

ESTABLISHMENT OF COASTAL MANAGEMENT LABORATORY AT PARADEEP

**Project Proposal Submitted For
Financial Support Under
Integrated Coastal Zone Management Project
(ICZMP)
(Annexure-IV)**



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SECTION I – PROJECT CONTEXT

A. State of Orissa - A brief profile

Orissa is situated in the East Coast of India between 17° 49'N to 22° 36'N Latitude and 81° 36'E to 87° 18'E Longitude with an area of 155,707 Sq km.

As per 2001 census, Orissa has a total population of 3,67,06,920 (male-1,86,12,340, female-1,80,94,580), out of which 3,12,10,602 live in rural Orissa. The density of population per sq km is 236. The decadal growth rate is 15.94 as against 21.34% for all India, and indeed this has been the third lowest growth rate of population among the major Indian states, higher than only Kerala (9.42%) and Tamil Nadu (11.94%).

The State has abundant mineral resources including precious and semi-precious stones. It has also plentiful water resources. Planned exploitation and optimum utilisation of rich natural resources like mineral, land, water and others including human resources holds the key to rapid economic development of the State. Orissa is rapidly industrializing- particularly through large extractive industries, such as, including aluminum and other mineral extraction, processing, and associated thermal generation

B. Physiography of the State

The state is broadly divided into four geographically regions viz. the northern plateau, central river basins, eastern hills and coastal plains. The northern plateau region comprises mainly, Mayurbhanj, Keonjhar and Sundergarh districts. The central river basins lie between the northern plateau and eastern hills and include Bolangir, Sonapur, Sambalpur, Deogarh, Bargarh, Jharsuguda, Dhenkanal and Angul districts, and a part of Cuttack district. The eastern hills which constitute the last portion of the eastern ghats, lie to the south and southwest of central river basins stretching for about 250 km in northeast – southwest direction through the districts of Koraput, Rayagada, Nawarangpur, Malkangiri, Kalahandi, Nuapara,

Gajapati and a part of Ganjam district. The eastern hills are elevated and are generally 900 m above sea level.

Orissa has a long coastline of 480 kms along the Bay of Bengal. The coastal plains comprise mostly of Balasore, Bhadrak, Kendrapara, Jagatsinghpur, Jajpur, Puri, Khurdha, Nayagarh and a portion of Ganjam and Cuttack districts. The areas of the state north of latitude 20°N have elevation of up to 500m above sea level, in general and in the south western districts, they rise to 1500-1600m above sea level.

C. Coastal Resources / Marine areas of the State

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D. Coastal Zone Management Status

D-1 Laws and Policies – CRZ, CMZ

Successful management of the sea coast & its ecological development depends upon scientific exploration and exploitation of the living and non-living resources in coastal waters. In order to conserve resources by controlling their depletion and regulate development activities, Government of India had enacted the Environmental (protection) Act 1986. Coastal Regulation Zone (CRZ) Notification 1991 was issued under section-3(i) and section 3(ii) (v) of the Environment (Protection) Act 1986 and Rule 5(3)(d) of Environment (Protection) Rules 1986 on February 19, 1991. Under this notification, the coastal stretches from High Tide Line to 500m towards land and from High Tide Line to Low Tide Line towards sea are identified as coastal regulation zone (CRZ). As per the notification, a stretch of 100m along the banks of creeks, estuaries, backwater and rivers come under Coastal Regulation Zone (CRZ). Through this notification, the coastline of the country has been declared as ecologically sensitive area, requiring regulation of development activities. The notification imposes restriction on the following activities.

- Setting up of new industries and expansion of existing industries, except those directly related to water front or directly needing foreshore facilities;
- Manufacture or handling or storage or disposal of hazardous substances.
- Setting up and expansion of fish processing units including warehousing (excluding hatchery and natural fish drying in permitted areas)

- Setting up and expansion of units/mechanism for disposal of waste and effluents, except facilities required for discharging treated effluents into the water course with approval under the Water (Prevention and Control of Pollution) Act, 1974; and except for storm water drains;
- Discharge of untreated wastes and effluents from industries, cities or towns and other human settlements.
- Dumping of city or town waste for the purposes of land filling or otherwise.
- Dumping of ash or any wastes from thermal power stations;
- Mining of sand, rocks and other substrata materials, except those rare minerals not available outside the CRZ areas.

All other activities in CRZ area , except those prohibited above, will be regulated as under:

- (1) Clearance shall be given for any activity within the Coastal Regulation Zone only if it requires water front and foreshore facilities.
- (2) The following activities will require environmental clearance from the Ministry of Environment and Forests, Government of India, namely:
 - (i) Construction activities related to Defence requirements for which foreshore facilities are essential (e.g. slip-ways, jetties, etc.); except for classified operational component of defence projects for which a separate procedure shall be followed. (Residential buildings, office buildings, hospital complexes, workshops shall not come within the definition of operational requirements except in very special cases and hence shall not normally be permitted in the CRZ).
 - (ii) Operational constructions for ports and harbours and light houses requiring water frontage; jetties, wharves, quays, slip-ways, etc. (Residential buildings & office buildings shall not come within the definition of operational activities except in very special cases and hence shall not normally be permitted in the CRZ);

- (iii) Thermal power plants (only foreshore facilities for transport of raw materials facilities for in-take of cooling water and outfall for discharge of treated waste water/cooling water); and
- (iv) All other activities with investment exceeding rupees five crores.

Under the notification, all areas within the coastal zone are to be classified as CRZ- I, II, III, IV or V based on geomorphology and other criteria, including ecological significance, existing developments and other features. The nature and kind of land uses permitted vary according to the specific zone within which an area falls, with greater restrictions in CRZ-I areas, fewer in CRZ-II areas and CRZ-III areas.

The Coastal regulation Zone Rules, 1991 has lead to setting of a number of standards for discharge of effluents in the coastal water and controlling activities within 500 m of high tide line on the landward side.

The Water (Prevention and Control of Pollution) Act, 1974 provides for framing of rules and standards with regard to discharge into the surface water system upto 5 km inside the sea.

The territorial waters, continental shelf, exclusive economic zone and other maritime zones Act-1976 and Indian coast guards Act-1978 are the other laws concerned with the control of the quality of the marine environment.

For sustainable development of coastal regions as well as conservation of coastal resources, Ministry of Environment and Forests has issued a Draft notification known as the Coastal Zone Management (CZM) Notification, 2007 under the Environmental (Protection) act, 1986. The objective of this notification is protection and sustainable development of the coastal stretches and marine environment through sustainable costal zone management practices based on sound, scientific principles taking into account the vulnerability of the coast to natural hazards, sustainable livelihood for local communities and conservation of the ecologically and culturally significant coastal resources.

Under this notification, "Coastal Zone" shall mean the area from the territorial waters limit (12 nautical miles measured from the appropriate baseline) including its

sea bed, the adjacent land area along the coast and inland water bodies influenced by tidal action including its bed, upto the landward boundary of the local self government/local authority adjoining the sea coast, provided in case of ecologically and culturally sensitive areas, the entire biological/physical boundary of the area may be included. Under this notification, the coastal zone shall be divided into four categories; Coastal Management Zone – I to IV depending upon the Ecologically Sensitive importance, economically important areas, high population density areas, and culturally/strategically important areas.

D-2 Institutions/ Authorities (Roles and Responsibilities)

Coastal zone management in the context of environment is integrally linked with the activities of industrial development, social and economic growth. The introduction of a requirement to prepare coastal zone management plans will mandate planning and coordination of development activities in the coastal zone. The preparation and effective implementation of coastal zone management plans is a long-term measure. For this, integrated action of Departments like Industry, Housing and Urban Development and Pollution Control Boards is essential.

Public & Government :

(a) Department of Industries

For proper planning of industrialization for sustainable development of a coastal belt having potential for industrial growth, the Department of Industry has the major role and responsibilities to play.

Industries Department of the State pursues a multi-pronged approach for industrial promotion in the State by providing infrastructure support, institutional support and pre and post-production incentives with a view to maximizing the triple objectives of value addition, employment generation and revenue augmentation. The Department is entrusted with the responsibility to fully operationalise and strengthen the industrial facilitation mechanism under Orissa Industries (Facilitation) Act 2004 and Rules 2005. The Department plays a major role in following activities :

1. To enhance the share of Industries in State Gross Domestic Product.

2. To make concerted efforts for balanced regional development.
3. To provide special incentive packages for promotion of thrust, priority and MSME sectors.
4. To promote entrepreneurship development for healthy industrial development.
5. To promote ancillary and downstream industrial parks at all major industrial hubs.
6. To create an enabling environment for development of industrial and related social infrastructure of international standards.
7. To promote specialized/ functional industrial area / park for thrust and priority sectors.
8. To maximize employment generation opportunities both direct and indirect.
9. To maximize linkages between micro, small, medium and large industries and make focused efforts for development of ancillary and downstream industries.
10. To maximize industry and institution linkages in the areas such as manpower planning, research and development etc.
11. To put in place an effective grievance redressal mechanism for speedy project implementation and also for addressing post implementation issues

(b) Housing & Urban Development Department

The Housing & Urban Development (H & UD) Department has a major role to play in providing basic amenity services in coastal areas having potential for economic growth in addition to projected population growth. The H & UD Department has been constituted with an objective to perform the statutory functions entrusted under Orissa Municipal Act, 1950 and Orissa Municipal Corporation Act, 2003. The Department has the major responsibility of providing basic city services like sanitation (both sewer and refuse), water, streets, schools, hospitals etc.

Private Sector -

Others –

(a) State Pollution Control Board, Orissa

State Pollution Control Board, Orissa, a statutory body, was constituted in pursuance of sub-section (1) of section 4 of the Water (Prevention and Control of Pollution) (Amendment) Act, 1974. Responsibilities of the Board however, can broadly be classified into the following four main categories:

1. Plan a comprehensive programme for prevention, control or abatement of pollution and enforce the environmental laws.
2. Advise the State Government on any matter concerning prevention and control of water and air pollution.
3. Conduct Environmental Monitoring and Research.
4. Create public awareness.
5. Stipulation of stricter environmental standards considering the assimilative capacity of the local environment.

The Board is entrusted with the responsibility of implementation of Environmental Acts, particularly the Water (Prevention and Control of Pollution) Act, 1974, Air (Prevention and Control of Pollution) Act, 1981 and the Environment (Protection) Act, 1986, as amended from time to time, and various rules framed thereunder. The Board is also expected to execute and ensure proper implementation of Environmental Policy of the Union and the State Government and various directives from the Courts.

The major Acts and Rules / Notification issued thereunder, which the Board is entrusted with, for implementation and execution are as follows.

