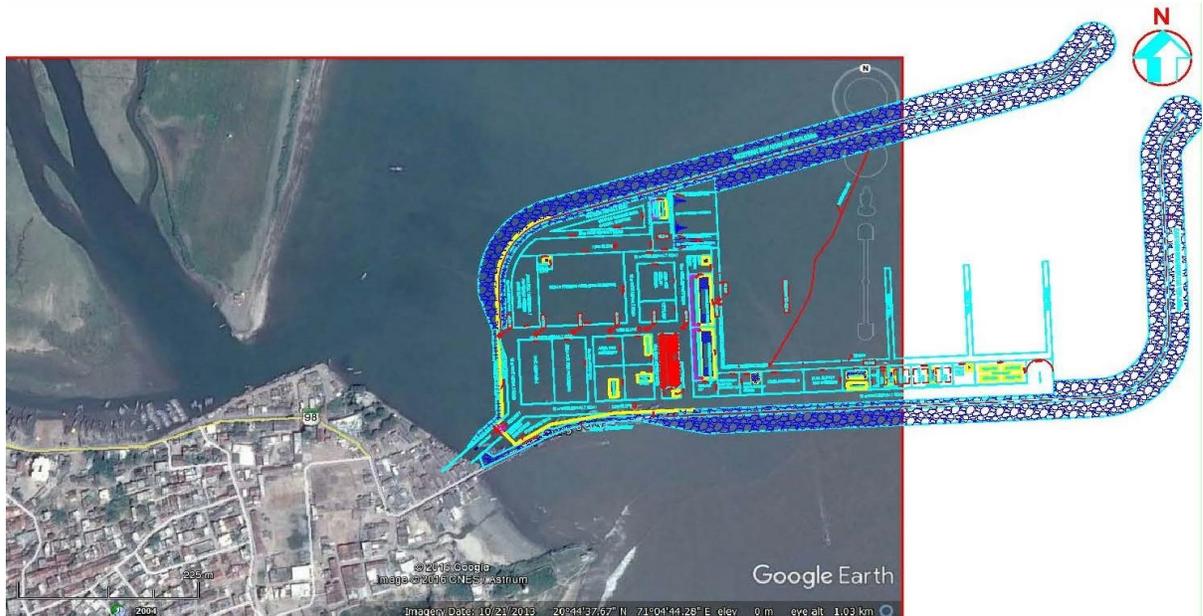




Commissioner of Fisheries

Government of Gujarat



Development of Fishery Harbour at Navabandar District Gir Somnath

Final Detailed Project Report



WAPCOS Limited

(A Government of India Undertaking)

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EXECUTIVE SUMMARY

Gujarat has a long coastline of 1600 km formed with several bays, inlets, estuaries and marshy lands. Brackish water areas are formed by the outfall of perennial rivers like Narmada, Tapti, Mahi, Ambika and Purna and several other seasonal rivers. The State has 40 minor and intermediate ports geographically dispersed across south Gujarat (13 ports), Saurashtra (23 ports) and in Kutch region (4 ports). These are under the administrative control of the Gujarat Maritime Board of the State Port Department. There is also a major commercial port of Kandla under the administrative control of the Ministry of Surface Transport of Government of India. Under the “Gujarat Port Policy”, Gujarat State government is developing ten deep water berthing ports of international standard, of which six ports will be entirely private ports with private capital investment and four ports will be developed under joint venture with major capital investment from private companies. The international airport of Ahmedabad is connected with Mumbai, Delhi and other cities by daily services. The State has nine other domestic airports at Vadodara, Bhavnagar, Bhuj, Surat, Jamnagar, Kandla, Keshod, Porbandar and Rajkot.

The State has been divided in to five geographic and political divisions i.e., Kutch-Saurashtra region, Ahmadabad, Northern region, Central region and southern region. In Saurashtra Morbi has become coastal district since Rajkot has been district divided in to Rajkot and Morbi and Rajkot has become inland district. Maritime districts of Jamnagar and Junagadh have been divided into four districts of Jamnagar & Dev Bhoomi Dwarka and Junagadh & Gir Somnath districts. Therefore 12 coastal districts have gone up to 14 Marine Districts.

Table: Region-wise Total No. of Districts, Coastal Districts and Assembly Segments in Gujarat

Name of the Region	Total No. of Districts	No. of Coastal Districts	No. of Assembly Constituencies
Kutch-Saurashtra	12	8	54
Ahmedabad	1	0	21
Northern Gujarat	6	0	32
Central Gujarat	7	0	40
Southern Gujarat	7	6	35
Gujarat State – Total	33	14	182

Considering the higher level of fishing activities including the number of fishing boats operating from Navabandar fishery Centre, the volume of fish landings and other fishery related activities at Navabandar, it is recommended to develop fishery harbor facilities. For designing a new harbour following types and number of the boats are considered as per year 2020 scenario. If the project is sanctioned in the end of 2016 then about 3 years would be for construction of the harbour i.e. ‘0’ year. From year 1 i.e. 2020 all the 1000 fishing boats are expected to operate from the proposed Navabandar Fishery Harbour. Therefore, economic evaluation has been done for 1000 fishing vessels comprising 220 no. of 10 metre FRP, 580 no. of 15 metre Dolenet/Gillnet and 200 no. of 18 metre trawlers.

Based on the design fleet size and fish species expected or predicted to be landed at the site, appropriate waterside and landside harbour facilities have been recommended for the smooth functioning of the fishery harbour. Shore side facilities considered include fish handling and auction hall, fish packing hall, fish loading facilities, ice plant, ancillary fish industries for fish salting/drying/curing, fish drying yards, solar dryers, fish and floor cleaning units, fishing gear storage sheds, net mending sheds, marine service station, boat repair/building yards, workshops, marine supply and provision stores, instrument and radio shops, fishery administrative office, fishermen rest sheds, dormitories, restaurants, fuel stations, vehicle parking areas, public toilets, approach roads and internal roads, fresh water supply and distribution, drainage and sewerage, electric power and lighting, safety and security measures in terms of fencing/compound walls, guard house, fire-fighting devices, life buoys and jackets, radio communication station and equipment.

While planning and designing the shore side facilities, national and international fish hygiene standards in force such as EU norms and HACCP practices have been incorporated. Further, the fishery harbour layout include appropriate facilities for fresh water supply systems for human consumption, sea water supply systems for washing of fish and for cleaning of common facilities, areas etc. Solid/liquid/hazardous waste management and treatment systems for appropriate waste management will also be included.

Benefits and Justification

The project would contribute substantially to increase the fish supplies to both domestic and export markets. The average annual total landings of fish from the year of stabilisation of the project would amount to 52,080 t valued at Rs. 44,680 lakhs, at the boatside price. The project would give employment to 7,700 sea-going fishermen comprise of 880 persons in 220 nos. of 10 metre FRP, 5220 persons in 580 nos. of 15 metre Dole netter/Gill netter and 1,600 persons in 200 nos. of 18 metre Trawlers besides 3,300 persons in shore-based establishments, distribution and marketing of fishery products. Thus, 11,000 persons would be benefited directly in the fishing industry from project implementation, apart from the indirect benefits that would accrue as a result of developmental efforts.

The income earned by the fishermen would be of the order of Rs. 9,281.98 lakhs, whereas the net income earned by vessel-owners after meeting provisions for fishing vessel maintenance, fishing gear maintenance & replacement, crew wage and vessel insurance etc., aggregate to Rs. 7,077.98 lakhs. The total sale of fishery products would amount to 44,928 tonne valued at Rs. 47,621.15 lakhs. Of this, export of frozen product is 1393.44 tonne valued at Rs. 5149.83 lakhs comprising prawn products 650 tonne valued at Rs.3,537.43 lakhs and fish products 743 tonne valued at Rs.1,612.40 lakhs.

The salient features of the project are given below:

(a)	Investment (Rs. lakhs)		
	Fishing Fleet	-	33,520
	Fishery harbour	-	15,845
	Shore-establishments	-	180
	Pre Development Expenditure	-	40
	TOTAL	-	49,585

b)	Fishing Fleet (No.)				
	10 metre FRP	-		220	
	15 metre DN/GN	-		580	
	18 metre Trawler	-		200	
	Total - Design Fleet / economic evaluation	-		1000	
(c)	Return on Vessel Investment (%)	-	<u>10 M</u>	<u>15 M</u>	<u>18 M</u>
	Before depreciation	-	20.2	20.5	22.8
	After depreciation	-	15.8	15.3	16.6
(d)	Landings of Fish and Crustaceans				
	Fish	-			
	- Quantity (tonne)	-		52,080	
	- Value (Rs. lakhs)	-		44,680	
(e)	Internal Rate of Return (%)				
	Basic statement (Appendix 11)	-		11 - 12 %	
	20% reduction of total fleet landings	-		Negative %	
	25% reduction in export income	-		7 - 8 %	
	25% increase in total investment	-		2 - 3 %	

The Internal Rate of Return (IRR) for this project works out to 11-12% on the estimated cost of the fishery harbour over a project evaluation period of 14 years. The net present value (NPV) of the project at 11% discount rate is Rs 1,361 lakhs. Hence, the project is commercially viable. Further, keeping in mind the other potential benefits (both quantifiable and unquantifiable), the project is considered beneficial for implementation.

It may be seen from Chapter 3 Management and Maintenance of the Fishery Harbour that surplus will occur from year 1 onwards on an annual basis on combined operations of fish auction hall and port management. The cumulative surplus at the end of 14th year of the project will amount to Rs. 16,741.06 lakhs provided the entire landings pass through the fish auction hall and the realization of the commission charges by the Fish Auction Hall Authority. Even one third of the above revenue goes down also Fishery Harbour Cost can be recovered within 14 years of period.

Chapter 1

BACKGROUND

1.1 General

India has a long coastline of over 8,118 km covering both East coast and West Coast including Andaman & Nicobar and Lakshadweep Islands with an Exclusive Economic Zone of 2.02 million sq. km and 53,000 sq.km of continental shelf. Among the top ten fish producing countries, India is the second largest producer of fish in the world. China is by far the top producer of fish with 55.3 million tonnes in 2012 up more than 1% from 2011. Apart from the primary production sector, fisheries and aquaculture provide numerous jobs in ancillary activities such as fish processing, packaging, marketing and distribution, manufacturing of fish processing equipment, net and gear making, ice production and supply, boat construction and maintenance, research and administration. All of this employment, together with dependants, is estimated to support the livelihoods of 14.49 million people. The annual per capita consumption of fishery products has grown steadily in developing countries from 5.2 kg in 1961 to 17.0 kg in 2009. A sizeable share of fish consumed in developed countries consists of imports, and owing to steady demand and declining domestic fishery production (down 10% in the period 2000–2010), their dependence on imports, in particular from developing countries like India, is projected to grow in coming years.

1.2 Fisheries Development in India

Fishing is one of the oldest means of livelihood of mankind and fisheries sector play an important role in the national economy and in the socio-economic development in India. It provides employment opportunities to large sections of the population, supplies rich protein diet at affordable costs and earns foreign exchange. The fisheries sector contributes US\$ 4.4 billion to the national income. The present fish production in the country as of 2012-13 is 9.04 million tonnes whereas the estimated fish potential is about 9.4 million tonnes. Fisheries sector contributed Rs.78053 crores to the GDP (at current prices) during 2012-13, which is 0.83% of the total GDP at factor cost and 4.75% of the GDP at factor cost from agriculture, forestry and fishing. The share of fisheries sector in the total GDP at factor cost in current prices has doubled from 0.40% in 1950-51 to 0.83% in 2012-13. The fisheries sector has also been one of the major contributors of foreign exchange earnings. During 2013-14, export of marine products reached 983 756 tonnes valued at Rs.30 213.26crores (over US\$5007.7million).

Importance of the fisheries sector to the Indian economy is widely acknowledged. Its significance lies in three major areas: First of all, it is a source of animal protein for human consumption. It is expected that by the year 2020, the fish eating population in the country would be around 650 million. Secondly, it is a source of employment. About 2.1 million fisher populace in India draw their livelihood from fisheries who belong to poor backward community of the society. Thirdly, it is a source of foreign exchange. Fisheries play an important role in the national economy, providing full-time or part-time employment to over 14.49 million people who are engaged fully, partially or in subsidiary activities pertaining to the sector. Objectives for future fisheries development include enhancing fish production, generating employment, improving socio-economic conditions of fishers, increasing marine products for export, and increasing per capita availability of fish to about 11 kg/annum. There would be a marginal improvement

in the nutritional status as a result of increased fish consumption. These objectives are intended to be achieved through an integrated approach to marine and inland fisheries and aquaculture, taking into account the need for responsible and sustainable fisheries. Conservation of aquatic resources and genetic biodiversity is another thrust area for the next millennium.

1.2.1 Fishery Resources

India has vast potential for fisheries from both inland and marine resources. Marine and inland fisheries resources of India are shown in **Table 1-1** below.

Table 1-1
Fisheries Resources of India – at a glance

Marine Resources & Fishery Statistics	
Coastline (km)	8 118
Exclusive Economic Zone (million km ²)	
West coast	0.86
East coast	0.56
A & N Islands	0.60
Total	2.02
Continental shelf ('000 km ²)	530
Fish production in tonne during 2013-14	
Marine	692488
Inland	91231
Total	783719
Fish export in 2013-14	
Quantity (tonnes)	983756
Value (Rs. in crore)	30213.26
Fishing Craft - as per Marine Fishery Census 2010	
MFVs	72,749
Motorised	73,410
Non-Motorised	52,982
Total	1,99,141
Contribution of fisheries to GDP at current prices (2012-13)	
GDP from fisheries (Rs. in crore)	Rs.78,053
GDP from agriculture	4.75%
In Total GDP	0.83%
Fisher families (Nos.)	1,03,072
Fisher folk population (Nos.)	5,58,691
Inland Resources	
Rivers & canals (km)	1,95,095
Reservoirs (lakh ha.)	29.26367
Tanks and ponds (lakh ha)	24.3276
Floodplain/derelict water bodies (lakh ha)	7.983
Brackish water (lakh ha)	11.55
Saline/alkaline affected area (lakh ha)	12.40

1.2.2 Marine Fisheries and Fish Production

Marine fishery is a renewable resource and is considered to be a pro-poor subsector. Marine fish production has been still found as a capture fishery resource registering the highest production (40%) from the northwest coast and the lowest (6%) from the northeast coast, with highest landings being through mechanized craft (64%). The traditional (artisanal) fishery, on which most people depend accounted for 37% in 1982, is currently contributing only 8%.

According to the Handbook on Fisheries Statistics, 2014 brought out by Department of Animal Husbandry, Dairying & Fisheries (DAHD&F), Ministry of Agriculture, Govt. of India which included data of National Marine Fisheries Census 2010, the Indian fishing craft consists of a total of 199 141 fishing crafts, comprising of 72 749 mechanized vessels and 73 710 motorized and the remaining 52982 traditional non-mechanized craft. As was reported in 2010, traditional crafts and motorized crafts are concentrated more in the east coast whereas the mechanized vessels are more along the west coast. The total number of fishing craft also is more on the east coast (**Table 1-2**).

Table 1-2
Fishing Craft in India

Sl. No	Maritime State/UT	Mechanized fishing vessels	Motorized Craft	Traditional non-mechanized craft	Total
1.	Gujarat	18 278	8 238	1 884	28 400
2.	Maharashtra	13 016	1 563	2 783	17 362
3.	Goa	1 142	1 297	227	2 666
4.	Daman & Diu	1 000	359	321	1 680
5.	Karnataka	3 643	7 518	2 862	14 023
6.	Kerala	4 722	11 175	5 884	21 781
7.	Lakshadweep Islands	129	606	727	1462
8.	Tamil Nadu	10 692	24 942	10 436	46 070
9.	Puducherry	369	1 562	662	2 593
10.	Andhra Pradesh	3 167	10 737	17 837	31 741
11.	Odisha	2 248	3 922	4 656	10 826
12.	West Bengal	14 282	-	3 066	17 348
13.	A & N Islands	61	1 591	1 637	3 189
Total		72749	73 410	52 982	199 141

After declaration of the Exclusive Economic Zone (EEZ) in 1977, the oceanic resources available to India are estimated at 2.02 million km², comprising 0.86 million km² (42.6 % of the total) on the west coast, 0.56 million km² (27.7%) on the east coast and 0.60 million km² (29.7%) around the Andaman and Nicobar Islands. The continental shelf area amounts to 530 000 km² of which 71% area is available in the Arabian Sea (west coast) and the remaining 29% in the Bay of Bengal (east coast). The country has a long coastline of 8 118 km and an equally large area under estuaries, backwaters, lagoons etc., which is highly amenable for developing capture as well as culture fisheries. As per the National Marine Fisheries Census, 2010, the marine fisheries activities are spread in approximately 1537 landing centres and 3 432 fishing villages located along the Indian coast.

The estimated marine resource potential of the Indian EEZ is 4.42 million tonnes at the present exploitation rates. In marine fisheries, while inshore waters have been almost exploited to the sustainable levels, contributions from the deep sea have been insignificant. The trend based surveys have indicated that in the depth range up to 100 m, which contributes to about 86% of the total exploited resources; practically there is little possibility of witnessing quantitative increase in fish production. However, the depth ranges beyond 100 m have avenues of expansion, albeit more in qualitative terms. In this domain, the possibility revolves around oceanic resources like tuna, bill fishes and allied species whose combined potential is pegged at 0.22 million tonnes with the lucrative yellow fin tuna contributing to the tune of 40% to it.

Among the maritime States, Gujarat (693560 tonne, 20.88%) has emerged as the leading producer of marine fish in the country during 2012-13, followed by Kerala (530 640 tonne, 15.98%), Maharashtra (448910 tonne, 13.52%) and Tamil Nadu (428440 tonne, **12.90%**). These four States together provide nearly 63% of the marine fish production of the country. Nearly 77% of the fish catch is marketed fresh. The fish drying and curing industry in India is on the decline, with only about 5% fish being used for curing. Frozen fish accounts for 9%, 4% goes for reduction to fish meal, 1% for offal reduction and 4% for miscellaneous purposes. Total fish production in the country has increased from 24.42 lakh tonne during 1980-81 to 90.40 lakh tonne during 2012-13. The figures of inland and marine fish production for the past 32 years from 1980-81 to 2012-13 are given in **Table 1-3** below:

Table 1-3
Fish production in India

Year	Inland (in lakh tonne)	Marine (in lakh tonne)	Total (in lakh tonne)
1980-81	8.87	15.55	24.42
1981-82	9.99	14.45	24.44
1982-83	9.40	14.27	23.67
1983-84	9.87	15.19	25.06
1984-85	11.03	16.98	28.01
1985-86	11.60	17.16	28.76
1986-87	12.29	17.13	29.42
1987-88	13.01	16.58	29.59
1988-89	13.35	18.17	31.52
1989-90	14.02	22.75	36.77
1990-91	15.36	23.00	38.36
1991-92	17.10	24.47	41.57
1992-93	17.89	25.76	43.65
1993-94	19.95	26.49	46.44
1994-95	20.97	26.92	47.89
1995-96	21.25	28.25	49.50
1996-97	29.67	23.81	53.48
1997-98	29.50	24.38	53.88
1998-99	26.96	25.66	52.62
1999-00	28.34	28.23	56.57
2000-01	28.40	28.10	56.50

2001-02	31.20	28.30	59.50
2002-03	32.10	29.90	62.00
2003-04	34.50	29.40	63.90
2004-05	35.26	27.79	63.05
2005-06	37.56	28.16	65.72
2006-07	38.45	30.24	68.69
2007-08	42.07	29.20	71.27
2008-09	46.38	29.78	76.16
2009-10	48.94	31.04	79.98
2010-11	49.81	32.50	82.31
2011-12	52.94	33.72	86.66
2012-13	57.19	33.21	90.40

It may be seen from the above **Table 1-3** that although there has been a substantial increase in the fish production, the marine fish landings in the country in the last five years are more or less stagnant around 3.3 million tonne. This has been mainly attributed to overexploitation of nearshore marine fishery resources. Under the circumstances, preserving the quality of fish landed through modern fish landing facilities and enhancing value-addition of fish and fishery products for both domestic consumption and export market seems to be a better proposition to compensate the revenue losses due to declining marine fish landings. Fisheries not only provide an important alternative source of protein rich food, but also contribute to socio-economic development by generating employment as well as stimulating subsidiary industries. It has stimulated growth of a number of other ancillary and allied fish industries. The strength of the fisheries consists of vast stretches of coastline and EEZ, underutilised areas of freshwater tanks/ponds, lakes and derelict water bodies, reservoirs, rivers, saline and brackish water resources.

According to the study conducted by the National Sample Survey Organisation of India (NSSO) during the period 1983 to 2000, the annual per capita fish consumption in the country was 2.45 kg in 1983 which increased to 3.45 kg in 1999-2000. The fish consumption pattern studied from the sample survey was for the total fish-eating population of the coastal and inland States which included rural, urban and different income groups. It was found that 35% of the total population in India was fish-eater and their annual per capita fish consumption was 9.8 kg in 1999-2000.

Out of the fish-eating population, 46% were in coastal States and 27% in inland States. The fish consumption was found to be higher in southern, eastern and north-eastern States compared to western and northern States, the lowest being in the western States. The fish consumption among rural and urban mass depicted increasing trend in fish consumption and it was found to increase from 6.97 kg/capita/year to 9.12 kg in rural areas and from 8.01 kg/capita/year to 11.05 kg in urban areas during the period 1983-2000. However, it is to be expected that wide regional variations do exist in fish consumption across regions, States and income groups. In view of the established trend for fish consumption, the above study established that the demand for fish is likely to grow at the rate of 1.6 to 2.4% per annum.

Maritime States along the west and east coasts of India are implementing closed season of 45 to 75 days for mechanized fishing vessels as a corollary to

their Marine Fishing Regulation Acts. Earlier there was no uniformity of ban period, but after the intervention of the Ministry of Agriculture, Govt. of India, the ban has been made uniform for 47 days all along the west coast (June 15 – July 31) and east coast (April 15 – May 31) States and Union Territories.

India's marine fisheries production has reached a plateau and, at best, only marginal increase is predicted in the near future. Most major stocks are fully exploited and further increase has to come from exploitation of deep-sea resources. Fishing efforts are largely confined to the inshore waters through artisanal, traditional, mechanized sectors. About 90% of the present production from the marine sector is from within a depth range of up to 50 to 70 m and remaining 10% from depths extending up to 200 m. While 93% of the production is contributed by artisanal, mechanized and motorized sector, the remaining 7% is contributed by deep sea fishing fleets confining their operation mainly to the shrimp grounds in the upper East Coast.

Depth-wise marine fish production potential shows that about 87% of the resources are available in the 100 m depth zone and only 8% beyond i.e. 100-200 m depth and 200-500 m depth zone. The resources in oceanic area have been estimated as 5% of the total potential. The oceanic resources largely comprise yellow fin tuna (80 000 tonnes), skipjack tuna (99 000 tonnes), bigeye tuna (500 tonnes), billfishes (5 900 tonnes), pelagic sharks (20 800 tonnes) and other species (3 800 tonnes).

1.2.3 Fish Export and Trend

The fishery sector is a major foreign exchange earner in the Indian economy. The export touched 9,83,756 tonnes valued Rs.30,213.27 crores during 2013-14. During the previous year, it was 9,28,214 tonnes valued at Rs.18,856.26 crores. Since 2009-10, the marine product exports have crossed US \$ 2 billion for the third consecutive time and during 2013-14, export earnings for the first time in 2013-14 touched US \$ 5.0 billion mark registering an increase of 6% in terms of volume and 60% by value compared to the previous year.

Presently, the global fish trade is estimated over US \$ 138 billion. The share of marine products in total export earnings from India is over 3% of which the share of frozen shrimp in the export earnings is very high and contributes about 64% of the total export earnings. While export of fish and shrimp in various forms, constitutes more than 80% of Indian sea food exports, shrimp alone accounts for 64% of the value of exports. However, the major share of the present export in volumetric terms is in bulk form while a small share of the exports comprise of value-added products. The export mainly consisted of frozen Shrimp (64%) followed by low valued fresh/frozen fin fish varieties (14.2%), frozen Cephalopods (10.3%) and dried seafood items (3.3%). Southeast Asia including China was the top most importer of Indian seafood shared close to 46.34% of export in terms of volume and 32.48% by value followed by USA (11.27% by volume & 25.63% by value), EU (17.76% by volume & 20.29% by value), Japan (7.27% by volume & 8.15% by value) and Middle East (5.90% by volume & 5.29% by value). There is also growing export of canned and processed fish from India.

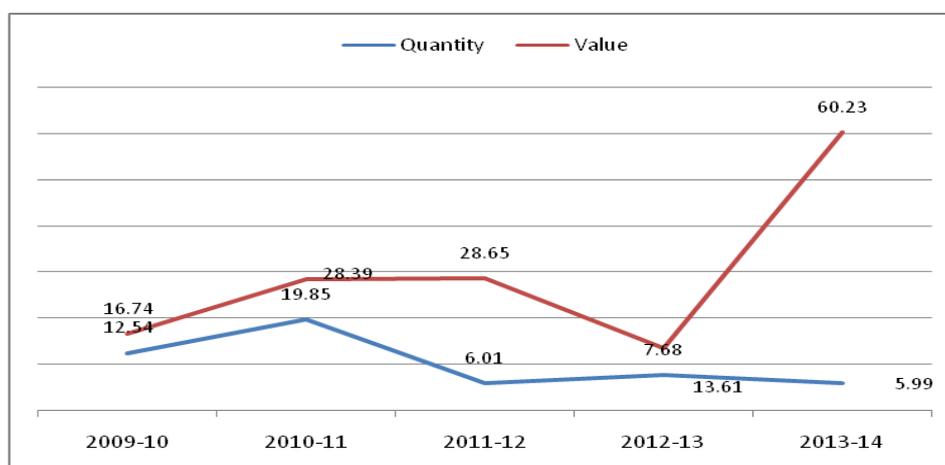
The major change noticed in the export trend, during the year 2013-14 is the emergence of South East Asia who continued to be the top most importer of

marine products in terms of volume and value followed by USA. The other individual markets, which increased their shares during 2013-14, are other countries like Canada, Mauritius, Australia, Switzerland, Maldives, New Zealand, Reunion, Panama, Venezuela, Taiwan, Bangladesh, Philippines, Turkey and Malta. The significant development in the expansion of export is the strengthening of India's presence in Southeast Asia and USA. These developments in the marine products export happened despite continuing recession in the international markets, debt crisis in European Union (EU) economies, continuing antidumping duty in US and the sluggish growth in US economy and political instability in the Arab world. The increased production and productivity of shrimps, *Litopenaeus vannamei* (white leg shrimp) and *Penaeus monodon* (black tiger shrimp) and better price realization of major items like cuttlefish, shrimp and squid helped realizing a higher export turnover. **Table 1-4** Marine Product exports from 2004-05 to 2013-14 and **Table 1-5** furnishes Item-wise export during the years 2012-13 and 2013-14.

Table 1-4
Fish Export from India (2004-05 to 2013-14)

Year	Quantity (tonnes)	Value (Rs. in crores)	Average Annual growth rate (%)	
			Quantity	Value
2004-05	461 329	6 646.55	11.97	9.10
2005-06	512 163	7 245.73	11.01	9.01
2006-07	612 643	8 363.52	19.62	15.43
2007-08	541 701	7 620.93	-11.58	-8.88
2008-09	602 834	8 607.95	11.29	12.95
2009-10	678 436	10 048.53	12.54	16.74
2010-11	813 091	12 901.46	19.85	28.39
2011-12	862 021	16 597.24	6.01	28.65
2012-13	928 214	18 856.26	7.68	13.61
2013-14	983 756	30 213.27	5.99	60.23

Source: Marine Products Export Development Authority (MPEDA), Kochi



Growth Percentage of Marine Product Export for the Past Five Years from 2009-10 to 2013-14

Table 1-5
Item-wise export of marine products

Item	2012 – 13		2013 - 14	
	Quantity (tonne)	Value (Rs.in crore)	Quantity (tonne)	Value (Rs. in crore)
Frozen Shrimp	2,28,620	9706.36	3,01,435	19368.00
Frozen Cuttlefish	63,296	1354.28	68,577	1387.98
Frozen squid	75,387	1378.06	87,437	1731.97
Frozen/Fresh Fish	3,43,876	3296.86	3,24,359	4294.81
Dried Fish	72,953	819.90	67,901	998.00
Live items	4,373	197.89	5,080	281.85
Chilled items	26,868	537.11	19,755	527.84
Others	1,12,841	1565.78	1,09,212	1623.50
Total	9,28,214	18856.26	9,83,756	30213.00

During the year 2013-14, Frozen Shrimp continued to be the largest item in India's seafood basket contributing 64.10% in value followed by Fresh/Frozen fish, Frozen Squid, Frozen Cuttlefish and others.

Out of India's total exports during 2013-14, South East Asia including China stood first in quantity, followed by EU, USA, Japan, Middle East and others. South East Asia continues to be the largest market for Indian marine products in terms of value relegating, US to the second, EU to third and Japan to the fourth position. Country-wise exports in 2012-13 compared with 2013-14 are given in **Table 1-6** below.

Table 1-6
Country-wise export of marine products

Country	2012-13		2013-14	
	Quantity (tonne)	Value (Rs. in crore)	Quantity (tonne)	Value (Rs. in crore)
Japan	76,648	2463.83	71,484	2463.83
USA	92,447	4026.48	1,10,880	7744.67
European Union	1,58,357	4176.42	1,74,686	6129.69
South East Asia including China	4,28,720	5802.14	4,55,844	9813.31
Middle East	41,419	1113.34	58,040	1599.37
Others	1,30,623	1738.29	1,12,822	2462.40
Total	9,28,214	18856.26	9,83,756	30213.27

1.3 Gujarat State

1.3.1 General

Gujarat is a state in western India and it borders Pakistan to the north west and the state of Rajasthan to the north and northeast, Madhya Pradesh to the east,

Maharashtra and the Union territories of Diu, Daman, Dadra and Nagar Haveli to the south. The international border with Pakistan is to the north-west. The Arabian Sea makes up the state's western coast. Its capital, Gandhinagar is a planned city and is located near Ahmadabad, the commercial center of Gujarat. Gujarat's coastal cities, chiefly Bharuch, served as ports and trading centres for the Maurya and Gupta empires.

1.3.2 Geography

The winters are mild, pleasant, and dry with average daytime temperatures around 83° F (29 °C) and nights around 53° F (12 °C) with 100 percent sunny days and clear nights. The summers are extremely hot and dry with daytime temperatures around 105° F (41 °C) and at night no lower than 85° F (29 °C). The time just before the monsoon the temperatures are similar to above but with high humidity which makes the air feel hotter. Relief comes when the monsoon season starts around in mid June. The day temperatures are lower to around 95° F (35 °C) but humidity is very high and nights are around 80° F (27 °C). Most of the rainfall occurs in this season. Though mostly dry, it is desertic in the north-west, and wet in the southern districts due to heavy monsoon season.

1.3.3 Culture and Economy of Gujarat

Gujarat's official and primary language is Gujarati. About 89% of the population of Gujarat is Hindu while Muslims account for 9%, Jain 1% and others 1%. 71% of Hindus in Gujarat speak Gujarati while the other 29% speak Hindi. Almost 88% of the Muslims speak Gujarati while the rest speak Urdu. Almost all of the Jains speak Gujarati (a few speak Marwari as well). Parsi Zoroastrians also speak Gujarati as their native language. Besides Gujarati the Kutchi language is widely spoken in Kutch District.

Gujarat is the main producer of tobacco, cotton, ground nut and fish and provides inputs for important industries like textile, oil and soap. Other important cash crops are paddy, wheat and bajra. The industrial structure in the State has been gradually diversifying with the development of industries like chemicals, petro-chemicals, fertiliser, engineering, electronics etc.

1.3.4 Fishery Sector

1.3.4.1 General Profile

Gujarat has a long coastline of 1600 km formed with several bays, inlets, estuaries and marshy lands. Brackish water areas are formed by the outfall of perennial rivers like Narmada, Tapti, Mahi, Ambika and Purna and several other seasonal rivers. The State has 40 minor and intermediate ports geographically dispersed across south Gujarat (13 ports), Saurashtra (23 ports) and in Kachchh region (4 ports). These are under the administrative control of the Gujarat Maritime Board of the State Port Department.

There is also a major commercial port of Kandla under the administrative control of the Ministry of Surface Transport of Govt. of India. Under the "Gujarat Port Policy", Gujarat State government is developing ten deep water berthing ports of international standard, of which six ports will be entirely private ports with private capital investment and four ports will be developed under joint venture

with major capital investment from private companies. The international airport of Ahmadabad is connected with Mumbai, Delhi and other cities by daily services. The State has nine other domestic airports at Vadodara, Bhavnagar, Bhuj, Surat, Jamnagar, Kandla, Keshod, Porbandar and Rajkot. The State has been divided into five geographical divisions i.e., Kutch-Saurashtra region, Ahmadabad, Northern region, Central region and southern region.

