EXECUTIVE SUMMARY

1.0 INTRODUCTION

Mazagon Dock Shipbuilders Limited (MDL) is a premier Warship and Submarine building yard in India primarily in the business of building front line warships and submarines for the defence needs of the country. The Company is a Defence Public Sector Undertaking (DPSU), under the administrative control of the Department of Defence Production, Ministry of Defence (MoD-DDP), Government of India. The MDL is situated on the leeside of Salsette/Mumbai Island on the west coast of India in the state of Maharashtra. The location of MDL is at Latitude 18°57'58" N and Longitude 72°51'00" E in the Mumbai harbour area. The location Map of MDL is shown in Figure-1.

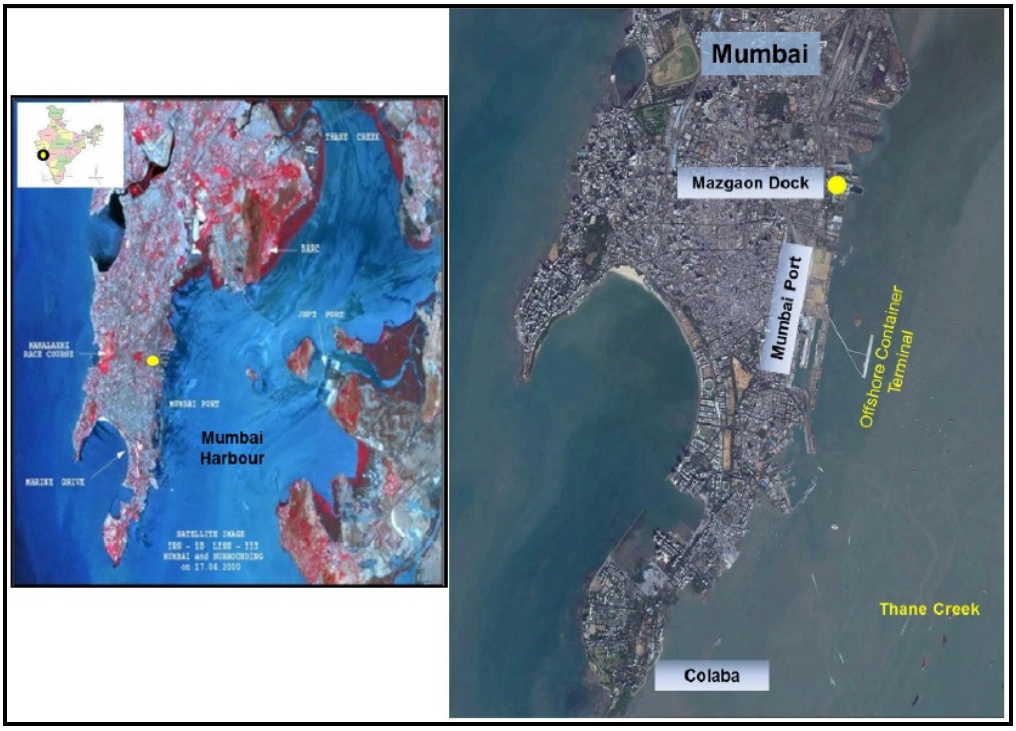


Figure-1: Location Map of Mazgaon Dock Shipyard

MDL is having a water front of approximately 700 meters from which the ships and submarines are launched into the sea. After launch, the vessels are taken for outfitting, trials to the dry docks of MbPT or the Naval Dockyard. The main navigation channel maintained by Mumbai Port has a depth of about 10-15 m depending upon the tide level. However, water depth available in front of MDL facility and existing channel up to Offshore Container Terminal (OCT) of Mumbai

