PRE FEASIBILITY REPORT

FOR

BHAVANAPADU PORT

Project Proponent:

Infrastructure Corporation of Andhra Pradesh

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Pre Feasibility Report for the proposed Bhavanapadu Port

at Bhavanapadu village, Santa Bommali Mandal,

Srikakulam District, Andhra Pradesh

M/s Infrastructure Corporation of Andhra Pradesh (INCAP)

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A. REVIEW AND REVISION HISTORY

History of revisions of the present report:

Rev	Date	Modifications
Rev. 00 Draft	19/09/2015	Draft PFR Report for submission to Client
Rev. 01	1/12/2015	After incorporating inputs from DoP
Rev. 02	10/02/2016	After incorporating inputs from INCAP

Table I: History of the Revisions

Document No. IND.BH.41.15.0224/HSR

Rev. 02	06/02/2016	After incorporating inputs from INCAP	K. Sandhya	M.V. Raghavacharyulu	E. Shyam Sundar
REV	**DATE**	**DESCRIPTION**	**REVIEW-1**	**REVIEW-2**	**APPROVAL**

This Report has been prepared by Bhagavathi Ana Labs Private Limited on behalf of and for the use of the Customer with due consideration and skill as per our general terms and conditions of business and terms of agreement with the Customer.

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EXECUTIVE SUMMARY

The Government of Andhra Pradesh has plans to develop Bhavanapadu and Kalingapatanam into non-major ports, both located in Srikakulam District. These proposed port areas are close to Vizianagaram district and Located in Srikakulam district of Andhra Pradesh and mineral rich states of Chattisghar, Jharkhand, Madhya Pradesh and Southern Orissa. Therefore, Infrastructure Corporation of Andhra Pradesh (INCAP) has planned to develop Bhavanapadu port as per the studies made by Indian Ports Association (IPA).

Traffic study has been made in between these two ports and has been submitted to IPA for evaluation of development of these ports. But the hinter-land indicates that only one port can sustain future traffic, therefore development of the port is done accordingly. Considering the aspects like rail/road connectivity, coastal configuration, etc., IPA recommends that Bhavanapuadu be selected for development of port facilities.

Situated at a point Latitude: 18°33' N and Longitude: 84°20' E the port area is drawn due east up to 10 meters of water sea ward from this point as southern limit. It is then drawn 10 meter east of sea-ward to point location Latitude 18°34'.7 N and Longitude 84°20' E as northern limit.

The project is expected to be implemented in three phases, However the cost has been analysed for the development of first two phases. Each phase will be completed in 36 months. The phase wise estimated capital cost of the project is given below:

- Phase I – ~INR 1,927 crore
- Phase II - ~INR 742 crore
- Replacement Cost - ~INR 1,055 crore
- Total Capital Cost (Excluding land acquisition) - ~Rs. 3,725 Crores
- Cost of Land Acquisition - ~INR 650 Crores

  Total Cost of Projects - ~INR 4375

The estimated cost includes cost of civil construction works, break waters, berths costs, dredging, development of land etc.

The annual operation and maintenance cost of the proposal is estimated at Rs. 255 crores for the first year of operations growing up to Rs. 841 crores till the end of concession period of 30 years from Commercial Operations Date.

Land requirement estimated at 4922.85 acres. The berth structure will be designed for 15000DWT vessel sige.

1. INTRODUCTION OF THE PROJECT

Being at a distance of 80 nautical miles of north east of port Visakhapatanam, Bhavanapadu port is located at Latitude 18°34'N and Longitude 84° 20'E on northern bank of Tekkali creek at 800m inside the from the confluence with sea. It is proposed to aquire 4922.85 acres of land for the proposed project. The Government of Andhra Pradesh has acquired 744.65 acres Zeroyiti Land is 4178.2 acres.

In spite of heavy littoral drift the mouth of Tekkali creek remains open throughout the year due to large tidal prism into the creek. The tidal ranges of the mouth at springs and neaps are 1.16 meters and 0.44 meter respectively. In accordance with the recommendations of the CWPRS in 1982 two grains on either side of the mouth have been provided for flushing out the drift.

The anchorage is located at a distance of about 20.4 Km (depth 12 meters) from confluence with the sea. A fishing harbor is located at the current port facility. The facility of this harbor include 50 meters wide navigation channel between two rubble bound groynes, 275 meters long quay parallel to creek, auction hall, vast reclaimed open area substation building, etc.

1.1. IDENTIFICATION OF THE PROJECT & PROJECT PROPONENT

The Government of Andhra Pradesh has plans to develop Bhavanapadu and Kalingapatanam into non-major ports, both located in Srikakulam District. These proposed area are close to Srikakulam and Vizianagaram districts of Andhra Pradesh and mineral rich states of Chattisghar, Jharkhand, Madhya Pradesh and Southern Orissa. Therefore, Infrastructure coorporation of Andhra Pradesh (INCAP) has finalized this area for construction of port through the studies made by IPA.

1.2. BRIEF DESCRIPTION OF NATURE OF PROJECT

The project for development of non-major port in phases on the east coast of Andhra Pradesh, in Srikakulam District for handling all types of cargos like bulk, general, liquid , containerized and captive type cargo which will be required to be handled for INCAP and other associated companies being promoted by group for developing port based industries.

1.3. NEED FOR THE PROJECT

Andhra Pradesh has long coastline of 974 Km with 12 non major ports and 2 Major port are available including Bhavanpadu out of above Vizag Port, Krishnapatnam Port, Gangavaram Port, Rawa Port, Kakinada (Deep water & Anchorage Ports) are in operation. Considering port sector growth projected for India as a whole and of Andhra Pradesh, and reported figures of actual handling, there is considerable gap in port infrastructure to handle projected cargo. In addition, there are plans to develop port based industries through backward/forward integration giving rise to captive cargo need. Data has been provided as "Out of total cargo demand gap of 43.725 MTPA for 2021-22 about 12.15 to 18.53 MTPA is planned initially for 2021-22 through this port"

1.4. DEMAND SUPPLY GAP

At present Indian ports are handling about 935 million tonnes against projected cargo of about 1600 million tonnes by 2025-26 which is considered very conservative estimate. The projected demand supply gap on east coast alone is considerably high. Therefore the projected demand of about 12.15 to 18.53 million tonnes per annum in initial years is quite reasonable. (IPA survey report)

1.5. IMPORT VS INDIGENOUS PRODUCTION

The proposed port is planned to be developed for handling of cargo for both import as well as export. The existing industries in hinterland as well as proposed industries through backward/forward integration would be able to effectively use the port.

1.6. EXPORTS POSSIBILITY

The proposed port would be suitable for export of material /products which are presently exported through distant ports as well as future products being manufactured in the hinterland.

1.7. DOMESTIC/EXPORT MARKETS

There is existing demand from the existing/ proposed industries for import of materials for

domestic use as well as export of materials/products.

1.8. EMPLOYMENT GENERATION

The project is estimated to generate ~3,000 direct jobs. The number may vary based on the level of mechanization at the port.

2. PROJECT DESCRIPTION

2.1. TYPE OF PROJECT:

The proposal is for development of Bhavanapadu Port in three Phases, Presently a fishing harbor is located in this area and that harbor will not be disturbed.

2.2. LOCATION:

The site for the proposed port is on the east coast of Andhra Pradesh, located near Bhavanpadu in Srikakulam district.

The National Highway-5 from Chennai to Kolkata is at a distance of about 25 kms from Bhavanapadu. It is connected to NH-5 by means of a single lane bituminous road of five meters. It passes through Naupada.

The Chennai - Kolkata broad gauge (BG) main lane passes about 7 kms from Bhavanapadu at Naupada Junction. There is a 90 km long branch line from Naupada Junction upto Gunpur which has been converted into broad gauge in 2011-12. Extension of the Gunpur - Naupada train upto Rourkela via Berhampur and Bhubaneswar will ensure faster and wider connectivity to the region. During 12^{th} Five Year Plan, there is a proposal to provide connectivity between Gunpur Tirubali (Near Rayagada) which is about 130 Km. This will help trains coming from Raipur to go to Naupada without touching Vizainagaram and thus save 2-3 hours of rail journey.

