

**Government of Kerala
Harbour Engineering Department**

**CONSTRUCTION OF BREAKWATER AT VELI IN
AAKULM SIDE, THIRUVANANTHAPURAM,
KERALA**

FINAL REPORT

SUMMARY RAPID ENVIRONMENTAL IMPACT ASSESSMENT

■ OCTOBER 2010

PREPARED BY

L & M ASSOCIATES, THIRUVANANTHAPURAM

COPYRIGHT: The concepts and information contained in this document are the property of Government of Kerala and Harbour Engineering Department. Use or copying of this document in whole or in part without the written permission of either Government of Kerala or Harbour Engineering Department constitutes an infringement of copyright.

A. Introduction

Thiruvananthapuram receives a very high average annual rainfall of over 1,800 mm. The city has undulating topography with ground level rising from the MSL up to 75 m. Undulated topography, porous soil and presence of watercourses facilitate natural drainage of storm water in the city. Two major rivers, viz Karamana and Killiar along with some small streams flow through the city area. The city has a large network of storm water canals and drains. However, most of the storm water drains and canals in the city carry semi-treated and untreated sewage and have been depositories for solid waste. Recurrent flood caused by improper drainage system is one of the major perpetual problems faced by Thiruvananthapuram city. Though the Government and the City Corporation had undertaken several initiatives to solve the issue, the problem remains unresolved, causing severe environmental issues affecting the health of the people. Even now, an abrupt rain of high intensity will disrupt the city life considerably. Deterioration of water quality as well as the problems associated with stagnation and water pollution are being faced by the city. Improper maintenance of the existing drainage network together with excessive run off from developed areas is the root cause of flooding in the city.

In order to find a solution to this issue, the Government of Kerala and the Thiruvnananthapuram Municipal Corporation had conducted various studies and formulated a comprehensive project to be implemented through Jawaharlal Nehru National Urban Renewable Mission (JNNURM) and Asian Development Bank (ADB) funded Kerala Sustainable Urban Development Project (KSUDP). The project includes:

- Improvements to Aamayizhanjan Thodu;
- Improvements to Pazhavangadi Thodu;
- Improvements of Roadside Drains in Thampanoor;
- Improvements of Roadside Drains in East Fort/Pazhavangadi;
- Construction of a pair of Breakwaters at Veli mouth; and
- Rainwater Harvesting.

Under these projects, the city drainage system will be de-silted, protection to the sidewalls and improvements to the culverts and bridges over the canals upto the outfall into Akulam Lake. The annual sand bar formation at the Veli mouth is obstructing the flow of storm water into the sea and the stagnation of water in the lake. The present project "Construction of Breakwaters at Veli" is one part of the Project to eliminate the formation of sand bar effectively.

B. Description of the Project

The proposed project activities are defined to construct the breakwaters at Veli with two training walls at a spacing of 130 m apart and having a length of 220 m to prevent the formation of sandbar at the river mouth and keep the river mouth open throughout

ensuring continuous discharge of water from the Lake into the sea. The layout of the proposed Breakwaters is shown in Fig 1.

C. Environmental Assessment Requirements of the Project

The Scope of the project is limited to the construction of breakwaters in the sea. No wastewater is generated due to the activities of the project and hence the Water (Prevention and Control of Pollution) Act is not applicable to the Project. The project does not emit any air pollutants into the atmosphere and hence the Air (Prevention and Control of Pollution) Act 1981 is not applicable. The construction activities require large quantity of blasted granite stones. No new quarry will be opened exclusively for supplying the granite stone to the Project. The granite stone required for the project will be sourced from quarries having valid statutory clearances.

The Environment Impact Assessment Notification, 1994 under the Environment (Protection) Act 1986 requires projects specified in the notification to obtain environmental clearance from Ministry of Environment and Forests, Government of India. This Notification is now superseded by the Notification dated 14th September, 2006 and provides a detailed and comprehensive framework for environmental clearance, requiring that Environmental Impact Assessments (EIA) be conducted for new development projects. Construction of breakwaters was not an item included in the schedule attached to the EIA Notification. Certain amendments were made to the EIA Notification on December 1, 2009 including beak waters and dredging under item No.7 (e) of the schedule attached to the Notification. Thus the project will now come under the preview of the EIA Notification. The project was conceived and approached State Pollution Control Board for approval prior to the date of notification of the amendments.