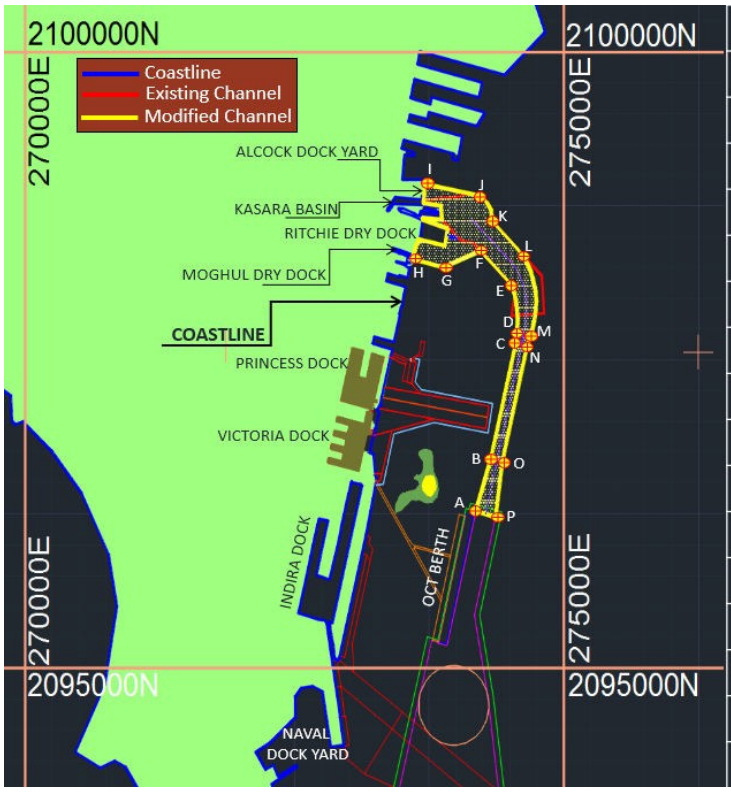
Port Trust (MbPT), is about 1.5 m to 2.0 m below Chart Datum (CD) and plying of ships from MDL totally depends on favorable tide levels. The maximum draft of fully fitted warships proposed to be built at MDL would be about 6.2m. However, maximum depth available during high tide varies from 6.0m to 6.5m. Considering keel clearance of 1.8m, the total required depth for safe navigation is 8.0m. Hence, MDL proposes the extension and deepening of navigation channel between MDL waterfront and OCT of MbPT.

2.0 PROJECT DESCRIPTION

MDL proposes to establish a well demarcated navigational channel from MDL (Kasara Channel) up to OCT berth. In this regard, MDL had approached WAPCOS Ltd and CWPRS to undertake various studies for deepening and extension of existing navigational channel from northern waterfront of MDL to OCT berth. Extension and dredging of navigation channel is proposed considering the following reasons:

- Water depth available at low waters is only 1.5 m to 2.0 m CD which means that the maximum water depth at a tide of 4.0 m (maximum tide available) is 5.5- 6.0 m.
- Maximum draft of a fully fitted Destroyer being built at MDL would be about 6.2 m, which leaves no room for navigation even at 4.5 m tide. Approximately, 1.8 m water depth below the vessel is required for safe navigation.
- Considering the maximum draft of the vessel and the clearances, a destroyer class vessel requires approximately 8.0 m water depth for safe navigation. Assuming that the vessel movement will be executed only at a minimum tide of 4.0 m, water depth required below CD is 4.0 m. The tentative alignment of navigation channel is shown in Figure-2.

Hence, considering the max draft of the vessel and the clearances, a destroyer class vessel requires approximately 8.0 m water depth for safe navigation. The quantum of capital dredging required to establish the navigational channel would be about 3.0 Mm^3 of which 0.22 Mm^3 is the hard rock .The quantity of maintenance dredging will be about 1.1 Mm^3 per annum.