2.3. DETAILS OF ALTERNATE SITE AND SELECTION CRITERIA:

The alternate site considered is at Kalingapatnam in Srikakulam district. The site was not selected due to traffic potential on the hinterland, the proximity of the national highway and trunk rail route. Also mineral rich states of Chattisgarh, Jarkhand, Madhya Pradesh and Southern Orissa are closer to Bhavanapadu. Map showing alternative site is provided in **Figure 3.**

2.4. SIZE OR MAGNITUDE OF OPERATION:

The proposed port will handle cargo around 14 MTPA by 2020 and 19.6 MTPA by 2026. The cargo to be handled will be LPG, LNG, Coking coal, Coal, Agricultural products, general cargo, etc.

2.5. PROJECT DESCRIPTION WITH PROCESS DETAILS:

The project is for development of greenfield port. There is no process involved except loading and unloading of cargo items and transportation of cargo from berths to various transit areas.

2.6. RAW MATERIALS REQUIRED WITH QUANTUM DATA:

The raw material required is only for port development and will be in the form of construction materials.

2.7. RESOURCE OPTIMIZATION AND RECYCLING:

The project is proposed to be developed independently apart from the Fishing harbor into port. Therefore, resource optimization will be in the form of effective use of infrastructure created and optimization of berth occupancy and utilities and services.

2.8. AVAILABILITY OF WATER AND SOURCE:

Water is required in the port for the following purposes.

- Drinking and cleaning purposes in the housing colony, offices and other areas of work
- Sprinkling water for horticulture, floriculture, arboriculture etc. Water requirement for ships
- Sprinkling water for dust control at coal stockpiles
- Fire water at berths, stackyard and other areas

Water requirement for each of the above purposes except fire fighting has been discussed in

the following paragraphs. For firefighting sea water will be used.

Water requirement for drinking, cleaning etc. in the port area depends upon the population in peak hours which comprises residents in the township, visitors, staff etc. Assuming a population of 2000 persons in the port premises at peak hours and per capita water requirements of 150 litres per day, daily requirement for this purpose works out as 12.50m3/hr. Water requirement for horticulture, floriculture, arboriculture etc. depends upon the area of green belt to be maintained in the port area. Assuming a total of 15 hectares of green belt to be maintained in the port premises, this will require about 250 m3 per hectare per year. With 250 days of watering in a year, water requirement for this purpose works out as 0.63 m3/hr. Requirement for sprinkling water for coal stockpile works out as (assuming 50% water is recycled) 470 m3/hr. At ultimate stage total about 1600 ships are likely to visit the port. Assuming 50% of ships require fresh water, water requirement of ships works out as 41.38 m3/hr.

Thus the total water requirement will be: 524.51 cum/hour or 12588.24 Kilolitre per Day Potable Water Supply requirement, for the port as worked out above, may be met from ground water near the proposed port site or may be obtained from AP Rural Water Supply and Sanitation Department. Underground and overhead tanks of suitable capacities with a closed loop grid system with necessary connections and valve stations would be provided inside the port premises. Water supply will be also provided to the berths by running pipelines. A water treatment plant is proposed for treatment of water before distribution for drinking purposes. Pump houses will be provided with necessary pumps and controls to pump the water to the overhead tanks and also supply water at the required pressure to reach various supply points.

2.9. ENERGY/POWER REQUIREMENT AND SOURCE:

The estimated power requirement, taking all of the requirements will be 4.5 MW in the first phase and additional 2.25 MW in the second phase.

The power will be received from state electricity board in the main sub station and distributed using three sub stations.

