

China: Meizhou Bay Navigation Improvement Project

**ENVIRONMENTAL Management Plan
(EMP)**

**Meizhou Bay Harbor Administration Bureau
Fujian Provincial Environmental Science Institute**

SEPTEMBER 2012

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1. INTRODUCTION

This Environmental Management Plan (EMP) is for Meizhou Bay Channel Improvement Project (Project). The project is undertaken by the Meizhou Bay Harbour Administration Bureau (MBHAB). Before the Project, MBHAB has implemented Phase I and Phase II Meizhou Bay channel improvement project. Therefore the Project is considered Phase III channel improvement.

Project environmental impacts were identified in the Meizhou Bay Improvement Project Environmental Impact Assessment (Project EIA). The EIA report was completed by Fujian Provincial Environmental Science Institute and cooperating organizations Hehai University, and Fujian Marine Research Institute. The EIA includes environmental law, project overview and engineering analysis, regional environment and socio-environment baselines, existing environmental quality, project impacts assessment, cumulative environment assessment, information disclosure and public consultation, risk assessment and emergency response plan, environmental management, and due diligence of relevant development projects within the Meizhou Bay. The EIA drew extensively on the existing Strategic Environmental Assessment (SEA) for Meizhou Bay Area Regional Development Plan and SEA for Meizhou Bay Port Development Master Plan in terms of cumulative impacts. The Project is classified as Category A based on the current EIA laws and regulations in China and World Bank's OP/BP4.01 EA, requiring a full EA study. The EMP references the EIA findings in defining management requirements.

Based on the findings and recommendations of the Project EIA, this EMP provides a comprehensive environmental management plan including key sub-management plans tailored to project implementation. The EMP follows requirements of national laws, regulation and technical guidelines, as well as World Bank safeguards policies, including the World Bank Group Environment, Health and Safety Guidelines (EHS Guidelines). It adopts available and economically sound strategies to achieve project impact mitigation targets. The major construction activities in the context of the EMP include dredging, rock blasting, dredged material ocean disposal, and dredged material disposal at confined facilities.

The EMP is developed to be a stand-alone document to allow readers an understanding of the EMP program rationale with EIA document references included as appropriate.

1.1 Meizhou Bay Project Area

Meizhou Bay, one of the natural deep-water harbors in costal Fujian, is located in the middle of the Fujian Province coastline in Southeast China, as shown in Figure 1.



Figure 1 Meizhou Bay and Surrounding Geographical Location in South China

1.2 Project Description

The World Bank will finance the dredging of the main navigation channel of Meizhou Bay, which is designated as Stage 2 of Phase III Meizhou Bay channel improvement program. The Project owner, Meizhou Bay Harbor Administration Bureau (MBHAB), will carry out dredging of several branch channels and anchorage/crossing zones ahead of the main channel through domestic financing, which is designated as Stage 1 of the Phase III. The

dredged materials from both Stage 1 and 2 will be placed in a permitted ocean dumping site outside the bay; and Xiaocuo and Putou Backfill Area inside the bay where planned port development will reuse the dredged materials for land reclamation. The Project EIA and EMP cover both stages of the Phase III activities.

Table 1 presents engineering details of the Stage 1 and Stage 2 covered by the EIA and EMP. **Error! Reference source not found.** shows the locations of needed dredging/rock learing, the ocean dumping site and the two back fill areas.

Table 1 Meizhou Bay Navigation Channel Improvement Project

Phase III – Stage 2 (Bank financed, domestic EIA reviewed and approved by Fujian Provincial Department of Ocean and Fisheries and Fujian Environmental Protection Department in November 2011)	
Main Channel	- 300, 000 DWT channel (52.1 km long, 350-500m wide upon completion) - Two sections totaling 21.5 km need to be dredged
Dredged Materials Disposal	- Meizhou Bay Marine Waste-Dumping Site - 6.7 million m ³ - Xiaocuo Backfill Area - 4 million m ³ - Putou Backfill Area – 7.2 million m ³
Phase III- Stage-1 , (Domestic financed, domestic EIA reviewed and approved by Fujian Provincial Department of Ocean and Fisheries and Fujian Environmental Protection Department in November 2011)	
Removal of Linchi Rock	Blasting and removal of sea-bed rock at Linchi area
Xiaocuo Channel	A 2.0 km long 150,000 DWT navigation channel which allows unidirectional tide-dependent navigation from F-point of the main channel to Xiaocuo operation zone.
Putou Channel	A 4.9 km long 70,000 DWT navigation channel which allows unidirectional tide-dependent navigation from G-point of the main channel to #4 berth of Putou operation zone.
Branch channel Dongwu Section	A 6.6km long 50,000 DWT branch channel which allows unidirectional tide-dependent navigation from D4-point of the Dongwu channel to the junction of main channel and Fujian Oil Refinery 100,000-DWT channel.
Putou North Channel	A 2.9km long 10,000 DWT branch channel which allows unidirectional tide-dependent navigation from the end of Putou 50,000 DWT channel to #25 berth of Putou operation zone.
Anchorage/crossing zone	Dredging of #4 and #5 anchorage zone and expansion of an existing crossing zone. (Two other proposed anchorage zones do not need dredging)
Dredged Material Disposal	Putou Backfill Area- 25.3 million m ³

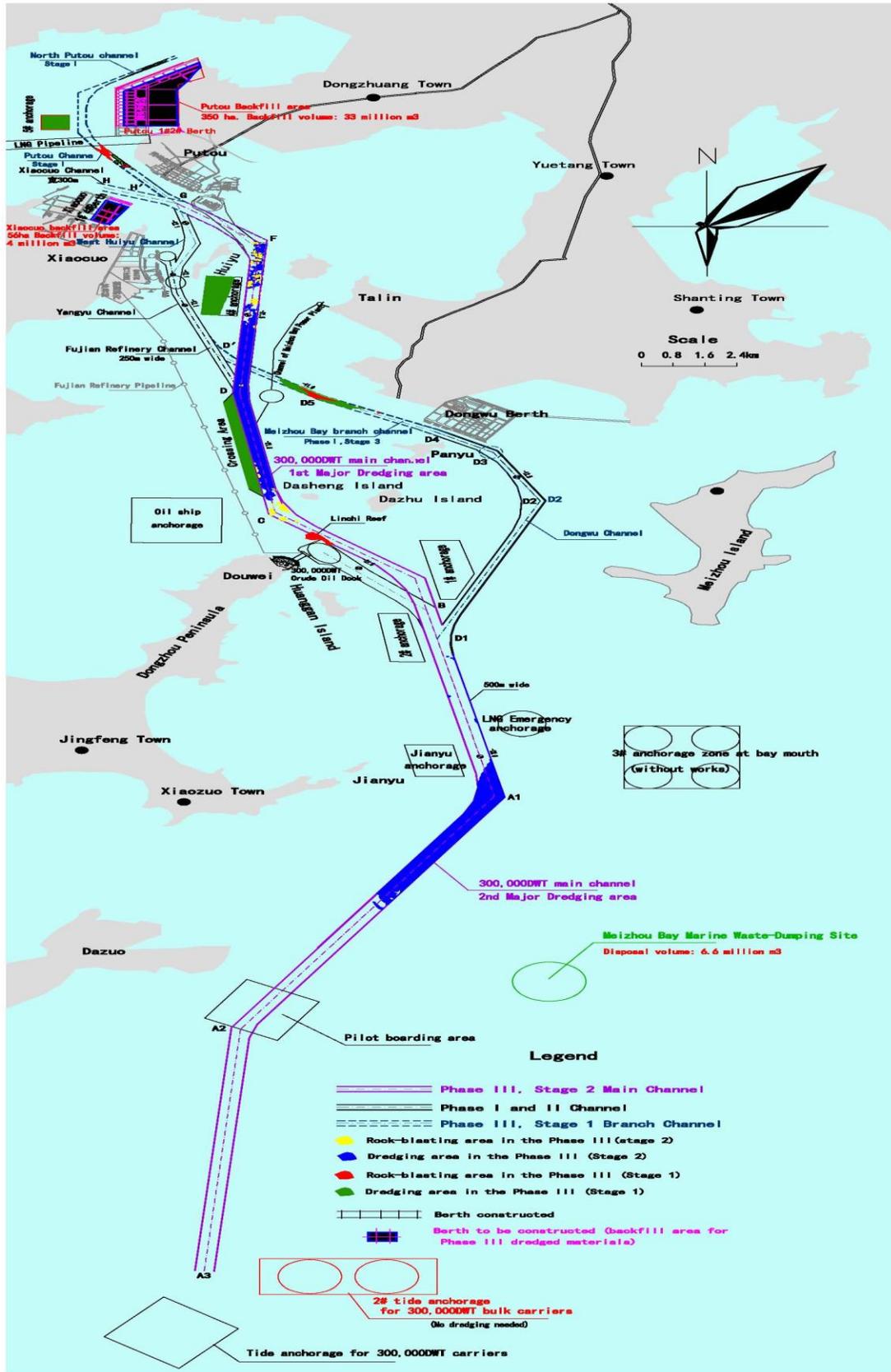


Figure 2 Project Location and Navigation Channels

1.3 EMP Focus

The EMP focuses on executing the mitigation measures for the identified environmental impacts and monitoring the effectiveness of the measures over the life cycle of the Project. Based on the EIA and SEA, the EMP is developed in accordance with Chinese environmental laws and guidelines, World Bank's safeguard policies, and best practices from similar projects. The EMP objective is to ensure consistency between EIA and EMP to achieve appropriate standard of environmental protection. The EMP effectively manages the regulatory requirements and directs the project owner in the management contractors and sub-contractors.

1.4 The EMP Structure and Objectives

The key components of the EMP include procedures for overall environmental management during Project construction and operation. EMP covers the following elements

- Environmental management roles and responsibilities
- Mitigation measures
- Supervision and Monitoring Plan
- Contractor Environmental Specifications
- Dredged Material Management Plan
- Emergency Response Plan
- Marine Ecology and Habitat Offset Plan
- Communication and Stakeholder Engagement Plan
- Environmental Training Plan, and
- EMP Budget

EMP provides sufficient information for the project proponent, contractors, sub-contractors to implement the EMP and set priorities to:

- Meet the environmental requirements set by the P. R. China, Fujian province and World Bank;
- Fulfill all environmental and socio-economic conditions associated with project approvals, permits and policies set out by the state, provincial and municipal levels;
- Develop, promote and foster a shared sense of responsibility for environmental and social performance during the implementation of the project;
- Promote environmental awareness and understanding among regulatory bodies and MBHAB including its retained contractors through training and identification of roles and responsibilities towards environmental and social management;
- Monitor environmental and social performance throughout the project and implement an adaptive management approach to continuous improvement and minimum cumulative impact in Meizhou Bay harbor zone;
- Work with local communities and project affected stakeholders to ensure that they benefit as a result of project development;
- Ensure the fisheries management and compensation program is implemented and compensatory mangrove habitat is established; and
- Maintain an ongoing commitment to informing, engaging and involving local stakeholders throughout all phases of the project through monitoring processes.

1.5 Environmental Laws, Polices and Regulations

Rules and legislative requirements as enacted by various levels of government in China and the World Bank are summarized below. Chapter 1, General Introduction, of the EIA provides complete relevant legislation, regulations and technical guidelines and standards and plans. The EMP adheres to these legislative objectives and enforcement policies and procedures.

Compliance with key Chinese national laws and regulations are summarized in Table 2.

Table 2 Compliance with China Domestic Laws and Regulations

China Laws and Regulations	Project Compliance
<i>Environmental Impact Assessment Law</i>	<ul style="list-style-type: none"> • Full EA prepared by the certified EIA consultant and Project proponent, reviewed and approved by Fujian Provincial Department of Ocean and Fisheries and Fujian Provincial Environmental Protection Department. • Two rounds of public participation conducted.
<i>Marine Environmental Protection Law</i>	<ul style="list-style-type: none"> • EA covers dredging, blasting, disposal of dredging materials (both ocean disposal and CDFs), land reclamation, waste management, oil spill risks, ecological protection and compensation, etc. • Ocean disposal site (Meizhou Bay Marine Waste-Dumping Site) designated by State Ocean Administration • Oil spill risk emergency response plan prepared • Ecological compensation plan prepared
<i>Notice on Strengthening EIA Management for Construction Projects Funded by Loans from International Financial Institutions</i>	<ul style="list-style-type: none"> • EIA and EMP are prepared in compliance with World Bank safeguards policies.
<i>Fishery Law</i>	<ul style="list-style-type: none"> • EMP incorporates measures to minimize impacts on fishery resources resulted from underwater blasting and construction. Affected aquaculture will be relocated before construction
<i>Harbor Law</i>	<ul style="list-style-type: none"> • Port development comply with relevant plans • EA covers the disposal of dredged materials for land reclamation
<i>Marine Traffic Safety Law</i>	<ul style="list-style-type: none"> • EA considers safety operation zone for construction activities.
<i>Marine Territory Utilization Administrative Method</i>	<ul style="list-style-type: none"> • EA covers land reclamation using dredged materials • Occupying sea areas have and will be approved by marine authorities.
<i>Administrative Regulations for Marine Pollution Prevention from Marine Engineering</i>	<ul style="list-style-type: none"> • Land reclamation using dredged materials covered by the EA. No natural spawning ground, breeding ground and feeding ground will be occupied. • Quality of the dredged/filling material complies with environmental criteria • EMP incorporates mitigation measures for blasting
<i>Administrative Regulations for Marine Pollution Prevention from Ship Wastes</i>	<ul style="list-style-type: none"> • Ship wastewater and solid wastes must be received and treated by port facilities.
<i>Administrative Regulations for Marine Waste Disposal and Interim Regulations for Dumping Site</i>	<ul style="list-style-type: none"> • Ocean disposal site (Meizhou Bay Marine Waste-Dumping Site) has been assigned by State Ocean Administration • Dredged Material Disposal Plan prepared • Before disposal, approval shall be obtained from marine authorities
<i>Navigation Safety Regulations for Above- and Under Water Activities</i>	<ul style="list-style-type: none"> • Construction shall start after approved by relevant authorities.
<i>Technical Regulations for Impact</i>	<ul style="list-style-type: none"> • EA assessed impacts on marine living resources resulted in

China Laws and Regulations	Project Compliance
<i>Assessment of Construction Projects on Marine Living Resources</i>	dredging, blasting and disposal of dredged materials <ul style="list-style-type: none"> EA evaluated the economics value of potential losses affected by the project. An ecological compensation plan covering fish reproduction and release and habitats protection prepared.

Of the ten World Bank safeguards policies, OP/BP4.01 Environmental Assessment, OP/BP4.04 Natural Habitats, and OP/BP 4.12 Involuntary Resettlement are triggered for the project.. The policy compliance is described in EIA Chapter 1 and summarized in Table 3.

Table 3 Compliance with the World Bank Safeguard Policies

No.	Safeguard Policies	Compliance
1	OP/BP4.01 Environmental Assessment	<ul style="list-style-type: none"> - Category A project. - Full EIA and EMP have been prepared. - Consultation conducted as part of EIA process
2	OP/BP4.04 Natural Habitats	<ul style="list-style-type: none"> - Ecological survey conducted as part of EIA - Mitigation measures developed to mitigate impacts - Ecological compensation and habitat offset program developed in EMP
3	OP/BP4.36 Forest	This policy is not triggered. The project will not finance activities that would involve significant conversion or degradation of critical forest areas or related critical natural habitats as defined under the policy.
4	OP/BP4.09 Pest Management	This policy is not triggered. The project will not procure any pesticides nor will an increased use of pesticides result from the project. No action is required under the policy.
5	OP/BP4.11 Physical Cultural Resources	This policy is not triggered. No cultural relics or other physical cultural resources are found. Chance-find procedure will be strictly followed.
6	OP/BP4.37 Dam Safety	This policy is not triggered. The project area does not include any dams.
7	OP/BP4.10 Indigenous Peoples	This policy is not triggered. There are no indigenous peoples live in project-located area, no impact on the indigenous peoples.
8	OP/BP4.12 Involuntary Resettlement	This policy is triggered. Resettlement is applicable and a Resettlement Action Plan has been prepared.
9	OP/BP7.50 Projects on International Waterways	This policy is not triggered. The project doesn't include any international waterways.
10	OP/BP7.60 Projects in Disputed Areas	This policy is not triggered. The project area does not include any disputed areas.