Point	Latitude (N)	Longitude (E)
A	2096273.20	274182.20
B	2096701.20	274326.70
C	2097648.50	274557.50
D	2097708.50	274564.40
E	2098102.20	274518.40
F	2098385.40	274225.40
G	2098254.40	273883.50
H	2098325.50	273584.60
I	2098929.10	273714.10
J	2098847.00	274163.00
K	2098630.50	274334.30
L	2098408.50	274562.20
M	2097679.00	274685.90
N	2097622.40	274664.40
O	2096675.10	274433.60
P	2096228.70	274365.00

Figure-2 : Alignment of Navigational Channel from MDL to OCT

3.0 NEED FOR THE EIA STUDY

The project envisages the dredging of navigation channel to achieve a depth of 8 m in 2.5 km long channel to make the channel navigable in all weather conditions. The total quantity of dredged material has been estimated to be approximately 3.0 Mm^3. As per the list of projects or activities requiring prior environmental clearance given in the EIA Notification issued by MoEF&CC on 14th Sept. 2006, proposed project as listed on S. No. 7(e) and requires Environmental Clearance from MoEF&CC. Since, the project is proposed in the coastal domain area, CRZ Clearance would also be required as per the CRZ Notification of Jan 2011. Application for Pre Environmental Clearance was submitted to MoEF&CC vide letter dated 3.11.2016. The Draft Terms of Reference was discussed in the 11th EAC meeting held on 24-25 November 2016 and approval of Terms Reference (TOR) for the EIA study was issued by MoEF&CC vide letter No.21-27/2016-IA-III dated 29.12.2016

EIA report has been prepared by WAPCOS and as suggested by MoEF&CC in the TOR, marine biodiversity study is carried out by CSIR- NIO,Goa. CRZ Categorization study was carried out through Institute for Remote Sensing (IRS) Annamalai University, Chennai, which is one of the authorized agency of MoEF&CC for High Tide Line/Low Tide Line demarcation. Shoreline changes study and mathematical model study has been carried out by CWPRS.

3.1 HTL/LTL Demarcation

The CRZ mapping for the proposed project has been done by Institute of Remote Sensing (IRS), Anna University, Chennai. The CRZ mapping report includes the HTL/LTL map covering an area of 7 km radius from the project site, and a dredging project layout map of 1:4000 scale. As per the HTL demarcation done by IRS, Chennai, the proposed dredging area falls in CRZ-IV (A) category. No mangroves or any other eco-sensitive entity is present at the proposed dredging site.

4.0 ENVIRONMENTAL BASELINE STATUS

The study Area for the EIA Report encompasses the entire area within a radius of 10 km from the navigational channel. The study area is depicted in Figure-3. Baseline Status of various environmental parameters in the Study Area is described in the following paragraphs:

Figure-3 : Study Area Map

4.1 Meteorology

Meteorological data with respect to wind speed, wind direction, temperature, rainfall, relative humidity, visibility, etc., monitored by IMD at Mumbai observatory was collected utilized in the EIA report.

4.2 Land-use Pattern

The land use pattern of the Study Area has been studied using satellite data. The major landuse category in the study area is water body, which accounts for

about 63.82% of the total study area. The area under vegetation and scrub is 7.27 % and 8.89% respectively. The beach portion is about 2.07% and open land is about 2.10%, while built-up area accounts for 15.86% of the total study Area.

4.3 Ambient Air Quality

Ambient Air Quality (AAQ) was monitored at 4 locations in the study area from 4th March 2016 to 28th May 2016. The average concentration of $PM_{2.5}$ at various stations monitored ranged from 68.54 to 80.41 µg/m^3. The average concentration of PM_{10} at various stations ranged from 133.25 to 154.04 µg/m^3. The average concentration of SO_2 was well below the prescribed limit of 80 µg/m^3 specified for industrial, residential, rural and other areas. NO_2 concentration at various sampling stations ranged from 25.56 to 26.96 µg/m^3. The average concentration of CO at various stations monitored ranged from 0.33 to 0.49 mg/m^3.It is observed that Lead, Benzene, Benzo-Pyrene, Arsenic and Nickel were found to be below detectable limit during the field survey

4.4 Ambient Noise Levels

Ambient Noise Levels were monitored at 4 locations in the Study Area. The day time equivalent noise level at various sampling stations ranged from 49.1 to 59.1 dB(A). The noise levels were observed to be well within permissible limits of 65 dB(A) specified for Commercial area.