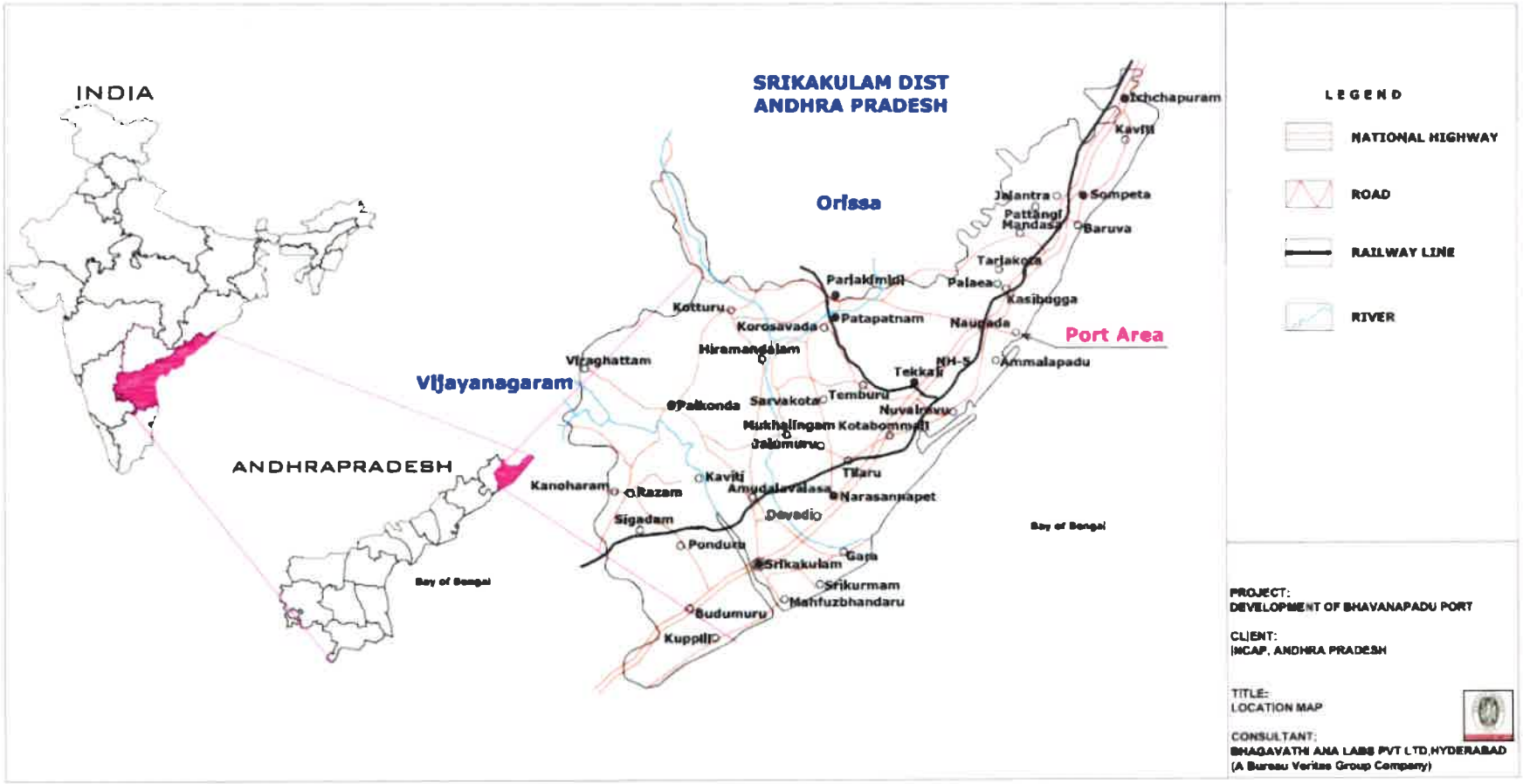

Figure 1: Location Map

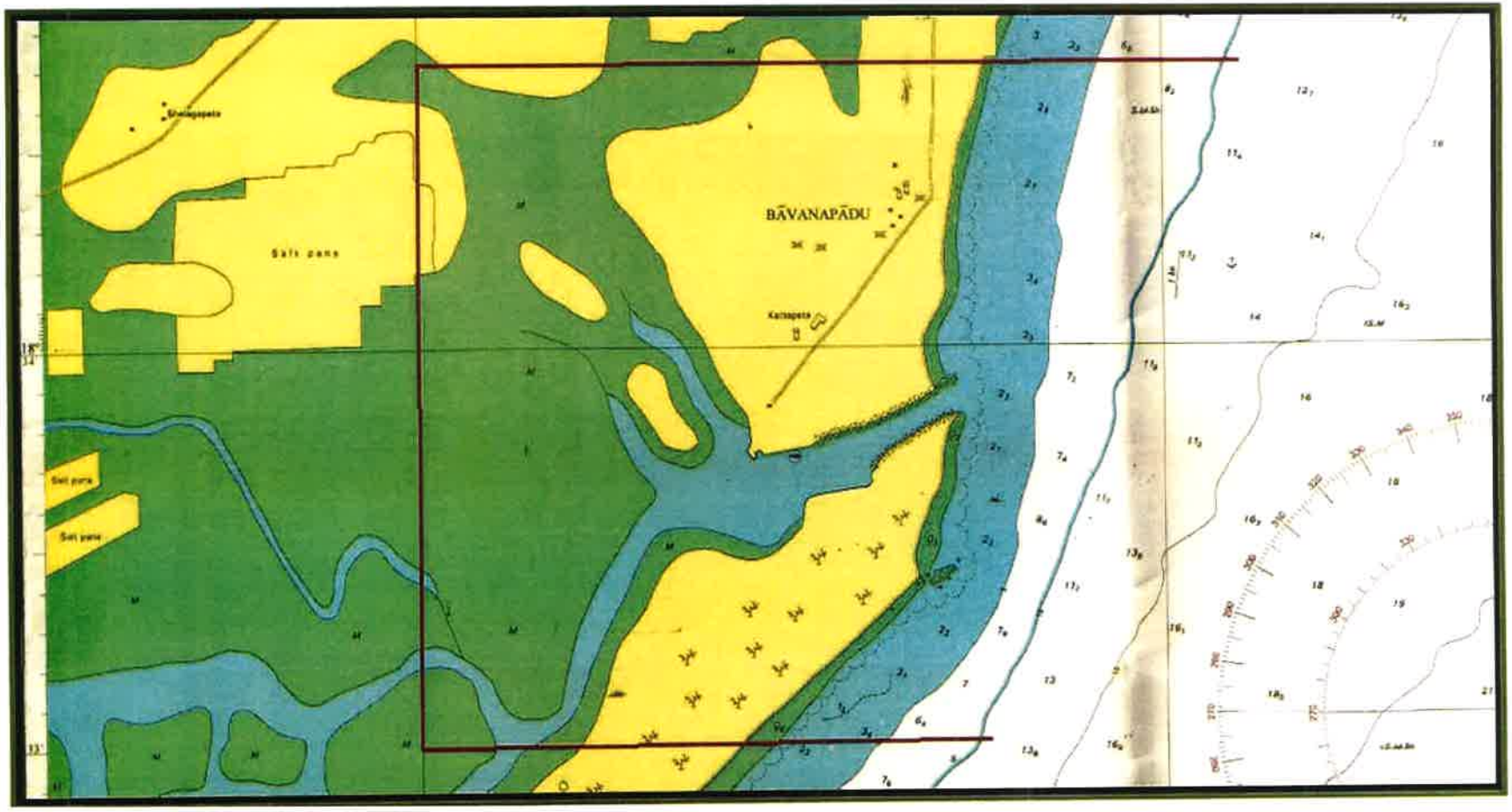

Figure 2: Port Limits of Bhavanapadu

2.10. QUANTITY OF WASTE:

The waste which is generated will be mainly municipal solid waste, which is managed and treated or sent to disposal. Collected waste oil will be sent to authorised TSDF Facility.

2.11. SCHEMATIC REPRESENTATION OF PROPOSED PROJECT

Drawings giving development plan of the proposed port, Technical Feasibility Report, location map, alternate site location, Port Limits, Area occupied by port are provided.

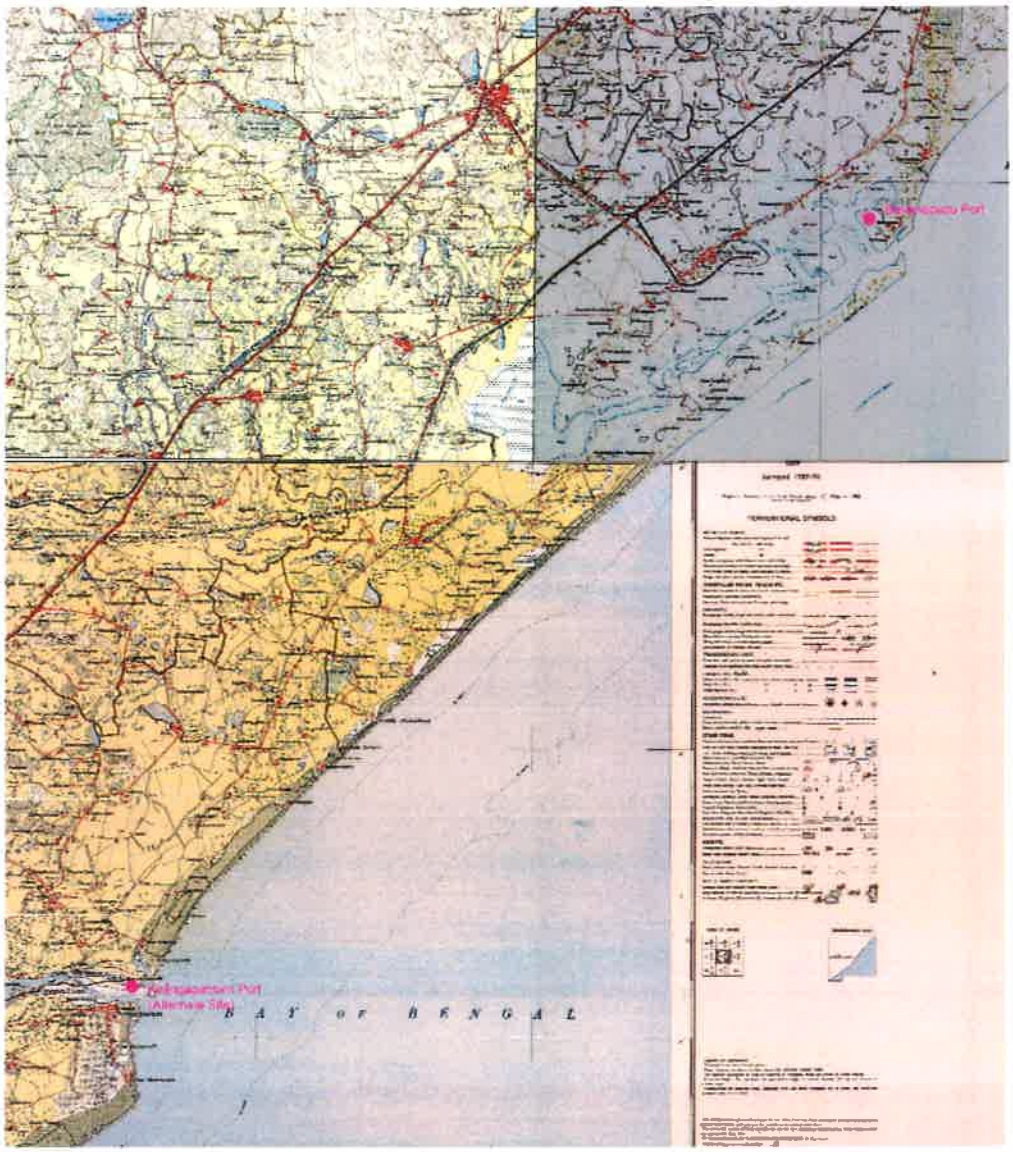

Figure 3: Alternative Sites

3. SITE ANALYSIS

3.1. CONNECTIVITY

The National Highway 5 from Chennai to Kolkata is at a distance of about 25 km from Bhavanapadu. It is connected to NH 5 by means of single lane road of five meters wide. It passes through Naupada.

The Chennai-Kolkata broad gauge main lane passes about 7 km from Bhavanapadu at Naupada junction. There is 90km long beach line from Naupada junction upto Gunpur which has been converted into broad gauge line.

3.2. LAND FORM, LAND USE AND LAND OWNERSHIP

At present a fishery harbor exists at Bhavanapadu. The facilities of this Harbor include 50 meters wide navigation channel between two rubble mound groynes, 275 meters long quay parallel to creek, auction hall, vast reclaimed open area, substation building, lighting etc., and also large open land is available around the port which can be occupied in case of need.

3.3. TOPOGRAPHY

The seabed has a relatively steep slope near shore and thereafter it has a very gentle slope. The 5 m contour is about 400 m from the coastline while the 10 m contour is at 800 m.; the 15 m contour is at 1400 m and the 20 m contour is almost 3200 m away from the shoreline. The breakwater will stretch from the shoreline up to almost 17 m water depths. The topography is depicted in **Figure 7.**

3.4. EXISTING LAND USE PATTERN

Existing land is a barren land with part cashew cultivation in private lands and borassus. The port falls under CRZ Area. Naupada salt pans are 4 kms away and Telineelapuram Bird nesting area is 8.5 kms away from Bhavanapadu port area.