1. Water (Prevention and Control of Pollution) Act, 1974 and amendments thereof.
2. The Water (Prevention and Control of Pollution) Cess Act, 1977 (subsequently amended in 1991) provides for collection of cess from the industries which is the major source of revenue to the State Pollution Control Board. In addition, the Board also collects consent and authorisation fees and other miscellaneous receipts.
3. Air (Prevention and Control of Pollution) Act, 1981 and amendments thereof.
4. Environment (Protection) Act, 1986 and amendments thereof.

5. Hazardous Waste (Management & Handling) Rules, 1989 and amendments thereof.
6. Manufacture, Use, Import, Export and Storage of Hazardous Microorganisms, Genetically Engineered Organisms or Cells Rules, 1989.
7. Manufacture, Storage and Import of Hazardous Chemical Rules, 1989 and amendment thereof.
8. Environment Audit Notification, 1993.
9. Environment Impact Assessment Notification dated 14.9.2006.
10. Public Liability Insurance Act, 1991.
11. Chemical Accidents (Emergency Planning, Preparedness & Response) Rules, 1996.
12. Biomedical Waste (Management & Handling) Rules, 1998.
13. Municipal Solid Waste (Management & Handling) Rules, 2000.
14. Recycled Plastics Manufacturers and Usage Rules, 1998 and amendments thereof.
15. Notification dated 14.09.1999 on Fly-ash utilization.
16. The Noise Pollution (Regulation and Control) Rules, 2000
17. Ozone Depleting Substance (Regulation) Rules, 2000
18. Batteries (Management & Handling) Rules, 2001

D-3 Status of Implementation so far

Department of Environment, Govt. of Orissa is the regulatory authority of the Orissa State for implementation of CRZ Notification, 1991. In addition to other responsibilities, the Department shall deal with environmental issues relating to coastal regulation zone. This calls for the involvement of the State Pollution Control Board in the management activities. Board implements the conditions laid down under Water (Prevention and Control of Pollution) Act, 1974, Air ((Prevention and Control of Pollution) Act, 1981 and Environment (Protection) Act, 1986 and notifications issued thereunder, for control of pollution caused by the industries, mines and urban local bodies (ULBs) operating in the coastal area.

Only few large scale industries like Paradeep phosphate Ltd., Indian Farmers Fertiliser Corporation Ltd., Paradeep Carbon Ltd., Indian Rare Earth Ltd., Jayashree Chemicals Ltd., and port at Paradeep are existing in the coastal area. These industrial and port activities are regulated under the existing provisions of Water (Prevention and Control of Pollution) Act, 1974, Air ((Prevention and Control of Pollution) Act, 1981 and Environment (Protection) Act, 1986 for management of environment. However, no integrated coastal zone management has been taken up so far in the coastal stretches of Orissa.

D-4 Current capacity building programs- achievements and limitations

Current capacity of the State Pollution Control Board, Orissa is limited to conduct the compliance monitoring and enforcement of various rules and regulations entrusted upon the Board. The current management approach of the Board towards coastal environment is reactive rather than proactive in nature. As there are only few industries operating in the coastal belt, and urban growth is limited, no adequate step has so far been taken to strengthen the Board to conduct in-depth coastal environmental study.

D-5 Overall budget/ resources spent in CZM in Orissa

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D-6 Key Issues in coastal zone management (entire State)

- (a) Institutional coordination issues – sub-state set up ? Decision making structures ?
- (b) Pollution/ sewage/ Marine life & resources/ Salinity ingress/ Livelihood issues/ fisheries/ oil spill risk management

Orissa has a coastal line of 480 Km from the marshes of Ichhapuram in the south to the east of Subarnarekha in the north-east. The Orissa coast has bulged out in the middle portion from Brahmagiri on Chilika lake in the south-west to Chandbali in the north-east where the Mahanadi, the Brahmani and the Baitarani have formed a combined delta. Uses of the coastline are generally considered under four main categories: resource exploitation (including fisheries, forestry, gas and oil, and mining); infrastructure (including transportation, ports, harbours shoreline protection works and defence); tourism and recreation; and the conservation and protection of biodiversity.

The coastal ecosystems are now highly disturbed and very much threatened, encountering problems like pollution, siltation, erosion, flooding, saltwater intrusion, storm surges, uncontrolled coastal development and other activities due to ever expanding human settlements. Some parts of the coasts have also been affected by indiscriminate development of brackish water culture systems. This poses a serious threat to the production of wild finfish and shellfish as well as to mariculture. The damage done is often unintentional, being a consequence of bad planning, lack of basic knowledge, and little coordination between agencies and authorities.

The major issues related to the coastal and marine resource management in the State of Orissa are briefly described below

(a) Coastal pollution

Water pollution is gradually emerging as an important issue in the state. Domestic wastes, industrial wastes, fertilisers and pesticide residues reach coastal & marine waters through rivers, creeks, bays etc. Lower reaches of all major rivers and the stream passing through urban areas are polluted.

There are 4 number of large scale industries operating in Paradeep- Dhamra stretch and 2 numbers in Gopalpur-Chilka stretch. Most of these industries are fertilizer, and chemicals which generate large volumes of waste water. The numbers of industrial units in Paradeep- Dhamra stretch are going to increase in near future after the completion of Dhamra port. Mega projects like Pohang Iron and Steel Company (POSCO), Essar Steel, Indian Oil Corporation Ltd. (IOCL) (oil refinery unit) , Deepak Fertilisers, and one Ship Yard will come up in Paradeep area.

The Port areas are also subjected to oil spill, though in limited extent. Orissa Government has identified strategic port locations at Gopalpur, Bahuda muhan, Palur, Baliharchandi, Astaranga, Jatadhari muhan, Barunei muhan, Dhamra, Chudamani, Inchuri, Chandipur, Bahablpur, Kirtania. Out of these thirteen locations, port construction activities at Gopalpur, Dhamra and Kirtania are in progress. All these activities will put severe stress on coastal environment.

The coastal water at Puri, Gopalpur, Chandbali having tourist importances are getting polluted due to the indiscriminate discharge of wastewater from the hotels. The intensive shrimp farms in coastal areas like Chilka also contribute to coastal water pollution.

Intensive agriculture practices in coastal belt use large amounts of fertilizers, pesticides to increase yield. This, in turn, leads to water pollution.

(b) Mining of beach placers or heavy minerals

Chhatrapur along Gopalpur coastal belt is endowed with a significant amount of beach placers or heavy mineral deposits. It is a mineral of strategic importance with high industrial value. Mining of placer deposit affects stability of beach and sometimes-hinder fishing & related activities. There are certain conflicts among the various stakeholders in this area. The expansion of existing industry, Indian Rare Earth Limited and establishment of Titanium dioxide plant, an Indo-Russian joint venture, at Chhatrapur may intensify these problems.

(c) Encroachment of beaches & coastal lands

Beach is the best protection for coast and is the habitat for many marine and inter tidal organisms. It is also an open space available to the coastal communities for different activities. There are periodic encroachments in the beaches and other coastal lands for settlement even when their susceptibility to erosion is well known. Systematic planning for habitat development is a felt need of the coastal area.

(d) Over exploitation of coastal resources

Extremely high population pressure, intense human activities, indiscriminate mechanisation of fishing, urbanisation, industrialisation, inappropriate resource use and absence of proper integrated management practices internalising conservation contribute in reduction of productivity of coastal waters, quality deterioration, reduction in marine fish catch and finally posing hardship for livelihood to the local community. Mechanisation in fishing, particularly the use of trawlers adversely affects the total fish availability in coastal waters and the nearshore fisherman, mostly local community, face extreme hardships. This also causes massive death of Olive Ridley Turtles at Devi river mouth, Gahirmatha in Bhitarkanika wildlife sanctuary and Rushikulya river mouth in Ganjam.

(e) Degradation of marine and coastal habitats

Wetlands, mangroves, mud banks, beaches, estuaries and cliffs are important habitats having close linkage with local economic activities. However, they are in various stages of degradation. Wetlands are increasingly being diverted for undesirable uses and mangroves are being depleted. Unabated reclamation, silting and pollution from industries and human wastes are damaging the estuarine & backwater ecosystem.

(f) Coastal erosion

The coastal erosion has become critical at several tourist places like Puri, Konark, Gopalpur etc. Chilka Is facing the problems like – siltation, shrinkage of area, choking of the inlet channel as well as shifting of the mouth connecting the sea.

(g) Coastal flooding & salt water intrusion

Flooding due to heavy rainfall is a common feature in the coastal belt of Orissa. In addition to this, the urbanisation, settlement expansion, construction of artificial structures, reclamation of wetlands and such others also contribute to this. Salt-water intrusion into the agricultural lands due to flooding creates problem to the coastal agricultural population which was clearly evident from Ersama area in Jagatsinghpur district and Astaranga area in Puri district during Supercyclone, 1999. Apart from this, due to regulation of river water flow, as a result of dam construction in the upper reaches and also due to river sand mining salt water/fresh water interface has been pushed land ward. This leads to problems of ground water quality.

E. Key learning from CRZ activities

Not taken up any in-depth environmental monitoring program in CRZ areas.

E-1 Important activities implemented in last 10 years

Not implemented.

E-2 Success and failures

Not applicable

F. Justification for the project (SWOT)

In addition to farming and fishing activities, there are several development interests that show a marked preference for the coastal region. Industries wish to be located here for easy access to the sea for discharge of effluents; thermal power plants, for easy access to the enormous quantities of cooling water they need; tourism promoters want to use the beaches for building hotels. There are also activities for which foreshore facilities are essential, for example ports, harbours, jetties, wharves and quays. All these new development pressures are in addition to demands already being made by existing coastal inhabitants.

Orissa, a principal maritime state is endowed with conducive, unique, natural and strategic port locations. The development of minor ports in Orissa is in its infant stage and have been identified for the phased future development. The integrated port policy of the State lay down the pathway for the development of ports and other associated infrastructure, for promoting industry, trade and commerce. The port locations and the perennial riverine systems of Orissa are ideally situated to adapt to the current developments in technology, in the areas of communication, automation, cargo handling and ship technology. It is in this perspective that the Government of Orissa, by evolving an integrated strategy, intends to implement its vision.

Such massive infrastructural development associated with population growth in future will cause the coastal zone under increasing pressure and result in degradation of coastal ecosystems and diminishing the coastal resources. Excessive exploitation of resources will make communities vulnerable to sea storms and other Ecological disasters. Thus there is an urgent need to protect the coastal ecosystems and habitats by implementing the coastal regulation zone notification and integrated coastal zone management study.

The Integrated Coastal Zone Management (ICZM) Plan will be a policy driven action in contrast to project mode implementation programme hitherto followed in most of the coastal zone development activities. Therefore the ICZM approach is concerned with long term anthropocentric perspective area development

plan. It will attempt to harmonize conservation and development with specific thrust on the welfare of local and indigenous communities, the traditional custodian of the coastal resources.

