

Ministry of Natural Resources & Environment



Seawall and reclamation at Savaian Hotel and adjacent property.

Preliminary Environmental Assessment Report Lalomalava-seawall



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Contents

Contents

1. Introduction	3
2. Project Proposal	4
3. Site Description	4
4. Justification of Proposal	6
5. Stakeholder Consultation	6
6. Assessment of Environmental and social Impacts	6
7. Proposed Alternatives	10
8. Mitigation Measures	11
8.1 Codes of Environmental Practice	12
9. General Environmental Management Plan	12
9.1 General / Administrative Procedures.....	12
10. COEP 10 – Coastal Protection	14
10.1 Design	14
10.2 Construction	15
10.3 Discharges to Air	16
10.4 Noise and Vibration	17
10.5 Construction Site Management	17
10.6 Erosion and Sediment Control Plan (from COEP 11 and COEP 13 - Draft)	18
10.7 Earthworks – Programme of Works	18
10.8 Use of Heavy Machinery in or close to Watercourses or the Coastal Margin	19
10.9 Clearing Vegetation	19
11. Drainage (COEP 11)	20
11.1 Design	20
11.2 Health, Safety and Efficiency	22
12. Conclusion	22

1. INTRODUCTION

1.1 The Government of Samoa under its Environmental Policy Framework established rules and procedures to be followed under IAMP Phase 2 with regard to environmental assessment, monitoring and mitigation of potential negative impacts.

1.2 For projects with no, or low but acceptable environmental impacts, the Chief Executive Officer (CEO), Ministry of Natural Resources and Environment (MNRE) may issue a waiver to the proponent from the further requirements of the draft EIA Regulations. In issuing a waiver, the CEO MNRE will rely on the advice of the Assistant CEO, PUMA. Such works are to be covered by Codes of Environmental Practice (COEP) provisions.

1.3 For other projects, in order to determine whether an EIA is necessary, a systematic procedure is followed, as indicated in the GoS Treasury Manual on Project Planning and Programming. This commences with a Preliminary Environmental Assessment Report (PEAR)

1.4 A screening checklist has been developed as part of the National EIA Guidelines under IAM-1's institutional strengthening and reform component which includes both physical and social impact components. The use of this screening checklist has been adopted by PUMA and would continue both for the IAM-2 project and for broader implementation of the EIA assessment system under the new environmental and planning legislation. The checklist has been incorporated into this PEAR.

1.5 IPA was engaged to provide this Preliminary Environmental Assessment Report (PEAR) for the Lalomalava Sea Wall project. The report describes the potential environmental and social impacts associated with the project and recommends the necessary action and responses to mitigate the adverse environmental impacts.

1.6 The PEAR was prepared in accordance with the *Environmental Impact Assessment (EIA) Regulations 2007* to determine the likely significance of impacts arising from the proposed Sea Wall project to support a development consent application to the Planning and Urban Management Agency for construction.

2. PROJECT PROPOSAL

2.1 The Government of Samoa received resources from the Global Environment Fund through the Pacific Adaptation to Climate Change (PACC) project that is being executed by the Secretariat for the Pacific Regional Environment Programme (SPREP). The objective of the PACC is to “enhance the capability of the participating countries to adapt to climate change, including variability, in selected key development areas”. National projects under this regional program are being coordinated through a national Project Management Unit established within the Ministry for Natural Resources and Environment (MNRE).