3.5. EXISTING INFRASTRUCTURE

A Fishing harbor is located currently with navigation channel, auction hall, substation building, lighting system, etc. the same is provided as **Figure 4.**

Figure 4: Existing Facilities

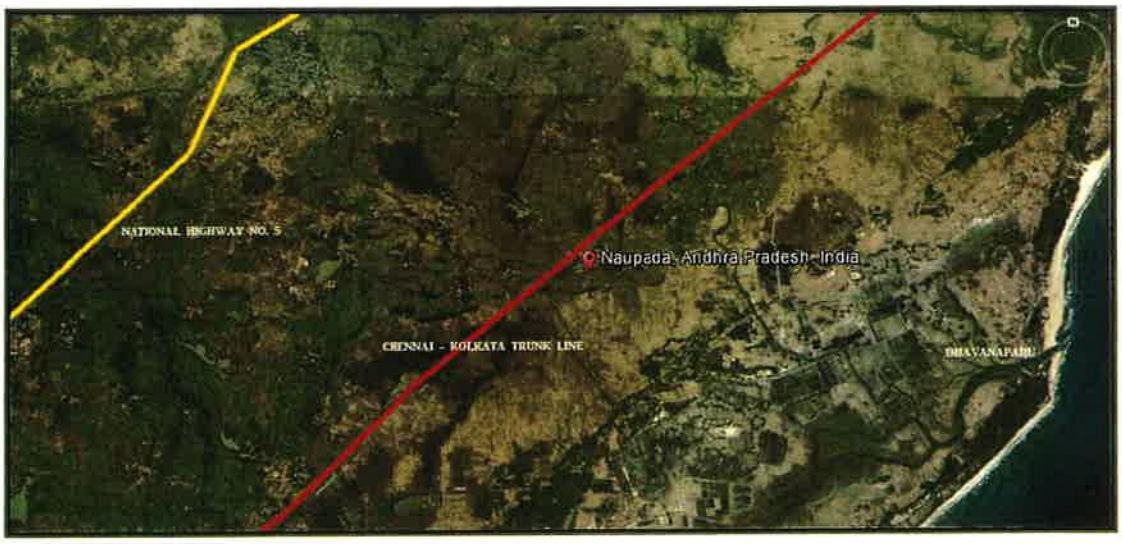

Figure 5: Road Connectivity to the Site

Figure 6: Railway Connectivity to the Site

Figure 7: Topography of Bhavanapadu port

3.6. SOIL CLASSIFICATION:

The soil classification observed in the area is of grayish brown silty soft to very stiff clay in the top layers upto about 13m deep and silty clayey to silty dense sand afterwards upto about 21m depth. The drainage Map is provided as **Figure 8.**

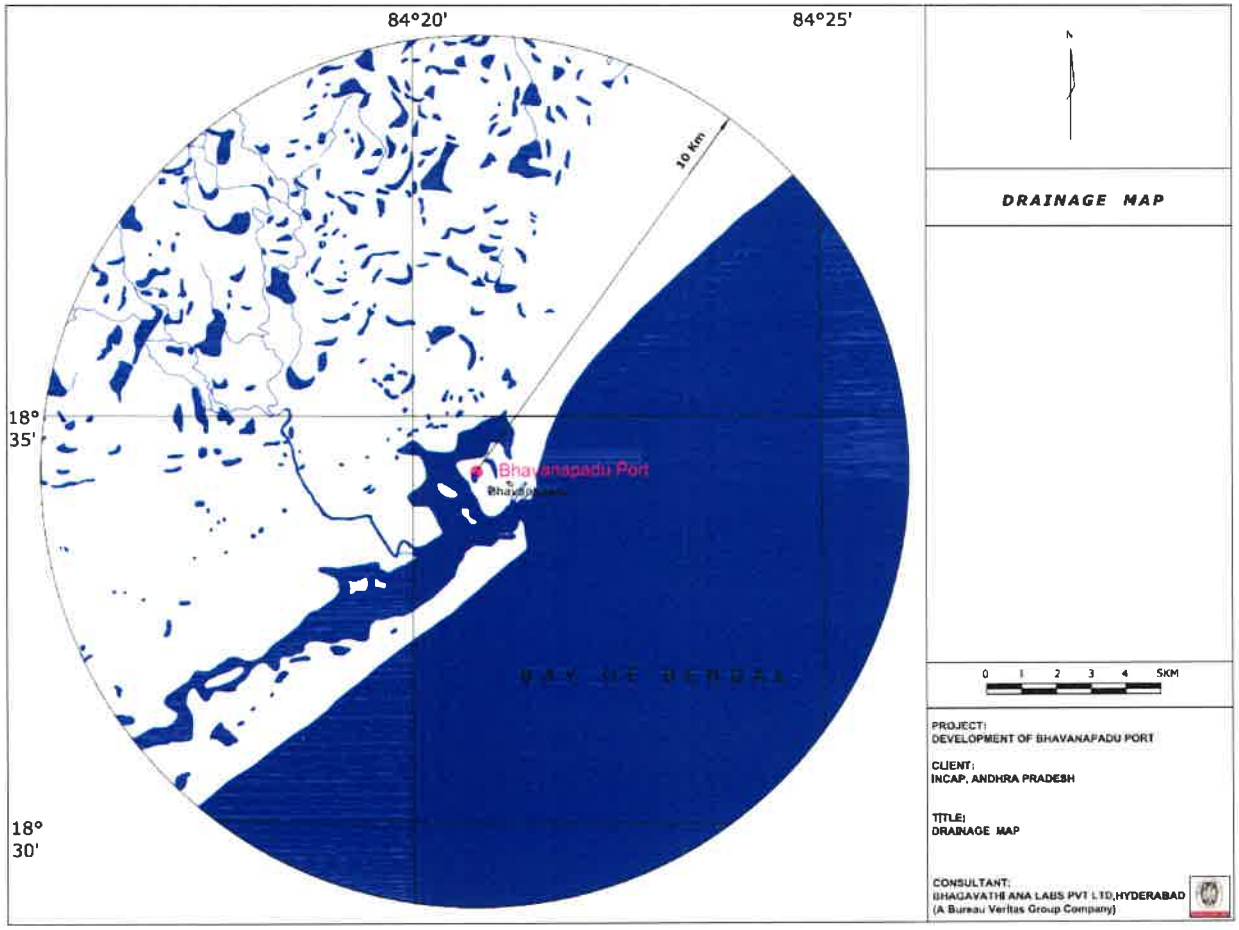

Figure 8: Drainage Map

3.7. CLIMATE:

There is no meteorological observatory near Bhavanapadu. The nearest observatory is at Calingapatnam which is about 50 km away. Hence the climatalogical data for Calingapatnam published by the Indian Meteorological Department (IMD) has been considered. The climate at Bhavanapadu is tropical. The period from March to June is the hot season with the daily mean maximum temperature reaching a high of 34.1^0 C in May while that from December to February is the cold season during which the daily mean minimum temperature reaches a low of 17.3^0 C in December. The region receives a total rainfall of 1643 mm every year. October is the wettest month (241.8 mm) and the monsoon period is from June to November. The region receives rainfall during southwest as well as northeast monsoons. The mean relative humidity during the day is 82% with a maximum of 86% in July and a minimum of 79% is December. The monthly variations of the relevant meteorological parameters are presented in the Table hereunder. Monthly variations of relevant meteorological data are given in **Table 1**.