The following management related activities will be envisaged while implementing ICZMP:

- Preparation and implementation of land and water use, activity zoning and siting policies
- Preparation of coastal profiles identifying critical areas, including eroded segments, physical processes, development patterns, user conflicts and setting priorities for action and management.
- Contingency plan for human induced and natural disasters including effects of potential climate change and sea level rise
- Contingency plan for degradation and pollution due to human activities
- Improvement of coastal human habitation covering housing, drinking water, sanitation, solid waste management and industrial management.
- Conservation and restoration of critical habitats
- Assessment and periodic monitoring of coastal and marine environment including changes in landuse (coastal zone), ambient air quality and water quality (coastal and marine waters)
- Development of environmental quality criteria
- Human resource development and training to maximize people's participation
- Public education, awareness, and information programme and
- To strengthen and develop institutions to work out and execute the programme with people's participation.

SECTION II – THE PROJECT

The Coastal Zone Management Plan for the sustainable development of a coastal area will work through integration of sectoral programmes for development of settlement, agriculture, tourism, fishing, infrastructure, industry, mining etc in that area with environment as the top priority.

Paradeep-Dhamra coastal stretch which covers about 80 kms is of prime concern on the basis of their existing and potential expansion. In addition to the existing Paradeep port, in near future, Dhamra is in the list of new major ports. These areas are going to witness rapid infrastructure development and establishment of mega projects including special economic zones. As such there will be large scale movement of goods and traffic in these coastal stretches.

The development of this coastal and marine areas and their resources, however have to balance the mutually competing enterprises like industries, ports, fisheries, tourism, offshore fishing, aquaculture, waste disposal, etc.

The studies conducted by Coastal Ocean Monitoring and prediction Systems (COMAPS) along Paradeep-Dhamra stretch indicates that the pollution problems are localised and mostly occur in thickly populated coastal towns and industrialized towns. However, because of dilution by sea water the levels of pollutants have not reached alarming stage. Due to interaction between the sediment and bottom layer, the pollutants gradually find their way into the sea and contaminate the seawater and marine life. Such areas are likely to become highly polluted areas in due course, severely affecting the benthic fauna and other bottom feeding organisms.

Basing on the economic importance and pollution potential of the area, the Board proposes to take up the Paradeep-Dhamra stretch under Coastal Zone Management Plan. The project activities in its initial phase will center around Paradeep and later on it will extend upto Dhamra.

In order to maintain the coastal sea water quality as demanded by the designated best use, a comprehensive programme on intensive monitoring of the

Paradeep-Dhamra stretch is suggested Under this programme, constantly monitoring of the pollution levels around and beyond the discharge points (both domestic and industrial), impact of discharge of domestic and industrial sewage into the estuarine waters will be investigated. The results obtained will be compared with the respective standards laid under Air (PCP) Act, 1981, Water (PCP) Act, 1974 and E(P) Act, 1986.

Based on the study, action plans will be suggested where coastal ecosystems are most affected, Coastal districts that have heavy development pressures as well as stressed and the key development pressures with the potential to affect coastal ecosystems.

B. Project Objectives and Key Indicators

Integrated Coastal Zone Management (ICM) Plan for Paradeep-Dhamra stretch sets its goal in terms of progress towards more sustainable forms of development seeking a balance between:

- economic development and use of the coastal region,
- protection and preservation of the coastal areas,
- minimization of losses of human life and property, as well as
- public access at the coastal zones.

The Objectives of the project are as follows :

1. To strengthen the Board in terms of manpower, infrastructure and laboratory to conduct the study on coastal environment.
2. To make it a certified laboratory under ISO 9001, ISO 17025 and NABL accredited laboratory. This will act as a Referral Laboratory on environmental analysis for the State.
3. Standardize sampling technique in the dynamic part of the coastal area and estuaries as well as analyzing technologies for practical use.
4. To analyze the sources, levels and pathways of various pollutants in the proposed coastal stretch.

5. To build up consistent time series data on the sources, pathways, levels of pollutants so as to contribute the scientific knowledge of the coastal zone.
6. To determine the trends of pollutant levels in the sea and also processes associated with land and sea interface.
7. To evaluate the sediment and biological parameters of water bodies and to correlate the impact of pollutant to biota of rivers / estuarine / coastal sea.
8. To evaluate the land and soil quality of the area for better understanding of the nutrient cycles of the different interface of environmental component
9. Qualitative and quantitative assessment of ambient air and point sources that are dynamic in the coastal zone and have impact on marine environment.
10. Evaluation of effectiveness of pollution control efforts.
11. Preservation of the microflora and benthic macroinvertebrates of the coastal ecosystems
12. Rational planning of pollution control activities for coastal areas.

Key Indicators :

- A well equipped and certified coastal management laboratory capable of monitoring, analyzing all parameters in water, air and soil.
- Coastal water quality to meet the primary water quality criteria for the designated best use of that stretch.
- Surface water quality to meet the water quality criteria for the designated best use.
- Ground water quality to meet the drinking water quality.
- Coastal Sediment quality and Soil quality
- Air quality to meet the national ambient air quality standards
- Aquatic biodiversity
- Density and distribution of microflora and benthic macroinvertebrates of coastal water

C. Project's Guiding Principle and Key Design Features

The guiding principles of the project are as follows :

- A long term view to identify critical problems with regard to environmental protection.
- A broad holistic approach to identify mechanisms required for closer coordination of efforts in the field of environmental protection and economic development.
- Support and involvement of all relevant administrative bodies to elaborate guidelines for national, regional and local authorities with reference to sustainable and environmentally friendly development in the coastal area.

Key Design Features

- Establish a laboratory at Paradeep as a part of capacity building and strengthening for implementation of ICZM at regional level (Paradeep).
- Assess the environmental status of Paradeep – Dhamra stretch.
- Evaluation of effectiveness of pollution control efforts to ascertain the management practice adopted and further to restore the water quality, air quality w.r.t. the designated class/ zone with a view to expanding industrial activities and number of ports and related human interferences along Paradeep – Dhamra stretch
- Rational planning of pollution abatement activities for coastal areas.

D. Project Area Description

Paradeep (21⁰15'55.44" N, 86⁰40'34.62"E) is one of the major ports of India and is the main out-let and in-let of the sea-borne trade of the eastern part of the country spread over States such as Orissa, Madhya Pradesh, Uttar Pradesh and Bihar. The natural resources and industrial products of this wide spread hinterland are immense and the value of the mineral trade of the country passing through the Port of Paradeep is considerably higher than many other Major Ports of India. Paradeep which is an estuary of the Mahanadi has evergreen forests, with islands and creeks, a good marine drive and beach. This is 94 kms. from Cuttack and 125

kms. from Bhubaneswar. Besides Paradeep Port, POSCO has proposed a captive port at Jatadhari Muhan in Jagatsinghpur district.

Satellite imageries of IRS 1D & P6 LISS III for the period 1999-2005 used to detect the changes in various land-use (such as forest, fallow land, sandy beaches, urban/reclaimed area, vegetation and water) that occurred in the areas around Paradeep port due to natural and anthropogenic activities. The results show that urban/reclaimed land has increased from 71.71 km² (1999) to 94.33 km² (2005) and in the same period, sand bodies also increased from 22.21 km² to 28.86 km², however, mangroves have reduced from 149.42 km² to 121.71 km². This significant reduction in mangroves and increase in the urban/reclaimed land reveal the human interferences on the natural environment. Increase in sand bodies explains accretion in their region. The decrease in mangrove forest has reduced the capacity of the coastal ecosystem to buffer storm surges and cyclonic winds. The decreasing of protective forest cover also made it possible for the floods to inundate large areas and cause much destruction. The devastation caused by Supercyclone in 1999 is an example of this.

At present, four major industries such as Paradeep Port Trust, Paradeep Phosphates Ltd., IFFCO, Paradeep Carbon Ltd., Cargill India (P) Ltd. are operating at Paradeep. Five other mega industries e.g. POSCO (I) Pvt. Ltd., Hygrade Pellets Ltd., Essar Steel Ltd., Indian Oil Corporation Ltd., Deepak Fertilizer and Chemicals are in pipeline. Development of Petroleum, Chemicals & Petrochemical Investment Region, Multi product Special Economic Zone (SEZ) and Paradeep Industrial Park are under the proposed schemes. Apejee Surrender Shipyard is existing in Paradeep area. The increase in industrial activity at Paradeep area in past decades and its immense potential to grow further necessitates for its management for sustainable development.

Port activities at Paradeep while promoting the economic pursuits also result in environmental impacts. Navigation, dry docking, ship breaking, loading and unloading operations are among the various port and harbour related activities, which cause environmental impacts.

The location of Dhamra in close proximity to the mineral belt of Orissa, Jharkhand and West Bengal and its deep draft suitable for large vessels is going to make Dhamra port the most cost-effective and efficient port on the Eastern coast of India in near future. Besides this, the port also poses serious threat to the turtles.

The State Pollution Control Board, Orissa wishes to address coastal protection in Paradeep in a more systematic manner and adopt long-term measures for sustainable development and extend this project upto Dhamra subsequently.

E. Project Description and Scope

The sustainable development of Paradeep- Dhamra stretch will mandate rational planning along with suitable environmental protection measures.

Scope of the Project :

Scope of the Project are

- to strengthen coastal pollution monitoring capacity of the Board to generate essential environmental quality data for decision makers;
- to review and analyze the impact of environmental protection works carried out in past in terms of the economic, ecological, and social conditions of the surrounding area that is under protection Plan.
- to review policies, strategies, plans, and regulations of the union government and state governments pertaining to coastal environmental protection, including the coastal regulation zone notification
- to identify, evaluate and prioritize the polluting sources in Paradeep- Dhamra stretch;
- to formulate strategies and action plans to restore water quality of different stretches of the water bodies including coastal water to the designated best use, air quality as per the categorized area.
- to develop monitoring programme and management practices for the safeguard of the coastal zone for next 10 years.
- to empower the Board to meet challenges due to global warming and sea level rise.

- to prepare the Board to suggest methods for conservation of coast keeping view the coming up dozen odd port related industries, oil refineries and pollution abatement due to urbanization.

F. Project Components and Component Description

Component A : Capacity Building

This component will finance for technical assistance and capacity building viz. Laboratory Infrastructure, Manpower Strengthening, Environmental monitoring, knowledge and information, Updation of skill, and software procurement.

The present technical manpower of the Board is given in Table-1. As evident from the Table there is a gap in the total strength in technical wing of the Board against the sanctioned strength.

