National Cyclone Risk Mitigation Project

Tandahar Singarpala Saline Embankments

Limited EIA & EMP REPORT

April 2013
TABLE OF CONTENTS

1.0 Introduction, & Project Background ................................................................. 1 to 6
  1.1 Introduction ........................................................................................................ 1
  1.2 Project Background ............................................................................................ 2
  1.3 Need of the Project ............................................................................................. 4
  1.4 Benefits of the Project ......................................................................................... 5
  1.5 Structure of the Report ....................................................................................... 5

2.0 Project Description .................................................................................................... 7 to 14
  2.1 Project Location ..................................................................................................... 7
  2.2 Topographical Features ....................................................................................... 8
  2.3 Groundwater Scenario ......................................................................................... 8
  2.4 Project Appreciation ............................................................................................ 9
  2.5 Proposed Development ....................................................................................... 10
  2.6 Design Criteria & Material Requirement ............................................................ 12
  2.7 Cost Estimate ...................................................................................................... 12
  2.8 Benefit Cost Ratio & I.R.R. ................................................................................. 12
  2.9 Risk Factor ........................................................................................................... 13
  2.10 Management and Maintenance ......................................................................... 13
  2.11 Quality Control and Monitoring Strategy ......................................................... 13
  2.12 Summary of Salient Features ............................................................................ 14

3.0 Policy, Legal and Administrative Framework ......................................................... 15 to 24
  3.1 Environmental Regulations & Legal Framework ................................................. 15
    3.1.1 Environment (protection) act, 1986 .............................................................. 15
    3.1.2 Environment (Protection) Rules, 1986 ....................................................... 15
    3.1.3 EIA Notification, 2006 .............................................................................. 15
    3.1.4 Coastal Regulation Zone Notification (CRZ), 2011 ..................................... 16
    3.1.5 Forest (Conservation) Act, 1980 and its amendment ................................. 17
    3.1.6 Wildlife Protection Act, 1972 ................................................................. 18
    3.1.7 Biodiversity Act, 2002 ............................................................................. 18
    3.1.8 The Water (Prevention and Control of Pollution) Act and Rules, 1974-1975... 18
    3.1.10 Ancient Monuments and Archaeological Sites and Remains Act, 1958.......................................................................................................................... 19
    3.1.11 The Land Acquisition Act (LA) of 1894 .................................................... 19
3.1.12 National Rehabilitation and Resettlement Policy, 2007 ........................................ 19
3.2 World Bank Policies ........................................................................................................ 20
  3.2.1 Environmental Assessment (OP/BP 4.01) ................................................................. 20
  3.2.2 Involuntary Resettlement (OP/BP 4.12) .................................................................... 20
  3.2.3 Indigenous Peoples (OP/BP 4.10) ............................................................................. 21
  3.2.4 Cultural Property (OP/BP 4.11) ................................................................................ 21
  3.2.5 Natural Habitat (OP 4.04) ....................................................................................... 21
3.3 Applicability of Environmental Regulations .................................................................... 22
3.4 Applicability of World Bank Safeguard Policies ................................................................ 24

4.0 Baseline Environmental Setup ....................................................................................... 25 to 33
  4.1 Introduction ..................................................................................................................... 25
  4.2 Physiography ..................................................................................................................... 25
  4.3 Seismicity ........................................................................................................................... 25
  4.4 Climate and Rainfall ......................................................................................................... 26
  4.5 Groundwater ..................................................................................................................... 26
  4.6 Soil Type and Land Use Pattern ..................................................................................... 27
  4.7 Flora ................................................................................................................................ 28
    4.7.1 Coastal Vegetation ...................................................................................................... 28
  4.8 Ecologically Sensitive Areas .......................................................................................... 29
  4.9 Archaeological Sites ........................................................................................................ 29
  4.10 Natural Calamities ......................................................................................................... 29
    4.10.1 Cyclones .................................................................................................................... 29
    4.10.2 Floods ....................................................................................................................... 30
  4.11 Profile of Project Affected Persons ............................................................................... 30
  4.13 Screening Outcome ....................................................................................................... 33

5.0 Public Consultation .......................................................................................................... 34 to 36
  5.1 Introduction ..................................................................................................................... 34
  5.2 Minutes of Public Consultation Meeting ....................................................................... 34

6.0 Analysis of Alternatives .................................................................................................... 37 to 39
7.0 Environmental Impacts & Mitigation Measures ........................................... 40 to 52
  7.1 Introduction ........................................................................................................ 40
  7.2 Topography & Geology ...................................................................................... 40
    7.2.1 Borrow Area ................................................................................................. 41
    7.2.2 Quarry Area .................................................................................................... 42
  7.3 Soil ....................................................................................................................... 42
  7.4 Land Use ............................................................................................................... 43
  7.5 Drainage ............................................................................................................... 44
  7.6 Water Use ............................................................................................................ 44
  7.7 Water Quality ...................................................................................................... 45
  7.8 Air Quality ........................................................................................................... 45
  7.9 Noise Level .......................................................................................................... 47
  7.10 Flora & Fauna .................................................................................................... 47
  7.11 Solid Waste ....................................................................................................... 48
  7.12 Construction Camp ........................................................................................... 48
  7.13 Occupational Health & Safety ........................................................................ 49
  7.14 Social Impact Assessment ................................................................................ 50
  7.15 Employment & Trading Opportunities ............................................................. 51
  7.16 Conclusion ......................................................................................................... 52

8.0 Environmental Management Plan ................................................................. 53 to 115
  8.1 Introduction ......................................................................................................... 53
  8.2 Stage Wise Environmental Management Measures ............................................. 53
    8.2.1 Pre-construction Stage ................................................................................... 53
    8.2.2 Construction Stage ......................................................................................... 59
    8.2.3 Operation Stage .............................................................................................. 73
  8.3 Greenbelt Development Plan ............................................................................. 74
    8.3.1 Objectives & General Guidelines ................................................................ 74
    8.3.2 Greening Strategy ......................................................................................... 74
    8.3.3 Species Suggested for Plantation ................................................................. 74
    8.3.4 Technical Specification for Plantation ......................................................... 76
    8.3.5 Number of Trees/Shrubs Planted ................................................................. 76
    8.3.6 Protection Measures ...................................................................................... 76
    8.3.7 Precautionary Measures ............................................................................... 76
    8.3.8 Budget for Greenbelt Development ............................................................ 77
  8.4 Environmental Monitoring Program ................................................................. 78
    8.4.1 Monitoring Location & Parameters ............................................................... 78
8.4.2 Environmental Monitoring Budget .......................................................... 79
8.5 Institutional Arrangements ........................................................................... 79
  8.5.1 Project Management Unit ...................................................................... 80
  8.5.1.1 PMU’S Environmental Experts - Roles & Responsibilities .......... 80
  8.5.1.2 Qualification and Experience (Environment Expert) ............... 81
8.5.2 Project Implementation Unit ................................................................. 81
  8.5.2.1 PIU’S Environment Specialists – Roles & Responsibilities .......... 81
  8.5.2.2 Qualification and Experience ......................................................... 82
  8.5.2.3 Line Department ........................................................................ 82
  8.5.2.4 Third Party Auditors ..................................................................... 82
  8.5.2.5 Project Monitoring and Reporting .............................................. 83
8.6 Environmental Budget ............................................................................... 84
8.7 Borrow Area Management Plan ............................................................... 85
8.8 Quarry Area Management Plan ................................................................. 90
8.9 Soil Erosion and Sedimentation Control ................................................... 94
8.10 Waste Disposal Site Management ........................................................... 96
8.11 Worker’s Safety in Common Operations during Construction ................. 98
8.12 Guidelines for Site Selection, Layout Plan and Basic Amenities at Construction Camp/S ........................................................ 103
8.13 Guidelines for Plantation and Grass Turfing ......................................... 108
LIST OF TABLES

Table 4.1  Ground Water Resources of Kendrapara District
Table 4.2  Pattern of Occurrence of Saline Aquifers in Kendrapara District
Table 4.3  Soil Type & Land Use Pattern (within 10 Km radius) of Embankment
Table 4.4  List of Trees to be felled
Table 4.5  Educational Level of PAPs
Table 4.6  Occupational Profile of Head of Household
Table 4.7  Summary of Screening outcome
Table 4.1  Analysis of Alternative
Table 7.1  List of Trees to be felled for Strengthening of Embankment
Table 8.1  Species Suggested for Plantation
Table 8.2  Budget for Greenbelt Development
Table 8.3  Environmental Monitoring Programme during Construction Period
Table 8.4  Environmental Monitoring Budget
Table 8.5  Detail Environmental Budget

LIST OF ANNEXES

Annex 5.1  Copy of Gram Sabha Resolution
Annex 8.1  Forms for Environmental Management Plan
**LIST OF ABBREVIATION**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASI</td>
<td>Archaeological Survey of India</td>
</tr>
<tr>
<td>BP</td>
<td>Bank Policy</td>
</tr>
<tr>
<td>CD</td>
<td>Cross Drainage</td>
</tr>
<tr>
<td>CES</td>
<td>Consulting Engineering Services</td>
</tr>
<tr>
<td>CITES</td>
<td>Convention of International Trade on Wildlife Flora and Fauna</td>
</tr>
<tr>
<td>CoI</td>
<td>Corridor of Impacts</td>
</tr>
<tr>
<td>CPCB</td>
<td>Central Pollution Control Board</td>
</tr>
<tr>
<td>CRZ</td>
<td>Coastal Regulation zone</td>
</tr>
<tr>
<td>DPR</td>
<td>Detail Project Report</td>
</tr>
<tr>
<td>EA</td>
<td>Environmental Assessment</td>
</tr>
<tr>
<td>EAC</td>
<td>Expert Appraisal Committee</td>
</tr>
<tr>
<td>EC</td>
<td>Environmental Clearance</td>
</tr>
<tr>
<td>EIA</td>
<td>Environmental Impact Assessment</td>
</tr>
<tr>
<td>EMP</td>
<td>Environmental Management Plan</td>
</tr>
<tr>
<td>ESMF</td>
<td>Environmental and Social Management Framework</td>
</tr>
<tr>
<td>FLC</td>
<td>Fish Landing Centre</td>
</tr>
<tr>
<td>GoI</td>
<td>Government of India</td>
</tr>
<tr>
<td>GPS</td>
<td>Global Positioning System</td>
</tr>
<tr>
<td>HTL</td>
<td>High Tide Line</td>
</tr>
<tr>
<td>IIT</td>
<td>Institute of Technology</td>
</tr>
<tr>
<td>IRC</td>
<td>Indian Road Congress</td>
</tr>
<tr>
<td>IRC</td>
<td>Indian Roads Congress</td>
</tr>
<tr>
<td>IRR</td>
<td>Internal Rate of Return</td>
</tr>
<tr>
<td>IS Codes</td>
<td>Indian Standard Codes</td>
</tr>
<tr>
<td>LA</td>
<td>Land Acquisition</td>
</tr>
<tr>
<td>LTL</td>
<td>Low Tide Line</td>
</tr>
<tr>
<td>MCS</td>
<td>Multipurpose Cyclone Shelters</td>
</tr>
<tr>
<td>MOEF</td>
<td>Ministry of Environment &amp; Forest</td>
</tr>
<tr>
<td>NAAQS</td>
<td>National Ambient Air Quality Standards</td>
</tr>
<tr>
<td>NCCBM</td>
<td>National Institute of Cement Concrete Building Materials</td>
</tr>
<tr>
<td>NCRMP</td>
<td>National Cyclone Risk Mitigation Project</td>
</tr>
<tr>
<td>Acronym</td>
<td>Full Form</td>
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<tr>
<td>---------</td>
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</tr>
<tr>
<td>NDMA</td>
<td>National Disaster Management Authority</td>
</tr>
<tr>
<td>OBC</td>
<td>Other Backward Class</td>
</tr>
<tr>
<td>OP</td>
<td>Operational Policy</td>
</tr>
<tr>
<td>ORSAC</td>
<td>Orissa Remote Sensing Application Centre</td>
</tr>
<tr>
<td>OSDMA</td>
<td>Orissa State Disaster Management Authority</td>
</tr>
<tr>
<td>PAP</td>
<td>Project Affected Persons</td>
</tr>
<tr>
<td>PCM</td>
<td>Public Consultation Meeting</td>
</tr>
<tr>
<td>PF</td>
<td>Protected Forest</td>
</tr>
<tr>
<td>PIA</td>
<td>Project Influence Area</td>
</tr>
<tr>
<td>QMC</td>
<td>Quality Monitoring Consultants</td>
</tr>
<tr>
<td>RAP</td>
<td>Resettlement Action Plan</td>
</tr>
<tr>
<td>RF</td>
<td>Reserved Forest</td>
</tr>
<tr>
<td>RFP</td>
<td>Request for Proposal</td>
</tr>
<tr>
<td>RI</td>
<td>Revenue Inspector</td>
</tr>
<tr>
<td>RoW</td>
<td>Right of Way</td>
</tr>
<tr>
<td>SC</td>
<td>Scheduled Castes</td>
</tr>
<tr>
<td>SEAC</td>
<td>State Expert Appraisal Committee</td>
</tr>
<tr>
<td>ST</td>
<td>Scheduled Tribes</td>
</tr>
<tr>
<td>TOR</td>
<td>Terms of Reference</td>
</tr>
<tr>
<td>TOR</td>
<td>Terms of Reference</td>
</tr>
<tr>
<td>WRD</td>
<td>Water Resource Department</td>
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</tbody>
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CHAPTER-1
INTRODUCTION, & PROJECT BACKGROUND

1.1 INTRODUCTION

The State of Orissa is one of the thirteen cyclone prone States in the country which are vulnerable to the destructive impacts of cyclones. The coastal districts of Orissa are prone to frequent cyclonic storms and concurrent flood hazards causing considerable loss of human lives, domestic animals, agriculture and other properties. The worst disaster of 20th century hit the coastal Orissa in the form of super cyclone on 29th & 30th October 1999 inflicting severe damages in 14 districts of the State. Thousands of lives perished due to non-availability of protected shelters, particularly in the areas prone to storm surge. In the after month of the super cyclone, the State Government decided to build elevated structures, which can withstand very high wind speeds and protect human and animal lives from flooding and saline inundation.

The Ministry of Home Affairs, Government of India drew up the National Cyclone Risk Mitigation Project (NCRMP) with a view to reducing the vulnerability of the coastal areas to cyclones. This project was later transferred to the National Disaster Management Authority (NDMA) with assistance from the World Bank. In this context, the Orissa State Disaster Management Authority (OSDMA) has submitted Investment Proposal (IP) to NDMA. The Investment proposal for the State of Orissa under NCRMP included three major sub-components namely:

- Construction of 149 multipurpose cyclone shelters (MCS) including 19 for fishermen (FLCs) and 6 shelter cum godowns
- Connectivity to proposed and existing cyclone shelters
- Raising and strengthening of saline embankments- 157.57 km in 23 packages

Initial investigation revealed that among the three sub-components, 50 multipurpose cyclone shelters and 157.57 km saline embankments are located in Coastal Regulation Zone. Finally it has been decided to take up 61.442 km saline embankment (10 packages) under this project.

The Water Resources Department (WRD), Government of Orissa would be executing the saline embankments sub-project (10 No. measuring 61.442 km) under National Cyclone Risk Mitigation Project (NCRMP) spread in six Districts namely, Balasore,
Bhadrapur, Kendrapara, Jagatsinghpur, Puri & Ganjam. The investment program covers raising the height and widening the base of existing embankments, strengthening the existing embankments, modifying alignment wherever required and also laying the top of the embankment with suitable materials. The proposed works under the project is likely to be taken up with World Bank assistance. The World Bank has agreed to support the project provided the implementation conforms to environmental and social safeguard policies of the World Bank and the legal framework of the country.

OSDMA has engaged Consulting Engineering Services (India) Private Limited, New Delhi to carryout environmental and social screening including preparation of Environmental & Social Management Plan in accordance with the Environmental and Social Management Framework (ESMF) developed for this project; to conduct Public Consultation Meeting for all the sub-components and preparation of documents for CRZ Clearance and any other clearance, if required. The study has been carried out as per Environmental and Social Safeguard Policies of the World Bank, as well as, the relevant Notifications/Acts/Guidelines of the Central and State Government.

To meet the World Bank requirement, Environmental Impact Assessment has been prepared based on the Detailed Project Report prepared for the Proposed Raising and Strengthening of Tandahar Singarpal Saline Embankment in the Astaranga Block under Puri district.

1.2 PROJECT BACKGROUND

The Orissa coast (480 Km long) extends from Talsari (8 km south of Digha in the North) to Sonepur (12 km away from Behrampur towards South), forms a part of east coast on India and is prone to multiple hazards. The coastal territory is drained by a number of rivers like Mahanadi, Brahmani, Baitarani, Devi, Budhabalanga, Subarnarekha, Rushikulya and some other smaller ones. These rivers carry a large volume of sediments which have formed the huge single delta. The shoreline of Balasore & Bhadrak districts are a narrow strip of 4-8 km in breadth interrupted by estuaries and sand beaches. Kendrapara district shoreline is mainly covered by the typical mangrove vegetation. In Jagatsinghpur & Puri districts, the coastal strip is broken up by innumerable creeks & big estuaries influenced by Mahanadi & Devi rivers. The Ganjam coast is also interrupted by Rushikulya river. Hence Orissa coast is under uninterrupted influence of fresh water flow and delta building process.
The coastline is in general oblique to the global wind system which generates strong littoral current and represents one of the world’s largest littoral drift areas, with 1 million m$^3$ of drift at Paradip. The average spring tide in the Orissa coast varies from 1 m to 4 m. The average significant wave height is within 2 m. In the northern Orissa coast i.e. north of Dhamra coast, the tidal range increases and wave energy diminishes resulting in formation of mudflats. The brackish water coastal lagoon i.e. Chilika lagoon may have formed through coastal submergence mechanism followed by coastal emergence. The other important features of Orissa coast are mangroves, estuaries and sand dunes.

The geographic location and physical environment of Orissa coast make it vulnerable to frequent cyclonic disturbances. The high wind speed together with torrential rain and storm surges associated with the cyclonic disturbances bring damages to the coastal settlements.

More than 80% of the geographical area of the State and nearly 90% of the population are vulnerable to one or more disasters. With more than 60% of the population living at or below the poverty line, the degree of their socio-economic vulnerability increases due to repeated exposure to disasters. Some severe calamities faced by the State are as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Calamity</th>
</tr>
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<tbody>
<tr>
<td>1994</td>
<td>Flood</td>
</tr>
<tr>
<td>1995</td>
<td>Flood &amp; Cyclone</td>
</tr>
<tr>
<td>1999</td>
<td>Super Cyclone</td>
</tr>
<tr>
<td>2001</td>
<td>Flood</td>
</tr>
<tr>
<td>2002</td>
<td>Flood</td>
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<tr>
<td>2003</td>
<td>Flood</td>
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<tr>
<td>2004</td>
<td>Flood</td>
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<tr>
<td>2005</td>
<td>Flood</td>
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<tr>
<td>2006</td>
<td>Flood</td>
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<tr>
<td>2007</td>
<td>Flood</td>
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<tr>
<td>2008</td>
<td>Flood</td>
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A severe cyclonic storm hit the coastal districts in general and Ganjam district in particular on 17$^{th}$ and 18$^{th}$ October 1999 causing widespread and unprecedented damages to the life and property of those districts. Within a span of 10 days, the State
was again hit by the most severe cyclone storm on 29th and 30th October, 1999 which ravaged all the coastal districts in general and Jagatsinghpur, Kendrapara, Cuttack, Khordha and Puri districts in particular. The devastation was so enormous that it was termed as **Super Cyclone**. The Super Cyclone was followed by torrential rains (447 mm to 955 mm rainfall) from 29th October to 1st November causing very high flood.

In the after month of the Super Cyclone, it was realized that death toll was high due to the adverse effect of the tidal surge and wave set up, apart from the back water of the flood, upstream of the outfall point, of the river mouth and sea and non-availability of safe shelter buildings in the coastal villages, which could have withstood the intensity of the cyclone and storm surge.

Hence, it is proposed to construct some Saline embankments and Multipurpose Cyclone Shelter (MCS) in the coastal districts, which can withstand very high wind speeds and flood water for protecting human and animal lives during disaster.

The locations of embankments are identified as per the recommendations of the committee, set up by Govt. of Orissa, the embankments are to be raised and strengthened in phases, to the recommended levels, depending upon land and fund availability.

### 1.3 NEED OF THE PROJECT

The existing saline embankment is very old and the existing profile is very low. It is an earthen embankment and got damaged by flood and erosion. It is being maintained by Water Resources Department, Government of Odisha time to time as per the requirement and availability of funds.

The proposed project would help to protect people, property, livestock and agricultural fields from saline water inundation. In the time of cyclonic gale these are of extreme importance to life and livelihood and help in sustainable agricultural production. Hence, there is a need to protect vulnerable areas by renovating the existing embankments. Implementation of this project will reduce variability of crop production and improve productivity in the coastal saline belts. Construction of Saline Embankment and coastal canals are required to stop saline ingress to coastal land.

Proper forecasting and other curative measures with proper Disaster Management program can mitigate the flood and cyclone to a great extent.
Hence, it is proposed to construct some Saline embankments in the coastal areas to withstand high wind speeds and flood water so that human and animal lives during disaster can be protected.

1.4 BENEFITS OF THE PROJECT

Area has a potential for maritime activity in addition to the betel gardening, fishery and allied activities. The raising and strengthening of these saline embankments will help prevent tidal surge from entering the coastal area. The embankments will also protect the area from river floods and sluices will help in evacuating the storm water from the cultivated fields. The benefits of the project are as follows:

- The protection to the agricultural lands from damage due to saline inundation.
- Saving of lives of the people in the locality by way of movement of rescue/relief and emergency aid.
- Provide a good communication facility on top of bank for marketing fish and betel product.

Raising and Strengthening of the *Tandahar Singarpal Saline Embankment*, overall socio-economic situation of the area will improve. Nearly 1,588 people of 8 villages of 2 gram Panchayats with geographical area of 2376.54 Acres will be benefited based on 2001 census data. The benefit cost ratio has been worked out to be 1.75 and Internal Rate of Return is worked out to be 0.68.

1.5 STRUCTURE OF THE REPORT

The structure of the Limited Environmental Impact Assessment (EIA) Report complete with necessary tables, drawings and annexes is as follows:

- Table of Content
- List of Abbreviation
- Chapter-1 : Introduction & Project Background
- Chapter-2 : Project Description
- Chapter-3 : Policy, Legal and Administrative Framework
- Chapter-4 : Baseline Environmental Setup
- Chapter-5 : Public Consultation
- Chapter-6 : Analysis of Alternatives
Chapter-7 : Environmental Impacts and Mitigation Measures
Chapter-8 : Environmental Management Plan
Annex-5.1 : Copy of Gram Sabha Resolution
Annex-8.1 : Forms of EMP
CHAPTER-2

PROJECT DESCRIPTION

2.1 PROJECT LOCATION

The Tandahar Singarpal Saline Embankment is one of the 10 embankments being taken under this project. This embankment comes under Jagatsinghpur Irrigation Division of Jagatsinghpur District. The area Tandahar Singarpala Saline Embankment for a length of 1.760 km from RD 0.00 km to RD: 1.760 km on right bank of river Kadua. The key plan presents the proposed portion for raising and strengthening of saline embankment for a length of 1.760 km.

