Report

Vaitele Street Environmental Management Plan
Draft

Prepared for Land Transport Authority (Samoa)
Prepared by Beca International Consultants Ltd (Beca)

13 June 2014
## Revision History

<table>
<thead>
<tr>
<th>Revision Nº</th>
<th>Prepared By</th>
<th>Description</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Neda Bolouri</td>
<td>Draft for internal review</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Document Acceptance

<table>
<thead>
<tr>
<th>Action</th>
<th>Name</th>
<th>Signed</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prepared by</td>
<td>Neda Bolouri</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reviewed by</td>
<td>Keith Frentz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approved by</td>
<td>John Hallet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>on behalf of</td>
<td>Beca International Consultants Ltd</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Contents

1 Introduction ......................................................................................................................... 1
  1.1 Background ................................................................................................................... 1
  1.2 Preliminary Environmental Assessment Report ............................................................ 1
  1.3 Codes of Environmental Practice .................................................................................. 2
  1.4 Implementation of Environmental Management Plan .................................................. 2

2 General Environmental Management .............................................................................. 4
  2.1 General / Administrative Procedures ........................................................................... 4
  2.2 Discharges to Air .......................................................................................................... 5
  2.3 Noise and Vibration ...................................................................................................... 6
  2.4 Working within a Watercourse (COEP11) ..................................................................... 6
  2.5 Site Tidy Up (from COEP 5 and COEP 13) ..................................................................... 6

3 Construction Site Management ....................................................................................... 7
  3.1 Haulage ........................................................................................................................ 7
  3.2 Construction Camps and Site Facilities (COEP 5) ........................................................ 7
  3.3 Refuelling and Maintenance Areas .............................................................................. 9

4 Erosion and Sediment Control Plan (from COEP 11 and COEP 13 - Draft) .......... 10
  4.1 Earthworks – Programme of Works ............................................................................ 10
  4.2 Stockpiles .................................................................................................................... 10
  4.3 Removal of Silt or Rubbish Debris from Watercourses ............................................... 10
  4.4 Temporary Silt Traps .................................................................................................... 10
  4.5 Use of Heavy Machinery in or close to Watercourses or the Coastal Margin ............... 11
  4.6 Clearing Vegetation ..................................................................................................... 11

5 Drainage (COEP 11) ......................................................................................................... 12
  5.1 Design .......................................................................................................................... 12
  5.2 Construction ............................................................................................................... 13

6 Coastal Activities ............................................................................................................. 14
  6.1 General ......................................................................................................................... 14
7 Traffic Management (COEP 12) AIM

7.1 Pre-Construction Warning of Works

7.2 Signage and Access

7.3 Health, Safety and Efficiency

7.4 Traffic Management Plan
1 Introduction

1.1 Background
This Environmental Management Plan (EMP) has been prepared as a management tool to provide guidance in the construction of civil works for the road widening and drainage improvements to 2.3km of Vaitele Street and to manage environmental impacts.

The EMP forms part of the Land Transport Agency’s (LTA) application for Development Consent and shall be implemented in accordance with that consent. A Final EMP will be attached to the contract documentation for the Project.

This EMP incorporates best practice environmental management in accordance with the Government of Samoa Codes of Environmental Practice (COEPs) where relevant.

The purpose of this EMP is to be included in the special conditions of contract for Vaitele Street improvements and implementation of the EMP is part of the Contractors contractual obligations, in particular the Environmental Management Plan required to be provided by the Contractor under clause 67 and Traffic Management required under clause 68.

This EMP is divided into the following sections:

- Section 1: Introduction, the PEAR, the COEPs and EMP implementation
- Section 2: General Environmental Management
- Section 3: Construction Management
- Section 4: Erosion and Sediment Control
- Section 5: Drainage
- Section 6: Traffic Management
- Section 7: Summary

1.2 Preliminary Environmental Assessment Report
The PEAR that forms the primary document to which this EMP is attached has been prepared in accordance with the Environmental Impact Assessment (EIA) Regulations 2007 to determine the likely significance of impacts arising from the proposed Vaitele Street road widening and drainage improvement work. The following areas were identified as requiring mitigation to avoid or minimise adverse impacts during the construction stage:

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

This EMP is prepared as a management tool to mitigate potential impacts identified within the PEAR.
1.3 Codes of Environmental Practice

The current Codes of Environmental Practice (COEPs) were prepared in 2007 to define 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.

