Sri Lanka Tsunami Reconstruction Program (SLTRP)

USAID Contract # 386-C-00-05-00166-00

Environmental Assessment for Hikkaduwa Fishery Harbor

March 2006

SLTRPR-00003

In association with Chemonics International, DEVTECH, FNI, Engineering Consultants LTD., EML Consultants, Lanka Hydraulic Institute, MICD and Uni-Consultancy Service

Table of contents

Abbreviations

ADB	Asian Development Bank
CBO	Community Based Organization
CCA	Coast Conservation Act
CCD	Coast Conservation Department
CEA	Central Environmental Authority
CFHC	Ceylon Fisheries Harbor Corporation
CTB	Ceylon Tourist Board
DS	Divisional Secretariat
EA	Environmental Assessment
ECL	Engineering Consultants Pvt Ltd
EIA	Environmental Impact Assessment
EMAP	Environmental Management Action Plan
EPL	Environmental Protection License
FI	Fisheries Inspector
GDP	Gross Domestic Product
GN	Grama Niladhari
GOSL	Government of Sri Lanka
GSMB	Geological Surveys and Mines Bureau
IEE	Initial Environmental Examination
ITI	Industrial Technology Institute
LA	Local Authority
LHI	Lanka Hydraulics Institute
MSL	Mean Sea Level
NARA	National Aquatic Resources Research and Development Agency
NGO	Non-Governmental Organization
PS	Pradheshiya Sabha
Reg. 216	22 CFR 216 (Regulation 216)
SLTRP	Sri Lanka Tsunami Rehabilitation Program
USAID	United States Agency for International Development
USEPA	United States Environmental Protection Agency

Executive Summary

Project background

The coastal and marine sector of Sri Lanka was one of the worst affected by the tsunami that hit the country's shores in December 2004. The loss of lives and livelihoods took a heavy toll, which is being gradually remedied by the post-tsunami rebuilding efforts of the Sri Lankan government with the assistance of international partners. The USAID-funded Sri Lanka Tsunami Reconstruction Program (SLTRP) is a valuable contribution to the effort of 'post-tsunami rebuilding' in Sri Lanka through its interventions to improve damaged infrastructure in a number of sectors. In the fisheries sector, SLTRP will rehabilitate and improve infrastructure in three fishery harbors, namely Puranawella, Mirissa and Hikkaduwa, which were affected by the tsunami.

Project description

The Hikkaduwa harbor rehabilitation work under the Sri Lanka Tsunami Reconstruction Program (SLTRP) includes: (a) repairing the damaged breakwaters; (b) extending the inner arm of the southern breakwater by 20 meters; (c) dredging the inner harbor basin to a depth to three meters, (d) slipway and (e) improvements to selected on shore facilities. These measures expect to address the key problems of this harbor: high turbulence inside the basin, lack of depth in the basin; and navigational difficulties.

Project Alternatives

As this is a rehabilitation of an existing fishery harbor there were few alternatives for consideration. However, the proposed project was compared with the 'no action' alternative, in addition to several layout plans considered for the breakwater extension. As demonstrated in this assessment the proposed project will have significant benefits to the community, fisheries sector and to the country. At the same time, the 'no action' alternative will lead to the continued deterioration of conditions in the harbor and will threatened its sustainability due to the structural weakness in key infrastructure such as the breakwaters. The evaluation placed significant importance to layout alternatives for breakwater extension. A key goal of the exercise was to prevent any alteration to outer harbor sediment movement in the reef area immediately surrounding the harbor that would be likely to increase siltation over said reef. This was achieved through the proposed breakwater extension.

Description of the environment

Physical Environment – Hikkaduwa is a well-known tourist destination located 100 kilometers south of Colombo along the Colombo-Galle Road. The harbor is situated at the northern end of the town. The wave climate in the Hikkaduwa area is characterized by the long period swell with an almost southerly direction in deep water and the shorter period waves during the southwest monsoon. The near shore currents are moderate and with the stronger currents occurring in the area immediately south of the southern breakwater. The tidal range is about 0.8 meters on average. The high sediment flow is a major consideration and people already complain of increase in sand siltation over the coral reef due to the construction of the harbor. In terms of the bathymetry, the area consists of coral reefs and rock outcrops. Reef areas are shallow and have a depth of one meter MSL or less.

Biological Environment – The Hikkaduwa coral reef park is the main habitat of importance in the area. The primary coral formation occurs as a shallow fringing reef in

the area just south of the southern breakwater of the fishery harbor and the Coral Gardens Hotel (which is about 1.25 kilometers south of the harbor). The reef extends for approximately 130 meters and has two sections, namely the reef lagoon and the seaward reef slope. The coral habitat is affected due to disposal of waste and other wastewater flows from hotels and siltation.

Social Environment – The total population in the project area consisting of surrounding villages is 4909 (four Grama Niladhari (GN) Divisions). The population is mainly Sinhalese Buddhists (98%). The area has a high population density (2283 per square kilometer) reflecting the largely urban nature of the project area. Tourism and fisheries are the two dominant economic activities in the area. However, the number employed in the fisheries in the project area is comparatively low (106) because of significant diversification of employment types due to urbanization and tourism. The education standard in the area is not very high as few pursue higher education. Availability of employment in tourism and fisheries sectors is a major reason for the young join the workforce rather than spending extended period in education.

The community in general welcomes the rehabilitation of the harbor. The authors of this assessment believe that active consultation with community is an important requirement for successful implementation the harbor improvement.

Anticipated impacts and mitigation measures

The key impacts associated with the construction stage and proposed mitigatory measures are summarized in the table below:

	Activity	**Impact**	**Significance**	**Mitigatory Measures**
1	Dredging	Disturbance to bottom sediments and decrease in water quality	Low-moderate	Effects will be temporary and localized
2	Disposal of dredged material	None	None	None
3	Movement of dredger and barges carrying dredged material	Inconvenience for navigation Area unusable within the harbor	High Low-moderate	Carry out dredging in sections; Avoid blocking of navigational paths when anchoring dredgers; Plan activities well with harbor management and inform all harbor users
4	Harbor construction activities	Decrease in air quality Increase in noise and vibration	Low Low	Proper maintenance of vehicles and machinery; protection of earthwork to minimize dust generation; enforcing speed limits etc
5	Movement of construction vehicles within harbor premises	Inconvenience to harbor operations, safety of harbor users	Moderate-high	Demarcate construction areas; avoid busy hours of the harbor; educate fishermen on times and areas of construction; educate fishermen on safety measures

6	Waste generation from worker camps	Pollution of the harbor from solid and liquid wastes	Moderate-high	Provide a suitable system for sanitation and waste disposal
7	Quarrying	Worker safety, emission of dust and particulate matter, noise & vibration	Identified quarry is an established one operating with GSMB approval and CEA EPL license	None

As presented above, the negative project impacts are assessed to be very minimal. The proposed extension will not impact the outer harbor sediment movement causing changes to rate of sand siltation in the Hikkaduwa Marine Park. The dredging and dredging disposal will also cause very minimal impact as the dredged material is mostly silted sand and limited quantity of soft rock material. Blasting will be an unlikely need. However, if required, only controlled blasting will be carried out to minimize vibration. The plan is to dispose the dredged material at a sand nourishment site located four kilometers north of the harbor, and will be carried out as per the guidelines issued by the CCD. Tests carried out by the University of Moratuwa proved that the material to be dredged does not contain toxic material. Furthermore, rock material will be obtained from an already operating quarry in the area. Therefore impacts are mostly of transient type construction impacts. These will be mitigated and minimized through environmental safeguards as indicated in the Environmental Management Action Plan.

The project will have definite positive environmental and social impacts. These include: enhancement of fishermen safety due to improvement of navigation aids; fewer damage to boats resulting from lower turbulence in the harbor; protection of the adjacent reef due to less fishing boats anchor in sensitive reef area resulting from the additional basin area available for boats; as well as enhanced long-tem sustainability of harbor infrastructure. In summary, the conclusion of this EA is that the proposed projects will bring significant benefits to the community and environment, whereas any negative impacts will be very minimal and transient in nature. These issues can be effectively managed through proper implementation of environmental safeguards.

1 Introduction

1.1 Project Background

The Indian Ocean tsunami, triggered by a massive earthquake off the coastline of Sumatra in 2004, wreaked havoc in the region and claimed over 200,000 lives, displacing hundreds of thousands of people and destroying billions of dollars of property. In Sri Lanka, twelve coastal districts were affected in one of the worst natural disasters in the country's history.

The coastal region of Sri Lanka hosts about 34% of the country's population. The economic and environmental value of this region is reflected in the country's dependence on its rich coastal habitats that support many industries and livelihoods and which comprise a substantial portion of the economy. The tsunami devastated coastal livelihoods and hit hard at the local economic base. Fishing, the predominant coastal economic activity in Sri Lanka, was one of the worst affected.

The coastal and marine fisheries sector in Sri Lanka is of major social and economic importance. The sector earned Rs 9.5 billion in 2003 through the export of fish and aquatic products, and accounts for more than 90% of the total fish production in the country. Its contribution to the country's GDP was estimated at 2.6% in 2003. The sector provides a considerable amount of direct and indirect employment, and supports about a million households. Almost 75% percent of beach areas are used for fishing activities. As a food source, coastal and marine fisheries provide 65% of the animal protein consumed within the country.

The fisheries sector suffered a severe blow from the tsunami. A high death toll of fishermen was reported. Around 41% of fisher houses were affected and nearly 67% of marine fishing crafts were destroyed or damaged (NARA, 2005). Loss of employment due to damaged equipment and infrastructure is estimated at 24% (NARA, 2005). Nine harbors, 34 anchorages and 200 landing sites were damaged (TAFREN, 2005) along with their facilities, causing severe constraints on fisheries operations in the post-tsunami period. Foreign exchange earnings from fish exports will be greatly reduced in 2005 due to the tsunami.

Restoration and recovery of the fisheries sector is of utmost economic and social importance to the country. The GOSL has made a commitment to 'building back better' through post-tsunami reconstruction with the funding assistance extended by the international community. The United States Agency for International Development (USAID) is contributing to post-tsunami reconstruction and rehabilitation through the Sri Lanka Tsunami Reconstruction Program (SLTRP). SLTRP will improve the physical infrastructure in a number of sectors including fisheries. In this sector, SLTRP will rehabilitate and improve the infrastructure of the fishery harbors of Hikkaduwa, Mirissa and Puranawella. This report will discuss activities relating to the proposed rehabilitation work in the Hikkaduwa fishery harbor in the southern district of Galle. The location of Hikkaduwa on the map of Sri Lanka is shown in Figure 1.

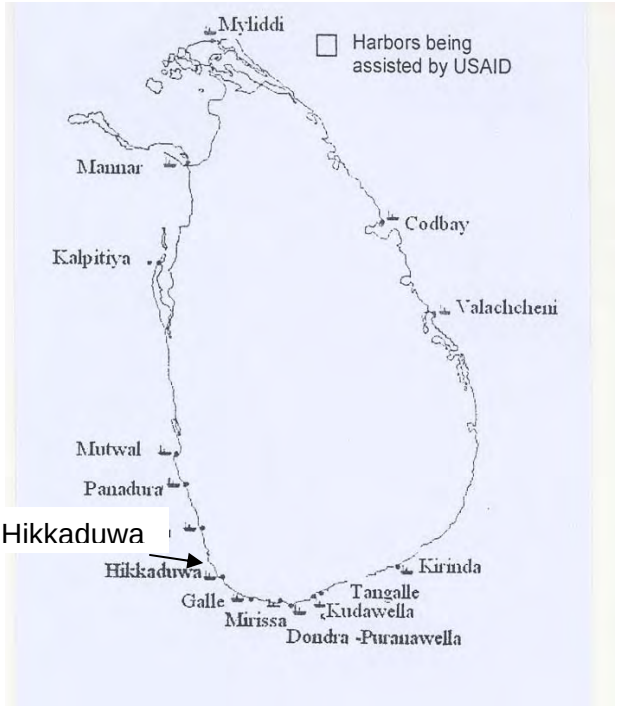

Figure 1 – Location of the project site

1.2 Project Overview and Objectives

The Hikkaduwa fishery harbor serves a large fleet of boats of varying sizes and acts as a hub of economic activity. However, the harbor is overcrowded and inefficient due to lack of berthing capacity and other basic facilities (USAID, IEE 2005). The Hikkaduwa fishery harbor rehabilitation project to be carried out by SLTRP focuses on restoring harbor structures to pre-tsunami conditions and improving the productivity of its facilities.

The specific interventions in this harbor will include: (a) repairs to damaged breakwaters; (b) measures to minimize the inner harbor sedimentation due to drifting of sand carried by refraction; and (c) measures to reduce the inner harbor turbulence. LHI is currently carrying out mathematical model studies to identify the most effective way of achieving the objectives behind activities (b) and (c). The model results carried out thus far has suggested that an extension of the inner arm of the southern breakwater by about 20 meters and dredging of the southern harbor basin up to a three meter depth would help achieve these objectives. However, a firm decision on the proposed interventions will be determined only after the completion of the model study and the value engineering exercise. A more detailed description is provided in Chapter 2.

In addition to physical rehabilitation of the harbor, SLTRP will be involved in skills capacity building for improved environmental management through the project's Participatory Coastal Management (PCM) component. Activities to be carried out by the PCM component are being identified in a number of ways, including through community consultations, environmental management needs assessments, and environmental assessments for construction and rehabilitation (including this document), and will include public awareness building, basic skills training, and linkages to SLTRP's

vocational education component. As activities are developed to complement the rehabilitation and construction activities described in this document, SLTRP expects to leverage enthusiasm generated by this improved harbor infrastructure to motivate stakeholders to adopt new skills and organizational mechanisms to improve their management of natural resources.

Recommendations developed through such assessments and any other SLTRP documents, including harbor master plans and the fisheries management action plan, will be prioritized and determined to be feasible or not feasible in the Coastal Development Action Plan (CDAP) to be submitted by SLTRP in April 2006. At that time, any activities that may require further assessment to establish potential environmental impacts will be identified. However, it is anticipated that all PCM activities will fall into the area of capacity building and improved environmental management, which was given a categorical exclusion in the SLTRP IEE (USAID 2005).

1.3 Government Policy

The GOSL fisheries sector policy identifies the need to develop fishery harbors to increase productivity through the development of the offshore fishery. The harbor rehabilitation activities of SLTRP fit within this policy framework and support the principles of long-term sustainability of the fisheries sector.

Thus, the objectives of the project are as follows:

- Contribute to the government's objective of 'building back better' in the fisheries sector through the provision of improved harbor infrastructure and facilities.
- Provide opportunity for increased and higher-value fish production.
- Alleviate some of the difficulties faced by fishermen through better planned and improved facilities.

1.4 Purpose of the Report

Both the GOSL and USAID have defined specific procedures for environmental screening as a pre-requisite to commencement of a development activity. The application of USAID and GOSL regulations on environmental safeguards, to the fishery harbors component of SLTRP is briefly explained below.

In keeping with the USAID regulation on environmental safeguards, which is governed by 22 CFR 216 (Reg. 216), an initial environmental examination (IEE) was prepared for the entire SLTRP, which included the sub-projects on fishery harbors. The IEE was completed prior to the commencement of project implementation, and indicated a positive determination for all key sub-projects of SLTRP. The *positive determination* (or positive threshold decision) resulting from the IEE establishes that the proposed action is likely to cause a significant impact or a reasonably foreseeable chance of significant harm to the environment, and that preparation of an EA or an Environmental Impact Statement (EIS) will be required. In the case of SLTRP, the IEE recommended the preparation of EAs for all its sub-projects.

In terms of the GOSL regulation, Coast Conservation Act (CCA) provisions apply, as the project falls within the purview of the coastal zone as regulated by the Coast

Conservation Department (CCD). Accordingly, as the project is associated with rehabilitation work only, a full report on environmental impacts is not required. Instead, the CCD will be consulted on a regular basis for its guidance and approval in making environmentally crucial decisions. This process will be described in greater detail in section 5.1.2 in Chapter 5.