Table 1: Monthly Variations of Meteorological Parameters

Month	Mean Temperature (centigrade)		Rainfall (mm)	Relative Humidity	
	Daily Max	Daily Min		Morning	Evening
January	27.5	17.3	5.8	82	72
February	29.9	19.6	6.8	81	73
March	32.1	22.6	7.1	80	77
April	33.1	25.2	15.5	79	81
May	34.1	26.8	35.3	79	81
June	33.5	26.5	123.3	82	81
July	31.6	25.6	177.3	86	81
August	31.7	25.5	169.5	85	83
September	32.0	25.3	183.2	85	82
October	31.1	24.0	241.8	84	77
November	29.1	20.2	70.1	81	70
December	27.3	17.3	6.2	79	68

3.8. WIND:

The mean coastal wind speeds for the coast of Kalingapatnam vary from 8.6 to 15.7 kmph. The annual occurrence of wind speed as published in the Climatology Table of India Meteorological Department is presented in **Table 2.** Apart from the obtained data, 10 years marine wind data collected from BMO off Visakhapatnam coast is presented in the form of wind rose diagram in **Figure 10.**

Table 2: Mean Coastal Wind Speed at Kalingapatanam

Month	Mean Wind Speed (KMPH)	Relative Humidity	
		Morning	Evening
January	8.6	NW,N	E,SE,S
February	8.6	NW,N,W	S,SW,SE,E
March	11.5	SW,W,NW	SW,S
April	15.7	SW,S,W	SW,S
May	15.6	SW,S,W	SW,S
June	14.4	SW,W,S	SW,S
July	13.6	SW,W,S	SW,S,W
August	11.0	W,SW,NW	SW,S,W
September	9.0	W,SW,NW	SW,S
October	8.6	NW,N,W	E,NE,SE,S
November	9.0	NW,N,W	E,NE,SE
December	9.2	NW,N	E,NE,SE,N

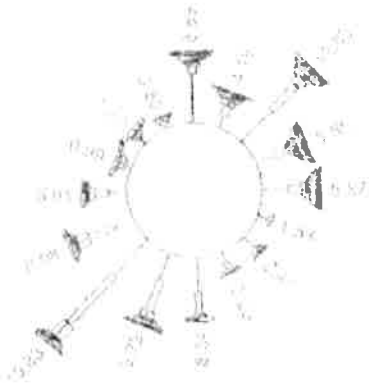

Figure 9: Annual Wind Rose off Vishkapatnam Coast

3.9. CYCLONES:

The extreme conditions such as depressions, cyclones and hurricanes at the coast of Kalingapatnam are taken from tracks for a 50 year period 1945 to 1955 and obtained from Global Tropical and Extra tropical Cyclone Climatic Atlas (GTECCA). It shows that most of the cyclones approach the coast from directions ranging from E to SE. The frequency of cyclonic storms that have occurred during this period within a radius of 200 km from Kalingapatnam are 64.

3.10. TIDAL DATA:

Tides at Kalingapatnam are semi-diurnal with a mean spring range of 1.4 m and a mean neap range of 0.6 m. The tidal levels with reference to Chart Datum as reported in Naval Hydrographic Chart No. 3024 are as follows:

Mean High Water Springs (MHWS): (+) 1.70 m CD
Mean High Water Neaps (MHWN): (+) 1.30 m CD
Mean Sea Level (MSL): (+) 1.00 m CD
Mean Low Water Neaps: (+) 0.70 m CD
Mean Low Water Springs: (+) 0.30 m CD

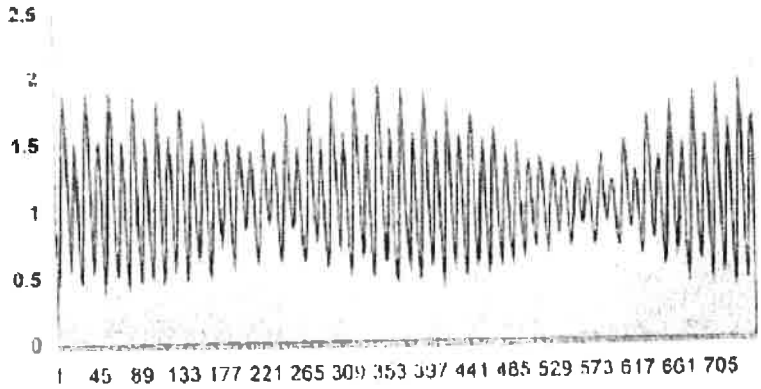

Figure 10: Simulated tides for Kalingapatanam

3.11. WAVES:

In the absence of site specific wave data measured through instruments at Bhavanapadu,

the deep water wave data collected for Visakhapatnam from British Meteorological Office (BMO) was used for this study. This data collected for a period of 9 years (1995-2004) comprising of 13,222 observations at the location Latitude 17.1° N: Longitude 83.1° E around 85 km away from Visakhapatnam coast. The same is analyzed for establishing deep water wave climate. The annual occurrence of wave heights described over different months is presented in **Figure 11.**

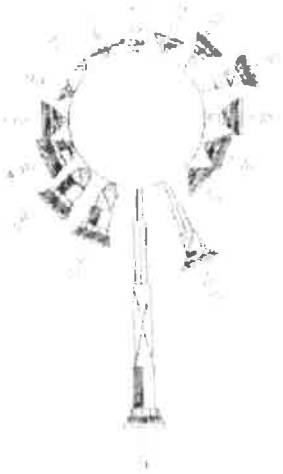

Figure 11: Wave rose diagram 85 Km off Vishakapatanam

It is observed from the wave rose diagram that offshore waves predominantly approach from NE (4.53%); ENE (7.94%); E (3.85%); SSE (13.88%); SSW (10.4%); SW (8.66%) and S (41.90%) to the near shore project site. The directional analysis shows that altogether 91.25% of the offshore waves are propagating towards the study area.

3.12. CURRENTS:

The region experiences tidal current as well as long shore current due to wave breaking. The peak velocity of tidal current is 0.80 m/s. This value is based on the published literature and can be confirmed by carrying out numerical modelling of tidal and wave generated current.

3.13. BATHYMETRY:

The Port Department of GoAP has got the bathymetric survey done at both Bhavanapadu

and Kalingapatnam through Sai Surveys of Mumbai during July-August, 2007. The bathymetric survey was carried out up to 16.0 m contour. According to them, the seabed, in general is gently sloping from west to east nearly perpendicular to the coast line with the contours running nearly parallel to the coast line. No isolated shallow patches or obstructions were found within the surveyed area. They observed that water depths of 2.5 m to 3.0 m were available all along the fishing jetty. About 50 m from the jetty, the depth decreased to 1.0 m. Beyond the 1.0 m contour, there is a sand bar running parallel to the jetty. The channel in between the trainer walls towards the seaside was nearly closed with shallow sand bars. Heavy breakers were observed near the mouth of the channel and no safe navigable passage out to the open sea was available.

Based on the survey, it is noted that 5.0 m contour is about 200 m from the coastline while 10.0 m contour is at 500 m and 15.0 m contour is at 1200 m respectively from the coastline.

3.14. SOCIAL INFRASTRUCTURE AVAILABLE:

The proposed location is in Bhavanpadu port where primary and secondary school and local medical center is available along with markets.

4. PLANNING BRIEF

4.1. PLANNING CONCEPT:

The port development plan is based on following parameters: The projected traffic for Bhavanapadu port have been given for three time lines of five year interval viz. 2016-17; 2021-22 and 2025-27.

First Phase

One coal berth; one container berth and 3 general cargo berths (total 5 berths)

Second Phase

One coal berth; two container berths and five general cargo berths (total 8 berths)

Third Phase

Two coal berths; three container berths; one limestone berth and eight general cargo berths (total 14 berths)

4.2. POPULATION PROJECTION:

The population projection of the project is related to only direct and indirect employment generation.

4.3. LAND USE PLANNING:

The cargo storage requirement for the ultimate phase under two scenarios has been assessed considering the certain land use planning parameters viz. dwell time, bulk density, stock pile height etc. The estimated land requirement for each of the cargo type and other activity are given in **Table 3**.

Table 3: Land requirement for each of the Cargo Type

Components	Area in Acres
Storage Area	
Coal	550

Components	Area in Acres
Container	60
General Cargo	40
Other Dry Bulk Cargo	250
Bert Apron	200
Buildings	
Administrative Buildings	40
Workforce Amenities	10
Common Areas	
Truck Parking and Rail Loading Bays	100
Roads and utilities	600
Green Belt and Open Areas	650
Other Areas	
Port based industries	750
Future Expansion	1000
Port Total	**4250**
External Connectivity Road and Rail	750
Total Area	**5000**

4.4. ASSESSMENT OF INFRASTRUCTURE DEMAND:

The infrastructure needs are assessed with respect to cargo demand and proposed to be developed in phases as per requirement.