Geographically, the proposal project area lies between latitudes of 19° 54’ 06” N to 19° 54’ 34” N and longitudes from 86° 12’ 59” E to 86° 13’ 23” E. This mostly covers the Block of Astarang in the district of Puri. This embankment is protecting 8 villages of 2 Gram Panchayats of Astarang block having an area of affected land of 2376.54 Acres (961.755 Ha) with population of 1,588 and household of 380 numbers. As far as topographic aspects are concerned, the area lies close to the Bay of Bengal, and river systems viz; Kaduanadi is the main drainage lines of the area.

Astarang block headquarter is 95 km away from district headquarter at Puri and 77 km from the Odisha state capital, Bhubaneswar. This embankment has a good communication as the project area is not only potential from future economic front but also culturally important, thus implementation of this project will make for the strides in all respects.

The climatic condition of the area is generally hot with high humidity during April and May & cold during December and January. The monsoon generally breaks during the month of June. The average annual normal rainfall is 1449.10 mm. In addition to monsoon rainfall, the area receives from cyclonic storms substantially. The average temperature varies from a minimum of 11.6°C to a maximum of 35.6°C. The variation of wind speed is spectacular which assumed as high as 350 km/ hour during the Super Cyclone of 1999.

2.2 TOPOGRAPHICAL FEATURES

Rivers viz; Kaduanadi and the Bay of Bengal do characterize the prominent topographic
features of the location. In the proposed project area, the general elevation of land varies from 1.00 m (R.L.) to 2.00 m (R.L.) Toposheet number E45 C5 (74 I/5) covers the area. Flood plains, river banks, and the coastal stretch are the topographic features of the area.

The Bay of Bengal is on an average 1.00 km away from the project site. From the history of natural disasters visiting this area it is observed that floods and tidal surge have played significantly. Most of the topographic features are the result of the recent geologic activity i.e., alluvial deposits, estuarine activities and fluvial and aeolian influences.

2.3 GROUNDWATER SCENARIO

The thick sedimentary pile in the coastal track contains extensive aquifer zones with vast development possibilities, despite constraints of salinity hazards. This calls for a strategy of balanced groundwater development without dislocating hydrodynamic or hydrochemical balance, which may lead to sea water ingress in coastal aquifer and also declining trend of ground water level due to over-exploitation. Similarly optimal development of groundwater conjunctively with surface water will ameliorate the water logging situations in canal commands, induce multiple cropping, increase irrigation intensity and agriculture production. Thus the long term exploitation of ground water resources requires an in-depth understanding of the aquifer distribution and characteristics under varied hydro geomorphic and hydro geological condition in the state.

(Source: Hydrogeological Atlas of Odisha, Govt. of India, Central Ground Water Board, MOWR, South Eastern Region, BBSR 1995)

2.4 PROJECT APPRECIATION

This project envisaging raising and strengthening of 1.760 km stretch of the coastal habitation along the existing drainage system with the proposal for construction of 2 numbers of sluices is a bold step to protect the interest of the coastal habitats in Astarang Blocks of Puri District, which is frequently visited by cyclonic
storm imparting consequent loss of life and property. From the detailed investigation and survey conducted at site on various aspects, the following are the noteworthy points:

i) The existing embankments in the project area are incapable to protect the coastal habitation from the wrath and fury of the devastating agencies, especially cyclonic storm and tidal surges.

ii) With the modern methodology and scientifically assessed parameters the design standards can be improved to accommodate uncertainties with acceptable risk and economy.

iii) After implementation of the project the entire project area comprising 8 numbers of villages will come under better and improved communication system, thereby facilitating the administration to reach affected people during emergency for smooth for evacuation and rescue operation.

iv) The problem like water logging, saline intrusion can be kept at bay. This will certainly enhance the productivity at the crop land directly and boost the economic standards of the farming community.

v) The project will carve a niche especially for the weaker sections (SC / ST & OBC) of the society who can avail a secured occupational output from age – old practices like fishing, farming, cottage industries etc. by improved access to the market places, service centers and knowledge centers, besides many other downstream indirect benefits.

vi) Besides socio – economic benefits, the project will attract ecological and environmental friendliness due to segregation of undue influence & ingress of the devastating agencies with minimal amplitude both on floral and faunal front. This will provide a better recipe for the fresh water resources of the area due to reduction of influence of saline water on the land side. Once the embankments are improved the influence of tidal surges can be minimized, saline ingress will be discouraged - there by the drinking water problem of the locality will be solved markedly.
Thus in a nutshell, it is in fitness of the things to say that this project is in the nick of the
time. Given the location of the area and number of people inhabiting it, the work for
raising and strengthening of the embankments with sluices is a sine qua none. It will
minimize the effect on loss of life and property of the inhabitants. The benefits to the
locality will be manifold directly and indirectly in socio-economic front. This will also
boost better administration, surveillance, education, health, sanitation, drainage,
agriculture and many more.

2.5 PROPOSED DEVELOPMENT

As shown in key plan, the proposed work envisages raising and strengthening of the
existing saline embankments from RD: 0.00km to RD: 1.760 km along with construction
of 2 numbers of sluices and launching aprons at vulnerable portion of the saline
embankment have been designed for a top RL of 5.20 m with a free board of 1.2 m. As
the height of embankment at some portion is more than 4.00 m, the stability of the slopes
has been analyzed for multiple design consideration based on the relevant clause of the
agreement & it is recommended that the slope should be 2 H : 1 V with the specified
material & quality requirement that has been assessed based on site investigation and
laboratory testing.

Though a free board of 0.6 m was in practice since long, the myth of 1999 Super
Cyclone has topsy-turvyied the entire episode by raising the surge height more than 7 m
along the coastal Odisha. But given the limitation of fund, economic consideration
acceptable range of risk and the return period of such events, a free board of 1.2 m is a
most acceptable figure for design, which is higher than the usual practice of 0.6 m but
less than the highest historic event. It is sobering to keep in mind that the historically
observed highest value may not be highest for all times to come because of stochastic
nature of the variants.

In addition to the above hydrometeorologic, it is also held that the exposure condition
should be taken as severe for structural design of sluices, slope protection measures are
to be ensured to prevent gullies and washouts.

The work also requires extra land in patches for raising & strengthening embankment as
shown in land requirement proposals submitted with this report.

**Road Carriage Way:** The Carriage way has been fixed for this embankment is 3.66 m.
of 20 mm premix carpet over Moorum and Sand admixture sub-base of 150 mm thick.
**Turning Circle:** The Turning Circles have been provided at interval of approximately 500 m. with top width 6.00 m. to facilitate the movement of double lane traffic which will be accommodated during strengthening of embankment with total of 6.00 m. road width all along the embankment for a length of 6.660 km. in future.

**Slope Protection Work:** In order to protect embankment from erosion, seaside/river side slope is proposed to be provided by Granite stone revetment with rock toe and graded filter material of approved quality and dub grass will be provided on the land ward side slope of the embankment.

**Sluice Gates:** As mentioned earlier, 2 numbers of sluice gates have been considered in the project in addition to the raising and strengthening of the saline embankment.

Following type of sluice gates has been considered:

a) Hume Pipe

These are provided based on the discharge worked out in accordance with the catchment area and will meet the requirement. A provision of 5 nos. of Sluice across the embankment has been provided with the following category:

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>R.D. in m.</th>
<th>Category of Sluice</th>
<th>Discharge in Cum</th>
<th>Ventage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>579</td>
<td>Hume Pipe</td>
<td>8.3</td>
<td>Dia of 1.2 m.</td>
</tr>
<tr>
<td>2</td>
<td>1290</td>
<td>Hume Pipe</td>
<td>11.6</td>
<td>Dia. of 1.6 m.</td>
</tr>
</tbody>
</table>

Source: DPR

**2.6 DESIGN CRITERIA & MATERIAL REQUIREMENT**

The reinforcement cover of foundations, sub-structure of sluices etc. will be provided as per IRC:SP:33 and for steel structures IS:800 will be followed. Corrosion Resistant steel reinforcement will be used.

The materials used and construction methodology will be adopted in conformity with relevant BIS specifications, CWPC practices and Orissa Water Resources Department Practices. Raw material requirement for the proposed development is tabulated below:

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Item</th>
<th>Quantity</th>
<th>Mode of Transportation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Earth</td>
<td>89,804 cum</td>
<td>By Truck, tipper on road net work</td>
</tr>
<tr>
<td>2</td>
<td>Sand</td>
<td>7,978 MT</td>
<td>By Truck, tipper on road net work</td>
</tr>
<tr>
<td>3</td>
<td>Steel</td>
<td>55.00 MT</td>
<td>By Truck, tipper on road net work</td>
</tr>
<tr>
<td>4</td>
<td>HG stone</td>
<td>48,651 MT</td>
<td>By Truck, tipper on road net work</td>
</tr>
<tr>
<td>5</td>
<td>Chips</td>
<td>6,750 MT</td>
<td>By Truck, tipper on road net work</td>
</tr>
<tr>
<td>6</td>
<td>Cement</td>
<td>-</td>
<td>By Truck, tipper on road net work</td>
</tr>
</tbody>
</table>

Source: DPR

**2.7 COST ESTIMATE**
The estimate amounting to Rs. **5,06,46,600.00** has been framed to meet the probable cost of expenditure for the following item of works.

i) Earthwork for Raising and strengthening of existing saline embankment from RD 0.00 km to 1.760 km with due compaction including hard granite packing on Sea/River side and Dub grass turfing on country side besides special slope protection works like Launching apron for a length of 510 m.

ii) Construction of 1 number of new sluices at RD: 1120 m and existing remodeling of old 1 no of sluices at RD: 579 m. Thus total no of sluice becomes 2 nos which have been proposed in the estimate.

iii) The estimate encompasses the provision for Premix Carpet road over Moorum Sand admixture sub-base IRC Grade-I metaling & IRC Grade III metalling having carriage way of 3.75 m to provide communication facilities benefiting 8 villages.

### 2.8 BENEFIT COST RATIO & I.R.R.

After implementation of the project, nearly 78,069 people of Astaranga Block will be benefited based on 2001 census data.

Benefit from the project has been assessed basing on the agriculture sector and embankment sector and the Internal Rate of Return (I.R.R.) has been mathematically calculated based on computer software. The results computed are given below.

**Benefit Cost Ratio (B.C. Ratio) = 1.75**  
**Internal Rate of Return (IRR) = 0.68**

### 2.9 RISK FACTOR

The renovation of embankments is being undertaken on the existing embankments. Thus no land acquisition problem will crop up in the proposed embankments which are renovated partially for the northern coastal area and fully for the northern coastal area and fully for the southern coastal area. However, unfavorable climate i.e. untimely rain may affect the work for days making the site unapproachable due to non-plying of the vehicles, but the gestation period of this risk being limited for a few days only; it can be safely borne with. Arrangement of construction materials including that of cement, MS rod, etc. is the responsibility of the executing agency and hence the situation of untimely supply of construction material will not arise. Proper co-operation and co-ordination of the local people with the executing agency/OSDMA/WR Dept. will be available since, the Project is implemented for the interest of the local beneficiaries.
2.10 MANAGEMENT AND MAINTENANCE

Management: The Water Resources Dept. of Govt. of Orissa can be made responsible for day to day management of all the construction packages, as WR Dept. is the owner and executing line department for saline embankment sector.

Maintenance:

(a) The embankments being the assets of WR Dept. are maintained by WR Dept., out of Annual State Budget (Non-plan) of WR Dept. Thus there is special budgetary provision for maintenance.
(b) As stated above, WR Dept. is to be entrusted with the maintenance and operation work of the assets created.

2.11 QUALITY CONTROL AND MONITORING STRATEGY

The quality control tests shall be done by the contractors at quality Control Laboratories of the department. Independent Quality Monitoring consultants (QMC) shall be engaged to monitor the quality control works. The QMC shall also conduct random sample field tests. The mobile quality control laboratory of the National Institute of Cement Concrete Building Materials, Ballavgarh (NCCBM) shall be engaged to carry out surprise and random sample tests as done for the cyclone reconstruction works. Department of Water Resources will monitor the progress and supervise the works of the quality monitoring consultants.

2.12 SUMMARY OF SALIENT FEATURES

<table>
<thead>
<tr>
<th>Name of Embankment</th>
<th>Tandahar Singarpala Saline Embankment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of Division</td>
<td>Nimapara Irrigation Division, Puri</td>
</tr>
<tr>
<td>Package No.</td>
<td>NCRMP – (O) – NMPD – (08)</td>
</tr>
<tr>
<td>Length of Embankment</td>
<td>1.760 km</td>
</tr>
<tr>
<td>No. of Sluices</td>
<td>2 nos.</td>
</tr>
<tr>
<td>HHTL Surge Level</td>
<td>4.00 m R.L.</td>
</tr>
<tr>
<td>L.T.L.</td>
<td>(-) 0.50 m R.L.</td>
</tr>
<tr>
<td>T.B.L.</td>
<td>5.20 m R.L.</td>
</tr>
<tr>
<td>Free Board</td>
<td>1.20 m</td>
</tr>
<tr>
<td>Top width</td>
<td>6.00 m</td>
</tr>
<tr>
<td>Road Formation Width</td>
<td>3.66 m</td>
</tr>
<tr>
<td>Side Slope</td>
<td>2 : 1</td>
</tr>
<tr>
<td>Turning Circles</td>
<td>2 nos. x 6.00 m. width</td>
</tr>
<tr>
<td>H.F.L. D/S</td>
<td>2.32m R.L.</td>
</tr>
</tbody>
</table>
- Turfing (Country Side) : from RD 0.00 to 1.760 km (on Country side)
- Granite Boulder packing : From RD 0.00 to 1.760 km (on Sea side – Full Length)

<table>
<thead>
<tr>
<th>Filter Material</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coarse Sand</td>
<td>0.10 m</td>
</tr>
<tr>
<td>6 mm Chips</td>
<td>0.05 m</td>
</tr>
<tr>
<td>20 mm Chips</td>
<td>0.05 m</td>
</tr>
</tbody>
</table>

- Cost of the Project : Rs. 5,06,46,600.00
- Benefit Cost Ratio : 1.75
- IRR : 0.68
CHAPTER-3

POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

This Chapter summarizes Policy, Legal and Administrative Framework with respect to the Environmental aspects.

3.1 ENVIRONMENTAL REGULATIONS & LEGAL FRAMEWORK

Government of India has prepared various National Policies, Acts, Rules to protect exploitation of natural resources and improve the environment and to safeguard forest and wildlife of the country. Brief description of applicable environmental regulations related to the proposed development is given below:

3.1.1 Environment (Protection) Act, 1986

The Environment (Protection) Act is the most comprehensive law on the subject. The law grants power to the Central Government to take all measures necessary to protect and improve the quality of environment and to prevent pollution of the environment. In terms of responsibilities, the Act and the associated Rules requires for obtaining environmental clearances for specific types of new/expansion projects (addressed under Environmental Impact Assessment Notification, 14th September 2006) and for submission of an environmental statement to the State Pollution Control Board annually.

3.1.2 Environment (Protection) Rules, 1986

These rules lay down the procedures for setting standards of emission or discharge of environmental pollutants. The rules prescribe the parameters for the Central Government, under which it can issue orders of prohibition and restrictions on the location and operation of industries in different areas. The Rules lay down the procedure for taking samples, serving notice, submitting samples for analysis and laboratory reports. The functions of the laboratories are also described under the Rules along with the qualifications of the concerned analyst.

3.1.3 EIA Notification, 2006

As per the Environmental Impact Assessment (EIA) Notification, 14th September 2006 and its amendment up to April 2011, new projects or activities require Prior Environmental Clearance. Projects have been grouped under Category ‘A’ requiring clearance from Expert Appraisal Committee (EAC) of MoEF, GoI and Category ‘B’ requiring clearance from the State Expert Appraisal Committee (SEAC). The concerned Committee (EAC or SEAC) will finalize the TOR on the basis of Form-1, proposed TOR & Pre-Feasibility/Feasibility Report. Environmental Impact Assessment study is to be
carried out as per the TOR provided by the Committee. Public Hearing is required for Category ‘A’ project.
List of projects requiring Prior Environmental Clearance is given in the “SCHEDULE” of EIA Notification.

3.1.4 Coastal Regulation Zone Notification (CRZ), 2011

Central Government have declared the coastal stretches of seas, bays, estuaries, creeks, rivers and back waters which are influenced by tidal action (in the landward side) up to 500m from the High Tide Line (HTL) and the land between the Low Tide Line (LTL) & High Tide Line (HTL) as “Coastal Regulation Zone” (CRZ), as per the provisions of the CRZ Notification 6th January 2011.

The main objectives of the Coastal Regulation Zone Notification, 2011 are:

- To ensure livelihood security to the fishing communities and other local communities living in the coastal areas;
- To conserve and protect coastal stretches and;
- To promote development in a sustainable manner based on scientific principles, taking into account the dangers of natural hazards in the coastal areas and sea level rise due to global warming.

For regulating development activities, the coastal stretches within 500 meters of High Tide Line on the landward side are classified into four categories, namely:

- **CRZ-I**: Areas that are ecologically sensitive and important, such as national parks / marine parks, sanctuaries, reserve forests, wildlife habitats, mangroves, corals / coral reefs, areas close to breeding and spawning grounds of fish and other marine life, areas of outstanding natural beauty / historically / heritage areas, areas rich in genetic diversity, areas likely to be inundated due to rise in sea level consequent upon global warming and such other areas, and Area between low tide line and the high tide line

- **CRZ-II**: The areas that have already been developed up to or close to the shoreline. For this purpose, “developed area” is referred to as that area within the municipal limits or in other legally designated urban areas which are already substantially built up and which have been provided with drainage and roads and other infrastructural facilities, such as water supply and sewerage mains.

- **CRZ-III**: Areas that are relatively undisturbed and those which do not belong to either CRZ-I or CRZ-II. These will include coastal zone in the rural areas (developed
and undeveloped) and also areas within Municipal limits or in other legally designated urban areas which are not substantially built up.

- **CRZ-IV:**

  A. the water area from the Low Tide Line to twelve nautical miles on the seaward side;
  B. shall include the water area of the tidal influenced water body from the mouth of the water body at the sea upto the influence of tide which is measured as five parts per thousand during the driest season of the year.

The development or construction activities in different categories of CRZ area shall be regulated by the concerned authorities at the State / Union Territory level, in accordance with norms stipulated in the CRZ regulation and in the state / UT coastal zone management plan.

### 3.1.5 Forest (Conservation) Act, 1980 and its amendment

This Act provides for the conservation of forests and regulating diversion of forestlands for non-forestry purposes. When projects fall within forestlands, prior clearance is required from relevant authorities under the Forest (Conservation) Act, 1980. State Governments cannot de-reserve any forestland or authorize its use for any non-forest purposes without approval from the Central Government. For diversion of forestland, the project proponent needs to apply to the State Government. Depending on the area required to be diverted, the proposals are cleared by MoEF Regional or Central Offices provided that the cost of compensatory afforestation, cost of rehabilitation of endangered/rare species of flora/fauna, and the net present value of the forest resources are deposited upfront with the state Forest Department.

- If the area of forests to be diverted exceeds 20 Ha (or 10 Ha in hilly area), prior permission of Central Government is required;
- If the area of forest to be diverted is between 5 to 20 Ha, the Regional Office of Chief Conservator of Forests is empowered to approve;
- If the area of forest to be diverted is below or equal to 5 HA, the State Government can give permission; and,
- If the area to be clear-felled has a forest density of more than 40%, permission to undertake any work is needed from the Central Government, irrespective of the area to be cleared.

### 3.1.6 Wildlife Protection Act, 1972

This Act empowers the Central and State Governments to establish National Parks and
Sanctuaries; to formulate rules and designate authorities for the maintenance of National Parks, Sanctuaries and Zoos; to protect and conserve the flora and fauna. Vide Circular No. 11-9/98-FC dated 4-12-1998 issued by the Asst. Inspector General of Forests states that the Ministry of Environment and Forest has taken a decision not to permit development activities inside National Park/Sanctuaries and Tiger reserves areas that are not in consonance of Section 29 of the Wildlife (Protection) Act, 1972.

3.1.7 **Biodiversity Act, 2002**

The Biological Diversity Act, which came into force in February 2003, aims to promote conservation, sustainable use and equitable sharing of benefits of India’s biodiversity resources. It provides for establishment of a National Biodiversity Authority at national level, State Biodiversity Boards at state level and Biodiversity Management Committees at the level of Panchayats and Municipalities.

The National Biodiversity Authority shall play a regulatory role with regard to access to biological resources by foreign citizens and grant of intellectual property rights. It shall play an advisory role in matters relating to the conservation, sustainable use and equitable distribution of biological resources.

3.1.8 **The Water (Prevention and Control of Pollution) Act and Rules, 1974-1975**

This Act represented India’s first attempts to comprehensively deal with environmental issues. The Act prohibits the discharge of pollutants into water bodies beyond a given standard, and lays down penalties for non-compliance. The act was amended in 1988 to conform closely to the provisions of the EPA, 1986. It set up the CPCB (Central Pollution Control Board), which lays down standards for the prevention and control of water pollution. At the state level, the SPCBs (State Pollution Control Board) function under the direction of the CPCB and the state government.


To counter the problems associated with air pollution, ambient air quality standards were established, under the 1981 Act. The Act provides means for the control and abatement of air pollution. The Act seeks to combat air pollution by prohibiting the use of polluting fuels and substances, as well as by regulating appliances that gives rise to air pollution. Under the Act establishing or operating of any industrial plant in the pollution control area requires consent from the state boards. The boards are also expected to test the air in air pollution control areas, inspect pollution control equipment, and manufacturing processes.

To empower the Central and State Pollution Boards to meet grave emergencies, the Air (Prevention and Control of Pollution) Amendment Act, 1987, was enacted. National
Ambient Air Quality Standards (NAAQS) for major pollutants were notified by the CPCB first time in April 1994 and further notified in 16th November 2009.

3.1.10 **Ancient Monuments and Archaeological Sites and Remains Act, 1958**

The legal requirement is to obtain from ASI a no-objection certificate if any protected cultural property is within 10km of the project.

3.1.11 **The Land Acquisition Act (LA) of 1894**

The private land acquisition will be guided by the provisions and procedures outlined in this Act. As per the LA Act, the District Collector or any other officer designated will function as the Land Acquisition Officer on behalf of the Government. There is a provision for consent award to reduce the time for processing if the land owners are willing to agree for the price fixed by the Land Acquisition Officer. The option of acquiring lands through private negotiations is also available.

3.1.12 **National Rehabilitation and Resettlement Policy, 2007**

This policy strikes a balance between the need for land for developmental activities & protecting the interests of land owners and others. The benefits under the new policy are available to all Project Affected Persons (PAP) & families whose land, property or livelihood is adversely affected by land acquisition, involuntary displacement due to natural calamities, etc.

3.2 **WORLD BANK POLICIES**

The objective of World Bank policies is to prevent and mitigate undue harm to people and the environment in the development process. These policies provide guidelines for the identification, preparation, and implementation of programs and projects. The NCRM project has been designed with full compliance to the requirement of World Bank safeguard policies. The following policies are relevant for the project.

3.2.1 **Environmental Assessment (OP/BP 4.01)**

The policy states that EA and mitigation plans are required for all projects having significant adverse environmental impacts or involuntary resettlement. EA’s should include analysis of alternative designs and sites, or consideration of “no option” requiring public participation and information disclosure before the Bank approves the project. In World Bank operations, the purpose of Environmental Assessment is to improve decision making, to ensure that project options under consideration are sound and sustainable, and that potentially affected people have been properly consulted and their concerns addressed.

