EXECUTIVE SUMMARY

1.0 INTRODUCTION

The project is the Phase-II development of the existing fishing harbour at Bandar, in Gilakaladindi village under Machilipatnam Mandal of Machilipatnam revenue division in Krishna district of Andhra Pradesh.

The coordinates of the project site correspond to Latitude 16°08'41" (N) and Longitude 81°11'10" (East). Machilipatnam is an operating fishing harbour and the nearest town is Machilipatnam Municipal town which is about 7 km away. The nearest railway station is at Machilipatnam, about 7 km from the project site. The nearest airport is at Vijayawada which is at a distance of about 57 km. The location of the proposed harbour is shown in Map 1.1.

For Phase-II development, detailed engineering investigation covering topographic/ hydrographic survey (November, 2016) and sub-soil investigation (Feb, 2017) at project site were carried out by WAPCOS Ltd., a Govt of India undertaking. Numerical / hydraulic studies were conducted by CWPRS, Pune. The CRZ mapping for the demarcation of HTL/LTL was done by the Institute of Remote Sensing (IRS) Anna University, Chennai and EIA study has been conducted by WAPCOS Ltd.,

1.1 PROJECT IDENTIFICATION AND PROJECT PROPONENT

The Department of Fisheries, Government of Andhra Pradesh envisaged the need for Phase-II development for expansion, renovation and upgradation of the existing fishery harbour at Machilipatnam with a view to addressing the logistical difficulties for landing, berthing and other support activities necessary for fishing due to siltation of the creek mouth and over-crowding of fishing vessels which has rendered the present infrastructure facilities grossly inadequate.

1.2 NEED FOR THE EIA STUDY

As per the list of projects or activities requiring prior environmental clearance given in the EIA Notification the proposed project is listed on Sl.No. 7e and comes under category “B” project under the Schedule to the EIA Notification, 2006. The project requires Environmental Clearance from State Environmental Impact Assessment Authority (SEIAA), Government of Andhra Pradesh. Since, the project is proposed in the coastal area, CRZ Clearance is also required as per the CRZ Notification of January 2011.

1.3 SCREENING, SCOPING AND GRANT OF TOR

The requisite Form-I application along with suggested TOR in the prescribed format was submitted to the State Level Environment Impact Assessment Authority (SEIAA), Government of Andhra Pradesh on 12.10.2017 and re-submitted on 23.02.2018. The TOR application was examined at the 113th meeting of the State Expert Appraisal Committee (SEAC), Andhra Pradesh on 24th February 2018 and TOR was granted by SEIAA, Andhra Pradesh on 16.04.2018. The Committee recommended preparation of EIA report based on

standard TOR along with public hearing, etc., with recommendation for obtaining CRZ Clearance from MoEF&CC as per CRZ Notification,2011.

Single season Rapid EIA Study was conducted was conducted from December 2017 to March, 2018.

2.0 PROJECT DESCRIPTION

The Phase-II development of the harbour aims to accommodate a total number of 550 fishing vessels comprising 300 nos. of 10m length motorized boats, 200 nos. of 15m length MFVs (trawler- Gill netters) and 50 nos. of 24 m length tuna long liners. After implementation of the project, envisaged fish landing at the harbour will be 23,500 TPA.

2.1 Proposed Marine and Offshore Facilities

The **waterside facilities** include Training Walls (northern wall – 1150 rm and southern wall – 1240 rm), Quays of 693 m length, RC Sloping hard (slope of ramp - 1V:10H), Reclamation (1.06 lakh sq.m), Revetment (1V:1.5H), Beach Landing area (13,181 sq.m), Navigational aids, etc. In addition, for adequate draught for navigation of fishing vessels dredging of 1.04 lakh cu. m has been proposed in the creek mouth. The HTL-LTL demarcation by the IRS, Chennai, shows that the dredging area falls in CRZ-I(B,) CRZ-III, CRZ -IV(A) and CRZ-IV (B) category.

The **landside facilities** include Fish handling and auction hall, Fish loading area, Fishery Administrative office, Fishermen's Gear sheds, Net mending sheds, Boat Repair shops, Restaurant, Fishermen Rest shed, Public Toilet block, Fish Merchants Dormitory, Commercial Complex, Community Hall, Radio-communication tower, Security/Guard house, Internal roads, Parking areas for vehicles, Boat Parking/Repair yard, Boat building and timber yard, Fresh and sea water supply and distribution system, Drainage/Sewerage and wastewater treatment system, Electric power and lighting system, Ice plant and chilled storage, Civic amenity site, Water Purification / R.O. Plant, Fire extinguishers, Greenery, Landscaping and Compound wall. In addition there will be **repairs/ improvement** of the existing quay, auction hall, administrative office, canteen, net mending shed, rest shed, workshop, overhead tank and security building. The project layout of fishing harbour is shown in Drawing 2.1

Project Cost

As per the DPR the project cost has been estimated at Rs. 252.00 crore.

The project being Phase-II development of the existing fishing harbour and availability of adjoining Government land, no alternative sites were considered.

3. DESCRIPTION OF THE ENVIRONMENT

The evaluation of baseline environmental scenario is an essential component of an EIA Study. Assessment of environmental impacts due to construction and commissioning of the proposed fishing harbour project requires a comprehensive and scientific consideration of various environmental aspects and their interaction with natural resources. The study was carried out within 10 km radial area i.e. Project Impact Area (PIA). The major environmental components studied both through secondary research and primary data generation for the purpose of the EIA Report include Physical environment, Biological Environment and Socio-economic Environment. Primary data was collected within 5 km radial area of the project site. The PIA is shown in Map-3.

3.1 Meteorology

Meteorological data with respect to wind speed, wind direction, temperature, rainfall, humidity etc. monitored by IMD at nearest observatory were collected and utilized in the EIA study.

3.2 Tides and Waves

It is observed from tide level data that the tidal variation during neap tides is of the order of 0.40 m, while the same during spring tides is 1.00 m. The tides are of mixed type generally exhibiting semi-diurnal nature with large diurnal inequalities meaning different levels between successive high and low waters. Furthermore, the extreme water level considering a storm surge of 0.67m occurs at the high-water level of +1.83m.