Restrictions were imposed on developmental activities on coastal areas by introducing the Coastal Regulation Zone (CRZ) Notification in 1991 under the authority of the Environment (Protection) Act, 1986. While prohibiting certain developmental activities within the coastal regulation zone, the notification specifies certain activities that can be taken up in the regulation zones. Activities connected with the construction of breakwater for prevention of sandbars is a permitted activity under the Coastal Zone Management Notification. The project site falls within the regulated zone and hence the approval from the Coastal Zone Management Authority (CZMA) has to be obtained as per the notification. Implementing Agency had already applied for approval under the Coastal Regulation Zone Notification. The application was considered by the State Coastal Zone Management Authority and forwarded to the Ministry of Environment and Forest, New Delhi for issuing final approval.

Fig 2.1: Layout of Proposed Breakwater

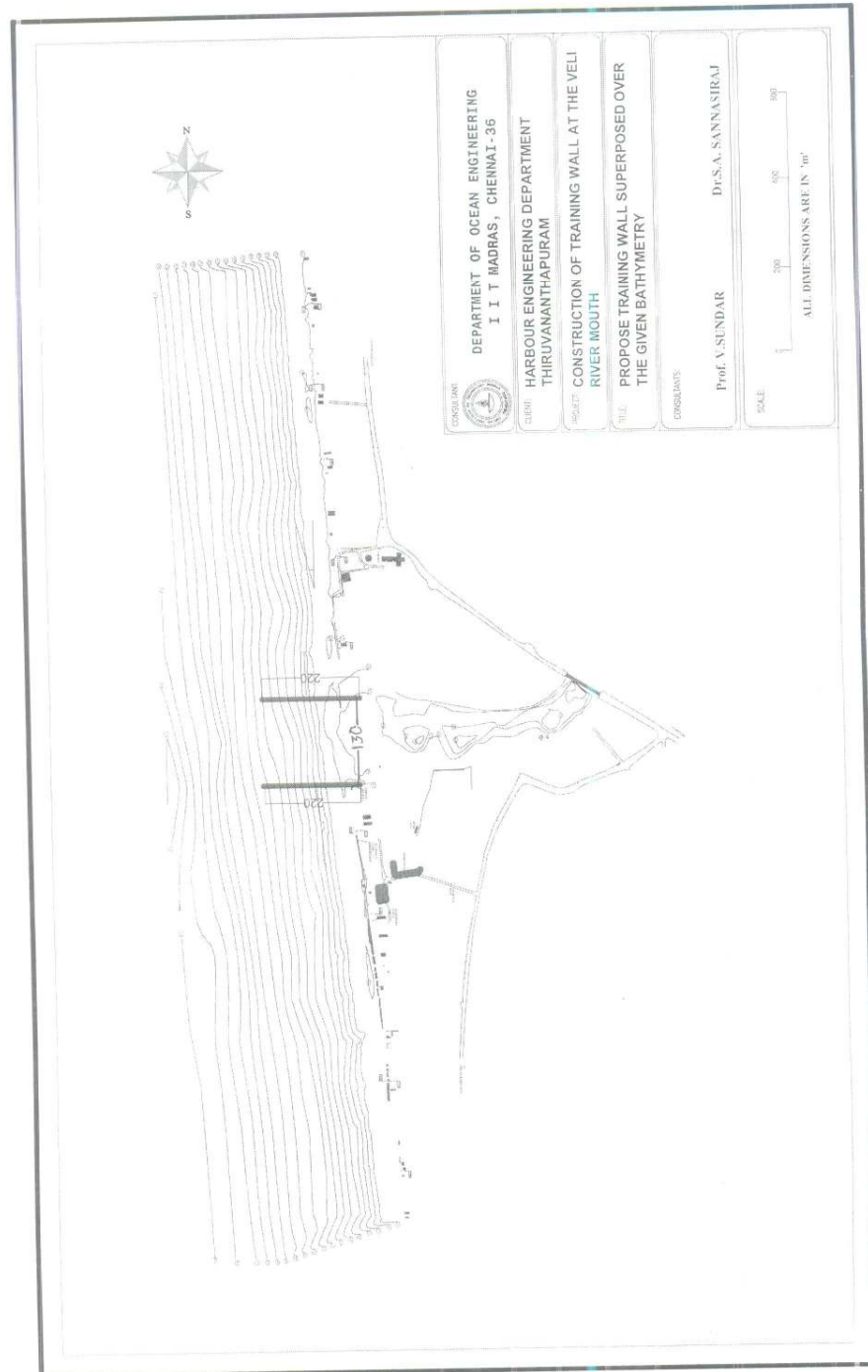
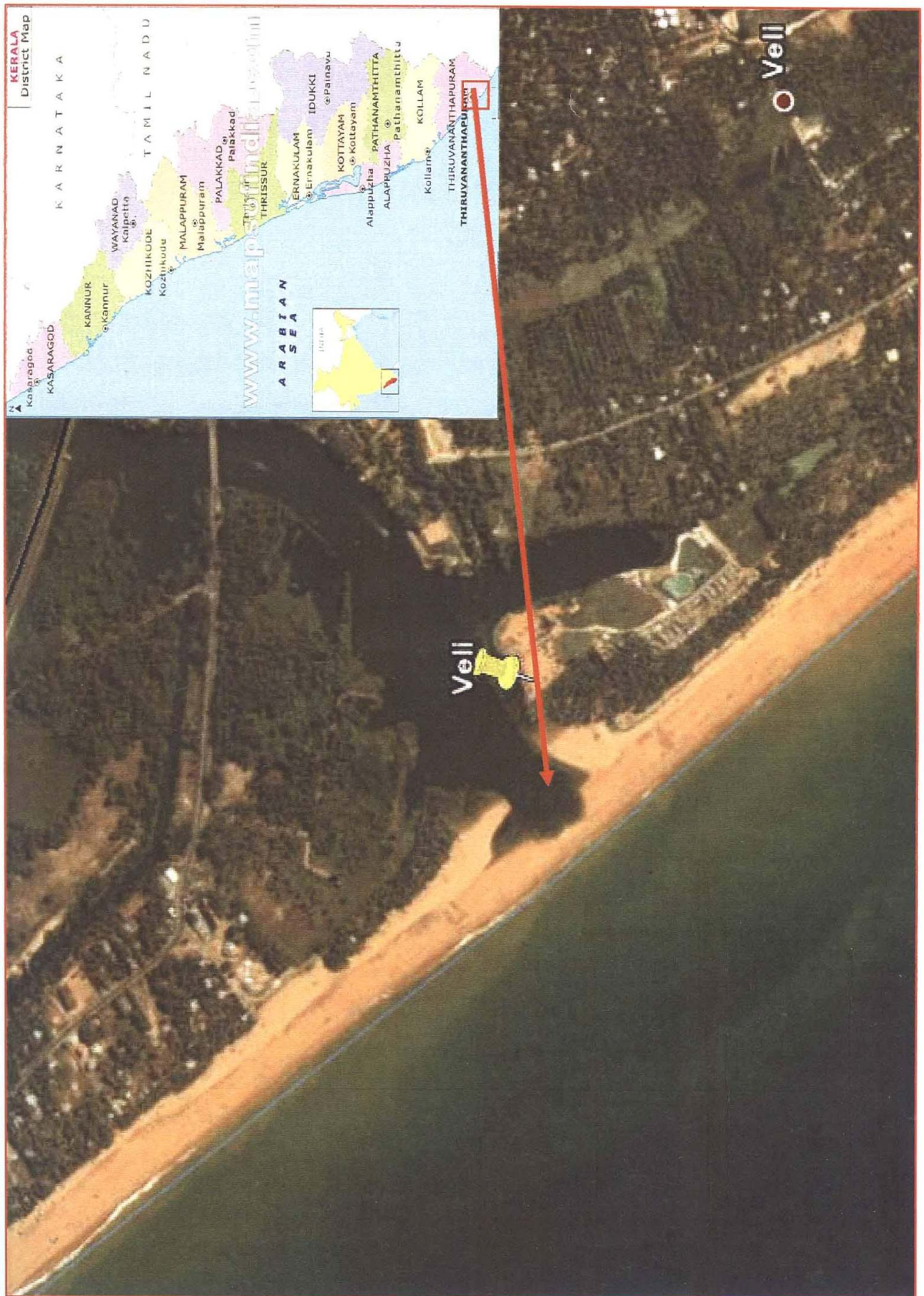