3.2.2 **Involuntary Resettlement (OP/BP 4.12)**
The Bank’s Operational Policy 4.12: Involuntary Resettlement is triggered in situations involving involuntary taking of land and involuntary restrictions of access to legally designated parks and protected areas. The policy aims to avoid involuntary resettlement to the extent feasible, or to minimize and mitigate its adverse social and economic impacts. It promotes participation of displaced people in resettlement planning and implementation, and its key economic objective is to assist displaced persons in their efforts to improve or at least restore their incomes and standards of living after displacement. The policy prescribes compensation and other resettlement measures to achieve its objectives and requires that borrowers prepare adequate resettlement planning instruments prior to Bank appraisal of proposed projects.

3.2.3 Indigenous Peoples (OP/BP 4.10):

The World Bank Policy on indigenous peoples, OP/BP 4.10, Indigenous Peoples, underscores the need for borrowers and Bank staff to identify indigenous peoples, consult with them, ensure that they participate in, and benefit from Bank funded operations in a culturally appropriate way – and that adverse impacts on them are avoided, or where not feasible, minimized or mitigated.

3.2.4 Cultural Property (OP/BP 4.11)

The World Bank Policy OP / BP 4.11 defines Physical cultural resources as movable or immovable objects, sites, structures, groups of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. Physical cultural resources may be located in urban or rural settings, and may be above or below ground, or under water. Their cultural interest may be at the local, provincial or national level, or within the international community. The Bank assists countries to avoid or mitigate adverse impacts on physical cultural resources from development projects that it finances. The impacts on physical cultural resources resulting from project activities, including mitigating measures, may not contravene either the borrower’s national legislation, or its obligations under relevant international environmental treaties and agreements.

The borrower addresses impacts on physical cultural resources in projects proposed for Bank financing, as an integral part of the environmental assessment (EA) process.

3.2.5 Natural Habitat (OP 4.04)

The policy implementation ensures that Bank-supported development projects give proper consideration to the conservation of natural habitats, in order to safeguard their unique biodiversity and ensure the sustainability of the environmental services and products which natural habitats provide to human society. This policy is applicable when a project (including any subproject under a sector investment or financial
intermediary loan) with the potential to cause significant conversion (loss) or degradation of natural habitats, whether directly (through construction) or indirectly (through) human activities induced by the project.
### 3.3 APPLICABILITY OF ENVIRONMENTAL REGULATIONS

<table>
<thead>
<tr>
<th>S. N.</th>
<th>Environmental Regulation</th>
<th>Applicability in the Sub-project</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Environment (Protection) Act, 1986</td>
<td>Triggered</td>
</tr>
<tr>
<td></td>
<td>Umbrella Act. All necessary mitigation measures have been suggested and detail Environmental Management Plan has been prepared along with Environmental Budget.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>EIA Notification, 2006 and its amendment up to April 2011</td>
<td>Not Triggered</td>
</tr>
<tr>
<td></td>
<td>Saline embankments are not covered by or fall under the preview of EIA Notification 2006, amended in 2009 and 2011. Further, the embankment is not located within notified eco-sensitive area like Wildlife Sanctuary or National Park and land acquisition is not proposed instead land owners have agreed to donate land voluntarily without any claim for compensation. Therefore, Environmental Clearance is not required for proposed project.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Coastal Regulation Zone Notification (CRZ), 2011</td>
<td>Triggered</td>
</tr>
<tr>
<td></td>
<td>This sub-project falls within CRZ-III category. CRZ clearance is required from State CRZ Authority/MoEF for the proposed development.</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Forest (Conservation) Act, 1980 and its amendment</td>
<td>Not Triggered</td>
</tr>
<tr>
<td></td>
<td>Strengthening of Chassisabha Saline Embankment does not involve diversion of forest land. Therefore, Forest Clearance is not required for the proposed development. However, tree felling permission will be required from the State Forest Department.</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Wildlife Protection Act, 1972</td>
<td>Not Triggered</td>
</tr>
<tr>
<td></td>
<td>The embankment is not located within the notified eco-sensitive area and strengthening of existing embankment will have no impact on any Wild Life/ Marine Sanctuary.</td>
<td></td>
</tr>
<tr>
<td>S. N.</td>
<td>Environmental Regulation</td>
<td>Applicability in the Sub-project</td>
</tr>
<tr>
<td>-------</td>
<td>------------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>6.</td>
<td>Biodiversity Act, 2002</td>
<td>Not Triggered</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Raising &amp; Strengthening of Saline Embankment will have no impact on Biodiversity</td>
</tr>
<tr>
<td>7.</td>
<td>The Water (Prevention and Control of Pollution) Act and Rules, 1974-1975</td>
<td>Not Triggered</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Due to raising &amp; strengthening of Saline Embankment, there will be no discharge of pollutants into the water bodies located adjacent/close to the embankment.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Raising &amp; strengthening of Saline Embankment will not affect any ancient monument or building as notified by ASI (Central/ State List)</td>
</tr>
<tr>
<td>10.</td>
<td>The Land Acquisition Act (LA) of 1894</td>
<td>Not Triggered</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Landowners have agreed to donate land voluntarily without any kind of claim for compensation</td>
</tr>
<tr>
<td>11.</td>
<td>National Rehabilitation and Resettlement Policy, 2007</td>
<td>Not Triggered</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Land owners have agreed to donate land voluntarily without any kind of claim for compensation</td>
</tr>
</tbody>
</table>
### 3.4 APPLICABILITY OF WORLD BANK SAFEGUARD POLICIES

<table>
<thead>
<tr>
<th>S. N.</th>
<th>Safeguard Policies</th>
<th>Applicability in the Sub-project</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Environmental Assessment (OP/BP 4.01)</td>
<td>Triggered</td>
</tr>
<tr>
<td></td>
<td>The present study includes an Environmental screening followed by preparation of EIA report for the saline embankment. All necessary mitigation measures have been suggested and detail Environmental Management Plan has been prepared along with Environmental Budget.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Involuntary Resettlement (OP/BP 4.12)</td>
<td>Not triggered</td>
</tr>
<tr>
<td></td>
<td>Landowners have agreed to donate land voluntarily without any kind of claim for compensation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Project doesn’t directly affect property / livelihood of any indigenous people. For the proposed development people are ready to donate their land voluntarily.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Raising &amp; strengthening of Saline Embankment will not affect any ancient monument or cultural property</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Natural Habitat (OP 4.04)</td>
<td>Not Triggered</td>
</tr>
<tr>
<td></td>
<td>The embankment is not located within notified eco-sensitive areas like wildlife sanctuary and national park. Strengthening of Pauta to Garhharishpur to Kalabedi Saline Embankment does not involve diversion of forest land.</td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER 4
BASELINE ENVIRONMENTAL SETUP

4.1 INTRODUCTION

In order to assess impacts due to the project, baseline environmental conditions have been studied and are discussed in the following sections of this chapter. The entire study area has been classified under two categories i.e. “Corridor of Impacts” and “Project Influence Area”. Corridor of Impacts defines the strips of land where the proposed construction activity will take place. Initially it was 31m when the height of embankment was 6.2m but after reduction in the height of embankment (5.2m), now it is 27m, which is the proposed Right of Way (RoW). Field survey was carried out within the RoW. On the other hand, 500 meter on the either side of the embankment has been considered as “Project Influence Area”. Critical environmental and social issues were identified at the screening stage. The existing environmental and social conditions of the study area (covering an area spread over 500 meter on the either side of the embankment), in general and Corridor of Impacts (27m strip), in particular, has been studied as described in subsequent sections. The study team conduct a transect walk along the embankment and its surrounding area to assess the physical, biological and social environment of the study area.

4.2 PHYSIOGRAPHY

Physiographically the State can be divided in to five distinct units, namely (i) Coastal plains, (ii) Northern uplands, (iii) The erosional plains of Mahanadi and other river valleys (iv) South Western hilly region and (v) Subdued plateau.

The coastal plains covering parts of Ganjam, Puri, Cuttack, Jagatsinghpur, Kendrapara, Jajpur, Bhadrak and Balasore district from south to north, form an extensive flat alluvial tract between the hills in the west and the coast in the east. It presents a flat topography gently sloping towards east with insignificant elevation difference. The general elevation of coastal plains varies from 1 to 10m above mean sea level.

4.3 SEISMICITY

Project location comes under the East India, which is a seismically moderate to low region. The embankment is situated in the Zone III (having moderate seismic intensity) of the seismic Map of India (as per IS: 1893, Part I, 2002) and therefore has a moderate risk of potential damage due to earthquake.

4.4 CLIMATE AND RAINFALL

The climatic condition of the area is generally hot with high humidity during April and May & cold during December and January. The monsoon generally breaks during the
month of June. The average annual normal rainfall is 1449.10 mm. In addition to monsoon rainfall, the area receives from cyclonic storms substantially. The average temperature varies from a minimum of 11.60°C to a maximum of 35.60°C. The variation of wind speed is spectacular which assumed as high as 350 km/hour during the Super Cyclone of 1999.

4.5 GROUNDWATER

The assessment of ground water resource has been done taking the blocks as the assessment units. According to the latest assessment, Puri district has an annually replenishable ground water resource of 88348 hect-metre (HM) and 60 % of it is considered as safe use. About 3187 HM is committed for domestic and industrial requirement for coming 25 years. The following Table 4.1 shows the utilisable ground water resources.

<table>
<thead>
<tr>
<th>District</th>
<th>Ground water resource assessed (HM)</th>
<th>Utilisable resource for domestic and industrial use (HM)</th>
<th>Annual draft for irrigation use (HM)</th>
<th>Gross annual draft for all uses (HM)</th>
<th>Stage of GW development</th>
</tr>
</thead>
<tbody>
<tr>
<td>Puri</td>
<td>88348</td>
<td>3187</td>
<td>4431</td>
<td>6770</td>
<td>7.32</td>
</tr>
</tbody>
</table>

Source: G.W.S & I Directorate

Costal Saline Area and Effect on Ground Water:

A considerable area of about 5.39 lakh hectares of the coastal alluvial tract is beset with salinity hazard. In a narrow tract it starts from Chandereswar in Balasore district in the north east and extends upto Brahmagiri in Puri district in the south west. The Saline aquifers occur in different depth. The salinity zone and pattern of occurrence of fresh and saline aquifers are presented in Table 4.2.

<table>
<thead>
<tr>
<th>District</th>
<th>Block</th>
<th>Full</th>
<th>Part</th>
</tr>
</thead>
<tbody>
<tr>
<td>Puri</td>
<td></td>
<td>-</td>
<td>Astarng, Brahmagiri, Delang, Gop, Kakatpur, Kanas, Krushna Prasad, Nimapara, Pipli, Puri, Satyabadi</td>
</tr>
</tbody>
</table>

Source: G.W.S & I Directorate
4.6 SOIL TYPE AND LAND USE PATTERN

Broadly, the soil of Orissa may be classified as transported and residual soil on the basis of its mode of formation. The catchment basins of the different drainage systems in Orissa are dominated by granite and gneissic rocks, which have resulted in a sandy soil. Clayey soils predominate the middle and lower reaches of the drainage channels. The coastal stretch of Orissa is dominated by Deltaic Alluvial soil followed by Saline & Sandy Saline Alkali soil and Coastal Alluvial soil. Site wise soil type and land use pattern within 10 km radius of the proposed Embankment is presented in Table-4.3.

District wise soil maps have been presented below in Figure 4.1.

Source: National Atlas Map

Figure 4.1 Soil Map of Puri District

Table 4.3 Soil Type & Land Use Pattern (within 10 Km radius) of Embankment
<table>
<thead>
<tr>
<th>District</th>
<th>Name of the Saline Embankment</th>
<th>Soli Type</th>
<th>Land Use Pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td>Puri</td>
<td>Tandahar</td>
<td>Deltaic Alluvial Soils</td>
<td>Agricultural, habitation, forest</td>
</tr>
</tbody>
</table>
4.7 FLORA

The forest of this region house many useful plants such as, various timber species, orchids, medicinal plants and aromatic plants. About one third of the total forest cover is predominated by sal (Shorea robusta), remaining is characterized by species such as teak (Tectona grandis), paisal (Prerocarpus marsupium) bandhan (Ougeinia ooejinensis), kangada (Xyilia xylocarpa), kasi (Bridelia retusa), sisu (Dalbergia sisoo), asana (Terminalia alata), karuma (Adina cordifolia) and dheura (Anogeissus acuminata). Various types of bamboos (Bambusa spp.), sandalwood (Santalum album), sal seed, resins (Jhuna), kendu (Diospyros melanoxylon) leaves, canes (Calamus app.), salap (Caryota urens) are some of the important minor forest products.

Ambo (Mangifera indica), bel (Aegle marmelos), siris (Albizzia lebbek), karanj (Pongamia pinnata), jamun (Syzygium cumini), tentuli (Tamarindus indica), neem (Azadirachta indica), arjun (Terminalia arjuna), bamboo (Bambusa tulda), coconut (Cocos nucifera), tal (Borassua flabellifer) and khajuri (Phoenix sylvestris) etc. have been observed in an around of the project sites.

4.7.1 Coastal Vegetation

The project area is rich in plant resources, which harbor mangrove and other types of plant species. The mangrove formation is the peculiarity of the coastal zone. These formations are met within the swamps either always or periodically inundated by tidal water. The flora is of evergreen nature. The most common species found in the coastal area are Sunderi (Heritiera fomes), Tunda (Lumnitzera racemosa), Rai (Rhizophora species), Sisumar (Xylocarpus granatum), Pitmari (Xylocarpus gangeticus), Poonanga (Calophyllum inophyllum), Kia (Pandanus fascicularis), Limba (Azadirachta indica), Tala (Borassua flabellifer), Nadia (Cocos nucifera), Kia (Pandanus fascicularia), Hental (Phoenix paludosa) etc.

Casuarinas, Pulmonary Nuts, Cashew Nuts, Palm and Coconuts have been planted along the coast to minimize the cyclonic effect. Casuarina (Casuarina equisetifolia) forms good shelter belt plantation and also helps in stabilizing sand dunes. Extensive shelter belt plantations are raised in coastal areas of Orissa. It protects soil erosion by reducing wind speed. The fine network of sub-surface roots also protects the soil against rain and wind. Because of its capability to fix atmospheric nitrogen, it improves the environmentally degraded soils.

Trees to be impacted: Total number of trees to be impacted for the proposed development is 74 (within 27m proposed RoW as per revised DPR). Village-wise and species-wise trees to be felled are presented in Table 4.4. All likely affected trees are located either on the slope of the existing embankment or within the proposed ROW of the embankment. All these trees are located on Govt. land.

<table>
<thead>
<tr>
<th>Name of village</th>
<th>Species</th>
<th>No. of trees within 31m strip</th>
<th>No. of trees within 27m strip</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tandahar</td>
<td>Palm</td>
<td>78</td>
<td>61</td>
</tr>
<tr>
<td>----------</td>
<td>-------</td>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td></td>
<td>Coconut</td>
<td>15</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Dhalannka</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Chakunda</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>95</strong></td>
<td><strong>74</strong></td>
<td></td>
</tr>
</tbody>
</table>

Source: Field Survey

4.8 ECOLOGICALLY SENSITIVE AREAS

In Orissa, there are 18 (eighteen) Wildlife Sanctuaries and National Parks. This sub-project doesn’t pass through any of these notified ecologically sensitive areas. There are no Biosphere Reserve, National Park, Wildlife/Bird Sanctuary, Tiger or Elephant Reserve, Mangroves Areas, Migratory Route of Wild Animals/Birds, Reserved/Protected Forest, Zoological Park/Botanical Garden within 1 km radius of the embankment.

4.9 ARCHAEOLOGICAL SITES

In Orissa, there are 78 centrally protected monuments under the control of Central Government and 218 protected monuments under the control of State Government. However, none of these are located within close proximity of the proposed embankment.

4.10 NATURAL CALAMITIES

4.10.1 Cyclones

The Bay of Bengal is the breeding ground of cyclones. A cyclone originates as low pressure becomes depression and converted into cyclone. A cyclone has three devastating factors (i) high wind speed (ii) heavy rain and (iii) surge. In general, Orissa coast receives 2 to 3 cyclone every year and the most severe one was the super cyclone of 1999. This has resulted wind speed of >300 Kmph, rainfall >500mm tidal wave of 3-6mt height and caused death of 12,000 persons besides huge loss of cattles. The super cyclone caused wide spread flooding in coastal belt of Orissa with severe damages in Baitarani & Salandi basin. Ersama block of Jagatsinghpur was worst affected within the state in this cyclone.

4.10.2 Floods

Orissa is one of the most chronically flood affected State in the country. The east flowing rivers like Mahanadi, Brahmani, Baitarani, Subarnarekha and Rushikulya causes flood from June to October when monsoon become active and this is caused with depression in Bay of Bengal with heavy precipitation occurring almost every third years. Floods in Mahanadi have been moderated to great extent by the Hirakud dam, but floods of 1980, 1982, 1991, 2001 & 2003 have demonstrated that a second dam in Mahanadi may be the answer to the problem. Rengali Dam across river Brahmani is able to moderate flood at
its delta head upto 4 lakhs cusecs but the confluencing of Baitarani, Brahmani & Mahanadi in the costal delta causes heavy damages which is almost recurring. The floods in 1980 in Vamsadhara river caused severe damage in Gunpur town and surrounding area. The flood in November 1990 in Ganjam district caused severe damages in the Rusikulya catchment. The unprecedented rainfall in 1991 in Thuamul-Rampur caused severe flooding in Indravati river and caused disaster in Upper Indravati Project. Flood is a curse for the people of coastal Orissa and the economy is severely strained due to this event year after year.

4.11 PROFILE OF PROJECT AFFECTED PERSONS

The following sections present socio-economic profile of the households likely to be affected by the proposed raising and strengthening of the saline embankment. Precise socio-economic baseline data is being presented here.

Project affected persons generally belong to two broad categories, viz, titleholders and non-titleholders. Titleholders are the ones who have legal papers for property units in their name, whereas non-titleholders include encroachers, squatters, kiosks, tenants, etc. In case of saline embankment under consideration only title holders (land owners) are likely to be affected. Impacts on private land are limited to Katakana and Tandahara revenue villages. A total of 79 private land plots shall be affected in varying proportions. Besides, 39 government land plots from the same revenue villages shall also be affected in various proportions. Socio-economic profile of the households likely to be affected is described below.

As per the survey, 592 persons comprising 336 males and 256 females from 34 households are likely to be affected by the proposed project. These households are likely to lose part of land area. The average size of the household works out to be 17, which is very high as compared to average size of the household in the district 5.22 (census 2011). This is due to combined/joint ownership of land plots and or undivided ownership of land plots (i.e. ownership is still continuing in the name of father or fore fathers). In fact, in some of the households there are more than 25 members. However, all the household members are not staying in the village or same in the building but have interests in the land plots likely to be affected. The sex ratio of PAPs works out to be very much in favour of males. There are 762 females for every 1000 males which are very less as compared to district average of 963 (Census 2011).

PAPs likely to be affected have been classified in three age groups viz., less than 14 years, 15 to 59 years and more than 59 years. There 12.5% persons who are less than equal to 14 years of age. 74.3% (440) of the PAPs are in the age group of 15 to 59 which is prime
Persons in the age group of 59 years and above constitute 13.2% of the PAPs.

Educational level of PAPs is presented in Table 4.5. It may be observed that illiterate and just literate together comprise a little more than one fourth of the total persons likely to be affected. Majority of the PAPs are literate. 35% of the PAPs have obtained middle and secondary level education followed by primary level education. PAPs having obtained Intermediate and Graduate/Post Graduate level education constitute about 11% of the total PAPs. Overall the educational level of PAPs is very good which would help PAPs in making meaningful choices with regard to alternative livelihoods, if required.

<table>
<thead>
<tr>
<th>Educational level</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illiterate</td>
<td>87</td>
<td>14.70</td>
</tr>
<tr>
<td>Just literate</td>
<td>76</td>
<td>12.84</td>
</tr>
<tr>
<td>Primary</td>
<td>154</td>
<td>26.01</td>
</tr>
<tr>
<td>Middle</td>
<td>97</td>
<td>16.39</td>
</tr>
<tr>
<td>Secondary</td>
<td>113</td>
<td>19.09</td>
</tr>
<tr>
<td>Intermediate</td>
<td>29</td>
<td>4.90</td>
</tr>
<tr>
<td>Graduate/ Post Graduate</td>
<td>32</td>
<td>5.41</td>
</tr>
<tr>
<td>Others</td>
<td>4</td>
<td>0.68</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>592</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Occupational profile of the household members is presented in Table 4.6. Occupations of project affected persons are limited. Agriculture and allied activities is the occupation of about 14% of the total persons (592) for whom information has been collected. Household work is primarily carried out by the women members of the households. As is evident from the data, about 33% of the total persons are occupied with household work and all of them are above 16 years. This is followed by service (government and private) and trade and business. All those involved in trade and business and service cover about 18.5% which indicates that these persons are not staying in the concerned village but their names have been included by the respondent of the households. One of the reasons for migration from the village could be the regular disruption of lives and properties by the disasters. Overall the economy of the villages is of mixed type. Cyclonic storms and tidal surges devastate economy of the village from time to time, one of the reasons for out migration of people to nearby areas. Lack of industrial development, lack of good connectivity, shortage of power, yearly flooding of the area has obstructed the diversification of local economy.
Respondents were also asked to provide indicative household’s monthly income and accordingly data were captured in the questionnaire survey. For the purpose of analysis the income groups to which the households belong to are discussed below. There are 234 persons out of 592, who are productively employed and contributing to the household income. Though, the combined income of household varies from a minimum of Rs. 2000/- per month to more than a lakh. The minimum and maximum earning members vary from 1 to 32. Average number of earning numbers per household works out to be seven whereas the average monthly income is approximately Rs. 3600/- based on the income indicated against earning members. Income of 43% of the total earning members is less than equal to Rs. 3000/- per month. Out of the total earning members (234), only nine members earn more than Rs. 10000/- per month and a maximum of Rs. 20000/- per month.

### 4.13 SCREENING OUTCOME

Environmental & social screening as per World Bank format has been done for each proposed Embankment. The screening outcome has been summarized and presented in Table 4.7.

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Members</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
</tr>
<tr>
<td>Agriculture</td>
<td>26</td>
</tr>
<tr>
<td>Agricultural labour</td>
<td>6</td>
</tr>
<tr>
<td>Allied agriculture</td>
<td>51</td>
</tr>
<tr>
<td>Non-agriculture labour</td>
<td>44</td>
</tr>
<tr>
<td>Household work</td>
<td>195</td>
</tr>
<tr>
<td>Non-school going children</td>
<td>20</td>
</tr>
<tr>
<td>School going children</td>
<td>75</td>
</tr>
<tr>
<td>College going student</td>
<td>16</td>
</tr>
<tr>
<td>Govt. Service</td>
<td>10</td>
</tr>
<tr>
<td>Private Service</td>
<td>59</td>
</tr>
<tr>
<td>Trade and business</td>
<td>40</td>
</tr>
<tr>
<td>Old</td>
<td>28</td>
</tr>
<tr>
<td>Retired</td>
<td>4</td>
</tr>
<tr>
<td>Handicapped</td>
<td>3</td>
</tr>
<tr>
<td>Others</td>
<td>13</td>
</tr>
<tr>
<td>No response</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>592</td>
</tr>
</tbody>
</table>

Table 4.7 Summary of Screening Outcome
<table>
<thead>
<tr>
<th>S. N.</th>
<th>Name of Saline Embankment</th>
<th>SIA Required</th>
<th>Abbreviated RAP Required</th>
<th>Full RAP Required</th>
<th>CRZ Clearance Required</th>
<th>Environmental Clearance Required</th>
<th>Forest Clearance Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Tandahar</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>
5.1 INTRODUCTION

Public consultations are an important medium where participants raise the various issues that need attention in reference to any project that would most likely touch upon their lives directly or indirectly, positively or negatively.