Based on data collected by National Institute of Oceanography, Goa, the significant wave heights are reported to be ranging between 0.3-2.3 m and mean significant wave height for a100-year return period is 3.0 m. Predominant average wave period is 8-10 seconds. Extreme wave conditions prevail under severe tropical cyclones during north east monsoon period. Waves at the site are primarily generated by the seasonal monsoon winds and by cyclones

South Easterly and North Easterly waves are the predominantly occurring wave directions during April – October & November to February respectively and maximum wave heights occur in these directions. Normal wave heights are 0.0 to 3.0 m in these directions. Extreme wave conditions prevail under severe tropical cyclones during north east monsoon period. Mean significant wave height in deep water during non-severe cyclones is 3.0 m and the Extreme wave height in deep water is 8.2 m for a 100-year return period.

3.3 Geology, Geomorphology, Seismicity

Geology

Lithirogically the area, around the location of the proposed Machlipatnam jetty site, comprises soft semiconsolidated deposits of grey and brown sand of Quaternany Age.

Geomorphology

The geomorphology of the area comprises zones of Active Beach and Paleco-beach Ridges. The former is made up of grey sand and the later by brown sand.

Drainage

The principal drainage, the Krishna River flows along the southwestern margin of the Krishna District and for quite a distance forms its boundary with Guntur District situated lying to its south west.

Groundwater

The groundwater of the area occurs within semi-consolidated forms formation in the Recent Allunium which constitutes fairly thick but discontinuous aquifers down to 150 m 6 gl. The permeability of the material range from 2 – 75 m/day. Specific yield ranges from 0.05 – 0.2 the material has yield prospects of 100 m3/hr. In the proposidana the groundwater is portable upto 3 – 5 m depth beyond which there is

Seismicity/Natural Hazards

The area falls in seismic Zone III. The area is subject to seasonal cyclone and flooding and has record of tsunami in 2004.

3.4 Ambient Air Quality

As a part of field studies, ambient air quality monitoring was carried out with a frequency of two samples per week for twelve consecutive weeks at four locations in the study area falling within 5 km radius of the project site from December 2017 to February, 2018. The parameters monitored as per MoEF Guidelines include $PM_{2.5}$, PM_{10}, Sulphur dioxide (SO2), Nitrogen dioxide (NO_2), Carbon Monoxide (as CO), Ozone (as O_3), Lead (as Pb), Ammonia (as NH_3), Benzene (as C_6H_6), Benzo (O) Pyrene (as BaP), Arsenic (as As) and Nickel (as Ni).

It was observed from the monitoring data that the ambient air quality for all the parameters is well within the permissible limits for industrial, residential and rural areas.

3.5 Noise Environment

The ambient noise quality readings were taken at 4 locations in the study area. The day and night time equivalent noise level at various sites located close to residential, commercial and silence area, were observed and found to be well below the permissible limit specified against their respective standard.

3.6 Land Use Pattern

The land use pattern of the study area has been studied through digital satellite imagery data procured from National Remote Sensing Agency (NRSA), Hyderabad. The data was initially processed for interpretation using TNT Mips software. The digital data was subsequently used for identifying and mapping of various land uses present in the study area. The overall coverage of the study area includes Sea (41.14 %) and Land (58.86 %). The land-use/land cover of the land area portion reveals that aquaculture occupies maximum coverage of 20.55 percent of the area, followed by 15.9 percent area under inoperative aquaculture tracts along with fallow land. Area under crop land occupies 15 percent of the total land area, while area under plantation and scrub occupies 10 percent. Mud flat with scrubs occupies 14.73 percent and is seen along the coast and in patches elsewhere. Around 2 percent of the area is occupied by salt pans. Since a part of Machilipatnam town falls within the study area, nearly 10 percent area is under habitation. Spit, a typical structure formed by deposited sand at the mouth of the river is found here and covers an area of about 0.5 percent. Open and dense scrub covers more than 4 percent. Rest of the area is occupied by rivers, canal, beach and water body.

3.7 Terrestrial Ecology

In Krishna district total forest area is 66,424.27 ha. which is 7,7 percent of the district geographical area. Wildlife forest area constitutes 16,463.62 ha. and Reserve forest 49,960.65 ha. spread over three Territorial Forest Ranges e.g. Mylavaram, Vijayawada and NUZVID. There are as many as 180 species of trees, 46 species of shrubs, 33 species of climbers, 9 species of grasses and only 2 species of bamboos occurring in the forest area under Krishna Division. The list of details is given the main report. Major faunal species in the district include spotted deer, jackal, porcupine, hare, macaque rhesus, macaque bonnet, fishing cat, barking deer and langur. In reptile group krait, chameleon, garden lizard, wall lizard, monitor lizard, crocodile, cobra, rat snake and Indian python. Avi-fauna in the district Forest Division is diverse with 105 species.

However, the project area is devoid of any floral or faunal species of rare or endemic in nature.

3.8 Aquatic Ecology

The intertidal wetlands of Krishna district contain productive habitats, including marshes, tidal flats and beaches which are essential to estuarine food web. The major part of the Krishna delta is a flat area with gentle slope towards Bay of Bengal. It has some undulations in the middle part of the delta in the form of deltaic lobes, beach ridges and flood plains. The highest elevation is about 16 meter above mean sea level near Vijayawada town and minimum is 3.50m level at Machilipatnam. The family Avicenniaceae is the single largest family in Machilipatnam region followed by Euphorbiaceae. The mangrove vegetation of Machilipatnam sea coast has been broadly classified into three main categories, i) The interior group of mangrove vegetation, which mainly consists of species of Avicenniaceae, Rhizophoraceae and Euphorbiaceae, ii) The mangrove vegetation of central area, which mainly consists of species of Sonneratiaceae, Combretaceae and Myrsinaceae and iii) Mangrove vegetation spread at peripheral or marginal areas, which consists of species of Acanthaceae, Verbenaceae, Chenopodiaceae, Fabeceae and Poaceae.

