and 41.6 µg/m³ at Kattupalli and Kalanji (during Winter season) and Attipattu (during Pre-monsoon season) respectively. NAAQ stipulated standard for PM_{2.5} for 24 hr average is 60 µg/m³.
- SO₂ concentration ranged between 3.8 µg/m³ and 11.9 µg/m³ at Kattupalli and Kalanji (during Pre-monsoon season) and Kattur (during summer season) respectively. NAAQ stipulated standard for SO₂ for 24 hr average is 80 µg/m³.
- NO₂ concentration ranged between 9.9 µg/m³ and 19.6 µg/m³ at Kattur (during summer season). NAAQ stipulated standard for NO₂ for 24 hr average is 80 µg/m³.
- CO, NH₃, Ozone, Pb, C₆H₆, Benzene(a) Pyrene, As and Ni are all observed to be BDL at all locations during entire study period.

2.1.2 Noise Quality

- It is observed that the day and night equivalent noise levels at all the locations noise limits are well within the prescribed CPCB standards.
- For Residential areas L_d ranged between 50.33 dB(A) at Karungalikuppam during Pre-Monsoon to 54.40 dB(A) at Kattur during Summer season and for Industrial areas, L_d ranged from 52.08 dB(A) at Kalanji during Winter season to 66.66 dB(A) at Attipattu during Summer season.
- For Residential areas, L_n ranged between 41.84 dB(A) at Karungalikuppam during Pre-monsoon season to 46.08 dB(A) at Neidavayal during summer season and for Industrial areas, L_n ranged from 40.28 dB(A) at Kalanji during summer to 57.60 dB(A) at Uranambedu during summer season

2.1.3 Water Quality

- All the Ground water parameters were observed to be well within the permissible limits of standard IS: 10500(2012) and its amendments.
- It is inferred that almost of the parameters for surface water sample are within the permissible limits as per ISI-IS2296-1982 Class C (Drinking water source with conventional treatment followed by disinfection) Standards for use-based Classification of Surface Water except Iron, TDS, Chloride, Sulphates, BOD, Cadmium and Lead at all locations during all seasons. Higher values for Electrical Conductivity, TDS and chlorides in surface water were also recorded due to the tidal influx.

2.1.4 Soil Quality

At Neidavayal, Attipattu & Kattupalli villages, sand was dominant in three seasons.

2.1.5 Flora

Among the 240 plant species reported from the study area no species is listed in IUCN (International Union for Conservation of Nature) threatened category from the project site.

2.1.6 Fauna

Among the 111-fauna species reported in 15 km buffer area, four species were listed in the IUCN/IWPA (Wildlife Protection Act, 1972) are discussed in **Table 3**.

Table 3: IUCN/IWPA Listed Fauna Species Reported in 10 km Buffer Area

S. No	Scientific Name	Common Name	IUCN	IWPA Schedule
1	<i>Pavo cristatus</i>	Indian peafowl	Least concern	I (Part III)
2	<i>Mycteria leucocephala</i>	Painted stork	Near Threatened	IV
3	<i>Pelecanus philippensis</i>	Spot-billed pelican	Near Threatened	IV
4	<i>Anhinga melanogaster</i>	Oriental Darter	Near Threatened	IV

Pulicat bird Sanctuary⁵ is located ~3.17 km, NW to the project site.

2.2 Marine Environment

Water and sediment samples for physico-chemical, petroleum hydrocarbons, heavy metals and biological analysis were collected from thirteen (13) locations including two (2) intertidal & two inside the port basin for three seasons.

2.2.1 Sediment Quality

- The percentage of sand ranged between 13% and 87%.
- The silt percentage ranged between 9% and 44%.
- The Clay percentage ranged between 3% at and 63%.

⁵ Pulicat Wildlife Sanctuary, Tamil Nadu boundaries vide G. O. Ms.No.1247, Forests and Fisheries dated 22nd September 1980. The areas (village boundaries) covered and also the areas included by the boundaries described shall be the "Pulicat Lake Birds" Sanctuary. As per the Minutes of 44th ESZ Expert Committee Meeting for the declaration of Eco Sensitive Zone (ESZ) around Wildlife Sanctuaries/National Park held on January 18, 2021, in the MoEF&CC, Tamil Nadu government stated that the proposal for ESZ around Pulicat Bird Sanctuary is under pre-draft stage with zero extent on sides of the Protected Area. It was stated that surrounding areas of the Protected Area are private non forest land and the sanctuary already includes 13 villages. The distance between the boundary of these villages from HTL of the lake ranges from about 450 m to more than 5 kms at certain places. It is informed that they are working on feasibility of proposing non-zero boundaries extent & expected to be submitted. Based on the outcome of same Kattupalli Port RMP shall undergo necessary wildlife clearance if any required.

- The sediment pH is alkaline in nature and varied from 8.02 to 8.46.
- The Sediment TOC ranged between 2.08 mgC/g and 4.56 mgC/g
- Cadmium values for sediment sample ranged from 6.24 µg/g to 10.53 µg/g
- The copper concentration ranged between 16.43 µg/g to 28.54 µg/g.
- The iron concentration ranged between 1490 µg/g to 1950 µg/g.
- The lead concentration ranged between 4.26 µg/g to 7.45 µg/g.
- The Zinc concentration ranged between 17.53 µg/g to 30.56 µg/g.
- The Mercury concentration ranged between 0.16 µg/g to 0.35 µg/g.
- The nickel concentration ranged between 7.58 µg/g to 12.64 µg/g.
- The Manganese concentration ranged between 40.13 µg/g to 65.41 µg/g.
- The chromium concentration ranged between 8.06 µg/g to 11.87 µg/g.
- E. coli ranged from 139 x10³ to 581 x10³ CFU/g
- Total Viable Count varied from 363 x10³ to 785 x10³ CFU/g
- Macrobenthos density varied from 49 to 125 Nos/m²
- Meiobenthos density varied from 31 to 126 Nos/10cm²

2.2.2 Water Quality

- Water temperature ranged from 29.0°C to 33.42°C
- Minimum and Maximum Salinity recorded varied between 31 ppt to 35 ppt
- pH ranged between 7.72 and 8.38
- Total suspended Solids varied from 48.1 and 142.4 mg/l.
- Turbidity varied from 1.83 and 9.08 NTU
- Dissolved Oxygen (DO) varied from 4.52 and 6.66 mg/l
- BOD ranged between 1.1 and 2.5 mg/l
- Nitrite concentration ranged between 0.82 to 2.1 µmol/l
- Nitrate concentration ranged between 1.75 and 3.83 µmol/l
- Ammonical Nitrogen concentration ranged between 0.016 to 0.34
- Total Phosphate concentration ranged between 1.43 to 3.92 µmol/l
- Inorganic Phosphate concentration ranged between 0.46 and 1.46 µmol/l
- Silicate concentration ranged between 24.89 and 42.56 µmol/l
- Total Nitrogen ranged between 13.33 to 22.34 µmol/l
- Particulate organic carbon concentration ranged between 70 and 138 µgC/l
- Petroleum hydrocarbons concentration is below detectable limit
- Cadmium varies between 0.43 to 2.54 µg/L
- Copper concentration ranged between 6.26 to 13.18 µg/L
- Iron concentration ranged between 10.45 to 17.45 µg/L
- Zinc concentration range is 12.13 to 19.71 µg/L
- Mercury concentration ranged from 0.09 to 0.33 µg/L.
- Lead concentration range is 0.26 to 3.27 µg/L
- Manganese concentration varied from 20.64 to 34.64 µg/L
- Nickel concentration ranged between 1.06 to 1.67 µg/L
- Chromium concentration ranged between 1.33 to 2.91 µg/L
- Phytoplankton density was recorded as 7600 and 33200 Cells/l
- Zooplankton density was between 200/m³ and 2800/m³
- Primary Productivity ranged from 4.02 to 6.82 mgC/m³hr
- Chlorophyll-a in water sample varied from 0.41 to 2.30 mg/m³
- Total Biomass varied between 16.24 ml/100 m³ and 31.54 ml/100 m³
- The E. coli population ranged between 106 x10³ CFU/ml and 513x10³ CFU/ml
- The Total Viable Count in the samples varied from 345 x10² to 785x10³ CFU/ml

2.3 Three Season Estuarine Study

As per the MoEF&CC ToR recommendations, three Season Estuarine Study was conducted by Centre for Advanced Studies in Marine Biology, Annamalai University (a pioneering institute in the estuarine, marine and oceanographic studies) during September and November, 2019 and January, 2020 and further revalidated with August to November, 2022 data by Suganthi Devadason Marine Research Institute (SDMRI).

Water and sediment samples for physicochemical, petroleum hydrocarbons, heavy metals and biological analysis were collected from Eight (8) locations for three seasons.