The aim of conducting both formal and informal public consultations was to involve all types of participants/stakeholders and consider their views related to the project and take actions wherever possible during design stage. Concerns expressed by participants during these consultations meetings included compensation at prevailing market rate, additional requirement of Sluice gates, required extension or diversion of proposed saline embankment, requirement for approach road and cyclone shelter wherever required and certain other issues. Mitigation measures were also suggested by the participants during these meetings. Concerns and mitigation measures suggested by participants have been presented in a tabular form covering issues under each major head. This has been shared with the design team so that the concerns expressed by the people are integrated into the design wherever feasible within the technical and financial limitations of the project. In this way loss of time and money both could be saved and the project would truly be people friendly. Minutes of the Public Consultation of Tandahar - Singarpala Saline Embankment are as under.

5.2 MINUTES OF PUBLIC CONSULTATION MEETING

First Public Consultation Meeting: Tandahar - Singarpala Saline Embankment

<table>
<thead>
<tr>
<th>District</th>
<th>Puri</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block</td>
<td>Astaranga</td>
</tr>
<tr>
<td>Village</td>
<td>Tandahar</td>
</tr>
<tr>
<td>Gram Panchayat</td>
<td>Sisua</td>
</tr>
<tr>
<td>Irrigation Division</td>
<td>Nimapara</td>
</tr>
<tr>
<td>Place</td>
<td>School Premises</td>
</tr>
<tr>
<td>Date &amp; Time</td>
<td>31.12. 2010; 11.00 AM</td>
</tr>
</tbody>
</table>

Minutes of Meeting/ Gramsabha:

Following persons were present in the meeting:
- Rabindra Senapati - Sarpanch
- Rabindra Nath Mohanty - Executive Officer
- Niranjan Chand - Additional BDO
- Sadhu Maharana - Ward Member (17)
Issues discussed in Gram Sabha Meeting are as under:

The gramsabha was held in the presence Kanhei Charan Pradhan (Executive Officer), Sanjay Kr. Kalia (Ward Member-6), Champaklata Raut (Ex Ward Member & SHG Secretary), CES officials and the villagers. Issues discussed during the Public Consultation Meeting (Gram Sabha Meeting) are as under:

- The villagers informed in the meeting that that they are surrounded by Bay of Bengal on the East, Nora River on the North and Kadua is on the West. Therefore to save their life from disaster like flood and cyclone strengthening and widening of saline embankment is very much required for them.

- They again informed that there is another river at the end of the proposed embankment and causes destruction in the months of rain. So they requested to change the direction of embankment, otherwise they will not be benefitted by the project.

- The participants commented in the gramsabha that the embankment should be constructed with proper measurement that it will serve the purpose of the villagers. They said that the side-packing of the embankment must be done with stone.

- Mr. S.K. Behera informed the villagers about the R&R Policy and compensation Package in detail.

- The villagers firmly said that the Resolution No. 2 should follow;
otherwise there is no need of renovation of embankment there.

- Members of local Self- Help Group present in the meeting said that there is an urgent requirement for a bridge across Nora River to reach Bangurigaon. They also stated that they had a boat to serve local people, but now it is not in a condition of use.

- They also informed that there is a narrow stretch of Jhau Forest will be affected due to the project. To avoid this adverse impact on environment they proposed for plantation alongwith the embankment.

- They stated in the Gramsabha that the adverse effect on their social life and daily earning will be less if they will receive proper compensation.
CHAPTER-6
ANALYSIS OF ALTERNATIVES

The present development activities under NCRMP include raising and strengthening of Tandahar saline embankment. Keeping in view the realistic options of development analysis of alternatives have been studied on the view of ‘With Project’ and ‘Without Project’ Scenario, in term of potential impacts. A comparative study has also been done considering 6.2 meter and 5.2 meter height of the embankment. The details are given in Table – 6.1.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Factors</th>
<th>Impacts Without Project</th>
<th>Impacts With Project</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Positive</td>
<td>Negative</td>
</tr>
<tr>
<td>1</td>
<td>Protection of Land, people and property resources</td>
<td>-</td>
<td>8 villages of 2 Gram Panchayats having an area of affected land 961.755 Ha with population of 1588 and household of 380 numbers are vulnerable from flood and cyclone.</td>
</tr>
<tr>
<td>2</td>
<td>Surface Run-off/drainage Accessibility</td>
<td>-</td>
<td>Improper drainage system cause flooding, water logging.</td>
</tr>
<tr>
<td>3</td>
<td>Improved communication and village road network</td>
<td>-</td>
<td>Present condition of the embankment is so poor and no road network is there on embankment for vehicular operation</td>
</tr>
<tr>
<td>4</td>
<td>Change in Land-use pattern</td>
<td>No change in land –use pattern as no construction works.</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>Loss of property and livelihood</td>
<td>No loss of property and livelihood.</td>
<td>-</td>
</tr>
<tr>
<td>Sl. No.</td>
<td>Factors</td>
<td>Impacts Without Project</td>
<td>Impacts With Project (6.2m height)</td>
</tr>
<tr>
<td>--------</td>
<td>------------------------------------------------------------------------</td>
<td>-------------------------</td>
<td>------------------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Positive</td>
<td>Negative</td>
</tr>
<tr>
<td>6</td>
<td>Change In Environmental Quality during construction</td>
<td>No adverse impact on air, water and noise, as no construction involved.</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td>Loss of vegetative cover</td>
<td>No loss of greenery and biodiversity.</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td>Employment generation</td>
<td>Living standard shall remain unchanged.</td>
<td>No development no changes in economic status and living standard of people.</td>
</tr>
<tr>
<td>Sl. No.</td>
<td>Factors</td>
<td>Impacts With Project (6.2m height)</td>
<td>Impacts With Project (5.2m height)</td>
</tr>
<tr>
<td>--------</td>
<td>--------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>1</td>
<td>Flood Protection</td>
<td>8 villages of 2 Gram Panchayats having an area of affected land 961.755 Ha with population of 1588 and household of 380 numbers will be saved if the surge height is 6.2 meter or less</td>
<td>8 villages of 2 Gram Panchayats having an area of affected land 961.755 Ha with population of 1588 and household of 380 numbers will be saved if the surge height is 5.2 meter or less</td>
</tr>
<tr>
<td>2</td>
<td>Use of Natural Resources (earth, sand, stone)</td>
<td>Approximately 200780.8 Cum material will be used for construction</td>
<td>Approximately 150092.8 Cum will be used, hence 50688 cum material will be saved</td>
</tr>
<tr>
<td>3</td>
<td>Land resources</td>
<td>Additional 0.7040 Ha of land acquisition will be there for raising the height of the embankment from 5.2m to 6.2m</td>
<td>0.7040 Ha land can be saved due to reduction of embankment height by 1m</td>
</tr>
<tr>
<td>4</td>
<td>Trees and vegetative cover</td>
<td>95 trees are likely to be affected due to the proposed construction</td>
<td>74 trees are likely to be affected due to the proposed construction. Approximately 21 trees will be saved subsequently lesser vegetation clearances.</td>
</tr>
</tbody>
</table>
CHAPTER-7  
ENVIRONMENTAL IMPACTS & MITIGATION MEASURES

7.1 INTRODUCTION

The proposed project will have no significant adverse impact on environment because the project will not involve:

- Diversion of ecologically sensitive area like National park, Wild life sanctuary etc. or any reserve or protected forest
- Destruction of ecologically sensitive areas/ecological resources
- Disturbance to aquatic fauna
- Significant change in land use pattern
- Significant change in topography and geology

However, there may be some short term impacts during construction period. Besides, above mentioned impact on natural & biological environment, there will be socio-economic impacts due to disruptions on the social and economic interactions of communities. Specific impacts on structures, PAPs, trees etc. will be confined within the Corridor of Impacts (Col) of the saline embankment while general impacts will cover the entire Project Influence Area (PIA). For investigation/ survey purpose the study area has been defined as under:

- Corridor of Impacts (Col) is proposed Right of Way i.e. 27 m
- Project Influence Area (PIA) is 500m on either side of the saline embankment

Identification of impacts is followed by recommendations of appropriate mitigation measures. These impacts along with the preventive measures to be taken up during construction stage are given in the following sections.

7.2 Topography & Geology

Impacts:
- Disfiguration of topography due to indiscriminate digging of borrow pits
- Uncontrolled digging of borrow pits resulting soil erosion; water accumulation in abandoned pits & breeding of vector disease
- Disturbance on geological setting due to quarrying

Mitigation Measures:
- Uncontrolled digging of borrow pits will be avoided to prevent soil erosion; water accumulation in abandoned pits which acts as breeding ground of disease vectors (mosquitoes)
Construction materials will be procured from existing approved and licensed quarries only where crusher is already operating. Therefore, mitigation measures for the environmental impacts due to quarrying and rehabilitation plan of the quarries is the responsibility and scope of the licence holder of the quarry.

Suitable seismic design of the embankment will be adopted to mitigate the earthquake impacts in future.

Guidelines for rehabilitation of Borrow and Quarry Areas are provided at the end of this chapter.

7.2.1 Borrow Area

The impacts on existing topographical setting originate primarily from opening up borrow pits to fulfill the huge requirement of earth material. Since about 8,05,154 cum of borrow materials will be required for the saline embankment, which has to be obtained from approved borrow areas located near by the saline embankment or borrow area to be constructed in the nearby villages. Borrow areas for the project will be selected by the Contractor. For opening and use of borrow material for the embankment, contractor have to follow Borrow Area Management Plan prepared for the project. However, some of the important provisions are presented below:

- Excavation and restoration of the borrow areas and their surroundings must be conducted in an environmentally sound manner to the satisfaction of the Supervision Engineer before final acceptance and payment under the terms of the contract.
- Areas will be graded to ensure drainage and visual uniformity, or to create permanent tanks/pond as required by land owner.
- Topsoil from the opening of borrow pits should be saved and reused in restoring the pits to the satisfaction of the Engineer.
- Additional borrow pits should not be opened without the restoration of those areas no longer in use.
- No borrow pits will be allowed in the forest/private forest areas.
- As a good practice trucks carrying the various construction materials should be covered with tarpaulin sheets.
- Guidelines for selection and rehabilitation of Borrow Areas are provided in Chapter-8 Environmental Management Plan.

7.2.2 Quarry Area

During raising & strengthening of embankment construction material mainly sand (7,978 MT), stone (48,651 MT) & aggregates (6,750 MT) will be required. Stone aggregates and sand will be brought from the pre-identified quarry areas.
Mitigation Measures:
- Quarriesites will be identified by the Contractor.
- Building materials will be procured from existing approved and licensed quarries only where crusher is already operating. Therefore, mitigation measures for the environmental impacts due to quarrying and rehabilitation plan of the quarries is the responsibility and scope of the licence holder of the quarry.
- Suitable seismic design of the CD structures will be adopted to mitigate the earthquake impacts in future.
- General guidelines for selection, operation and rehabilitation of Quarry Areas are provided in Chapter-8 Environmental Management Plan.

7.3 SOIL

Impacts:
Placing of loose soil for embankment widening would cause significant soil erosion in case appropriate compaction & stabilization measures are not adopted promptly. The erosion at construction stretches will result in increased sediment load in recipient streams. Loss of productive soil may result from uncontrolled opening up of borrow pits. Any leakage of lubricants in equipment yard will cause soil contamination.

Mitigation Measures:
Soil erosion at construction stretches can be prevented & controlled by following methods:

- **Grassing of Slopes:** For this purpose it is best to use locally growing grasses and bushes, as these are best adapted to the local soil, temperature and rainfall conditions. The plantation is best done just after the first pre-monsoon showers, which gives a time of 2-3 weeks for the grass to take root before the onset of monsoon. Normally no watering of the grassed slopes is done following the planting. However, watering of the slope may be provided if the planting is done in the non-monsoon season or to respond to dry condition following planting. The above methods of providing vegetation cover on embankment slope follow provisions in IRC 56-1974 “Recommended Practice for Treatment of Embankment Slopes for Erosion Control”.

- **Use of pitching to control Erosion:** stones are hand laid on the surface and lightly tamped. The interstices between the stones are filled up with soil. Grasses may be dibbled into the soil filled spaces. As the grass grows it develops a good binding effect on the pitching.
General guideline on Soil Erosion & Sediment Control is provided in *Chapter-8 Environmental Management Plan*.

### 7.4 LAND USE

Widening of existing embankment will lead to change in land use pattern of areas adjacent to the embankment that comes under the proposed ROW. The existing land adjacent to the embankment at present is predominantly agricultural & barren with some residential & commercial plots at certain discrete stretches which will need to be acquired for widening of the embankment.

Additional land area required for the proposed improvement works out to be 25.10 ha (62.00 acres). It includes both private and government land. Private land comprises 28.66% (7.19 ha) of the total land requirements. The remaining land area i.e., 71.34% (17.91 ha) is the government land.

Preparatory activities like clearing of ROW, construction of temporary construction camps and storage of construction materials etc. will be confined within the camp & ROW. This will not hamper the land use aspects outside ROW. However, indirectly there may be some change in the land use pattern of the proximate area due to influx of construction work-force and supplier who are likely to construct temporary tents in the vicinity. The on-site land use will more or less have a temporary impact in terms of fugitive emission from handling of construction material.

**Impacts:**
- Loss of agricultural land resources due to land acquisition for the embankment
- Generation of solid waste in the form of construction spoils from construction sites
- Changes in existing land use pattern of the ROW for widening of the embankment

**Mitigation Measures:**
- Earth material generated from excavation will be reused to the maximum possible extent as filling material during site development.
- The small amount of construction debris and surplus excavated material will be disposed of by mechanical transport in suitable pre-identified (jointly by project proponent & local administration) dumping areas in tune with the local condition to avoid land degradation & water logging due to indiscriminate dumping.
- Dumping areas will be biologically reclaimed through top soil cover & plantation.
- Construction camp will be provided for construction personnel to avoid indiscriminate settlement of construction workers & labourers.
- Construction activities will be kept confined to ROW only.

### 7.5 DRAINAGE
Raising & strengthening of saline embankment will not alter the existing drainage system of the area. Care has been taken in such a manner that it does not affect the natural flow of water or the drainage pattern of the area. The existing embankments as well as Cross Drainage Structures are in poor condition and incapable to protect the coastal habitation from the wrath and fury of the devastating agencies, especially cyclonic storm and tidal surges.

**Mitigation Measures:**
- Adequate cross drainage (CD) structures (sluices) will be provided for smooth passage of runoff to avoid flooding & formation of water pool
- 2 numbers of sluice gates have been considered in the project in addition to the raising and strengthening of the saline embankment.
- Filling of existing drainage courses will be strictly avoided
- Suitable drainage at construction site & camp will be provided to eliminate the chances of formation of stagnant water pools that leads to soil erosion & breeding of mosquitoes

**7.6 WATER USE**

**Impacts:**
- Short term Impact on the local water sources due to use of construction water.

**Mitigation Measures:**
- Minimum use of water from existing sources for construction purpose will be ensured to minimize likely impacts on other users.
- All the projects will be taken up in the coastal districts where water is available in abundance; water will not be over utilized during the process of construction.
- Prior permission should be taken from local statutory agency if large scale extraction of ground water is involved with the proposed construction.

**7.7 WATER QUALITY**

Wastewater from construction activities would mostly contain suspended impurities. Other pollutants which may find their way to it will be in insignificant concentrations and may be safely disregarded.

The deterioration of surface water quality during construction phase is expected due to wastewater disposal from the workers camp and sullage generated from construction sites. If adequate arrangements are not made to ensure proper drainage of wastewater from the construction sites, such waters may form stagnant pools and aggravate soil erosion or pollute the nearby surface water body. Stagnant pools of water promote breeding of mosquitoes and create generally unsanitary conditions.
Impacts:
- Increase of sediment load in the run off from construction sites and increase in turbidity in receiving streams/surface water bodies.
- Water pollution due to sewage from construction camps

Mitigation Measures:
- Quality of construction wastewater emanating from the construction site will be controlled through suitable drainage system with sediment traps for arresting the silt/sediment load before its disposal into the main natural drainage system around the site.
- Proper sanitation facilities will be provided at the construction site to prevent health related problems due water contamination.
- All the construction and preparatory activities including construction of sluices/culverts will be carried out during dry seasons only.

7.8 AIR QUALITY

Particulate matter would be the predominant pollutant affecting the air quality during the construction phase as it is likely to generate dust, especially during dry condition. Dust will be generated mainly during excavation, backfilling, hauling & transportational activities through under construction embankment, loading/unloading & transportation of construction materials, spilling of material during transportation, and open storage of fine construction materials.

Undesirable gaseous pollutants will be generated mostly by the automobile traffic and construction machineries. However, this would not lead to any tangible effect.

Operation of concrete batching plant will cause emission of fumes and gases.

Impacts:
- Deterioration of air quality due to fugitive dusts emission from construction activities like excavation, backfilling & concreting, and hauling & dumping of earth materials & construction spoils, and vehicular movement along under construction embankment
- Deterioration of air quality due to gaseous emissions from construction equipment
- Deterioration of air quality due to emission from concrete batching plant

Mitigation Measures:
- Proper and prior planning and appropriate sequencing and scheduling of all major construction activities will be done, and timely availability of infrastructural
supports needed for construction will be ensured to shorten the construction period vis a vis reduce pollution

- Construction materials will be stored in enclosed spaces to prevent the wind blown fugitive emissions
- Truck carrying construction materials will be duly covered to avoid spilling
- Adequate dust suppression measures such as regular water sprinkling on unpaved haul roads & vulnerable areas of the construction sites from trucks or other suitable means will be undertaken to control fugitive dust during material handling & hauling activities particularly near habitation especially in the dry seasons
- Low emission construction equipment, vehicles and generator sets will be used
- It will be ensured that all the construction equipment & vehicles are in good working condition, properly tuned and maintained to keep emissions within the permissible limits and engines turned off when not in use to reduce pollution
- Concrete batching plant will be located at least 500 m away from inhabited areas

7.9 NOISE LEVEL

Impacts:
- Increase in noise level due to construction activities like operation of construction equipment & vehicular traffic

Mitigation Measures:
- Construction camp will be located away from the immediate vicinity of the construction sites
- Protective gears such as ear plugs etc. will be provided to construction personnel exposed to high noise levels as preventive measure
- Low noise construction equipment will be used
- It will be ensured that all the construction equipment & vehicles used are in good working condition, properly lubricated & maintained to keep noise within the permissible limits and engines turned off when not in use to reduce noise
- Construction activities carried out near residential area will be scheduled to the daytime only so that minimum disturbances are caused to people

7.10 FLORA & FAUNA

Impacts:
- Felling of trees due to strengthening of embankment (Table 7.1).
- No impact on fauna is envisaged

<table>
<thead>
<tr>
<th>Table 7.1 List of Trees to be felled for Strengthening of Embankment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of the embankment</td>
</tr>
<tr>
<td>------------------------</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
Mitigation Measures:

- Appropriate compensatory plantation will be initiated to compensate the vegetation loss due to felling of trees. For trees to be felled, sufficient compensatory plantation will be done.
- Cooking fuel will be provided to construction workers to avoid cutting/felling of trees for fuel wood.

7.11 SOLID WASTE

Impacts:
- Various construction activities such as demolition of structures, cutting of trees, earth etc. will result in generation of construction waste. Further, domestic solid waste will also be generated from construction camps. Improper disposal of these wastes may obstruct water flow resulting in reduction in water carrying capacity of the water body. Unscientific disposal of domestic waste may cause filthy smell resulting in health problems of workers and local residents.

Mitigation Measures:

- Dumping of debris in or nearby water bodies shall be strictly avoided.
- Solid waste shall be disposed in pre-identified or existing dumping areas in tune with the local condition to avoid land degradation & water logging due to indiscriminate dumping.
- Dumping areas will be biologically reclaimed through top soil cover.
- Regular inspection of haul roads, construction site & camp will be carried out to ensure regular and timely removal of construction debris to the dumping sites.
- A comprehensive waste management plan shall be prepared by the contractor prior to initiation of any works. General guideline on “Waste Disposal Site Management” is provided in Chapter-8 Environmental Management Plan.

7.12 CONSTRUCTION CAMP

Impacts:
- Influx of construction work-force & supplier who are likely to construct temporary tents in the vicinity
- Likely sanitation & health hazards & other impacts on the surrounding environment due to inflow of construction labourers

**Mitigation Measures:**
- Temporary construction camps at designated & demarcated sites with adequate sanitation, drinking water supply & primary health facilities.
- Most of the construction work is labour intensive. As most of the job will be done by contractors, it will be ensured that the contractor's workers are provided with adequate amenities, health & sanitation facilities in the camp by the contractor. Such facilities shall include potable water supply, sanitary facilities (such as dry pit latrines), solid waste collection & disposal system and primary health facilities (such as first aid facilities) etc.
- It will be ensured through contract agreement that the construction workers are provided fuel for cooking to avoid cutting of trees for fuel wood from the adjoining areas.
- Domestic as well as the sanitary wastes from construction camp will be cleared regularly.

**7.13 OCCUPATIONAL HEALTH & SAFETY**

**Impacts:**
- Accident risk to workers from construction activities shall be happen due to poor maintenance of machines and vehicles, poor light conditions at the work place, carelessness and poor management of work, vehicles and equipment.
- Unsafe storage and handling of hazardous substances pose yet another threat to the safety and security of workers.
- Health problems to workers may arises due to unhygienic conditions at work place, camp sites, non-availability of good drinking water and inadequate access to clean and hygienic sanitation facilities.

**Mitigation Measures:**
- To ensure safe construction environment, guidelines given in Chapter-8 Environmental Management Plan
- Safety of workers undertaking various operations during construction should be ensure by providing helmets, masks, safety goggles etc.
- Regular tool talks, mock drills, training program to be organized towards educating workers towards adopting safe working methods
- The electrical equipment should be checked regularly to avoid risk to workers
At every work place a ready available first aid unit including an adequate supply of dressing materials, a mode of transport (ambulance), nursing staff and an attending doctors to be provided

- Adequate drainage, sanitation and waste disposal facilities to be provided at work places
- Periodical medical check-up facilities to be provided to all the workers
- At every work place good & sufficient water supply shall be maintained to meet the daily needs of the residing population
- Measures to be implemented so that waste water is collected in septic tanks or soak pits. No surface stagnation of water will be allowed to avoid vector outburst.
- The rules as defined in Environment Protection Act 1986 should be complied
- Transport of the hazardous materials (if any) by road is regulated by the Motor Vehicle Act 1989 which provides precautions to be followed by the Consignor, owner of the goods carrier and its driver to minimise the risk of accident and damage control in the event of mishap.
- For delivery of hazardous substances three certificates namely permit licence, driving licence and guarding licence issued by the Transport Department should be maintained
- Vehicles carrying hazardous substances should display mandatory safety signs
- As a precautionary measures the project operating agency shall obtain insurance cover to provide for loss of property and life and also for the cost of clean-up operations
- In case of spillage, it should be reported to relevant department and their instructions should be followed
- Cleaning of the spills at the accident site should be carried out as per regulations

7.14 SOCIAL IMPACT ASSESSMENT

The proposed project involves widening, raising, strengthening and extension of existing saline embankment. The project impact is limited to land only. No structures, common property resources, and other properties and assets are likely to be affected. Land plots likely to be affected have been worked out based on the design prepared by the technical consultant (M/s Orbital Consultants). Land plots likely to be affected were marked by superimposing the design on the village revenue maps. Land owners list were provided by the technical, consultants. The socio-economic survey was conducted as per the land owners list.