a) Water Quality : Sea and Creek water

The water temperature fluctuated from 28.1 to 28.5°C. The water salinity varied from 36.4 to 36.9 ppt. The water pH is alkaline in nature and moved between 7.9 and 8.2. The Total Suspended Solids values ranged between 14 mg/l and 118 mg/l. The turbidity in the sample stations varied between 8 and 65 NTU. The Dissolved Oxygen level in the water varied between 6.2 and 6.5 mg/l. The BOD values ranged between <2 and 3mg/l. The nitrite level fluctuated from 1.3 to 1.8 mg/. Nitrate concentration ranged between .BDL to 0.26 mg/l. The range of Total nitrogen values was from 1.5 to 2.1 mg/l. The silicate values ranged between 0.35 and 0.84 mg/l. The Total Organic Carbon level ranged between 7 and 14 mg/l. The ammonia concentration, Total phosphorus, Inorganic Phosphate and PHC level in all the stations were found at BDL level. The range of physico-chemical parameters was found to be within the permissible range. Similarly, the ecologically sensitive chemical parameters such as Dissolved Oxygen, BOD, nutrients were also at the optimal concentration with a few exceptions which might be owing to the prevailing seasonal variation.

In the field of heavy metals, the iron level varied from 0.13 to 2.78 mg/l**,** while the Manganese level from 0.11 to 0.26 mg/l, the copper level from 0.15 to 0.19 mg/l. the other heavy metals like zinc, cadmium, nickel, chromium, lead and mercury were found to exit at BDL level. The concentration of heavy metals in the study area has been observed to be within permissible limits.

b) Sediment Characteristics

The sediment pH varied between 7.4 and 8. The maximum sand content is 89.9 percent and minimum 6.7 percent. The silt content varied between 4.9 percent and 12.6 percent. The maximum clay content was 82.6 percent and minimum 3.4 percent. As regards soil texture, the sand, silt and clay fraction at each station along with their textural classification indicated that the sand and clay composition was higher when compared to silt during this survey.

In case of heavy metals in sediment, the iron level varied from 1.791 percent to 2.14 percent, Zinc level from 16.48 to 27.62 µg/kg**, t**he Manganese level from 288.92 to 670.21 µg/kg, while the Nickel level varied from 25.19 to 36.29 µg/kg and the Copper concentration from 31.28 to 44.0 µg/kg. The levels of cadmium, chromium, lead and Mercury concentrations were found at BDL level in all the monitoring stations. The concentration of heavy metals in sediment samples indicates that it is well within the ERM (Effective Range Median) which means there are no possibilities of Heavy metal contamination in the region.

c) Biological Environment

Phytoplankton

In the present survey, species belonging to three groups namely Bacillariophyceae (diatoms), Dinophyceae (dinoflagellates) and Chlorophyceae (green algae) were recorded. Of these, Bacillariophyceae were found to be the dominant group with 18 species. Dinophyceae formed next group with 6 species and Chlorophyceae came last in the order with 4 species in all the stations. Density of phytoplankton varied from 561 to 716 Nos × 10^{-1}/l, depending on the locations.

Zooplankton

Macro zooplanktons reported in the study area constitute *Amphipods, Tintinnids, Chaetognaths, Copepods, Polychaetes, Fish eggs, Gastropods, Lamellibranchs, Ostracods, Nauplius larva, Mysis larvae* and *Oikoplura larva.* Among these *Copepods* were found to be the dominant, followed by *Polychaetes* and *Ostracods*. The zooplankton density varied from 1626 to 2583 nos/m^3, depending upon the location.

Benthos

Amongst Macro-benthic organisms, five groups of benthic organisms namely *Nematodes, Polychaetes*, *Bivalves, Gastropods* and *Crustaceans* were recorded. Of these, *Nematodes* constituted the dominant group followed by *Polychaetes, Bivalves. Gastropods* and *Crustaceans*. The population density varied from 123 to 386 Nos./m^2. Likewise, amongst Meio-benthic organisms, five groups of benthic organisms namely *Foraminiferan, Ostracods, Ampihipods, Harpacticoids and Nematodes* were recorded. Of these, *Foraminiferan* constituted the dominant group followed by *Ostracods, Nematodes* and *Harpacticoids*. The population density varied from 334 to 549 Nos /10 cm^2.

Corals and Other Endangered Species

The project impact area is devoid of corals, turtle nesting grounds and other endangered species.

Fisheries

The most important livelihood option of the district is fishing. Marine finfish and shellfish are exploited along the coast with a multitude of gears, comprising gill nets and long liners deploying motorized boats and trawl nets deploying mechanized vessels. Gill nets are also

used by the mechanized vessles when in need during fishing. In pelagic fishing anchovies, sardines, seer fish, mackerel, ribbonfish and tunas are caught using gillnets and trawlers. Demersal fisheries resources are primarily exploited by bottom trawling and the important species caught are perch, silver bellies, scads, ribbon fishes, sciaenids, lizard fishes, goat fishes, sharks, rays, prawns, crabs, sand lobster, squids and cuttlefishes.

3.9 Socio-economic aspects

The aim of the socio-economic study is to assess the overall impact on various facets of socio-economic environment due to implementation of Phase-II of the fishery harbour at Machilipatnam.

Demographic profile of study area

The total population of the PIA is 2, 09,860 with sex ratio of 1020 females per 1000 males and density of population at 1134 persons per sq. km. Family size in the PIA is 4 members per household. SC and ST populations are 7.8 percent and 1.8 percent respectively. The overall literacy rate is about 73 percent of which male literacy rate is 51.4 percent and female 48.6 percent.

The total workforce in the PIA is 85,150**,** which is around 40.6 percent of the total population of the PIA. Male workforce constitutes about 28.2 percent while female workforce 12.4 percent. Of the total workforce, main workers constitute 82 percent and marginal workers 18 percent.