There are 14 COEPs, including COEP 1 – *Administrative Procedures* which provides for the authority for the codes, definitions and format and the process for implementation and monitoring of the COEPs. The relevant COEPs for the Vaitele Street Improvement Works are:

- COEP 1 - Administrative Procedures
- COEP 5 - Construction Camps
- COEP 11 - Drainage
- COEP 12 - Traffic Control During Construction
- COEP 13 - Earthworks (Draft)

All works shall be undertaken in accordance with the relevant COEPs.

1.4 Implementation of Environmental Management Plan

This EMP should be implemented using the following procedures:

1. Compliance with the EMP is the responsibility of the Construction Site Manager who is the authorised representative of the Contractor under clause 69 of the special conditions of contract. The Site Manager will be identified by the successful Contractor.

   In his absence from the site, a suitably trained deputy will take responsibility as Site Manager and therefore responsibility for compliance with this EMP. The Site Manager will be responsible for:

   - daily site inspections;
   - weekly reporting;
   - incident reporting;
   - following up on complaints;
   - identification of where corrective action is required and ensuring they are undertaken;
   - maintaining records of the above; and
   - 24 hours contact details for the Contractor and Construction Site Manager shall be available on site at all times.

2. Training of staff will be undertaken in respect to environmental expectation and a training record will be kept. All construction staff will be briefed on the EMP and its requirements.

3. All sub-contractors or suppliers who have the potential to undertake activities that may result in adverse impacts will be required to read the EMP and sign a declaration that they have read and understood it. No sub-contractor will be allowed to commence work until this form is completed.

4. Where necessary, sub-contractors must supply evidence that they have undertaken the necessary action to adhere to the requirements of the EMP.
5. This EMP will be reviewed on an ‘as required’ basis.

6. No access shall be given to the site until such time as a complete Traffic Management Plan and an Environmental Management Plan have been approved by PUMA / LTA. If, in the opinion of the Project Engineer, the Contractor is not in compliance with the approved plans at any time during the execution of the site work the Engineer shall notify the Contractor and may suspend the work if the Contractor fails to rectify the deficiencies within the time period specified (clause 67 and 68, Special Conditions of Contract).
2 General Environmental Management

2.1 General / Administrative Procedures

2.1.1 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.

2.1.2 Complaints Procedure
All employees of the Contractor will immediately report any complaints from site visitors, neighbouring villages, or the surrounding community to the Site Manager.

All complaints received in respect of the construction work will be recorded by the Site Manager in a Complaints Register, which will be maintained by the Site Manager throughout the duration of construction work.

The register will record:
- Date and time of complaint;
- Name and address of complainant;
- Name / nature of the event complained about;
- Details of complaint;
- Weather conditions at the time of which the incident complained about occurred;
- Action to prevent further similar complaints;
- Date of verbal response provided to complainant; and
- Date of written response sent (if required).

The Site Manager will be required to respond to the complainant within 48 hours of the complaint being received, with a response that confirms the details of the complaint and which indicates what action is proposed or has been taken.

The Site Manager will provide a copy of all complaints to the LTA within two working days of the complaints being made.
2.1.3 General Construction Phase Operating Procedures

- The Contractor shall undertake all reasonable steps to ensure minimum nuisance to adjacent land users during construction.

- Normal hours of work are between 7.00am and 4.00pm Monday to Fridays. No work shall occur on public holidays or at weekends except for emergency work, unless given prior approval by the Engineer (see also clause 45.1, Special Conditions of Contract).

- 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 re-vegetation 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 the Special Conditions of Contract, as required.

2.2 Discharges to Air

2.2.1 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.

2.2.2 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 and generally in accordance with the manufacturer’s specifications.

- Waste materials are to be removed from the site and not burnt.
2.3 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 manufacturer’s 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.

2.4 Working within a Watercourse (COEP11)
Works within a watercourse shall be undertaken in accordance with COEP 11.

- Disturbance of water courses shall be minimised. Excavation or disturbance of the bed of any waterway shall not occur unless required as part of construction.
- Exposed surfaces in close proximity to watercourses (within 20 metres) shall be minimised and re-vegetated or sealed as soon as practicable.
- Weather conditions should be taken into account in programming earthworks.