Additional land area required for upgrading and strengthening of saline embankment have been worked out by the technical consultant. As per the design a minimum of 27 m land
width is required. The existing land area available is 2.74 ha [comprising 44.53% government land and 55.47% private land]. Additional land area required for the proposed improvement works out to be 7.87 ha (19.49 acres). It includes both private and government land. Private land comprises 49.17% (3.872 ha) of the total land requirements. The remaining land area i.e., 4.00 ha (50.83%) is government land, which includes Abadjogya Anabadi (presently vacant but meant for residential purposes) and Rakshita Anabadi (gramya jungle, nala, etc). The government land shall be transferred by inter departmental arrangements. Private land area likely to be affected is mainly agricultural land plot. It covers two revenue villages viz., Katakana and Tandahar under RI Bangurigram. Percentage of land area likely to be affected from each land plot is tabulated below.

<table>
<thead>
<tr>
<th>Land area affected (%)</th>
<th>Land plots affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than equal to 10</td>
<td>19</td>
</tr>
<tr>
<td>11 to 20</td>
<td>12</td>
</tr>
<tr>
<td>21 to 50</td>
<td>23</td>
</tr>
<tr>
<td>More than 50</td>
<td>25</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>79</strong></td>
</tr>
</tbody>
</table>

It may be observed that less than equal to 10% of the land area will be affected in case of 24.05% of the land plots. There will be loss of 11 to 20% of the land area in 15.19% of the land plots. In case of 29.11% of the land plots, substantial portion (between 21-50%) of the land area will be affected. Similarly, in case of 31.65% of the land plots more than 50% of the land area will be affected. It can be seen that all the land plots (79) are very small in size (less than 1 ha), a criteria for consideration as marginal farmer\(^1\) (un-irrigated land holding upto 1 ha or irrigated land holding upto 0.5 ha).

Requirement of private land area for the construction of saline embankment is not likely to affect livelihood of majority of land owners rather construction of embankment will help consolidate their properties and assets.

\(^1\) Marginal farmer – refers to a cultivator with an un-irrigated land holding upto 1 ha or irrigated land holding upto 0.5 ha.
No residential and commercial structures are likely to be affected. However, two cattle sheds are likely to be affected. In addition, ten coconut trees are also likely to be affected. No encroacher and squatters have been found during the survey. There will be no displacement by the proposed work. Further, no common property resource is likely to be affected. A total of eight coconut trees will be affected.

7.15 EMPLOYMENT & TRADING OPPORTUNITIES

Throughout the construction phase labour will be required. The construction materials like stone chips and sand will be procured locally from identified quarry sites. The other construction materials like cement, iron rod, brick, steel etc. will be procured through various local sources. Thus there is a possibility of generation of local employment & trading opportunities, though temporary.

7.16 CONCLUSION

The National Cyclone Risk Mitigation Project aims at reducing the risk of cyclone & allied disasters in the coastal Orissa. It will not only reduce the impact of disasters but also create a network of disaster infrastructure including roads and relief line. Beyond strengthening the disaster preparedness & capacity building of the vulnerable community, this will also help to increase the economic activity in the locality. After construction of the embankment, the socio-economic condition of the locality will be greatly improved. Aesthetic beauty of the proposed sites will be enhanced due to plantation along the inner boundary of embankment. The project will not create or add any pollutant of any kind.
CHAPTER-8
ENVIRONMENTAL MANAGEMENT PLAN

8.1 INTRODUCTION

Environmental Management Plan (EMP) is the key to ensure a safe and clean environment. The desired results from the environmental mitigation measures proposed in the project may not be obtained without a management plan to assure its proper implementation & function. The EMP envisages the plans for the proper implementation of management measures to reduce the adverse impacts arising out of the project activities.

8.2 STAGE WISE ENVIRONMENTAL MANAGEMENT MEASURES

8.2.1 Pre-construction Stage

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Environmental Issues</th>
<th>Management Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>P 1.</td>
<td>Preservation of Trees</td>
<td>All efforts will be made to preserve trees including evaluation of minor or adjustments/alternatives (as applicable) to save trees. Specific attention will be for protecting giant trees. Tree cutting is to proceed only after all the legal requirements including attaining of In-principle and Formal Clearances from the State Forest Department are completed and subsequently a written order is issued to the Contractor. Stacking, transport and storage of the wood will be done as per the relevant norms. Systematic corridor level documentation for the trees cut and those saved will be maintained by the Contractor.</td>
</tr>
<tr>
<td>P.2</td>
<td>Joint Field Verification</td>
<td>The Environmental Expert of Contractor and Officials of Water Resource Department (WRD) will carry out joint field verification to ascertain the possibility to saving environmental and community resources. The verification exercise should assess the need for addition or changes in design/scale/nature of protection measures including the efficacy of enhanced measures suggested in the EMP. Proper documentation and justifications/reasons shall be maintained in all such cases where deviation from the original EMP is proposed.</td>
</tr>
<tr>
<td>P.3</td>
<td>Location of, hot-mix plants, WMM Plant, Concrete Batching plats etc.</td>
<td>Hot mix plants; WMM Plants and Concrete Batching plats will be sited sufficiently away from settlements, agricultural operations and any commercial establishments. Such plants will be located at least 500 m away from the nearest village/settlement preferably in the predominant downwind side. Mobile equipment can be placed...</td>
</tr>
<tr>
<td>Sl. No.</td>
<td>Environmental Issues</td>
<td>Management Measures</td>
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<tr>
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<td></td>
<td>within 50 m from the nearest dwelling. The Contractor shall submit a detailed lay-out plan for all such sites and approval of the WRD shall be necessary prior to their establishment. Specifications of hot mix plants will comply with the requirements of the relevant current emission control legislations and Consent/NOC for all such plants shall be submitted to the WRD. The Contractor shall not initiate plant operation till the required legal clearances are obtained and submitted.</td>
</tr>
</tbody>
</table>
|        |                                                          | P.4 Other construction vehicles, equipment and machinery All vehicles, equipment and machinery to be procured and brought to site for construction will conform to the relevant Bureau of India Standard (BIS) norms and the manufacturer’s specifications. The discharge standards promulgated under Environment Protection Act, 1986 will be strictly adhered to. Noise limits for construction equipment to be procured such as compactors, mobile front loaders, concrete mixers, cranes (moveable), vibrators and saws will not exceed the value specified in the Environment (Protection) Rules, 1986. The equipment proposed to be used for Sluice construction and installed close to waterway/streams, must be checked and certified fit, especially with respect to the potential leakage of oil and grease. The inspection should verify that:  
  ▪ Equipment is clean (free of mud, dirt and oil)  
  ▪ Equipment is in good working order.  
  ▪ A drip pan is available for equipment that will be stored on site.  
  ▪ Contractor has a spill kit  
  ▪ Operator is trained on the refuelling, maintenance and emergency spill procedures (See Appendix for procedures).  
  ▪ A log book will be maintained documenting all fuelling and maintenance events (date, time, location, condition of site, weather conditions, amount of fuel on maintenance event, issues).  
  ▪ Adequate inspections will be conducted during the construction period. |
<p>|        |                                                          | P.5 Borrow Areas Finalizing borrow areas for borrowing earth and all logistic arrangements as well as compliance to environmental requirements, as applicable, will be the responsibility of the contractor. The Contractor will not start borrowing earth from select borrow area until a formal agreement is signed between the land owner and the Contractor and a copy is submitted to the WRD. Format for reporting will be as per the Reporting Format for Borrow Area (Form P.1 of Annex-8.1) and will include a reference map. In addition to testing for the quality of borrow materials by the WRD. |</p>
<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Environmental Issues</th>
<th>Management Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>P.6</td>
<td>Quarry Areas</td>
<td>The quarry materials requirement of this project may be fulfilled from the existing approved quarries near the project site.</td>
</tr>
<tr>
<td>P.7</td>
<td>Arrangement for construction water</td>
<td>The Contractor can use the nearby water bodies, but before using any pond/river water contractor should obtain written consent from the local body and submit it to WRD. The Contractor will provide a list of locations and type of sources from where water for construction will be used. To avoid disruption/disturbance to other water users, the Contractor will extract water from fixed locations and consult the Environmental Expert before finalizing the locations. The Contractor will not be allowed to pump from any irrigation canals or surface water bodies used by the community. The Contractor will need to complying with the requirements of the State Ground Water Department and seek its approval for doing so and submit copies of the permission to Environmental Expert of WRD.</td>
</tr>
<tr>
<td>P.8</td>
<td>Site identification for disposal of unsuitable materials</td>
<td>The Contractor shall identify site(s) away from the project area where unsuitable materials (debris, solid waste) generated in the course of the construction can be safely disposed off. Such locations shall be inspected by the Environmental Expert of WRD and approved before construction work starts.</td>
</tr>
<tr>
<td>P.9</td>
<td>Labour requirements</td>
<td>Local people will be given preference for unskilled and other jobs created during the construction phase of the project. The contractor would notify requirement of unskilled labours in nearby/surrounding villages. In case local labours are not interested/available then a certificate/letter shall be issued by the Panchayat officials to the Contractors in this regard.</td>
</tr>
<tr>
<td>P.10</td>
<td>Construction camp – location, design and lay-out</td>
<td>Sitting of the construction camps will be as per the guidelines below: Locations identified by the Contractor will be reported as per format. Construction camps will not be proposed within 500 m from the nearest settlements to avoid conflicts and stress over the infrastructure facilities with the local community. Location for stockyards for construction materials will be identified at least 500 m from water sources. The waste disposal and sewage system for the camp will be designed, built and operated such that no odour is generated.</td>
</tr>
<tr>
<td>P.11</td>
<td>Arrangements for temporary land</td>
<td>The Contractor as per prevalent rules will carry out negotiations with the landowners for obtaining their consent for temporary use of lands for workers quarters, construction sites/hot mix plants etc. The Environmental Expert will ensure that...</td>
</tr>
<tr>
<td>Sl. No.</td>
<td>Environmental Issues</td>
<td>Management Measures</td>
</tr>
<tr>
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<tr>
<td></td>
<td></td>
<td>clearing up of the site prior to handling over to the owner (after construction or completion of the activity) is duly carried out by the Contractor. From P.2 and From P.3 (given in Annex-8.1) shall be used for reporting status of temporarily acquired land to Environmental Expert</td>
</tr>
</tbody>
</table>

Environment & Ecology Department
8.2.2 Construction Stage

Construction stage is the most crucial and active stage of the EMP. It is very much essential to monitor construction activity to ensure that the environment is not impacted beyond permissible limits. In addition, the need for a balanced evaluation and planning for risks associated with construction activities such as accidental spillages and consequent damage to the surrounding environment in terms of loss of flora and fauna, agricultural crops or loss of fertile land continues to grow in importance.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Environmental Issues</th>
<th>Management Measures</th>
</tr>
</thead>
</table>
|         |                      | Vegetation will be removed from the construction zone before commencement of construction. All works will be carried out such that damage or disruption to flora other than those identified for cutting is minimum. Only ground cover/shrubs that impinge directly on the permanent works or necessary temporary works will be removed with prior approval from the Environmental Expert. The Contractor, under any circumstances will not cut or damage trees. Trees identified under the project will be cut only after receiving clearance from the Forest Department of Odisha (as applicable).
Vegetation only with girth of over 30 cm measured at a height of 1.0 m above the ground, will be considered as trees and shall be compensated. Form C.1 (given in Annex-8.1) shall be used as target sheet for tree cutting. |
<p>| C.1     | Site Clearance       | Contractor Department of Water Resource, Government of Odisha |
| C.1.1   | Clearing &amp; Grubbing  | The topsoil from all areas of cutting and all areas to be permanently covered will be stripped to a specified depth of 150 mm and stored in stockpiles. A portion of the temporarily acquired area and/or Right of Way will be earmarked for storing topsoil. The locations for stock piling will be pre-identified in consultation and with approval of Environmental Expert. The following precautionary measures will be taken to preserve them until they are used: |
| C.1.2   | Generation of debris | The contractor will suitably dispose off unutilized debris materials at designated disposal locations, subject to the approval of the Environmental Expert. All arrangements for transportation during construction including provision, maintenance, dismantling and clearing debris, will be planned and implemented by the Contractor as approved and directed by the Environmental Expert. The pre-designed disposal locations will be a part of Comprehensive Solid Waste Management Plan (CSWMP) to be prepared by the Contractor in consultation with the Environmental Expert of WRD. |
| C.1.3   | from dismantling     | |
|         | structures            | |
|         |                      | |
|         |                      | |
|         |                      | |
|         |                      | |
|         |                      | |
|         |                      | |
|         |                      | |
|         |                      | |</p>
<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Environmental Issues</th>
<th>Management Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(a) Stockpile will be designed such that the slope does not exceed 1:2 (vertical to horizontal), and height of the pile is restricted to 2 m. To retain soil and to allow percolation of water, the edges of the pile will be protected by silt fencing. (b) Stockpiles will not be surcharged or otherwise loaded and multiple handling will be kept to a minimum to ensure that no compaction occur. The stockpiles shall be covered with gunny bags or vegetation. (c) It will be ensured by the contractor that the topsoil will not be unnecessarily trafficked either before stripping or when in stockpiles. Such stockpiled topsoil will be utilized for -</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• covering all disturbed areas including borrow areas (not those in barren areas) &lt;br&gt; • top dressing of the embankment and fill slopes &lt;br&gt; • in the agricultural fields of farmers, acquired temporarily. Residual topsoil, if there is any will be utilized for the plantation.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C.1.4 Accessibility</td>
<td>The Contractor will provide safe and convenient passage for vehicles, pedestrians and livestock and property accesses connecting the embankment. The Contractor will also ensure that the existing accesses are not blocked without providing adequate provisions and to the prior satisfaction of Environmental Expert.</td>
</tr>
<tr>
<td></td>
<td>C.2 Procurement of Construction Material</td>
<td>No borrow area will be opened without permission of the Environmental Expert. The location, shape and size of the designated borrow areas will be as approved by the Environmental Expert of SC and in accordance to the recommended practice for borrow pits for road embankments (IRC 10:1961). The borrowing operations will be carried out as specified in the guidelines for setting and operation of borrow areas. The Contractor will rehabilitate the borrow areas as soon as borrowing is over from a particular borrow area in accordance with the Borrow Area Rehabilitation/Redevelopment Guidelines or as instructed by the Environmental Expert.</td>
</tr>
<tr>
<td></td>
<td>C.2.2 Construction water</td>
<td>The Contractor will arrange adequate supply and storage of water for the whole construction period at his own costs. The Contractor will submit a list of source/s from where water will be used for the WRD. The Contractor will source the requirement of water preferentially from ground water but with prior permission from the relevant authorities, if required. A copy of the permission will be submitted to WRD prior to initiation of construction.</td>
</tr>
<tr>
<td>Sl. No.</td>
<td>Environmental Issues</td>
<td>Management Measures</td>
</tr>
<tr>
<td>--------</td>
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<td>---------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The Contractor will take all precaution to minimize the wastage of water in the construction process/operation. Form C.2 (given in Annex-8.1) shall be used for reporting.</td>
</tr>
<tr>
<td>C.3</td>
<td>Construction Work</td>
<td></td>
</tr>
<tr>
<td>C.3.1</td>
<td>Drainage &amp; Flood Control</td>
<td>The Contractor will ensure that construction materials like earth, stone, etc. are disposed off so as not to block the flow of water of any watercourse, cross drainage channels. The Contractor will take all necessary measures to prevent the blockage of water flow.</td>
</tr>
<tr>
<td>C.3.2</td>
<td>Siltation of Water Bodies &amp; Degradation of Water Quality</td>
<td>The Contractor will not excavate beds of any stream/canals/any other water body for borrowing earth for embankment construction. The Contractor will construct silt fencing at the base of the embankment construction for the entire perimeter of any water body adjacent to ROW and around the stockpiles at the construction sites close to water bodies. The fencing will be provided prior to commencement of earthwork and continue till the stabilization of the embankment slopes, or particular sub-section of the road. Equipment and plants shall be located at least 100 m away from any water body. The Contractor will ensure that construction materials containing fine particles are stored in an enclosure such that sediment-laden water does not drain into nearby water body.</td>
</tr>
<tr>
<td>C.3.3</td>
<td>Slope Protection and Control of Soil Erosion</td>
<td>The Contractor will take slope protection measures as per design, or as directed by the WRD to control soil erosion and sedimentation through use of dykes, sedimentation chambers, basins, fisher mats, mulches, grass, slope, drains and other devices. All temporary sedimentation, pollution control works and maintenance thereof will be deemed as incidental to the earth work or other items of work and as such no separate payment will be made for them. The Contractor will ensure the following safeguards: During construction activities on embankment, the side slopes of all cut and fill areas will be graded and covered with stone pitching, grass and other materials as per design specifications prepared by DPR Consultant. Turfing works will be taken up as soon as possible provided the season is favourable for the establishment of grass sods. Other measures of stabilization will include mulching, netting and seeding of batters and steepening of slopes immediately on completion of earthworks. In borrow pits, the depth shall be so regulated that the sides of excavation will have a slope not steeper than 1 vertical to 2 horizontal.</td>
</tr>
</tbody>
</table>
### environmental management measures

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Environmental Issues</th>
<th>Management Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>the edge of the final section of the bank.</td>
</tr>
</tbody>
</table>

### C.4 Pollution

#### C.4.1 Water Pollution

<table>
<thead>
<tr>
<th>C.4.1.1</th>
<th>Water pollution from construction wastes</th>
<th>The Contractor will take all precautionary measures to prevent wastewater generated during construction from entering into streams, water bodies or the irrigation system. He will avoid construction close to streams or water bodies during monsoon. All waste arising from the project is to be disposed of in the manner acceptable to the State Pollution Control Board or as directed by Environmental Expert.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.4.1.2</td>
<td>Water pollution from fuel and lubricants</td>
<td>The Contractor will ensure that all construction vehicle parking locations, fuel/lubricants storage sites, vehicle, machinery and equipment maintenance sites are located at least 100 m away from any water body. The Contractor will also ensure that spillage of fuels and lubricants does not contaminate the ground. If fuel storage and refuelling areas are located on agricultural land or areas supporting vegetation, the top soil will be stripped, stockpiled and returned after cessation of such activities.</td>
</tr>
</tbody>
</table>

#### C.4.2 Air Pollution

<table>
<thead>
<tr>
<th>C.4.2.1</th>
<th>Dust pollution</th>
<th>The Contractor will take every precaution (water sprinkling etc.) to reduce the level of dust generating from construction site. All the plants will be sited at least 1 km in the downwind direction from the nearest human settlement. The suspended particulate matter value at a distance of 40m from a unit located in a cluster should be less than 500 µg/m³. The pollution monitoring is to be conducted as per the monitoring plan. Form C.3, and Form C.4 (given in Annex-8.1) shall be used for reporting to WRD.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.4.2.2</td>
<td>Emission from construction vehicles, equipments and machineries</td>
<td>The Contractor will ensure that all vehicles, equipments and machineries used for construction are regularly maintained and confirm that pollution emission levels comply with the relevant requirements of Odisha Pollution Control Board (PPCB). The Contractor will submit PUC certificates for all vehicles/ equipment/ machinery used for the project and maintain a record of the same during the contract period.</td>
</tr>
</tbody>
</table>

#### C.4.3 Noise Pollution

<table>
<thead>
<tr>
<th>C.4.3.1</th>
<th>Noise from vehicles, equipments and</th>
<th>The Contractor will confirm the following:</th>
</tr>
</thead>
</table>

### Sl. No. | Environmental Issues | Management Measures
--- | --- | ---

machineries

- All plants and equipments used in construction shall strictly conform to the MoEF/CPCB/OPCB noise standards.

- All vehicles and equipment used in construction will be fitted with exhaust silencers.

- Servicing of all construction vehicles and machinery will be done regularly and during routine servicing operations, the effectiveness of exhaust silencers will be checked and if found defective will be replaced.

- At the construction sites within 150 m of the nearest habitation, noisy construction work such as crushing, concrete mixing will be stopped during the night time between 9.00 pm to 6.00 am.

- No noisy construction activities will be permitted around educational institutions/health centres (silence zones) up to a distance of 200 m from the sensitive receptors.

### C.5 Safety

| C.5.1 | Personal safety measures for labour | The Contractor will provide:
--- | --- | ---

- Protective footwear and protective goggles to all workers employed in mixing asphalt materials, cement, concrete etc.

- Protective goggles and clothing to workers engaged in stone breaking activities

- Earplugs to workers exposed to loud noise, and workers working in crushing, compaction, or concrete mixing operation.

- Adequate safety measures for workers during handling of materials at site.

- The Contractor will comply with all the precautions as required for ensuring the safety of the workmen as per the International Labour Organization (ILO) Convention No. 62 as far as those are applicable to this contract.

- The Contractor will make sure that during the construction works all relevant provisions of the Factories Act, 1948 and the Building and other Construction Workers (regulation of Employment and Conditions of Services) Act, 1996 are adhered to.