The World Bank Group Environmental, Health and Safety Guidelines (WBG EHS Guidelines) also apply to the Project. The project Environmental Management Plan includes the mitigation measures that are fully in compliance with the EHS General Guidelines (especially related to Construction management), as these general requirement in the Guidelines is equally required in Chinese laws, regulations, guidelines and construction management norms. As required by the World Bank, the EMP measures are also fully consistent with the dredged material management practice specified in the EHS Guidelines for Ports, Harbor and Terminals, which is illustrated in Table 4.

Table 4 Compliance with WBG EHS Guidelines for Ports, Harbor and Terminals

World Bank Group EHS Guidelines	EIA /EMP Compliance
Dredging should only be conducted if necessary, and based on an assessment of the need for new infrastructure.....	Dredging is needed for the improvement of main channel which is justified. During operation stage, no dredging is envisaged due to advantages of hydrodynamics in Meizhou Bay.
Prior to initiation of dredging activities, materials should be evaluated for their physical, chemical, biological, and engineering properties to inform the evaluation of dredge materials reuse or disposal options. Dredged material should be analyzed in order to select appropriate disposal options (e.g. land reclamation, open water discharge, or contained disposal).	Sediments were monitored and confirmed to be in conformity with national standards of ocean sediments standards (GB18668-2002). Non hazard is conformed.
Excavation and dredging methods should be selected to minimize suspension of sediments, minimize destruction of benthic habitat, increase the accuracy of the operation,.....	Alternative dredging methods were compared based on these considerations, and final selected equipment is the one that meet these requirements.
Areas sensitive for marine life such as feeding, breeding, calving, and spawning areas should be identified.	Ecological baseline survey were conducted which confirmed that there are no such sensitive sites within the dredging impact scope.
Dredging and blasting should be conducted in a manner so as to avoid fish migration or spawning seasons, routes, and grounds	Dredging and blasting is arranged to avoid fish spawning season.
Inspection and monitoring of dredging activities should be conducted to evaluate the effectiveness of impact prevention strategies, and re-adjusted where necessary.	On-site supervision staff will be arranged to monitor the dredging and blasting impact.
Use of lateral containment in open water disposal should be considered. Use of borrow pits or dikes reduces the spread of sediments and effects on benthic organisms. Use of cap containment sediments with clean materials should be considered Confined disposal facilities should be used.	Dredged material is reused as backfilling material for land reclamation for berth construction. Enclosure dike is to be built to contain the material, and sedimentation and filtration will be deployed to confine the impact on water and benthic organisms. Concrete capping will eventually be applied as part of dock construction.
Port operators should prepare a spill prevention, control, and countermeasure plan	Risk analysis is an integral part of EIA, which comprehensively analyzed the potential risk of spill and conducted scenario simulations, identified impact scope and sensitive areas to be affected. EIA also described the emergence response measures which include management structure, equipment and response team capacity.

2. MEIZHOU BAY REGIONAL ENVIRONMENTAL BASELINES

2.1 Planned Coastal Features

The SEA completed for Meizhou Bay Port Development Master Plan includes the coastal area immediately north (Xinghua Bay) and south (Quanzhou Bay) of Meizhou Bay as an integrated coastal functional zone (see Figure 3). This approach was similar to the approach taken for the Xiamen area further south along the coastline, where integrated coastal management (ICM) was successfully applied to help resolve conflicts between transportation and aquaculture, coastal engineering and conservation, waste disposal and tourism, fisheries.



Figure 3 Meizhou Bay Regional Coastline

The planned Putian and Quanzhou coastal line were as follows.

- Meizhou Bay apparently enjoys exceptional physical conditions in terms of deep water, spacious waters, long coastal line, strong tidal conditions and limited sediments inputs from land;
- port coastline is widely distributed, of which the proportion of newly developed port coastline is large;
- port scale and required infrastructure has expanded rapidly and will increase quickly; and
- regional port development will primarily be within the Meizhou Bay.

2.2 Resource and Environmental Constraints

The following resource and environmental constraints for the Putian and Quanzhou coastal area were identified.

- Land resources available for development in Putian City and Quanzhou are limited. Port construction is best land use due to land capability and freshwater resource constraints.
- There are environmentally and ecologically sensitive areas in the region. Notably, the Quanzhou Bay estuary wetland nature reserve, the Meizhou Island as an ecological reserve and important tourism attraction, and the Xinghua Bay as important fishery waters.
- Port facilities should incrementally improve environmental protection measures as harbor traffic increases and port development proceeds.

2.3 Regional Marine Functional Zoning

Various planning processes have been initiated regionally for effective integrated management of the coastal areas of Fujian Province. Fujian Marine Functional Zoning stipulates that the sea area in Meizhou Bay includes Channel Zone, Port Zone, Mudflat Aquaculture Zone, Shallow Sea Aquaculture Zone, Tourism Zone, and Marine Bed Pipeline Zone. The sea area around Meizhou Island (which is located near the bay mouth) is designated Marine Ecological Special Protection Zone, as is shown in Figure 4.

The Fujian Provincial Marine Environmental Protection Plan (2011-2020) classifies the province's marine waters into three general levels based on an assessment of marine ecological sensitivity and significance of marine ecological services (see Figure 5). The first level includes legally designated protected areas and "important biotope and ecological service area". The second level refers to marine areas that are under "controlled protection and utilization". This level requires reasonable development and utilization on a principle that the main ecological services function will not be harmed. The third level "development supervision area" includes those marine areas that can be used for urban, industrial and port development, and ocean disposal. According to the Plan, waters within Meizhou Bay have been designated as either level 3 for development (mostly coastal area) and level 2 for controlled protection and utilization (specifically, for navigation and water exchange between inside- and outside- bay). The northern Xinghua Bay is designated as fishery waters. The southern Quanzhou Bay has an important estuary wetland reserve for protection. The Fujian Provincial Ecological Zoning also indicates that the "important marine biotope" in Meizhou Bay is "insensitive".

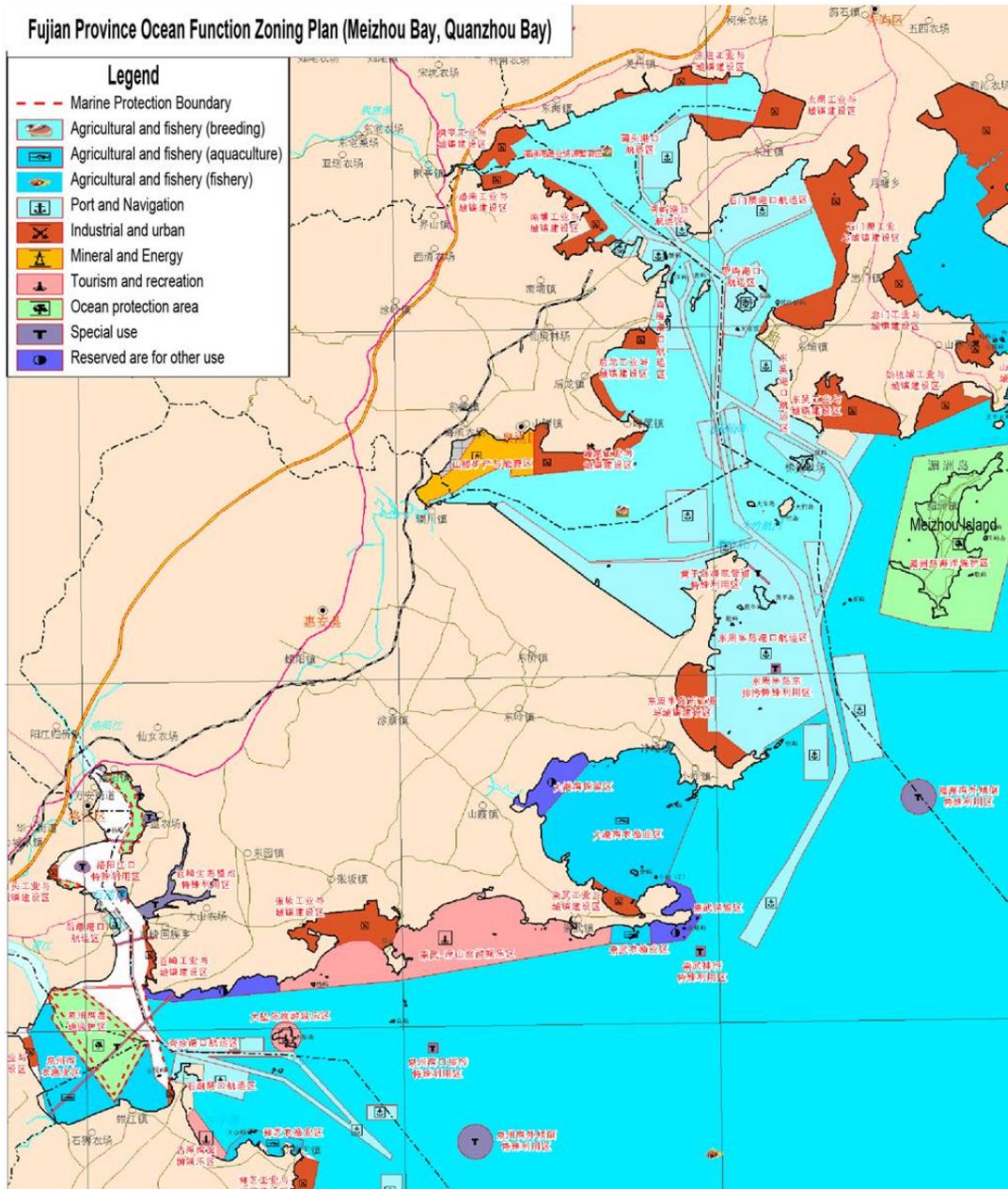


Figure 4 Marine Functional Zoning in Meizhou Bay and Quanzhou Bay

In terms of nature reserves, the nearest one to the Project is Meizhou Island Ecological Nature Reserve, which is located to the northeast of the bay mouth and is about 7 km away from the Project construction site. The area of the nature reserve is 9,990ha, including the island and adjacent sea area. The Meizhou Island features coastal sand beach and rocky landscape. A small piece of mangroves (about 20 ha) were found in the west of the island. The mangroves’ development has been subject to limited freshwater feeding. The island holds many fish boats

for offshore fishing, while inside the Meizhou Bay fishing is not economic. The Meizhou Island is a major tourist attraction because it is the home to Mazu (Matsu). Annually some 100,000 pilgrims, mostly from Taiwan, come to the island to visit Heavenly Empress Place – Meizhou Ancestral Temple which commemorates Mazu.

A nature reserve that resides outside of the Project development area, but in relatively close proximity south of the project is the Quanzhou Bay Estuary Wetland Reserve. This reserve features coastal wetland, mangroves, rare and endangered birds, fishes, marine mammals. Meizhou Island is actually less significant component in the integrated coastal context. By contrast, Quanzhou Bay has many species listed or acknowledged in IUCN, Red List and by other international organizations. It is classified as Important Bird Areas (IBA) in China, by Bird Life International, a Non-Governmental Organization (NGO). Quanzhou Bay represents a higher value area for natural habitat compensation program related to the Project. Restitution of mangrove forests will occur in Quanzhou Bay as the key feature of ecological compensation for Project impacts on natural habitats. This program is discussed in the EIA and the action plan included in the EMP.



Figure 5 Fujian Marine Environmental Protection Plan (2010-2020) for Meizhou Bay and Quanzhou Bay

2.4 Environmental Quality

During EA preparation, sampling and tests of water, sediments and biological quality in Meizhou were conducted to characterize the physical, chemical and biological conditions of the project area. Results show the water and sediments are clean uncontaminated and meet the relevant Chinese quality standards. These results are consistent with other environmental quality monitoring previously conducted. Biological quality generally met quality objectives, and air and noise levels are suggestive that the area has an increased industrial base.

2.5 Main Environment-sensitive Receptors

The list of environmental and social sensitive receptors that are potentially impacted by the project is listed in Table 5

Table 5 Environmental and social sensitive receptors

No.	Sea Environment-sensitive Area	Status and Planning Function	Position Relation to Project Construction Region(km)	
			Distance to Dredging Area	Distance to Rock-blasting Area
1	Putou Sea Cultivation Area	Mainly cultivate laver presently, planning port area	1.1km to Dredging Area of Putou Channel	0.85km to Rock-blasting area of Putou
2	Sea Cultivation Area Surrounding Luoyu	Mainly Cultivate abalones in cages, kelp and laver presently, planning port area	0.78km to 4# dredging area of anchorage zone	0.04km to Rock-blasting area of main channel
3	Dongwu Sea Cultivation Area	Mainly Cultivate abalones in cages and alga presently, planning port area	0.41km to dredging area of branch channel	0.4km to Rock-blasting area of Dongwu Channel
4	Submarine oil pipeline of Fujian Oil Refinery	Submarine oil pipeline area of Fujian Oil Refinery	0.26km to dredging area of meeting area	0.7km to Rock-blasting area of Linchi Rock
5	Meizhou Bay LNG Submarine Pipeline	LNG Submarine Pipeline Area	0.13km to Dredging area of Putou Channel	0.122km to rock-blasting area of Putou Channel
6	Water Intake of Meizhou Bay Thermal Power Plant	Completed	2.6km to 4# anchorage zone and not in the tidal direction	The shortest Distance to Luoyuxi Rock-blasting area is around 1.8km
7	Water Intake of Nanpu Power Plant	Completed	1.6km to Putou Dredging Area	The shortest Distance to Putou Rock-blasting area is around 1.6km
8	Water Intake of LNG Power Plant	Under construction	1.2km to West Huiyu Dredging Area	The shortest Distance to West Huiyu Rock-blasting area is around 1.5km

3. ENVIRONMENTAL MANAGEMENT ROLES AND RESPONSIBILITIES

3.1 Agencies and Institutions Involved in the Environmental Management

The implementation of this EMP requires the involvement of several agencies and institutions, each fulfilling a different but vital role to ensure effective environmental management for the Project.

Essentially there are two groups of institutions involved in the process of environmental management: those responsible for organizing or implementing the EMP, and those that enforce the standards, laws and regulations relevant to the project, supervise the EMP and the overall environmental performance during the construction and operation of the Project. The EMP institutional structure for Project construction is shown in Figure 6.

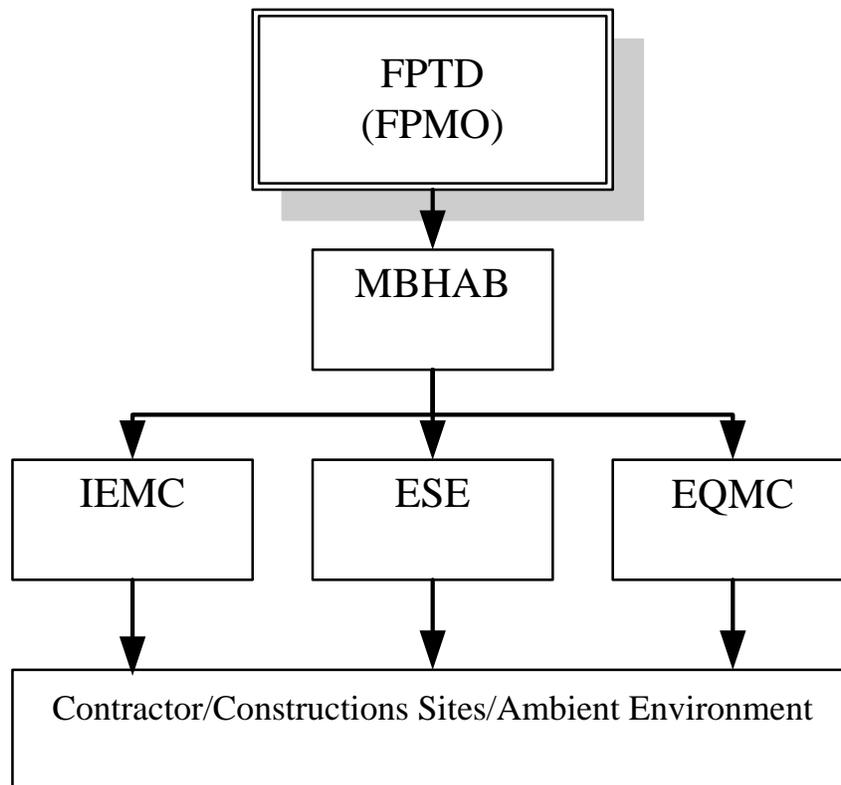


Figure 6 Management Structure During Construction

The main environmental responsibilities of the respective institutions are summarized in Table 6.