4.5. AMENITIES AND FACILITIES:

Amenities and facilities proposed are in relation to infrastructure proposed, which is developed in phases.

4.6. TRAFFIC POTENTIAL

The projected traffic for Bhavanapadu port is presented in Table 4, the projections have been given for 2020-2026. The projections have also been given for two scenarios i.e. low and high.

While handling these cargoes, the following modes have been assumed;

The export cargo of Cashew kernels, raw and polished granite, jute and jute products will all be handled through containers. Soy meal will be exported in bags weighing 60 kg each as is being done now at Kandla. Iron & Steel products as well as Ferro products & alloys will be handled as break-bulk.

The import cargo of LPG and soy oil will be handled in liquid bulk. Thermal coal, coking coal, lime stone and fertilizers will all be handled as dry bulk. Raw cashew will be handled in containers. Iron & steel scrap will be handled as break-bulk cargo. Accordingly, the import container traffic will be given in **Table 4.**

Table 4: Traffic projections for Bhavanapadu in MTPA

Estimated Traffic (in MTPA)

Scenario Low							
	2020	2021	2022	2023	2024	2025	2026
Container	0.8	0.9	0.9	1.0	1.0	1.1	1.1
Liquid Bulk	0.5	0.5	0.5	0.6	0.6	0.7	0.7
Coal	5.5	6.0	6.5	7.0	7.5	8.0	8.6
General	1.8	1.9	2.0	2.2	2.3	2.4	2.6
Total	8.6	9.3	10.0	10.7	11.4	12.2	13.0
Scenario High							
	2020	2021	2022	2023	2024	2025	2026
Container	1.3	1.3	1.4	1.5	1.5	1.6	1.7
Liquid Bulk	0.8	0.8	0.9	0.9	1.0	1.0	1.1
Coal	8.9	9.5	10.1	10.8	11.4	12.0	12.8
General	3.0	3.2	3.4	3.6	3.8	3.9	4.1
Total	14.0	14.9	15.8	16.7	17.6	18.5	19.6

4.7. ROAD NETWORK:

The port could be connected to National Highway No. 5 (Chennai - Kolkata). There are two feasible routes available; The shorter route, is about 10 km long passing through Pete

Marripadu, Rarnesvaram, Burgam, Dimiladda, Narsipuram and joining the Highway about 4 km north of Tekkali.

However, there is no continuous road existing at present. The small roads appear to be disjointed. A proper route survey needs to be carried out and the alignment marked.

The longer route is about 20 km long passing through Pete Marripadu, Chimpurupalli, Pallada, Upparapeta and joining the Highway north of Bendi Reserve Forest area. There is an existing good road for the entire length and running almost parallel to the trunk railway line.

4.8. RAILWAY:

The nearest rail head is at Naupada Junction which lies on the Chennai - Kolkata broad gauge (BG) main line. It is about 7 kms from Bhavanapadu. There is a 90 km Long Branch line from Naupada Junction up to Gunpur which has been converted into broad gauge in 2011-12. Extension of the Gunpur - Naupada train up to Rourkela via Berhampur and Bhubaneswar is likely to ensure faster and wider connectivity to the region.

There is also a branch line from Naupdad Junction eastwards up to a place called Kotta Naupada which is closer to Bhavanapadu. This line can be extended up to the proposed port area. This line may have to pass through salt pans and may have to cross the Tekkali backwaters. A detailed route survey will be required for marking the proper alignment of this route.

4.9. TYPE OF COMMODITY TO HANDLE:

4.9.1. Thermal Coal

It has been assessed that the thermal coal traffic at Bhavanapadu will be initially for the thermal power plant of East Coast Energy Pvt. Ltd. Considering that the imported thermal coal will be to supplement the domestic supply, it is assumed that the coal will be moved in Panamax carriers upto 80,000 dwt with a parcel size of 75,000 Tons. These vessels will be normally gearless and hence shore based unloaders need to be provided. During the next phases of development, the size could be increased to cape size of maximum 120,000 dwt.

4.9.2. Coking Coal

In this case also, initially it is assumed that the coal will be moved in Panamax carriers up to 80,000 dwt with a parcel size of 75,000 Tons. These vessels will be normally gearless and hence shore based unloaders need to be provided. During the next phases of development, the size could be increased to cape size of maximum 120,000 dwt.

4.9.3. Containers

With the number of containers to be handled being limited, this port is likely to attract only feeder vessels. Such vessels will not be more than 40,000 dwt with an average parcel size of about 400 TEU.

4.9.4. Break-Bulk

Soya meal, iron & steel products, Ferro products & alloys, iron & steel scrap are all will be handled as break-bulk general cargo. For these, the vessel size will be general cargo liner vessels of up to 25,000 dwt.

4.9.5. Fertilisers

Fertilisers will be handled through vessels up to 40,000 dwt.

4.9.6. LPG

Among Indian flag LPG carriers, smaller carriers are very old and the later trend is to go for larger carriers of over 35,000 dwt. Since most of the carriers operate on multi-port calls, such carriers are considered for planning purposes at Bhavanapadu.

4.9.7. Soya Oil

It is considered that soya oil will be imported in small ships up to 25,000 dwt with an average parcel size of 12,000 tonnes.

4.9.8. Rate of Discharge of Goods

For planning purposes, the rate of discharge of different cargo from vessels is taken as given below;

Thermal and coking coal	40,000 tonnes per day.
Containers	800 TEU per day
Fertilisers	10,000 tonnes per day
Break-bulk general cargo	1000 tonnes per day
LPG	10,000 tonnes per day
Soya Oil	10,000 tonnes per day

5. INFRASTRUCTURE REQUIREMENT

5.1. PORT RELATED INFRASTRUCTURE:

5.1.1. Breakwater

Breakwater will be constructed to afford required tranquillity for handling the ships. The breakwater will be aligned due east for a distance of 2000 m.

For fixing the breakwater parameters such as the crest height, crest width, type and size of armour units a detailed analysis of the cyclonic data near the site is required. Mathematical model studies need to be carried out for hind casting the extreme design wave heights. The breakwaters elements have to be designed for a 1 in I 00 year return period waves.

The breakwater will be a conventional rubble mound breakwater constructed from shore through end-on method. The elements will be rock and concrete accropode as armor units. The crest elevation will be determined based on tidal data and storm surge. The breakwater will be designed for over topping conditions during extreme wave conditions. The crest width will be decided based on requirements of the moving equipment during construction and maintenance.

5.1.2. Coal Berth

5.1.2.1. Siting of the Berth:

The coal berth will be handling Panama carriers upto 75,000 dwt initially and later cape size vessels upto 150,000 dwt. The Panamax carriers will have a draft of 13.5 m and will require water depth of 15.00 m. Hence it is proposed to locate the berth is natural water depths of 15 m so that no dredging need to be done.