- The Contractor will not employ any person below the age of 14 years for any work and no woman will be employed on the work of painting.
<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Environmental Issues</th>
<th>Management Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>with products containing lead in any form.</td>
<td>The Contractor will also ensure that no paint containing lead or lead products is used except in the form of paste or readymade paint. He will ensure that no form of spray or a surface having lead paint is rubbed and scraped. The Contractor will mark ‘no smoking’ in high risk areas and enforce compliance of use of PPE with zero tolerance. These will be reflected in the Construction Safety Plan to be prepared by the Contractor during mobilization and will be approved by SC and PIU.</td>
</tr>
<tr>
<td>C.5.2</td>
<td>Risk from electrical equipments</td>
<td>The Contractor will take all required precautions to prevent danger from electrical equipment and ensure that –</td>
</tr>
<tr>
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<td></td>
<td>- No material will is so stacked or placed as to cause danger or inconvenience to any person or the public.</td>
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<tr>
<td></td>
<td></td>
<td>- All necessary fencing and lights is provided to protect the public in construction zones.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>All machines to be used in the construction will conform to the relevant Indian Standards (IS) codes, are free from patent defect, are kept in good working order, regularly inspected and properly maintained as per IS provision and to the satisfaction of the Environmental Expert.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The Contractor will arrange for –</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- A readily available first aid unit including adequate supply of sterile dressing materials and appliances as per the Factories Rules in every work zone.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Availability of suitable transport at all times to take injured or sick person(s) to the nearest hospital</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Equipment and trained nursing staff at construction camp.</td>
</tr>
<tr>
<td>C.5.3</td>
<td>First aid</td>
<td>The Contractor will provide, erect and maintain informatory/safety signs, hoardings written in English and local language, wherever required or as suggested by the Environmental Expert of WRD.</td>
</tr>
<tr>
<td>C.5.4</td>
<td>Informatory Signs and Hoardings</td>
<td>The Contractor will carry out the plantation as per the Green Belt Development Plan given in the EMP. Minimum 80 percent survival rate of the saplings will be acceptable otherwise the Contractor will replace dead plants at his own cost. The Contractor will maintain the plantation till he handover the project site to WRD. The Environmental Expert of WRD will inspect regularly the survival rate of the plants and compliance of tree plantation guidelines.</td>
</tr>
<tr>
<td>Sl. No.</td>
<td>Environmental Issues</td>
<td>Management Measures</td>
</tr>
<tr>
<td>--------</td>
<td>----------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td></td>
<td><strong>C.7 Labour Camp Management</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>C.7.1 Accommodation</strong></td>
<td>The Contractor will follow all relevant provisions of the Factories Act, 1948 and the Building and the other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 for construction/management of labour camp. The location, layout and basic facility provision of each labour camp will be submitted to WRD before construction. The construction will commence only after the written approval of the Environmental Expert. The Contractor will maintain necessary living accommodation and ancillary facilities in functional and hygienic manner and as approved by the WRD.</td>
</tr>
</tbody>
</table>
|        | **C.7.2 Potable water** | The Contractor will provide potable water facilities within the precincts of every workplace in an accessible place, as per standards set by the Building and other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996. The Contractor will also guarantee the following:  
  - Supply of sufficient quantity of potable water (as per IS) in every workplace/labour camp at suitable and easily accessible places and regular maintenance of such facilities.  
  - If any water storage tank is provided, the bottom of the tank will be kept at least 1mt. from the surrounding ground level.  
  - If water is drawn from any existing well, which is within 30mt. proximity of any toilet, drain or other source of pollution, the well will be disinfected before water is used for drinking.  
  - All such wells will be entirely covered and provided with a trap door, which will be dust proof and waterproof.  
Environmental Expert will be required to inspect the labour camp once in a week to ensure the compliance of the EMP. |
|        | **C.7.3 Sanitation and sewage system** | The Contractor will ensure that -  
  - The sewage system for the camp will be designed, built and operated in such a fashion that it should not pollute the ground water or nearby surface water.  
  - Separate toilets/bathrooms, will be arranged for men and women.  
  - Adequate water supply is to be provided in all toilets and urinals.  
  - All toilets in workplaces are with dry-earth system (receptacles) which are to be cleaned and kept in a strict sanitary condition.  
  - Night soil (human excreta) is to be disposed off by putting layer of it at the bottom of a permanent tank prepared for the purpose and covered with 15 cm. layer of waste or refuse and then covered with a layer of earth for a fortnight. |
<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Environmental Issues</th>
<th>Management Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.7.4</td>
<td>Waste disposal</td>
<td>The Contractor will provide segregated garbage bins (biodegradable and non-biodegradable) in the camps and ensure that these are regularly emptied and disposed off in a hygienic manner as per the Comprehensive Solid Waste Management Plan approved by the Environmental Expert of WRD. Unless otherwise arranged by local municipal authority, arrangements for disposal of night soils (human excreta) suitably approved by the local municipal authority or as directed by Environmental Expert, will be arranged by the Contractor. Form C.5 (given in Annex-8.1) shall be used for hygiene reporting of construction/labour camps.</td>
</tr>
<tr>
<td>C.8</td>
<td>Contractor’s Demobilization</td>
<td>The Contractor will prepare site restoration plans, which will be approved by the Environmental Expert of WRD and PMU. The clean-up, restoration operations are to be implemented by the Contractor prior to demobilization. The Contractor will clear all temporary structures; dispose all garbage, night soils, POL waste and all construction zones as per Comprehensive Waste Management Plan and as approved by WRD. All disposal pits or trenches will be filled in and effectively sealed. Residual topsoil, if any will be distributed on adjoining/ proximate barren land or areas identified by Environmental Expert in a layer of thickness of 75 mm-150 mm. Form C.6 (given in Annex-8.1) shall be used for reporting to SC.</td>
</tr>
</tbody>
</table>
### 8.2.3 Operation Stage

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Environmental Issues</th>
<th>Management Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>O.1</td>
<td>Monitoring Operation Performance</td>
<td>The WRD will monitor the operational performance of the various mitigation/enhancement measures carried out as a part of the project. The indicators selected for monitoring includes the survival rate of trees; rehabilitation of borrow areas; restoration of Construction Camp Site etc.</td>
</tr>
<tr>
<td>O.2</td>
<td>Maintenance of Drainage</td>
<td>WRD will ensure that all Sluices are periodically cleared especially before monsoon season to facilitate the quick passage of rainwater and avoid flooding. WRD will ensure that all the sediment and oil and grease traps set up at water bodies are cleared once in every three months. Form O.1 (given in Annex-8.1) shall be used for reporting by WRD.</td>
</tr>
</tbody>
</table>
8.3 GREEN BELT DEVELOPMENT PLAN

8.3.1 Objective & General Guidelines

Green areas not only improve the floral status, land use and the aesthetic look of an area, but also serve the dual purpose of filtering any fugitive dust from unpaved, open areas, help to abate noise effects through dampening, and replenish oxygen and ameliorate the surrounding temperature. In addition it also reduces soil erosion caused due to surface runoff. Therefore, development of green belt is nowadays imperative as a part of development projects.

The Greenbelt Development Plan provided here contains:

- Greening strategy
- Species suggested for plantation
- Technical specification for plantation
- Precautionary & protection measures

8.3.2 Greening Strategy

The followings are being proposed:

- Greenbelt will be developed along the country side of the proposed embankment
- The plantation of trees will be completed in the construction period so that sustainable growth is achieved when the project is completed.
- The plantation programme has been drawn to conform to natural climatic conditions and adaptability of the species.
- The plantation would consist of a mixture of locally available indigenous, fast growing species of trees having ornamental value and soil binding property. In addition to that tree species must be resistant to high wind speed.
- Preferential plantation of flowering trees with less timber & fruit (except cashew) value will be carried out.
- Adequate mangroves plantation shall be raised in the seaward side.
- Dub grass turfing on the country side should be done to restrict the surface runoff naturally

8.3.3 Species Suggested for Plantation

Keeping in view the climatic condition of the area, species for green belt development has been identified. All the identified trees have quick growth rate and are mostly evergreen. The list of plant species suggested for plantation is presented below:

<p>| Table 8.1 Species Suggested for Plantation |</p>
<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Common Name</th>
<th>Scientific Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Jhau</td>
<td>Casuarina equisetifolia</td>
</tr>
<tr>
<td>2</td>
<td>Cashew/kaju</td>
<td>Anacardium occidentale</td>
</tr>
<tr>
<td>3</td>
<td>Amaltas</td>
<td>Cassia fistula</td>
</tr>
<tr>
<td>4</td>
<td>Anjan</td>
<td>Hardwickia binnata</td>
</tr>
<tr>
<td>5</td>
<td>Coconut</td>
<td>Cocos nucifera</td>
</tr>
<tr>
<td>6</td>
<td>Dhak</td>
<td>Butea monosperma</td>
</tr>
<tr>
<td>7</td>
<td>Karanj</td>
<td>Pongamia pinnata</td>
</tr>
<tr>
<td>8</td>
<td>Mahaneem</td>
<td>Cedrella toona</td>
</tr>
<tr>
<td>9</td>
<td>Mahua</td>
<td>Madhuca indica</td>
</tr>
<tr>
<td>10</td>
<td>Neem</td>
<td>Azadirachat indica</td>
</tr>
<tr>
<td>11</td>
<td>Shisham</td>
<td>Dalbergia sissoo</td>
</tr>
<tr>
<td>12</td>
<td>Fountain tree</td>
<td>Spathodea campanulata</td>
</tr>
<tr>
<td>13</td>
<td>Gulmohar</td>
<td>Delonix regia</td>
</tr>
<tr>
<td>14</td>
<td>Palas</td>
<td>Butae frondosa</td>
</tr>
<tr>
<td>15</td>
<td>Keya</td>
<td>Capnella sp.</td>
</tr>
<tr>
<td>16</td>
<td>Varun</td>
<td>Lamarckia sp</td>
</tr>
<tr>
<td>17</td>
<td>Bougainvillea</td>
<td>Bougainvillea sp.</td>
</tr>
<tr>
<td>18</td>
<td>Lantana</td>
<td>Lantana camara</td>
</tr>
<tr>
<td>19</td>
<td>Yellow Oleander</td>
<td>Thevetia peruviana</td>
</tr>
<tr>
<td>20</td>
<td>Kaner</td>
<td>Thavetia nerifolia</td>
</tr>
<tr>
<td>21</td>
<td>Chameli</td>
<td>Jouminum grandiflorum</td>
</tr>
</tbody>
</table>

**Turfing with grasses:**

The grass species recommended for turfing are *Cynodon dactylon*, *Cithocline purpurea*, *Solanum nigrum*, *Xanthium strumerium*. *Desmostachya bipinnata*, *Cenchrus ciliaris* and *Aristida hystrix*. All these species are locally available in the surrounding area. Contractor will ensure that the condition of the site is good enough for successful establishment of grasses. They will also supervise all field operations like preparation of surface, sowing of grasses and quality of grass seeds used.

### 8.3.4 Technical Specification for Plantation

**Tree Plantation**

- Spacing between the plants: 4 m
- Size of the pits: 60 X 60 X 60 cms
- No of trees per km: 250 (1 tree/4m)
- Height of the plant: Not less than 2m
Age of the plant : Not less than 3 years

**Hedge Plantation**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spacing between the plants</td>
<td>4 m</td>
</tr>
<tr>
<td>Size of the pits</td>
<td>20 X 20 X 20 cms</td>
</tr>
<tr>
<td>No of plants per km</td>
<td>250 (1 tree/4m)</td>
</tr>
<tr>
<td>Height of the plant</td>
<td>Not less than 1 ft</td>
</tr>
<tr>
<td>Age of the plant</td>
<td>Not less than 1 year</td>
</tr>
</tbody>
</table>

It is proposed to use the prescribed species on country side of the embankment. Such trees will mature at about the same time giving pleasant appearance. Plantation will also reduce soil erosion and ultimately provide strength and protection to the embankment.

8.3.5 **Number of Trees/Shrubs to be planted**

Trees at 4m interval in 1 row along the country side of the embankment

\[= (250 \text{ trees/km x 1.760 Km}) = 440 \text{ trees}\]

Shrubs at 4m interval in 1 row along the country side of the embankment

\[= (250 \text{ shrubs/km x 1.760 Km}) = 440 \text{ shrubs}\]

8.3.6 **Protection Measures**

Barbed wire fencing around the plantation area may be provided to protect the plants.

Angle iron is required to be fixed at a spacing of 5 m and 3-stand barbed wire is to be stretched.

8.3.7 **Precautionary Measures**

- Plantation activity to be carried out in monsoon months
- The height of the plants should not be less than 1 ft and should be in polythene bags and are not to be removed till the time of planting
- All plants supplied must be planted within three days of removal from the nursery
- The contractor will be required to water the area in case of insufficient rains after planting
- 2 kg of compost/manure are suggested for each pit before plantation.
- To ensure better growth and survival of plants, surface should have sufficient layer of good quality soil (up to 45 cm)
**Shrubs:** Prior to planting it is suggested to remove all loose debris, fill up with good soil and level the area. To ensure better growth and survival of shrubs, the surface should have sufficient layer of good quality soil (up to 45 cm).

**Turfing with Grass:**
- A cover of 25 gm of grass seed per sq.m. of surface is to be prepared
- Bed is to be prepared in June. The seed sowing must be carried out before the onset of monsoon, so that the yield desired result. Till the onset of monsoon, watering of the surface to be done by tankers with controlled flow sprinklers
- After sowing, mulch of prepared and dried out herbs to be laid over the whole seeded area in a thin layer, so that the direct sunlight and transportation loss may not affect the grass.

### 8.3.8 Budget for Greenbelt Development

The budget for greenbelt development is presented in **Table-8.2**

<table>
<thead>
<tr>
<th>Component</th>
<th>Stage</th>
<th>Item</th>
<th>Unit</th>
<th>Quantity</th>
<th>Cost (Rs.)</th>
<th>Total Cost (INR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plantation</td>
<td>Construction</td>
<td>Plantation of trees &amp; its maintenance for 2 years</td>
<td>Nos.</td>
<td>1,000</td>
<td>440</td>
<td>4,40,000</td>
</tr>
<tr>
<td>Plantation</td>
<td>Construction</td>
<td>Plantation of shrubs &amp; its maintenance for 2 years</td>
<td>Nos.</td>
<td>1,000</td>
<td>440</td>
<td>4,40,000</td>
</tr>
</tbody>
</table>

**Total** 80,008
8.4 ENVIRONMENTAL MONITORING PROGRAM

8.4.1 Monitoring Location & Parameters

Environmental monitoring is an essential component for sustainability of any project. It is an integral part of any environmental assessment process. Environmental monitoring program refers to the set of activities that will provide environmental (physical, chemical & biological) data of the project site during construction of the project. When successfully integrated with the Environmental Management Plan for the project, environmental monitoring can provide valuable feedback about the effectiveness of environment protection measures.

**Table-8.3 Environmental Monitoring Programme during Construction Period**

<table>
<thead>
<tr>
<th>Environment</th>
<th>Environmental Monitoring Programme</th>
<th>Institutional Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Component</strong></td>
<td><strong>Parameters</strong></td>
<td><strong>Location</strong></td>
</tr>
<tr>
<td>Air Quality</td>
<td>PM$<em>{10}$, PM$</em>{2.5}$, SO$_2$, NOx, CO,</td>
<td>2 locations Equipment yard and Nearby village</td>
</tr>
<tr>
<td>Noise Level</td>
<td>Noise level in dB(A)</td>
<td>2 locations Equipment yard and Nearby village</td>
</tr>
<tr>
<td>Surface Water Quality</td>
<td>pH, BOD, COD, TDS, TSS, DO, Oil &amp; Grease, Total hardness, Total alkalinity, Cl, SO$_4$, NO3, PO4, F, Na, K, Ca, Mg, Fe, Zn, and Heavy Metals like As, Cd, Cr, Se, Pb, Hg</td>
<td>1 location</td>
</tr>
</tbody>
</table>

8.4.2 Environmental Monitoring Budget
A capital cost provision of about Rs. 6.04 Lakhs has been kept for environmental monitoring through external agency during the construction phase. The budgetary cost estimate for environmental monitoring is elaborated in Table-8.4.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Stage</th>
<th>No. of Samples</th>
<th>Unit Cost (Rs.)</th>
<th>Total Cost (INR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient Air Quality</td>
<td>Construction</td>
<td>80</td>
<td>5,000/sample</td>
<td>4,00,000</td>
</tr>
<tr>
<td>Noise Level</td>
<td>Construction</td>
<td>48</td>
<td>500/measurement</td>
<td>24,000</td>
</tr>
<tr>
<td>Surface Water Quality</td>
<td>Construction</td>
<td>18</td>
<td>10,000/sample</td>
<td>1,80,000</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>104,005</strong></td>
</tr>
</tbody>
</table>

Note: 1) Construction period is 18 months

8.5 INSTITUTIONAL ARRANGEMENTS

The delivery of the NCRMP is overseen by a National Steering Committee that is supported by a Project Management Unit (PMU). The PMU will be established at the NDMA for active oversight on the different components across the states. Each state in turn has State Steering Committee and a Project Implementation Unit (PIU) for coordinating the day to day activities with the relevant line departments. The overall implementation structure is as follows:

![Diagram of institutional arrangements]

Both the PIU and the PMU have functional and management teams comprising of the Project Managers, Engineers, Procurement specialists, Financial specialists, Environment
& Social specialists and support staff. The role of the different agencies for the environment management is as follows:

8.5.1 **Project Management Unit**

One member of the PMU will be designated as Environmental Officers to oversee the implementation of EMP/ESMF as well as any other environmental provisions as deemed fit for project implementation as per the regulations of the World Bank and the Government of India. The role of this specialist is indicated as follows:

8.5.1.1 **PMU’S Environmental Experts - Roles & Responsibilities**

- Preparation and updating of the EMP/ESMF
- Training and orientation of the PIU teams on the requirement of the EMP/ESMF
- Reviewing the monitoring reports submitted by the districts/Irrigation divisions for compliance with the EMP
- Visit a sample of environmentally sensitive sites, across the implementing district/division, to review compliance with the EMP
- Provide guidance and inputs to the State PIU on environment management aspects
- Act as a single point of contact for resolving queries by the Bank

8.5.1.2 **Qualification and Experience (Environment Expert)**
A Master’s Degree in Environment/Natural Resources or related areas with experience on the environmental safeguard policies of agencies like World Bank and Asian Development Bank. The candidate must possess good writing, reporting and communication skills.

8.5.2 Project Implementation Unit

The Environmental Officer shall oversee the implementation of ESMF as well as any other environmental and social provisions as deemed fit for project implementation as per the regulations of the World Bank and the Government of India.

8.5.2.1 PIU’S Environment Specialists– Roles & Responsibilities

The primary scope of work of the Environmental Specialist is to help the State Project Implementation Unit in preparing and implementing the approved Environmental and Social Management Framework (ESMF) and Environment Management Plan (EMP). Other duties/works include but not limited to the following:

- Coordinate the preparation of environmental screening report of project sites assessments
- Preparation of site specific environment management plans (EMP) for selected sub-projects
- Capacity building of staff, contractors, stakeholders and consultants (wherever detailed Environmental Impact Assessments (EIAs) are taken up) on environmental safeguard issues, practices and procedures to be followed;
- Organizing training for line departments on ESMF / EMP implementation
- Ensuring appropriate application of the ESMF to all components and sub-projects.
- Identifying and providing oversight to other consultants who may be deployed to carry out sub-project specific EAs and EMPs of sub-projects (wherever required);
- Prepare information, communication, and education strategy to enable proper conduct of stakeholder consultations and documenting the implementation of EMPs;
- Detailing all the environmental laws and regulations of the state and national government which will apply to specific sub project activities;
- Liaising with various State line departments & other implementing agencies to provide necessary advice on environmental matters;
- Coordinating with MoEF/SEAC and State-level regulatory authorities for obtaining environment clearances in a timely manner;
- Periodic site visits to ensure that environmental requirements in the ESMF are being followed during implementation of projects activities by the Line departments and contractors, identify shortcomings and advise on the remedial measures.
Preparing and / or providing necessary inputs to project quarterly progress reports on environmental matters pertaining to ESMF implementation;

Supporting hiring of external environmental auditors where appointed by the PIU’s and coordinating the conduct of these audits as per the ESMF requirements. Oversee the working of the third party auditors for social and environment compliance, including review of:
- The audit plan,
- The results and the exceptions of the audits and recommended corrective action

8.5.2.2 Qualification and Experience

A Master’s Degree in Environment/Natural Resources or related areas. Good and demonstrated understanding of the environmental safeguard policies of agencies like World Bank and Asian Development Bank is a prerequisite for this position. The person shall have hands on experience in projects funded by the WB and/or other multilateral agencies in India and the State (preferably). Must possess good writing, reporting and communication skills.

8.5.2.3 Line Department

The line department has the overall responsibility for execution of the contracted work through the contractors/department itself. The line department is responsible for ensuring that the EMPs are implemented for their respective sub-projects.

Roles & Responsibilities:
- Leading the environment screening for the sub-project site
- Onsite review for compliance with the EMP

8.5.2.4 Third Party Auditors

Third party auditors may be appointed by the PIU to provide independent assurance on compliance with the EMPs across project sites.

Roles & Responsibilities:
- Support the PIU in preparing the audit plan
- Prepare compliance report for sub-project activities with ESMF guidelines and other statutory requirements as applicable through scheduled or unscheduled audits
- Conducting random field visits especially at the environmentally or socially sensitive areas
- Review the performance of the project through an assessment of periodical monitoring reports submitted by the line department/PIUs.
Share audit findings with the PIU to aid in timely decision making and adopting appropriate mitigation action if necessary.

8.5.2.5 Project Monitoring and Reporting

Each PIU shall have a designated Environment Specialist. They shall be responsible for overseeing compliance of the sub-projects with the safeguards as well as reviewing the timely implementation of environment as per the ESMF, EMP where applicable. The objectives of Environment monitoring include:

- Successful completion of environmental management, identified in the EMP as per the implementation schedule
- Compliance with the environmental policy

The Environment specialist shall play a key role in reporting the progress of implementation as well as compliance to the PIU, PMU and the World Bank. The following set of MIS shall be made available for review:

<table>
<thead>
<tr>
<th>No.</th>
<th>Particulars</th>
<th>Frequency of updation</th>
<th>Reporting Responsibility</th>
<th>Monitoring responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.</td>
<td>Environment site visit report encapsulating – a. plan vs actual b. exceptions noted in visit</td>
<td>Quarterly</td>
<td>PIU – Environmental Expert</td>
<td>PIU - Project Director, PMU – Environmental Expert</td>
</tr>
</tbody>
</table>

8.6 ENVIRONMENTAL BUDGET

A capital cost provision of about Rs.18.52 Lakh has been kept towards implementation of environmental management plan. The budgetary cost estimate for greenbelt development, environmental monitoring & mangrove plantation is elaborated in Table-8.5.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description</th>
<th>Amount (INR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Greenbelt Development Program</td>
<td>0</td>
</tr>
<tr>
<td>2.</td>
<td>Environmental Monitoring Program (construction phase)</td>
<td>0</td>
</tr>
<tr>
<td>3.</td>
<td>Mangrove Plantation</td>
<td>2,00,000</td>
</tr>
<tr>
<td>4. Silt Fencing*</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>------------------</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>16,84,000</td>
<td></td>
</tr>
<tr>
<td>Contingency @ 10%</td>
<td>1,68,400</td>
<td></td>
</tr>
<tr>
<td>Grand Total</td>
<td>152,417</td>
<td></td>
</tr>
</tbody>
</table>

*Note: Silt fencing cost will be finalized by OSDMA
8.7 BORROW AREA MANAGEMENT PLAN

Borrow Area Selection

Borrow areas for the project will be selected by the Contractor. All provisions stipulated in the EMP and other contract specifications shall be strictly adhered to. The finalization of all such locations depends upon the approval given by the Supervision Consultant on technical and environmental grounds (including haul road network). This includes on-site verification by the SC to cross-check the correctness of details provided by the Contractor in the prescribed format. Only after receipt of the written approval from the SC, the Contractor shall enter into a formal agreement with landowner. If any environmental, safety or community concerns come into light during the site verification process, either appropriate mitigation measure/s shall be provided, as suggested by the Environmental Officer of SC or alternative arrangements for locating other sources of supply of material for road construction will be made by the Contractor. Compliance with environmental requirements/legal provisions with respect to excavation and rehabilitation of borrow areas, as stipulated by the Ministry of Environment and Forests, Government of India, Indian Roads Congress guidelines and local authorities shall be adhered to by the Contractor, for which he shall bear the sole responsibility.

Criteria for Site Selection

The contractor in addition to the established practices, rules and regulation shall also use the following criteria before finalizing the locations of borrow areas:

1) The borrow area should not be located in agriculture field unless unavoidable i.e. barren land is not available. In case borrowing needs to be done on an agricultural land, top-soil stripping, stacking and preservation is a must. Damage to productive and fertile areas has to be minimum. This includes appropriate planning of haul roads.
2) Borrow pits shall not be located within a distance of 100 mts. from any NH, SH or other roads.
3) Borrow pits shall be preferably located 500 mts. away from settlements/ habitations.
4) No borrow pits shall be located within 250 mts. from schools, colleges, playgrounds, religious structures and health centers.
5) No borrow area shall be opened within 500 mts. from a reserved or protected forest area, protected sites, wildlife movement zone and cultural heritage site.
6) No tree cutting shall be undertaken.
7) Borrow area near any surface water body will be at least 100mts. away from the toe of the bank or high flood level, whichever is maximum.

