



## **Sri Lanka Tsunami Reconstruction Program (SLTRP)**

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

### **Harbor Master Plans:**

### **Hikkaduwa, Mirissa, and Puranawella Harbors**

**April 2006**

SLTRPR-0013



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

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## List of Abbreviations

CCD	Coast Conservation Department
CEA	Central Environmental Authority
CFC	Ceylon Fisheries Corporation
CFHC	Ceylon Fisheries Harbors Corporation
EA	Environmental Assessment
EML	Environmental Management Lanka
FRP	Fiber-reinforced plastic
GOSL	Government of Sri Lanka
HFC	Harbor Fishery Committee
LHI	Lanka Hydraulic Institute
MFAR	Ministries of Fisheries and Aquatic Resources
MSL	Mean Sea Level
O&M	Operations and Maintenance
PAR	Preliminary Assessment Report
PCM	Participatory Coastal Management
RDA	Road Development Authority
SLTRP	Sri Lanka Tsunami Reconstruction Program
USAID	United States Agency for International Development

## Executive Summary

The Harbor Master Plans for Hikkaduwa, Mirissa, and Puranawella (Dondra) were developed under the United States Agency for International Development (USAID)-funded Sri Lanka Tsunami Reconstruction Program (SLTRP). The present document was developed in conjunction with the Ceylon Fisheries Harbors Corporation (CFHC) to guide reconstruction work and to put those efforts in the context of future development. The master planning process – which must continue beyond the submission of this document – will help to ensure that the harbor facilities are planned, constructed, operated and maintained so as to maximize their efficiency and sustainability, as well as produce the maximum and equitable benefits for harbor users. It is intended that these master plans will fill an existing information gap, as well as serve as a model for similar harbor planning endeavors around the country.

The tsunami of 26<sup>th</sup> December 2004 caused substantial damage to these three fishery harbors, all of which are located along the southwest coast of Sri Lanka. In addition to causing a tremendous loss of life, the tsunami wrought havoc upon the infrastructure of the area, destroying numerous fishing boats, causing substantial damage to the breakwaters that protect these harbors, and extensive damage to the quays, buildings and other elements of harbor infrastructure.

Part I of this document presents master plans for the three harbors. The master plans address the reconstruction and initial improvement work to be carried out under SLTRP, which has been agreed upon and prioritized by CFHC and USAID/SLTRP with significant input from stakeholders in each harbor and the surrounding community. At this time, the first priority is to make the repairs to the breakwaters required to secure the integrity of these structures before further damage is caused. The second priority will be to repair and improve the berthing facilities, which will reduce congestion at the quays and reduce turn-around times at port for multi-day boats. Boat repair and maintenance facilities are also among the major works. These improvements will result in increased boat trips per year, leading to increased fishing yields and greater incomes derived from the fisheries industry. Finally, dredging is anticipated to be carried out in two of the harbors to provide sufficient basin depths in the anchorage and navigation areas of these harbors.

A number of smaller infrastructure works, including the repair and refurbishment of auction halls, provision of new toilet blocks, provision of additional and improved refueling and potable water points, and more, are seen by CFHC and the Harbor Fishery Committees (HFCs) as essential steps in improving market performance and fishers' welfare. These works support the critical objective of adding value to the existing fish catch by improving quality through improved handling and storage. The priority minor works for each harbor have been included in SLTRP's construction scope.

Also included in Part I are recommendations to improve operational and maintenance (O&M) currently in place at the three harbors. These priorities are presented in a consolidated manner

to assist CFHC in addressing them in an integrated manner. The plans also define problems facing the harbors, which must be explored further in a participatory manner by CFHC, with support from SLTRP, to determine appropriate and site-specific approaches. Issues currently exhibited in the harbors include the following:

- The need for significant improvement in the supply and quality of ice, which can be achieved by encouraging the re-establishment of ice-making plants within and adjacent to the harbors (managed either by the public or the private sector);
- The need for education and awareness programs, including pilot demonstrations to prompt attitudinal changes, leading to improvement in fish quality and market performance;
- The need for local government to become actively involved in the improvement of environmental aspects at the harbors, most notably solid waste management;
- The need to establish formal rules, procedures and regulations applicable to harbor managers and HFCs in order to resolve management issues;
- The need for greater participation by the HFCs in the management of the harbors.

The Master Plans also outline physical improvements to be made in the harbors over the next ten years. These proposed improvements are based on the assumptions that:

- The number of boats using the harbors will increase;
- It will be desirable to provide additional berths for boats in order to reduce congestion and turn-round times;
- The master plans themselves will be a tool for CFHC to leverage funding from GOSL and other sources, beyond that provided by USAID.

These longer-term recommendations were developed collaboratively to the extent possible, but the process is not complete: it is recommended that CFHC lead a collaborative process of galvanizing support for the improvements detailed here, both physical and operational, to help ensure equitable distribution of benefits from development to various stakeholders as well as the fundamental ownership of objectives that will enable the plans to be successful and sustainable.

Part II of this document presents more detailed discussions of the current situation in each harbor to provide a context for understanding the objectives of the master plans.

## Introduction

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### Background

The tsunami of 26<sup>th</sup> December 2004 destroyed infrastructure along approximately three-fourths of Sri Lanka's coastline. As agreed with the Government of Sri Lanka (GOSL), a key element of the reconstruction activities under the USAID Sri Lanka Tsunami Reconstruction Program (SLTRP) will be the rehabilitation of three fishery harbor facilities on the southwest coast of the island, namely those at Hikkaduwa, Mirissa, and Puranawella (Dondra). All three harbors are managed by the Ceylon Fisheries Harbors Corporation (CFHC). Development of the master plans presented here is an important step to guide the construction work as well as to initiate a process among stakeholders to plan, manage, and maintain the facilities with maximum sustainability and benefit to users.

### Objective

In the aftermath of the tsunami, donors have faced tremendous pressure to respond rapidly to the myriad of needs for relief and reconstruction assistance. This urgency brings about the potential danger of hasty reconstruction resulting in poorly designed, constructed, and/or operated facilities. Creating master plans is therefore of utmost importance to guide the construction activities planned for rehabilitating the damaged facilities at Hikkaduwa, Mirissa, and Puranawella. Furthermore, investigations have failed to find any comprehensive master planning documents for these harbors. Therefore, the master plans will not only fill a serious information gap in these specific sites, but may also serve as models for similar planning documents in other fishery harbors.

The process of developing, adopting, and implementing comprehensive master plans is an opportunity to build capacity and instill ownership by harbor management and resource users. SLTRP has developed these plans using a collaborative process, relying on direct input from CFHC staff from Colombo and harbor users and management in each of the sites. Continued collaboration is required to develop and maintain a common vision among stakeholders for development and management of these harbors, as well as to fully transfer ownership of these documents to CFHC. In supporting this master planning process it is SLTRP's intention to build capacity in each harbor by introducing the tools and approaches necessary to maximize the utility, lifespan, and positive livelihood impacts associated with the infrastructure in each site.

It is important to note that SLTRP's mandate on fish harbor construction is consistent with the current national fisheries sector policy. The Director General of the Ministry of Fisheries and Aquatic Resources (MFAR) has indicated that the Government of Sri Lanka (GOSL) plans to increase the average consumption of fish from the present 17 to 22 kilograms per person per year. This increase is in part dependent upon the health of the fish stocks in near and offshore waters, the success of planned aquaculture projects and the ability of Sri Lankan vessels to increase fish yields in international waters. In order to achieve its goal of enabling increased fish consumption, the GOSL is also planning the construction of larger multi-day boats. Boats

up to 19.8 meters long are being considered, and the construction of boats up to 24 meters is possible within the next ten years. Finally, the GOSL wishes to increase the present exports of high quality fish to Japan and other countries. This will require that a greater percentage of the catch is of high quality (at present about 40% of the total catch is stated to be post-harvest loss), which will involve improving fishing methods, handling and storage, as well as marketing.

Given the above, the master plans for each fishery harbors must accommodate:

- The prioritized needs of CFHC and the fishers at each harbor;
- The repairs and improvements to be carried out by SLTRP;
- Anticipated physical improvement needs over the next ten years;
- Approaches to improve the ability of harbor users to respond to market forces;
- Improvements in collaborative decision-making and conflict resolution (good governance).

### **Approach**

Development of this document relied on input from an interdisciplinary team of SLTRP staff, CFHC representatives, harbor users and management, and broader stakeholders in the harbor communities. Additional recommendations for physical and operational improvements to the harbors were contributed by the United States Army Corps of Engineers and USAID staff. This report also draws upon outputs from a number of other SLTRP activities, described briefly below.

*Community Consultations.* Consultations with stakeholders in each fishery harbor were carried out early in project implementation and will continue as construction goes forward and additional needs arise. These consultations have identified priority needs for rehabilitation of the harbors as well as gaps in management capacity, while also providing information to develop participatory coastal resource management (PCM) activities to be carried out under SLTRP.

Following submission of this report and finalization of tender packages for construction, SLTRP staff in partnership with CFHC will conduct an additional round of consultations in each community. The objective of these discussions will be to inform stakeholders of the priority interventions that have been selected for implementation by SLTRP – both in the short- and medium-term, with some small works to be initiated in early spring of 2006 – and to encourage harbor management and users to take ownership of this plan and implement it for greatest positive impact on the harbor facility.

*Engineering Studies.* A number of engineering studies were conducted while preparing the design of each harbor. The process began with an initial engineering study to obtain available information through a literature review, and was followed by field investigations and mathematical modeling to fill critical information gaps. Details of these studies can be found in the preliminary assessment report.



*Preliminary Assessment Report (PAR).* The PAR was developed and submitted as part of the engineering studies and designs carried out to identify the works needed, the fundamental design concepts and preliminary construction cost estimates. The PAR assesses the status of harbor infrastructure, and summarizes the engineering studies noted above. Furthermore, it provides construction-related information related to fish harbor repair, and makes conclusions and recommendations to support the next phase of studies, leading to preparation of tender documents.

*Environmental Assessments (EAs).* Environmental impacts of proposed rehabilitation and improvement works were assessed for each harbor and submitted to USAID in early 2006. Overall negative environmental impacts were determined to be very minimal, as the construction consists largely of rehabilitation of infrastructure rather than significant development of new facilities.

*Fisheries Management Assessment.* A fisheries management study was carried out in December 2005 to develop recommendations to improve the fisheries value chain while promoting responsible stewardship of coastal resources. This effort also resulted in recommendations for timely implementation of certain highly visible, practical and tangible improvement projects, primarily small infrastructure works and O&M approaches, to be carried out in each of the three harbors.

*Collaborative Master Plan Design.* In January 2006 an intensive effort was carried out which resulted in the foundation of the plans presented here. This process involved numerous site visits to observe operations in each harbor and to engage CFHC and harbor stakeholders in debating approaches to long-term development. All findings of this activity are incorporated in the present report.

*PCM Action Plan.* The PCM Action Plan, to be submitted in April 2006, will consolidate information gathered through a number of SLTRP activities and assessments, and prioritize needs in a preliminary work plan to be implemented by PCM staff over the next year. This action plan will specify which elements of harbor management capacity building are priorities in the context of the overall component objective of improving collaborative coastal resource governance in project sites.

Just as the aforementioned activities have supported the development of this document, the master plans will in turn be used to facilitate an ongoing process of capacity building – particularly in O&M issues – to be carried out by SLTRP to the extent resources allow. It is worthwhile to reiterate that the proposed plans and recommendations provided here are directed at CFHC as well as stakeholders at the harbors such as the HFCs. Further activities to be carried out by SLTRP in harbor capacity building will be detailed in the PCM Action Plan, to be submitted shortly after the present document.

## **Outline of the Report**

This document is divided into two parts: Part I presents master plans for Hikkaduwa, Mirissa, and Puranawella, as well as an O&M Plan applicable to all three harbors; Part II presents information on each harbor that supports the recommendations contained in the master plans.

# **PART I: MASTER PLANS**

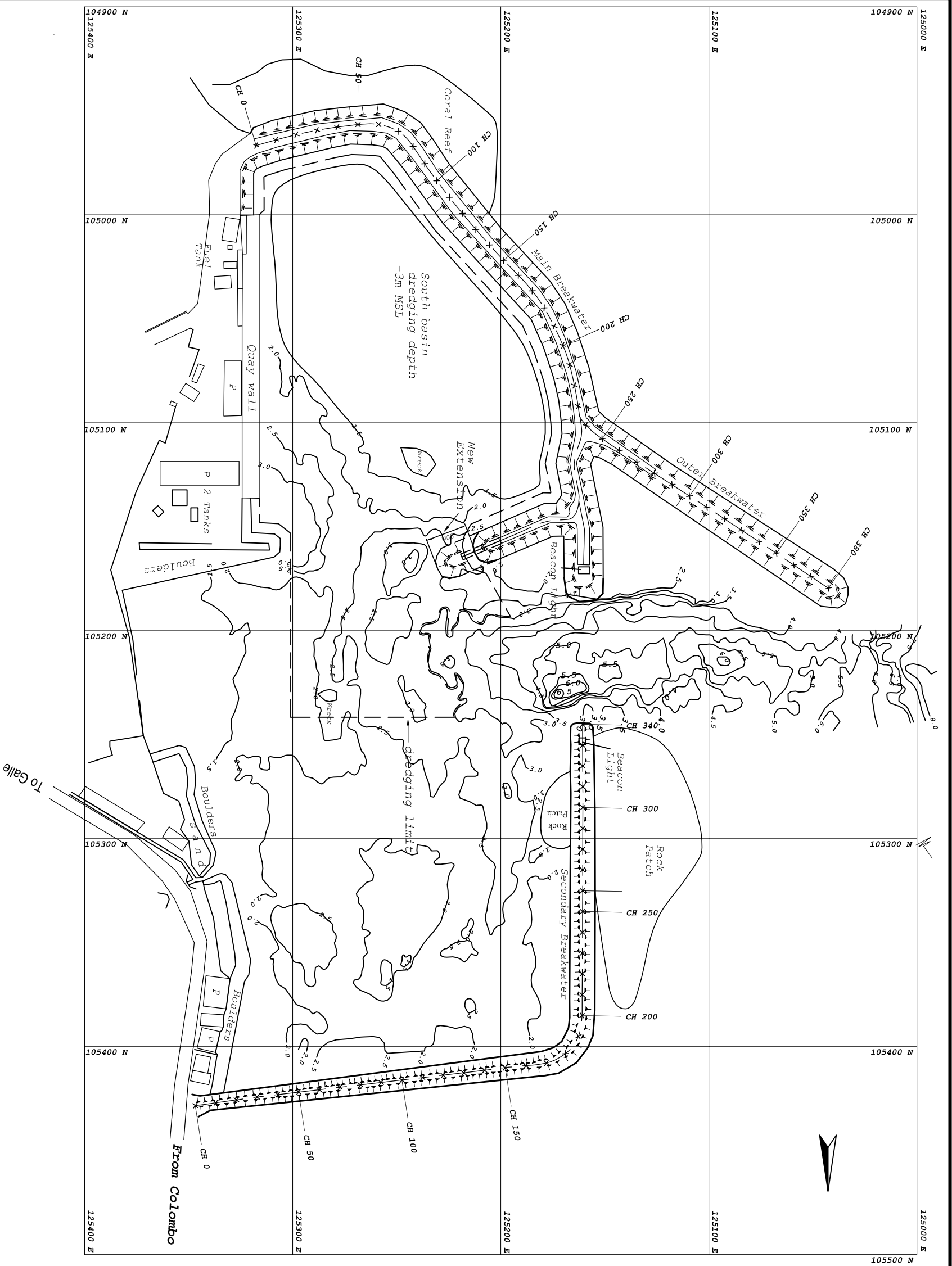
## **A. Physical Infrastructure**

Physical infrastructure master plans for Hikkaduwa, Mirissa, and Puranawella are presented in the following pages.

## Master Plan: Hikkaduwa Fish Harbor Infrastructure Development

Implementation Time Scale	Infrastructure Item	Implemented by SLTRP	Options available to CFHC	Remarks
<b>Immediate within 2 years</b>	Rehabilitation of tsunami damaged breakwaters including provision of pavement on surface	Yes		Complete in Full
	Extend inner breakwater to reduce wave turbulence in the south basin	Yes		Complete in Full
	Dredging of operational areas of south basin to three meters below MSL	Yes		Complete in Full
	Navigational aids	Yes		Complete in Full
	Provision of boat-lifting facility (slipway)	Yes		Complete in Full
	Improve drinking water and potable water supply system	Yes		Complete in Full
	Construct new toilet facilities	Yes		Complete in Full
	Construct brackish water supply system	Yes		Complete in Full
	Provision of kerosene oil dispensing facility for small boat users	Yes		Complete in Full
	Construct perimeter security wall and gate	Yes		Complete in Full
	Repair tsunami damage to roof of auction hall	Yes		Complete in Full
	Construction of ice plants	No		Invite Private Developers

<b>Medium Term 2-5 years</b>	Procure a mobile crane of approximately 30 ton capacity	No	Pursue donor funding	
	Upgrade fenders and bollards on quays	No	GOSL	Presently in adequate condition
	Provision of accommodation for the harbor manager on the premises	No	GOSL	
	Procurement of a standby generator	No	GOSL	
	Provide additional net mending facilities as number of users increases	No	GOSL	
<b>Long Term 5-10 years</b>	Construction of jetties and breakwaters in the north basin to allow development of this area	No	Pursue donor funding	
	Dredging of operational areas of the north basin to three meters below MSL	No	Pursue donor funding	
	Beach reclamation in north basin to permit the construction of a road	No	GOSL	
	Provide fuel tanks at the new jetties in the north basin	No	Invite Private Developers	
	Construct auction hall and net mending facilities at new jetties	No	GOSL	
	Provide water and sanitation facilities at new jetties	No	GOSL	



**Work Proposed under this Project**

Location	Proposed Work
<b>Main Breakwater</b>	
1). 0-100m Sea side	Re-arrangement and Armour Filling (1-3T)
2). 175-200m Sea side	Re-arrangement and Armour Filling (1-3T)
<b>Outer Breakwater</b>	
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
<b>Secondary Breakwater</b>	
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)
<b>Inner Breakwater</b>	
1). New extension of 20m	New construction with Toe and primary armour
<b>Pavement works</b>	
1). Main Breakwater & Secondary Breakwater	Repair & Bitumen surface
2). Outer Breakwater	Provide concrete pavement
<b>Dredging</b>	
Dredging	South basin up to -3m M.S.L
<b>Navigation Aids</b>	
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

