Report

Samoa West Coast Road Drainage - Preliminary Environmental Assessment Report

Prepared for Land Transport Authority (Samoa) (Client)

By Beca International Consultants Ltd (Beca)

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EXECUTIVE SUMMARY

This Preliminary Environmental Assessment outlines the current issues and potential impacts of the proposed West Coast Road drainage improvement works.

Minor adverse impacts of the drainage improvement work include:

- temporary impacts on water quality during construction as a result of physical work within the drainage system;
- temporary impacts associated with disruption caused by the construction operations, however, any disruption will be mitigated through careful environmental, health and safety and traffic management;
- noise and vibration impacts will be temporary and mitigation measures will be incorporated into the construction stage;
- temporary impacts occurring during construction associated with earthworks would be mitigated through sediment control measures;
- temporary, minor disturbance to local freshwater habitats during the construction stage in relation to the removal, alteration or replacement of existing drainage infrastructure or from maintenance activities that clear sediment and rubbish debris; and
- minor impacts on the marine environment, however, due to the short term and minor significance of the impacts, it is unlikely that the coastal ecosystem will be altered.

These impacts can be avoided, remedied or mitigated in accordance with the measures outlined in Section 8 of this report and in accordance with the requirements outlined in the Environmental Management Plan.

There are also likely to be significant positive impacts of the proposed work, in particular for the health and safety of the community.

The establishment of new easements will provide compensation to landowners while protecting the drainage management system from future encroachment and allowing some ongoing use of the land.

Overall, adverse environmental impacts will be minor or insignificant during construction. Once the improvements are complete, the operation of the drainage system is anticipated to have a positive impact.
1 Introduction

1.1 Context

The Ministry of Works Transport and Infrastructure (MWTI) has commissioned Beca International Consultants to identify and design drainage improvements required for the West Coast Road in order to improve the stormwater management system. The works will result in an improvement to the quality of water being discharged to the lagoon and to reduce surface water flooding on the road and surrounding land during times of heavy rainfall. As a result there will be improved social, environmental and economic benefits to the local communities and to the country as a whole.

The Planning and Urban Management Agency (PUMA) has advised that the requirement for the assessment of environmental impacts of the proposed work can be met through the submission of a Preliminary Environmental Assessment Report (PEAR), in accordance with the Environmental Impact Assessment Regulations 2007, due to the fact that the nature of the work is predominantly improvements to existing infrastructure and therefore, as this assessment report shows, not likely to generate significant adverse impacts.

This PEAR has been prepared to identify and assess the environmental impacts associated with the proposed work and to consider alternatives. The PEAR will be submitted by MWTI to the PUMA and seek approval under the Planning and Urban Management Act 2004 (the Act) and the associated Environmental Impact Assessment Regulations 2007 (the Regulations) to undertake the proposed work as described in Section 2 of this report.

1.2 PEAR Structure

This report structure is based on the PEAR requirements outlined in Part I (section 1) Schedule – Content of an EIA of the Regulations:

Executive Summary: Provides a summary of key issues and a conclusion of the environmental assessment report

Section 1: Introduction and provisions of the Act and the Regulations to manage the EIA process for development projects.

Section 2: Provides a description of the proposed work.

Section 3: Provides a description of the site where the works are proposed and the surrounding environment.

Section 4: Background to, and justification for, the proposed work.

Section 5: Identifies the stakeholder consultation undertaken (to be undertaken).

Section 6: Outlines the environmental impacts of the proposed works and their likely significance in the short and long term.

Section 7: Considers alternatives to the proposed works, including the do-nothing option.

Section 8: Provides appropriate measures to mitigate or avoid identified adverse environmental impacts.
1.3 EIA Requirements

The Act makes provision for EIA to provide supporting information required for development applications. The Regulations determine whether an EIA is required and if so, to what extent assessment is required. This PEAR has been prepared in accordance with the Regulations, which, under Section 4 of the Regulations require a PEAR because some of the EIA ‘Qualifying Criteria’, contained in Section 5 of the Regulations, apply but it is not likely that the proposed drainage improvement work will have a significant adverse impact on the environment. The relevant Qualifying Criteria sub-sections from Section 5 of the Regulations are:

(a) adverse impacts on people, an existing activity, building or land;

(d) adverse impacts on or in the coastal zone;

(e) adverse impacts on or in any waterway or aquifer;

(f) adverse impacts arising from the discharge of any contaminant or environmental pollutant;

(j) adverse impacts on traffic or transportation.

The project consists of 42 discrete work packages or upgrade sites along the West Coast Road from Vaitele to the Mulifauua wharf. While the total value of the works in the project will be determined by the current MWTI works maintenance budget, the value of each individual work package or site upgrade is expected to be not more than WST 20,000 in most cases.

In nearly all cases, each upgrade site is unconnected to the adjacent site and there are no cumulative consequences that could result in the value of the work being considered cumulatively.
2 Description of Development Proposal

2.1 The Current Problem

The West Coast Road, running from Apia to the International Airport at Faleolo and the Mulifanua wharf, intersects water courses as well as the overland flow from the highland areas and coastal plains to the lagoon on the north coast of Upolu. Drainage facilities exist to intercept this flow of water and carry it under the road and out to the coast. During periods of heavy rain flooding is a problem in many places along the road. A location plan is shown in Figure 1 below.

![Location Plan of West Coast Road between Faleolo and Apia](Source: Google Maps 2009)

**Figure 1: The West Coast Road between Faleolo and Apia.**

The flooding is caused by a number of problems including:

- inadequate culvert sizes;
- inadequate culvert inlets;
- broken/blocked culverts;
- inadequate or blocked/filled culvert inlets and outfall channels; and
- the very flat grades constructed for some sections of the surface water channels alongside the road.

The flooding problem is further exacerbated by poor drainage maintenance and in some cases the deliberate filling of drainage outfall channels where these traverse through built up village areas.

At a number of points along the route of the road, the surrounding land floods due to runoff from the road during times of heavy rain and many drains and culverts are fully or partially blocked or are undersized for the runoff volumes experienced. These issues present a problem in regards to road safety, damage to land and property and water quality.