4.5 Marine Ecological Study

Maine Ecology and Biodiversity assessment and preparation of Biodiversity Management Plan was prepared by CSIR-National Institute of Oceanography (NIO), Goa. As a part of the study NIO collected the baseline data on water and sediment quality, Maine Ecology and Biodiversity from 12 locations in the study area in the month of May 2017. During the survey, marine water and sediment samples were collected to assess physicochemical and biological parameters, including the status of sea weeds, sea grasses, and fishery resources.

a) Physiochemical parameters of marine water

Surface water temperature ranged from 31°C to 32.3°C at various sampling stations. The salinity values varied from 35.7 to 36.0 ppt in surface water to 35.4 to 36.2 ppt in bottom water at various sampling locations in the study area. The pH

values varies from 7.2 to 8.0 in surface and bottom water samples, which indicates that the pH of marine water is in the normal range in the study area. The Total Suspended Solids value ranged between 26.4 to 26.8 ppm. The Dissolved Oxygen level in the water samples varied from 3.7 to 5.4 mg/l at various sampling locations. Texture of sampled sediments was found to be fine clay.

b) Biological Characteristics

Chlorophyll '*a*' in the surface ranged from 2.9 to 14.1 mg m^{-3} and from 1.2 to 6.3 mg m^{-3} in the bottom waters. The Phaeopigments content varied from 0.01-3 mg m^{-3} and 0.01-0.7 mg m^{-3} in the respective depths. A total of 47 species of phytoplankton were recorded from the study area. Phytoplankton density in surface water varied from 800 to189168 cells/l and from 2413 to 11616 cells/l in the bottom waters. Total 10 groups of zooplankton were identified. Zooplankton biomass ranged from 0.08 to 1.02 ml m^{-3} and abundance from 333 to 32316 individuals m^3. The macrofaunal community in the present study comprises of 32 taxa belonging to 7 groups. Among all the groups, polychaete was the most dominant macrofauna followed by crustaceans. The polychaete were abundant with 42% followed by crustaceans (36%) and bivalve (17%) and the remaining 4%. The macrofaunal abundance varied from 29 to 2860 ind./m^2. The macroaunal biomass ranged from 0.20 to 290.65 g/m^2.

4.6 Terrestrial Ecology

The proposed project envisages the dredging of navigation channel at MDL waterfront in Mumbai. No major forest and vegetation cover were found in the project area. However, a littoral and swamp forest occurs along the creeks and mudflats. The sparse vegetation observed in 10 km area has a mixture of dry and moist deciduous type. The common floral species observed in and around the project area are Suru (*Casuarina equisetifolia),* Narali (*Cocos nucifera),* Shiris (*Albizzia lebbek),* Amba *(Mangifera indica*), Tambadsheng (*Peltophorum pterocarpum),* Avala Bor *(Zizuphus mauriliana),* Savar (*Bombax ceiba),* Kumbhi (*Careya arborea), Lagerstroemia* sp, and Bherali mad (*Caryota urens).*

It is observed that the Sewri and Thane creek has good mangrove vegetation. Mangroves and mangrove associates reported in the area were *Acanthus*

ilicifolius, Avicennia marina acutissim, Avicennia marina, Avicennia officinalis, Excoecaria agallocha, Sonneratia alba, Sonneratia apetala, Sonneratia caseolaris, Aegiceras corniculatum, Bruguiera gymnorrhiza, Ceriops tagal, Rhizophora mucronata, Rhizophora apiculate etc

The proposed project site is within Arabian sea and located near Mumbai town and therefore did not support good habitat for wild life. However, the study area comprises of sewri creek, Thane creek and intertidal mudflats which serves as good habitat for mangroves. Area is regularly visited by variety of migratory birds in large numbers. Mangroves provide suitable shelter for nest building for these birds while intertidal mudflats and creek harbor diversity of aquatic fauna from phytoplankton, annelids, echinoderms, crustaceans and vertebrates which provides food source to support big population of migratory birds. Owing to its biological diversity and threats due to urbanization, Thane Creek Flamingo Sanctuary has been established to protect mangroves and allied ecosystems and associated flora and fauna

Wild animals reported in the area include Monkey, Jackal, common Mangoose, Flying fox, Bat, Squirrel etc. Amongst reptiles, Moniter Lizard, Garden Lizard, Common Skink and Rat Snake, are common. Some of the species observed in the study area falls under various categories as per the conservation status specified by IUCN and details are covered in the EIA report. The nearest National Park is Sanjay Gandhi National Park, which is located >15 km from the proposed navigation channel.