Fig 2.2: Location of Project Site



D. Description of Environment

The project site is Veli river mouth, on the Aakkulam Lake side in Thiruvananthapuram District. The geographical position of Veli river mouth is at 8° 30' N latitude and 76° 53' E longitude. A fairly uniform temperature characterizes the climate of Thiruvananthapuram where the project site is situated with high humidity throughout the year due to the city's proximity to the sea. The average annual rainfall is 1,803 mm, which is lower than other parts of State. On an average there are 102 rainy days in a year. Soil Characteristics of the project site is predominately sandy loam. The ambient air quality is very pristine with low human interference. Noise level was also found to be within the limit. With the accumulation of organic pollutant carried by the storm water from the city area, the water in Aakkulam Lake situated adjacent to the project site is highly contaminated.

The monthly distributions of deep-water wave heights in terms of percentage of occurrence derived from the wave atlas. It is observed that the most frequently occurring wave height is 1.0 m with a percentage of occurrences between 20 to 35% for the months February to May, October and December. The months January and November experiences wave height of 1.5 m with a percentage of occurrence between 20 and 30%. The most frequently occurring wave heights during the months June to September is found to be 2.0 m with a percentage of occurrences between 20 and 25%. The maximum percentage of occurrences is with waves associated with periods ranging between 5 and 6 sec.

Mangrove vegetation is an important coastal ecosystem associated with tidal / mud flats and backwater systems. About 15 hectares of mangrove with 14 major species exists in Thiruvananthapuram District. However, no mangroves are seen near to the project site at Veli. The project site is not having any trees or vegetation. Coconut trees are predominantly growing adjacent to the project site.

As per the Coastal Regulation Zone (CRZ) Notification, 1991, coastal stretches of sea between the Low Tide Lines and High Tide Lines and upto 500 meters on the landward side from High Tide Line and upto 100 meters from the bank or width of the creek, river or backwater whichever is less will come under the regulated zone. The State Government has prepared the Coastal Zone Management Plan and according to the Management Plan the coastal area at Veli is categorized as CRZ II.

E. Potential Environmental Impacts

The project "Construction of Breakwaters at Veli" is proposed with an aim to prevent the sand bar formation at sea mouth at Veli and thereby a continuous discharge of storm water from the city area into the sea. The project together with other measures proposed in the master Plan for Storm Water Drainage in Thiruvananthapuram city will reduce the flooding in the low lying area in the city. Thus the project has lots of positive impacts and large number of people in the city will be benefited by the project. However, there may be some negative impacts which may arise at various stages of implementation of the project. The major environmental impacts associated with the project are:

- Impact on shoreline due to construction of breakwaters;
- Impact on tourism;
- Impact due to quarrying;
- Dust generation during construction activities;
- Emission from vehicles and machineries;
- Noise from vehicles and plants;
- Impact due to dredging;
- Impact on marine water quality;
- Impact on lake water quality due to opening of drain mouth; and
- Sediment movement along the neighbourhood shoreline and drain mouth.

F. Environment Management Plan

The environmental impacts anticipated due to the implementation of the project “Construction of Breakwaters at Veli in the Aakulam Side, Thiruvananthapuram” and the mitigation measures proposed were discussed in detail under Chapter 4. Mitigation measures are identified after detailed assessment of the impacts of the project on the environment. Mitigation measures suggested for each of the potential negative impacts are consolidated to form the Environment Management Plan (EMP) and presented in Table 5.1. The EMP will be implemented as part of the project to ensure that the implementation of the project will have only minimum impact on the environment.