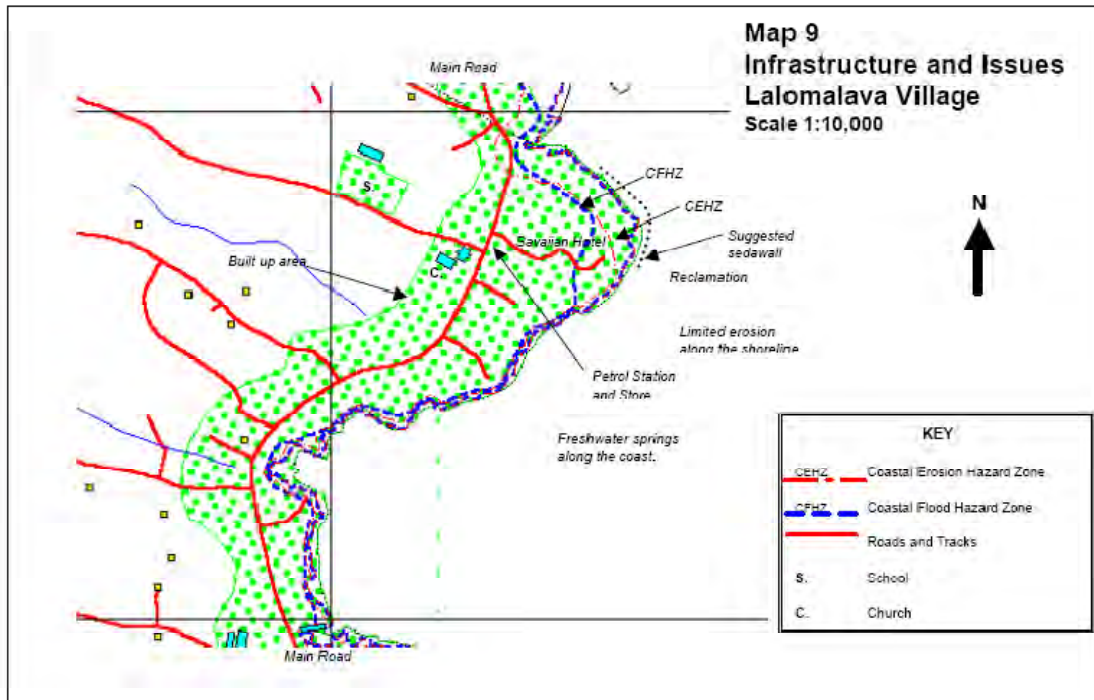
2.2 In relation to Samoa the PACC identifies demonstration measures to reduce vulnerability in coastal areas to strengthen resilience to the adverse impacts of climate change. The Faasaleleaga coastline including Lalomalava is identified as being a high risk area in the *National Coastal Infrastructure Management Strategy* and Coastal Infrastructure Management Plans (CIM Plans) prepared under the Samoa Infrastructure Asset Management programme through a credit from the World Bank.

3. SITE DESCRIPTION

Lalomalava:

3.1 Lalomalava village extends from the edge of the area reclaimed for the Savaiian Hotel and the adjacent property to the boundary with Safua village. Average erosion along the coast including the reclaimed area ranges from about 0.1m at the southern end to 0.6 m per year at the northern end of the village. The reclamation appears to have been built up over an existing rocky headland and is substantially protected with large rocks and construction debris. There are no Hotel buildings in the CEHZ. The infrastructure of the village in both the CEHZ and CFHZ includes three village houses, two of which are about 30 m from the shore and the third is at the landward edge of the zone about 50 m from the shore. The houses closer to the shore are at **moderate** risk and susceptibility. The main Hotel building and two adjacent houses are in the CFHZ outside of the CEHZ. These buildings are built up above the flood level and are generally at **low** risk and susceptibility to flooding. The remainder of the village is outside of the hazard zones. There are a number of freshwater springs along the coast. These are not developed as pools at present and if development is considered in the

future investment should be considered in relation to the coastal location and the likelihood of damage from erosion and flooding. The springs are at **low** risk and susceptibility.



3.2 The infrastructure in Lalomalava significant to the village and residents in the village (refer to Section 3 for district infrastructure), is listed in the Table below.

Summary of Existing Resilience

Infrastructure	Risk	Susceptibility	Existing Resilience
Village houses in the CEHZ and CFHZ	Moderate	Moderate	Moderate
Hotel building and houses in CFHZ	Low	Low	High
Freshwater springs along the coast	Low	Low	High

4. JUSTIFICATION OF PROPOSAL

4.1 Under the CIM Plans developed for Lalomalava, the hazard mapping component of the work identified the provision of a seawall along the coast from the north of the Savaian Hotel to the boundary of the village with Safua village as one of the solutions proposed following an evaluation of the physical, social and economic effects of a number of solutions by the District CIM Committee and the CIM Plan Team.

4.2 The CIM plan noted that in many instances current village and family practices, such as managing domestic sand mining and raising building floor levels will improve resilience. However, in the long term the actions proposed in this Plan (such as a seawall) will provide greater and more sustainable benefit than continuing to maintain existing infrastructure and current practices and processes in the coastal area.

5. STAKEHOLDER CONSULTATION

5.1 The CIM Plan is a Partnership between the Government of Samoa and the villages within the Plan area. Both partners have responsibility for different levels of infrastructure in the local communities and the Plan gives an integrated approach to the provision of services and improvement of resilience now and in the future

5.2 The existing district Coastal Infrastructure Management Plan and recommendations for Lalomalava were developed after consultations with the village fono on the 10th May 2002. The village fono is considered the appropriate planning mechanism for participatory planning. The CIM Plan Committee representing all of the Villages in the area met on 11 June 2002. Comments on the draft CIM Plan were received from the Committee on 17 July, 2002.