1.3.4.2 Fishery Resources of Gujarat

As compared to other States of India, Gujarat offers an excellent opportunity in the fisheries sector because of the vast natural fishery resources at its disposal. The inland water resources include 3,865 km of rivers and canals; 3.48 lakh ha of reservoirs; 0.22 lakh ha of ponds and tanks; 0.12 lakh ha of oxbow lakes and derelict waters; and 3.76 lakh ha brackish water area. The State has a longest coast line of 1600 km representing one fifth of the nation's water front with a continental shelf area of 1,64,000 sq.km and EEZ area of 2,14,060 sq.km. The area available for marine fishing activities extends from Lakhapat in Kachchh district in north to Umbergaon in Valsad district in south.

Important commercial inland and marine fish species viz., Catla, Rohu, Mrigal, Cat fish, Mulllets, Pomfret, Thread fin, Clupeids, Eel, Jew fish, Bombay duck, Shrimp, Lobster, Squid, Cuttle fish, Silver bar, Hilsa, Shark, Ribbon fish, Seer fish, Perches, Leather jacket, Indian salmon, Crabs, Croakers etc., are caught in large quantities in Gujarat inland and seawaters. Of these marine fish species, Lobster, Seer fish, Pomfrets, Perches, Shrimp, Prawn, Squid, Lobster, Ribbon fish, Bombay duck etc., are of exportable varieties. In addition, the Gulf of Kachchh has congenial conditions for growth and sustenance of different types of Oysters, Shellfish and Seaweeds. Gujarat and Maharashtra are the major contributors of Bombay duck and Ribbon fish production, together producing over 86% of the all India production. Bombay duck is available in plenty mainly in south Gujarat coast. They are caught in "dol net or bag net" which is essentially bag net of conical shape.

The full moon day of Shraavan month of Hindu calendar (Normally in the month of August) is celebrated with characteristic fervour in different parts of Gujarat and is known as Naarali Purnima which is the beginning of fishing season. Local fishermen appease the sea-god by offering coconut before sailing their decorated boats. Fishing period is almost for 10 months from Mid-August to Mid-May.

According to the Handbook on "Gujarat Fisheries Statistics (2011-12)" published by the Commissionerate of Fisheries, Gandhinagar, there are 1058 fish landing centres out of which 260 are in marine area, 716 in inland areas and 82 are in estuarine areas. The fisher population is 5.59 lakh comprising 3.28 lakh marine fisher population and 2.31 inland fisher population. There are 2.18 lakh actively engaged in fishing, fish processing, marketing of fish and repairing of boats/nets, fish seed collection etc. There are a total of 1,03,072 households accounting 57,013 households in marine sector and 46,059 in the inland sector. There has been a steady growth of fisher population in the State which has increased from 4.93 lakh in 2003 to 5.59 lakh in 2007 livestock census.

Towards the end of March 2012, there were 24,566 fishing boats in the State, of which 23,110 were mechanised boats comprising 7470 trawlers, 1834 Gill Netters and 2401 Dole Netters besides 11,405 FRP boats. There were 1,456

non mechanised boats. Growth of fishing boats for the past five years can be seen from **Table 1-7**.

Table 1-7
Coastal District-wise No. of Fishing Vessels in Gujarat
during the year 2011-12

Coastal Districts	Coastline (km)	Trawlers	Gill Nette rs	FRP IBM	FRP OBM	Dol net & Other s	Total Mecha nised	Total Non-Mecha nised
Kutch	406	12	231	931	2	198	1374	163
Rajkot	26	0	0	83	0	0	83	57
Jamnagar Dev Bhoomi Dwarka	342	216	402	852	1347	5	2822	385
Porbandar	105	2324	115	16	2344	0	4799	133
Junagadh Gir Somnath	156	4119	169	337	4667	598	9890	257
Amreli	62	0	30	21	0	573	624	0
Bhavnagar	152	0	0	206	0	0	206	0
Anand	51	0	0	0	0	0	0	0
Bharuch	127	0	0	28	0	0	28	0
Surat	83	0	10	57	12	0	79	1
Navsari	27	250	0	123	0	313	686	297
Valsad	63	549	877	325	0	768	2519	163
Total	1600	7470	1834	2979	8372	2455	23110	1456

As of end March 2012, there were 532 ice plants of total daily capacity of 9,505 tonne, 278 cold storages of 21,500 tonne, 94 fish processing plants of a total daily capacity of 3247 tonne with a total frozen storage capacity of 40,388 tonne. Majority of these plants are located in Junagadh district followed by Porbandar district. The natural fisheries resource potential of the State enriches its economy by generating employment for the rural mass. The opportunity for creation of number of jobs in fisheries sector is second only to agriculture sector which includes transportation and marketing of fish and fishery products, fish pre-processing and processing industry, cold storage chain, boat building and repair, net making/mending, workshop and related activities. Gujarat is one of the States where traditional fishing community have greatly benefited by fishery cooperatives.

1.3.4.3 Fish Production in Gujarat

Gujarat is the second largest fish producing States in the country only next to West Bengal. Among all the maritime States, Gujarat accounts for a significant share insofar as marine fish production in the country is concerned and stands as the largest marine fish producer. During the year 2011-12, the total fish production (marine and inland) in the State touched 7.84 lakh tonne worth Rs.4604.80 lakhs. The marine fish production constituted around 88% of the total fish production of the State (see **Table 1-8**).

Table 1-8
Fish production in Gujarat

Year	Fish production (in tonne)			Value (Rs. in crore)
	Marine	Inland	Total	
2002-03	743638	34267	777905	1889.36
2003-04	609136	45436	654572	1688.15
2004-05	584951	50628	635579	1701.09
2005-06	663884	69936	733829	2435.46
2006-07	676762	76821	753583	2705.34
2007-08	680848	78780	759628	2844.02
2008-09	683855	82047	765902	3063.24
2009-10	687445	84071	771516	3493.74
2010-11	688930	85972	774902	4151.05
2011-12	692488	91231	783719	4604.80

Source: Office of the Commissioner of Fisheries, Gandhinagar

The fishery statistics available for the year 2003-04 suggest that nearly 68% of the fish is consumed within the State and the remaining 32% is marketed outside State which also includes foreign export. Utilisation of fish produced in the State is meant for fresh fish consumption including dried fish, fish meal, fish manure and fish fins and maws.

The marine fish production of Gujarat has reached a substantial level from 7.4 lakh tonne in 2002-03 to as high as 6.9 lakh tonne in 2011-12. As per the district-wise fish production figures available for the year 2011-12, out of coastal districts, Junagadh is the major fish producing district accounting for 41% of the total fish production in the State, followed by Porbandar, Valsad, Kutch, Jamnagar and Amreli districts may be seen in Table 1-9.

Table 1-9
District-wise marine fish production in Gujarat (2011-12)

Sl. No.	District	Quantity in tonne	%
1	Valsad	87,594	12.65
2	Navsari	20,159	2.91
3	Surat	3,208	0.46
4	Bharuch	6,405	0.92
5	Anand	456	0.07
6	Rajkot	955	0.14
7	Kachchh	72,897	10.53
8	Jamnagar	67,146	9.70
9	Junagadh	2,80,897	40.56
10	Porbandar	89,555	12.93
11	Amreli	60,576	8.75
12	Bhavnagar	2640	0.38
Total		6,92,488	100.00

1.3.4.4 Marine Fish Exports from Gujarat

The marine fishery sector in Gujarat has achieved significant progress from the year 1996-97 onwards due to the increase in the mechanisation of traditional fishing craft, trawlers and use of improved fishing gear. This has significantly led to an increase in the exportable varieties of marine fish such as Shrimp, Ribbon fish, Cat fish etc. Gujarat has a share of 15.27% value and 22.84% quantity in India's export of fish and fishery products during the year 2011-12. The total export of marine products from the State was 1,96,850 tonne worth Rs.2534 crore during 2011-12. Contribution of Gujarat in export of marine fish and fish products vis-à-vis total exports from the country is given in **Table 1-10**.

Table 1-10
Export of marine products from Gujarat

Year	Quantity (tonne)	Value (Rs. in crore)	% share of Indian exports (in quantity)	% share of Indian exports (in value)
2002-03	1,34,047	760.36	28.69	11.05
2003-04	1,08,386	614.41	26.31	10.09
2004-05	1,19,951	704.59	26.00	10.60
2005-06	1,36,485	934.88	26.65	12.90
2006-07	1,88,166	1,264.61	30.71	15.12
2007-08	1,50,727	1,141.97	27.82	14.98
2008-09	1,64,725	1,485.72	27.33	17.26
2009-10	1,83,870	1,838.75	27.10	18.30
2010-11	1,98,297	2,156.20	24.57	16.81
2011-12	1,96,850	2,533.99	22.84	15.27

The quantum and value of fish and fish products exported from the commercial ports in Gujarat State in the last 5 years is given in **Table 1-11**.

Table 1-11
Port-wise export of fish and fish products
Quantity – Qty. (tonnes) and Value (Rs. in crore)

Year	Pipavav		Mundra		Others Including Kandla & Ahmadabad		Total Gujarat	
	Qty.	Value	Qty.	Value	Qty.	Value	Qty.	Value
2007-08	149734	1075	830	11	163	56	150727	1142
2008-09	163866	1408	661	11	198	67	164725	1486
2009-10	182053	1674	671	11	1146	154	183870	1839
2010-11	197478	2026	263	4	556	126	198297	2156
2011-12	186377	2309	401	9	10072	216	196850	2534

Item-wise export of fish and fish products from Gujarat State for the year 2011-12 is given in **Table 1-12**.

Table 1-12
Item-wise export of fish and fish products from Gujarat
 (Quantity in Tonne and Value Rupees in Crore)

Item	2011 – 12	
	Quantity	Value
Frozen Shrimp	4,538	132.75
Frozen Cuttlefish	16,416	365.29
Frozen squid	18,675	251.56
Frozen/Fresh fish	1,35,409	1,465.70
Dried items	2,948	93.83
Chilled items	221	5.44
Others	18,643	219.42
Total	1,96,850	2,533.99

1.4 Fishery Profile at Junagadh-Gir Somnath District Level

The Junagadh undivided district in which Navabandar, Madhwad and Mangrol fishery harbours are located on the Kathiawar peninsula in western Gujarat. It is surrounded by Rajkot District (North), Porbandar District (North-West), Amreli District (East). To the South and West is the Arabian Sea. Porbandar, Gandhi's birthplace, was earlier a part of this district, before the Porbandar district was carved out of Junagadh district. Junagadh has a mountain range called Girnar which is a place of pilgrimage for Jainism and Hinduism. There are 14 taluks are in Junagadh and Gir Somnath districts and they are Junagadh, Talala, Maliya Hatina, Keshod, Mendarda, Veraval, Una, Kodinar, Visavadar, Manavadar, Mangrol Bhesan, Sutrapada and Vanthli.



Gir Somnath District was split from Junagadh district of Gujarat State in August 2013, Veraval, Talala, Sutrapada, Kodinar, Una and Gir-Gadhada are the talukas of Gir Somnath District. Gir Somnath District is located on the southern corner of the Kathiawar peninsula with its headquarters at the town of Veraval. Veraval has a population around 3.5 lakh. **Veraval** is a municipality and the headquarters of Gir Somnath district in the Indian state of Gujarat. It is 6 km from Somnath. The Gir Forest is a home of many wildlife creatures including lions, deer, and monkeys. Asiatic Lions can be only found in the Gir Forest. Gir Somnath District enshrines the Somnath Temple at Somnath, Prabhaspatan near Veraval. Somnath is the first out of the 12 Jyotirlingas. Gir Somnath contains the Gir Forest National Park, which is the only home to Asiatic lions. Junagadh city is situated right at the base of the temple-studded Girnar Hill, and is the departure point for visits to the Gir Forest. This interesting and unspoilt town has some exotic old buildings, most of them in a state of disrepair, and is a fascinating place

to explore. The background information covering the existing status of the marine fishery industry in Junagadh and Gir Somnath districts combinable is furnished in the following **Table 1-13**.

Table 1-13
General information on marine fishery industry
in undivided Junagadh district

Sl. No	Particulars	
1	Length of coastline (km)	156
2	Fishing villages and population (As per 18 th fishermen census 2007)	
	2.1 Number of fishing centres	32
	2.2 Fishermen Households	15,289
	2.3 Total fishermen population	92,028
	2.4 Male	46,665
	2.5 Female	45,363
	2.6 Marine fishermen households	14,704
	2.6 Marine fishermen population	88,274
	2.7 Marine active fishermen	39,955
3	Actual number of fishing vessels currently in operation for the year 2011-12	
	3.1 Mechanised fishing vessels (MFVs)	9,890
	3.2 Traditional craft	257
	Total	10,147
3 a	Break-up of MFVs: Trawler	4119
	Gill Netter	169
	FRP IBM	337
	FRP OBM	4667
	Dol Net & Others	598
	Total Mechanised plus Motorised Fishing Vessels	9890
4	Marine fish production in tonnes for the year 2011-12	280897
5	Shore-based facilities	
	5.1 Ice plants nos. & capacity in tonnes	109 & 3246
	5.2 Cold storage nos. & capacity in tonnes	92 & 5914
	5.3 Freezing plants nos. & capacity in tonnes	76 & 2423
	5.4 Frozen storage nos. & capacity in tonnes	76 & 28089

1.4.1 Marine Fish Production in Junagadh-Gir Somnath Districts

The species-wise marine fish production of undivided Junagadh district during the year 2011-12 is summarised in the **Table 1-14** below.

Table 1-14
Marine fish production of undivided Junagadh district
(Quantity in tonne)

Sl. No.	Species	2011-12	%
1	White Pomfret	1228	0.44
2	Black Pomfret	1000	0.36
3	Bombay Duck	13130	4.67
4	Thread fin	223	0.08
5	Jew fish	2153	0.77
6	Hilsa	545	0.19
7	Other Clupeids	3501	1.25
8	Coilia	674	0.24
9	Shark	5542	1.97
10	Mullet	200	0.07
11	Cat fish	12562	4.47
12	Eel	2298	0.82
13	Leather jacket	1790	0.64
14	Seer fish	3643	1.30
15	Ribbon fish	36908	13.14
16	Silver bar	3604	1.28
17	Perch	5966	2.12
18	Small Scianeids	123233	43.87
19	Shrimp	6708	2.39
20	Prawns	1118	0.40
21	Lobster	174	0.06
22	Crab	5112	1.82
23	Cuttlefish/Squid	15003	5.34
24	Tuna	3372	1.20
25	Carangids	6614	2.35
26	Ranifish	4658	1.66
27	Sole	4450	1.58
	Miscellaneous	15488	5.51
	Total	280897	100.00

It may be seen from the above that Small Scianeids, Pomfret, Bombay duck, cat fish, Ribbon fish, Cuttle/Squids and Rani fish constitute about two-third of the total fish landings while Small Sciaenid's alone shares about 44% of the total marine fish landings the district. Marine fish landings of Junagadh district constitute more than 40% during the year 2011-12.

1.4.2 Fishing Season in Junagadh District

The fishing season in Junagadh district commences around second week of August after Naarali Purnima for all type of fishing and closes around second week of May, just before the onset of south west monsoon. The peak months, however, vary for each type of fishing. For instance, August to November is

considered peak months for trawling while August to October is considered as peak season for gill netting. The FRP boats which are using gill nets get maximum fish catches during the period from August to October. Small scianoids, pomfret, bombay duck, catfish, ribbonfish, cuttlefish (squid) and rani fish form the main varieties of fish besides prawns & crab in the district.

1.4.3 Profile of Marine Fishing Centres in undivided Junagadh District

The fishery profile of main fishing centres of Junagadh district is furnished below in **Table 1-15** wherein there are three centres in Mangrol taluk. Una taluk has got more number of fishing centres and fishermen population as per 2007 live stock census.

Table 1-15
Taluk-wise fishing centres and fisher folk in Junagadh district

Sl. No.	Fishery centres	No. of Households	Total fishermen population	Active fishermen
Una Taluk				
1	Rajpara	820	4892	3100
2	Shimar	155	834	675
3	Dandi	157	945	995
4	Shejaliya	222	1202	1130
5	Khada	338	1728	1443
6	Karapan	266	1600	1562
7	Khatrivad	81	396	455
8	Manekpur	225	1352	1290
9	Nava Bandar	1546	10542	8107
10	Nadan	128	900	555
Sub total		3938	24391	19312
Veraval Taluk				
11	Veraval	4996	30178	8390
Sub total		4996	30178	8390
Sutrapada Taluk				
12	Sutrapada	703	4368	1822
13	Hirakot	230	1378	532
14	Vadodrabara	22	132	56
15	Dhamlej	576	3817	1295
Sub total		1531	9695	3705
Kodinar Taluk				
16	Madhvad	757	4065	1358
17	Kotda	404	2270	1017
18	Mul Dwarka	657	3972	1622
19	Chhara	124	765	281
Sub total		1942	11072	4278
Mariya Hatina Taluk				
20	Chorvad	430	2318	626
Sub total		430	2318	626
Mangrol Taluk				
21		1601	8514	3015
22		225	1794	537
23		41	312	92

Sub total	1867	10620	3644
Total	14704	88274	39955

1.4.4 Fishing Vessels and Fish Marketing

Towards the end of March 2012, there were 10,147 fishing boats in Junagadh district, of which 9,890 were mechanised boats and 257 were non-mechanised boats. Mechanised boats comprise of 4,119 nos. of trawlers, 169 nos. of gill netters, 337 nos. of FRP IBM, 4667 nos. of FRP OBM Dol Netters & Others 598 numbers. All the 257 traditional craft were FRP non-motorised boats.

Fish landings are generally sold by auction and prawn catches are procured by the processing companies through their agents who are stationed at the fishery harbour premises and fish landing centres. The commercially important species of fish being landed in Junagadh district are Catfish, Bombay duck, Ribbonfish, prawns, Cuttlefish (Squids) and Pomfret. Small Sciaenid's, Pomfret, Bombay duck, catfish, Ribbonfish, Cuttlefish (Squids) and Ranifish constitute about two-third of the total fish landings. While Small Sciaenid's alone shares more than 40% of the total marine fish landings of the district.

1.4.5 Ownership, Management and Finance

The fishermen of Junagadh district own these boats on individual and family basis. The Govt. of Gujarat provides financial assistance in the form of subsidy for that group of fishermen who go in for construction of new MFVs under NCDC scheme. The State Fisheries Department is also providing financial assistance for the construction of non-mechanised fishing boats.

1.4.6 Government Fisheries Administration

The entire responsibility of implementing the various policies and programmes for the development of fishery sector and welfare of fishermen community vests with the Commissioner of fisheries, Gandhinagar. He is assisted by a host of Senior Officers on technical and administrative matters. As far as the administration of fisheries at district level is concerned, the Regional Deputy Director of Fisheries, stationed at Veraval holds the responsibility. He is assisted by an Assistant Director of Fisheries, Superintendent of Fisheries and Assistant Superintendent of Fisheries.

1.5 Fishery Profile at Navabandar Fishery Centre level

Navabandar is one of the important Fishing Village of Una taluk in Junagadh district. Total population of village is around 15,000 as per 2011 census. There is two religious community live i.e. Hindu and Muslim. Village have connected with National Highway by Pakka Road. Navabandar is located 9 km from Una; it is well connected with the inland districts with road network. The main connectivity to NH 8E is through road via Una. However, nearest domestic airport is Diu and nearest International airport is Ahmadabad. It is located 125 km towards South from District head quarters Junagadh. About 374 from State capital Gandhinagar.

Navabandar Pin code is 362510 and postal head office is Delvada 2 km away. Nandan, Kalapan, Naliya Mandvi, Khan are the nearby Villages to

Navabandar. Navabandar is surrounded by Diu Taluk towards west, Jafrabad Taluk towards East, Kodinar Taluk towards west, Kambhat Taluk towards North. Una, Kodinar, Rajula, Savarkundla are nearby towns. Delwada Railway Station, Una Rail Way Station are the very nearby railway stations to Navabandar. However Rajkot Junction is major railway station 196 KM away. Diu airport is 18 km away. All the infrastructure facilities like electricity, water supply, port and telegraph, road communication, educational and banking facilities are available at Navabandar. The nearest railhead is Delwada 5 km and hospital facilities are available at Una 10 km away.

Drying of fish done very widely, which cover around 2.5 km area from village and it has well constructed concrete jetty. Mainly mechanized Dolnetters numbering more than 500 and small canoes numbering 100-150 operate from this village. An old passenger jetty constructed some 50 years is exists at the centre. The fishing vessels are landing their catches on either side of the structure. The fishing boats after landing their catches are not going inside the river for berthing. The boats get all their out fitting requirements at the old passenger jetty itself. Navabandar is located about 90 Km away from Veraval Port situated on the mouth of Machhundri River, on Arabian Sea. Most of the village population are connected with fishery activity.

As on today there is no trawlers operating at the site and it is reported that 200 numbers of 17 m trawlers belonging to villages in & around Navabandar operating at northern part of Gujarat is expected to come and operate once the proposed Navabandar fishery harbour is constructed. Therefore, in the design fleet size 200 numbers of 17 metre trawlers included along with 220 numbers of 10 Metre FRP boats and 580 numbers of 15 metre Dolnetters.

The Dole netters or Bag netters fix 3 to 4 nets each at different locations in the sea and with the help of GPS they reach their respective nets and collect their catches. These boasts make 8-9 days duration trips. The area of operation is upto 50 to 60 km and the depth of fixing the net would be around 120 to 130 feet.

For designing a new harbour following types and number of the boats are considered as per year 2020 scenario. At present no of trawler is zero. It is assumed that 200 number of trawler boat will operate from the new harbour. If the project is sanctioned in the end of 2016 then about 3 years would be for construction of the harbour i.e. '0' year. From year 1 i.e. 2020 all the 1000 fishing boats are expected to operate from Navabandar Fishery Harbour therefore, economic evaluation has been done for 1000 fishing vessels comprising 220 no. of 10 metre FRP, 580 no. of 15 metre Dolnetters and 200 no. of 18 metre trawlers. Brief characteristics of fishing boats are furnished below:

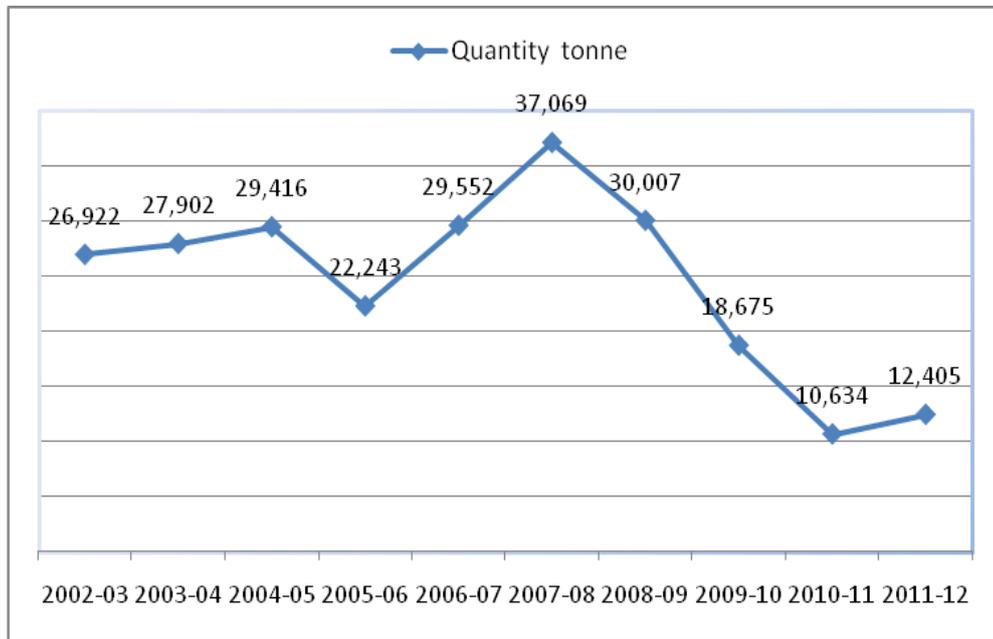
Table 1-16
Fishing Vessel, Duration of trips and Landings
in respect to the proposed Navabandar FH Project

1	Type & Size of the Vessel	FRP	DN/GN	Trawler
		10 Metre	15 Metre	18 Metre
2	Days per Trip	1	9	9
3	Total Number of Trips	200	24	24
4	Total fishing Days	200	216	216
5	Rest Days	70	54	54
6	Fishing Season Days	270	270	270
7	Landings per Trip (Qty. in kg)	120	2500	2500
8	Landings per Season (Qty. in ton)	24	60	60
9	Total Number of Vessels	220	580	200

During the year 2007- 08 was the highest fish productions at Navabandar fishery centre and it is about 37,000 tonnes while latest two years it is less than one-third and the main reason of this decline growth rate is mainly due to situation in existing fisheries harbour which is situated inside the creek. Once the fishery harbour constructed and commissioned the landings would go up as projected in the economic evaluation chapter.

Table 1-17
Marine Fish Production at Navabandar
For the past Ten Years from 2002-03 to 2011-12

Year	Quantity (in tonnes)
2002-03	26,922
2003-04	27,902
2004-05	29,416
2005-06	22,243
2006-07	29,552
2007-08	37,069
2008-09	30,007
2009-10	18,675
2010-11	10,634
2011-12	12,405



**Marine Fish Production at Navabandar
For the past Ten Years from 2002-03 to 2011-12**

Chapter 2

PROJECT DESCRIPTION

2.1 Introduction

This Chapter summarises the main features of the project proposal. The text should be read in conjunction with the Appendices attached to this part of the report. To facilitate presentation of essential features of the project, brief tables are incorporated in the text. These are used simply to highlight indispensable elements and to reduce, where appropriate, the need for lengthy textual explanations.

2.2 Time - Scale

The project described in this report is based on certain assumptions about "time". It may be seen that in some of the Appendices, the time- scale commences with year '0'. As it is unknown at this stage (September 2016) as to when the harbour construction works will be commenced and completed or advanced to a point, when it would be practicable for fishing vessels to use facilities, year '0' has been chosen to cover the indefinite period of time elapsing between project formulation and commissioning of the harbour. During the period year '0' it is assumed that the existing fishing operations will continue in the same manner, as described in the previous chapter. However some expansion and reorganisation may occur due to harbour construction.

By the time the Navabandar harbour development is complete, the existing fishing vessels will continue fishing operations. During year '0' those concerned with shore-based activities may construct facilities such as ice plants, cold storage etc. to meet the needs of the total fishing fleet. The project ' time-scale' therefore, covers two time divisions. Firstly, an indefinite period of time covered by the concept of year '0' and secondly a definite period of 14 years has been taken for evaluation. The project as cast in the report reaches maximum efficiency and the level of stabilisation in the first year itself. **Table 2-1** outlines the relationship between "time" and "project implementation"

Table 2-1

Project Activity	Time - Year
Project formulation, preparation of tenders, securing of official Sanctions, letting of tenders, etc.	"0"
Harbour under construction	"0"
Harbour commissioned, beginning of	1
Building of shore-based facilities if any, during later part of year	"0"
Project reaches maximum efficiency and period of stabilization	1
Period for economic evaluation	"0" to 14

2.3 Fleet Size

The harbour has been designed to accommodate 1000 mechanised fishing vessels comprising 220 numbers of 10 m FRP boats, 580 nos. of 15 m Dole net/Gill

net and 200 numbers of 18 m Trawlers. **Appendix 1** gives details of the fishing fleet. Most of the fishing vessels are already in operation and increase in existing fishing vessels and also if the project is sanctioned in the end of 2016 then about 3 years would be for construction of the harbour i.e. '0' year. From year 1 i.e. 2020 all the 1000 fishing boats are expected to operate from Navabandar Fishery Harbour therefore, economic evaluation has been done for 1000 fishing vessels comprising 220 no. of 10 metre FRP, 580 no. of 15 metre DN/GN and 200 no. of 18 metre trawlers. Fishing vessels, which may cease operation due to old age and major repairs, are expected to be replaced by new ones in the normal process by the vessel owners.

2.4 Fishing Operations

The 10 m FRP boat would undertake 200 trips of one day duration lands about 120 kg per trip, 15 m DN/GN and 18 m trawler each undertake 24 trips of nine days duration in a fishing season spread over nine months. 15 m lands about 3.0 tonnes each per trip while 18 m also lands about 3.0 tonnes per trip. The operational schedule for each type of fishing vessel is shown in section 2.0 of **Appendix 3**.

2.5 Catch Composition and Vessel Landings

Appendix 2, for each type of fishing vessel, contains information about the composition of landings on a seasonal basis. Obviously, landings will not be constant on a year-to-year basis. Hence, the data included in **Appendix 2** represent averages over the time span of project evaluation. The basis for the estimate is essentially the existing effort and some expectations in future after harbour construction.

Throughout the Appendices attached to the report, reference is made to various classes of fish and prawns for example, Prawns - Class 3, Fish - Class 4 etc. The Department of Fisheries has identified about 40 species of fish and prawns of commercial importance, which may be taken from the waters off Gir Somnath district. To include detailed accounts, from a catch composition point of view, of all such species, would involve unnecessary space in report presentation. Hence to facilitate evaluation procedure, a simple grading system (based on boat-side price) has been adopted. The resultant class / price relationship is shown in **Table 2-2**.

Table 2-2

Grade	Price Range (Rs./kg)	Average Price (Rs./kg)
Prawns		
Class 1	300-500	400
Class 2	200-300	250
Class 3	60-120	90
Fish		
Class 1	110-190	150
Class 2	90-110	100
Class 3	50-90	70
Class 4	20-40	30

As mentioned earlier, the catch composition and landings per season for each type of fishing vessel are shown in **Appendix 2**. The quantity and value (boat-side) of landings on an annual basis for each type of fishing vessel is briefly summarised in **Table 2-3**.

Table 2-3

Item	Fishing Vessels		
	10 m FRP	15 m DN / GN	18 m Trawler
Prawns			
Landings (Kg)	-	-	9,000
Value (Rs)	-	-	18,48,000
Fish			
Landings (Kg)	24,000	60,000	51,000
Value (Rs)	15,48,000	50,10,000	42,60,000
Total Fish and Prawns			
Landings (Kg)	24,000	60,000	60,000
Value (Rs.)	15,48,000	50,10,000	61,08,000

Total landings and value (boat side) per year for the period of staged development are summarised in **Table 2-4**. The landings and value given in the **Table 2-4** would more or less be same throughout the project evaluation period.

Table 2-4

Item	10 metre	15 metre	18 metre	Total
Prawns				
Quantity (tonne)	-	-	1,800	1,800
Value (Rs. in lakhs)	-	-	3,696	3,696
Fish				
Quantity (tonne)	5,280	34,800	10,200	50,280
Value (Rs. in lakhs)	3,406	29,058	8,520	40,984
Total				
Quantity (tonne)	5,280	34,800	12,000	52,080
Value (Rs in lakhs)	3,406	29,058	12,216	44,680

Table 2-5 shows the relative importance of each class of prawns and fish in relation to total landings of the fleet and total value of boat side sales. The percentages given cover the period for any year from years 1-14.

Table 2-5

Item	Fish landings	
	Quantity (%)	Value (%)
Prawns		
Class 1	0.69	3.22
Class 2	1.15	3.36
Class 3	1.61	1.69
Total	3.46	8.27
Fish		
Class 1	17.83	31.18
Class 2	23.99	27.96
Class 3	28.85	23.54
Class 4	25.88	9.05
Total	96.54	91.73
Total fish and prawns	100.00	100.00

2.6 Sea-going personnel

The crew size for each type of fishing vessel according to professional grades is indicated in **Table 2-6**. The total number of fishermen employed in the fishing vessels would work out to 7,700 sea going personnel.

Table 2-6

Grade	10 m FRP boat		15 m trawler		18 m trawler	
	Per vessel	Total fleet	Per vessel	Total fleet	Per vessel	Total fleet
Skipper 1st	1	220	1	580	1	200
Skipper 2nd	0	0	1	580	1	200
Deckhands	3	660	7	4060	6	1200
Total	4	880	9	5220	8	1600

The crew members of 10 m, 15 m and 18 m are paid their wages on share basis @ 60%, 40% and 30% of gross earnings respectively after deducting the costs of fuel, food allowance and ice. In addition to their share, the vessel owners spend about Rs.80,000, Rs.1,94,400 and 1,72,800 per season for 10 m, 15 m and 18 m fishing vessels respectively towards the cost of food for the crew members. The annual crew salaries for 10 m, 15 m and 18 m fishing vessels works out to R.5,05,800, Rs.11,37,120 and Rs.7,86,960 respectively.