Adverse environmental consequences of poor drainage management include increased sedimentation and contamination of the lagoon and wetlands resulting in coral damage and a loss of biodiversity in these areas. Adverse economic consequences are reduced travel times between Apia and the airport and wharf affecting international as well as local services. Flooding also damages the road and adjacent infrastructure weakening the subgrade and eroding the chipseal surface increasing maintenance costs. Adjacent infrastructure is damaged as water seeps into...
underground telephone services resulting in disrupted communications which exacerbate social and economic consequences.

The floodwaters, although temporary, have significant adverse social, environmental and economic effects on the lives of residents and users of the road. Adverse social effects include property, flooding and damage, difficulties in accessing dwellings, shops, employment centre and emergency services and adverse health problems as the standing water attracts mosquitoes resulting in an increase in disease vectors.

The photographs below demonstrate some of the current problems described above.

2.2 Summary of Works Proposed

There are approximately 50 sites which were assessed as needing some drainage improvement work. The drainage improvement work proposed has been prioritised according to the issues and solutions identified at each site along the length of the road. Of the 50 sites assessed as needing some drainage improvement, 42 have been given a priority ranking that will require work to be progressed if the physical works budget alows. The drainage improvement work is summarised as:

- replace damaged culverts and pipes with new;
- construct new, larger culverts and pipes to replace existing where they are undersized;
- construct new outlet drains and new swales to convey stormwater;
- extension of grouted rock walls / channels;
- construct grate covers on outlet chambers.
Of the 42 sites requiring drainage improvements, 19 sites require the establishment of an easement over private land for outfall channels or pipes between the road and the coast.

Where drainage easements are required, consultation with the property owners/occupiers will be carried out by MWTI staff with assistance from the Beca team in regard to plans and potential easement alignments.

Easements are proposed rather than the outright purchase of the land as the property owner retains ownership of the land and may continue to use the land provided that the easement or drain is not blocked with any permanent structure. This arrangement benefits both parties to the easement agreement and ensures ongoing access to maintain the drainage system. Easements are not required and will not be provided over or alongside permanent free-flowing watercourses.

Appendix A provides a brief description of the drainage improvement work required at each site in a summary table and plans showing the location of each site and the work proposed.
3 Description of Site

3.1 West Coast Road Overview

The main road between Apia and Faleolo, along the north western coast of Upolu, is the most important transport link in Samoa. It provides a road link between Apia and the International Airport and to the vehicle and passenger ferry services which run between the islands of Upolu and Savai'i. It is, therefore, of strategic national significance. It also provides overseas visitors with their first impression of Samoa as they travel to Apia from the International Airport (see Figure 1, Location Plan).

The primary objective of the drainage improvement work is to improve stormwater management along the road to maintain safe and efficient use of the road and to avoid or mitigate impacts caused by poor drainage.

3.2 Existing Environment

In order to assess potential environmental impacts, it is important to firstly understand the existing environment of the West Coast Road drainage improvement sites and their environs. A brief description of the existing environment is provided below:

- **West Coast Road Alignment** - the road follows the coast along the north of Upolu west of Apia to Faleolo and at some points runs immediately adjacent to the coast. It is a two-laned, sealed road with grass berms along the majority of its length.

- **Land Use** - current land uses vary along the route, from the urban city centre of Apia (although the project starts from the outskirts of the urban area at Vaitele), to coastal villages and rural areas. There are residential properties adjacent to the road along much of the route. The terrain is predominantly flat with steeper topography further inland.

- **Watercourses and Water Quality** - the road crosses a number of small streams and rivers which form part of the drainage catchment of the area and drain water from the inland hills and surrounding land, to the coast. The sea is the receiving environment for the watercourses and road derived stormwater. Overflowing of the drainage system can potentially cause the water draining to the sea to be of a poor quality in terms of silt, contaminants and potentially rubbish.

- **Flooding and Drainage** – culvert pipes are provided at points where the road crosses the watercourses, however, some of the existing culvert pipes are undersized, damaged or blocked, which prevents water flow. Additionally, some outlets are inadequate and create a build up of water in the drainage system. In times of high rainfall, the drainage system can overflow and cause surface water to pond on the road and flood adjacent land.

- **Ecology and Natural Habitats** - the land use adjacent to the road is generally modified for use by residential, access and community related facilities. The closest sensitive natural habitat is the marine environment, including reefs located off the coast. The coastal environment along the West Coast Road is varied and consists of rocky outcrops and sandy beaches. A fringing reef provides protection along the coast, ranging from 500m at its closest, to over three kilometres at its furthest. Within the reef the lagoon averages 1.5 metres in depth and supports abundant marine biodiversity. There are no specifically identified marine protection areas on the stretch of coast that the road follows, with the nearest protected marine environment being the **Palolo Deep Marine Reserve** on the eastern side of the centre of Apia.
- **Socio-Economic** - a number of villages are accessed from the West Coast Road and residential properties and access routes are affected by stormwater and drainage problems in some areas during times of high rainfall. Drains and swales pass between private properties with no easements which makes it difficult to manage and maintain the stormwater system because access over private property for workers and equipment is limited. The West Coast Road is a nationally significant road which businesses, particularly in Apia, and people, rely on as a good connection to the international airport and the ferry services to Savai'i.
4 Justification of the Development Proposal

The current drainage system along the West Coast Road requires improvement work and maintenance to provide infrastructure to an adequate standard. The work proposed focuses on improving existing infrastructure, replacing damaged or inadequate infrastructure with new and constructing new conveyance structures where required. Maintenance activities on the existing drainage system will then be the responsibility of the maintenance contractors.

The key justification for the proposed work is to reduce the occurrence of surface water flooding on the road and surrounding area caused by the overflowing of the drainage system, to improve the quality of water draining to the coast by maintaining the system to minimise the build up of silt and rubbish debris in the drains and to reduce the incidence of standing water as a breeding ground for mosquitoes.