Table 6 Summary of Environmental Management Responsibilities

No	Agency/Unit	Responsibilities
1	Fujian Provincial Transport Department (FPTD)	The FPTD will take the overall responsibility for the management and coordination of project implementation. Its readily-established Project Management Office (FPMO) handles the day-to-day management and coordination of project implementation. It will oversee the implementation of the Project and fulfill the requirements of World Bank.
2	Fujian Provincial Environmental Protection Department (FPEPD)	The FPEPD reviewed and approved the Project EA. It will be responsible for the enforcement of the laws, regulations, technical guidelines, and environmental quality standards for the Project construction and operation.
3	Fujian Provincial and local Ocean and Fisheries Department (FOFD)	The FOFD is in charge of marine and fishery development and conservation in Fujian Province. Its responsibilities includes: (i) in collaboration with other agencies to develop and supervise the implementation of marine functional zoning plans, marine development and utilization plans and marine and fishery mater plans. Coordinating other agencies' marine utilization and development activities. (ii) undertake the ecological conservation for marine environmental and fishery water bodies. In collaboration with other agencies, organizing and develop marine environmental conservation plan, proposing and implementing pollutants discharge and total amount control institutions. Managing the environmental protection against marine engineering and marine waste dumping. Supervising land source pollution discharge into ocean, biodiversity and marine ecological conservation; and (iii) organizing key fishery related EIA and ecological compensation activities.
4	Project Owner – Meizhou Bay Harbor Administration Bureau (MBHAB)	The MBHAB, a subsidiary agency of FPTD, will implement the main channel improvement works, including the procurement, construction management, safeguards implementation and compliance, as well as the monitoring, reporting tasks under the Project.
5	Environmental Supervision Engineers(ESE)	The ESE are responsible for inspecting, supervising, and auditing all construction works and other activities undertaken by the Contractor(s), and for ensuring compliance with the environmental protection requirements and contractual requirements.
6	Contractor(s)	Contractor(s) is hired by the Project Owner to undertake the detailed design and the construction activities for the Project.
7	Independent Environmental Management Consultant (IEMC)	The IEMC is hired by the Project Owner and is independent of the ESE and Contractor. The objectives of the IEC assignment is to assess the implementation and performance of the Project EMP during construction, provide management recommendation to the Project owner, and eventually ensure Project compliance with the EMP.
8	Environmental Quality Monitoring Consultant (EQMC)	The EQMS refers to specialized monitoring institutes who will conduct environmental quality monitoring according to the environmental monitoring plan included in the EIA reports. The Project Owner will contract EMS to implement the monitoring plan.

3.2 Environmental Management Responsibilities During Construction

● *Meizhou Bay Harbor Administration Bureau (MBHAB)*

The MBHAB will be the project owner and implementation agency for the Project. It is responsible for FPTD and World Bank for overseeing the Project implementation. Therefore it is responsible to ensure that the project environmental management complies with EMP and relevant legislations.

MBHAB's environmental management responsibilities include, but not limited to, the following aspects.

- 1) Ultimately supervise the implementation of mitigation measures and other environmental protection measures during project construction, including incorporation of the measures into bidding documents and contracts, organizing training for the contractors, enforce other environmental management programs and conduct periodically inspection of the construction sites.
- 2) Engage and supervise environmental monitoring consultant (for example, IEMC and EQMC) to carry out environmental monitoring in accordance with the project environmental monitoring plan.
- 3) Engage and supervise the IEMC to provide technical support including management advice, training, periodical field inspection, and preparation of reports.

MBHAB will appoint 1-2 dedicated environmental staff who will be responsible for overall coordination of the EMP implementation. The dedicated environmental staff must have adequate knowledge on environmental management as well as environmental legislation to understand and implement the EMP. Their duties include the following:

- 1) Ensure the project environmental management is in compliance with EMP and relevant legislation. Take appropriate actions if non-compliance is identified.
- 2) Maintain open and smooth communication between MBHAB, supervision engineers and contractors with regard to environmental issues.
- 3) Review and approve site-specific Environmental Protection Implementation Plan for key project activities with potential environmental signification impacts that are prepared by Contractors.
- 4) Organize regular site inspections of all construction areas with compliance with the EMP.
- 5) Review and filing reports from Contractors and Environmental Supervision Engineers with regard to environmental management.
- 6) Monthly reporting to MBHAB on environmental issues at construction sites.

● *Contractors*

The Contractor and its employees shall firstly at all times try to avoid the negative impacts that may result from the project construction activities and secondly adhere to mitigation measures

specified in the EMP and contracts to minimize harm and nuisances on the environment and local communities.

Remedial actions which cannot be effectively carried out during construction stage should be carried out on completion of the works and before issuance of the acceptance of completion of works.

The Contractor shall establish a robust environmental management system that addresses institutional, site-specific measures, monitoring, training and reporting requirements.

Detailed Environmental Specifications for Contractors are included in [Chapter 6](#).

● ***Environmental Supervision Engineer (ESE)***

ESE is an integral part of Supervision Engineer's function. Each Supervision Engineer company will assign at least one ESE to each contract/working group. The responsibilities of the ESE include:

- 1) Review and ensure the Contractor's construction organization plan in compliance with the EMP and project engineering with regard to environmental protection and impact mitigation;
- 2) Review Contractor's site-specific Environmental Protection Implementation Plan and Environmental Protection Construction Organization Plan for key project activities with potential environmental significance impacts (if any), prior to the project owner's final review and approval.
- 3) Carry out day-to-day site inspection and ensure the Contractor's activities in compliance with EMP and other relevant regulations. Instruct the Contractor to take corrective actions within the ESE determined timeframe in case non-compliance or discrepancies identified.
- 4) Provide assistance to the MBHAB, as necessary, in the implementation of the environmental monitoring and supervision program. .
- 5) Regularly monitor the performance of the Contractor's environmental management system, including environmental staff, procedure and reporting. Verify and confirm environmental supervision procedures, parameters, monitoring locations, equipment and results. In case any discrepancies identified, the ESE will instruct the Contractor to take corrective actions, including capacity building for or replacement of the Contractor's environmental staff.
- 6) Regularly prepare environmental supervision reports and submit to the MBHAB for review and filing.
- 7) As integral part of Supervision Engineer, approve invoices or payments with consideration of EMP performance.

● ***Independent Environmental Management Consultant (IEMC)***

MBHAB will engage an IEMC to provide technical support for environmental protection during the construction period. The IEMC is independent of the ESE and Contractors, and will directly report to MBHAB. The IEC shall be led by a person who can independently and professionally examine records, procedures and processes. He/she may require a small team to assist he/she

with checking the site (i.e. the IEMC team). The IEMC shall have extensive knowledge and experience in environmental monitoring and auditing to provide independent, objective and professional advice on the environmental performance of the project (at least 5 years experience is required). The IEC shall familiarize himself with the project works through review of the reports, including the project EMP. In particular, the IES is expected to perform the following duties:

- 1) Review and audit in an independent, objective and professional manner in all aspects of the EMP;
- 2) Validate and confirm the accuracy of monitoring results, monitoring equipment, monitoring locations, monitoring procedures and locations of sensitive receivers;
- 3) Carry out random sample check and audit on monitoring data and sampling procedures, etc;
- 4) Conduct random site inspection;
- 5) Audit the EIA recommendations and requirement against the status of implementation of environmental protection measures;
- 6) Review the effectiveness of environmental mitigation measures and project environmental performance;
- 7) On a need basis, verify and certify the environmental acceptability of the construction methodology, relevant design plans and submissions. Where necessary, the IEC shall seek the least impact alternative in consultation with the designer, the Contractor(s), and MBHAB;
- 8) Verify the investigation results of any non-compliance of the environmental
- 9) Quality performance and the effectiveness of corrective measures;
- 10) Feedback audit results to MBHAB and ESE team according to EMP procedures of non-compliance in the EMP, and provide Supervision Engineer (ESE) suggestions on actions of penalty, suspension or other punishment;
- 11) Provide environmental training to the Contractors, Environmental Supervision Engineers (ESE) and the MBHAB staff prior to and during construction;
- 12) Help prepare semi-annual environmental monitoring report to the MBHAB, FPTD and the World Bank.

Box 1 Terms of Reference for IEMC**Terms of Reference
for
the Independent Environmental Monitoring Consultant**

The tasks outlined below are indented to assess the implementation and performance of the project EMP during construction, provide management recommendation to the project owner and ensure project compliance with the EMP.

Task 1 – Review Project Documents

The IEMC is expected to review the project EIA, EMP, RAP and relevant regulations. A work plan shall be prepared based on the review and submitted to the project owner for approval.

Task 2 – Provide EMP Training

Prior to the commencement of construction, the IEMC will prepare training materials based on the EMP and provide training to the Project owner, contractor and supervision engineer. During the Project implementation, the IEMC will based on actual needs to carry out such EMP training at least one time a year.

Task 3 – Field Visit and Supervision

- 1) Prior to the commencement of construction, the IEMC will assist the Project owner in checking the contractor's construction plan's environmental protection measures and providing comments as appropriate.
- 2) During construction, carry out regular field visit to the project site. During the field visit, the IEMC will check the environmental management related documents such as construction environmental protection plan, environmental monthly report; check institution and staffing arrangement, and implementation of mitigation measures. Provide corrective recommendations to the non-compliance practices and promote good practices.
- 3) Visit and interview affected people and provide management recommendations to the Project owner. And
- 4) Identify environmental issues that may not be identified during the Project preparation stage, and provide recommendations on alternatives and/or mitigation measures to the Project owner;

Task 4 – Environmental Monitoring

The project owner will contract an environmental quality monitoring consultant to carry out monitoring during construction. The IEMC is expected to prepare the terms of reference for the monitoring based on EMP requirements, assist in the implementation of monitoring , review the monitoring results and report to the project owner.

Task 5 –Implementation of Ecological Compensation Program

The project will support the implementation of ecological compensation program consisting of two components: fish breeding and release and habitats rehabilitation. The IEMC is expected to assist the project in working with design institute and local marine authorities to implement the ecological compensation program and carry out monitoring and supervision.

Task 6 – Reporting

During the Project implementation, assist in the Project owner to prepare semiannual environmental monitoring and supervision report and submit to the MBHAB, FPTD and the World Bank.

● Environmental Quality Monitoring Consultant (EQMC)

In order to closely monitor the environmental quality in the project area and minimize environmental impacts during construction and operational stage, the MBHAB will engage specialized environmental monitoring consultants to implement the environmental monitoring plan developed during EA stage. The responsibilities of the EQMC include:

- 1) Familiar with the project works and the EMP, particularly the environmental monitoring plan.
- 2) Carry out the environmental monitoring in a timely and professional manner in accordance with the environmental monitoring plan.
- 3) Validate and confirm the accuracy of monitoring results, monitoring equipment, monitoring locations, monitoring procedures and locations of sensitive receptors.
- 4) Submit monitoring results and recommendations to MBHAB in a timely manner.

3.3 Management of Contractors

Contractors working on the project will be a key component in environmental management, pollution control and impact mitigation during construction. During the construction period, the contractor, who shall always station in the construction site, shall be mainly responsible for effective controlling and reducing the impact on the environmental. Most of the environmental protection measures shall be implemented by the contractor. In order to ensure the environmental protection measures and Environmental Management Plan to become the duty of the contractor, the following measures shall be taken:

- 1) During pre-qualification, the environmental management shall be included in the authentication clause when the contractor's qualification is reviewed. Under the same condition, priority shall be given to the bidders who have passed the ISO9000 and ISO14000 authentication;
- 2) In preparation the bidding document, the project owner shall ensure mitigation measures

included in the EMP are fully incorporated, and require the potential bidders to prepare the bids that fully cover the budgetary estimates for EMP implementation. Therefore, the implementation of the environmental protection measures will become the obligation and responsibility of the successful bidder;

- 3) Every Contractor will be required to provide at least one dedicated full time environmental staff on each section of the Project. In order to be qualified for the job, the environmental staff will receive an environmental training program first;
- 4) Prior to construction, the Contractor are required to submit site-specific Environmental Protection Implementation Plan and Environmental Protection Construction Organization Plan for key project activities with potential impacts (if any). The Plans shall be demonstrate compliance with domestic environmental regulations, the mitigation measures specified in the EMP. The plans shall provide details such as commitment to environmental protection by the Contractor's project management team; methodology of implementing the project EMP; detailed designs and installation of pollution control facilities (e.g. drainage channel, settling tank, temporary noise barrier, etc); environmental control mechanism; detailed earthworks management plans and site operation plans outlining the measures that are proposed to minimize, mitigate and manage the effects, for the duration of the construction works; and environmental monitoring program during different stages of construction period.
- 5) Prior to the commencement of construction, the Contractor shall receive adequate training on EMP and relevant regulations. Each section/sub-contractor and a Contractor shall send at least one Project Manager and one environmental engineer to join the training. In addition, the ESE shall also join the training.

4. ENVIRONMENTAL IMPACT AND MITIGATION MEASURES

Based on the key findings of EIA, the highlighted environmental impacts and mitigation measures are summarized in the following sections. Table 7, Table 8, and Table 9 list the major activities and stages of the projects, identified potential environmental impacts and typical mitigation measures, as well as implementation and monitoring responsibilities. Table 10 shows site-specific mitigation measures for sensitive receptors

These mitigation measures are developed to address the identified impacts of design, construction and operation stages, in accordance with relevant national laws, regulations, guidelines and norms, as well as World Bank policies, including the *Environment, Health and Safety General Guidelines* and specific *Guidelines for Ports, Harbor and Terminals*.

Detailed management plan for marine ecological compensation and restoration, dredging and blasting, dredged material disposal, contractor specifications and contingency plan are further elaborated in the Chapter 6-8.

Table 7 Implementation Plan of Environmental Protection measures during Design Phase

Activities	Potential Impact/Problem	Mitigation Measures	Reference to EMP/RAP	Who implement	Who Monitor	Monitoring Indicators	Monitoring Frequency
Land acquisition and resettlement	Potential impacts on aquaculture farmers	<ul style="list-style-type: none"> Preparation of Resettlement Plan in accordance with national policy and World Bank policy. 	Details in RAP	Hehai University	MBHAB, World Bank	RAP approved by World Bank	Prior to appraisal
Dredging, blasting and disposal	Benthic, inter-tidal habitats and fishery resources will be affected	<ul style="list-style-type: none"> Ecological compensation (offset) measure developed, budgeted and included in the EMP; Fish breeding and release program prepared; Offset program for mangroves rehabilitation prepared. 	EMP Chapter 9	MBHAB EIA Consultant	MBHAB, FOFD, FPEPBD	<p>Programs approved by FOFD</p> <p>EIA approved by FPEPD</p>	Prior to appraisal
Dredging, blasting and disposal	Sediments disturbance, dredged material spills to increase water turbidity and impact water quality and ocean ecology	<ul style="list-style-type: none"> Prepare Environmental Management Plan, including Dredged Material Management Plan 	EMP Chapter 7	EA consultant	MBHAB, World Bank	EIA approved by World Bank, FPEPD	Prior to appraisal
Emergency accidents of oil spill and CNG pipeline damage	Dredging and blasting has the risk of damage oil and CNG pipelines and vessels during construction which will affect coastal and ocean ecology	<ul style="list-style-type: none"> Emergency response plan has been thoroughly assessed and developed in the EIA and EMP 	EMP Chapter 8	EA consultant	MBHAB, World Bank	EIA approved by World Bank, FPEPD	Prior to appraisal
Contractor obligations	Inadequate environmental management practice may cause severe environmental impacts	<ul style="list-style-type: none"> Contractor specifications developed in the EMP, and are to be incorporated into the bidding documents and construction contracts 	EMP Chapter 6	EA consultant	MBHAB, World Bank	EIA approved by World Bank, Specifications included in bidding documents	<p>Prior to appraisal</p> <p>Before issuing bidding</p>

Table 8 Implementation Plan of Environmental Protection measures during Construction Phase