After identification of borrow area location/s, the Contractor will fill the prescribed reporting format and submit the same for approval to the “Site Engineer” at least 7 working days before commencement of earth works. A written approval from SC shall be necessary before any activity/work is commenced.
**Borrow Area Management**

Before the start of operations, the area to be borrowed shall be marked by the contractor with wooden or stone pegs to ensure that the land required for slope stabilization or bund creation is maintained. Supervision Consultant has to ensure that this marking is done on the ground to avoid issues at a later date. Any disregard of this condition shall be made good at the contractor’s and/or consultant’s own expense.

The following principles shall be adhered to during borrow area operations in specific conditions:

**a. Borrow Areas located in Agricultural Lands**

- A 15 cm topsoil layer will be stripped off from the borrow pit and this will be preserved in stockpiles in a designated area with a height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).
- Borrowing of earth will be allowed up to a depth of 1.5 mtr from the existing ground level only.
- Ridges of not less than 8m width will be left at intervals not exceeding 300m. Small drains will be cut through the ridges, if necessary, to facilitate drainage.
- The slope of the edges will be maintained not steeper than 1:4 (vertical: Horizontal).
- Rehabilitation shall be satisfactorily undertaken immediately after the use has ceased and at least three weeks prior to monsoon.
- Preserved top soil has be spread uniformly over the section of the farmland used as a borrow area.

**b. Borrow Areas located in Elevated Lands**

- A 15 cm topsoil will be stripped off from the borrow pit and this will be preserved in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).
- Silt fencing at the base of the top soil stockpile shall be provided for preventing wash out or loss of top soil.
- The borrowing shall not be permitted beyond a depth of 1.5 mt below the adjacent ground level.
- Preserved top soil has be spread uniformly over the land used as a borrow area.

**c. Borrow Areas near Riverside and Structures**

- A 15 cm topsoil will be stripped off from the borrow pit and this will be preserved in stockpiles in a designated area for height not exceeding 2m and
side slopes not steeper than 1:2 (Vertical: Horizontal).

- Silt fencing at the base of the top soil stockpile shall be provided for preventing wash out or loss of top soil.
- Borrow areas should be at least 250 mts. away from the toe of the embankment, flood control structures, culverts, bridges, unlisted cultural property etc., to prevent any damage to the stability of such structures.
- The borrowing shall not be permitted beyond a depth of 1.5 mt below the adjacent ground level.
- Preserved top soil has be spread uniformly over the land used as a borrow area.

**d. Borrow Areas near Settlements and Roads**

- A 15 cm topsoil will be stripped off from the borrow pit and this will be preserved in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).
- Borrow areas should be at least 250 mts. away from the settlements including schools, colleges, hospitals, playgrounds and religious structures.
- Borrow area should be at least 100 mt. away from the toe line of an access road or a highway.
- Preserved top soil has be spread uniformly over the land used as a borrow area, is is being rehabilitated as a farmland or a plantation area. Or else it should be used in the plantation zone along the highway.
- Bunds and temporary fencing (using barbed wire) along with plantation should be provided in case the borrow area is developed as a pond to ensure safety of the residents and the cattle. However, the depth shall not exceed 1.5 mts.
Rehabilitation or Re-development of Borrow Areas

The objective of the borrow area rehabilitation is to return the borrowing sites to a safe and environmentally sound condition. The concept entails enhancing benefits (including those linked to livelihood) for the community and individuals. Top soil preservation (and its re-use) and proper stabilization of slopes are the fundamental requirements of the rehabilitation process.

Re-development plan shall be prepared and submitted along with reporting format by the contractor before the borrowing operation is permitted by the Supervision Consultant. The redevelopment is to be prepared in consultation with land owner/s (whether public, private or institutional) and by within the environmental and safety requirements of the EMP.

Some key points on borrow area rehabilitation are presented in the table provided below. However, the contractor is free to prepare other rehabilitation scheme/s subject to the approval by the Environmental Officer of the Supervision Consultant.

<table>
<thead>
<tr>
<th>S. N.</th>
<th>Type/Form of Rehabilitation</th>
<th>Re-use of Top Soil</th>
<th>Actions required for Rehabilitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Farm land</td>
<td>Yes</td>
<td>➢ Leveling</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>➢ Slope Stabilization along the edges if there is a level difference</td>
</tr>
<tr>
<td>2.</td>
<td>Ponds including creation of new ones and enhancing capacity of existing ones (for irrigation; pissiculture and general uses by people and/or cattle)</td>
<td>No</td>
<td>➢ Slope Stabilization (angle/benching)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>➢ Access / Approach Ramp</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>➢ Bund creation and Temporary Fencing</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>➢ Plantation in the periphery</td>
</tr>
<tr>
<td>3.</td>
<td>Water recharging areas/percolation tanks (depth up to one meter)</td>
<td>No</td>
<td>➢ Slope Stabilization</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>➢ Small bund creation</td>
</tr>
<tr>
<td>4.</td>
<td>Leveled lands that can be developed later for various uses (such as residential areas, parking lots, community grounds etc.)</td>
<td>Generally No</td>
<td>➢ Leveling</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>➢ Top soil re-use depends on the type of developmental work envisaged</td>
</tr>
<tr>
<td>5.</td>
<td>Construction waste disposal sites (for non-toxic/non-hazardous wastes) (reinstated with top-soil with plantation over the rehabilitated site)</td>
<td>No</td>
<td>➢ Depression after filling-in of wastes to be leveled-up</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>➢ Top soil re-use depends on the type of developmental work envisaged</td>
</tr>
<tr>
<td>6.</td>
<td>Plantation Zones</td>
<td>Yes</td>
<td>➢ Leveling</td>
</tr>
<tr>
<td>S. N.</td>
<td>Type/Form of Rehabilitation</td>
<td>Re-use of Top Soil</td>
<td>Actions required for Rehabilitation</td>
</tr>
<tr>
<td>------</td>
<td>-----------------------------</td>
<td>-------------------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No</td>
<td>➢ Selection of Species as per OSRP Project Guidelines</td>
</tr>
<tr>
<td>7.</td>
<td>Water holes for animals and birds (outside forest and protected areas)</td>
<td></td>
<td>➢ Gentle Slopes on all sides</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>➢ Plantation in the periphery</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>➢ Depth upto 1.5 mt.</td>
</tr>
</tbody>
</table>

Top soil that cannot be re-used in rehabilitation of borrow areas shall be used in the plantation belt/zone along the road.

Rehabilitation works shall be undertaken immediately upon the exhaustion of the approved quantity and shall not be delayed. The Supervision Consultant shall take appropriate action in case delays are observed.

**Documentation**

The reporting format for seeking approval for the borrow area on environmental and safety aspects shall include a pre-operation photograph. Likewise, at the end of the operation, photographic documentation after rehabilitation works are completed shall be maintained both by the contractor and the Supervision Consultant. Certification/documentation including approval for rehabilitation works and thereafter hand-over to the owner shall be properly maintained by the contractor, Supervision Consultant and OWD/PMU.
8.8 QUARRY AREA MANAGEMENT PLAN

Quarry Area Selection:

Quarry areas for the project will be selected by the Contractor. All provisions stipulated in the EMP and other contract specifications shall be strictly adhered to. The finalization of all such locations depends upon the approval given by the Supervision Consultant on technical and environmental grounds (including haul road network). This includes on-site verification by the SC to cross-check the correctness of details provided by the Contractor in the prescribed format. Only after receipt of the written approval from the SC, the Contractor shall proceed with the preparation of operational plans/permissions for the quarry area.

If any environmental, safety or community concerns come into light during the site verification process, either appropriate mitigation measure/s shall be provided, as suggested by the Environmental Officer of SC or alternative arrangements for locating other sources of supply of material for road construction shall be made by the Contractor.

Compliance with environmental requirements/legal provisions with respect to selection/operation/rehabilitation of quarry areas, as stipulated by the Ministry of Environment and Forests, Government of India, Indian Roads Congress guidelines and local authorities shall be adhered to by the Contractor, for which he shall bear the sole responsibility.

The Contractor may finalize the location/s of the quarry from the list given by DPR Consultants for procuring materials. The Contractor can be allowed to open a new quarry only with the prior consent of the Mining Department, District Administration, PMU/OWD, Supervision Consultant in cases when:

(i) lead from existing quarries is uneconomical and
(ii) alternative/other material sources are not available for his use.

Quarry Area Operations:

After the required permissions are sought, the operation plan for the quarry is to be submitted by the contractor to the PMU/OWD and the Supervision Consultant prior to commencing any work at the quarry site with complete details of the work programme including procurement of materials, transportation and haul road management, storage of quarry materials, safety plan and pollution control measures. The Supervision Consultant and the PMU/OWD have to ensure that operations are not initiated without the said submission.
Apart from the stipulations in the EMP, the following measures shall be undertaken to minimize the adverse impacts during excavation of material:

i) Quarry boundaries shall be properly demarcated on the ground using fence posts.

ii) The top soil to a depth of 15 cm to 20 cm shall be stripped, stored in stockpiles and preserved for re-use in plantation sites. If the plantation sites are ready, the top soil should be directly taken to these areas for spreading, which saves the time and resources required for handling and preservation.

iii) Adequate drainage system shall be provided to prevent the water logging or flooding in the excavated area.

iv) At the stockpiling locations, the Contractor shall construct sediment barriers/silt traps to prevent the loss of excavated material (and subsequent siltation) due to the run-off.

v) Construction of offices, laboratory, workshop, accommodation and rest areas shall be done in the up-wind of the quarry and crusher plant to minimize the adverse impact due to dust and noise.

vi) The access road to the crusher plant shall be constructed and maintained properly to prevent dust generation. The lay-out shall be such that minimal compaction of fertile land takes place.

vii) In case of storage of blasting material, all precautions shall be taken as per The Explosive Rules, 1983.

viii) The contractor shall ensure that all safety measures for the workers and the residents along the haul roads shall be done as required under the law of the land and as specified in the EMP.

ix) The contractor shall ensure provision and regular maintenance of pollution control measures at crushers regularly as per manufacturer's recommendation and as per Environmental Officer’s (of SC) instructions.

x) Overburden shall be removed and reused/disposed in line with approved Comprehensive Waste Management Plan.

xi) Slope stabilization requirements as per the characteristics of the strata and the depth of excavation shall be implemented.

Quarry Area Rehabilitation/Redevelopment:

The Contractor shall prepare a Redevelopment Plan for the quarry site, which will be approved on technical, environmental and safety grounds by the concerned Regulatory Authorities, Environmental Officers of the Supervision Consultant and the PMU/OWD. This plan shall be submitted along with the request for opening of the site. Any request for opening/operating quarry without a rehabilitation plan shall not be accepted by the Supervision Consultant.
The contractor shall also restore all haul roads constructed for transporting the material from the quarry to the construction camps/sites.

Rehabilitation includes both the under-mentioned scenarios -
1. Redevelopment of new quarry opened by the contractor for the project
2. Redevelopment of existing quarry operated by other agencies/individuals

In the first case, the contractor shall be responsible for the redevelopment/rehabilitation which must be completed prior to the handing-over of the works. These sites shall be maintained throughout the Defect Liability Period. The compliance certificate shall be issued upon site verification through joint inspection of the Supervision Consultant and PMU/OWD.

In the second case, the redevelopment of the exhausted quarry shall be the responsibility of the agency/department that has provided the permission/consent for initiation and operation.

Possible re-development options:

**Option A:** Re-vegetation of the quarry to merge with surrounding landscape with reuse of top soil mixed together with farm yard manure.

**Option B:** Development of exhausted quarries as water bodies, where the quarry pit is developed into pond or a rainwater harvesting structure. In this case, the rock system, the stability of the structure, location of the habitation down hill (which might be impacted in case of any breach - necessary re-enforcement of the weaker areas by masonry structures or spill way to drain out excess water) has to be considered. The slopes of the quarry may require benching (depends on depth and strata) to prevent slips. Plantation along the boundary, erosion control measures and access ramps also need to be introduced as a part of the rehabilitation plan.

**Documentation:** The reporting format for seeking approval for the quarry area on environmental and safety aspects shall include a pre-operation photograph. Photographic records shall also be maintained during the operation of the quarry. Likewise, at the end of the operation, photographic documentation after rehabilitation works are completed shall be maintained both by the contractor and the Supervision Consultant.

Certification/documentation including approval for rehabilitation works and thereafter hand-over to the owner shall be properly maintained by the contractor, Supervision Consultant and OWD/PMU.
8.9 SOIL EROSION AND SEDIMENTATION CONTROL

All materials shall meet commercial grade standards and shall be approved by the Engineer before being used in the work.

Construction Operations

Prior to the start of the construction work, the contractor shall submit to the Supervision Consultant/Engineer the plan, methodology and time schedule for carrying out temporary and permanent erosion/sedimentation control works for approval. as are applicable for the items of clearing and grubbing, roadway and drainage excavation, embankment/sub-grade construction, bridges and other structures across water courses, pavement courses and shoulder. This plan shall also submit for approval his proposed method of erosion/sedimentation control on service road and borrow pits and his plan for disposal of waste materials. Work shall not be started until the erosion/sedimentation control schedules and methods of operations for the applicable construction have been approved by the Engineer and the Supervision Consultant’s Environment Export.

The surface area of erosion prone earth exposed by clearing and grubbing, excavation, borrow and fill operations shall be limited to the extent practicable. The contractor may be directed to provide immediate control measures to prevent soil erosion and sedimentation that will adversely affect construction operations, damage adjacent properties, or cause contamination of nearby streams or other watercourses. Such work may involve the construction of temporary berms, dikes, sediment basins, slope drains and use of temporary mulches, fabrics, mats, seeding, or other control devices or methods as necessary to control erosion and sedimentation.

The Contractor shall be required to incorporate all permanent erosion and sedimentation control features into the project at the earliest practicable time as outlined in his accepted schedule to minimize the need for temporary erosion and sedimentation control measures.

Temporary erosion /sedimentation and pollution control measures will be used to control the phenomenon of erosion, sedimentation and pollution that may develop during normal construction practices, but may neither be foreseen during design stage nor associated with permanent control features on the project.

Where erosion or sedimentation is likely to be a problem, clearing and grubbing operations should be so scheduled and performed that grading operations and permanent erosion or sedimentation control features can follow immediately thereafter if the project conditions permit; otherwise temporary erosion or sedimentation control measures may be required between successive construction stages. Under no conditions shall clearing
and grubbing or excavation without prior approval of the Engineer and Environment consultant expose a large surface area of credible earth material at one time.

The Engineer may limit the area of excavation, borrow and embankment operations in progress, commensurate with the Contractor's capability and progress in keeping the finish grading, mulching, seeding and other such permanent erosion, sedimentation and pollution control measures, in accordance with the accepted schedule.

Temporary erosion is sometimes caused due to the Contractor's negligence, carelessness or failure to install permanent controls. Sedimentation and pollution control measures then become necessary as a part of the work as scheduled or ordered by the Engineer, and these shall be carried out at the Contractor's own expense. Temporary erosion, sedimentation and pollution control work required, which is not attributed to the Contractor's negligence, carelessness or failure to install permanent controls, will be performed as ordered by the Engineer.

Temporary erosion, sedimentation and pollution control may include construction work outside the right of way where such work is necessary as a result of road construction such as borrow pit operations, service roads and equipment storage sites.

He shall maintain the temporary erosion, sedimentation and pollution control features installed by the Contractor till these are needed, unless otherwise agreed by the Engineer.
8.10 WASTE DISPOSAL SITE MANAGEMENT

A comprehensive waste management plan shall be prepared by the contractor prior to initiation of any works. This plan should at least contain the following information:

- Estimated quantity of waste
- Type of wastes
- Disposal Plan shall be in line with the work program

Criteria for Site Selection

The locations of waste disposal have to be selected such that:

- Residential areas are located on the up-wind direction of the site.
- The site is minimum 500 mts. away from sensitive locations like settlements, ponds/lakes or other water bodies, wetlands, protected areas, forests, wildlife movement areas, seasonal streams, rivers, canals, flood plains, educational institutions, medical centers, religious sites, cultural or heritage sites and play grounds.
- No hazardous and contagious waste material will be disposed at such locations.
- The selected site meets with the local regulatory requirements (including those of SPCB, Municipalities etc.).
- The sites selected by the contractor shall be assessed and approved by the environmental, health and safety grounds by the Environmental Officer of the Supervision Consultant. The Resident Engineer shall be responsible to ensure that approval/s for work programme are not provided without the environment, health and safety plan submission.
- While disposing debris / waste material, the contractor will take into account the wind direction and location of settlements to ensure against any dust problems.
- Proper barricading is made to prevent spread of the waste material through action of wind, water, scavengers or rat pickers.
- Precautions to be Adopted during Disposal of Debris/Waste Material
- The contractor shall take the following precautions during transportation and disposal disposing of debris/waste material:
- During the site clearance for disposal of debris, the contractor will take full care to ensure that public or private properties are not damaged/affected and that the traffic is not interrupted.
- Contractor will dispose off debris only at the identified places only after prior written permission of Supervision Consultant and OWD/PMU has been received.
- In the event of any accidental spill or spread of wastes onto adjacent parcels of land, the contractor will immediately remove all such waste material/s and restore the
affected area to its original state to the satisfaction of the Engineer-in-charge of works.

- The contractor will at all times ensure that the existing ponds, canal and drains within and adjacent to the site are kept free from any debris/wastes.
- Contractor will ensure effective water sprinkling during the handling and transportation of materials when dust is likely to be created.
- Materials having the potential to produce dust will not be loaded beyond the side and tail board level and will be covered with a tarpaulin in good condition.
- Any diversion required for traffic during disposal of debris shall be provided with traffic control signals and barriers after discussion with the local people and as approved by the Engineer-in-charge of works.
- During the debris disposal, contractor will take care of surrounding features and avoid any damage to trees and properties.

**Rehabilitation of Waste Disposal Sites**

- Along with the format seeking permission/approval for the disposal site/location from the Engineer/Supervision Consultant, the contractor shall also submit a rehabilitation plan for the area.
- The dump sites shall be suitably rehabilitated by planting local species of shrubs and other plants. The species (region specific) shall be chosen from the list suggested in the EA/EMP. Local species of trees should be selected so that the landscape is coherent and is in harmony with the surrounding environment.
- Rehabilitation can also include conversion into farm land, playground, parking area, block plantation area etc.
- Some of the dumpsites could be used either for plantation or for growing agricultural produce such as ginger, turmeric or oranges etc.
- Care should always be taken to maintain the hydrological flow in the area.

8.11 WORKER’S SAFETY IN COMMON OPERATIONS DURING CONSTRUCTION

**Plant Sites, Construction Camp and Quarry Areas**

- Install perimeter fencing.
Ensure good visibility and safe access at site entrances.

- Provide adequate warning signs at the entrance and exit, as necessary.
- Provide adequate space/area for loading and unloading, storage of materials, plant and machinery.
- Display emergency procedure and statutory notices at conspicuous locations.
- Provide areas for collecting garbage and other waste material, and also arrange for their regular/periodic disposal.
- Arrange appropriate storage, transportation and use of fuel, other flammable materials and explosives in line with the license requirements obtained from concerned authorities.
- Provide defined access roads and movement areas within the site.
- Ensure availability of first aid facilities and display notices at various work places showing the location of first aid facilities and emergency contact numbers.
- Provide and enforce use of PPE at plant and quarry sites.

### House Keeping Practices

- Provide proper slope in kitchen, canteens, washrooms, toilets and bathrooms for easy and immediate draining of water.
- Keep all walkways and circulation areas clear and unobstructed at all times.
- Ensure that spillages of oil and grease are avoided and in case of accidental spills, these are immediately collected.
- Use metal bins for collection of oily and greasy rags.
- Stack raw materials and finished products out of walkways.
- Do not leave tools on the floor or in any location where they can be easily dislodged.
- Keep windows and light fittings clean.
- Maintain the workplace floors dry and in a non-slippery condition
- Provide and maintain proper drainage system to prevent water logging and unhygienic conditions.
- Ensure that protruding nails in boards or walls are moved or bent over or removed so that they do not constitute a hazard to people.
- Store all flammable materials in appropriate bins, racks or cabinets with proper cover and labels – as required for various products.
- Make sure that hazardous/dangerous chemicals are kept in the goods stores with the appropriate labeling, display of the material-safety-data-sheet (MSDS) and other precautionary measures.
- Display ‘no smoking’ signs in areas with high risks of fire, (eg. near fuelling areas, diesel/oils/lubricant/paint storage area, hessians, rubber, wood and plastic etc.) in and around working area.

### Operation of Trucks and Dumpers

- Ensure that only trained, authorized and licensed drivers operate the vehicles.
- Enlist help of another worker before reversing the vehicle.
- Switch-off the engine when not in use to save fuel, prevent accidents and unnecessary noise and air pollution.
- Lower the tipping bodies when the machine is unattended, but if it is necessary to leave them in the raised position they should be blocked to prevent their fall by fixing a sturdy support below.
- Carryout periodic servicing as per the manufacturer’s requirements. All records of maintenance and repairs should be in writing and available for verification.
- Keep the vehicle tidy and the cabin free from clumsy utilities, which might obstruct the controls and create hazards.
- Follow safe driving principles including speed limits as per traffic signage.
- Avoid carrying additional passengers in the cabin or on the body of the dumper, while in field operation other than the connected workers.
- Provide stop blocks when the vehicle is tipping into or running alongside excavations or when it is parked.
- Do not overload the vehicle.
- Carry only well secured loads and use proper covers and fasteners.

**Manual Handling and Lifting**

- Avoid manual handling of heavy and hazardous objects and chemicals.
- Pre-assess the actual requirement of manpower in case of emergency situations.
- The hazardous and poisonous materials should not be manually handled without proper equipments/gears and prior declaration of the risks needs to be made to the involved workers.
- All concerned persons shall be trained in proper methods of lifting and carrying.
- In all manual operations where groups of workers are involved, a team leader with necessary training to handle the entire work force in unison has to be provided for.
- Watch and ward to control/supervise/guide movement of equipments and machineries, loading and unloading operations, stability of the stockpiled materials and irregularly shaped objects have to be provided for safety and security of workers.
- Carriageway used by the workers must be free from objects, which are dangerous.
- Loading and unloading from vehicles shall be under strict supervision.

**Electrical Hazards in Construction Areas**

- Statutory warning leaflets/posters are to be distributed/displayed by the Contractor in the vicinity of work sites for the benefit of all workers, officers and supervisors as well as the public, indicating the do’s and don’ts and warning related to electrical hazards associated with operations to be executed/in progress.
- All wires shall be treated as live wires.
- Report about dangling wires to the site-in-charge and do not touch them.
- Only a qualified electrician should attempt electrical repairs.
- Train all workers about electrical safety.
Shut down the equipment that is sparking or getting over heated or emitting smoke at the time of operation, if it is not the normal way of working of such machines. Inform technical person/s for required maintenance.

Never used damaged wires for electrical connection.

Demolition, tree felling and removal of overhead transmission lines shall be undertaken with strong, efficient and closely monitored arrangements to avoid accidents.