Establishing new easements where required at some sites, will provide an enhanced ability for the drainage infrastructure, such as outfall drains or pipes, to be maintained and accessed by the maintenance contractor in the future.

Given that the West Coast Road is of national importance as the key transport linkage between Apia and the international airport and the ferry terminal, it is essential that floodwaters do not impede the efficient use of the road or compromise road safety.

Additionally, the drainage improvement work will reduce the risk of flooding to adjacent land, access and nearby properties which is important for communities.
5 Alternatives Considered

5.1 Do Nothing (no physical improvement works and no new easements)

This option accepts the present situation. If this option was followed, there would be no discernable improvements to the drainage system along the length of the West Coast Road. Although short term capital improvement costs would reduce, there would be increased maintenance costs to maintain the existing drainage as insufficient capacity in the system would continue to result in blockages that may require additional maintenance work in the future to rectify the problem.

5.2 Improvement Works Only (retain private ownership without easements)

Without the proposed easements there is the potential for more landowners to encroach or fill in the drainage channels to increase the buildable areas of their plots. This would result in an unacceptable risk to the wider drainage management system that would result in increased flooding and greater damage to public and private property. There would also be increased health and economic risks as a result.

5.3 Improvement Works and Land Purchase (no easements but private land purchased as public land)

To ensure access could be provided to the channels and drains following the improvement work proposed, areas of private land could be purchased and owned by the Government, allowing right of access and use of the land for maintenance of and use as the drainage network. This is not considered as a suitable option as it would mean that current landowners would loose the use of some portion of their land and not be permitted to utilise that space in the future.

5.4 Preferred Option

The current problem with drainage along the West Coast Road is an environmental, social and economic issue and therefore, the above options are not considered the preferred solution. Therefore, undertaking drainage improvement works and establishing easements is the preferred option as it allows private land owners to retain their land ownership and some use of the land, while not compromising access to the drainage system for ongoing maintenance in the future.
6 Stakeholder Consultation

The proposed works will be undertaken in two stages. The first stage will be drainage sites entirely within the public road reserve while the second stage will also involve defining easements and works on private property. Consultation to date has been with regard to the project in general and to Stage 1 in particular. The following is a summary of the consultation to date.

6.1 LTA

The Land Transport Authority (LTA) is the sponsor for this project and is fully aware of the proposed drainage improvements. The LTA is also the operator of the roading network and in preparing for the drainage improvements has indicated a concern for the management of traffic on the road to ensure that the road continues to operate safely and efficiently without any undue delays or danger.

These issues are addressed in Sections 7 and 8 by providing for detailed traffic management plans for each work site.

6.2 PUMA

The Planning and Urban Management Agency (PUMA) has been advised of the proposed works and have attended a site visit with the Consultants on 3 December 2009. Ferila Brown, Mandria Sua and Kirisimasi Seumanutafa attended on behalf of PUMA.

Issues raised include, the need to consult and to keep people informed before entry to private property is undertaken, the need for appropriate traffic management and to maintain access to properties along the works area and the need for appropriate compensation to be agreed with individual land owners and, in some cases, villages.

LTA and the Consultants have continued to consult and to inform people of the project through village meetings and Pulenu’u meetings. Further consultation will be undertaken for Stage 2 once the preliminary design is prepared. Traffic Management Plans will be part of the contract documents and are included in the Environmental Management Plan that forms part of this document. Compensation will be discussed during Stage 2 when the preliminary design has been prepared.

6.3 Village Pulenu’u, Private property / land owners

Village Pulenu’u have been advised of the project at joint meetings held on the 30 November and 1 December 2009. They have also been informed and updated on progress as survey work has been carried out within the villages. Land owners have also been consulted before survey teams have gone onto properties for the topographic survey needed to provide input to Stage 2, Design, of the drainage improvement project.

Stage 1 work within the road reserve is not of concern to the Pulenu’u or land owners apart from the need to maintain access to all properties along the area of the works.

Further consultation will be undertaken with affected land owners for Stage 2 once the preliminary design has been prepared.
7 Assessment of Environmental Impacts

This section considers the possible environmental impacts of the drainage improvement work proposed. The assessment of impacts has considered the short and long term and the primary and secondary consequences of the activities and identified the likely significance of any impacts. Additionally, mitigation measures to minimise or avoid adverse impacts are identified in Section 8 of this PEAR.

7.1 Air Quality and Dust

7.1.1 Construction Stage

Construction activities related to the drainage improvement work have the potential to impact on air quality during the construction stage in the form of:

- vehicle emissions released from the use of construction related vehicles and machinery; and
- the generation of dust from earth disturbing activities.

The significance of these impacts will depend on the following considerations:

- the location of nearby receptors such as residential areas, wildlife and buildings which may be affected by emissions and dust; and
- the extent of the physical work required, particularly earth disturbing activities.

The physical work covered by this development application is predominantly the improvement of existing infrastructure, and will, therefore, involve limited earthworks and construction vehicles. It is considered that there will only be minor adverse impacts relating to air quality and dust during the construction stage provided that areas of land exposed during construction are either sealed or have vegetation planted following completion of the construction stage of work. Mitigation measures for construction work will be applied to further minimise air quality and dust impacts, particularly for sites near to residential properties. Mitigation of dust proposed during construction includes limiting the areas of exposed earth during the works and providing for damping in the event dust is generated. Details of the mitigation proposed are provided in Section 8 of this report.

7.1.2 Operation Stage

The impacts of the operation of the drainage improvements will be dependent on periodic maintenance operations. The associated impacts of ongoing, operational maintenance will be more minor than those during the construction stage and will predominantly involve cleaning of drains only and mowing grass and vegetation. In this regard it is considered that operational impacts relating to air quality and dust will be insignificant.

7.1.3 Summary – Air Quality and Dust

It is considered that adverse impacts relating to air quality and dust are of minor significance during construction or insignificant once operational. Mitigation is outlined in Section 8.
7.2 Water Quality and Hydrology

7.2.1 Construction Stage

The key water related impacts that could potentially occur during the construction of the required drainage improvement work are:

- increased sedimentation in the drains through the disturbance of silt due to earthworks activities within or adjacent to the drainage channels; and
- effects on water quality within the drains, streams and marine environment due to the potential release of sediment, or the accidental release of oil, rubbish and other waste materials.