Activities	Potential Impact/Problem	Mitigation Measures	Reference to EMP/RAP	Who implement	Who Monitor	Monitoring Indicators	Monitoring Frequency
Site Layout	Potential disturbance to areas on the site and that construction activities take environmental, groundwater, drinking water supply	<ul style="list-style-type: none"> Locate the camp away from immediately adjacent property owners. A layout plan for construction activities needs to be developed and approved by the Environmental Supervision Engineer 	EMP Chapter 6.2	Contractor	ESE, IEC	Site plan approved by ESE	Prior to construction
Contractor management	Sewage, domestic garbage, community disturbance, secure safety	<ul style="list-style-type: none"> Staff facilities, ablutions, chemical toilets, potable water, first aid equipment must be provided for the staff Enforce code of conduct for workers Safe storage of fuel and dangerous materials. Proper treatment of wastewater, collection and disposal of solid waste Maintain continuous community consultation. Disclosure of project information. Keep complains register in camp office 	EMP Chapter 6.3-6.9	Contractor	ESE, IEMC	<p>Facilities provided;</p> <p>Training provided; Material and waste properly managed;</p> <p>Disclosure board installed</p>	Daily
Dredging	Marine suspended sediment pollution Benthonic habitat and fish resources impact	<ul style="list-style-type: none"> Dredging Management Plan developed in EMP. Contractor will develop detailed construction plan to be approved by Environmental Supervision Engineer On-site monitor the dredged 	EMP Chapter 7.2	Contractor	ESE, IEMC	Dredging plan approved; On site supervision by ESE; Specification followed;	<p>Prior to dredging</p> <p>Daily</p>

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Activities	Potential Impact/Problem	Mitigation Measures	Reference to EMP/RAP	Who implement	Who Monitor	Monitoring Indicators	Monitoring Frequency
		<ul style="list-style-type: none"> material storage barge to prevent spill. Enforce <i>Dredging Engineering Technical Specification</i>, Apply the GPS, dredge depth indicators to accurately control dredging; Strengthen the management on mud gate, the overflow time is controlled within 0.5 hour to reduce the suspended sediment flow into sea; The interval of dredging vessels shall be over 500m to avoid the overlapping impact of suspended sediments Implementation of fish breeding and release program 		MBHAB		<p>GPS installed;</p> <p>Overflow time controlled;</p> <p>Safety distance maintained;</p> <p>Fish released.</p>	Yearly
Rock blasting	<p>Impulse wave impact on ocean organisms, aquaculture farms</p> <p>Noise and vibration</p> <p>Blasting safety</p>	<ul style="list-style-type: none"> Follow the <i>Blasting Safety Procedure</i> (GB136722-86), <i>Navigation Project Blasting technical Guidelines</i> (JTJ286-90). Blasting plan must be submitted to local ocean and fishery authority for approval before implementation. Millisecond blasting technology, max load 100kg Inform the administration of maritime affairs, navigation, release the Navigation Stopping Notice, and prior notice to nearby entity before 6 hours, prior area 	EMP Chapter 7.3	Contractor	ESE, IEMC	<p>Blasting plan approved by authorities,</p> <p>Explosive charge recorded; Notice issued;</p>	<p>Prior to blasting</p> <p>Daily</p>

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Activities	Potential Impact/Problem	Mitigation Measures	Reference to EMP/RAP	Who implement	Who Monitor	Monitoring Indicators	Monitoring Frequency
		<p>clearing and notice before 30mins, set the safeguard distance of 250m;</p> <ul style="list-style-type: none"> • Run noisy drilling machine and compressor to compel fish away from the area. Trial blasting with small load to drive away fish • Blasting is arranged avoiding end of spring and early summer (April – June) to minimize impact on fish reproduction • Establish safety zone, deploy watching ships, ban underwater personnel operation within 1500m radius • After blasting, examine whether there is blind shot; • Monitor large-size marine fishes within 2km boundary, once they're found, the blasting will be canceled. Rescue large ocean fish if found and report to local ocean and fishery authority 				<p>Fish compelling measures done;</p> <p>Schedule controlled;</p> <p>Safety zone patrolled;</p> <p>Inspection;</p> <p>Visual inspection</p>	
	Potential impact on LNG pipelines and oil pipeline	<ul style="list-style-type: none"> • Blasting plan must also be submitted to LNG and Fujian Oil Refinery port authority for agreement before blasting • Mark LNG and oil pipeline zone to avoid anchorage etc. • Emergency plan is in place 	EMP Chapter 7.3 and 8	Contractor	ESE, IEMC	<p>Blasting plan agreed by CNG and Oil companies,</p> <p>Safety zone marked; Emergency plan in place</p>	<p>Prior to blasting</p> <p>Daily</p>
Dredged Material Transportation	Marine suspended sediment pollution	<ul style="list-style-type: none"> • Transported to designated backfill area, dumping at will is 	EMP Chapter 7.4	Contractor	ESE, IEC	No spill observed;	Daily

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Activities	Potential Impact/Problem	Mitigation Measures	Reference to EMP/RAP	Who implement	Who Monitor	Monitoring Indicators	Monitoring Frequency
	ship collision	<p><i>Preventing Collisions at Sea</i> as well as the navigation requirements of the local maritime authorities.</p> <ul style="list-style-type: none"> • Prior notice to clear the construction zone, prepare emergency plan, equip communication facilities and signals, assign watching staff, liaison with weather authority, mark LNG and oil pipeline zone to avoid anchorage etc. 					
Physical cultural resources protection	Chance-find of physical cultural resources may be damaged	<ul style="list-style-type: none"> • In case of chance-find of any suspected physical cultural resources, dredging/disposal operation shall stop. Relevant cultural resources authority be notified. Dredging/disposal resumes only after approved by relevant authority. 	EMP Chapter 6.10	Contractor	ESE, IEMC	Record of chance find	Daily

Table 9 Implementation Plan of Environmental Protection measures during Operation Phase

Activities	Potential Impact/Problem	Mitigation Measures	Reference to EMP/RAP	Who implement	Who Supervise	Monitoring Indicators	Monitoring Frequency
Site Rehabilitation	Camp and operation site may be left with garbage, unlevelled or not rehabilitated which is subject to erosion Visual and landscape nuisance	<ul style="list-style-type: none"> Remove all rubble, rubbish, litter, unused building equipment, contaminated soils or any other relevant articles from the site following the end of the construction phase 	EMP Chapter 7.2	Contractor	ESE, IEC MBAHB	Site cleaned and rehabilitated	Upon project completion
Waste from ships	Oil containing wastewater, solid waste from ships, if discharged into water, will cause adverse impact on marine ecology and water quality	<ul style="list-style-type: none"> Enforcement of national and international regulations e.g. Management Regulations on Preventing Vessels from Polluting Marine Environment, Fujian Marine Environmental Protection Regulations and other relevant laws and regulations. Wastewater and solid waste are forbidden to be discharged into the coastal sea area, and must be unloaded to the waste treatment facilities in the port for treatment. 		Ship owners	MBAHB	Visual inspection; Waste disposal record	Daily
Navigation traffic in Meizhou Bay	LNG carrier, oil tankers and other vessels that carry dangerous or hazardous materials pose safety risk of leakage and spill. Oil spill may potentially affect the	<ul style="list-style-type: none"> Safety operation procedures are well established Emergency response plan is in place. Special emergency response team and facility are deployed in Meizhou Bay. Improve vessel traffic control system in Meizhou Bay as well as the monitoring capacity of law enforcement team. 	EMP Chapter 8	MBAHB	FPEPD, FOFD	Accidents records	Monthly

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	Meizhou Island						
Ecological compensation and habitat offset		<ul style="list-style-type: none"> • Reproduction and releasing seed of various chosen marine species over 2012 and 2020. • Mangrove plantation and enhance program in Luoyang Jiang mangrove in Quanzhou Bay Estuary Wetland Reserve, to be implemented during 2014-2016. A TORs is developed in EMP to scientifically design the program. 	EMP Chapter 9	MBHAB	FOFD, FPEPD	<p>Fish released</p> <p>Area of mangrove planted</p>	Yearly
Cumulative impacts	Ecological impacts such as loss of benthic organisms and inter-tidal zone; Water quality degradation; impacts on aquaculture, etc.	<ul style="list-style-type: none"> • Cumulative impacts addressed in Meizhou Bay Port Master Planning EA, Meizhou Bay (Quanzhou - Putian) Strategic Environmental Assessment (SEA) Report • Function Zoning has been developed following Integrated Coastal Management (ICM) approach • Adopt Best Management Practice (BMP) by Meizhou Bay Harbor Administration Bureau • Habitat improvement programs under ICM framework (fish breeding and release, artificial fish rock deployment, mangrove habitat enhancement programs etc.) • Dialogue mechanism among stakeholders to monitor the development and ecological status of Meizhou Bay 	EMP Chapter 10	<p>MBHAB</p> <p>FOFD</p> <p>MBHAB</p> <p>FOFD/MBAHB</p> <p>MBHAB</p>	FPEPD	<p>SEA report approved</p> <p>Function Zones maintained;</p> <p>Area of habitat improved;</p> <p>Meetings organized</p>	<p>Yearly</p> <p>Yearly</p>

Table 10 Site-specific Mitigation Measures for Sensitive Receptors

No	Receptor	Current situation and planning	Distance to construction area		Environmental and Social Impacts	Main Mitigation Measures	Current Field Photos
			To dredging area	To blasting area			
1	Putou Aquaculture Zone	Current: laver and seaweed cultivation; Planned for port development	1.1km to Putou Channel dredging area	0.85km to Putou channel rock blasting area	1. Construction of Putou North channel will result in sediment suspension in the aquaculture area. 59.1 ha will have increased sediments concentration exceeding applicable standards 10mg/L. 2. Construction of 5# anchorage zone will impact 566 ha, but the increased the sediments suspension is small to cause significant impact.	Limit overflow time to less than 0.5hr to reduce suspension. Distance between dredging ships shall be kept more than 500m to avoid cumulative sediments suspension.	
2	Luoyu West Aquaculture Zone	Current: abalone net cage, seaweed and laver. Planned for port development	0.78km to 4# anchorage zone dredging	0.04km to main channel blasting	Dredging of main channel in the west of Luoyu. will result in sediment suspension in the aquaculture area. 9 ha will have increased sediments concentration exceeding applicable standards 10mg/L.	Temporarily relocate abalone net cage out of impact zone before the dredging. Limit overflow time to less than 0.5hr to reduce overflow. Distance between dredging ships shall be kept more than 500m to avoid cumulative sediments suspension.	
					Rock blasting in the main channel in the west of Luoyu will impact the aquaculture zone.	Blasting can be conducted only after relocation of abalone net cage. Single-stage explosives no more than 100kg	

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3	Dongwu Aquaculture	Current: abalone net cage, seaweed and laver. Planned for port development	0.41km to Branch Channel dredging site	0.4km to Branch Channel blasting site	Sediment suspension exceeding-standard plum will not reach the aquaculture area.	Precaution measure taken: Limit overflow time to less than 0.5hr to reduce suspension. Distance between dredging ships shall be kept more than 500m to avoid cumulative sediments suspension.	
					No significant impacts resulted from blasting will impact the Dongwu abalone cultivation.	Precaution measure taken: Single-stage explosives no more than 100kg	
4	Huiyu Aquaculture	Current: abalone net cage, seaweed and laver.	Overlap with Huiyu West channel		Dredging of 4# anchorage zone will impact 95ha where will have increased sediments concentration exceeding applicable standards 10mg/L. but the increased sediments suspension is small to cause significant impact.	Limit overflow time to less than 0.5hr to reduce suspension. Distance between dredging ships shall be kept more than 500m to avoid cumulative sediments suspension.	
5	Fujian Refinery port and seabed oil pipeline	Seabed oil pipeline zone	0.26km to the dredging site of crossing zone	0.58km to blasting site	Blasting is far away from the oil pipeline so the shock wave resulted from the blasting is insignificant to the oil pipeline	(1) Single-stage explosives no more than 100kg (2) Linchi rock blasting shall be carried out only when the 300,00 DWT ship is not operating in the ports. (3) Prohibit navigation in the case explosives has not exploded.	
6	Meizhou Bay seabed LNG pipeline	seabed LNG pipeline	0.13km to Putou channel dredging area	0.122km to Putou channel blasting site	Blasting is far away from the LNG pipeline so the shock wave resulted from the blasting is insignificant to the LNG pipeline	(1) Single-stage explosives no more than 100kg ; (2) Prohibit navigation in the case explosives has not exploded.	

5. SUPERVISION AND MONITORING PLAN

5.1 Supervision for Environmental Management

The Supervision Engineer Company is responsible for inspecting, supervising and auditing all construction activities to ensure that mitigation measures adopted in the EMP are properly implemented, and that the negative environmental impacts of the project are minimized. The Supervision Engineer Company is required to designate Environment Supervision Engineer (ESE) who will be responsible for daily on-site supervision of environmental mitigation measures implementation by contractors.

The key supervision contents of ESE include:

5.1.1 Phase I: Preparation

Phase I is to lay the groundwork for the successful execution of the project. In this phase, the ESE will:

- Review the Environmental Impact Assessment (EIA), the Environmental Management Plan (EMP), project designs and technical specifications and confirm that there have been no major omissions of mitigation measures;
- Prepare guidelines for contractors for implementation of the EMP; and
- Develop and execute a training program for all parties involved in construction activities.

The main tasks in the phase I preparation is highlighted as follows:

- Review of Project Documents: The ESE will review the EIA, EMP, project designs and technical specifications and confirm in writing that there have been no major omissions of mitigation measures. If any issues are identified, the ESE shall propose to the Project Management Office (PMO) updates to the EMP and the design and technical specifications to address these issues. Once approved by PMO, the ESE will update the EMP.
- The ESE will review and approve the EMP Implementation Plan presented by the contractors.
- Environmental Supervision Checklist: The ESE will establish a comprehensive checklist which will be used during the construction of the project to monitor the contractor's performance. This will cover major aspects of the project, required mitigation/control measures and their implementation schedule.
- Log-Book: The ESE will keep a log-book of each and every circumstance or change of circumstances which may affect the EIA or which may result in non-compliance with the recommendations made by the ESE to remediate the non-compliance.

- **Environmental Training:** The ESE shall design and execute a comprehensive training program for all involved parties including Supervision Engineers, PMO staff, contractor's Safety and Environment Officer (SEO), contractor's workers, etc., on the environmental requirements of the project, and how they will be supervised, monitored and audited, giving particular attention to:
- **EMP:** The requirements of the EMP, the agreed environmental monitoring checklists, the environmental monitoring forms, how non-compliance with the EMP will be handled, and all other key issues shall be covered. Particular attention will be paid to the specific provisions in each contract's technical specifications indicating how the EMP is to be complied with.
- **Health and Safety:** The health and safety requirements of the project shall be clearly identified and communicated with the contractors and the PMO.
- At the conclusion of the training, contractors will also sign a statement acknowledging their awareness of the environmental regulations, the EMP, the compliance framework, and health and safety obligations. The CST shall sign a similar statement confirming their understanding of the supervision responsibilities. This shall be provided to the PMO and the World Bank.