Sectoral engagement of the workforce in the study area reveals that cultivators account for about 3 percent, while agricultural labourers 25 percent of the total workforce in the study area. Such predominance of workforce in agriculture labour category indicates that the area has high land-man ratio implying low marginal productivity of labour. Only 4.5 percent of the working population is engaged in household industrial units. About 67.5 percent is engaged under 'Other Worker' category which includes non-household industrial activities as well as service sector and tertiary sector activities and fishing and allied activities, Primary field investigation reveals that about 75 percent of the population residing in and around the proposed fishing harbour villages are economically linked to fishing and allied activities. The remaining 25 percent is related to the activities either in the service sector or small business or tertiary activities. Gender-wise occupation data revealed that male dominance is pronounced in every sector of activity.

4.0 ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Identification of Impacts

The proposed Phase-II development of Machilipatnam fishery harbour involves a planning process that broadly covers pre-construction, construction and operation phases. Environmental impacts will be caused during ***construction phase*** due to construction activities viz. training walls, dredging of entrance channel, land reclamation, revetment protection, quay, site preparation and creation of other facilities in the harbour complex as well as for operation of construction machinery and equipments. During the ***operation phase*** environmental impacts will be caused due to activities like movement of MFVs, fish handling, washing and cleaning, movement of vehicular traffic, generation and disposal of sewage and solid wastes, etc. In addition, proper planning of activities at the ***pre-construction phase*** adhering extant

environmental, situational and construction guidelines / standards forms the basis of alleviating environmental impacts and formulating appropriate mitigation measures.

4. ANTICIPATED IMPACTS AND MITIGATION

4.1 *Land Environment*

During the construction phase there will be land use change because of construction of training wall, reclamation and revetment. Land / soil erosion due to earthwork as well as civil construction is likely to occur in the construction area. The site does not have any human settlement. There are access roads and preparatory activities like construction of temporary workers quarters, godowns, etc. will be on the vacant spaces in the existing harbor complex. The project area is free from agriculture or allied activities.

Mitigation Measures - Land Environment:

Construction Phase

- Foreshore and inter-tidal facilities to be set up as per MoEF's CRZ Notification, 2011 and Coastal Zone Management Plan of Andhra Pradesh
- Earthquake resistant designs to be followed for construction.
- Minimum land clearance to minimize soil erosion.
- Hazardous materials to be stored following safety standards

Inter tidal /Reclamation :

Of the total quantum of 1.59 lakh cu m of earth required for reclamation, 1,27,200 cu m will be sourced from dredged materials and the balance 31,800 cu m will be borrowed earth. The dredged material to be used for reclamation is non-toxic and uncontaminated. Hence adverse impact on marine environment is not anticipated.

4.2 Water Environment- Anticipated Impacts

Activities related to construction of training walls, dredging (10.5 lakh cu m) of entrance channel, land reclamation and revetment, quays, RC sloping hard, Beach landing slope, etc. will involve miscellaneous civil work, movement of construction materials, etc. which will have potential impacts.

Dredging and other construction activities will increase turbidity level in the water column. This will be short term and restricted to the construction period only. The change in the drainage system due to construction of the training and dredging at the channel entrance with respect to tide, current and circulation will be temporary in nature and better flushing of the existing channel will offset any negative impact caused over period of time.

Sewage generated from labour camps during construction period will be 20.8 m^3/day which is quite low and will be treated prior to its disposal into the aquatic phase. The construction phase will not result in any significant long-term negative impact on coastal water quality of the local environment.

During the operation phase, environmental implications could result from movement of mechanised fishing vessels, escape of oily wastes, left over residues and junk items from the vessels, fish washing, ice plant, sewage and solid waste generated at the landing centre, leaching of antifouling paints during repair and maintenance of the vessels. The impacts can be mitigated through appropriate EMP.

Mitigation Measures

Ground Water:

Construction Phase

- Adequate caution while undertaking digging activities to avoid degradation of water aquifer and water quality.

- Ground water not to be drawn from deep bore well within the CRZ.
- Rainwater harvesting and recharge to be encouraged.

Surface Water

Construction Phase

- Avoidance of activities beyond the specified area of implementation. Various activities should be well coordinated and optimized to avoid time and cost over-run.
- Run-off of fuel / engine oil and lubricants from construction sites will be controlled.
- Temporary colonies of construction workers will be established with adequate sanitation facilities sufficiently away from the HTL.

Operation Phase

- Sludge generated from various sources will be collected in the manholes at respective locations and finally treated in the Effluent Treatment Plant.
- Regular monitoring of the water parameters as recommended to be made and results reported to the concerned authority.
- Adequate safeguard to deal with oil spills by the fishing vessels.
- Surface run-off from oil handling areas will be treated for oil separation before discharge.
- Appropriate steps to be taken to minimize suspended solids by controlling discharge of wastes containing suspended solids.
- Periodic monitoring of the creek mouth to assess sediment trapping in the training wall.

4.3 Biological Environment (Coastal and Marine Ecology)

Aquatic:

The coastal environment is a significant component for planktonic and other organism biodiversity and is ecologically important. Construction activities like excavation, dredging, training wall, etc will cause changes in the aquatic environment. Interventions like tetrapod training wall, quay, reclamation and revetment which will interfere with the water body is likely to influence local ecology and will have adverse impact on the biota with increase in turbidity. Similar impacts are also likely to occur during this phase for other activities. This could negatively influence the process of photosynthesis and hence, primary productivity. Most of the impacts on the aquatic environment will be short lived and confined to the construction phase only.

During the operation phase disposal of untreated wastes into the immediate surroundings will lead to environmental degradation of the aquatic phase. Movement of fishing vessels, fuel spills from the vessels, leaching of anti-foulants used in paints and wastewater run-off into the creek / sea together have the potential to adversely affect the water quality. Run-off from the repairing activities is also potential source of contaminants. Litter, miscellaneous discarded items, both perishable and non- perishable, plastic wastes which degrade the harbour area may lead to increased microbial load in the aquatic phase if not controlled after implementation of the project.

Terrestrial:

Impact of construction activities will be primarily confined to the construction area. There will not be any loss of terrestrial flora or fauna as the construction area has no significant terrestrial floral or faunal presence. Wastes (both solid and liquid) generated during operation have some environmental implications, which will not have any long term effect on the terrestrial environment, if proper mitigation measures are adopted.