2.3.1 Sediment Quality

- Sand ranged between 13.02%% and 96.48%
- Silt ranged between 2.4% and 76.48%
- Clay between 1.12% and 11.2%
- pH is alkaline in nature and varied from 8.23 to 8.65
- Cadmium values ranged from 0.47 µg/g to 14.6 µg/g
- TOC ranged between 3.9 mg C/g to 7.4 mg C/g.
- Copper ranged between 8.4 µg/g and 34µg/g
- Iron ranged between 10.42 µg/g to 33.7 µg/g
- Lead ranged between 4.62 µg/g and 11.5 µg/g
- Zinc ranged between 15.6 µg/g and 28.597 µg/g
- Mercury concentration ranged between 0.11 µg/g and 0.33 µg/g
- Nickel concentration ranged between 1.81 µg/g and 8.47 µg/g
- Chromium concentration ranged between 1.05 µg/g to 4.25 µg/g
- Manganese concentration ranged between 2.9 µg/g and 11.53 µg/g

2.3.2 Water Quality

- Water temperature ranged from 27.6 to 29.1°C
- Minimum and Maximum Salinity recorded varied between 14.5 ppt and 40.5 ppt
- pH ranged between 7.5 and 8.3
- Total suspended Solids varied from 73.65 mg/l to 156.69 mg/l
- Turbidity varied from 7.3 NTU to 8.6NTU
- Dissolved Oxygen (DO) varied from 4.2 mg/l to 5.5 mg/l
- BOD ranged between 1.1 mg/l and 2.1 mg/l
- Nitrite concentration ranged between 0.43 and 0.79 µmol/l
- Nitrate concentration ranged between 1.42 µmol/l and 1.97 µmol/l
- Ammonical Nitrogen concentration ranged between 0.017 µmol/l and 0.057 µmol/l
- Total Phosphate concentration ranged between 2.22µmol/l and 3.15 µmol/l
- Inorganic Phosphate concentration ranged between 0.82 µmol/l and 1.01µmol/l
- Silicate concentration ranged between 23.13 µmol/l and 29.94 µmol/l
- Total Nitrogen ranged between 13.09 µmol/l and 18.14 µmol/l
- Particulate organic carbon concentration ranged between 83 µgC/l and 112 µgC/l
- Petroleum hydrocarbons concentration are below detectable limit
- Cadmium varies between 0.41 µg/l and 3.76 µg/l
- Copper concentration ranged between 15.9 µg/l and 24.5 µg/l
- Iron concentration ranged between 10.34 µg/l and 25.57 µg/l
- Zinc concentration range is 10.9 µg/l to 25.5 µg/l
- Lead concentration range is 1.94 µg/l to 5.35 µg/l

- Mercury concentration varied from 0.1 µg/l to 0.15 µg/l
- Manganese concentration varied from 5.52 µg/l to 11.3 µg/l
- Nickel concentration ranged between 0.11 µg/l to 3.35 µg/l
- chromium concentration ranged between 1.07 µg/l to 1.8 µg/l
- Phytoplankton density was recorded as 1200 to 9500 Nos/l
- Zooplankton density was between 200 Nos/m³ to 1800 Nos/m³.

2.4 Marine Biodiversity Assessment

- Molluscan diversity is fair in the study area comprising a totally 37 species were recorded in the Marine zone. The mean density is 9.66 nos/5m². *Babylonia spirata* is most dominant species *Agaronia gibbosa*, *Cerithium columna*, *Turritella attenuata* and *Donax scortum*.
- Very low population of Marine sponges has been observed. Only 12 species were observed, of these, *Clathria* sp., *Spirastrella* sp., and *Cliona* sp. are the dominant species. The mean density is 2.35 no/5 m².
- Sparse occurrence of soft coral communities was observed in deep waters. Only 5 species of soft corals were observed, of which, *Carijoa* sp., *Virgularia* sp. and *Cavernulina* sp. were the common species. The mean density is 1.27 no/5 m².
- Relatively poor occurrence of other fauna was observed in the marine zone. Totally 9 species were recorded, Holothuria and Stichodactyla were sighted during the present survey. Marine mammals, Sea snakes and sea turtles were not sighted in the present survey
- Fish communities in terms of diversity and abundance were relatively low. A total of 56 fish species were recorded in the study area. Mean abundance was 42.82 no/250 m². *Rastrelliger kanagurta*, *Sardinella* sp., *Sphyræna jello*, and *Selaroides leptolepis* are the most dominant fishes.
- Underwater assessment carried in the study area revealed that the seascape is dominated by sandy and clayey bottom. Because of the bottom topography and prevailing strong currents, benthic communities were very less in number and variety. Dynamic and ecologically sensitive marine habitats such as coral reefs and seagrasses are not observed in any of the assessed grids due to the unsupportive environmental parameters. Because of the absence of critical habitats, density and diversity of fish and other biodiversity are comparatively low.
- Three species of mangroves are observed in the study area. *Avicennia marina*, *Avicennia* sp. and *Rhizophora mucronata* belonging to family Avicenniaceae and Rhizophoraceae. The study area is dominated by *Avicennia marina*, whereas *Avicennia* sp. and *Rhizophora mucronata* are scanty and limited to the northern side of the study area.
- Five types of halophytic plants were observed in the study area. They are *Sesuvium portulacastrum*, *Suaeda monoica*, *Suaeda* sp., *Suaeda nudifolra* Moq. and *Salicornia brachiata* Roxb. They are seen in the periphery of mangrove patches and also with Mangrove along the banks of the river.
- The Macrofauna communities in marine zone, A total of 110 species was found in the marine zones. Among the groups, Polychaetes was predominantly occurs in the marine sediments with 301 individuals followed by Gastropods with 132 individuals while low abundance was exhibited for the Isopods and Bivalves with 42 and 47 individuals totally 840 benthic meiofauna individuals were recorded Mean density is 105 nos./10cm². Foraminiferan is most dominant group followed by Nematodes and Harpacticoides.
- In Buckingham Canal, totally 375 macrobenthic faunal individuals were recorded. The mean density is 31.16nos./10cm². Among the groups, Polychaetes, Amphipods are the most dominant groups. Totally 58 benthic meiofauna individuals were recorded in the

Buckingham Canal. Mean density is 100.83 nos./10cm². Nematodes and Foraminifera are the most dominant groups.

- Totally 461 macro benthic faunal individuals were recorded in Mangrove zone. The mean density is 41.91nos.0.0256m². Polychaetes are most dominant group followed by Gastropods and Amphipods. The Meiofauna communities had relatively fair occurrence, totally 1,217 benthic meiofauna individuals was recorded in Mangrove zone. Mean density is 110.64 nos./10cm². Foraminiferans and Nematodes are the most dominant groups.
- In the Pulicat Lake and Ennore Creek area Totally 489 macrobenthic faunal individuals were recorded. Mean density is 42 nos./10cm². Polychaetes and Amphipods are the most dominant groups. Totally 1,272 benthic meiofauna individuals were recorded. Mean density is 115.63 nos./10cm². Foraminifera and Nematodes are the most dominant groups
- In Kosathaliyar river, totally 451 macrobenthic faunal individuals were recorded. Mean density is 34.69 nos./10cm². Polychaetes and Amphipods are the most dominant groups. Totally 1495 benthic meiofauna individuals were recorded in the Kosathaliyar river area. Mean density is 115 nos./10cm². Foraminifera and Nematodes are the most dominant groups.
- In Buckingham Canal, a total of 14 species of Phytoplankton were recorded. *Hemidiscus hardmannianus* and *Thalassionema nitzschioides* are the most abundant species. A total of 15 species of Zooplankton, was observed. Maxillopoda and Hexanauplia are the most abundant classes.
- In Ennore Creek, a total of 17 species of Phytoplankton were observed. *Coscinodiscus* sp. and *Thalassionema nitzschioides* are the most abundant species. In Zooplankton, a total of 10 species are found. Maxillopoda are the most abundant class.
- In Mangrove waters, a total of 10 species of Phytoplankton were observed. *Chaetoceros affinis* and *Hemidiscus hardmannianus* are the most abundant species. In zooplankton, a total of 14 species were observed. Maxillopoda are the most abundant class.
- In Pulicat Lake, a total of 16 species of Phytoplankton were observed. *Coscinodiscus* sp. and *Pleurosigma* sp. are the most abundant species. In Zooplankton, a total of 12 species were observed. Spirotrichea and Maxillopoda are the most abundant class.
- In Kosasthalaiyar River, a total of 10 species of Phytoplankton were observed. *Hemidiscus hardmannianus* and *Pleurosigma elongatum* are the most abundant species. In zooplankton, a total of 12 species were observed. Maxillopoda and Spirotrichea are the most abundant classes.
- In Marine zone, a total of 54 species of phytoplankton were observed. *Chaetoceros* sp., and *Hemidiscus hardmannianus* are the most abundant species. In zooplankton, a total of 34 species were observed. Maxillopoda and Hexanauplia are the most abundant classes.
- Microbial parameters are within the optimum levels in the study area, In Ennore Creek, maximum total viable count is 8.10 X10⁴ CFU/ml. In Pulicat Lake, maximum total viable count is 5.23X10⁴ CFU/ml.
- In Kosasthalaiyar River, total viable count is 6.43 X10⁴ CFU/ml. In Ennore Creek in sediment samples total viable count is 8.78X10⁵ CFU/g. In mangrove area, total viable count is 6.24 X10⁵ CFU/g.
- In marine zone, total viable count is 8.71 X10⁵ CFU/g. In Ennore Creek total viable count is 1.89 X10⁴CFU/ml. In Pulicat Lake, total coliform is 2.01 X10⁵ CFU/g. In Kosasthalaiyar River, total coliform is 1.42 X10⁵ CFU/g.
- In mangrove area, total coliform is 2.04 X10⁵ CFU/g. In Buckingham Canal, total coliform is 1.24 X10⁵ CFU/g. In marine zone, total coliform is 2.41 X10⁵ CFU/g.
- In Kosasthalaiyar River totally 7 species of fishes, 5 species of crabs, 6 species of shrimps, 5 species of bivalves, 12 species of gastropods and polychaetes were observed.