**Noise Hazards and its Control**

- Plan camp lay-out in a manner that ensures barriers/buffers between residential/office units and high noise generating zones.
- Use sound meters to measure the level of noise and if it exceeds 75 dB(A), then ensure preventive measures.
- Make personnel aware of noisy areas by using suitable warning signs and insist on use of ear protectors/ear plugs to prevent excess noise affecting the workmen.
- Reduce noise at source by: use of improved equipments; regular and proper maintenance the machinery as per the manufacturer’s manual; by replacing rickety and noisy equipments and machineries. Screening locations with noise absorbing material; making changes in the process/equipment; controlling machine speeds; ensuring that two noise-generating machines are not running at the same time close to each other at same location; using cutting oils and hydraulic noise breakers; providing vibration and noise absorbing platform and firm embedding of equipments with fasteners.
- Appoint a competent person to: carryout a detailed noise assessment of the site; designate ear protection zone/s; give training/instructions on the necessary precautionary measures to be observed by site personnel including using suitable type of ear protection equipments.

**Personal Protective Equipment**

**General**

- Provision of personal protective equipment has to be made over and above all measures taken for removing or controlling safety hazards on a work site.
- Ensure that sufficient personal protective equipments are provided and that they are readily available for every person who may need to use them.
- The Contractor’s Project Manager shall ensure that all persons make full and proper use of the personal protective equipment provided.
- Provide instruction/s and training for the proper use and care of personal protective equipment.
- Ensure that the personal protective equipments are in good condition.
- Train workers to report unintentional damages for replacement and to always keep the personal protective equipment clean.
- PPE includes, but may not be limited to, hard hats, goggles, ear plugs, gloves, air filters/masks, boots, ropes etc.

**Eye Protection**
- Road construction work sites, quarries and crushers are full of dust particles, sand, splinter, harmful gases, bright light and welding arc lights, which are injurious for the eyes. Therefore, eye protection and adequate lighting in work areas is required.
- All workers, supervisors and inspection officers and dignitaries coming over for study of works should be compelled to wear eye protecting glasses/goggles properly fitting the eye sockets to prevent damage due to dust, gases and other particles.

**Head Protection**
- Hard hats are compulsory for all workers, supervisors and managers/officials while working and/or inspecting a work sites.
- Hard hat areas shall be demarcated clearly.

**Hearing Protection**
- Provide ear plugs or ear muffs to the workers and to those who need to get in and out of a high noise area frequently. Use re-usable earplugs when the reduction required (15-25 dBA) is not excessive. Use earmuffs where a large attenuation of upto 40 dBA is demanded.
- Do not use dry cotton wool for hearing protection because it doesn’t provide any such protection.
- Provide disposable ear plugs for infrequent visitors and ensure that these are never re-used.
- Replenish ear plugs from time to time for those who need to work continuously for a long period in a high noise area/s.
- Use ear muffs with replaceable ear cushions because they deteriorate with age or may be damaged in use.
- Avoid wearing spectacles with ear muffs.
- Use soap and water or the recommended solvent for cleaning ear muffs.

**Respiratory (Protective) Equipment**
- Wear suitable makes for protection when there is a potential for small particles entering the lungs, e.g. emptying of cement bags, working at crusher sites etc.
- Provide training to all persons using the masks/respirators for their correct fitting, use, limitations and symptoms of exposure.
- Clean and inspect all respirators before and after use.
- Store respirators properly when not in use.

**Safety Footwear**
- Wear suitable footwear for work
- Use safety footwear on site or in other dangerous areas.
Wear suitable safety shoes or ankle boots when working anywhere where there is high risk of foot injuries from slippery or uneven ground, sharp objects, falling objects etc.

All safety footwear, including safety shoes, ankle boots and rubber boots, should be fitted with steel toecaps.

Avoid wearing flip flops, high heeled shoes, slippers, light sport shoes in situations where there is a risk of foot injury.

Keep shoelace knots tight.

**Hand Protection**

Wear suitable gloves for selected activities such as welding, cutting and manual handling of materials and equipment.

Do not wear gloves where there is a risk of them becoming entangled in moving parts of machinery.

Wash hands properly with disinfectant soap and clean water before drinking or eating.

Wash hands immediately after each operation on site when the situation warrants.

**First Aid**

Provide first aid boxes at every work site in a cool and shaded place.

Ensure that training on the use of the first aid box is provided to at least every supervisor on the site.

Display the list of persons along with their contact numbers who are trained on providing first aid.

Ensure that every first aid box is marked "First Aid" in English and in Oriya.

Check for expiry dates and replace the contents, as necessary.

Maintain a register on health records including injuries/accidents.

**Accident Investigations**

Carryout the investigation/s as quickly as possible.

Investigation should be carried out both internally as well as through third party.

Conduct interviews with as many witnesses as necessary including the affected persons and supervising officials.

Do not rely on any one/limited source of evidence.

Check all the log books, stock registers, issue registers, movement registers on site safety regulations, traffic signals and signal men activities, signage, as well as other field positions and keep a record of all investigations through audio-visual and electronic medium for presenting an evaluation of the incident/s.

After completion of the investigation/enquiry, a summary of the facts recorded, sequence of happenings, persons-in-charge, persons examined, equipments and machineries tested, follow-up of action as per legal requirements, copy of station diary entry, hospital entry, safety regulations etc. to be prepared with a comparative analysis for proper assessment.
8.12 GUIDELINES FOR SITE SELECTION, LAYOUT PLAN AND BASIC AMENITIES AT CONSTRUCTION CAMP/S

Construction camps include, but may not be limited to, office space; laboratory; vehicle repair and maintenance workshop/s; fuel pumps and associated areas; parking spaces; accommodation or quarters for engineers, workers and labour; basic amenities such as mess, kitchen, potable water supply, first aid room, garbage collection and disposal facility, sanitation (toilets, bathrooms, washing areas and water supply for such needs), material stack yards or storage areas, circulation areas, hot-mix plants, batching plants, crushers and any other space/area associated with similar activities.

Location or Siting of Construction Camp/s

The contractor shall identify the location of the construction camp/s, on the basis EMP clauses. Apart from these clauses, the Contractor shall adhere to the following provisions:

- To the extent possible, agricultural lands and fertile lands shall be avoided.
- Barren or wastelands are to be preferred during site selection.
- All such sites must be above the HFL with adequate drainage facility.
- In areas prone to floods, cyclones, cloud bursts or heavy rainfall, selection of the site shall be made keeping in mind the safety of the camp and its habitants.

The selected site/s shall be approved by Environmental Officer of WRD after considering the compliance with the EMP clauses including the activities proposed for such a site. No agreements or payments shall be made to the land owner/s prior to receipt of a written approval from the WRD/PMU. Any consequence of rejection prior to the approval shall be the responsibility of the Contractor and shall be made be made good at his own cost.

Layout

The lay-out of a construction camp site has to be carefully planned and prepared keeping in view the various activities proposed for a particular site. The lay-out plan will contain details pertaining to, but not limited to, the cardinal points, wind direction, dimensions, surrounding features and proposed activities. This shall be submitted with complete details provided in the prescribed reporting format to the WRD for written approval before any physical work (includes storage of materials, equipment etc.) is undertaken on a particular site.

The WRD will carefully examine the proposals in light of the various EMP and regulatory provisions and provide suggestions, as necessary. Both the
Resident Engineer and the Environmental Officer shall be responsible for satisfactory and timely completion of this EMP requirement.

Some of the principles governing a lay-out plan have been listed below:

- The prevailing wind direction shall be kept in mind while planning out the lay-out of internal facilities.
- No trees shall be cut and the existing ones need to be integrated into the lay-out plan with proper planning.
- The stripping, stacking and preservation of top soil will be mandatory in case of farm lands and fertile areas and absolutely no material stacking or equipment installment or vehicle parking or any other activity shall be allowed prior to the satisfactory completion of this activity.
- The proposed top soil stacking areas along with the quantity shall be clearly depicted on the lay-out plan.
- Proper circulation paths and parking spaces need to be provided.
- Fuel pumps, storage facility for inflammable and hazardous chemicals/ materials shall be provided at safe distance from office, mess and residential areas inside the camp.
- Proper fire safety precautions including safe exits, warning signs need to be provided at all locations including vulnerable areas like plant sites, kitchen, workshops, fuel pumps, stores etc.
- Electric safety practices shall be integrated/incorporated during the lay-out plan preparation.
- All sites must be graded and rendered free from depressions such that water does not get stagnant.
- Appropriate drainage shall be provided for.
- Fencing of the camp site is necessary.
- New plantation needs to be taken-up along the boundaries using guidance from the OWD’s Forestry and Wildlife Expert.

Basic Amenities/Facilities

The Contractor will provide, erect and maintain necessary (temporary) living accommodation and ancillary facilities (including first-aid and emergency response arrangements) for the staff/workers/labour to the standards and scales mentioned in the EMP and relevant legislation. This includes maintaining facilities in such a fashion that uncontaminated water is available for drinking, cooking and washing.

Accommodation: The height of the workers and labour accommodation shall not be less than 3mt. from floor level to lowest part of the roof. Sheds shall be kept clean, with proper cross ventilation, and the space provided shall be on the basis of one sq.mt per head or as per the relevant regulation, whichever is higher. Fire and electrical safety pre-
Cautions shall be adhered to. Cooking, sanitation and washing areas shall be provided separately as per the EMP clauses.

Potable Water: **Safe drinking water is be provided to the dwellers of the construction camps – periodic tests shall be conducted by the Contractor and independently by the OWD/PMU to ascertain this.**

**Mess and Kitchen Facilities:** The Contractor shall adhere to the sanitary/hygiene requirements of local medical, health and municipal authorities and at all times adopt such precautions as may be necessary to prevent soil and water pollution at the site while operating mess or kitchen facilities.

**Sanitation Facilities:** Sanitation arrangements in the construction camp/s shall be provided as per the clauses mentioned in EMP. The required washing and bathing places shall be provided and kept in clean and drained condition. Drains and ditches should be treated with bleaching powder on a regular basis. The sewage system for the camp must be properly designed, built and operated so that no health hazard occurs and no pollution to the air, ground or adjacent watercourses takes place. Compliance with the relevant legislation must be strictly adhered to. The SC shall take immediate action in case of any non-compliance and the Contractor shall rectify the situation as per EMP and regulatory requirements at his own cost.

**Day Creche Facility:** At every construction site, provision of a day creche shall be made so as to enable women to leave behind their children while going to work. At least one attendant shall be provided to take care of the children at the crèche. At construction sites where 20 or more women are employed, there shall be at least one shelter for use of children under the age of 6 years belonging to such women. Shelters shall not be constructed to a standard lower than that of thatched roof, mud walls and floor with wooden planks spread over mud floor and covered with matting. Such areas shall be safely barricaded (not sharp sheets or barbed wires that may injure a child) from rest of the camp for the safety of children. Shelters shall be provided with suitable and sufficient openings for light and ventilation. There shall be adequate provision to keep the place clean. The size of a crèche may vary according to the number of children on a camp site.

**Monitoring and Reporting**

The WRD/PMU shall closely monitor and record compliance with regard to setting-up and operation of construction camp/s in the agreed formats and shall immediately take action in case non-compliance is observed. The WRD needs to be specifically vigilant during the initial stages so as to avoid issues pertaining to improper site selection and poor lay-out planning.
8.13 GUIDELINES FOR PLANTATION AND GRASS TURFING

Compensatory Afforestation

Compensatory afforestation sites shall be decided in consultation with the Divisional Forest Officer and a suitable map of the area mentioning the north, south, east and west boundary features, along with the plot number of the proposed non-forest land identified for the purpose shall be prepared. The Department of Forests, Govt. of Orissa will thereafter finalize the afforestation scheme providing therein details of work schedule, the specific cost structure for implementation of the same and proposed monitoring mechanism.

Selection of Tree Species

Selection of tree species for plantation should be based on site-specific conditions and features as per the scheme prepared by the forest department (concerned forest division, where the non-forest land has been identified for compensatory afforestation), with species as suggested there in to be taken up by forest department, subject to condition of utilization certificate in this regard submitted to OWD (OSRP) for audit and reference purposes, basing on the funds released during a specific financial year and works undertaken as per the provisions of the scheme.

Avenue Plantation

The choice of species being dependant on the type of soil and underground water table browsable or non browsable nature of species, there may be deviation to choose the trees /shrubs with signing leaves from out of the list of species indicated for corridor. Wire mesh tree guards shall be provided for browsable species only.

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<tr>
<th>Sl. No</th>
<th>Species</th>
<th>Browsable/ Non Browsable</th>
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Bamboo (Bambusa arundinacea) or thorny bamboo, palms, shrubs and small trees could be chosen to reduce the effect of noise and dust pollution from the road. In the matter of selection of species for avenue planting, stakeholders need be consulted and their views should be accommodated within the purview of above mentioned species selection criteria.

Planting Pattern

**Monoculture planting has to be avoided. Mixed culture of shade-giving, flowering and fruit-bearing species should be preferred.**

**Avenue Plantation**

- The percentage of non-browsable species shall be more than 70 percent to keep down the cost of maintenance and tree guards.
- In areas where dust generation is a problem, dwarf bamboos shall be planted on either side at 1mtr spacing to lower the impact of noise and dust generated due to road operation. These plantations of bamboo shall be either from off-set planting or rhizome planting with barbed wire fencing.
- The trees and shrubs will be at spacing of 5mtr from plant to plant with inter planting of dwarf bamboo and flowering shrubs in between two trees /shrubs that is to say this spacing in the row shall be 2.5mtr from each plant to plant.
- At road intersections or junctions, the islands erected with PCC road curb shall be planted of with dwarf Duranta varigata species and its spacing shall be 45cm to 1mtr apart with trimming of the plant to a height of 0.7mtrs.

**Scope of Work**

Contractor will furnish all materials, labour and related items necessary to complete the work assigned in the Contract with regards to plantation.

**Plantation Mechanism**

- All plants supplied must be planted within three days of removal from the nursery.
- The relocated plants shall be placed in pits of 1x1x1mtr size and shrubs and bamboos shall be put in 30x30x30cm size pits. The pit size will be 45x45x45 for medium and tall trees.
- The manuring and watering will be carried out according to seasons - manuraing during early rains and late rains (early winter) and watering from mid-February to mid-June.
- No. of plants per km at (a) 5mtr spacing 400 (200 each on both sides) (b) 2.5mtr spacing 800 (400 each both side)
(c) 1mtr spacing 2000 (1000 each both side)

- Use of compost/farm yard manure/cow dung manure – 5kg per pit thoroughly mixed the soil.

Materials

- Saplings/seedlings shall be well-formed and free from defects such as knots, sun-scaled, windburn, injuries, abrasion or disfigurement. All saplings shall be healthy; sound; free from plant diseases, insects and pests; and with well-developed root systems.
- Plants suitable for planting must be healthy with average height upto 0.25mtr, free from diseases, broken branches or as per the forest expert’s written recommendation in special cases.
- All plants should bear an identification tag when final planting is complete after the first year of planting and casualty replacement. This shall be in form of aluminum foil identification tag plates fixed to the plant with small Gi nails or tags of Gi wire fixed loosely around any branch of the tree/shrub/shrub/bush/bamboo clump containing the tag bearing the name of the plant variety in English and in Oriya punched over it. The size of the tag should be 70mmx50mm with eyelets at either end for fixing.
- While planting the exposed loose routes and broken/damage roots will be trimmed and treated with anti-fungal solutions such a mancozeb or carbendazim mixed with water in ratio of 2gm per liter.

Soil

It should be loam or sandy loam or clayey loam mixed with manure and fine sand in the proportion of 1:1:1 together with Chlorop pyrophos (20%EC) @ 25 to 50 gms per pit depending upon the size of the pit.

Manure

Only organic manure will be used for plantation. Composts from municipal solid wastes and distillery waste may be used. Manure shall be free from extraneous matter, insects or grubs.
Addition of Alteration in the Scope of Work

No plant material which is exotic or has not been recommended for avenue planting or site enhancement, shall be planted unless and until the Forestry Expert agrees in writing for such a change in species with sufficient justification. Specific requests of the public and institutions for special type of plants may be considered, only if these are not exotic and can be easily grown in the area, provided a written note to this effect is issued by the Forestry Expert.

While procuring the plants from any commercial nursery instead of the site nursery, it shall be mandatory for the Contractor to furnish the copy of registration certificate of the supplier to recognize that the nursery is impaneled with the State Govt. as a plant supplier to OWD or Forest Department, subject to certification of being free from contagious diseases and pests.

Planting

As has been described in the planting mechanism, all saplings shall be supplied with adequate protection as approved. After delivery, if planting is not to be carried out immediately, plants should be placed under shade and bottoms covered with moist paddy straw or moist leaves through sprinkling of water.

Back Filling

The soil will be back filled and watered thoroughly and gently pressed down when semi-dry up to half of the pit. Plant will be then placed in the centre of the pit and filled with the mixed soil and manure up to the beam and pressed around gently. Taller saplings after planting bend to one side or tilt backwards. In all such cases arrangement should be made to ensure stability of the plant. The soil shall be pressed down by treading it down, leaving a shallow depression all around for watering.

Planting

- No pits shall be dug until final position has been pegged out for approval.
- Care shall be taken that the plant sapling when planted is not be buried deeper than in the nursery, or in the pot.
- Planting should not be carried out in waterlogged soil.
- Plant shrubs at the original soil depth; soil marks on the stem is an indication for this – this should be maintained on the finished level, allowing for setting of the soil after planting.
- All plastic and other imperishable containers should be removed before planting.
- Any broken or damaged roots should be cut back for sound/healthy growth.
- The bottom of the planting pit should be covered with 50 mm to 75 mm of soil.
- Bare roots should be spread evenly in the planting pit; and small mound in the center of the pit should be created on which the roots are well laid and evenly spread.
- Soil should be placed around the roots, gently shaking it to allow the soil particle to shift into the root system to ensure close contact with all roots and prevent air pockets.
- Back fill soil should be firmed as filling proceeds, layer by layer with care being taken to avoid damage to the roots.

**Staking**

The stacks put for spaying the location of the pits before digging shall be reused for providing support to the transplanted seedlings by placing it near the plant and tying a rope around the stack and plant to keep it stable.

**Methods**

The main methods of staking shall be:

(A) A single vertical shake, 900mm longer than the clear stem of the shrubs driven 600mm to 900mm into the soil.

(B) Two stakes as above driven firmly on either side of the shrubs with a cross bar to which the stem is attached. Suitable for bare-rooted or ball material.

(C) A single stake driven in at an angle at 45 degrees and leaning towards the prevailing wind, the stem just below the lowest branch being attached to the stake. Suitable for small bare-rooted or ball material.

(D) For plant material 3m to 4.5m high with a single stem a three-wire adjustable guy system may be used in exposed situations.

The end of stake should be pointed and the lower 1m to 1.2m should be coated with a non-injurious wood preservative allowing at least 150mm above ground level.

**Tying**

Each shrub should be firmly secured to the stake so as to prevent excessive movement. Abrasion must be avoided by using a buffer, rubber or Hessian, between the shrubs and stake. The shrubs should be secured at a point just below its lowest branch, and also just above ground level; normally two ties should be used for shrubs. These should be adjusted or replaced to allow for growth.

**Grass Turfing**

The specifications for grass turfing are to be referred from ‘specifications for Roads and Bridge works’ by MOST, Section 300, Clauses 307.1, 307.2, 307.3.
Preparation of Ground

All locations where grass turfing for landscape development as suggested should have to be sprayed weedicide and planted in rose close to each other. During period prior to planting, the ground shall be maintained free from weeds. Grading and preparation of the area shall be completed at least three weeks prior to the actual sowing. Regular watering shall be continued until sowing by dividing the area into portions of approximately 5 m squares by constructing small bunds to retain water. These 'bunds' shall be leveled just prior to sowing of grass plants; it shall be ensured that the soil has completely settled.

Soil
The soil itself shall be ensured to the satisfaction of Landscape Architect to be a good-Fibrous loam, rich in humus.

Showing the grass roots
Grass roots (cynodon dactylon or a local genus approved by the Landscape Architect) shall be obtained from a grass patch, seen and approved before hand.

The grass roots stock received at site may be stored and shall be manually cleared of all weeds with water sprayed over areas.
Small roots shall be dibbled about 5 cm apart into the prepared grounds. Grass will only be accepted as reaching practical completion when germination has proved satisfactory and all weeds have been removed.

Maintenance
As soon as the grass is approximately 3 cm high, it shall be rolled with a light wooden roller, - in fine dry weather – and when it has grown to 5 to 8 cms, above to the ground weeds must be removed and regular cutting with the scythe and rolling must begun. A top – dressing of farmyard manure or vermi compost, which is properly pulverized sieved is spread @250gm per 1sqm. When the grass is sufficiently secure in the ground to bear the moving machine, the blades must be raised an inch above the normal level for the first two or three cuttings. That is to say, the grass should be cut so that it is 4 to 5 cm in length, instead of the 3cm, necessary for mature grass.
Failure of the rain continuously for more than two days requires watering through manual or mechanical device except during late winter and summer month up to mid June by regular daily watering.
Damage due to fungus, ants, termites, cater pillars, weevils, aphids and bugs, which are the causes of dying back besides lack of watering has to be controlled by application of insecticides, fungicides mixed with sand or fine silt and spread thinly over the turf and watered.
Rolling
A light roller shall be used periodically, taking care that the area is not too wet and sodden.

Maintenance
Normal maintenance procedure like pruning of the sides and edges, application of fertilizer mixed with water, weeding of the turf to free it from other grasses and herbs has to be carried out regularly before rolling, so that the area remains healthy and green. Repairs to damaged portions has to be done by replacing the entire affected area together with soil and then relaying and replanting with new stock of grass or grass sods of same variety fixed in position over newly laid earth and watered regularly.

Nursery Stack
Planting should be carried out as soon as possible after nursery stacks reach the site. Where planting must be necessarily delayed, care should be taken to protect the plants from pilferage or damage by people and animals. Plants with bare-roots should be heeled-in as soon as received or otherwise protected from drying out and others set closely together and protected from wind. If planting is delayed for more than a week, packaged plants should be unpacked, the bundles opened up and each group of plants heeled in separately and clearly labeled. If for any reason, the surface of the roots becomes dry the roots should be thoroughly soaked before planting.

General Requirements of Earth, Manure and Fertilizers

Earth: Good earth shall be agricultural soil of loamy texture, free from kankar, morrum, shingles, rocks, stones, building rubbish and any other foreign matter. The earth shall be free from clods or lumps of sizes bigger than 50mm in any direction. It shall have pH ranging between 6.5 to 7.5.

Manure: Well-decayed organic matter obtained in dry state from the municipal dump or other similar source shall be approved as manure by the Project Engineer. The manure shall be free from earth, stone or other extraneous matter. Well screened manure shall be supplied at site.

Fertilizers: If the soil tests indicate pH value not as per the above specification namely between ‘6.5 to 7.5’, following measures need to be taken.
- If pH exceeds 7.5, aluminium sulphate or equivalent fertilizer should be added at the rate of 1 kg per cubic meter to lower the pH by one full point.
- If pH is below 6.5, add ground limestone or equivalent fertilizer at the rate of 1 kg per cubic metre to raise pH by one full point.
Strip plantations should be properly fenced/protected (GI barbed wire fencing with RCC fence posts and 6 strands of barbed wire or bamboo mats with bamboo prop support) to prevent damage by herbivores animals. Wherever required, live-hedges may be provided, particularly in stretches near sensitive receptors such as schools, colleges, hospitals etc to act as dust filters.

Two agencies that would be involved in the execution of the plantation activities will also undertake regular monitoring and supervision by OFDC and Forest Department involved, involvement of communities along the roads for protection and maintenance of plantation/s would be explored through a mechanism of sharing of usufructs. Local voluntary organizations, sports/youth clubs, VSS units, religious property trusts, eco-clubs would be encouraged for protection and maintenance of such plantation carried out under the project.