During operation, the levels of pollutants likely to occur around the project site will be much lower and as such are not envisaged to cause any significant stress on the environment. Wastes (both solid and liquid) generated during operation have some environmental implications, which will not have any long term effect on the terrestrial environment, if proper management measures are adopted.

Biological Environment – Mitigation Measures

Construction Phase

- Restoration of sub-tidal and inter-tidal areas to their original contours after construction.
- Toilets connected to well-designed septic tanks, soak pits to be provided for maintaining proper hygiene standards and to ensure minimum environmental impact.
- No damage to the mangrove vegetation in the buffer zone and alongside the creek.

Operation Phase

- No untreated discharge of wastes, run offs and garbage into the aquatic phase.
- Covered vats to be provided and wastes disposed of to designated site(s) identified by the local village Panchayat.
- Sewage water from the fish handling and auction area shall be properly treated before letting into the aquatic phase.
- Special double-walled containers will be used for collection of spent engine oil and lubricants from the quays / landing / berthing areas, which will be placed inside the oil reception shed.
- Solid waste will be collected in air tight containers and receptacles placed at strategic locations of the harbour complex depending upon the type of solid waste (organic and inorganic) being generated.
- Accidental catch of endangered marine species, if any, during voyage shall be released under guidance of the wildlife rescue squad of the Forest Department. Any information on poaching to be reported to the appropriate authorities e.g. office of the Conservator of Forest, Guntur.
- Programmes on awareness for conservation of biodiversity both marine and terrestrial highlighting protected species under Wildlife {Protection} Act, 1972 shall be organized in association with the Forest Department, Gram Panchayats. Active participation of all the stakeholders involving children from local schools and women folks from the fishing communities should be encouraged.

4.4 Air Environment- Impacts

During *construction* dust generation and fugitive emission from movement of vehicles, disposal of construction wastes will be the prominent pollutants likely to impact air quality. Combustion of diesel from various construction machinery can be a possible source of air pollution. However such impact will be temporary in nature and confined to the construction period only. During *operation* phase the likely impacts will be from the emissions of fishing vessels as well as vehicular traffic which can be mitigated through appropriate management plan.

Air Environment – Mitigation Measures

Construction Phase

- Regular water sprinkling around the vulnerable areas of the construction sites through a suitable method to control fugitive dust and from the excavated materials.

- For control of smoke emission from vehicles and other mechanical devices those with valid emission control certification to be engaged.
- Earth and bulk filling materials to be covered during transportation.
- Workers to use mask against dust and other obnoxious air pollutants.
- Enclosures to control fugitive particulate emission and prevent them from becoming air borne.

Operation Phase

- Regular sprinkling of water for maintaining a clean environment and reducing generation of fugitive dust from vulnerable spots.
- Vehicles transporting fish, ice and other merchandise with valid emission control certification and cars using unleaded petrol to be encouraged.
- Air quality monitoring to be done bi-yearly as per guidelines of APPCB.

4.5 *Noise Environment - Impacts*

Noise during construction phase will involve movement and operation of machinery and equipment as well as handling, loading, unloading of materials. Operation of mixer machines, cranes, winch machine, dumpers, pile drivers, etc., as well as movement of trucks will generate noise. The nearest village Machilipatnam is about 2 km away and as there are no residential areas within the vicinity, the adverse impact of noise during construction will be negligible. However, this cannot be avoided and impacts due to this will be temporary in nature. During the operation phase, noise will be generated from movement of MFVs, transportation vehicles, vehicular horns, loading and unloading of fish and other merchandise. The impact due to variation in noise level on account of increase in vehicular movement during operation phase is not expected to be significant. These will not be heavy and continuous and will not cause any undue disturbances to the local habitation.

Noise Environment – *Mitigation Measures*

Pre-Construction Phase

- The implementing agency / contractor will undertake training of construction workers on operation of construction machinery / equipments in keeping with the environmental requirements and local sensitivities.

Construction Phase

- Appropriate measures for minimizing noise from use of mechanical devices will be undertaken by the implementing agencies /contractors by adopting damping, absorption, dissipation and deflection methods and other methods like creation of sound enclosures, applying mufflers, mounting noise sources on isolators, etc.
- DG sets be installed with acoustic enclosures and silencers so as to reduce noise up to the standard level as far as possible.
- The implementing agency will use properly maintained equipments.
- Ear protective devices to be used by workers exposed to noise levels above 85 dB (A).

Operation Phase

- Restriction on vehicular horns
- Daytime activities to be encouraged
- Regular monitoring of noise to be done to maintain environmental quality.

4.6. *Solid Waste – Anticipated Impacts*

Generation of solid wastes is inevitable during both construction and operation phases. Solid generated during construction period will constitute debris, construction wastes, discarded metal items of construction utilities, spares and equipments, tyre, dry cell / batteries, etc. in addition, domestic wastes will be generated from the temporary labour camps at project site.

The likely impacts from such wastes will be on the soil and aquatic phase if it escapes into the water body.

The impacts during construction phase will be temporary in nature and confined to the construction period only. During the operation phase solid waste will constitute fish offal, discarded fish boxes, utility and plastic items, ropes, nets, dry cell / batteries, etc. in addition to domestic waste to be generated from the eatery, dormitory, etc., within the harbor complex. The likely impacts from such wastes will be on soil, sanitation and water quality. Impacts during this phase will be continual, for which proper management plan is required for mitigation of such impacts

Waste Management – Mitigation Measures

Construction Phase

- Solid waste will be collected regularly and kept in a covered vat for disposal at designated site of the local Panchayat.
- Recyclable items will be disposed of / sold to recyclers.
- Toxic wastes like dry cell / acid batteries will be collected in separate vats with covered lids and disposed of recyclers or disposed of at designated site of the Panchayat.
- Domestic waste generated from labour camps will be collected and kept in covered vats before disposal at designated site of the Panchayat.
- The implementing agency / contractor shall remove all discarded equipments and debris and clean the site after completion of construction work.