6. ASSESSMENT OF ENVIRONMENTAL AND SOCIAL IMPACTS

6.1 In this preliminary assessment of the environmental and social impacts, the issues for consideration in building the proposed sea wall are:

Environmental Screening Checklist

(adapted from DEC Guidelines and IAMP1)

Use or disturbance of natural resources

No Lo Hi

1. Is there potential for water (freshwater or marine), land or air pollution? (*Esp. liquid wastes reaching inshore waters (from groundwater contaminated with sewage, fertilizers, pesticides, herbicides, etc.), but also air pollution, dust, noise and smell nuisances*)
2. Will the level of sewage treatment for the activity eliminate the threat of pollution?
3. To what extent might the quantity of water available for other uses (*especially for human use, but also, for example, to maintain aquatic ecosystems*) be affected the activity? (*Is there enough water to supply this proposal as well as other uses?*)
4. Will there be a loss of indigenous vegetation cover? (*Especially primary forest, but also wetlands, mangroves, etc.; due to site clearance, construction activities, mining, etc.*)
5. Will there be a radical change in the vegetation cover over the large area? (*Apart from exposing soil, etc.; even secondary vegetation is important as a habitat for native fauna, and can often conceal elements of the indigenous flora.*)
6. Is there danger of soil erosion? (*Due to vegetation removal for site preparation, construction activities, road building, etc.*)
7. Is there danger of run-off from eroding land surfaces carrying sediment into the lakes, rivers, lagoon, reef, etc.?
8. Is there potential for increased solid waste generation from the activity?
9. Is it likely that there will be other damage to the reef, or the lagoon system?
10. Is it possible that the important species of flora and/or fauna, on land or in water, might be affected? (*Especially through habitat change, but also through direct impacts on the populations through collection, hunting, etc.; and especially endangered species*)
11. Will there be destructive areas with high conservation value or potential for conservation?
12. Is there potential for the exportation of flora/fauna species overseas?
13. Is there potential for introducing plant or animal pests, or diseases that would affect plants or animals in Samoa, or would affect agriculture, fishing or other resource uses? (*E.g. the introduction/importation of invasive species*)
14. Is there potential for introducing diseases that would affect plants or animals in Samoa, or would affect agriculture, fishing or other resource uses?
15. Will there be adequate energy supplies to meet the needs of the proposed development (*especially electricity*)?
16. Are the arrangements for waste disposal likely to cause problems? (*E.g.: no provision made for disposal of large volume of solid waste; specific kinds of waste will be generated, requiring particular treatment and disposal*)

methods; the local landfill is not suitable for the new waste stream from the proposed development; etc.)

Social and Cultural

17. Is there activity likely to have significant impact on the local way of life? (*E.g.: by employing lots of women or changing economic or social processes, especially of families; by introducing markedly non-Samoan social activities; by affecting subsistence base of village life (fishing, agriculture, etc.)*)
18. Is the activity likely to affect the daily or normal activities of men and women?
19. Will any local people be displaced by the proposed activity?
20. Is there concern amongst local people about possible changes in their way of life? (*See also Public Consultation below.*)
21. Will the proposed development place too great a pressure on any local services? (*Especially health, education, and housing, through the migration of individuals and families into the area as a result of the development*)
22. Are there particular issues relating to the social or economic position of women?
23. Are there particular issues relating to the social or economic position of men?
24. Are there particular issues relating to the social or economic position of young people?
25. Are there potential adverse impacts that are likely to affect particular groups in the community to a markedly greater extent than other groups?
26. Is it likely that the proposed development will attract a significant number of people from outside the area, the island or the country (*and therefore create problems for the local communities*)?
27. Are there likely to be any health implications associated with the proposed activity? (*Esp. by enhancing breeding conditions for possible disease vectors, esp. mosquitoes; but also socially-linked diseases such as STD*)
28. Are there likely to be any risks to human health and safety through accidents? (*Including accidental spillages or emissions from industrial plants; potential motor vehicle accidents due to increased traffic on local roads; etc.*)
29. What would be the wider environmental consequences of accidental release of hazardous materials used in the activity?
30. Are there likely to be any impacts on cultural resources or values? (*Loss or damage to heritage or historic sites; loss of medicinal and craft resources, etc.*)
31. Are there likely to be any impacts on traditional knowledge and practices?
32. Will the proposed activity affect scenic or amenity values (*of natural and/or built-up areas*)?