2.7 Shore-based facilities

The cost estimate for the harbour complex (Rs.15,845 lakhs) contained in **Appendix 8** of this report includes *inter-alia* provision for fish auction hall, repair facilities, gear shed/net mending shed, rest shed, traffic and surface areas, water supply, electricity, sanitary arrangements etc. The total capacity for ice plant, chilled fish storage, fish curing/drying yards have been established on the basis of the total landings shown in **Appendix 1** and the assumptions about marketing of fish and prawn products listed in **Appendix 4**. The total capacity of ice plants required to meet the needs of the fishery industry at Navabandar fishery harbour has been estimated at 350 tonne/day and ice & chilled fish storage capacity of 700 tonne. The reconciliation of these estimates and assumption is contained in **Appendix 6**. **Table 2-7** shows the capacities of ice plants etc., required for the need of the fishing industry. In addition to existing ice plants in the district and the project area, it is recommended 20 tonne ice plant with 40 tonne chilled fish storage at an estimated cost of Rs.180 lakhs. Besides the above, trucks coming for taking fish would bring some quantity of ice from their towns/centres. Daily requirement of drying/curing for 50 tonne required with 170 tonne storage facility.

Table2-7

Type of plant	Capacity
Ice making	350 tonne per day
Ice & Fish Storage	700 tonne

2.8 Transport

The fishery harbour development project outlined in this report does not include any capital investment on trucks to move fish products to inland markets. To do so, would result in unused capacity during off-season or poor fishing season. It is assumed that road transport will be hired and it will be further supplemented by rail service. The hinterland of the project area has a fairly good network of all-weather roads and vehicular transport is possible throughout the year. The hiring of transport may perhaps present some difficulties during peak landing periods and the existing ice plants and chilled fish storage capacities would take care of the additional requirements.

The cost of transport is shown in **Appendices 7(a)** and **7(c)**. The amounts shown make no provision for income, which may be earned by a truck-owner for either forward or back loading, as the case may be. With respect to overseas shipment of frozen products, it is assumed that this will take place from Pipavav Port. In **Appendix 7(a)**, under the heading "Transport to Market or Shipment", an amount of Rs.1500 per tonne of product is charged. This estimate includes transport and lightage, if applicable.

2.9 Marketing

Appendices 4 and **5** give details of the basic assumptions covering the disposal of landings (raw material) and allocation of products to various markets.

In **Appendices 4 to 7 (c)** inclusive and **Appendix 10** market areas are shown as "Export", "Local" and "Inland". The export market is any place outside India. The local market area comprises towns and villages, within 30 km from the fishery harbour. The figure of 30 km is chosen, because it roughly represents the distance a bicycle/ moped vendor travels with his baskets, in order to catch an evening market. Inland markets are those places towards hinterland of the fishery harbour. For the purpose of transport costs, it is assumed that the average distance between the fishery harbour and the inland markets is around 300 km, though some consignments may be sent to much shorter distances than the figure indicated. The relative importance of each market area with respect to sales can be seen in **Table 2-8**.

Table 2-8

Market	Percentage raw material intake	Percentage product weight sold	Percentage total product sales
Export	4.27	3.10	10.81
Local	25.27	27.28	21.25
Inland	70.46	69.62	67.94
Total	100.00	100.00	100.00

Landings have been allocated into five types of products, namely, frozen prawns, fresh prawns, fish frozen, fish fresh and fish dried and/ or cured fish. The importance of each product type in relation to total vessel landings, total production of products and total product value is shown in **Table 2-9**.

Table 2-9

Product	Percentage of total raw material	Percentage of total product weight	Percentage of total product sales
Prawns			
Frozen	2.49	1.45	7.43
Fresh	0.97	1.12	1.00
Fish			
Frozen	1.78	1.65	3.39
Fresh	76.65	88.85	81.93
Dried/Cured	18.11	6.93	6.25
Total	100.00	100.00	100.00

Table 2-9 is the total picture for all landings that is for prawns plus fish. Fish landings may be analysed from the point-of-view of prawns and fish separately and the results are tabulated in **Table 2-10**.

Table 2-10

Product	Percentage of total raw material	Percentage of total product weight	Percentage of total product sales
Prawns			
Frozen	72.00	56.34	88.13
Fresh	28.00	43.66	11.87
Total	100.00	100.00	100.00
Fish			
Frozen	1.85	1.70	3.70
Fresh	79.39	91.19	89.48
Dried/Cured	18.76	7.11	6.82
Total	100.00	100.00	100.00

The price range and the weighted average price per kilogram for prawn and fish products are given in **Table 2-11**.

Table 2-11

Product	Price range (Rs/kg)	Weighted average price (Rs/kg) Retail or FOB
Prawns		
Frozen	268 – 714	544
Fresh	92 – 97	95
Fish		
Frozen	217	217
Fresh	31 – 158	98
Dried/Cured	93 – 96	95

2.10 Ownership and Management

2.10.1 Fishery Harbour

It is assumed that the Department of Fisheries (**DOF**), Government of Gujarat (**GOG**) will be responsible for:

- a) The control of fishing vessels using the harbour to ensure maximum benefit from the space available; and
 - b) Generally, the overall supervision and maintenance of facilities and amenities provided at the fishery harbour.
- The DOF, GOG, should make adequate arrangements for the proper management and utilisation of the facilities created. Except under emergency circumstances during natural calamities etc. the facilities should not be used for any purposes other than fishing and fishery related activities. Any use of the land reclaimed during construction, building etc., for purpose other than fisheries related activities should be undertaken only in a way which is not detrimental to the interest of the fishing community. Any income generated by way of lease rent, license fee should be deposited in the Bank Account maintained for depositing the user charges as mentioned in the Para three below.
 - The DOF, GOG, shall formulate a policy for management of the harbour and will have the authority to privatise the management, maintenance and operation of the facilities created under the Central Sector Scheme. For the management, the DOF, GOG, can give the function to an autonomous body/ private body or perform the function through a registered society which may manage the integrated Malpe fishery harbour by formulating suitable hire charges and fix lease rent for both the buildings and land.
 - The revenue generated out of the lease rent, user charges will be deposited in an account to be maintained in a scheduled nationalised bank situated in the area. The amount realised, will be used for day-to-day operation, management, maintenance, expansion, repair/ renovation and modernisation of the fishing harbour.
 - The DOF, GOG, will provide the additional funds if needed, over and above the user charges collected by the society and required for maintenance function. The Government of India will not bear any operational cost to be incurred for maintenance of the harbour. The society that will manage the harbour will include, at least one representative each from DOF, GOG, fishermen association, fishing vessel operators and Department of Ports. Other officers shall, be as decided by the DOF, GOG.
 - The DOF, GOG, will ensure the efficient operational conditions of the fishing harbour in accordance with the hygienic standards/ specifications in force from time to time. The Chairman or the Chief Engineer of the DOF, GOG, will review the maintenance, management and operation of the fishing harbour created under the scheme annually and submits the report to Government of India.

It is further assumed that within a short time after the harbour becomes effective, a Fisheries Terminal organisation (FTO) would be established under the Indian Companies Act, to ensure that the essential shore facilities and services are made available to both fishermen and processors in the port. The FTO would also operate the fish auction hall, introduce fish auctioning system and ensure that accurate statistical records of catches are maintained. In addition, FTO would also look after the maintenance and functioning of net mending shed/gear shed and rest shed provided for the fishermen within the fishery harbour complex.

The port office would serve as a headquarters for the Port Officer in charge of the port. It could also accommodate fishery personnel, who may be assigned to the project to supervise or watch over progress with respect to fishery resources, technology and economics.

The Commissioner of Fisheries, Government of Gujarat is responsible for implementing fishery welfare schemes, registration of MFVs, issue of diesel, ensuring smooth functioning of fishery harbour etc. Further, he may also be entrusted to operate the fish auction hall, introduce fish auctioning system by a separate set of staff as shown in **Table 2-17** and ensure that accurate statistical records of landings are maintained. In addition, he will also look after the maintenance and functioning of net mending shed/ gear shed and rest shed and other facilities provided for the fishermen within the harbour complex.

2.10.2 Fishing Vessels

All the 10 m, 15 m and 18 m fishing vessels are owned and operated by individual, family or cooperative basis. The range of investment for these vessels is shown in **Table 2-12**.

Table 2-12

(Amount in Rupees)

Item	10 m	15 m	18 m
Fishing vessel	3,70,000	30,00,000	40,00,000
Fishing gear	2,30,000	10,00,000	5,00,000
Total Investment	6,00,000	40,00,000	45,00,000

2.10.3 Fish auction hall, Net mending shed, Gear shed, Rest shed, Ice plant and Cold storage

As mentioned earlier, it is envisaged that an FTO will operate and manage the fish auction hall, net mending shed, gear sheds and rest sheds. As regards the other shore-establishments they could be well run by fishing boat owners' cooperative societies. As the range of industrial activities recommended in this report is not sophisticated and in fact, all are currently being, or have been, undertaken somewhere along the coastline, the suggestion is not unrealistic. The economies from the financial point-of-view of one management are obvious. Apart from monetary savings, single ownership gives a much better chance of ensuring that facilities and services are programmed on a coordinated basis to meet within season fluctuations in landings. In addition, with control over processing, distribution etc., boat owners would achieve better profits and so avoid exploitation by middlemen who often for very little effort or risk reap the major financial rewards.

2.10.4 Fish Curing and/or Drying

The implementation of the project as outlined in this report will mean that substantial quantities of fish will be available for curing and/or drying. From year 1 onwards the quantity of raw material available for curing/drying will be 9,433 tonne of fish, giving 3,113 tonne of product weight. The throughput during the peak month would be about 50 tonne of raw material per day. The curing and/or drying of fish offer an opportunity for a labour-intensive activity, in which the families of fishermen may well take part. It may be possible to organise marketing cooperative, taking into

account the cooperation and unity existing among the local fishermen. As the volume of raw material increases, it may be necessary to introduce a "factory" approach with mechanical drying and more advanced technology.

2.11 Investment

2.11.1 Fixed Assets

The scale and timing of investment (new funds) required to implement the fishery development project outlined in this Chapter, is indicated in **Appendix 8**. The investment of Rs.15,845.00 lakhs in fishery harbour occur mostly in Year "0" i.e., Rs.14,260.50 lakhs, but an amount of Rs.1,584.50 lakhs is shown in Year 1 to cover final bills, retention money etc. With regards to fishing vessels, the total investment is Rs.33,520.00 lakhs, which have already been incurred by the fishermen and the fishing vessels are in operation. Hence, no new investments are required for fishing vessels. However for evaluation purpose, the fishing vessels investment has been accounted for under year '0'.

10 m FRP boat	220 nos. x Rs.6.00 lakhs	= Rs. 1,320 lakhs
18m trawler	580 nos. x Rs.40.00 lakhs	= Rs.23,200 lakhs
18m trawler	200 nos. x Rs.45.00 lakhs	= Rs. 9,000 lakhs
	Total	= Rs.33,520 lakhs

Total investment (Rs.49,585 lakhs) is made up as follows:

Table 2-13

Item	Total investment (Rs. in Lakhs)	Percentage of Total investment
Fishing vessels		
10 m FRP Boat	1,320	2.66
15 m Trawler	23,200	46.79
18 m Trawler	9,000	18.15
Sub-total	33,520	67.60
Fishery harbour	15,845	31.96
Shore – Establishments	180	0.36
Pre Development expenditure	40	0.08
Total	49,585	100.00

The amount of investment required each year is shown in **Table 2-14**. As the MFVs are already in operation, no new investment is required. Hence, the additional investments required are for fishery harbour, shore establishments and pre-development expenditure.

Table 2-14

Year	Investment in fixed assets (Rs. in lakhs)	Percentage of Total investment
"0"	14,480.50	90.14
1	1,584.50	9.86
Total	16,065	100.00

2.11.2 Operating Capital

No additional capacities in respect of processing industries have been suggested. As the existing capacity available in and around the fishery harbour and the district and other towns is expected to absorb the prawn and fish landings for processing and export as is being done now. Hence, no operating capital for fishing vessels or cost of interest on operating capital for processing plants is considered for economic evaluation.

2.12 Government Revenue and Expenditure

In this report, no detailed analysis has been made to establish the amount of revenue, which will accrue to the government from levying of income tax, sales tax, excise duty etc. In section 2.10 of this Chapter, some observations have been made on "Ownership and Management" aspects. If the COF, GOG elects either in the short or long term to run the project as a public sector enterprise, then the project's profits will flow to COF, GOG revenue. On the other hand, if it is the COF, GOG's policy to encourage the fishermen and others to be responsible for project implementation, then the COF, GOG's opportunity for direct revenue from the project, apart from indirect revenue, which may flow from taxes etc., is limited to Port fees, rent charged for gear sheds, rent paid by the users of the fish auction hall and fees paid by those, who may lease land, in order to build ice plants and fish storage, etc.

If the COF, GOG decides to control the boat side sale of fish and prawns, then it will be entitled to all the commission chargeable on such sales. In this report, it is assumed that all landings of fish and prawns will be liable to commission, whether those are sold by auction or not. If all sales take place within the fish auction hall, there will be no difficulty in deducting commission. However, problems may arise, if some quantity of fish is sold by auction and the rest by private deals. Hence, if the COF, GOG chooses to run an orderly fish auction system, with a fair sharing of all monetary benefits, it must insist that all landings pass through the fish auction hall, or some other checking point, so that commission can be assessed and reasonable deductions made from payments due to boat owners.

On the basis of information contained in item 5.07 of **Appendix 3**, the total amount of commission payable on boat side sales by owners of fishing vessels will be of the order as shown in **Table 2- 15**.

Table 2- 15

Item	10 m	15 m	18 m	Total
Commission payable by each fishing vessel per year (Rs.)	46,440	1,50,300	1,83,240	
Number of fishing vessels	220	580	200	1000
Total amount payable by fishing fleet - Rs. Lakhs	102.17	871.74	366.48	1,340.39

As indicated in the opening paragraph of this Section of the report, the COF, GOG will be entitled to collect port dues from vessel owners. Section 5.0 of **Appendix 3** (Vessel operating costs) includes these charges and the amount for 10 m FRP Boat, 15 m DN/GN and 18 m trawler are respectively Rs.50,000, 84,000

and Rs.96,000 per annum respectively at the rate of Rs.250/trip, Rs.3500/trip and Rs.4000/trip. Total collections accruing to the COF, GOG from year 1 onwards are shown in **Table 2-16**. Collection of port dues from the fishing vessels would amount to Rs.789.20 lakhs from year 1 onwards.

Table 2-16

Item	Vessel class	No. of Vessels	Rate(Rs.)	Total (Rs. in Lakhs)
Port Dues	10 m	220	50,000	110.00
	15 m	580	100,000	487.20
	18 m	200	100,000	192.00
Total Collection		1000	-	789.20

The COF, GOG will certainly wish to manage the fishery harbour. If it also decides to run the fish auction hall, net mending shed and gear shed, either as a Departmental or Corporate activity, a separate establishment, staff, temporary labour etc., will have to be provided in addition to those people, whose task it would be to carry out the functions of harbour management outlined in paragraphs (a) and (b) of sub-section 2.10.1 of this Chapter.

The cost of harbour management and maintenance has been assessed at Rs.200.00 lakhs and Rs.316.90 lakhs respectively per year from year 1 onwards. The "Management" expenditure covers salaries of Port Officer, Port Engineer, Clerical assistance, Watchman, temporary labour, staff for gear shed, general overheads, excluding maintenance and depreciation. Harbour maintenance has been treated as a separate item, and it is assumed that most, if not all of this work will be done under contract. The rate of expenditure on maintenance is based on a percentage of the total cost of the harbour works, fish auction hall, net mending shed/gear shed, rest shed, etc. The rate is 2% of harbour cost i.e. Rs.316.90 lakhs per year from year 1 onwards.

The COF, GOG's control of fish auction hall, net mending shed/gear and rest shed will involve substantial expenditure with respect to salaries for a permanent staff, wages for temporary or seasonal labour, expendable equipment, general working expenses, etc. **Table 2-17** summarises the sort of expenditure, which might be incurred, if the COF, GOG accepts the responsibility of conducting a fish auction system. The estimates given relate to year 1 and onwards.

Table 2-17

Item	Number of persons	Cost from Year 1 onwards (Rs.)
Manager	1	6,00,000
Wharf Superintendent	2	9,60,000
Fish auction hall Superintendent (a)	2	9,60,000
Accountant	2	6,00,000
Fish auctioneer (b)	10	24,00,000
Fish auctioneer's Clerk	10	24,00,000

Item	Number of persons	Cost from Year 1 onwards (Rs.)
Cashier	10	24,00,000
Statistical Assistant	2	4,80,000
Clerk/Typist	2	4,80,000
Foreman(C)	2	4,80,000
Peon	2	3,60,000
Watchman	4	<u>7,20,000</u>
Sub-Total	49	128,40,000
Temporary Labour (d)		<u>25,80,000</u>
Sub-Total		154,20,000
Add: 10% for contingencies		<u>15,42,000</u>
Sub-Total		169,62,000
Provision for equipment(e)		10,00,000
General expenses (f)		<u>20,38,000</u>
Total expenditure		2,00,00,000

Note:

- (a) In-charge of delivery of fish from boat side to fish auction hall and clearance after sales.
- (b) Selling rate assumed to be 50 tonne per hour
- (c) In-charge of temporary labour gangs, which would be responsible for cartage of fish and cleaning fish auction hall after selling periods.
- (d) Cost of temporary labour assessed on a basis of Rs.50 per tonne of fish in and out of fish auction hall.
- (e) Nominal sum to cover fish auction hall equipment, boxes, etc., (this relates to the expenditure in Year 1)
- (f) To cover office expenditure, printing, water, electricity, etc.

Table Below gives a consolidated Statement of revenue and expenditure for combined operations of harbour management and the running of the fish auction hall, net mending shed, gear shed and rest shed. The statement also includes provisions for maintenance of all facilities and depreciation. The cost of depreciation is taken at two percent of total investment in the harbour and its associated facilities (2% of Rs.15,845 lakhs = Rs.316.90 lakhs).

Table 2-18

Item	Years 1-14
Fish auction hall	
Revenue from commission	1,340.39
Less expenditure on Salaries, Wages, overheads	200.00
Surplus	1,140.39
Port management	
Revenue from Port fees and rampway charges	789.20
Less expenditure on Salaries, wages, overheads	100.00
Maintenance	316.90
Surplus	372.30

Consolidated statement for fish auction hall and port management	
Surplus: Fish auction hall	1,140.39
Surplus: Port management	372.30
Total combined operations: surplus	1,512.69
Less depreciation on harbour, fish auction hall etc.	316.90
Surplus after depreciation	1,195.79

It may be seen from **Table 2-18** that surplus will occur from year 1 onwards on an annual basis on combined operations of fish auction hall and port management. The cumulative surplus at the end of 14th year of the project will amount to Rs.16,741.06 lakhs provided the entire landings pass through the fish auction hall and the realisation of the commission charges by the Fish Auction Hall Authority.

Chapter 3

MANAGEMENT AND MAINTENANCE

3.1 General

At present, major fishing harbours developed under Central Scheme in India are managed and maintained by Port Trusts. The Fisheries Department of the State Governments/Union Territories look after minor fishery harbour and fish landing centres. Apart from above, there are few fishery harbours managed and maintained by the Fishermen Co-operative society and organizations viz., PWD/Harbour Engineering Wings/Maritime Board. In other words, the responsibilities of the management are scattered with many organizations/agencies of both State and Central Government. Irrespective of the agency managing the activities, the conditions of the fishery harbours have deteriorated over a period of time due to lack of proper management and maintenance. One of the main reasons for the pathetic condition is most of the fishery harbours could not raise enough revenue on their own.

Fishery Harbour could be leased to an independent private operator/Co-operative Societies giving sufficient autonomy for a definite lease time. The role of the Government could be restricted to financing/construction of fishery harbour. The idea of co-operative management of fisheries harbour may also be a successful method of management as it opens avenue to the stakeholders in decision-making. In this method, the fishermen and other fisheries industry people are sure to feel a sense of participation and their whole-hearted involvement prepares them to shoulder the responsibilities of harbour administration and maintenance.

In the present Indian scenario, Fisheries is the State subject and the greater responsibility for fishery development lies with the State governments. As such, the State governments have the prime duty to promote fishery harbour development in their respective States. The coastal State governments are playing a major role in the overall development of marine fisheries including initiating action on identifying fish landing centre/fishery harbour sites, constructing and maintaining fish landing centre/fishery harbours. The Central government's role has been that of catalytic agent to boost up the fishery industry of the country by supplementing and complementing the efforts of the State governments by finance through the centrally sponsored scheme. The State government legislate for fisheries in inland and territorial sea waters up to 12 nautical miles; while the formulation of fishing laws beyond the territorial waters in deep-sea is the prerogative of the Central government.

As regards the development of infrastructure facilities for creation of fishery harbours/fish landing centres in the State is concerned, the Gujarat government has a very good organizational setup to execute the fishery infrastructure projects. Fisheries Department of Gujarat State Government is giving emphasis for providing the harbour infrastructure facilities at the new sites to help the coastal fishermen.

3.2 Project Management and Maintenance

It is observed that many of the fisheries harbour management authorities could not generate sufficient revenue, required for day-to-day maintenance and upkeep of hygiene and sanitation of the harbour. Further, it is observed that the fisheries harbour complexes have been encroached by hutments resulting in unhygienic condition and non-availability of sufficient space for various activities. Under these circumstances, there is a need to formulate an Act like “Indian Fisheries Harbour Regulation Act” as there seems to be no guidelines are available for fisheries harbour developed so far. Such an act shall empower the agency responsible to regulate the activities in a professional manner. It would be desirable to establish a State Implementing Agency in each State/UTs prior to the sanctioning of the fisheries harbour/fish-landing centre in order to monitor the progress of the project more effectively. This would not only facilitate to improve the standard of construction but also to complete the projects in time provide the facilities to the fishermen community as well as exploit the resources. All the maritime States can prepare the Master Plan to identify more economically viable fisheries harbour sites and explore the possibility of generating interest among the public and private sector by way of offering them fisheries harbours on terms like Build-Own-Transfer (BOT), Build-Own-Operate and Transfer (BOOT), and Build-Own-Operate-Share and Transfer (BOOST) basis.

3.3 Improvement of Database

The Management has to know the quantum of fish caught and auctioned so that they can collect some levy on agreed formula to augment revenue for the maintenance of the Fisheries Harbour/Landing Centre. Periodical data on marketing and consumption of marine fish (in different forms) should be collected by a single centralized organization. Fishery administration office under the overall guidance of the reconstituted Harbour Management Committee/Authority is expected to operate and discharge the following functions:

1. Harbour administration and accounts
2. Harbour operations
3. Harbour maintenance
4. Fishery statistics and
5. Quality control

3.4 Items of main source of revenue

As explained in Chapter 2, if the Commissioner of Fisheries, Government of Gujarat chooses to run an orderly fish auction system, with a fair sharing of all monetary benefits, it must insist that all landings pass through the fish auction hall, or some other checking point, so that commission can be assessed and reasonable deductions made from payments due to boat owners. On the basis of information contained in item 5.07 of Appendix 3, the total amount of commission payable on boat side sales by owners of fishing vessels will be Rs.1,340.39 Lakhs and the details given below:

Table 3-1

Item	10 m	15 m	18 m	Total
Commission payable by each Boat per year in Rs.	46,440	1,50,300	1,83,240	
Number of fishing vessels	220	580	200	1000
Total amount payable by fishing fleet - Rs. Lakhs	102.17	871.74	366.48	1,340.39

If the Commissioner of Fisheries, Government of Gujarat will be entitled to collect port dues from vessel owners. Section 5.0 of Appendix 3 (Vessel operating costs) includes these charges and the amount for 10 m FRP Boat, 15 m DN/GN and 18 m trawler are respectively Rs.50,000, 84,000 and Rs.96,000 per annum respectively at the rate of Rs.250/trip, Rs.3500/trip and Rs.4000/trip. Total collections accruing to the COF, GOG from year 1 onwards are shown in **Table 3-2**. Collection of port dues from the fishing vessels would amount to Rs.789.20 lakhs from year 1 onwards.

Table 3-2

Item	Vessel class	No. of Vessels	Rate(Rs.)	Total (Rs. in Lakhs)
Port Dues	10 m	220	50,000	110.00
	15 m	580	100,000	487.20
	18 m	200	100,000	192.00
Total Collection		1000	-	789.20

The cost of harbour management and maintenance has been assessed at Rs.200 lakhs and Rs.316.90 lakhs respectively per year from year 1 onwards. The "Management" expenditure covers salaries of Port Officer, Port Engineer, Clerical assistance, Watchman, temporary labour, staff for gear shed, general overheads, excluding maintenance and depreciation. Harbour maintenance has been treated as a separate item, and it is assumed that most, if not all of this work will be done under contract. The rate of expenditure on maintenance is based on a percentage of the total cost of the harbour works, fish auction hall, net mending shed/ gear shed, rest shed, etc. The rate is 2% of harbour cost i.e. Rs.316.90 lakhs per year from year 1 onwards.

Table 3-3

Item	Number of persons	Cost from Year 1 onwards (Rs.)
Manager	1	6,00,000
Wharf Superintendent	2	9,60,000
Fish auction hall Superintendent (a)	2	9,60,000
Accountant	2	6,00,000
Fish auctioneer (b)	10	24,00,000
Fish auctioneer's Clerk	10	24,00,000
Cashier	10	24,00,000
Statistical Assistant	2	4,80,000
Clerk/Typist	2	4,80,000
Foreman(C)	2	4,80,000

Peon	2	3,60,000
Watchman	4	<u>7,20,000</u>
Sub-Total	49	128,40,000
Temporary Labour (d)		<u>25,80,000</u>
Sub-Total		154,20,000
Add: 10% for contingencies		<u>15,42,000</u>
Sub-Total		169,62,000
Provision for equipment(e)		10,00,000
General expenses (f)		<u>20,38,000</u>
Total expenditure		2,00,00,000

Note:

- In-charge of delivery of fish from boat side to fish auction hall and clearance after sales.
- Selling rate assumed to be 50 tonne per hour
- In-charge of temporary labour gangs, which would be responsible for cartage of fish and cleaning fish auction hall after selling periods.
- Cost of temporary labour assessed on a basis of Rs.50 per tonne of fish in and out of fish auction hall.
- Nominal sum to cover fish auction hall equipment, boxes, etc., (this relates to the expenditure in Year 1)
- To cover office expenditure, printing, water, electricity, etc.

Table 3-4

Item	Number of persons	Cost from Year 1 onwards (Rs.)
Port Officer	1	12,00,000
Executive Engineer	1	12,00,000
Assistant Engineer	1	9,60,000
Junior Engineer	1	7,20,000
Fishery Expert	1	12,00,000
Economist	1	12,00,000
Health Inspector	1	6,00,000
Statistician	1	6,00,000
Cashier	1	4,80,000
Clerk/Typist	1	4,80,000
Peon	2	6,00,000
Watchman	2	<u>6,00,000</u>
Sub-Total		98,40,000
Other expenses		<u>1,60,000</u>
Total expenditure		1,00,00,000

Table Below gives a consolidated Statement of revenue and expenditure for combined operations of harbour management and the running of the fish auction hall, net mending shed, gear shed and rest shed. The statement also includes provisions for maintenance of all facilities and depreciation. The cost of depreciation is taken at two

percent of total investment in the harbour and its associated facilities (2% of Rs.15,845 lakhs = Rs.316.90 lakhs).

Table 3-5

Item	Years 1-14
Fish auction hall	
Revenue from commission	1,340.39
Less expenditure on Salaries, Wages, overheads	200.00
Surplus	1,140.39
Port management	
Revenue from Port fees and ramp way charges	789.20
Less expenditure on Salaries, wages, overheads	100.00
Maintenance	316.90
Surplus	372.30
Consolidated statement for fish auction hall and port management	
Surplus: Fish auction hall	1,140.39
Surplus: Port management	372.30
Total combined operations: surplus	1,512.69
Less depreciation on harbour, fish auction hall etc.	316.90
Surplus after depreciation	1,195.79

It may be seen from above table that surplus will occur from year 1 onwards on an annual basis on combined operations of fish auction hall and port management. The cumulative surplus at the end of 14th year of the project will amount to Rs.16,741.06 lakhs provided the entire landings pass through the fish auction hall and the realization of the commission charges by the Fish Auction Hall Authority.

Additional sources of revenue can be collected from following items

Item of revenue
House / room rent
Supply of water
Supply of energy
Hire charges for slipway
Cover area charges
Open area parking Charges
Entry charges for two wheelers
Entry charges for persons
Entry charges for ice
Entry charges for heavy vehicles
Entry charges for light vehicles

Chapter 4

ECONOMIC EVALUATION

4.1 Introduction

It seems desirable to place the proposed commitment of resources in some frame of reference for example, how does the magnitude of total resources to be used (monetary and otherwise), compare with subsequent benefits? How important is the investment in harbour structures, compared with resources which must be used to provide and operate fishing vessels, shore facilities, etc.? A frame of reference for evaluating the fishery harbour and other necessary investments is given by calculation of an Internal Rate of Return on all investment. Some knowledge about the Internal Rate of Return will make it possible to compare the "usefulness" of the project, with that of any other development proposal. Any possibility of invalid assumptions and the consequences of making them are also to be examined. With certainty, it is not possible to make accurate predictions about long-term fishery development. Therefore, it is advisable to indicate how sensitive the outcome of the analyses (Internal Rate of Return and vessel operations) is, to changes in key assumptions.

As part of project economic evaluation, financial analyses of the costs and income of the project are represented as financial statements (cash inflow/outflow). For this, all the physical inputs such as civil works (buildings and infrastructure), equipment etc., required over the project's economic life period are phased out and then costed on an annual basis, in present day prices. All these costs and benefits are converted into current prices by applying discount rates. Price contingencies for inflation are not included in cash flows (although they may form part of project budget estimates) as the analysis is undertaken in current prices.

4.2 Economic Analysis

The first step in the preparation of economic analysis is to estimate the capital and operating costs of the project. Estimation of the capital costs include investment to be made in the fishery harbour facilities and associated infrastructure, timing of the capital costs over the life of the project, renewal and replacement costs of fishing boats, if the project's life is extended beyond the average economical life, machinery, equipment, shore based facilities, investment made in fishing vessels, ice plants, fish processing plants etc.

Secondly, estimation of the annual operating costs of the project include fishing vessel operating costs (costs of fuel, maintenance of vessel and engine, salaries for crew, ice, commission on sale of fish landings, harbour dues, fish landing and wharfage charges, insurance, interest & loan instalment including fishery harbour management and maintenance, costs of fish processing, distribution and marketing, fishery harbour management and maintenance.

Finally, estimation of income for the project is made based on the average annual fish landings and value for each size and type of fishing vessels and the number of fishing boats which are already in operation and the new vessels proposed to be introduced during project development. After estimating the cash inflow and outflow of the project, annual surplus is calculated by subtracting the capital costs and operating costs from the income year by year for the assumed

economic life of the project. During the first one or two years, the profit could be negative for some of the projects; thereafter it will be positive during the rest of the project life. The annual surplus will be discounted to the project's present value. The discount rate would reflect the rate of return that one might reasonably expect to be best alternative investment of comparable risk.

Sensitivity analyses are done to allow for risks and uncertainty inherent in the project by putting the project into several sensitivity tests like assuming lower level of fish landings by about 20% (consequently reducing the fishing vessel/project's income), reduction in export income by 25%, increasing the capital investment costs by about 25% etc.

4.2.1 Economic Evaluation Methods

Several methods are available to evaluate the projects for taking investment decisions and it may be emphasised here that these methods are only tools for decision making. The methods most widely used to appraise and compare the economic feasibility of investment are the Pay-back Period method, the Average Rate of Return method and the Discounting method. The last method is also called Present Value method and it includes the Net Present Value (NPV), the Internal Rate of Return (IRR) and the Benefit-Cost Ratio methods. IRR is the most useful measure of the economic feasibility of investment and it is widely used by the international banks such as ADB, World Bank etc., including organisations like FAO/UNDP.

4.2.1.1 Net Present Value Method

In order to use this method, costs have to be subtracted from the benefits (income) on a year to year basis throughout project's life to arrive at the net benefit or surplus. The annual net benefits are discounted to a pre-determined discount rate or the interest rate on loan. The net present value can also be calculated by separately discounting the stream of annual cash inflow and cash outflow and subtracting the latter from the former. The discounting will be made by the Discounting Table. If the NPV is more than zero, the investment would be profitable, if it is less than zero, the project would not be profitable and if it is equal to zero then the project is at break-even.