The significance of impacts relating to water quality and hydrology can depend on a number of factors, including:

- the scale and duration of earthworks;
- localised topography at the site where work is to be carried out;
- soil types;
- rainfall levels; and
- the sensitivity of the receiving water environment.

The limited scale of earthworks, the fact that they will be restricted to the existing road and drainage corridors and the construction management techniques to mitigate accidental spillages means that only minor adverse impacts are anticipated during the construction stage in regards to water quality.

Mitigation during construction will include the use of sediment traps and earthwork management techniques as described in the Codes of Environmental Practice (COEPs). Details of the mitigation measures proposed for this are considered in Section 8.

7.2.2 Operational Stage

The proposed drainage improvements will improve the capacity of the drainage system where there are currently restrictions caused by undersized or inadequate infrastructure and poor maintenance. This is considered as being a significant positive impact.

The improved drainage will allow the system to function more effectively, by reducing the risk of drains overflowing due to blockages or insufficient capacity and therefore, improving the quality of the water being discharged through the drainage system to the marine environment. Larger capacity outfalls will result in the velocity of flow being reduced, allowing more sediment to be deposited before it reaches the lagoon. Improved maintenance procedures facilitated by the proposed easements will result in earlier and more regular intervention to remove debris and contamination.
7.2.3 Summary – Water Quality and Hydrology

Temporary, minor adverse impacts on water quality are anticipated during construction as a result of physical work within the drainage system.

It is envisaged that there will be a significant positive impact on the hydrology of the area as a result of the drainage improvement work proposed, as it will provide greater capacity to manage stormwater and road surface water runoff, reducing the effects of flooding on the road and surrounding land.

7.3 Socio-economic Impacts

7.3.1 Construction Stage

The proposed drainage improvement work has the potential to generate socio-economic impacts such as:

- Access to small sections of the foreshore, minor roads and private access that connect with the West Coast Road may be restricted at times during the proposed work. For example, when carrying out improvement or maintenance work to outlets or when upgrading pipes that cross adjoining roads and accesses. However, suitable traffic management measures and access will be provided for, resulting in only a minor adverse impact to the community and road users.

- Potential accidental release of construction materials, such as oil, during construction operations has the potential to contaminate the local watercourse or marine environment which is utilised by the local community for fishing and recreation. However, it is not anticipated that a significant amount construction machinery will be required and measures identified in Section 8, such as ensuring that equipment storage is undertaken at a distance from the work sites, will be applied to avoid the risk of accidental spills from construction machinery. With mitigation in place, a minor adverse or insignificant impact is considered likely.

- Construction work has the potential to affect the safety and well-being of the local community through the presence of heavy vehicles and machinery operating on the drainage improvement sites. However, any disruption and health and safety matters will be mitigated by making the community aware of the works beforehand, providing barriers, traffic management and other safety measures, and planning work times to minimise disruption. Therefore, the impact is anticipated to be minor and temporary.

7.3.2 Operational Stage

In the past, development has encroached on the outfalls, to the extent that they can no longer carry the typical peak flow of runoff. In some cases the channels have been filled in completely and built over without any alternative provision for drainage being made. The negotiation of an easement for access for maintenance provides four likely advantages compared to either land purchase or leaving it in private ownership without easements for drainage:

1. The channel is maintained as an open area to convey stormwater runoff with less risk of being blocked resulting in localised flooding;

2. Landowners and the wider community are educated through this process on the importance of maintaining open drainage channels;

3. By creating an easement the landowners retain ownership of the land and can still use the area for non-permanent activities such as gardens when access for maintenance is not required; and
4. The easement is able to be valued and the landowner is compensated for the loss of the full use of the land while retaining ownership.

The drainage improvement work will reduce surface water flooding on the road and surrounding properties, help to manage water quality being discharged to the marine environment and reduce health risks associated with mosquitoes that breed in standing water. Both will benefit the local communities and road users by providing a safer and better operating transport link while also reducing the risk of flood damage to land and property, thereby resulting in a positive impact on the socio-economics of communities and road users.

The establishment of easements will provide significant improvements to the current drainage and flooding situation.

7.3.3 Summary – Socio-economic

With careful environmental, health and safety and traffic management in place, the potential adverse socio-economic impacts associated with construction operations are likely to be of minor significance.

The improved operation of the West Coast Road drainage system and ability to provide access for ongoing maintenance over private land by establishing easements will result in a significant positive impact following completion of the drainage improvement work.

7.4 Noise and Vibration

7.4.1 Construction Stage

The presence of heavy vehicles and machinery can increase noise and vibration levels and has the potential to cause disturbance near populated areas. However, it is not anticipated that the drainage improvement and maintenance work will create significant adverse impacts because the work at each site is relatively minor and confined to a small area. The disruption will be dependent on a number of factors, including time of operation, distance to residential and community areas and the intensity of the work. Controls over the timing of activities are provided as mitigation and included in the Environmental Management Plan (EMP) (a draft is attached in Appendix B). The approved EMP will also be included in the contractor’s tender documents. Details of mitigation are included in Section 8.

7.4.2 Operational Stage

The drainage improvement project will not result in any activities that are not already occurring in the existing environment. However, low levels of noise may be generated during the periodic maintenance of the drainage system once the improvements are operational. The impact of such activity is likely to be insignificant.

7.4.3 Summary – Noise and Vibration

Any adverse impacts relating to noise and vibration are expected to be temporary and of minor significance. Appropriate mitigation measures will be incorporated into the construction stage to minimise or avoid impacts where possible.
7.5 Traffic

7.5.1 Construction Stage

There may be some minor disruption to traffic during improvement work at each site along the road. These sites are relatively confined and the extent of the disruption will be limited.