4.7 Fisheries

Proposed project is located near to Mazgaon Dock and Mumbai Port area and fishing is not permitted in this area. However 3 major fish landing centers of Greater Mumbai also fall within the study area of the proposed project. Bombay dock constituted >40%, of the landing followed by non-penaeid prawns, Ribbon fish, *Coilla* spp and Panaeid prawns in the study area. Maximum fish landing during 2013-14 was of Penaeid prawns (22%) followed by Loligo (11%), Ribbon fish (10%) and Upeneus spp (10%), whereas Bombay Duck was reduced to 9%. While in 2014-15, there was increase in shrimp (25%) and Loligo (20%) catches

and the trend continued in 2015-2016 in favour of penaeid prawns (34%) and Upeneus spp. (18%).

4.8 Socio-Economic Aspects

The information on socio-economic aspects has been extracted from Primary Census Abstract 2011. The total study area comprises of about 41 settlements, including 39 municipal corporation wards and 2 villages. The total population in the study area is of the order of 30,93,543 persons residing in 6,76,333 households as per Census of India 2011. The number of females per 1000 males is 832. The total literate population in study area villages is of the order of 81.32%.

5.0 ASSESSMENT OF IMPACTS

Based on the project details and the baseline environmental status, potential impacts that are expected to occur as a result of the execution and operation of the proposed dredging project have been identified and the same are listed below:

5.1 Impacts due to dredging

Dredging operations are likely to increase turbidity, reduction in light penetration leading to decreased primary productivity and also changes the nutrient regime in the water column. Increase in turbidity may lead to reduction in the aesthetic value of water in the dock area and surroundings. Dredging and dumping activities will also lead to loss of benthic fauna.

5.2 Impacts on Marine Biodiversity

Dredging activity might result in some adverse impact on biodiversity by disturbing the biological community structure both at dredging as well as dumping sites. The major impact of dredging is the destruction of benthic habitat within the dredged foot-print area because of dislodging of the sediments. High bacterial biomass is recoded in the study areas which point to the impact of various ongoing activities (e.g dredging, tourism, fishing, sewage etc) in this area. However, the values are within the range recorded for similar coastal waters along the west coast of India. The water in the Mazagaon area has moderate productivity as observed from the chlorophyll "*a*" concentration. Higher chlorophyll "*a*" in the proposed dumping sites indicates leaching of nutrients from the dumped sediments. Fish eggs and larvae were not found during the study, pointing that the area is not conducive for

spawning of pelagic and benthic fisheries.

5.3 Impacts due to Turbidity & Plume Generation

The impacts of dredging of navigation channel and disposal of dredged material would lead to the generation of a plume as the dredged spoil material is released to the water column during the dredging and spoil disposal operation. Increase in turbidity may lead to reduction in the aesthetic value of water in the dock area and surroundings. These are temporary phenomena and the marine environment will gain normalcy shortly after the termination of dredging operations. Impacts also may occur as a result of the physical changes to bathymetry and hydrodynamic processes due to dredging.

5.4 Impacts due to Aqueous Discharges

The impact of dredging on sea water quality will have a short term negative impact on the marine biota of the study area. However, the impacts of dredging will be limited to the period of dredging and dumping operations only. There will be no liquid discharges from the dredging activities. All liquid and solid wastes from dredgers will be collected and transported onshore at regular intervals for proper treatment and subsequent disposal at designated place.

5.5 Impacts of Rock Dredging

Reduction in habitat or loss of benthic primary producers due to dredging and dumping activity may affect the fisheries in the navigation channel and dumping area. Generation of noise during dislocation/ cutting of hard rock will have adverse impact on marine organisms. However, adult fish are likely to move away or avoid dredging areas.