33. Will the proposed activity affect recreational resources available to the community?
34. Will the proposed activity affect any alienated lands (*e.g.: WSTEC, SLC, privatized etc.*)

Policy and Plan Context

35. Will there be an irreversible commitment of important resources to the activity?
36. Will future options for resource use be prevented or severely constrained?
37. Is the Activity consistent with the policies and plans of government departments or agencies?
38. Are the policies and plans of the government departments or agencies in themselves a source or cause of impacts?
39. Will there be impacts because the proposed activity is not in accord with local village views?
40. Will the overall impacts of the activity exacerbate problems caused by existing activities? (*This is one aspect of cumulative impacts.*)
41. Will the activity require other actions that themselves will have significant impacts on the environment (*E.g.: the activity may require sand dredging from a lagoon; or a new borehole for water supply, etc.*)
42. To what extent would the supply of electricity to the area be affected as well as other utilities?
43. Will there be sufficient parking space provided?
44. Will the activity require other actions that themselves will have significant impacts on the environment (*E.g.: the activity may require sand dredging from a lagoon; or a new borehole for water supply, etc.*)

Public Consultation

45. Are there likely to be problems with local people because their views have not yet been sought?
46. If local views are not known, are there likely to be any contentious issues?
47. Are there likely to be problems because the proponent has not indicated how the proposal will be modified, or at least justified the decision not to change the proposal, to address known local community concerns? (*e.g.: after consulting people, and reporting their views the proponent might not respond to those views, causing further problems and bad feeling.*)

6.2 In addition to the above assessment and specifically focusing on the key issues for Lalomalava:

- the ability of the seawall to protect infrastructure (from extreme events (such as flooding, storm surges) including climate change

- Depending on the design and scale, the sea wall is a hard adaption option that will protect assets and communities from extreme events and climate change
- whether the seawall will prevent sand f erosion past the sea wall noting that South of the Hotel development the coast is eroding at a rate of about 0.1 m per year and there are no assets identified in the Coastal Erosion Hazard Zone that require protection.
 - the sea wall should halt the further erosion inland past the seawall).
- the effect on the social amenity of people who have lived in the area without a sea wall
 - the village fono is authoritative with respect to village development issues noting that most issues are settled on a consensus basis.

7. PROPOSED ALTERNATIVES

7.1 Alternative measures to enhance adaptive capacity were also identified in the CIM plans for Lalomalava. This include:

- Identifying a new sustainable source for domestic sand in the vicinity. This will provide for a sustainable supply of sand for commercial and domestic use close to an area which does not have a natural sand resource.
- To continue to consider building foundations at a level that takes into account the CFHZ in the vicinity of buildings. This will avoid coastal erosion and flood hazards.
- To relocate outside of the CEHZ and the CFHZ This will enable development to be set back from the coast.
- To ensure investment within the hazard zones is considered in relation to the potential for damage from coastal erosion and flooding. This will reduce cost of damage to the investment in the hazard zone.
- To continue planting mangroves and other vegetation in coastal areas and to protect young plants from damage from domestic animals. Planting along the beach helps to stabilise these areas and reduce the potential for erosion.