5.1.2 Phase II: Supervision of Construction Activities

- Review and inspect, in an independent, objective and professional manner, all aspects of the implementation of the EMP;
- Carry out random monitoring checks and review on records prepared by the contractor's SEO;
- Conduct regular site inspections;
- Review the status of implementation of environmental protection measures against the EMP and contract documents. Major non-compliance by the contractor will be cause for suspension of works and other penalties until the non-compliance has been resolved to the satisfaction of the ESE.
- Verify contractor's compliance with regulations governing the environment, public health and safety.
- Review the effectiveness of environmental mitigation measures and project environmental performance;
- Review the environmental acceptability of the construction methodology (both temporary and permanent works), relevant design plans and submissions. Where necessary, the ESE shall seek and recommend the least environmental impact alternative in consultation with the designer, the contractor(s), and the PMO;
- Verify the investigation results of any non-compliance of the environmental quality performance and the effectiveness of corrective measures;
- Provide regular feedback audit results to the PMO and CST according to the procedures for non-compliance in the EMP;

- Provide training programs at minimum six monthly intervals and every time there are new workers or new contractors coming into the site. The training shall include EMP requirements, prohibitions, compliance, and environmental awareness.
- Regularly monitor the performance of the ET, verifying monitoring methodologies and results. In case where the ESE considers that the SEO or any member of his team fails to discharge duties or fails to comply with the contractual requirements, instruct the contractor(s) to replace the SEO or the member of the team;
- Instruct the contractor(s) to take remedial actions within a specified timeframe, and carry out additional monitoring, if required, according to the contractual requirements and procedures in the event of non-compliances or complaints;
- Instruct the contractor(s) to take actions to reduce impacts and follow the required EMP procedures in case of non-compliance/discrepancies identified;
- Instruct the contractor(s) to stop activities which generate adverse impacts and/or when the contractor(s) fails to implement the EMP requirements/remedial;
- The ESE shall ensure compliance with the requirements of the health and safety clauses in the contract documents.
- The ESE shall closely audit the construction activities through regular site inspections accomplished through daily site visits, walks and visual inspections to identify areas of potential environmental problems and concerns. The area of inspection shall cover both the construction areas and the environment outside the site area that could be affected, directly or indirectly, by the contractor's activities.
- The ESE shall have their own hand-held and portable monitoring equipment such as cameras, transport and other resources. Where additional monitoring is necessary to resolve contentious issues or to impose penalties, the ESE may contract third parties to carry out specific monitoring at the locations under review.
- Where there is infringement of technical specifications, or condition of contracts, or non compliance with the EMP, the ESE shall be immediately inform the contractor's Safety and Environment Officer (SEO). The ESE shall also report all infringements to the PMO as part of the monthly reporting.
- Regular joint environmental site inspections (e.g. weekly) shall be organized by the ESE with participation of the contractor's SEO. These shall be used as an opportunity for the ESE to further train contractors' staff.
- ESE field engineer's log-book shall be kept readily available for inspection by all persons assisting in project management.
- The ESE shall also regularly review the records of the contractors to ensure that they are up to date, factual and meet the EMP reporting requirements (e.g. environmental complaint register).
- Complaints will be received by the contractor's site office. The ESE shall be provided a copy of these complaints and ESE shall confirm that they are properly addressed by the contractor in the same manner as incidents identified during site inspections.

- The ESE shall work closely with the contractors and the PMO in the event that an incident arises which was not foreseen in the EMP or EIA and confirm satisfactory resolution to the incident. The ESE shall then update the EMP and the implementation guidelines, training the contractors' staff accordingly.
- The ESE shall confirm the monthly payments for environmentally related activities as recommended by the ESE to the client.

At a minimum the ESE shall prepare the following written reports:

- Weekly report of non-compliance issues;
- Summary monthly report covering key issues and findings from reviewing and supervision activities; and
- Consolidated summary report from contractor's monthly report

The ESE shall also collect and report on data as requested by the PMO.

- At the end of the project the ESE shall prepare a final report summarizing the key findings from their work, the number of infringements, resolutions, etc. as well as advice and guidance for how such assignments should be conducted in the future.
- During the course of the project the ESE shall provide briefings as requested to the PMO, environmental agencies, the World Bank and others as requested by the PMO on the project progress, incidents, and other issues associated with environmental management and supervision. At a minimum these are expected to be at six-month intervals.

5.2 Environmental Monitoring Plan

The Independent Environmental Consultant (IEC) will check, review, verify and validate the overall environmental performance of the project through regular inspections and review. This review will provide confirmation that the reported results are valid and that the relevant mitigation measures and monitoring program provided in the EMP are fully complied with. IEMC will review and audit in an independent, objective and professional manner in all aspects of the EMP through regular and random inspection to:

- Audit the EMP measures against the status of implementation of environmental protection measures;
- Review the effectiveness of environmental mitigation measures and project environmental performance;
- On a need basis, verify and certify the environmental acceptability of the construction methodology (both temporary and permanent works), relevant design plans and submissions.
- Verify the investigation results of any non-compliance of the environmental
- Feedback audit results to MBHAB and ESE team according to EMP procedures of non-compliance in the EMP, and provide Supervision Engineer (ESE) suggests on actions of penalty, suspension or other punishment;

- Prepare semi-annual report to the MBHAB, FPTD and the World Bank.

The environmental monitoring during project implementation stage will be carried out by Environmental Quality Monitoring Consultant (EQMC) appointed by the Project Proponent. The EMS will collect periodically environmental samplings (including water, air, noise, etc.) at selected locations. Such monitoring results, audits and sampling results will be submitted to the Proponent and they will serve as indicators of compliance of the project with environment regulations

Monitoring plans in this EMP context shall focus on the following key perspectives:

- The project proponent commits to undertaking numerous monitoring programs in relation to the Project;
- Monitoring programs will be implemented for aspects of the Project which have been predicted to have an effect on the environmental and social resources in the Project area, including air quality, noise, water quality, sediment quality, quality and quantity for aquatic resources, and socio-economic resources;
- Proponent periodically completes a trend analysis of the monitoring data on a program by program basis to evaluate the success of the various monitoring programs. This analysis will be used to determine if any changes or adjustments to the monitoring programs are required; and
- Work with Environment authorities to design updated monitoring programs as necessary.

Based on the EIA results, it is concluded that, under normal circumstances, during the implementation of the Project has certain effects on the surrounding environment. In general, this effects can be decreased by environmental protection measures. Planning and implementation of Meizhou Bay development process will produce significant beneficial effects. The comprehensive monitoring program and evaluation plan has been developed in the EMP.

In order to examine the effectiveness of the mitigation measures, monitoring procedures need to be undertaken to confirm mitigation effectiveness over a reasonable timeframe. Monitoring must compare environmental parameters to the base line data and prescribed criteria objectives in the EIA Chapter Section 1.4 Laws regulations or standards.

5.2.1 Introduction to Monitoring Procedures

The monitoring program and monitoring frequency shall be designed to quantify the overall environmental performance of the project works as well as any short-term impact due to intense construction activities. More specifically, as an integral and critical part of the EMP, the environmental monitoring program shall include the following objectives:

- Confirm the impacts forecasted by environmental impact assessment processes, EMP development and monitoring processed;
- Determine the actual extent and magnitude of the impacts;
- Evaluate the effectiveness of the mitigation measures; and
- Identify and justify any additional mitigation measures against unexpected impact as may be necessary during project implementation; and
- Keep tracking and update the monitoring methods and objectives of the environmental quality relating to the project according any updated regulatory criteria.

During the peak construction period or at the request of the client, the EMS will also carry out additional measurements to monitor short-term impact. If non-compliance with environmental quality performance criteria is identified, additional monitoring may be carried out.

5.2.2 Monitoring Parameters

The monitoring program shall include the following:

- Air and sediment quality along plume front development, as well as ambient water quality;
- Wastewater quality and watercourse water quality; and
- Ecological status

Table 11 Monitoring Plan during Construction Stage

Monitoring Factors	Monitoring Place (Stretches)	Indicator	Monitoring Frequency	Who to implement
Water Quality	1 monitoring point will be set at 100m, 200m, 300m respectively in flooding and ebbing direction to each dredged point, 1 monitoring point shall be set at 50m and 100m respectively in flooding and ebbing direction to the overflow port of hydraulic filling area.	SS and Oil	Once every month during dredging, separately for flooding and ebbing tide of big and small tide.	Independent Environmental Monitoring Consultant
Fishery Resources	Monitored in the place around 2000m outside the edge of Rock-blasting area	Maritime Large-size fishes	When blast rock for the first time, the maritime creature death shall be observed, if many creatures die due to blasting, the explosive for single stretch shall be reduced.	ESE
Marine Dumping Area for	10 monitoring points established around the dumping area	Water quality, sediment, phytoplankton,	Twice every year for water quality, organisms, fishery	Independent Environmental Monitoring

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Dredged Materials in Outer Bay Stretch		zooplankton, benthos, fishery resources.	resources, separately in May and August, once in August for sediment, benthos	Consultant
Water environment, sediment and ecology	The monitoring points set by Environmental Protection Bureau and Ocean administrations	Water quality, sediment, phytoplankton, zooplankton, benthos, fish eggs and larvae and juveniles and nekton etc.	Twice every year, separately in Spring and autumn	Independent Environmental Monitoring Consultant
Air quality	Work locations with extensive operating equipment., unpaved roads or bare ground near sensitive receptors or sensitive environments.	Total Suspended Particulates (TSP)	Random sampling during dry conditions in response to complaints	Independent Environmental Monitoring Consultant

Table 12 Monitoring Plan during Operational Stage

Monitoring Factors	Monitoring Place (Stretches)	Indicator	Monitoring Frequency	Who to implement
Water environment, sediment and ecology	The monitoring points set by Environmental Protection Bureau and Ocean administrations	Water quality, sediment, phytoplankton, zooplankton, Shallow marine benthos, fish eggs and larvae and juveniles and nekton etc.	Twice every year, in Spring and autumn separately	Qualified Monitoring Institution contracted with MBHAB

6. CONTRACTOR ENVIRONMENTAL SPECIFICATIONS

Contractor Environmental Specifications provide guidelines, processes and procedures that can ensure that the ecosystem environment is not detrimentally affected by the contractor's activities during project implementation. The Contractor is required to adhere to the guidelines established in this document. The general environmental issues associated with the contractor activities include the following:

- Site management
- Fuel and material storage and handling
- Dust and noise nuisance control
- Sewage management
- Waste management

Environmental issues related to specific project activities, i.e. dredging/blasting, dredged material disposal, ecological rehabilitation program, emergency response plan etc, are further detailed in the following chapters.

6.1 Contractor's Environmental Protection Plan

The Contractor must be provided with a copy of the EMP and the EMP must form part of tender documents. Before commencement of construction, contractors are required to submit a site-specific Environmental Protection Plan (EPP) for their work which will be reviewed and approved by Environmental Supervision Engineers (ESE) and MBHAB. The EPP shall include the plans for the generic environmental mitigation measures (as well as specific mitigation measures for dredging, blasting, disposal, emergency response etc.), including, but not be limited to, the following items:

- A site plan showing work areas, fuel containment areas and refueling locations, laydown areas, parking areas, equipment maintenance area, material storage area and camp area.
- A detailed drainage handling plan including ditching requirements, site runoff, location of detention pond(s) and check dams as well as the location of all water exit points and water quality monitoring locations;
- Sediment and erosion control installations including silt fence and containment berm locations;
- Waste management plan;
- Dust control plan;
- Noise control plan, and
- Spill response plan including location and contents of spill response materials storage and designated personnel to maintain spill response materials.

6.2 Site Establishment

Locate the camp away from immediately adjacent property owners. A layout plan for construction activities needs to be developed and approved by the Environmental Supervision Engineer.

6.2.1 Labor employment

- If appropriate, the employment of labors should give priority to local labors.
- The contractors should publicize appropriate work positions to the villages and towns along Meizhou Bay.
- The workers and the staff members should have legal contracts for employment
- The contractors should provide the workers with the educational training of environmental protection and occupational health and safety.

6.2.2 Requirements for Camping Site

- The contractors should provide appropriate and safe quarters for the workers.
- Independent and sufficient toilet facilities (toilet and shower) should be provided on the camping site for male and female workers respectively. Sufficient water supply, soap and toilet paper should be provided in the toilet. All these facilities should be accessible and clean.
- The kitchen on the camping site should have clean water and should be in hygienic condition.
- The toilet should be indicated with "Male" or "Female" obviously.
- The domestic sewage of the camping site should be treated in the septic tank at least and should not be directly discharged into any waters.
- The camping site should provide medical and emergency facilities. First-aid kit should be provided at any camping site and managed by specially assigned persons who should have full first aid training and qualification and could send the injured or the diseased to local hospital in time. The above medical and health supplies should be replenished in time.

6.3 Code of Conduct

The Code of Conduct will be established for the workers with emphasis on appropriate behavior, refusing drug abuse and alcohol and conforming to the relevant laws and regulations so as to reduce the influence on the society. Each worker should be informed of the Code of Conduct. The Code of Conduct for workers should be also known to the local community. Failing to obey the code of conduct, disciplinary punishment should be enforced. The "Code of Conduct" includes but not limits to the following measures:

- All the staff members should obey the national laws and regulations;
- Hazard materials and dangerous weapons are prohibited;

- Pornographic materials and gambling activities are prohibited;
- No fighting is allowed;
- No interference to the production and life of the neighborhood as well as the local people;
- No disrespect to native traditional culture, custom and traditional activities;
- Smoking is only allowed in appointed area;
- Appropriate clothes and personal hygiene standard;
- Appropriate sanitary condition for the dormitory;
- The workers should obey the relevant code of conduct when visiting the neighborhood as well as the local people.

Prohibition

The following activities are prohibited on the construction site or nearby:

- Injury to the wild animals and the cultivated marine products in the sea areas nearby;
- Capture of protection animals or collection of protection plants;
- Purchasing protection animals as food;
- Interference and destruction of objects with architecture and history values;
- Bonfire;
- Drinking in working hours;
- Mechanical maintenance (replacement of engine oil and lubricant) outside the specified area;
- Dumping outside the specified area;
- Driving in danger on local road;
- Working without safety clothes (e.g. safety boots and crash helmet);
- Causing interference to the people nearby;
- Leakage of pollutants, e.g. oils;
- Fishing with explosion or other chemical methods;
- Burning refuse.

Any constructor, office worker or other staff member, if found breaking these regulations, should be punished by the discipline, by means from oral criticism to dissolution of labor contract as the severity.

6.4 Health and Safety

- The contractors should ensure the projects conforming to all the national and local safety regulations as well as the other measures about damage avoidance.
- Before the construction, the contractors should provide safety training for the workers.
- Sufficient daylight and night illumination should be provided;
- Adequate fencing needs to be provided around the site. This needs to be checked and maintained during the construction phase;
- No other people is allowed to enter camp site without approval by management staff of the contractor;
- The camping site should be provided and equipped with fire-protection equipment and fire extinguisher;
- The contractors should provide the workers with enough personal safety protecting devices, e.g. protective glasses, gloves, protective mask, dust cover, safety helmet, ear protectors, steel helmet and so on, and ensure them to be used on the construction site.

- The safety rules, the emergency pre-plan and the emergency contact information should be indicated on the bulletin board at the construction site.
- All the places with potential damage should be marked for warning.
- High risk regions, e.g. the areas at the channel for reef explosion, the areas with blind shot, should be marked with temporary caution lights to prohibit vessels.
- The explosives should be managed following the stipulations of the state strictly.
- Safety protection distance should be determined according to the relevant regulations.
- The contractors should take all reasonable measures to prevent the risk rising and ensure the construction site and all the camping sites provided with fire-protection equipments.
- The contractors should keep in contact with the meteorological department to understand disadvantageous weather conditions and start up the typhoon-protection and tide-control emergency pre-plan in time.
- Any engineering requiring open flame could only be performed at the places approved by and in supervision of the environmental supervision engineers. And meanwhile, the fire-protection equipments should also be in place.
- The contractors should carry out annual physical examination for all the workers.
- The contractors should also carry out the training of personal basic hygiene and epidemic prevention, including respiratory disease and infectious disease.
- The contractors should carry out the educational activities about disease prevention and cure, esp. the protection against AIDS and venereal disease, including the propaganda on the construction site and in the neighborhood in the form of notification and training class.
- The contractors should provide the workers with basic first-aid service and emergency.
- The contractors should establish necessary warn and speed bump etc. in the access road near local communities if any to ensure the traffic safety nearby.

6.5 Storage of Fuel, Cement, Dangerous and Toxic Materials

- All fuels that are stored on site shall be banded to 110% of the capacity of the bulk fuel storage container. The fuel storage area must not be located near (i.e. less than 100m) any water resource.
- Hazardous materials should also be stored in specifically designed storage facilities. Provision needs to be made for the temporary storage of hazardous materials such as fuels, oils and paints. These could be stored in a ventilated, banded area that can contain 150% of the volume of the largest container.
- Access to this storage area should be limited only to relevant staff.
- The site must be protected from vehicle damage and must be regularly inspected for leaks, damage or pollution.
- Machine and equipment repairs must only take place within the confines of the contractor's camp. An appropriate work surface (i.e. banded concrete floor) must be provided that can collect oils, fuels and the like and these must be collected into an appropriate bin. Where there have been oil/fuel leakages, contaminated soil must be removed and disposed of at an appropriately permitted site.
- Precautionary measures must at all times be taken to prevent the pollution or contamination of the soil and water by grease, oil, fuels, solvents, chemicals, etc.