Operation Phase

- Putrefied and discarded parts of harvested produce, offal, by-catch and small fish of no commercial value, etc, shall be removed from the landing, berthing, auction and packaging areas and kept in covered vats before final disposal to designated site.
- Fish offal will be disposed in separate plastic drum with air tight cover so as to desist pests and domestic animals form littering the area.
- Solid wastes kept in vats/generated to be disposed of at designated zones for final disposal at identified sites of the concerned local body. Use of plastic containers and polythene bags to be strictly prohibited in the landing centre.

4.7. Socio- economic Environment – Anticipated Impacts

Construction Phase

During the construction phase workers, including some with families will stay near the construction site which can lead to competing demand on the locally available infrastructure and resources. With adequate support facilities for the construction workers, who will mostly be from the nearby villages, there will be no long term negative impact on the competing uses of water, power, transportation, communication, education and community health during the construction phase.

During the operation phase unpleasant odour can arise from cleaning, packing, storage and auction areas which can be mitigated through proper management plan. The Phase-II implementation of the fishery harbor will entail de-siltation of the channel mouth and harbor basin which at present is hindering fishing activities leading to sub-optimal utilization of the

existing harbour. The proposed development construction would address the the long standing demand of the fishing community. Thus, the project will have significant positive impact on the fish production and leading to increased income, generation of employment and overall improvement in the economic and environmental health of the region / State. There will be no displacement of people or loss of land or livelihood of the local population. The project site is free of any historical landmarks / archaeological sites.

5. ENVIRONMENT MANAGEMENT PLAN (EMP)

Following up with the mitigation measures an EMP has been drawn up considering pollution abatement, resource conservation, environmental and social security covering the three phases of the activities viz. (i) EMP during Pre-Construction phase (ii) EMP during Construction phase and (iii) EMP during Operation phase. The Environmental Management Plan (EMP) for the proposed fisheries harbour is suggested to maximize positive impacts and to minimize negative impacts.

5.1 Land environment

The surface roads, which are proposed to be utilized during construction, shall be black topped to avoid fugitive dust. No new quarry is proposed to be specifically opened and the construction material is to be extracted from existing operating quarries, located outside the study area. Hence, project proponents are not required to implement management measures related to quarry slope stabilization.

5.2 Solid Waste Disposal

Many of the waste items can be recycled and reused. This involves collecting and sorting the discarded materials suitable for recycling, paper, plastic, glass and aluminium cans, etc. Wet organic matter can be converted into compost. It is advisable to have separate containers to facilitate the segregation of wastes into bio-degradable and non-biodegradable components. Floating garbage is best collected by small boats using a scoop net or two vessels working together using a floating net boom at the designated dumping areas of the local administration. Plastic drums of 100-litre capacity with airtight lids shall be bought and used to collect offal from fish markets or moored boats. Other organic fish wastes generated near the quay and auction hall area will be collected in air tight containers and sent to the organic waste composter, bio- mechanical composter of the local body.

5.3 Water Environment

The major source of water pollution in the construction and operation phases is the sewage generated by the workers and employees. As a part of control of water pollution adequate numbers of community toilets connected to one septic tank will be constructed.

The main source of wastewater generated during operation phase, will be the effluent generated from the fish washing, auction hall cleaning etc. The sewage will be generated from administrative block, toilet blocks etc. and it will be treated in septic tank. For treatment of sewage, an Effluent Treatment Plant has been proposed within the fishery harbour.

5.4 Control of Impacts of Dredging on Marine Environment

The impact on coastal environment during construction phase would be mainly from the activities in the inter-tidal phase due to construction of fishing harbour. Hence, as a part of the management strategy various activities shall be well coordinated and optimized to avoid time and cost over-run, which are given below:

- As part of conservation strategy, dredging will not be carried out during the fish breeding season (during April 15 to June 14). As part of this exercise, the dredger will be equipped with spill response kits and dredging will be carried out in confined manner to reduce the impacts on marine environment.
- Dredging and construction activities to be scheduled and planned to minimize impacts on fishermen and marine ecology providing necessary mechanisms to trap the spillage of fuel / engine oil and lubricants from the construction site to minimize impacts on benthos.
- Temporary colonies of the construction workers would be established sufficiently away from the High Tide Level (HTL) with adequate sanitation facilities and waste treatment measures..
- Construction debris shall be disposed safely in the designated areas.
- Sufficient number of barges shall be used for dumping, transporting and disposal of the dredged material to the project site and to designated dumping site outside the CRZ limits.
- Waste consignment notes to be prepared and documented for disposal of dredged material.
- Aqueous discharge in to sea during dredging shall be prevented.
- After completion of the construction activities, clean-up of the project area including the inter-tidal areas will be done and all left over items and discharged materials will be removed from the site After completion of construction activities,.

5.5 Control of Oil Pollution

To mitigate oil pollution, the administrative head of the fishery harbour shall take necessary action to:

- Provide shore-based reception facilities for oily wastes (bilge water and spent oil) from vessels
- Minimise leaks while bunkering.
- Assist those responsible for containment and clean-up operations if, a major oil spill occurs in the vicinity.

5.6 Control of Oil Spills

When an oil spill occurs in the vicinity of the fishery harbour, the administrative head of the fishery harbour will render assistance to the team responsible for combating the spill and for subsequent clean-up operations. Considering the size of the proposed fisheries harbour mechanical containment in the form of booms is recommended. Booms prevent the spreading, and facilitate oil recovery.

5.7 Air Environment

Control of Emissions

The following measures are recommended to control air pollution:

- Contractor will be responsible for maintaining properly functioning of construction equipment to minimize exhaust.
- Construction equipment and vehicles will be turned off when not used for extended periods of time.

- Unnecessary idling of construction vehicles to be prohibited.
- Effective traffic management to be implemented.
- Road damage caused by sub-project activities will be promptly attended to with proper road repair and maintenance work.

Air Pollution Control due to DG Sets

The Central Pollution Control Board (CPCB) has issued emission limits for generators up to 800 kW. The same standards need to follow by the contractor operating the DG sets.