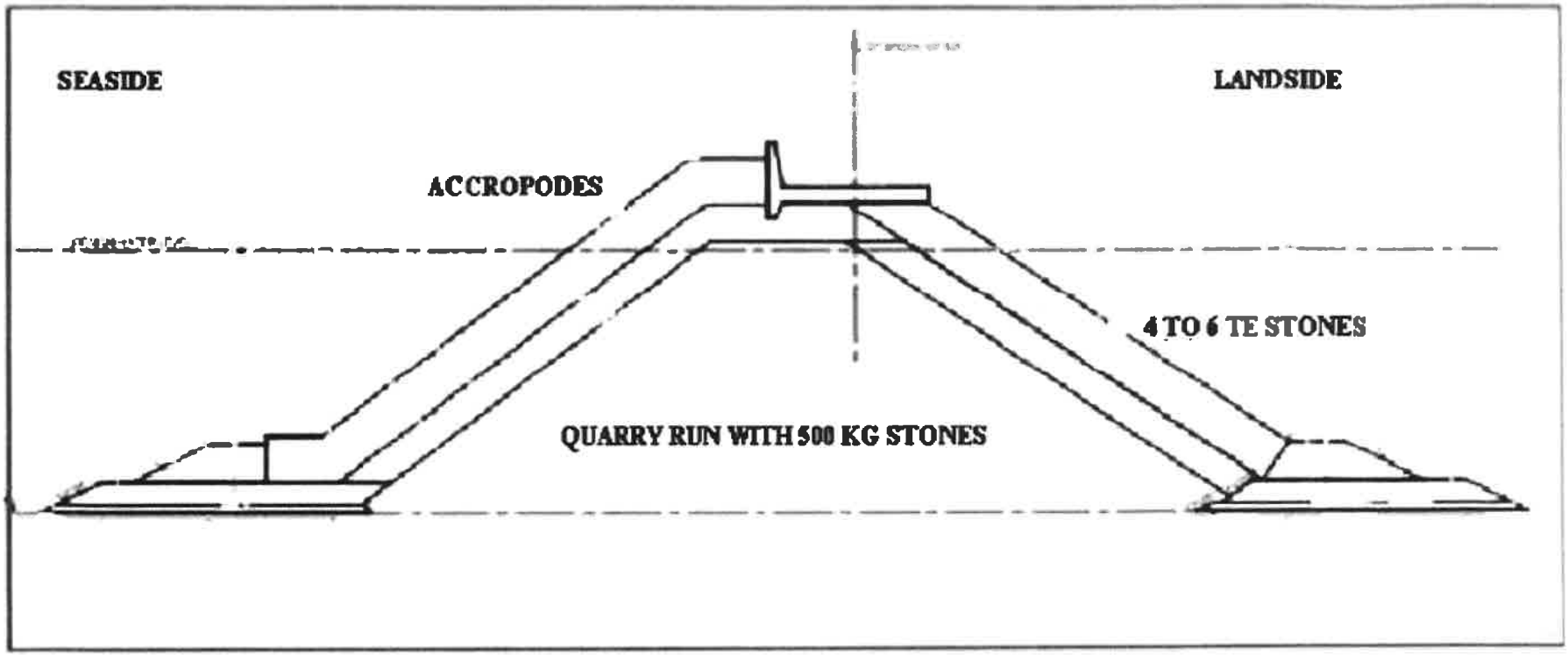

Figure 12: Cross section of breakwater

5.1.2.2. Tranquillity Conditions:

For carrying out cargo handling operations at these berths, there is a limit to the wave conditions to ensure that there are no excessive movements of the ship that will hamper the loading/unloading operations. This limit varies with the handling system for the different types of cargo. The maximum acceptable wave conditions for cargo handling operations at the berth are dependent upon the size of the ships, the type and method of ship-shore transfer and the direction of the wave incidence - beam waves cause the vessel to roll and affect the cargo handling operations more than head waves. The limiting wave height HS for different wave directions for dry bulk handling operations are furnished below:

The limiting wave height for Head or Stern (00) waves - HS = I .5m
The limiting wave height for Quadrant (450 -900) waves - HS = 1.0m

5.1.2.3. Length of the Berth

The structure of the berth will be designed for the largest vessel i.e. 150,000 dwt. Considering the overall length of the design vessel, i.e. 275m and allowing 25m on either side for mooring, the length of berth works out to 325m.

Width of the berth:
The minimum width of the berth keeping in mind the rail span of the gantry grab un-loader, the service duct and the end clearance should be 25 m.

5.1.2.4. Deck Elevation

The deck elevation is kept at +4.50 m (CD) taking into account the tidal levels, storm surge, wave height during operations, deck thickness and air gap.

5.1.2.5. Berth Structure

The berth structure will be designed for the largest vessel of 150,000 dwt. It will be designed as an open piled structure. The proposed structure will comprise four rows of bored cast-in situ concrete piles spaced at 6 m c/c The diameter of the piles and their founding depths will be defined during detailed engineering after carrying out proper geotechnical investigations at the location. The deck structure will comprise main beams supported over the piles which in turn will support beams in the longitudinal direction. A deck slab will be provided over the

secondary longitudinal beams. Bollards and rubber fenders will be provided along the berthing face at 25 m intervals. A service trench will be provided near the berthing face to accommodate cables/utilities.

5.1.2.6. Alongside Berths

During the first phase four berths are required for handling general cargo, containers, fertilizers, limestone, LPG, and soya oil. The ships have different lengths and drafts. The traffic is not sufficient to have exclusive berths for each commodity. Hence, in order to have flexibility in berthing of ships, it is proposed to have a continuous wharf for a length of 880 m with a water depth of 13.0m giving an under keel clearance of 1.5 m. These alongside berths will be constructed parallel to the shore. As indicated earlier, it is proposed to construct a reclamation retaining bund at about 4 m water depth. The alongside berths will be constructed in front of the retaining bund.

The berth structure will be designed for the largest vessel of 40,000 dwt. It will be designed as an open piled structure. While dredging the berthing face to 12.5 m below chart datum, the sea bed will be left to retain its natural slope. Accordingly, the width of be berth will be 40 m. The proposed structure will comprise four rows of bored cast-in-situ concrete piles spaced at 7 m c/c both across and alongside. The diameter of the piles and their founding depths will be defined during detailed engineering after carrying out proper geotechnical investigations at the location. The deck structure will comprise main beams supported over the piles which in tum will support beams in the longitudinal direction. A deck slab will be provided over the secondary longitudinal beams. Bollards and rubber fenders will be provided along the berthing face at 20 m intervals. A service trench will be provided near the berthing face to accommodate cables/utilities.

5.1.3. Port Land:

The port back up land area will be developed in phases. During the first phase, two transit sheds will be constructed for handling general cargo. The area behind the first berth has been left vacant to serve for stacking fertilizers, limestone etc. The container parking yard has been located away beyond the transit sheds. This has been located more or less centrally so that it is equidistant from the other berth during the second phase.

The stack yard for thermal and coking coal is provided at the western end of the plot and

near to the railway siding. The entire area will be provided with service roads all around along the compound wall as also inside the area to serve the different utilities.

The other facilities to be located in the port area will be as follows:

- Administrative building
- Port Operational building
- Canteen I Dispensary
- Workshop
- Fire station
- Security Compound wall and Gate House
- Raw water reservoir and overhead tank
- Water Treatment Plant
- Sewerage system
- Effluent Treatment system

Of these buildings, the administrative building and the Port Operational building will be located just outside the compound wall near to the main gate house for easy and unrestricted entry.

5.1.4. Dredging

It has been proposed that the coal berth will be located in natural deep waters so that no capital dredging will be required. However, the alongside berths will be located nearshore and hence dredging will have to be done to access these berths. The natural water depths along the berthing face of the alongside berths will be about 4.5 m below chart datum. This has to be dredged to 13.0 m below chart datum. Accordingly an approach channel of 200 m width starts from the 13 m contour which is about 800 m from the shoreline. This channel will have a length of 350 m. There will be a turning circle of 450 m in front of the berthing face. The berth pocket will extend for a distance of 100 m from the berthing face. Hence a trapezoidal area will have to be dredged. This will be extended during Phase II. Quantity of Dredging anticipated: 2 x 10^6 cum of sand in Phase-I and 2.25 x 10^6 cum for Phase-II

5.1.5. Retaining Bund and Reclamation:

It is proposed to create the backup area for the port by reclamation from the sea without affecting the inhabitation near the port area. For this purpose, a rubble bund will be

constructed approximately along the 4m contour. It will be initially constructed to cover the Phase I area and later extended during the Phase II. The area will be reclaimed using the dredged sand if it is found suitable or from borrow material. The entire land will be reclaimed upto a level of + 4.0 m CD.

In Phase-I: About 54 Ha is planned to be reclaimed/ filled to a level of average 3.50m in the backup area for storage of cargo, with construction of rubble bund with geo textiles along -4m contour for a length of 950m.

In Phase-II: About 18 Ha is planned to be reclaimed/ filled up to a level of average 3.50m in the backup area for storage of cargo, with construction of rubble bund with geo textiles along -4m contour for a length of 680m.

5.1.6. Residential Area:

Staff quarters will be provided outside the port vicinity in separate residential colony with related infrastructure developed few kilometers from proposed site near Bhavanapadu village.

5.1.7. Green Belt:

About 33% of the Port area will be developed with green belt as per MOEF and APPCB Norms.

5.1.8. Social Infrastructure:

In addition to develop social infrastructure related to residential area which is proposed to be developed, local infrastructure like medical centers will also be developed due to port activity.

5.1.9. Connectivity:

It is proposed to develop the single lane road connecting the highway to the port to two lane road in the future. The rail network from port area is also proposed to be monitored and serviced.