- The Emergency Spill Response Plan will be posted on-site, and all personnel made aware of its content and location of response materials;
- Oil spill response materials and equipment such as sorbent pads, booms and leak proof containers, will be kept on-site in sufficient quantities and in an easily accessible location;
- Equipment operators and personnel responsible for spill response will review the spill response plan regularly to ensure that it is up to date, and all required materials are on site and easily accessible;

6.6 Waste Management

- During the construction phase the Contractor must make provision for the appropriate removal of waste from the site to a permitted waste disposal facility. The accumulation of construction waste materials must be avoided as far as possible.
- All domestic waste generated by the contractor's activities at the contractor's camp must be stored in either refuse bins (i.e. steel or plastic 210L drums) or in a waste skip. The Contractor must ensure that these containers are emptied on a weekly basis, or as and when required.
- All litter shall immediately be deposited into refuse bins or the waste skip. No litter must be left in the work areas or contractor's camp.
- Construction waste must be stockpiled in the contractor's camp and the Contractor must dispose of this waste properly. Contaminated construction waste must be dealt with separately.
- Soils that have been contaminated by diesel, petrol, oil or any other substance that may inhibit the growth of plants must be removed to a registered waste disposal site for hazardous waste. Only appropriate fill shall be used to replace the lost material.
- The burning of waste on site shall be prohibited.

6.7 Wastewater and Storm Water Management

- Wastewater from construction site and camp are not allowed to be directly discharged into sea water;
- Domestic sewage must be properly treated through, e.g. septic tank, before discharge.
- Implementation of measures to dissipate the energy of the stormwater before it is released into the drainage areas;
- The distribution of stormwater runoff as evenly as possible from the site; and
- Use of gabions, riffle beds and swales to reduce the velocity of water runoff.

6.8 Control of Noise

- Limit construction times to the day times;
- No noisy activities during weekend near local communities;
- Should blasting be required during the construction phase, the necessary permits must be obtained from the local authority and any other relevant authority.

- The contractor must comply with all applicable occupational health and safety requirements.
- Blasting times must be limited to the hours from 08:00 to 17:00 during weekdays only.
- Personnel, visitors and workers on the site must at all times be equipped with appropriate hearing protection measures to ensure noise impacts do not damage the persons hearing.
- The ESE must regularly inspect the site and ensure compliance with the Occupation Health and Safety.

6.9 Community Engagement and Complaints Register (CR)

- During the construction period, the contractors should remain open communication with the local governments and the people of the relevant community.
- Before the construction, the contractors should publicize the project information to the influenced party (e.g. local departments, enterprises and residents) in the form of community meeting.
- All the construction sites should have striking signs about the project information, including but not limited to:
 - a) brief project description;
 - b) construction plan;
 - c) major construction activities;
 - d) principal environmental problems and mitigation measures;
 - e) names and telephones etc. of the project manager, the supervision engineer and the environmental protection personnel.
- The contractors and the environmental supervision engineer should regularly communicate with major sensitive receptors, including aquaculture farmers so as to minimize the negative influence on these objects.
- As for the construction activities with great influence, e.g. rock explosion, the contractors should communicate with the local parties that may be influenced.
- All the contractors should provide the workers with the training about neighborhood relationship maintenance, communication, local custom and the code of conduct as well.
- Complaints channel information must be disclosed at the entrance of the site;
- A complaints register must be kept on site in the main construction camp office. All complaints, issues and concerns shall be incorporated in feedback reports to ESE and MBHAB;
- Where a complaint requires corrective action, this must be communicated to the relevant parties to ensure that the complainant is satisfied.

6.10 Material Cultural Resources

- To provide training for the workers about historic relic education as well as historic relic discovery and protection procedures.
- In case of chance-find:
 - a) The contractors should stop the construction immediately and protect the scene;
 - b) Report to the ESE and the owner as well as the local cultural resources authority;
 - c) During the period of the investigation made by the local authority, the contractors

- should take appropriate measures to protect the historic relic spot and implement weather precaution;
- d) Only after consent by related authorities, the contractors can resume the construction.

7. DREDGING, ROCK BLASTING AND DREDGED MATERIAL MANAGEMENT PLAN

7.1 Dredging and Disposal Methodology

The dredging and disposal methodology and management measures to be implemented for the Meizhou bay project are designed to comply with the *Technical Specification of Dredging Engineering* and the actual condition of this project. In addition, as a best management practice of the dredging engineering practice, the dredging methodology for the Project aims to:

- Minimize sediment plume mobilization;
- Minimize any impacts of dredging operations on marine life and water quality; and
- Reduce the potential impacts from noise generated by dredge equipment.

The management of water quality to minimize adverse impacts from the mobilization of sediments will incorporate the following components:

- Proactive operational measures in dredging and disposal works to reduce sediment mobilization;
- Predictive modelling of Total Suspended Solids (TSS) levels and plume direction;
- Vessel based monitoring to confirm modelling predictions and satellite estimates of TSS;
- Visual observations of plume movement and dispersal; and
- Reactive management based on continuous turbidity monitoring at all port area and dredging zones.

Soil investigations onsite in the ocean have revealed that the material to be dredged consists of three main types:

- Alluvial material – typically consisting of sand, gravel and clay;
- XW rock and stiff clays; and
- Competent weathered rock and fresh rock requiring drill and blast pre-treatment.

The equipment to be used in the dredging works are as follows:

- Backhoe Dredge (BHD) (towed by tug) – for all dredging works;
- x 1,000 t Split Hopper Barges (towed by tugs) – for offshore disposal of material
- Self Elevating Platform (SEP) – for drill-and-blast works
- x Flat Top Barges – for onshore disposal of material
- Survey and personnel transport vessels – in support of all dredging works
- Towed Mechanical Plough – if required for reprocessing of material in the spoil ground
- Trailer Suction Hopper Dredge (TSHD) – if required for reprocessing of material in the spoil ground

All material will be removed using the BHD, which is a mechanical excavator mounted on a rotating turret on a specialised barge. At the work site, the BHD lowers vertical legs called spuds to the seabed to provide a stable and secure working platform. As the dredge works, it gradually moves back along a rail system, the spud carrier. When the dredge reaches the end of the spud carrier, it raises the spuds, re-positions, and the process repeats. Each of these spud carriage movements propels the BHD into the face of the excavation by approximately 10 m, and the width of the excavation will measure approximately 20 m as the excavator works in an arc extending back to the working spud.

The rock layer needs to be pre-treated by drilling and blasting (where drilling and charging of holes occurs from the SEP), before the backhoe dredge can remove this material. The drill and blasted rock will be disposed of directly onshore. To minimise the amount of drilling and explosives needed for the blasting of the rock layer, the material overlaying the rock will be removed first. The material overlaying the rock is called the overburden layer and consists of alluvial material and XW material. It is expected that the full depth of the overburden will be removed in one pass of the BHD. This implies that the full range of material types is likely to be encountered over a relatively short distance and time frame in most of the dredging areas (described in detail below).

7.2 Dredging

Mitigation Measures

The environmental protection measures for dredging (including the maintenance dredging during the operation period) are advanced based on the *Technical Specification of Dredging Engineering* and the actual condition of this project.

- 1) Well prepare and organize construction in a scientific and appropriate way. The constructors shall design the construction organization and appropriately choose dredging facilities and construction method after completely researching the contract terms and technical requirements, surveying and analyzing the site construction conditions, then make proper arrangement on the engineering quality, construction schedule and quality as well as the resource consumption, to make the construction quality and period meet the contract's requirement.
- 2) The advanced dredging facilities and process are adopted, all the dredgers, survey vessels, shipping lighters shall be equipped with accurate auto-monitoring facilities and DGPS, dredge depth indicators, making the constructors adjust the drilling depth at any time based on draft and tide variation, so to realize high-accurate depth locating and dredging, on condition that the dredging effect and environment protection are ensured, try to reduce over-dredging volume, the disturbance on surrounding water and impact on surrounding water quality and marine ecology.
- 3) The dredging shall comply with the dredging specification, the overflow time of full dredger cabin shall be controlled within half an hour and the inflow suspended sediment shall be

reduced.

- 4) All the construction facilities, especially the mud gate shall be strictly inspected before construction, if the possibly leaked pollutant is found (including oil for vessel use and excavated sediment), which shall be repaired first then the construction can be executed, whether the pollutants exist during construction shall be attached with great importance, arrange personnel and equip with necessary instruments to monitor the sea water quality, the necessary measures shall be timely taken once the oil or sediment leakage exists.
- 5) Dredging equipment will be selected to minimise turbid plume formation, for example by ensuring that the type and size of the dredge head matches the characteristics of the suction pump;
- 6) The constructors shall strictly monitor the environment during construction; the contracts shall cover clauses on environmental protection which shall be strictly followed.
- 7) The channel dredging and rock-blasting will avoid the breeding season for fishery resources in late spring and early summer (April-June), try to shorten the construction period and reduce the negative impact on environment to a lowest extent.”
- 8) Operational procedures for dredging will be optimised to reduce the mobilisation and dispersion of suspended sediment. Such measures include:
 - a) The use of a backhoe dredge, which is known to reduce turbidity generation relative to other types of dredge; and
 - b) The operator will minimise spillage of material from the bucket into the surrounding water.
- 9) Operations will be conducted in favourable weather, tide, and current conditions to the extent practicable.

Monitoring

Vessel-based water quality monitoring will be conducted in proximity to the area to be dredged to verify the modelled water quality values and validate satellite imagery of the associated sediment plumes.

The vessel-based monitoring program for dredging operations will consist of:

- 1) A suitable survey vessel will traverse a transect line perpendicular to the direction of the visual plume at a distance of 250 m downstream of the dredging operation.
- 2) Water quality sampling sites will be at 100 m intervals along the transect, and extend at least 250 m beyond the edges of the visible plume. There will also be a sampling site 250 m upstream of the dredge site, located approximately on the longitudinal axis of the visual plume. The location of sampling sites may be varied due to safety and port operations constraints. Sampling transects located a greater distance downstream would be likely to interfere with port operations, given the expected prevailing north to northeast direction of the plume;

- 3) At each site, turbidity, temperature, conductivity, and depth will be measured at 1 m above the seabed, the mid-point of the water column, and 1 m below the surface with a submersible water quality instrument;
- 4) If feasible, measurements of PAR will be collected in conjunction with the turbidity measurements;
- 5) Instruments will be intercalibrated with all other instrumentation used in the water quality program;
- 6) Water samples (one per survey) will be collected at each of the three depths at the mid-point of the transect and analysed for Total Suspended Solids (TSS) concentration to verify the relationship between TSS and turbidity (and if possible, PAR); and
- 7) At the commencement of dredging operations, the vessel-based monitoring will be conducted once per day during daylight hours, subject to weather conditions. The frequency of monitoring will be reviewed in consultation with the ESS and MRG after at least two weeks of dredging operations.

Visual plume monitoring will be regularly undertaken by crew of the dredge and dump barges. Records of visual observations of turbidity plumes generated by dredging and disposal activities will include:

- Name of person recording the observations;
- Date, time, and location of observations (including GPS coordinates for observations at dump sites);
- Weather conditions (wind speed and direction, rainfall, visibility);
- Sea state (swell size and direction, tidal stage);
- Plume characteristics (water colour, direction of movement, estimate of distance of dissipation); and
- Additional comments (e.g. oil slicks, rubbish etc).

7.3 Rock Blasting

The research results documented in EIA and SEA indicate that it is feasible to use not bigger than 100kg explosive charge of single stage at a 450m safety distance to the closest net-cave cultivation. This safe operation can avoid the damage of underwater rock blasting to neighboring net-cage cultivation.

In relation to mitigation and control, all reasonable noise, vibration and blast emission mitigation measures will be implemented wherever be applied where reasonable and feasible, during dredging, drilling and blasting. A fundamental objective is to ensure that the best available technology and best management practices are used at the work sites in order to minimise the extent of adverse noise, vibration and blast emissions impacts.

Mitigation Measures

The environmental protection measures for rock-blasting are advanced based on the *Specification of Blasting Safety* (GB6722-2003) and the actual condition of the project.

- 1) ESE will review of detailed blasting design and the regulatory permit or approval processes before blasting operation, to confirm charge type, charge weight, shaped charges, using timing delays of large explosive charges, decking, stemming elements of the blasting design.
- 2) The dredging area and the rock blasting area are centralized. According to the construction method, rock blasting and rock clearing engineering shall be performed firstly and then dredging after rigid sweeping at a definite depth and acceptance;
- 3) The constructors shall strictly follow the *Specification for Blasting Security* (GB136722-86) and the *Blasting Technical Specification of Waterway Transportation Engineering*(JTJ286-90) to ensure the security of vessels and people. The millisecond delay blasting shall be applied, the maximum capacity of total explosive and explosive for each stretch (no more than 100kg) shall be strictly under control, the method of using explosive at low detonation speed shall be considered to reduce the impact from underwater shock on the marine creatures, the underwater blasting method (including the capacity of explosive for each stretch) shall be implemented after passing the safety assessment and can't be changed at will;
- 4) Before the underwater blasting, the constructive sectors shall report to local marine and fishery administration and handle with the procedures after wining the approval;
- 5) In the early stage of construction, the explosive in small capacity will be initiated within the kill radius so to increase the explosive capacity by times after the fishes get away from the blasting area, then decide whether to reduce the maximum capacity of explosive by monitoring the result of site blasting experiment;
- 6) When drilling, the noise produced by air compressor, drill rigs as well as the large-area splash has the function to drive the fishes away from the construction area, therefore, the blasting shall be implemented once the drilling is completed. If the air compressor, drill rigs stops running for a long time, it's recommended that before blasting, the air compressor, drill rigs be launched for 10 minutes to reach the aim of driving the fishes away from the blasting area;
- 7) The appropriate blasting plan shall be made based on the *Approval on EIR of the Meizhou Bay Navigation Channel Phase-III Engineering Project (Stage I)* ,“The channel dredging and rock-blasting shall avoid the breeding season for fishery resources in late spring and early summer, try to shorten the construction period and reduce the negative impact on environment to a lowest extent.”;
- 8) After blasting, blaster should earnestly examine as stipulated whether there is blind shot in the blasting area. Blind shot found or in doubt should be reported immediately and treated in time. For those unable to be treated in time, clear signals should be set up nearby with corresponding safety measures and the administrations shall be informed. The vessels are not allowed to pass, especially for LNG ships and liquid chemicals vessels. In case of blind shot for electric ignition, cutoff the power immediately and short-circuit the explosion

network in time. When dealing with blind shot, safety and guard work should be performed well and nonessentials must not enter the scene. After treatment, the explosion stack should be examined carefully with explosive remnant collected for disposal. Registration card should be filled out by the handler for specific circumstance;

- 9) Safety guarding program for explosion
 - a) The safety guarding scope for explosion is controlled to be 250m practically;
 - b) Navigation Notice shall be released through the maritime administrative agency before construction. Region explosion bulletin shall be set up in the land area;
 - c) At 6 hours before blasting, we shall give pre-notification to the surrounding entities. At 30 minutes before blasting, we shall give timing notification and clear the site within 250m around for the explosion;
 - d) Three inter-visible guarding sentries shall be established at a spacious place 250m outside the land area of the blasting area;
 - e) Three guard-ships shall be arranged within 300-1,500m sea area of the blasting area with clear megaphone aboard as flow guard to suppress underwater operation below 1,500m.
- 10) The post responsibility system shall be established during construction, the activities of large-size marine fishes within 2000m to the construction area shall be monitored, if these fishes emerge, the blasting must be canceled and the artificial acoustic wall is proposed to apply to drive them away from the blasting-influenced area to prevent the damage on them;
- 11) The post responsibility system shall be established during construction, the activities of large-size marine fishes near the construction site shall be monitored closely, before blasting, the person shall be specially assigned to monitor whether there are large-size fishes and notify to cancel blasting once found. When the large-size fishes wound, run aground during blasting, the blasting must be canceled and the emergency preplan shall be launched to notify the Quanzhou Ocean and Fishery Resources Bureau and call for the first aids;
- 12) The emergency preplan for large-size fishes rescue shall be made to carry out the timely rescue to wounded, stranded large marine creatures, the Xiamen Ambulance Depots of Submarine World under the Xiamen Ambulance Centre for Aquatic Wildlife, Fujian Province is designated as the emergency aids institution and staffed with marine biology experts, veterinarian, cat man, diver, logistical supporters as well as special stretcher, medicine, probe tube and fresh-keeping box, diving equipments and rescue pool etc.