- In the mangrove region, 11 species of fishes, 8 species of crabs, 6 species of shrimps, 6 species of bivalves and 20 species of gastropods were observed.
- In Buckingham Canal, 5 species of fishes, 2 species of crab, 6 species of shrimps, 5 species of bivalves and 8 species of gastropods were recorded.
- In Pulicat Lake, totally 9 fish species, 3 crab species, 6 shrimp species, 7 bivalve species, 13 gastropod species along with polychaetes were observed.
- In Ennore Creek, 7 fish species, 3 crab species, 3 shrimp species, 7 bivalve species and 8 gastropod species were observed, 8 fish species, 4 crab species, 6 shrimp species, 6 bivalve species and 14 gastropod species were observed.
- Migratory and resident birds were sighted and a total of 37 species of birds were sighted dominated by *Ardea intermedia*, *Sterna albifrons*, *Mycteriya leucocephala*, *Pelecanus philippensis*, *Tringa glareola* and *Himantopus himantopus*.
- Terrestrial mammals recorded within the study area includes cows, buffaloes, squirrel, field mouse, bat, house rat, hare, dog, snake and tree lizards.

2.5 Socio Economic Conditions

The socio-economic profile of the 15.0 km (Study area) secondary data for Kattupalli Port expansion is studied and analysed based on the Census of India 2011.

- The project area falls in six notified revenue villages i.e., Kalanji, Kattupalli, Kattur-II, Ebrahampuram, Puzhudevakkam, Voyalur out of which only four villagers are inhabited and two villages are un-inhabited (viz. Ebrahampuram and Puzhudevakkam).
- In the study area, 108 revenue villages are falling which includes hamlets and settlement villages of three talukas i.e Gummidiipoondi, Ponneri and Mathavaram talukas of Thiruvallur Districts of Tamil Nadu.
- In the study area, the population is 6,79,695 of which males are 50.21% and females are 49.79%. The sex ratio of the study area is 992 females over 1000 males.
- The literate population in the study area is 5,11,558 which constitute to be 75.26% of the total population of the study area.
- The working population in the project area are 2,67,917 which are around 39.42% out of which males are constituted to 76.08% and females account to 23.92%
- The study area covers 7 fishing villages and 12 fish landing centres.
- Traditional fishermen families are 1065 with Fisher folk population of 3585 from seven villages of ponneri taluk from Thiruvallur District.

3 Anticipated Environment Impacts and Mitigation

Measures anticipated impacts on the environmental and social attributes, which are likely to arise due to construction and operation of proposed project have been identified, predicted and mitigation measures are evaluated.

3.1 Construction Phase

The development activities such as capital dredging, reclamation, dredge spoil disposal, expansion/modification of navigational facilities, offshore structures will impact marine environment. Site development, civil construction, mechanical erection of infrastructure and backup area development is likely to cause impacts on the terrestrial environment.

Capital dredging (estimated ~ 85 Mm³) / maintenance dredging (around 1.25 to 3.2 Mm³/Annum), reclamation, dredge spoil disposal and development of offshore structures will result in disturbance to marine environment.

Deepening the approach channel will most likely increase the amount of deposition in the channel there by increasing the needed maintenance dredging. The predicted quantities of maintenance dredging with the proposed Master Plan are around 1.25 to 3.2 Million m³/year of predominantly fine material from the approach channel, turning circle and berth area.

Dredged material will be disposed at two spoil grounds, both the spoil grounds having an area of 1716264 m² and ~4.5km away from the proposed port location. The maximum bed level change incurred due to dumping is around 0.28m at both the dumping grounds after 60 days simulation period.

Most of impacts during construction are short-term in nature and will cease on completion of construction activities.

Summary of possible construction phase impacts and appropriate mitigation measures are discussed below.

3.1.1 Impacts Due to Port Activities and Infrastructures

Possible Impacts:

- Change in marine water quality/Ecology
- Increase in noise levels.
- Disturbance to benthic communities
- Changes in species diversity and density
- Impact on nearby mangroves

Mitigation Measures:

- Dredge Management Programme
- Discharge of waste into sea will be prohibited.
- Adoption of standard reclamation and construction methods with containment system
- Slop tanks are provided to barges/ workboats for collection of liquid/ solid waste.
- Disposal of unused Dredged material at the identified offshore disposal area only
- Discharge of toxic/hazardous materials during the port construction would not be allowed.
- Awareness will be imparted to workers in the port about the importance of mangroves and their conservation
- Mangrove Monitoring & Management Plan
- Biodiversity Management Plan

3.1.2 Material Transport and Construction Activities

Possible Impacts:

- Exhaust emission and noise from vehicles
- Windblown and fugitive emission during material movement and unloading.
- Emission and noise from DG sets
- Emission and noise from construction activities
- Disturbance to natural drainage pattern
- Strain on existing infrastructure and traffic addition

Mitigation Measures:

- Impacts during construction phase of the project are temporary in nature and will cease upon completion of construction phase. Necessary measures such as Emission control norms; Periodic checking and washing of vehicles & construction machinery; Adequately sized construction yard; Enclosures on all sides of construction site; Non-peak hour movement and onsite speed control; Water sprinkling; Environmental awareness program; Noise levels to be maintained below threshold levels stipulated by CPCB/TNPCB; Maintenance of construction equipment; Scheduling of High noise generating activities at daytime (6.00 am to 10 pm); Personal protective equipment's etc will be followed/adhered.
- Few natural third/fourth order drains passing through the project site, therefore, storm water drainage network is proposed to facilitate proper drainage of the area by diverting the drains flowing across the project site. Based on existing drainage pattern and catchment area, main outfall drains are proposed to carry storm water discharge.
- The outlets drain the storm water from the proposed backup area either into the river (for port area on the west of the river) or directly into the sea (for port areas east of the river).
- Construction activities shall be limited within the site and dust shall be contained within the construction area.
- A 100 m wide ROW for Road Corridor is also proposed by TNRDC as Northern Port Access Road (NPAR) to connect both Ennore and Kattupalli Port to NH-16 where construction is initiated which will improve the traffic conditions.
- National Water Way (NW-4) will also be used for the transport of part of construction material which will reduce likely congestion on road.
- Proper lighting, signboards shall be provided at required locations.

3.1.3 Land Reclamation

Possible Impacts:

Impact on the existing water resources such as groundwater and surface water

Mitigation Measures:

- Existing protective bunds (salt dyke) and slope gradient will prevent inundation of salt water to the adjoining land.
- Return seawater from reclamation areas will be channelled back to sea.
- Regular monitoring of return water (turbid water) from the reclamation area will be carried out at nearby points in the sea.

3.1.4 Marine Side Construction Activities and Fishing

Possible Impacts:

Ship traffic may disturb fishing activities like fishing nets getting entangled with the moving vessels in outer harbour areas which may cause financial losses to fishing communities.

Mitigation Measure:

- Proper access to the sea for the local fishermen is considered during planning stage itself.
- Signboards will be placed at the construction activities in order to make fishermen aware of the on-going construction activities.
- Necessary marker buoys will be installed.
- Regular Interactions will be initiated with the fishing community before commencement of construction works.

3.1.5 Solid Waste Management including Handling of Hazardous Waste

Possible Impacts:

- Impact on soil quality due to disposal on ground
- Fire accidents
- Impact on terrestrial and marine environment

Mitigation Measures:

- Solid Waste Management Rules, 2016 (as amended) and Construction & Demolition Waste Management Rules, 2016 (as amended) will be followed for environmental sound management of respective waste.
- Construction waste will be utilized for filling low lying areas.
- Hazardous and other waste Management Rules, 2016 (as amended) will be followed for environmental sound management of hazardous waste.
- OSHA standards will be adopted.
- Hazardous wastes will be disposed through approved TNPCB/CPCB vendors.

3.1.6 Water Resource

Possible Impacts:

- Water scarcity and pollution on existing surface water body resource.

Mitigation Measures:

- Groundwater table at Kattupalli is high. However, optimization of water resource will be done
- Based on existing drainage pattern and catchment area, main outfall drains are proposed to carry storm water discharge from village area and port area and discharging into seas.
- Construction camp wastewater will be collected and treated. Treated wastewater will be used for Plantation/Greenbelt development.
- The return sea water quality from the reclaimed area shall be monitored during reclamation phase.
- Groundwater quality shall be monitored.
- An adequate drainage system will be provided at the site with separate collection streams to segregate the storm run-off from roads, open areas, material storage areas, vehicle wash water and other wastewater streams. Suitable measures will also be taken to prevent the washing away of construction materials into the drainage system.
- Contaminated storm water will be collected and conveyed to sedimentation tank for removing grit.
- Mobile STP units shall be provided at site /construction workers camp or existing STP will be used for treatment of wastewater.
- No wastewater shall be disposed directly on land or on existing surface water resources without appropriate treatment.
- Construction workers camp shall be located outside CRZ area.

3.2 Operation Phase

The operational phase impacts due to all components of the projects have been identified, predicted and evaluated. Some of the models used for prediction of impacts are given below.