5.6 Impacts due to disposal of Dredged Material

Disposal of dredged material shall be done at designated dumping sites identified by CWPRS based on hydrodynamic and dispersion studies. Disposal of sediments will lead to burial of benthic fauna in the dumping area. However, benthic fauna is not well developed in this area.

5.7 Impacts on Air Environment

The combustion of diesel in the dredgers could be one of the possible sources of incremental air pollution during the construction phase. The proposed area is

having regular ship movement due to the proximity to Mumbai port and JNPT. Hence, the incremental increase in concentration due to the dredging operations is not expected to be significant. However, proper maintenance of dredgers and barges will be ensured.

5.8 Impacts in Water Environment

Total 50 persons are likely to be deployed on dredgers and 75 persons are likely to be deployed on barges during the dredging. The fresh water requirement will only for the operating crew and would be of the order of 5625 liter/day i.e.@45 lpcd x 125 persons. Dredgers and barges will have the drinking water and toilet facilities. Sewage from the toilets of dredgers will be transferred to the existing sewage handling facilities at Mazgaon Dock.

5.8 Impacts on Shoreline Change

The shoreline from MDL waterfront up to Naval dockyard and even beyond consists of vertical wall type of solid structure with its foundation resting on hard stratum. Erosion/accretion is related to incoming dynamic wave conditions and the littoral transport. The changes of these dynamic wave and littoral transport are due to changes in waves, tides, ocean currents, storms, monsoon, etc.

Study carried out by CWPRS on Impacts of dredging on shoreline indicates that there is practically no impact on the shoreline due to proposed deepening and widening of channel from MDL waterfront up to OCT of Mumbai Port Trust. Hence no impact on shore line is anticipated due to proposed deepening and widening of navigational channel.

6.0 ENVIRONMENTAL MANAGEMENT PLAN (EMP)

The EMP proposes to integrate the baseline conditions, impacts likely to occur, and the supportive and assimilative capacity of the system. The most reliable way to achieve the above objective is to incorporate the management plan into the overall planning and implementation of the project. The EMP for the proposed maintenance dredging activities is given below.

6.1 Control of Impacts on Marine Environment

The impact on coastal environment during dredging phase would be mainly on marine water quality and ecology. An important factor in minimizing adverse

impacts would be optimizing the dredging period and avoidance of activities beyond the specified area of implementation. Hence, as a part of the management strategy various activities should be well coordinated and optimized to avoid time and cost over-run. Various dredging methods have been considered for the dredging of proposed navigation channel.

It is proposed to use Grab dredger to carry out the soil / clay dredging and Backhoe Dredger (BD) for dredging hard material and weathered rock. The rock shall be dredged by carrying out controlled blasting, and the dislodged and disintegrated rock particles will be removed using back hoe dredgers. Also a barge mounted back hoe dredger with sufficient leverage not only excavates fractured rock but also to minimize the need for blasting. Due to rock dredging, no major impact due to increase in turbidity is envisaged

6.2 Dredging and Disposal Management Plan

The total quantity of dredging is 3.0 Mm^3 which includes 0.22 Mm^3 of rock. The work is proposed to be completed in a period of about 240 days. The total dredging quantity per day is estimated at 14400 m^3 /day in order to complete the task within the scheduled completion period. Disposal of dredged spoils shall be carried out at the designated site suggested by CWPRS. Other management measures include:

- Hopper door seals will be maintained in proper condition to ensure minimum loss of sediment during transport
- Timing of dredging operations shall be scheduled to avoid fish breeding season
- Hopper losses will be controlled by adequate engineering and operational controls including the use of spill control valves.
- Disposal of dredged material will occur only within the designated disposal site
- Hopper de-watering will be confined to the dredging and spoil disposal areas

6.3 Biodiversity Recovery Plan

The recovery of biodiversity is dependent on various ecological and physical factors and also on the magnitude of the impact posed by anthropogenic activities. Mitigation measures suggested for biodiversity conservation:

- Inorganic waste, hazardous waste including oil and grease will be stored appropriately and delivered to authorized vendors for proper disposal.
- Dredging and associated activities will not be undertaken during the notified fish breeding season (June-July).
- Disposal of dredged material will be at designated sites recommended by CWPRS.