Impacts will be dependent on a number of factors including time and duration of operation, proximity to main roads and populated areas, number of construction vehicles present and the use of traffic management. It is not anticipated that any road closures will be necessary as the work will take place in areas where existing infrastructure already occurs.

However, as mitigation, a traffic management plan for each work site will be prepared in accordance with the COEPs. This is detailed in Section 8.

7.5.2 Operational Stage

Impacts from the operational stage of the drainage improvements will be associated with maintenance activities, such as cleaning of the drains. Once the culvert under the road is permanently established, maintenance work is likely to be along the side of the road or off-road completely and standard procedures for working alongside roads will be adopted. More details on this are provided in Section 8. The impact of such maintenance operations is anticipated to be insignificant as it is unlikely to cause disruption to the road or adjoining accesses.

7.5.3 Summary - Traffic

It is considered that minor adverse traffic related impacts may occur at some of the drainage improvement sites. The majority of sites where work is proposed will not cause disruption to traffic or access. Minor impacts will be temporary during the construction stage.

7.6 Landscape

7.6.1 Construction Stage

The proposed drainage improvement work will be restricted to the existing road and drainage corridors, and will, therefore, have an insignificant impact on the landscape beyond this area. Some minor earthworks may be required where trenching work is carried out but this will not be sufficient to create large stockpiles of material and trenching will be back-filled once the improvement or upgrade to the drainage infrastructure has been installed.

7.6.2 Operation Stage

It is anticipated that impacts on landscape once the drainage improvements are completed will be similar to the existing road environment, with some positive impacts associated with areas where sediment/silt and rubbish debris currently collects that will be cleaned up. The drainage system will operate more efficiently with the improvements in place and there will be less standing water as a result.
7.6.3 Summary - Landscape

It is likely that the construction of the drainage improvement work will have an insignificant impact on the landscape of the current environment as views of new above ground structures will be limited to the localised setting only. Infrastructure such as culverts and pipes are already in place in the existing environment. Additionally, the visual impact of the proposed work once operational is expected to generate a positive impact on the landscape in regards to the visual appearance of the drains and surface water ponding on the road and surrounding land.

7.7 Archaeological and Cultural Assets

Discussions with residents of villages along the route during a previous PEAR undertaken in relation to rehabilitation and improvement work to the West Coast Road did not identify any archaeological or cultural assets that would be impacted upon by the proposed work. All known archaeological and cultural assets are avoided in the proposed work.

7.7.1 Summary – Archaeology and Culture

Due to the previous discussion undertaken and the extent of the proposed work being related to existing infrastructure and modified land use already in place, it is not considered likely that archaeological finds will be encountered. Therefore, the impact on archaeology and cultural assets is considered insignificant.

7.8 Soil, Geology and Coastal Hazards

7.8.1 Construction Stage

Some of the infrastructure requiring work is identified as being within the coastal erosion and flood hazard zones. The topography is typically flat and the minor physical work proposed will not increase the risk of erosion or flooding. Where it is proposed to replace existing culverts or pipes with new larger pipes, there will be some minor earthworks required to construct the upgraded infrastructure, however, this will occur within the existing road and drainage network. Where earthworks are required, suitable erosion and sediment control measures will be implemented as mitigation to minimise or avoid potential minor adverse impacts. Any new or replacement structures required will be constructed to a design standard that takes into account the risk inherent in the coastal area. Details of this are included in Section 8.

7.8.2 Operational Stage

The land use of the sites and the surrounding areas will not change and the proposed drainage improvement and maintenance work will not take place outside of the existing drainage corridors at the sites identified. It is, therefore, considered that the impact of the operation of the improvement work on soils, geology and coastal hazards would be insignificant.

It is noted that some of the Coastal Infrastructure Management (CIM) Plans for this area identify drainage as being an issue and the upgrade and maintenance of these drains as being a recommended solution. This project implements the recommendations of these CIM Plans.
7.8.3 Summary – Soils and Geology

There is the potential for minor adverse impacts to occur during construction associated with earthworks for the installation of replacement infrastructure; however, this would be temporary and mitigated through erosion and sediment control measures. New or replacement structures will be designed and built in accordance with the coastal hazards identified for the sites.

7.9 Freshwater Habitats

7.9.1 Construction Stage

Impacts on freshwater habitats can arise where the habitat of freshwater species has been disturbed or altered. The removal or alteration of culverts or other structures in the drainage channels, may result in a temporary discharge of silt or sediment which has accumulated upstream of any blockages. Where possible, whenever culverts are being removed, and where there is evidence of siltation, the bulk of silt will be removed by excavator and placed clear of watercourses, rather than be allowed to flow downstream. Where works are required within or immediately adjacent to watercourses, there is the potential for minor adverse impacts to occur. This will be mitigated with appropriate silt management devices as detailed in COEP 13 and Section 8 of this report.

7.9.2 Operational Stage

The majority of the watercourses requiring drainage improvement work are already modified watercourses or man-made drains or swales that form part of the catchment drainage system. In many cases current drainage is inadequate for the volume of water that results during wet season peak flows and this blockage creates an artificial dam that can result in ponding and siltation upstream of such ‘dams’, and increased scour and erosion, downstream. Many of these temporary ponds that form during high rainfall can also attract mosquitoes. The proposed drainage improvement work will reduce the likelihood of this problem occurring, and improve the management of water through the drainage system, generating a minor positive impact on the freshwater habitats once operational.

7.9.3 Summary – Freshwater Habitats

There may be temporary, minor adverse impacts on the local freshwater habitats during the construction stage in relation to the removal, alteration or replacement of existing drainage infrastructure or from maintenance activities that clear sediment and rubbish debris.

It is considered that there will be a positive impact on the freshwater habitats within the drainage system once the drainage improvement work is operational, as blockages will be removed and upstream flooding occurrences reduced.