4.2.1.2 Benefit Cost Ratio Method

Benefit Cost Ratio can be defined as the ratio of the total present value of the benefits to the costs. The benefit cost ratio can be done by two methods i) by discounting the stream of benefits and costs separately or ii) by discounting the net benefits which are arrived by subtracting the costs from the benefits. If the benefit cost ratio is greater than one, then the project may be considered as economically feasible.

4.2.1.3 Internal Rate of Return Method

While applying the present value and benefit cost ratio methods, one may encounter the problem regarding choosing the appropriate rate of discount. The method that avoids this difficulty is the internal rate of return. The internal rate of return on an investment is the discount rate that makes the future net cash flow equal to zero. It represents the average earning power of the money invested in

the project over the project's life. If the IRR is greater than the opportunity cost of the capital, or the interest rate at which funds were borrowed, then the investment is considered to be feasible. In the present project, the Financial Internal Rate of Return (FIRR) is worked out by following the discounted cash flow method.

4.3 Assumptions of a General Nature

The average prices of fish and prawns prevailed during 2016 have been used to calculate the operating results of fishing vessels (**Appendix 3**) and to calculate unit costs of processing, distribution and marketing of fish and prawn products (**Appendix 7(a)**). Up-to-date costing has also been applied to investment in fixed assets (**Appendix 8**). From the point of income, boat side prices for landings (**Appendix 2**), and retail or shipside prices for marketing (**Appendices 7(b)** and **10**), 2016 have also been taken as the base.

The problem of ownership is not a critical one from the point of the economic analysis contained in this Chapter. In Section 3.10 of Chapter 3, certain observations have been made about ownership and management. Firm recommendations in these matters are outside the scope of this report. Therefore, only a framework of ownership has been suggested to give a general background to the development proposal. An important assumption about ownership is that it will be linked with efficient management, both at sea and on shore. The construction of a fishery harbour will provide one of the facilities necessary for further development. Expansion and financial success will occur only, if fishermen and other entrepreneurs take advantage of economic opportunities, as they arise. That they will do so, serves as one of the most general assumptions in this report.

This report is in no way, a detailed socio-economic study of the project area. Without a considerable amount of fieldwork, it would not be possible to plot with any precision all of the benefits, which will flow from project implementation. Therefore, the evaluation is mainly limited to an assessment of the direct monetary benefits, which may accrue and omits an assessment of the indirect benefits, which would flow from improved per capita income, etc.

On the expenditure side, the evaluation excludes certain costs incurred in public utilities, in addition to town or village social services, in training sea-going personnel and those whose task it will be to manage shore-based facilities. No deductions have been made from costs for taxes, duties and levies imposed by Government authorities. The inclusion of these items is in line with the methodology of using ruling market prices. Equally, no deductions have been made for subsidies or indirect assistance, which may be rendered by a Government, in order to accelerate development. Hence the evaluation is primarily a commercial investment analysis, wherein the major costs and benefits are identified.

As explained in Section 3.2 of Chapter 3, a period of fifteen years (Year "0" plus Years 1 to 14) has been chosen to evaluate the costs and benefits of the integrated project covering harbour construction, vessel operations and shore-based activities, to either a retail or shipside (export) level. Of course, the fishery harbour, some of the fishing vessels, and part of the industrial plants, will have a longer working life, than fifteen years. These facilities will still be available to the local fishing industry, after the end of 14 years. Residual investment at the end of Year 14 has not been taken into account when discounting benefits and cost, as it would have only a marginal effect on the Internal Rate of Return.

4.4 Sensitivity Analyses of Vessel Operations

4.4.1 Basic Vessel Operations

Appendix 3 gives a detailed account of vessel operations under six headings, "General Information", "Operational Schedule", "Landings per Trip and per Season", "Investment", "Vessel Operating Costs", and "Financial Results". The information and estimates contained in **Appendix 3** are based on current activities (2016) and expectations about the future. On the basis of the accounting shown in relevant sections of **Appendix 3**, net earnings as a percentage of capital employed are as shown in **Table 4 -1**.

Table 4 -1

Type of Vessel	(Percent)			
	Earnings before Depreciation	Earnings after Depreciation	Earnings after Depreciation and Interest	Earnings after Instalment Payment
10 m	20.2	15.8	9.1	-3.4
15 m	20.5	15.3	8.5	-4.0
18 m	22.8	16.6	9.9	-2.6

4.4.2 A 25% Reduction in Prawn Landings

What would happen to net earnings, if the quantity of prawn landings were 25% less than those forecast in **Appendix 2**? A reduction would lower vessel earnings (**Appendices 2 and 3**), unless a fall in landings was offset by increased prices. However, assuming constant prices (**Appendix 2**), a 25% reduction would alter the quantity and value of boat side sales, as indicated in **Table 4-2**.

Table 4-2

Type of vessel	As per appendices 2 and 3		With a 25% reduction	
	Prawn Quantity (kg.)	Value (Rs.)	Prawn Quantity (kg.)	Value (Rs.)
18 m trawler	9,000	18,48,000	6,750	13,86,000

The income reductions outlined in **Table 4-3** change percentage returns on investment in the following way.

Table 4-3

Item	18 m
Before depreciation	16.1
After depreciation	9.9
After interest payment	3.2
After instalment payment	-9.3

The 10 metre FRP Gill netter and 15 metre Dole netter/Gill netter do not catch any prawns. For 18 m trawler prawns are crucial. It may be seen from the above that 18 m boat earn surplus till after interest payment and losses to the extent of Rs.4,20,250 after payment of loan instalment.

4.4.3 A 20% Reduction in Total Landings of Fish and Prawns

The implications of an overall 20% reduction in landings for both fish and prawns are shown in **Table 4-4**

Table 4-4

(Amount in Rupees)

Item	10 m	15 m	18 m
As per Appendices 2 and 3			
Total landings - Quantity (kg.)	24,000	60,000	60,000
Total Landings - Value (Rs.)	15,48,000	50,10,000	61,08,000
With a reduction of 20%			
Total landings - Quantity (kg.)	19,200	48,000	48,000
Total landings - Value (Rs.)	12,38,400	40,08,000	48,86,400

The foregoing reductions severely affect the financial results of all the four fishing vessels. The financial losses that these boats would incur are summarised in **Table 4-5**.

Table 4-5

(Amount in Rupees)

Item	10 m	15 m	18 m
Before depreciation	11,300	2,58,000	2,16,400
After depreciation	-14,600	48,000	-63,600
After interest payment	-55,100	-2,22,000	-3,67,350
After instalment payment	-1,30,100	-7,22,000	-9,29,850

All the size of vessels incurs loss after depreciation except 15 m. Therefore both 10 m and 18 m boats are very sensitive for a given 20 % reduction in total landings.

4.4.4 A 25% Increase in Investment in a Fishing Vessel

An increase in investment involves increases in some items of vessel operating costs. The items affected are maintenance of vessel and engine, maintenance of fishing gear, vessel insurance, provision for gear replacement, depreciation, interest and instalment payment. The net earnings as a percentage of capital employed are given in **Table 4-6**. The 10 m FRP boat might incur a loss of Rs. 80,125 after payment of loan instalment, 15 m incur a loss of Rs. 5,57,500 while 18 m vessels incur a loss of Rs. 5,29,813 after loan instalment payment.

Table 4-6

(Rupees)

Item	10 m	15 m	18 m
Before depreciation	96,625	6,67,500	9,03,000
After depreciation	64,250	4,05,000	5,53,000
After interest payment	13,625	67,500	1,73,313
After instalment payment	-80,125	-5,57,500	-5,29,813

4.4.5 What Quantity of Landings is required to maintain a Minimum of 12% Return on Vessel Investment?

This "break-even" type of analysis assumes that only enough surpluses is left, after deducting operating costs (Item 5.15), from income (Item 3.12) to maintain

a 12% return on investment. The 10 m, 15 m and 18 m boats have an option 4%, 5% and 5% reduction in basic landings more catches respectively to get a 12% return on investment after depreciation. The effects of the foregoing reductions in terms of quantity and value of landings are shown in **Table 4-7**.

Table 4-7

Item	10 m	15 m	18 m
As per Appendices 2 and 3			
Total landings - Quantity (kg.)	24,000	60,000	60,000
Total Landings - Value (Rs.)	15,48,000	50,10,000	61,08,000
With a minimum Requirement of 12% Return on Investment			
Total landings - Quantity (kg.)	23,040	57,000	57,000
Total landings - Value (Rs.)	14,86,080	47,59,500	58,02,600

4.4.6 The Situation in a "Poor" Fishing Season

The information about catch composition and landings given in **Appendix 2** represents what may be termed as "average" over a long period of time, say, the working life of fishing vessels, described in this report. In some years, landings would be greater than those shown and in other years, those would be less. With regard to the day-to-day operations of a fishing vessel, the quantity of landings is not constant, and, of course, the catch composition changes with season, in accordance with the abundance of individual species within the total resources being exploited. Fluctuations also occur between what is commonly referred to as the "peak" and "lean" months, during a fishing season. These sorts of fluctuations also occur over a time spread of seasons (years). Most of the analysis in this section of the report has dealt with reduction in catches with a related commitment, that day to day operating expenses would be met by boat owners and that annual fixed costs would be paid. In a really "poor" fishing season, it may be possible to pay only daily expenses and payment of overheads may have to be postponed to a later time, when fishing efforts are more rewarding.

What are the quantities of landings required to meet daily operating expenses during a really bad fishing year? In other words, at the prices shown in **Appendix 2**, how much fish must be sold to cover such costs as fuel, basic wages, commission, maintenance and any other item for which, under normal circumstances, payment cannot be deferred?

Before answering this question, it is necessary to introduce two basic assumptions. Firstly, it is assumed that the "poor" fishing season is a local phenomenon and hence a shortage of fish and prawns is not offset by higher prices from the boat owner's point-of-view. In this connection, the relative unimportance of the "local" market should be noted (see Section 3.9 of Chapter 3). Secondly, it is assumed that boat-owners are either unwilling to take their fishing vessels to another region or State, where fishing activities would be more profitable. Some of the assumptions relating to vessel operating costs, as summarised in Section 5.0 of **Appendix 3** would change to reflect "poor" fishing season. The consequential amendments could be as follows:

For all types of Vessel

Fuel and lubricating oils	80%	of Item 5.01
Maintenance of vessel	50%	of Item 5.02
Maintenance of fishing gear	70%	of Item 5.03
Basic wages for crew	75%	of Item 5.04
Food allowances	50%	of Item 5.05
Port dues	100%	of Item 5.08

For ice and commission of Item 5.06 and 5.07

	10 m	15 m	18 m
Ice	76%	61%	63%
Commission	76%	61%	63%

On the basis of the foregoing assumptions, the revised operating costs for each type of fishing vessel would be as follows. The figures in brackets are the costs of the basic statement shown in section 5.0 of **Appendix 3**.

10 m FRP	Rs. 11,76,480	(Rs.13,70,000)
15 m DN/GN	Rs. 30,56,100	(Rs.39,00,000)
18 m Trawler	Rs. 38,48,040	(Rs.48,60,000)

The average boat side price per kilogram of landings of fish and prawns, as per quantities and values shown in Appendices 2 and 3, are shown in **Table 4-8**.

Table 4-8

Item	10 m	15 m	18 m
Total landings-quantity (kilogram)	24,000	60,000	60,000
Total landings-value (Rupees)	15,48,000	50,10,000	61,08,000
Average price per Kilogram (Rupees)	64.50	83.50	101.80

If the minimum operating costs of Rs. 11,76,480, Rs.30,56,100 and Rs. 38,48,040 for a 10 m, 15 m and 18 m respectively are divided by the average price per kilogram shown in **Table 4-8** then the quantities of landings of fish and prawns needed to support fishing effort during a "poor" fishing season are as given below (the figures in brackets are the tonnages shown in **Appendix 2**):

10 m FRP boat	-	18.24 tonne (which is 76.0 % of 24 tonne)
15 m DN/GN	-	36.60 tonne (which is 61.0 % of 60 tonne)
18 m Trawler	-	37.80 tonne (which is 63.0 % of 60 tonne)

From the foregoing, it is obvious, that all types of fishing vessels could withstand substantial reductions in landings during a "poor" season. This statement, *inter alia* assumes that

- there would not be any difficulty about late payment of certain fixed costs and
- that the "poor" season is only a short-term phase in the long-term exploitation of local fishery resources.

4.5 Sensitivity Analysis of the Project

Appendices 1 to 10 outline in detail, a fishery development proposal for Navabandar fishery harbour project. **Appendix 11**, which reconciles cash inflows and cash outflows, provides the base for calculating Financial Internal Rate of Return (FIRR) on investment for integrated project operations. This reconciliation and its consequent Financial Internal Rate of Return serves as the "Basic Statement" of project objectives expressed in financial terms. The Financial Internal Rate of Return (FIRR) on the basic statement works out to 11 - 12 %.

What would be the Internal Rate of Return if annual vessel landings, as described in this report, were over estimated by 25 percent? What would be the effect on total operations if the landing of prawns fell by 25%? The answers to these questions and others are given in **Table 4-9**.

Table 4-9

**With The Financial Internal Rate of Return (FIRR)
Being Calculated for the Integrated Project**

Sl. No	Proposition	Internal Rate of Return
1.1	Basic statement (Appendix 11)	11 - 12 %
1.2	Total fleet landings, hence total products, being reduced by 20%	Negative %
1.3	The value of export income being reduced by 25%	7 – 8 %
1.4	The investment cost of all fishing vessels and fishery harbour being increased by 25% other variables constant except for necessary consequential amendments	2 - 3 %

Appendix - 1

Fleet Size, Fishermen Employed and Average Annual Landings

Item	Year	
	1	2 - 14
Vessels Operating		
10 metre FRP	220	220
15 metre Dole Net / Gill Net	580	580
18 metre Trawler	200	200
Total	1000	1000
Fishermen Employed		
10 metre FRP	880	880
15 metre Dole Net / Gill Net	5220	5220
18 metre Trawler	1600	1600
Total	7700	7700

Item	Year	
	1	2 - 14
Average Annual Landings (tonne)		
10 metre FRP Fish		
- Class 1	528	528
- Class 2	792	792
- Class 3	1584	1584
- Class 4	2376	2376
Total Fish	5280	5280
15 Metre Dole Netter/Gill Netter Fish		
- Class 1	6960	6960
- Class 2	8700	8700
- Class 3	10440	10440
- Class 4	8700	8700
Total Fish	34800	34800
18.0 Metre Trawler Prawns		
- Class 1	360	360
- Class 2	600	600
- Class 3	840	840
Sub-total	1800	1800
Fish		
- Class 1	1800	1800
- Class 2	3000	3000
- Class 3	3000	3000
- Class 4	2400	2400
Sub-total	10200	10200
Total Prawns and Fish	12000	12000
Total Fleet Prawns		
- Class 1	360	360
- Class 2	600	600
- Class 3	840	840
sub – total	1800	1800
Fish		
- Class 1	9288	9288
- Class 2	12492	12492
- Class 3	15024	15024
- Class 4	13476	13476
sub – total	50280	50280
Total Fish and Prawns - Qty. (tonne)	52080	52080
- Value (Rs. in lakhs.)	44680	44680

**Average Landings and Value per Season for a Typical
10 M FRP, 15 M Dole Net / Gill Net and 18 M Trawler.**

Item	Boatside Price Rs./Kg.	10 M FRP			15 M DN / GN			18 M Trawler		
		%	Quantity (Kg.)	Value (Rupees)	%	Quantity (Kg.)	Value (Rupees)	%	Quantity (Kg.)	Value (Rupees)
Prawns										
Class - 1	400							3	1800	720000
Class - 2	250							5	3000	750000
Class - 3	90							7	4200	378000
Sub-total								15	9000	1848000
Fish										
Class - 1	150	10	2400	360000	20	12000	1800000	15	9000	1350000
Class - 2	100	15	3600	360000	25	15000	1500000	25	15000	1500000
Class - 3	70	30	7200	504000	30	18000	1260000	25	15000	1050000
Class - 4	30	45	10800	324000	25	15000	450000	20	12000	360000
Sub-total		100	24000	1548000	100	60000	5010000	85	51000	4260000
Total Prawns and Fish	-	100	24000	1548000	100	60000	5010000	100	60000	6108000

Note : Catch composition is given in Percentage (%)

Appendix – 3

General Information, Operational Schedule and Estimated Annual Financial Statement for a Typical

10 M FRP, 15 M Dole Netter/Gill Netter and 18 M Trawler.

(Monetary Values in Rupees)

SL. No.	Item	Fishing Vessel		
		10 Metre	15 Metre	18 Metre
1.00	GENERAL INFORMATION			
1.01	Length (metre)	10	15	18
1.02	Beam (metre)	2.0	4.5	6.0
1.03	Draught (metre)	1	1.5	2.2
1.04	Engine horse power	8	88	122
1.05	Fish plus ice carrying capacity (tonne)	3	6	6
1.06	Number in crew	4	9	8
1.07	Fishing method mainly	GN	DN/GN	Trawl
2.00	OPERATIONAL SCHEDULE			
2.01	Number of trips per year	200	24	24
2.02	Days per trip	1	9	9
2.03	Days at sea per year (2.01 x 2.02)	200	216	216
2.04	Days between trips	70	54	54
2.05	Length of fishing season (2.03+2.04)	270	270	270
3.00	LANDINGS PER TRIP AND PER SEASON			
3.01	Per trip - Prawns - Landings - Kg.	0	0	375
3.02	- Value - Rs..	0	0	77000
3.03	- Fish - Landings - Kg.	120	2500	2125
3.04	- Value - Rs..	7740	208750	177500
3.05	- Total - Landings - Kg.	120	2500	2500
3.06	- Value - Rs..	7740	208750	254500
3.07	Per season - Prawns - Landings - Kg.	0	0	9000
3.08	- Value - Rs..	0	0	1848000
3.09	- Fish - Landings - Kg.	24000	60000	51000
3.10	- Value - Rs..	1548000	5010000	4260000
3.11	- Total - Landings - Kg.	24000	60000	60000
3.12	- Value - Rs..	1548000	5010000	6108000
4.00	VESSEL INVESTMENT			
4.01	Hull and Fittings	250000	2200000	3000000
4.02	Engine and Equipment	120000	800000	1000000
4.03	Sub - total	370000	3000000	4000000
4.04	Fishing gear	230000	1000000	500000
4.05	Total Investment	600000	4000000	4500000
5.00	VESSEL OPERATING COSTS			
5.01	Fuel and lubricating oils **	610000	1900800	3168000
5.02	Maintenance of vessel & engine (5% of item 4.03)	7400	150000	200000
5.03	Maintenance of fishing gear (20 % of item 4.04)	46000	200000	100000

5.04	Salaries for Crew - Details given below	505800	1137120	786960
5.05	Food allowances (Rs.400, 8100/7200/trip for 10 m,15m&17 m)	80000	194400	172800
5.06	Ice cost(0.05 t, 2 t. & 4 t for 10 m, 15 m & 17 m @ Rs.1500 / t.	15000	72000	144000
5.07	Commission on sales - 3 % of item 3.12	46440	150300	183240
5.08	Port Dues (lumpsum)	50000	84000	96000
5.09	Sundries and overheads	9360	11380	9000
5.10	Sub - total	1370000	3900000	4860000
5.11	Vessel insurance - 3.0 % of item 4.03	11100	90000	120000
5.12	Provision for gear replacement - 20%of item 4.04	46000	200000	100000
5.13	Sub - total	1427100	4190000	5080000
5.14	Depreciation - 7 % of item 4.03	25900	210000	280000
5.15	Sub - total	1453000	4400000	5360000
5.16	Interest - on capital - 12% of item 4.05	40500	270000	303750
5.18	Sub - total	1493500	4670000	5663750
5.19	Loan instalment payment - 1/ 8 of item 4.05	75000	500000	562500
5.20	Total operating costs	1568500	5170000	6226250
6.00	FINANCIAL RESULTS			
6.01	Surplus before depreciation	120900	820000	1028000
6.02	Surplus after depreciation	95000	610000	748000
6.03	Surplus after interest payment	54500	340000	444250
6.04	Surplus after instalment payment	-20500	-160000	-118250
6.05	RETURN ON INVESTMENT			
6.06	Before depreciation - item 6.01 as a % of 4.05	20.2	20.5	22.8
6.07	After depreciation - item 6.02 as a % of 4.05	15.8	15.3	16.6
6.08	After interest payment - item 6.03 as a % of 4.05	9.1	8.5	9.9
6.09	After instalment payment - item 6.04 as a % of 4.05	-3.4	-4.0	-2.6

Fuel

10 M FRP OBM - Kerosene 60 lit /trip @ Rs.45/lit & Petrol 5 lit/trip @ Rs. 70/lit for 200 trips.
15 M Dol Net/Gill Net - Diesel 1200 lit /trip @ Rs.60/lit + 10% for oil for 24 trips.
18 M Trawler - Diesel 2000 lit /trip @ Rs.60/lit + 10% for oil for 24 trips.

Salaries

10 M FRP OBM - 60 % after deducting Fuel, FA and Ice.
15 M Dol Net/Gill Net - 40 % after deducting Fuel, FA and Ice
18 M Trawler - 30 % after deducting Fuel, FA and Ice

Recovery Factors and Percentages of Landings - Allocated to various Products and Markets

Class of Landings And Type of Products	Markets							
	Export		Local		Inland		Total	
	RF	PLAM	RF	PLAM	RF	PLAM	RF	PLAM
Prawns								
Frozen - Class 1	60	100					60	100
Class 2	50	100					50	100
Class 3	40	40					40	40
Fresh - Class 3			100	30	100	30	100	60
Fish								
Frozen - Class 1	80	10					80	10
Fresh - Class 1			100	20	100	70	100	90
Class 2			100	20	100	80	100	100
Class 3			100	30	100	70	100	100
Class 4			100	20	100	10	100	30
Dried/Cured- Class 4			33	10	33	60	33	70

Note : RF = Recovery Factor (Raw Material to Product Weight)
: PLAM = Percentages of Landings Allocated to Product /Market.

Allocation of Raw Material and Products Produced for Each Market Outlet

Class of Landings and Type of Products	Markets							
	Export		Local		Inland		Total	
	RM	PW	RM	PW	RM	PW	RM	PW
Prawns								
Frozen - Class 1	360	216					360	216
2	600	300					600	300
3	336	134					336	134
Fresh - Class 3			252	252	252	252	504	504
Fish								
Frozen - Class 1	929	743					929	743
Fresh - Class 1			1858	1858	6502	6502	8359	8359
2			2498	2498	9994	9994	12492	12492
3			4507	4507	10517	10517	15024	15024
4			2695	2695	1348	1348	4043	4043
Dried/Cured - Class 4			1348	445	8086	2668	9433	3113
Total for all Markets	2225	1393	13158	12255	36697	31280	52080	44928

Note : RM = Raw Material
: PW = Product Weight

Estimates of Capacities of Shore – establishments
(Quantity in Tonnes)

Demand for Facility	Assumptions Regarding Requirments	Year 1 - 14
Ice making capacity		
10 metre FRP	50 kg / trip x200 x 220 vessels	2200
15 metre Dole Net / Gill Net	2000 kg / trip x24 x 580 vessels	10560
18 metre Trawler	4000 kg / trip x 24 x 200 vessels	19200
	Sub - total	31960
Fish and Prawns for overnight storage prior to transportation Distribution	Ratio 1:1 for 20% of all fresh sales of fish and prawns	8084
Prawns - fresh - local	Ratio 0.2 : 1 for all sales	50
- inland	Ratio 1 : 1 for all sales	252
Fish - fresh - local	Ratio 0.2 : 1 for all sales	2312
- inland	Ratio 1 : 1 for all sales	27431
- Total	Sub - total	30045
Total annual demand summarised		
Fishing fleet		31960
Overnight storage		8084
Distribution		30045
Total	Total	70089
Calculation of capacity required		
Total demand brought forward		70089
Peak monthly demand	15% of annual demand	10513
Daily requirement	Divide peak monthly demand by 30 (days) and rounded	350
Ice and fish storage - Capacity needed	Multiply daily ice making capacity by two	700
Fish curing / drying yard		
Raw material - Fish class - 4		9433
Peak monthly demand	15% of raw material	1415
Daily requirement	Divide peak monthly demand by 30 (days) and rounded	50
Storage for products	Multiply daily requirements by RF 33.33% and multiply by 10 and rounded	170

Appendix - 7 (a)

**Cost of Production, Distribution and Marketing per Tonne of Fish and Prawn Products for
any Year 1 - 14
(Rupees)**

Market - Product	Drying and / or Sorting	Processing and/or Freezing and Packing	Ice and / or Storage	Transport to Market or Shipside	Marketing Expenses NEI	Sub - total of costs
EXPORT MARKET						
Prawns - Frozen - Class 1	500	30000	8000	1500	-	40000
Class 2	500	30000	8000	1500	-	40000
Class 3	500	30000	8000	1500	-	40000
Fish - Frozen - Class 1	500	20000	5000	1500	-	27000
LOCAL MARKET						
Prawns - Fresh - Class 3	500	-	500	-	300	1300
Fish - Fresh - Class 1	300	-	500	-	300	1100
Class 2	300	-	500	-	300	1100
Class 3	300	-	500	-	300	1100
Class 4	300	-	500	-	300	1100
Dried / Cured - Class 4	1500	-	-	-	300	1800
INLAND MARKETS						
Prawns - Fresh - Class 3	500	500	1500	2500	500	5500
Fish - Fresh - Class 1	300	500	1500	2500	500	5300
Class 2	300	500	1500	2500	500	5300
Class 3	300	500	1500	2500	500	5300
Class 4	300	500	1500	2500	500	5300
Dried / Cured - Class 4	1500	200	500	1500	500	4200

Appendix - 7 (b)

Retail or F.O.B Prices per Tonne of Product Weight
(Rupees)

Market - Product	Sub-total of Costs. App-7(a)	Cost of Raw- Material	Total Costs	Product Price	Surplus
EXPORT MARKET					
Prawns - Frozen - Class 1	40000	666667	706667	714000	7333
Class 2	40000	500000	540000	545000	5000
Class 3	40000	225000	265000	268000	3000
Fish - Frozen - Class 1	27000	187500	214500	217000	2500
LOCAL MARKET					
Prawns - Fresh - Class 3	1300	90000	91300	92000	700
Fish - Fresh - Class 1	1100	150000	151100	153000	1900
Class 2	1100	100000	101100	102000	900
Class 3	1100	70000	71100	72000	900
Class 4	1100	30000	31100	31000	-100
Dried / Cured - Class 4	1800	90000	91800	93000	1200
INLAND MARKETS					
Prawns - Fresh - Class 3	5500	90000	95500	97000	1500
Fish - Fresh - Class 1	5300	150000	155300	158000	2700
Class 2	5300	100000	105300	107000	1700
Class 3	5300	70000	75300	77000	1700
Class 4	5300	30000	35300	36000	700
Dried / Cured - Class 4	4200	90000	94200	96000	1800

Consolidated Statement of Cost of Production, Distribution and Marketing of Fish and Prawn Products - For any Year 1 - 14

(Rs.'000)

Market - Product	Product Weight (tonne)	Drying and / or sorting	Processing and/or Freezing & Packing	Ice and / or Storage	Transport to Markaet or Shipline	Marketing Expenses NEI	Total costs
EXPORT MARKET							
Prawns - Frozen - Class 1	216	108	6480	1728	324	0	8640
- Class 2	300	150	9000	2400	450	0	12000
- Class 3	134	67	4032	1075	202	0	5376
Fish - Frozen - Class 1	743	372	14861	3715	1115	0	20062
LOCAL MARKET							
Prawns - Fresh - Class 3	252	126	0	126	0	76	328
Fish - Fresh - Class 1	1858	557	0	929	0	557	2043
- Class 2	2498	750	0	1249	0	750	2748
- Class 3	4507	1352	0	2254	0	1352	4958
- Class 4	2695	809	0	1348	0	809	2965
Dried / Cured - Class 4	445	667	0	0	0	133	800
INLAND MARKETS							
Prawns - Fresh - Class 3	252	126	126	378	630	126	1386
Fish - Fresh - Class 1	6502	1950	3251	9752	16254	3251	34458
- Class 2	9994	2998	4997	14990	24984	4997	52966
- Class 3	10517	3155	5258	15775	26292	5258	55739
- Class 4	1348	404	674	2021	3369	674	7142
Dried / Cured - Class 4	2668	4002	534	1334	4002	1334	11207
TOTAL FOR ALL MARKETS	44928	17594	49212	59075	77622	19316	222819

Cash outflow Statement - New Investment

(Rs. in Lakhs)

Item	Year		Total
	" 0 "	1	
Fishing vessels (already invested)			
10 metre FRP	1320.00		1320.00
15 metre Dole Net / Gill Net	23200.00		23200.00
18 metre Trawler	9000.00		9000.00
Total	33520.00	-	33520.00
Fishery Harbour			
New Investment	14260.50	1584.50	15845.00
Shore - Establishments	180.00		180.00
Pre Development Expenditure	40.00		40.00
Total Investment summersid			
Fishing vessels	33520.00		33520.00
Fishery harbour investment	14260.50	1584.50	15845.00
Shore - Establishments	180.00		180.00
Pre Development Expenditure	40.00		40.00
Total Investment	48000.50	1584.50	49585.00

Cash outflow Statement
Operating Costs for Integrated project Operations
(Rs. In Lakhs)

Item	Year	
	1	2-14
Fishing vessels		
10 metre FRP	3139.62	3139.62
15 metre Dole Net / Gill Net	24302.00	24302.00
18 metre Trawler	10160.00	10160.00
Total	37601.62	37601.62
Processing, Distribution and Marketing		
Drying and/or sorting	175.94	175.94
Processing and/or freezing and packing	492.12	492.12
Ice and/or storage	590.75	590.75
Transport to market or ship side	776.22	776.22
Marketing expenses not elsewhere included	193.16	193.16
Total	2228.19	2228.19
Harbour Management and Maintenance		
Harbour Management	200.00	200.00
Harbour maintenance	316.90	316.90
Total	516.90	516.90
Total operating costs summarized		
Fishing vessels	37601.62	37601.62
Processing, Distribution and Marketing	2228.19	2228.19
Harbour management and maintenance	516.90	516.90
Total	40346.71	40346.71

Cash Inflow Statement
Income from Sale of Fish and Crustacean Products
(Rs. in Lakhs)

Market – Product	Product price Rupees Per tonne	Product Weight (Qty - tonne)	Year	
			1	2 - 14
EXPORT MARKET				
Prawns - Frozen - Class 1	714000	216	1542.24	1542.24
Class 2	545000	300	1635.00	1635.00
Class 3	268000	134	360.19	360.19
Fish - Frozen - Class 1	217000	743	1612.40	1612.40
LOCAL MARKET				
Prawns - Fresh - Class 3	92000	252	231.84	231.84
Fish - Fresh - Class 1	153000	1858	2842.13	2842.13
Class 2	102000	2498	2548.37	2548.37
Class 3	72000	4507	3245.18	3245.18
Class 4	31000	2695	835.51	835.51
Dried / Cured Class 4	93000	445	413.58	413.58
INLAND MARKETS				
Prawns - Fresh - Class 3	97000	252	244.44	244.44
Fish - Fresh - Class 1	158000	6502	10272.53	10272.53
Class 2	107000	9994	10693.15	10693.15
Class 3	77000	10517	8097.94	8097.94
Class 4	36000	1348	485.14	485.14
Dried / Cured Class 4	96000	2668	2561.52	2561.52
TOTAL FOR ALL MARKETS	-	44928	47621.15	47621.15

Appendix - 11

Reconciliation of Cash Inflow and Cash Outflow Statements

(Rs. in Lakhs)

Item	Reference	Year		
		" 0 "	1	2 - 14
Cash inflow				
Income from sale of fish and prawn products	App - 10		47621.15	47621.15
Less				
Cash outflow				
Investment in new fixed assets	App - 8	48000.50	1584.50	-
Operating costs (Fishing fleet + Harbour Management and Maintenance)	App - 9	-	40346.71	40346.71
Balance to be discounted for the Calculation of Financial Internal Rate of Return	-	48000.50	5689.94	7274.44

Note : The above statement represents the 'Basic statement' for the purpose of financial evaluation

The Financial Internal Rate of Return (FIRR) on this statement works out to 11 - 12 %

(1) A 20% Reduction in total landings

Appendix - 11 A

Reconciliation of Cash Inflow and Cash Outflow Statements

(Rs. in Lakhs)

Item	Reference	Year		
		" 0 "	1	2 - 14
Cash inflow				
Income from sale of fish and prawn products	App - 10	-	38096.92	38096.92
Less				
Cash outflow				
Investment in new fixed assets	App - 8	48000.50	1584.50	-
Operating costs (Fishing fleet + Harbour Management and Maintenance)	App - 9	-	36089.07	36089.07
Balance to be discounted for the Calculation of Financial Internal Rate of Return	-	-48000.50	423.35	2007.85

Note : The above statement represents the 'Basic statement' for the purpose of financial evaluation

The Financial Internal Rate of Return (FIRR) on this statement works out to Negative %

(2) A 25% reduction in export income**Appendix – 11 B****Reconciliation of Cash Inflow and Cash Outflow Statements**

(Rs. in Lakhs)

Item	Reference	Year		
		" 0 "	1	2 – 14
Cash inflow				
Income from sale of fish and prawn products	App - 10	-	46333.69	46333.69
Less				
Cash outflow				
Investment in new fixed assets	App - 8	48000.50	1584.50	-
Operating costs (Fishing fleet + Harbour Management and Maintenance)	App - 9	-	40346.71	40346.71
Balance to be discounted for the Calculation of Financial Internal Rate of Return	-	-48000.50	4402.48	5986.98

Note : The above statement represents the 'Basic statement' for the purpose of financial evaluation

The Financial Internal Rate of Return (FIRR) on this statement works out to 7 - 8 %

(3) A 25% increase in total investment**Appendix – 11 C****Reconciliation of Cash Inflow and Cash Outflow Statements**

(Rs. in Lakhs)

Item	Reference	Year		
		" 0 "	1	2 – 14
Cash inflow				
Income from sale of fish and prawn products	App - 10	-	47621.15	47621.15
Less				
Cash outflow				
Investment in new fixed assets	App - 8	60000.63	1980.63	-
Operating costs (Fishing fleet + Harbour Management and Maintenance)	App - 9	-	42220.89	42220.89
Balance to be discounted for the Calculation of Financial Internal Rate of Return	-	-60000.63	3419.64	5400.26

Note : The above statement represents the 'Basic statement' for the purpose of financial evaluation

The Financial Internal Rate of Return (FIRR) on this statement works out to 2 - 3 %

Chapter 5

Surveys and Studies

5.1 General

Navabandar is a small village in Una taluk of Junagadh district, located at 9 km from Una. The village is well connected with good road network. The main connectivity to NH 8E is through road via Una. Nearest railway station is at Veraval, domestic airport is at Diu and International airport is Ahmedabad.