Table -1 Technical manpower strength of the Board

Sl. No.	Name of the Post	Total No. of Post Sanctioned	Staff in Position	Gap in Staff strength
1	Env. Engineer	06	05	1
2	Env. Scientist	09	08	1
3	Asst. Env. Engineer	21	15	6
4	Asst. Env. Scientist	25	20	5
5	Lab. Asst.	05	03	2
6	Senior Technical Assistant	07	05	2

These posts were sanctioned a decade ago. In the meantime, several new legislations as given below have been framed and amendments made in the existing Rules and entrusted upon the Board for its implementation.

1. Biomedical Waste (Management & Handling) Rules, 1998.
2. Municipal Solid Waste (Management & Handling) Rules, 2000.
3. Recycled Plastics Manufacturers and Usage Rules, 1998 and amendments thereof.
4. Notification dated 14.09.1999 on Fly-ash utilization.
5. The Noise Pollution (Regulation and Control) Rules, 2000

6. Ozone Depleting Substance (Regulation) Rules, 2000
7. Batteries (Management & Handling) Rules, 2001
8. Right to Information Act, 2005

However, the staff structure are not enhanced in the same pace, for which several mandates of the Board either could not be addressed at all, or if addressed, not to the desired level.

To start the ICZMP project work at the existing Central laboratory of the Board is not possible due to lack of space, manpower constraint, as well as overload of instrumental work. So, it is proposed to establish a well equipped Coastal Management Laboratory at Paradeep with the staff structure as listed in Table-2

Out of the proposed 20 staffs, only 9 staffs as indicated in the Table-2 will be supported by the project and the State Board will support the rest 11 staffs during the project period. After completion of the project period, all the manpower proposed under the project will be absorbed in the Board's pay roll as per their suitable cadre. Further, the Coastal Management Laboratory along with its set-up developed under the project will be taken up under the administrative control of the Board.

Software for preparation of coastal environmental database will be procured to understand the behaviour of pollutants in estuarine and coastal waters and use this knowledge to predict eco-toxicological risks posed by their presence in these eco-systems.

Parameters to be studied

(a) Water

Physical: Conductivity, Colour, Flow rate, Odour, Sludge Volume index (S.V.I), Solids (dissolved), Solids (fixed), Solid (Volatile), Suspended Solids, Temperature, Total Solids, Turbidity

Chemical: Acidity, Alkalinity, Aluminium, Ammonical Nitrogen, Arsenic, Absorbable Organic Halides (AOX), Antimony, Barium, Beryllium, Bicarbonate, Biochemical Oxygen Demand, Boron, Bromide, Cadmium, Calcium, Carbon dioxide, Carbonate, Chloride, Chlorine Demand, Chlorine Residual, Chromium (VI), Chromium Total, Cobalt, Chemical Oxygen Demand, Copper, Cyanide, Detergents, Dissolved Oxygen, Fluoride, Free Ammonia, Hardness, Iodide, Iron, Lead, Magnesium, Manganese, Mercury, Molybdenum, Nickel, Nitrite-Nitrogen, Nitrate-Nitrogen, Oil & Grease, PAH, Percent Sodium, Pesticide residues, pH, Phenol, Phosphate (Ortho), Phosphate (Total), Potassium, Salinity, Sodium Absorption Ratio, Selenium, Silica, Silver, Sodium, Strontium, Sulphate, Sulphide, Sulphite, Tin, Total Kjeldahl Nitrogen, Total Organic Carbon, Volatile organic acids, Zinc

Microbiological: Total Coliform, Fecal Coliform, E. Coli, Salmonella (Enterobacteria)

Biological (bio-monitoring): Phyto- and Zoo Plankton, Biomass, Primary productivity, Bioassay, Bioaccumulation **(a)**

(b) Soil

Physical: Bulk density, Moisture, porosity, texture, Water Holding Capacity

Nutrients: Magnesium, Nitrate, Nitrite, Total Kjeldahl Nitrogen, Total Nitrogen, Organic Carbon, Organic matter, Phosphorus (available), Phosphate (Ortho), Phosphate (total), Potash (available), Potassium, Sodium, Sodium Absorption Ratio, Sodium%, , Total water- Soluble salts, Calcium, Boron

Trace metals: Copper, lead, cobalt, nickel, cadmium, zinc, mercury and iron

Ionic parameters: Cation Exchange Capacity, Electrical Conductivity, Chloride, Ammonia, Fluoride, Sulphate, Bicarbonate, Cyanide,

Specific parameters: Gypsum requirement, Oil & Grease, Poly-Aromatic Hydrocarbon, Pesticide residues

(c) Sediments

Total Organic Carbon, Organic matter, Magnesium, Nitrate, Nitrite, Total Kjeldahl Nitrogen, Total Nitrogen, Phosphorus (available), Phosphate (Ortho), Phosphate (total), Potash (available), Potassium, Sodium, Heavy metals (Copper, lead, zinc, cobalt, cadmium, nickel, zinc, iron), Mercury, Chromium (VI), Boron, Cation Exchange Capacity, Chloride, Electrical Conductivity, Fluoride, Sulphate, Cyanide, Oil & Grease, Poly-Aromatic Hydrocarbon, Pesticide residues

(d) Air

Improvement in environmental quality is an integrated improvement of air, water and soil of that area. Since air is one of the major components of environment it is proposed to monitor the air quality (ambient air, Source, Noise, Vehicular exhaust) in the area. The coastal environment is very dynamic in nature. Therefore, the air pollutants released into the environment subsequently gets precipitated and ultimate became water pollutants because of high moisture content, precipitation etc. All the activities in the area has impact on water and air environment. If the major component, air , will not be included in the study, the overall environmental condition could not be assessed for restoration.

Keeping in view the importance of air parameter, it is suggested to include the air component into the project study. The parameters to be studied in air component are as follows.

General: Suspended Particulate Matter, Respirable Suspended Particulate Matter, PM_{2.5}, Sulphur dioxide, oxide of Nitrogen (NOx), Carbon monoxide, Carbon dioxide

Specific: Poly Aromatic Hydrocarbon, Acid mist, Chloride, Fluoride, Hydrocarbon, Organics (Benzene, Toluene, Xylene), Ammonia, Lead

Noise

Vehicular pollution monitoring :

Smoke density, Carbon monoxide & Hydrocarbon

Environmental Monitoring

In initial phase of project, environmental monitoring will be mainly conducted at and around Paradeep with an occasional monitoring along Paradeep-Dhamra stretch. In subsequent years, the monitoring along Paradeep-Dhamra stretch. will be conducted in a regular pattern. The monitoring plan is presented in Table-3.

Table-3 Monitoring Plan

Component	Type	Source	No. of stations	Frequency
Water	Surface water	River (Mahanadi, Dhamra and other rivers)	10	M
		Creek (Atharabanki)	10	M
		Lentic water bodies	10	Q
		Taladanda Canal	05	M
	Ground water	Bore well / dug well	15	Q
	Waste water	Industrial / Domestic	25	M
Air	Ambient	Continuous monitoring station at Paradeep	01	C
		Monitoring station as per CPCB guideline	08	104 [#]
	Source	Industrial Stack monitoring	30	Q
	Noise			T
	Vehicular monitoring			T
Soil		In and around of specific zones	30	Q
Sediment	River		10	Q
	Creek		10	Q
	Coastal area		20	Q

M : Monthly, Q: Quarterly; T: Twice a year; C : Continuous;

[#]: sampling/station/year

Component B : Certification of the Laboratory under ISO:9001, ISO:14000 and NABL accreditation

This component will finance for the certification of the Coastal management Laboratory at Paradeep under under ISO:9001, ISO:14000 and NABL accreditation which is essential to make the laboratory a self sustaining one after the completion of the project. This will provide a ready means for customers to find reliable testing and calibration services according to their needs.

Component C : Mitigation measures of the Environmental Impact of the Project

This component will finance for the integrated management of various wastes generated during laboratory analysis. Laboratory wastes, whether chemical or biological, can pose a significant risk to human health and the environment, if not handled correctly. The project is committed to make sure that all wastes generated during its execution within the premises of the laboratory constructed under this project are properly identified, contained, and disposed of in accordance with applicable laws, regulations, and best management practices.

A wide range of wastes arise in chemical laboratories. Examples include:

- Waste water from laboratory analyses
- Solid materials, such as chemicals, glass, packaging, paper, solid and soil samples
- Gaseous emissions, such as those from laboratory fume cupboards.

(a) Management of liquid waste

Waste water generated from the laboratory and the sanitary waste water will be treated in the integrated waste water treatment plant. This plant will be a hybrid of Aerobic and Anaerobic process. It will use the principle of Reactor baffle Chamber (RBC) process and Anaerobic baffle chamber reactor process carried out in four different chambers connected in a series. There will also be a secondary clarifier, disinfection and tertiary treatment provision.

(b) Management of Solid waste

Solid waste may comprises of broken glasses, packaged materials, broken plastic containers, soil/ solid samples, expired chemicals etc. These will be segregated, labeled, stored and disposed off as per the Rules. Hazardous wastes will be stored in a lined pit constructed as per the Rule.

(c) Treatment of fumes

Fumes will be generated during the acid digestion of samples. To channelise the acid fumes, digestions will be carried out in Fume cupboards only. The fumes will then be scrubbed through an alkaline medium before being allowed to discharge to atmosphere.

Component D : Monitoring and Evaluation of the Project

This component will finance (a) to monitor and evaluate the project activities and intermediate results as implementation proceeds, (b) Measure the impact of selected interventions under the project, and (c) install the database, information base for understanding the development of project activities.

G. Project Costs

G-1 Estimates- by Components, by year

The project work will continue for five years after sanction of the project grant.

* Layout plan of the proposed Coastal Management Laboratory at Paradeep is enclosed as Figure-1.

G-2 Project's Finance and Fund flow arrangement

The project cost will be financed by the World Bank. The Project financial and disbursement arrangements will be based on the Board's existing systems of fund flow, accounting, reporting and audit. The funds will be routed through the Board.