7.10 Coastal Habitats

The coast and marine water is the receiving environment for the discharge from the stormwater drainage system. The reef is of economic, environmental and social significance, protecting the land as well as fish stocks contained in the lagoon.
7.10.1 Construction Stage

The key potential impact of the proposed drainage improvement work is for sediment to be released into the marine environment and the accidental discharge of contaminants, such as oil from construction vehicles. Undertaking physical work, such as maintenance and physical construction, within or immediately adjacent to drains and watercourses could create a minor adverse impact on the coastal habitat in relation to silt and debris discharge downstream. Mitigation measures will be implemented to minimise the disturbance and potential for discharge of silt and rubbish debris to the marine environment. Mitigation measures have been proposed to address work within the drains during the construction stage and can be found in Section 8 of this report.

7.10.2 Operational Stage

The drainage improvements will maintain the existing use of swales to treat road derived water runoff and the work will reduce the risk of silt and sediment build up in the drainage network which can be transferred to the receiving environment. Reducing the potential for build up of silt and rubbish debris in the drainage network, will improve the flow of the discharge to the marine environment.

7.10.3 Summary – Coastal Habitats

In undertaking physical work as part of the construction of drainage improvement activities, there is the potential for temporary minor adverse impacts on the marine environment. However, due to the likely minor and short term nature of the impacts, it is considered unlikely that the coastal ecosystem will be altered or damaged. Impacts on the coastal ecosystem once the drainage improvements are operational are considered to be insignificant as the drainage system and discharge of stormwater activities already exist.

7.11 Conclusion of the Assessment of Impacts

Overall it is considered that adverse impacts will be no more than minor and some operational, positive impacts are likely as a result of the proposed work.

Table 1 below provides a summary of the significance of impacts identified.

<table>
<thead>
<tr>
<th>Impact Issue</th>
<th>Significance of Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Short Term</td>
</tr>
<tr>
<td></td>
<td>Long Term</td>
</tr>
<tr>
<td>Air Quality and Dust</td>
<td>Minor adverse</td>
</tr>
<tr>
<td></td>
<td>Insignificant</td>
</tr>
<tr>
<td>Water Quality and Hydrology</td>
<td>Minor adverse</td>
</tr>
<tr>
<td></td>
<td>Major positive</td>
</tr>
<tr>
<td>Socio-economic</td>
<td>Minor adverse</td>
</tr>
<tr>
<td></td>
<td>Major positive</td>
</tr>
<tr>
<td>Noise and Vibration</td>
<td>Minor adverse</td>
</tr>
<tr>
<td></td>
<td>Insignificant</td>
</tr>
<tr>
<td>Traffic</td>
<td>Minor adverse</td>
</tr>
<tr>
<td></td>
<td>Insignificant</td>
</tr>
<tr>
<td>Landscape</td>
<td>Insignificant</td>
</tr>
<tr>
<td></td>
<td>Minor Positive</td>
</tr>
<tr>
<td>Archaeology and Culture</td>
<td>Insignificant</td>
</tr>
<tr>
<td></td>
<td>Insignificant</td>
</tr>
<tr>
<td>Soil, Geology and Coastal Hazard</td>
<td>Minor adverse</td>
</tr>
<tr>
<td></td>
<td>Insignificant</td>
</tr>
<tr>
<td>Freshwater Habitats</td>
<td>Minor adverse</td>
</tr>
<tr>
<td></td>
<td>Minor positive</td>
</tr>
<tr>
<td>Coastal Habitats</td>
<td>Minor adverse</td>
</tr>
<tr>
<td></td>
<td>Insignificant</td>
</tr>
</tbody>
</table>
8 Mitigation of Adverse Environmental Impacts

In accordance with the Regulations, possible alternatives have been considered for undertaking the proposed work to mitigate identified adverse environmental impacts. Additionally, mitigation measures are proposed to minimise or avoid adverse environmental impacts. In brief, mitigation will be implemented through the development and implementation of an Environmental Management Plan (EMP) which will be contained in the contractors tender documents and should be monitored to ensure compliance. A draft EMP is provided in Appendix B and covers:

- Traffic management;
- Erosion and sediment control; and
- Construction management.

A summary of mitigation measures proposed is shown in Table 2 below.

<table>
<thead>
<tr>
<th>Mitigation Measures</th>
<th>Impacts Mitigated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dust Control:</td>
<td>Air quality and Dust</td>
</tr>
<tr>
<td>Limit areas of open earthworks to no more than 200 m²</td>
<td>Socio-economic</td>
</tr>
<tr>
<td>at any one time.</td>
<td></td>
</tr>
<tr>
<td>Carry out watering of access road and disturbed earth</td>
<td></td>
</tr>
<tr>
<td>during dry conditions. Ensure that a water tanker is</td>
<td></td>
</tr>
<tr>
<td>available for this.</td>
<td></td>
</tr>
<tr>
<td>Phase construction work to minimise disturbance (for</td>
<td></td>
</tr>
<tr>
<td>example, sites near schools may be worked on during</td>
<td></td>
</tr>
<tr>
<td>school holidays).</td>
<td></td>
</tr>
<tr>
<td>General Construction Site Management:</td>
<td></td>
</tr>
<tr>
<td>Restrict hours of site operation to be Monday – Friday</td>
<td></td>
</tr>
<tr>
<td>7:00am – 4:00pm.</td>
<td></td>
</tr>
<tr>
<td>Limit the length of time construction vehicles and</td>
<td></td>
</tr>
<tr>
<td>machinery are left idling on site to no more than 10</td>
<td></td>
</tr>
<tr>
<td>minutes.</td>
<td></td>
</tr>
<tr>
<td>Provide advance warning of work to nearby residents</td>
<td></td>
</tr>
<tr>
<td>and other sensitive activities at least 5 days prior to</td>
<td></td>
</tr>
<tr>
<td>work beginning.</td>
<td></td>
</tr>
<tr>
<td>Provide a point of contact for any complaints and a</td>
<td></td>
</tr>
<tr>
<td>system for addressing these.</td>
<td></td>
</tr>
<tr>
<td>Use quiet and / or sound proofed equipment and vehicles</td>
<td></td>
</tr>
<tr>
<td>in accordance with manufacturers' recommendations.</td>
<td></td>
</tr>
<tr>
<td>Prohibit the refuelling or maintenance of construction</td>
<td></td>
</tr>
<tr>
<td>machinery within 20 metres of watercourses or the</td>
<td></td>
</tr>
<tr>
<td>coast.</td>
<td></td>
</tr>
<tr>
<td>Prepare a spill response plan to deal with accidental</td>
<td></td>
</tr>
<tr>
<td>release of all contaminants.</td>
<td></td>
</tr>
<tr>
<td>Any equipment or material storage yards are to be</td>
<td></td>
</tr>
<tr>
<td>fenced.</td>
<td></td>
</tr>
<tr>
<td>Any refuelling areas are to be bunded.</td>
<td></td>
</tr>
</tbody>
</table>
### Mitigation Measures