The present document fulfills the EA requirement for the Hikkaduwa fishery harbor in accordance with the USAID environmental regulations. It presents potential environmental and social impacts arising out of project activities in the area and recommends measures to implement the project with minimum adverse impacts on the environment.

1.5 Definition of Project Impact Area

The region of influence for determining environmental impacts is defined as the Hikkaduwa harbor and a surrounding area of one kilometer in radius both on the marine and landward directions. In determining the region of influence for social impacts, five Grama Niladhari (GN) divisions in the Hikkaduwa Divisional Secretariat (DS) division located around the Hikkaduwa fishery harbor have been selected. The general physical setting of the project area is shown in Figure 2.

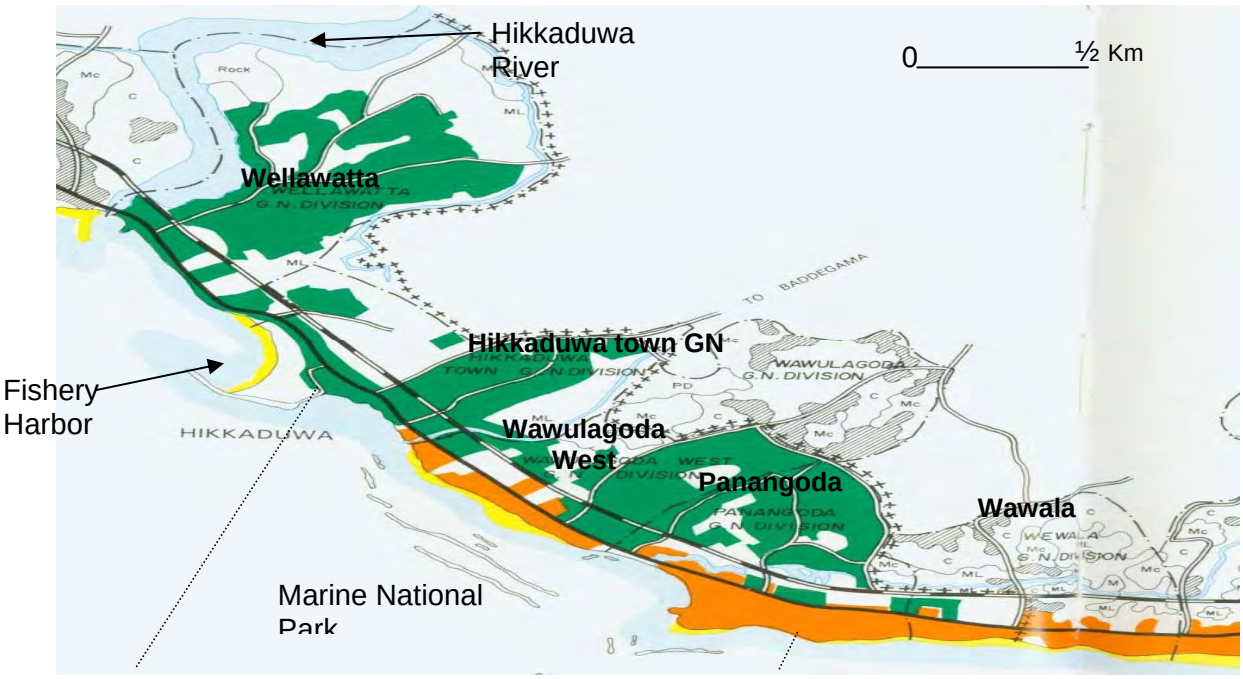

Figure 2 – Physical setting of the project area

1.6 Methodology of the EA

The physical, biological and social environment has been defined by data collected by a variety of methods as described below:

- Literature survey of all available and relevant physical and biological environmental information. Communication with experts was conducted to supplement the literature survey as needed.
- Collection of socio-economic data through a short survey of sources, such as statistics available at the GN offices and local community-based organizations (CBOs), interviews with agency officers who support relevant livelihood programs, and focus group discussions with target communities and other relevant stakeholders (such as the fishing community, traders, fishing vessel repairers, service providers, indirect beneficiaries, etc.).
- Consultations with harbor users were carried out to get their feedback on the proposed project and to gain insight into problems and issues faced during the usage of the harbor.

  Note: A list of people met during the EA preparation is included in Annex 5.

Environmental impacts and mitigation measures have been identified based on a brainstorming session conducted by the EA preparers (names given in Annex 2) with contributions from the SLTRP staff managing the construction planning. These impacts and proposed measures are based on past professional experience of team members in executing similar projects, expert opinion, field knowledge of the harbor environmental setting and reference to relevant published literature.

Classification of impacts as ‘low’, ‘moderate’ and ‘high’ have been applied based on appropriate environmental criteria including threshold values, standards and expert opinion.

Recommendations for management of potential environmental impacts are based primarily on the adoption of necessary safeguards to proactively avoid impacts, rather than on the mitigation of impacts after they have occurred through standard best practices. For example, congestion inside the harbor due to construction vehicles during busy hours, such as the morning auction time, is considered significant based on feedback from the harbor users. The Environmental Management Action Plan (EMAP) suggests ways and means to avoid this situation through consultative planning of construction work with harbor users and management.

2 Project Description

There are a number of issues in the Hikkaduwa Fishery harbor that result in a reduction of its efficiency. The main issues are the siltation and high turbulence present in the inner basin. The siltation in this harbor is a recurrent process due to drifting of sand through the harbor mouth. However, the tsunami also may have contributed significantly to the present level of siltation in the harbor. The turbulence inside the harbor is also considered as high enough to cause operational difficulties. In addition fishermen also complain of navigational difficulties at the harbor entrance due to presence of rock outcrops and turbulence. The primary areas of concerns in the rehabilitation of this harbor are:

1. Poor navigation safety at harbor entrance
2. Inadequate depth inside the harbor
3. Damage to the breakwaters
4. High turbulence in the harbor basin

(See Annex 3 for layout of Hikkaduwa harbor with proposed changes)

2.1 Breakwater Repairs

The project will repair the damaged breakwaters, restoring them to their original condition based on the same design. Damage from tsunami waves occurred at various locations in both the southern and northern breakwaters impacting the toe, core and armor layers. The reconstructed toe and core layers will consist of rubble ranging from 100 kilograms to one or two ton boulders. The armor layer will be constructed of four to eight ton boulders. The rock material will be brought from an already operating quarry site located in Galgoda, approximately 15 kilometers from the harbor site (See Annex 4 for location of quarry site). A new concrete pavement of five meters width will also be constructed over the breakwater.

2.2 Breakwater Extension and Harbor Basin Dredging

One of the main problems encountered in the Hikkaduwa fishery harbor is the prevalence of turbulent conditions at the entrance of the harbor and within the inner harbor. This situation increases difficulties of navigation and handling of boats when berthed. In order to reduce turbulent conditions in the harbor, an extension to the innermost arm of the southern breakwater and dredging of the inner harbor basin has been proposed by a number of stakeholders. Dredging of the inner harbor basin has another purpose, which is to create the required depth of three meters (as per the original design) for the multi-day boats.

LHI studies several arrangements/layouts for breakwater extension. Accordingly, the LHI proposes to extend the inner arm of the main breakwater by 20 meters. In addition deepening of the south basin to 3 meters is also proposed. These actions in combination will be able provide adequate calmness within the harbor basin. Also the proposed extension will not cause adverse impact on coral reef in terms of increasing the sand deposition over it.

3 Project Alternatives

The fishery harbor in Hikkaduwa was established in 2001. Prior to construction, LHI conducted a detailed modeling exercise to determine the optimum design layout for the harbor, taking into consideration the coastal processes that govern the physical environment in the site. A detailed Environmental Impact Assessment (EIA) was also conducted in 1997 that described the harbor construction project as an environmentally beneficial one, mainly due to the opportunity to relocate the large numbers of fishing boats that were being anchored in the adjacent coral reef area. The EIA considered alternative sites and layouts, and concluded that the project proposed at that time (present site and layout) was the preferred alternative.

In the absence of location and major layout alternatives, following alternatives are considered in this study. These are:

1. Proposed project
2. Alternative locations/layouts for the breakwater extension
3. No action

The proposed project has been described in detail in Chapter 2. It consists of: (a) repairs to tsunami damaged breakwaters; (b) extension to inner most arm of the southern breakwater by 20 meters; (c) dredging of the inner harbor basin; and (d) a slipway and improving few on shore facilities.

The proposed activities of the project are related to the rehabilitation and improvement of the existing Hikkaduwa harbor, which are essential for its efficient functioning and safe anchoring of boats. The rehabilitation work, which includes the repair of breakwaters, is urgently needed due to damage resulting from the tsunami. The ‘no action’ alternative, would result further deterioration of the breakwater structures and increasingly undermine the safety and capacity of the harbor. This will affect the fishery community that depends on the harbor for their livelihood. In this context, repairing the damaged breakwater is clearly the preferred action.

The harbor improvement work, which includes the proposed extension to the breakwater and the deepening of the basin, is needed to control the turbulent conditions in the harbor and to create the desired depth for multi-day boats. Mathematical model study by the LHI proved that these two actions in combination can minimize the turbulence in the south basin of the harbor to an acceptable level. The other alternative layouts for breakwater extension [(a) extending the seaward arm of the southern breakwater; and (b) adding a new breakwater in the north side of the entrance diagonal to the northern breakwater] are discarded due to the possibility of increased sedimentation on the adjacent coral reefs. The proposed layout however, may have an impact on navigation. The acceptability of the proposed layout to the community will be verified in the future through the community consultation.

4 Description of the Environment

4.1 Physical Environment

4.1.1 Topography and Land Use

Hikkaduwa – a fishing village and an attractive tourist center in the Southern Province of Sri Lanka – is located at a distance of about 100 kilometers southwest of Colombo. It is situated in the administrative district of Galle and the DS division of Hikkaduwa. Hikkaduwa is predominantly a flat area with maximum elevations less than 20 meters above mean sea level (MSL). Low elevations are dominant within one kilometer of the shoreline (ECL, 1997; USAID, 2005).

4.1.2 Hydrology

Rainfall

Figure 3, below, presents the annual rainfall variation in Hikkaduwa. Hikkaduwa experiences two rainfall peaks, one in May and the other in October. The annual average rainfall is reported to be around 2073 mm (ECL, 1997).

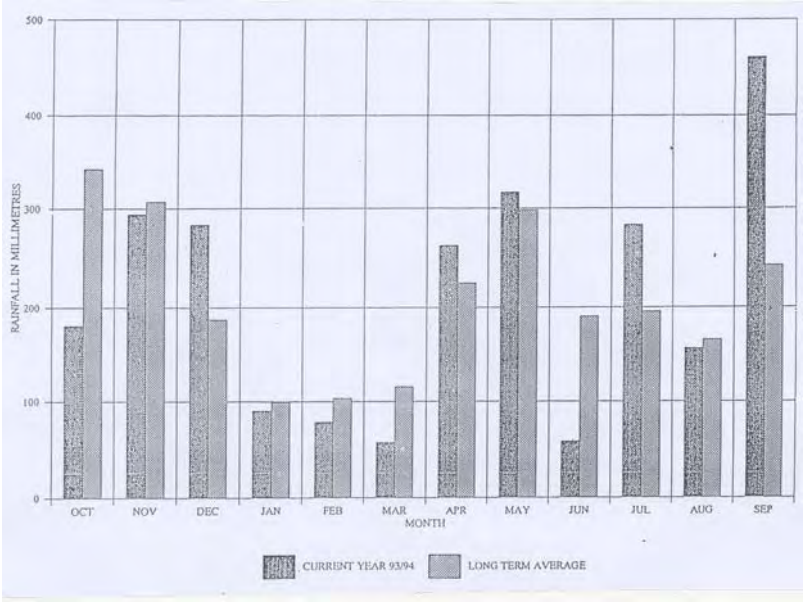

Figure 3 - Variation of rainfall (Galle)

Surface Water and Ground Water

The major surface watercourses in the area include Hikkaduwa River (approximately 0.5 kilometers north of the fishery harbor), Mawakada Ela (approximately 1.25 kilometers south of the fishery harbor) and the Kuduwegoda Ela (less than 0.5 kilometers south of the fishery harbor). These watercourses generally have a slow flow, except during the rainy seasons (ECL, 1997). Refer to Figure 2 for a general presentation of the location.

The Hikkaduwa River is in fact an estuary that forms a lake near its outlet. There is continuous sand deposition inside the lake (visible as sand shoals or islands from Galle Road), and this sand is transported mainly from the marine environment along with the rising tide. Sand release from the lake into the marine environment is not significant as it primarily accumulates within the lake (ECL, 1997).

The Mawakada Ela is a polluted tidal canal that skirts the present garbage dump site at Pannangoda where the municipal solid waste from the Hikkaduwa town is dumped. The waste is collected daily by the Pradheshiya Sabha, and the dump is leveled manually and covered with soil. This site is partly marshy and is in the flood plain of the Mawakada Ela (ECL, 1997).

The Kuduwegoda Ela canal has a blocked outlet due to sand bar formation, which is almost becoming a permanent feature. This canal drains a marshy area of about five hectares (ECL, 1997).

The ground water table occurs within two to five meters of the surface and is mildly saline. While salinity itself is not a major issue, fecal pollution from toilet cesspits makes the water not potable for direct human consumption. Such contamination is common in the developed coastal belt supporting tourism establishments, but the resulting impact is not significant because the area of Hikkaduwa harbor (by Galle Road) is fed with pipe-borne water. All tourist resorts also depend on the municipal water supply, and there are no large-scale groundwater extractions (ECL, 1997).

In the interior areas beyond the town and Galle road where municipal water supply is unavailable, people depend on shallow well water. These areas have lesser problems of groundwater contamination by fecal matter compared with coastal tourist areas.

Natural Drainage

The area is drained by the Hikkaduwa River, which has a catchment area of about 5,000 hectares and includes two tidal canals, Mawakada Ela and Kuduwegoda Ela. These streams drain catchment areas, which support diminishing areas of mangrove and other wetland ecosystems, paddy, vegetable gardens and urban and suburban settlements. During the dry season the flow diminishes but, following intense rainfall events, it can carry heavy loads of organic fine sediments, coarse solid wastes accumulated along the channels, and undoubtedly some pesticides, oils and other contaminants including heavy metals such as lead and zinc. Stream discharges during the wet season are high and pollution impacts from such chemical contaminants are minor (ECL, 1997).

There is also a small canal in the area, which drains a marshy area of about four hectares into the northern harbor basin.

Sand bar formation is rare at the Hikkaduwa estuary mouth as a result of outlet structures, which have prevented coastal flooding. However, the accumulation of sand inside the lake poses a future case for inefficient floodwater release. This situation combined with the restricted outflow through the fixed railway and highway bridges may form critical sections during high flows, which may lead to future flood hazards (ECL, 1997).

4.1.3 Geology

The broad coastal plains of southwestern Sri Lanka are developed on basement rocks (mainly basic igneous intrusives) on the lower margin of a broad syncline which tilts downwards to the southwest. A few low hills on the plain surface form rocky islands off the southwest coast, and small groups of islands occur near Hikkaduwa. During periods of lower sea level, elongated rocky ridges existed on the coastal plain, which now form a discontinuous rocky reef lying about 500 meters to one kilometer offshore. The seaward and upper surfaces of these submarine-rises support coral growth (ECL, 1997).

4.1.4 Coastal Dynamics

Hydrodynamics

The wave climate in the Hikkaduwa area is similar or comparable to that generally occurring on the southwest coast of Sri Lanka. It is characterized by two simultaneous wave systems: the long period swell with an almost southerly direction in deep water, with only minor differences in the wave height during the course of the year, and the shorter period waves during the southwest monsoon lasting from May to September. Table 1 presents the main wave parameters at an eight meter depth off Hikkaduwa (ECL, 1997).