**SRI LANKA TSUNAMI RECONSTRUCTION PROGRAM**

**HIKKADUWA FISHERY HARBOUR RECONSTRUCTION AND INITIAL IMPROVEMENTS**

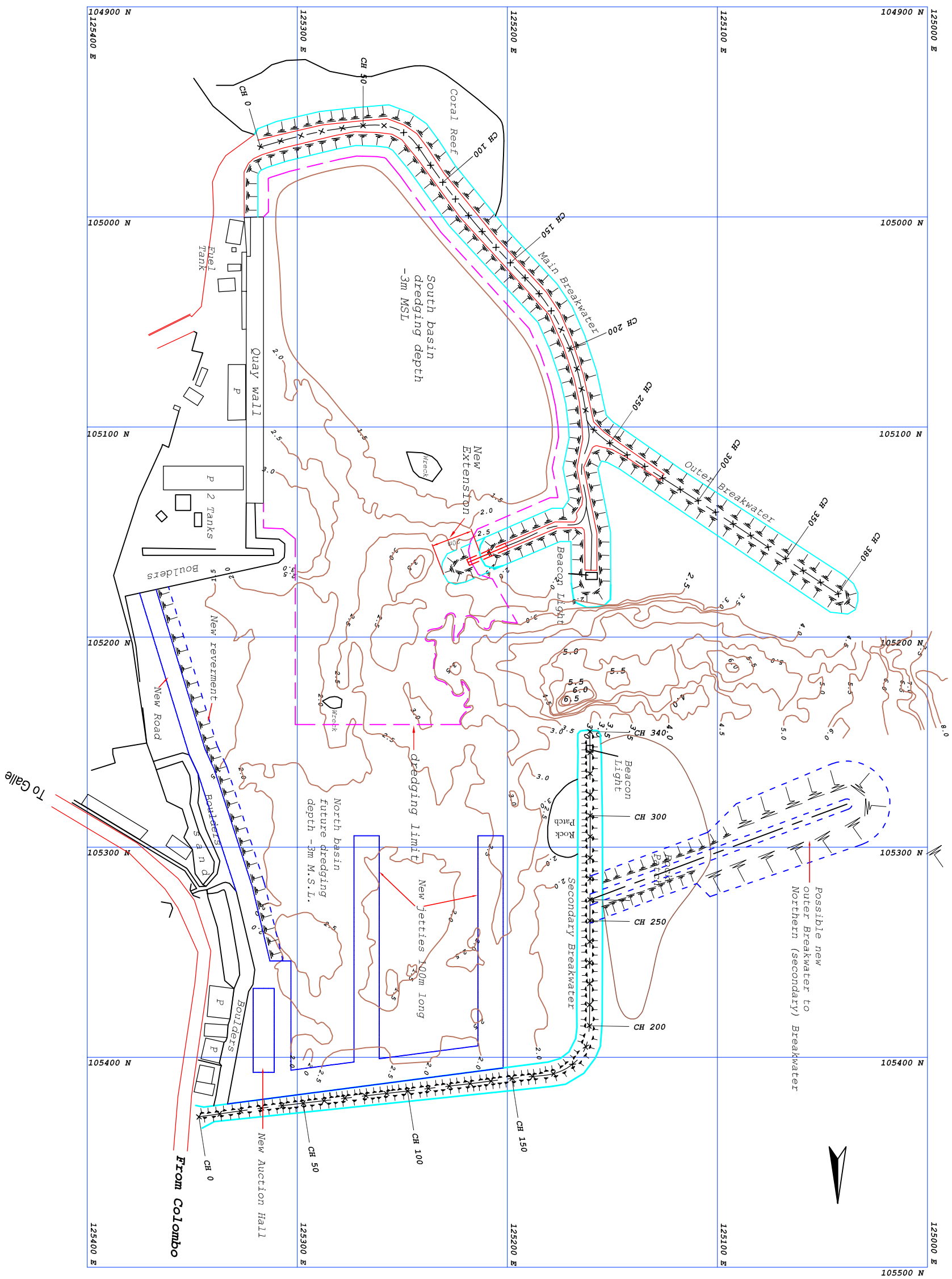


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Colombo, Sri Lanka

Figure 1



SRI LANKA TSUNAMI RECONSTRUCTION PROGRAM

HIKKADUWA FISHERY HARBOUR  
PROPOSED LONGER TERM DEVELOPMENT

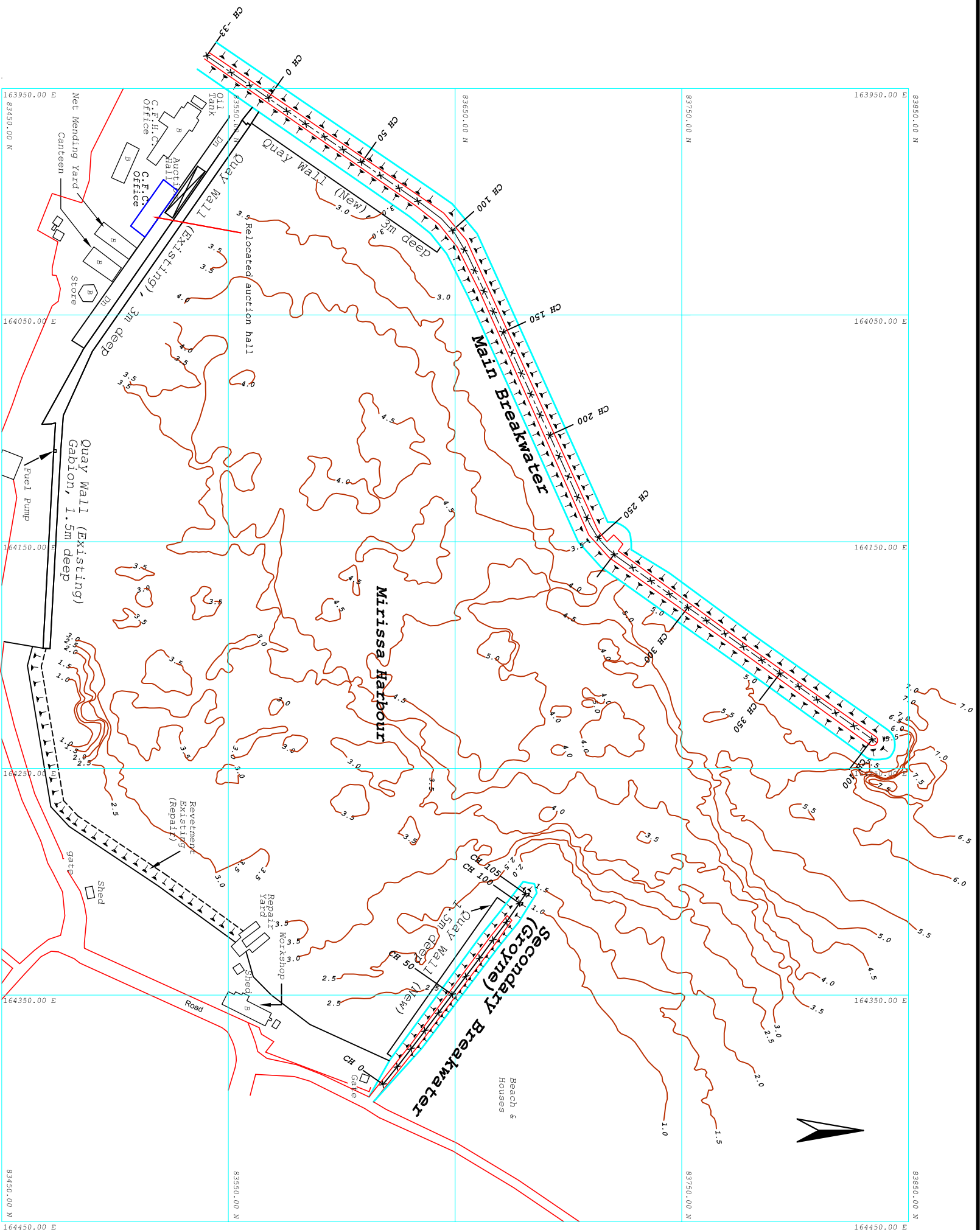
Figure 2

## Master Plan: Mirissa Fish Harbor Infrastructure Development

Implementation Time Scale	Infrastructure Item	Implemented by SLTRP	Options available to CFHC	Remarks
<b>Immediate within 2 years</b>	Rehabilitation of tsunami damaged breakwaters including provision of pavement on surface	Yes		Complete in Full
	Construction of 100 meter quay for multi-day boats	Yes		Complete in Full
	Construction of 75 meter quay for single day boats	Yes		Complete in Full
	Boat lifting facility (dock and travel lift)	Yes (civil works)		Travel lift provided by a donor
	Provision of navigational beacons	Yes		Complete in Full
	Improve drinking water and potable water supply system	Yes		Complete in Full
	Construct brackish water supply system for washing	Yes		Complete in Full
	Construct new sanitary facilities	Yes		Complete in Full
	Replace tsunami damaged bollards and fenders	Yes		Complete in Full
	Construct new fish auction hall	Yes		Complete in Full
	Renovate eave of existing auction hall to prevent damage to masts	Yes		Complete in Full
	Redevelopment of beach area for small craft landing	Yes		Complete in Full
	Construction of ice plants	No		Invite Private Developers



<b>Medium Term 2-5 years</b>	Procure a mobile crane of approximately 30 ton capacity	No	Pursue donor funding	
	Construction of harbor protection revetments	No	Pursue donor funding	
	Construct two-storey building for 24-hour radio surveillance	No	GOSL	
	Provision of accommodation for the harbor manager	No	GOSL	
	Procurement of a standby generator	No	GOSL	
	Provision of additional refueling points fleet size increases	Yes		Complete in Full
	Construction of boundary fencing around harbor perimeter	No	GOSL	
<b>Long Term 5-10 years</b>	Construct one or more jetties from the shoreline and from the rock revetment at the eastern side of the harbor	No	Pursue donor funding	
	Provide additional net mending facilities as numbers of users increase	No	GOSL	



**Work Proposed under this Project**

Main Breakwater	Location	Proposed Work
	1). 0-100m Sea side	Provide Toe, re-arrangement and Armour filling (4-6T)
	2). 100-200m Sea side and harbour side	re-arrangement and Armour filling (4-6T) in seaside on (3-4T) on harbour side
	3). 200-365m Seaside	Provide Toe re-arrangement and Armour filling (4-6T)
	4). 200-280 Harbour side	Provide Toe
	5). 365 - End	Provide Toe, re-arrangement and Armour filling (4-6T)
	6). Head	Provide Toe and Armour filling (4-6T)

**Secondary Breakwater (Groyne)**

1). 38m at end	Reconstruct with Toe, Core and armour filling (2-4T)
----------------	------------------------------------------------------

**Pavement Works**

Breakwater crest	Provide new Concrete pavement
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**Quay Walls**

Along Main Breakwater	100m long, 3m depth
At Secondary Breakwater	75m long 1.5 m deep and 25m along shore

**Revetment**

Existing revetment	100m, Repair damages
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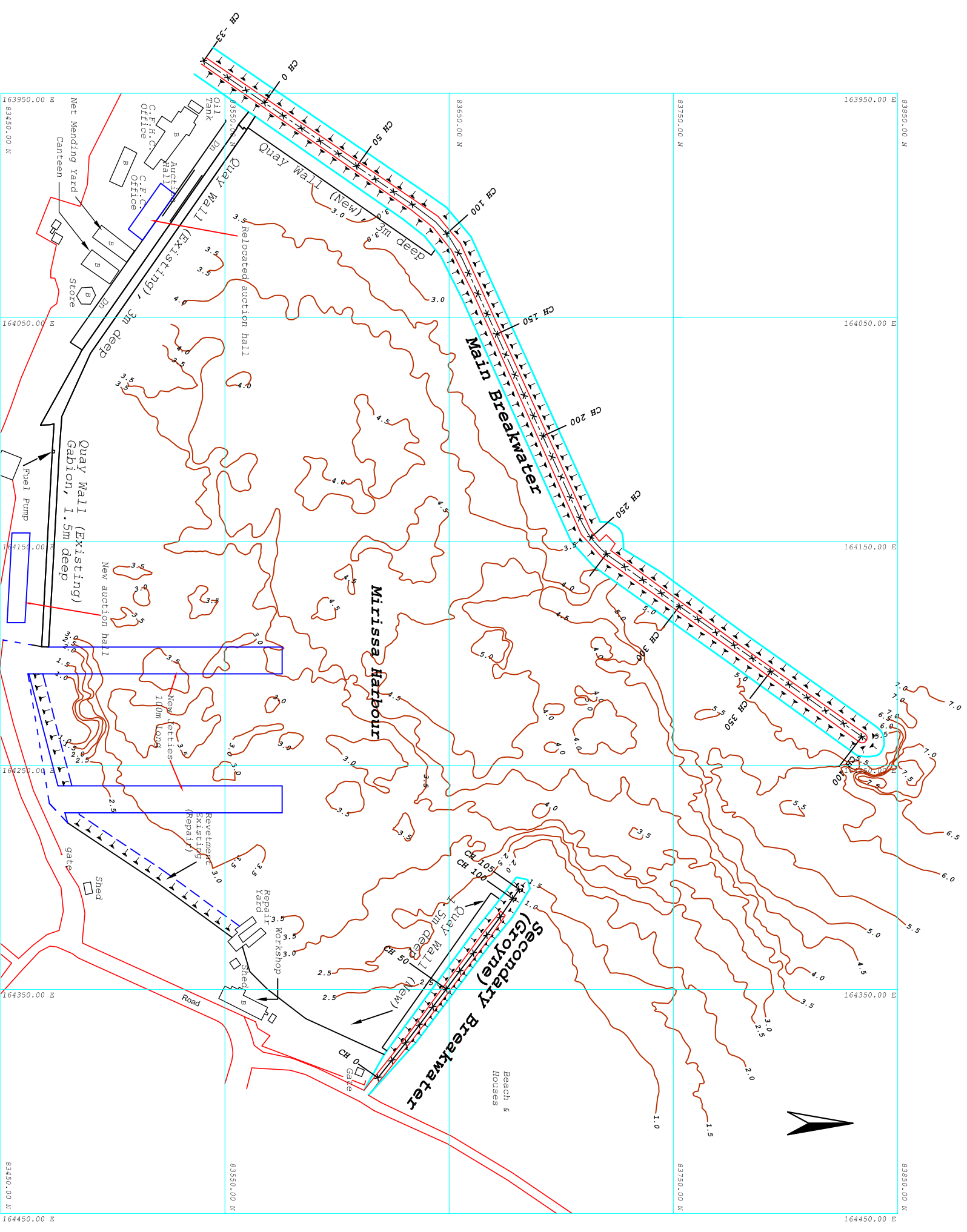
**Minor Works**

- 1) New fish auction hall
- 2) Improvement to drinking waters supply
- 3) Brackish cleaning water supply
- 4) Replacement of damaged Fenders and Bollards in the quay wall



SRI LANKA TSUNAMI RECONSTRUCTION PROGRAM  
MIRISSA FISHERY HARBOUR  
RECONSTRUCTION AND INITIAL IMPROVEMENTS

Figure 3



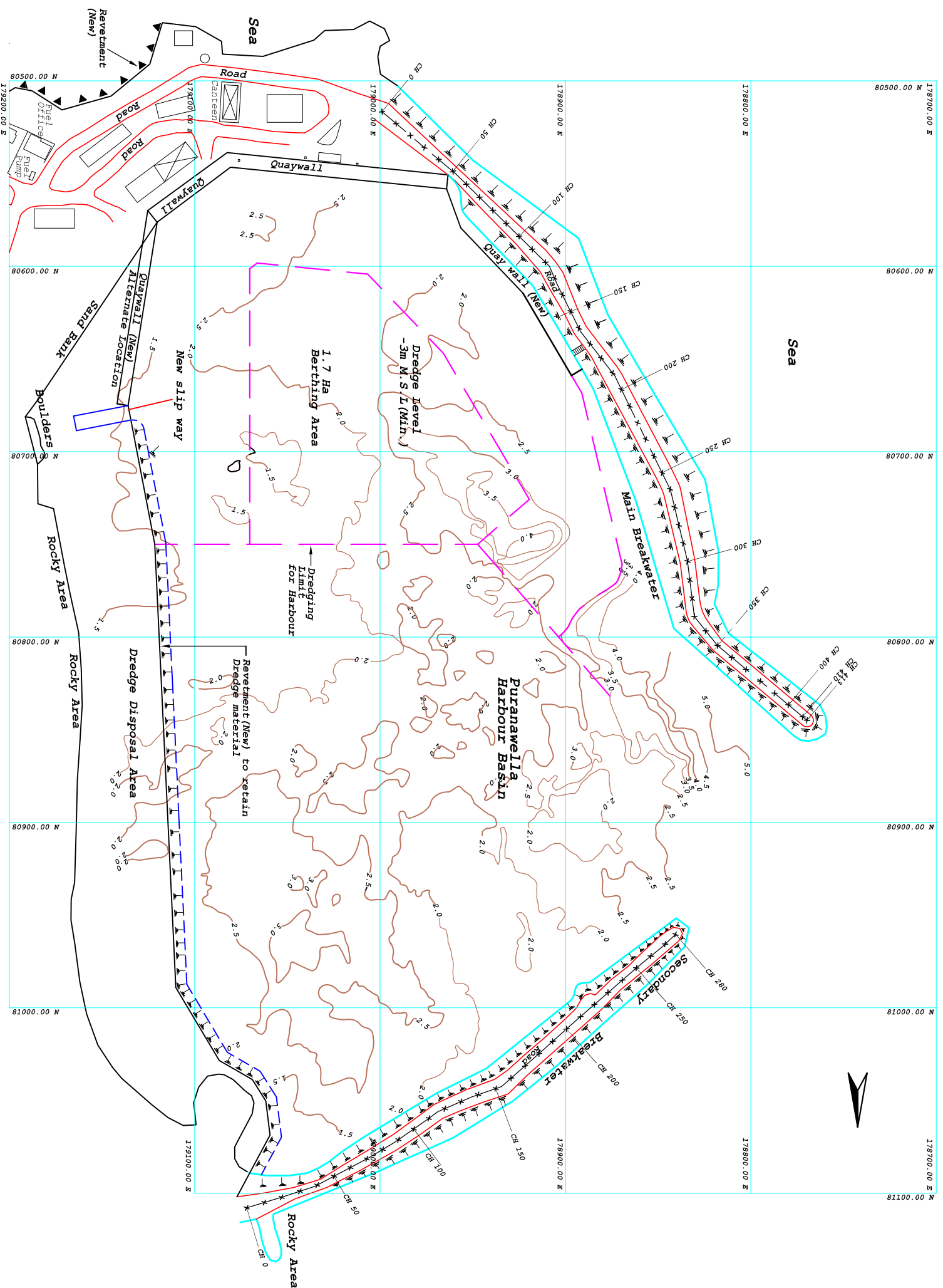
SRI LANKA TSUNAMI RECONSTRUCTION PROGRAM  
 MIRISSA FISHERY HARBOUR  
 PROPOSED LONGER TERM DEVELOPMENT

Figure 4

## Master Plan: Puranawella Fish Harbor Infrastructure Development

Implementation Time Scale	Infrastructure Item	Implemented by SLTRP	Options available to CFHC	Remarks
<b>Immediate within 2 years</b>	Rehabilitation of tsunami damaged breakwaters including provision of pavement on surface	Yes		Complete in Full
	Construction of 100 meter quay for multi-day boats	Yes		Complete in Full
	Construction of harbor protection revetments	Yes		Complete in Full
	Dredging of operational areas of harbor basin to three meters below MSL	Yes		Complete in Full
	Provision of boat lifting facility (slipway)	Yes		Complete in Full
	Provision of navigational beacons	Yes		Complete in Full
	Improve drinking water supply system	Yes		Complete in Full
	Construct new toilet facilities	Yes		Complete in Full
	Construct brackish water supply system for washing	Yes		Complete in Full
	Replace tsunami damaged bollards and fenders	Yes		Complete in Full
	Construction of ice plants	No	Invite private developers	

<b>Medium Term 2-5 years</b>	Procure a mobile crane of approximately 30 ton capacity	No	Pursue donor funding	
	Install additional fuel points at existing quay	Yes	Invite private developers	
	Construct internal access road connecting secondary breakwater with main harbor	No	GOSL	
	Rehabilitate existing auction hall, including 15 meters extension in length at the northeast end	No	GOSL	
	Procurement of a standby generator	No	GOSL	
	Provision of a rest house for visiting fishers from other Sri Lankan fishery harbors	No	Invite private developers	
<b>Long Term 5-10 years</b>	Construct one or more jetties adjacent to the existing gabion wall quay to provide additional berths	No	Pursue donor funding	
	Dredging to ensure a depth of 3 meters below MSL in the remaining area of the basin	No	GOSL	
	Provide fuel tanks at the new jetties in the north basin	No	Invite private developers	
	Provide water and sanitation facilities at new jetties	No	GOSL	
	Construct auction hall and net mending facilities at new jetties	No	GOSL	
	Improve road access to the harbor from the main Matara-Tangalle road	No	GOSL	Seek RDA involvement



**Work Proposed under this Project**

Location	Proposed Work
1). 0-50m Sea side	Re-arrangement and Armour Filling (2-47)
2). 50-176m Sea side and crest	Repair of Toe re-arrangement and Armour Filling (4-67)
3). 176-240 Sea side	Repair of Toe re-arrangement and Armour Filling (4-67)
4). 176-240 Harbour side	Repair of Toe, Re-arrangement and Armour Filling (4-67)
5). 240-325 Sea side & Harbour side	Repair of Toe, Re-arrangement and Armour Filling (4-67)
6). 325 - End	Repair of Toe, Re-arrangement and Armour Filling (3-87)
7). Breakwater Head	Re-arrangement and Armour Filling (5-87)
8). 200 - End	Place 5-87 Boulder layer on sea side edge