3.2.1 Hydrodynamic Study

2-dimensional hydrodynamic model (MIKE 21 HD FM) was set-up and calibrated for the baseline conditions in order to simulate the water levels and current pattern from Ennore to Pulicat creek. The model account for bottom friction, wind effect, wave radiation stresses. The open boundaries were provided with water levels. The simulation was carried out with tide and pre monsoon wind conditions for a period of 15 days, which covers spring and neap tidal cycles. The simulated water levels and currents are having a good agreement with the measured water level and current data. The two major forcing functions, i.e., tide and wind, influence the circulation pattern, latter being a dominant forcing function, which controls the direction of current. The flow field south of Kattupalli Port was complex and circulation north of port was influenced by the presence of shoals. Hydrodynamic model study with proposed masterplan shows that there is no change in the circulation pattern at Pulicat lake and Ennore shoal area due to proposed development of the Kattupalli Port.

3.2.2 Spectral Wave Study

Spectral Wave model (MIKE 21 SW) was to predict the annual wave climate along Ennore-Pulicat creek. The basic requirement for the model i) wave boundary data, which was obtained from NIOT Wave model ii) the bathymetry, which was obtained from echosounder survey and C-map source.

The annual distribution of wave data indicates that during November-December the waves are mostly from 600-700 in other months from 120⁰-140⁰. Thus, the annual wave climate along Kattupalli Port leads to a net northward littoral sediment transport pattern over a year. Most percentage of waves occurs in the height range 0.5 to 1.5 m and in the periods of 4-10 sec.

Simulations were conducted for predominant wave directions prevailing at Kattupalli. The coast north of Kattupalli experiences concentrations of wave energy at some places due to convergence of wave rays resulting from complex bathymetry (shoals).

The spatial variation of significant wave height was 1.3 m and peak wave period was 16 Sec for baseline and layout conditions were observed.

There was an insignificant change observed during the assessment of model results of baseline and layout conditions. The only change observed after introducing the layout in the spectral wave model is a shadow zone with less energy waves are noticed immediate north of the breakwater when waves are coming from southwest direction. Otherwise, the wave transformation study indicates the similar results for baseline and layout models.

3.2.3 Historical Shoreline Changes

GIS techniques were used to estimate the changes historical shoreline changes and Littoral Process FM model was used to predict the coastline for 15 years with the proposed master plan. Satellite images were downloaded for years from 2000-2020 to estimate the historical shoreline changes. The shorelines from each image are digitised using GIS techniques to estimate the changes. Coastline from the entire study area is divided in to Six zones (Zone-A to Zone-F).

From the results it is observed that the Zone A is the most protected by seawall and groynes. In Zone B where the seawall and groynes are located, erosion / deposition patterns are not showing any trends. But at Ennore Creek mouth, the erosion / deposition is predominant In Zone C i.e. area located between two ports i.e. Ennore and Kattupalli Ports has shown no

significant changes, and that area is stable. The north side area of Kattupalli Port (Zone-D), where erosion is observed. In Zone D, the tendency of erosion and deposition is decreasing, while moving from Kattupalli Port towards Pulicat Creek. In Zone E, sand deposition is more compared to erosion. Zone F is more dynamic because the coast is located nearby the mouth of Pulicat Creek. Therefore, the shoreline is more-or-less stable.

3.2.4 Shoreline Change Prediction

The shoreline modelling studies on behaviour of Shoreline due to RMP shows that (i) Pulicat Zone is more stable (ii) Pulicat mouth is varying from dynamic to stable (iii) Below Pulicat mouth (open Coast) is varying from Stable to Erosion (iv) North of Kattupalli port, an erosion of 117 m is observed immediately near to the northern breakwater. From 15 years estimation, approximately, 84 m of erosion is observed at 300m distance, 50 m of erosion at 500 m distance and 4 m of erosion at 1km distance from the northern breakwater. After the first 1km stretch, the coast is mostly observed to be stable (v) South of Kattupalli Breakwater is accreting on both the ends and eroding in the middle. (vi) South of Ennore Port is showing tendency of erosion as well as accretion near Ennore creek.

The model studies for shoreline change for the proposed Master Plan indicates that the first 1km north coast of Kattupalli is eroding, at the rate of 8m/yr. To prevent the Erosion/loss of land, artificial nourishment combined with groyne field on the northern side of the proposed master plan is planned. The length of the first and last groin is 100m and the middle groin is 150m, the distance between the groins is 1 km. Following the implementation of beach fill along with groyne field, the rate of erosion is reduced to 3.6 m/year, but the erosion extent shifted further 3 km from the proposed development. This would be minimized with additional nourishment of 0.5 million Cu.m of sand at every alternate year to protect the area immediate north of the groin filed. Overall, the extent of erosion is limited to 3km north of the proposed groyne (last).

Thereafter the coastline is stable and not subjected to any erosion. The Pulicat lake mouth is further 7 km north from the erosion region hence, it will have no impact either from the proposed Master plan development or from the proposed shoreline protection measures (beach fill along with groyne field). Monitoring of shoreline with the help of high-resolution satellite imageries during operation phase shall be carried out periodically.

3.2.5 Tsunami Modelling

The historical tsunamis are generated in Bay of Bengal and Indian Ocean, three of them are simulated to predict the water levels and currents at the proposed port development. The maximum water level predicted at the existing and proposed port entrance is 2.18m and 2.23m. The corresponding current speed at existing and proposed port entrance is estimated to 3.1m/s and 3m/s respectively. The water level and current speed produced by 2004 tsunami along Ennore to Pulicat region are not having any significant differences between baseline conditions and proposed master plan layout. This indicates that the proposed master plan is not causing any impact to Ennore shoals and also to the adjacent Ennore creek and Pulicat mouth.

3.2.6 Cyclone Modelling

The cyclones are the extreme conditions and most of the time all the port operations need to be shut down after receiving cyclone warning. The damages to coastal structures, beach erosion and flooding inundation are often associated with the cyclonic storms that form through cyclogenesis in the Bay of Bengal.

Nine (09) cyclonic events were selected for cyclone study and the cyclone data are collected from IMD. From the 9 cyclones, December 2016 Vardah cyclone made severe impact at the study area. At Kattupalli Port location, the Vardah cyclone has caused a maximum surge height of 0.78m and a maximum current speed of 2.74 m/s. Similarly, the maximum significant wave height estimated at Kattupalli Port due to 2016 Vardah cyclone was 5.15 m.

The hydrodynamic and spectral wave modules of DHI's MIKE 21 FM modelling system have been applied in a coupled fashion to compute the surge levels and wave heights along the coastal stretch of Kattupalli for the nine historical cyclone conditions. The results indicated that the proposed master plan development has not caused any changes to submerged shoals in terms of surge height and storm wave and these shoals are still acting as barrier in protecting the coast during cyclone events.

3.2.7 Ship Tranquillity Study

The simulated results of the model have provided keen insight into the performance of the harbour layout in the wave agitation point of view. From the study results it could be seen that the tranquillity inside the harbour is very good.

Across all modelled scenarios the breakwater provides a large reduction of wave height for the modelled combination of wave periods and direction.

3.2.8 Flood Model Study

The inundation depth and current speed in the vicinity of the port area induced by the 2015 flood event with baseline configuration was studied. It is observed from the model that the maximum water depth is 3.5 m near the meandering area of the Kosasthalaiyar river where multipurpose area for the port is expected. The west side of the port (right bank of the river) is heavily flooded, where depth is varying between 1.8 m and 3.5 m. Because of the existing high ground elevation, flooding has minimal impact on the eastern part of the port (left bank of the river) compared to other area. The current speeds are low in this area, less than 0.2 m/s, presumably due to the flat terrain.

Recommendations & Management Aspects:

- Flood model studies indicate that the raising of proposed Master Plan backup area of the port to +5m CD is effective in protecting the port infrastructure from the overtopping of the river during a 100-year rainfall event of 24-hour duration.
- Locations where the embankments of the Kosasthalaiyar backwater river and B-canal are damaged must be identified and strengthened to reduce overtopping from the banks.
- Locations where the banks are not continuous or have breaches/gaps must also be identified and continuous embankments of the river and B-canal must be ensured.
- Storm Water Drainage network plan has to be laid out to drain the storm water from the port area into the river/canal or the sea. The port backup area will be raised, and the flow directions will be ensured into the drains
- The existing open channel towards the western side and periphery of the port backup is recommended to be retained for mitigation of flooding in this area.
- The de-silting of this canal is important to have a quick recession of flood water.
- Existing open channel towards the western side and periphery of the port backup is recommended to be retained. The de-silting of this canal is important to have a quick recession of flood water. The open channel must also be extended as suggested in the previous section and integrated with the Storm Water

3.2.9 Sedimentation Study

Sediment transport is dependent on hydrodynamic conditions hence the calibrated hydrodynamic model is extended to sediment transport process calculations. The DHI's MIKE 21 Mud Transport (MT) model is used to assess the sedimentation in the approach channel, turning circle and berth pocket.

From the study the following broad conclusions can be drawn:

- To maintain a water depth of 27m w.r,t CD in the approach channel of the proposed Master Plan, the predicted average and maximum dredging quantities are 8,54,045 m³/year and 1,56,5750 m³/year respectively.
- To maintain a water depth of 25m w.r,t CD in the basin area of the proposed Master Plan, the predicted average and maximum dredging quantities are 2,23,363 m³/year and 1,21,2543 m³/year respectively.
- To maintain a water depth of 20.5m w.r,t CD in the basin area of the proposed Master Plan, the predicted average and maximum dredging quantities are 1,80,342 m³/year and 4,50,856 m³/year respectively.
- To maintain a water depth of 16m w.r,t CD in the basin area of the proposed Master Plan, the predicted average and maximum dredging quantities are 3119 m³/year and 3119 m³/year respectively.