5.2 Location

Navabandar is a fish landing centre for small vessels on the west coast of India corresponds to latitude $20^{\circ} 45' N$ and longitude $71^{\circ} 05' E$ (**Fig. 1**).



Fig. 1: Location of existing fish landing centre

5.3 Surveys and Investigations

5.3.1 Project Datum

The survey datum used for topographic survey, hydrographic survey and sub-soil investigations for the project refers to a Survey of India benchmark whose description is as below as per the Coastal Benchmarks, India.

“BOM cut on SE corner of the step in front of the entrance to Kazi Mohamad Pir situated above Shanker Deo’s Cave at Navabandar”. The value of the benchmark is 22.40 feet viz. 6.8275 m above Chart Datum.

Photographs **1 & 2** of **Annexure 1** to this Chapter shows the benchmark location.

5.3.2 Topographic Survey

Topographic survey of the project site was conducted from 1st to 2nd November 2011 by M/s. Techno Engineering Consultancy & Allied Services, Bhavnagar. The topographic survey was carried out in 8.12 Ha area at the existing fish landing centre, where the fishery harbour is proposed to determine ground levels and existing features (**Fig. 2**). Contours have been plotted at 0.50 m interval. For the convenience of topographic survey, two temporary benchmarks (TBMs) were established in the project area. Their location and values are as below:

TBM	Easting (m)	Northing (m)	Value in m above CD	Remarks
TBM-1	715773.56	2295119.06	4.177	Near to boat parking area (water tank)
TBM-2	715828.31	2295055.87	4.157	Near to temple on opposite side of boat parking area



Fig. 2: Topographic survey area at the site

Drawing showing the existing features of topographic survey is provided at **Chart no. 1 in Annexure 1.**

5.3.3 Hydrographic Survey

Hydrographic survey of the project site was conducted from 28th – 29th April 2012 by M/s. EGS Survey Pvt. Ltd., Mumbai. This hydrographic survey was carried out for an area 630 m x 210 m (**Fig. 3**) and plotted with a scale of 1:1000.

The seabed within the surveyed area is gently dipping eastwards, with small local undulations. The contours generally trend north-south direction with an increase in depth towards north-eastern and south-eastern boundaries. Western boundary of the area could not be accessed by the survey boat due to insufficient depth. The survey indicates the seabed is generally rocky, with little or no sedimentary cover.

Photographs 3 & 4 of **Annexure 1** to this Chapter shows the survey vessel used for hydrographic survey and setup of data acquisition instruments in the boat respectively. Drawing showing the existing features of topographic survey is provided at **Chart no. 2**.



Fig. 3:Hydrographic survey area at the site

5.3.4 Sub-Soil Investigations

The Geo-technical investigation was conducted by M/s. M.K. Soil testing Laboratory, Ahmedabad during December 2012. Four boreholes (two boreholes conducted on land and two boreholes in water) were conducted. The coordinates of these boreholes are given below along with their termination depths.

Sl. No.	Borehole No.	Easting	Northing
1.	BH-1 (on land)	2295040	716437
2.	BH-2 (on land)	2294910	716541
3.	BH-3 (in water)	2295190.27	716797.46
4.	BH-4 (in water)	2295154.15	717025.39

The location plan of these boreholes is presented at **Fig. 4** below.

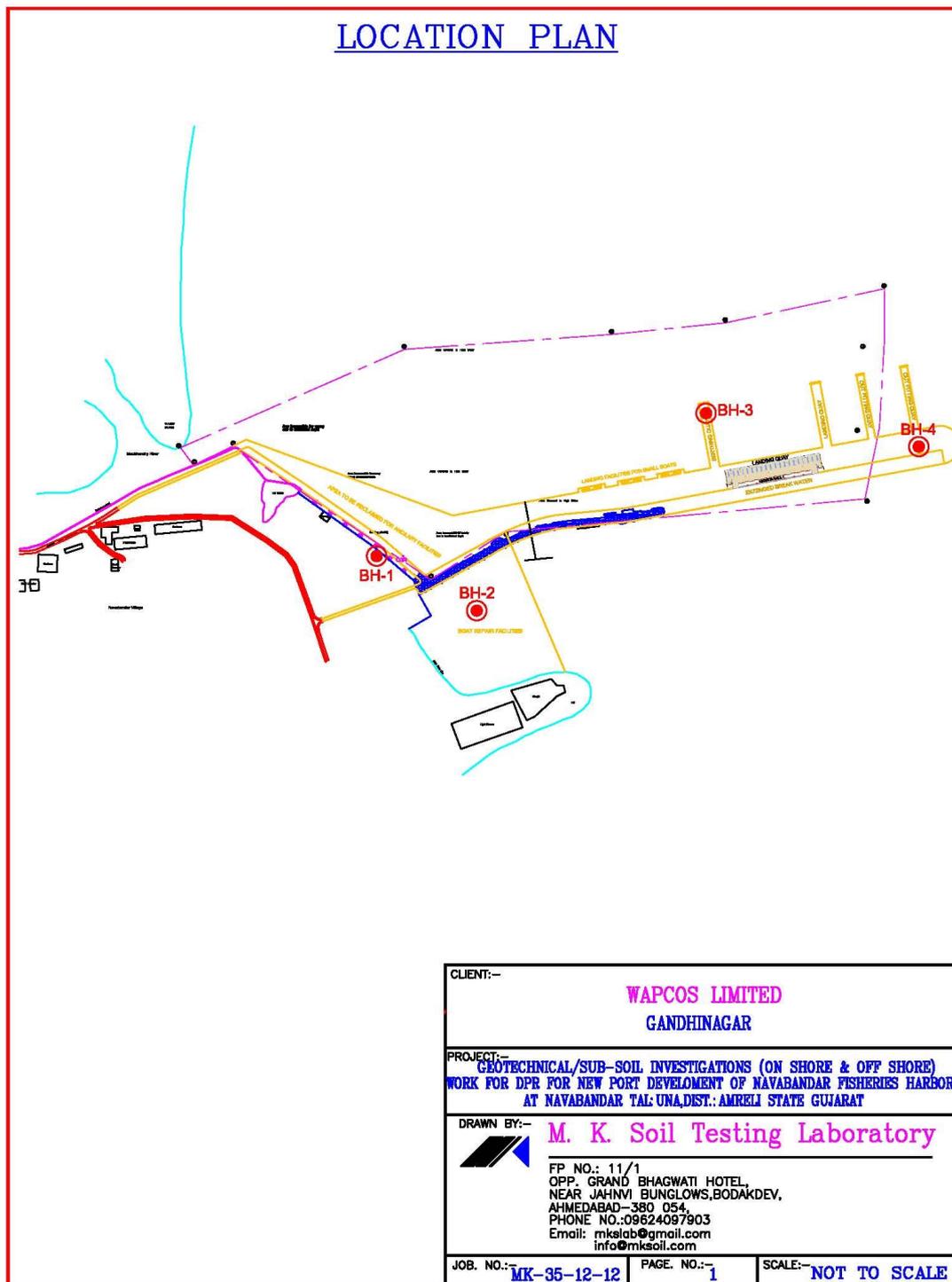


Fig. 4: Location plan of boreholes at project site

5.3.4.1 Method of Sub-Soil investigations

The two land boreholes having 100 mm diameter were drilled with rotary drilling method up to 10 m depth below the existing ground level (EGL). Remaining two water boreholes were drilled up to 20/10 m depth below EGL.

Undisturbed soil samples could not be collected in thin walled sampling tubes due to sandy or rocky strata. However, disturbed soil samples were collected during drilling for finding index properties of the soil. The samples from split spoon sampler

tubes were treated as disturbed soil samples. The Standard Penetration Test (SPT) were performed in accordance with IS 2131:1981. The soil stratification in the boreholes are as below:

Soil Stratification of borehole

Borehole No	Depth (m)	Stratification	Observed SPT value
BH-1	0.00-3.50	Filled up soil	26-51
	3.50-6.00	Yellowish completely weathered calcareous sand stone obtained in the form of gravel & boulder form.	Refusal
	6.00-10.0	Yellow coloured calcareous sand stone in highly weathered very poor condition. CR = 12% to 26%, RQD = Nil to 10%	-
BH-2	0.00-1.50	Yellowish brown non plastic silty sand (SM)	52
	1.50-7.50	Yellowish calcareous sand stone in highly weathered very poor condition. CR = 16% to 42%, RQD = Nil to 14%	-
	7.50-10.0	Yellowish calcareous sand stone in moderately weathered poor condition. CR = 50% to 54%, RQD = Nil to 10%	-
BH-3	0.00-3.0	Completely weathered rock calcareous & sand stone. CR = 10% to 13% and RQD = Nil	-
	3.00-16.50	Reddish to yellowish highly weathered very poor calcareous sand stone. CR = 13% to 41%, RQD = Nil	-
	16.50-20.00	Yellowish brown moderately weathered very poor calcareous sand stone CR = 57% to 70%, RQD = Nil to 12%	-
BH-4	0.0-10.0	Reddish brown to yellowish brown highly weathered very poor calcareous sand stone CR = 16% to 28%, RQD = Nil to 12%	-

The chemical analysis of water sample collected at boreholes 1 & 2 and properties of rock samples collected at the boreholes are shown in the following tables.

Chemical Analysis of Water sample

Borehole No	pH	Chloride (mg/l)	Sulphate (mg/l)	TDS (mg/l)
BH-1	7.38	14905	2270	29687
BH-2	7.15	15086	2295	29873

Borelogs of all the boreholes are presented from **Fig.5 to 8** and results of the grain size analysis of soil samples is presented at **Fig. 9 of Annexure 1**.

Properties of Rock Sample

BH. No.	Depth (m.)	Rock Unit Wt. (g/Cc)	W.A. (%)	Porosity	Compressive Strength	
					Dry (kg/cm ²)	Saturated (kg/cm ²)
BH-1	9.00	2.18	3.96	8.61	-	21.10
	10.00	2.57	-	-	42.20	-
BH-2	3.00	1.42	5.10	7.24	-	12.10
	4.50	1.82	-	-	15.10	-
	6.00	1.88	-	-	10.6	-
	10.00	1.94	3.93	7.63	-	10.4
BH-3	9.00	1.67	5.57	9.25	-	15.10
	12.00	2.05	-	-	110.90	-
	16.50	1.98	3.77	7.47	-	23.03
	20.00	2.11	-	-	129.60	-
BH-4	4.50	1.42	-	-	10.50	-
	9.00	1.71	5.04	8.61	-	27.18
	10.00	2.10	-	-	147.70	-

5.3.5 Summary of Sub-Soil Investigations

- Soil generally consists of medium dense silty sand/filled-up soil followed by completely highly weathered calcareous sandstone up to 10 m termination depth below existing ground level at BH-1&2 locations. Highly weathered very poor calcareous sandstone up to 10/20 m termination depth at BH-3&4.
- Net safe bearing capacity for open foundation at BH-1&2 was recommended as 30 t/sqm.
- Alternatively cast-in-situ socketed uniform concrete pile of diameter 600 to 900 mm was recommended.

5.4 Meteorological Data**5.4.1 Tidal Data**

The tide levels with respect to port chart datum is as below.

Mean Low Water Neaps (MLWN)	+ 0.80 m
Mean Low Water Springs (MLWS)	+ 1.50 m
Mean Sea Level (MSL)	+ 1.70 m
Mean High Water Neaps (MHWN)	+ 2.00 m
Mean High Water Springs (MHWS)	+ 2.40 m

Tidal data was observed at the site at the fishing wharf for one lunar cycle from 27th April 2012 to 26th May 2012 (**Fig. 10**).

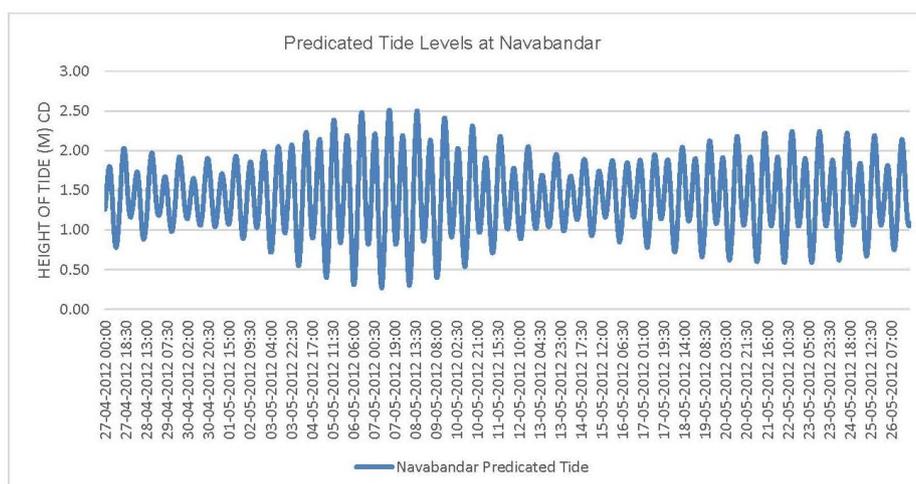


Fig. 10: Predicted tide levels at Navabandar

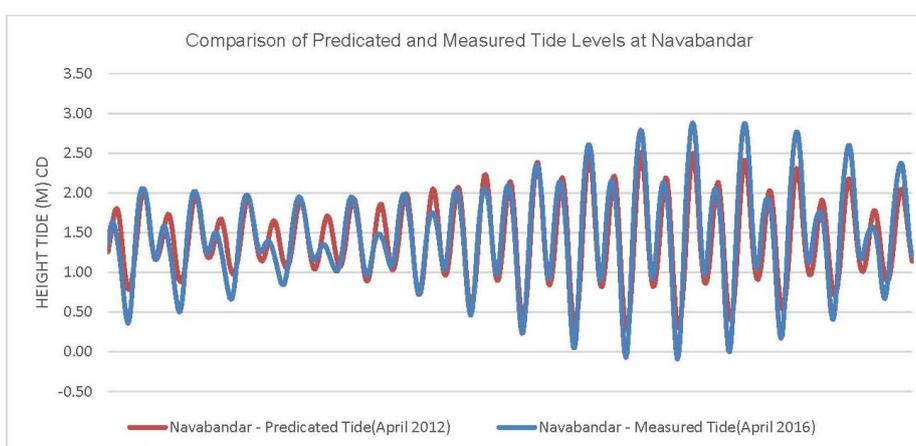


Fig. 11: Comparison of predicted and measured tide levels at Navabandar

Fig. 11 shows comparison of predicted tide levels and measured tide levels at fishing wharf at Navabandar, which are almost matching.

5.4.2 Waves

Due to the open sea at south of the Navabandar, the waves are very critical at the outer portion of the Navabandar during monsoon period. Wave height during the non-monsoon period between October and May sea is relatively calm although there can be some strong winds to generate waves from the north-east particularly during February and March. To achieve tranquillity in the harbour basin, breakwaters are proposed on the east and west sides.

5.4.3 Currents

The effect of the current in the Navabandar region is significant. However, the harbour is proposed with two breakwaters, which ensures no adverse effect of currents.

5.4.4 Temperature and Relative Humidity

The average temperatures for period of year of this location have been shown in the figure below.

Parameter	Jan.	Feb.	Mar.	Apr.	May	Jun	Jul	Aug.	Sep.	Oct.	Nov.	Dec.	Avg
Temp. Mean Value	21.5	22.3	24.9	27.0	28.6	29.5	28.4	27.4	27.6	27.9	26.2	23.2	26.2 1
High Temp. Mean Value	28.7	29.4	31.3	31.8	32.0	32.0	30.5	29.5	30.8	33.5	33.0	30.4	31.0 7
Low Temp. Mean Value	14.2	15.2	18.4	22.1	25.2	26.9	26.2	25.2	24.3	22.3	19.3	16.0	21.2 8
Relative Humidity Mean Value	58	66	71.0	79.0	82.0	84.0	87.0	87.0	85.0	75.0	62.0	59.0	74.5 8

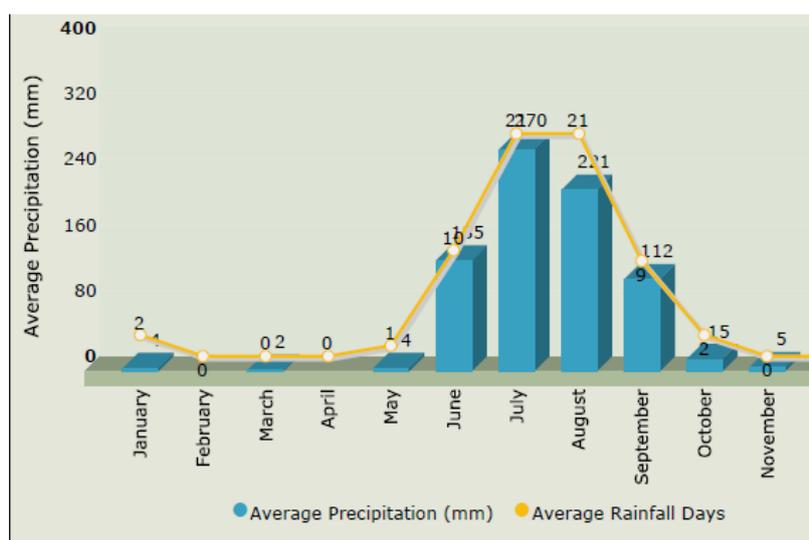
5.4.5 Wind data

Statistics based on observations taken between Oct.2009 to June 2011 daily from 7am to 7 pm local time.

Parameter	Jan.	Feb.	Mar.	Apr.	May	Jun	Jul	Aug.	Sep.	Oct.	Nov.	Dec.	Avg.
Wind probability > = 4 Beaufort (%)	6	12	17	17	27	55	78	41	24	13	5	7	25
Average Wind Speed (Knots)	5	7	7	7	8	11	14	10	7	6	6	6	7

5.4.6 Rainfall

The monsoon period in Navabandar region is mid of May to mid of September. Annual rainfall is concentrated with much of it falling during the monsoon period. Average monthly rainfall and occurrence of rainy days is given in below Figure.



5.5 Hydraulic Model Studies

Mathematical model studies for finalising the alignment of breakwaters and wave flume studies for finalising the cross-sections of breakwaters are being carried out at Central Water & Power Research Station (CWPRS), Pune.

Annexure -1



Photo 1: Location of benchmark at Kazi Mohamud Pir Dargah, Navabandar



Photo 2: Location of Survey of India benchmark on top step of Dargah.