Table 5.1: Environment Management Plan

Sl. No	DETAILS OF IMPACT	MITIGATION MEASURES
A. Location and Design Impacts		
1	Impact on shoreline due to construction of breakwaters	Numerical model study conducted by Department of Ocean Engineering of Indian Institute of Technology, Madras Finalised the alignment and design based on the recommendation of IIT, Madras to ensure no erosion of shoreline. The spacing of training wall shall be decreased from 200 m proposed to 130 m recommended by the numerical model study.
2	Impact on tourism	Develop tourism facilities such as walkway and access to the beach existing at southern side of the southern training wall
3	Impact due to quarrying	Rock quarries from where blasted rocks, metal aggregate and mines from where sand is obtained shall have requisite statutory approvals. Blasting shall be carried out only after obtaining all relevant permissions and clearances. All the statutory laws, regulations, rules, etc. pertaining to acquisition, transport, storage, handling and use of explosives shall

Construction of Breakwater at Veli in Akulam Side, Thiruvananthapuram

		<p>be strictly followed.</p> <p>Blasting shall be carried out during fixed hours (preferably during mid-day). The timing should be made known to all the people within a distance as required by the statutory from the blasting site in all directions.</p> <p>People, except those who are directly associated with the blasting activity shall be excluded from the area as determined by the statutory requirements from the blasting site in all directions before the blasting.</p> <p>The maintenance and rehabilitation of the quarry access roads in the event of damage by the contractor's operations shall be a responsibility of the contractor.</p>
4	Dust generation due to construction activities	<p>Plants, machinery and equipment used for construction shall be so handled (including dismantling) so as to minimize generation of dust.</p> <p>Rock quarries from where Granite stone and mines from where sand are obtained shall have requisite statutory approvals;</p> <p>Regular wetting of roads used for transportation of materials to suppress dust</p> <p>Sprinkler system for dust suppression shall be installed.</p> <p>Materials required shall be purchased from person/firm having valid consent/ clearances from statutory authorities.</p>
5	Emission from construction vehicles, equipment and machinery	<p>The statutory emission standards shall be strictly adhered to.</p> <p>All vehicles, equipment and machinery used for transportation of dredged materials shall be regularly serviced and well maintained to ensure that emission levels comply with the relevant statutory standards.</p>
6	Noise from vehicles, plants and equipments	<p>All machinery and equipment should be well maintained and fitted with noise reduction devices to ensure noise levels within the statutory norms.</p> <p>At construction sites noisy construction work such as crushing, concrete mixing and batching, mechanical compaction, operation of heavy vehicles and plants etc., will be stopped between 2200 hours to 0600 hours, especially close to the environmentally sensitive receptors.</p> <p>All vehicles and equipment used in construction shall be fitted with exhaust silences. During routine servicing operations, the effectiveness of exhaust silencers shall be checked and if found to be defective shall be replaced.</p> <p>The noise level from any item of plant(s) must comply with the relevant legislation for levels of sound emission. Non-complying plants shall be removed from site.</p> <p>The vehicles, equipment and machinery shall be maintained properly to keep noise from these at a minimum.</p>
7	Impact due to dredging	<p>Adopt modern technology and dredging equipments to minimise suspension of sediments.</p> <p>Powerful suction pumps which are capable to suck up the suspended sediments should be fitted with dredger</p> <p>Periodic monitoring of the water quality near to the dredging location</p> <p>No dredging operations in periods of rapid water movements, especially in rainy season</p> <p>Avoid sensitive area for filling. Dredged materials will be used to reclaim the project site.</p> <p>Demarcate the area to be filled and provide bunds to prevent silt run off during rain.</p> <p>Ensure that dredged material does not contain toxic or</p>