For the given Master Plan consisting of approach channel, turning circle and berthing area, the total predicted average and maximum dredging quantities are 12,60,869 m³/year and 32,32,267 m³/year respectively.

During the dredging period, it has been observed that the impact on the quality of marine water is mostly in the immediate vicinity of the port area was high and subsequently the turbidity level will reach the ambient level within a very short period of time. Thus, it can be inferred that dredging would have a short-term and localized impact on the quality of marine water in the study area.

3.2.10 Dredge Soil Disposal and Dispersion

Deepening the approach channel will most likely increase the amount of deposition in the channel there by increasing the needed maintenance dredging. The predicted quantities of maintenance dredging with the proposed Master Plan was around 1.25 (Avg)-3.2 (Max) Million cu.m/yr of predominantly fine material from the approach channel, turning circle and berth area.

In the present study, two spoil grounds are considered, both the spoil ground having an area of 1716264m² and approx.4.5km away from the proposed port location.

The maximum bed level change incurred due to dumping was around 0.28m at both the dumping grounds in 60 days simulation period. The spread of the disposed sediment on the seabed is presented in the form of bed level change and total suspended solid concentration. The model results show that the dumped materials not spreading beyond the port limit and also 1.25 -3.2 MCM of annual maintenance dredging will not make any impact to the Pulicat lake.

3.2.11 Recirculation Study

The recirculation study of 100 MLD and 30 MLD Seawater Desalination Plant showed that in all the simulations the excess salinity does not influence at the intake locations. It is concluded that the 100 MLD and 30 MLD outlets result in excess salinity below 5 PSU and 1.5 PSU at

the point of discharge and 0.1 PSU at the farthest point from the outlet. For 100MLD and 30MLD outlets the excess temperature is comparatively less, and the values are 0.18°C and 0.07°C respectively.

Recirculation study for 20 MMTPA LNG/LPG facility which will be utilising about 1,20,000 m³ of sea water for its regasification facility is carried out. The cold water discharge through outfall modelling results indicates that, there will not be any recirculation and there will be no impact on water quality at the intake as well as at the shore due to the disposal from the proposed outfall discharge as well as free from siltation. The dispersion is taking place inside the port and around the proposed breakwater tip with less temperature difference in comparison to ambient temperature.

3.2.12 Oil Spill Risk Assessment

Eight oil spill scenarios have been modelled.

- Scenario 1 to 4: Collision at the turning circle with Gas oil and Heavy oil for NE and SW monsoon.
- Scenario 5 to 8: Collision at SPM location with possible rupture from hale.

Some key observations include:

Spillage occurrence at turning circle was not having any shoreline impact. This is due to the shelter effect of the proposed breakwater and predominant wind direction was from southeast direction. The oil slick was concentrated within the berth area and does not travel far away. For some combination of tide and wind conditions, the oil slick tends to get trapped within the port.

Spillage occurrence at SPM location was having shoreline impact on the northern side of the proposed development. During the southwest monsoon (June to August), winds from south-easterly was making oil slick moving very far to the east.

As far as the intake structures are concerned, if the spill occurs at the turning circle and at basin, there is no risk of an oil spill at the intake locations. If the spill were to occur at the SPM location, there would be moderate to high risk at the intake location.

3.2.13 Air Modelling

AERMOD, steady state Gaussian model was used to predict the incremental concentration of air pollutants at the receptors in the study area. Results show that predicted incremental/resultant concentrations are within the NAAQS, i.e., maximum resultant concentration (baseline + incremental) of PM₁₀ is 89.37 at Urnambedu, PM_{2.5} is 44.62 at Attipattu, SO₂ is 17.18 at Attipattu and NO₂ is 48.44 at Attipattu.

Some of the operation phase impacts and appropriate mitigation measures during the operation phase of the Revised Master Plan are discussed below.

3.2.14 Cargo Handling / Inland Cargo Movement / Storage / Regasification / Equipment Operation

Possible Impacts:

- Emission and Noise due to loading/unloading, DG sets, vehicles, regasification process
- Traffic addition due to cargo from/to port

Mitigation Measures:

- Most of the cargo transportation will be through rail and road.
- Dry bulk cargo shall be transported through covered conveyors from berth to the stockyard.
- Use of specialised ship loaders/unloaders, wagon tippler, track hopper, covered conveyors and rapid loading system through silos; Dust Suppression measures; Scientific and regulated stacking of cargo piles; Periodic cleaning of cargo spills; Greenbelt Development; Proper housekeeping; Regularisation of truck movement etc.
- Wind screens will be provided along stack yard
- Use of tarpaulin covers and speed regulations for vehicles/wagons engaged in transportation.
- Acoustic Barriers, Enclosures and Personal Protective Equipment (PPE)
- National Water Way (NW-4) will also be used for the transport of cargos which will reduce likely congestion on road.
- Proposed rail and road will be sufficient to cater the MIDPL revised master Plan transportation requirements.

3.2.15 Aqueous Discharges including Accidental Spills

Possible Impacts:

- Impact on marine water quality and ecology due to discharge ship wastes (sullage), sewage, bilge water, Desalination Plant reject water, LNG/LPG regasification return water etc.

Mitigation Measures:

- Ships will exchange Ballast water in deep sea prior to arrival in the harbour; prohibited from discharging wastewater, bilge, oil wastes, etc. into the near-shore as well as harbour waters, Comply with the MARPOL regulation.
- Waste Reception facility will be provided.
- Oil spill contingency plan prepared and will be implemented.
- Proposed 30 MLD Desalination Plant Outlets (reject TDS) result in excess salinity below 1.5 PSU at the point of discharge and 0.1 PSU at the farthest point from the outlet.
- LNG/LPG regasification return water with low temperature (<7°C than ambient) will be sent back through marine outfall system with diffusers at identified location through mathematical model studies which will ensures attainment of ambient conditions (within 600 m) in the harbour area.
- Maximum recovery of oil with oil spill control equipment with quick response time

3.2.16 Maintenance Dredging

Possible Impacts:

- Impact on marine water quality and ecology

Mitigation Measures:

- Dumping of dredged material will be uniform and at identified location.
- Bathymetry monitoring pre and post dumping
- Marine Environment monitoring will be carried out.

3.2.17 Water Resource

Possible Impacts:

- Impact on existing water resources

- Water quality due to discharge of runoff and brine reject from 100 MLD plant and proposed 30 MLD plants.

Mitigation Measures:

- 3 intake & outfall location for proposed 30 MLD Desalination plant have been studied along with existing 100 MLD Desalination plant and most appropriate intake & outfall locations have been proposed based on modelling outcome. Necessary permission for the same shall be obtained.
- Raw water from intake location at Kattupalli port for the proposed 30 MLD Desalination Plant and necessary permission shall be obtained from the concerned authorities.
- On the basis of the studies, it is concluded that the 100 MLD and 30 MLD outlet result in excess salinity below 1.5 PSU at the point of discharge and 0.1 PSU at the farthest point from the outlet. For 30MLD outlet the excess temperature is comparatively less, and the values are 0.18°C and 0.07°C respectively.
- Collection of runoff from stock piles and directing into settling ponds and supernatant water will be used for dust suppression
- Neutralisation using lime to ensure settlement of heavy metals, if any.
- STP of 240 KLD capacity will be developed to treat the sewage generated in the premises.
- ETP 1500 KLD capacity will be developed to treat the effluents.
- The oil contaminated water will be sent to ETP and the separated oil will be given to the authorised waste oil recycler.
- Storm Water Drainage System
- Treated Sewage and effluents shall be reused for dust suppression, irrigating greenbelt and other requirements.

3.2.18 Seawater (Regasification) and Water (Desalination Plant) Withdrawal

Possible Impacts:

- Impact on marine/river ecology due to Impingement/Entrainment/Entrapment of aquatic life

Mitigation Measures:

- Intake with proper screens and maintaining Low Intake Velocity to minimise the Entrainment & impingement.
- Seawater Intake is proposed in protected harbour basin and near to the LNG terminal will reduce major marine organism entry.

3.2.19 Solid Waste Management including Handling of Hazardous Waste

Possible Impacts:

- Impact on groundwater and soil quality due to disposal on ground
- Fire accidents
- Impact on terrestrial and marine environment

Mitigation Measures:

- 5 R (Reduce /Reuse/Recover/Recycle and Re Process) principle shall be explored
- Solid Waste Management Rules, 2016 (as amended) will be followed for environmental sound management of respective waste
- Hazardous waste Management Rules, 2016 (as amended) will be followed for environmental sound management of hazardous waste.
- OSHA standards will be adopted
- Hazardous wastes will be disposed through approved TNPCB/CPCB vendors.

3.2.20 Fishing

Kattupalli port is an existing port which is operational since 2012. Fisher men around the vicinity are well aware of operations of Kattupalli port. Safe navigation routes shall be earmarked for movement of fishing vessels.