SECTION-III PROJECT IMPLEMENTATION ARRANGEMENT

A. Institutional arrangement

A-1 The Overall Institutional Model (and rationale)

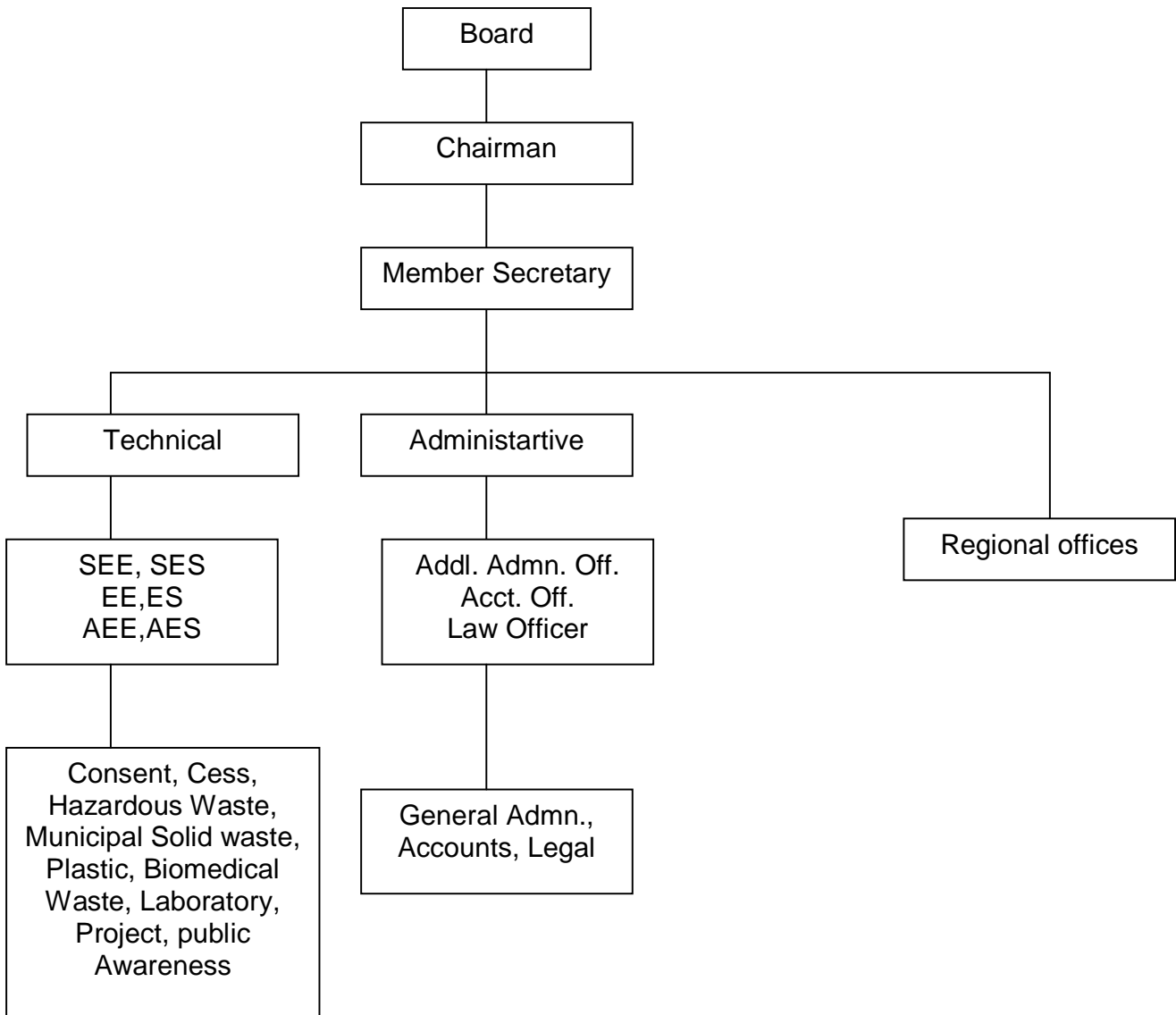
The Ministry of Environment and Forests (MOEF), the apex policy making body in the field of environment, acts through the Central Pollution Control Board (CPCB) and the State Pollution Control Boards (SPCBs). The CPCB, a statutory organization, was formed in 1974 under the Water Act. As the nodal agency in pollution control, its role is to advise the Central Government on matters concerning pollution, plan and execute a nation-wide programme for prevention and control of pollution, coordinate and provide technical assistance to the State Boards, organize programmes for mass awareness, disseminate pollution related information, lay down, modify or annul, in consultation with State Governments, standards for air and water quality and so on.

The State Board of Orissa has a two- tier administrative set up. The first tier- comprising its Chairman, Member Secretary and other members, not exceeding 15, all nominated by the State Government. The first tier generally meets once in three months unless an emergency warrants an urgent meeting. The Second tier- consisting of appointed regular staffs- manages the day-to-day administration and function of the Board under the supervision of the Member Secretary and Chairman.

The Board has nine regional offices at Angul, Balasore, Berhampur, Bhubaneswar, Cuttack, Keonjhar, Rayagada, Rourkela and Sambalpur.

The Board may constitute committees consisting wholly of members or wholly of other persons or partly of members and partly of other distinguished persons for specific purposes.

Organisational Chart of State pollution Control Board, Orissa



A-2 Implementing Agencies –Roles and Responsibilities

The Ministry of Environment and Forests, Government of India, has created a statutory innovation in the form of a legal notification for the protection and planned development of coastal areas, including the reservation of areas in coastal zones set aside as No-Development Zones. The notification crystallizes a fairly firm policy to protect coastal areas from unplanned and indiscriminate human activities.

Government of India, has constituted the National Coastal Zone Management Authority with the Additional Secretary (Impact Assessment), MOEF as the Chairman. The authority has the responsibility for taking measures for protecting and improving the quality of the coastal environment and preventing, abating and controlling environmental pollution in coastal areas. It will work as an inter-departmental coordination mechanism to be convened on a regular basis for planning and monitoring the coastal management activities, to provide technical assistance and guidance to the concerned State Governments.

At the state level, Orissa Coastal Zone Management Authority has been constituted with the Principal Secretary, Forest and Environment Department, Government of Orissa, as the Chairman. Director of Department of Environment, Government of Orissa acts as the Member Secretary of the said authority and also the implementing agency. The primary responsibility of the implementing agency is to take adequate measures for protecting and improving the quality of the coastal environment and preventing, abating and controlling environmental pollution in coastal areas of the State of Orissa. The State Pollution Control Board, Orissa acts as the regulating authority for implementation of the Coastal Zone Notification.

The roles and responsibilities of the Board are as follows:

- To deal with the environmental issues of the coastal stretch in Orissa;
- To examine all the industrial projects in coastal regulation zone areas and give their recommendation with regard to pollution control measures before the project proposals are referred to the Central Government.

- To grant, suspend or cancel authorization for collection, reception, treatment, transport, storage and disposal of hazardous wastes and to allow for import of these wastes for processing and re-use as raw materials.
- To make, vary or revoke any order for the prevention, control or abatement of discharges of wastes into streams or wells.

A-3 Staffing Plan

Currently there are 200 number of employees working in the Board. The technical and Scientific staff comprise of around 39 % of the total staff. Detail present staffing plan is presented below.

Sl. No.	Name of the Post	Total No. of Post Sanctioned	Staff in Position
1	Senior Env. Engineer	02	02
2	Senior Env. Scientist	03	03
3	Env. Engineer	06	05
4	Env. Scientist	09	08
5	Administrative Officer	01	01
6	Asst. Admn. Officer	01	01
7	Section Officer, L-I	01	01
8	Law Officer	01	01
9	Section Officer, L-II	02	02
10	Asst. Law Officer	01	01
11	Accts. Officer	01	0
12	Asst. Env. Engineer	21	15
13	Asst. Env. Scientist	25	20
14	Public Relation Officer	01	0
15	Public Relation Assistant	01	0
16	Biological Assistant	Nil	0
17	Chemical Assistant	Nil	0
18	Physical Assistant	Nil	0
19	Lab. Asst.	05	03
20	Senior Technical Assistant	07	05
21	Accountant	04	02
22	Private Secretary	01	01
23	Personal Assistant	01	01
24	Store Keeper	01	01
25	Asst. Librarian	01	01
26	Sr. Asst.	11	11
27	Sr. Steno	05	05
28	Sr. Typist	01	01
29	Jr. Steno	07	03

30	Jr. Asst.	15	14
31	Jr. Typist	07	07
32	Receptionist	01	01
33	Diarist	01	01
34	Despatcher	01	0
35	Driver	13	12
36	Tressery Sarkar	01	01
37	Lab. Attendant	10	10
38	Draftary	01	01
39	Zamadar	01	01
40	Peon	23	20
41	Watchman	02	02
42	W.C.S.	04	04
	Total	200	168

B. Financial Management Arrangement

B-1 Financial Management Framework

Member Secretary, State Pollution Control Board, Orissa is the head of the financial wing. He is assisted by Administrative Officer of OAS cadre, an Accounts Officer of OFS Cadre, a Section Officer and two experienced Accountants. The Orissa Government Financial Rules is followed during observation of all financial formalities of the Board.

B-2 Fund Flow and Disbursement arrangement

The Board has own source of receipt as per provision of Water (PCP) Act, 1974 and Air (PCP) Act, 1981 and other Acts and Rules inforce. It receives fund from Govt. of India to undertake various schemes/ projects. All receipts are being deposited in the Bank and payments are made in shape of cheque / D.D. observing all financial formalities. The Accounts wing of the Department led by an Accounts Officer manages budgeting and accounting.

The sources of the Board's financial resources include grant-in aid from the State Government, funds received under specific projects from central Government, State Government and CPCB, reimbursement of water cess charges collected by the Board and credited to the Consolidated Fund of India, Consent fee collection, sample testing charges, fines and forfeitures, interest on investment.

The funds received for the project from the World Bank will be kept in a separate interest bearing bank account to be opened as per the instructions of the State Government. The books of accounts will be maintained separately in respect of the projects based on the sound accounting procedure in vogue and in consonance with the guidelines of the funding agency.

B-3 Accounting Policies and Procedures

The Board follows State Govt. financial rules in principle. But it maintains records as per company Act as provided under Water (PCP) Rules, 1983 such as double entry system of cash book, ledger, bank reconciliation statement, receipt and expenditure account, balance sheet etc.

B-4 Staffing and Capacity Building

There is division of labour for smooth functioning of financial work of the Office. In-service training is being imparted to the personnels for improving their performances. However, capacity building is needed for the financial department to efficiently and effectively manage the world bank fund in a time bound manner.

B-5 Financial Reporting

Financial statements provide an overview of the Board's financial condition in both short and long term approaches. There are four basic financial statements, viz. (i) Balance sheet, (ii) Income Statement, (iii) Statement of retained earnings and (iv) statement of cash flow..

B-6 Internal Control Mechanism

Every year accounts of the Board are being audited by the Chartered Accountant as an internal arrangement.

B-7 Audit arrangements

The Govt. of Orissa in Forest & Env. Dept. appoints auditors in consultation with CAG of India to audit the accounts of the Board.

B-8 Retroactive Financing

Retroactive Financing is not usually practiced in the Board.