Control of Pollution due to Increased Vehicles

The vehicles emitting pollutants above the standards should not be allowed to ply either in the project construction or in the operation phases. Vehicles and construction equipment shall be fitted with internal devices i.e. catalytic converters to reduce CO and HC emissions.

Water sprinkling shall be done at least thrice a day at the construction sites, haul roads and other access roads. Measures such as covering the trucks while transporting the construction material shall be initiated to control fugitive dust as also to control the re-suspension of particulate matters from the excavated materials.

Staff involved in construction shall be provided with suitable Personnel Protective Equipment (PPE) such as dust masks, ear plugs, gum boots, gloves, etc. Idling of delivery trucks or other equipment shall be avoided during loading and unloading of construction material.

5.8 Control of noise

It is proposed to develop a greenbelt along the road stretches. The contractors will be required to maintain properly functioning equipment and comply with occupational safety and health standards. The construction equipment will be required to use available noise suppression devices and properly maintained mufflers. Ear protective devices should be used by the construction workers where they are exposed to steady noise levels above 85 dB. Noise from the DG set shall be controlled by providing an acoustic enclosure. To prevent the adverse effects of noise the exposure period of affected persons be limited as specified by Occupational Safety and Health Administration (OSHA).

5.9 Greenbelt Development

It is proposed to develop greenbelt with indigenous / local species around various project appurtenances, which will go a long way to achieve environmental protection and mitigation of pollution. The maintenance of the plantation area will also be done by the project proponents.

5.10 Prevention of Soil Contamination

Vehicle/machinery and equipment operation, maintenance and refueling will be carried out in such a fashion that spillage of fuels and lubricants does not contaminate the ground. Oil interceptors will be provided within the construction camps. All spills and collected petroleum products will be disposed off in accordance with Ministry of Environment, Forest and Climate Change (MoEF&CC) and Andhra Pradesh Pollution Control Board (APPCB) guidelines.

5.11 Safety Practices during Construction Phase

The Contractor is required to comply with all the precautions as required for the safety of the workers. The contractor will supply all necessary safety appliances such as safety goggles, helmets, masks, etc., to the workers and staff. Contractor shall follow all relevant provisions of the Factories Act, 1948. Construction camps will not be set up within 1000 m or sufficiently away from nearest habitation and away from the water bodies.

5.12 Disposal of Construction Waste

Debris generated from pile driving or other construction activities shall be disposed off in systematic manner such that it does not flow into the marine water or form mud puddles in the area. The contractor as per regulations in force shall identify dumping sites.

5.13 Awareness Campaigns

An awareness campaign needs to be conducted for various fishermen. This campaign could comprise of:

- Inter-personal communication
- Use of video and slide shows
- Deployment of posters, videos, stickers and signboards
- Organizing group activities.

5.14 Traffic Management

The following measures are recommended as a part of Traffic Management Plan.

- Local villagers within the Mandal will be informed about the construction schedule.
- Traffic management with diversion through alternate routes will be implemented by providing adequate sign boards.
- Upon project completion, quick clearance of debris, etc. will facilitate access by customers to local business and residents to their households
- Placement of traffic staff to facilitate easy of movement.

5.15 Decontamination of Containers

All usable containers will be cleaned with disinfectant and rinsed with water before completely being dried and reused. All vats and containers unsuitable for re-use will be sold to the local recyclers.

5.16 Odour Management

A number of systems and indigenous low-cost methods are applied to reduce the impact of typical odour from fishing harbour areas. These technologies includes Odour neutralising agents, windbreak walls, Air scrubber, Bio filter, Short, Active oxygen, Ozone treatment, etc.

5.17 First-aid posts

It is proposed to maintain one first-aid post manned by a qualified doctor and support staff during construction phase. The first-aid post will have all emergency medicines and appliances required for meeting emergencies arising during construction as well as a stand-by ambulance. The activities of this centre will include coordinating local vector control programmes / campaigns.

5.18 Social Upliftment of the Fishermen Community

The social upliftment of the local habitations and villages will include village roads, community halls, bus shelters, footpaths, distribution of free medicine, etc.

5.19 Energy Conservation Measures

Energy conservation measures would be implemented to ensure that the use of non-renewable resources is minimised. A key component of achieving energy conservation would be the development of an Energy Management Action Plan.

6. PROJECT BENEFITS

There will be no removal of vegetative cover including mangroves. No endangered floral or faunal species are in the project site. The benefits to accrue due to the project are (i) Upgradation and improvement of the existing infrastructure of the harbour and creating physical conditions conducive to fishing activities in scientific manner (ii) Improvement over the present environmental condition of the harbour. (iii) Improvement in social services (iii) employment generation and (iv) overall development in economy and improved quality of life of the local population.

7. RISK ANALYSIS AND DISASTER MANAGEMENT PLAN

Disaster Management planning is an integral and essential part of loss prevention strategy. Disasters are intimately linked with sustainable development and that sustainable development and DRR (Disaster Risk Reduction) are mutually supportive goals. For the fishery project at Machilipatnam, the types of hazards and disaster agents have been broadly grouped into four generic categories as (i) Water and Climate related (ii) Geology / Geomorphology related (iii) Chemical, Industrial and Accident related and (iv) Epidemic related. The potential hazards which can lead to disasters resulting in loss of life, damage to property and environment have been identified.

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. However, there still remains small possibilities that disaster may occur. This Disaster Management Plan also sets out the procedures and measures to be taken into account in the event of loss of containment and consequence thereof in the fishery harbor at Machilipatnam .

The main objectives of the Disaster Management Plan would be as follows :

- Ensure that loss of life and human injuries are minimized
- Damage to environment and physical assets is minimized
- Relief, rehabilitation and disaster response is prompt and effective
- Minimize the outage duration of the facilities.

The details of DMP including likely emergencies, communication systems, medical services, early warning systems etc. have been discussed in detail in the Rapid EIA report.

Mitigation methods and preparedness contribute largely in reducing risks and related impacts.