#### Erosion and Sediment Control:
- Implement a sediment control plan when excavating during construction, such as a sediment trap downstream of the work. This will be in accordance with COEP 6.
- Minimise the use of heavy machinery within or close to watercourses or in the coastal margin.
- Ensure that any bare earth areas are stabilised against erosion as soon as practical.

#### Protecting the Natural Environment:
- Remove rubbish and debris from drainage system prior to undertaking construction activities.
- Avoid undertaking physical work in or immediately adjacent to watercourses during high rainfall.

#### Traffic Management:
- Provide advance warning of work taking place to road users and provide road warning signage in accordance with COEP 12.
- Provide safe, signed access for vehicles and pedestrians when work affects access.
- Establish alternative bus stops where existing ones are closed by construction work.
- Restrict movement of construction vehicles through good planning, to minimise disruption to road users.

#### Easements:
- Establishing easements where drains and channels are located on private land will ensure the future maintenance of the drainage network can be achieved.
- Establishment of easements will be in general accordance with Code of Environmental Practice (COEP) 4 – *Land Acquisition and Compensation*.

#### Impacts Mitigated

- **Erosion and Sediment Control**:
  - Water Quality
  - Soils, Geology and Coastal Hazards
  - Freshwater Habitats
  - Coastal Habitats

- **Protecting the Natural Environment**:
  - Water Quality
  - Freshwater Habitats
  - Coastal Habitats

- **Traffic Management**:
  - Socio-economic
  - Traffic
  - Noise and Vibration

- **Easements**:
  - Socio-economic
  - Water Quality
  - Freshwater Habitats
  - Coastal Habitats
Appendix A