Monitoring

To minimise the likelihood of adverse impacts on marine fauna, Exclusion Zones will be monitored for the presence of marine mammals, sea turtles and large schools of fish, as well as large flocks of seabirds and/or concentrations of jellyfish. Detonation will not occur if these animals are detected within the designated Exclusion Zone, until the animals move out of the exclusion zone of their own volition.

Visual monitoring task will be undertaken by ground observer, boat based observers.

- Ground Observers: Ground Observers will visually monitor the Exclusion Zone. The observer teams will maintain radio contact with the Blast Observer. All personnel involved in visual monitoring will receive specific training in the monitoring methods and procedures.
- Boat-based observers: Two teams of boat-based observers will also visually monitor the seaward portion of the exclusion zone. One team will be located 1,150 m from the works. The second team will be located at the seaward edge of the 2 km exclusion zone and will monitor both the Exclusion Zone and the surrounding area to provide warning of approaching animals. Like the Ground Observers, the Boat-Based Observers will maintain radio contact with the Blast Observer and receive specific training in methods and procedures defined in the procedures manual.

A procedures manual will be developed for pre-detonation visual surveys and will include:

- 1) provisions for structured sector-by-sector searches for prescribed time intervals
- 2) A prescribed elevation for the observer (at a minimum, standing in the boat)
- 3) Minimum visibility conditions
- 4) Prescribed intervals for alternating between searching with binoculars and the naked eye
- 5) Passive acoustic detection
- 6) Passive acoustic detection refers to the detection of marine mammals by listening for the sounds/calls that they make. If these sounds are getting louder with time, then the assumption can be made that these mammals are approaching the monitoring location. This means of detection is only meant to support visual detection methods and should not be considered the prime method of monitoring the safety zone.
- 7) The presence of marine mammals will be monitored by placing a hydrophone in the water at the outer rim of the safety zone (at 2 km) and at 1,150 metres from blasting site. The output of the hydrophone will be monitored aurally using a headset, and visually using a computer display of the acoustic frequency spectrum. The presence of marine mammals will be associated with their calls, and when picked up, this information will be relayed to the Blast Observer. If the marine mammal sounds continue and are getting louder, then the visual observers will be notified to be on the lookout. If the marine mammal sound level decreases, this indicates that the marine mammal is leaving the area and the visual lookouts will be notified accordingly.
- 8) All relevant personnel will be trained in the use of the equipment including familiarisation with the different possible sounds associated with marine mammals that frequent the area.
- 9) Proposed monitoring/mitigation program methodology
 - a) This section presents an indicative procedure to be followed during the monitoring/mitigation program at HPCT. The procedure will be refined in relation to the exact procedures developed in the monitoring procedures manual.

- b) All monitoring teams (Boat-Based Observers and Ground Observers) will report to the Monitoring Coordinator, who will be responsible for supervising and communicating visual and acoustic detections and to halt the blast detonation in the event that an animal is spotted within or approaching the Exclusion Zone. The blast countdown will not resume until the animal moves away from the area of its own volition. Marine mammals and sea turtles must not be herded away or harassed into leaving. If the animal is not sighted a second time, the event will not resume until half an hour after the sighting.

Pre-blast monitoring

The monitoring procedure will be executed as follows:

- Monitoring will be undertaken during daylight hours and in conditions where visibility is adequate to monitor the Exclusion Zone.
- Half an hour prior to the blasting (following the cessation of blasthole drilling), monitoring of the Exclusion Zone and surrounding area will commence. The visual and acoustic monitoring teams will combine to monitor the Exclusion Zone. The Monitoring Coordinator will enter all visual and acoustic marine fauna detection/monitoring information, including species, numbers of individuals, time and location of detection and behaviour, into a marine animal tracking and detection database.
- Go/No-Go Decision Process: the Monitoring Coordinator will have the authority to declare the range fouled and recommend a hold until monitoring indicates that the Exclusion Zone is and will remain clear of detectable animals. The fire mission will be postponed if any marine mammal, sea turtle, large school of fish, large flock of seabirds, or concentration of jellyfish is visually or acoustically detected within or approaching the designated Exclusion Zone (2 km for cetaceans and 1,150 m for dugongs, turtles and large schools of fish). The delay will continue until the animal(s) that caused the postponement are confirmed to have moved outside the Exclusion Zone or until at least 30 minutes after the last sighting within the relevant Exclusion Zone.

Post-blast monitoring

Post-blast monitoring is designed to determine the effectiveness of the pre-blast mitigation by reporting any sightings of dead or injured marine species. Post-detonation monitoring will commence immediately after each blast. Boat-based and ground-based visual monitoring is intended to be utilised for post-blast monitoring. If any animals are observed or detected in the Exclusion Zone during the post-blasting monitoring, the location, number, species and behaviour will be recorded.

7.4 Mitigation Measures for Operation Vessels

- 1) The Management Methods of Treating Vessels Pollutions on Marine Environment (take effect since the Mar.1, 2010) shall be followed, at the request of maritime administrations, the oil-contained sewage in bilge of construction vessel shall be collected to

store in the sewage cabin and disposed by qualified sectors. The construction vessels management shall be strengthened to prevent oil leakage accident;

- 2) Solid waste from construction vessel or facilities maintenance shall not be dumped into sea at will, the vessels shall be equipped with sewage recycling bin and records for waste reception, the recycling shall be managed by qualified waste-treatment ships;
- 3) Dredging and rock-blasting of this project last a long time, many vessels for construction results in the occupying the resources of channel will bring certain impact on vessel sailing, the construction vessels shall abide by the Maritime Traffic Safety Law of the P.R.C. and the International Regulations for Preventing Collisions at Sea and the navigation requirement of local maritime affairs administration;
- 4) The following effective measures shall be taken to prevent the occurrence of vessel risks and accidents and ensure the navigation safety, which include:
 - The navigation notice shall be released before construction, the irrelevant vessels are prohibited to enter the operation waters;
 - Equip necessary telecommunications facilities and formulate emergency plan, when the construction vessels encounter emergencies, the necessary measures shall be taken and reported to marine transport administration centre;
 - During construction, all the constructive vessels shall display signals based on MOT's signals regulations;
 - Arrange staffs to keep on duty on the constructive vessels, the operators shall strictly follow the operation procedures;
 - When dredging is carried out, the contact with local weather prediction sectors shall be strengthened. The dredging shall be canceled at once under bad atmosphere to avoid the occurrence of vessel accidents;
 - The construction vessels shall strictly abide by the *International Regulations for Preventing Collisions at Sea*, through the contact with local marine affairs bureau, marine administration, timely understand the inward and outward vessels in the same day and take corresponding anti-collision measures to avoid the occurrence of vessel accidents;
 - The constructors can carry out reef-blasting in Putou channel within the prescriptive period after winning the approval from the LNG administration.

7.5 Ocean Disposal of Dredged Material

- 1) The marine dumping permission will be applied from the State Ocean Administration of P.R.C. following the *Marine Dumping Management Methods of P.R.C.* and the *Marine Dumping Implementation Methods*, the dumping can be implemented after obtaining the permission;
- 2) The center coordinate of the Meizhou Bay Marine Dumping Area of Dredged Materials is 119° 04' 48"E24° 52' 33"N, the radius is 0.5 n.m., the dumping is permitted only within the radius and the dumping beyond the radius is forbidden;
- 3) The course of dumping will be monitored by administration of ocean and maritime affairs to make sure the dumping place, quantity and use meet the designated

requirement. According to the *Report of Selecting the Meizhou Bay Marine Dumping Area of Dredged Materials*, the annual total dumping quantity for this area is controlled within the 4 million m³, the maximum daily dumping quantity is 22,680 m³;

4) The dredging shall avoid the breeding season (April -June) for fishery resources at the request of the official reply from the Fujian Provincial Department of Ocean and Fishery Resources;

5) The dumping shall be implemented during the ebb tide, which is beneficial for the suspended sediment to disperse outwards.

7.6 Mitigation Measures for Backfilling

1) Dredged material can only be disposed of in the designated backfilling area where cofferdam enclosure has been built. The backfilling can only be implemented after the cofferdam and filter layer is established, see the figure 4 for analogical backfill area;

2) Dredging operation with the self-propelled bow-blowing TSHD whose transfer blowing pump blows silt to backfill area by hydraulic filling;

3) The hydraulic fill area shall be appropriately planned to make sure the sediment have the enough sedimentation time inside the cofferdam then make the suspended sediments settling to reduce the concentration of sediments discharged from overflow port.

4) Control the elevation and side slope of the backfill region strictly to prevent spill



8. EMERGENCY RESPONSE PLAN

8.1 Emergency Response Plans

A major risk of Meizhou Bay during operation stage is identified as potential oil spill. A Risk Assessment and Emergency Response plan has been developed in the EIA study process. In conclusion, Meizhou Bay area has established a three-tier (national/regional, district and corporate) vessel oil spill emergency system, thus laying a solid foundation for ensuring the navigation safety of incoming and outgoing vessels, avoiding vessel pollution accidents and facilitating the emergency recovery in case of abrupt accidents. On the basis of water area risk evaluation and supervision landscape study, the Meizhou Bay Harbor Administration Bureau will integrate the emergency resources of entire Meizhou Bay, develop the oil spill emergency plan for the entire bay, and achieve integrated maritime supervision of Meizhou Bay Port, so as to further enhance the oil spill emergency response capacity.

There are well elaborated emergency response regulations and procedures for the region and specifically for the Meizhou Bay area, including:

- National-level: *Emergency Plan of China against Oil Spills from Ships at Sea and Oil Spill Emergency Plan for Taiwan Strait (March 2003)*.
- Provincial-level: *Emergency Plan against Ship Pollution in the Sea Areas of Fujian (August 2010)*, by Fujian Provincial Government.
- Municipal-level: In 2007, Quanzhou developed and implemented the *Emergency Plan for Oil Spills in the Sea Areas of Quanzhou*; Putian also developed and implemented the *Emergency Plan against Oil Spills in the Sea Areas of Putian*.
- County-level: In September 2006, Quangan District People's Government of Quanzhou City approved and promulgated the *Emergency Plan against Oil Spills in the Sea Areas of Quangan*.
- Corporate-level: All dock-based enterprises at Meizhou Bay have developed their own emergency preparedness and response plans against oil spills.

8.2 Emergency Response Capacity

Fujian Marine Safety Administration established Meizhou Bay Comprehensive Administration Patrol Brigade in January 2005. Upon its establishment, Meizhou Bay Comprehensive Administration Patrol Brigade has integrated various maritime administration resources and basically achieved the goal of "5 Centralization" in the sea area of Meizhou Bay (namely centralized navigation environment management, centralized vessel traffic order maintenance and dynamic supervision, centralized use of administration resources, centralized administration criteria and standards, and centralized emergency treatment of vessel pollution accidents and risks). This significantly enhanced the maritime administration strength in the sea area of Meizhou Bay, effectively advanced the supervision efficiency and administration level of Fujian MSA with regard to key water areas and key vessels, effectively safeguarded the navigation safety of incoming and outgoing vessels, avoided water pollution caused by vessels, and made positive contributions to the thriving development Strait West Economic Zone

Under the Meizhou Bay Comprehensive Administration Patrol Brigade, Quanzhou Maritime Patrol Base of Fujian Maritime Safety Administration has been constructed on the south side of

the traffic quay of Fengwei Island, and supporting facilities and Vessel Oil Spill Emergency Equipment Warehouse are also provided. Quanzhou Maritime Patrol Base was put into operation in July 2011. To strengthen the emergency response capacity in Meizhou Bay, Meizhou Bay Comprehensive Administration Patrol Brigade has invested RMB 110 million to build three key capacities, namely Meizhou Bay Vessel Traffic System, Quanzhou Maritime Patrol Base of Fujian Maritime Safety Administration and Taiwan Strait Vessel Oil Spill Emergency Equipment Warehouse.

8.3 Spill Prevention Measures

During construction, the construction vessel will occupy the navigation channel and interfere with the navigation of incoming and outgoing vessels. Therefore, the contractor and the construction vessels must properly organize construction works according to the situations of vessels, earnestly follow the *Maritime Traffic Safety Law of the People's Republic of China*, and abide by the *International Regulations for Preventing Collision at Sea 1972 (1989 Rev.)*, local port regulations and other navigations rules. Major measures include:

- 1) During operation, the construction vessels shall hang cresset and signal, which must comply with relevant state rules.
- 2) Before construction, the construction vessels must consult with the maritime safety authority and the dispatching department of port authority with respect to the mutual interference between construction vessels and navigation vessels, so as to develop a proper avoidance plan which will be released by the port navigation supervision department.
- 3) The maritime safety administration must strengthen the monitoring and management of incoming and outgoing vessels, continuously monitor the position and status of vessels, timely identify problems and take precautionary measures, so as to reduce accident potential and provide favorable conditions for the safe navigation of vessels.
- 4) Incoming and outgoing vessels must submit to the coordination, supervision and administration of maritime safety department and port administration department. The port will be equipped with necessary staff and maritime safety support facilities to provide safety and supervision services such as marine communication, marine navigation, piloting, navigational aid, beacon guidance, warning, meteorological/oceanic forecast and etc.
- 5) The dock berthing and anchorage anchoring system shall be implemented. This shall include anchorage application, anchoring density (spacing), navigation speed for entering/exiting the anchorage, and the observation system under various weather conditions, so as to avoid the clubbing, collision, squeezing, grounding, and stranding of vessels at the anchorage.
- 6) The deck officer shall be qualified. According to the Regulations of the People's Republic of China respond on Administration of Prevention and Control of Pollution to the Marine Environment by Vessels (2010), the port shall impose rigid written management requirements on vessels and crew, and stipulate their responsibilities and obligations to prevent oil spills of vessels, while measures related to pollution prevention as stipulated therein shall be implemented. The crew shall study and understand the human factors and natural factors of potential oil spill accidents, and enhance their understanding of oil spill impacts and the consciousness of safe transportation.

8.4 Oil Spill Response Measures

Training on emergency reporting procedures must be provided to contractors and Environmental

Supervision Engineer. Upon oil spill accidents, contractors and ESE shall immediately contact the MBHAB and the emergency response team which will implement mitigation measures according to the emergency response plans. Main oil spill response measures include:

1) Deployment of oil containment booms

The method of oil spill recovery with oil containment booms involves the operating ship and two towing ships. The steps are shown below:

- a) Deploy the operating ships at one end of the oil polluted water area and deploy the towing ship at the other end of oil polluted water area. Prepare for towing the oil containment booms and pump oil slicks.
- b) Two towing ships tow the oil containment booms from one end of the oil polluted water area to the operating ship at the other end. In the meantime, activate the skimmers on the operating ship.
- c) When the both ends of oil containment booms pass the telescopic guide arm mounted to the operating ship, use the guiding device to guide the oil booms and pull the inner side of oil booms to the sealing brush of guide arm.
- d) The towing ships continue towing at the set speed and gradually narrow the containment area until reaching the predetermined minimal value.
- e) Upon completion of oil recovery, the guide arm will release the oil booms and the skimmers will stop operation.

2) Oil spill recovery and clean-up

By containing the oil spills with the oil booms, the recovery and clean-up devices will then be applied to quickly recover the oil, or the dispersant will be used to clean up oil spills (or through biological degradation), so as to prevent other areas from being polluted.

Currently, recovery and clean-up facilities applied in China include: skimmers for recovering various oil products, oil recovery net, submersible pump, absorbent, oil spill recovery vessel and etc.

9. MARINE ECOLOGY AND HABITAT OFFSET PLAN

9.1 Ecological Resource Loss

The main construction activities include dredging/rock blasting, transportation and disposal of dredged materials at two backfill areas and the Meizhou Bay Marine Waste-dumping Site. Based on the environmental impacts scoping and screening, the key impacts on marine ecology during construction stage include:

- (1) Dredging will damage the benthic organisms at the dredged section;
- (2) Dredging will cause turbidity of sea water which will have impact on marine life;
- (3) Rock blasting wave will have negative impacts on marine life;
- (4) Backfilling the dredged materials (land reclamation) at Xiaocuo and Putou Backfill Area will cause loss of coastal wetland, and its ecosystem service function for aquaculture cultivation.
- (5) Ocean dumping of dredged materials will have impacts on benthic organisms and water quality.