Table 1 - Main wave parameters (at eight meter depth off Hikkaduwa)

Wave Parameter	Swell Waves		Sea Waves	
	May-Sept	Oct-Apr	May-Sept	Oct-Apr
Significant wave height (m)	0.9-3.3	0.6-2.1	1.0-3.3	Not significant
Wave period (seconds)	11.0-13.6	10.5-12.8	4.4-7.0	
Dominant direction	205-220^{o}N	205-220^{o}N	230-270^{o}N	

The near-shore currents are moderate and the majority of them are in the range of two to 34 centimeters per second with the stronger currents occurring in the area immediately south of the southern breakwater. LHI model studies have also documented strong currents in the direction of the river mouth. These currents and their approximate directions in the vicinity of the project site are illustrated in Figure 4.

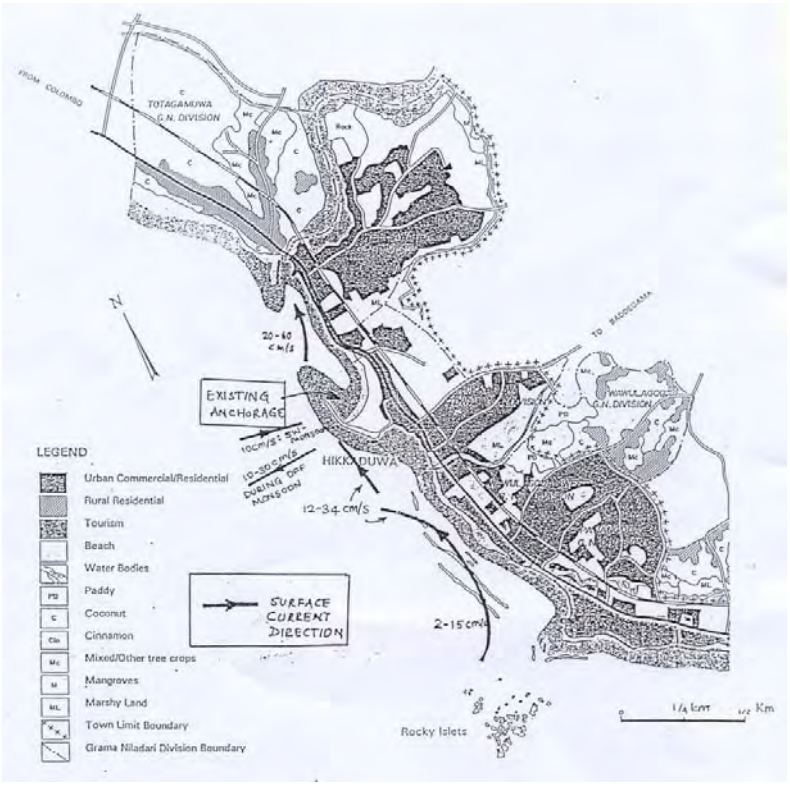

Figure 4 - Approximate surface current pattern in the Hikkaduwa area

The tidal range is about 0.8 meters on average. Tidal currents have been attributed as the cause of sand shoaling in the interior of the Hikkaduwa river mouth (ECL, 1997).

Wind

Wind patterns in the Hikkaduwa area – which are similar to those in Galle – are shown in Figure 5. Wind speeds range between 5.5 and 12.5 kilometers per hour. The higher wind speeds occur between May and October, which is the southwest monsoon season. The average wind speed during this season is approximately one kilometer per hour (ECL, 1997).

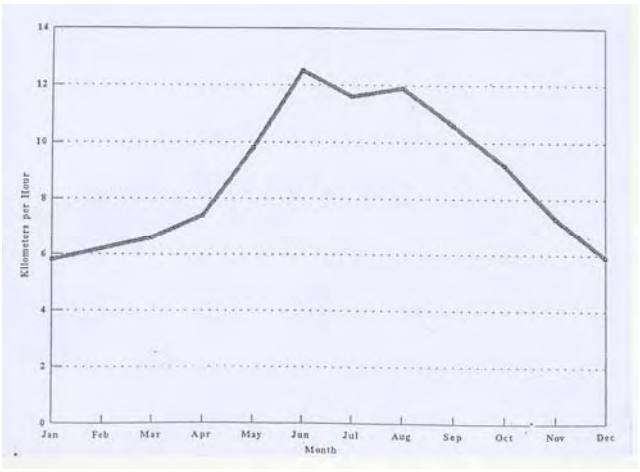

Figure 5 - Mean monthly wind speed in Galle, 1983-1992 (Meteorology Department)

Bathymetry

Bathymetry in the vicinity of the project area is illustrated in Figure 6. The nearshore area comprises coral reefs and many rock outcrops. The reef areas are shallow and have depths of one meter or less below MSL. The average slope of the continental shelf is about 1/50 (vertical/horizontal distance) (ECL, 1997).

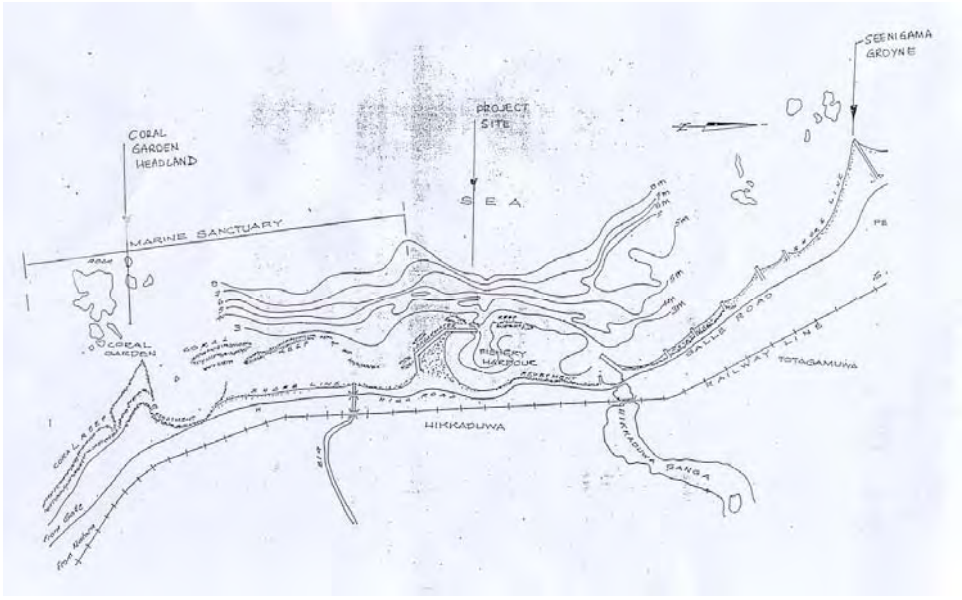

Figure 6 - Bathymetry of the project area

Sediment Transport

The nodal point of longshore transport in the southwest coast lies between Dodanduwa and Akurala. The coastal stretch between the Seenigama groyne and the Coral Garden headland, between which the fishery harbor lies, is a sub-section along this stretch which has a sediment budget that is minimally affected by neighboring beaches. Beaches between the Coral Garden headland and the fishery harbor are fronted by coral reefs, thereby blocking any significant longshore supply of sand. The only stream within this coastal stretch is the Hikkaduwa River, which hardly supplies any sediment to the beach. Therefore the most significant source of sediment is the coral-generated sediment from the nearshore zone. It is clear that the Hikkaduwa area has a highly localized and delicate sediment budget (ECL, 1997).

According to past studies the loss or removal of sediment between the reef and the shoreline averages about 5000 m^3 per year. The sand is either being trapped in the Hikkaduwa River (confluence north of the harbor) or transported north of Seenigama. Somewhat uniform spatial distribution of high percentage of calcium content (15-25%) indicates a reduced discharge of river sediment to the sea. However it is also observed that during dry spells the river acts as a sediment sink. After rains it discharges sediments to the reef, and some sand is transported north by the currents (USAID, 2005).

4.1.5 Beaches and coastal structures

The shoreline north of the project area has several short groynes and revetments running a distance of nearly two kilometers parallel to Galle Road. These include the river mouth training groynes of the Hikkaduwa River (or estuary). Sandy beaches (fine sand with mean diameter of about 0.1 millimeter) occur north of Seenigama. The shoreline immediately south of the anchorage is also reverted to a distance approximately 300 meters, up to the mouth of the Kuduwegoda Ela. Sandy beaches occur thereafter in front of the reefs of Hikkaduwa Marine National Park. The shoreline is again reveted in the vicinity of the Mawakada Ela outlet. Sandy beaches are known to occur south of Coral Garden beach over a distance two to three kilometers (ECL, 1997). Figure 4 represents these features of the shoreline.

4.1.6 Physical Resources

The major physical resources occurring in the project area are marine corals, beach sand, inland coral deposits and granite rock. Of these, marine corals are a protected resource, legally unavailable for mining. Inland coral mining is permitted, however, and is exploited fairly intensely, especially in Akurala. Beach sand mining is also prohibited by CCD in the project area. However, there is no restriction on sand mining from Hikkaduwa Lake. Nevertheless, no mining takes place in the lake and also mining permits have not been issued by the Divisional Secretary (ECL, 1997).

The granite rock occurring in Wellawatta, which is approximately 0.8 kilometers from the project area, is partly government-owned and partly privately-owned. This rock has been quarried for more than fifteen years in relatively small quantities. One large scale use of

the rock has been by the Irrigation Department for construction of the Hikkaduwa anchorage breakwater. At present this quarry supplies material for building and road construction (ECL, 1997).

4.2 Ecological Environment

The ecological environment in the area can be broadly categorized into terrestrial and aquatic habitats. The different types of habitats, both natural and man-made, that occur in the area and their approximate locations are described below in Table 2.

A description of the significant ecological habitats is presented below.

Main category	Sub-division	Habitat Type	Name or location
Terrestrial habitats	Human habitats	Urban commercial & residential, rural residential and settlements	
	Cultivated habitats	Coconut, cinnamon, mixed homesteads and other tree crops	
	Natural habitats	Inland rock	Wellawatte
		Natural Vegetation	Scattered
Aquatic/Wetland habitats	Freshwater wetlands	Riverine	Hikkaduwa Ganga
		Marshlands	Scattered in the area
	Man-made wetlands	Paddy cultivation	Scattered in the area
	Coastal/marine habitats	Tidal canals	Kuduwegoda Ela and Mawakada Ela
		Riverine estuary	Hikkaduwa river mouth
		Mangroves	Small patches associated with the Kuduwegoda Ela and the Mawakanda Ela
		Coral reefs	Hikkaduwa National Park
		Beaches	South of Hikkaduwa river

Table 2 – Ecological habitats in the area
Source – EIA Hikkaduwa Fishery Harbor - ECL, 1997

4.2.1 Coral reefs

Coral reefs are a primary tourist attraction in Hikkaduwa, but just as elsewhere in Sri Lanka they have suffered extensive degradation (Coastal Environmental Profile of Hikkaduwa, 1994). The main coral reefs in Hikkaduwa occur primarily as fringing reefs in the Hikkaduwa Marine National Park between the Coral Garden Hotel to the south and the fisheries harbor to the north (see Figure 2). The reef was declared as a marine sanctuary under the Fauna and Flora Protection Ordinance in 1979 and was later upgraded to a national park. The reef extends for approximately 130 meters seawards before dropping to soft substrate at a depth of seven to ten meters. It has two sections, namely the coral reef within the reef lagoon and the seaward reef slope.

The coral reefs in Hikkaduwa have been studied fairly rigorously. Surveys have been conducted by NARA in 1985, 1992 and 1994 to assess the condition of the coral reefs within the national park. Reef studies were also been conducted in 1999 after the Indian Ocean coral bleaching event and in 2005 after the Indian Ocean tsunami.

In 1994, the overall live coral cover in the national park was 34%, with 46 coral species represented belonging to fourteen families. This was a significant increase from the overall coral cover of 18.9% recorded in 1985 (see **Table 3** below), mainly observed in the reef lagoon. However, the coral cover in the middle section of the coral reef, where anchoring of fishing boats took place before the construction of the fishery harbor, was reduced significantly during the period between 1985 and 1994. Although an increase in live coral cover was seen between 1985 and 1994, the diversity of coral species had dropped (Coastal Environmental Profile of Hikkaduwa, 1994).

Substrate	% Cover in 1985	% Cover in 1994
Live hard coral	18.7	33.8
Live soft coral	0.2	0.2
Total live coral	18.9	34
Dead Coral	29.0	16.8
Total dead substrate (sand, coal rubble and dead coral)	77.3	64.7
Algae/ Sea grass	3.8	1.3

Table 3 – Comparison of percent coral reef substrate cover in the marine sanctuary in 1985 and 1994.

In 1994, the reef recorded 176 species of reef fish belonging to 76 genera and 40 families. The diversity and abundance of reef fish had decreased over a period of time due to several reasons, including collection of ornamental reef fish for the aquarium trade, lobster fishing, dynamite fishing, and others (Coastal Environmental Profile of Hikkaduwa, 1994).

Following the Indian Ocean coral bleaching event in 1998, the coral reef in Hikkaduwa Marine National Park was completely destroyed (Rajasuriya, 2000). Live coral cover was recorded as 7% in 1999, which reflected the recovery of several coral colonies (Rajasuriya, 2000). There was also a loss of butterfly fish (Chaetodontidae) and damselfish (Pomacentridae) populations associated with this loss of live coral cover (NARA/CORDIO/IUCN, 2005 and Rajasuriya, 2000). The abundance and diversity of

butterfly fish are closely related to the type and composition of corals, which explains their population decline after 1998.

In late 2004 the reef suffered high levels of smothering due to sand and other extraneous matter brought in by the tsunami (NARA/CORDIO/IUCN, 2005). Mechanical damage to corals was assessed as high in intensity and moderate in extent (NARA/CORDIO/IUCN, 2005). However, fish life seemed relatively unaffected, although some habitat destruction was observed.

Management Issues

The coral reefs in Hikkaduwa have been heavily impacted by both natural and human-induced factors. Prior to the construction of the harbor in 2001 (USAID, 2005) about 40 fishery boats were anchored in the reef area. It was estimated that the damage caused by the fishery boats accounted for about 20% of all factors that were causing degradation of the coral reefs (EIA for Hikkaduwa Fishery Harbor, ECL, 1997). The large number of glass bottom boats operating in the area has also contributed significantly to coral damage and continues to do so. However, the tsunami damaged a large number of glass bottom boats and only about 20 to 30 boats are operational at present. Wastewater discharges from beach hotels and restaurants, solid waste and litter generated by beach visitors and sediment laden storm water discharges have been the other critical human-induced factors affecting the coral reef over the years. However, at present most of the hotels discharge their wastewater into waste/septic tanks. A central waste treatment facility, funded by AUSAID to treat wastewater from the tourist establishments will become operable in 2006. The solid waste is currently collected by the local authority and dumped in open areas under its jurisdiction. However, small amounts of litter can still be seen on the beaches of Hikkaduwa.

The reef lagoon is highly degraded due to sedimentation and loss of live coral. Many corals are now buried under sand and the exchange of water has also been restricted by the accumulation of silt in one of the passages at the southern end of the coral reef. This causes stagnation of water and prevents the washing out of silt and pollutants. The abundance of the calcareous alga *Halimedia* has increased to a level where the growth of live coral has been impeded. The growth of the algae is also contributing to increased sedimentation (Rajasuriya, 2000).

Reef walking is another problem affecting the coral reef. Sedimentation has reduced the depth of the reef lagoon, allowing people to wade through and walk on the reef and cause damage to the corals.

4.2.2 Turtle nesting beaches

It is recorded that the following endangered species of turtles inhabit the marine waters of the Hikkaduwa National Park: (a) Leathery turtle (also known as Leatherback turtle) and (b) Green turtle. However, a survey conduced by NARA in 1997 on turtle nesting beaches in Sri Lanka has reported that the beaches of Hikkaduwa are rarely nested (see chapter 8 for reference).