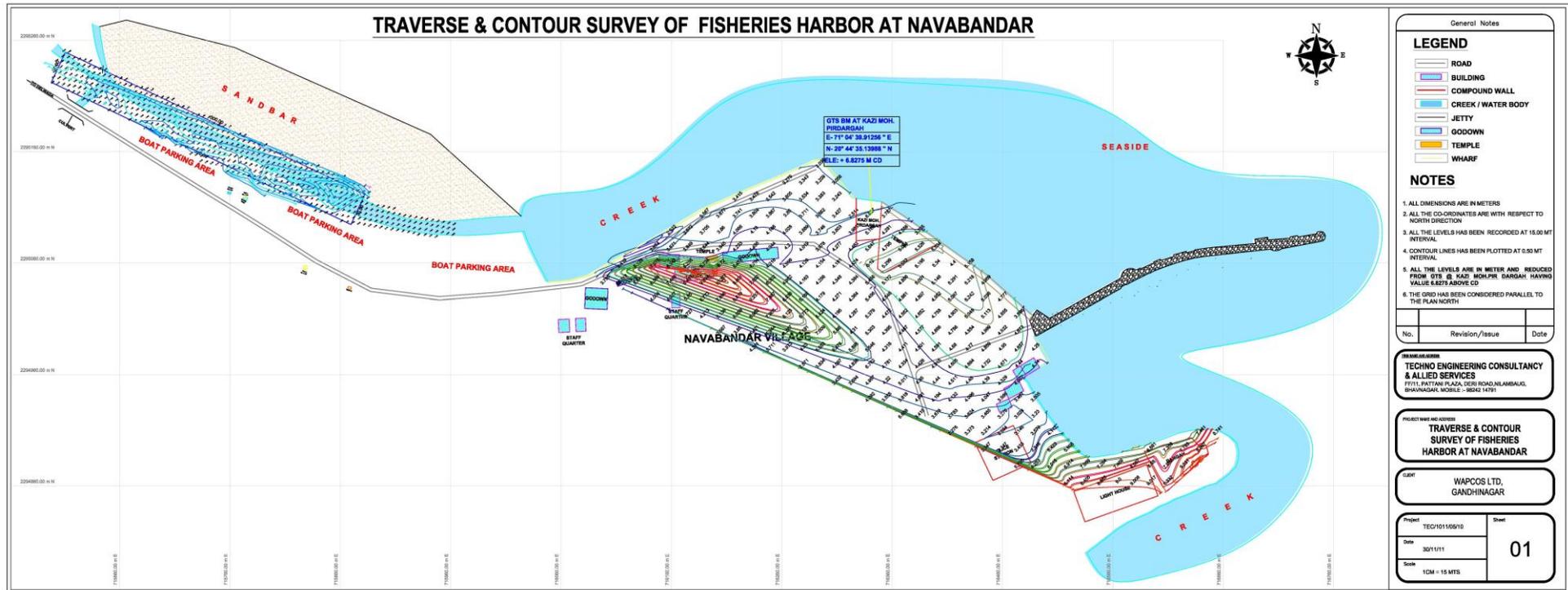


Chart no.1: Topographic survey



Photo 3: MFB Sai Shradha conducting hydrographic survey at project area



Photo 4: Set-up of data acquisition instruments in the survey boat

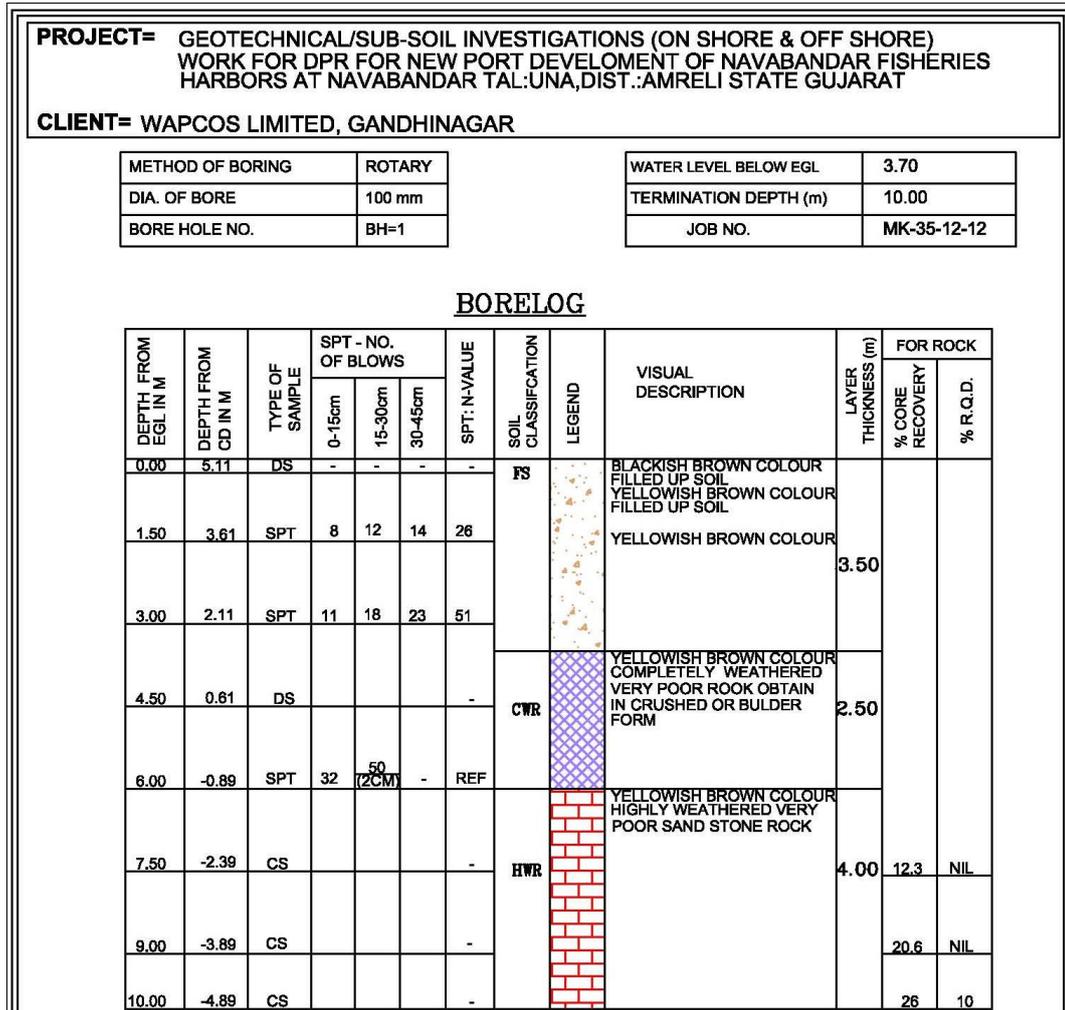


Fig. 5: Bore log for borehole – 1

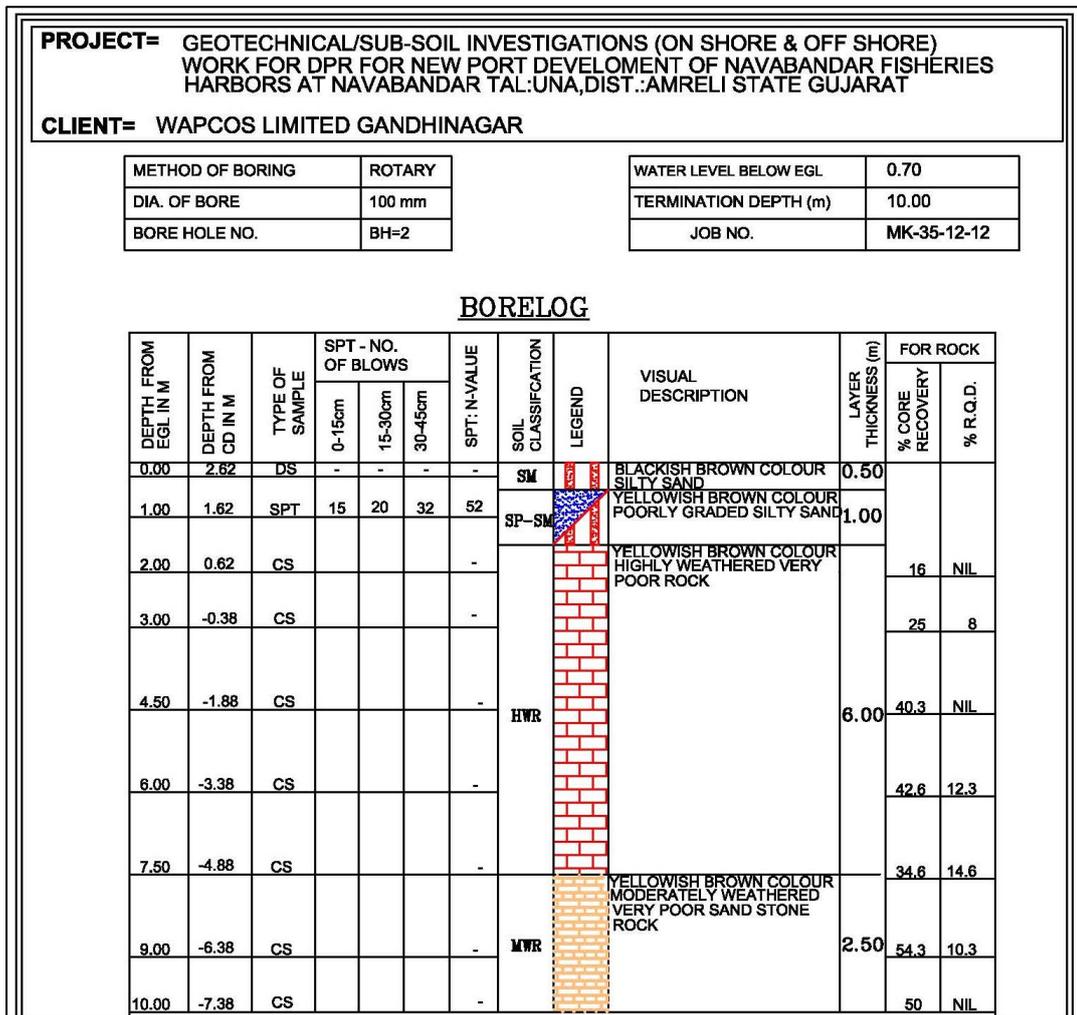


Fig. 6: Bore log for borehole – 2

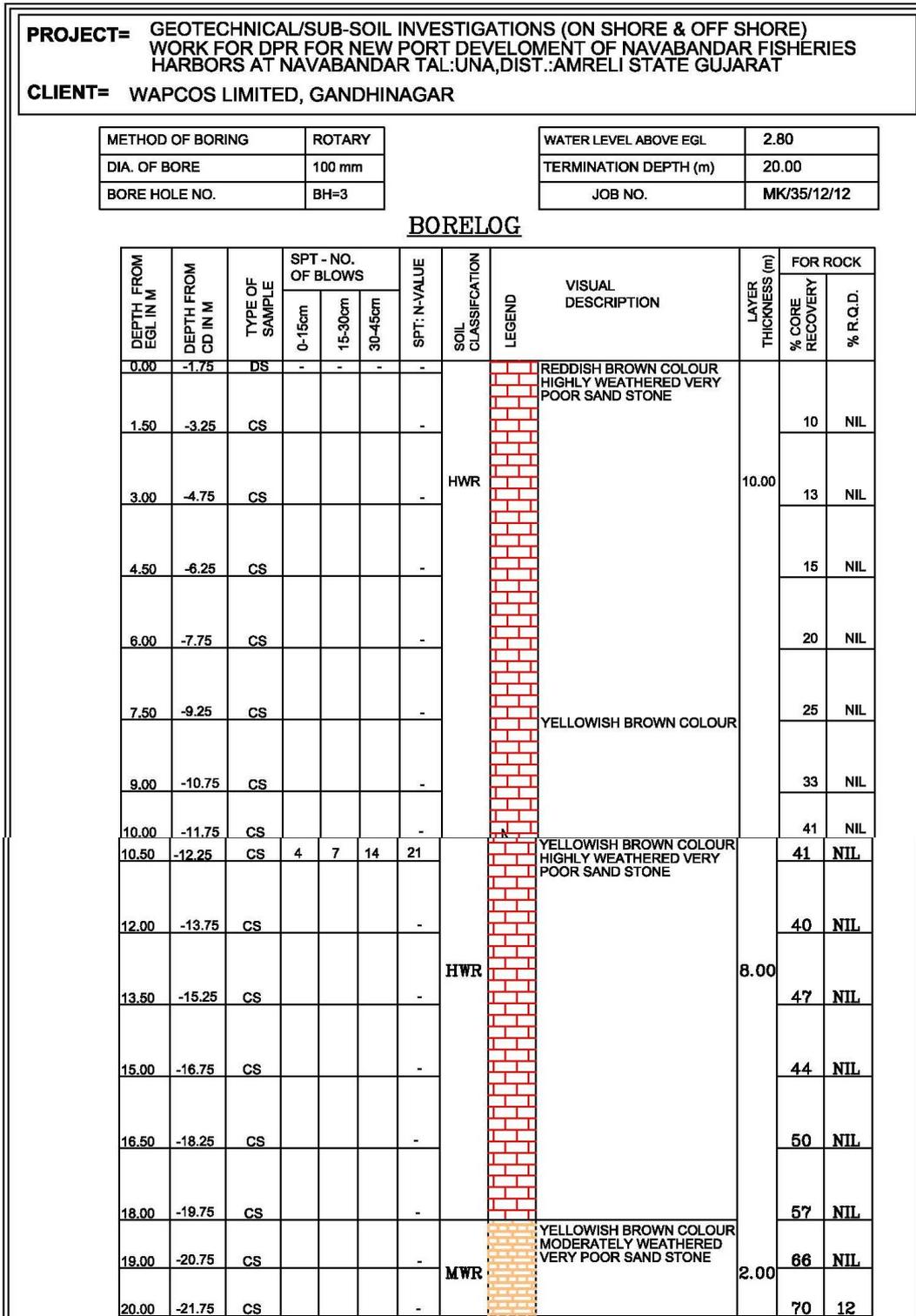


Fig. 7: Bore log for borehole – 3

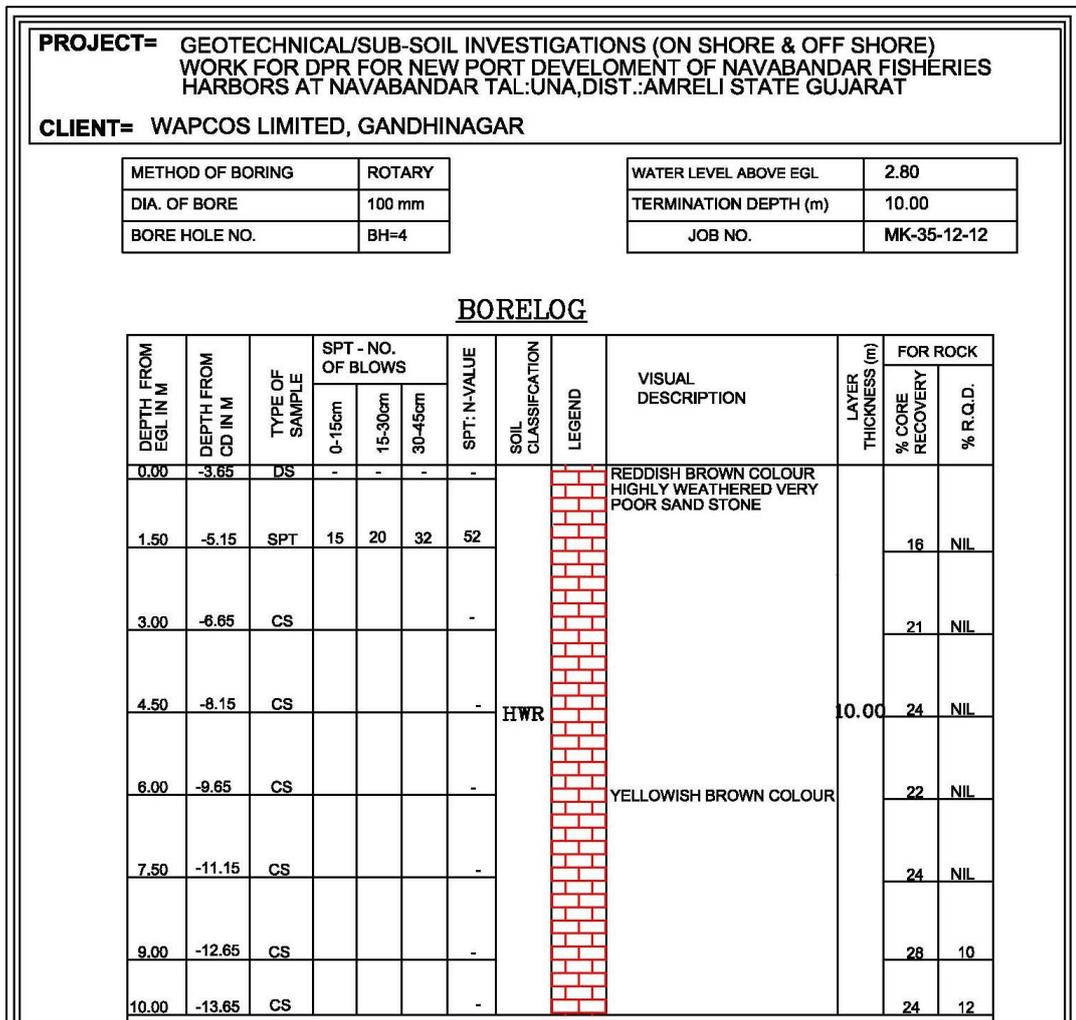


Fig. 8: Bore log for borehole – 4

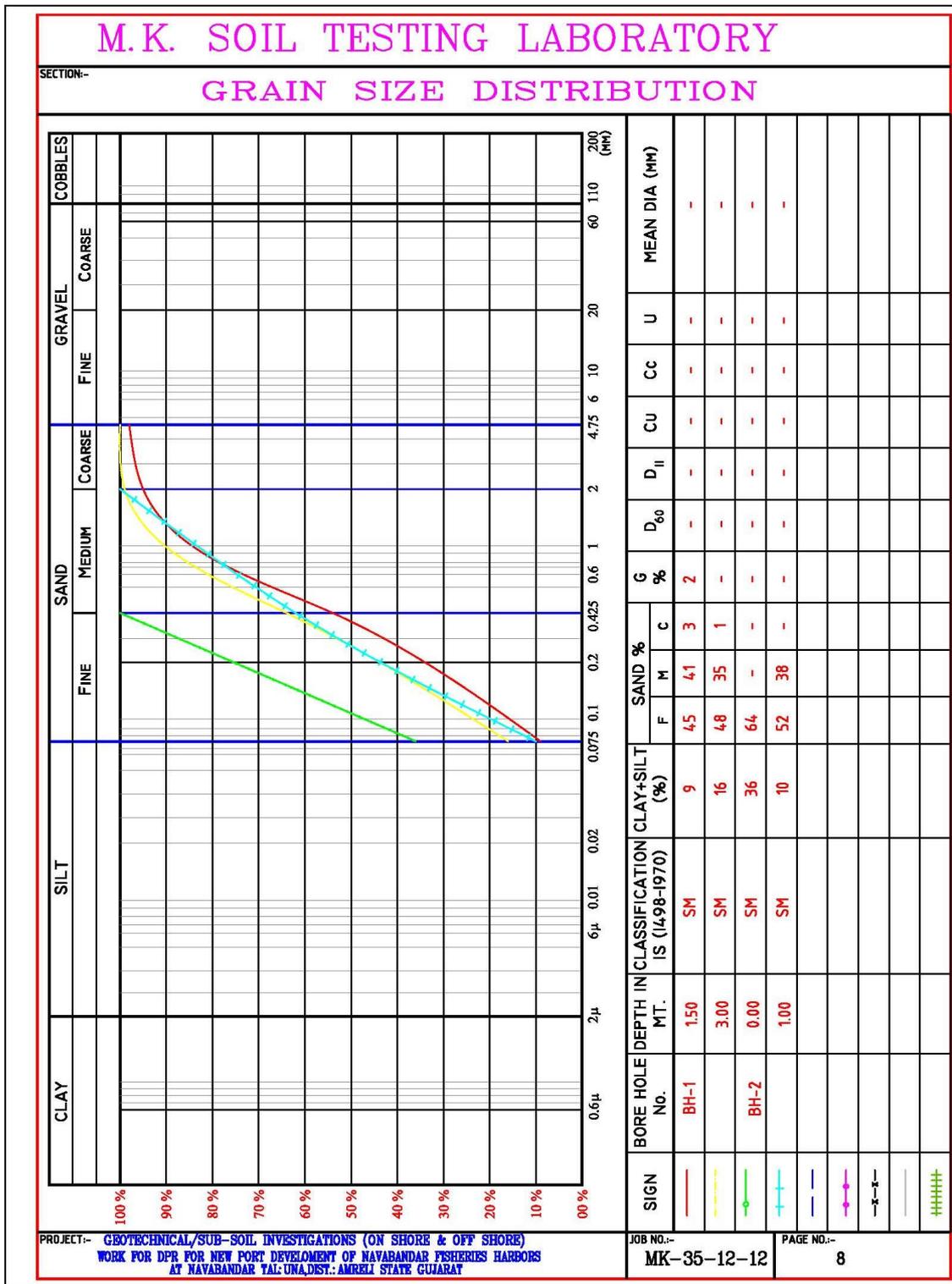


Fig. 9: Results of grain size analysis of soil samples

Chapter – 6

Design of Fishery Harbour

6.1 Existing Facility

Gujarat Maritime Board has constructed the Navabandar fish landing facility long back. Salinity ingress bund was also constructed in north-west side to prevent entry of tidal water to the landing facility for safe fish landing. Further, in the past, Maharaja Sayajirao Gaekwad has constructed the existing solid vertical jetty (breakwater), which is about 282 m long. The fishery centre also consists of an old wharf of about 261 m length. Fishermen are utilising the existing breakwater for landing and outfitting, in the absence of other landing facilities.

Even though, the fishery centre is protected from direct attack of rough sea waves naturally due to its headland from south-west direction, due to the deposition of silt with the ingress bund, bigger boats were to wait for tide to use the facility; which caused diminishing of trawler numbers at this landing centre.

6.2 Fishing Fleet

For the present proposal of development of fishery harbour at Navabandar, it is anticipated that trawlers would come and operate, once full-fledged all weather fishery harbour is developed. Considering the scenario by the year 2020, the fishery harbour is designed for the following fleet size:

OAL of fishing vessels	No. of Vessels
Trawler 18 m	200
Gill netter 14.6 m	580
IBM/OBM 10 m	220
Total	1000

6.3 Fishing Vessel Characteristics

The vessel characteristics of the fishing vessels proposed for Navabandar fishery harbour are given below.

Table 6-1 Vessel Characteristics

Parameters of the vessels	IBM/OBM	Gill Netter	Trawler
LOA	10 m	14.6 m	18.0 m
Beam	2.5 m	3.5 m	4.7 m
Loaded draft	1.2 m	1.8 m	2 m

The quantum of yearly fish landings, fishing trips and their duration estimated for the design fleet size of the fishery harbour project are given below.

Table 6-2 Design Data of Fish landings

Overall length of vessel (average)	No. of vessels	Average landing per boat (kg) per trip	No. of days in fishing season	No. of fishing days	Rest days	Duration of each trip (days)	No. of fishing trips	Boat crew
10 m	220	120	270	200	70	1	200	4
14.6 m Gill netters	580	2,500	300	240	60	9	26	7
18.0 m Trawlers	200	2,500	300	240	60	9	26	7

6.4 Harbour Planning

The following facilities are proposed in the fishery harbour.

i) RCC diaphragm wall	-	645.6 m
ii) RCC jetties (3 nos. each 130 m)	-	390 m
iii) Breakwaters	-	2,028 m
iv) Dredging of harbour basin	-	-2.5 m level
v) Fish auction hall	-	3 nos.
vi) Fishery Administration office	-	1 no.
vii) Fishing gear shed	-	4 nos.
viii) Net mending shed	-	2 nos.
ix) Fishermen rest shed	-	2 nos.
x) Boat repair shop	-	1 no.
xi) Restaurant	-	1no.
xii) Fish merchants dormitory	-	1 no.
xiii) Public toilet	-	2 nos.
xiv) Area for beach landing	-	60 m
xv) Asphalt roads	-	2,298 m
xvi) RC sloping hard	-	20 m wide
xvii) Radio communication centre	-	1 no.
xviii) Security/guard house with main gate	-	1 no.
xix) Area for ice plants	-	1,500 sqm
xx) Area for cold storage	-	2,700 sqm
xxi) Area for boat parking and repair	-	15,075 sqm
xxii) Area for fuel supply & storage	-	1,716 sqm
xxiii) Area for vehicle parking	-	3,958 sqm
xxiv) Area for civic amenities	-	6,094 sqm
xxv) Area for chilled storage	-	2,700 sqm
xxvi) Area for effluent treatment plant	-	778 sqm
xxvii) Area for fish processing	-	4,213 sqm
xxviii) Compound wall	-	613 m

In addition, high mast lights, electrical, fresh water supply, greenery, electrical substation, navigational aids and radio communication equipment, drainage and sewerage including bilge oil water separator etc. are also proposed.

6.5 Water side Facilities

6.5.1 Depth of Harbour Basin

The maximum draft of the fishing vessel using the harbour (18 m Trawler) is 2.0 m as given in **Table 6-1** above. Based on the PIANC guidelines, the following general recommendations on under keel clearances shall be adopted to determine the dredge depths:

- Approach Channel: less exposed to swell, gross under keel clearance should be about 10% of the draft.
- Maneuvering and berthing areas protected (full protection by breakwater): gross under keel clearance to be about 7% of the draft.

The MLWN at site is 0.80 m, the basin depth required for safe operation of vessels considering an under keel clearance of 0.34 m (17% of draft) should be 2.34 m, viz. RL -1.54 m. However, as it is seen from the geotechnical investigations that basin area completely highly weathered calcareous sandstone up to 3 m. This infers expensive rock dredging to create safe harbour basin. Further, to avoid huge quantity of rock dredging and also to create land area for housing shore based facilities, more area is proposed for land reclamation away from the shoreline as shown in the fishery harbour layout. This consequently creates more basin area keeping future expansion of harbour in view.

In view of the above and considering possible siltation and possible bigger boats operation in future, dredging up to -2.5 m level is proposed.

6.5.2 Quay Lengths Requirement

The structures proposed for the above purpose consists of block work gravity structure for quay and jetty to enable the fishing vessels to berth alongside the quay/jetty; discharge fish catch and take on fuel, ice, and fresh water, fishing gear and food provisions and berth during idle period.

Following assumptions have been made in the quay length calculations:

- 10 m vessels are of traditional/out board fitted boats, requiring beach landing facility.
- 10% of the fishing fleet may not go out for fishing due to maintenance, repair or some other reason.
- The 18 m OAL trawlers and 14.6 m OAL gill netters, which go on 9 days trip, will be equally distributed on each day with same number of departures/arrivals.
- During peak season, 40% of daily trip vessels will arrive in peak hour with 20% increase in fish catch.
- During peak season, 20% of the multiday trawlers and gill netters may arrive in a

day with 20% increase in fish catch.

- A uniform manual unloading rate of 4,500 kg/hour is assumed for all the fishing vessels.
- Permissible duration of fish landing and outfitting by trawlers and gill netters are reasonably assumed to be 6 and 8 hours respectively.
- The fish landing quay length for all the fishing vessels consists of overall length of the vessel in their category plus a free spacing of 10% of its overall length between the boats to facilitate safe maneuvering.

6.5.2.1 Beach landing length (for 10 m traditional boats)

The number of boats operating per day = $0.9 \times 220 = 198$ nos.

No. of arrivals in a day during peak hour (40%) = $198 \times 0.40 = 79.2$ say 80 nos.

Average fish landing per boat = 120kg

Peak fish landing per boat with 20% additional catch = $1.2 \times 120 = 144$ kg

Time required for beach landing and undocking = 5 min.

No. of berths required to handle 80 vessels in one hour = $(5 \times 80)/60 = 7$ nos.

Fish landing beach length required = $7 \times (10 + 1) = 77$ m

Considering two boats abreast lands at a time, landing length = $77/2 = 39$ m

6.5.2.2 Landing Quay Length for MFVs

The basic objective of landing quay is to make the fish landing operation more efficient and rational. The distance between the landing quay and the Auction hall shall be as short as possible for efficient handling of the fishing harbour. The surface of the landing quay shall be moderately smooth so that it will not be slippery when it is wet. Enough bollards/mooring rings with 10 m interval are proposed on landing quay so that boats can be quayed on it rigidly. Enough number of ladders shall be provided on the landing quay so that it permits personnel to climb up and down whenever there is low tide level. For the convenience of fish landing operation during low and high tides, differential landing with top of quay as +2.30 m as low level quay and +3.50 m as high level quay are proposed. This is demonstrated in the fishery harbour layout drawing.

The landing quay length is normally calculated on the assumption that the number of the vessel operating from the fishery harbour will be equally distributed on the each trip. Hence the landing quay can be used by more than one vessel of the same size depending upon the time it takes to unload its catch and the duration of the fish landing hours of the harbour.

As per the parameters of the vessels and assumptions made above, the calculation of the landing quay requirement is as given below:

a) 14.6 m size Gill netters - 580 numbers (9 days trip)

The number of boats operating per day = $0.9 \times 580/9 = 58$ nos.

Number of arrivals in a day during peak season = $1.2 \times 58 = 69.6$ say 70 nos.

Average fish landing per boat = 2,500 kg

Peak fish landing per boat = $1.2 \times 2,500 = 3,000$ kg

Time required for docking and undocking = $5 + 5 = 10$ min.

Time required for unloading at 4,500 kg/hour = $(3,000 \times 60)/4,500 = 40$ min.

Total time required = $10 + 40 = 50$ min.

No. of berths required to handle 70 boats in 6 hr = $70 \times 50 / (6 \times 60) = 9.72$ say 10 nos.

Length of the fish landing quay required = $10 \times (14.6 + 1.4) = 160$ m

b) 18 m size Trawler -200 numbers (9days trip)

The number of boats operating per day = $0.9 \times 200/9 = 20$ nos.

Number of arrivals in a day during peak season = $1.2 \times 20 = 24$ nos.

Average fish landing per boat = 2,500 kg

Peak fish landing per boat = $1.2 \times 2,500 = 3,000$ kg

Time required for docking and undocking = $5 + 5 = 10$ min.

Time required for unloading at 4500 kg/hour = $(3,000 \times 60)/4,500 = 40$ min.

Total time required = $10 + 40 = 50$ min.

No. of berths required to handle 24 vessels in 6 hr = $(24 \times 50) / (6 \times 60) = 3.33$
Say 3nos.

Length of the fish landing quay required = $3 \times (18 + 1.8) = 60$ m

6.5.2.3 Outfitting Quay Length for MFVs

The fishery boats will take the fuel, fresh water and ice from the outfitting quay before proceeding on a fishing trip. However, to avoid spillage of fuel and fresh water in the outfitting quay, the storage tanks are kept away from it and buried pipes or covered pipe arrangement shall be made thereby, obstruction to the fishermen movement on outfitting quay can be avoided. For safety point of view, the storage tank for the fuel shall be underground and the fresh water tanks shall be overhead with lids.

As per the parameters of the vessels and assumptions made in the fishery operation, the calculation of the outfitting quay requirement is as given below.

a) 14.6 m size Gill netters - 580 numbers (9 days trip)

No. of boats requiring outfitting in a day during peak season = $1.2(0.9 \times 580 / 9) = 70$ nos.

Time taken on an average for each boat to receive fuel, ice and water = 15 min.

No. of berths required for outfitting in 8 hours = $(70 \times 15) / (8 \times 60) = 2.18$ say 2 no.

Length of outfitting quay required = $2(14.6 + 1.4) = 32$ m

b) 18 m size Trawler - 200 numbers (9 days trip)

No. of boats requiring outfitting in a day during peak season = $1.2(0.9 \times 200 / 9) = 24$ nos.

Time taken on an average for each boat to receive fuel, ice and water = 15 min.

Number of berths required for outfitting in 8 hours = $(24 \times 15) / (8 \times 60) = 0.75$ say 1 no.

Length of outfitting quay required = $1(18 + 1.8) = 19.8$ m say 20m

6.5.2.4 Repair Quay Length for MFVs

Fishing boats need occasional repairs to their engine/machinery and other parts. Keeping this in view, repair quay of one boat length each for 18 m and 14.6 m vessels is proposed.

14.6 m size Gill netters = $1(14.6 + 1.4) = 16$ m

18 m Trawlers = $1(18 + 1.8) = 19.8$ m say 20 m

6.5.2.5 Idle-Berthing Quay Length for MFVs

After fishing trip, the fishing gear which is carried by the fishing vessel may be wet and get damaged to some extent. Also fuel and freshwater would be exhausted from the boats. The fishing vessel at the berthing quays can be moored either alongside or perpendicular to the quay.

It is assumed that five fishing vessels lie abreast at the idle-berthing to optimize the length of idle-berthing quay. Further, it is assumed that the sick fishing vessels lie in boat repair/parking yard, the idle-berthing length provided is for the active boats resting in the fishery harbour after return from their fishing trips. As per the parameters of the vessels and assumptions made in the fishery operation, the calculation of idle berthing quay requirement is as given below:

a) 14.6 m Gill netters - 580 nos.

Number of boats operating excluding the sick ones = $(0.9 \times 580)/9$ = say 58 nos.

Rest days in between trips = $60/26 = 2.3$ say 3 days

Additional Idle berths required for rest days = $3 \times 58 = 174$ nos.

Assuming that the vessels are idle-berthed five abreast = $174/5 = 34.8$ say 35nos.

Length of idle-berthing quay required = $35 (14.6 + 1.4) = 560$ m

b) 18 m trawlers - 200 nos.

Number of boats operating excluding the sick ones = $(0.9 \times 200)/9$ = say 20 nos.

Rest days in between trips = $60/26 = 2.3$ say 3 days

Additional Idle berths required for rest days = $3 \times 20 = 60$ nos.

Assuming that the vessels are idle-berthed five abreast = $60/5 = 12$ nos.

Length of idle-berthing quay required = $12 (18 + 1.8) = 237.6$ say 238 m

Total length of idle berthing required = $560 + 238 = 798$ m

The necessity for providing idle-berthing for all boats could arise on national holidays and some important festival days or during rough weather when boats will skip fishing. On such occasions, the boats not finding berth on quayside will anchor in the harbour basin or use boat parking areas.

The summary of total quay length provided for fish landing, outfitting, repair and idle-berthing of fishing vessels in the proposed fishery harbour is given in **Table 6-3** below:

Table 6-3 Quay length calculations summary

Sl. No.	Description	14.6 m Gill netters	18 m trawler	Total quay length
1.	Fish landing quay	160 m	60 m	220 m
2.	Outfitting quay	32 m	20 m	52 m
3.	Repair quay	16 m	20 m	36 m
4.	Idle berthing quay	560 m	238 m	798 m
Total				1,106 m

Apart from this, beach landing facility for a length of 60 m is proposed for fish landing from 10 m OAL OBM boats.

6.5.3 Crest Level of Quays

The criteria for fixing of the top level of the fish landing quay is that it should facilitate easy unloading of fish by manual labour during mean high water of springs and mean low waters of springs. Keeping this in view, the crest level of the fish landing and other quays are proposed at R.L.+3.50 m. For the convenience of fish landing during low tides, a low level quay with crest level at R.L. +2.3 m is proposed as explained at paragraph 6.5.2.2.

6.5.4 Quay Structure

Basically choosing the type of structure and their structural design depends on the type of substrata met at site. Considering the results of subsoil investigation conducted at site, solid gravity structure in the form of precast RCC block work for the alongside quay and jetty is proposed. The following loadings/load combinations have been assumed for the structural design of the quay structure. The grade of concrete to be used for RCC Block work quay/jetty structure is M30.

Live Loads:

Vertical : i) Horizontal pressure due to surcharge of $1t/m^2$
ii) Line load of 5t acting at 5 m from the face of the wall and

Horizontal : i) Mooring pull of $1t/m$ perpendicular to the quay face.
ii) Active and passive earth pressures on the wall
iii) Horizontal pressure due to tidal lag

6.5.5 Breakwaters

As the proposed fishery harbour is situated in open sea, the harbour basin needs shelter from the brunt of sea waves. For protection of the port from the natural wave action, the basin is proposed to be engulfed with breakwaters to achieve desired tranquillity. The alignment and orientation of the proposed breakwaters shall be determined by following factors.

- Bottom depth contours
- Approach channel width
- Navigational aspects
- Wave and current climate
- Sediment transport
- Provision of sufficient harbour space within the port
- Operability in channel

As such two arms of breakwater viz. eastern and western arms are proposed to create tranquillity condition as below.

Type of Breakwater	Length (m)
Eastern	1052
Western	976

Mathematical model studies for finalising the alignment and wave flume studies for finalising the cross-sections of breakwaters have been carried out at Central Water & Power Research Station (CWPRS), Pune.

6.5.6 Navigational Aids

In order that the fishing boats do not face inconvenience in using the fishery harbour facilities such as harbour entrance channel, basin and different harbour facilities like quays should be visually and/or electronically identifiable by the fishing boats during day and night times. For this purpose, the navigation aids should include tall beacons, coloured / lighted buoys, markers, navigation lights etc. Among all these navigation aids, buoys have their own special 'significance and application. Therefore, it is important that the fishermen should be in a position to identify the colour and shapes of buoys and their precise meaning in the context of safe marine - traffic regulations. As such, it is proposed to develop breakwater light, navigation buoy, navigation light etc. for safe navigation of boats. Lump sum provision is made in the abstract estimate for this purpose.

6.5.7 Dredging

As discussed in the earlier paragraph **6.5.1**, the dredged level proposed is -2.50 m and hence, as per the bathymetric data, the dredging quantity works out to 18,500 cum.

6.5.8 Revetment

Stone revetment is proposed all around the reclaimed area to keep the reclamation intact. Stones weighing up to 40 kg are provided on 1V:1.5H slope in the armour course over a core layer of stones up to 10 kg. A geo-textile filter of suitable specification is suggested below the core layer of slope to check the leakage and stability. The cross section of the stone revetment is shown in **Drawing**.

6.5.9 RC Sloping Hard

An RC sloping hard of 20 m wide is proposed to haul up small vessels requiring necessary repairs near the beach landing portion. The slope of ramp is 1V:10H. Sufficient space is provided behind the sloping hard for boat parking and repair of vessels. The cross section of the RC sloping hard/ramp is shown in **Drawing**.

6.6 Shore Side Facilities

Following are the different land side facilities proposed in Navabandar Fishing Harbour.

6.6.1 Land Reclamation

The ground level at proposed fishery harbour site is proposed to be reclaimed to +3.50 m level near the quay allowing a longitudinal slope of 1:200.

6.6.2 Fish Auction Hall

Fish auction halls are the sheltered sheds, covered from all the sides for the auctioning of the fresh fish. Various fish handling operations done in the auction hall are

- Sorting of fish
- Weighing of fish
- Auctioning of fish
- Icing process
- Packing of the fish
- loading of the packed fish to the transport vehicles

Generally covered auction hall is preferred due to following reasons:

- Quality of fish can deteriorate due to heat
- Melting of ice can easily take place and hence fish can be deteriorate
- Dirt and insects can stick to fish
- Birds and animals can make the environment grubby

Hence the covered auction halls are meant to the benefit of the fishermen, processor, exporter and wholesaler in processing the quality of fish and fetching the better price of the fish from the market.

It is preferable to that the fish auctioning and clearance shall take place before the next batch of fish landing boats starts arrive at the landing quays. Hence the total length of the auction hall shall be approximately equal to the length of the landing quay.

Normally, the fish are kept in display in the 25 kg to 50 kg boxes in rows in the display area of the fish auction hall over the raised floor with sufficient walking place all around so that the bidder can take good look at the displayed fish without stamping or spoiling it.

The fish auction hall width shall be sufficient enough to handle the other activities and the crowd of the people. Sometimes it is desirable to have cabins for the benefit of wholesaler and retailer to have their offices and stores for the fish boxes such as refrigerators, storage room and chilled rooms for short term fish storage activities.

The following specification of the Auction hall is desirable.

- RCC frame structure with slab.
- Steel shed at back side for fish loading area
- Design of building as per coastal environment and seismic zone as suggested by Indian Standard code of practice
- Closed structure on all four sides
- Inside smooth finish cement plaster
- Outside double coat sand face plaster
- Proper flooring which facilitates non-slippery, easily cleanable with proper drainage
- Pressure cleaning system and Hose pipe outlet at every bay
- Glazed tile cladding up to lintel level
- Concealed wiring

- Aluminium section window
- Flush door with wooden frame
- Facility of syntax water tank above slab

Two fish auction halls are proposed for MFVs and one for traditional boats separately. Based on the specifications and the assumptions made in the vessel size and fishery operation, the calculation for the requirement of the size of the Auction Hall is as given below.

Fish auction hall for– MFVs

a) 14.6 m size Gill netters - 580 numbers (9 days trip)

The number of boats operating per day = $0.9 \times 580/9 = 58$ nos.

Number of arrivals in a day during peak season = $1.2 \times 58 = 69.4$ say 70 nos.

No. of arrivals in an hour during fish landing hours = $70/6 = 11.66$ say 12

Average fish landing per boat = 2,500 kg

Peak fish landing per boat = $1.2 \times 2,500 = 3,000$ kg

Total landing from 12 boats = $12 \times 3,000 = 36,000$ kg = 36 t

b) 18 m size Trawler - 200 numbers (9 days trip)

The number of boats operating per day = $0.9 \times 200/9 = 20$ nos.

Number of arrivals in a day during peak season = $1.2 \times 20 = 24$ nos.

No. of arrivals in an hour during fish landing hours = $24/6 = 4$

Average fish landing per boat = 2,500 kg

Peak fish landing per boat = $1.2 \times 2,500 = 3,000$ kg

Total landing from 4 boats = $4 \times 3,000 = 12,000$ kg = 12 t

Total landings = $36 + 12 = 48$ t

It is assumed that 55% of the fresh fish landed at the harbour is likely to be taken into the fish handling auction hall and remaining 45% will be trash fish meant for fish drying fish meal etc.

Total fish coming into the auction hall = $48 \times 0.55 = 26.4$ tonne/hour

Since, the fish auctioning process for each batch may take about 1.5 to 2 hours, fish catch landed during 2 hours is $26.4 \times 2 = 52.8$ tonne is considered for the computation of the plinth area of fish auction hall.

The size of each fish box is 0.60 m x 0.40 m x 0.30 m. Each fish display area of 4.6 m x 2.6 m will hold at least 2.6 tonne of fish when arranged in 13 rows and 4 columns of fish boxes in two levels with a weight of each fish box taken as 25 kg

$$\text{Number of bays required} = 52.8/2.6 = 20.3 \text{ bays}$$

Hence it is proposed to provide two auction halls of eleven bays each for MFVs. The proposed area of each auction hall is 1,273.41 sqm.

Fish auction hall for beach landing boats – 10 m boats daily trip – 220 nos.

10 m vessels of daily trip with average fish landing of 120 kg = 220 nos.

The number of boats operating in a day = $0.9 \times 220 = 198$ nos.

Number of arrivals in a day during peak hour = $0.4 \times 198 = 79.2$ say 79 nos.

Average fish landing per boat = 120 kg

Peak fish landing per boat = $1.2 \times 120 = 144$ kg

Total fish landing from 80 boats = $79 \times 144 = 11,376$ kg = 11.4 t

It is assumed that 50 % of the fresh fish landed at the harbour is likely to be taken into the fish handling auction hall and remaining 50% will be trash fish meant for fish drying, fish meal etc.

$$\text{Total fish coming into the auction hall would be } 11.4 \times 0.5 = 5.7 \text{ tonne/hour}$$

Since, the fish auctioning process for each batch may take about 1.5 to 2 hours, fish catch landed during 2 hours will be $5.7 \times 2 = 11.4$ tonne is considered for computation of the plinth area of fish auction hall. The size of each fish box is 0.60 m x 0.40 m x 0.30 m.

Each fish display area of 4.6 m x 2.6 m will hold at least 2.2 tonne of fish when arranged in 11 rows and 4 columns of fish boxes in two levels with a weight of each fish box taken as 25 kg

$$\text{Number of bays required} = 11.4/2.2 = 5.18 \text{ say 5 bays}$$

Hence it is proposed to provide one auction hall of four bays for traditional boats. The area of proposed auction hall is 258.1 sqm.