These impacts have been thoroughly assessed in this EIA. In summary, the project will result in permanent loss of around 400 ha inter-tidal zone along that are considered as habitats, and related benthonic and marine life. To mitigate such impacts, the project has developed two ecological compensation and rehabilitation programs:

- Fisheries Compensation Program
- Natural Habitat Offset Program – Mangrove Management Plan

9.2 Fisheries Resources Compensation Program – Fish Breeding and Releasing Plan

Fish resource compensation to be implemented through reproduction and releasing seed of various chosen marine species, i.e. yellow fin bream, plectorhynchus, black porgy, *Epinephelus coioides*, long-haired shrimp *Marsupenaeus japonicus*, etc. These species are Meizhou bay typical local wild indigenous economic species. The sub-generation and second sub-generation seed to be released over 2012 and 2020.

The program is led by Fujian Provincial Oceanic and Fishery Department and composed of coordination group with members from:

- Fujian Province Department of Transportation,
- Meizhou Bay Harbor Administration Bureau, and
- Fujian Provincial Fisheries Research Institute

Fisheries Research Institute of Fujian Province is contracted to implement the program, including:

- Background investigation prior to program implementation,
- Fingerling reproduction and release, and
- Monitoring and reporting

Monitoring will be carried out by the Fujian Provincial Oceanic and Fishery Department, Transportation Department of Fujian Province and Fujian Province, MBAHB. They will provide on-site supervision to ensure program specifications are met and comply with the relevant regulations and norms.

Release schedule is shown in the Table below.

Table 13 Fish Reproduction and Release Specifications

Species	Release season	Body size (Cm)	Number of release (1000)	Price (\$ / Tail)	Seed fee (Million)
Sparus latus	April-June	3-5	170	0.40	68
Plectorhynchus	May-July	4-5	120	0.55	66
Black Snapper	April-May	4-5	140	0.50	70
Coioides	June-July	3	10	4.60	46
Long-haired Fenneropenaeus chinensis	June-July	0.8	10000	0.50×10^{-2}	50
Marsupenaeus japonicus	June	0.8	10000	0.50×10^{-2}	50
Total			20440	-	350

Although the program could be altered based on planned investigations, program specifications for fish species are presently as follows:

- yellow fin bream average body length 3-5cm,
- pepper snapper average body length of 4-5cm,
- black sea bream
- average body length of 4-5cm,
- oblique band grouper average body length of 3 cm,
- long hair shrimp average body length 0.8 cm,
- Japanese capsule shrimp average body length 0.8 cm,

The project implementation period is 2013-2020;

- 2013 for the brood stock,
- 2014, 2016, 2018 and 2020 regular annual reproduction and releasing of yellow fin snapper, Plectorhynchus and black sea bream fingerlings 1.48 million;
- 2015, 2017 and 2019 regular annual proliferation discharge of E. coioides, long hair shrimp and Marsupenaeus japonicus seedlings 94.05 million

Before program implementation a confirmatory background investigation of the sea fisheries resources will be carried out from April-July 2013. A follow-up investigation and monitoring program from 2014-2020 will be undertaken to assess the effectiveness of the program.

Table 14 Fish Reproduction and Release Schedule

Species	Yearly reproduction and release (unit =10,000)						
	2014	2015	2016	2017	2018	2019	2020
Sparus latus	50	-	40	-	40	-	40
Plectorhynchus	30	-	30	-	30	-	30
Black Snapper	35	-	35	-	35	-	35
Coioides	-	4	-	3	-	3	-
Long-haired Fenneropenaeus chinensis	-	4000	-	3000	-	3000	-
Marsupenaeus japonicus	-	4000	-	3000	-	3000	-
Total	115	8004	105	6003	105	6003	105

Program Funding is provided by MBHAB and funds released as outlined in the Table below. Program costs from 2013-2020 are estimated at 700 million RMB.

Table 15 Reproduction and Release Funding

Years	Seed fee	Seed quarantine /testing	Seed acceptance Cost	Background investigation and monitoring	Impact assessment	Other costs
2013	-	-	-	20	-	5
2014	50	4	5	10	-	6
2015	50	4	5	10	-	6
2016	50	4	5	10	-	6
2017	50	4	5	10	-	6
2018	50	4	5	10	-	6
2019	50	4	5	10	-	6
2020	50	4	5	-	20	6
Total	350	28	35	80	20	47

Program Schedule is planned as follows but will adapt to Project schedules as required:

Table 16 Reproduction and Release Implementation Schedule

June-December 2012	carry out early all the preparatory work and coordination,
January-December 2013	larval rearing commission contract for yellow fin sea bream black sea bream fingerlings
January-December 2014	larval rearing commission contract for E. coioides, long-haired shrimp Marsupenaeus japonicus seed artificial captive breeding.
2014, 2016, 2018, 2020:	release from quarantine into sea areas
2015, 2017, June-July 2019	release from quarantine into sea areas
January 2014 to September 2019	post-release follow-up survey
October-December 2020	project technical reports and report on the work

9.3 Habitat Offset Program – Mangroves Restoration

Based on Integrated Coastal Management approach, Quanzhou Bay, with valuable mangrove habitat yet facing significant threat of habitat loss due to invasive species, offers a feasible option for habitat offset program under the Project. The choice of Mangrove Habitats as compensation was taken as these habitats provide the highest potential for compensatory programs. The

refurbishment of the existing mangrove areas lost to the invasive grass *Spartina* on Quanzhou Bay was the best available solution within an Integrated Coastal Management approach.

A mangroves rehabilitation plan has been proposed. The program intends to plant mangrove in Luoyang Jiang mangrove in Quanzhou Bay Estuary Wetland Nature Reserve. The program contemplates that the mangrove planting area will be located in the wetland protection area district in Quanzhou Bay Estuary Wetland Reserve Luojiang Mangroves Protection Zone (Wan'an Area). The site was selected through consultation with provincial and local department of fishery and ocean.

This program implementation period is 2014-2016. The mangroves plantation activity will be undertaken combined with the planting of mangrove management, maintenance. MBHAB is responsible for fund provision and overall mangrove planting in collaboration with the local authorities.

The details with respects to the region for planting, the budgeting, and implementation and administration agreement are being planned pending technical input from MBHAB. MBHAB will provide technical details to support the following activities.

- details the management measures that are implemented to mitigate the potential impacts to mangroves;
- detail on the area to be planted;
- details on technical aspects of Mangrove reestablishment to support existing data and methods; and
- monitoring programs for the duration of planting and maintenance.

The science supporting such a compensatory program is not immediately available. This lack of supporting data could lead to an inappropriate or ineffective compensatory program. Therefore MBHAB has developed a ToR to qualified individuals or institutions to carry out a study with the purpose of focusing the Mangrove Planting Program to achieve the correct compensatory results and be sustainable. The work is envisioned to enhance a Mangrove reestablishment program underway in Quanzhou Bay Estuary Wetland Nature Reserve.

Box 2 Terms of Reference for Natural Habitats Offset

**For
A Program to Compensate for Natural Habitat Loss in Meizhou Bay**

The task outlined below are intended to be developed and detailed with the focus of comparing intertidal habitat loss in Meizhou Bay from backfilling and land reclamation

Task 1 – Evaluation of Intertidal Habitats in Meizhou Bay

The intertidal habitats found at the proposed land reclamation sites in Meizhou Bay (Putou and Xiaocuo) are typical for inner harbour areas; one closer to a small estuary than the other. A detailed evaluation of the habitat quality and productivity of these habitat types is required to understand what reasonable compensatory actions should be taken.

Task 2 – Evaluation of the Quanzhou Bay mangrove areas

Quanzhou Bay has a large wetland conservation area that has been recognized for Mangrove reestablishment. An evaluation of the habitat quality and productivity of this habitat type is required to understand what area of Mangrove reestablishment is necessary to achieve a sustainable Mangrove habitat. This should include a review of the entire areas to determine which has the most opportunity to achieve the goals of sustainable natural habitat restoration. This should include Mangrove mapping in Meizhou and Quanzhou Bay areas

Task 3 – Review of Local Government and Institutional Management

As this program is being funded by MBHAB there is a necessity to clearly understand the lines of authority for efficiently achieving habitat compensation. The local authorities in Quanzhou Bay need to be consulted and included in the effort to avoid jurisdictional issues and achieve the highest effect from the capital investment. A complete project regulatory and management structure is required prior to the program being initiated.

Task 4- Removal of Invasive Species

The Quanzhou Bay wetland area has been changed by the invasive plant *Spartina*. The program evaluation must review and discuss the reasons for *Spartina* and how these effects can be lessened to ensure Mangrove replanting success.

Task 4- Pollution Inputs

Quanzhou Bay is heavily populated and research shows that it is increasingly affected by urban pollution sources. The types and sources of pollutants and the effect on Mangrove success needs to be understood. Programs to limit pollutant runoff into the Bay need to be outlined.

This information should then be used to determine the Mangrove planting areas which have the most likelihood of long-term success.

Task 5 – Integrated Planting Strategy

Quanzhou Bay local authorities have been funded to re-establish some Mangroves already. While limited this funding could be linked with the Meizhou Bay capital to increase the effectiveness of the programs with result of increasing habitat restoration areas.

Task 5 – Planting Program

A program based on the above task outputs should be developed for presentation to the MBHAB including detailed budgets for root stock, Spartina removal (if required), site preparation, planting and protection.

Task 6 – Management Program

Compensatory habitat development often does not succeed due to lack of management and protection during early stages of development. Based on the successful reestablishment already occurring in Quanzhou Bay a management plan to achieve the same or better success needs to be outlined. Management planning should outline how adaptive the planting program elements will be to support success and avoid failure.

Mangrove health surveys will be undertaken in an effort to ensure program success. The program will be described in the detailed plans and schedules.

Task 7 – Monitoring Reporting

The compensatory program requires a detailed monitoring and reporting plan in order for the MBHAB PMO to track the use of funds and success of the program. Monitoring and reporting will form the backbone of an adaptive management strategy.

Aerial photography and/or field surveys will be used to map the distribution and coverage of mangrove vegetation and other wetland associations situated near the planting footprint. Aerial photography will be ortho-rectified to allow for determination of mangrove cover. Mangrove mapping will be undertaken:

- prior to the commencement of the project to provide current information on mangrove distribution;
- at project milestones including the completion of Spartina clearing activities within the infrastructure corridor; and
- on completion of the project

10. COMMUNICATION AND STAKEHOLDER ENGAGEMENT

10.1 Public Participation

Public participation has been extensively conducted during the preparation of Environmental Impact Assessment (EIA) and Resettlement Action Plan (EIA), through which, public concerns have been incorporated into the EIA/EMP and RAP.

For the purpose of minimizing impacts, communication with project affected people will continue throughout the project. The aim of the communications is to provide a two-way information channel through which project progress and implementation of EMP can be introduced to the affected community, and communities' feedback on ongoing project impacts can be timely communicated to the contractor and MBHAB.

Contractors are required to disclose information about project contents, key environmental issues and mitigation measures, compliant receiving person contact at project construction site. Regular consultation meetings with project affected communities (aquaculture farmers) must be organized during the dredging/blasting and disposal operation period, at least quarterly.

A grievance mechanism is also established under the Resettlement Action Plan to address the public concerns about the land acquisition and livelihood compensation issues.

10.2 Stakeholder Dialogue Mechanism

A stakeholder dialogue mechanism will be established during the project operation stage. The dialogue mechanism provides a forum to monitor and evaluate the regional development activities, change of marine and terrestrial ecological environmental status and social development progress in the Meizhou Bay area. The key purpose of such a dialogue mechanism is to keep all the relevant agencies and public informed about the regional development and cumulative environmental and social impacts.

MBHAB will be responsible for organizing stakeholder dialogue meeting on a yearly basis. Stakeholders invited include (but not limited to) Fujian Province Ocean and Fishery Department (FPOFD), Fujian Province Environmental Protection Department (FPEPD), ocean fishery agencies in Quanzhou and Putian, environmental protection bureaus from Quanzhou and Putian, local Development and Reform Commission, local marine affair agencies, district governments, representatives from key industrial enterprises around the Meizhou Bay area, Meizhou Island Nature Reserve Authority, and representatives from local communities and aquaculture business communities.

Environmental and marine ecological monitoring data in Meizhou Bay during the project operation will be fully shared among the stakeholders. The key findings and recommendations from the meeting will be formally communicated to relevant governments for necessary follow-up actions to ensure a sustainable development of Meizhou Bay, with integration and harmonization of socio-economic development and ecological functions maintenance.

11. ENVIRONMENTAL TRAINING PLAN

The proponent MBHAM shall ensure that all staff is adequately trained prior to undertaking any activities associated with the Meizhou Bay project. The training will be provided to environmental management staff of MBHAB, Environmental Supervision Engineer and contractors.

Training to MBHAB staffs and ESE

The aim of training to ESE and staffs from MBHAB is to strengthen the environmental management during construction and operation period and ensure the effectiveness of environmental management so as to improve the overall project quality. Through the training, the ESE and environmental management staff can identify the main environmental problems and defects in environmental management, and cause the contractor so take necessary preventive measures ASAP. During construction, the MBHAB will invite the environment consultants with similar experience (environment specialist or environmental institution) to carry out site training to potential problems and corresponding solutions.

Training to Contractors

Before commencement, the environmental staffs and workers of the winning bidder shall receive the systematic environmental knowledge training provided by ESE and MBAHB environmental management team, to avoid bringing environmental damages due to operation errors. The training to environmental staffs of contractors is to specify the environmental management liability of constructors, the training to workers is to address the correct operation method during construction to reduce or avoid unnecessary damage. Through training, the contractors shall be aware of environmental protection liability undertaken and result possibly caused by environmental damage, the workers can get a clear view of protection method and degree of environment-sensitive points, the training to workers shall last one week based on actual condition.

The training plan with budget estimation is developed in Table 17.

Table 17 Environmental Protection Training Plan

No.	Trainee	Content	Organizer	Participants	Duration	Place	Budget (RMB)
1	EP Staffs from MBHAB, ESE	<ul style="list-style-type: none"> - Learn Environmental protection and management knowledge - EMP measures 	MBHAB, IEC	3	5 days	Quanzhou	10,000
2	EP Staffs from MBHAB	<ul style="list-style-type: none"> - Study tour to visit similar channel projects focusing on environmental protection 	MBHAB, IEC	3	5 days	Quanzhou	50,000
3	ESE	<ul style="list-style-type: none"> - Relevant regulations - EMP requirement - Emergency Plan 	MBHAB, IEC	10	10 days	Quanzhou	20,000
4	Main technical chief and construction chief from contractors	<ul style="list-style-type: none"> - Relevant regulations - EMP requirement - Emergency Plan 	MBAHB, IEC	30	10 days	Quanzhou	20,000
5	Construction Vessel and operation workers	<ul style="list-style-type: none"> - Relevant regulations - EMP requirement - Emergency Plan 	Contractors, IEC	20	3 days	Quanzhou	20,000
Total							120,000

12. EMP BUDGET

The EMP implementation during construction and operation has been budgeted as is shown in Table 18 and Table 19. The total environmental investment includes the environmental mitigation measures, monitoring and engineering management for environmental protection and main works as well as the investment of alleviating or eliminating the negative impacts on environment. It should be noted that many mitigation measures are of management practice nature whose budget are all inclusive in the overall contract, and may not be practically specified.

Table 18 Budget for Environmental Measures During Construction Period

No.	Measures	Investment (RMB 10,000)	Note
1	Ocean Dumping Fee	500	Dredged material from the main channel outer bay section dredging (section in the south of Jianyu anchorage zone) will be dumped at the “Meizhou Bay Marine Waste-Dumping Site”. Per domestic regulation, the marine authority charges the dumping fee for environmental monitoring, protection and ecological compensation.
2	Backfill area discharge control	400	Including filter layer and other protection measures.
3	Waste management for construction ships	120	Wastes to be collected and treated by specialized waste management company.
4	Compensation for Aquaculture Farm Relocation	1000	/
5	Ecological Compensation	1980.4	For the Fish Reproduction and Release Program and Habitats Rehabilitation Program
6	Environmental Management, Risk Prevention and Follow-up Monitoring	150	/
	Total	4150.4	

Table 19 Budget for Environmental Measures During Operation Period

No.	Measures	Investment (RMB 10,000)	Note
1	Disposal of Maintenance Dredged Material	60	In case needed
2	Maintenance ship wastes treatment	15	/
3	Ecological compensation	20	/
4	Environmental Management and Follow-up Monitoring	25	/
	Total	120	/