Possible Impacts:

- Local Fishermen approach to sea
- The port approach channel orientation and vessel movements
- Interference to fishermen and fishing activities during seaside construction activities.
- The construction of cargo berths, approach trestle and activity of capital dredging, etc. are likely to impact the fishing activity near port.
- Impacts on benthic and pelagic organisms would also eventually affect the fishery resources of the area
- Pelagic and benthic fishery resources will be disturbed and dislocated and hence their population is likely to be affected during dredging operations.
- Associated fishery resources are also likely to be affected during maintenance dredging and disposal during the operational phase.
- Any impact on fishery resources would possibly affect livelihood of fishermen of nearby villages.

Mitigation Measures:

- Safe navigation routes will be earmarked for movement of fishing vessels and the route will be finalised in consultation with fish landing authorities and fishing communities.
- Necessary sign boards and marker buoys shall be installed, and interactions shall be initiated with the fishing community about the marker buoys indicating the areas of operation
- Fishing is being carried out at deep sea. Therefore, significant impact on fishing is not envisaged.
- Fishermen in the study area operate motorised and non- motorised fishing boats. Fishermen with motorised boats generally go up to 10 km in the sea for fishing.
- Deployment of Artificial Fish Habitats/Reef Structures to enhance biodiversity and fish production.
- Sea ranching of cultured fingerlings of these shrimps and crabs would provide sustainable fishery yield to the fishermen.
- AFH and Sea ranching will enhance the biodiversity, fish production and socio-economic conditions of the dependent fisher folk.

However, the port activities involved in the operation phase will be confined to the project area. All appropriate measures will be taken to minimize the hindrance to fishing activity during construction & operation phase.

3.2.21 Reclaimed Backup Area or Bund

Possible Impacts:

- Impact on Shoreline
- Change in hydrodynamics.

Mitigation Measure:

- Variation of flow regime will be limited to development location and localised in nature.

- Monitoring of shoreline with the help of high-resolution satellite imageries during operation phase shall be carried out periodically.
- Based on the monitoring results and if required, appropriate remedial measures such as beach nourishment/ creation of sand trap/ any other suitable methods shall be carried out to maintain the stability of coast
- Adequate buffer shall be maintained near the mangrove areas.

3.2.22 Operation of Port

Possible Impacts:

- Socio-economic conditions of the region
- Natural Hazards
- Induced development

Mitigation Measures:

- Employment generation and local people will be given preference based on qualification and skill. Project will help to enhance the socio-economic conditions of the area
- Disaster Management Plan (DMP) is already in place and will be suitably modified/upgraded and continued after expansion with appropriate resources as necessary.
- Proposed port operation will offer an efficient and cost-effective supply chain/value proposition to the local importers and exporters

3.2.23 Proposed use of LNG FSRU and LPG FSO as an Interim Option

LNG jetty shall be designed to accommodate LNG carriers in the size range of 20,000 m³ to 265000 m³. However, during further review of the LNG Terminal Technical aspects and development Plan, it has been understood that Kattupalli LNG onshore terminal shall take few years and there is a need for an interim solution to serve the country by easing the immediate energy needs. For this purpose, FSRU is planned with a maximum capacity of 2.5 MTPA (interim arrangement) as a part of Revised Master Plan.

It is pertinent to mention that the impacts and Risks scenarios related to FSRU is much lesser than the impact and Risk predicted for Onshore LNG terminal (as the maximum inventory considered in Risk Assessment will not exceed 1,80,000 m³) and hence the measures considered for Onshore Terminal will holds good for FSRU.

Similar to LNG, the details of LPG Onshore Terminal including Handling, storage and heating. Kattupalli LPG onshore terminal shall take few years and there is a need for an interim solution to serve the country by alleviating the immediate energy needs. For this purpose FSO is planned with a maximum storage capacity of the compartments of vessel not more than 25000 MT at a time (interim arrangement) as a part of Revised Master Plan.

It is pertinent to mention that most of the impacts and Risks scenarios predicted for Onshore LPG terminal will remain same or less compared to FSO and the measures suggested for Onshore LPG terminal will holds good for FSO.

4 Environmental Monitoring Programme

Comprehensive Environmental Monitoring Programme for construction and operation phases of project has been formulated. The Environmental Monitoring Programme for Both Terrestrial and Marine environment covers the technical and network design of monitoring including measurement methodologies, frequency, location, etc., and budgetary estimates.

5 Additional Studies

5.1 Risk Analysis

Risk analysis covering the Hazard Identification including potential release events and Failure Frequency and Consequence modelling of release rate and damage distances was carried out. In this revised master plan development, the proposed cargos are divided into different class i.e. (i) Class - A Petroleum (ii) Class - B Petroleum (iii) Class- C Petroleum (iv) Excluded Petroleum (v) Other Gases and (vi) Other liquid Cargos. In case of accident, all the above cargo likely to cause Fire & Explosion and Toxic effects except other liquid cargos. **Among these cargos, representative items from each class which cause maximum damage distances based on NFPA hazard classification have been selected and risks associated were quantified.** It is implied that any other cargo having lesser risk against the representative cargos considered for RA can be handled.

Storage of cargo in the CRZ area will be as per the CRZ Notification 2011/2019 (as amended).

Also, scenarios from other cargos have health hazard as the most probable hazard. The necessary measures will be taken during handling, transfer and storage of such cargos.

5.2 Traffic and Transportation Study

The detailed traffic survey was conducted for the road connectivity in the Road Corridor around Kattupalli port. The intent of the study conducted inline to address the specific ToR requirement on the cumulative impact of all development and a detailed traffic management and a traffic decongestion plan was drawn.

5.3 Proposed Road Connectivity

The traffic study reveals that Under Scenario 2 (Kattupalli Port Expansion -50% of Master Plan - year 2030), the Port Access Road is assumed to be widened to 2+2 in line with the widening plans. With this configuration, the level of service of Port Access Road is LOS B. Further, the Level of Service of SH-56 Road with 2+2 lanes will be LOS C. With the upgradation of above roads, the peripheral Road also need to be upgraded to 3+3 from 2+2 lane configuration. However, the level of service will be LOS C.

In the Year 2040 (Scenario 3) i.e., with the capacity expansion of Kattupalli Port to 100% of the Master Plan & Ennore Port @5% Per Anum, SH-56 Road (Location 3) will need 3+3 lanes & Peripheral Road (Location 7) will require a 5+5 lanes configuration in order to maintain a reasonable LOS i.e., LOS C.

Alternately, it is proposed to explore an additional Northern Link from Pulicat. This link will also help to enhance connectivity from the proposed Ponneri Industrial Node, as and when the same is developed. In all of the above, it is assumed that an additional rail link will connect Kattupalli Port and will be of requisite capacity.

5.4 Proposed Railway Connectivity

The rail connectivity to existing Kattupalli port is also proposed from the nearby railway line and is termed as southern link. However, in parallel to RMP to cater immediate cargo evacuation requirement, connecting to southern rail link is being taken up and separate CRZ

clearance for the same has been obtained by MIDPL vide letter no. F. No.11-22/2019-IA.III dated December 02, 2019.

In future the existing facility of southern connectivity of the Kattupalli port is proposed to be augmented to cater the projected increase in traffic of the port by adding another railway link to the Kattupalli port from Minjur station, situated on the north side of existing railway link and is termed as northern link. Rail corridor lengths within and outside the port has been mentioned in the **Table 4**. Separate CRZ clearance for Southern link has been obtained.

Table 4: Details of Rail Corridor

Details off Rail Corridor		
	Northern Link (Double Line)	Southern Link (Double Line)
Inside Port	12.32 Km (Running Length)	2.29 Km (Running Length)
Outside Port	1.5 Km (Running Length)	3.74 Km (Running Length)

5.5 Proposed Inland Waterway Connectivity

To augment the efficacy of NW-4 and treating it as great opportunity, evacuation by waterways is also proposed just like railways and roadways in our RMP. Waterway Evacuation is considered approximately 5% of total projected traffic. In NW-4 barges of capacity 300 Tons (40m X 9m) will be navigating, which requires 1.5 m draft. Two 'weirs' at both end of berthing area is proposed which will maintain same water level as that of Buckingham Canal all around the year and will also not obstruct water flow during heavy monsoon season.

5.6 Social Impact Assessment

This assessment is specifically addressing the potential impacts which will be generated as a result of proposed development of Port. It states the following:

- Revision of master plan development will be carried in total area of 2472.85 hectares which includes 136.28 ha of existing area, 927.11 Ha of government land, 613.31 ha of private and proposed sea reclamation of 796.15 hectares including basin all developable area. The site selected is without Habitations hence no R&R issue is envisaged.
- The anticipated impact on nearby settlements during construction phase such as air pollution and the noise generating will be of temporary nature and cease upon completion of the construction.
- Dust suppression measures and enclosures around high noise generating areas will be provided.
- During the construction phase approximately 500-1000 workers will be employed in the form of skilled, semiskilled, unskilled and technical manpower is envisaged. During operation phase, direct and indirect employment generation of the proposed revised master plan is expected to be 1,500 and 4,500.
- The port management will conduct regular consultation with fishermen associations reading safe navigation. Conflicts, if any, with fishing community will be amicably resolved in all cases.

All Appropriate measures will be taken to minimize the hindrance to fishing activity during construction & operation phase. The port management will conduct regular consultation with fishermen associations reading safe navigation. Conflicts, if any, with fishing community will be amicably resolved in all cases.