B-9 User Cost Sharing Principles

There are significant costs associated with the implementation of various Rules and Acts as listed under Item D-2 of Section II by the Board. The cost sharing is made through various fee structures like Consent to establish fees, Consent to Operate fees, Hazardous waste authorization fees, Water cess, Biomedical waste authorization fees etc. User costs are also allocated between public and private stakeholders to create a cost sharing framework according to one or more of the following principles:

- Polluter pays principle, where the person who contributes to the pollution of the Water, air or soil, pays for the implementation of the pollution control measures on their own property, and the remediation of the pollution that is the direct result of their actions;
- Beneficiary pays principle, where anyone who will receive a direct benefit from the implementation of the on ground works should contribute to the cost of those works, and
- Beneficiary compensates principle, where anyone who derives an indirect benefit, such as improved recreational amenity, should contribute.

Under Environment (Protection) Act, 1986, the Board has established laboratory to carry out the analytical works associated with its regulatory compliance and research activities, The Board charges Users fee to them whoever wishes to use laboratory facilities for their purpose.

C. Procurement arrangement
C-1 Procurement Responsibility

The procurement arrangement aims to assist and ensure that the operation of the project is subjected to the Financial Management arrangement and achieve value for money in their procurement activities of properties and services. The Procurement Officers are further supported by a collection of Guidance documents and Finance Circulars (e.g. Orissa Govt. Finance Rules), which provide more detailed advice on the procurement framework.

C-2 Procurement Methods

The procurement procedure broadly consists of the following steps:

1. Assessment of requirement
2. Deciding procurement strategy including technical specifications
3. Mode of procurement
4. Preparation of tender document
5. Advertisement of the tender
6. Issue of tender documents
7. Opening of the tender
8. Evaluation of the tender
9. Clearance of World Bank, wherever required
10. Award of contract
11. Notification of delivery to consignee
12. Inspection and testing
13. Receipt of consignment
14. Acceptance and storage of the consignment.
15. Resolution of disputes, if any

The methods of procurement normally followed are :

As per OGFR, Rule-1 to Rule-4

Rule 1 All articles required to be purchased for the State Service shall be purchased on the condition that delivery shall be made in Orissa for payment in Rupees.

Rule 2 Except for the articles obtainable from firms on rate contract approved by the Director- General of Supplies and Disposals, Government of India or Director of Export Promotion Marketing, Government of Orissa, and from Co-operative Agencies duly registered under Orissa Co-operative societies Registration Act, sealed tenders should be invited, giving wide publicity for the purchase of articles, the value of which exceeds rupees fifty thousand unless it is in the public interest not to call for tender. Where it is considered inadvisable in public interest to invite tenders, the concerned authority shall record the reasons therefore. In respect of purchase of articles, the value of which does not exceed rupees fifty thousand quotations shall be invited. In all cases, a comparative statement of rates should be prepared and placed before the authority competent to order purchase. When the sealed tenders are opened on the notified date, the concerned authority should initial all pages of the tender and corrections in the tenders so as to avoid any manipulation. The number of pages of the tender and the correction in each page attested by the competent authority should be Boards indicated at the bottom of the last page of the tender in red ink by him at the time of opening the tenders in the presence of the tenderers, if any.

Rule 3 – All articles whether manufactured in India or abroad shall be subject to inspection before acceptance and articles for which specifications and / or tests have been prescribed by the competent authority shall be required to conform to such specifications and / or to satisfy the prescribed test or tests which may be carried out during manufacture or before or after dispatch from the suppliers premises.

Rule 4 – Important plan machinery and iron and steel works shall ordinary be obtained from firms approved by the Director-General of supplies and Disposals, New Delhi and specified in the lists mentioned by him.

Procurement may be made through

- Open advertised tender/ National Competitive Bidding (NCB)
- Limited Tender (National / International)
- Shopping (National)
- Single tender/ Direct Contracting
- Procurement of Civil Works through IIDCO

C-3 Procurement Thresholds

Within Rs. 1000/-	Direct procurement	No Bids required
Rs. 1000/- - Rs. 50,000/-	Local Quotation	Three quotes must be solicited by letter, fax, e-mail
Above Rs. 50,000/-	Open tender	Formal competitive Bidding

C-4 Overall Procurement Plan

While resorting to procurement, specific budget provision should be available for meeting the expenditure in the financial year in which it is to be incurred. Preparation of a procurement plan is an essential requirement.

- Procurement plan covering civil works equipment, goods, consultancy services and resource support shall be prepared on a firm basis for first year of the programme and on a tentative basis for the subsequent years.
- Procurement plan shall be prepared every year for proper monitoring and execution.
- Method of purchase shall be based on the value of the contract, urgency of the demand, type of goods/services and availability of different sources of supply etc
- Limit of value per contract applicable to the particular procurement procedure shall be strictly adhered to.
- It shall be ensured that the procurement is based strictly on actual need.

C 5 Procurement Manual

Procurement Manual details about the

1. Procurement Plan
 - Flow of Funds
 - Release and Allocation of Funds
 - Procurement Matrix (Responsibility)
 - Constitution of Empowered / purchase / executive committee
2. Procurement Procedures
 - Forecasting/ Assessment of the Requirement
 - Deciding on Procurement Strategy
 - Mode of Procurement
 - Preparation of Tender
 - Award of Contract
 - Disclosure
 - Quality Assurance through Inspection, Sampling and
 - Notification of Delivery of the Consignee and Receipt of Consignment

C 6 Annual Procurement Plan

Board prepares the annual procurement plan after receiving the indents from all the sections and regional offices. Prioritisation of purchase of equipment, machinery, etc. for a given financial year is made based on the available budget and priorities of the specific project need. The final list of annual procurement is then made after verifying the non-availability of the stock. This list then becomes the basis for deciding how these items should be combined or divided into contract packages, what method of procurement should be used for each, and the scheduling for procurement activities. The choice of procurement method depends on:

- the nature of the goods and services to be procured;
- the value of the procurement;
- critical dates for delivery.

After selecting the procurement method, follow-up actions are :

- (a) calling for tender/quotations and processing of tender papers by the purchase department,

- (b) Evaluation of the tender/ quotations and preparation of comprehensive fact sheet,
- (c) Submission of the papers to the competent authority for sanction
- (d) Placement of orders
- (e) Arrival of procured items and installation in case of machinery/ equipment and stock entry.

Financial powers of the competent authority are as follows :

Authority	Financial Power
Chairman	Above Rs. 50,000/-
Member Secretary	Upto Rs. 50,000/-
Administrative Officer	Upto Rs. 20,000/-
Sr. Env. Engg. / Scientist	Upto Rs. 20,000/-
Regional officer	Upto Rs. 15,000/-
Env. Scientist (Lab.)	Upto Rs. 10,000/-
Drawing and Disbursement Officer	All statutory dues

C 7 Procurement of Works

The civil works are classified under two categories: (a) Original Works and (b) Repairs Works. "Original works" means all new constructions, additions and alterations to existing works, special repairs to newly purchased or previously abandoned buildings or structures, including remodelling or replacement. "Repair works" means works undertaken to maintain building and fixtures.

Following are the stages in planning, sanctioning and execution of work.

- (a) Inclusion in Procurement Plans
- (b) Preparation of Preliminary Project Report (PPR)
- (c) Acceptance of necessity and issue of 'Go ahead' sanction.
- (d) Preparation of Detailed Project Report (DPR) & Detailed Estimates
- (e) Administrative Approval
- (f) Technical Sanction

- (g) Appropriation of funds
- (h) Preparation of Tender documents
- (i) Call of Tenders and Award of Work
- (j) Execution of works
- (k) Monitoring of works and Quality Assurance.

C 8 Procurement at Community Level – Not done

C 9 Key Procurement Guidelines

The “Guidelines for Procurement” provide the essential information and step-by-step procurement procedures in brief to achieve the following objectives

- Procurement plan and procedures
- Assessment of the requirement
- Deciding on Procurement Strategy
- Mode of procurement
- Award of Contract
- Inspection, Sampling and Testing Procedures
- Notification of Delivery to Consignee
- Receipt of consignment
- Storage
- Resolution of Disputes
- Laws Governing The Contract
- Arbitration
- Extension of Contract
- Complaint Redressal Mechanism

D. Environmental and Social safeguards

D-1 Current Regulatory Framework

India has an extensive environmental management system with a comprehensive set of environmental laws, specific statutory mandates, regulatory instruments and institutional frameworks to implement and enforce environmental policy objectives. Environmental legislation is on the national list. After the Stockholm Conference, in 1976, constitutional sanction was given to environmental concerns through the 42nd Amendment, which incorporated it into the Directive

Principles of State Policy and Fundamental Rights and Duties. The Policy Statement for Abatement of Pollution and the National Conservation Strategy and Policy Statement on Environment and Development were brought out by the MoEF in 1992, to develop and promote initiatives for the protection and improvement of the environment. The EAP (Environmental Action Programme) was formulated in 1993 with the objective of improving environmental services and integrating environmental considerations in to development programmes.

Environmental legislation involves a shared responsibility between the center and the States, with the Central Government having responsibility for policy and regulatory formulations and the State Governments for ensuring implementation and enforcement of national policies and laws. At the central level, the Ministry of Environment and Forests and the Central Pollution Control Board are the nodal agencies responsible for environmental compliance and enforcement. Similarly at the State level, the State Government Departments of Environment and Forest and the State Pollution Control Boards are the designated agencies to perform these functions.

Different Acts and Rules enacted by Government of India for the protection of Environment and Control of air and water pollutions are as follows.

1. Water (Prevention and Control of Pollution) Act, 1974 and amendments thereof.
2. The Water (Prevention and Control of Pollution) Cess Act, 1977 (subsequently amended in 1991) provides for collection of cess from the industries which is the major source of revenue to the State Pollution Control Board. In addition, the Board also collects consent and authorisation fees and other miscellaneous receipts.
3. Air (Prevention and Control of Pollution) Act, 1981 and amendments thereof.
4. Environment (Protection) Act, 1986 and amendments thereof.
5. Hazardous Waste (Management & Handling) Rules, 1989 and amendments thereof.