**Secondary Breakwater**

- 1). 0-100m Harbour side and crest
- 2). 100-200m Harbour side
- 3). 200 - End & Head

**Pavement works**

- 1). 0 - 200m
- 2). 200 - End

**Quay Wall**

Along Main Breakwater or end of existing Quaywall

**Revetment**

Seaside of existing access Road Parallel to shore line for dredge disposal area

**Dredging**

Harbour basin area

1.7Ha of berthing area, navigation channel and quay wall

**Minor Works**

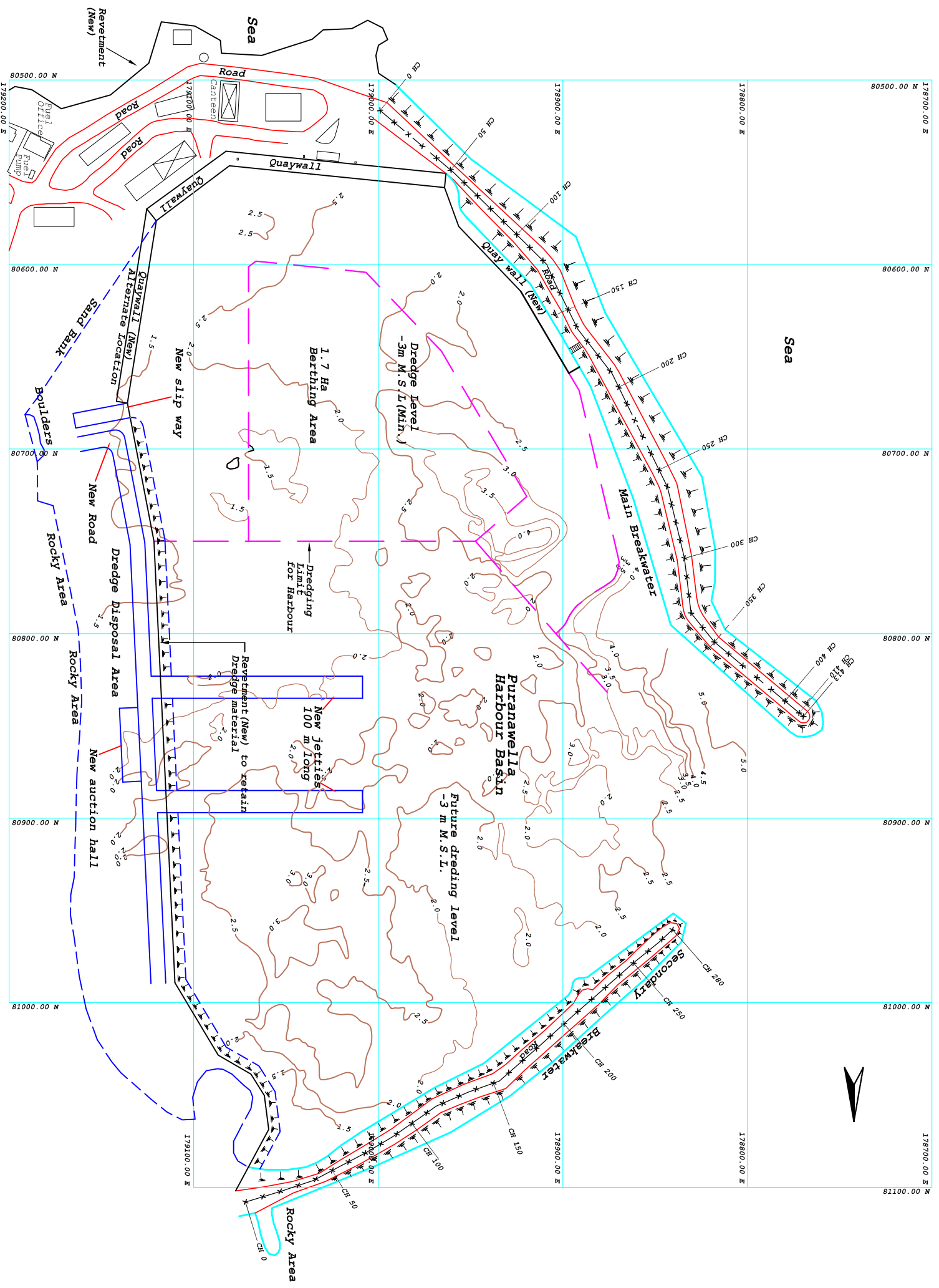
- 1) New toilet block
- 2) Improvement to drinking waters supply
- 3) Brickish cleaning water supply
- 4) Replacement of damaged Fenders and Boulders in the quay wall



**SRI LANKA TSUNAMI RECONSTRUCTION PROGRAM**  
**PURANAWELLA FISHERY HARBOUR RECONSTRUCTION AND INITIAL IMPROVEMENTS**

Figure 5





SRI LANKA TSUNAMI RECONSTRUCTION PROGRAM

PURANAWELLA FISHERY HARBOUR  
PROPOSED LONGER TERM DEVELOPMENT

Figure 6

## B. Operations & Maintenance Plan

This plan presents operations and maintenance (O&M) priorities for application by the CFHC to its management of the fishery harbors at Hikkaduwa, Mirissa, and Puranawella. The priorities are grouped in three areas, namely waste management and environment; market performance; and governance. Each activity is recommended for either immediate implementation (within one year), medium-term implementation (within two to five years), or long-term implementation (within five to ten years).

### I. Waste Management & Environment

**Objective:** The primary objective of the waste management and environment plan is to achieve a clean and neat physical environment within each harbor. The secondary objective of the plan is to meet the health related environmental requirement established by fish importing countries, such as EU member countries and Japan. These objectives will be achieved by focusing on the following four areas.

#### A. Wastewater management

- Educate and create awareness among all major stakeholders including boat owners, skippers, cleaners, etc. on the importance of appropriate and safe disposal of wastewater (*immediate*);
- Achieve 100% effectiveness in the present program of collection of waste oil through provision of disposal facilities at appropriate locations and educating boat crews on importance of compliance with collection program (*immediate*);
- Prevent flow of wastewater to harbor basins completely (*medium-term*);
- Develop appropriate, low cost, and non-complex treatment technology for auction hall wash wastewater by encouraging government research institutions and universities to carry out research and development on treatment and disposal methods (*medium-term*);
- Implement acceptable treatment and disposal systems for fish auction hall wash wastewater in all three harbors (*medium-term*).

#### B. Solid waste management

- Educate and create awareness among all stakeholders on importance of proper collection and disposal of solid waste (*immediate*);
- Accomplish daily disposal of solid waste collected at each harbor at municipal solid waste disposal site through cooperation with local authorities (*immediate*);
- Provide solid waste collection bins at appropriate locations (*immediate*);
- Achieve segregation of organic and non-organic solid waste at the source level through provision of separate collection bins (*medium-term*);
- Promote recycling of organic waste (namely fish waste) through conversion of such waste into pet food, etc. (*medium-term*).



**C. Environmental management**

- Introduce a workplace organization and standardization system, such as the “5S system”, in each harbor as means of environment management (*medium-term*);
- Carry out environmental audits at each harbor once in two years (*medium-term*);
- Achieve ISO 14000 certification for each harbor (*long-term*).

**D. Institutional aspects**

- Provide training on environmental management and environmental management systems to managers of each harbor (*immediate*);
- Develop linkages between relevant institutions such as Local Authority, Coast Conservation Department (CCD), and Central Environmental Authority (CEA) with regards to fish harbor management (*immediate*).

**E. Spill response**

- Develop a practical fuel spill response plan that may occur, particularly in fuel-dispensing areas (*immediate*);
- Run spill-response drills twice per year to practice containment of spills (*immediate*).

## Market Performance Improvement

**Objective:** The primary objective of the market performance improvement plan is to increase the income of fishermen. Accordingly, market performance improvement at the harbor level is aimed at: (a) improving fish quality offered for sale; (b) reducing wastage of fish; and (c) achieving adequate competition at fish auction.

### A. Improving fish quality

- Educate and create awareness among fishermen on best practices on fish handling and storage (*immediate*);
- Implement a pilot project to demonstrate quality improvement actions on fish storage in multi-day boats through modifications to the fish-hold shelves, or conversion to cold rooms (*medium-term*);
- Introduce manually operated trolleys for the transport of fish from the boat to the auction hall, and encourage fishermen to adopt the practice (*medium-term*);
- Training of fishers, vessel crew and boat handlers in an array of practices that maintain high quality of fish (*medium-term*);
- Provision of better quality (i.e. brackish) water for fish washing (*immediate*).

### B. Reduce wastage of fish

- Educate and create awareness among all fishermen on best practices on fish handling and storage (*immediate*);
- Ensure good quality ice is available at harbor in adequate quantities (*immediate*).
- Provide adequate cold room or cold box facilities at harbors for storage of unsold (excess) fish (*medium-term*);

### C. Achieve adequate competition at fish auctions

- Improve physical conditions of auction halls, including tilling of floors, provision of stainless steel auction tables, adequate illumination, provision of wash water, etc. (*medium-term*);
- Limit or control the participation in auction to fishermen registered in the particular harbor (*medium-term*);
- Meet environmental, health, and safety requirements of fish importing countries (*medium-term*);
- Promote harbor among buyers for local and international markets (*medium-term*).

### III. Governance

**Objective:** The primary objective of the governance improvement plan is to ensure equitable delivery of harbor services to beneficiaries in an efficient manner. This objective will be achieved through: (a) improving the institutional capacity of harbor manager's office; (b) enhancing the decision making capability at harbor level; (c) enhancing community participation in harbor management; (d) establishing a suitable mechanism for conflict resolution; and (e) improving health and safety issues at the harbor.

#### A. Improve institutional capacity at harbor manager's office

- Review of harbor financial management to identify potential efficiencies, fee structures, and opportunities and approaches for private sector involvement (*immediate*);
- Enhance the management and technical skills of harbor managers by providing training on management techniques and technical aspects relevant to efficient operation of harbors (*immediate*);
- Develop skills of the harbor manager's staff on areas relevant to their jobs and functions, and create new positions in line with effective organization (*immediate*);
- Establish linkages between harbor manager's office and other key institutions, such as Local Authority of the area (*immediate*);
- Provide IT facilities to harbor manager's office including training (*immediate*);
- Eliminate redundant staff and bring office overhead to acceptable level (*medium-term*).

#### B. Enhancing decision making capability at harbor level

- Provide more independence to harbors managers through delegation of more powers and forming harbors into cost centers (*medium to long-term*);
- Enhance the management and technical skills of harbor managers by providing training on management techniques and technical aspects relevant to efficient operation of harbors (*immediate*);
- Develop skills of the harbor manager's staff on areas relevant to their jobs and functions (*immediate*);
- Establish a Management Information System (MIS) in each harbor (*medium-term*).

#### C. Enhance community participation in harbor management

- Strengthen the inclusiveness of all stakeholders in the FHC by: (a) establishing a democratic and transparent process for selection of members to FHC; and (b) allowing representation of all stakeholder groups in the FHC (*immediate*);
- Develop rules, regulations and procedures for FHC functioning, which are acceptable to stakeholders (*immediate*);
- Establish an effective mechanism for communicating the decisions made at the FHC to the community (*immediate*);
- Provide financial resources for implementation of FHC decisions (*medium-term*).

**D. Establish conflict resolution mechanism at each harbor**

- Formation of sub-committee of FHC with harbor manager as a member to handle conflicts, act as conflict resolution board and establish procedure for conflict hearing, resolution and appeals (*immediate*);
- Appoint an officer of CFHC to receive complaints and maintain a complaint register (*immediate*);
- Appoint an officer of CFHC to monitor the implementation and abidance of the conflict resolution board decisions by the parties (*immediate*).

**E. Enhance fisher health and safety considerations**

- Review first aid and medical emergency capability to determine adequacy and upgrade capacity as needed (*immediate*);
- Ensure adequate radio monitoring for offshore vessel emergencies (*immediate*);
- Develop an offshore emergency response capability to assist distressed vessels, including possible coordination with Sri Lankan Navy (*medium-term*).

# **PART II: SUPPORTING ASSESSMENTS**

## A. Operations & Maintenance Recommendations

Numerous resources are available for achieving both tactical and strategic management objectives of the fishery harbors. Their applicability may differ according to the objective being pursued, but all should be considered during planning processes and assigned according to their availability, applicability, and likelihood of positive contribution to the issues at hand. The resources potentially available include the following:

***National Funding.*** Funding by the national government is a perennial issue and its vagaries are certainly beyond the purview of this program. Nevertheless, potential for funding management initiatives does exist, and should not be forgotten during planning stages.

***Donor Funding.*** Funding provided by foreign governments – including bilateral and multilateral assistance – will likely continue to be a major resource in harbor development in Sri Lanka. In relation to harbors, funds from these sources can be solicited by demonstrating a sound foundation of management and planning infrastructure to ensure sustainability. Organizations – including CFHC – that demonstrate the management capacity to absorb funds effectively may be more attractive as recipients of these funds.

***Funding from Local Operations.*** CFHC receives income from three sources at the harbor level, which are: boat registration fees; direct provision of services such as water and fuel; and fees from private service providers who operate within harbors. Income from boat registration is negligible, thus CFHC relies largely on service charges for income. However, these income sources do not provide adequate income for harbors to be self-financing with regard to O&M; the available income is inadequate for meeting the operational cost and maintenance of harbor structures. A levy from fish produced (Rs. 1 per kilogram) was proposed by the CFHC some time ago to raise revenue to meet O&M costs. Although this scheme has not gained much political support, it does indicate a willingness to consider effective approaches to achieve financial sustainability. This is in line with prevailing government policy in other sectors that O&M costs be met by the users of facilities, with capital inputs made by the central government.

Potential funding may come from local operations, including user registration and licensing fees, dock fees, facility entry fees, parking fees, transaction taxes (e.g. fees based on fish sales and purchases), facility user fees, commodity fees (e.g. ice), profits on fuel and potable water sales, canteen or commissary profits, HFC membership dues, and more. Some of these sources have been tapped in the past, while others have not. It is certain that any proposed increases in user fees will be closely scrutinized, and stakeholders will likely demand improved benefits commensurate with the new cost of doing business. Higher fees must also be perceived as justifiably needed by the recipient of these fees, and not as merely providing windfall revenues. It is therefore strongly recommended that all new fee proposals be thoroughly vetted in an effective participatory forum, as discussed elsewhere in this document.

***National Government Expertise.*** Numerous relevant resources exist within the GOSL structure, including managers and technical experts within the CFHC, as well as political and

legal specialists in other organizations. As it is likely that legislative approvals will be required to restructure fee payments, organizational and procedural structures, pro bono contributions of time and technical assistance by sympathetic legal and political mentors should be solicited during early stages of fishery harbor management evaluations.

Additional improvements may be best organized at the national level, including research into better fishing and fish handling methods, or organization of vocational training facilities, as high priority examples. Improvement objectives beyond resolution with local resources should be recognized as such and be considered for implementation or resolution by MFAR or others at the national level.

Finally, senior CFHC managers are responsible for supervising and evaluating the performance of Harbor Managers, and the support they provide to projects will always be crucial to successfully improving harbor operations and management.

***Local Management Expertise.*** Local fishery harbor managers are experienced in the current system of harbor management. They are familiar with the realities facing local fisheries operations and users, and are acquainted with supervisors and senior personalities within CFHC and other national agency management structures. They are therefore key players in communicating and implementing management priorities. As new harbor managers are appointed in the future, they should be recruited based on their ability to interact with organizational superiors and subordinates alike, as well as their practical fisheries-related experience. Their assigned duties should relate to management of operations as well as people. The Harbor Manager should be supported by an office manager responsible for collection and accounting of fees, bookkeeping requirements, and appropriate personnel issues.

***Local Management Staff Capabilities.*** Every procedural change and meaningful management task requires leg- and paper-work, as well as staff coordination, monitoring of schedules and task completion, and numerous other tasks that require a trained and committed local administrative staff. These resources are controlled and supervised by the Harbor Manager, and should therefore be considered available for assignment to new and innovative initiatives as deemed appropriate by that supervisor. Similarly, pollution control officers and security personnel may be considered for assignment to tasks aimed toward improving harbor management, again at the discretion of the Harbor Manager and his supervisors.

***Stakeholder Participation and Contributions.*** Numerous stakeholder groups participate in fishery harbor management and operations, and their inclusion is crucial to improve the operational efficiency of facilities. As the livelihoods of all stakeholders depend significantly upon sustained efficient management of fishery harbor facilities, each individual is instilled with a personal incentive to witness – and contribute to – improvements.

- *Fishers* are the reason fisheries harbors exist. If the harbors fail to serve the fishers, they fail to fulfill their reason for being. The participation and “buy-in” of fishers to management actions is therefore crucial to the success of any effort to improve harbor operations. The behavior of fishers in conducting their daily work determines whether management decisions are recognized as credible and worthy of compliance, and

therefore of successful implementation. Fishers may participate as members of Fishery and Harbor Management Committees, as task volunteers, and in participatory forums involving decision-making. Fisher participation must be solicited at each of these levels to the maximum extent possible.

- *Boat Owners* are equally significant stakeholders in the area. Indeed, there is substantial overlap between fishers and boat owners, as owners frequently captain their fishing vessels, and crewmembers work as fishermen (and are often relatives). As a result, proposed plans that will affect fishers will likely have an equivalent affect upon boat owners.
- *Fisher Family Members* are also significant stakeholders, as their well being depends upon fishing and marketing success. They also have very significant interest in social programs such as pension, welfare, social security, worker safety, fisher rescue, and health care programs that may ultimately impinge upon fisher welfare, and consequently upon the long-term sustainable and constructive involvement of fishers in the management of fishery harbors. It is recommended, therefore, that future operations and management programs seek to involve fisher family members, with emphasis on fisher spouses, whose personal interest in family security frequently yields significant influence over fisher participation.
- *Fish Buyers* should be included in consultations, particularly as they affect vehicle traffic flow and parking within harbor areas, proposed taxes and fees, security issues, and product quality initiatives. Any programmatic attempts to associate particular fishery harbors, and perhaps fishery harbor labels, with superior quality product and improved profitability, for example, would have to successfully incorporate support of buyers and wholesalers.
- *Provisioning Suppliers* are an important component influencing vessel turn-around time, while the cost of their services and commodities influence fisher profitability. Uncontrolled access by provisioners can also add to harbor area congestion, and their input during discussions of harbor area vehicle traffic issues may be helpful. Discussions and planning for a potential commissary system, as discussed elsewhere in this document, may also be greatly abetted by active participation from this group of stakeholders.
- *Local Authorities* should also be included whenever management discussions impinge upon areas of potential local authority such as pollution control and waste management issues, when local interests are affected such as vehicle traffic management, or when local resources may provide potential assistance to the successful implementation of management objectives.

***Educator Contributions.*** It may be appropriate to enlist an influential educator associated with fisheries vocational training either from the GOSL system or from the vocational training portion of the SLTRP. Early involvement will enable this participant to develop a deep



understanding of the educational needs of the fisher communities, and in doing so, recommend and implement appropriate and effective interventions.

***Expert Consultant Support.*** This recommended operations and management program is ambitious and aggressive. It may therefore benefit from encouragement and mentoring from third-party expertise from both Sri Lanka experts as well as expatriate specialists. This mentoring will be most beneficial if provided over an extended performance period; this may be feasible under USAID’s current project (SLTRP), but hopefully will be considered for additional support by USAID or others.

### **Operations & Management in the Harbors**

Two overriding principles should guide O&M recommendations for the three fishery harbors:

- (1) Management decisions and actions should be objective-driven, and,
- (2) Objectives should be guided by the goal of improving port facilities and operations beyond the level existing prior to the tsunami (i.e. “building better”).

Once the objectives are agreed upon, the resources needed to implement the objectives must be inventoried. Assignment of resources and task responsibilities may then be developed as the means for achieving outputs or conclusions supporting the desired objectives.