5.7 Disaster Management Plan

The Disaster Management Plan (DMP) is aimed to ensure safety of life, protection of environment, protection of installation, restoration of production and salvage operations in the same order of priorities. For effective implementation of DMP, it should be widely circulated and personnel training is to be provided through rehearsals/drills.

The Disaster Management Plan (DMP) for Kattupalli port is already in place and will be used and improved suitably to match the requirements of revised master plan. The disaster management plan mainly deals with continuous and integrated process of planning, organising, coordinating and implementing measures. An On-Site Emergency Preparedness Plan and Off-Site Emergency Preparedness Plan including Oil spill contingency plan were prepared to deal with emergencies and prevent disasters.

The clear assignment of roles and responsibilities was prepared with which location of Emergency Control Centre and Assembly Points is identified. Communication system and alarm systems for effective communication in the event of a disaster are identified. DMP for natural hazards such as floods, cyclones, tsunami and earthquake was prepared.

5.8 Analysis of Alternatives

Kattupalli port is an operational port. For expansion/revision of Master Plan of the port no other site selection criterion has been considered and study of site alternatives has least significance.

LTSB Shipyard and Kamarajar Port are located on south side and therefore there is not much scope for expansion in southern part of the existing port. Port expansion is being proposed mostly towards North, east and west ward directions.

Majority of areas under proposed expansion will be developed through reclamation of Sea in order to avert Resettlement and Rehabilitation (R&R).

6 Project Benefits

- Probable infrastructure development due to project expansion in the region would facilitate creation of additional/improved communication, health, education, sanitation, hygiene and other basic need of the locality.
- Due to proposed project expansion the surrounding population would get maximum benefits from upcoming of industries and its allied ancillary units in form of direct and indirect employment, self-employment and start up, skill development opportunities etc.,
- Improved socio-economic conditions.
- Quality of life in the region is likely to improve due to increase in per capita/per family earning and value appreciation of local resources that would provide economic freedom and facilitate a higher standard of living.
- As part of the Corporate Social Responsibility (CSR), MIDPL is strongly committed towards fulfilling its social obligations and has taken up and proposed many activities for improving the way of living of people the locality in field of Education, Health care, Community development and Sustainable livelihood development⁶
- The proposed project shall further act as a catalyst to industrialization and urbanization of the region.

⁶ CSR budget of INR 23.25 crore were proposed as five year plan for identified activities based on need based assessment carried out and same may be revised based on the consultations during the public hearing according to its merits and priority. The CSR activities will be taken up in a phased manner as per project development activities.

- During the construction phase there will be large-scale employment generation (around 500-1000 workers) in the form of skilled, semiskilled labourers and technical staff. During operation phase, direct and indirect employment generation expected is approximately 1500 and 4500 respectively.

6.1 Corporate Social Responsibility (CSR)

Kattupalli Port has been propagating the community development through a broad based Corporate Social Responsibility (CSR) program in the project area through Adani Foundation since 2018 to ensure inclusive growth and catering to the developmental needs of the community at the grassroots level. The project area encompasses 11 panchayats covering about 71 villages within 10 Km radius of the Kattupalli Port. The key interventions introduced in the project area are as under:

- Education
- Community Health
- Sustainable Livelihood Development
- Rural Infrastructure Development
- Emergency Response – Relief support

An amount of INR 23.25 Crores has been budgeted for 5 years under Education, Community health, Vulnerable Section/Special Focus Groups, Sustainable Livelihood Development, and Rural Infrastructure Development. The CSR is one of the mandatory and regular activities of MIDPL and the same shall be implied for Revised Master Plan. MIDPL is committed to carry out CSR activities in all focused areas. Same will be reviewed on a yearly basis and accordingly implemented.

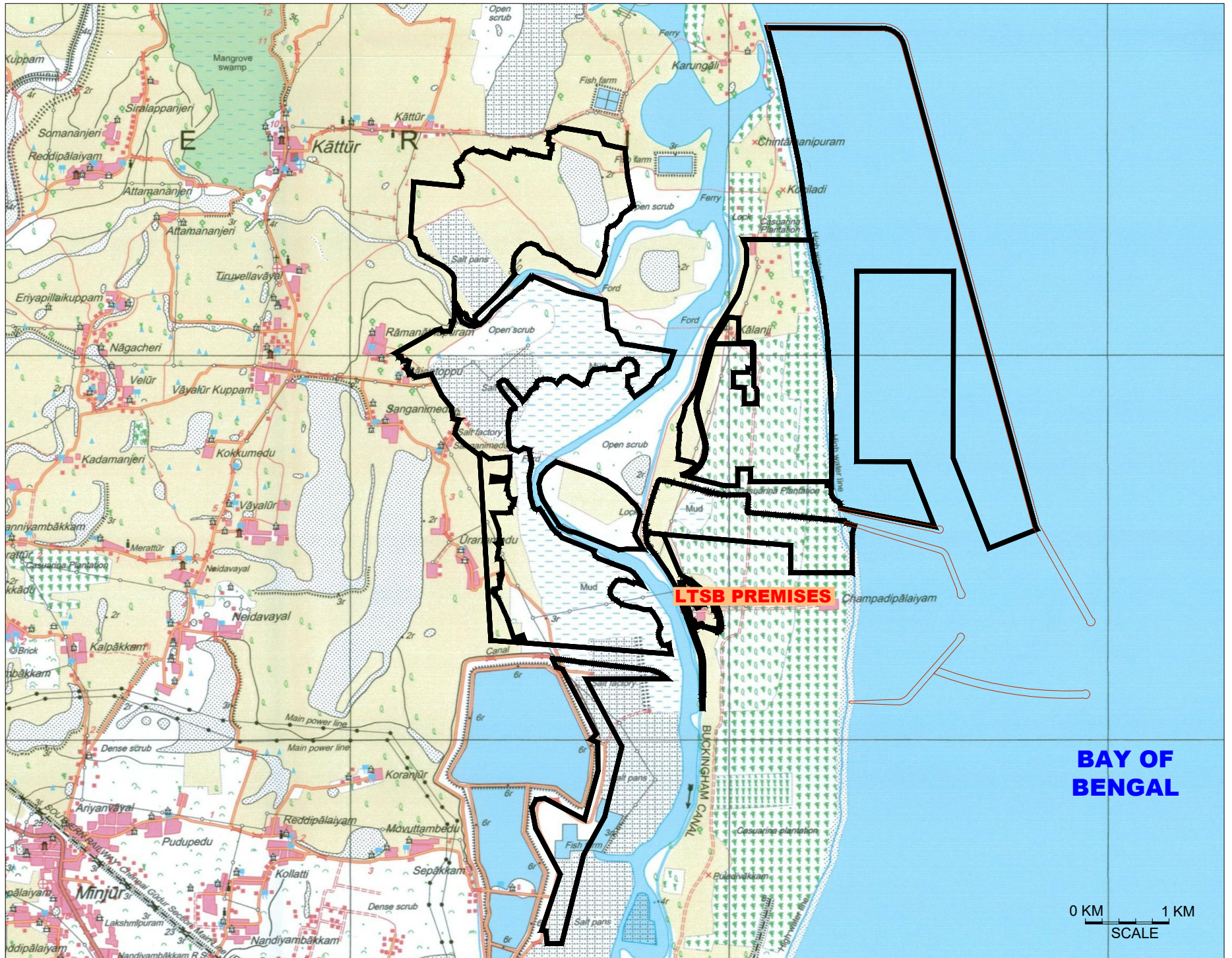
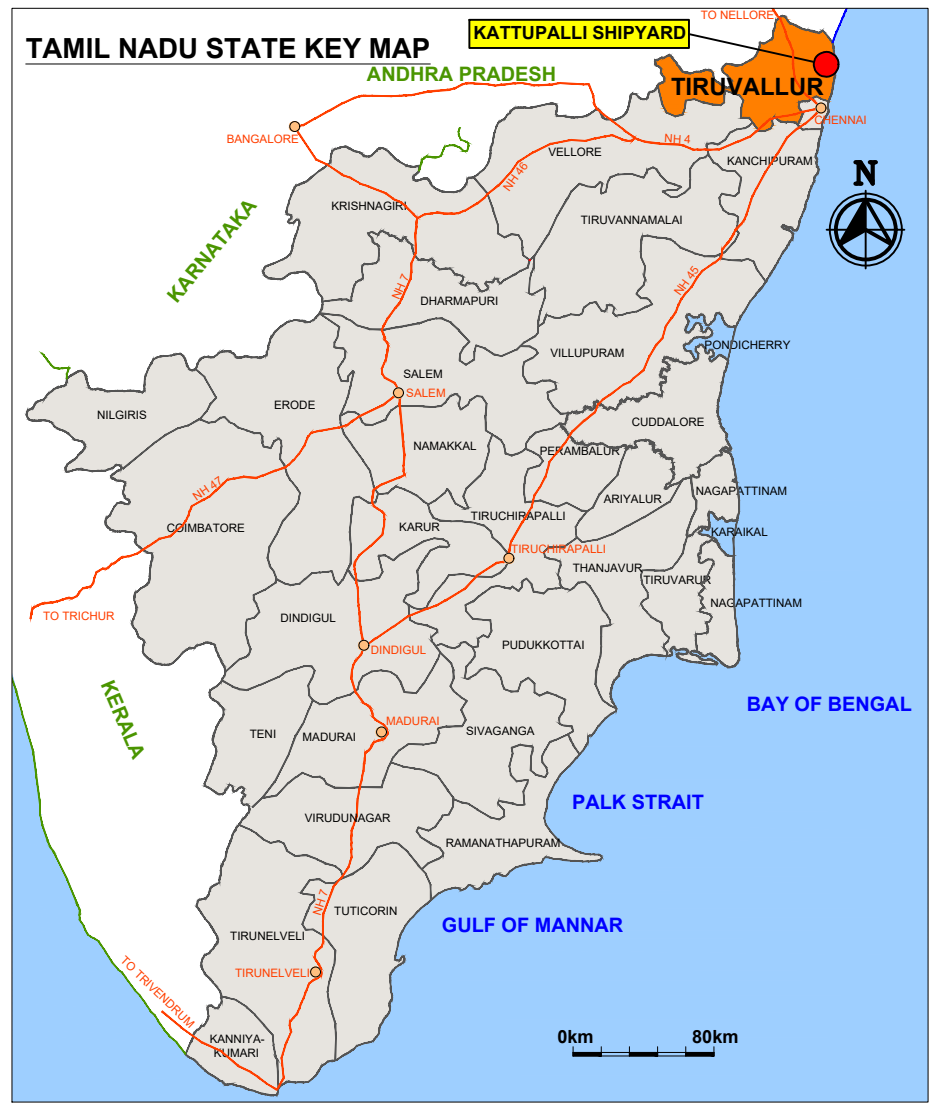
7 Environment Management Plan