5.1.10. Water Requirement

Water is required in the port for the following purposes. Drinking and cleaning purposes in the housing colony, offices and other areas of work Sprinkling water for horticulture, floriculture, arboriculture etc. Water requirement for ships Sprinkling water for dust control at coal stockpiles Fire water at berths, stackyard and other areas

Water requirement for each of the above purposes except fire fighting has been discussed in the following paragraphs. For firefighting sea water will be used. Water requirement for drinking, cleaning etc. in the port area depends upon the population in peak hours which comprises residents in the township, visitors, staff etc. Assuming a population of 2000 persons in the port premises at peak hours and per capita water requirements of 150 litres per day, daily requirement for this purpose works out as 12.50m3/hr. Water requirement for horticulture, floriculture, arboriculture etc. depends upon the area of green belt to be maintained in the port area. Assuming a total of 15 hectares of green belt to be maintained in the port premises, this will require about 250 m3 per hectare per year. With 250 days of watering in a year, water requirement for this purpose works out as 0.63 m3/hr. Requirement for sprinkling water for coal stockpile works out as (assuming 50% water is recycled) 470 m3/hr. At ultimate stage total about 1600 ships are likely to visit the port. Assuming 50% of ships require fresh water, water requirement of ships works out as 41.38 m3/hr.

Thus the total water requirement will be: 524.51 cum/hour or 12588.24 Kilolitre per Day Potable Water Supply requirement, for the port as worked out above, may be met from ground water near the proposed port site or may be obtained from AP Rural Water Supply and Sanitation Department. Underground and overhead tanks of suitable capacities with a closed loop grid system with necessary connections and valve stations would be provided inside the port premises. Water supply will be also provided to the berths by running pipelines. A water treatment plant is proposed for treatment of water before distribution for drinking purposes. Pump houses will be provided with necessary pumps and controls to pump the water to the overhead tanks and also supply water at the required pressure to reach various supply points.

5.1.11. Sewerage System:

Storm water drainage system using rational method of drains is proposed. The drains will ultimately discharge into sea through outfalls at various locations. The sewerage system will

have sewage plant of required capacity as per design using standard manual of sewage and sewage treatment.

5.1.12. Waste Management:

There is no industrial waste except waste water and solid waste from port activities.

5.1.12.1. Solid Waste Management:

The biodegradable part of the waste would be treated in waste effluent treatment plant and the remains of the treatment is used for manure or compost. The non biodegradable part of the waste is sent to local dump yard.

5.1.13. ELECTRIC SUPPLIES

5.1.13.1. PHASE I

Power for Equipment and Conveyors

There will be a network of Conveyors on the Berth and along the route leading to the Stack Yards. The equipment proposed will mainly consist of two numbers of Gantry Unloaders on the berth and Stackers. The total installed power requirement of the equipment and Conveyors for the handling is estimated to be 2650 BHP.

Out of the equipment proposed for Container Handling, power will be required for the Harbour Mobile Cranes used for unloading from the ships. The estimated total installed power for this will be 1000 BHP. All the other equipment will either be diesel driven or diesel electric driven.

Out of the equipment proposed for Fertilizer handling power will be required for Wharf cranes only and the estimated power will be 450 BHP. Out of the equipment proposed for General Cargo handling power will be required for Wharf cranes only and the estimated power will be 450 BHP. This will mean an installed power requirement of 4250 KVA, assuming a Power Factor of 0.8 and efficiency of Power equipment as 80%.

Power for Illumination

The illumination system will consist mainly of berth lighting, lights to be provided along the Conveyors and illumination at the Stack Yards.

Power Supply

The estimated power requirement, taking all the requirements of power for conveyors, equipment and illumination including future requirements, will be 5000 KVA.

5.1.13.2. PHASE II

The additional equipment proposed in Phase II will have an Installed power of 1900 BHP hence; the power requirement with a power factor of 0.8 will be 2000 KVA. Power for Illumination The additional requirement for illumination will only be 24 KVA.

The estimated additional power requirement, taking all the requirements of power for conveyors, equipment and illumination including future requirements, will be 2500 KVA.
This can be met by installing one more transformer in the existing Main Substation itself and distributed with an additional substation.

The power will be received from the State Electricity Board in the Main Substation and distributed using three sub stations, two for the supply to the Berths and one for the supply to the Yards.

6. REHABILITATION AND RESETTLEMENT

As per the National R&R Policy all the Rehabilitation and Resettlement will be taken up.

7. PROJECT SCHEDULE AND COST ESTIMATION

7.1. CAPITAL COST:

The unescalated Base Cost for Phase 1 and Phase 2 is INR 3,725 crores. The details of the total cost are given in the **Table 5.**

Table 5: Estimated Capital Cost

Component	Phase I	Phase II	Replacement Cost	
			Phase I P&M	Phase II P&M
Civil works	800	273	-	-
Plant and Machinery (P&M)	594	264	790	265
Other costs*	519	118	102	
Unescalated Cost	1,913	655	1157	
Escalation	300	274	1,593	
Total	2,213	929	2,752	

7.2. OPERATION AND MAINTENANCE COST:

Annual Operation & Maintenance Cost is estimated under the scenario "Low". The key assumptions are given below.

Repairs & Maintenance Cost
Civil Works 1% of GFA civil
Mechanical, Electrical, Floating crafts & IT system 5% of GFA P&M
Maintenance Dredging 10% of Cap. Dredging

Power Charges 0.01% of traffic troughput (lakh/ton)

Fuel Charges 0.02% of traffic troughput (lakh/ton)

Insurance 1% of NFA

License fee As per AP Port policy (6% of market value) + 2% escalation every year

Other Expenses 5% of Capex

Man Power 5% of revenue which consists of the following in **Table 6.**

Table 6: Annual Operation and maintenance cost

(in INR crores)

Particulars	2020	2025	2030	2035	2040	2045	2049
Repairs & Maintenance Cost:							
Civil Works	8	11	11	11	11	11	11
Mechanical, Electrical, Floating crafts & IT system	51	74	74	97	179	191	231
Maintenance Dredging	5	11	11	11	11	11	11
Power Charges	9	12	17	25	28	28	28
Fuel Charges	17	24	35	49	57	57	57
Insurance	21	26	21	20	30	24	26
License fee	10	11	12	13	14	16	17
Other Expenses	111	157	157	180	262	274	314
Man Power	23	37	58	93	119	133	145
Total	**255**	**364**	**396**	**498**	**710**	**746**	**841**

7.3. ANNUAL FINANCIAL REVENUE EARNINGS:

The financial revenue earnings from the project to the PPP operator will comprise earnings from cargo related charges such as Wharfage & Handling charges and vessel related charges such as Port dues, Pilotage and Berth hire charges. Profit Loss statement is given in **Table 7.**

Table 7: Profit Loss Statement

(in INR crores)

Particulars	2020	2025	2030	2035	2040	2045	2049
Gross revenues	470	744	1,162	1,853	2,372	2,655	2,906
Total expenditure	245	354	384	486	770	812	914
PBDIT=Gross Revenue-Total Expense	225	391	778	1,367	1,602	1,843	1,992
Less: Depreciation (as per companies act)	76	113	113	121	154	160	160
Less: Amortisation	2	-	-	-	-	-	-
PBIT	147	278	665	1246	1448	1683	1832
Less: Interest	242	267	166	45	0	0	0
PBT	-95	11	499	1201	1448	1683	1832
Less: Tax	-	2	97	388	414	544	629
PAT	-95	9	402	813	1034	1139	1203

8. ANALYSIS OF PROPOSAL

As seen from the details are given in preceding chapters, the project of developing modern port near Bhavanapadu, district Srikakulam, on east coast of Andhra Pradesh is technically and economically viable even under the worst cases of risk analysis.

However, apart from the cost-benefit analysis from economic considerations, the project has considerable benefits from the point of view of social cost benefit analysis. The project is coming up in the undeveloped/underdeveloped area of Bhavanapadu covering Srikakulam district and nearby area is economically backward due to its remote location and non-existence of any industry in the vicinity.

The population is mainly dependent on agricultural income, which is seasonal, grossly inadequate and uncertain due to dependency on vagaries of nature.

The proposed project will have major impact on social and economic improvement of the region by overall improvement in living standard through creation of new jobs, increase in volume of general trade, general improvement in infrastructural facility with better transport and communication network. Thus, after completing necessary formalities with respect to various permissions from statuary and local bodies, the project is viable from all aspects such as technical, economic and social aspects.