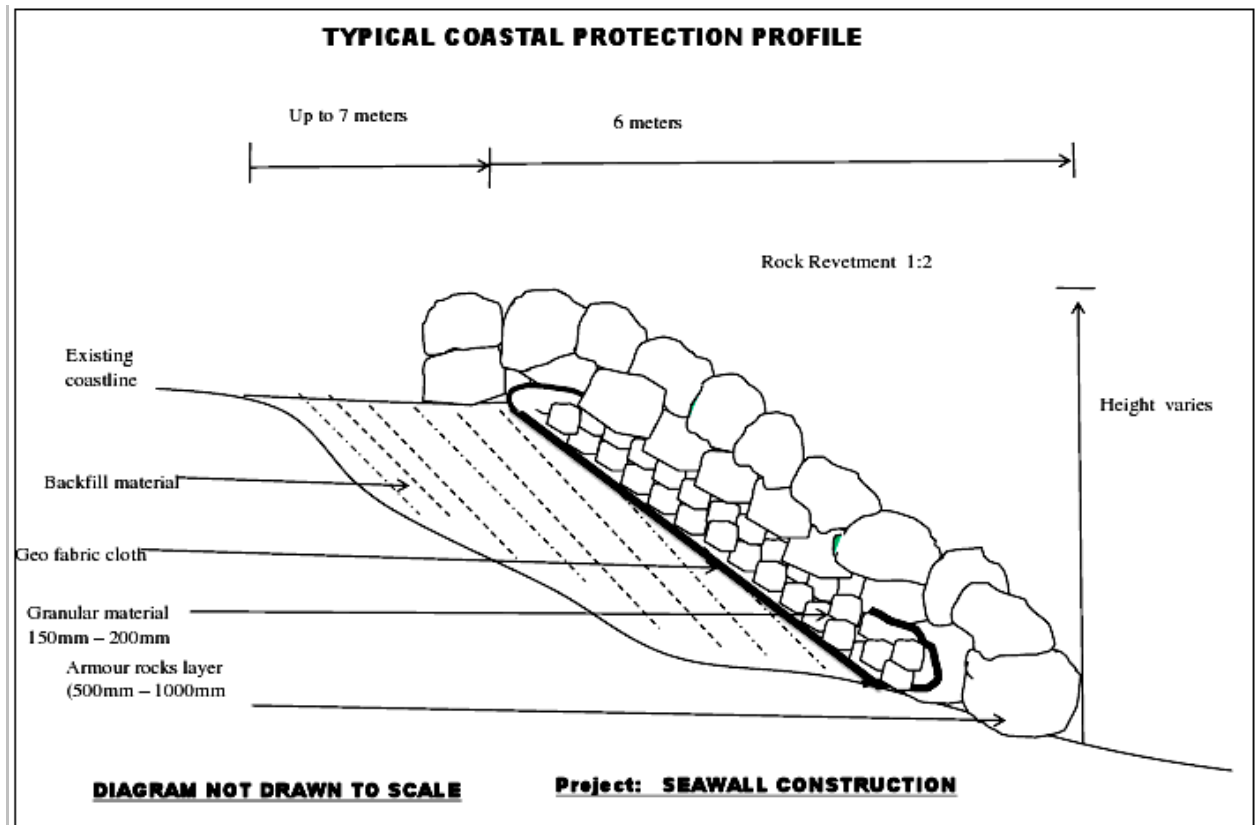


Figure 1: Rock Wall Design

8. MITIGATION MEASURES

The PEAR indicates low risk of adverse impacts on the environment during construction stage. The following areas have been identified as requiring mitigation to avoid or minimise adverse impacts:

- ☒ Air quality and dust;
- ☒ General construction site management;
- ☒ Erosion and sediment control;
- ☒ Protection of the natural environment; and

8.1 CODES OF ENVIRONMENTAL PRACTICE

Under the SIAM project, *Codes of Environmental Practice (COEPs)* were prepared in 2007. The COEP defines methods and/ or procedures that provide guidance to be followed by consultants, designers and contractors to avoid or mitigate adverse environmental impacts associated with infrastructure development or maintenance projects.

The relevant COEPs for this Work are:

- COEP 1 - Administrative Procedures
- COEP 5 - Construction Camps
- COEP 6 - Erosion Control
- COEP 10 – Coastal Protection¹
- COEP 11 - Drainage
- COEP 13 - Earthworks (Draft)

9. GENERAL ENVIRONMENTAL MANAGEMENT PLAN

9.1 GENERAL / ADMINISTRATIVE PROCEDURES

9.1.1 COMMUNITY INVOLVEMENT

The Contractor will undertake the contracted activities in a manner, which will ensure that the works do not cause any unnecessary, adverse impacts on surrounding sites and villages.

The Contractor shall provide 48 hours notice of entry onto private property to undertake works related to the contract.

The public has the right to approach the Site Manager in the event of unexpected problems of nuisance from the construction work.

9.1.2 GENERAL CONSTRUCTION PHASE OPERATING PROCEDURES

¹ The objective of this Code of Environmental Practice (COEP) is to prescribe the basis of design for hard coastal protection works, and to define construction procedures for those works. Hard works comprise seawalls, revetments and the like. Soft coastal protection works include planting, managed retreat and the like.

- The Contractor shall undertake all reasonable steps to ensure minimum nuisance to adjacent land users during construction.
- Normal hours of work are between 7.30am and 5.30pm Monday to Fridays. No work shall occur on public holidays or at weekends except for emergency work, unless given prior approval by the Engineer.
- Operations that cannot be reasonably undertaken or completed in normal working hours can be undertaken outside normal hours subject to providing notice to the adjacent of affected occupiers and within 100 metres of the location of the intended operation. The notice to undertake such work needs to be given not less than five working days before the commencement and shall include reference to the location, nature, potential impacts, proposed timing and duration of work.
- The Contractor shall ensure that reasonable and useable access is maintained to private land and villages not directly affected by construction. The provision of access needs to be balanced against health and safety implications and ensure that health and safety is not compromised at any time.
- The Contractor shall ensure that plants, seedlings, and cuttings used for revegetation and landscaping are, wherever possible, taken from the immediate area, and from as close as possible to the restoration site.
- The Contractor shall be responsible for preparing management and mitigation plans for project activities, which are considered to create adverse impacts.
- The Contractor shall comply with the Contract Specification and any Special Conditions of Contract, as required.