2.5 Site Tidy Up (from COEP 5 and COEP 13)
As part of the completion of the construction work, the Contractor shall ensure that the following activities will be undertaken in accordance with COEP 5 and COEP 13 where applicable:

- All construction materials shall be removed from the area.
- All silt traps / filters shall be removed.
- Vegetation and grass shall be planted, or allowed to grow in areas where earth is exposed.
- All disturbed surfaces shall be rehabilitated.
- All rubbish shall be removed from the area.
3 Construction Site Management

3.1 Haulage
To minimise the extent of heavy traffic and construction impacts on adjacent 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. Use of vehicles and machinery on roads shall be in accordance with clause 68 of the Special Conditions of Contract and any road traffic regulations in effect at the time.

- 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.

3.2 Construction Camps and Site Facilities (COEP 5)

3.2.1 Construction Camp Site Facilities
Site facilities shall be established as set out in COEP 5. Site facilities include offices, ablutions and areas designated for workers, and as such are activities which have the potential to generate litter and other waste material. These facilities shall not be located within 30 metres of a watercourse of the mean high tide mark, of in an ecologically sensitive area. Site facilities include:

- Site offices, building and facilities as necessary;
- Covered rubbish bins; and
- Regular disposal of rubbish off-site at an appropriate location.

General Conditions of Contract clause 27 apply to the establishment of work depots and construction camps.

Within 14 days of the commencement date of the contract the Contractor shall submit to the Project Engineer for approval a detailed layout plan for the development of the construction camp or site facilities showing the relative locations of all temporary buildings and facilities that are to be constructed, with the location of site roads, storage areas and drainage facilities. The Contractor shall also submit brief specifications for the
materials to be used for the construction of all building and facilities and defining the standard of construction for all work to be undertaken at the construction camp site.

In preparing such specifications the Contractor shall incorporate the following minimum requirements:

- The site shall be completely fenced with a security fence at least 2 metres high, the design of which shall be entirely suitable for its purpose. The fence shall be constructed from galvanised posts and wire.

- Areas for the storage of fuel or lubricants or where machinery or equipment is to be serviced shall be bunded to prevent the escape of spillages of fuel or lubricants from the site. Drainage of such bunded areas shall be through purpose designed and constructed oil traps.

- A minimum of one water closet toilet, one urinal and one shower shall be provided per 10 personnel employed either permanently or temporarily on the contract project. Separate toilet and wash facilities shall be provided for male and female employees.

- All discharge from toilets, washrooms, showers, kitchens, laundry facilities and the like shall be piped to a purpose designed approved sewage system treatment plant for treatment prior to discharge to a natural watercourse.

- All dormitories, dining halls and other accommodation shall be ventilated and illuminated to ensure the health and safety of the Contractor’s workforce.

- All storm water drainage from the site shall be channelled or piped to a silt retention pond prior to discharge from the site. The retention pond shall be sized to provide a minimum of 20 minutes retention for storm water flow from the whole site that will be generated by a 20 year return period rainfall having a duration of at least 15 minutes. The run-off coefficient to be used in the calculation of retention pond volume shall be 0.9.

- All discharge from the silt retention pond shall be channelled to discharge to natural water via a grassed swale at least 20 metres in length with suitable longitudinal gradient.

All camp facilities shall be maintained in a safe, clean and / or appropriate condition throughout the construction period. The silt retention pond shall be maintained in efficient condition throughout the construction period. Trapped silt and soil shall be periodically removed and transported and placed in waste material disposal areas.

The Contractor shall provide, equip and maintain adequate first aid stations and erect conspicuous notice boards directing where these are situated. The Contractor shall provide all required transport. The Contractor shall comply with the government medical or labour requirements at all times and provide, equip and maintain dressing stations where directed and at all times shall have experienced first aid personnel available throughout the period of contract work to attend to injuries.

Throughout the period of the contract work, the Client / Employer, the Project Engineer or their representatives, shall have uninterrupted access to and from the Contractor’s construction camp for the purpose of carrying out routine inspections of all buildings, facilities or installations of whatever nature, to ensure compliance with this specification.
3.2.2 Private Land

Unless otherwise specified the Contractor is at liberty to make their own arrangements with land owners to establish construction camps or work site facilities. Prior to developing such a camp the Contractor shall submit to the Project Engineer a signed authority of the land owner for the Contractor to establish the facility on any land, after proceeding as COEP 4.