Timelines may also be assigned, recognizing differences among short-, medium- and long-term outcomes, thereby facilitating reasonable expectations among fishers, managers, and other stakeholders. Accordingly, the planning timelines may incorporate interim short-, medium- and long-term task completions, all focused on the ultimate satisfaction of a single management objective. Realistic planning of such milestones coupled with periodic and transparent performance reviews and audits can then provide tangible evidence to stakeholders that progress is being made, encouraging extended constructive participation.

Existing management of the fishery harbors currently appears to be largely top-down, with management decisions made by senior managers in Colombo and implemented by local managers. Fees are collected by local managers and port security is provided, but it appears that daily local fishery operations are operated on a largely *laissez-faire* basis. The exception to this rule is in revenue-generating activities, which are monitored to the extent that revenue recipients are ensured of payment. Beyond this, dockside behavior, fish handling, and other necessary activities are conducted without significant oversight. Although these management realities may be acceptable in under-utilized harbors, the need for improvement in organizational structure is increasing as use of the Sri Lankan fishery harbors grows. The fundamental management structures should therefore be examined in order to ensure efficiency and optimum benefit to users of the facilities.

Stakeholder interviews revealed that a lack of effective implementation of past decisions by Harbor Management Committees is a common concern. While insufficient funding is the most

commonly cited cause for poor implementation, it is also likely that failures result from other factors as well, potentially including:

- Deficiencies in effective planning
- Lack of assigned responsibility and accountability
- Lack of incentives and disincentives
- Lack of effective oversight
- Limitations in stakeholder buy-in and participation

In order to “build better,” it is therefore imperative to upgrade operational structures and processes to optimize achievement of management objectives. While the tsunami impacts have been devastating, it should be recognized that the rebuilding program currently underway provides a timely and unusual opportunity for evaluating and improving the operational and management architecture of the harbor facilities. As new or improved facilities are provided, innovative management policies may be implemented if stakeholder participation and support are effectively marshaled on a timely basis.

### **Management Objectives**

As the fishery harbor management objectives are extensive, their prioritization must be accomplished at an early stage of the program if they are to be accomplished. Each prioritized objective must then be divided into specific subtasks, and assigned adequate and appropriate staffing and physical resources. Implementers should then design a plan for completing tasks, determine a schedule of task completion, and assign supervisory responsibility to monitor and report progress. Individuals charged with implementing the objectives must accept the associated responsibilities, and understand that they will be held accountable by their constituencies and/or supervisors.

Although several potential management objectives are presented below, this should not be construed of as a comprehensive list. Additional objectives are likely to emerge during participatory discussions, as the sustained long-term operation and management of harbor facilities is an ongoing process. Although the suggestions presented below are grouped by general category for discussion purposes, it is emphasized that they will be reorganized depending upon the outcomes of the prioritization process. It is also notable that discussions of several of the objectives presented below overlap, as many are interconnected in scope or results. These connections must be recognized during the participatory management process recommended here.

### ***Organizational Objectives***

*Establishment of Stakeholder Participation Architecture:* This activity must be pursued at the onset of the project. Although the Harbor Management Committee has been used to solicit stakeholder participation thus far, this approach must be broadened to create a sense of ownership amongst the stakeholders whose buy-in is required for operational success. Representation must be sought from Fishery Committees, boat owners, fish buyers, relevant educators, fisher family members, and local government and business entities. Representatives

from each interest group must be selected using a transparent process, which should result in a true representation of constituency interests (as opposed to political appointments). Techniques to achieve this broad based representation should be explored in discussions with local harbor managers, Fishery Committee Representatives, Harbor Management Committee representatives, and senior CFHC managers. Those involved in the planning process must not only consider these issues of equal representation, but also decide upon the frequency and locations of meetings, determine who will have the authority to establish temporary task forces and committees, and devise the internal organization and operating rules of the participatory sessions.

*Initiate Stakeholder Participation Process:* Once the above organizational matters are achieved, the long-term process of participatory management may begin.

*Establish Constituency Communications Requirements:* It is crucial that effective mechanisms be established and enforced leading to regular, clear, and thorough communication with the rank and file of the stakeholder group. Individual stakeholders must be made aware of issues under consideration and potential outcomes in order to ensure that their voices are heard. This process of actively soliciting feedback will likely lead to increased support of harbor management projects. At a minimum, each harbor should have a highly visible posting area where required meeting summaries and issue statements are displayed. Each stakeholder group should be aware of their representatives' identities to enable interaction. The rank and file should have the right to submit their arguments in writing to management group leaders.

*Prioritize Objectives:* Once active, the participatory management group must identify potential management and operations issues, thus framing the debate around which objectives to prioritize. Resulting action lists must consider not only the importance of issues, but the practicality of achieving reasonable responses. Such consideration will ensure that the project establishes a record of success against achievable goals, rather than a record of failure against unachievable aspirations and unrealistic expectations.

*Define Roles and Responsibilities and Task Performance Accountability:* For each established management objective, roles and responsibilities of both individuals and agencies must be explicitly established in writing. People assigned specific tasks should be prepared in subsequent meetings to inform the management group about task progress, problems, and required adjustments to enable successful completion. Task schedules should be specified in the roles and responsibility statements.

*Ensure Effective Enforcement of Approved Harbor Rules:* Policies and rules are meaningless without enforcement, and it is unlikely that users will comply with outlined rules unless enforcement responsibilities are clearly defined and implemented. Significant rules affecting operational effectiveness of the harbor should be inventoried and the persons and offices having responsibility for enforcing each rule or policy should be identified. Their administrative supervisors then must be charged with responsibility of monitoring for effectiveness and for determining solutions to overcome deficiencies.

*Ensure Harbor Security:* Harbor security forces should define what is meant by harbor security and assess their ability to achieve the intended results. For example, does harbor security refer merely to preventing unauthorized entry to the harbor area, or does the definition extend to deterrence of criminal behavior within the harbor area, or even terrorism prevention? Security expectations should be defined as a means to determining its effectiveness.

*Ensure Adequate Stakeholder Revenues:* Under virtually any scenario it would be beneficial for Fisheries Committees to have access to revenues to support their cooperative management activities, and under some scenarios an income would even be required. For example, if a Fisheries Committee is asked and accepts responsibility for day-to-day sanitation of fish auction floors, then it would require income to pay an employee for his/her labor. It is therefore important to explore potential sources of revenue generation in cooperation with harbor management. The committee could for example share revenues from fuel and potable water sales, or even open and operate a canteen which could be assigned to the Committee as a profit-sharing concession from the CFHC. This concept might well be expanded to include operation of a provisioning commissary centered on the canteen-operating nucleus. These and other potential revenue sources should be identified and evaluated so that realistic harbor management innovations may be considered.

*Manage Fuel and Water Prices:* Regardless of how fuel and water sale revenues are shared, it behooves CFHC harbor managers to obtain supplies with the most favorable pricing arrangements possible. Any favorable difference between open economy fuel prices and prices paid at harbor pumps will be perceived by fishers and boat owners as a positive benefit of operating from the harbor. This perception will create value by generating support for docking and other harbor use fees, which maybe charged so long as fishers perceive a net benefit between their costs and the services received. It may also be worthwhile to examine the possibility of national fuel subsidies through political action in Colombo. A strong and viable fishery will benefit Sri Lanka and help the GOSL meet its objectives, and a small subsidy to support its growth may be politically justifiable.

*Manage Ice Prices:* The same arguments made for fuel and water prices apply to ice prices. Another dimension is added, however, by the commercial ownership of ice houses supplying fisheries harbors. Ice prices should not be set under monopoly conditions, which is apparently the current practice in some areas. Options should be explored to overcome monopoly conditions and obstacles to adequate supply of high quality ice. Accurate costs of ice production should be investigated to ensure that fishers are not overcharged. The feasibility of alternative ice production capabilities such as government-owned or Fishery Committee-owned ice plants should also be examined.

*Identify and Clarify Services Available to Registered Harbor Users:* When dealing with public opinion, perceptions often becomes “reality,” whether or not they are true. The perception of boat owners and fishers concerning the value of operating from the fisheries harbors is directly reflected in their willingness to pay for services and facilities. An inventory should be made, therefore, of the facilities and services currently available to registered harbor users. Additional services that would benefit users should also be identified and evaluated for implementation

potential. Results of these initiatives should be made public to harbor users, and their suggestions for additional services should be solicited and evaluated.

### ***Daily Port Operation Objectives***

*Ensure Efficient Dock Usage:* There are plans for updating harbor fueling and watering facilities, but these improvements will be of little value without appropriate management of dock space access and use. As these facilities are limited, it is crucial that regulations be established outlining use. Malingerers must be discouraged from usurping or monopolizing dock space by rule or harbor policy, which must be enforced. Similarly, vessels withholding their catch to raise market prices should not be permitted to occupy dock space, which may block other vessels from unloading or re-provisioning. If anchorage space is available, inactive vessels should be assigned to anchorage rather than dock space. Finally, options for nose-in or stern-in docking should be explored to optimize use of dock space, especially as future larger multi-day vessels are integrated into the fishery. Nose-in docking is used successfully in Negombo, and should be examined for use in these fishery harbors as well.

*Establish In-Harbor Fish Handling Policies and Procedures:* If modernized fish auction facilities are to be fully utilized, current practice of selling fish from the quay in front of unloading vessels must be discouraged or even disallowed. If fishers are expected to sell catch from the auction floor, rules must be established to require that catch be transported to the auction floors in a reasonable manner (and these rules must be enforced). It is imperative that these rules and new policies be developed in concert with stakeholders if they are to have any chance of success. Without clear policy, user support, and enforcement, it is unlikely that existing practices will significantly change.

*Improve Vehicle Traffic Flow in Harbor Areas:* Vehicle traffic flow within harbor areas should be assessed to determine if it can be improved. The harbors are now substantially congested during primary auction hours, and while the system appears uncontrolled, long-term practices are in place and are operable. The potential for improvements in vehicle traffic patterns, parking area controls, and loading areas should nevertheless be examined.

*Maintain Buildings and Structures:* The meaning of “maintenance” of these facilities should be defined, with production of guidelines. For example, frequency of cleaning, availability of waste containers, frequency of emptying waste containers, provision of air conditioning (if used) and its maintenance, lighting maintenance, etc. should be examined to determine that user needs are being met.

*Maintain Sanitary Facilities:* Public toilet facilities in harbor areas must be maintained in a sanitary condition, not only for the benefit of fishers and visitors, but also for general cleanliness and sanitation of fishery products being handled in the harbor area.

### ***Common Area Management Objectives***

*Define Common Area Resources:* Common areas are those used by everyone and publicly owned. Maintenance of such areas frequently suffers from a “tragedy of the commons”, as no

single person or organization has any incentive to do the work. It is unlikely, for instance, that a single fisher would bother to clean the fish auction area, because it will be used and soiled by others before he himself has an opportunity to use the area he cleaned. It is therefore necessary to make other to care for common areas, which may include auction floors and display facilities, quay areas, roads, parking areas, canteen grounds, and more. Tasks in these areas should be inventoried so that operation and maintenance responsibilities may be assigned.

*Establish Auction Floor Operational Rules:* Rules must be developed to ensure that space within the auction floors is equitably assigned. For example, space allocations among fishers, proper use of display facilities, cleanliness standards, and similar issues should be decided to optimize effective use of the facility.

*Ensure Auction Floor and Fish Display Facility Sanitation:* A longer-term objective may involve a desire to establish fishery harbor products as superior quality seafood demanding higher prices from customers. A basic underpinning of such a desire rests upon sanitary handling of fish, which is an appropriate issue for participatory management consideration. Realistically, development in this area may require time to become credible among fishers.

*Ensure Adequate Ice Supply on Auction Floor:* Proper handling of fish should require icing display fish in the auction area. It is suggested that maintaining such supplies at the auction floors may be the responsibility of the Fisheries Committees. Funding for such a purpose could come from either trivial user charges applied to buyers and sellers conducting business in the auction facility, or from minor fees.

*Ensure Effective Canteen Management:* Properly managed harbor canteen facilities would provide refreshment and a welcome respite for fishers. It is suggested that Fishery Committees manage the canteens, thus generating a revenue stream from the profits. If necessary, CFHC could be included in the management/profit sharing structure.

*Expand Canteen to Commissary Function:* Canteen operations could be expanded to provide commissary services, providing vessels with provisions such as groceries, kerosene, fishing supplies, and similar items. Such a facility could potentially purchase supplies in bulk, and thus be able to offer products at highly favorable prices. This would lower fisher costs while providing further opportunities for Fisheries Committees to generate operating income, again under concession agreements with CFHC.

### ***Educational Objectives***

*Plan, Implement and Establish Vocational Training Programs:* Stakeholders universally agree that establishing vocational training programs for fishers is desirable and necessary. These programs should be seen as a high priority, and can either draw from the vocational training facilities provided by SLTRP, local universities, or CFHC itself.

*Fisheries Vocational Training:* Training in fishing and fish handling technology should be designed and implemented as soon as possible. Establishment of these services will likely stimulate participatory cooperation among CFHC, fishers, and other stakeholders.

*Product Quality Education:* Training concerning product quality must be initiated for fishers as well as consumers.

*Harbor Management Training:* Technical and professional training should also be provided to CFHC harbor managers, who in some cases are assigned management responsibilities without adequate preparation. Professional management training at this level could have very effective results.

*Health and Safety Education:* Issues for specific training in this area should be explored, but at a minimum should include first aid/emergency medical response geared towards dealing with situations likely to occur on fishing vessels.

*Family Welfare Education:* This training should involve fisher spouses as well as the fishers themselves. Potential subjects include the value of family and personal savings plans, methods for saving, understanding the basics of credit purchases including fishing vessel provisions, and preparing for lean times.

### ***Logistical Objectives***

*Optimize Anchorage Arrays:* As discussed elsewhere, fishing vessels should not be allowed to monopolize dock space if they are not loading, unloading, or provisioning for their next voyage. Proposed solutions include installing anchorages at locations separate from the docks, and providing harbor managers with the capacity to move vessels in order to optimize dock space.

*Ensure Adequate Potable Water Supply:* Arrangements must be made to ensure that new and improved potable water tanks are continuously supplied with potable water at a reasonable price, allowing for cost savings to be passed on to fishers. To successfully meet this objective, procedures must be devised and responsibilities need to be assigned to ensure that water quality in storage tanks and dispensing lines remains high.

*Ensure Wash Water Supply:* The separate non-potable wash water supply must be maintained. Responsibility for this task must be assigned.

*Ensure Dependable Electricity Supply:* Electricity should be supplied 24 hours per day if possible. Emergency generators and generator fuel supplies must be maintained and subjected to periodic testing. These responsibilities must be assigned so that all stakeholders understand whose role this is.

*Ensure Adequate Diesel and Kerosene Fuel Supplies:* Dependable fuel supplies must be provided at reasonable costs so that cost savings may be passed on to fishers. Fuel and potable water at favorable prices should be regarded as a benefit of doing business with the CFHC.

*Ensure Adequate Ice Supply for Vessels and Fish-Transport Vehicles:* Existing ice supplies are inconsistent in both availability and quality, and many fishers complain about ice prices. Ice production must be thoroughly evaluated, and the option for providing on-site ice production

should fall within this evaluation. This is another area of potential Fishery Committee concessionary operation, which would provide operating revenue for common area maintenance services potentially provided by the Committees, as well as providing a mechanism for airing fisher and boat owner complaints through the Committee structure of which they are members.

*Create Efficient Vessel Provisioning Capacity:* This is likely a longer term objective related to the establishment of a commissary, as discussed elsewhere.

### ***Pollution Control Objectives***

*Define All Pollution Sources in the Fishery Harbors:* An inventory of all pollution sources, including both vessel and harbor operations, must be made to determine environmental protection priorities. Dumping of any types of material into harbor waters should be discouraged.

*Develop and Implement a Solid Waste Collection and Disposal System:* Solid waste is commonly generated on fishing vessels, including used food containers and wrapping, damaged fishing gear, and other materials. Waste collection receptacles should be distributed throughout the harbor and periodically emptied, with waste materials being properly disposed of off site. If necessary, an awareness campaign might be appropriate to encourage use of the receptacles.

*Develop and Implement a Waste Oil Collection and Disposal System:* Convenient collection facilities for waste oil should be provided for the fishers and boat operators. Waste oil should be periodically collected and properly disposed of, preferably at a recycling facility if one is available.

*Develop and Implement a Fish Waste Offal Collection and Disposal System:* Inventory should be made of fish offal generated in the harbor area, and if appropriate, a sufficient system for collection and disposal should be developed. Use of fish waste in fertilizer production may be possible if sufficient quantities are generated.

*Develop a Practical Spill Response Plan:* Notable fuel spills are probably most likely during diesel refueling operations, so contingency plans for containment of spills in fuel dispensing areas should be developed. Individuals responsible for implementation of the plans should be identified, and responses should be practiced on site from time to time, at least twice per year.

*Develop Other Pollution Control Programs as Needs are Identified:* Self explanatory.

### ***Vessel Repair Facility Objectives***

*Ensure Efficient Use of In-Harbor Boat Repair Facilities and Availability of Cost-Effective Boat Repair:* Boat pull-out and repair yards are located within the grounds of the fishery harbors, and their operation should be regulated in conjunction with CFHC. Concessionaires should be safeguarded from favoritism, variable pricing, price gouging, and other inequitable



practices. Boat repair yard operations should be periodically audited to ensure that facilities are being used efficiently, and that slow or delayed vessel repairs are not caused by mismanagement of CFHC facilities. Habitual mismanagement should be considered reasonable grounds for termination of a concession.

### ***Fisher Safety and Welfare Objectives***

*Establish and Ensure Effective and Timely First-Aid and Medical Emergency Services in the Harbor Area:* Existing first aid and medical emergency capability in the fishery harbors should be examined to determine its adequacy. If deficient, the capabilities should be upgraded and staffed to ensure adequate access to treatment during emergencies.

*Ensure Adequate Radio Monitoring for Offshore Vessel Emergencies:* Existing monitoring of emergency radio frequencies in Sri Lanka has been described as sporadic. These reports should be investigated, and if necessary steps should be taken to ensure 24 hour per day monitoring.

*Promote and Develop an Offshore Emergency Response Capability:* It has been reported that no capability or services exists to provide emergency rescue to fishing vessels at sea. If this is indeed the case, then communications with the Sri Lankan Navy should be undertaken to determine whether some level of emergency response might be possible to save lives during emergency situations.

### ***Management Policy Objectives***

*Prohibit In-Harbor Sale of Fish from Outside Sources:* As is the case elsewhere in the world, Sri Lankan fishery harbors enable fishers to make a living. Fish harbors are not intended to be, nor are they designed to be fish markets. Importing fish products from other fishing areas has the potential for flooding the harbor market, thereby diluting prices and local fisher income. This practice is especially unfair to fishers who pay registration fees for using the facility. Such imports of outside product should be strictly prohibited, without exception.

*Review Rules for Vessel Registration:* Rules for boat registration and dock fees have apparently been applied unevenly. Some owners of multiple boats are said to register only one or two vessels, but dock three or even more. Other vessels are said to not be registered at all, while others follow the rules and register. These circumstances lead to the question of whether the registration regulations or rules are clearly written, or are open to various interpretations. This issue should be investigated by a group formed by the participatory management process. If the rules are unclear, they should be rewritten or codified in writing so that their meaning is clear to all. The provisions of these rules should also be open to public debate so that stakeholders can provide input and agree upon their provisions.

*Ensure Effective Management and Enforcement of Vessel Registration Rules:* Once the vessel registration rules are clarified, provisions should be made for impartial and effective enforcement. This will provide for equal treatment of fishers under the law, and it will have a secondary effect of stabilizing CFHC income streams from vessel registration fees.

*Harmonize Harbor Operations and Management Rules, Practices and Policies with National and Local Legislative Authorities, such as the CFHC Act:* It is probable that certain policy or rule changes desired by stakeholders may conflict with existing legislation or policies of the GOSL. In such cases, the management team should solicit the assistance of legal and political mentors to determine whether changes or improvements may be possible, and how to go about promoting them.