6.6.3 Fish Loading Area

As per the HACCP/MPEDA norms, the fish should not be directly exposed to the sun. Hence, behind the proposed fish handling and auction halls, fish loading area with sunshades are proposed to avoid the fish boxes/packages getting exposed to direct sunlight while loading into trucks. The fish loading area is of concrete surface for the entire length of fish handling and auction hall to withstand the vehicle loads and spillage of water. About 1,723 sqm of fish loading area behind the fish auction halls is proposed

to be concrete surfaced. The formation layers of concrete surface are shown in **Drawing**.

6.6.4 Vehicle Parking Areas

There will be many fish traders and consumers visiting the fishery harbour on their vehicles like trucks, vans, cars, auto rickshaws, scooters, bi-cycles, tri-cycles etc., for collecting and transporting fish and fish products to nearby fish markets. In addition, there will be vehicles connected with the fishery industry bringing ice and other commodities. Therefore, concrete surface vehicle parking area is proposed behind the proposed fish handling and auction halls. The total area earmarked for vehicle parking is of 3,958 sqm. Cross section of concrete surface is shown in **Drawing**.

6.6.5 Fresh Water Supply and Distribution System

Fresh water supply during the operation of fishery harbour must be adequate to meet the requirements of fishing vessels to carry out their fishing trips, for manufacture of ice, industrial and drinking purposes. The water used by vessels, fish industries, domestic purposes and ice making must be potable. Daily freshwater requirement for the fishery harbour is computed as below:

- A. For Fishing vessels
- a) 10 m vessels conducting 1 day fishing trip at 100 litres/boat/day
= 220 x 100 = 22,000 litres
 - b) 14.6 m gill netters conducting 9 days trip at 200 litres/boat/day
= 580 x 9 x 200 = 10,44,000litres
 - c) 18 m trawlers conducting 9 days fishing trip at 200 litres /boat/day
= 200 x 9 x 200 = 3,60,000litres
- Subtotal = 22,000 + 10,44,000 + 3,60,000 = 14,26,000 litres

- B. For ice plant (20 tonne ice capacity/day)

Considering 2 days reserve ice capacity, requirement is 20,000 litres x 2 days = 40,000 litres

- C. For fishermen and fishery industry people working within the fishery harbour complex = 1,500 Nos. x 50litres/day = 75,000 litres

Total daily fresh water requirement (A+B+C) = (14,26,000 + 40,000 +75,000)
= 15,41,000 litres

However, it is proposed to provide an OHT with capacity of 4,50,000 litres with a ground level sump of 1,00,000litres capacity with a pumping station and freshwater distribution system. The fresh water over head tank, sump and pump house are proposed to be located in a central area close to landing module viz. fish handling and auction hall and outfitting module such that freshwater can be distributed to outfitting quay and other buildings.

Freshwater would be pumped 2 to 3 times daily from the ground water sump and stored in the freshwater overhead tank. Uninterrupted power supply to pump freshwater

from the sumps is ensured through electric power, failing which diesel genset would supply the required power at any time.

6.6.6 Fuel Supply and Storage

Fuel outlets are proposed on the outfitting quay for the convenience of fishermen. A plot of about 1,716 sqm is reserved just behind the outfitting quay for fuel storage which can be entrusted to private entrepreneurs for running and maintenance.

6.6.7 Approach Road and Internal Roads

The fishery harbour is proposed to be connected with good approach road of about 100 m. Similarly, the fishery harbour is proposed with network of 10 m and 18 m wide internal asphalt roads of 2,298 m length. The road sections with the formation layers are shown in **Drawing**.

6.6.8 Fishermen Gear Sheds

Between the rest days of the fishing voyages and during non-fishing season, some fishing vessel operators for security reasons prefer to keep their fishing gears in the fishermen gear sheds instead of keeping them in the fishing vessels. As such, fishermen gear storage cabins with locking arrangements are required to be provided in a fishery harbour. Hence, four nos. of fishermen gear sheds each having 12 cabins with a plinth area of 161.3 m² for 24 vessel operators have been proposed near the idle-berthing quay for MFVs and another near beach landing area for traditional boats. The proposed three blocks have a total plinth area of 645.20 m². The plan, elevation and section of the proposed fishermen gear sheds are shown in **Drawing**.

6.6.9 Fishermen Rest Sheds

Fishermen need rest in between the trips and also before they start a fresh voyage. They may have to go into the sea at early hours and may be coming back after fishing at late nights. As such, two fishermen rest sheds are proposed with a total plinth area of 213.50 m² in the berthing module. The fishermen rest shed is provided with facilities like bath rooms, toilets, urinals, wash basins, sit-outs and cupboards for storing few important personal things carried by the fishermen. The plan, elevation and section of the fishermen rest shed are shown in **Drawing**.

6.6.10 Net Mending Sheds and Net Drying Yards

Fishermen's nets would become wet and damaged after each fishing trip. As such, a top covered shed with four sides open is required for the fishermen to mend/repair their nets sitting under the sunshade and net mending yard to make them dry. For this purpose, two nos. of such net mending sheds, having a total plinth area of 413.9 m² for MFVs are proposed in the berthing module. Each net mending shed is 10.23 m wide and 20.23 m long with a plinth area of 206.95 m². The net drying area is proposed with paver blocks. About 20 m wide net drying yard is proposed on either side of the net mending sheds for the fishermen to dry their nets under the sun-light. The plan, elevation and section of the net mending shed are shown in **Drawing**.

6.6.11 Fishery Administrative Office

Fishery administrative office is necessary for the management and maintenance of harbour facilities, for regulating activities relating to fishery industry such as fish handling and auction hall, fish prices and the movement of fishing vessels in and out of the harbour. Fishery Administrative Officer along with his supporting staff is expected to work from this office to look after the day-to-day activities. As such, the proposed fishery harbour complex provides for a fishery administrative office with a plinth area of 162.56 m². The typical plan, elevation and cross-section of the fishery administrative office are shown on **Drawing**.

6.6.12 Boat Repair Shop

For carrying out electrical/mechanical/electronics/carpentry related repairs to the fishing vessels and communication equipment, checking of lubrication and cooling systems of the engines etc., a boat repair shop of plinth area 95.34 m² is proposed near the sloping hard. It consists of an office room, a mechanical shop, an electrical workshop and a carpentry shop with toilet facility in addition to work spaces. The typical plan, elevation and cross-section of the boat repair shop building are shown on **Drawing**.

6.6.13 Restaurant

For the purpose of fishermen, daily visitors and those working in the harbour office, a canteen of plinth area 127.70 m² is proposed in the public utility module. It consists of rooms for dining, kitchen, workers room, store, service, gas and toilet block. The restaurant should be maintained neat and clean with hygienic conditions. The plan, elevation and section of the restaurant are shown on **Drawing**.

6.6.14 Dormitory

Dormitory facility would be needed for the fish merchants, traders operating from the fishery harbour and for those visiting harbour on regular business trips. Lodging and boarding facilities would be desirable right at the fishery harbour project so that it will be convenient for the fish merchants to stay. As such, a dormitory of 320.9 m² plinth area is provided within the fishery harbour complex. The building provides for single, double and dormitory rooms to accommodate more persons. Further, dining facilities, reception, waiting lounge, kitchen, store for food provisions, dish wash, bathing, toilet facilities etc., are added to the dormitory. Details of dormitory building are shown in **Drawing**.

6.6.15 Public Toilet Block

A fishery harbour layout essentially needs to have public toilet block containing facilities for water closet and bath room. Hence, two toilet blocks of 67.73m² plinth area each (total 203.19m²) – one near the net mending shed and another near vehicle parking area for MFVs are proposed. The proposed blocks may be operated on 'pay and use' basis for both gents and ladies. In addition, usual toilet and bathing facilities are also made available in the fishermen's rest shed, canteen and other buildings. It is necessary

that toilet blocks should be maintained neat and clean so that hygienic conditions prevail. The plan, elevation and section of the public toilet block are shown on **Drawing**.

6.6.16 Security/Guard House

To check the entry and exit of all types of vehicles and visitors, security/guard house is necessary in a fishery harbour. Hence, it is proposed to construct a guard house of plinth area 27.2 m² at the entrance of the premises. In addition, it is proposed to have an entrance gate for the fishery harbour. The plan, elevation and section of the guard house and entrance gate are shown at **Drawing**.

6.6.17 Radio-Communication Centre

A radio-communication centre is required in a fishery harbour in order to coordinate the shore-to-ship and vice-versa communication between the fishing vessels, to watch and regulate vessel movements, to provide information regarding fishing grounds, movement of fish shoals, navigation hazards etc., to the fishermen. The radio-communication building would provide facilities for display of signals, flags and lamps required regarding the weather information and cyclone warnings during rough weather to the fishermen. As such, a radio-communication building of area 199.8 m² is proposed at the outfitting quay. The plan, elevation and section of the radio-communication building are shown on **Drawing**.

6.6.18 Plots for Boat Parking Area

After the fishing season is over, the migratory fishing vessels may like to return to their original base whereas the native fishing boats will be parked in the fishery harbour complex. During this period, the fishing boats need to be pulled on to shore for regular maintenance and repairs to hull, engine etc. For the above purposes, two plots of open land space of 15,075 m² one for MFVs and other for traditional boats are provided for parking. The boat parking yard has maneuvering lanes of WBM with adequate width for movement of boats. Thus, the transfer of fishing vessels from water to land to their designated plots in the yard through sloping hard and vice-versa is made easy.

6.6.19 Drainage, Sewerage

The storm and surface water from the road surfaces would be collected in the storm water drains provided alongside the road surfaces. The details of storm water drain have been shown in the **Drawing**. The sullage from the fish handling and auction hall, fish processing places etc. and the sewage from public toilets need pre-treatment before disposal. As such, it would be necessary to have separate drainage and sewerage systems for both storm water and sewage. In order to treat the sewage, a compact effluent treatment plant of suitable capacity is proposed near the gear sheds for MFVs. Sewage from all the buildings, fish auction halls will be conveyed to this ETP and the output of the treatment plant after treating to tolerable limits can be safely discharged into the river water. Sewer lines, inspection chambers and manholes would be built wherever required in the fishery harbour complex to collect and guide sewage.

Provisions are made for the solid/wet waste collection, spent engine oil reception shed, toxic waste reception shed for the collection of toxic waste such as lead acid starter batteries, dry cells etc., bilge oil water separator where bilge water would be

pumped from the fishing boats in to the bilge oil water separator for removal of oil from the water. Their locations are shown in the harbour layout.

6.6.20 Power and Lighting

Electric power line is available at the existing fishery centre from the nearby village. However to cater to the needs of the proposed fishery harbour, a transformer station of appropriate capacity is proposed to be installed for distribution of electric power near the main gate.

Sufficient number of high mast lights are proposed in the fishery harbour at important locations. Further, street lights at 50 m spacing are proposed to illuminate all the roads, surfaces during night hours of operation. Covering all these items, lump sum provision is made in the abstract cost estimate for power and lighting.

6.6.21 Compound Wall

To safeguard the facilities proposed in this fishery harbour, a compound wall of 836 m long circumscribing the premises is proposed. The compound wall is proposed with a 230 mm thick brick masonry wall in CM.1:6 with 150 mm thick concrete coping at its top. Barbed wire is connected to an equal angle section over the coping for security, which makes the total height of the compound wall as 2.5 m above the ground level. The cross section of compound wall is shown on **Drawing**.

6.6.22 Plot areas for Fish Processing & Ice Plant and Chilled Storage

Fish processing needs in a fishery harbour start when the boats with fish catch pull alongside the fish landing quay. Fish processing needs are many such as icing, chilling, freezing, canning, drying etc. By using ice and other chilling methods, fish can be preserved in a fresh condition anything from a few days up to a week depending on the fish species. However, on some occasions, it becomes necessary to preserve certain varieties of fish and Shrimp even longer than a few weeks either for exporting to distant countries, or to hold the fish stock until such reasonable time needed to secure better prices or to even out fish supplies in the national and international markets.

As such, the proposed fishery harbour provides for a plot area of 4,213 sqm for setting up of fish processing activities, a plot area of 1,500 sqm for setting up of an ice plant and a plot area of 2,700 sqm for setting-up of chilled storage in the utility module. The provisions made are only for the land as the investment for fish processing industries and ice plant-cum-chilled storage are later expected to come up from the private entrepreneurs.

6.6.23 Plot area for Civic Amenities

Fishermen require many items such as fish nets, baskets, sinkers, buoys, anchors, ropes, automobile/machinery parts/products etc., for their fishing vessels and gear. The fishermen also need to carry food provisions before going on a fishing trip. Therefore, marine supply and provisions stores are required to be set up in the fishery harbour complex. It is also necessary for the mechanised fishing vessels to possess on-board electronic equipment such as fish finder, echo sounder, walkie-talkies, radio, electronic

position finder etc. Therefore, instrument and radio shops for sales/servicing and facilities to repair these electrical and electronic gadgets if available within the fishery harbour complex would avoid fishing vessel operators to go in search of such services to cities.

Apart from the above services, the proposed fishery harbour needs civic amenities such as food courts/outlets, tea/coffee and soft drink dispensers, fast food counters, post and telegraph facilities including telephone, telex, fax and e-mail and internet cafes, medical stores and health services, financial institutions such as banks preferably with automated teller machines (ATMs), institutions extending credit/insurance services etc. Since large number of people congregate in a fishery harbour during peak fishing season, a police outpost may be necessary to maintain law and order and to thwart any untoward incidents effectively.

To meet the above demands, the proposed fishery harbour complex provides plots of civic amenity sites at two locations of total area 6,094 sqm for setting up the above mentioned services in the fishery harbour complex. The area reserved for the civic amenity sites is capable of accommodating many vendor shops of various services. The provision made is only for the land in respect of the civic amenity site as the investment for actual civic amenity facilities/shops is expected to come up from the user groups like private entrepreneurs, governmental and non-governmental agencies. In addition to vendor shops, the civic amenity site would have open spaces for greeneries, vehicle parking area etc.

6.6.24 Greeneries and Landscaping

In order to enhance the aesthetics and beauty of the surrounding environment, greenery could be provided at important locations in the fishery harbour.

6.6.25 Fire Extinguishers

In case of outbreak of fire at any location within the fishery harbour complex by any reason, it is necessary to extinguish the fire at the instant without waiting for the fire brigade to come and do so. For that purpose, fire extinguishers are necessary to be installed at important locations. Hence, a lumpsum provision is made to this purpose in the estimate.

6.6.26 Effluent Treatment Plant

Water is one of the important natural resource used for various domestic and industrial purposes. About 70-75% of Earth's surface is covered by water resources out of which only 2.5% is fresh water suitable for human consumption. Of this only 0.5% is available as ground water and 0.01% as surface water in the form of lakes, streams, rivers etc. which can be readily accessible. The remaining is in the form of ice caps. This small amount of water is used for different purposes like drinking, transportation, heating and cooling, industry etc. by human population.

India is the second most populous country in the world and is likely to surpass china by 2050 but is 7th largest country in terms of area. India has 4% water resources and 2.45% land area of the world but it has 16% of the world population. As per an

estimate India has only 1,000 m³ of water per person i.e., less than 1,700 m³ of water per person per year and is considered as water-stressed country.

Water Scarcity problems in India are due to rapid population growth, inadequate water treatment facilities and lack of finances for investment. Wherever facilities are available those are not maintained properly. Presently, only about 10% of the waste water generated is treated and the balance is discharged into water bodies without proper treatment thereby polluting water bodies. So there is a need to recycle the waste water effectively to fulfil the increasing water demand and to protect the health of water bodies.

6.6.27 Use of water in industries

Water is the main component which is used in all type of the Industries. Water is used for different processes in the industries. It may be used for washing, dilution, formation and condensing the steam. But all water used in the different industry is not totally consumed. Generally, almost all the industries generate waste water that needs urgent attention. Water use in industry is a double-edged sword. On one hand it puts immense pressure on local water resources. On the other, wastewater discharged from the industry pollutes the local environment. Water is required, often in large volumes, by industries as process inputs in most industries. In other cases, like food and beverage and chloro-alkali industry, water is used as a raw material turned into a manufactured product and exported out of the local water system. However, in most industries it is essentially used as input and mass and heat transfer media. In these industries a very small fraction of water is actually consumed and lost. Most of the water is actually meant for non-consumptive process uses and is ultimately discharged as Effluent treated water from ETP.

6.6.27.1 Industrial waste water sources

a) Iron and Steel Industry

The production of iron from its ores involves powerful reduction reactions in blast furnaces. Cooling waters are inevitably contaminated with products especially ammonia and cyanide. Production of coke from coal in coking plants also requires water cooling and the use of water in by-products separation. Contamination of waste streams includes gasification products such as benzene, naphthalene, anthracene, cyanide, ammonia, phenols, and cresols together with a range of more complex organic compounds known collectively as polycyclic aromatic hydrocarbons (PAH). The conversion of iron or steel into sheet, wire or rods requires hot and cold mechanical transformation stages frequently employing water as a lubricant and coolant. Contaminants include hydraulic oils, tallow and particulate solids. Final treatment of iron and steel products before onward sale into manufacturing includes pickling in strong mineral acid to remove rust and prepare the surface for tin or chromium plating or for other surface treatments such as galvanization or painting. The two acids commonly used are hydrochloric acid and sulfuric acid. Wastewaters include acidic rinse waters together with waste acid. Although many plants operate acid recovery plants, (particularly those using Hydrochloric acid), where the mineral acid is boiled away from the iron salts, there remains a large volume of

Highly acid ferrous sulphate or ferrous chloride to be disposed of. Many steel industry wastewaters are contaminated by hydraulic oil also known as soluble oil.

Food Industry

Wastewater generated from agricultural and food operations has distinctive characteristics that set it apart from common municipal wastewater managed by public or private sewage treatment plants throughout the world: it is biodegradable and nontoxic, but that has high concentrations of biochemical oxygen demand (BOD) and suspended solids (SS). The constituents of food and agriculture wastewater are often complex to predict due to the differences in BOD and pH in effluents from vegetable, fruit, and meat products and due to the seasonal nature of food processing and post harvesting. Processing of food from raw materials requires large volumes of high grade water. Vegetable washing generates waters with high loads of particulate matter and some dissolved organics. It may also contain surfactants. Animal slaughter and processing produces very strong organic waste from body fluids, such as blood, and gut contents. This wastewater is frequently contaminated by significant levels of antibiotics and growth hormones from the animals and by a variety of pesticides used to control external parasites. Insecticide residues in fleeces is a particular problem in treating waters generated in wool processing. Processing food for sale produces wastes generated from cooking which are often rich in plant organic material and may also contain salt, flavourings, colouring material and acids or alkali. Very significant quantities of oil or fats may also be present.

b) Complex Organic Chemicals Industry

A range of industries manufacture or use complex organic chemicals. These include pesticides, pharmaceuticals, paints and dyes, petro-chemicals, detergents, plastics, paper pollution, etc. Waste waters can be contaminated by feed-stock materials, by-products, product material in soluble or particulate form, washing and cleaning agents, solvents and added value products such as plasticisers. Treatment facilities that do not need control of their effluent typically opt for a type of aerobic treatment, i.e. Aerated Lagoons.

c) Need of effluent treatment

The effluent treatment is necessary to protect and maintain the health of the rivers, lakes & sea, failing which the health of the water bodies is under deterioration, thereby threatening the public health, wildlife habitat, fisheries, recreation and ultimately the quality of human lives. The treated waste water can also be used for the purposes where drinking water quality is not required.

Effluent treatment plant is essential in a fishery harbour for various reasons listed below:-

- (a) To separate the solid waste generated whilst fish processing procedures.
- (b) To maintain hygienic standards and EU compliance.

The waste water after treatment is proposed for use in green belt, in & around the harbour.

Effluent treatment plant is proposed to be located near the Overhead tank in proposed layout of Navabandar Fishery harbour. Effluent from the auction hall is collected into a manhole which, thereafter leads to the screen chamber of ETP.

6.7 Effluent treatment plant

Industrial waste water treatment covers the mechanisms and processes used to treat waters that have been contaminated in some way by anthropogenic industrial or commercial activities prior to its release into the environment or its re-use. Most industries produce some wet waste although recent trends in the developed world have been to minimize such production or recycle such waste within the production process. However, many industries remain dependent on processes that produce wastewaters. So, industries produce wastewater, otherwise known as effluent, as a bi-product of their production. The effluent contains several pollutants, which can be removed with the help of an effluent treatment plant (ETP). The “clean” water can then be safely discharged into the environment.

Advantages of waste water systems

- (a) Manufacturers face strict regulations on discharge and waste. Non-compliance can lead to expensive fees and operations interference. A wastewater treatment skid will help you:
- (b) Stay in compliance
- (c) Reduce hauling and off-site treatment costs
- (d) Eliminate municipal fees
- (e) Reduce supply costs by recovering production materials out of the waste-stream for re-use
- (f) Eliminate unnecessary water usage during processing

6.7.1 National standards for waste water

Effluent from industries must meet the national effluent discharge quality standards set by the Government. Consequently any ETP must be designed and operated in such a way that it treats the wastewater to these standards.

The regulations state that these quality standards must be ensured from the moment of going into trial production for industrial units. They also state that the Department of Environment can undertake spot checks at any time and the pollution levels must not exceed these quality standards. Furthermore, the quality standards may be enforced in a more stringent manner if considered necessary in view of the environmental conditions of a particular situation.

The waste discharge quality standards differ according to the point of disposal. So, the standards are different for inland surface water (ponds, tanks, water bodies, water holes, canals, river, springs or estuaries); public sewers (any sewer connected with fully combined processing plant including primary and secondary treatment); and irrigated land defined as an appropriately irrigated plantation area of specified crops based on quantity and quality of wastewater.

Table: B – Standards for discharge quality based on different disposal areas

Parameter	Inland surface waters	Public sewers	Land for Irrigation
Ammonia cal nitrogen	50	50	-
Arsenic	0.2	0.2	0.2
Biological oxygen demand (for 5 days at 20 ⁰ c)	30	350	100
Boron	2	2	2
Cadmium	2	1	-
Chemical oxygen demand	250	-	-
Chlorides	1000	1000	600
Chromium (hexavalent)	0.1	2.0	-
Copper	3	3	-
Cyanides	0.2	2	0.2
Fluorides	2	15	-
Lead	0.1	1.0	-
Mercury	0.01	0.01	-
Nickel	3	3	-
Oil and grease	10	20	10
Pesticides	-	-	-
pH	5.5-9.0	5.5-9.0	5.5-9.0
Phenolic compounds	1	5	-
Selenium	0.05	0.05	-
Sodium (%)	-	60	60
Sulphates	1000	1000	1000
Sulphides	2	-	-
Suspended solids	100	600	200
Total dissolved solids (inorganic)	2100	2100	2100
Total residual chlorine		-	-
Zinc	1	15	-
iron	5	-	3

Source:

1. Central Pollution Control Board, Pollution Control Acts, Rules, and Notifications issued thereunder. Fourth edition pp. 358-359. New Delhi, CPCB, Ministry of Environment and Forests 897 pp.
2. TERI Energy Data Directory & Yearbook, 2005-06, Tata Energy Research Institute, New Delhi.

6.7.2 Treatment methods

Effluent can be treated in a number of different ways depending on the level of treatment required. These levels are known as preliminary, primary, secondary and tertiary (or advanced). The mechanisms for treatment can be divided into three broad categories: physical, chemical and biological, which all include a number of different processes (Table 1). Many of these processes will be used together in a single treatment plant.

Table C: Wastewater Treatment Levels and Processes

Treatment Level	Description	Process
Preliminary	Removal of large solids such as rags, sticks, grit and grease that may damage equipment or result in operational problems	Physical
Primary	Removal of floating and settleable materials such as suspended solids and organic matter	Physical and chemical
Secondary	Removal of biodegradable organic matter and suspended solids	Biological and chemical
Tertiary/advanced	Removal of residual suspended solids / dissolved solids	Physical, chemical and biological

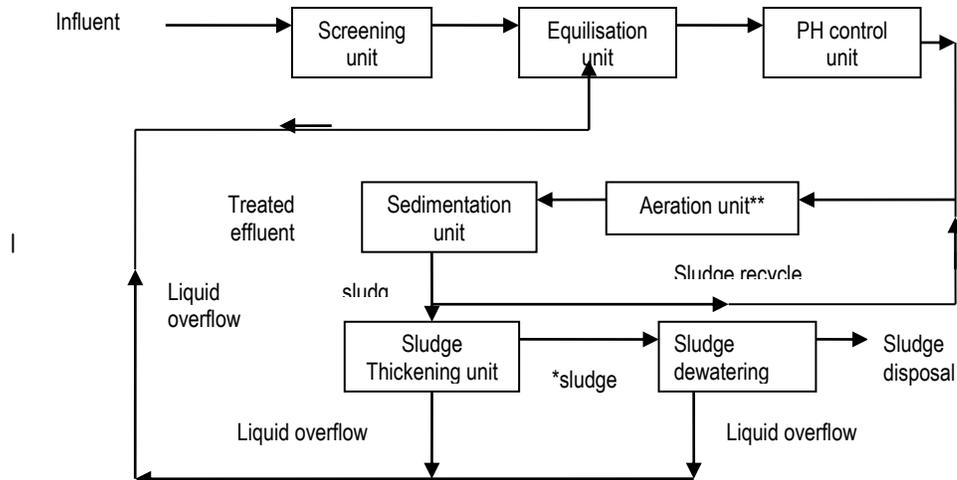
6.7.3 Operation and control

Operating data from wastewater treatment plants has generated some useful operational control strategies. Some of these control methods include:

- (a) Mixed liquor suspended solids
- (b) Sludge Volume Index and Sludge Density Index
- (c) Sludge Age; Mean Cell Residence Time (MCRT)
- (d) Food/Mass Ratio
- (e) Constant MLSS
- (f) Return Activated Sludge Control (RAS)

6.7.4 Biological treatment

The basic units needed for biological treatment are: screening; an equalization unit; a pH control unit; an aeration unit; and a settling unit (Figure 5). A sludge dewatering unit may also be included. Biological treatment plants require the presence of microorganisms that are adapted to degrade the components of the effluent to be treated. Textile industry waste will not contain suitable microorganisms so these must be added to the ETP when it is set up. Traditionally in South Asia cow dung is used as a source of microorganisms. While it may be useful to use cow dung it is unlikely to be the best source of microbes for treatment of textile waste. If possible new reactors (either activated sludge or fixed film systems) should be set up using activated sludge from an existing ETP, preferably one treating a similar waste. If this is not possible polluted river water is likely to be a good source of suitable microorganisms and can be used together with cow dung or activated sludge. It is likely to take several months for the microbial population to establish itself and successful treatment to result.



Typical Flow Diagram of a Biological Treatment Plant

- * A sludge recycle line is essential for activated sludge systems but is not needed for fixed film systems.
- ** The aeration unit can be either activated sludge or a fixed film reactor.

6.7.5 Output Quality

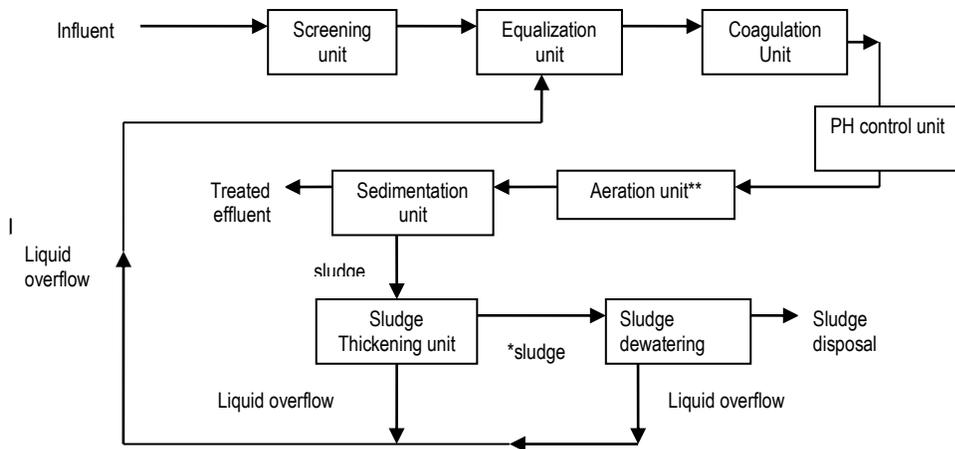
Evidence shows that output quality from biological treatment can satisfy the national standards for most of the required parameters except colour. According to Metcalf & Eddy (2003) a properly designed biological ETP can efficiently satisfy BOD, pH, TSS, oil and grease requirements. However, as already mentioned, the compounds in industrial wastewater may be toxic to the microorganisms so pretreatment may be necessary. Similarly most dyes are complex chemicals and are difficult for microbes to degrade so there is usually very little colour removal.

6.7.6 Physico-chemical Treatment

The basic units needed for a stand-alone physico-chemical treatment plant are screening, an equalization unit, a pH control unit, chemical storage tanks, a mixing unit, a flocculation unit, a settling unit and a sludge dewatering unit (Figure 2).

Output Quality

With physico-chemical treatments (coagulation and flocculation) it is possible to remove much, possibly the entire color depending on the process used. It is however difficult to reduce BOD and COD to the value needed to meet the national effluent discharge standard, and impossible to remove TDS. The removal rate is dependent on the influent wastewater quality. The removal efficiency of this type of treatment has been found to be 50% and 70% for BOD₅ and COD respectively.



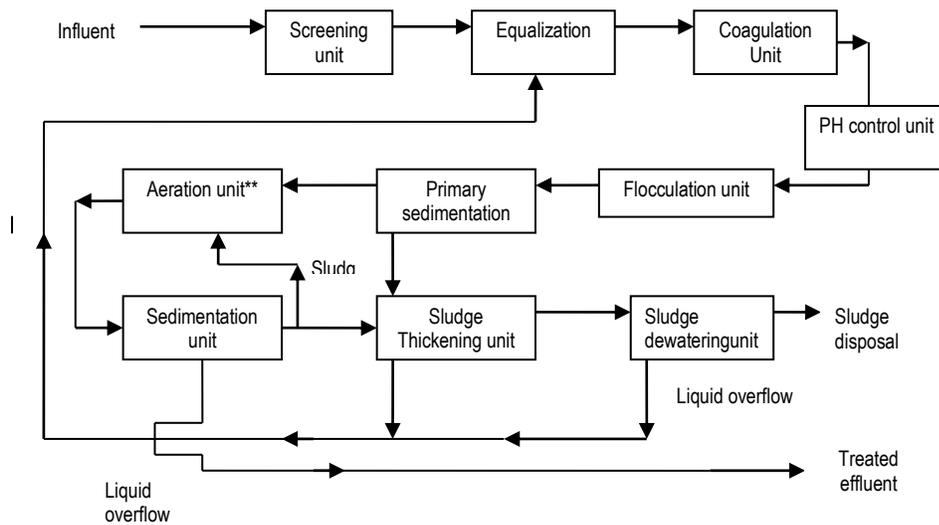
Typical Flow Diagram of a Physico-chemical Treatment

6.7.7 Physico-chemical and Biological Treatment

In this type of treatment a combination of physical operations, and physico-chemical and biological processes are used. The basic units needed for a physico-chemical and biological treatment plant are screening, an equalization unit, a pH control unit, chemical storage tanks, mixing units, flocculation units, a primary settling unit, an aeration unit, and a secondary settling unit (Figure 3). The physico-chemical unit always comes before the biological unit.

6.7.8 Output Quality

These are the most common form of ETP used for the treatment of textile waste and are the most likely to meet the water quality standards set by the Government, as they provide the benefit of physical, chemical and biological treatment and can therefore raise the efficiency of BOD and COD removal to 90 %.



Typical Flow Diagram of a Physico-chemical and Biological Treatment Plant

- * A sludge recycle line is essential for activated sludge systems but is not needed for fixed film systems.
- ** The aeration unit can be either activated sludge or a fixed film reactor.

6.7.9 Area Requirement Comparison

The area needed for an ETP depends mostly on the quality of wastewater to be treated, flow rate, the type of biological treatment to be used and the orientation of different treatment units. In general physicochemical treatment plants require the least area and biological treatment plants require the largest area (Table 4), but good civil engineering can greatly reduce the land area required. This will require extra pumps and piping, and stronger tank walls, so construction costs may be higher for tall structures.

Common Area Requirements of Different Types of ETP

	Physico-chemical	Biological	Combined physico-chemical chemical and biological
Area required (for 30 cubic meter/hour flow)	80 Sq M	170 Sq M	140 Sq M

6.7.10 ETP with SCADA System

The effluent treatment plant is controlled by SCADA (Supervisory Control and Data Acquisition) system. After treating the effluents, the treated water is proposed to be sent to green belt area and the solid waste/sludge to the sludge sump.