6. Manufacture, Use, Import, Export and Storage of Hazardous Microorganisms, Genetically Engineered Organisms or Cells Rules, 1989.
7. Manufacture, Storage and Import of Hazardous Chemical Rules, 1989 and amendment thereof.
8. Environment Audit Notification, 1993.
9. Environment Impact Assessment Notification dated 14.9.2006.
10. Public Liability Insurance Act, 1991.
11. Chemical Accidents (Emergency Planning, Preparedness & Response) Rules, 1996.
12. Biomedical Waste (Management & Handling) Rules, 1998.
13. Municipal Solid Waste (Management & Handling) Rules, 2000.
14. Recycled Plastics Manufacturers and Usage Rules, 1998 and amendments thereof.
15. Notification dated 14.09.1999 on Fly-ash utilization.
16. The Noise Pollution (Regulation and Control) Rules, 2000
17. Ozone Depleting Substance (Regulation) Rules, 2000
18. Batteries (Management & Handling) Rules, 2001

D-2 Baseline Environmental Situation

At present, four major industries such as Paradeep Port Trust, Paradeep Phosphates Ltd., IFFCO, Paradeep Carbon Ltd., Cargill India (P) Ltd. are operating at Paradeep. Five other mega industries e.g. POSCO (I) Pvt. Ltd., Hygrade Pellets Ltd., Essar Steel Ltd., Indian Oil Corporation Ltd., Deepak Fertilizer and Chemicals are in pipeline. Development of Petroleum, Chemicals & Petrochemical Investment Region, Multi product Special Economic Zone (SEZ) and Paradeep Industrial Park are under the proposed schemes. Apejee Surrender Shipyard is existing in Paradeep area. Port activities at Paradeep while promoting the economic pursuits also result in environmental impacts. Navigation, dry docking, ship breaking, loading and unloading operations are among the various port and harbour related activities, which cause environmental impacts.

The location of Dhamra in close proximity to the mineral belt of Orissa, Jharkhand and West Bengal and its deep draft suitable for large vessels is going to make Dhamra port the most cost-effective and efficient port on the Eastern coast of India in near future.

D-3 Environmental Management Framework

The main environmental management instrument include

- (i) Environmental Impact Assessment (EIA) system to regulate the siting and approval of large projects that requires the project proponent to prepare an EIA that is subject to public hearing near the project site and then is appraised and decided upon at the central level by the MoEF,
- (ii) Forestry Clearances that are processed separately by the DoF at both the State and Central Govt. level, and require the project proponent to deposit the compensatory afforestation payment and the net present value (NPV) of diverted forest land with the DoF to obtain clearance and
- (iii) Consent to Establish (CTE) and Consent to Operate (CTO), issued by State Pollution Control Board that regulate the establishment and operation of facilities at the State level. These vital “command and control” instruments are the principle foundations of any environmental regulatory system.

The key approaches of pollution control strategies are

- Pollution Charges – Polluter Pays Principle
- Market Driven Pollution Control (pollution credits, the threat of market reaction to adverse publicity, etc.)
- Information Driven pollution control (involving communities, media, etc.)

D-4 Environmental Monitoring Plan

Monitoring function being one of the core activities of OSPCB, well-evolved systems are in place for inspection and monitoring. To enable effective monitoring of all industrial and mining activities, the Board has opened nine Regional Offices across the State. The Board has also streamlined the monitoring system by

specifying the frequency of monitoring for various categories of industries (e.g. Red, Orange and Green).

Water and waste water quality monitoring and Ambient air quality monitoring is done as per guidelines specified by CPCB.

D-5 Institutional arrangement for Environmental Management

Same as discussed in item A-2 of Section III

D-6 Capacity Building

The environmental management of State of Orissa is being carried out by the State Pollution Control Board, Orissa through compliance monitoring and enforcement of various Rules and Regulations discussed earlier. The present management approach is reactive rather than proactive in nature. Currently the capacity of the Board is limited with regards to the present responsibilities of the Board. In order to carry out the coastal environmental management studies under ICZMP plan, it is necessary to strengthen the present capacity of the Board. This has been discussed in detail in Item F of Section I.

D-7 Budget

The State pollution Control Board allocates a fraction of the total budget towards public awareness programme, public hearing, training/ workshop for school students, teachers, NGOs.

SECTION IV PROGRAM AND IMPLEMENTATION SCHEDULE

The ICZMP project will be implemented by the State Pollution Control Board by creating a cell under the name “Coastal Management Cell” at Paradeep. The Board will appoint one Project Coordinator with rank no less than a Senior Class-I Officer to execute the above said project. The Board will form a project steering committee chaired by the Member Secretary of the Board, with the participation of the Heads or representatives of other related Departments of Orissa Government and Project Coordinator to provide technical advice on the policy matters and monitoring system. The project will be executed through the establishment of “Coastal Management Laboratory” at Paradeep. The working groups will comprise the staffs as indicated in Component A of Sub Section F.

The project will be implemented over a period of 5 years from the sanction of the Project proposal by World Bank. The project equipment/ instrument will be procured by the Board in accordance with Board’s Procurement Policy. The Cell along with the Laboratory will pass to the Board after completion of the Project.

The overall draft phasing of the implementation plan describing the sequence and envisaged duration of major activities, and reporting is given in following page. During the Inception Phase a detailed Project Implementation Plan will be elaborated. The Inception period for the Project is 12 months. Before the end of this period, the Project Management will prepare an Inception Report describing the followings.

- 1) A detailed Project Implementation Plan (PIP) which is a work programme that will be revised annually;
- 2) Description of mechanisms for exchange of data and information between the involved stakeholder institutions;
- 3) A report on main issues studied at reconnaissance level;
- 4) A manual for the Project comprising administrative, organisational, technical and quality assurance procedures;

Upon receipt of the Inception Report, the project steering committee will convene a meeting to evaluate the Inception Report and make recommendations to for necessary revisions and amendments to the Project Implementation Plan and Project Document.

The Coastal Management Cell will submit Progress Report on annual basis. The report will have separate sections emphasising the summing up of processes and experiences from the preceding year. Upon completion of the project, the experience will be used by Coastal Management Cell as input to prepare a set of guidelines for development of sampling technique in the dynamic part of the coastal area and estuaries as well as analyzing technologies for practical use and rational planning of pollution control activities for coastal areas.

The Project shall be subject to an external review after the completion of the project. The review will be done on the initiative of the Orissa Coastal Zone Management Authority who will identify the members of the review team. The Board, who is the Executing Agency shall have the opportunity to suggest a member of the review team. The review will, among others, consider the options of further support and assistance following the completion of the Project.

1. Overall Program Phasing

Programme	1 st Year		2 nd Year		3 rd Year		4 th Year		5 th Year	
	1 st half	2 nd half	1 st half	2 nd half	1 st half	2 nd half	1 st half	2 nd half	1 st half	2 nd half
A. Recruitment of project staff										
1. Advertisement	←→									
2. Selection procedure & Recruitment		←→								
3. Initial Manpower Training		←→				As and when required				
B. Infrastructure										
1. Land acquisition	←→									
2. Construction of Building and Waste Treatment Plant		←→								
3. Lab. & Office setup *			←→							
C. Procurement of Instrument/ Chemicals/ Glasswares and Lab Accessories										
1. Preparing, Finalizing, Specifying and Tendering process for instruments and Equipments	←→									
2. Importing Foreign Instrument and equipments		←→								
3. Procuring Indian Instrument and equipments		←→								
4. Preparing, Finalizing, Specifying and Tendering process for Chemicals, glasswares, filter papers, and other accessories	←→									
5. Procuring Chemicals, glasswares, filter papers, and other accessories		←→								

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Programme	1 st Year		2 nd Year		3 rd Year		4 th Year		5 th Year		
	1 st half	2 nd half	1 st half	2 nd half	1 st half	2 nd half	1 st half	2 nd half	1 st half	2 nd half	
6. Preparing, Finalizing, Specifying and Tendering process for Office equipments, office Consumables	←→										
7. Procuring Office equipments, office Consumables		←→									
D. Environmental Survey & Monitoring											
1. Field Monitoring and Analysis			←→								
2. Annual Report preparation			←→		←→		←→		←→		
3. Final report									←→	←→	
E. Certification and Accreditation of Laboratory											
1. Tendering for Consultant Hiring and finalization		←→									
2. Certification and Accreditation		←→									

* During this initial phase of laboratory set up, the office activities will be carried out in rented building.

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B. First year Implementation plan

Sl. No.	Activity	1 st	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th	9 th	10 th	11 th	12 th
1	Land Acquisition and Possession	█											
2	Advertisement and Tender Processing for Construction of Building		█										
3	Construction of the Building								█				
4	Advertisement and Tender Processing for Integrated wastewater treatment Plant						█						
5	Security Deposit for Power Connection			█									
6	Deployment of Board Staff for Project	█											
7	Engagemnet of Project Staff		█										
8	Selection of a rented buildingfor Office at Paradeep	█											
9	Security Deposit for Telephone line Connection		█										
10	Advertisemnet and Tender Processing for Procurement of Office Stationary, Office equipments, Office Furnitures	█											
11	Advertisemnet and Tender Processing for Procurement of Laboratory Equipment/ Instrument and Consumables							█					
12	Advertisemnet and Tender Processing for Procurement of Laboratory Furnitures and Fixtures							█					
13	Preparation of Project Implementation Plan								█				
14	Preparation of Project Manual									█			
15	Preparation of Project Inception Report								█				

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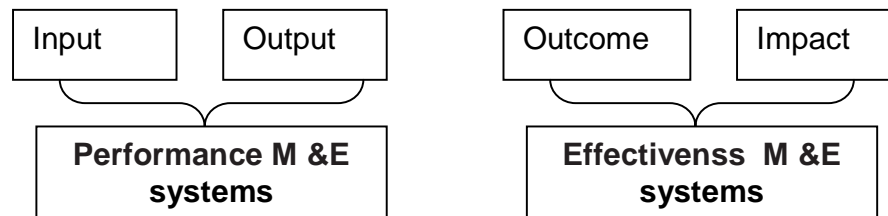
SECTION V MONITORING AND EVALUATION

A. Objective

The objective of Monitoring and Evaluation is to guide coordinated and efficient execution of the program, sample collection, analysis, generation and use of data that will enable the tracking of the overall progress made in the ICZMP. Monitoring and evaluation of the project will provide better means for learning from past experience, improving service delivery, planning and allocating resources, and demonstrating results as part of accountability to key stakeholders.

B. Components of monitoring

The diagram below illustrates the components for the Monitoring and Evaluation (M &E) Framework of the project execution by the Board.



(a) Performance M &E systems

Monitoring implementation will be done through the following:

- (i) **Quarterly Programme Activity reports (MPR)** by the Coastal management Laboratory. The information for this report will be collected using already developed forms and tools.
- (ii) **Financial management report (FMR)**. These will be reports of Financial Monitoring. The reports will be provided by the implementers of the programs to be linked to program activity reports.

(i) Inputs

World Bank will provide Rs. 15 crore in grant as funds to support the project, which will cover 20 persons-month, office equipment, laboratory

infrastructure, transport and office facilities, funds for field investigations and computer-modeling fees, Training and library facilities.

The related state government Departments and other agencies will provide access to data and information necessary to assess coastal management and site-specific coastal protection measures.

(ii) Outputs

3. Standardized sampling technique in the dynamic part of the coastal area and estuaries as well as analyzing technologies for practical use.
4. A framework and action plan for sustainable coastal management.