*Optimize Harbor Management Staffing:* All three CFHC harbor management teams are operating with expenses exceeding revenues. While the initial reaction to such news is usually geared at increasing revenue streams, an alternative proposal is to assess current staffing of the management offices and determine if all personnel expenses are justified. Once such an assessment has been conducted, adjustments can be made as necessary.

*Review and Optimize Harbor Management Budgets:* Tasks conducted by harbor management and staffing employed to accomplish these tasks should be periodically reviewed for efficiency. This is probably not an issue for participatory management, but it should be accomplished by CFHC, perhaps with the assistance of outside mentors.

The sections that follow present the physical contexts in each harbor, and describe both short-term development plans (i.e. those to be carried out by USAID/SLTRP), as well as proposed ten-year development plans in each harbor. However, for any of the physical development plans to be carried out, it will be necessary to address a number of the O&M issues discussed above. Indeed, for even the SLTRP investment in infrastructure to be truly effective and reasonably sustainable, significant headway must be made in enabling collaborative, market-savvy, and science-based decision-making to occur in each harbor.

## **B. Hikkaduwa Harbor Assessment**

### **I. Introduction**

Hikkaduwa Fishery Harbor is situated on the southwest coast of Sri Lanka, about 18 kilometers north of Galle, and just over one kilometer north of Hikkaduwa Point. The northern limit of the marine sanctuary at Hikkaduwa coincides with the alignment of the initial length of the main (southern) breakwater of the harbor. As the harbor is not protected from the southwest monsoon waves by headlands or other natural features, the protection afforded by the original main breakwater has been supplemented by outer and inner extensions, as well as by a secondary (northern) breakwater (see Figure 1).

The main breakwater, originally about 300 meters in length, is now 380 meters from its root to the new head, due to the addition of an outer breakwater that extends seaward from near the original head. Other recent additions include a spur extending landward from the original head, measuring roughly 45 meters, a 75-meter groin extending seaward from the shoreline opposite the new spur, and a northern breakwater of 340 meters.

The westward-facing harbor entrance is about 70 meters wide between the original head of the main breakwater and the head of the northern breakwater. The harbor water area extends to a total of some 6.6 hectares, and the existing quay – located at the east (landward) side in the southern harbor between the root of the main breakwater and the groin – is approximately 135 meters long. The southern harbor basin has a depth of less than two meters below Mean Sea Level (MSL), except in front of about 70 meters of the quay, where depths are between two and three meters below MSL. In the northern part of the harbor, depths are generally between two and 2.5 meters below MSL. The shoreline between the groin and the northern breakwater is a mixture of sandy beach with boulders, with rock revetment in some places.

The harbor features a roofed and open-sided auction hall located adjacent to the quay. The open-sided net mending area forms the ground floor of the harbor manager's large office, and a small canteen is located at one end of the ground floor. The area also contains a toilet block at the southern area behind the quay, as well as a building for 24-hour radio surveillance and a store. The short road access to the harbor from the main road through Hikkaduwa is in reasonable condition.

The primary damage caused by the tsunami was to the seaward faces of the breakwaters in a number of locations, due to removal or settlement of some of the armor rock layer, with consequent loss of armor to the top berm. The harbor-facing side of the northern breakwater was also damaged in two locations. In addition, the pavement along the top of the breakwater was stripped over significant lengths of the breakwaters. Apart from loss of and damage to fishing boats, some of which are still lying on the crest of the main breakwater, damage to other facilities appears to have been mainly limited to damage of the quay surfacing and fenders, as well as to the auction hall.

### **A. Current Usage of the Harbor**

The basic characteristics of Hikkaduwa harbor in terms of current use, waste management, and other environmental considerations are presented below.

*Number and Size Range of Boats.* Approximately 75 multi-day boats use the harbor, as well as about 100 3½ ton inboard-engine boats. The maximum length of boats using this harbor is 40 feet, of which there are 25. Additionally, approximately 100 one-day boats use the harbor.

*Fish Handling and Marketing.* Fish are handed manually from boats to the quay, where they are weighed and washed, and either auctioned on the quay or loaded into trucks and taken to sell in Colombo. The auction hall at Hikkaduwa is not in use for its intended purpose, apparently due to the fishers' preference or habit of using the quay to display and sell fish.

*Availability of Ice.* Ice is not made within the harbor premises. Ice from a privately-owned ice plant in Hikkaduwa with a capacity of five tons per day is brought in by truck in 50 kilogram bags, as is additional ice from Beruwala in smaller quantities. The ice requirement at the harbor is said to be 70 tons per day for multi-day boats alone, thus indicating a dramatic shortfall in supply relative to demand.

*Net Mending Facilities.* The area provided for net mending is the open-sided ground floor of the harbor manager's office, and is adequate for present use.

*Boat Repair and Maintenance.* There are no facilities for multi-day boat repairs and maintenance within the harbor, which requires that boats be removed from the harbor for these tasks. Furthermore, there are reportedly only two skilled mechanics working at Hikkaduwa also qualified to carry out electrical repairs.

*Diesel Fuel and Potable Water Supplies.* One diesel pump is available quayside, which is fed by an 8,000 liter storage tank. It takes approximately 1.5 hours to refuel a multi-day boat with 1,000 liters of fuel. One potable water supply point is available, which has a ½-inch diameter pipe. It takes approximately two hours to supply 2,000 liters to a multi-day boat. There is a 2,500 liter storage tank for potable water; a new ground tank has been requested.

### **B. Navigation & Safety**

As can be seen firsthand in visits to the harbor, sea conditions can be relatively rough, and one can easily appreciate the difficulties experienced by the fishers in transiting the entrance under such conditions, particularly at night. Representatives of the Hikkaduwa HFC stated strongly that removal of a rock outcrop about 150 meters southwest of the entrance would reduce wave action in the entrance, and also suggested that an outer breakwater extending over the reef flat from the bend in the northern (secondary) breakwater towards the head of the southern outer breakwater would also reduce wave action in the entrance. The wave conditions at the quay have been studied in a numerical model of the harbor and its approaches by the Lanka Hydraulic Institute (LHI), and solutions to reduce residual wave heights have been put forward. These include extending the inner breakwater by 20 meters (see 1.4.1 above).

Additionally, navigational safety into and out of the harbor at night is compromised by the lack of functional beacons marking the limits of the entrance.

## **II. Physical Infrastructure**

This section describes present conditions, near-term improvements to be carried out by SLTRP, and recommended improvements to be implemented over the next ten years with resources to be identified by CFHC with technical assistance from SLTRP. Sanitation, waste management, and other environmental considerations are discussed in Section III, Operations & Maintenance.

### **A. Proposed Initial Reconstruction and Improvement Works**

The following section presents physical improvements to be carried out by SLTRP.

#### **A1. Breakwaters, Groins and Revetments**

Repairs and extension to the breakwaters on the southern side of the harbor are required as follows:

*Main breakwater:* Armor re-arrangement and filling with one to three ton rock armor is required on the seaward side over a 100 meter length of the main breakwater at the root, and over a 25 meter length nearer the junction with the outer breakwater. The bitumen paving to the breakwater needs repair.

*Outer breakwater:* Armor re-arrangement and filling with one to three ton rock armor is required on both sides over a 30 meter length near the head, as is armor re-arrangement and filling with six to eight ton rock armor, as well as repair of the toe at the head. In addition, six to eight ton rock armor needs to be placed on the seaward edge of the crest at the head. A new concrete pavement is proposed along the crest of this breakwater.

*Inner breakwater:* A 20 meter extension is required, with toe and primary armor.

*Northern (secondary) breakwater:* Armor re-arrangement and filling with 0.25 to 0.5 ton rock armor is required on the harbor side over a 50 meter length of the breakwater at the root. On the seaward side, armor re-arrangement and filling with four to six ton rock armor is required over a 20 meter length at the bend in the breakwater. Additionally, the bitumen paving to the breakwater needs repair.

*Navigational Aids.* Beacon lights will be provided on the head of the outer and inner breakwaters, and the light currently at the head forming the entrance will be repaired or replaced.

#### **A2. Quays**

Fenders and bollards are in acceptable condition.

### **A3. *Dredging***

It is proposed to provide depths of three meters below MSL over the operational areas of the southern part of the harbor; this will involve the capital dredging of about 30,000 m<sup>3</sup> of sand.

### **A4. *Buildings***

The fish auction hall will be repaired, including mending damage to the roof.

A drawing of the reconstruction and initial improvements is presented in Figure 1.

## **B. Proposed Longer-term Physical Improvements to the Harbor**

The following points have been determined to be recommended physical improvements, but are not anticipated to be carried out by SLTRP at this time. That said, project staff will work with harbor stakeholders to build capacity to plan and, optimally, to ultimately undertake the suggested improvements by leveraging other resources.

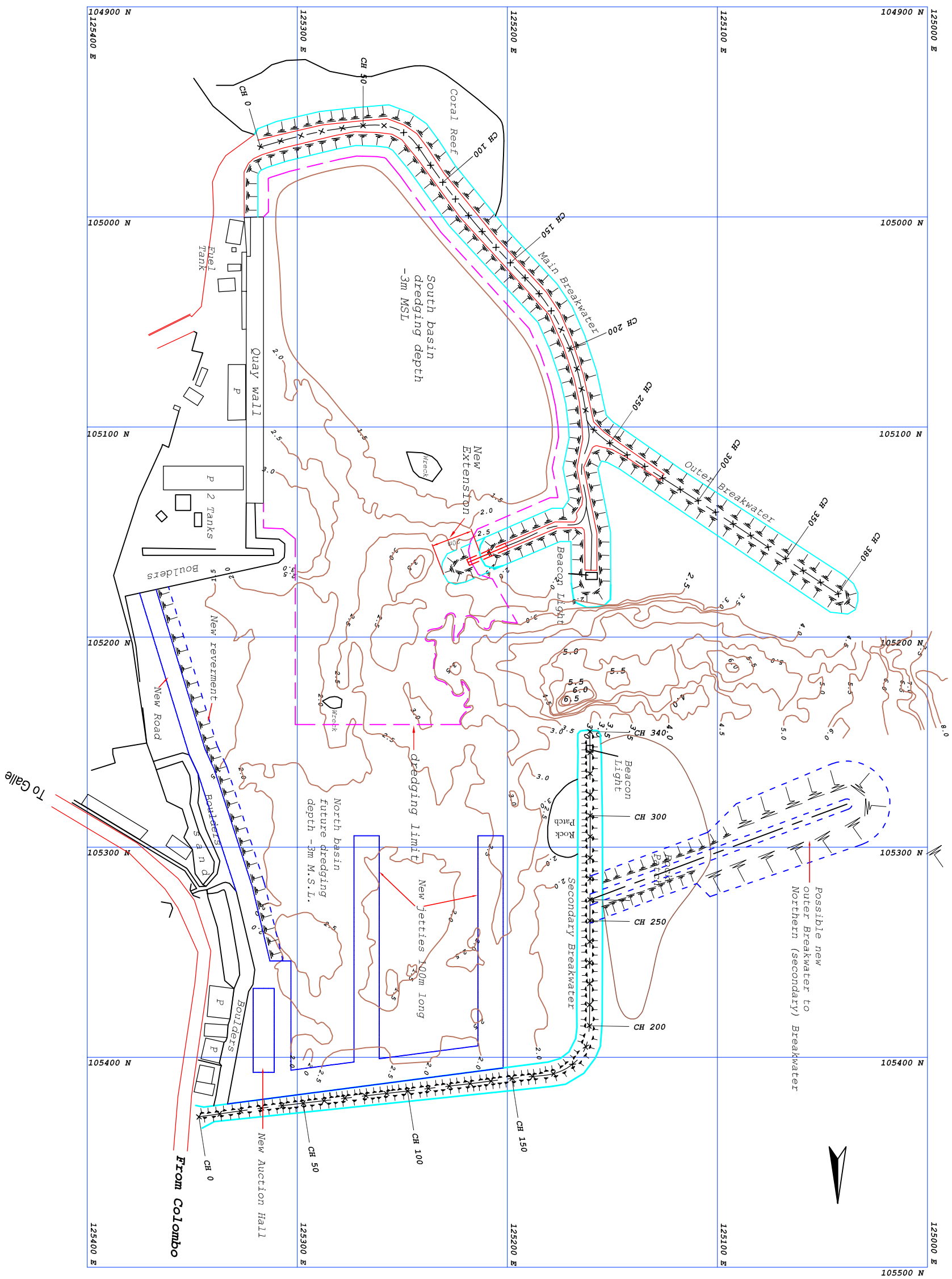
### **B1. *Breakwaters, Groins and Revetments***

New berthing facilities could be provided in the northern part of the harbor, where wave conditions are calmer, and would be further improved by providing an outer breakwater extending westward from the secondary breakwater (see Figure 2). The difficulty of transiting the entrance, however, would not be resolved by this approach.

### **B2. *Quays and Jetties***

The initial reconstruction and improvement works (see above) will not include extension of the existing quay length. When new berthing and unloading facilities are needed, these should be provided by one, or possibly two, jetties of approximately 100 meters that extend at right angles from the inner arm of the northern (secondary) breakwater (see Figure 2). These could provide additional berthing for boats on both sides of the jetty, typically for about eight 40-foot boats on each side (exclusive of rafting), and with an appropriate width of deck could accommodate trucks serving each side, with room for trucks to pass between trucks parked on each side, and to turn at the outer end of the jetty. The jetties would most likely be piled with a reinforced concrete deck. This type of construction is economical and avoids wave reflection from vertical walls which would otherwise increase movement of moored boats.

In this scenario, a roadway along the harbor side of the secondary breakwater would be required for vehicle access to the jetties, and road access to the root of the secondary breakwater could be provided by reclaiming the foreshore, within CFHC property, between the groin and the secondary breakwater. This reclamation would be protected on its seaward side by a rock revetment. Furthermore, it might be possible in the future to make a second entrance to the harbor at the root of the secondary breakwater.



**SRI LANKA TSUNAMI RECONSTRUCTION PROGRAM**  
**HIKKADUWA FISHERY HARBOUR**  
**PROPOSED LONGER TERM DEVELOPMENT**

Figure 2

**B3. Dredging**

In the northern part of the harbor, present depths are generally between two and 2.5 meters below MSL. If new berths were provided in this part of the harbor, as suggested above, it would be necessary to dredge the operational areas to allow a depth of three meters below MSL.

It was noted that MFAR envisages that multi-day boat sizes will increase, with boats up to 24 meters possibly in use within the next decade, and that these boats are likely to require a depth of about five meters below MSL. Since this is considerably deeper than presently provided or planned at Hikkaduwa, these boats would likely operate from other, deeper harbors. In the unlikely event that a decision is made to introduce boats of this size to Hikkaduwa harbor, it would be necessary to use capital dredging to deepen the harbor from three to five meters, notably over the operational areas over which boats sail, anchor and berth. In this event, it would be very important to implement the dredging at a reasonable distance from existing structures (such as breakwaters, groins, revetments, and quays), to ensure that structures are not endangered.

**B4. Buildings**

If unloading and other operations are centered in the northern part of the harbor at some point in the future, a new auction hall and toilet block would be needed near the proposed jetties. These buildings could be on the proposed reclamation along the east shoreline of the harbor, or on a widened area adjacent to the root of the jetties and to the northern (secondary) breakwater. In the former case, which is preferred, some means of transporting unloaded fish from the jetties to the auction hall would be required. This could take the form of a tractor and trailer, operated by the CFHC. Furthermore, net mending facilities will need to be further extended as the number of boats using the harbor increases.

Additionally, the harbor manager should have accommodation in addition to an office in the harbor area. Currently, his office hours do not coincide with the main hours of fisher activity, and position responsibilities call for him to be reachable if required during these hours.

**B5. Diesel Fuel, Potable Water, and Electricity Supplies**

Further refueling and potable water supply points, with adequate rates of flow, will be needed as the fleet increases in size. These could be provided on the proposed jetties, with fuel tanks and potable water overhead tanks sited near the root of the jetties. As electricity supplies are subject to power cuts, the provision of a standby generator for the harbor is desirable (if not already provided under the reconstruction and initial improvement program).

**B6. Boat Repair and Maintenance Facilities**

A mobile crane of around 30-ton capacity is proposed for the longer term. The crane should be capable of lifting multi-day boats out of the water and up onto cradles on an adjacent flat surface.



***B7. Navigation and Safety Provisions***

Several options are open to investigation as possible approaches to improving navigation and safety in the harbor. The numerical model of the harbor and its approaches should be studied to investigate if rocks or other features of the seabed are causing higher wave conditions in the approaches to the port (as suggested by the fishers' representatives as noted above). If this is found to be the case, steps should be taken to mitigate the effect if practicable (e.g. by blasting and/or dredging, if feasible). Additionally, a possible outer breakwater to the northern (secondary) breakwater across the reef flat may reduce wave heights in the existing entrance, and thus improve conditions for boats transiting the entrance, is discussed above. Additionally, adequate cylindrical rubber fenders and bollards should be provided to any jetties constructed in the northern part of the harbor.

**C. Summary of Recommendations for Physical Improvements*****C1. Proposed Initial Reconstruction and Improvement Works***

The proposed initial reconstruction and improvement works which have been agreed between USAID, CH2MHill, and CFHC should be carried out as presented in the PAR, and as summarized below.

Major Rehabilitation/Construction Activities:

- Repairs to damaged section of the breakwaters including repairs to pavement and provision of concrete pavement where necessary;
- Extension of inner breakwater arm by 20 meters;
- Dredging of the south basin to three meter depth (measured from MSL);
- Provision of slipway facility for taking boats away for repairs;
- Provision of navigation aids in the forms of beacons/lights.

Minor Rehabilitation/Construction Activities

- Improvement of drinking water supply system;
- Improvement of sanitation through construction of new toilet facilities;
- Brackish water supply system for cleaning and washing fish;
- Perimeter security wall and gate;
- Repair of auction hall roof;
- Kerosene oil dispensing unit.

***C2. Proposed Longer Term Physical Improvements to the Harbor***

The longer term physical improvements to the harbor during the next decade proposed in this report are based on the assumptions that:

- The number of boats registered at Hikkaduwa and using the harbor will increase;

- It will be desirable to provide more berths to reduce congestion and turn-round time, and to minimize boat damage caused to rafting;
- Works and improvements seen as important by CFHC and/or the fishers for which USAID funds are not presently available will be carried out as with resources identified by CFHC, with assistance from SLTRP's short-term harbor finance specialist.

It should be noted that the first assumption listed above is in part dependent on GOSL policy, on the fish stocks available in Sri Lankan waters and hence the 'maximum sustainable yield', and on market forces generally. The number of boats using the harbor during the next decade is therefore not possible to define at this time.

Based on these assumptions, it is recommended that:

*C2a. Major works and improvements:*

1. Future berths should be provided in the north basin for multi-day boats at one or more jetties extending south from the northern breakwater. The width of the jetties should be sufficient for a truck to pass parked trucks on both sides of the jetty, and to turn at the outer end of the jetty. Adequate bollards and cylindrical rubber fenders with stainless steel chains and shackles should be provided to the berthing faces of the jetties.
2. Prior to the construction of the jetties, dredging to provide a depth of three meters below MSL should be carried out in the operational areas of the North Basin.
3. Reclamation should be used to form a strip of land along the east shoreline of the harbor, between the harbor manager's office and the northern breakwater, to permit the construction of a road connecting the existing land area of the harbor with the proposed jetties in the north basin. This reclamation should be protected on the harbor side with a rock revetment. This access road should continue along the harbor side of the northern breakwater to the jetties.
4. The effect of an outer breakwater extending seaward from the northern breakwater in reducing wave action at the existing entrance to the harbor and at the existing quays, its effect on siltation in the harbor, and its environmental effect on the adjacent marine sanctuary, should be studied in detail in a numerical model.
5. A boat lift gantry of around 30 ton capacity, capable of lifting out multi-day boats up to 50 foot long onto cradles on an adjacent flat surface, should be procured.
6. Additional points for refueling and for potable water should be provided at the existing quay, initially. If and when the proposed jetties are built, points for refueling and potable water should be provided along those jetties, with fuel tanks and potable water overhead tanks sited near the root of the jetties.