An appropriate response mechanism / Disaster Management Plan in coordination with the District Disaster Management Authority (DDMA), Krishna, which is the nodal authority for planning, coordinating and implementing disaster management activities will be in place. The DDMA headed by the District Collector (Krishna) has developed an institutional mechanism which includes a District Disaster Management Action Plan (DDMAP). In line with this and as part of the disaster risk reduction strategy the harbour authority / project proponent should set up a Disaster Management Cell (DMC) with a small team trained in relief and rescue operations required for the anticipated emergencies. Programmes in association with the Village Panchayats of all the adjoining villages around Machilipatnam, local NGOs, District authorities and the Indian Coast Guard / Coastal police, which should include disaster mitigation measures, social mobilization and capacity building should be undertaken.

Health, Safety and Environment (HSE)

Health, Safety and Environment (HSE) management system is an effective means of ensuring that proper attention is paid to the health and safety of individuals working in the project site as well as the protection of the environment from the environmental impacts associated with construction activities. While outsourcing any project activity either for construction or

repairs, the project proponent should ensure that all activities are covered under an overarching formal HSE Management system. The system shall be well documented with HSE Manual with clearly laid out aims and objectives of the HSE Policy.

8. ENVIRONMENTAL MONITORING PROGRAMME

Environmental monitoring is the major component for understanding the sustainability parameters of any development activity. Monitoring evaluates the efficacy of the mitigation measures proposed in the EMP, evaluates the adequacy of the EIA, suggests improvements in the EMP, if required, enhances the overall environmental quality and complies with the statutory, social and community obligations.

The summary of the Environmental Monitoring Programme including the parameters to be monitored and frequency of monitoring is presented below.

Monitoring during the Construction phase will be as follows.

1. Marine Water :

Physico-chemical parameters (4 sites) : pH, Salinity, EC, TDS, Turbidity, Phosphates, Nitrates, Sulphates, Chlorides. Frequency: Quarterly .

Biological Parameters (4 sites): Light penetration, Chlorophyll, Primary productivity, Phytoplanktons, Zooplanktons. Frequency: Yearly

2. Sediments

Physico-chemical parameters (4 sites) : Texture, pH, Sodium, Potassium, Phosphate, Chlorides, Sulphates. Frequency : Quarterly

Biological Parameters (4 sites): Benthic Meio-fauna, Benthic Macro-fauna. Frequency : Yearly

3. Ambient Air Quality

AAQ Parameters (Construction site) : PM_{10}, $PM_{2.5}$, SO_2 and NO_2.. Frequency : Twice a week during pre and post monsoons and winter

4. Ambient Noise Quality (Construction sites) : Equivalent noise level. Frequency : Peak construction activity. For DG Set : The parameters to be monitored once a month at the DG installation site are PM_{10}, SO_2, NO_2 and CO.

Monitoring during the Operation phase will be as follows.

1. Marine Water :

Physico-chemical parameters (4 sites) : pH, Salinity, EC, TDS, Turbidity, Phosphates, Nitrates, Sulphates, Chlorides. Frequency : Quarterly .

Biological Parameters (4 sites) : Light penetration, Chlorophyll, Primary productivity, Phytoplankton, Zooplankton. Frequency : Yearly

2. Sediments

Physico-chemical parameters (4 sites) : Texture, pH, Sodium, Potassium, Phosphate, Chlorides, Sulphates. Frequency : Quarterly

Biological Parameters (4 sites) : Benthic Meio-fauna, Benthic macro-fauna. Frequency : Yearly

3. Ambient Air Quality

AAQ Parameters (Harbour complex) : PM_{10}, $PM_{2.5}$, SO_2 and NO_2.. Frequency : Twice a week during pre, post monsoon and winter

4. Ambient Noise Quality (Harbour complex) : Equivalent noise level. Frequency : Peak period / activity.

5. Green Belt : Once a month monitoring the survival and growth of the species planted

Environment Monitoring Cell

For effective implementation of the suggested environmental safeguards the project proponent shall set up a separate Environmental Monitoring Cell. The overall responsibility of the Environment Monitoring Cell (EMC) will vest with the Asst. Director of Fisheries (ADF), Marine of the concerned district who will coordinate closely with the Fishermen Societies as well as with the State Pollution Control Board. The post-project compliance requirements as may be stipulated by SEIAA / APPCB shall also be monitored by the aforesaid incumbent.

Monitoring Agency

For monitoring of water and sediments, the State Institute of Fisheries Technology (SIFT), Kakinada may be involved. Assistance from reputed external agencies accredited by NABL / recognized by MoEF, Govt. of India which has knowledge of the local environmental and ecological conditions may be taken. Periodic monitoring of the creek mouth and around the training wall is suggested to review the status of geomorphic changes over time. For this purpose IIT, Madras or CWPRS, Pune may be associated.

Cost for Environment Management and Environmental Monitoring :

The cost of the suggested Environment Management Plan (EMP) has been estimated at Rs. 186.00 lakh. The cost of Environmental Monitoring Programme for Construction phase has been estimated at Rs. 60.00 lakh and for Operation phase at Rs. 24.00 lakh per year.

9. SUMMARY AND CONCLUSION

The EIA study for the proposed project indicates that the project after implementation will have no major negative impacts on its environment. A number of measures have been prescribed as part of EMP to mitigate such impacts and restrict them within tolerable limits for all the three phases viz. pre-construction, construction and operation. The project site covers the existing fishing harbour and its adjoining areas falls within CRZ-IA (50m Buffer from mangroves), CRZ-IB, CRZ-III, CRZ-IVA and IVB. The project area has sporadic patches of degraded mangroves, though not diversified, in the adjoining creek and falls within the 50 m buffer zone for the mangroves. The site is neither declared as critically polluted not part of migratory corridor of any endangered faunal species and does not constitute the breeding or nesting grounds of any endangered species.

Apart from facilitating smooth movement of larger mechanized fishing vessels which in turn will lead to higher landings leading to overall economic growth, the project will greatly benefit in the overall socio-economic uplift of the local population whose livelihoods depend on fishing activities. The spin-off benefits likely to accrue from the incremental activities involving both fresh and dry fish will not only help in securing and sustaining the livelihoods of a large number of poor fishermen but will also help generate direct and indirect economic options.