10. COEP 10 – COASTAL PROTECTION

COEP 10 shall be read in conjunction with COEP 1 – Administrative Procedures. The objectives were to prescribe the basis of design for coastal protection works, and to define construction procedures for those works.

10.1 DESIGN

10.1.1 DESIGN PROCEDURE

Estimation of design wave heights and design procedures and methods used for coastal protection works shall generally be in terms of the United States Army Corps of Engineers Shore Protection Manual (4th Edition, Vols I and II, 1984) or subsequent editions as applicable.

Where practicable road embankments shall be located shoreward of anticipated maximum erosion of any coastline. This will minimize construction cost, and the natural process of beach erosion and replenishment will be unaffected. The potential erosion of a coastal system shall be determined after consideration of previous studies, aerial photographs, historical surveys and discussions with local residents.

The construction of embankments in mangrove areas shall be avoided wherever possible.

Where embankments are to be constructed within a beach system (including surf zone) they shall be protected from erosion and shall be designed such that fine materials shoreward of the erosion protection can not be leached out through the erosion protection system. Any protective structure shall be designed to maintain the littoral drift of sediment without down drift erosion.

The preferred erosion protection system is sloping rock revetments and these shall be used wherever practicable. Particular care shall be taken to detail effective measures to prevent erosion of the toe of any revetment.

In some cases due to other design factors it may not be possible to design revetments or walls to prevent overtopping by design waves or wave run up. In such cases care shall be taken to provide sufficient capacity and erosion protection in drainage systems to rapidly drain water from the road surface without causing scour.

The design of drainage systems for coastal roads shall be where ever practicable such as to drain road surface water for treatment across grassed swales prior to discharge to a natural drainage system. Direct discharges onto beaches shall be avoided.

All road shoulders, berms, and side drains on coastal roads shall be grassed or otherwise protected from erosion as set out in COEP 6.

10.1.2 DESIGN DIRECTIVE

The consultant or road designer shall undertake the design of coastal protection works with due regard for the procedures set out in COEP 6 as well as this COEP 10.

10.2 CONSTRUCTION

10.2.1 STORAGE OF MATERIALS

All construction materials such as aggregate stockpiles, cement, formwork, and the like shall be stored in areas above the effects of tidal and wave action. Temporary drains or bunds shall surround such stored materials as set out in COEP 6 so as to prevent the discharge of storm water from the storage areas direct to coastal waters.

10.2.2 CONSTRUCTION CAMPS

Construction camps shall be sited above the effects of tidal and wave action and shall be developed in terms of COEP 5.

10.2.3 PERMIT CONDITIONS

The construction of any coastal protection works shall meet any permit conditions imposed by the MNRE or MWTI.

10.2.4 CONSTRUCTION SEQUENCE

The construction of any revetment or sea wall or other coastal protection works inclusive of filter cloth or other filtration systems shall at all times be at a higher elevation than fill materials that are to be placed and compacted on the shoreward side of such protection works.

The discharge of surface water runoff from any earthwork directly to tidal waters is to be avoided at all times.

10.2.5 DRAINAGE CHANNELS

Temporary or permanent channels together with silt fences or silt retention ponds shall be constructed and maintained in efficient operating condition throughout the construction and maintenance period as set out in COEP 6.

All channels shall discharge to grassed swales prior to water entering natural water courses or being discharged to culverts.

10.2.6 GRASSED SURFACES

All surfaces to be grassed such as road shoulders, berms, benches, road side drains and swales shall be surfaced as soon as practicable and progressively as the works proceed.

10.2.7 CLEAN UP

At the completion of the works the whole site including any construction camp or storage areas shall be cleaned up. All surplus materials and construction debris shall be removed from the site and any exposed earth surfaces shall be trimmed and shaped to conform to surrounding topography and sown with appropriate grass.