*C2b. Minor works and improvements:*

7. Accommodation for the harbor manager and his deputy should be provided within the harbor area.
8. A standby generator should be provided in the harbor area.
9. If future unloading and other operations are centered on the northern part of the harbor, a new auction hall and a new toilet block should be constructed near the proposed jetties.
10. Additional net mending facilities should be provided as the number of boats using the harbor increases.

### **III. Operations & Maintenance**

As discussed above, for the most part the operations & maintenance (O&M) context in each harbor – including Hikkaduwa – are most appropriately addressed at the central level, as CFHC is responsible for managing and operating these harbor facilities. However, in the course of developing near-term and future construction recommendations, combined with lessons gleaned from community consultations and other information-gathering, the basis was provided for a preliminary discussion of O&M issues and areas for improvement in Hikkaduwa harbor. While this should not be considered a comprehensive or “fully-vetted” improvement plan, it may be useful as a starting point from which the harbor management and HFC may launch an effective operational improvement process.

#### **A. Waste Management & Environmental Considerations**

A number of pressing environmental issues are present in the harbor, namely in the area of waste management. Improvements to sanitary, solid and other wastes disposal, including oil separation and disposal where relevant, including those suggested below, should be carried out by CFHC in conjunction with the local government. The issue of wastewater from the hotel adjacent to the harbor, which is channeled into the harbor, should be approached in a similar manner.

*Fish Offal and Other Solid Waste Disposal.* Responsibility for collection of fish waste pertains to the municipal refuse collection service, but in reality does not take place with adequate regularity. In a practical sense, the harbor manager and the HFC must explore suitable ways to provide collection bins near the quay, as well as a regular disposal service. For example, a small tractor and trailer could collect and dispose of waste daily, taking the waste to the local municipal waste facility.

*Washing Carried out at Quays and Auction Hall.* All water used for washing fish and harbor facilities presently finds its way into the harbor. Furthermore, there is no means of accommodating and separating oil wastes from boats, spillage of diesel fuel on the quay, etc. In the longer term, this is not acceptable without at a minimum screening for solids and grit.

*Harbor Pollution.* The water in the parts of the harbor is fairly polluted at present. This is due to diesel spillage that occurs during refueling, bilge water leaks, fish waste, fish wash water, etc. With appropriate measures the degree of harbor pollution from these sources can be reduced.

An additional source of pollution of the harbor that is a cause of concern is wastewater (although not sewage) discharge from an adjacent hotel. This is channeled between the harbor manager's office and the boundary fence into the northern part of the harbor. Discussions should be held between the CFHC, local government, and the hotel in question with the objective of ensuring that treatment of this waste water is carried out before it is discharged into the harbor.

## **B. Market Performance**

There is a need to promote harbors as "brand" to attract more buyers to harbors. At present no such marketing is taking place. This is because the CFHC is not involved in marketing and they do not gain from higher fish prices anyway. The marketing arm of the Fisheries Ministry the Ceylon Fisheries Corporation is not involved in harbor based promotional campaign. However, the Hikkaduwa harbor in some ways is suitable for such promotional campaign. This is because there is a perception that fish at Hikkaduwa is better in taste and quality. The reason behind this is most of the boats in Hikkaduwa harbor are single day boats or small multiday boats, which stay only 3-4 days in the sea. As a result fish available at Hikkaduwa auction are comparatively fresh (fish brought by large multi-day boats are 14-21 days old). Advantages of harbor based marketing of fish are: creation of competition among harbors that would improve fish quality; fishermen are compensated for maintaining better quality; improved market mobilization, etc.

Market performance in the fisheries sector is determined by a number of factors. In the three harbors addressed in this document, this includes the quality of the fish at the time it is sold at the harbor; this varies, depending on the waiting time for unloading, the quality of ice and its availability in required quantities, and the methods of storage employed. The number of buyers and sellers participating in the market has an obvious impact, as do any supply control mechanisms applied, such as withholding of fish until price reaches an acceptable point to sell. The level of waste occurring, which impacts the supply of high-quality fish, as well as the existence of appropriate facilities to support high quality and effective marketing are also key.

*Availability of Ice.* As mentioned above, there is an acute shortage of ice at Hikkaduwa harbor, as only 200 blocks of ice are available per day from the production unit at the closest location to the harbor, while the demand exceeds 1000 blocks per day. Therefore ice blocks have to be brought from distant locations including Beruwala, Tangalle, Galle, Weligama and Mirissa.

*Fish Washing Practices.* Poor sources of water supplies in terms of rate of flow, and the high prices of potable water at the harbor, coupled with lack of knowledge, have compelled the fishers to depend on the polluted water in the harbor for washing fish. This practice impacts the quality of fish produced, and in turn reduces the price that can be attained.

*Handling and Storage.* A multitude of opportunities may be explored in the harbor for increasing value of fish catch through improved storage and handling. A few recommendations include the following:

- Improvements to fish storage on multi-day boats through modifications to the fish-hold shelves, or conversion to cold rooms; a pilot practice could be introduced for demonstrations to the fishers to motivate boat owners to adopt these modifications;
- Introduction of manually operated two- or four-wheeled trolleys for the independent movement of fish when unloading fish from the boat to the auction hall;
- Training of fishers, vessel crew and boat handlers in an array of practices that maintain high quality of fish.

*Trading in the Harbor Premises.* There are 20 to 30 wholesale traders and 300 to 400 small traders visiting the harbor on a daily basis. Several traders from Negombo and other distant locations bring fish of different varieties and quantities in trucks to be sold at the harbor, and this influences the available supply, thus decreasing the prices of fish landed by the boats operated from Hikkaduwa Harbor. This competition from outside suppliers and traders is seen as unfair by many registered users of the harbor, who feel that their entrance to the harbor should be suspended to enable the local fishermen to gain better prices for their fish. The lack of clear information about who is allowed entrance, and what services are entitled to those paying registration, exacerbates this situation and contributes to tension as related to prices fishers can obtain for their catch. Clarification by harbor management of whether outside traders should be allowed to participate in selling fish within the facility will help to reduce conflict and focus energy of registered vendors on constructive, competitive efforts.

*Auction Hall Utilization.* The fish auction hall at Hikkaduwa is underutilized because the fishers are used to selling their produce within the quay area, thus hindering the preparation of the multi-day boats for return voyages. The existing auction hall is dilapidated and should be relocated landwards and improved, according to the fishermen. It should also be redesigned to feature additional hall space, fish storage facilities, a raised and tiled section to display fish, and a cement floor to avoid slippery conditions. The HFC is in a position to influence the fish traders and the boat owners to move them to auction fish at the auction hall, provided the necessary improvements are made.

The use of improved auction halls will occur only if there is a quality-conscious set of buyers and sellers who can influence prices. An attitudinal change is essential for moving the buyers and sellers from the open space on the quay to an improved auction hall. Drastic action by the HFC, whose members are fishery community leaders, could influence the buyers and sellers to meet at the auction hall if it has an attractive environment in terms of cleanliness and maintenance, and a space where the quality of fish could be seen clearly. Adequate space needs to be maintained within the auction hall for each supplier and buyer to bargain over the price. It should be established at a prime location within the harbor, which can be accessed by many buyers and sellers.

*Adequacy of Facilities.* Limitations in infrastructure facilities such as berthing, fuel and water supply facilities have slowed the market performance and efficiency of operations, as long

delays occur in the unloading of fish when the demand is high, such as in auctions and during preparation for turn around of vessels. This supports the argument for future development plans to consider augmenting available key space – potentially towards the north of the existing quay – to relieve current congestion. From a management perspective, this also supports the argument for improving collaborative planning in the harbor; bringing together the actors who feel the impacts of management failures in their pocketbooks for constructive problem-solving will be central to any sustainable resolution of these issues. This point is discussed further in the following section.

### **C. Decision-Making, Consultation, and Conflict Resolution**

A number of actors make decisions on a daily basis that impact the overall operation and functioning of the harbors, including such stakeholders as harbor management (employed by CFHC), boat owners, hired fishers, fish buyers, and service providers such as ice merchants. The most formal instruments for governance in the harbor are: first, the CFHC management staff, responsible for operation, management, and maintenance of the harbor; and second, the HFC, comprised of fishers representing users of the harbor, which has minimal resources at its disposal.

There are 30 CFHC staff at Hikkaduwa harbor, headed by a manager, a cashier, six clerks (for accounts, boat registration, fuel operations, water, electricity, administration and officers' incentives), a jetty controller, a maintenance worker, seven security officers, five marine pollution guards, five contract laborers, a driver, a steno-typist and an ice-plant technician who attends to stores. The official decisions pertaining to the harbor operations are made by the harbor manager on the basis of circulars issued by the CFHC Head Office in Colombo, and the necessary instructions are given to subordinate staff accordingly.

Consultations among different stakeholders for common decisions take place through the HFC, which consists of ten members representing the boat owners (also representing different categories of boats), crew member fishermen and traders. The harbor manager serves as the secretary to the committee. Although the HFC meets once every two months to discuss the details of development of the harbor activities, there have been constraints on the implementation of the decisions, due to lack of resources and commitment, and to poor mechanisms for disseminating information and seeking feedback from stakeholders.

Given the present situation of congestion, limitations of services due to constraints in the availability of ice, workshop facilities, refueling and water supply facilities, harbor users have been extremely patient and co-operative with one another as well as the harbor management. Although many instances of arguments have arisen, they have been amicably settled, with conflict resolution taking place through the interventions of the harbor manager and his staff. Concern regarding the absence of adequate services, coupled with limitations in the availability of sufficient space on the quay, of fuel service stations and of water supply points during out-of-office hours, has been raised, particularly during the peak fishing season from October to March, when most of the boats are operated from the harbor.

With the exception of the HFC, which does not significantly influence management of the harbor at present, there is no mechanism for consultations with or dialogue among stakeholders on a periodic basis. There is no set of rules, procedures, and regulations that have been introduced and practiced for efficient operations of the harbor facilities to safeguard the interests of the different harbor users, including environmental waste management and maintenance of the quality of fish.

An example of both the opportunities and constraints existing at Hikkaduwa Harbor follows: a decision was taken among management and users to reduce harbor water pollution. Subsequently, carts were provided to transport waste oil from the boats to a storage tank, from which the waste oil will be disposed of periodically by selling it to outside agencies and to the private sector. As a result, an improvement in the quality of water in the harbor basin is expected. This demonstrates a coordinated approach to solving a pervasive problem hindering many elements of harbor operations. However, the program was not accompanied by educational or awareness-raising creation program, which would allow for increased adherence to the cart system. This presents a valuable experience from which to approach future interventions.

## C. Mirissa Harbor Assessment

### I. Introduction

Mirissa Fishery Harbor is situated in southern Sri Lanka on the west side of Mirissa Point, at the eastern end of Weligama Bay, approximately 16 kilometers west of Dondra Head and about 27 kilometers east of Galle. Mirissa Point provides some protection from waves from the east and southeast. A main breakwater 400 meters long also provides protection from waves from the west and southwest (see Figure 3). There is also a 95 meter groin which extends from the shoreline on the east side of the harbor which acts as a secondary breakwater.

The harbor water area extends to some seven hectares, and the main existing quay length at the southern end of the harbor is about 160 meters long. Adjoining this quay and on its east side is an additional quay of about 100 meters, constructed on gabions. The shoreline on the east side of the harbor, between the east end of the quays and the groin, is protected over much of its length by a rock revetment. This revetment, however, is not continuous. The harbor generally exceeds 3.0 to 3.5 meters in depth below MSL, but in some limited areas at the quays, the depth is around 1.5 meters below MSL. The effective harbor entrance between the main breakwater and the groin, which faces northeast, is some 130 meters wide.

The fishery harbor hosts an auction hall situated on the quay as well as a net mending area. Both of these buildings are roofed and open-sided. Other main buildings include the Harbor Manager's office, CFHC offices and cold store, a canteen, and a toilet block. A small boat repair yard and workshop is located near the groin.

The road access from the main Weligama-Matara road, which is approximately one kilometer long, is narrow, in poor condition, and can only accommodate two trucks to pass side-by-side.

The main effect of the 26<sup>th</sup> December 2004 tsunami was to cause damage to the seaward face of the main breakwater in a number of locations. This was mainly due to settlement of the armor rock layer with consequent loss of armor to the top berm that exposed the under layer rock and the core rock. The harbor side face of the main breakwater was also damaged, mainly over its outer length. In addition, the pavement along the top of the breakwater was stripped over a significant length of the breakwater. The tsunami also caused damage to the head of the secondary breakwater (groin). Apart from loss of and damage to fishing boats, damage to other facilities appears to have been limited to some damage to the quays and to their surfacing and fenders.

#### A. *Current Usage of the Harbor*

A summary of usage of Mirissa harbor is presented below.

*Number and Size Range of Boats.* The number of multi-day boats that use the harbor is about 280, with a maximum boat length of 54 feet. The number of one-day boats that use the harbor



is about 140, including about 60 outboard-motored traditional craft made of fiber-reinforced plastic (FRP) and 40 outboard-motored traditional craft (Oru).

*Fish Handling and Marketing.* Fish are handled manually from the boat to the quay, where they are weighed, washed, and either auctioned on the quay or loaded into trucks at the quay and taken to Colombo. As the auction hall at Mirissa is situated on the quay, with less than two meters between the seaward edge of the building and the quay face. This is not the optimum location for the auction hall, which is currently used for net mending, instead of its intended purpose.

*Availability of Ice.* Ice is not made within the harbor premises, and critical shortage often delays departure of boats to sea by days or weeks. Ice from privately owned plants is brought by truck from outside in 50 kilogram bags.

*Net Mending Facilities.* A roofed open-sided building is provided for net mending. This is an inadequate area as only two nets can be mended at any one time, leading to the use of the auction hall for this purpose.

*Boat Repair and Maintenance.* There are limited facilities for boat repair and maintenance at the harbor. Boats up to 34 feet in length can be lifted out of the water with a 20-ton capacity mobile crane, which is owned by the CFHC, and repaired on the quay. Larger boats must visit other ports for repair facilities. There is a small boat repair yard with a small ship lift and a workshop situated near the secondary breakwater which has been leased to a private operator.

*Diesel Fuel, Potable Water, and Electricity Supplies.* There are two one-inch diameter diesel fuel lines from quayside pumps available for refueling boats that can deliver 50 liters per minute. With these pumps it typically takes three hours to refuel a multi-day boat. There are six 1/2-inch diameter potable water lines supplied by a one-inch diameter main from a 10,000 gallon tank. It can take from five to twelve hours to supply a multi-day boat in these circumstances.

## **B. Navigation & Safety**

Navigation into and out of the harbor does not appear to be a significant problem at Mirissa, except that functioning lights are required both on the head of the main breakwater and groin for navigating during the hours of darkness. The depth of water in the entrance is about four meters below MSL.

There is, however, a problem with the smaller one-day boats being damaged by the larger multi-day boats when they are moored next to each other in a practice known as “rafting”. This could be remedied by requiring a separation of each type of boat when moored at the quay. Use of the gabion wall quay could be restricted to one-day boats. The proposed new quay at the secondary breakwater is designed to be used by one-day boats only. The fendering at the quays, which consists mainly of old rubber tires, is in poor condition and is contributing to boat damage. The replacement of damaged tires and other existing fender materials with stainless steel chains and shackles should be considered.

## II. Physical Infrastructure

The following section describes present conditions, near-term improvements to be carried out by USAID/SLTRP, and recommended improvements to be implemented over the next ten years. Sanitation, waste management, and other environmental considerations are discussed in Section III, Operations & Maintenance.

### A. Proposed Initial Reconstruction and Improvement Works

The physical improvements to be carried out by SLTRP are presented below.

*A1. Breakwaters, Groins and Revetments.* Repairs to the main breakwater are required on both the seaward and harbor side. It is estimated that primary rock armor is required on the seaward side over a 33 meter length of the main breakwater at the root, and over a 25 meter length at the location of the turning area between chainages 250 and 275 meters. The primary rock armor on the seaward side requires re-arrangement due to settlement over the full 400 meter length, with additional primary armor being required in some places. On the harbor side primary armor rock is required over the full 400 meter length. Some armor rock in the six to eight ton range is available at the harbor for re-use. The existing asphalt pavement along the top of the main breakwater requires replacement over the full 400 meter length. Repairs to the rock armor of the groin are required at the head and along a length 15 meters back from the head. Repairs to the existing rock revetment to the shoreline at the east side of the harbor as well as a new revetment where shoreline erosion has been significant is proposed over a total length of about 100 meters.

*A2. Quays.* Some rehabilitation to the surface and fendering of the existing quays is required. To reduce the congestion at the existing quays, a new quay of 100 meters in length is proposed for multi-day boats. This will be situated at the west side of the harbor, along the harbor side of the main breakwater, extending from, and at right angles to, the existing quay. Any wave overtopping of the breakwater that occurs here under extreme conditions during the southwest monsoon will be acceptable.

In addition, a new quay for one-day boats with a total length of 75 meters, a depth of water of 1.5 meters below MSL, and situated at the secondary breakwater (groin) is proposed. This quay will be located along the southwest face of the groin.

*A3. Dredging.* The harbor in general has adequate depths in the operational areas for the boats presently using the harbor, and thus no capital dredging is planned. However, there are some areas near the existing gabion quay wall where the depths are less than three meters below MSL. CFHC has suggested that these areas be dredged to three meters below MSL. If dredging to this depth were to be carried out, it would be essential to check the 'as made' design of the quay wall to ensure that dredging to this level would not undermine the stability of the quay wall. Dredging to this depth at the quay is not recommended.

*A4. Buildings.* The auction hall located on the quay makes fish unloading and marketing operations here difficult and inefficient. This building should be demolished and rebuilt in a more appropriate location (to be determined by the Harbor Manager and the Harbor Fishery

Committee) probably landward of the present location and further southeast along the quay, nearer the net mending shed, to allow adequate vehicle access between the relocated auction hall and the CFHC offices. As the auction hall is currently used largely for net-mending, it would then be desirable to widen the net mending building in view of the limited number of nets that can be mended at any one time. A two-storey building for 24-hour radio surveillance, including a store, will eventually be required. A new suitably located toilet block with washing facilities is also required; an appropriate location should be determined by the Harbor Manager in conjunction with the Mirissa HFC.

## **B. Proposed Longer-term Physical Improvements to the Harbor**

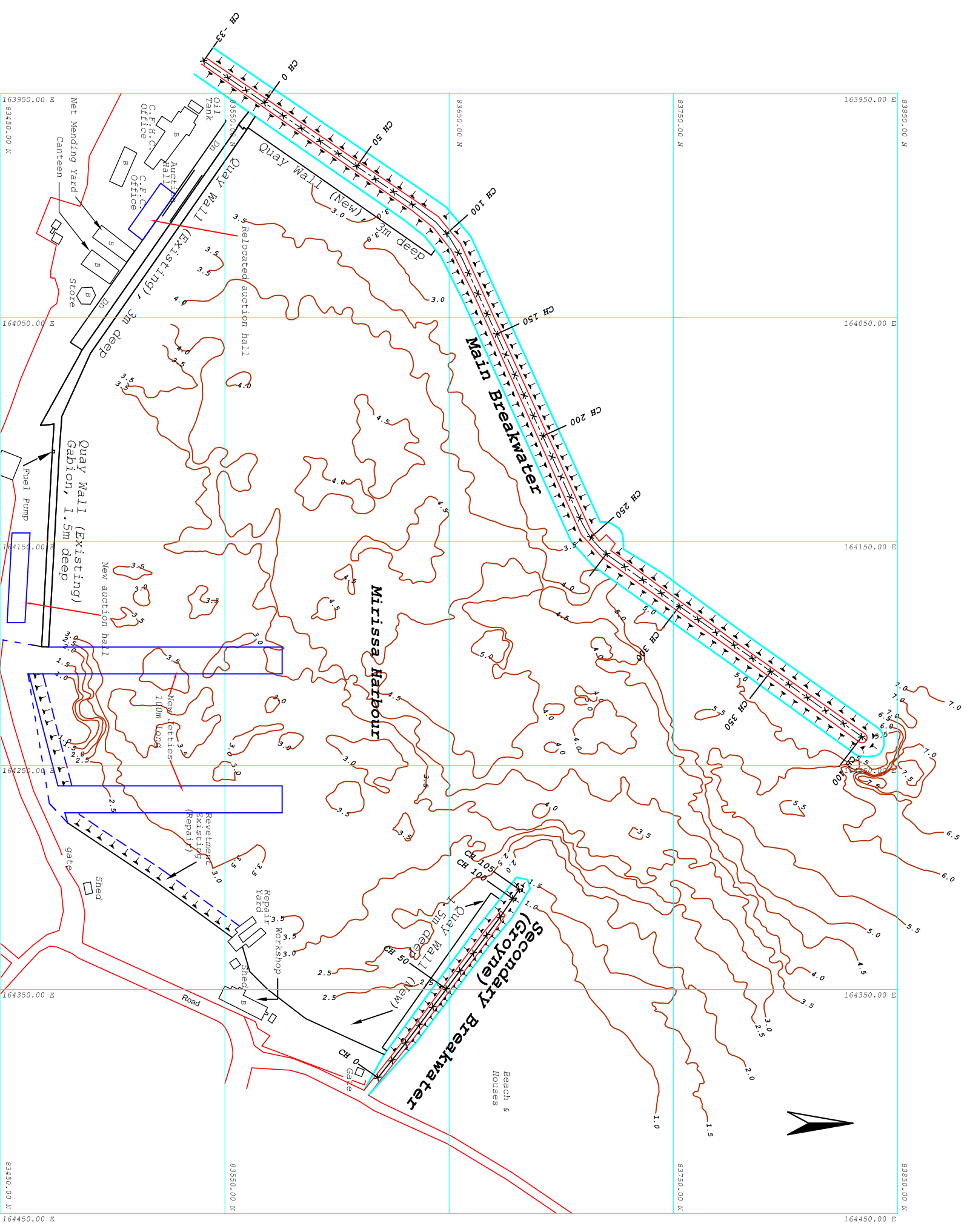
Recommendations for physical improvements to be made to the harbor over the next ten year period are presented below. It is expected that CFHC will access funds to complement the construction carried out by USAID through SLTRP; as discussed previously, the project will provide technical assistance in harbor finance to support capacity development in this area.