6.4 Vessel Management Plan

All domestic, toxic, and hazardous waste such as oil, petroleum hydrocarbons, empty drums and other containers, and any other waste materials will be collected, handled, stored, and disposed in accordance with existing National waste management policies and procedures.

Dredging contractor will ensure that adequate toilet facilities are provided on the dredgers and other vessels. All waste, including grey water, are to be contained on board and legally disposed on land.

6.5 Fishery Management Plan

Proper care will be taken to avoid spill of contaminants in the ambient water to avoid impact on fisheries. Fishing activity are not permitted around the navigation channel. However, precautionary measures will be undertaken while transporting the dredged material to the dumping site to avoid fishing nets getting entangled with the moving vessels which cause huge financial losses to the coastal fishing community. Strict measures will be ensured to prevent the oil spills from the dredgers and barges.

6.7 Hydrodynamics and Siltation Studies

Proposed project envisages the 3.0 Mm^3 of capital dredging including 0.22Mm^3 of rock dredging. Hence, MDL has assigned the work of identification suitable dumping sites to CWPRS, Pune. CWPRS carried out the modelling dispersion studies and recommended two dumping areas for the disposal of dredged material.

7.0 RECOMMENDATIONS

Though the anticipated adverse impacts are low, it is recommended to follow safe dredging practices and regular monitoring of the impacted areas.

- Ecological and environmental impacts during suction dredging in the dredged area and in the immediate environs are inevitable. However, such disturbances are found to be minimal and localized in the dredged area and in the immediate environs and reestablishment of the fauna is expected within a period of 4 months. In view of this, dredging could be permitted with a proper environment management plan.
- Comparison of the Base line status of the diversity and population of biota along with the post dredge survey and regular monitoring surveys will give a better understanding of the response of the environment to the dredging activity.
- Possibility of providing silt curtains around the dredged area may be explored, if the prevailing current pattern is favorable.

8.0 DISASTER MANAGEMENT PLAN

Disaster Management planning is an integral and essential part of loss prevention strategy. The nature of the proposed project is such that there are minimal chances of accidents. The project operations do not entail any risk or hazard. MDL has a Medical & Occupational health center with 1 emergency bed and a first aid post at various locations. There are 7 doctors, 19 medical assistance and 6 pharmacists attached to the medical center at MDL. MDL also have 1 cardiac ambulance and 3 non cardiac ambulances. The center works 24x7 and is equipped with necessary facilities to handle accidents.

A detailed Risk and Disaster Management Plan is in place at the Mazgaon Dock Limited and the same shall be implemented in case of any unlikely event of emergency.

9.0 ENVIRONMENTAL MONITORING PROGRAMME

Monitoring of important environmental parameters is an essential and integral component of the impact "assessment / mitigation" of any development activity. The physical, chemical and biological characteristics of marine "water / sediments" shall be monitored periodically during the dredging phase at, both, dredging and disposal sites. Surface and bottom waters and sediments will be sampled and analyzed, periodically. Considering, a dredging period of 8 months the monitoring can be conducted for two seasons. The marine water and sediment sampling and analysis shall be conducted through a "MOEF&CC/NABET" accredited external expert agency.

10.0 COST ESTIMATE

The Total cost estimate for implementing Environmental Management Plan works out to Rs. 7.5 million. The details are given in Table-10.1.

Table-10.1 : Summary of cost estimate for implementing Environmental Management Plan (EMP)

Sr. No.	Description of Item	Cost (Rs. In lakh)
1	Vessel Management Plan	10
2	Water Quality	5
3	Oil Spill Prevention and Contingency Plan	5
4	Fishery Management Plan	10
5	Biodiversity Monitoring Plan during implementation of the project.	20
Total		50