4.2.3 Estuary

The biological diversity in the interior of the Hikkaduwa river estuary comprises of small patches of mangroves vegetation, marshy lands, fish (including ornamental fish), birds and reptiles. One of the main ecological functions of the estuary is recruitment of fish and shrimp larvae into the estuarine habitat and the inshore coastal waters. These in turn support the livelihoods of many people who engage in small-scale fishing (for fish and shrimp) in the estuary, river and inshore coastal waters (EIA for Hikkaduwa Fishery Harbor, ECL 1997).

4.3 Socio Economic Environment

The socio-economic environment of the Hikkaduwa area has been well studied, and was described in the Coastal Environmental Profile of Hikkaduwa (1994) and the EIA Report for Hikkaduwa Fishery Harbor (1997). Although changes in the socio-economic statistics may have occurred over the past few years, it is believed that the socio-economic character of the area remains essentially unchanged. Therefore, the present study has made use of the available literature on the socio-economic character of the area and obtained updates of socio-economic statistics, where necessary, applicable to the project area from relevant offices. A summary of is the information gathered presented below.

Project area

The project area comprises five GN divisions, namely, Wellawatte, Hikkaduwa Town, Wawulagoda West, Pannangoda and Wewala. The locations of these GN divisions are indicated in Figure 2 on page 4.

4.3.1 Population

In 2004, the total population of the five GN Divisions in the project area stood at 4909, comprising of 2568 males and 2341 females. Table 4 gives the population distribution in the project area according to GN division as well as the gender distribution within each GN division.

G.N. Divisions	Male	Female	Total
Wellawatta	621	661	1282
Hikkaduwa Town	627	557	1184
Wawulagoda West	417	335	752
Panangoda	506	443	949
Wewala	397	345	742
Total	2568	2341	4909

Table 4 – Population distribution in the GN divisions of the project area
Source - Department of census and statistics, 2005

Population density

The following table indicates the high population density in the project area compared to the population density in Galle District of 613 people per square kilometer (*Source – Department of Census and Statistics, 2005*). The Hikkaduwa town GN division has a population density of 9,102 per square kilometers and is the highest in comparison with

the other GN divisions in the project area, and which reflects the largely urban nature of the town area. The density of population has a direct impact on the usage of and impact on natural resources. High population density is generally associated with negative impacts on the environment.

G.N. Divisions	Total Population	Extent of the GN in Km^2	Population Density per Km^2
Wellawatte	1,282	0.48	2,670
Hikkaduwa Town	1,184	0.13	9,102
Wawulagoda West	752	0.26	2,895
Panangoda	949	0.52	1,825
Wewala	742	0.76	976
Total	4,909	2.15	2,283

Table 5 – Population density in the project area
Source - Department of census and statistics, 2005

4.3.2 Ethnic and religious composition

In terms of the ethnic and religious background of the people in the area, a large majority (98%) are Sinhalese Buddhists. Although the southern coastal area has a caste oriented societal structure, caste no longer is an influential factor in determining employment. However, in social interactions and politics caste consciousness is still an important issue.

4.3.3 Education

There are schools in almost every GN division. The standard of education in the project area is comparable with the situation in other harbor areas, including in Mirissa and Puranawella. Many attend school up to grade six to ten, and afterwards the percentage of school dropouts is high. The percentage of the population that pursues tertiary education is very low.

4.3.4 Economic Activity in the Area

Tourism and fisheries are the two most important economic activities in the area. The following table indicates the type of livelihood activities taking place in the area and the number of people engaged in these activities.

According to statistics maintained at the Hikkaduwa DS office, 106 people are engaged in the fisheries industry and its related activities. However, it must be cautioned that that the relatively low number of people engaged in the fishery industry in the project area should not be used as an absolute guide to estimate the importance of this industry in Hikkaduwa. The EIA report for the Hikkaduwa harbor reports that the Fisheries Inspector (FI) Divisions in Hikkaduwa namely, Hikkaduwa South, Hikkaduwa North and Dodanduwa, has approximately 50% of the fishermen in Galle (nearly 7,500 fishermen). The aforementioned three FI divisions encompass a much larger area (approx 30 to 35 GN divisions) than the five GNs selected as the project area for the present EA.

The fisheries sector analysis presented in the Coastal Environmental Profile for Hikkaduwa also states fisheries as one of the main economic forces in Hikkaduwa. The

report further states that both the tourism and fisheries industries employ a high percentage of people from adjacent areas.

Therefore, the following reasons may explain the reasons behind the relatively low number of people engaged in the fisheries sector in the project area.

1. Relatively small geographical extent of the project area when compared to the distribution of fishery families in Hikkaduwa that depend on the harbor.
2. The presence of the Hikkaduwa town in the project area, which is a main urban center, and which has a large population engaged in commercial activities.

G.N. Division	Tourist	Fishing	Coir Industry	Fishing Related industry	Govt.	Others
Wellawatta	10	20	08	02	28	104
Hikkaduwa Town	20	37	02	28	43	117
Wawulagoda West	13	17	1	1	04	11
Panangoda	12	1	1	-	04	32
Wewala	09	1	0	-	02	12
Total	64	76	12	30	81	276

Table 6 – Main livelihood activities in the project area and the number of people engaged in each activity
Source: Divisional Secretariat Hikkaduwa 2005

Hikkaduwa is one of the prime tourist resorts in the country. In general, tourism growth in Hikkaduwa was unplanned and is comprised of both formal and informal sectors. The formal sector is mostly larger establishments approved by the Ceylon Tourist Board (CTB) while the informal sector is made up of the smaller, unapproved establishments not registered with the CTB. The informal tourist sector in Hikkaduwa is quite large, which in fact has earned the area a reputation as the center for informal tourism (Coastal Environmental Profile for Hikkaduwa, 1994). Although tourism has stimulated the growth of the local economy, the unplanned development has resulted in many social and environmental impacts.

Tourism in Hikkaduwa is primarily concentrated on the beach activity and shopping. Wawulagoda West and Pannangoda GN divisions have narrow beaches and therefore have a high density of use. Wewela GN division has a wide segment of beach, which also has a great number of beach users.

Table 7 indicates the number and types of tourist establishments in the project area. Although the area has a high number of tourist establishments, a majority of the people servicing the industry are employed from outside (See Table 6 above).

No.	G.N. Divisions	Hotels	Guest Houses	Restaurants & Shops	People engaged in Tourism sector
1	Wellawatta	-	3	1	10
2	Hikkaduwa Town	-	7	7	20
3	Wawulagoda West	4	10	32	13
4	Panangoda	-	12	61	12
5	Wewala	4	23	36	9
	Total	8	55	137	64

Table 7 – Number of tourist establishments in the project area
Source - Hikkaduwa Hoteliers Association

At the commencement of the rehabilitation project, a community consultation was held in the Hikkaduwa harbor with the members of the Hikkaduwa Harbor Fisheries Committee. This was done in order to educate the harbor users about the proposed project and to obtain their feedback on the problems and issues they encounter in the usage of the harbor. The following section describes the issues raised by the harbor users during this consultation. It is presented in the manner in which they were mentioned.

Infrastructure
With regard to infrastructure facilities within the harbor, the following issues were raised as development needs:

- The entrance to the harbor is treacherous at present, and needs to be made safer. Shifting of the breakwater was suggested as a solution.
- The basin is of an inadequate depth to accommodate the potential and current uses
- The jetty on the northern side needs to be reconstructed
- Fueling facilities for kerosene oil are lacking
- There is a lack of facilities for ice making within the harbor
- There is a lack of safe drinking water
- Security is lacking within the harbor
- There is a need to relocate and expand the existing toilet facilities
- There is a lack of a place to store fishing equipment
- An insufficient supply of electricity exists within the harbor
- A beacon light is needed to illuminate the harbor mouth for safe passage
- Another pier is needed on the northern side of the harbor
- Need for an appropriate auction hall for selling fish
- The northern breakwater should be extended to the length of the southern breakwater to reduce wave action into the harbor
- There is a need for a crane to lift multi-day boats
- A workshop is needed for engine repair

Environment
With regard the environment, the following issues were mentioned:

- The harbor lacks a system for collecting fish waste. Therefore, waste is put directly into the harbor.
- At times, town waste is brought and dumped in the harbor.

Economic and Social
With regard to economic and social issues, the following were mentioned.

- Insufficient facilities to sell fish.
- The lack of ice facilities requires that fishermen pay a high price to outside providers

Of the issues above, the following were identified as priorities by the Fisheries Committee at Hikkaduwa Harbor:

- Priority No.1 – Making the harbor entrance safer.
- Priority No.2 – Deepening the harbor.
- Priority No.3 – Reconstructing the jetty from the northern side, particularly to extend the boat docking facilities.
- Priority No.4 – Strengthening security within harbor. There was a call for the construction of a security wall around the harbor.
- Priority No.5 – Extending the breakwater in north to the length of the southern breakwater.
- Priority No. 6 – The acquisition of a crane to lift multi day boats.
- Priority No. 7 – A workshop to repair engines.

5 Anticipated Environmental Impacts

The potential impacts associated with the construction activities are discussed in this section. Most of the potential impacts are related to the breakwater extension and deepening of the harbor basin. Occurrence and extent of these impacts will depend on the final decision with regard to the undertaking of these two activities.

5.1 Construction Related Impacts

5.1.1 Extension to the breakwater

An extension (20 meters) to the innermost arm of the southern breakwater (pointing towards the shore) has been proposed to reduce the turbulent conditions in the inner harbor. The construction related impacts of the breakwater are mostly related to possible obstructions to navigation of fishing vessels and noise, which are discussed in general in separate sections of this chapter. There is no important benthic habitat to be affected.

5.1.2 Deepening the harbor basin (dredging and blasting)

The following table outlines the likely activities involved in the deepening of the harbor basin in Hikkaduwa and the associated impacts.

	Activity	Sub-activities	Impacts	Significance
1	Dredging	Dredging using hopper type dredger	Disturbance to bottom sediments and decrease in water quality	Low-Moderate
2	Disposal of dredged material	Loading to barges	None	None
		Disposal at site	Change harbor basin bed formation	None
3	Movement of dredger and barges carrying dredged material		Area unusable within the harbor for berthing	Low-Moderate
			Inconvenience for navigation and boat movement	High

Table 8 – Significance of impacts associated with harbor deepening activity

Re-suspension of bottom sediments due to dredging is anticipated to be temporary and localized. Investigations in the harbor basin indicate that bottom sediments consist mainly of medium-sized sand and dead coral rocks. The tidal currents and waves inside the harbor are not strong enough to disperse the re-suspended material over a large area. Therefore, it is not anticipated that the re-suspended material will travel a

significant distance from the point of origin. Impacts on the coral reefs in the national park due to construction-related sedimentation, if any, will be negligible.

Furthermore, chemical analysis carried out for the bottom sediments of Hikkaduwa harbor indicates that toxic metals are present in very low quantities and well below the USEPA specified levels (see table below). Therefore, contamination of the water column by the transfer of toxic metals will be insignificant.

Table 9 – Concentrations of toxic metals present in a Sample of bottom sediments of the Hikkaduwa Harbor

Metal	Sample (mg/l)	USEPA Limit (mg/l)
Cr	0.197	5
Zn	0.143	100
Cd	0	1
Pb	0.033	5
Ni	0.014	-
Ag	0.007	5

Note: The sediment sample was analyzed using the Toxicity Characteristic Leaching Protocol (TCLP) in accordance with USEPA guidelines by the University of Moratuwa.

5.1.3 Disposal of dredged material

Disposal of dredged material is one of the main environmental issues that will be associated with dredging. The CCD is the approving authority with regard to disposal of the dredged material. The CCD favors useful application of dredged material when compared to offshore disposal. Therefore, the plan is to use the dredged material for beach nourishment. A suitable beach nourishment site is available at Seenigama just 4km north of the Hikkaduwa Harbor. Therefore the proposed approach for disposal of dredged material is environmentally beneficial.

5.1.4 Impact on air quality

During construction there will be an increase in emission of air pollutants, such as suspended particulate matter (dust and cement) and exhaust emissions from construction vehicles. However, the overall impact of this will be low given that the construction activities are not extensive, and that strong coastal winds in the area will disperse the emissions over a large area (thus diluting the emissions to negligible concentrations). However, safeguard measures are necessary to minimize unwarranted release of dust due to construction activities and vehicle movement. These measures are explained in the Environmental Management Action Plan.

5.1.5 Noise levels and vibration

Noise due to construction machinery and equipment can exceed 75 dBA or over, which is the maximum allowable limit for public areas. However, this will not be a significant impact as the construction area is away from sensitive receptors such as schools and hospitals. The prevailing noise in the harbor is high during busy hours such as mornings and evenings; during these hours a large number of boats arrive and depart the harbor daily. The noise generated by these boats is comparable with machinery and equipment that would be used in the construction. The general safeguard measures will be adequate for addressing the noise issue caused by construction machinery and equipment.

5.1.6 Impacts of waste generation from worker camps

At present, waste and wastewater management at this harbor is poor. Solid and liquid wastes are discharged into the harbor basin. Significant quantities of floating waste matter can be observed at stagnant corners of the basin. Lack of a waste management system for the worker camps, if located within the harbor can add to this situation during the construction period. Worker camps should be provided with bins to collect garbage and regularly emptied at a safe location. Adequate toilet facilities should be provided to construction workforce. All toilets should be connected to septic tanks.

5.1.7 Impacts from quarrying operations

Rock material will be obtained from an operating quarry at Galgoda (Annex 4), which is about five kilometers inland from the harbor. The quarry already has Geological Surveys and Mines Bureau (GSMB) approval and the required Environmental Protection License from the Central Environmental Authority (CEA). Therefore it is assumed that environmental safeguard measures are already in practice at this quarry. The route from this quarry to the harbor site has already been used for transport of rock material. Impact on the amount of traffic and the condition of this road by trucks using the road to transport rock material from the site to the harbor will be insignificant. However, it is incorporated into the EMAP that any damage to roads and road structures caused by transport vehicles used by the contractor will be rectified by the contractor himself.

5.1.8 Employment opportunities

The project will create a demand for skilled and casual construction laborers during the construction period for which local people are potentially suitable. It is expected that at least part of the employment opportunities created by this project will be filled by the local people. This will result in short-term positive impact to the area.

5.1.9 Impact on harbor operations

If the breakwater extension and dredging of the harbor are undertaken, this will create certain inconveniences for navigation and boat movement during the construction period, especially when work is carried out near the harbor entrance and the quay wall. The areas where work is underway will be rendered temporarily inaccessible to fishermen's boats.

In addition, during construction there will be frequent movement of heavy trucks carrying construction material inside the harbor. Setting up of storage areas and labor huts will restrict the land space, and movement of trucks could interfere with normal harbor operations. Under such circumstances ensuring safety of the harbor users is of importance.

It is important that construction work is well planned in consultation with harbor management to minimize disturbance to harbor operations and ensure safety of its users. Measures to be adopted include: (a) restricting traffic during morning busy hours; (b) carrying out dredging in sections, thus leaving ample space for fishermen to navigate boats; (c) anchoring dredgers during non-working hours so as not to block navigational paths; (d) demarcating areas for construction work; (e) educating fishermen on the planned activities, times and areas of construction; and (f) educating fisherman on appropriate safety measures to avoid accidents and injuries.

5.2 Anticipated Operation stage impacts

5.2.1 Harbor pollution

Waste management (both solid and wastewater) is already a problem in Hikkaduwa harbor. Wastewater is discharged to the harbor basin. Significant quantities of floating waste matter can be observed at stagnant corners of the harbor basin. The proposed project will result in increased usage of the harbor facilities thus increasing the waste generation.

Through the PCM component of the SLTRP the issue of waste management will be studied. This study will assess the status of waste management in the community surrounding Hikkaduwa Harbor, and make recommendations both for the project and local authorities and CBOs (including the Harbor Fishery Committee) to consider implementing. It is anticipated that the assessment will identify practical measures to minimize the waste and waste water and manage in environmentally acceptable manner, and is likely to include measures that raise awareness among harbors users on good management practices and correct disposal of waste.