*B1. Breakwaters, Groins and Revetments.* Apart from the repairs to the main breakwater, the groin and the existing rock revetments in the harbor, no new lengths of breakwaters or groins are proposed, either at present or within the next ten years.

*B2. Quays and Jetties.* As the number of boats using the harbor increases, pressure on berth availability for unloading the catch and re-provisioning will increase. Additional berths could be provided in the future at Mirissa in two alternative ways: 1) by constructing a quay parallel to the shoreline and to the rock revetment at the eastern side of the harbor; or 2) by constructing one or more jetties extending into the harbor from the shoreline and from the rock revetment in this area.

In the first option, a maximum of about 160 meters of quay could be located parallel to the rock revetment. About 50 meters of this would be in continuation of the existing gabion wall quay alignment and about 110 meters extending northeast towards the groin. The alternative of constructing one or more jetties of about 100 meters long could provide additional berthing for boats on both sides of the jetty for about eight 40-foot long boats on each side (exclusive of rafting). With an appropriate width of deck, these jetties could also accommodate trucks serving each side with room for trucks to pass between trucks parked on each side and to turn at the outer end of the jetty. New jetties would be best located extending from the rock revetment on the east side of the harbor, aligned towards the harbor entrance in order to minimize the movement of moored boats due to wave action (see Figure 4). Jetties in this location are preferable to a quay, at which moored boats would be subjected to residual waves propagating from the entrance on the beam of the boat. This would lead to excessive rolling and heaving, associated difficulty in unloading the fish, and an increased risk of boat damage. A jetty would also have the major advantage of being able to berth boats on both sides.

*B3. Dredging.* No further capital dredging is envisaged once a depth of three meters below MSL has been provided in the main operational areas of the harbor, including the operational areas in the vicinity of the proposed jetties, unless the draught of multi-day boats using the harbor at Mirissa is forecast to increase. Some periodic and limited maintenance dredging of sand brought in by wave action during the southwest monsoon is likely to be required.



SRI LANKA TSUNAMI RECONSTRUCTION PROGRAM  
 MIRISSA FISHERY HARBOUR  
 PROPOSED LONGER TERM DEVELOPMENT

Figure 4

In Section II above, it was noted that MFAR envisages that multi-day boat sizes will increase, with boats up to 24 meters (79 feet) long possibly in use within the next decade to 2016. These boats are likely to require a depth of about five meters below MSL. Since these larger multi-day boats will require considerably deeper water than currently available or planned at Mirissa, these boats will probably operate from other harbors with deeper water. If in the unlikely event that it is planned that boats of this size would use Mirissa harbor, capital dredging from three to five meters below MSL for the operational areas to deepen the harbor where these boats would sail, anchor, and berth would be required. In this event, it is very important that such dredging not be carried out too near existing structures such as breakwaters, groins, revetments, and quays, so that the stability of the structures is not endangered.

*B4. Buildings.* Net mending facilities will need to be further extended as the number of boats using the harbor increases. A two-storey building for 24-hour radio surveillance, including a store, is required if not already constructed under the reconstruction and initial improvement program. A new toilet block with washing facilities is required if not already constructed under the reconstruction and initial improvement program. It is desirable for the Harbor Manager to have accommodation as well as an office in the harbor area since his office hours do not coincide with the main hours of fisher activity.

*B5. Diesel Fuel, Potable Water, and Electricity Supplies.* Further refueling points and potable water supply points with adequate rates of flow will be needed as the fleet increases in size. Because electricity supplies are subject to power cuts, the provision of a standby generator for the harbor will be advisable.

*B6. Boat Repair and Maintenance.* A boat lift gantry of approximately 30-ton capacity and capable of lifting out multi-day boats up to 50 feet long onto cradles on an adjacent flat surface is proposed for the longer term.

*B7. Navigation and Safety.* It is probable that for the longer term safety of navigation through the entrance in hours of darkness, beacons with lights powered by solar panels will be required not only on the heads of the main breakwater and the groin, but at locations in the approaches to the harbor where isolated rocks and reefs may endanger navigation by the larger boats that are anticipated in the future. Where continuing hazards to navigation in the approaches to the harbor and through the entrance are due to isolated rocks and boulders, they should be removed by blasting and grab dredging where practical and environmentally appropriate. Adequate boundary fencing or walls should be provided around the perimeter of the harbor with secure lock-ups provided for the temporary storage of equipment and engines, where not already in place.

*B8. Sanitation and Waste Management.* Improvements to sanitary, solid, and other wastes disposal, including oil separation and disposal where relevant, should be carried out by CFHC in conjunction with the local authorities.

## **C. Summary of Recommendations for Physical Improvements**

The following section briefly consolidates the recommended physical improvements to be carried out immediately (over the SLTRP project period) as well as over the next ten years.

### ***C1. Initial Reconstruction and Improvement Works***

It is recommended that the proposed initial reconstruction and improvement works which have been agreed between USAID, CH2MHill, and CFHC should be carried out. These works include the following:

#### Major Rehabilitation/Construction Activities

- Repairs to the damaged section of the breakwaters, including repairs to pavement and provision of concrete pavement where necessary;
- 100 meter long quay wall at the main breakwater for berthing of multi-day boats;
- 75 meter quay wall along the secondary breakwater for berthing of single day boats;

#### Minor Rehabilitation/Construction Activities

- Improvement of drinking water supply system;
- Brackish water supply system for cleaning and washing fish;
- Replacement of damaged bollards and fenders;
- New fish auction hall;
- Modify the eave of the existing fish auction hall to prevent damage to masts.

### ***C2. Proposed Longer Term Physical Improvements to the Harbor***

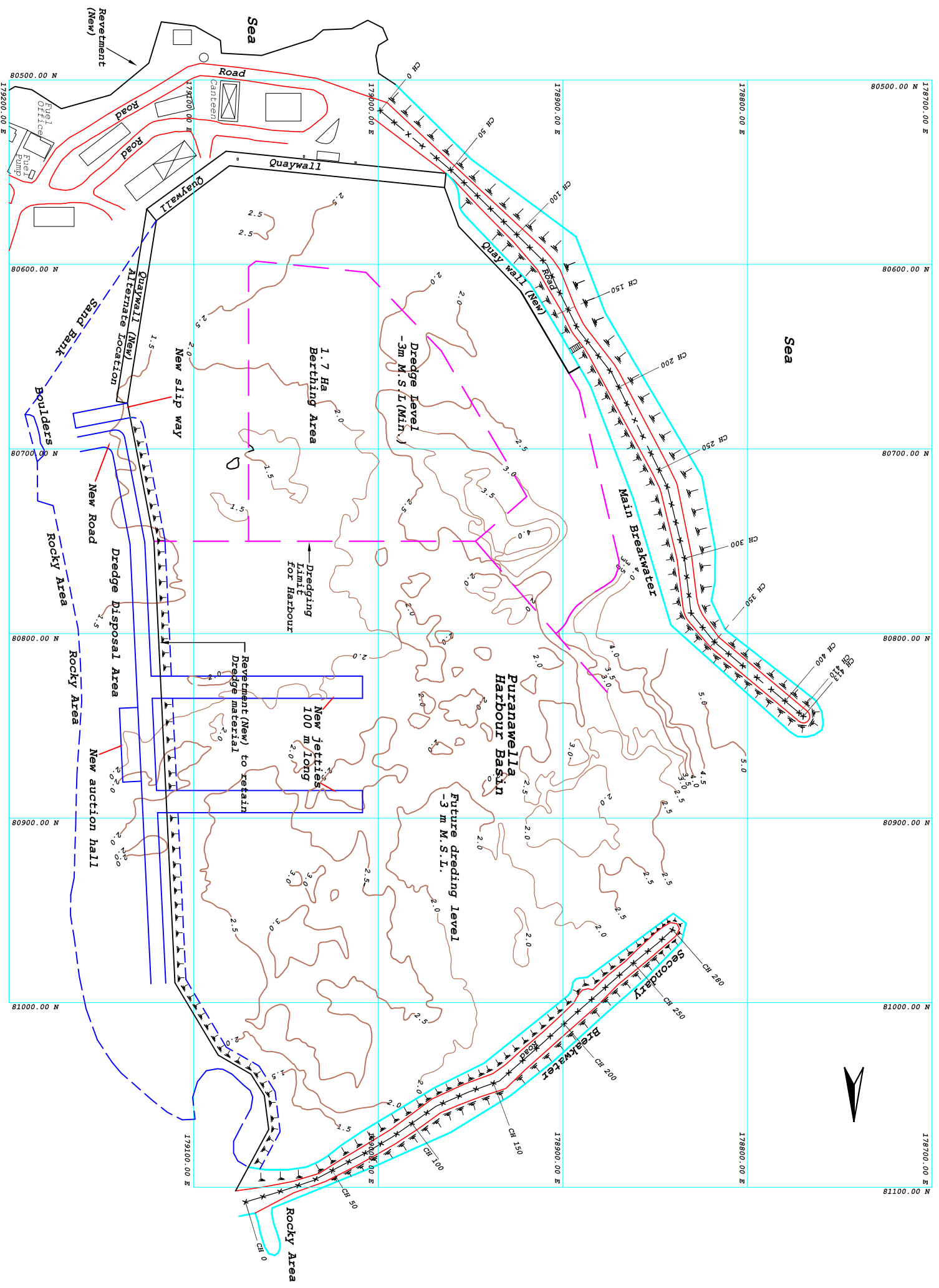
As in the case of Hikkaduwa, the longer term physical improvements to the harbor at Mirissa during the next decade up to 2016 proposed in this report are based on the assumptions that:

- The number of boats registered at Mirissa and using the harbor will increase;
- More berths will be required to reduce congestion and turn-round time, and to minimize any damage due to rafting
- Works and improvements desired by CFHC and/or the fishers, but for which USAID/SLTRP are not planning to implement, will be carried out as and when funds are available, during the next decade

As before, it should be noted that the first assumption listed above is in part dependent on GOSL policy, on the fish stocks available in Sri Lankan waters and hence the 'maximum sustainable yield', and on market forces generally. The number of boats using the harbor during the next decade is therefore not possible to define at this time.

Based on these assumptions, it is recommended that:

#### ***C2a. Major works and improvements:***



SRI LANKA TSUNAMI RECONSTRUCTION PROGRAM

PURANAWELLA FISHERY HARBOUR  
PROPOSED LONGER TERM DEVELOPMENT

Figure 6

1. Future berths for multi-day berths should be provided at the south-eastern side of the harbor at one or more jetties adjacent to the existing gabion wall quay, extending north towards the harbor entrance. The width of the jetties should be sufficient for a truck to pass parked trucks on both sides of the jetty and to turn at the outer end of the jetty. Adequate bollards and cylindrical rubber fenders with stainless steel chains and shackles should be provided to the berthing faces of the jetties.
2. Prior to construction of the jetties, dredging to ensure a depth of 3 meters of water below MSL should be carried out in the operational areas in the vicinity of the jetties.

*C2b. Minor works and improvements:*

3. A boat lift gantry of around 30-ton capacity, capable of lifting out multi-day boats up to 50 feet-long onto cradles on an adjacent flat surface, should be provided.
4. Additional points for refueling and for potable water should be provided at the existing quays initially. When the proposed jetties are built, points for refueling and potable water should be provided along the jetties with fuel tanks and potable water overhead tanks sited near the root of the jetties.
5. A new toilet block with washing facilities should be provided if not already constructed under the reconstruction and initial improvement program.
6. A two-storey building for 24-hour radio surveillance, including a store, should be provided if not already constructed under the reconstruction and initial improvement program.
7. Accommodation for the Harbor Manager and his deputy should be provided within the harbor area.
8. A standby generator should be provided in the harbor area.
9. If future unloading and other operations are centered on the eastern part of the harbor, a new auction hall and a new toilet block should be provided near the proposed jetties.
10. Additional net mending facilities should be provided as the number of boats using the harbor increases.
11. The road access to the harbor from the main Weligama-Matara road, which is in poor condition, should be improved by the relevant Authority.

The recommendations above should be reviewed on an ongoing basis by harbor stakeholders in a participatory manner to allow development plans to evolve as circumstances change.



### III. Operations & Maintenance

Section II of this document provides an assessment and recommendations for CFHC to address O&M issues in collaboration with SLTRP and other stakeholders. A brief description of harbor-specific O&M issues is also provided below to guide the initiation of a harbor-level operational improvement initiative in Mirissa.

#### A. Waste Management & Environmental Considerations

Improvements to sanitary, solid and other wastes disposal, including oil separation and disposal where relevant, including those suggested below, should be carried out by CFHC in conjunction with the local government. The HFC may be a useful mechanism by which the Harbor Manager can fully understand these issues in the harbor, and thus allow for more effective communication with local government.

*Fish Offal and Other Solid Waste.* The Harbor Manager and the HFC need to explore suitable ways of providing collection points and waste disposal from such points at regular intervals. Collection and disposal could be by means of a small tractor and trailer taking the waste to the local municipal waste facility. Fish waste is said to amount to around 200 kilograms per day, and proper facilities for its disposal do not exist.

*Waste Water from Quays, Auction Hall, etc.* Wastewater from washing fish on the quay and from washing the auction hall floor drains directly into the harbor. In the longer term this is not acceptable without screening for solids and grit.

*Harbor Pollution Status.* The water in the harbor is polluted, due largely to diesel spillage during refueling, bilge water leaks, fish waste, and fish wash water. No means of accommodating and separating oil wastes from boats or spillage of diesel fuel on the quay exists.

#### B. Market Performance

Conscious review of market performance factors, and appropriate management response to identified issue, is easily linked to improvements in other related O&M issues; that is, increasing returns to fishermen, boat owners, and other businesspeople in the harbors is a great motivator for proactively addressing additional management issues. Furthermore, increased revenue to harbor users theoretically increases the ability of users to pay registration fees, perhaps even at increased levels, potentially corresponding to improved provision of services, and subsequent increases again to market performance in the harbor.

There are constraints in provision of certain services that affect the production and quality of fish in the market place. For example, the auction hall is located adjacent to the quay and it is currently used for net mending. The fish auctions take place on the open quay itself. The auction hall is under-utilized due to a lack of space and because it is located in one corner of the harbor where fish have to be transported by hand along the quay for a considerable distance. The boat owners complain that there is no difference between selling the fish in the open and selling them in the auction hall since the area is not adequate for movement of fish

and people and is not conducive to the sale of fish inside the auction hall without proper facilities such as tiled floors for display of fish and weighing, as well as with proper drainage facilities. The auction takes place with three fish on display at a time from a single boat, irrespective of the weight. It is therefore very much a matter of the quality of the fish and the experience of the buyer in judging the weight by appearance.

There is heavy congestion along the quay for the berthing of multi-day boats. There is a need for additional quays or jetties for fish landing to ease congestion and to improve fish unloading and services. The boat owners have identified the need for two additional quays or jetties for multi-day boats and one for one-day boats.

There are two refueling stations but these operate with a very low pressure. There are eight potable water supply points for drinking water and for washing the fish holds of boats. The time taken for refueling and for water supply is around five to six hours and since unloading also requires five hours. This is not acceptable to meet the demands. There is a need for high dispensing units of fuel and water supply to enable the boats to reduce turn around time and to maintain the high quality of fish.

There is a great shortage of ice at Mirissa Harbor and this has become a critical factor in turn around delays and in maintaining fish quality. The ice plant that used to be operational has been damaged and is not in use. Sometimes the boats have to wait for weeks in seeking their minimum ice requirement and this has a direct impact in maintaining the high quality of fish that fetches high prices in the market.

The average monthly revenue collected from the harbor services is around Rs. 375,000 against an average monthly expenditure of Rs. 380,000. Thus the situation here is roughly a break even one. However there could be a surplus if proper strategies were adopted for cost reduction in recurrent expenditure on surplus staff and related expenditure, while also addressing the non-settlement of registration fees by legitimate boat owners who use the facility, particularly by owners of the small boat categories. There is also an issue raised by owners in relation to the lack of facilities such as anchorage and kerosene supplies.

### **C. Decision-Making, Consultation, and Conflict Resolution**

The staff strength at the Harbor Manager's Office is 27 and consists of: the Harbor Manager, seven clerks (for accounts, cashier, typist/computer operator, boat registration, fuel/water, administration and stores), two pump operators, three laborers, four marine pollution prevention guards, a maintenance worker, a laborer for water dispensing, an office aid, and seven security officers. In addition, there are four policemen and a sub-inspector of police. The decisions made by the Harbor Manager are implemented by the subordinate staff as per the instructions circulated by the CFHC head office.

Many decisions that are made on functions related to management and service provisions, including fees charged, are not governed by regulations and hence need to be regularized by amending the CFHC Act. The role of the Police Post is not defined, although the police may cater to maintenance of law and order within the harbor premises at the request of the Harbor Manager.

There are eight members in the Harbor Fishery Committee and consist of: the Harbor Manager, representatives of multi-day boats owners, one-day boats and 3 ½ ton vessels, crew members of multi-day boats and one-day boats, and businessmen and buyers representing wholesale and retail trades. They meet once every two months to discuss harbor development issues and proposals for improvement of management efficiency of the harbor. There is an issue at Mirissa regarding the lack of commitment and allocation of resources towards implementation of decisions made by the Committee.

## D. Puranawella Harbor Assessment

### I. Introduction

Puranawella Fishery Harbor is located on the west side of Dondra Head, which forms the southernmost point of Sri Lanka, at the eastern end of Matara Bay. Dondra Head provides some protection from waves from the east and southeast: a main breakwater 413 meters long and a secondary breakwater 280 meters long provide protection from waves from the west and southwest (see Figure 5).

The harbor water area extends to approximately 14.6 hectares, and the existing quay length – located at the southern end of the harbor – is approximately 165 meters long. To the east of the quays, a sandy beach approximately 130 meter long provides an area where boats can be hauled out and repaired. The east side of the harbor is bound by rocky shoreline, which was eroded of its sandy beach prior to the construction of the breakwaters. The harbor generally exceeds two meters in depth below MSL, but is limited to around 1.5 meters below MSL in a few small areas. The harbor entrance is approximately 120 meters wide and faces northwest.