The Contractor shall also submit to the Project Engineer, the following information signed by the land owner and the Contractor:

- Details of compensation to be paid;
- Agreed period of tenure;
- Any specific requirements of the land owner;
- Photographs of the site in its original condition; and
- Details of the proposed and agreed site restoration after completion of the contract work.

At the completion of the contract work, the Contractor shall submit to the Project Engineer a signed statement from the land owner confirming that the compensation has been paid, if relevant, and that the land owner is satisfied with the restoration of the site. If such a statement is not submitted the Client / Employer may withhold money owing to the Contractor in a sum sufficient to pay for the compensation and the site restoration necessary.

3.2.3 Construction Camp Site Restoration

At the completion of the construction work, the Contractor shall dismantle and remove from the site all facilities established within the construction camp including the perimeter fence and lockable gates. The whole of the construction camp site shall be grassed and if trees originally grew on the site they shall be replaced with similar tree species. At the completion of restoration the site shall be in no way inferior to the condition that pertained prior to commencement of the construction work.

Any oil or fuel contaminated soil shall be carefully removed from the site and transported and buried in waste soil disposal areas approved by the MNRE.

3.3 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.
4 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 COEP 11 – *Drainage*.

4.1 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 are 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 re-vegetation are implemented to minimise the period over which earth surfaces are exposed to the potential for erosion.

4.2 Stockpiles

Stockpiles shall be sited such that storm water run-off from such stockpile areas can be collected, controlled and discharged through devices to remove suspended solids prior to discharge to natural watercourses.

- No stockpiles shall be established within 10 metres of the mean high tide mark.
- No stockpiles shall be established on the road such that they will adversely impact the sightlines or safe movement of vehicles.

4.3 Removal of Silt or Rubbish Debris from Watercourses

- When obstructions, debris and materials which limit hydraulic efficiency are cleared away from drains, channels and culverts, such work shall be programmed for implementation during the month prior to the onset of each wet season as a minimum.
- Material cleared from drainage systems should be loaded onto a truck and transported to designated waste disposal areas for appropriate disposal. On no account should silt, rubbish debris or other waste materials removed from watercourses, be disposed of on site.

4.4 Temporary Silt Traps

Throughout the construction of the work, the Contractor shall install silt traps in all temporary and permanent drains where work is occurring in or within 30 metres of such drains or other watercourses. Silt traps shall be constructed of appropriate materials as detailed and / or as specified by the Project Engineer.

Silt traps shall be maintained in sufficient operating condition throughout the construction work. Material periodically cleaned from such silt traps and drains shall be transported and disposed of in waste disposal areas established as detailed and specified in accordance with COEPs 11 and 13.
The Contractor shall identify the need for, construct and maintain silt traps in accordance with design documents, provided by the Project Engineer, and where necessary manage the impacts of silt run-off and discharge. A sediment control plan shall be included in the Contractor’s EMP. In the event of any unforeseen discharge, the sediment control plan and the EMP shall be reviewed and, where it is considered necessary, amended to better manage the control of silt.

The following forms the key approach to silt control during construction either within or immediately adjacent to watercourses:

- A sediment trap will be placed downstream of the site where construction work is due to take place, prior to the work commencing to intercept flow from disturbed surfaces, particularly the bed of the watercourse during silt excavation or rubbish removal.
- The Contractor shall install silt fences
- The disposal of material that is periodically cleaned from silt traps shall be specified to ensure that it does not re-enter any natural watercourses or the marine environment.
- Throughout the construction period and, if necessary, during maintenance activities, the discharge of silt laden water from construction sites to watercourses shall be minimised. In ecologically sensitive natural habitats and along any foreshore untreated discharge shall be prevented.
- At the completion of construction work, silt traps shall be cleaned out and removed to allow natural flow of the watercourse.
- Where silt traps are required, details of these shall be provided by the Site Manager to the Project Engineer.

4.5 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.

4.6 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 occurred. On no account is cleared vegetation to be burned. Such vegetation shall be removed from the site.
5 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.

5.1 Design

5.1.1 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._

5.1.2 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.

5.1.3 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.