Recommendations provided in the solid waste assessment will be prioritized and determined to be feasible or not feasible in the CDAP to be submitted by SLTRP in April 2006. It is anticipated that any such activities will fall into the area of capacity building and improved environmental management, which was given a categorical exclusion in the SLTRP IEE (USAID 2005) as discussed above.

5.2.2 Increase in employment opportunities and income

The project will enable the harbor to operate at a higher capacity than at present due to the deepening of the harbor and reduced turbulence. This is anticipated to encourage new boats to enter and utilize the facility, perhaps with larger capacity. This is likely to create employment opportunities for the unemployed members of the community and generate a higher income for harbor management.

6.0 Environmental Management Action Plan

The Environmental Management Action Plan (EMAP) for the Hikkaduwa Harbor rehabilitation project, detailed below, will minimize adverse environmental and social impacts that could arise from project activities. The EMAP should form part of the bid documents and shall be considered alongside the specifications. Thereby the prescriptions detailed in the EMAP are mandatory in nature and contractually binding. The EMAP will be equally applicable to all categories of sub-contractors. The main contractor will be responsible for the compliance with the requirements of the EMAP by sub-contractors, including nominated sub-contractors. The "Engineer" on behalf of the Employer will enforce and monitor the compliance of EMAP by the contractor.

Environmental monitoring in construction projects falls into two areas: effect monitoring and compliance monitoring. This section explains the consultants' proposal for environmental monitoring of rehabilitation and improvement works of the Hikkaduwa Harbor.

The EA proved that both long and short term negative effects of this project are mostly negligible. However, the blasting effects on nearby structures, particularly older structures, may be significant if the contractor fails to take control measures. Therefore, it is recommended that blasting impacts be monitored during the construction. If blasting is involved in the harbor dredging, it is recommended that the contractor be asked to submit a program for monitoring the blasting impacts to the engineer for approval. The contractor must submit its plan prior to commencement of blasting work. The contractor's monitoring plan/program shall establish the monitoring parameters, baseline conditions, measurement procedure and frequency of measurements.

The compliance monitoring will enforce the implementation of environmental safeguards as specified in the EMAP. The overall responsibility of enforcement of the compliance of environmental safeguards will rest with the Engineer. However, the effectiveness of compliance regime can be strengthened by participation of other stakeholders, mainly the community in monitoring. Therefore the consultants recommend that an "Environmental Monitoring Committee" be established under the direction of the harbor manager. This committee shall be comprised of the CH2MHill Engineer or site representative, the contractor's senior resident engineer/manager, Local Authority representative, Divisional Secretary and three members from the harbor committee representing the community. The committee should meet once a month to review the effects and compliance with environmental safeguard measures. The committee decisions shall be implemented within the framework provided by the contract agreement and as directed by the Engineer.

The proposed EMAP is presented below:

Environmental Issues				**Protection And Preventative Measures That Have To Be Taken By The Contractor**
1.	**Earthwork and Soil Conservation**			
	1.1	**Disposal of Debris and Spoil**		
			(a)	Dredged spoil shall be disposed only at a location specified by the approving authority (CCD) under recommended guidelines.
			(b)	All other debris and residual spoil material including any remaining earth shall be disposed only at locations approved by the engineer for such a purpose. If directed by the Engineer the contractor shall obtain the necessary approval from the relevant local authority for disposal of debris and spoil at the specified location.

Environmental Issues			Protection And Preventative Measures That Have To Be Taken By The Contractor	
			©	The debris and spoil shall be disposed in such a manner that (i) drainage paths are not blocked (ii) the disposed material should not be washed away by runoff/floods and (iii) should not be a nuisance to the public.
			(d)	If consented to by the Engineer, the contractor can dispose the debris and spoil as a filling material provided that the contractor can ensure that such material is used for legally acceptable purposes with disposal conducted in an environmentally acceptable manner.
	1.2	**Protection of Ground Cover and Vegetation**		
			(a)	Construction vehicles, machinery and equipment shall be used and stationed only in the areas of work and in any other designated areas by the Engineer.
			(b)	Contractor shall provide necessary instructions to drivers and operators not to destroy ground vegetation cover unnecessarily.
	1.3	**Prevention of Soil Erosion**		
			(a)	Work that leads to heavy erosion shall be avoided during the raining season. If such activities need to be continued during the rainy season, prior approval must be obtained from the Engineer by submitting a proposal on actions that will be undertaken by the contractor to prevent erosion.
			(b)	The work, permanent or temporary shall consist of measures as per design or as directed by the Engineer to control soil erosion, sedimentation and water pollution to the satisfaction of the Engineer. Typical measures include the use of berms, dikes, sediment basins, fiber mats, mulches, grasses, slope drains and other devices. All sedimentation and pollution control works and maintenance thereof are deemed as incidental to the earthwork or other items of work and no separate payment will be made for their implementation.
	1.4	**Contamination of Soil by Fuel and Lubricants**		
			(a)	Vehicle/machinery and equipment serving and maintenance work shall be carried out only in designated locations/service stations approved by the Engineer.
			(b)	Waste oil, other petroleum products and untreated wastewater shall not be discharged on ground so that it causes soil pollution. Adequate measures shall be taken against pollution of soil by spillage of petroleum/oil products from storage tanks and containers. All waste petroleum products shall be disposed of in accordance with the guidelines issued by the CEA or the engineer.
			(c	Sites used for vehicle and plant service and maintenance shall be restored back to their initial status. Site restoration will be considered as incidental to work.
	1.8	**Disposal of Harmful Construction Wastes**		
			(a)	The Contractor, prior to the commencement of work, shall provide list of harmful, hazardous and risky chemicals/materials that will be used in the project work to the Engineer. The Contractor shall also provide the list of places where such chemicals/materials or their containers or other harmful materials have been dumped as waste at the end of the project.
			(b)	New disposal sites shall not be created as part of this project. Disposal of such waste shall occur at the sites designated by the CEA or the Engineer.
			(c)	The contractor shall clean up any area including water bodies affected/contaminated (if any) as directed by the Engineer at his own cost.
	1.9	**Quarry Operations**		
			(a)	Rock quarries from where metal aggregate is obtained shall have approval from the Geological Survey and Mines Bureau as well as the current Environmental Protection License. It is recommended not to obtain material from quarries that have ongoing disputes with the community.
			(b)	The maintenance and rehabilitation of the access roads in the event of damage by the contractor's operations shall be a responsibility of the contractor.
2.	**Water – Protection of Water Sources and Quality**			
	2.1	**Contamination of Water from Construction Related Wastes**		
			(a)	Dredging and blasting should be carried out in such a manner that pollution of the harbor basin is minimized (e.g. by using non-disruptive dredging techniques, carrying out construction during the northeast monsoon period, etc.).
			(b)	The discharge standards promulgated under the National Environmental Act shall be strictly adhered to. All waste arising from the project is to be disposed in a manner that is acceptable to the Engineer and as per the guidelines/instructions issued by the CEA.

	2.2	**Contamination from Fuel and Lubricants**		
			(a)	All vehicle and plant maintenance and servicing stations shall be located and operated as per the conditions and/or guidelines issued by the Engineer/Central Environmental Authority. In general these should be located away from harbor basin and wastewater shall not be disposed without meeting the disposal standards of the CEA. Wastewater from vehicle and plant maintenance and servicing stations shall be removed of oil and grease and other contaminants to meet the relevant standards before discharging to the environment.
	2.3	**Locating, Sanitation and Waste Disposal in Construction Camps**		
			(a)	Sitting of labor camps shall have the Engineer's approval and shall comply with any guidelines/recommendations issued by the CEA/LA. Construction laborers' camps, if located outside the harbor, shall not be located within 60 meters of waterways, near to a site or premises of religious, cultural or archaeological importance, school or any other sensitive area.
			(b)	Labor camps shall be provided with adequate and appropriate facilities for disposal of sewerage and solid waste. The sewage systems shall be properly designed, built and operated so that no pollution to ground or adjacent water bodies/watercourses takes place. Garbage bins shall be provided in the camps and regularly emptied. Garbage should be disposed off in a hygienic manner, to the satisfaction of the relevant norms. Compliance with the relevant regulations and guidelines issued by the CEA/LA shall be strictly adhered to.
			(c)	Contractor shall ensure that all camps are kept clean and hygienic. Necessary measures shall be taken to prevent breeding of vectors.
			(d)	Contractor shall report any outbreak of infectious disease of importance in a labor camp to the Engineer and the Medical Officer of Health (MOH) or to the Public Health Inspector (PHI) of the area immediately. Contractor shall carry out all instructions issued by the authorities, if any.
			(e)	Contractor shall adhere to the CEA recommendations on disposal of wastewater. Wastewater shall not be discharge to ground or waterways in a manner that will cause unacceptable surface or ground water pollution.
			(f)	All relevant provisions of the Factories Act and any other relevant regulations aimed at safety and health of workers shall be adhered to.
			(g)	Contractor shall remove the labor camps fully after their need is over; empty septic tanks, if instructed by the engineer shall be closed; remove all garbage, debris and clean and restore the area back to its former condition.
	2.4	**Wastage of Water and Waste Minimization**		
			(a)	The contractor will minimize wastage of water in the construction process/operations.
			(b)	The contractor shall educate and made employees aware of water conservation, waste minimization and safe disposal of waste.
	2.5	**Extraction of Water**		
			(a)	The Contractor is responsible for arranging adequate supply of water for the project purpose throughout the construction period. Contractor shall not obtain water for his purposes including for labor camps from public or community water supplies without approval from the relevant authority.
			(b)	The Contractor shall not extract water from groundwater or from surface water bodies without permission from the Engineer. If directed by the Engineer the contractor must obtain approval from the relevant agency for extraction of water prior to the commencement of the project.
			(c)	The Contractor may use the natural sources of water subject to the provision that any claim arising out of conflicts with other users of the said natural sources of water shall be made good entirely by the contractor.
3.	**Prevention of Water Logging**			
	3.1	**Blockage of drainage paths and drains**		
			(a)	Contractor's activities shall not lead to water logging as a result of blocked drainage paths and drains. The contractor shall take all measures necessary or as directed by the Engineer to keep all drainage paths and drains clear of blockage at all times.
			(b)	If water logging or stagnation of water is caused by contractor's activities, contractors shall provide suitable means to (a) prevent loss of access to any land or property and (b) prevent damage to land and property. Contractor shall compensate for any loss of income or damage as a result.

4.	**Air Pollution**			
	4.1	**Generation of Dust**		
			(a)	The contractor shall effectively manage the dust generating activities such as earthwork during periods of high winds
			(b)	All stockpiles of material generating dust shall be located sufficiently away from sensitive receptors
			(c)	All vehicles delivering materials shall be covered to avoid spillage and dust emission.
			(d)	The contractor shall avoid where possible and take suitable action to prevent dirt and mud being carried to the roads (particularly following wet weather);
			(e)	The contractor shall enforce vehicle speed limits to minimize dust generation
			(f)	The contractor shall spray water for dust suppression on all exposed areas as required (note: the use of waste water / waste oil for dust suppression is prohibited).
			(g)	All cleared areas shall be rehabilitated progressively.
			(h)	All earthwork shall be protected to minimize generation of dust.
			(i)	All existing highways and roads used by vehicles of the contractor, or any of his sub-contractor or supplies of materials or plant and similarly roads which are part of the works shall be kept clean and clear of all dust/mud or other extraneous materials dropped by such vehicles or their tires.
			(j)	Clearance shall be effected immediately by manual sweeping and removal of debris, or, if so directed by the Engineer, by mechanical sweeping and clearing equipment, and all dust, mud and other debris shall be removed satisfactorily. Additionally, if so directed by the Engineer, the paved areas/road surfaces shall be hosed or watered using appropriate equipments.
			(k)	Plants, machinery and equipment shall be so handled (including dismantling) so as to minimize generation of dust.
			(l)	The Contractor shall take precautions to reduce the level of dust emission from the batching plants to the satisfaction of the Engineer in accordance with the relevant emission norms.
	4.2	**Emission from Batching Plants**		
			(a)	The batching plants shall be sited in accordance with Engineer's guidelines. It is recommended that batching plants to be located sufficiently away from sensitive sites, if located outside the harbor. Sensitive sites include vulnerable habitats, religious, cultural and archaeological sites, residential areas, schools and industrial areas.
	4.3	**Odor and Offensive Smells**		
			(a)	Contractor shall take all precautions to prevent odor and offensive smells emanating from chemicals and processes applied in construction works or from labor camps. In a situation when/where odor or offensive smell does occur contractor shall take immediate action to rectify the situation. Contractor is responsible for any compensation involved with any health issue arisen out of bad odor and offensive smells.
			(b)	The waste disposal and sewerage treatment system for the labor camps shall be properly designed, built and operated so that no odor is generated. Compliance with the regulations on health and safety as well as CEA guidelines if any shall be strictly adhered to.
	4.4	**Emission from Construction Vehicles, Equipment and Machinery**		
			(a)	The emission standards promulgated under the National Environment Act shall be strictly adhered to.
			(b)	All vehicles, equipment and machinery used for construction shall be regularly serviced and well maintained to ensure that emission levels comply with the relevant standards.
5.	**Noise Pollution and Vibration**			
	5.1	**Noise from Vehicles, Plants and Equipment.**		
			(a)	All machinery and equipment should be well maintained and fitted with noise reduction devices in accordance with manufacturer's instructions.
			(b)	All vehicles and equipment used in construction shall be fitted with exhaust silencers. During routine servicing operations, the effectiveness of exhaust silencers shall be checked and if found to be defective shall be replaced. Notwithstanding any other conditions of contract, noise level from any item of plant(s) must comply with the relevant legislation for levels of sound emission. Non-compliant plant(s) shall be removed from site.
			(c)	Noise limits for construction equipment used in this project (measured at one meter from the edge of the equipment in free field) such as compactors, rollers, front loaders, concrete mixers, cranes (moveable), vibrators and saws shall not exceed 75 dB(A).
			(d)	Maintenance of vehicles, equipment and machinery shall be regular and proper, to the satisfaction of the Engineer, to keep noise from these at a minimum.

			(e)	Workers in vicinity of strong noise, and workers working with or in crushing, compaction, batching or concrete mixing operations shall be provided with protective gear.
6.	**Impact on Flora**			
	6.1	**Loss or Damage to Trees and Vegetation**		
			(a)	All works shall be carried out in a manner that the destruction to the flora and their habitats is minimized. Trees and vegetation shall be felled / removed only if they impinge directly on the permanent works or necessary temporary works. In all such cases contractor shall take prior approval from the Engineer.
			(b)	Contractor shall make every effort to avoid removal and/or destruction of trees of religious, cultural and aesthetic significance. If such action is unavoidable the Engineer shall be informed in advance and carry out public consultation and report on the same should be submitted to the Engineer.
			(c)	Contractor shall adhere to the guidelines and recommendations made by the Central Environmental Authority, if any, with regard to felling of trees and removal of vegetation.
7.	**Impact on Fauna**			
	7.1	**Loss, Damage or Disruption to Fauna**		
			(a)	All works shall be carried out in such a manner that the destruction or disruption to the fauna and their habitats is minimized.
			(b)	Construction workers shall be instructed to protect fauna and aquatic life as well as their habitats. Hunting, poaching and unauthorized fishing by project workers is not allowed.
8.	**Disruption to Users**			
	8.1	**Loss of Access**		
			(a)	At all times possible, work in the harbor basin and shore areas shall be planned and carried out in a way that will minimize obstruction to the activities of fishermen (vessel movement, loading, unloading, fuelling, auctioning, boat repairing etc). The contractor shall, in close consultation with the representatives of the fishing community, develop a time chart of construction work and display it for purpose of public information.
			(b)	At all times, the Contractor shall provide safe and convenient passage for vehicles and pedestrians inside the harbor, livestock to and from side roads and property accesses connecting the access road. Contractor will demarcate construction areas in consultation with the harbor management and minimize vehicular traffic during the busy hours of the harbor. Work that affects the use of access roads and existing accesses shall not be undertaken without providing adequate provisions to the prior satisfaction of the Engineer.
			(b)	The works shall not interfere unnecessarily or improperly with the convenience of public by use and occupation of public or private roads, railways and any other access footpaths to or of properties whether public or private.
			(c)	On completion of the works, all temporary obstructions to access shall be cleared away, all rubbish and piles of debris that obstruct access be cleared to the satisfaction of the Engineer.
	8.2	**Traffic Jams and Congestion**		
			(a)	Contractor shall assess the impact of his activities on traffic in access roads and plan for minimizing traffic related inconvenience to public shall be submitted to the Engineer for approval. If directed by the Engineer the contractor shall obtain the consent for the traffic arrangement from the Local Police.
			(b)	Any temporary diversion of traffic to facilitate construction work shall have the approval of the Engineer. If directed by the Engineer the contractor shall obtain the consent for the traffic arrangement from the Local Police.
			(d)	The contractor shall ensure that the running surface is always property maintained, particularly during the monsoon so that no disruption to the traffic flow occurs.
			(e)	Temporary traffic detours shall be kept free of dust by frequent application of water, if necessary.
			(f)	Personnel used for traffic control by the contractor shall be properly trained, provided with proper gear including communication equipment and luminous jackets for night use. All signs, barricades, pavement markings used for traffic management should be to the standards and approved by the Engineer/ Police.
	8.3	**Traffic Control and Safety**		
			(a)	The Contractor shall take all necessary measures for the safety of traffic during construction and provide, erect and maintain such barricades, including signs, markings, flags, lights and flagmen as may be required by the Engineer for the information and protection of traffic using the access roads.