(b) Effectiveness M &E systems

Evaluation of achievements/ impact of the implementation of the project in coastal stretch of Paradeep- Dhamra will be done through the following:

(i) Outcome

The following two investment proposals that addresses long-term measures for sustainable management of the coastal stretch of Paradeep-Dhamra will be implemented.

- (i) Construction of a municipal solid waste dumpsite; and
- (ii) Construction of a municipal solid waste processing unit.

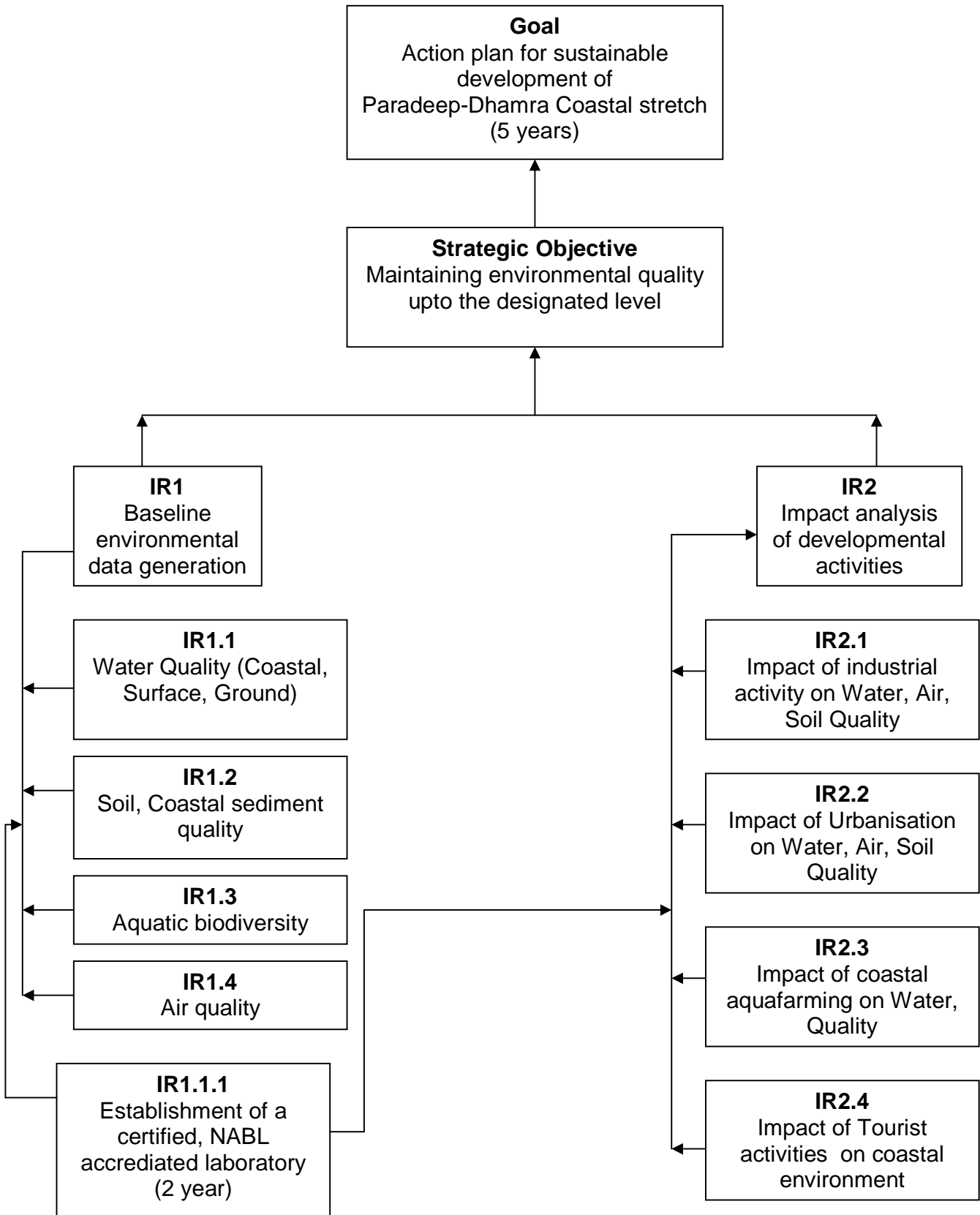
(ii) Impacts

To contribute towards the improved wellbeing of coastal communities, greater sustainability of coastal ecosystems, of coastal stretch of Paradeep-Dhamra. This is achieved through

- Restoration of Air quality to meet the national ambient air quality standards
- Restoration of surface water quality to primary water quality criteria designated best use.
- Restoration of coastal water quality to primary water quality criteria designated best use.

The measurements will be carried out against baseline conditions established during the execution of the project.

C. Results Framework



D. Implementation Arrangement

Orissa State Coastal Management Authority is mandated to take the measures for protecting and improving quality of coastal environment and preventing, abating and controlling environmental pollution in coastal area. Under it, the Dept. of Environment and Forests is entrusted with the task of coordinating all environmental protection measures taken for sustainable development of coastal area. State Pollution control Board, Orissa is entrusted with the responsibility of compliance monitoring and to act as a regulating authority for overall environmental management. The Board will constitute a Project Monitoring and Evaluation Committee with Member Secretary of the Board as the Chairman and 2-3 Senior Level Officers of the Board as Member.

Specifically, the responsibilities of Monitoring and Evaluation Committee will be:

- (i) Responsible for overall management and ensuring implementation of the Framework;
- (ii) Development of M&E implementation plan;
- (iii) Development of M&E operational manual;
- (iv) Dissemination of M&E Framework to all stakeholders;
- (v) Resource mobilisation (Financial and technical) for M&E;
- (vi) Utilise the reports from M&E systems and research for decision making;
- (vii) Ensuring quality control in M&E systems;

D1. Arrangements for Result Monitoring

The State Pollution Control Board, Orissa is the implementing authority of the Project. The Project will be executed by the Coastal Management Laboratory at Paradeep. During the inception phase of the project, standardised Forms and Formats will be developed for Monthly Progress Report (MPR), Quarterly Progress Report (QPR) , Annual Progress Report, Final Report and Financial statements. Project Coordinator will be in charge of the day-to day implementation

of Project activities. The Project Scientist will submit the MPRs to the Project Coordinator. Based on the MPRs, the Project Coordinator will compile the QPR and consolidated Annual Progress Report along with the financial statement. The Annual Progress Report will include the following elements:

- A description of steps taken to achieve the Project objectives during the past one year.
- A summary of achievements relative to each objective specified in this progress report.
- A description of project outcome data collected and its interpretation.
- An assessment of progress relative to targets.
- A list of concerns about progress toward activity objectives and suggested remedial steps.

The Annual Progress Report will be reviewed by the Monitoring and Evaluation Committee of the Board. An online database system with password protection system will be created as a part of the environmental monitoring studies for easy access of the data by the Monitoring and Evaluation Committee. The Accounts Officer of the Board will prepare a “Statement of Project Fund Operation” that will be incorporated in the Annual Progress Report. The statement will include information on: (a) the status of receipt and expenditure of the fund, (b) interest income; (c) resources committed or allocated; and (d) resources available for next year.

D2. Programme Management Reports

The Project Management will be carried out by the Project Steering Committee. This Committee will report to World bank and has the power, on behalf of World bank, to approve changes in Project activities and outputs within certain limits set forth by World bank. The Monitoring and Evaluation Committee will attend the Project Steering Committee Meetings in observer capacity. Regular Steering Committee Meetings will be held on an annual basis, and shortly after the Coastal Management Cell has submitted the Project Inception report.

The Monitoring and Evaluation Committee and the Project Steering Committee will have access to all project reports, performance information, studies and evaluations submitted by the Coastal Management Cell.

D3. Program Operations Management Information System

The database is the medium through which programme managers and scientists communicate. Scientists will put their data in the system (e.g., time series) and the database expert will retrieve it in the format the manager understands (e.g., graphs and maps). To avoid duplicacy of work and exchange of information, following Program Operations Management Information System will be developed.

- Development of ICZM information system and database to link all data generated and interdisciplinary information
- Preparation of ICZM page on the website including information, progress and project reports on ICZM organisation methods, practices and results as well as results of ICZM monitoring, evaluation and reporting
- Exchange of information with other coastal states about the implementation of the environmental conventions and the ICZM aspect
- International exchange of information about the ICZM theory and practices with the international ICZM community.

D4. Data Collection Tools

Most information requirement will be site specific and related to their specific coastal problem. Different types of information are also required at different stages of implementation of the project. Data collected should provide information that allows the understanding of the coastal physical, biological, chemical and geological processes; the concept of coastal health; ocean and coastal biodiversity; the functions performed by coastal ecosystems; climate variability and climate change; structure and dynamics of coastal settlements and coastal resources management. Table 1 provides a list of the kinds of tools

useful in providing information to enable policymaking and decision-making within the ICZM context.

Table 1: Data Collection Tools

Information Needs	Information Gathering Tools
Data collection and processing	<ul style="list-style-type: none"> • Available reports, census data, basic statistics and maps, field surveys, core sampling • Groundwater basin analyses, hydraulic measurements, stream flow and water quality sampling • Hydrology of the area • Geographic Information Systems (GIS)
Analysis of natural systems and natural processes	<ul style="list-style-type: none"> • Rainfall-runoff and watershed erosion models • Fresh and saline surface water system models (movement of water, sediments and pollutants; water and sediment quality; salt intrusion into river estuaries; wave climate) • Models of sub-surface waters groundwater movement, quantity (levels) and quality; salt intrusion into coastal aquifers) • Local/regional and long-range models for atmospheric transport and deposition • Models of coastal morphology, i.e. shoreline sediment budget and erosion/accretion processes • Land subsidence models • Models for the assessment of flood risks in relation to natural and man-made flood protection systems • Models for the assessment of habitat loss by type and quality of habitat
Assessment of ecological impacts	<ul style="list-style-type: none"> • Cause-effect relationships • Eutrophication models • Primary production and food-web models • Bio-accumulation models • Habitat approaches
Analysis of socio-economic activities	<ul style="list-style-type: none"> • General definition of activity analysis: development of functional relationships between the amount of goods and services produced and costs of production, resources/energy used and residuals produced. • Activity analyses may apply to e.g. agriculture (farms), industries, households, (off-shore) mineral extraction, navigation

	and fisheries operations.
Economic and demographic projections	<ul style="list-style-type: none"> • Input-output models • Econometric models • Cohort-fertility analysis • Migration models • Shift-share analysis • Economic base analysis • Empirical cost models • Travel cost and contingent valuation methods • Demand functions and trend analysis