Work Proposed and Engineering Drawings
<table>
<thead>
<tr>
<th>Site ID No. (see drawings)</th>
<th>Description of Work Required</th>
<th>New Easement Required (Yes / No)</th>
</tr>
</thead>
<tbody>
<tr>
<td>543</td>
<td>Needs larger pipe. Construct swale across fairway to rough.</td>
<td>Yes</td>
</tr>
<tr>
<td>1135</td>
<td>Swale across fairway to rough is first priority, pipe is second priority.</td>
<td>Yes</td>
</tr>
<tr>
<td>5504</td>
<td>Needs larger pipe across road and place pipe under drive.</td>
<td>Yes</td>
</tr>
<tr>
<td>7760</td>
<td>New pipe across the road and outlet drain down old road reserve/across property.</td>
<td>Yes</td>
</tr>
<tr>
<td>7843</td>
<td>New pipe across the road and outlet drain to 7760 if possible.</td>
<td>Yes</td>
</tr>
<tr>
<td>8100</td>
<td>Check capacity, needs outlet drain.</td>
<td>Yes</td>
</tr>
<tr>
<td>13663</td>
<td>Needs larger pipe &amp; outlet maintenance.</td>
<td>Yes</td>
</tr>
<tr>
<td>13904</td>
<td>Needs larger pipe &amp; maintenance.</td>
<td>Yes</td>
</tr>
<tr>
<td>21125</td>
<td>Capacity unknown, but small flow, mostly needs outlet construction.</td>
<td>Yes</td>
</tr>
<tr>
<td>22072</td>
<td>Capacity unknown, but small flow, mostly needs outlet maintenance.</td>
<td>Yes</td>
</tr>
<tr>
<td>22486</td>
<td>Needs larger pipe &amp; outlet maintenance.</td>
<td>Yes</td>
</tr>
<tr>
<td>22677</td>
<td>Under capacity, but small flow, mostly needs cover on outlet chamber.</td>
<td>Yes</td>
</tr>
<tr>
<td>24837</td>
<td>Needs larger pipe.</td>
<td>Yes</td>
</tr>
<tr>
<td>25658</td>
<td>Needs larger pipe &amp; outlet construction.</td>
<td>Yes</td>
</tr>
<tr>
<td>25929</td>
<td>Outlet drain high priority but pipe replacement not needed for low flow.</td>
<td>Yes</td>
</tr>
<tr>
<td>27721</td>
<td>Needs larger pipe &amp; inlet maintenance.</td>
<td>Yes</td>
</tr>
<tr>
<td>13035</td>
<td>Needs larger pipe.</td>
<td>Yes</td>
</tr>
<tr>
<td>20109</td>
<td>Under capacity but mostly need maintenance.</td>
<td>Yes</td>
</tr>
<tr>
<td>8380</td>
<td>Under capacity, but small flow, mostly needs maintenance.</td>
<td>Yes</td>
</tr>
<tr>
<td>9551</td>
<td>Under capacity, but small flow, mostly needs maintenance.</td>
<td>Yes</td>
</tr>
<tr>
<td>14960</td>
<td>Under capacity, but small flow, mostly needs maintenance.</td>
<td>Yes</td>
</tr>
<tr>
<td>18748</td>
<td>Capacity unknown, but small flow, mostly needs maintenance.</td>
<td>Yes</td>
</tr>
<tr>
<td>23034</td>
<td>Under capacity, but small flow.</td>
<td>Yes</td>
</tr>
<tr>
<td>23612</td>
<td>Under capacity, but small flow.</td>
<td>Yes</td>
</tr>
<tr>
<td>Site ID No. (see drawings)</td>
<td>Description of Work Required</td>
<td>New Easement Required (Yes / No)</td>
</tr>
<tr>
<td>---------------------------</td>
<td>---------------------------------------------------------------------------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>13228</td>
<td>Capacity unknown, but small flow, mostly needs maintenance.</td>
<td>Yes</td>
</tr>
<tr>
<td>24640</td>
<td>New pipe across road.</td>
<td>Yes</td>
</tr>
<tr>
<td>2765</td>
<td>Replace pipe &amp; clean outlet drain.</td>
<td>No</td>
</tr>
<tr>
<td>3312</td>
<td>Construct outlet swale for 30 m.</td>
<td>No</td>
</tr>
<tr>
<td>3617</td>
<td>Replace first 2.4 m section of pipe.</td>
<td>No</td>
</tr>
<tr>
<td>4324</td>
<td>Replace pipes.</td>
<td>No</td>
</tr>
<tr>
<td>6745</td>
<td>Install 12 m of 300 pipe under side road.</td>
<td>No</td>
</tr>
<tr>
<td>8780</td>
<td>New 600 pipe across WCR + pipe across side road.</td>
<td>No</td>
</tr>
<tr>
<td>9140</td>
<td>Replace pipe.</td>
<td>No</td>
</tr>
<tr>
<td>9976</td>
<td>Construct outlet pipe to sea.</td>
<td>No</td>
</tr>
<tr>
<td>10420</td>
<td>Replace pipe.</td>
<td>No</td>
</tr>
<tr>
<td>11746</td>
<td>Clear seawall rock at outlet and grout rock HW &amp; channel.</td>
<td>No</td>
</tr>
<tr>
<td>12020</td>
<td>Replace pipe.</td>
<td>No</td>
</tr>
<tr>
<td>14330</td>
<td>Gout rock headwall at outlet and form rock basin in seawall at pipe outlet.</td>
<td>No</td>
</tr>
<tr>
<td>15280</td>
<td>Extend grouted stone headwall at outlet.</td>
<td>No</td>
</tr>
<tr>
<td>15460</td>
<td>Clear seawall rock at outlet and grout rock HW &amp; channel.</td>
<td>No</td>
</tr>
<tr>
<td>15600</td>
<td>Clear seawall rock at outlet and grout rock HW &amp; channel.</td>
<td>No</td>
</tr>
<tr>
<td>15880</td>
<td>Clear seawall rock at outlet and grout rock HW &amp; channel.</td>
<td>No</td>
</tr>
<tr>
<td>16286</td>
<td>Replace pipe &amp; grout rock channel at outlet.</td>
<td>No</td>
</tr>
<tr>
<td>17369</td>
<td>Replace 2.4m from outlet.</td>
<td>No</td>
</tr>
<tr>
<td>17654</td>
<td>Replace with box culverts.</td>
<td>No</td>
</tr>
<tr>
<td>21393</td>
<td>Replace pipe &amp; grout rock channel at outlet.</td>
<td>No</td>
</tr>
<tr>
<td>21920</td>
<td>Install headwall and inlet pipe on south side to drain property.</td>
<td>No</td>
</tr>
<tr>
<td>23811</td>
<td>Construct grate cover on outlet chamber.</td>
<td>No</td>
</tr>
<tr>
<td>24160</td>
<td>Cut batter back, widen shoulder to get extra fall &amp; new K&amp;C.</td>
<td>No</td>
</tr>
<tr>
<td>Site ID No. (see drawings)</td>
<td>Description of Work Required</td>
<td>New Easement Required (Yes / No)</td>
</tr>
<tr>
<td>---------------------------</td>
<td>------------------------------</td>
<td>----------------------------------</td>
</tr>
<tr>
<td>7186</td>
<td>Replace with box culverts.</td>
<td>No</td>
</tr>
<tr>
<td>16890</td>
<td>Replace with box culverts.</td>
<td>No</td>
</tr>
</tbody>
</table>
Appendix B

Draft Environmental Management Plan
Report

West Coast Road
Environmental Management Plan

Prepared for Land Transport Authority (Samoa) (Client)

By Beca International Consultants Ltd (Beca)

July 2010

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### Revision History

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<th>Revision Nº</th>
<th>Prepared By</th>
<th>Description</th>
<th>Date</th>
</tr>
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<tr>
<td>A</td>
<td>Sarah Cotterill</td>
<td>First Draft - Internal</td>
<td>28/01/10</td>
</tr>
<tr>
<td>B</td>
<td>Keith Frentz</td>
<td>Final</td>
<td>16/07/10</td>
</tr>
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### Document Acceptance

<table>
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<th>Name</th>
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<tr>
<td>Prepared by</td>
<td>Sarah Cotterill</td>
<td></td>
<td>16/07/10</td>
</tr>
<tr>
<td>Reviewed by</td>
<td>Keith Frentz</td>
<td></td>
<td>16/07/10</td>
</tr>
<tr>
<td>Approved by</td>
<td>John Hallett</td>
<td></td>
<td>28/07/10</td>
</tr>
<tr>
<td>on behalf of</td>
<td>Beca International Consultants Ltd</td>
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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 drainage improvements to the West Coast Road sites and to manage environmental impacts.

The EMP forms part of the MWTI’s application for Development Consent and shall be implemented in accordance with that consent.

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 West Coast Drainage Improvements and implementation of the EMP is part of the Contractor’s 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

A PEAR was prepared in accordance with the Environmental Impact Assessment (EIA) Regulations 2007 to determine the likely significance of impacts arising from the proposed West Coast Road 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 West Coast Road Drainage Improvement Work 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 .........................................................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 Ministry of Works, Transport and Infrastructure (MWTI) 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 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 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.

- 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 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.

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 revegetated 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 stormwater 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 revegetated 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 stormwater 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 stormwater 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 time have experienced first aid personnel available throughout the period of contract work for attending 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 tree 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 COEP11 – *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 revegetation 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 stormwater 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 as 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 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.

6.1 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.

6.2 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 MWTI 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.

6.3 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.
6.4 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.