6.7.11 SCADA System

The term SCADA (Supervisory Control and Data Acquisition) usually refers to centralized systems which monitor and control entire site, or complexes of systems spread out over large areas (anything from an industrial plant to a nation). It is a type of industrial control system (ICS). Industrial control systems are computer-based systems that monitor and control industrial processes that exist in the physical world.

SCADA systems historically distinguish themselves from other ICS systems by being large-scale processes that can include multiple sites, and large distances. These processes include industrial, infrastructure, and facility-based processes.

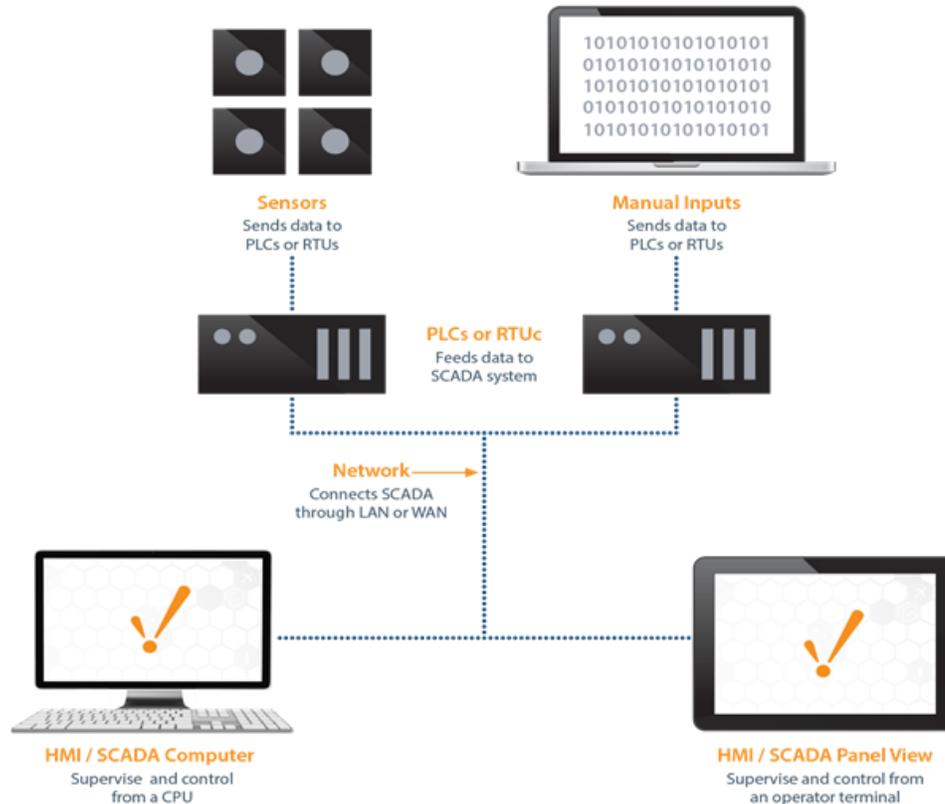
6.7.12 How Do SCADA Systems Work?

SCADA systems deploy multiple software and hardware elements that allow industrial organizations to:

- a) Monitor, gather, and process data
- b) Interact with and control machines and devices such as valves, pumps, motors, and more, which are connected through HMI (human-machine interface) software
- c) Record events into a log file

In SCADA, information from sensors or manual inputs are sent to PLCs (Programmable Logic Controllers) or RTUs (Remote Terminal Units), which then send

this information to computers with SCADA software. SCADA software analyzes and displays the data in order to help operators and other workers to reduce waste and improve efficiency in the process. Effective SCADA systems can result in significant savings of time and money



Basic SCADA System

6.7.13 Need of automation in effluent water treatment plants

The existing economic and environment concerns require an approach for increasing productivity, improving quality of product, reducing downtime and operating costs with the sole objective to optimize the use of resources (raw material, power, labour/manpower, etc.) and process efficiency. This can be achieved by automation which is the introduction of scientific techniques to automate the operation or control of system in order to minimize human intervention and to improve productivity and efficiency of the system.

Manual operation control includes collection of physical samples and its testing in standard laboratory and accordingly the control elements are adjusted manually to maintain the water quality parameters within desired ranges. As the technology becomes affordable direct measurement instrumentation like online sensors, portable spectrophotometers and handheld meters replaced the standard laboratory testing methods but still optimisation is not achieved due to the time lag between measurements and adjust of control elements.

So, ETP needs specific time based logic to achieve consistent quality of treated water that can never be achieved with accuracy by manual operation.

6.7.14 Underground sludge sump

Sludge is a semi-solid slurry and can be produced from waste water treatment processes or as a settled suspension obtained from conventional drinking water treatment and numerous other industrial processes. The term is also sometimes used as a generic term for solids separated from suspension in a liquid. This material usually contains significant quantities of interstitial water (between the solid particles). Industrial waste water solids are also referred to as sludge, whether generated from biological or physical-chemical processes.

The solid waste from the Effluent treatment plant is collected at sludge sump. The solid waste will be disposed regularly by the maintenance personnel. A non-return valve has been placed before the sludge sump for avoiding the reverse flow.

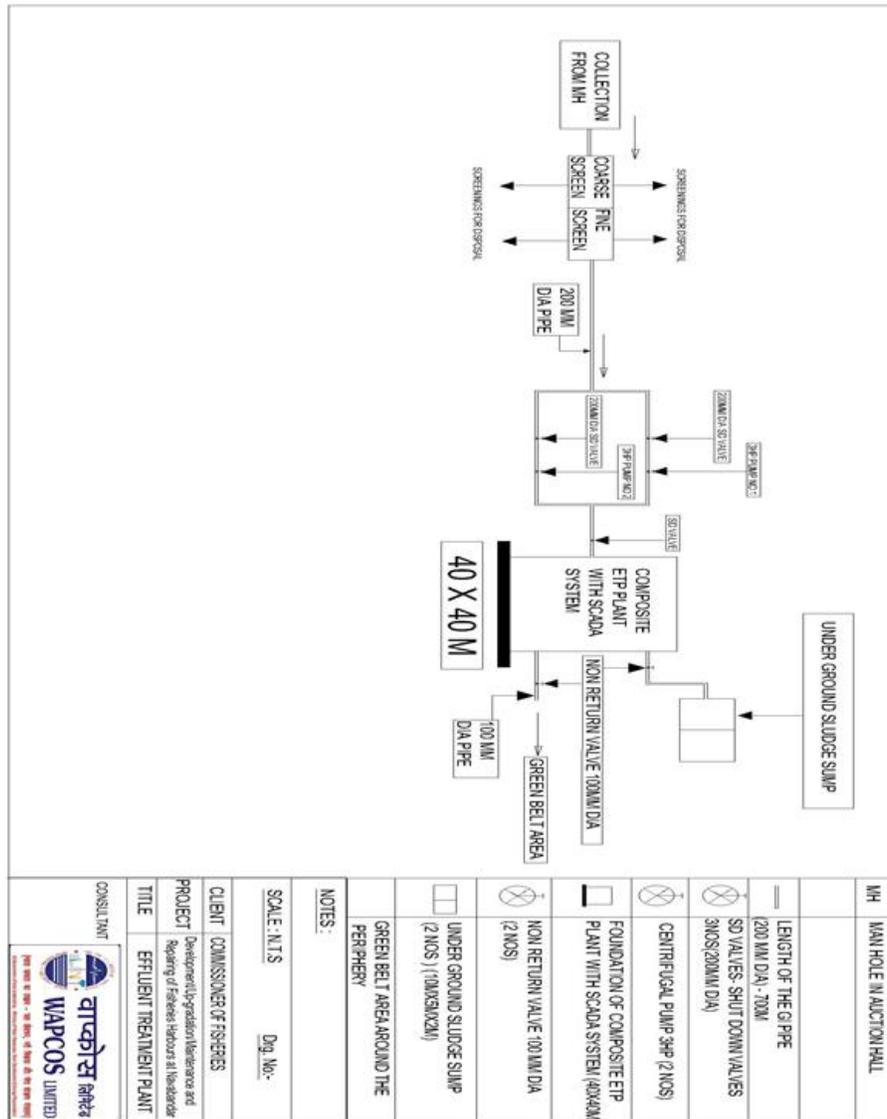
6.7.15 Green belt area

Green belt is a land use planning to retain areas for developing greenery or landscaping in and around the FH.

Green belt in the FH will lead to:

- a)** Improvement in public health and environment
- b)** Pleasant look
- c)** Improvement in air quality
- d)** Protects natural or semi-natural environments
- e)** Protects the unique character of rural communities that might otherwise be absorbed by expanding suburbs.

The treated water from the ETP will be sent to the Green Belt area by drip/sprinkler irrigation. A non-return valve has been placed after the treatment plant to avoid the reverse flow.



ETP Layout

The block cost estimates have been prepared for setting up the ETP of 0.5 MLD amounting to Rs. 85 lakhs. The figure may vary at the time of final DPR submission.

Chapter 7

Public Private Partnership (PPP) model recommendations

7.1 Background

Modern governance models across the world are increasingly using the Public Private Partnership (PPP) vehicle for achieving the governance objectives. The term Public Private Partnership describes a range of possible relationships between the Government and any private entity in the context of infrastructure and other services. PPPs present a framework which acknowledge and structure the role of Government in ensuring that social obligations are met through engaging private partnership.

Fisheries Harbours across India are currently very poorly managed with respect to quality control, hygiene, food safety, sanitation and consumer safety. The European Union has stipulated strict norms for the fish products being imported to the European Union countries and are in the process of benchmarking fisheries harbours in countries who are exporting to the European markets. In this emerging situation, it is highly essential that Indian harbours upgrade themselves to the best management practices with respect to Hazard Analysis and Critical Control Points (HACCP) norms and operational protocols to ensure compliance to EU standards. Thus construction of modern harbour perse is not adequate to ensure compliance to EU norms, but also are needed necessary O &M mechanisms to manage the new harbours to be EU compliant.

Fisheries Harbour Management in India currently uses three models which are more or less similar to each other. This model uses the vehicle of a Management Society registered under the Charitable Societies Act for registering and running the operation, maintenance and management of fisheries harbour. This model provides the operational flexibility, full control of the harbour at the operational level, professional overseeing, truncated and monitorable work components, delegation of work and responsibilities, prevents abuse of the facilities, prevents interferences of vested interests, judicious use of internal revenues and full realization of economic gains from investment.

7.2 What are PPP Models ?

A partnership between the government and the public entity can be called a PPP model in its simplest definition. The term Public Private Partnership describes a range of possible relationships between the Government and any private entity in the context of infrastructure and other services. PPPs present a framework which acknowledge and structure the role of Government in ensuring that social obligations are met through engaging private partnership. The public partners in a PPP are the government entities including ministries, departments, municipalities or state owned enterprises while the private partners are the businesses or investors, non- government organizations (NGOs) or community based organizations (CBOs) who represent stake holders who are directly affected by the activity. Effective PPPs recognize that both the governmental and private sectors have certain advantages in performing the specified tasks. The government contribution may be in the form of capital investment or other commitments that supports the partnership while the private sector makes use of

the expertise the government has provided in commerce, management, operation and innovation to run the business efficiently and benefit from it.

7.3 Types of PPP Models and Operations

Basically there are three broad types of Public Private Partnership models. These are:

- BOO (Build, Own and Operate)
- BOT / BOOT (Build, Own, Operate and Transfer)
- BOL (Build, Own and Lease)

Any of these can be adopted for infrastructure development either by the Public entity (government) or Private entity (an NGO, private organization, Cooperative etc.).

In the BOO model, the government invests on developing the infrastructure, owns the infrastructure and operates it with or without levying a user fee. E.g. Airports, Railways, Roads.

In the BOT / BOOT model, generally the infrastructure investment is by the Private entity who builds the assets, operates it for a mutually agreed fixed period and realize the user fee and other service charges and after the end of the contracted period, transfers the ownership to the public (government) which will thereafter own and keep it open for use for people without levying an user fee. Example: Toll Ways, Bridges etc.

In the BOL model, the government invests on the infrastructure development, owns the developed facility and gives the operation and maintenance to a Private partner (NGO, company, society) who will levy the user fee which is used for meeting the operation and maintenance costs. Quite often, such lease rights are auctioned and given to the highest bidder who will pay the government the bid amount on a recurring basis annually (or monthly), meet the operational costs from the surplus by judicious financial and administrative management and realises a profit from the surplus thus earned/ saved. Because of certain administrative reasons, sometimes the government appoints a specially created body to operate the facility, collect the user fee and meet the cost of operation and maintenance from the user fee collected.

Thus, the BOL model gives greater flexibility in the administrative and management approaches. The basic BOL model is ideal for operation / maintenance of fisheries harbours. This could be in the form of:

1. Service Contracts
2. Management contracts
3. Lease contracts

7.4 Rationale for Recommendation of PPP Model in Fisheries Harbours

The rationale for recommending a PPP mode for day to day operation and maintenance of a fisheries harbour is based on the following considerations.

1. A fisheries harbour is distinctly different from a commercial harbour

dealing with handling of products of commerce.

2. A fisheries harbour handles a highly perishable commodity, the fish and shellfish, which is an edible food item with a high speed of perishability. The deterioration of fish commences within a few minutes after its capture from the sea unless immediately placed in ice of temp less than 5 degrees Celsius.
3. At all levels of handling, the fish has to be kept chilled below 5 degrees Celsius
4. The landing of fish and subsequent handling has to be done in a rapid mode.
5. Unlike commercial harbours, fisheries harbours work round the clock, 24x7, irrespective of Sundays, national holidays. Fish landing can happen at any time of day or night.
6. Because of the above reason, normal governmental work schedules and work cultures do not fit into the operational schedules of fisheries harbours.
7. Thus creation of a special work group which can work in turns/shifts on a continuous basis is needed.
8. A fisheries harbour infrastructure developed by the government using governmental funds is a public service facility for promoting the societal obligations and helping people to have a better life through permitted fishing and related activities. It is not a centre of profit. However, operation, maintenance and management of the fisheries harbour costs money which can be realized through a nominal user fee from the users depending on the quantum of use by the end users. This logic is the basis for the operational and maintenance financial rationale for a fisheries harbour. The principle "PAY & USE" or "USER PAYS" is applied here.

7.5 Structure & Functions of a PPP Model in Fisheries Harbour

The fisheries harbours in the State of Gujarat are proposed to be constructed by the Government using governmental financial resources. The PPP model proposed is the BOL model where the government builds and owns the harbour, while the O & M is handed over to a private entity who will operate it under governmental guidance and supervision. The Private entity / operator will be the successful bidder who will pay the government recurring annual lease amount. This will ensure steady and fixed firm revenue to the Government on a yearly recurring basis over a long period and also shall ensure proper, hygienic and up to date upkeep and maintenance of the FH. Such hygienic maintenance and operation are necessary to comply with EU standards.

There are no firm and fixed PPP model for fisheries harbours. Models can be designed to suit local needs, practices, perceptions, responses and local cultures. The objective is to create revenue for O&M of the harbour. Normally the O & M is given away by auction to the highest bidder. If there are no bidding

above the basic floor price, O & M can be managed by a Society created by the Government which collects the levies and runs the harbour by employing labour on contract work basis. These decisions are left to the government.

In a normal BOL mode, the government invites Expression of Interest (EOI) from interested parties who could bid for the O & M of the Harbour for the agreed concessionaire period. The bidder who agrees to pay higher annuity amount shall be successful bidder and shall deposit the annuity amount which is higher than the floor price fixed by the government. The amount is deposited to the Government in lump sum annually till the completion of concessionaire period which forms the revenue to the Government. Thereafter, the bidder controls the O&M of the FLC and levies the charges as per the approved governmental rates from the users. Records are maintained by the bidder.

7.6 Development of a Harbour Management Plan through PPP

7.6.1 Objectives

The objectives of management of a modern fisheries harbour are:

1. Operate, manage and maintain the fisheries harbour for all weather /all season readiness for all Fisheries operations including off season berthing (parking)
2. Provide hygienic state of the art facilities for landing, sorting, washing, packaging, icing fish on a 24 x 7 operational mode
3. Establish a well-managed auctioning / pre-processing hall where the actual owners and fishers can take care of their catch without interferences and exploitation by middlemen.
4. Provide and maintain hygienic HACCP / EU compliant pre-processing hall where fish can be handled before moving out to the processing factory by following the best operational practices.
5. Provide a safe area for parking (berthing) fishing vessels before and after fishing operations and also for undertaking out fitting, repair of vessels, mending of nets etc.
6. Render various ancillary services for Fisheries operations such as providing RO water, RO ice, ETP, solid waste disposal, drying yard, stores, canteen, ATM, toilets, rest rooms etc.
7. Collect user fee / levies and other revenue from users of the harbour
8. Maintain data base on the vessels, trips, logs, catch records, personnel sailed out and returned through biometric identification and registrations.

7.6.2 Management Model

A modern fisheries harbour can run efficiently only through a specially constituted agency (usually private entity) as per the directions of a Management Committee who takes administrative and management decisions and a harbour operative unit at the site headed by a nominee of the government who will be the Harbour Manager responsible for the smooth functioning of the day to day activities of the fisheries harbour. His office shall be situated in the harbour administrative block. He will oversee the team of officials / operatives who are appointed by the Private Entity who has successfully won the bid for operation.

In situations where no private entity is coming forward to bid for O& M, the entire harbour management and operation can be carried out through a specially constituted and registered Society which functions as per the directives of the Management Committee. The sample harbour management is as per the details below.

- Chairman of the Fisheries Harbour Management Society : District Collector
- Vice Chairman : Superintending Engineer, Harbour Engineering Department
- Member Secretary: Joint Director of Fisheries /Harbour Manager
- Members
- Representative (one each) from various categories of users
- Representative from local self-government and Trade Unions

7.6.3 Operational Details

The Management Committee is responsible for Licensing of labourers, auction agents, allotment of shops, collection of user charges, other levies for all facilities inside the harbour. The revenue collected is credited to a separate bank account and utilized for maintenance, operation, management of the harbour. Accounts are audited by an independent Chartered Accountant. Society can borrow external funds for its operation and development.

Adopting such system for a fisheries harbour, is of substantial financial viability for the project. An example for Veraval harbour is projected here. As per Dept. of Fisheries (CoF) data, the 2013-14 annual landings of all fish at Veraval were 19,16,73,101 kg. Of this, 48,06,843 kg were Crustaceans (prawns, shrimps small, big etc). So the fish catch alone was 18,68,66,258 kg. At a moderate rate of Rs. 2 per kg of fish as user fee for the harbour pre-processing facilities provided, the annual earnings will be to the tune of Rs. 37,37,32,516 /= (Rs.37.37 crores) and from Crustaceans at the rate of Rs. 3 per kg, the earnings will be Rs.1,44,20,529/= (Rs.1.44 crores). Other levies for landing, berthing, etc will be about Rs.2 crores. So altogether a sum of Rs. 40 crores will be the revenue earnings per year. After deducting the operational costs (which are to be worked out), there will be a substantial net savings from this management model. A detailed economic feasibility has to be carried out before

adoption. Normally, it is anticipated that these models will fully realize the capital invested in less than ten years.

7.7 Functional Planning of a PPP Model for Fisheries Harbour

Functional planning of the fisheries harbour is of vital importance in ensuring smooth operation.

For the purpose of functional planning the structure of the O & M team has to be fixed. The O & M roles are left to the ground staff who are in the harbour on a daily / rotation basis. The thumb nail sketch of the operatives are as below.

1. Harbour Manager (overall on site administration & management)
2. Assistant Engineer (In charge of all vessel management, berthing, unloading, outfitting operations)
3. Technical Officer (in charge of all fish related activities such as movement of fish to the pre-processing hall, washing, sorting, icing etc.)
4. Fish Inspectors (in charge of quality control overseeing, weighing the fish and issue of tokens for payment of levies, loading to trucks and movement of fish out of the harbour)
5. Vessel management staff (in charge of issuing berthing tokens, outfitting, ice loading, fuel loading)
6. RO and Ice Plant operator (water supply, RO and Ice Plant operation)
7. Sanitary inspector (in charge of ETP, cleaning, disinfecting, toilets, steam cleaning)
8. Administrative Assistant (for office administration, management of records)
9. Data entry operator & accounting assistant (for data entry, accounting, handling receipts, deposit to bank etc.)
10. Security in charge and security guards (for overall security. Fire safety).

A detailed Operation Manual by CoF has to be prepared defining the duties and responsibilities of each of the above functionary and adequate training has to be provided before operation of the harbour on a commercial scale.

7.8 Operational Management

A modern fisheries harbour follow the principle of a production system management as seen in modern factories which are not fully automated. The unidirectional flow of goods is the key for quality control of the fish. For this purpose and for ensuring the principles of HACCP, detailed protocols are needed

to identify every point of contamination and address those points to eliminate any contamination. HACCP is the key for compliance to EU standards. So in addition to providing the necessary infrastructure like RO water, RO ice, clean sorting platforms, steam cleaning of floors etc, the fish must be treated as an item of food and handled with care to prevent contamination and cross contamination.

To achieve these objectives, the following management interventions are needed.

1. Preparation of a detailed Harbour Operation Manual (bilingual)
2. Training of all staff on their duties and general principles of hygiene and sanitation
3. Hands on experience on each of the mandated operational elements as per their work allocations.
4. Dry runs before commissioning
5. Video recording of the operational process for documentation and for presentation to EU at the time of inspections
6. Monitoring, supervision and corrections
7. Keeping of records of all operations, interventions, quality control checks
8. Technical backstopping from experts
9. Reviews, mid-course corrections, bench marking

7.9 Fixation of User Fee and Levies

The principle “user pays” is applied for management of all modern fisheries harbours. The objective is to generate adequate revenue for meeting operational, management and repair expenses of the fisheries harbour and to partially recover a fraction of the amount spent by the government for construction of the harbour. This is achieved by fixing user fees for various services and facilities in the fisheries harbour. Some details are given below.

7.9.1 Suggested Levies to be collected in PPP mode

Sl. No	Type of levy	Basis for levying	Remarks
1	User fee for pre-processing hall-Fish	Per Kg of fish washed using RO water.	Charged per kg of fish washed using the RO water and sorting platforms
2	User fee for pre-processing hall - Shrimp	Per Kg of shrimp washed using the RO water	Charged per kg of Shrimp washed using the RO water and sorting platforms
3	Use of RO ice	Per block of ice of 50 Kg	Charged for using ice made from RO water using the

Sl. No	Type of levy	Basis for levying	Remarks
			cassette plant
4	Use of RO water for other purposes	Per litre	Charged for using RO water for other purposes
5	Use of cold room	Per Kg of fish stored	Charged for using the cold room for every 24 hours or part thereof
6	Use of drying	Per Kg of fish dried	Charged per kg of fish dried in a cycle of drying
7	Entry fee for people	Per person	Charged per person per entry
8	Entry fee for vehicles	Per vehicle depending on type of vehicle	Charged for every 2 hours or part there of
9	Berthing fee for boats in the landing quay	First 1hour free, for every additional hour charged	Charged for using the landing quay
10	Parking the boats in the berthing quay	For every 24 hours or part there of	Parking of boats in the berthing quay
11	Display of signage, advertisements, posters	As fixed by the Govt.	Charged on a tenure based pattern
12	Boat registrations	As fixed by the Govt.	One time registration fee for operation from the FLC/FH
13	Use of repair yard	As fixed by the Govt.	Space usage charged on daily basis

The following USER FEE may be levied;

1. Entry fee:

Depending on the type of vehicles entering (eg. Truck Rs. 75/-, Mini Lorry Rs50/-, Car Rs. 30/-, Auto truck, tempo auto Rs. 20/-, Person Rs. 3/-, Ice Rs. 5/-per 50 kg block)

2. Wharfage fee:

Various transport vehicles leaving the harbour with commodities are charged (eg. Loaded truck / lorry with fish Rs.200/-, Loaded truck/lorry with shrimp or crustaceans or shell fish Rs.1000/- Loaded Mini lorry with fish Rs. 150/-, Loaded mini lorry with shrimp or shell fish Rs. 700/-, Loaded Tempo with fish Rs. 100/-. Loaded tempo with shrimp / shell fish Rs. 350/- etc. Even cycle, head load persons pay fixed rates)

3. Landing charges:

Various types of fishing vessels which land their catch at the harbour pay the following user fee (eg. Trawl net boat Rs. 50/-, Purse seine boat Rs. 200/-, Gill netter Rs. 50/-, OBM Rs 20/-. Small IBM Rs. 40/-)

4. Renewal licence fee:

Various licenses granted are renewed periodically by collecting user fee (e.g. Auction Agent Rs. 200/-per month, Merchant Rs. 500/-per month, Petty Merchant Rs. 100/- per month, Harbour Labourer pass Rs 200/ per year)

5. Photography:

All photography by visitors or professionals are charged (eg. Video shoot Rs. 5000/- for one session, Movie shoot Rs. 10,000/- for one session)

6. Rest rooms, guest rooms:

Guest rooms are charged (Room Rent Rs.750/- per day, Hall rent Rs.1500/- per day)

7. Ground rent:

- For repair / mending
- Open area Rs. 100/-per day. Covered area Rs. 150/- per day)

8. Berthing/Parking of boats in the designated area:

Any boat Rs. 30/-per day

9. Entry to breakwater:

Rs. 10/ per person per entry

The tariffs for the various facilities may be formulated / fixed after consultation with various stakeholders like Fishermen Cooperatives, Department of Fisheries, GMB, etc. Hence, for the purpose of calculating the IRR, an average cost per ton of fish landing for using all the FLC facilities is considered for the revenue estimation and projection.

The "user tariff" is meant for the service facilities provided in the FLC for handling the fishing boats at quays and fish catch handling at pre-processing hall. An average tariff of Rs. 3.00 per kg of fish handled can be levied as the PFR has adopted this for estimation and projection of revenues and FIRR. The tariff increases at 5% every year. However, the cost for buying fresh RO water, Fuel and Ice for carrying out the fishing trip shall be borne by the boat owner/operator.

It is suggested that a detailed study and analysis is done before fixing the user charges at each of the harbour. Further modification of the above table is needed through a more objective and rational levy structure based on the actual quantities of fish / shell fish moved through the harbour. This should be justified as basic infrastructure of the pre-processing halls such as raised sorting platforms, RO water through sprinklers, effluent treatment of the wash outs, lighting, dust proofing, pest control (rodents, birds, insects), provision of RO ice for re packing etc are provided and used by the users. Instead of charging by truck load / lorry load, the charges could be more specific and rational, based on the actual quantities. A moderate fee of Rs. 3 per kg of fish handled and Rs. 6 per kg of shellfish (shrimps, cuttlefish, and crabs), Rs 100 for slab of RO ice provided for repacking is recommended.

Chapter 8

Project Cost Estimate

8.1 General

The need for developing a comprehensive fishery harbour at Navabandar with the required waterside and landside facilities keeping in mind the fishery related activities has been explained in the preceding chapters supported by required project design, drawings and description of the facilities.

The abstract cost estimate of the fishery harbour project amounting to Rs. 15,845 lakhs delineating the various waterside and landside facilities may be seen at para 8-2. Against each of the harbour components, the unit, quantities and costs are indicated in the abstract cost estimate based on the detailed estimates worked out for these items, wherever possible. The unit rates furnished for the items are based on the schedule of rates for the year 2015-16 of Gujarat Maritime Board, which is applicable to Navabandar fishery harbour site.

The waterside facilities provided in the abstract cost estimate include breakwaters, revetment and navigation aids. The landside facilities provided include land reclamation, fish handling and auction hall including fish loading and vehicle parking areas, sea water pumping and distribution system for cleaning of fish auction hall and fish boxes, fishermen gear sheds, sheltered net mending sheds and net drying areas, boat repair shop, boat parking/repair yard/building yard, restaurant, fishermen rest sheds, internal fresh water storage, supply and distribution, drainage and sewerage, storm water drains including waste water treatment system, , toxic waste and spent oil reception sheds, bilge water oil separators, electric power and lighting, compound wall to delineate the fishery harbour complex area and to secure the harbour complex from intruders, asphalted and WBM surfaces, RC sloping hard, land areas for fish processing industries and ancillary fish industries, etc. Provision made for the electric power supply and lighting, fresh water and river water supply and distribution, navigational aids and for some other items is on lump sum basis and the actual details would be worked out at the time of project implementation. The provisions made in the abstract cost estimate are for the internal electric power distribution and general lighting, internal asphalt and WBM roads only. The internal roads are of single lane/two-lane asphalted/WBM roads depending on the importance and usage of the roads.

In addition to the above, the proposed fishery harbour complex provides for putting up greeneries, gardens and landscaping in open spaces at various locations throughout the complex area to improve aesthetics and beautify the fishery harbour complex area. Provision is made for the study being conducted on environmental impact assessment and monitoring from the viewpoint of environmental protection/clearance of the project. Further, the abstract cost estimate of the project includes the contingencies and work charged establishment charges at the rate of 3% and 2% of the project cost respectively

8.2 Abstract Cost Estimate

The total cost of construction of the Fishery Harbour worked out to Rs.158.45 Crores as per the SoR 2015. The abstract cost estimate of the project is given below.

Annexure 8-1

ABSTRACT COST ESTIMATE

Sl. No.	Description	Unit	Quantity	Rate (Rs.)	Amount (Rs.)
1	Breakwaters				
	i) Eastern Breakwater	Rm	1051.81	357319.08	37,58,31,782
	ii) Western Breakwater	Rm	975.90	295101.96	28,79,90,003
2	Dredging and Disposal	Cum	18500	450.00	83,25,000
3	Reclamation and levelling	Cum	548700	309.31	16,97,18,397
4	i) Quays (Block work) for MFVs	Rm	645.60	371700.74	23,99,69,998
	ii) Jetty (Block work) for MFVs	Rm	390.00	456358.97	17,79,79,998
5	Traffic areas and surfacing				
	a) Asphalt roads within the harbour complex				
	i) Double lane	Sqm	30660.00	1222.44	3,74,80,020
	ii) Single lane	Sqm	7660.00	1417.75	1,08,60,000
	b) Approach Road	Sqm	2000.00	1100.00	22,00,000
	c) WBM surface	Sqm	18372.26	605.80	1,11,29,920
	d) Vehicle parking area behind the fish auction hall	Sqm	9052.57	1937.57	1,75,39,990
	e) Concrete surface-Fish loading area	Sqm			
6	Fish Handling and Auction Hall for MFVs	Sqm	2546.82	13915.39	3,54,40,000
7	Fish Handling and Auction Hall FRP boats	Sqm	258.10	24796.31	63,99,900
8	Fishery Administrative Office	Sqm	162.56	19684.85	32,00,000
9	Fishermen gear sheds (4Nos.x161.30 Sqm)	Sqm	645.20	14321.14	92,40,000
10	Net mending sheds (2Nos.x206.95 Sqm)	Sqm	413.90	6378.35	26,40,000
11	Fishermen rest sheds (2Nos.x213.40 Sqm)	Sqm	426.80	11668.23	49,80,001
12	Boat repair shop	Sqm	95.34	13530.52	12,90,000
13	Restaurant	Sqm	127.70	19577.13	25,00,000
14	Dormitory	Sqm	320.90	14926.77	47,90,000
15	RC sloping hard	Sqm	1800	11527.78	2,07,50,004
16	Security/guard House	Sqm	27.2	25697.50	7,00,000
17	Compound wall	Rm	613	3474.71	21,29,997
18	Radio Communication Tower	Sqm	199.8	14863.38	29,70,001
19	Public Toilet (2Nos.x67.73)	Sqm	203.19	20227.37	41,09,999
20	Navigational and radio-communication equipment		LS		5,00,000

Sl. No.	Description	Unit	Quantity	Rate (Rs.)	Amount (Rs.)
21	Electric power supply and distribution including electric substation and general lighting		As per detail estimate		1,50,00,000
22	Fresh water storage, supply and distribution with ground water sumps, pump house and overhead tank		L.S		80,00,000
23	Seawater supply and distribution with shallow water tube well, pump house and overhead tank		L.S		15,00,000
24	Drainage and sewerage including effluent treatment plant, storm water drains and cross drainage works		L.S		2,00,00,000
25	Greeneries and landscaping in front of main gate and at other places		LS		5,00,000
26	Fire extinguishers, fire hydrants and other equipment		LS		5,00,000
27	Consultancy charges for Subsoil investigations, field data collection, model studies including detailed structural design of harbour components and preparation of Detailed Project Report		LS		2,00,00,000
28	Environmental impact assessment, mitigation measures and monitoring		LS		20,00,000
				Sub Total	Rs. 1508165010
Add 3 % for Contingencies					Rs. 45244950
				Sub Total	Rs. 1553409960
Add 2 % for Work charged establishment charges					Rs. 31068199
				Total Rs.	1584478159

Say Rs.158.45 Crores

Photographs of existing Fishery Centre