10.3 DISCHARGES TO AIR

10.3.1 DUST CONTROL

- The Contractor shall undertake dust control measures following prolonged dry periods, where earth has been exposed, by spraying water onto the dry earth area. Water used for dust control shall be collected either from rain storage tanks or local watercourses. The Contractor shall have a watering truck available for use at all times. All care shall be taken to ensure excess water does not find its way into watercourses.
- Any stockpiles shall be grassed where practicable.
- All surfaces shall be constructed to their final design requirements as quickly as practicable.
- Covers shall be used where practicable on small areas that may generate dust.
- Materials, such as gravel, that do not produce dust, will be used as cover where practicable.
- Hydrocarbons shall not be used as a method of dust control.

VEHICLE EMISSIONS / SMOKE OR NOXIOUS AIR POLLUTANTS

- All vehicles and machinery shall be operated in a safe manner including the use of effective exhaust systems.
- Waste materials are to be removed from the site and not burnt.

10.4 NOISE AND VIBRATION

- All vehicles and machinery shall be operated in a safe manner including the use of effective noise suppressors or silencing systems installed in accordance with the manufacturers recommendations.
- The Contractor shall ensure that all best practicable options are taken to avoid a public noise nuisance beyond the boundaries of the site.
- In areas where there is the potential for excess noise or vibration to be created the Contractor shall advise potentially affected parties 24 hours in advance of the activity causing the noise / vibration commencing.

10.5 CONSTRUCTION SITE MANAGEMENT

10.5.1 HAULAGE

To minimize the extent of heavy traffic and construction impacts on the villages and other residential areas, the following shall apply, where applicable, to the use of public, private and purpose-built roads by machinery and vehicles used in undertaking, and the completion of, the contract.

- Vehicles and machinery using public and private roads shall be clean and loads secured to the effect that the accidental deposit of material on the road is kept to a minimum. As a minimum, truck and machinery wash-down areas shall be provided and haul trucks shall use secure tailgates.
- Runoff from truck and machinery wash-down areas shall pass through storm water treatment devices regularly inspected and maintained.
- Construction and establishment of haul roads shall be kept to a minimum.
- The establishment of haul roads and the use of private roads shall minimise the extent of traffic and construction impacts on adjacent villages and other residential areas.
- Where ever possible haul roads and the use of private roads shall avoid water crossings.
- General noise control measures set out in the EMP shall apply to haul roads and the operation of vehicles and machinery.
- Haul roads, wash-down areas and associated temporary construction site related structures shall be removed upon completion of the work and the area reinstated.

- The areas affected by haul roads and wash-down areas shall be reinstated and re-vegetated as soon as it possible.

10.5.2 REFUELLING AND MAINTENANCE AREAS

Procedures for refuelling and maintenance areas relate to the location of and facilities at Construction Camps (COEP 5) and general civil construction works (COEP2).

- Refuelling and maintenance facilities shall not be located, or refuelling and maintenance activities shall not take place, within 30 metres of a watercourse of the mean high tide mark, or in ecologically sensitive areas, where ever practicable. If a 30 metres limit is impracticable then a lesser limit may be adopted provided approval from the Planning and Urban Management Agency (PUMA) is obtained. On no account shall the limit be less than 10 metres.
- Vehicles and plant shall not be stored within 30 metres of a watercourse or the mean high tide mark, or in ecologically sensitive areas, overnight or when not in use.

10.6 EROSION AND SEDIMENT CONTROL PLAN (FROM COEP 11 AND COEP 13 - DRAFT)

All earth disturbing activities shall be undertaken in accordance with COEP 13 – *Earthworks (Draft)* which provides planning and work guidelines for earthworks activities associated with development projects. All activities within watercourses shall be undertaken in accordance with COEP11 – *Drainage*.

10.7 EARTHWORKS – PROGRAMME OF WORKS

The Contractor shall provide measures that will ensure the protection and conservation of the environment and provide for the construction of work in terms of agreed programmes, methods and procedures that will prevent or mitigate against erosion. The Contractor shall employ such temporary measures as are necessary to prevent or mitigate impacts caused by erosion or siltation of any natural watercourse in addition to permanent drainage or erosion control systems that shall be detailed in the contract documents.

All contract project work shall be undertaken with a conscious approach to the need for preventing or minimising erosion of any exposed earth surface. In addition to permanent drainage or erosion control systems that are required to be constructed, temporary measures to prevent erosion are to be implemented

whenever these are clearly necessary to mitigate impacts of the erosion of exposed surfaces.

The Contractor shall programme the works to demonstrate that the sequence of operations involving drainage installation, earthworks, drainage facilities, erosion protection measures and revegetation are implemented to minimise the period over which earth surfaces are exposed to the potential for erosion.