The effective implementation and close supervision of the environmental management to mitigate the environmental impacts, which are likely to arise due to the construction and operation phases of the project will be best achieved through a suitable institutional mechanism.

Environment Management Plan for the revised master plan has been prepared keeping in mind the sensitivity of area in the vicinity of Kattupalli port and MIDPL commitment towards sound environment management practices. The environment management plan consists of Greenbelt Development Plan; Marine Biodiversity Management Plan; Wildlife Conservation Awareness Programme; Exploring Renewable Source of Energy in terms of Solar and Wind; MIDPL Measures towards India's Commitment for Climate Change; Occupational health and Safety etc., Apart from these the designed inbuilt components such as Air pollution abatement measures, water and wastewater treatment measures, Storm water management Plan, Stockyard runoff management plan, Noise abatement measures, Solid and hazardous waste management measures, selection of suitable outfall locations etc., which will ensure effective environment management.

7.1 Budgetary Estimate for Environment Management

The budgetary estimate for Capital Environmental Management Cost for Revised Master Plan (including immediate development plan) is ~ **INR 2324.11 crores** and the annual budgetary estimate during operational phase is ~**INR 120.19 crore**.



AUTO PATH: D:\WORK FROM HOME FOLDERS\C1161303 - CEJA KATTUPALLI PORT EXPANSION-DRAWINGS\REPORT DWGS\R7-DRAFT EIA\FD0101-R7-PROJECT LOCATION MAP.DWG

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PATH: REFER BOTTOM LEFT CORNER OF THE DRAWING

PROJECT: REVISED MASTER PLAN DEVELOPMENT OF KATTUPALLI PORT

TITLE: PROJECT LOCATION MAP

PROJECT NO: C1161303

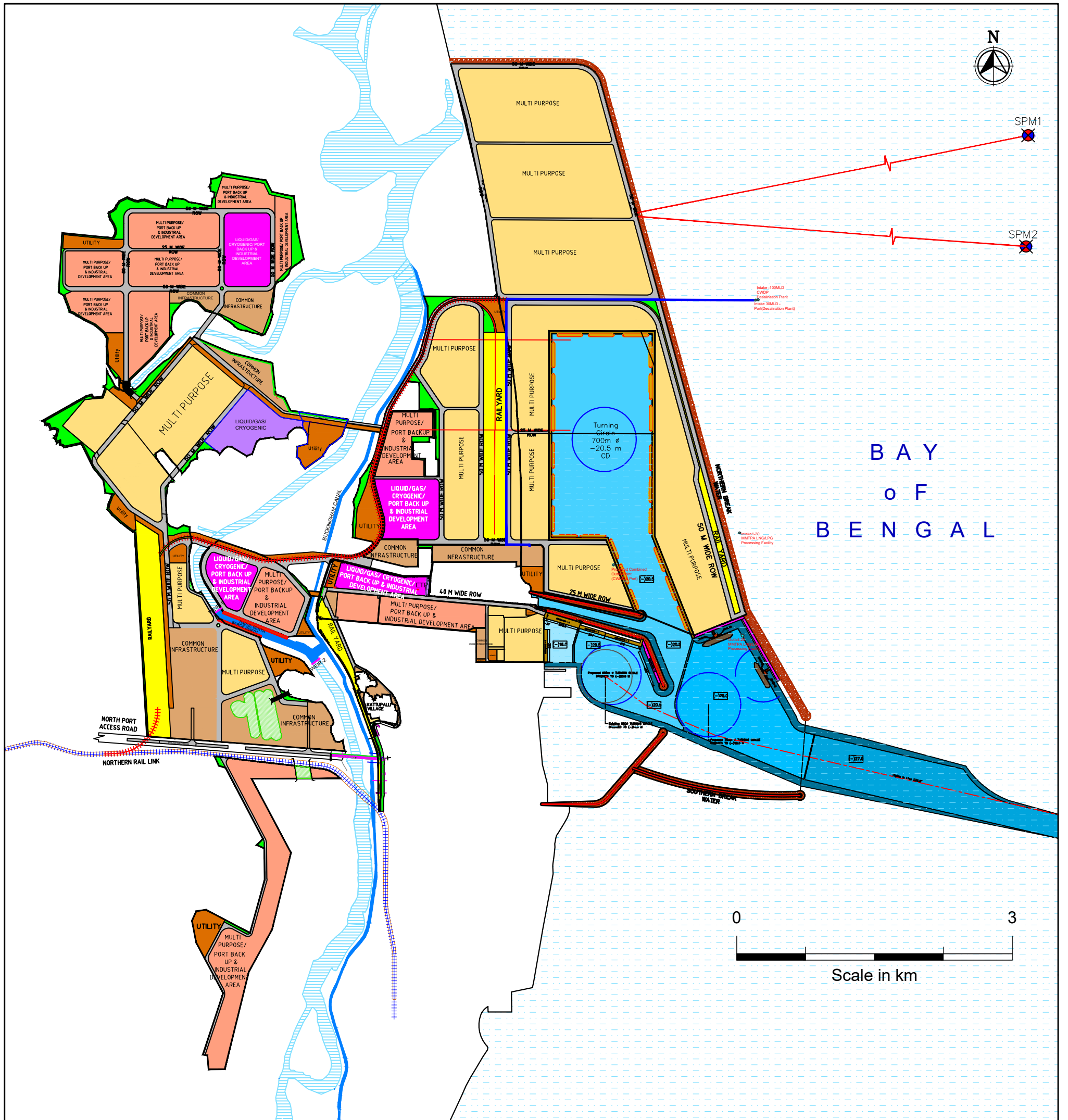
DATE: 03.04.2020

MADE: ASN

FIGURE NO: FD0101 **REV: 0**

 **L&T Infra Engineering**

L&T Infrastructure Engineering Ltd.



LEGEND:

- PROJECT BOUNDARY
- MULTIPURPOSE
- MULTI PURPOSE/ PORT BACK UP & INDUSTRIAL DEVELOPMENT AREA
- LIQUID/GAS/CRYOGENIC
- LIQUID/GAS/CRYOGENIC/ PORT BACK UP & INDUSTRIAL DEVELOPMENT AREA
- GREEN BELT AREA
- COMMON INFRASTRUCTURE
- UTILITY AREA / CORRIDOR
- ROAD ROW
- RAIL YARD
- MANGROVE & 50 MTR BUFFER ZONE
- RAIL CORRIDOR
- MULTIPURPOSE/LIQUID BERTH
- MULTIPURPOSE/LIQUID/CRYOGENIC/GASES BERTH
- SINGLE POINT MOORING (SPM)

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PROJECT: CEIA/EMP FOR KATTUPALLI PORT EXPANSION	PROJECT NO: C1161303
TITLE: REVISED COMPREHENSIVE MASTER PLAN	DATE: 24.10.2020
	MADE: BNK
L&T Infra Engineering	FIGURE NO: FD0202
L&T Infrastructure Engineering Ltd.	REV: 0

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Loc Name	Distance (km)	Direction
Kattupalli	-	-
Urnamedu	-	-
Kalanji	-	-
Ramanathapuram	-	-
Karungali kuppam	0.6	N
Kattur	1.5	NW
Attipattu	2.3	SW
Neidavayal	3.2	W

- LEGEND:**
-  AIR, NOISE & SOIL MONITORING LOCATION
 -  GROUNDWATER SAMPLING LOCATION
 -  SURFACE WATER SAMPLING LOCATION

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PROJECT: REVISED MASTER PLAN DEVELOPMENT OF KATTUPALLI PORT
TITLE: BASELINE TERRESTRIAL SAMPLING LOCATIONS MAP
 **L&T Infra Engineering**
L&T Infrastructure Engineering Ltd.

PROJECT NO: C1161303
DATE: 03.04.2020
MADE: BNK
FIGURE NO: FD0301
REV: 0