5.1.4 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 downstream erosion, the design of outlet structures shall include appropriate energy dissipation measures.

5.2 Construction

5.2.1 Channels and Open Drains
It is the Contractor’s responsibility to ensure that:

- Prior to commencing site clearance or earthworks the Contractor shall install all temporary or permanent drainage channels as appropriate together with silt fences or silt retention ponds to minimise the discharge of surface water containing sediment particles to any natural watercourse or on the land adjacent to the construction site.
- All permanent drains shall be lined as specified as soon as practicable after formation.
- Specified erosion control measures at channel discharge locations shall be operational prior to the construction of the relevant permanent drainage.

5.2.2 Culvert Construction
It is the Contractor’s responsibility to ensure that:

- Where culverts are to be constructed in existing watercourses care shall be taken to minimise the clearance of vegetation from existing banks and inverts to just that necessary for the construction work.
- Construction shall be undertaken utilising methods that limit to practical levels the amount of water contaminated with sediment particles.
- Temporary downstream silt filters should be installed to provide a stilling basin for the settlement of suspended soils and these shall be cleaned out and silt transported to waste soil disposal areas before the temporary filter is dismantled.
6 Coastal Activities

6.1 General
The following actions will be taken to avoid any adverse impacts on the coast.

- No fuel, lubricants or hazardous substances will be stored within 30 metres of the mean high tide mark.
- No material will be tipped into the sea, or allowed to enter the sea, unless expressly approved by MNRE or LTA.
- Should coastal defence works be required, these will be constructed in accordance with COEP 10.
- The Contractor shall take into account the Coastal Infrastructure Management Strategy and, where complete, relevant Coastal Infrastructure Management Plans in the preparation of the Contractor’s Environmental Management Plan.
7 Traffic Management (COEP 12)

Traffic management during construction shall be in accordance with COEP 12 – Traffic Control During Construction. The following provides a summary of the key procedures that shall apply to the Contractor, and in addition, the Contractor shall prepare a Traffic Management Plan (TMP) in accordance with the requirements of clause 68 of the Special Conditions of Contract.

7.1 Pre-Construction Warning of Works

Advance warning of work to road users and adjacent land users through the use of road signage, stating the date that work is due to start and the approximate length of time that work is occurring on or immediately adjacent to the road. Advance warning shall be a minimum of 5 working days before commencement.

7.2 Signage and Access

- All traffic signs used for the warning or direction of traffic at road work sites shall comply with the requirements of the LTA and appropriate traffic regulations. Home-made signs shall not be used.

- Advance warning signs during construction are to be placed beside the road to warn approaching traffic about events where Contract personnel will be near or on the road. As a guide, signs should be placed in advance of the site in a position where they can be seen for at least 60 metres by oncoming traffic in an urban area and at least 90 metres in a 60 km/h zone.

- Safe access for vehicles and pedestrians shall be provided by the Contract at all times during construction when work affects access ways. Safe access shall be provided through the use of appropriate signage and traffic cones to clearly direct road users or traffic.

- Traffic cones shall be used to warn and slow down traffic approaching the work areas. They should be placed along the centre-line or shoulder of the road as appropriate. Where this is insufficient the cones can also be placed on the other side of the carriageway in order to narrow the effective carriageway width, and slow oncoming traffic. Cones are essential if the work site requires through traffic to deviate from the normal line of travel. In such cases the cones should be used to taper traffic to their desired position.

7.3 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 on or adjacent to any road shall wear reflective red jackets while on the construction work site.

- Appropriate traffic management shall be implemented to manage traffic flow past the site.

- Unless otherwise provided for in the form of temporary deviations and the like, all roads shall have at least one lane open for the passage of traffic at all time. Where one-way traffic lines are required, the Contractor shall ensure that personnel be positioned at each end of any one-lane section of road equipped with stop / go paddles to provide instructions to passing vehicles. Where personnel directing the traffic are not inter-visible, they shall be equipped with radio telephones in good working order.

- Should lane closures be required, they shall be organised by the Contractor in consultation with and with the approval of the Land Transport Authority.
7.4 Traffic Management Plan
The Contractor shall prepare a Traffic Management Plan (TMP) for each work site. The TMP shall be approved by the Project Engineer on behalf of the Land Transport Authority prior to construction work at such sites commencing.