The harbor hosts an auction hall and a net mending area, both of which have roofs but are open-sided. Other noteworthy buildings include the Harbor Manager's office, a canteen, and a toilet block. Access to the harbor from the main Matara-Tangalle road is narrow and in poor condition, with room enough for only two trucks to pass.

The main impact of the tsunami of 26<sup>th</sup> December 2004 was the damage caused to the seaward face of the main breakwater in a number of locations. This damage was mainly due to settlement of the armor rock layer, with consequent loss of armor to the top berm. In addition, the pavement along the top of the breakwater was stripped over a significant length of the breakwater. The tsunami also caused damage to the seaward face of the secondary breakwater in some locations, and damage to the pavement. However, apart from loss of and damage to fishing boats, damage to other facilities appears was relatively limited in Puranawella. The fishers believe that sand is percolating through the core of the main breakwater into the harbor, and that this was particularly the case during the tsunami.

#### A. *Current Usage of the Harbor*

*Number and Size Range of Boats.* Approximately 325 multi-day boats currently use the harbor. Ten of these are 40 feet long (the maximum length of boats using this harbor), 150 are 38 feet long, and the rest are 35 feet long. In addition, 40 boats of 38 feet in length are currently being built. Nine one-day boats also use the harbor .

*Fish Handling and Marketing.* Fish are handled manually from the boat to the quay, where they are weighed and washed. They are then either auctioned at the quay or auction hall, or loaded onto trucks and taken to Colombo for sale.

*Availability of Ice.* A significant shortage of ice exists regularly in the harbor, with no ice production within the harbor premises. Rather, it is brought by truck in 50 kilogram bags; 200

bags (ten tons) are typically required by a multi-day boat before it sails. The ice factories that supply the harbor are said to be able to produce 30 tons per day in block ice, and 30 tons per day in flake, giving a total of 60 tons per day. Ideally a supply of 120 tons/day of ice would be available for use by multi-day boats. Therefore, delays in sailing frequently result while operators wait for ice to arrive, with obvious impacts on efficiency of operations.

*Net Mending Facilities.* The roofed, open-sided building available for net mending is considered to accommodate current usage, although more area will be required in the future. It was noted, however, that driving rain often enters the building during the southwest monsoon.

*Boat Repair and Maintenance.* The harbor has poor facilities for boat repair and maintenance. Boats are hauled up onto the sandy beach by a built-wheeled cradle, which in turn is hauled by a tractor. The use of privately owned cradles is also reported to be costly.

*Diesel Fuel, Potable Water, and Electricity Supplies.* Three one-inch diameter diesel fuel lines from quayside pumps are available for refueling boats, as are four one-inch diameter potable water lines. The potable water tank reservoir is in very poor condition, and urgently needs replacement. Additionally, electricity is subject to power cuts; a standby generator is desirable.

## **B. Navigation and Safety**

There is general concern among the fishers about safety in transiting the entrance, especially in the evenings when there is low visibility. Concern relates primarily to the presence of unmarked rock outcrops. An additional safety concern that has been expressed by the fishers regards the safety of their equipment within the harbor area, because of the lack of continuous fencing or walls around the harbor area, or the presence of a locked building which could store boat outboard motors and other equipment.

## **II. Physical Infrastructure**

Improvements to harbor infrastructure can be approached in collaboration in various ways with supporting partners ranging from the Government of Sri Lanka to donor organizations. The following section describes the improvements to existing infrastructure to be supported by USAID through SLTRP, and recommends further investments to be undertaken in the longer term through other funding sources.

### **A. Proposed Initial Reconstruction and Improvement Works**

The following works have been identified as priority needs, and thus will be carried out under SLTRP.

#### **A1. Breakwaters and Revetments**

Repairs to the main breakwater are required; specifically, armor re-arrangement and filling with two to four ton rock armor is needed on the seaward side. Additionally, armor re-arrangement and filling with four to six ton of rock armor is required over the adjacent 126 meter length, as well as over an 85 meter length where settlement has occurred nearer the head.

Toe repairs on the seaward side are required over most of the breakwater, specifically the outer 363 meters. The final 88 meters, including the head of the breakwater, requires armor re-arrangement and filling with five to eight ton rock armor on the seaward side. It is further proposed to place six to eight ton rock on the crest of the breakwater on the seaward side to reduce wave overtopping over the outer 213 meters of the breakwater. On the harbor side, the armor requires re-arrangement over a length of 150 meters and filling with two to four ton rock armor over the inner half, and four to six ton armor rock over the outer half. The existing asphalt pavement along the top of the main breakwater requires repair over the first 200 meters from the root, and a new concrete pavement is needed over the remaining 213 meters.

Repairs consisting of re-arrangement of armor rock are required by the secondary breakwater over 200 meters of the harbor side slope. At the head of this breakwater a limited amount of six to eight ton armor rock is required. A new rock revetment with a total length of 135 meters is required on the seaward side of the harbor land area at the southern end, backed by suitable fill material.

## **A2. Quays**

Replacement cylindrical rubber fenders with stainless steel chain slings and shackles and replacement bollards are required on the existing quays. A total length of 100 meters of new quay wall is proposed to increase the berthing capacity of the harbor. Two possible locations for this new quay are considered:

- Along the inside face of the main breakwater near the root, making an angle of some 140° with the existing quay, or
- Adjacent to the existing quay, extending the quay roughly north-south. At the north end of this new quay, it is proposed that a concrete slipway should be provided. Boats would be hauled up this slipway for repair and maintenance on cradles.

An advantage of the first location is the more shelter it provides from wave action penetrating the harbor from the entrance. The two main disadvantages of this location are: first, the quay could become subject to wave overtopping under extreme conditions especially during the southwest monsoon (LHI is analyzing the probable extent of this scenario); and second, access quay would be limited due to narrowness of the road leading to the quay, and short length of the existing quay would be lost at its west end. An advantage of the second location is that the back-up area would be significantly wider and would have better road access though the worse wave conditions for boats moored at the quay would be a significant disadvantage for this location. Taking the operational advantages and disadvantages of these two locations into account, the second alternative location is preferred.

### **A3. Dredging**

Although in general the depths of water in the harbor exceed two meters below MSL, there are areas where the depth is only 1.5 meters or less below MSL. It is proposed to provide depths of three meters below MSL over the operational areas of the harbor; this will involve the capital dredging of about 40,000 m<sup>3</sup> of sand and about 50,000 m<sup>3</sup> of hard material. The latter is likely to involve some blasting. It is proposed that the dredged spoil be placed along the eastern edge of the harbor where the shoreline is relatively rocky, to form a reclaimed strip of land with a rock revetment along the harbor side. It is proposed that, after necessary consolidation of the dredged spoil, a new road be located near the harbor side of this reclaimed area.

### **A4. Buildings**

It would be desirable to provide a removable screen to prevent driving rain from entering the harbor buildings during the southwest monsoon. A new toilet block is also required, the location of which will be determined by Harbor Manager and the Harbor Fishery Committee.

## **B. Proposed Longer-term Physical Improvements to the Harbor**

**B1. Breakwaters, Groins and Revetments.** Apart from the repairs to the main and secondary breakwaters, no new lengths of breakwaters or groins are proposed, either at present or within the next ten years.

**B2. Quays and Jetties.** As the number of boats using the harbor increases, pressure on berth availability for unloading the catch and re-provisioning will increase. One or more jetties approximately 100 meters long and extending from the shoreline could provide additional berthing for boats on both sides of the jetty. This additional berthing space would provide space for about eight 40 foot long boats on each side (exclusive of rafting), and with an appropriate width of deck could accommodate trucks serving each side. New jetties are best located at the proposed reclamation on the east side of the harbor, aligned towards the harbor entrance as this would minimize movement of moored boats due to wave action (see Figure 6).

Jetties at this location would be preferable to a quay, as moored boats would be subjected to residual waves. This location is preferable because the entrance would lead to excessive rolling and heaving, and the associated difficulty of unloading fish and the increased risk of boat damage.

**B3. Dredging.** No further capital dredging is envisaged once a depth of three meters below MSL has been provided over the main operational areas of the harbor. However, if the draught of multi-day boats using the harbor at Puranawella is likely to increase and this would require further dredging. Some periodic and limited maintenance dredging of sand brought in by wave action during the Southwest Monsoon is likely to be required.

In Section II, it was noted that MFAR predicts that multi-day boat sizes will increase, with boats up to 24 meters (79 feet) long possibly within the next decade to 2016; these boats would be likely to require a depth of about five meters below MSL. Since these larger multi-day boats will require considerably deeper water than at present provided or planned at Puranawella,

these boats will probably operate from other harbors with deeper water available. If in the unlikely event that it is planned that boats of this size would use Puranawella harbor, capital dredging to deepen the harbor from three to five meters below MSL would be required over the operational areas of the harbor so that these boats could sail, anchor, and berth. In this event, it would be very important that such dredging should not be carried out near existing structures such as breakwaters, groins, revetments, and quays, in order to maintain the stability of these structures.

**B4. Buildings.** As the number of boats using the harbor increases, the net mending facilities will also need to be increased in area. Some means of protection from driving rain during the southwest monsoon should be provided. The existing auction hall should also be improved, and extended some 15 meters in length at the northeast end, to make it more accessible to the roadway. If jetties are built in the location suggested, it is proposed that a second auction hall be built at the landward end of these jetties, and thereby reduce the distance from the unloading point to the auction hall.

In addition, due to the location of the existing toilet block it suffers from low utilization. Two or more toilet blocks are needed, in more appropriate locations and these are to be determined by the Harbor Manager in conjunction with the Harbor Fishery Committee.

It is desirable for the Harbor Manager to have his accommodation and office in the harbor area, since his office hours do not coincide with the main hours of fisher activity, and he is accessible after working hours. A request was also made by the Harbor Manager for a rest house for 'migrant' fishers, i.e. visiting fishers from other Sri Lankan fishery harbors.

**B5. Diesel Fuel, Potable Water, and Electricity Supplies.** Further refueling points, with an adequate rate of flow, will be needed as the fleet increases in size. A new overhead reservoir of 50,000 liters capacity for potable water is also required. The present tank has 20,000 liters capacity and is in poor condition; thus it is deemed insufficient for future usage. In view of the frequent power cuts, the harbor should also be provided with a standby generator.

**B6. Boat Repair and Maintenance.** The present means of boat repair and maintenance, which includes hauling out of the water on a cradle onto the sandy beach (by private contractors), is unsatisfactory and is perceived to be very costly by boat owners. In the long term, a boat lift gantry of approximately 30 tons in capacity, and the capability of lifting multi-day boats up to 50 foot long from cradles on the slipway (a slipway should be constructed in the initial improvement program), to an adjacent flat surface, is proposed.

**B7. Navigation and Safety.** It is probable that for the longer term safety of navigation through the entrance during low visibility, beacons with lights powered by solar panels will be required. The locations of these beacons will be agreed upon with the Harbor Fishery Committee.

Continuing hazards to navigation when approaching the harbor and the entrance are attributed primarily to isolated rocks and boulders. These impediments should be removed by blasting and grab dredging.



Adequate boundary fencing should be provided around the perimeter of the harbor, with secure lock-ups provided for the temporary storage of equipment and engines.

### **C. Summary of Recommendations for Physical Improvements**

#### ***C1. Proposed Initial Reconstruction and Improvement Works***

The proposed initial reconstruction and improvement works which have been agreed between USAID, CH2MHill, and CFHC should be carried out as presented in the PAR, and as summarized below.

##### *Major Rehabilitation/Construction Activities:*

- Repairs to the damaged section of the breakwaters including repairs to pavement and provision of concrete pavement where necessary;
- 100 meter quay wall for berthing of multi-day boats;
- Construction of harbor protection revetments;
- Dredging of approximately 3.5 hectares of harbor area up to three meters depth (measured from MSL);
- Provision of slipway facility for taking boats away for repairs;
- Provision of navigation aids in the form of beacons/lights.

##### *Minor Rehabilitation/Construction Activities:*

- Improvement of drinking water supply system;
- Improvement of sanitation through construction of new toilet facilities;
- Brackish water supply system for cleaning and washing fish;
- Replacement of damaged bollards and fenders.

#### ***C2. Proposed Longer Term Physical Improvements to the Harbor***

As in the cases of Hikkaduwa and Mirissa, the long term physical improvements to the Puranawella harbor during the next decade up to 2016, as proposed in this report, are based on the following assumptions:

- The number of boats registered and used at Puranawella harbor will increase
- It is desirable to provide more berths for boats to reduce congestion, thereby reduce turn-round time, and minimize any damage resulting from rafting
- Works and improvements desired by CFHC and/or the fishers, as expressed through the Harbor Fishery Committee, but for which USAID funds are unavailable, will be carried out when funds become available during the next decade

It must be noted that the first assumption listed above is partly dependent on GOSL policy, the fish stocks available in Sri Lankan waters and hence the 'maximum sustainable yield', and on

relevant market forces. The number of boats using the harbor during the next decade is therefore not possible to define at this time.

Based on the above mentioned assumptions, that the following is recommended:

*Major works and improvements:*

1. Future multi-day berths should be provided at the eastern side of the harbor at one or more jetties adjacent to the existing gabion wall quay, extending roughly towards the West, and aligned towards the harbor entrance. The width of the jetties should be sufficient for a truck to pass parked trucks on both sides of the jetty, and to turn at the outer end of the jetty. Adequate bollards and cylindrical rubber fenders with stainless steel chains and shackles should be provided to the berthing faces of the jetties.
2. Prior to construction of the jetties, dredging to ensure a depth of 3m of water below MSL should be carried out in the operational areas of the jetties.

*Minor works and improvements:*

1. A boat lift gantry of approximately 30 ton capacity, capable of lifting multi-day boats up to 50 foot long from cradles to an adjacent flat surface, should be provided.
2. Additional points for refueling and for potable water should be provided at the existing quays. When the proposed jetties are built, points for refueling and potable water should be provided along the foot of the jetties.
3. The existing auction hall should be improved, and extended approximately 15 meters in length at the northeast end. If jetties are built in the location suggested, a second auction hall should be built at the landward end of these jetties. This would reduce the distance from the unloading point to the auction hall. A toilet block should also be provided in this area.
4. Accommodation for the Harbor Manager and his deputy should be provided within the harbor area.
5. A standby generator should be provided in the harbor area.
6. A rest house for visiting fishers from other Sri Lankan fishery harbors should be provided.
7. Additional net mending facilities should be provided as the number of boats using the harbor increases.
8. The road access to the harbor from the main Matara-Tangalle road, which is in poor condition, should be improved by the relevant Authority.

### III. Operations & Maintenance

This section provides a cursory site assessment and corresponding recommendations for Puranawella. It should be considered in conjunction with Part II of this document, which provides an operations review that addresses the situation in all three harbors – Puranawella, Hikkaduwa and Mirissa – with CFHC as the targeted entry point for initiating appropriate responses to these issues.

#### A. Waste Management & Environmental Considerations

The water in the harbor is fairly polluted due to spillage that may occur during refueling, bilge water leaks, fish waste, fish wash water, etc. With appropriate measures the degree of harbor pollution can be reduced.

*Fish Waste.* The disposal of fish waste is handled by the Harbor Manager using a boat and dumping the waste at sea. However, fishermen continue to dump fish waste within the harbor. It is important to create awareness and encourage better environmental management. The Harbor Manager and the Harbor Fishery Committee need to explore suitable ways of providing collection bins and waste disposal from waste bins at regular intervals. Collection and disposal could be by means of a small tractor and trailer taking the waste to the local municipal waste facility.

*Wastewater.* Currently, waste water from washing fish on the quay and the auction hall floor, etc, drains directly into the harbor. It was noted during the visit that the drainage channels around the auction hall were blocked in several places.

*Oil Waste.* There is no means of accommodating and separating oil wastes from boats, spillage of diesel fuel on the quay.

*Sewage.* Sewage from the toilet block, toilets in offices, and so forth is treated in septic tanks adjacent to the toilets.

As discussed in previous sections, improvements to sanitary, solid and other wastes disposal, including oil separation and disposal where relevant, should be an effort conducted in full partnership between the CFHC, local government, and harbor users. Public awareness activities, including education of benefits to health and incomes that accompany environmental management, should be highlighted.

#### B. Market Performance

Puranawella Fishery Harbor is one of the largest fisheries in terms of boat concentration, and is dominated by multi-day boats. The production and sale of fish per day averages 25 to 30 tons during the fishing season. During lean periods, fish landings reduce to 10-15 tons per day. There are approximately 20 wholesale traders who visit the harbor for transactions. In addition, there are around 50 small-scale traders who depend on vans for transport of fish to different destinations, such as major townships.

Market performance is hindered by the value chain from the time of landing the catch to the catch disposal. Main constraints are due to congestion at the quay due to inadequate space for berthing, and unavoidable waiting time for turn around arising from inadequate service provisions. For example, the auction hall is fully utilized at present and this has created much congestion due to the limited space available for movement of produce. The hall is usually congested with over 500 to 1000 buyers and sellers and their assistants occupying the building during fish sales. The facilities in the auction hall should be refurbished in line with modern standards in order to enhance the quality of sales.

There are restrictions in the availability of ice, both in terms of quantity and quality. Due to the poor quality of ice, the rate of melting has increased. The weight per block has reduced from 50 to 35 kilograms, and prices have increased over the years. The current price stands at Rs.101 per block of 50 kilograms (nominal), of which the actual weight is reduced. The quality of fish is affected due to the poor quality of ice produced at many ice plants using different sources of water.

The deterioration of quality has been largely due to long hours of storage with limited ice. But, many boats have modified their hold storage to consist of wooden racks to avoid the impact on quality of piling layers of fish at the bottom of the hold. Many boats are at sea for over a month and 10% waste is a common phenomenon; these fish fetch 50% of the price of good quality fish, and in most instances they are used for conversion to Maldives fish. However, boat owners expressed willingness to follow modern methods of storage through a demonstration under the pilot project.

There are restrictions resulting in waiting time for maintenance and repair due to lack of workshop facilities within the harbor premises. The charges for hauling out the boats by the privately owned boat cradle and tractor are exorbitant, and the wait time is determined by the highest charges a boat owner is willing to pay.

The Ceylon Fisheries Corporation operates within the premises, but do not provide any assistance with regards to stabilizing the market prices. This is mainly due to the fact that their work hours begin after the auction is over.

### **C. Decision-Making, Consultation, and Conflict Resolution Processes**

The Harbor Fishery Committee has been active, with ten members meeting on a monthly basis. Membership has been offered to representatives of boat owners, wholesale and retail traders, fishing crew members of boats and the Harbor Manager. There are complaints by the President of the Committee that no actions are taken to implement the decisions that are made by the Committee. This lack of action is attributed mainly to the lack of commitment and resource allocations. It is also stated that the Committee is not considered a part of management, but its role is to seek ideas for development of the harbor. The Committee would like to be involved in transparent participatory management where they could play a role towards the improvement of the operational efficiency of the harbor. There are well educated businessmen among the boat owners, who are confident that they could run the harbor on a viable basis. There are also frequent conflicts as a result of competition among the boat owners, including

on issues such as orderly and equitable use of the boat cradle. These points highlight the clear opportunity available for the HFC – or another body, if preferred by stakeholders – to take a stronger role in governing management of the harbor in collaboration with CFHC.

It is suggested that an increase of income from boat registrations needs to be introduced that can raise the incomes by ‘netting’ those defaulters who evade settlement of dues while using the harbor facilities. It is also suggested that an income stream could be generated from the buyers of fish by a quantity-based charge at the gate. The necessary equipment for weighing the trucks, vans, motor cycles and bicycles would need to be installed to realize this objective.

#### **Puranawella Harbor Management Staff**

The total number of staff at the Harbor Manager’s Office is 30 and consists of the Harbor Manager, deputy manager, seven clerks (for accounts, cashier, typist/boat registration, fuel, water, administration and stores), six laborers, seven pollution guards, a circuit bungalow keeper, a care taker for the gymnasium, and six security officers. In addition, there are two policemen serving at the gate, along with the security personnel who have limited powers of intervention. The average monthly revenue is Rs. 400,000, while the monthly expenditure is over Rs. 550,000, mainly due to staff salaries and allowances.