9.	**Accidents and Risks**			
	9.1	**Public and Worker Safety**		
			(a)	All reasonable precautions will be taken to prevent danger of the workers and the public from accidents such as fire, explosions, blasts, falling rocks, falling to excavated pits, breaking flood diversions, chemical sprays, unsafe power supply lines, etc.
			(b)	The Contractor shall comply with requirements for the safety of the workmen as per the International Labor Organization (ILO) convention No. 62 and Safety and Heath regulations of the Factory Ordinance of Sri Lanka to the extent that those are applicable to this contract. The contractor shall supply all necessary safety appliances such as safety goggles, helmets, masks, boots, etc., to the workers and staff.
	9.2	**Prevention of Risks of Electrocution**		
			(a)	All electrical wiring and supply related work should conform to relevant Sri Lankan Standards. Adequate precautions will be taken to prevent danger of electrocution from electrical equipment and power supply lines including distribution boards, transformers, etc. Measures such as danger signboards, danger/red lights, fencing and lights will be provided to protect the public and workers. All electric power driven machines to be used in the construction shall be free from defect, be properly maintained and kept in good working order, and be regularly inspected to the satisfaction of the Engineer.
	9.3	**Risk at Hazardous Activity**		
			(a)	All workers employed in hazardous activities shall be provided with necessary protective gear. These activities include mixing asphalt material, cement, lime mortars, concrete etc., welding work, work at crushing plants, blasting work, operators of machinery and equipment such as power saws, etc.
			(b)	The use of any toxic chemical shall be strictly in accordance with the manufacturer's instructions. The Engineer shall be notified of toxic chemicals that are planed to be used in all contract related activities. A register of all toxic chemicals delivered to the site shall be kept and maintained up to date by the Contractor. The register shall include the trade name, physical properties and characteristics, chemical ingredients, health and safety hazard information, safe handling and storage procedures, and emergency and first aid procedures for the product.
10.	**Health and Safety**			
	10.1	**Prevention of Vector Based Diseases**		
			(a)	Contractor shall take necessary actions to prevent breeding of mosquitoes at places of work and labor camps, as well as at office and store buildings. Stagnation of water in all areas including gutters, used and empty cans, containers, tires, etc. shall be prevented. Approved chemicals to destroy mosquitoes and larvae should be regularly applied.
			(b)	Contractor shall keep all places of work, labor camps, plus office and store buildings clean and devoid of garbage to prevent breeding of rats and other vectors such as flies.
	10.2	**Workers Health and Safety**		
			(a)	Contractor shall comply with the provisions in Health and Safety regulations under the Factory Ordinance with regard to provision of health and safety measures and amenities at work place(s).
	10.2	**First Aid**		
			(a)	At every workplace, a first aid kit shall be provided as per the regulations. At every workplace an ambulance room containing the prescribed equipment and nursing staff shall be provided.
	10.3	**Potable Water**		
			(a)	In every workplace and labor camps portable water shall be available throughout the day in sufficient quantities. Water should be easily accessible. In general cold portable water is acceptable.
	10.4	**Hygiene**		
			(a)	The contractor shall provide and maintain necessary (temporary) living accommodation and ancillary facilities for labor to standards and scale approved by the resident engineer.
			(b)	At every workplace and labor camp a sufficient number of bathing facilities, latrines and urinals shall be provided in accordance with the Health and Safety regulations and/or as directed by the Engineer. These bathroom and toilet facilities shall be suitably located within the workplace/buildings. Latrines shall be cleaned at least three times daily in the morning, midday and evening and kept in a strict sanitary condition. If women are employed, separate latrines and urinals, screened from those for men and marked in the vernacular shall be provided. There shall be an adequate supply of water, within and close to latrines and urinals.

			(c)	The sewage system for the camp must be properly designed, built and operated so that no health hazard occurs and no pollution to the air, ground or adjacent watercourses takes place. Compliance with the relevant legislation must be strictly adhered to
			(d)	Garbage bins must be provided in the camp and regularly emptied and the garbage disposed off in a hygienic manner. Construction camps shall have a clean hygienic environment and adequate health care shall be provided for the work force.
			(d)	Unless otherwise arranged for by the Local Authority, the contractor shall arrange proper disposal of sludge from septic tanks. The contractor shall obtain approval for such disposal from the Public Health Inspector of the area.
11	**Protection of Archaeological, Cultural and Religious Places and Properties**			
	11.1	**Chance Found Archaeological Property**		
			(a)	All fossils, coins, articles of value of antiquity and structures and other remains or things of geological or archaeological interest etc. discovered on the site and/or during construction work shall be the property of the Government of Sri Lanka, and shall be dealt with as per provisions of the relevant legislation.
			(b)	The contractor shall take reasonable precaution to prevent his workmen or any other persons from removing and damaging any such article or thing and shall, immediately upon discovery thereof and before removal acquaint the Engineer of such discovery and carry out the Engineer's instructions for dealing with the same, awaiting which all work shall be stopped in the respective area.
			(c)	If directed by the Engineers the Contractor shall obtain advice and assistance from the Department of Archaeology of Sri Lanka on conservation measures to be taken with regard to the artifacts prior to recommencement of work in the area.
12	**Environmental Enhancement**			
		Handling Environmental Issues during Construction		
			(a)	The Contractor will appoint a suitably qualified Environmental Officer following the award of the contract. The Environmental Officer will be the primary point of contact for assistance with all environmental issues during the pre-construction and construction phases. He/She shall be responsible for ensuing the implementation of this EMAP.
			(b)	The Contractor shall appoint a person responsible for community liaison and to handle public complaints regarding environmental/social related matters. All public complaints will be entered into the Complaints Register. The Environmental Officer will promptly investigate and review environmental complaints and implement the appropriate corrective actions to arrest or mitigate the cause of the complaints. A register of all complaints is to be passed to the Engineer within 24 hours of when they are received, with the action taken by the Environmental Officer on complaints thereof.
			(c)	Contractor shall develop a suitable method to receive complaints. The complaint register shall be placed at a convenient place, easily accessible by the public.
			(d)	The contractor shall be responsible for reporting the implementation of the EMAP to the employer based on an agreed reporting format either monthly or periodically, as agreeable. The report should carry observations of the Engineer who will continuously monitor compliance with the EMAP. Periodic field supervision shall be undertaken by the employer (or representatives) to make observations on the implementation progress of the EMAP.

6 Conclusions

The project construction activities have been selected with due consideration of sustainability and safety of harbor structures as well as enhancing the capacity and functionality of the harbor. Accordingly project will improve the harbor facilities in addition to repairing the tsunami damaged infrastructure.

The proposed activities will not cause significant environmental impacts. The main concerns are with the extension to the inner breakwater arm and dredging. The proposed extension to breakwater will not cause negative environmental impacts as it will not affect the outer harbor sediment movement. Dredged material will be used for beach nourishment at Seenigama 4kms north of the harbor. This will be an environmental benefit. The construction impacts are not significant and can be well managed through application of environmental safeguards as described in the EMAP.

Furthermore, the project will bring many social and environmental benefits; thus the community welcomes its implementation.

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Annex I

Defining the scope of work for Environmental Assessments for the Fishery Harbor rehabilitation in Puranawella, Mirissa and Hikkaduwa

Introduction

Coastal infrastructure suffered a severe blow when the tsunami waves hit the country in December last year. Among them were the fishery harbors that play a pivotal role in the lives of fisher folk living in the coastal belt. The US government as part of its response to the widespread destruction caused by tsunami has come forward to provide assistance to reconstruct damaged infrastructure. In this backdrop, the Tsunami Rehabilitation Project has been formulated to design and implement an appropriate plan of work focusing on infrastructure reconstruction in selected sites including three fishery harbors in Puranawella, Mirissa and Hikkaduwa. The purpose of this document is to define a scope of work for environmental clearance to be obtained for the proposed rehabilitation work in these three fishery harbors.

Sri Lanka has a comprehensive legislative framework for environmental management, which requires certain projects/activities to be scrutinized for possible environmental impacts. In the coastal zone, which is under the jurisdiction of the CCD, the process of environmental management is stipulated by the Coast Conservation Act. Accordingly, a decision is taken as to whether a certain project/activity is required to undergo an IEE or EIA process. The rehabilitation of the fishery harbors (activities mentioned below) will not need an IEE or EIA according to the country's regulatory requirements.

From the side of the donor, USAID, environmental management process is determined by the REG216 according to which an IEE prepared at the initial stages determines whether further environmental analysis is required and if so the level of detail in the analysis required. The IEE has determined that further analysis is required and that Environmental Assessments have to be prepared for all of the sub-projects under consideration.

Need for EA reports

The following rehabilitation work will be taken into account in carrying out the Environmental Assessments (EA) of the fishery harbor rehabilitation projects. These have been identified and proposed by the US Army Corps of Engineers during their investigations here after the tsunami to assess damage to the fishery harbors and design appropriate response strategy to be financed by the US Government. Inclusion of those rehabilitation work proposed by the community into the EAs was discussed by the team members but decided to refrain from doing so as it is difficult to ascertain how much of the proposed rehab work would be accommodated at this point due to limited finances. Inclusion of a long wish list into the EA, which would be a public document, might run the risk of raising hopes of stakeholders concerned and eventually negatively affecting the project. Hence the EAs would focus on the activities proposed by the US Army Co of Engineers.

According to the availability of money, other activities from the list of improvements wished for within each harbor will be selected and if necessary environmental impacts of

those specific activities will be added on to the present EA as separate sections/addendums.

General work

- Dredging and removing boulders from the bottom of the harbor basin and entrance which will include blasting (excluding Mirissa)
- Replacement of existing flexible pavements on breakwaters with permanent concrete
- Repair of breakwaters using existing displaced boulders as well as new boulders.
- Repair and strengthening of existing revetments within the harbor
- Repairs to buildings
- Extensions to quay walls along the breakwaters

Specific work

- Extension to the breakwater in Hikkaduwa. This will be excluded from the present EA it is still under consideration and if selected will require more detailed environmental studies and data collection for modeling of sediment movement and turbulence. A separate EA will be prepared for this part of the rehabilitation work in the Hikkaduwa harbor when data and results from modeling studies have been conducted.

Using the common Terms of Reference given below separate Environmental Assessment Reports will be prepared for fishery harbors of Puranawella, Mirissa and Hikkaduwa. *(Note : The TOR has been designed in accordance of the provisions in Reg 216 of USAID)*

i Executive Summary

1 Introduction

2 Description of the proposed project
Description of all activities proposed under the project, geographical scope of project site, compatibility with plans & policies of fisheries and coastal sector

3 Project Alternatives

4 Description of the existing environment

Physical environment

- Topography and land-use (natural and man-made features)
- Hydrology (surface and ground water, natural drainage)
- Geology
- Coastal dynamics (general information on wind, bathymetry, sediment movement, coastal structures)
- Physical resources
- Ecological habitats (terrestrial and wetland eco-systems, natural and man-made, structures and functions,

Socio-economic environment

- Socio-economic profile in the project site
- Main economic activities
    - Fisheries sector
    - Other
- Cultural resources

Existing environmental problems in the project site

5 Environmental impacts
This section will be a discussion of the environmental impacts of the proposed project activities. Impacts of following nature will be discussed and analyzed as it would apply to structures and functions described in chapter 5

- Constructional and operational phases
- On-site & Off-site effects
- Direct and indirect effects
- Short-term and long-term
- Conflicts between proposed actions Vs plans and policies

6 Mitigatory measures & Environmental Management Plan

7 Conclusions and recommendations

Methodology

The EAs would be based primarily on existing literature and discussions with experts. There are EIA reports available for the three harbors concerned and the present EA would be seen essentially a build-up on that focusing on the activities of the projects.

Initial field visits have been conducted and another round of field investigations would be carried out to the proposed sites, if deemed necessary.

Work Plan

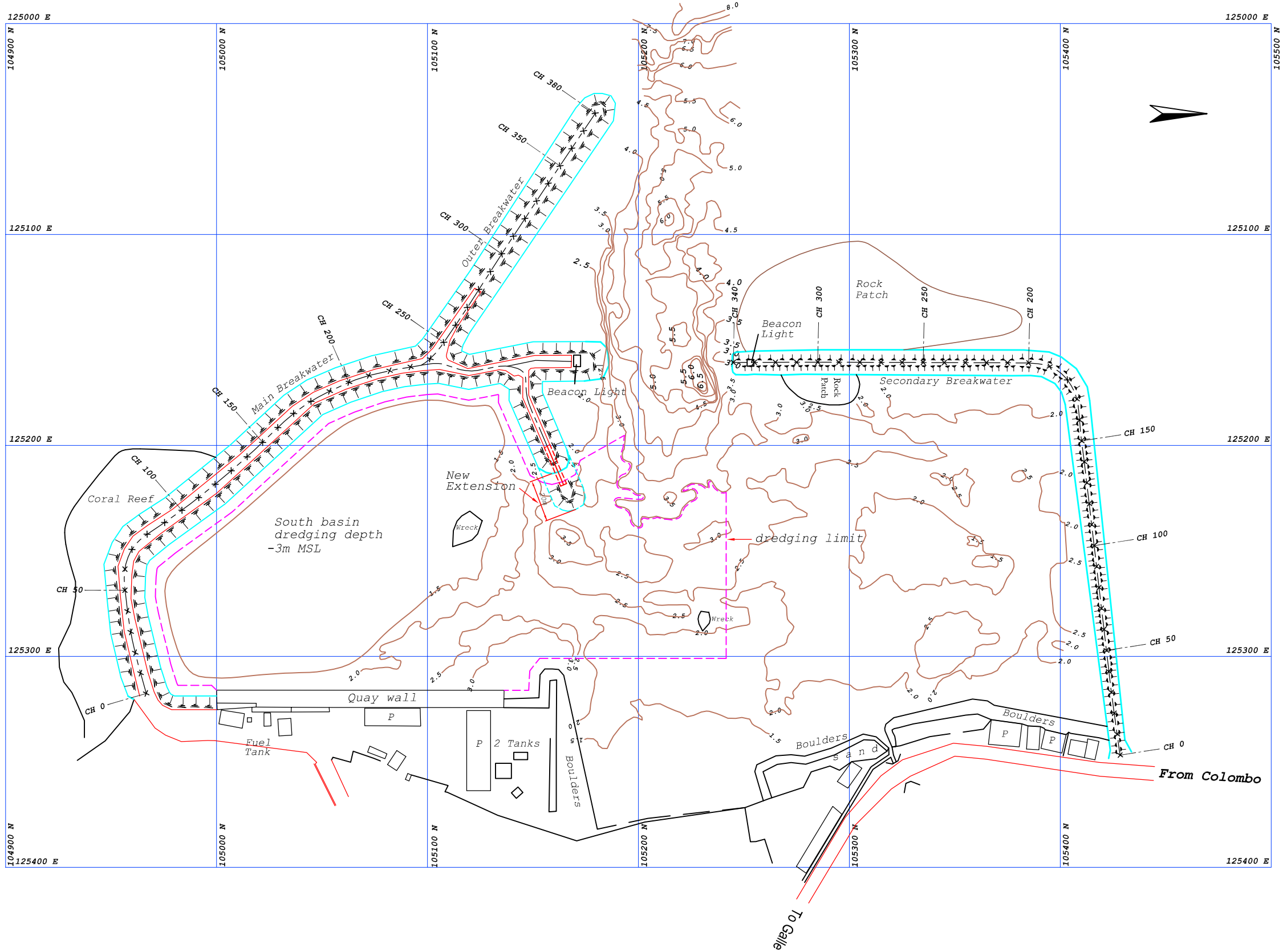
Activity	Week of						
	21st Nov	28th Nov	5th Dec	12th Dec	19th Dec	26th Dec	2nd Jan
Group meetings	↓	↓	↓	↓	↓	↓	↓
Setting scope of EAs and assembling team	—						
Literature review		—	—				
Discussions with experts		—	—	—			
Field visit – contd (if necessary)		—					
Data Analysis			—	—	—		
Report Writing				—	—	—	
Draft EA for review by TRP team						↓	
Final EA for review by USAID							↓