		hazardous materials and suitable for land filling by analysis of dredged materials
8	Impact on marine water quality	<p>All works shall be carried out within the project site and the right of way of approach road in such a manner that the destruction to the flora and their habitats is minimized. Trees and vegetation shall be felled / removed only if those impinge directly on the permanent works or necessary temporary works. In all such cases prior approvals from the relevant authorities in accordance with the existing national /state/local regulations will be obtained.</p> <p>The riparian areas adjacent to areas of construction activity shall not be disturbed, degraded, or destabilized by the said activities.</p> <p>The labour quarters, site office, material stockpiles and containers will be located without damaging any natural resources.</p> <p>During construction, if a rare/threatened/endangered flora species is found, it shall be immediately informed to the project authorities. All activities that could destroy such flora and/or its habitat shall be stopped with immediate effect. Such activities shall be started only after obtaining the relevant approvals. Contractor shall carry out all activities and plans in a manner to conserve such flora and/or its habitat.</p>
9	Impact on Lake water quality due to the opening of river mouth	<p>The storm water and the treated sewage from the city shall be taken to the river mouth through diversion channel to ensure sufficient flow at the river mouth to minimise the saline water intrusion into the Lake</p> <p>Continuous flow from the Lake into the sea will prevent the saline water from entering into upstream side.</p> <p>Monitor the water quality in the Lake at regular interval</p>
10	Undue behaviour of sediment movement along the neighbourhood shoreline and drain mouth	<p>Continuous monitoring of neighbourhood shoreline and river mouth for two years regarding the impact due to the construction of breakwaters.</p> <p>If required, strengthen the existing training wall at regular interval.</p>

G. Institutional Arrangements and Monitoring Plan

The project is proposed to be implemented as part of the storm water drainage improvements proposed under JNNURM. Kerala Sustainable Urban Development Project (KSUDP) is the implementing agency of JNNURM in Thiruvananthapuram. The Harbour Engineering Department will be the implementing the project on behalf of the implementing agency. The Harbour Engineering Department will implement the scheme through their field offices. The Technical staff at field office at Vizhinjam will closely monitor the implementation of the project including the implementation of the environment management plan proposed for the project. The field office will submit quarterly progress report to the Head Office on the implementation of the project. The progress report should contain a separate section detailing the progress of implementation of the EMP.

During the implementation of the project as well as during the operational phase of the project, the lake water quality should be monitored periodically to assess the extent of accumulation pollutants in lake and to assess the extent of saline water intrusion. The behaviour of the neighbourhood shoreline and drain mouth shall be monitored

continuously for two years to identify any impact on the shoreline and drain mouth. Such monitoring report should also form part of the progress report. The Implementing Agency should hire the service of environmental experts, if required, for the monitoring and reporting of EMP implementation.

H. Conclusion

Considering the scope of project activities and the selected site location, it is concluded that the negative impacts due to the construction of the breakwaters at Veli will be insignificant. The major issues of construction of breakwaters are the impacts on shorelines on both sides of the breakwaters and reformation of sand bar at river mouth. Numerical model studies were conducted through Department of Ocean Development of Indian Institute of Technology, Madras before finalizing the design of the breakwaters. The design was finalized based on the recommendations of the study to ensure minimum impact on the shorelines. After the implementation of the project, HED shall continuously monitor the neighbourhood shoreline and drain mouth for a period of 2 years for identifying any undue behavior of sediment movement and reformation of sand bar at drain mouth. In case of any erosion of coastline, the existing training wall shall be strengthened. Another major issue identified is related to the impacts on quality of water in Aakulam Lake due to the salinity intrusion as a result of opening of river mouth during summer. As the river mouth is open for 6 to 8 months in a year, the extension of the opening to another 6 to 4 months will provide a stable ecosystem in the lake. HED shall monitor the quality of water in the Lake and take appropriate measures to avoid any adverse impact on the quality water in the Lake. There may be some localized temporary impacts such as air and noise pollution at the quarry supplying the raw materials for the project activities, impact on water quality at the project site etc. These can be solved through proper environmental monitoring and management measures. An Environment Management Plan has been worked out and the Institutional requirements for implementing the EMP have also been suggested. Harbour Engineering Department will be responsible for management, technical supervision and quality assurance of the project. The proposed location of the project site falls within the coastal regulation zone (CRZ II). The construction of facilities for prevention of sand bar formation is a permitted activity in CRZ II. Since no wastewater is generated from the project activities no impact on water quality is anticipated.. The materials required will be purchased from quarry or stone crusher having valid Consent to Operate from Kerala State Pollution Control Board. The mitigation measures suggested in the EMP shall form part of the bid document and will be implemented along with the project. The Harbour Engineering Department will continue to monitor the operation of the facilities created under this project and ensure that the operation and maintenance of the facilities will not cause any adverse impact on the coastline and the environment around the facilities.