10.8 USE OF HEAVY MACHINERY IN OR CLOSE TO WATERCOURSES OR THE COASTAL MARGIN

- All earthworks shall be constructed in accordance with COEP 13 and in such a way as to prevent or minimise accelerated erosion, accelerated sedimentation and disturbance. This applies to all work carried out on land, or in the water, where natural sediment will be disturbed.
- Use of construction machinery in watercourses shall occur in accordance with COEP 11 so as to minimise the clearance of vegetation, minimise the release of sediment to the downstream environment and ensure sediment traps are in place prior to works in such areas commencing.
- The Contractor shall utilise equipment of an appropriate nature and scale relevant for the physical activity required and not utilise heavy machinery where a less intrusive approach is better suited.

10.9 CLEARING VEGETATION

The Contractor shall only clear vegetation, in accordance with COEP 5 and COEP 13, from within the areas agreed with the Project Engineer, for the construction camp, construction camp access or other site works described in the contract. On no account is the Contractor to damage vegetation outside the above areas. Should such damage occur the Contractor shall forthwith take such steps as are necessary to prevent erosion and to re-establish vegetation lost through the damage that had occurred. On no account is cleared vegetation to be burned. Such vegetation shall be removed from the site.

11. DRAINAGE (COEP 11)

All design, construction and maintenance of drainage are to comply with COEP 11 to minimise short term and long term environmental impacts of drainage structures and drainage channels.

11.1 DESIGN

11.1.1 CAPACITIES

The following design directive, as provided in COEP 11, shall be applied:

The Designer shall design all channels, culverts, bridge waterways and other drainage structures such that they are able to discharge their design flow without overtopping or surcharge. In the design of bridge waterways and major culverts care shall be taken to assess appropriate overland flow paths for the discharge of flood flows arising from extreme rainfall in excess of the specified design rainfall. Such overland flow paths shall be such as to avoid the overtopping of any bridge super structure.

Overland flow paths shall be arranged wherever practicable to mitigate the adverse effects of flooding of land or buildings both upstream and downstream of any bridge or major structure. Flow paths across roads shall be protected against scour by appropriate methods.

11.1.2 CHANNEL LINING

The Consultant, Project Engineer or Contractor shall ensure that erosion protection measures for channels and channel discharge locations are as prescribed in COEP11 – *Drainage* are implemented.

- All permanent drainage channels shall be lined to mitigate against erosion.
- Where practical, channels shall be grassed.
- Where flow velocity is likely to scour grassed surfaces, impervious lining such as concrete shall be used.

11.1.3 CHANNEL DISCHARGE

The Consultant, Project Engineer or Contractor shall ensure that erosion protection measures for all channels and channel discharge locations as prescribed in COEP 11 are implemented.

- All channel discharge locations shall be protected against erosion.

- Where the installation of grassed swales is impracticable, channel discharge locations shall be protected against scour by the installation of rip rap or energy dissipation structures of similar scour protection systems.

11.1.4 CULVERTS INLETS AND OUTLETS

The Consultant, Project Engineer or Contractor shall ensure that the potential for scour at all culvert inlets and outlets is eliminated by the design and specification of work described in COEP11.

- All culvert inlets and outlets shall be protected against erosion.
- Erosion of the watercourse bed both up stream and down stream shall be mitigated by the installation of rock mattresses where necessary.
- Bank erosion at culvert inlets and outlets shall be avoided by the design of appropriate wing walls, gabion baskets or similar.
- Where necessary to minimise culvert exit velocities and hence minimise the risk of down stream erosion the design of outlet structures shall include appropriate energy dissipation measures.

11.2 HEALTH, SAFETY AND EFFICIENCY

- The Contract shall ensure that a safe work site is provided for the public and site personnel at all times and in all conditions.
- All personnel engaged in construction related activities shall wear reflective red jackets while on the construction work site.

The consent holder is required to conform in all aspects to the requirements for environmental management of the planned construction works as specified below.

12. CONCLUSION

The PEAR review builds on existing studies and past assessment of the areas. The need for a sea wall has been identified by the villagers of Lalomalava as a priority under the CIM Plans. After a PEAR, the conclusion is the impact on the environment is low but acceptable environmental impacts. In making this conclusion the construction should nevertheless, follow proper standards according to codes of environmental practice that have been identified above.

References;

1. Assessment of Coastal Hazards Zones for Samoa-Stage II, 2004;
2. BECA WCR Draft Environment Management Plan , February 2010;
3. Coastal Infrastructure Management Plan –, April 2007;
4. Code for Environmental Practice 2007