Annex 2 – Members of the EA team

Name	Position	Responsibility
Ms. Nadeera Rajapakse	Lead Author and Coordinator	Co-ordination, compilation, editing and final presentation of report
Dr. Mahesh Jayaweera	Environmental Engineer	Compiling the physical environment of Mirissa
Mr. Arjan Rajasuriya	Marine Ecologist	Compilation of the biological environment of Mirissa
Mr. K. Jinapala	Social Scientist	Compilation of the socio-economic environment of Mirissa
Dr. Vasantha Sririwardhane	Environmental Engineer	Compilation of the project description and reviewing the final report
Ms. Amy Bodmann	Participatory Coastal Management Lead	Review of the final report
Socio-economic survey team	Data collectors	Collection of socio economic data for the EA

In addition to the responsibilities mentioned above, the entire team participated in the identification of possible impacts and in proposing suitable mitigatory measures.

Annex 3 – Layout of proposed harbor rehabilitation work in Hikkaduwa



Work Proposed under this Project

Main Breakwater	
Location	**Proposed Work**
1).0-100m Sea side	Re-arrangement and Armour filling (1-3T)
2).175-200m Sea side	Re-arrangement and Armour filling (1-3T)
Outer Breakwater	
1).350-380 bothsides	Re-arrangement and Armour filling (1-3T)
2).380 - End	Provide Toe, re-arrangement and armour filling (6-8T) Row of boulders on seaside edge
Secondary Breakwater	
1).0-50m, 270-330 harbour side	Re-arrangement and Armour filling (0.25-0.5T)
2).180-200m seaside	Re-arrangement and armour filling (4-6T)
Inner Breakwater	
1).New extension of 20m	New construction with Toe and primary armour
Pavement works	
1).Main Breakwater & Secondary Breakwater	Repair & Bitumen surface
2).Outer Breakwater	Provide concrete pavement
Dredging	
Dredging	South basin up to -3m M.S.L
Navigation Aids	
Navigation Aids	Provide Beacon lamps at Outer Breakwater and new extension

Minor Works

1) Improvement to drinking waters supply
2) Brackish cleaning water supply
3) New toilet block
4) Kerosene oil dispensing unit
5) Replacement of damaged Fenders and Bollards in the quay wall

0 50 100 150m

DRAFT
Revised on 12/01/2006

Client : **CH2M HILL**

Project : Sri Lanka Tsunami Reconstruction Program

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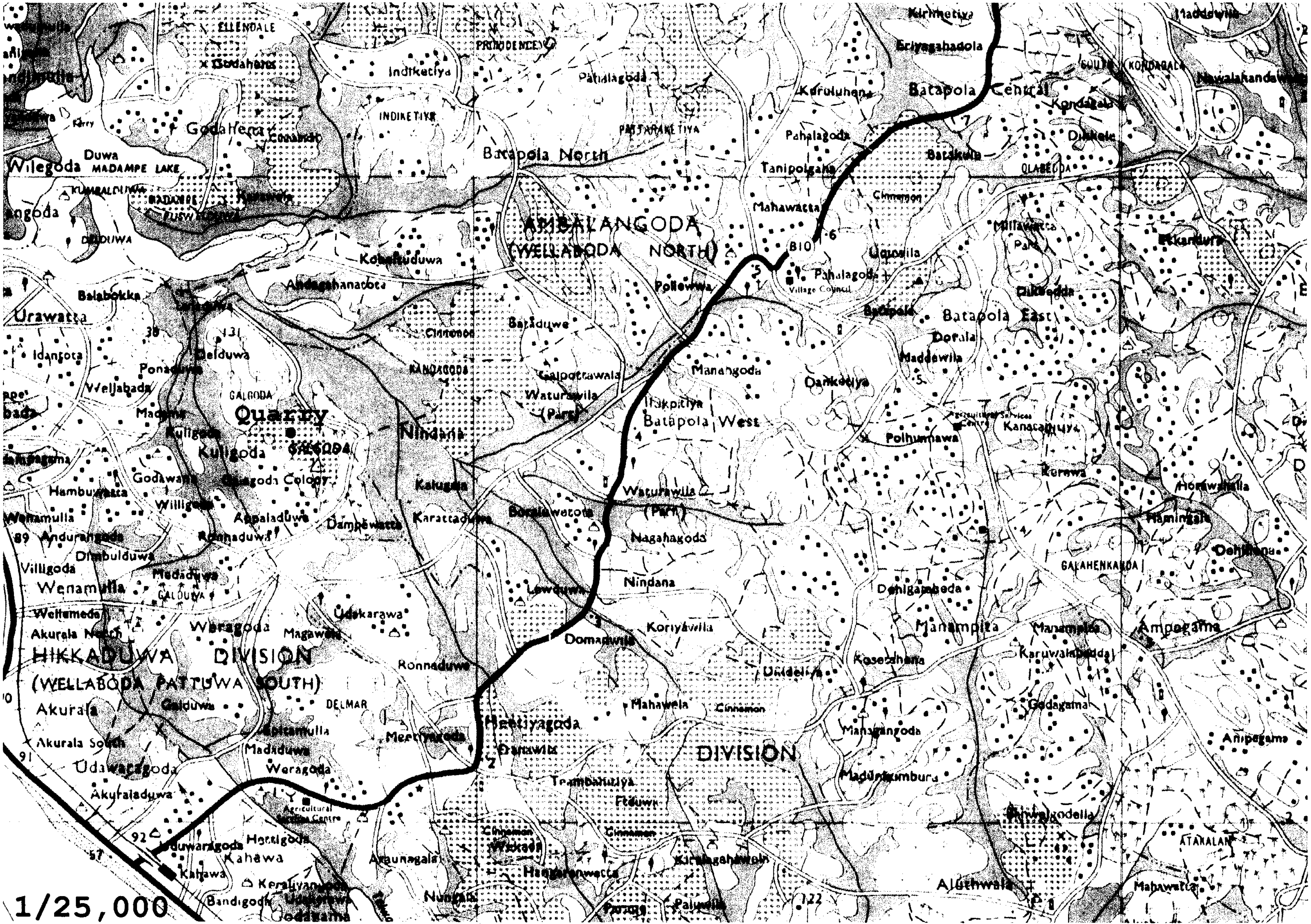
Design By :	Drawn By :	Date :
SB, RJ, LVT	TMS	12-01-2006

Title : Hikkaduwa Fishery Harbour - Layout of Proposed Work

Scale : As shown

Drawing No : HIK 1

Annex 4 - Map showing the location of rock quarry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PROVIDENCE
Godahena
Indiketiya
INDIKETIYA
Patialagoda
Kuruluhena
Eriyagahadola
Batapola Central
Kirimetiya
Maddewila
Nawalahandawila
Kondagala
Dikkele
Batakula
OLABEDDA
Pahalagoda
PATTAWAKETIYA
Batapola North
Tanipolgaha
Duwa
Wilegoda
MADAMPE LAKE
KUMBALDUWA
Cinnamon
Mahawatta
AMBALANGODA
(WELLABODA NORTH)
B10
Pahalagoda
Village Council
Uduwila
Millawatta
Palle
Ekkanduwa
Kobeituduwa
Andagahanaboda
Pollewwa
Batapola East
Balabokka
Urawatta
Baraduwe
Dorala
Maddewila
Idangoda
Delduwa
Manangoda
Dankediya
Galpottawala
Waturawila
(Part)
Weljabada
GALGODA
Quarry
Batapola West
Nindana
Kuligoda
Polhunnawa
Kanatamuya
Kerawa
Godawalla
Colony
Hambuwatta
Willigoda
Waturawila
(Part)
Hamingala
Appaladuwa
Dampewatta
Karattaduwa
Nagahagoda
Andurangoda
Dimbulduwa
Villigoda
Wenamulla
Madaduwa
GALDUWA
GALAHENKANDA
Nindana
Dehigahabeda
Udakarawa
Welitameda
Akurala North
Weragoda
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Koriyawila
Domanwila
Manampita
Ampegama
HIKKADUWA DIVISION
(WELLABODA PATTUWA SOUTH)
Ronnaduwe
Kosetahena
Karuwalabedda
Akurala
DELMAR
Mahawela
Cinnamon
Meetiyagoda
DIVISION
Godagama
Akurala South
Madaduwa
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Manawangoda
Anipegama
Udawaragoda
Weragoda
Madunkumbura
Akuraladuwa
Teambahaliya
Agricultural Services Centre
Hettigoda
Kahawa
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Kiralagahawela
Aluthwala
ATAKALAN
Mahawatta
Keraliyangoda
Bandigoda
Nungala
Paluwila
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Annex 5 – Consultation report, including list of people met during EA preparation

Sri Lanka Tsunami Reconstruction Program (SLTRP)

USAID Contract # 386-C-00-05-00166-00

Hikkaduwa Harbor Consultation

December 22, 2005

CH2MHILL

In association with CHEMONICS, DEVTECH, FNI, Engineering Consultants LTD., EML Consultants, Lanka Hydraulic Institute, MICD and Uni- Consultancy Service

CONTENTS

Section I. Introduction

Project Background

The Sri Lanka Tsunami Reconstruction program (SLTRP) was implemented in response to devastation inflicted by a tsunami that swept over more than 700 miles of the Sri Lankan coastline on December 26, 2004. The program has three aspects which includes physical reconstruction, vocational education and coastal management components. The SLTRP adopts a cross cutting participatory in these components that aims to promote community ownership of the project interventions.

The Harbor Consultations

In the start up stage, the project looked at the community consultations and meetings as a way to "kick start" the participatory component of the project. Concurrently observations were made towards developing a strategy to take the participatory approach forward in this project that would potentially play a role in setting in place the longer term goals of the project. This report provides an overview of the outcomes of these initial consultative meetings in Hikkaduwa Harbor by the Sri Lanka Tsunami Reconstruction Project (SLTRP) team in the harbors and highlights the priorities the fishing community selected for consideration in the harbor reconstruction components of the project.

The consultations were carried out early in the project assessment phase to allow stakeholders an opportunity to provide input to fishery harbor reconstruction. Additionally, the intention was to solicit information that would provide the groundwork for catalyzing a participatory coastal resource management and planning exercise, which will be defined as work progresses in collaboration with USAID.

For reasons of proximity the first series of consultations were organized in the harbors with the "Harbor Fishery Committees" (comprised of a membership of the fishermen using each harbor) through the facilitation of the harbor managers with support from the project. Due to the presence of a wider fishing community outside the harbors, some meetings were conducted with fishing community, women's groups and families outside the harbors, to solicit information on the prevailing context to support a participatory coast management plan in the future. Notes from these discussions have been presented in Annex 3 of this document, so as not to detract from the issues raised inside the harbors necessary for the reconstruction component.

The team from CH2MHill carrying out these meetings consisted of Mr. Anil Premaratne, PCM Planning Specialist, Ms. Nadeera Rajapakse, Environmental Assessment Lead, Ms. Tania Weerasooria, Outreach and Public Awareness Specialist, and Ms. Amy Bodmann, PCM Lead. The team concludes that, although these initial meetings were a valuable first step, further arrangements to bring tangible benefits to community needs to occur in the short term as the construction develops. In-house team discussions to identify ways to do this have taken place and will get formalized as the project evolves. Through these strategies it is intended to promote user community ownership of the construction process.

The consultative process indicated that three fundamental needs exist in all three sites with regards to harbor infrastructure; these include: 1) safe access and entry into the harbor; 2) dredging to allow for more effective use of the harbor space; and 3) addition, extension, or rehabilitation of quays, jetties (anchoring facility), and breakwaters to secure the safety of boats docked within the harbor, and improve efficiency of services (i.e. reduce turn around time of boats).

The unique issues identified in Hikkaduwa Harbor by the groups consulted, both multi-day boat and small boat owners, are described in more detail within this report.

Section II: The Approach

With the endorsement of the Ceylon Fisheries Harbor Corporation (CFHC) in Colombo, the project contacted the harbor manager in each respective harbor selected for reconstruction under this project. On an initial visit to these sites the harbor managers agreed to organize consultation sessions to solicit feedback from fishermen in the harbor with involvement from the project team to lead the discussions.

Among other meetings held by the SLTRP team in preparation for the consultations, a meeting was held in Colombo with the USAID Transparent and Accountable Local Governance (TALG) Project. The result of this meeting was an agreement to collaborate, specifically through the use of officers in the Local Authorities who were trained by the Asia Foundation as facilitators to assist in the consultation activities. An intention here was also to build linkage with another USAID intervention in the area and facilitate synergies that would benefit the overall impact of the projects in the longer term.

The planned agenda for each session was to identify and discuss the issues in each harbor, allow time for facilitated group work under the headings – a) infrastructure, b) management, c) social d) economic e) environment; and finally to review and prioritize issues in plenary sessions. However in practice, the group work only partially followed this format, and that too only at two of the locations, with the dominant voices, mainly multi-day boat owners taking control of the discussions. A second round of consultations through focus group meetings with small boat operators were also carried out for each harbor. Given what the fishermen expected from the project, the discussions were mainly around the issues of the subject of infrastructure, and the other topics were only marginally addressed. For the construction component this has been deemed sufficient at this stage of the project, and it is believed that an initial sense of involvement has been created within the fishermen in the project planning process.

Section III: Priority Issues Identified at Hikkaduwa Harbor Consultation

Provided in this section are the issues and requirements that emerged from the harbor consultations in general at each locality, and below that the specific issues prioritized at each locality. Annex I presents the issues at each site listed in the order that they were raised, with the issues selected as

priority during the last stage of discussion given a ranking number. In the main body of the text only the priority list has been provided.

The informal discussions following the closure of the meeting and during the walk-about with the fishermen inside the harbor with volunteers identified during the session, point to three main cross-cutting issues in all three harbors. These are as follows:

a) Access to the harbor from the sea, (especially at Hikkaduwa);
b) Depth of the harbor; and
c) The need to extend quay /and anchoring facility in a manner that protects boats from various risks of damage, and basic facilities such as fuel, drinking water, etc.

As stated, the full lists of issues identified at Hikkaduwa Harbor are provided as an annex.

In the case of the small boat owners, the three main issues highlighted were as follows -

a) The reconstruction to provide a separate area for anchoring of small boats
b) In proximity to this anchoring area, provide a lower pier so that the larger boats would not encroach into that area.
c) Provide a kerosene oil pumping station within the harbor in proximity to the small boat anchorage. These three services, if provided, would encourage payment of the harbor fee to the Corporation, they said. Presently very few small fishermen are registered within the harbor as services to them are limited.

The above sets of factors were highlighted by multi day boat owners and small boat owners respectively. The first round of consultations at each harbor site with the Harbor Fishery committees, highlighted the harbor requirements for multi-day boat, but many of these are of relevance to the small boats as well. The general concerns of the small boat owners which were captured separately, have been presented in boxes below the priority list for each harbor as stated by the fishermen.

Hikkaduwa Harbor Consultation

- Drawing of harbor brought by the fishermen. Issues raised during discussion being noted down by facilitator (trained by the USAID/TALG project)

The following issues were identified as priorities by the Fisheries Committee at Hikkaduwa Harbor:

- Priority No. 1: The entrance to the harbor from the sea is treacherous. This needs to be made safer, for example by shifting out the breakwater. The issue of safe passage was expressed in various ways at each harbor discussion, and was most emphasized at Hikkaduwa.
- Priority No. 2: Deepening the harbor. This again was a recurrent issue in each harbor with the most acute appearing to be experienced in Hikkaduwa.
- Priority No. 3: Reconstruct jetty from northern side. Another recurring issue, this request was to extend the boat docking facilities, either using a breakwater in a duel role, or in another manner as the engineers find feasible through their investigations.
- Priority No. 4: Security within harbor is an issue; there was a request for the construction of a security wall around the harbor. (Note: This request was made by the UC Chairman, and it was not clear how much the fishermen request this.)
- Priority No. 5: Extend breakwater in north to the length of the southern breakwater. (There is some lack of clarity and consensus on what the true issue is with regard to this point; however keen interest was shown on this matter (connected to Issue 1 on safe access to harbor from the sea). The fishermen gathered for the meeting had come with a colored drawing of the break water locations in the harbor to illustrate how they perceive the structures would best support the safety factor. The SLTRP team made clear to the participants that these matters will get decided upon following the hydraulic and engineering investigations. It is recommended the designs – once closer to finalization – are presented by the project engineers directly to the

fishermen, to appeal directly for the latter's buy-in and understanding prior to finalization and construction.

- Priority No. 6: A crane to lift multi day boats is needed. Again, a lack of repair facilities is a recurring issue in all three harbors. This point and the following relate to this concern.
- Priority No. 7: A workshop to repair engines.

The attendant list of this meeting records 45 fishermen participating in this meeting, many of them multi-day boat owners/users.

- Discussion in progress at Hikkaduwa

Notes on the general concerns of the small boat fishermen

Hikkaduwa

"We badly need anchoring and pier facility separated out for our small boats. In doing this it would be very useful if the piers demarcated for us are constructed at a lower level than for the multi-day boats. This would deter the big boats encroaching into our pier facility area. An ice plant would be of great help to improve the marketing and the price we can get for our fish catch. If these matters can be addressed it would very helpful".

At Hikkaduwa a discussion with the Harbor Manager pointed to security issues in the Galle harbor prompting the navy point there to disallow Hikkaduwa registered boats to dock in Galle, even in case of emergency. This prompts the fishermen of this harbor to register their boats in Galle, which results in the income collection at the Hikkaduwa being negatively affected.

In regard to the request for a wall around the harbor, which was prioritized with some inputs by the local authority chairman, the harbor manager states that this is useful for the fishermen (as even for the Corporation) as it would help to keep their boat equipment safe. The length of the wall is approximately 1000 meters.

Section IV: Lessons Learned and Next Steps

The lessons learned through these initial discussions is that these were challenges faced due to the short time frame this process was allowed given the requirement to have input from these consultation before the construction work started. Further, it is now clear that some level of in-situ mobilization and facilitation of these Harbor Fishery Committees would be required to bring more voices to the process on an on-going basis and promote the fishery community ownership of the construction process. As an initial activity this two tired consultation has demonstrated to the harbor user community the project interest in helping to make their voices heard.

Additionally, discussions were held with fishermen operating in the surrounding fishing area, families, some women's group CBOs that have proved sustainable in the area. Notes from these discussions have been presented in Annex 2 to be considered as initial ground breaking in regard to developing participatory coastal resource management plans. The fishing community and the coastal community in tourist areas have tasted the fruits of hard work, and likely to be a dynamic and entrepreneurial group to work with if presented with the right signals and opportunities.

All groups met had no objections to the harbors and were keen that the issues of the fishermen were met. In Hikkaduwa however, there were some apprehension expressed by the Hotelier group at the recent phenomena of sand deposits in the marine sanctuary area (independent of the tsunami). The hotelier community acknowledges that the fishermen have to operate and pursue their livelihood, but steps need to be taken to study the reasons behind the sand depositing process, and find a way to clear sand depositing on the coral.

It should be noted that government policy is to promote use of the harbors for multi-day boats more so than for day boats. In addition to analyzing the demographic composition of stakeholder groups at our sites, we also need to come to firm agreement with GoSL and USAID about who our target beneficiaries will be, and how the project proposes to deliver services to them. It may just be the reality that those services may not be delivered uniformly among different groups. For example, in terms of benefiting directly from use of the harbors, the multi-day boat owners may continue to be the dominant group. However, plans to benefit other stakeholders (e.g., small businesses, shore fishermen, women and youth, marginalized groups) through other project investigations, i.e. promotion of on-shore livelihood activities, vocational training, coastal resources management, and awareness-raising activities are envisaged.

Towards building community ownership of the construction process itself and an appreciation of the benefits they will get from the harbor through the reconstruction, several team members have suggested that small visible achievable activities be handed to them. Further, identifying mechanisms to have fishermen's involvement in the construction supervision has been recommended. These interventions will be discussed through with the counter part agency, in this case the Ceylon Fishery Corporation, and suitable operational methods formulated.

Annex I: Hikkaduwa Harbor Consultation

Unabridged List of Issues Identified by Hikkaduwa HFC Consultative Group – Presented in order in which they were raised and subsequent prioritization. – 12th Nov 2005

Infrastructure

- The opening to the harbor from the sea is treacherous. Make it safe, by shifting out the breakwater. **(priority one)**
- Deepen the harbor basin **(priority 2)**
- Reconstruct Jetty from northern side **(priority 3)**
- Provide fueling facilities for kerosene oil
- Facilities for ice making within harbor
- Long time required for collection of drinking water; find a way to address this problem
- Security within harbor is an issue; construct a wall **(priority 4)**
- Relocate and expand toilet facilities
- Provide place to store fishing equipment.
- Electricity supply within harbor not sufficient
- To light up harbor mouth, provide a beacon lamp
- Set up another pier on the northern side of harbor
- Construct an auction hall for selling of fish
- Extend breakwater in north to the length of the southern breakwater **(priority 5)**
- A crane to lift multi-day boats **(priority 6)**
- A workshop to repair engines **(priority 7)**

Environment

- Fish refuse is put into the harbor
- Town waste is dumped in harbor at times

Economic and Social

- Not enough facilities to sell the fish (no auction hall)
- No icing facilities, and that which is available outside being very expensive.

Annex 2: Discussions in Hikkaduwa Community

- The Divisional Secretary – Ms. Kusum Piyaratne. She assured that the DS office will give the necessary cooperation to support the project implementation.

- District Manager, Arthacharya district office – Ms. Renuka Jayasinghe. This NGO is implementing environmental, community development and training programs in the area. These include a solid waste management initiative, small group credit scheme, computer training courses, and other community development activities. They informed that a fishery anchoring site is being constructed in the Doddanduwa area, located approx 3 kilo away, where one of their credit societies were functioning. A visit to that society was arranged for the next day.

- Arthacharya CBO in Dodanduwa – Ms. Ruwanthi, the Artharchary field coordinator facilitated a group meeting of the Dodanduwa Women's group to meet with the project team. Thirty three women attended the meeting. Nearly all the families were living off the fishing industry. The women folk were engaged in a solid waste management activity mobilized by Arthacharya. They were keen to obtain skills in hand crafts for income generating purposes, and requested sewing machines and *beeralu* (a lace making device which has evolved from the Dutch period in the area) tools.

- President, Hikkaduwa Hoteliers Association – Mr. Siri Goonewardene - A pioneer in planning and lobbying for the protection of the Marine Santuary in the area, this person provided a history of the formation of the Fishery harbor in this locality. He observed that the construction of the fishery harbor was a big achievement for the hoteliers in the area, as it cleared the marine sanctuary area of fishing boats and confined them within the harbor. But an alarming impact is being observed in the last 3-5 years, where the coral areas are getting covered with sand deposits, and it is widely believed that this has developed as a consequence of the harbor. He said he has been lobbying with both government and donor agencies on this matter, but to this date no action has been taken. He indicated commitment to keep lobbying on this issue. Another matter he was lobbying for was a by-pass road of the Colombo-Galle highway that would allow for the spread of the hotel enclave in the Hikkaduwa, and reduce the high transport traffic and noise levels in the area.

- Glass Bottom boat owners - President of this association – Mr. M. V. Jayaweera (Sunil). He informed that since the Tsunami the local tourist to the area has severally dropped. And from among the 50 boats that were previously operating, only around 8 are operating at present. Another contributory factor was that a locally run Zoo in the area had been a draw for local tourists. This institution had run into some regulatory issues and been compelled to close down.

- President, Hikkaduwa Protection Society – Mr. Pial Gunarathna. His hotel establishment was most popular among surfers. The sea in front of his hotel was good for this, and he is not affected by the sand deposits on coral. But he said this has been coming up as an issue in the area in the last 5-6 years.

- President, Small hotels and restaurants – Mr. A.B.Jayasundara – He was not available in Hikkaduwa that day, however obtained his name card from his office for future reference.

- The Chief monk, Jananda-ramaya, Hikkaduwa – He was supportive of the Harbor and was especially keen that the mouth to the harbor from the sea be made safer as he personally is aware of the danger the fishermen face even in moderate bad weather coming from the sea into this harbor. He related the case of the large boat which was awash on top of one the breakwaters, how it had first crashed on the rocky outcrops just outside the harbor prior to the Tsunami. But later got washed inland and on to the breakwater as a result of the Tsunami.

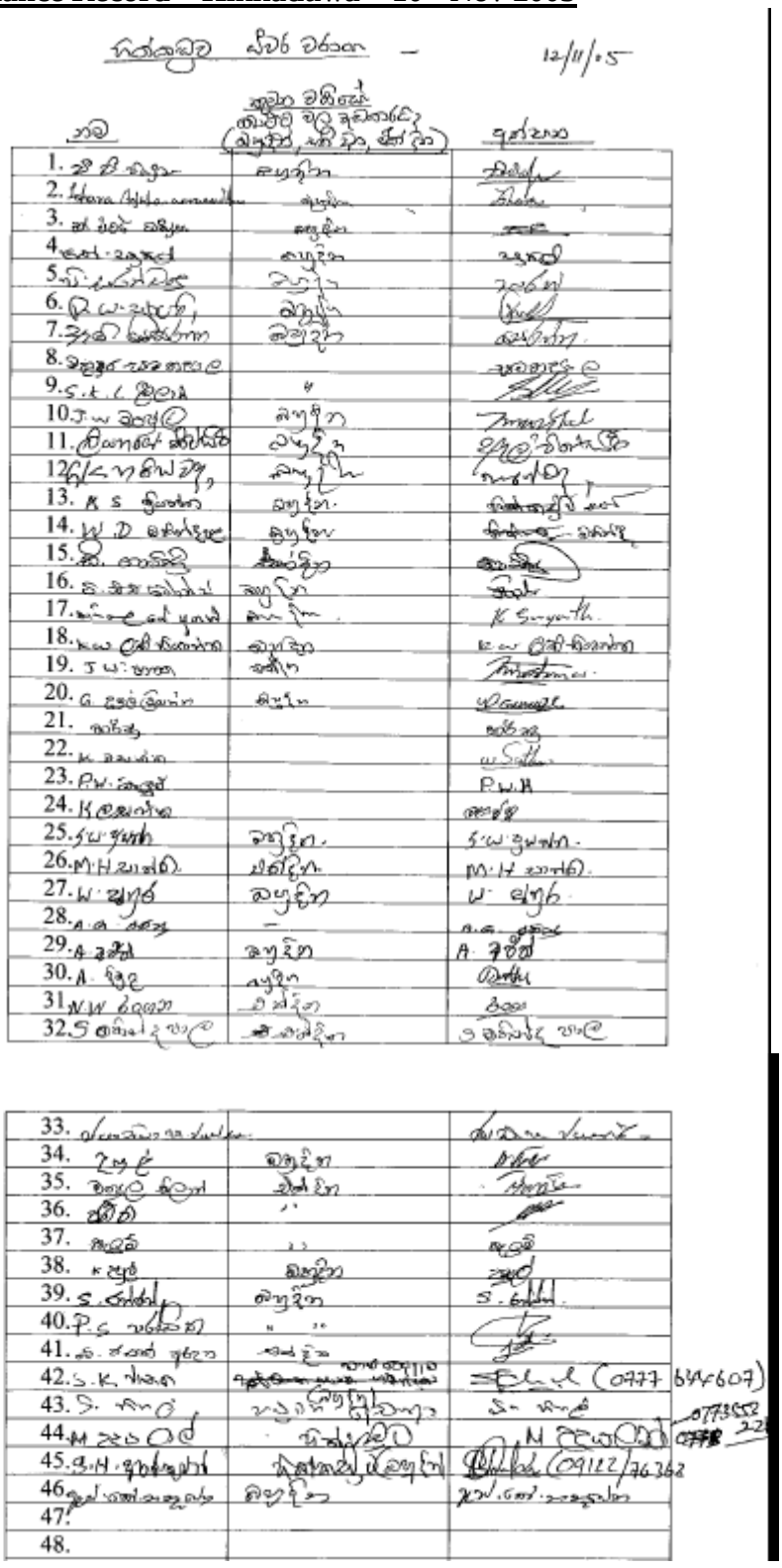
- Educational Zonal officer for Environment –Ms. N. Kalansuriya. She has been involved in teachers training programs for the area as a master teacher for three years. And during this time she also has organized several beach cleaning programs and environmental education programs with the participation of teachers and students in the area. She indicated interest to carry out environment education programs for fishermen in the Hikkaduwa fishery harbor on environment education together with students, if technical guidance is provided through "training of trainer" inputs to conduct such programs.

Annex 3 – Additional Persons met during the field visits

Mr. Ananda Niroshan – Hikkaduwa Harbor Manager
Ms. Kusum Piyaratne - The Divisional Secretary, Hikkaduwa.
Mr. Manoj Krishantha – Chairman, Hikkaduwa PS (the LA)
Mr. Karunananda, Additional Divisional Secretary, Hikkaduwa
Mr. Anthony, Grama sevaka, Hikkaduwa Town
Mr. Samaradeera, Public Health Inspector, Hikkaduwa Town
Ms. Renuka Jayasinghe - District Manager, Arthacharya Foundation district office
Ms. Ruwanthi - Field coordinator, Arthacharya district office
Ms. Mallika, Development Officer, Hikkaduwa PS (trained by the TALG-USAID Project)
Ms. Neelamani – Environment officer, Hikkaduwa PS(-do -) Office
Mr. Siri Goonewardene - President, Hikkaduwa Hoteliers Association
Mr. M. V. Jayaweera (Sunil) – President of the Glass Bottom Boat Owners Association
Mr. Pial Gunarathna - President, Hikkaduwa Protection Society
Chief monk, Jananda-ramaya Temple, Hikkaduwa
Mr. Dhammika Mahendre – Program Officer, USAID Transparent and Accountable Local Governance (TALG) Project
Mr. Nagahawatte – Assistant Director, Fisheries Department, Galle

Annex 4: Attendance at the Harbor consultations

Attendance Record – Hikkaduwa – 10th Nov 2005



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Annex 5 – Newspaper article on team's harbor visits, 6th Dec 2005, Divaina (sinhala paper).

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